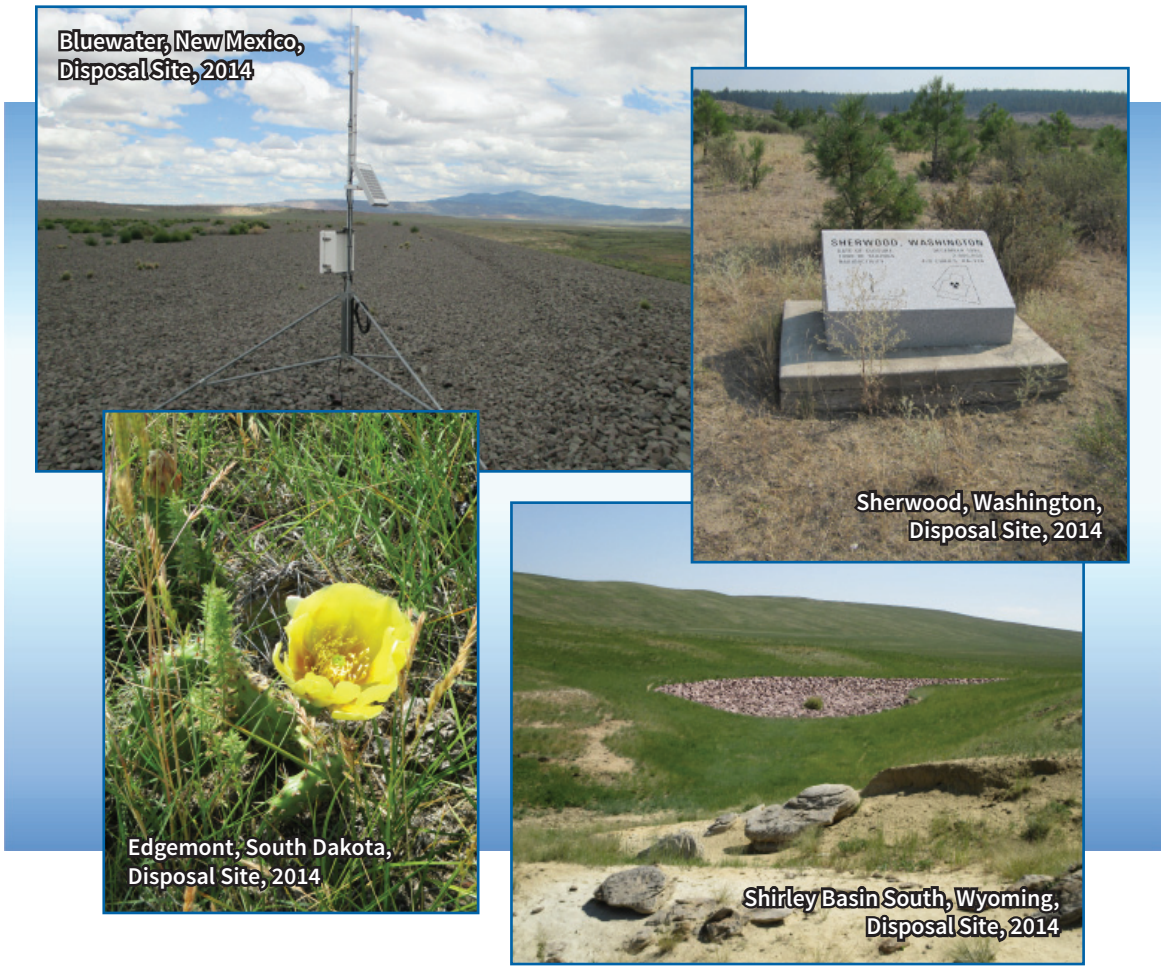
LMS/S12266

U.S. DEPARTMENT OF ENERGY

Legacy Management

2014 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title II Disposal Sites

November 2014



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Abbreviations

AAS	alternate abatement standard
ACL	alternate concentration limit
BLM	U.S. Bureau of Land Management
CFR	*Code of Federal Regulations*
DOE	U.S. Department of Energy
EMP	erosion monitoring program
LTSP	long-term surveillance plan
MCL	maximum concentration limit
mg/L	milligrams per liter
NMED	New Mexico Environment Department
NRC	U.S. Nuclear Regulatory Commission
PCB	polychlorinated biphenyl
pCi/L	picocuries per liter
PL	photograph location
PMF	probable maximum flood
POC	point of compliance
POE	point of exposure
Stoller	The S.M. Stoller Corporation
TDS	total dissolved solids
UMTRCA	Uranium Mill Tailings Radiation Control Act of 1978 (88 USC 7901, et seq.)
WDEQ	Wyoming Department of Environmental Quality

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Executive Summary

This report, in fulfillment of a license requirement, presents the results of long-term surveillance and maintenance activities conducted by the U.S. Department of Energy (DOE) Office of Legacy Management in 2014 at six uranium mill tailings disposal sites reclaimed under Title II of the Uranium Mill Tailings Radiation Control Act (UMTRCA) of 1978. These activities verified that the UMTRCA Title II disposal sites remain in compliance with license requirements.

DOE manages six UMTRCA Title II disposal sites under a general license granted by the U.S. Nuclear Regulatory Commission (NRC) established at Title 10 *Code of Federal Regulations* Section 40.28. Reclamation and site transition activities continue at other sites, and DOE ultimately expects to manage approximately 27 Title II disposal sites.

Long-term surveillance and maintenance activities and services for these disposal sites include inspecting and maintaining the sites; monitoring environmental media and institutional controls; conducting any necessary corrective action; and performing administrative, records, stakeholder services, and other regulatory functions.

Annual site inspections and monitoring are conducted in accordance with site-specific long-term surveillance plans (LTSPs) and with procedures established by DOE to comply with license requirements. Each site inspection is performed to verify the integrity of visible features at the site; to identify changes or new conditions that may affect the long-term performance of the site; and to determine the need, if any, for maintenance, follow-up inspections, or corrective action. LTSPs and site compliance reports are available online at http://www.lm.doe.gov.

DOE performed routine activities in 2014, including groundwater monitoring, erosion and vegetation monitoring, and noxious weed control. The following nonroutine activities[1] occurred in 2014:

- **Bluewater, New Mexico:** Uranium concentrations continued to exceed the UMTRCA maximum concentration limit for uranium in both aquifers at the site. DOE developed a groundwater conceptual model to evaluate the extent of contamination and potential risk to downgradient groundwater users. Site-derived uranium contamination is not expected to impact the local municipal water supplies.
- **Bluewater, New Mexico:** Site roads damaged by rainfall runoff were repaired.
- **Bluewater, New Mexico:** A small depression on the carbonate tailings disposal cell and several small depressions around the perimeter of the asbestos disposal area were repaired.
- **Shirley Basin South, Wyoming:** Concentrations of radium-226 and radium-228 continued to exceed their respective alternate concentration limits (ACLs) at two wells. NRC concluded that there is no current risk to human health and the environment. Groundwater monitoring will continue in accordance with the LTSP.

[1]Nonroutine activities are activities implemented in response to changes in site conditions, the regulatory setting, or the management structure following an extraordinary event or a regulatory compliance review.

Results of the annual site inspection, maintenance, and monitoring activities are reported in the site-specific chapters that follow. Significant actions and issues at each site are summarized in Table ES-1. The table includes an index number for each item, which can be found in the left margin next to the corresponding text in the respective site chapter.

Table ES-1. 2014 Summary of UMTRCA Title II Site Issues and Actions

Site	Chapter	Page	Index No.	Issues and Actions
Bluewater, New Mexico	1	1-2	1A	Repaired damaged site roads.
		1-6	1B	Repaired small depression in carbonate tailings disposal cell.
		1-6	1C	Repaired small depressions around asbestos disposal area.
		1-8	1D	Conducted groundwater monitoring.
		1-9	1E	Developed a groundwater conceptual model.
		1-10	1F	Alluvial aquifer groundwater with elevated uranium concentrations is leaving the site.
		1-11	1G	Bedrock aquifer groundwater with elevated uranium concentrations is leaving the site.
		1-12	1H	Site-derived uranium contamination is not expected to impact municipal water supplies.
Edgemont, South Dakota	2			None.
L-Bar, New Mexico	3	3-9	3A	Conducted groundwater monitoring.
		3-9	3B	Measured cell cover erosion and vegetation.
Maybell West, Colorado	4			None.
Sherwood, Washington	5	5-6	5A	Conducted dam safety inspection.
		5-7	5B	Conducted groundwater monitoring.
Shirley Basin South, Wyoming	6	6-7	6A	Conducted groundwater monitoring.
		6-8	6B	Continued to exceed ACLs for radium-226 and radium-228.
		6-9	6C	Concluded that elevated radium concentrations pose no risk to human health and the environment.

1.0 Bluewater, New Mexico, Disposal Site

1.1 Compliance Summary

The Bluewater, New Mexico, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title II Disposal Site was inspected on August 20 and 21, 2014. Several shallow depressions that exist on the main tailings disposal cell cover had ponded water at the time of the inspection; disposal cell performance is being evaluated to determine if additional monitoring or cover enhancement is necessary.

Small elm tree saplings growing on the main tailings disposal cell top cover were treated with herbicide. Monitoring well access roads were damaged at several locations by precipitation runoff and were repaired in September. A small depression was present on the carbonate tailings disposal cell top slope and several depressions were found around the perimeter of the asbestos disposal area; all of the depressions were repaired in September. Windblown sand had accumulated along the perimeter fence near the site entrance and was removed in September. Inspectors identified no other maintenance needs or cause for a follow-up inspection.

Groundwater monitoring in 2014 indicated that no alternate concentration limits (ACLs) were exceeded, but that groundwater leaving the site has uranium concentrations exceeding the UMTRCA maximum concentration limit (MCL) and the State of New Mexico drinking water standard. Downgradient sampling and development of a groundwater conceptual model indicate that drinking water wells in the vicinity of the site have uranium concentrations below the drinking water standard, and that uranium contamination from the Bluewater site is not expected to impact the local municipal water supplies.

1.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the Bluewater site are specified in the *Long-Term Surveillance Plan for the DOE Bluewater (UMTRCA Title II) Disposal Site Near Grants, New Mexico* (LTSM003407, July 1997) and in procedures established by the U.S. Department of Energy (DOE) to comply with requirements of Title 10 *Code of Federal Regulations* Section 40.28 (10 CFR 40.28). Table 1-1 lists these requirements.

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

Requirement	Long-Term Surveillance Plan	This Report
Annual Inspection and Report	Sections 3.3 and 3.4	Section 1.4
Follow-up Inspections	Section 3.5	Section 1.5
Routine Maintenance and Emergency Measures	Section 3.6	Section 1.6
Environmental Monitoring	Section 3.7	Section 1.7

1.3 Institutional Controls

The 3,300-acre site is owned by the United States of America and was accepted under the U.S. Nuclear Regulatory Commission (NRC) general license (10 CFR 40.28) in 1997. DOE is the licensee and, in accordance with the requirements for UMTRCA Title II sites, is responsible for the custody and long-term care of the site. Institutional controls at the site include federal ownership of the property and the following features that are inspected annually: a site marker, boundary monuments, and warning/no-trespassing signs.

1.4 Inspection Results

The site, located approximately 9 miles northwest of Grants, New Mexico, was inspected on August 20 and 21, 2014. Results of the inspection are described below. The inspection was conducted by R. Johnson and D. Traub of The S.M. Stoller Corporation, a wholly owned subsidiary of Huntington Ingalls Industries (Stoller). Stoller is the Legacy Management Support contractor at the DOE office in Grand, Junction, Colorado. D. Barr, the DOE Site Manager, and J. Parrott, R. Evans, and K. Conway of NRC attended the inspection.

The purposes of the inspection were to confirm the integrity of the visible features at the site, to identify changes in conditions that might affect site integrity, and to determine the need, if any, for maintenance or additional inspection and monitoring. Numbers in the left margin of this report refer to items summarized in Table ES-1 of the "Executive Summary."

1.4.1 Site Surveillance Features

The locations of site surveillance features are shown on Figure 1-1 (south area) and Figure 1-2 (north area). 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 on the figures by photograph location (PL) numbers.

1.4.1.1 Site Access and Interior Roads

Access to the site is directly off gravel-surfaced Cibola County Road 63; no private property is crossed to gain site access. The entrance gate is a tubular steel, double-swing gate. The gate is secured by a chain and locks belonging to DOE and the various utility companies that have rights-of-way across the site. The gate was locked and in good condition (PL-1).

The site access road is surfaced with crushed basalt and extends northward along a narrow strip of DOE property for approximately 1,700 feet from the entrance gate to the main site access gate. The access road was in good condition.

Interior tertiary roads used to access DOE assets consist of a dirt track covered at places with crushed basalt. The roads are susceptible to erosion, and are repaired when they become impassable. Several locations were damaged from precipitation runoff and difficult to cross.
1A These locations were repaired in September 2014.

1.4.1.2 Perimeter Signs and Boundary Monuments

Fifty-five warning signs, referred to as perimeter signs, are mounted on steel posts along the site boundary and around the main and carbonate tailings disposal cells. Perimeter signs P3 and P10 have gunshot damage but are still legible. All other observed signs were in good condition (PL-2).

Twenty-four boundary monuments define the site boundary. These monuments are typically inside the perimeter fence and several feet inside the true corner or boundary line. The boundary monuments observed during the inspection were in good condition (PL-3). Some monuments tend to get covered by drifting sand, and metal t-posts have been driven at those locations to help inspectors find them.

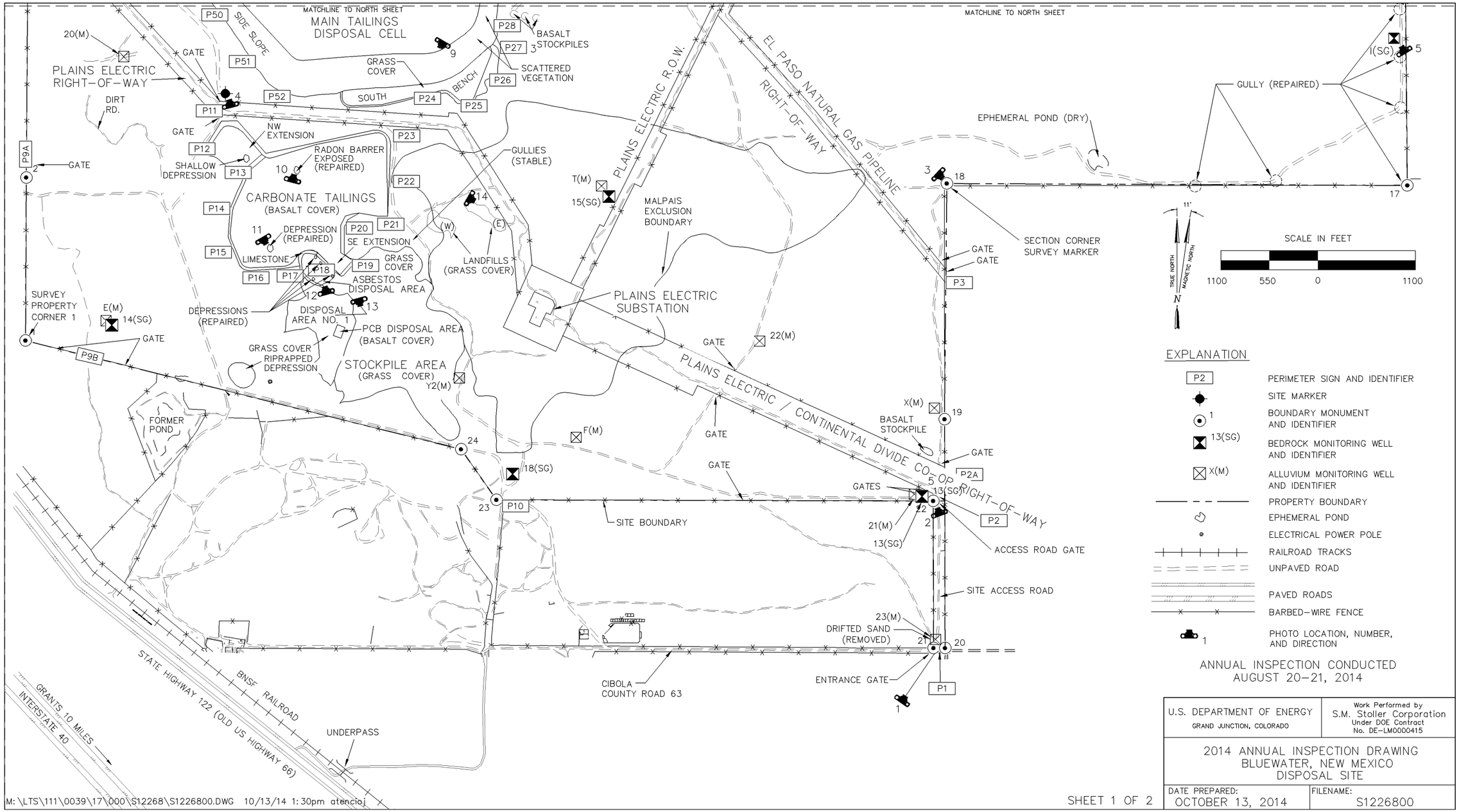


Figure 1-1. 2014 Annual Inspection Drawing for the Bluewater, New Mexico, Disposal Site (South Area)

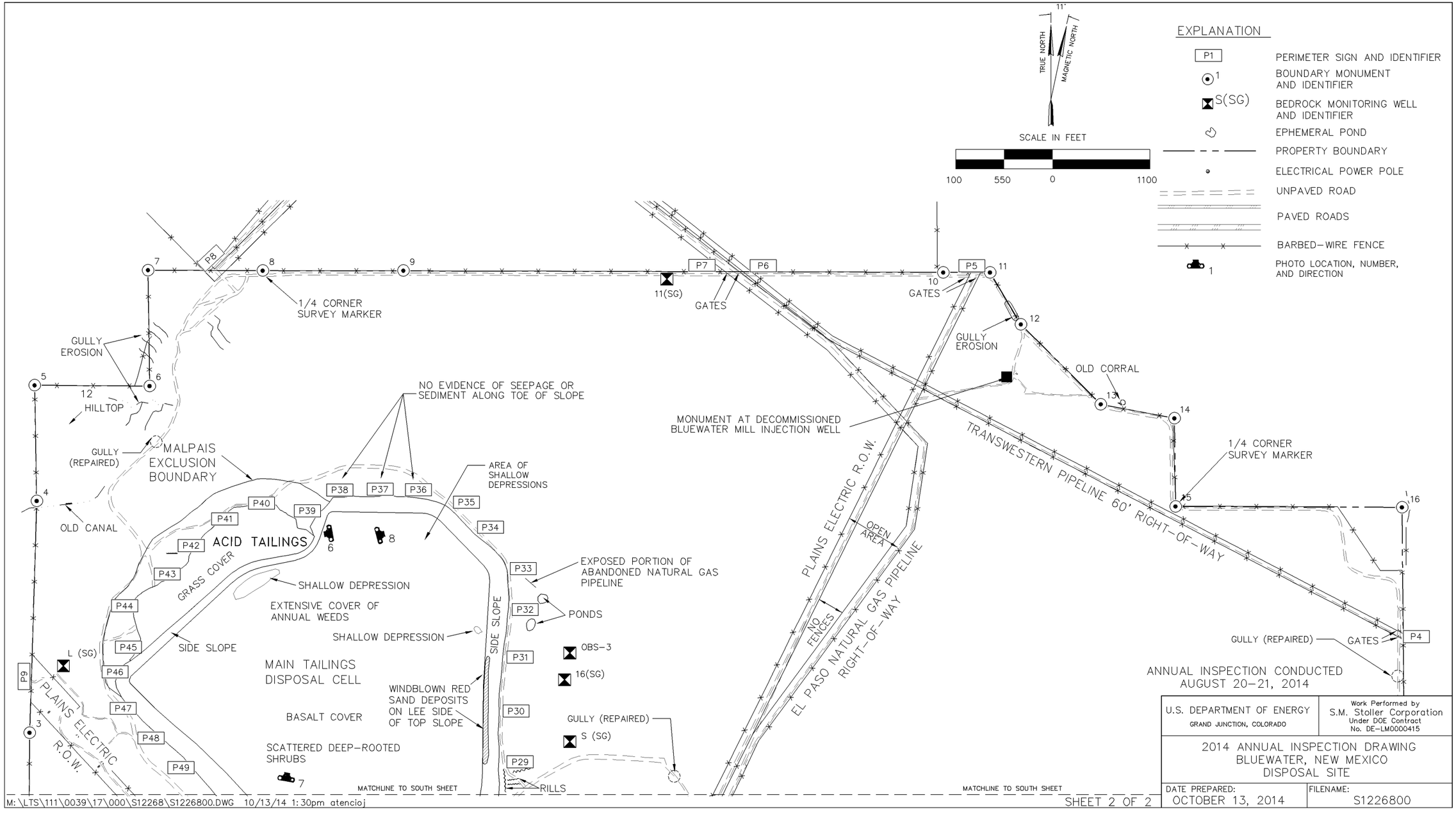


Figure 1-2. 2014 Annual Inspection Drawing for the Bluewater, New Mexico, Disposal Site (North Area)

1.4.1.3 Perimeter Fence

A four-strand barbed-wire fence encompasses the site to facilitate land management by DOE. A local subcontractor has been retained to periodically check the site perimeter fence and to remove trespassing cattle. Minor fence repairs are conducted as needed. The fence was in good condition. Sand had drifted to near the top of a portion of the perimeter fence near the site entrance and was removed in September 2014.

1.4.1.4 Site Marker

A granite site marker is between the southwest corner of the main tailings disposal cell and the northwest corner of the carbonate tailings disposal cell. The site marker was in excellent condition (PL-4).

1.4.1.5 Monitoring Wells

The groundwater monitoring network consisted of nine wells when the site was transferred to DOE. Two additional wells were installed in summer 2011, and eight more wells were installed in summer 2012 in response to elevated uranium concentrations in the two aquifers at the site. The onsite groundwater-monitoring network now consists of 19 monitoring wells.

Nine wells are screened in Rio San Jose alluvium underlying basalt lava flows and are identified as E(M), F(M), T(M), X(M), Y2(M), 20(M), 21(M), 22(M), and 23(M). The other 10 wells are completed in the San Andres Limestone-Glorieta Sandstone hydrogeologic unit, known as the San Andres aquifer, which is the uppermost bedrock aquifer at the site. The bedrock wells are I(SG), L(SG), OBS-3, S(SG), 11(SG), 13 (SG), 14(SG), 15(SG), 16(SG), and 18(SG). Several wells have transducers to obtain continuous water level measurements, and the data are transmitted to the DOE office in Grand Junction. The wells and their associated telemetry towers were secure and in excellent condition (PL-5).

1.4.2 Inspection Areas

In accordance with the Long-Term Surveillance Plan (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 main tailings disposal cell, including the acid tailings disposal area and the south bench; (2) the carbonate tailings disposal cell, including the asbestos disposal area, the polychlorinated biphenyl (PCB) disposal area, and associated landfills; (3) the region between the disposal structures and the site perimeter; and (4) the site perimeter and outlying area.

Within each area, inspectors examined the specific site surveillance features and looked for evidence of erosion, settling, slumping, or other disturbances that might affect the site's integrity, protectiveness, or long-term performance.

1.4.2.1 Main Tailings Disposal Cell, the Acid Tailings Disposal Area, and the South Bench Disposal Area

The main tailings disposal cell and the acid tailings and south bench disposal areas are contiguous, and together they constitute one large disposal area of approximately 354 acres. The main tailings disposal cell is covered with basalt riprap and slopes northward. The top slope

grade is 3 to 4 percent at the south end and decreases to less than 0.5 percent at the north end. The top slopes of the acid tailings (PL-6) and the south bench disposal areas are essentially flat and covered by healthy grass. Basalt riprap protects the side slopes of the three disposal areas. The riprap was in excellent condition.

Plant encroachment (annual weeds, perennial grasses and forbs, and scattered perennial shrubs) continues on the cell cover and side slopes (PL-7). Saplings of Siberian elm have been present on the cell cover and are periodically cut and their stumps are treated with herbicide; several saplings were observed during the inspection and were treated with herbicide.

Several shallow depressions exist on the relatively flat north end of the top slope of the main tailings disposal cell and along the east and northwest edges of the cover. Ponds often develop in the depressions after rainfall events, and some of the depressions had standing water at the time of the inspection (PL-8). Because of a concern that the ponds were degrading disposal cell performance, NRC requested DOE to evaluate the performance of the radon barrier. Radon flux measurements on top of the radon barrier in the area of depressions were collected in July 2013. All radon measurements were below the detection limit, indicating that the radon barrier in that portion of the disposal cell is performing as designed. Results of the investigation will be used to determine, in consultation with NRC, if additional monitoring or cover enhancements are necessary.

1.4.2.2 Carbonate Tailings Disposal Cell, Asbestos and PCB Disposal Areas, and Landfills

The 54-acre carbonate tailings disposal cell is south of the main tailings disposal cell (PL-9). Basalt riprap covers the top and side slopes of the disposal cell. The top, for the most part, slopes gently eastward. The cell includes extensions to the northwest and southeast. A shallow depression exists on the northwest extension, and water was present in the rock cover at the time of the inspection. Annual weeds, perennial grasses, and scattered woody shrubs were present on the cell and its extensions. Saplings of Siberian elm have been present on the cell cover and are periodically cut, and their stumps are treated with herbicide; no saplings were observed during the inspection.

The top surface of the radon barrier was exposed in a very small area of the cell cover (PL-10). Apparently an animal scraped away the thin rock cover to expose vegetation. The rock cover was repaired in September 2014.

A small depression a couple of feet deep in the south portion of the top slope was noted for the
1B first time during the inspection (PL-11). The depression was repaired in September 2014. It was apparent that radon barrier material had been placed over basalt boulders at that location. The material eventually filtered into spaces between the boulders causing a small collapse in the surface. No tailings materials were exposed in the depression. During repair activities, the cover rock was removed from the depression and radon barrier material was added to the depression in compacted lifts. The cover rock was replaced after the radon barrier surface matched the surrounding surface.

The 2-acre asbestos disposal area is a bowl-like feature just south of the carbonate tailings disposal cell (PL-12). The north, west, and south side slopes of this feature are covered by limestone riprap; the bottom of the bowl (the asbestos cell cover) is grass-covered. Four small
1C depressions were noted around the perimeter of the disposal area and were subsequently repaired in September 2014 by filling them with small-diameter rock. The depressions formed when

cover materials collapsed into underlying voids in the buried basalt terrain. No encapsulated materials were exposed in the depressions.

The 11-acre grass-covered disposal area south of the asbestos disposal area was in excellent condition, as was the small riprap-covered PCB cell located within the disposal area (PL-13). The two grass-covered landfills east of the carbonate tailings disposal cell, totaling about 2 acres, were in excellent condition (PL-14).

1.4.2.3 Area Between the Disposal Cells and the Site Perimeter

Other areas inside the site were inspected by driving the site perimeter road and other roads and tracks. Much of the southern and western portions of the site are inaccessible by vehicle because they are covered by basalt flows.

Small ponds often form in an area along the east side of the disposal cell and in other low spots following storm events and were present at the time of the inspection. The areas of ponding are far enough from the cell to not impact it.

A monument consisting of a steel well casing set in concrete is located at the decommissioned mill process fluid injection well near the northeast corner of the site. Information pertaining to the well is welded onto the monument.

Several utility companies have rights-of-way that cross the site. These rights-of-way are bordered by stock fences with locked gates where the rights-of-way cross the site boundary. Roads along the rights-of-way typically are covered with crushed basalt to provide the utility companies with all-weather access. DOE is not responsible for maintaining the right-of-way roads, fences, or associated gates.

An electric power substation, enclosed by a security fence, is located near the center of the site. Utility company personnel visit the substation frequently. DOE is not responsible for maintaining the substation or its security fence and access road.

1.4.2.4 Site Perimeter and Outlying Areas

Surrounding land is used for livestock grazing and wildlife habitat. The area outside the site boundary for 0.25 mile was visually inspected for erosion, development, changes in land use, or other phenomena that might affect the long-term integrity of the site. No such impacts were observed.

1.5 Follow-up Inspections

DOE 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) DOE 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 during the inspection.

1.6 Routine Maintenance and Emergency Measures

Elm saplings on the main tailings disposal cell cover were treated with herbicide during the inspection. Erosion-damaged locations along monitoring well access roads and depressions in the

carbonate tailings cell cover and around the asbestos disposal area were repaired in September 2014. Drifted sand was removed from the perimeter fence near the site entrance in September 2014. No other maintenance needs were identified.

Emergency measures are corrective actions that DOE will take in response to unusual damage or disruption that threatens or compromises site health and safety, security, integrity, or compliance with 40 CFR 192. No emergency measures were identified.

1.7 Environmental Monitoring

1.7.1 Groundwater Monitoring

1D Groundwater monitoring is required at the Bluewater site. The well network acquired by DOE at the time of site transition and included in the LTSP consisted of wells E(M), F(M), T(M), Y2(M), X(M), L(SG), OBS-3, S(SG), and I(SG). The LTSP requires annual sampling for PCBs and triennial sampling for molybdenum, selenium, and uranium in the alluvium aquifer background and point-of-compliance (POC) wells. The LTSP also requires triennial sampling of the San Andres (bedrock) aquifer background and POC wells for selenium and uranium. Alluvium aquifer well X(M) and bedrock aquifer well I(SG)—point-of-exposure (POE) wells located along the east property boundary—were to be sampled only if specified ACLs are exceeded. The monitoring network, including new wells installed in 2011 and 2012, is described in Table 1-2. ACLs are listed in Table 1-3.

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

Monitoring Well	Network Application
E(M)	Alluvium background well
F(M)	Alluvium POC well
T(M)	Alluvium POC well
Y2(M)	Alluvium POC well
X(M)	Alluvium POE well
20(M)	Alluvium upgradient well
21(M)	Alluvium downgradient well
22(M)	Alluvium downgradient well
23(M)	Alluvium downgradient well
L(SG)	Bedrock background well
OBS-3	Bedrock POC well
S(SG)	Bedrock POC well
I(SG)	Bedrock POE well
11(SG)	Bedrock crossgradient well
13(SG)	Bedrock downgradient well
14(SG)	Bedrock crossgradient well
15(SG)	Bedrock downgradient well
16(SG)	Bedrock replacement POC well
18(SG)	Bedrock downgradient well

Key: POC = point of compliance; POE = point of exposure

Table 1-3. Groundwater Alternate Concentration Limits for the Bluewater, New Mexico, Disposal Site

POC Well	Analyte	ACL (mg/L)
Alluvium F(M) and T(M)	Molybdenum Selenium Uranium	0.10 0.05 0.44
Bedrock OBS-3 and S(SG)	Selenium Uranium	0.05 2.15

Key: ACL = alternate concentration limit; mg/L = milligrams per liter; POC = point of compliance

The New Mexico Environment Department (NMED) requested DOE's assistance in investigating and evaluating regional groundwater contamination associated with the former Grants Mineral Belt uranium mining industry. NMED suspected that contaminants from the Bluewater site were migrating offsite and contaminating the regional groundwater. In response to NMED's concerns, DOE reinitiated annual sampling at all of the site wells in fall 2008, including the POE wells. Semiannual sampling was initiated in 2011 in response to an ACL exceedance. DOE also began evaluating the hydrogeology and groundwater quality at the site in 2009, and analyzes a larger suite of constituents than required by the LTSP to characterize the site aquifers and to support NMED's regional groundwater investigation. In consultation with NRC, DOE installed additional monitoring wells in 2011 and 2012, evaluated disposal cell performance, and has developed a groundwater conceptual model to address uranium contamination issues.

1E

1.7.2 Alluvial Aquifer

Alluvial aquifer analytical results from the most recent sampling event in April 2014 are provided in Table 1-4. Alluvium POC well T(M) was not sampled because it continues to be dry. The uranium concentration in well T(M) trended upward since DOE began monitoring the well in 1999, and the November 2010 concentration of 0.557 milligram per liter (mg/L) exceeded the ACL of 0.44 mg/L. DOE notified NRC of the exceedance upon receiving the results from the laboratory. Uranium concentrations in the well continued to exceed the ACL and had remained steady in four subsequent samples until the well dried up after the May 2012 sampling event. Concentrations for the other analytes in all of the wells remain below their respective ACLs. PCBs have never been detected in the wells at the site.

Table 1-4. April 2014 Alluvium Aquifer Monitoring Results

Well	Molybdenum (mg/L) ACL = 0.10 mg/L	Selenium (mg/L) ACL = 0.05 mg/L	Uranium (mg/L) ACL = 0.44 mg/L
20(M)	0.0021	ND	0.0143
21(M)	0.0010	0.0121	0.137
22(M)	0.0010	ND	0.393
23(M)	0.0057	ND	0.0262
E(M)	0.0006	ND	ND
F(M)	0.0010	ND	0.0078
T(M)	NS	NS	NS
X(M)	0.0007	0.0079	0.121
Y2(M)	0.0016	ND	0.0051

Key: mg/L = milligrams per liter; ND = not detected (below method detection limit); NS = not sampled

Alluvium well 21(M) is located adjacent to the southern site boundary, where the estimated deepest part of the former Rio San Jose channel coursed prior to being buried by basalt lava flows. Alluvium well 22(M) is located approximately halfway between POC well T(M) and well 21(M). The uranium concentrations in the new wells are below the ACL (Table 1-4). However, the uranium concentrations in both wells, shown in Figure 1-3, continue to exceed the
1F UMTRCA MCL of 0.044 mg/L (40 CFR 192, Table 1) and the State of New Mexico drinking water standard of 0.03 mg/L. Based on the elevated uranium concentrations in well 21(M), alluvial groundwater with elevated uranium is leaving the site.

The extent of contamination in the alluvial aquifer has been evaluated as part of the groundwater conceptual model. Approximately 1 mile downgradient of the Bluewater site the alluvial groundwater flow from the site merges with contaminated alluvial groundwater flow from the Homestake mill site. The combined alluvial groundwater flows southeast toward the Village of Milan. Uranium concentrations reduce with distance from the Bluewater site due to natural attenuation processes (primarily dispersion). Although some alluvial aquifer monitoring wells downgradient of the Bluewater site have uranium concentrations exceeding the New Mexico drinking water standard, samples from the nearest downgradient drinking water well had uranium concentrations below the drinking water standard.

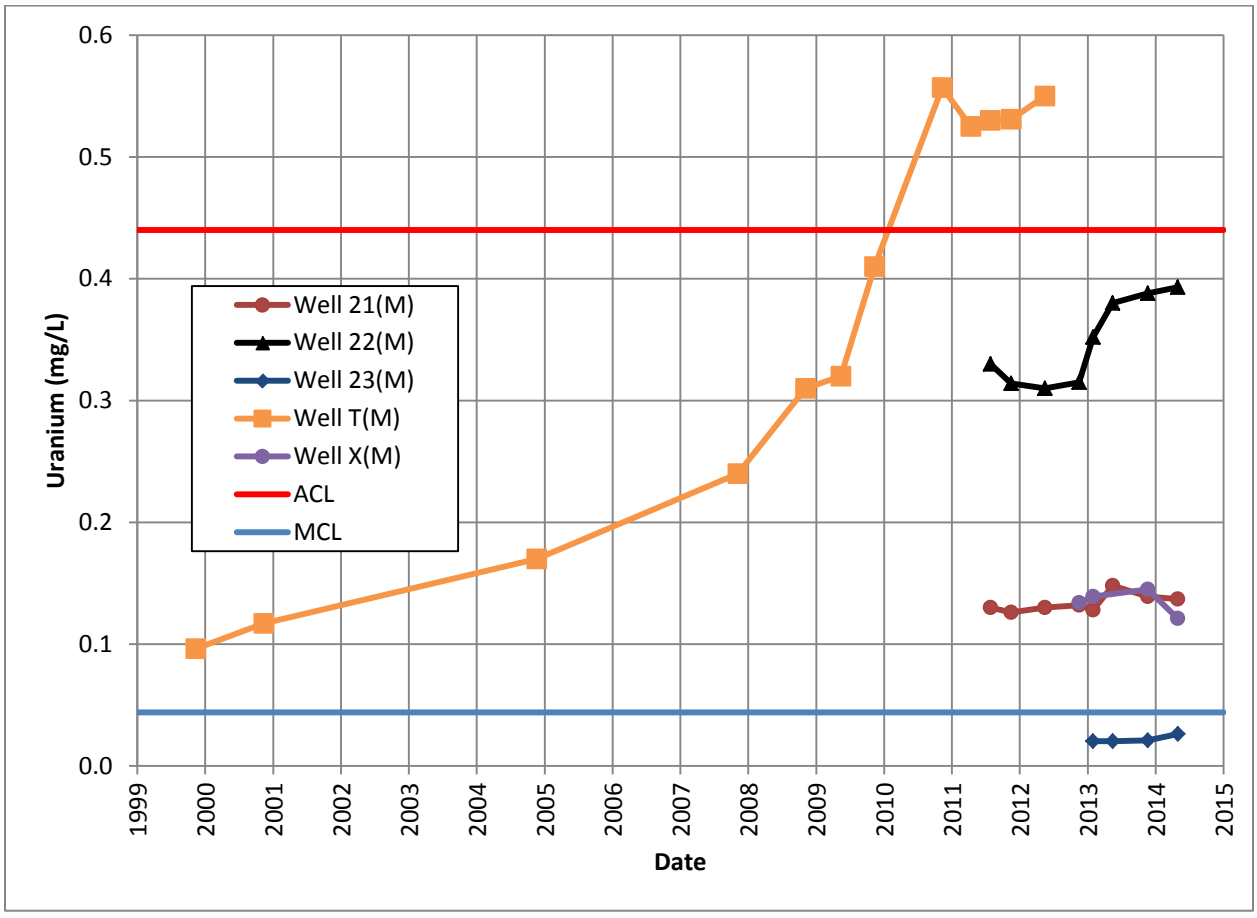


Figure 1-3. Uranium Concentrations in Alluvium POC Well T(M) and Downgradient Wells

NRC requested DOE to evaluate the performance of the main tailings disposal cell to see if there is a correlation between cell performance and the elevated uranium concentrations in POC well T(M). A cell cover and water balance evaluation of the disposal cell (including the radon study referred to in Section 1.4.2.1) concluded that the increase in uranium concentrations in well T(M) cannot be attributed to a reduction in disposal cell performance—no surge of tailings fluids from the cell has occurred. The increase in uranium concentration is apparently related to the declining water level at the well location and the influence of groundwater from contaminated weathered Chinle Formation material at the bottom of the well screen. Elevated uranium concentrations observed in the site groundwater monitoring network are the result of seepage of tailings fluids during milling operations and a subsequent mineralized zone that developed in the geologic materials and faults beneath the tailings impoundment.

1.7.3 Bedrock Aquifer

Bedrock wells 11(SG), 13(SG), 14(SG), 15(SG), 16(SG), and 18(SG) were installed in summer 2012 to gain a better understanding of the hydrogeological characteristics of the San Andres aquifer at the site, and because a nearby offsite private well (HMC-951) completed in the same aquifer had elevated uranium concentrations. There were no bedrock wells in the south portion of the site prior to this well construction project. Wells 11(SG) and 14(SG) are considered to be crossgradient of the disposal cells, and all of the other new wells are downgradient of the cells. Well 16(SG) was installed between POC wells OBS-3 and S(SG) because their well screens are highly corroded and their uranium concentrations seemed to be anomalously low. Because of the poor well conditions, sample results from wells OBS-3 and S(SG) are not considered to berepresentative of aquifer conditions, but they continue to be sampled in accordance with the LTSP.

Bedrock wells I(SG) and L(SG) were completed with open-borehole construction through the entire thickness of the San Andres Limestone and Glorieta Sandstone formations, which comprise the San Andres aquifer. All of the new San Andres aquifer wells, except well 16(SG), are screened in the upper 50 feet of the San Andres Limestone as are most San Andres aquifer wells in the region because this is the most productive zone of the aquifer. Well 16(SG) is screened in the Glorieta Sandstone because the San Andres Limestone is dry at that location.

In response to questions by NMED about the possibility of stratification of contamination within the aquifer, downhole conductivity was measured in wells I(SG) and L(SG) in spring 2013. No change in conductivity with depth was observed in background well L(SG). However, three zones of different conductivities were noted in POE well I(SG)—conductivity was lowest in the water within the well casing, higher in the upper portion of the open borehole, and highest in the lower portion of the open borehole. In 2013, low-flow samples collected in each zone in well I(SG) demonstrated that uranium concentrations increased with conductivity: 0.005 mg/L within the well casing, 0.15 mg/L in the upper portion of the open borehole, and 0.34 mg/L in the lower portion of the open borehole. Well L(SG) was also sampled at three depths for comparison purposes and all results were 0.003 mg/L.

Analytical results for the required constituents in bedrock wells are provided in Table 1-5. A low-flow sample was collected in the lower portion of the open borehole in well I(SG) to represent the highest uranium concentration. The selenium and uranium concentrations did not exceed ACLs in the POC wells. However, the uranium concentrations in downgradient wells
1G 13(SG), 18(SG), and I(SG), located along the site boundary, exceed the UMTRCA MCL of

0.044 mg/L and the New Mexico drinking water standard. Therefore, San Andres aquifer groundwater with elevated uranium is leaving the site. The uranium concentration in private well HMC-951, used for monitoring purposes only, exceeded the New Mexico drinking water standard.

Table 1-5. April 2014 Bedrock Aquifer Monitoring Results

Well	Selenium (mg/L) ACL = 0.05 mg/L	Uranium (mg/L) ACL = 0.44 mg/L
11(SG)	ND	0.0157
13(SG)	ND	0.108
14(SG)	ND	0.0643
15(SG)	ND	0.129
16(SG)	0.0171	1.29
18(SG)	ND	0.134
I(SG)[a]	0.0081	0.288
L(SG)	ND	0.0031
OBS-3	ND	0.0077
S(SG)	0.0122	0.456
HMC-951	ND	0.0317

Key: mg/L = milligrams per liter; ND = not detected (below method detection limit)
[a] Sample collected at the depth of highest conductivity.

To evaluate the extent of contamination, DOE sampled private wells near the Bluewater site in 2013. Most of the private wells near the site are completed in the San Andres aquifer because of the limited extent of the alluvial aquifer near the site. A stock well near the south boundary of the site, which had been a production well for the Bluewater mill, had a uranium concentration above the drinking water standard but below limits considered safe for livestock consumption. All other San Andres wells sampled by DOE, whether permitted for drinking water or agricultural use, had uranium concentrations below the drinking water standard. The nearest downgradient municipal wells, operated by Milan, produce from the San Andres aquifer and do not have elevated uranium concentrations or show upwards trends.

The extent of uranium contamination in the San Andres aquifer and the potential risk to downgradient groundwater users was evaluated in DOE's groundwater conceptual model. Evaluation of previous groundwater studies in the region and available groundwater data indicated that the flow path of the aquifer from the Bluewater site is in the east-southeast direction. The groundwater from the site passes under the Homestake mill site and continues through an area north of the community of Grants. The flow path is substantially north of the Milan municipal wells.

The uranium plume follows the groundwater flow path, and the leading portion is in the vicinity of the Homestake site. Groundwater monitoring results obtained by various entities over the last several decades indicate that uranium contamination from Bluewater mill operations reached the Homestake site by 1980 and that the plume has essentially stabilized. Uranium concentrations attenuate with distance from the Bluewater site primarily through dispersion. No known drinking water wells are completed within the uranium plume, and Bluewater site-derived uranium
1H contamination in the San Andres aquifer is not expected to impact the Milan or Grants municipal water supplies.

1.8 Photographs

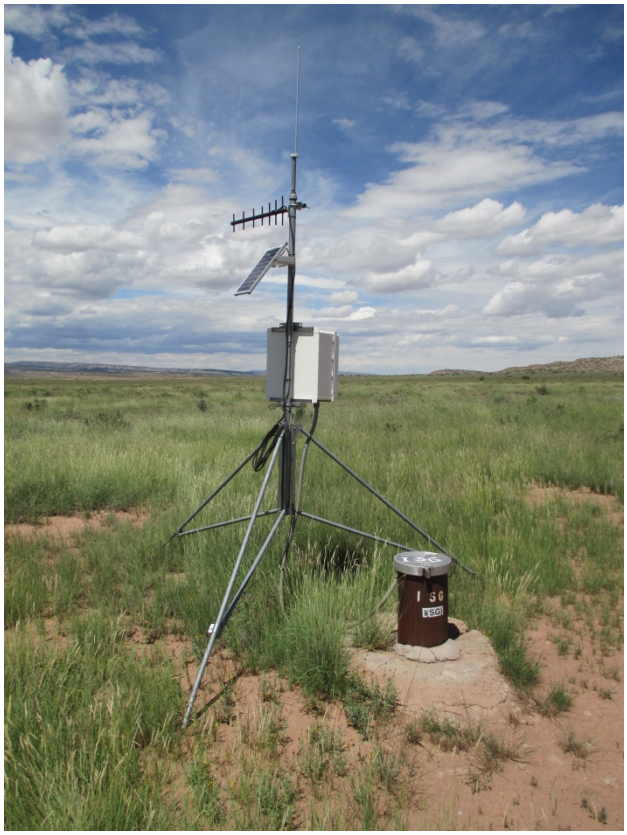
Photograph Location Number	Azimuth	Photograph Description
PL-1	35	Site entrance gate.
PL-2	340	Perimeter sign P2.
PL-3	135	Boundary monument BM-18.
PL-4	345	Site marker.
PL-5	330	Monitoring well I(SG) and water level monitoring telemetry tower.
PL-6	260	Acid tailings disposal area adjacent to main tailings disposal cell.
PL-7	10	Vegetation on main tailings disposal cell top slope.
PL-8	75	Ponded water in shallow depressions on main tailings disposal cell top slope.
PL-9	210	Carbonate tailings disposal cell viewed from main tailings disposal cell.
PL-10	15	Exposed radon barrier surface on carbonate tailings disposal cell top slope.
PL-11	150	Depression on top slope of carbonate disposal cell.
PL-12	345	Asbestos disposal area.
PL-13	165	Cover of PCB disposal area.
PL-14	120	East landfill.

BLU 8/2014. PL-1. Site entrance gate.

BLU 8/2014. PL-2. Perimeter sign P2.

BLU 8/2014. PL-3. Boundary monument BM-18.

BLU 8/2014. PL-4. Site marker.



BLU 8/2014. PL-5. Monitoring well I(SG) and water level monitoring telemetry tower.

BLU 8/2014. PL-6. Acid tailings disposal area adjacent to main tailings disposal cell.

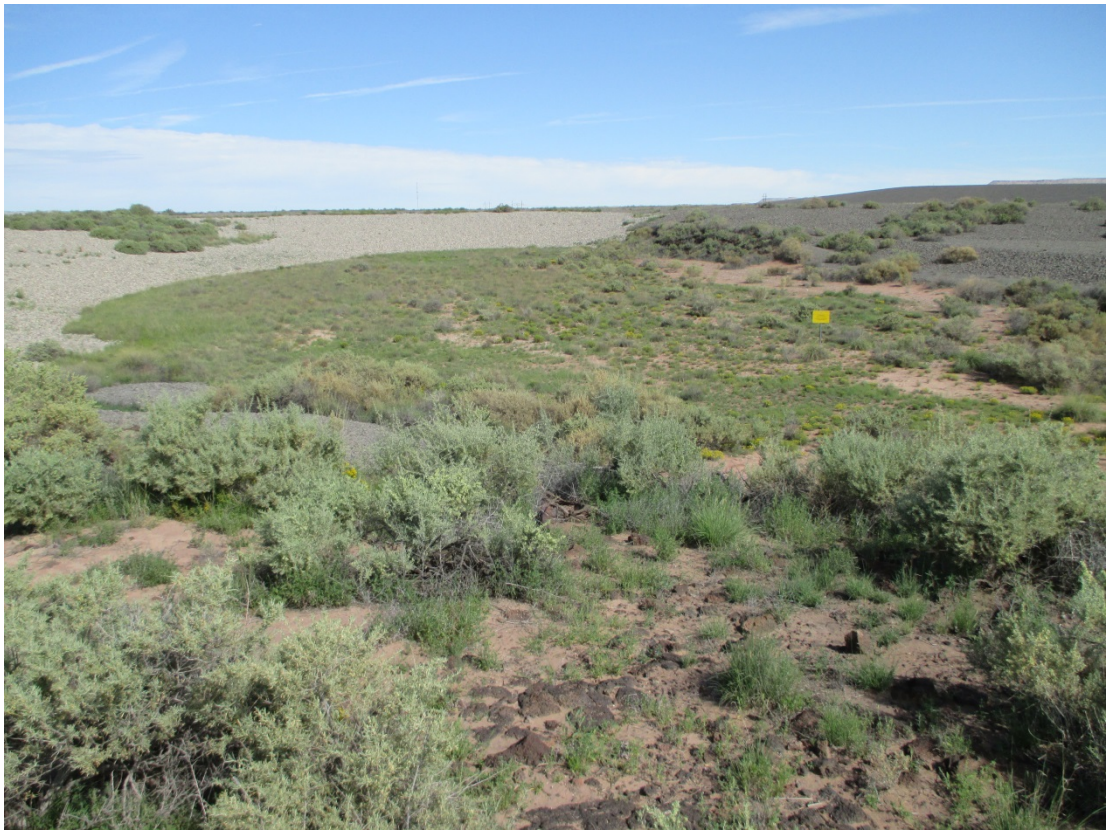
BLU 8/2014. PL-7. Vegetation on main tailings disposal cell top slope.

BLU 8/2014. PL-8. Ponded water in shallow depressions on main tailings disposal cell top slope.

BLU 8/2014. PL-9. Carbonate tailings disposal cell viewed from main tailings disposal cell.

BLU 8/2014. PL-10. Exposed radon barrier surface on carbonate tailings disposal cell top slope.

BLU 8/2014. PL-11. Depression on top slope of carbonate disposal cell.



BLU 8/2014. PL-12. Asbestos disposal area.

BLU 8/2014. PL-13. Cover of PCB disposal area.

BLU 8/2014. PL-14. East landfill.

2.0 Edgemont, South Dakota, Disposal Site

2.1 Compliance Summary

The Edgemont, South Dakota, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title II Disposal Site was inspected on July 1, 2014. The disposal cell and all associated surface-water diversion and drainage structures were in excellent condition and functioning as designed. Inspectors identified no maintenance needs or cause for a follow-up inspection.

2.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the Edgemont site are specified in the *Long-Term Surveillance Plan for the DOE Tennessee Valley Authority (UMTRCA Title II) Disposal Site, Edgemont, South Dakota,* (U.S. Department of Energy [DOE], Grand Junction, Colorado, June 1996) and in procedures established by DOE to comply with the requirements of Title 10 *Code of Federal Regulations* Section 40.28 (10 CFR 40.28). Table 2-1 lists these requirements.

Table 2-1. License Requirements for the Edgemont, South Dakota, Disposal Site

Requirement	Long-Term Surveillance Plan	This Report
Annual Inspection and Report	Sections 3.3 and 3.4	Section 2.4
Follow-up Inspections	Section 3.5	Section 2.5
Routine Maintenance and Emergency Measures	Section 3.6	Section 2.6
Environmental Monitoring	Section 3.7	Section 2.7

2.3 Institutional Controls

The 360-acre site is owned by the United States of America and was accepted under the U.S. Nuclear Regulatory Commission general license (10 CFR 40.28) in 1996. DOE is the licensee and, in accordance with the requirements for UMTRCA Title II sites, is responsible for the custody and long-term care of the site. Institutional controls at the site include federal ownership of the property and the following features that are inspected annually: a site marker, boundary monuments, warning/no-trespassing signs, and a perimeter fence and its access gates.

2.4 Inspection Results

The site, located approximately 2 miles south of the town of Edgemont in Fall River County near the southwestern corner of South Dakota, was inspected on July 1, 2014. The inspection was conducted by R. Johnson and D. Traub of The S.M. Stoller Corporation, a wholly owned subsidiary of Huntington Ingalls Industries (Stoller). Stoller is the Legacy Management Support contractor at the DOE office in Grand Junction, Colorado. W. Dam (DOE Site Manager) also attended the inspection.

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

2.4.1 Site Surveillance Features

The locations of site surveillance features are shown on Figure 2-1. 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 on Figure 2-1 by photograph location (PL) numbers.

2.4.1.1 Site Access, Entrance Sign, and Gates

Access to the Edgemont site is immediately off County Road 6N. No private property is crossed to gain access. The entrance sign was in excellent condition.

A tubular metal entrance gate is secured by a locked chain and was in excellent condition (PL-1). Three wire gates are along the perimeter fence: at the northwest corner of the property; approximately 700 feet north of the southeast corner; and at the southeast corner of the site. All gates were closed and in good condition.

2.4.1.2 Perimeter Fence and Perimeter Signs

A four-strand barbed-wire fence was installed in 1999 along the site perimeter to demarcate DOE property and to control grazing on the property. The fence truncates the southeast corner to allow livestock access to a preexisting stock pond. A grazing license granted by DOE allows a local rancher to graze his cattle on the site; in return, the rancher monitors site security and maintains the perimeter fence. The fence was in excellent condition. The two warning or perimeter signs, located next to access gates, were in excellent condition.

2.4.1.3 Site Marker

One granite site marker identifying the site is just inside the entrance gate and was in excellent condition (PL-2).

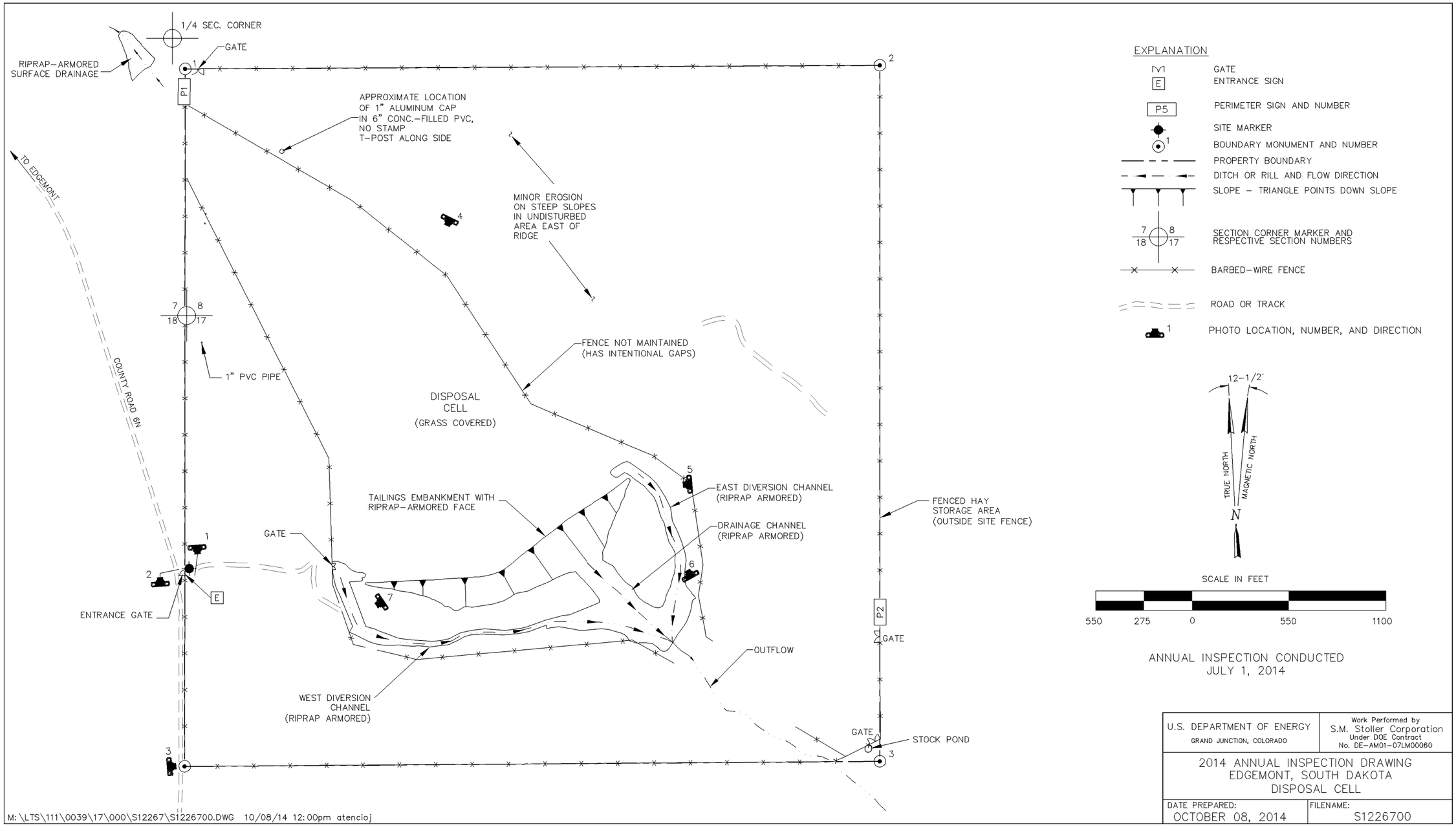
2.4.1.4 Boundary Monuments

Boundary monuments are located at each of the four corners of the property. The observed monuments were in excellent condition (PL-3).

2.4.2 Inspection Areas

In accordance with the Long-Term Surveillance Plan (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 grass-covered disposal cell top; (2) the riprap-covered embankment face and associated drainage and diversion channels; (3) the region between the disposal cell and the site perimeter; and (4) the outlying area.

Within each area, inspectors examined the specific site surveillance features and looked for evidence of erosion, settling, slumping, or other disturbances that might affect the site's integrity, protectiveness, or long-term performance.



EXPLANATION

- GATE
- E — ENTRANCE SIGN
- P5 — PERIMETER SIGN AND NUMBER
- SITE MARKER
- 1 — BOUNDARY MONUMENT AND NUMBER
- PROPERTY BOUNDARY
- DITCH OR RILL AND FLOW DIRECTION
- SLOPE – TRIANGLE POINTS DOWN SLOPE
- 7 8 / 18 17 — SECTION CORNER MARKER AND RESPECTIVE SECTION NUMBERS
- BARBED–WIRE FENCE
- ROAD OR TRACK
- 1 — PHOTO LOCATION, NUMBER, AND DIRECTION

SCALE IN FEET

550 275 0 550 1100

ANNUAL INSPECTION CONDUCTED
JULY 1, 2014

U.S. DEPARTMENT OF ENERGY GRAND JUNCTION, COLORADO	Work Performed by S.M. Stoller Corporation Under DOE Contract No. DE–AM01–07LM00060
2014 ANNUAL INSPECTION DRAWING EDGEMONT, SOUTH DAKOTA DISPOSAL CELL	
DATE PREPARED: OCTOBER 08, 2014	FILENAME: S1226700

Figure 2-1. 2014 Annual Inspection Drawing for the Edgemont, South Dakota, Disposal Site

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2.4.2.1 Top of the Disposal Cell

The 100-acre top of the disposal cell, completed in 1989, is grass-covered and was in good condition (PL-4). No signs of erosion, settling, or other modifying processes that might affect the integrity of the cell were noted.

2.4.2.2 Embankment Face and Drainage and Diversion Channels

The tailings embankment face, the steepest manmade slope onsite, is covered with riprap, and was in excellent condition (PL-5). The slope is stable, and the riprap showed no signs of degradation. Scattered plants, mostly grass and annual weeds, grow in the riprap. These plants do not threaten the stability or function of the embankment face.

Diversion and drainage channels are grass-covered on their upslope portions (these are gentle swales on each side of the disposal cell) and riprap-armored on their downslope portions and on steeper slopes. These structures were in excellent condition (PL-6 and PL-7). Grass in the vegetated portions of the channels upgradient of the tailings embankment was in good condition, and there was no evidence of erosion. Minor amounts of vegetation are present in the riprap. The vegetation helps to stabilize these areas and does not impair the function of the channels. Precipitation runoff pooling and wetland vegetation are present at the base of the diversion channels.

2.4.2.3 Region Between the Disposal Cell and the Site Perimeter

The area between the disposal cell and the site perimeter consists of undisturbed areas covered with native shrubs, grasses, and forbs, and formerly disturbed areas covered primarily with seeded grasses and annual weeds. Some minor erosional features are present on steep slopes in an area isolated from the disposal cell; these features were stable.

2.4.2.4 Outlying Area

The site is surrounded by private land used primarily for grazing and wildlife habitat. The area approximately 0.25 mile beyond the site boundary was inspected from within the boundary fence. A surface drainage area just outside the northwest corner of the property, riprap-armored to prevent headward erosion onto the site, was stable and in good condition. The town of Edgemont operates a municipal landfill north-northwest of the site, and minor amounts of windblown trash have been observed onsite or along the fences; however, landfill trash was insignificant at the site this year. There was no evidence of activity or changes in land use that could affect the site.

2.5 Follow-up Inspections

DOE 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) DOE 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 during the inspection.

2.6 Routine Maintenance and Emergency Measures

No maintenance needs were identified.

Emergency measures are corrective actions that DOE will take in response to unusual damage or disruption that threatens or compromises site health and safety, security, integrity, or compliance with 40 CFR 192. No emergency measures were identified.

2.7 Environmental Monitoring

In accordance with the LTSP, groundwater monitoring is not required at this site due to the presence of a 300- to 700-foot-thick layer of competent, unweathered shale bedrock lying between the encapsulated tailings and the uppermost confined aquifer. Additionally, clay liners were constructed to isolate the tailings from the shallower, unconfined, perched groundwater present as a result of local precipitation. There is no evidence of any direct hydraulic connection between the perched groundwater and the underlying confined bedrock aquifer.

An annual visual inspection of vegetation conditions at the site is required by the LTSP. The vegetation across the site was in excellent condition. There were no cattle grazing on the site during the inspection, and there were no indications that cattle had been on the site in 2014. A separate vegetation monitoring program was initiated in 2009 to monitor the effects of grazing. Vegetation monitoring data will be evaluated to manage the grazing in order to maintain healthy ecological conditions at the site.

2.8 Photographs

Photograph Location Number	Azimuth	Description
PL-1	180	Site entrance gate and sign.
PL-2	NA	Site marker.
PL-3	90	Boundary monument BM-4 near fence corner post.
PL-4	210	View south across disposal cell surface.
PL-5	270	View west across tailings embankment.
PL-6	80	East diversion channel.
PL-7	225	West diversion channel.

EDG 7/2014. PL-1. Site entrance gate and sign.

EDG 7/2014. PL-2. Site marker.

EDG 7/2014. PL-3. Boundary monument BM-4 near fence corner post.

EDG 7/2014. PL-4. View south across disposal cell surface.

EDG 7/2014. PL-5. View west across tailings embankment.

EDG 7/2014. PL-6. East diversion channel.

EDG 7/2014. PL-7. West diversion channel.

3.0 L-Bar, New Mexico, Disposal Site

3.1 Compliance Summary

The L-Bar, New Mexico, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title II Disposal Site was inspected on August 19, 2014. The tailings impoundment was in excellent condition. Erosion and vegetation measurements to monitor the condition of the impoundment cover indicated that no erosion is occurring, and perennial vegetation foliar cover at the measurement plots continued to be substantially less than measured during the 2012 inspection due to continuing drought conditions. Inspectors identified no maintenance needs or cause for a follow-up inspection.

Triennial groundwater monitoring was conducted in November 2013. No compliance limits or standards were exceeded, and there are no upward trends in contaminant concentrations.

3.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the L-Bar site are specified in the *Long-Term Surveillance Plan for the U.S. Department of Energy L-Bar, New Mexico, (UMTRCA Title II) Disposal Site, Seboyeta, New Mexico* (DOE−LM/GJ709−2004, September 2004) and in procedures established by the U.S. Department of Energy (DOE) to comply with the requirements of Title 10 *Code of Federal Regulations* Section 40.28 (10 CFR 40.28). Table 3-1 lists these requirements.

Table 3-1. License Requirements for the L-Bar, New Mexico, Disposal Site

Requirement	Long-Term Surveillance Plan	This Report
Annual Inspection and Report	Section 3.3 and 3.4	Section 3.4
Follow-up Inspections	Section 3.5	Section 3.5
Routine Maintenance and Emergency Measures	Section 3.6	Section 3.6
Environmental Monitoring	Section 3.7	Section 3.7

3.3 Institutional Controls

The 738-acre site is owned by the United States of America and was accepted under the U.S. Nuclear Regulatory Commission (NRC) general license (10 CFR 40.28) in 2004. DOE is the licensee and, in accordance with the requirements for UMTRCA Title II sites, is responsible for the custody and long-term care of the site. Institutional controls at the site include federal ownership of the property and the following features that are inspected annually: a site marker, boundary monuments, and warning/no-trespassing signs.

3.4 Inspection Results

The site, located approximately 15 miles north of Laguna, New Mexico, and 2 miles east of Seboyeta, New Mexico, was inspected on August 19, 2014. The inspection was conducted by R. Johnson, D. Traub, M. Kastens, and L. Sheader of The S.M. Stoller Corporation, a wholly owned subsidiary of Huntington Ingalls Industries (Stoller). Stoller is the Legacy Management Support contractor at the DOE office in Grand, Junction, Colorado. D. Barr, the DOE Site Manager, and K. Conway, R. Evans, and J. Parrott of NRC attended the inspection.

The purposes of the inspection were to confirm the integrity of the visible features at the site, to identify changes in conditions that might affect site integrity, and to determine the need, if any, for maintenance or additional inspection and monitoring. Numbers in the left margin of this report refer to items summarized in Table ES-1 of the "Executive Summary."

3.4.1 Site Surveillance Features

The locations of site surveillance features are shown on Figure 3-1. 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 on Figure 3-1 by photograph location (PL) numbers.

3.4.1.1 Site Access and Interior Roads

Access to the L-Bar site is via a public gravel road (Cibola County Road 1). Approximately 300 feet of Cebolleta Land Grant property is crossed to enter the site, and access is provided for and described in the warranty and quitclaim deed for the site. The access road was in good condition.

Interior tertiary dirt roads and tracks are present to access DOE assets. Portions of the roads are susceptible to erosion and are repaired when they become impassable. All roads used during the inspection were in good condition.

3.4.1.2 Signs and Boundary Monuments

Entrance signs installed on metal posts are located at three access points to the site. Entrance signs E1 (main site entrance) and E2 (along the east access road) have several bullet holes but are legible (PL-1). Thirty-four warning or perimeter signs are attached to a barbed-wire fence that surrounds the disposal site structures. The perimeter signs were in good condition.

Eight flush-mounted boundary monuments define the site boundary; some are set in concrete and some consist of aluminum caps on rebar driven into the ground (PL-2). The boundary monuments observed during the inspection were in excellent condition.

3.4.1.3 Fence and Gates

A barbed-wire stock fence encompasses the tailings impoundment and associated drainage structures and is intended to prohibit trespassing and livestock intrusion on the tailings impoundment structures. The fence is located as much as 3,300 feet inside the property boundary, and the area between the fence and the boundary is grazed in accordance with a DOE grazing license with the Cebolleta Land Grant that owns the surrounding property. Four tubular steel gates with DOE locks allow vehicle access through the fence (PL-3). The fence and gates were in excellent condition.

3.4.1.4 Site Marker

A granite site marker is located north of the disposal cell adjacent to the site access road. The marker was in excellent condition (PL-4).

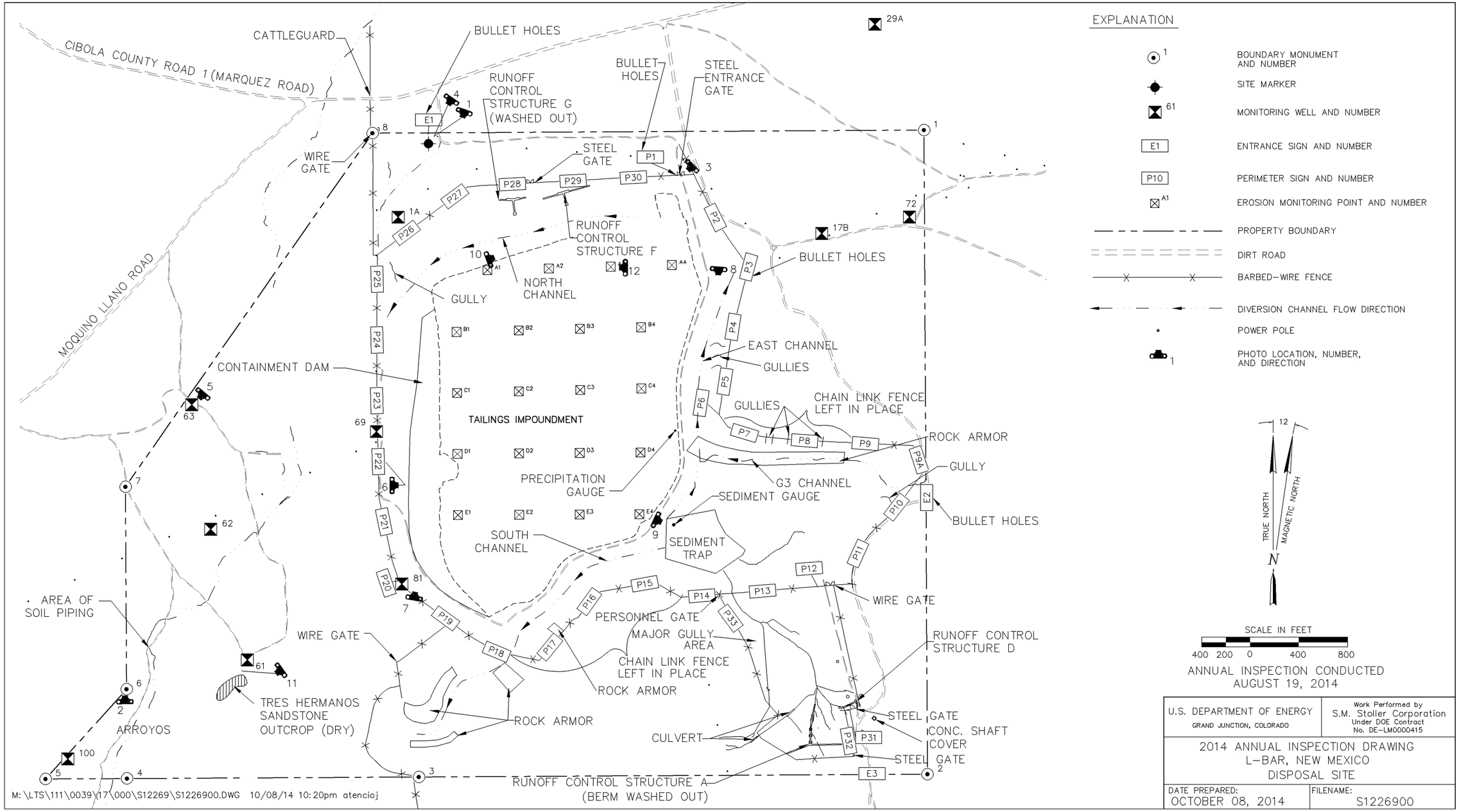

Figure 3-1. 2014 Annual Inspection Drawing for the L-Bar, New Mexico, Disposal Site

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3.4.1.5 Monitoring Wells

The site groundwater-monitoring network consists of 10 wells. Nine of the wells are located on DOE property; monitoring well 29A is located outside the northeast corner of the site. All of the wells were locked and in good condition (PL-5). Some well locations do not have established access roads or tracks but are accessible by 4-wheel drive vehicle if the ground is dry.

3.4.2 Inspection Areas

In accordance with the Long-Term Surveillance Plan (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 cover of the tailings impoundment; (2) the containment dam; (3) the diversion channels; and (4) the site perimeter, outlying areas, and balance of the site.

Within each area, inspectors examined the specific site surveillance features and looked for evidence of erosion, settling, slumping, or other disturbances that might affect the site's integrity, protectiveness, or long-term performance.

3.4.2.1 Cover of the Tailings Impoundment

The soil-covered tailings impoundment, completed in 2000, occupies approximately 100 acres. Its surface is minimally sloped to the west toward the central portion of the containment dam to promote drainage and minimize runoff water velocities and the potential for erosion. Although the cover was not seeded because plant growth was not expected to be successful, revegetation is occurring naturally with native species. The establishment and maturing of vegetation is expected to reduce wind and water erosion of the surface and help prevent precipitation from infiltrating into the tailings.

Cracks are usually present in the surface soil of the tailings impoundment cover. They are confined to the upper couple of feet of the cover soil and appear to result from drying of the gypsum-rich soil after precipitation events. The cracks tend to heal as they fill with windblown sediment and as perennial vegetation continues to establish.

In accordance with the LTSP, erosion and vegetation are monitored on the impoundment cover. Section 3.7.2 describes the monitoring program and presents the results to date.

3.4.2.2 Containment Dam

The tailings impoundment was constructed by damming the head of a natural drainage basin. The face of the earthen containment dam has a 20 percent slope and is rock-armored to prevent erosion and degradation. Large-diameter rock was used to protect the central portion of the containment dam where runoff from the tailings impoundment surface would spill (PL-6). Native vegetation is well established on the face, which is desirable for increasing the erosion protection of the surface (PL-7). There were no indications of erosion, settlement, seeps, or other modifying processes that might affect the integrity of the dam.

3.4.2.3 Diversion Channels

The surface water diversion system consists primarily of the east, north, and south channels that divert runoff water away from the impoundment. The system is designed to accommodate probable maximum flood discharges.

Runoff from an upgradient watershed east of the tailings impoundment is designed to be conveyed away from the site to a northeastward-flowing drainage via the east channel. The east channel is separated from the impoundment by a dike. Gullies are present along the east slope of the east channel, but the erosion and sediment deposition are not impairing the function of the channel (PL-8).

A tributary channel, the G3 channel, was constructed to divert runoff from a smaller watershed into the east channel. Gullies have formed along the north slope of the G3 channel. The erosion is not impairing the function of the channel, but gullies are encroaching on the perimeter fence in that area. This area will be monitored, and repairs will be made as needed to ensure the integrity of the fence.

Some erosion was expected to occur in a watershed that encompasses the southeast portion of the site and adjacent property. Storm runoff from this watershed discharges into a sediment trap, where the sediment load is expected to settle out. If a runoff event overtops the sediment trap, the flow is diverted to the east channel; the sediment trap has not been overtopped yet. The sediment trap had a couple of inches of standing water at the time of the inspection (PL-9).

The sediment trap was designed to function for 600 years before accumulated sediment would need to be removed. However, multiple high-intensity storm events since the completion of site reclamation have caused deep gullies to form in the highly erodible soils and fill materials upgradient of the sediment trap, resulting in an accelerated rate of sediment deposition in the sediment trap. Construction of runoff control structures to reduce the rate of erosion in the area and prevent headward migration of gullies into adjoining private property was completed in January 2010. Runoff from a storm event in September 2011 overtopped an earthen runoff control berm and caused substantial damage to the berm. Repairs are not planned at this time because erosion from this area is not impacting the integrity of the tailings impoundment.

Runoff water from the area north of the tailings impoundment is captured by the north channel (PL-10). The water is diverted away from the site to the west. Deep gullies had formed in the weathered shale and alluvium along a portion of the north bank of the channel, and headward erosion was rapidly migrating to the north toward the site access road and property boundary. The eroded channel bank was restored to its original design configuration, and two runoff control structures were constructed to reduce erosion and sedimentation; construction was completed in January 2010. The east structure (Structure F) was in good condition at the time of the inspection. The west structure (Structure G), however, suffered severe erosion during runoff events in August and September 2011 and continues to erode. Repairs are not planned at this time because erosion from this area is not impacting the integrity of the tailings impoundment.

The south channel diverts storm runoff from the higher terrain immediately south of the tailings impoundment toward the channel outlet to the west. Two riprap aprons are present on the north-facing slope (south bank) to inhibit erosion along natural drainage paths. Minor erosion is

occurring on the unprotected slope surfaces, resulting in some sediment accumulation in the channel. The erosion and sediment deposition are not impairing the function of the channel.

3.4.2.4 Site Perimeter, Outlying Areas, and Balance of the Site

The site is surrounded by open private land that is used primarily for grazing. Uranium exploration activities, mine reclamation activities, and associated access road construction are occurring on properties adjacent to the site. These activities do not appear to be detrimental to site security.

A Tres Hermanos sandstone unit of the Mancos Shale crops out in the southwest corner of the site. This unit is hydraulically connected to contaminated groundwater under the impoundment, and the outcrop is considered to be a potential evapotranspiration area. There was no indication of seepage or evaporation at the outcrop (PL-11). This location will continue to be monitored for seepage and recommended for sampling if seep water is present.

Several legacy features, including concrete pads (a large pad covers the mine shaft) and abandoned sewer manholes, are near the southeast corner of the site. These features will be monitored to ensure that they remain in a safe condition.

The access road to monitoring well 100, located in the southwest corner of the site, is damaged by subsurface erosion (soil piping) near the head of an arroyo. The affected area has been mapped, metal fence posts have been installed next to soil collapse features, and the information is shown on the inspection and sampling maps to prevent injury or vehicle damage.

3.5 Follow-up Inspections

DOE 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) DOE 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 during the inspection.

3.6 Routine Maintenance and Emergency Measures

No maintenance needs were identified during the inspection.

Emergency measures are corrective actions that DOE will take in response to unusual damage or disruption that threatens or compromises site health and safety, security, integrity, or compliance with 40 CFR 192. No emergency measures were identified.

3.7 Environmental Monitoring

3.7.1 Groundwater Monitoring

Groundwater monitoring is required at the L-Bar site. The monitoring network consists of 10 DOE wells on or adjacent to the site, and two Moquino Water Users Association wells approximately 2 miles west of the site in the village of Moquino. Table 3-2 lists the wells that are in the monitoring network. Samples are analyzed for chloride, nitrate, selenium, sulfate, total dissolved solids, and uranium. Analytical results are compared to the LTSP-required

concentration limits listed in Table 3-3 that consist of alternate concentration limits (ACLs) granted by NRC and alternate abatement standards (AASs) stipulated by the New Mexico Environment Department.

If an ACL or AAS is exceeded in any specified well (Table 3-3), DOE will inform NRC of the exceedance and conduct confirmatory sampling. If confirmatory sampling verifies the exceedance, DOE will develop an evaluative monitoring work plan and submit that plan to NRC for review prior to initiating the evaluative monitoring program. Results of the evaluative monitoring program will be used, in consultation with NRC, to determine if corrective action is necessary.

Table 3-2. Groundwater Monitoring Network for the L-Bar, New Mexico, Disposal Site

Monitoring Well	Network Application
1A	POC source zone well
17B	POC source zone well
29A	Background well
61	Seepage indicator well
62	Seepage affected area indicator well
63	POE seepage indicator well
69	POC source zone well
72	POE well on east property boundary
81	POC source zone well
100	POE well on west property boundary
Moquino New	Public water supply well in Moquino
Moquino Old	Backup public water supply well in Moquino

Key: POC = point-of-compliance; POE = point-of-exposure

Table 3-3. Groundwater Alternate Concentration Limits and Alternate Abatement Standards for the L-Bar, New Mexico, Disposal Site

Analyte	New Mexico Standard	ACL (Wells 1A, 17B, 69, 81)	AAS Source Zone (Wells 1A, 17B, 69, 81)	AAS Affected Area (Well 62)
Chloride (mg/L)	250	NA	1,127	NA
Nitrate (mg/L)	10.0	NA	1,180	NA
Selenium (mg/L)	0.05	2.0	2.0	NA
Sulfate (mg/L)	4,000[a]	NA	13,110	5,185
TDS (mg/L)	5,880[a]	NA	20,165	7,846
Uranium (mg/L)	5.0	13.0	13.0	NA

Key: AAS = alternate abatement standard; ACL = alternate concentration limit; mg/L = milligrams per liter; NA = not applicable; TDS = total dissolved solids
[a] Background value.

As stipulated in the LTSP, the requirements for annual groundwater monitoring were met in 2007. Consequently, the sampling frequency changed to once every 3 years beginning in fall 2010 in accordance with the LTSP. Groundwater monitoring will continue as long as a New Mexico standard (Table 3-3) is exceeded in any well.

3A Groundwater monitoring was conducted in November 2013, and the results are provided in Table 3-4. The Moquino Old well was out of service and could not be sampled. The next sampling event will occur in 2016.

Table 3-4. November 2013 Groundwater Monitoring Results for the L-Bar, New Mexico, Disposal Site

Monitoring Well	Analyte (mg/L)[a,b]					
	Chloride	Nitrate[c]	Selenium	Sulfate	TDS	Uranium
1A	*433*	0.0667	ND	*4,640*	*8,050*	0.00769
17B	*423*	*590*	*0.3*	*4,750*	*11,600*	0.0316
29A	175	ND	ND	*4,380*	*6,990*	0.000122
61	102	0.216	ND	2,980	4,990	0.000325
62	44.8	ND	ND	541	1,470	0.000073
63	40.6	ND	ND	513	1,420	0.000111
69	*684*	ND	ND	*9,930*	*16,800*	1.85
72	174	4.31	0.00625	3,900	*6,180*	0.00805
81	193	*15.8*	*0.0733*	*4,730*	*7,710*	0.0226
100	29	1.17	ND	2,430	3,850	0.00179
Moquino New	6.42	0.132	ND	91.9	459	0.000097
Moquino Old	NS	NS	NS	NS	NS	NS

Key: mg/L = milligrams per liter; ND = not detected (below laboratory detection limit); NS = not sampled; TDS = total dissolved solids

[a] Significant digits are reported by the laboratory and are based on detection limits.

[b] *Italicized* results exceed a New Mexico standard.

[c] Nitrate plus nitrite as nitrogen (NO_3 + NO_2 as N).

No ACL or AAS Source Zone levels were exceeded in any of the POC wells, and no AAS Affected Area levels were exceeded in monitoring well 62. Therefore, the groundwater at the site is in compliance with the LTSP requirements. Currently, there are no trends that suggest that an ACL, AAS Source Zone, or AAS Affected Area concentration will be exceeded. At least one New Mexico standard is exceeded in six of the DOE wells, including background well 29A (sulfate and total dissolved solids).

3.7.2 Erosion Monitoring Program

An erosion monitoring program (EMP) was developed to address potential erosion of the tailings impoundment cover over time and was incorporated as an LTSP requirement. SOHIO Western Mining Company developed the plan at the request of the New Mexico Water Quality Control Commission as a condition for granting alternate abatement standards for groundwater at the site.

The cover of the impoundment consists of a 4.1-foot-thick (minimum) compacted layer of clay to function as a radon barrier, overlain by clay-rich soil materials. Total thickness of the cover ranges from 6 to 10 feet. The EMP has two parts: (1) measuring erosion and (2) measuring the
3B progress of revegetation. Measurements were made during the annual site inspection on August 19, 2014.

3.7.2.1 Erosion Monitoring

In accordance with the EMP, the former licensee installed a grid of 20 evenly spaced monitoring points on the cover in November 2003. These points are shown on Figure 3-1. The locations were initially measured in December 2003 to establish a baseline data set.

Each monitoring point consists of a 5-foot length of half-inch-diameter, epoxy-coated rebar surrounded by three metal t-posts that were installed to help locate the rebar and provide orientation for the measurements. The rebar was driven at each point such that approximately 1 foot remained above the cover surface. Each rebar has a metal tag indicating the point location number (the tag for monitoring point A2 is missing). The t-posts are set approximately 6 feet from the rebar and form an equilateral triangle, with one point of the triangle due east of the rebar.

Erosion measurement is accomplished by placing a 4-foot-long level centered at the base of the rebar such that the east end of the level points to the easternmost t-post. The height of the rebar is measured from the base of the level to the top of the rebar and is recorded to the nearest 1/16 inch, using the method established during baseline measurements in 2003.

In accordance with Appendix C of the LTSP, erosion measurements will be performed annually for 20 years (through 2024) and once every 10 years for the following 80 years. Erosion will be considered excessive when 2 feet of erosion is noted at more than half of the monitoring points. If this occurs, DOE will initiate discussions with NRC to assess likely remedial scenarios and develop an appropriate mitigation protocol, if required.

Results of the 2014 measurements are presented in Table 3-5. Baseline measurements are included for comparison. The surface elevation has increased at all of the monitoring points when compared to the baseline measurements. These results indicate that the surface of the disposal cell is accreting instead of eroding. The vegetation on the cover may be raising the surface elevation through root growth, the accumulation of organic materials in the surface soil, or the trapping of windblown sediment derived from locations upwind of the tailings impoundment.

3.7.2.2 Vegetation Monitoring

DOE established 10 vegetation monitoring locations to measure the progress of revegetation over time. Plots were established at existing erosion monitoring points to streamline measurement activities at the site (monitoring points A1, A3, B2, B4, C1, C3, D2, D4, E1, and E3). At each location, three t-posts were used to form three corners of the plot; the fourth point was projected south of the three t-posts to form a parallelogram covering approximately 100 square feet (PL-12).

The primary requirement is to measure the percentage of the foliar cover (canopy) of all live vegetation within the plot. Percent foliar cover represents the approximate total area under the maximum circumference of each of the live plants within the plot. In addition to estimating the cover of live plants, litter (organic detritus often consisting of dead annual plants), rock, bare ground, and plant species also were recorded.

Table 3-5. Surface Elevation Changes on the L-Bar, New Mexico, Tailings Impoundment Cover Between 2003 and 2014

Monitoring Point	Length of Rebar Above Surface (inches)				Change in Surface Elevation[a] Baseline to Present (decimal inches)
	2003 (Baseline)		2014		
	(fraction)	(decimal)	(fraction)	(decimal)	
A1	12 10/16	12.625	10 10/16	10.625	2.000
A2	12 7/16	12.438	11 14/16	11.875	0.563
A3	12 15/16	12.938	11 10/16	11.625	1.313
A4	12 6/16	12.375	11 6/16	11.375	1.000
B1	12 10/16	12.625	10 10/16	10.625	2.000
B2	12 8/16	12.500	12 0/16	12.000	0.500
B3	13 0/16	13.000	12 3/16	12.188	0.812
B4	12 15/16	12.938	11 5/16	11.313	1.625
C1	12 8/16	12.500	10 14/16	10.875	1.625
C2	13 1/16	13.063	12 8/16	12.500	0.563
C3	12 2/16	12.125	11 2/16	11.125	1.000
C4	12 6/16	12.375	11 14/16	11.875	0.500
D1	12 7/16	12.438	11 12/16	11.750	0.688
D2	12 12/16	12.750	12 3/16	12.188	0.562
D3	12 3/16	12.188	11 3/16	11.188	1.000
D4	12 12/16	12.750	12 8/16	12.500	0.250
E1	13 1/16	13.063	11 11/16	11.688	1.375
E2	12 14/16	12.875	11 12/16	11.750	1.125
E3	12 9/16	12.563	12 0/16	12.000	0.563
E4	12 15/16	12.938	11 9/16	11.563	1.375

[a] A positive change indicates that the surface elevation at that point increased; a negative change indicates that the surface elevation at that point decreased.

The average foliar cover of live vegetation in the vicinity of the L-Bar disposal site, according to the U.S. Department of Agriculture and estimated from observation, is approximately 25 percent. The predominant vegetation in the area consists of perennial grasses, forbs, and shrubs. In accordance with the EMP, DOE will perform annual vegetation measurements until at least 20 percent foliar cover is achieved, and this criterion will be satisfied when more than half of the measurement plots exceed 20 percent cover. Because annual and biennial plants do not necessarily germinate each year, and their germination is highly dependent upon weather conditions, it is assumed that this criterion is based on perennial plant cover. Once the success criterion is met, annual monitoring will not be required unless a significant reduction in plant density is noted during an annual site inspection; then, the plots will be measured again. Annual vegetation monitoring will continue until the success criterion has again been satisfied.

Results of the 2014 measurements, compared to the 2012 and 2013 measurements, are presented in Table 3-6. Perennial plant species observed within the monitoring plots include Nelson's globemallow (*Sphaeralcea parvifolia*), silverleaf nightshade (*Solanum elaeagnifolium*), Bigelow's tansyaster (*Macaeranthera bigelovii*), bottlebrush squirreltail (*Elymus elymoides*), James'galleta grass (*Pleuraphis jamesii*), broom snakeweed (*Gutierrezia sarothrae*), rubber rabbitbrush (*Ericameria nauseosa*), and fourwing saltbush (*Atriplex canescens*). Only one of the plots contained more than 20 percent perennial foliar cover in 2014. Although vegetation is well established on the impoundment cover (PL-12), the continued minimal perennial plant cover at

the vegetation plots is most likely due to the extended drought. Annual vegetation monitoring will continue until six or more plots meet or exceed the 20 percent foliar cover requirement.

Table 3-6. Comparison of Perennial Plant Cover on the L-Bar, New Mexico, Tailings Impoundment Cover from 2012 Through 2014

Plot Location	Percent Perennial Plant Cover in 100-ft^2 Plots		
	2012	2013	2014
A1	28	12	10
A3	12	7	8
B2	0	0	0
B4	23	13	8
C1	24	7	16
C3	2	2	1
D2	10	9	7
D4	5	1	3
E1	25	5	25
E3	12	6	5

3.8 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL-1	200	Entrance sign E1 and site marker.
PL-2	0	Boundary monument BM-6.
PL-3	225	Site entrance gate.
PL-4	215	Site marker.
PL-5	220	Monitoring well 63.
PL-6	90	Rock-armored tailings impoundment spillway.
PL-7	10	Tailings impoundment containment dam.
PL-8	185	East diversion channel.
PL-9	115	Vegetation and standing water in sediment trap.
PL-10	70	South bank of north diversion channel.
PL-11	235	Tres Hermanos sandstone unit outcrop (no seep).
PL-12	270	Erosion monitoring point and vegetation plot A3.

BAR 8/2014. PL–1. Entrance sign E1 and site marker.

BAR 8/2014. PL–2. Boundary monument BM-6.

BAR 8/2014. PL–3. Site entrance gate.

BAR 8/2014. PL–4. Site marker.

BAR 8/2014. PL–5. Monitoring well 63.

BAR 8/2014. PL–6. Rock-armored tailings impoundment spillway.

BAR 8/2014. PL–7. Tailings impoundment containment dam.

BAR 8/2014. PL–8. East diversion channel.

BAR 8/2014. PL–9. Vegetation and standing water in sediment trap.

BAR 8/2014. PL–10. South bank of north diversion channel.

BAR 8/2014. PL–11. Tres Hermanos sandstone unit outcrop (no seep).

BAR 8/2014. PL–12. Erosion monitoring point and vegetation plot A3.

4.0 Maybell West, Colorado, Disposal Site

4.1 Compliance Summary

The Maybell West, Colorado, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title II Disposal Site was inspected on August 5, 2014. The disposal cell, ancillary cell, and all associated surface-water diversion and drainage structures were in good condition and functioning as designed. The small shallow depression on top of the disposal cell has increased slightly in size but does not currently threaten the integrity or performance of the cell. Noxious weeds present on the site were treated with herbicide. Inspectors identified no other maintenance needs or cause for a follow-up inspection.

4.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the Maybell West site are specified in the *Long-Term Surveillance Plan for the Maybell West (UMTRCA Title II) Disposal Site, Moffat County, Colorado,* (LMS/MAW/S01879, U.S. Department of Energy [DOE] Office of Legacy Management, February 2010) and in procedures established by DOE to comply with the requirements of Title 10 *Code of Federal Regulations* Section 40.28 (10 CFR 40.28). Table 4-1 lists these requirements.

Table 4-1. License Requirements for the Maybell West, Colorado, Disposal Site

Requirement	Long-Term Surveillance Plan	This Report
Annual Inspection and Report	Sections 3.3 and 3.4	Section 4.4
Follow-up Inspections	Section 3.5	Section 4.5
Routine Maintenance and Emergency Measures	Section 3.6	Section 4.6
Environmental Monitoring	Section 3.7	Section 4.7

4.3 Institutional Controls

The 180-acre site is owned by the United States of America and was accepted under the U.S. Nuclear Regulatory Commission (NRC) general license (10 CFR 40.28) in 2010. DOE is the licensee and, in accordance with the requirements for UMTRCA Title II sites, is responsible for the custody and long-term care of the site. Institutional controls at the site include federal ownership of the property and the following features that are inspected annually: a site marker, warning/no-trespassing signs, and boundary monuments.

4.4 Inspection Results

The site, located approximately 4 miles north-northeast of the town of Maybell in Moffat County in northwestern Colorado, was inspected on August 5, 2014. The inspection was conducted by S. Hall and L. Sheader of The S.M. Stoller Corporation, a wholly owned subsidiary of Huntington Ingalls Industries (Stoller). Stoller is the Legacy Management Support contractor at the DOE office in Grand Junction, Colorado. J. Nguyen (DOE 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, to identify changes in conditions that might affect site integrity, and to determine the need, if any, for maintenance or additional inspections and monitoring.

4.4.1 Site Surveillance Features

The locations of site surveillance features are shown in Figure 4-1. 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 4-1 by photograph location (PL) numbers.

4.4.1.1 Site Access

Access to the site is provided via County Road 53 that 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 Maybell UMTRCA Title I disposal site (approximately 3 miles from U.S. Highway 40). The gravel-surfaced county road was in good condition.

From that point the access road continues west as a dirt two-track road on U.S. Bureau of Land Management (BLM) property and through a second unlocked gate. Just past the second gate the access road turns south and continues past an abandoned open pit uranium mine known as Rob Pit for approximately 0.5 mile where it meets the former haul road for the Maybell West site. The access road continues north on the former haul road for approximately 0.25 mile to the Maybell West UMTRCA Title II disposal site. The access road to the site was in good condition.

Because the portion of the access road that leads to the Maybell UMTRCA Title I disposal site is a county road, maintenance up to that point is performed by Moffat County. Beyond that point (identified by the first gate), DOE is responsible for maintenance of the remaining portion of the access road under a BLM right-of-way permit.

4.4.1.2 Fence and Entrance Gate

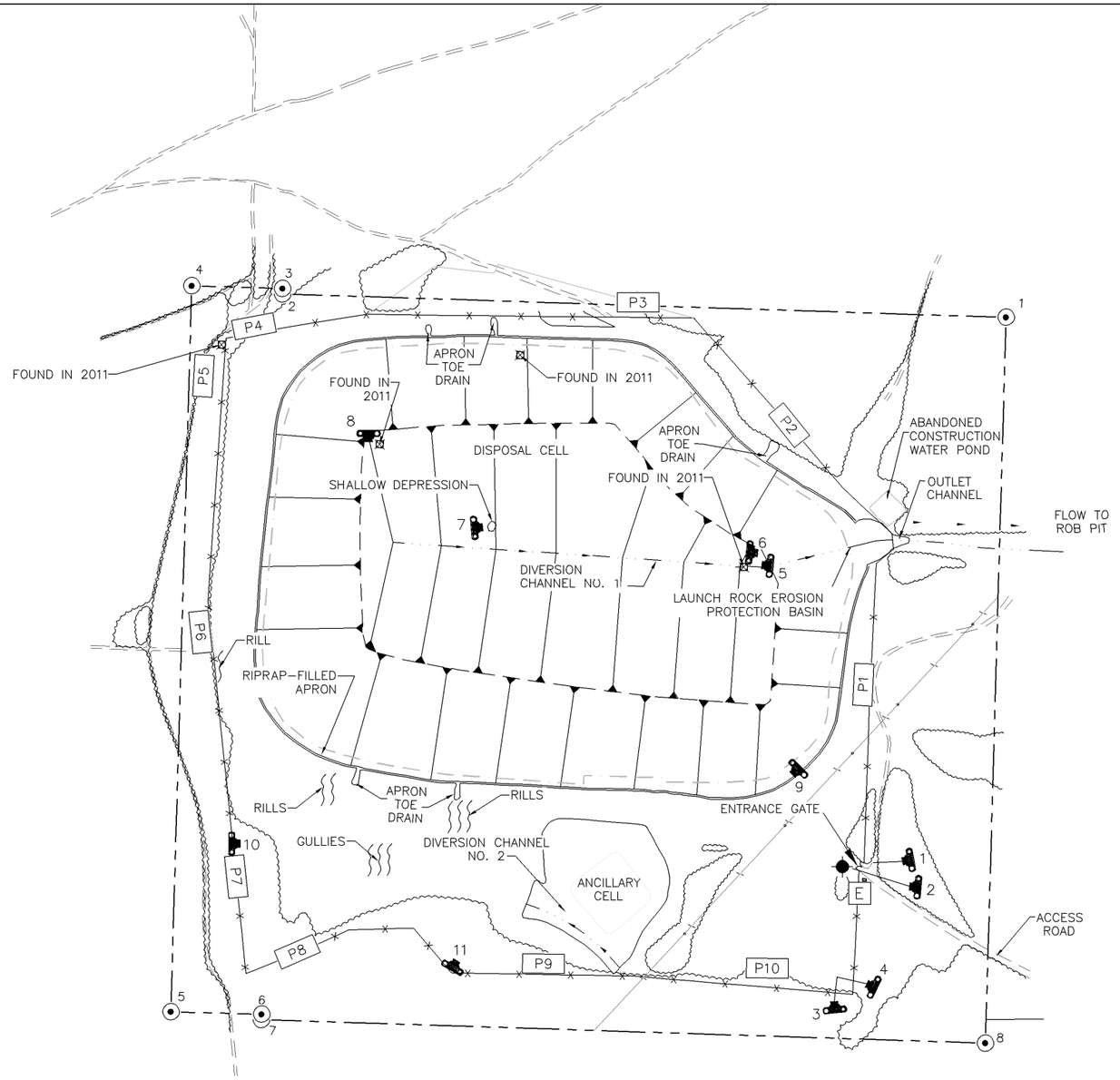
A standard four-strand barbed-wire stock fence surrounds the disposal cell, the ancillary cell, and the drainage structures to facilitate land management by DOE. The site is located in wintering grounds frequented by big game animals (primarily pronghorn, deer, and elk) and is also surrounded by open range land used for grazing by cattle. The fence was in good condition.

The entrance gate, a standard tubular metal stock gate, is located near the southeast corner of the site (PL-1). The gate was locked and in good condition. There are no other gates at the site.

4.4.1.3 Signs

The entrance sign is mounted on a perimeter fence metal t-post directly south of the entrance gate (PL-1). The entrance sign was in good condition.

Ten warning (perimeter) signs are mounted on perimeter fence metal t-posts around the site. The perimeter signs were in good condition.



N

SCALE IN FEET

500 250 0 500 1000

EXPLANATION

- E — ENTRANCE SIGN
- P1 — PERIMETER SIGN AND IDENTIFIER (APPROXIMATE LOCATION)
- SITE MARKER
- BOUNDARY MONUMENT AND IDENTIFIER
- MINING CLAIM LOCATOR STAKE
- PROPERTY BOUNDARY
- WIRE FENCE
- POWER LINE
- DIRT ROAD
- CHANGE IN SLOPE
- DRAINAGE AND FLOW DIRECTION
- SLOPE– TRIANGE POINTS DOWN SLOPE
- 1 — PHOTO LOCATION, NUMBER, AND DIRECTION

ANNUAL INSPECTION CONDUCTED
AUGUST 5, 2014

U.S. DEPARTMENT OF ENERGY GRAND JUNCTION, COLORADO	Work Performed by S.M. Stoller Corporation Under DOE Contract No. DE–AM01–07LM00060

2014 ANNUAL INSPECTION DRAWING
MAYBELL WEST, COLORADO
DISPOSAL SITE

DATE PREPARED:	FILENAME:
OCTOBER 08, 2014	S1227200

M:\LTS\111\0039\17\000\S12272\S1227200.DWG 10/08/14 12:30pm atencioj

Figure 4-1. 2014 Annual Inspection Drawing for the Maybell West, Colorado, Disposal Site

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4.4.1.4 Site Marker

One granite site marker is located on the site near the entrance gate (PL-2). The site marker was in good condition.

4.4.1.5 Boundary Monuments

Eight surveyed monuments are located on the site boundary outside of the fenced area. Four of the monuments are at the property corners, and the others define a slight offset that occurs along both the north and south boundaries where the fee land adjoins the BLM withdrawal area on the western portion of the site. The boundary monuments were not checked during the inspection.

4.4.2 Inspection Areas

In accordance with the Long-Term Surveillance Plan (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 top slope of the disposal cell; (2) the side slopes of the disposal cell; (3) the ancillary cell; (4) the diversion and drainage channels; and (5) the site perimeter and balance of the site.

Within each area, inspectors examined the specific site surveillance features for evidence of erosion, settling, slumping, or other disturbances that might affect the site's integrity, protectiveness, or long-term performance.

4.4.2.1 Top Slope of the Disposal Cell

The rock-covered disposal cell, a reclaimed former heap leach area that occupies about 60 acres of the site, was in good condition (PL-3 and PL-4). It rises to a maximum height of approximately 75 feet above the surrounding landscape.

The top slope of the cell was designed to drain surface-water runoff to the center and into riprap-armored Diversion Channel No. 1 (PL-5), which is graded toward and then down the east side slope of the cell (PL-6). Surface-water runoff ultimately discharges into a former open pit uranium mine (known as Rob Pit) east of the site. An erosion protection structure, referred to as the launch rock erosion protection basin (PL-6), was constructed at the outfall of Diversion Channel No. 1 to protect the disposal cell from head-cutting that may occur from the deep channel that runs into Rob Pit.

No evidence of slumping, erosion, or rock degradation was observed. However, a small shallow depression is present just north of Diversion Channel No. 1 (PL-7). This depression, approximately 25 feet long, 15 feet wide, and 1 foot deep in the center, appears to be the result of settlement of the underlying materials since completion of the cell. The depression has increased slightly in size since the last annual inspection (measurements during the 2013 inspection were 25 feet long, 10 feet wide, and 1 foot deep). Continued measurements of the depression will be performed during annual inspections to determine if additional settlement is occurring. The depression currently does not threaten the integrity or performance of the disposal cell.

Various species of plants were present on the cell top. Noxious weeds are controlled in accordance with the LTSP.

Several mining claim locator stakes were observed on the site during the 2010 and 2011 inspections; no new stakes were noted during this inspection. The stakes are located on the disposal cell and other portions of the site. BLM has informed DOE that these stakes are not actual claims but are lode mining claim locators, which are the precursor to a claim. Research would be needed to determine if there are valid subsurface mineral rights that pre-date the BLM withdrawal for the site. Valid third-party subsurface mineral rights exist on the fee land acquired on the west side of the site. However, in accordance with 10 CFR 40, Appendix A, Criterion 11, a notice was filed in the local public land records that indicates the land is being used for the disposal of radioactive materials and is subject to an NRC license that prohibits the disruption and disturbance of the disposed material. Should it be determined that senior subsurface rights exist that pre-date the withdrawal, protections pursuant to the NRC general license for the disposal site appear to preclude any mining activity that would jeopardize the disposal cell and its associated drainage control structures (i.e., 10 CFR 40.28[d]).

4.4.2.2 Side Slopes of the Disposal Cell

The disposal cell was designed to control surface-water runoff resulting from a probable maximum flood event. The side slopes of the disposal cell, constructed with a 20-percent slope grade and covered with a 1-foot-thick layer of riprap, were in good condition (PL-8). Surface-water runoff from the side slopes of the disposal cell is conveyed by an apron at the toe of the cell to several appropriately spaced toe drains that lie perpendicular to, and slope away from, the apron. The apron and toe drains are constructed channels with a minimum depth of 2 feet and filled with riprap that has a minimum 12-inch-diameter rock size. Minor erosion has occurred adjacent to a toe drain along the north side of the disposal cell, but that has not impacted the performance of the toe drain.

4.4.2.3 Ancillary Cell

The ancillary cell, which was in good condition (PL-9), was constructed to contain all waste materials associated with the reclaimed evaporation pond area. A heap drainage storage pond that was constructed below grade and adjacent to the heap leach repository was used as the footprint for this cell. At the close of reclamation activities for the main disposal cell, the synthetic pond liner material, evaporation pond material, and other contaminated debris remaining on the site were compacted in the ancillary cell. The ancillary cell slopes gently toward the southwest. A rock berm wraps around the eastern and northern sides of the ancillary cell to provide protection from surface-water runoff. Diversion Channel No. 2 runs along the south side of the ancillary cell to convey surface-water runoff away from the cell (PL-10).

Various species of plants were present on the cell top. Noxious weeds are controlled in accordance with the LTSP.

4.4.2.4 Diversion and Drainage Channels

Final surface conditions at the site are a combination of rock armoring and contouring to achieve the necessary surface-water drainage control and erosion protection necessary to satisfy the design longevity requirements. The diversion channels and outlet channel of the launch rock erosion protection basin were in good condition.

The rock berm that runs along the northern edge of the ancillary cell continues west across the slope south of the main disposal cell to provide protection against erosion (PL-11). Several gullies and rills have developed along this slope but do not threaten the integrity of the disposal cell. They will continue to be monitored and repaired as needed. This erosion is expected to stabilize over time as site vegetation improves. The rock berm appears to be effective at controlling head-cutting from these gullies and providing protection to the disposal cell.

4.4.2.5 Site Perimeter and Balance of the Site

The balance of the site and the site perimeter were in good condition. Reclaimed surfaces at the site were planted with a mix of native and adaptive grasses to provide soil stability, and the vegetation continues to improve. Noxious weeds are controlled in accordance with the LTSP.

During each site inspection, the area surrounding the site is checked to ensure that changes in land or water use do not affect site protectiveness. For example, a resurgence of interest in uranium mining and processing or oil and gas exploration could lead to increased activity in the vicinity of the site and an increased potential for site disturbance. There was no evidence of such activities that might affect the long-term performance or stability of the site.

4.5 Follow-up Inspections

DOE will conduct follow-up inspections if (1) an annual inspection or other site visit reveals a condition that must be reevaluated during a return to the site, or (2) a citizen or outside agency notifies DOE that conditions at the site are substantially changed. No need for a follow-up inspection was identified during the inspection.

4.6 Routine Maintenance and Emergency Measures

Noxious weeds were treated with herbicide. No other maintenance needs were identified during the inspection.

Emergency measures are corrective actions that DOE will take in response to unusual damage or disruption that threatens or compromises site health and safety, security, integrity, or compliance with 40 CFR 192. No emergency measures were required.

4.7 Environmental Monitoring

Groundwater monitoring is not required at the site because 30 years of historical monitoring performed at the site by the former licensee indicated that groundwater has not been contaminated by site-related activities. Twenty-three of the 30 years of monitoring occurred after mill operations ceased, and 10 of those years occurred after completion of site reclamation.

4.8 Photographs

Photo Location Number	Azimuth	Photograph Description
PL-1	260	Entrance gate, entrance sign, and site marker (disposal cell in background).
PL-2	275	Site marker.
PL-3	355	Southeast portion of disposal cell.
PL-4	295	Southwest portion of disposal cell.
PL-5	275	Diversion Channel No. 1 on top of disposal cell.
PL-6	95	Diversion Channel No. 1 outlet into launch rock erosion protection basin on east side slope of disposal cell (Rob Pit in background).
PL-7	85	Shallow depression on top of disposal cell.
PL-8	180	Intersection of west side slope and top of disposal cell.
PL-9	225	South side slope of disposal cell (ancillary cell in background).
PL-10	90	Southwest portion of site (Diversion Channel No. 2, ancillary cell, and disposal cell in background).
PL-11	30	Diversion Channel No. 2 (rock berms and southwest portion of disposal cell in background).

MAW 8/2014. PL-1. Entrance gate, entrance sign, and site marker (disposal cell in background).

MAW 8/2014. PL-2. Site marker.

MAW 8/2014. PL-3. Southeast portion of disposal cell.

MAW 8/2014. PL-4. Southwest portion of disposal cell.

MAW 8/2014. PL-5. Diversion Channel No. 1 on top of disposal cell.

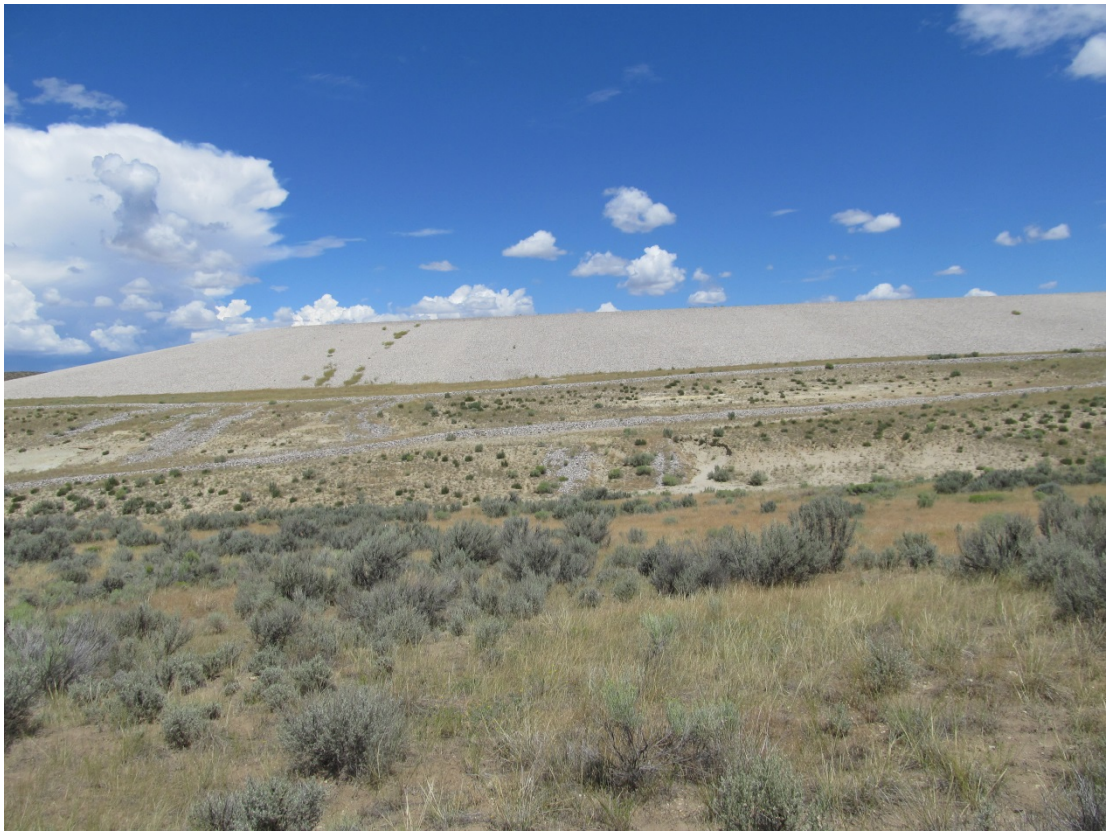
MAW 8/2014. PL-6. Diversion Channel No. 1 outlet into launch rock erosion protection basin on east side slope of disposal cell (Rob Pit in the background).

MAW 8/2014. PL-7. Shallow depression on top of disposal cell.

MAW 8/2014. PL-8. Intersection of west side slope and top of disposal cell.

MAW 8/2014. PL-9. South side slope of disposal cell (ancillary cell in the background).

MAW 8/2014. PL-10. Southwest portion of site (Diversion Channel No. 2, ancillary cell, and disposal cell in background).



MAW 8/2014. PL-11. Diversion Channel No. 2 (rock berms and southwest portion of disposal cell in background).

5.0 Sherwood, Washington, Disposal Site

5.1 Compliance Summary

The Sherwood, Washington, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title II Disposal Site was inspected on July 16, 2014. The tailings impoundment, dam, and diversion channel were in good condition. The dam inspection and associated piezometer water level measurements verified that the tailings dam is functioning as designed. A damaged perimeter sign will be replaced in 2015. Inspectors identified no other maintenance needs or cause for a follow-up inspection.

5.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the Sherwood site are specified in the *Long-Term Surveillance Plan for the DOE Sherwood Project (UMTRCA Title II) Reclamation Cell, Wellpinit, Washington* (U.S. Department of Energy [DOE], Grand Junction, Colorado, February 2001) and in procedures established by DOE to comply with the requirements of Title 10 *Code of Federal Regulations* Section 40.28 (10 CFR 40.28). Table 5-1 lists these requirements.

Table 5-1. License Requirements for the Sherwood, Washington, Disposal Site

Requirement	Long-Term Surveillance Plan	This Report
Annual Inspection and Report	Sections 3.3 and 3.4	Section 5.4
Follow-up Inspections	Section 3.5	Section 5.5
Routine Maintenance and Emergency Measures	Section 3.6	Section 5.6
Environmental Monitoring	Section 3.7	Section 5.7

5.3 Institutional Controls

The United States of America, in trust for the Spokane Tribe of Indians, owns the 380-acre site. The site was accepted under the U.S. Nuclear Regulatory Commission (NRC) general license (10 CFR 40.28) in 2001. Because the site is on the Spokane Indian Reservation, no agreement of transfer was necessary for conveying the property rights to DOE. However, an agreement for permanent right-of-access and long-term surveillance and maintenance, which lets DOE fulfill its custodial responsibilities required for UMTRCA Title II sites, was executed between the Tribe and DOE. Institutional controls at the site include federal ownership of the property and the following features that are inspected annually: a site marker, boundary monuments, and warning/no-trespassing signs.

5.4 Inspection Results

The site, located near Wellpinit, Washington, was inspected on July 16, 2014. The inspection was conducted by D. Traub and L. Sheader of The S.M. Stoller Corporation, a wholly owned subsidiary of Huntington Ingalls Industries (Stoller). Stoller is the Legacy Management Support contractor at the DOE office in Grand Junction, Colorado. D. Smith (U.S. Bureau of Indian Affairs), R. Connolly (Spokane Tribe of Indians Superfund Coordinator), and B. Stasney (Washington State Department of Health) attended all or part of the inspection.

The purposes of the inspection were to confirm the integrity of the visible features at the site, to identify changes in conditions that might affect site integrity, and to determine the need, if any, for maintenance or additional inspection and monitoring. Numbers in the left margin of this report refer to items summarized in Table ES-1 of the "Executive Summary."

5.4.1 Site Surveillance Features

The locations of site surveillance features are shown on Figure 5-1. 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 on Figure 5-1 by photograph location (PL) numbers.

5.4.1.1 Site Access and Entrance Gates

The site and adjacent lands are part of the Spokane Indian Reservation. The U.S. Bureau of Indian Affairs maintains Elijah Road, the all-weather site road over which DOE has permanent right-of-access. Two double-swing steel gates across the road were intended to control access to the disposal site and the nearby Sherwood mine area and Tribe-owned facilities. Both gates were open at the time of the inspection.

5.4.1.2 Perimeter Signs

Six warning or perimeter signs, designated P1 through P6, are located along the site boundary at likely access points around the site. The signs are attached to steel posts set in concrete. Sign P2 was damaged due to delamination (PL-1). It is still legible but will be replaced in 2015. The other signs were in good condition.

5.4.1.3 Site Marker and Boundary Monuments

One granite site marker is present on the southwest side of the site where the access road lies closest to the site boundary. The marker was in excellent condition (PL-2).

Six boundary monuments set in concrete define the site boundary. Boundary monument BM-3A, located near the northwest corner of the tailings dam, is bent but does not need to be repaired. Because surrounding vegetation had made it difficult to locate some of the monuments, metal t-posts have been installed at each monument location (PL-3). Due to safety concerns related to the presence of a buffalo herd, several of the boundary monuments were not verified during the inspection.

5.4.1.4 Monitoring Wells and Piezometers

Three monitoring wells are located on the site and are designated wells 2B, 4, and 10. The wells were secure and in good condition.

As part of the dam safety inspection program, four piezometers, designated PZ-1 through PZ-4, were installed in November 2000 along the crest of the tailings dam at a depth equivalent to the base of the dam. All piezometers were secure and in good condition.

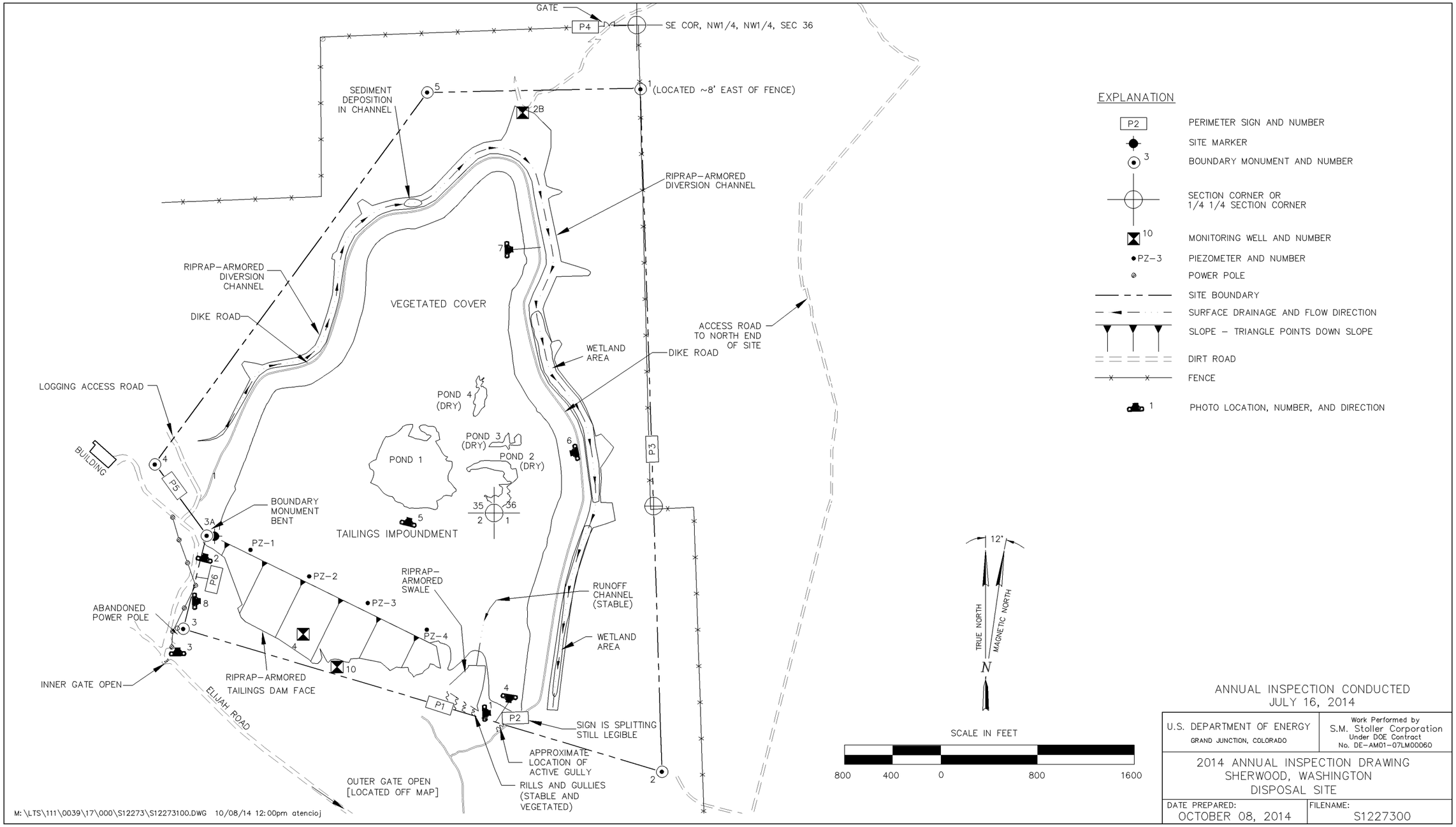


Figure 5-1. 2014 Annual Inspection Drawing for the Sherwood, Washington, Disposal Site

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5.4.2 Inspection Areas

In accordance with the Long-Term Surveillance Plan (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 cover of the tailings impoundment; (2) the diversion channel and impoundment dam face, and (3) the area between the diversion channel and site boundary, and the outlying area.

Within each area, inspectors examined the specific site surveillance features for evidence of erosion, settling, slumping, or other disturbances that might affect the site's integrity, protectiveness, or long-term performance.

5.4.2.1 Cover of the Tailings Impoundment

The cover of the 100-acre tailings impoundment, completed in 1996, consists of 12 to 20 feet of uncompacted soils. During site reclamation, surface soils were seeded and planted with native shrubs, forbs, grasses, and trees.

A small, shallow channel developed by runoff from the cell top is present near the southeast corner of the cell. Runoff has scoured the channel down to the quartz monzonite bedrock and discharges into a riprap-armored swale located east of the tailings dam. The channel is stable and is not over an area containing tailings; however, it will continue to be monitored to ensure that it does not affect the integrity of the cell.

A gully has formed along a site road near perimeter sign P2 (PL-4). This erosion is not impacting site features or access but will continue to be monitored.

Designers of the cell predicted that some settlement would continue after the uncompacted cover was put in place, and that the cover would be self-healing with regard to impacts from freezing and thawing, biointrusion, and settlement (LTSP, page 2-14). The largest area of settlement is referred to as Pond 1 (PL-5), but only a very small portion had standing water. The plant species present indicate that there is year-round moisture below the surface of the pond area. Other minor depressions, designated as Ponds 2, 3, and 4, were dry (PL-6). The shallow ponds are considered to be favorable features on the impoundment cover, but DOE will continue to monitor the surface for unusual settlement features to verify the cover's integrity and ensure that the impoundment is performing as designed.

5.4.2.2 Diversion Channel and Impoundment Dam Face

The riprap-armored diversion channel around the tailings impoundment was in good condition. The channel was designed to allow trees to grow and stabilize the surfaces, and their presence in the channel is not expected to hinder the channel's ability to convey design flows. Volunteer plant intrusion within the diversion channel, including trees, is evident in most areas of the channel. Sediment deposition is evident in places on the west leg of the diversion channel but does not interfere with the channel's design function; upslope areas that have contributed to the sedimentation have stabilized with vegetation. Two permanent wetland areas have formed along the bottom of the east side of the channel due to seeps that are present in those areas. Wildlife, buffalo, and horse trails cross the channel at numerous locations and have caused displacement

of the diversion channel riprap in several places (PL-7). These disturbances will be visually monitored for erosion, but are not in areas that would impact the tailings impoundment.

5A The tailings embankment on this site is classified as a dam because of the saturated condition of the impoundment, so an annual dam safety inspection is required by the LTSP to ensure continued compliance with the National Dam Safety Program Act. The tailings dam face was inspected in accordance with the Dam Inspection Checklist included at the end of this report. No evidence of seepage, slumping, erosion, wetland vegetation, or instability was observed.

Measurements of water levels in the four piezometers were obtained on May 23, 2014. These annual measurements, collected since the piezometers were installed in 2000, provide a direct means of determining moisture conditions in the dam. Steadily increasing water levels in any of the piezometers could indicate a potential problem with the performance of the dam. Piezometers PZ-1, PZ-3, and PZ-4 were dry. Piezometer PZ-2, which normally contains 1 to 3 feet of water, had 1.26 feet of water this year. The minor amount of water in PZ-2 is the result of a small, perched lens of water that exists because of localized differences in permeability. The lateral extent of the lens is unknown, but there is more than 200 feet of unsaturated material beneath the PZ-2 perched zone. On the basis of the 2014 piezometer measurements, the tailings dam is considered to be in an unsaturated condition.

The tailings dam face has a rock cover consisting primarily of highly durable quartz monzonite; the rock appeared to be in excellent condition. The face was designed to allow a vegetated cover, including mature trees, to establish and stabilize the surface and prevent erosion. Consequently, the presence of this vegetation does not harm the function of the dam, and the dam will not be compromised if the rock cover eventually degrades. The dam face is thickly vegetated (PL-8).

5.4.2.3 Area Between the Diversion Channel and Site Boundary, and Outlying Area

Ponderosa pine forest constitutes most of the area outside of the diversion channel. The surrounding lands are part of the Spokane Indian Reservation and are used for timber harvesting and wildlife habitat. No residences are located within 0.25 mile of the site boundary. A vacant metal building, left in place from earlier mining operations, is located about 500 feet west of the western site boundary. No new development was evident east of the site along Elijah Road.

5.5 Follow-up Inspections

DOE 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) DOE 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 during the inspection.

5.6 Routine Maintenance and Emergency Measures

Damaged perimeter sign P2 will be replaced in 2015. No other maintenance needs were identified.

Emergency measures are corrective actions that DOE will take in response to unusual damage or disruption that threatens or compromises site health and safety, security, integrity, or compliance with 40 CFR 192. No emergency measures were required.

5.7 Environmental Monitoring

5.7.1 Groundwater Monitoring

5B Groundwater compliance monitoring is not required at the Sherwood site. However, as a best management practice stipulated in the LTSP, DOE conducts limited groundwater monitoring for designated indicator parameters. Samples are collected annually from one background well north of the tailings impoundment, identified as well 2B, and two downgradient wells near the base of the tailings dam, identified as wells 4 and 10. Samples are analyzed for sulfate, chloride, and total dissolved solids. Sulfate and chloride are the primary indicator parameters.

Monitoring results are evaluated for evidence of groundwater impact from the reclamation cell. Should the concentration of sulfate or chloride exceed the State of Washington water quality criteria values of 250 milligrams per liter for either parameter, DOE will conduct confirmatory sampling of the downgradient wells. If the confirmatory sampling verifies the exceedance, DOE will develop an evaluative monitoring work plan, in consultation with the Tribe and the U.S. Bureau of Indian Affairs, and submit that plan to NRC for review prior to initiating the evaluative monitoring program. Results of an evaluative monitoring program would be used to determine if corrective action is necessary.

Groundwater sampling was conducted on May 23, 2014, and the results are presented in Table 5-2. Groundwater constituent concentrations continue to be less than the action levels for confirmatory sampling, and no upward trends are apparent.

Table 5-2. 2014 Groundwater Quality Results for the Sherwood, Washington, Disposal Site

Constituent	Water Quality Criterion[a]	Background Well 2B	Downgradient Well 4	Downgradient Well 10
Chloride, mg/L	250	2.7	0.82	2.1
Sulfate, mg/L	250	4.2	18	30
TDS, mg/L	N/A	250	280	610

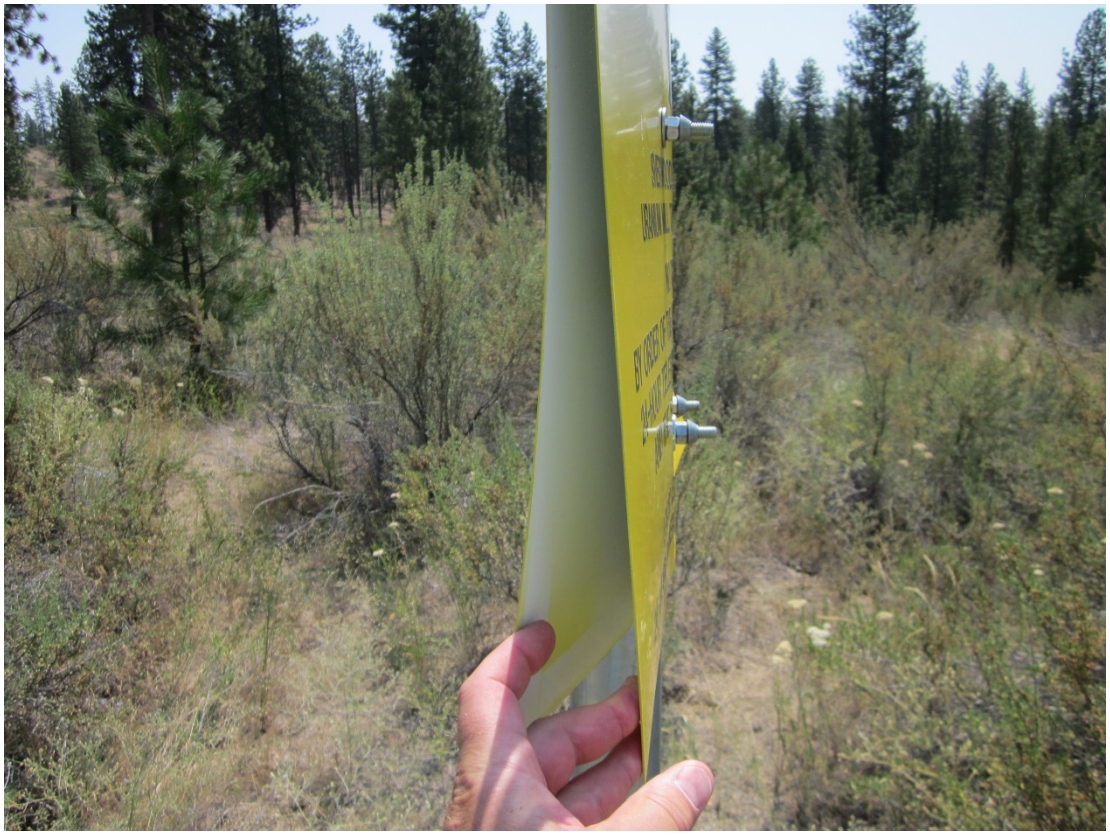
Key: mg/L = milligrams per liter; N/A = not applicable; TDS = total dissolved solids
[a] State of Washington water quality criteria used as action levels.

5.7.2 Vegetation Monitoring

The LTSP requires annual visual inspections of the cell's vegetated cover to ensure that it satisfies erosional stability criteria and is self-sustaining. Vegetation on the cell cover includes native shrubs, forbs, grasses, and trees. Vegetation on the cell cover appeared to be heavily grazed and drought-stressed. It will continue to be monitored. Noxious weeds continue to be managed through biocontrol efforts and the application of herbicide.

5.8 Photographs

Photograph Location Number	Azimuth	Description
PL-1	90	Damaged perimeter sign P2.
PL-2	0	Site marker.
PL-3	270	Boundary monument BM-3.
PL-4	30	Erosion near perimeter sign P2.
PL-5	240	Pond 1 area on tailings impoundment cover.
PL-6	60	Dry depressions and cell cover.
PL-7	90	Displaced riprap along animal trails in diversion channel.
PL-8	90	Vegetation on tailings dam face.



SHE 7/2014. PL-1. Damaged perimeter sign P2.

SHE 7/2014. PL-2. Site marker.

SHE 7/2014. PL-3. Boundary monument BM-3.

SHE 7/2014. PL-4. Erosion near perimeter sign P2.

SHE 7/2014. PL-5. Pond 1 area on tailings impoundment cover.

SHE 7/2014. PL-6. Dry depressions and cell cover.

SHE 7/2014. PL-7. Displaced riprap along animal trails in diversion channel.

SHE 7/2014. PL-8. Vegetation on tailings dam face.

Dam Inspection Checklist
Sherwood, Washington, UMTRCA Title II Disposal Site

Date of Inspection: July 16, 2014

Inspector	Organization
David Traub	S. M. Stoller
Linda Sheader	S. M. Stoller

Piezometer PZ-1 current year water depth: (2014 Dry) (Previous year depth: Dry)	dry
Piezometer PZ-2 current year water depth: (2014 DTW 61.66) (Previous year depth: 2.42') 62.92 is total depth	1.26
Piezometer PZ-3 current year water depth: (2014 Dry) (Previous year depth: Dry)	dry
Piezometer PZ-4 current year water depth: (2014 Dry) (Previous year depth: Dry)	dry
Was evidence of significant seepage observed on the dam face? If yes discuss in report.	No
Was evidence of significant slumping observed on the dam? If yes discuss in report.	No
Was evidence of significant erosion observed on the dam? If yes discuss in report.	No
Was vegetative growth that could compromise dam stability observed? If yes discuss in report.	No
Was any condition that presents an imminent hazard to human health and safety or to the environment observed? If yes immediately contact the following: DOE Site Manager: Rich Bush (970) 248-6073 NRC Operations Center: (301) 951-0550 Spokane Tribal Police/Sheriff: (509) 258-4400 State Department of Ecology — Dam Safety: Jerald LaVassar (360) 407-6625	No

Note: Piezometer water levels measured during sampling trip on May 23, 2014.

Inspector Signature: David Traub Date: 7/16/14

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6.0 Shirley Basin South, Wyoming, Disposal Site

6.1 Compliance Summary

The Shirley Basin South, Wyoming, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title II Disposal Site was inspected on July 2, 2014. The disposal cell and all associated surface water diversion and drainage structures were in excellent condition and functioning as designed. Inspectors identified no maintenance needs or cause for a follow-up inspection.

Groundwater monitoring indicated that the radium-228 concentration continues to exceed the alternate concentration limit (ACL) at a downgradient well between the disposal cell and the site boundary, and radium-226 continues to exceed the ACL in a downgradient well next to the site boundary. There is no risk to human health and the environment, and groundwater monitoring will continue in accordance with the Long-Term Surveillance Plan (LTSP).

6.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the Shirley Basin South site are specified in the *Long-Term Surveillance Plan for the U.S. Department of Energy Shirley Basin South (UMTRCA Title II) Disposal Site, Carbon County, Wyoming* (DOE–LM/GJ766–2004, December 2004) and in procedures established by the U.S. Department of Energy (DOE) to comply with requirements of Title 10 *Code of Federal Regulations* Section 40.28 (10 CFR 40.28). Table 6-1 lists these requirements.

Table 6-1. License Requirements for the Shirley Basin South, Wyoming, Disposal Site

Requirement	Long-Term Surveillance Plan	This Report
Annual Inspection and Report	Section 3.3 and 3.4	Section 6.4
Follow-up Inspections	Section 3.5	Section 6.5
Routine Maintenance and Emergency Measures	Section 3.6	Section 6.6
Environmental Monitoring	Section 3.7	Section 6.7

6.3 Institutional Controls

The 1,512-acre site is owned by the United States of America and was accepted under the U.S. Nuclear Regulatory Commission (NRC) general license (10 CFR 40.28) in 2005. DOE is the licensee and, in accordance with the requirements for UMTRCA Title II sites, is responsible for the custody and long-term care of the site. Institutional controls at the site include federal ownership of the property and the following features that are inspected annually: a site marker, boundary monuments, and warning/no-trespassing signs.

6.4 Inspection Results

The site, located approximately 35 miles south of Casper, Wyoming, was inspected on July 2, 2014. Results of the inspection are described below. The inspection was conducted by R. Johnson and D. Traub of The S.M. Stoller Corporation, a wholly owned subsidiary of Huntington Ingalls Industries (Stoller). Stoller is the Legacy Management Support contractor at the DOE office in Grand Junction, Colorado. S. Surovchak (DOE Site Manager) and W. Dam (DOE) attended the inspection.

The purposes of the inspection were to confirm the integrity of the visible features at the site, to identify changes in conditions that might affect site integrity, and to determine the need, if any, for maintenance or additional inspection and monitoring. Numbers in the left margin of this report refer to items summarized in Table ES-1 of the "Executive Summary."

6.4.1 Site Surveillance Features

The locations of site surveillance features are shown in Figure 6-1. 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 6-1 by photograph location (PL) numbers.

6.4.1.1 Site Access and Entrance Gate

Access to the Shirley Basin South site is immediately off of Carbon County Road 2 and is unimpaired. No private property is crossed to gain site access.

The entrance gate is a barbed-wire gate in the stock fence that surrounds the site. The gate, located along the south portion of the perimeter fence, was secured by a padlock and chain to the adjoining post and was in good condition.

6.4.1.2 Fence and Perimeter Signs

A four-strand barbed-wire perimeter fence encompasses the site to facilitate land management by DOE. The perimeter fence was in excellent condition except for a damaged portion crossing the north end of Pit 4. The damaged portion is not maintained because of steep slopes and recurring snow damage. The grazing licensee, in cooperation with the adjacent property owner, erected a solar-powered electric fence around the north rim of Pit 4 in 2007 to bypass the damaged section and to give cattle access to each side of the pit. Sections along the north perimeter are secured with a temporary wire fence. Ur-Energy, the adjacent landowner, will use these sections to reach a topsoil stockpile area on the DOE site.

Nine perimeter signs (warning/no-trespassing signs) are along the site perimeter at potential points of access, and another 25 signs are positioned around the disposal cell (PL-1). Other than perimeter signs P1 and P2, which have bullet holes in them, the signs were in excellent condition.

6.4.1.3 Site Marker and Boundary Monuments

The granite site marker, which is located at the site entrance, was in excellent condition (PL-2). Twenty-six monuments delineate the site property boundary; the observed boundary monuments were in excellent condition (PL-3).

6.4.1.4 Monitoring Wells

The site groundwater monitoring network consists of 14 wells; six of these wells were installed downgradient of the disposal cell during fall 2008. The wells were in excellent condition (PL-4).

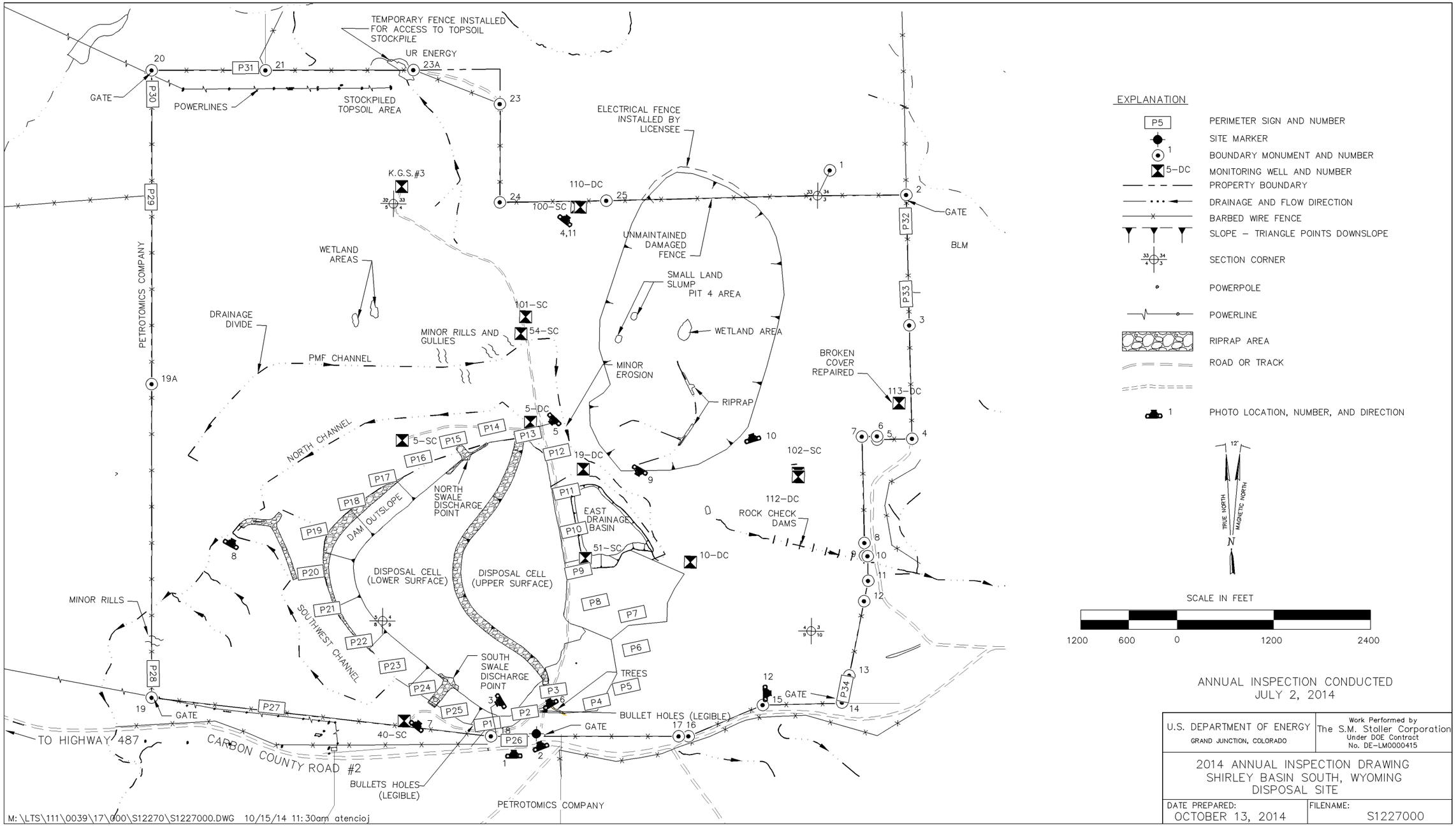

Figure 6-1. 2014 Annual Inspection Drawing for the Shirley Basin South, Wyoming, Disposal Site

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6.4.2 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 cover of the tailings impoundment; (2) the containment dam and diversion channels; and (3) the balance of the site and the site perimeter.

Within each area, inspectors examined the specific site surveillance features and looked for evidence of erosion, settling, slumping, or other disturbances that might affect the site's integrity, protectiveness, or long-term performance.

6.4.2.1 Cover of the Tailings Impoundment

The tailings impoundment (disposal cell), completed in 2000, occupies approximately 142 acres. It has a soil cover and was revegetated primarily with native grasses. The vegetation on the disposal cell and throughout the site was in good condition and is managed through a grazing license with a local rancher. The disposal cell surface is constructed at two elevations—the upper surface and the lower surface (PL-5)—separated by a riprap-armored slope (PL-6). These features were in excellent condition; there were no indications of erosion, settlement, or other modifying processes on the disposal cell cover or side slopes that might affect the integrity of the disposal cell.

Windblown sediment is accumulating in the riprap on the slope, which has led to gradual vegetation encroachment. The establishment of perennial vegetation enhances the slope's stability. Wetland vegetation is establishing in areas at the toe of the slope that are usually wet due to snowmelt runoff and summer precipitation. These areas were wet at the time of the inspection.

The eastern (upper) surface is contoured to drain into a basin east of the cell and west over the riprap-protected slope to the western (lower) surface. The lower surface drains to the north and south at riprap-armored discharge points; the discharge structures were in excellent condition (PL-7). The riprap dissipation basins of the discharge points usually hold snowmelt runoff water in spring and early summer; water was present at the time of the inspection.

6.4.2.2 Containment Dam and Diversion Channels

The tailings pile was reclaimed in place and was contained behind a horseshoe-shaped earthen dam. The containment dam is predominantly grass-covered, but the steeper portion (5:1 slope) of the dam is protected by riprap. The containment dam was in excellent condition; there were no indications of erosion, settlement, or other modifying processes that might affect the integrity of the dam. Vegetation is encroaching on the riprap surfaces, which enhances the stability of the slope.

The surface-water diversion system consists of a combination of diversion channels, drainage basins, and contoured surfaces. Riprap armor was placed on the steeper slopes and flow concentration points where design flow velocities could erode surfaces and impact the tailings dam and impoundment (PL-8). A probable maximum flood (PMF) channel was constructed north of the tailings impoundment along the side of the reclaimed mine overburden spoil pile. Part of the PMF channel drains to the southwest and discharges to a small closed basin. The

portion of the PMF channel that flows eastward and discharges into the east drainage basin captures a larger drainage area; this basin contained water at the time of the inspection (PL-9). These closed drainage basins are large enough to accommodate the PMF water volumes. The diversion channels were in excellent condition, and no active erosion was apparent in the channels.

6.4.2.3 Balance of the Site and the Site Perimeter

The other major feature on the site is reclaimed Pit 4, in the northeast portion of the site (PL-10). Reclamation activities included rounding the side slopes, partially backfilling the pit to an elevation above the local water table, revegetating the surfaces, and protecting potential erosion areas with riprap. Vegetation is well established, and a wetland area has formed at the bottom of the pit where standing water from runoff is often present; the surface of this area tends to dry out later in the summer. Overall, Pit 4 was in good condition, with some minor slumps and displacement features present on the west side slope of the pit.

Public land administered by the U.S. Bureau of Land Management and private land surround the site. Land on three sides is used primarily for livestock grazing. Ur-Energy is the property owner north of the site and is currently conducting uranium exploration on the future UMTRCA Title II Shirley Basin North disposal site for potential in situ recovery mining (PL-11). Ur-Energy has access to and use of stockpiled topsoil on the DOE site. This access is in accordance with an agreement originally established between Petrotomics Company, the former licensee of the Shirley Basin South site, and Pathfinder, which was acquired by Ur-Energy. DOE is the successor to Petrotomics, and the terms of the agreement remain in effect. The Wyoming Department of Environmental Quality (WDEQ) extended Pathfinder's mine area permit to include the soil stockpile area. In accordance with the permit, Ur-Energy will be required to reclaim the disturbed area, including fence replacement, when they have finished removing topsoil from the stockpile. No stockpiled topsoil has yet been removed.

A grazing license granted by DOE to a local rancher allows the rancher to graze his livestock on the site in exchange for maintaining the perimeter fence (PL-12). The license also allows the rancher to pump water from well K.G.S. #3 for livestock watering purposes and to install watering facilities and solar-powered electric fences to manage the livestock. The grazing licensee has installed these features.

6.5 Follow-up Inspections

DOE 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) DOE 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 during the inspection.

6.6 Routine Maintenance and Emergency Measures

No maintenance needs were identified during the inspection.

Emergency measures are corrective actions that DOE will take in response to unusual damage or disruption that threatens or compromises site health and safety, security, integrity, or compliance with 40 CFR 192. No emergency measures were identified.

6.7 Environmental Monitoring

6A Groundwater monitoring is required at the Shirley Basin South site. The monitoring network, as described in the LTSP, consisted of eight wells completed in aquifers of the Wind River Formation. In consultation with NRC, DOE installed six additional monitoring wells in fall 2008 to provide a better understanding of the groundwater chemistry and flow directions of the two aquifers of concern. DOE evaluated the monitoring requirements and sampling results, and provided recommended monitoring program revisions to NRC in August 2013. NRC directed DOE to continue monitoring in accordance with the LTSP. The current monitoring network is described in Table 6-2.

Table 6-2. Groundwater Monitoring Network at the Shirley Basin South, Wyoming, Disposal Site

Monitoring Well	Network Application
5-SC	POC well; upper sand aquifer
40-SC	Upgradient well; upper sand aquifer
51-SC	POC well; upper sand aquifer
54-SC	Downgradient well; upper/main sand aquifer
100-SC	Downgradient well; upper sand aquifer
101-SC	Downgradient well; upper sand aquifer
102-SC	Downgradient well; upper sand aquifer
5-DC	POC well; main sand aquifer
10-DC	Downgradient well; main sand aquifer
19-DC	POC well; main sand aquifer
110-DC	Downgradient well; main sand aquifer
112-DC	Downgradient well; main sand aquifer
113-DC	Downgradient well; main sand aquifer
K.G.S. #3	Lower sand aquifer

Key: POC = point of compliance

Water level, pH, and electrical conductivity are measured at the time of sampling, and the samples are analyzed for cadmium, chloride, chromium, lead, nickel, nitrate, radium-226, radium-228, selenium, sulfate, thorium-230, total dissolved solids (TDS), and uranium. Analytical results are compared to the ACLs and Wyoming Class III groundwater protection standards provided in Table 6-3. There are no applicable limits or standards for nitrate at this site. However, it is included as an analyte because it may be an indicator of contaminant migration. Water level elevations are measured at the wells to evaluate flow direction as the upper aquifers recover from mining and reclamation activities.

The intent of the annual groundwater quality monitoring is to verify that the ACLs are not exceeded at point of compliance (POC) wells and to verify continued compliance with the pertinent groundwater protection standards. If an ACL is exceeded at a POC well, or if trends indicate that a groundwater protection standard may be exceeded at the site boundary, DOE will inform NRC and WDEQ of the results and conduct confirmatory sampling. If the confirmatory sampling verifies the exceedance or threat of exceedance, DOE will develop an evaluative monitoring work plan and submit that plan to NRC for review prior to initiating the evaluative monitoring program. Results of the evaluative monitoring program will be used, in consultation with NRC, to determine if corrective action is necessary.

Table 6-3. Alternate Concentration Limits and Groundwater Protection Standards for the Shirley Basin South, Wyoming, Disposal Site

Analyte	ACL	Groundwater Protection Standard[a]
Cadmium (mg/L)	0.079	NA
Chloride (mg/L)	NA	2,000
Chromium (mg/L)	1.83	NA
Lead (mg/L)	0.05	NA
Nickel (mg/L)	6.15	NA
Radium-226 (pCi/L)	91.3	NA
Radium-228 (pCi/L)	25.7	NA
Selenium (mg/L)	0.12	NA
Sulfate (mg/L)	NA	3,000
Thorium-230 (pCi/L)	2,409	NA
TDS (mg/L)	NA	5,000
Uranium (mg/L)	9.2	NA

Key: ACL = alternate concentration limit; mg/L = milligrams per liter; NA = not applicable; pCi/L = picocuries per liter; TDS = total dissolved solids
[a] Wyoming Class III Groundwater Protection Standards for livestock use are applicable to this site.

The results for cadmium in POC well 5-SC and radium-228 in POC well 5-DC for DOE's initial sampling in July 2005 exceeded their respective ACLs. The 2005 radium-228 concentration in non-POC well 54-SC also was substantially above the ACL. When compared with historical results provided by the previous site licensee, the results for cadmium in well 5-SC and for radium-228 in wells 5-DC and 54-SC were within the range of historical measurements. NRC and WDEQ were notified of the exceedances. To provide a better understanding of the site groundwater characteristics, DOE installed six additional monitoring wells in fall 2008.

The second sampling event after installation of the new wells was conducted in July 2009 and indicated that radium-226 exceeded the ACL in new downgradient well 110-DC near the north site boundary. NRC and WDEQ were notified of the exceedance, and DOE began to evaluate the cause of the exceedance.

Analytical results for the July 2014 sampling event are provided in Table 6-4 (upper sand aquifer) and Table 6-5 (main sand aquifer). Samples could not be collected in wells 51-SC and 101-SC because they continue to be dry.

The concentration for cadmium in well 5-SC remained below the ACL and has since 2005.
6B Radium-228 continued to exceed the ACL in well 54-SC but dropped below the ACL in well 5-DC (Figure 6-2). Additionally, the ACL for radium-226 continues to be exceeded in well 110-DC (Figure 6-3).

Although radium-228 concentrations are elevated in two of the wells, they are less than the peak concentrations that occurred in these wells in the early 1990s during site groundwater remediation activities. Radium-228 is a decay product of thorium-232, which is highly immobile. Because the half-life of radium-228 is relatively short, the thorium-232 source must be near the wells of concern. DOE attributes the cause of elevated radium-226 and radium-228 in the site

wells to natural mineralization in the aquifers rather than evidence of diminished cell performance or contaminant plumes migrating offsite. NRC considers it possible that the elevated radium may represent leakage from the cell. However, NRC has concluded that additional evaluation of the cause of the elevated radium concentrations by DOE is not warranted at this time because there is no risk to human health and the environment. The groundwater is not
6C a current or potential future source of drinking water, and the source of livestock water at the site is from an aquifer that is not impacted by former milling operations.

Table 6-4. 2014 Groundwater Monitoring Results in the Upper Sand Aquifer Wells at the Shirley Basin South, Wyoming, Disposal Site

Analyte (Limit or Standard)	5-SC (POC)	40-SC	51-SC (POC)	54-SC	100-SC	101-SC	102-SC
Cadmium (0.079 mg/L)	0.036	ND	NS	0.00091	0.00019	NS	0.00026
Chloride (2,000 mg/L)	320	34	NS	360	160	NS	180
Chromium (1.83 mg/L)	0.25	ND	NS	0.38	ND	NS	ND
Lead (0.05 mg/L)	0.00014	ND	NS	0.00054	0.00009	NS	0.00007
Nickel (6.15 mg/L)	2.60	ND	NS	1.9	0.0011	NS	ND
Nitrate/Nitrite as N (mg/L)[a]	ND	0.87	NS	ND	0.02	NS	0.49
Radium-226 (91.3 pCi/L)	4.99	0.479	NS	11.8	4.10	NS	1.82
Radium-228 (25.7 pCi/L)	2.61	0.718	NS	**76.8**[b]	3.98	NS	1.85
Selenium (0.12 mg/L)	0.12	0.0042	NS	0.085	0.0001	NS	0.00019
Sulfate (3,000 mg/L)	*12,000*[c]	1,500	NS	*8,300*[c]	1,100	NS	600
Thorium-230 (2,409 pCi/L)	411	ND	NS	7.47	ND	NS	ND
TDS (5,000 mg/L)	*17,000*[c]	2,400	NS	*12,000*[c]	2,100	NS	1,400
Uranium (9.2 mg/L)	3.2	0.00021	NS	0.021	0.0028	NS	0.010

Key: mg/L = milligrams per liter; ND = not detected (below method detection limit); NS = no sample collected (dry well); pCi/L = picocuries per liter; POC = point of compliance; TDS = total dissolved solids
[a] No designated limit or standard.
[b] Result exceeds an ACL.
[c] Result exceeds a Wyoming Class III groundwater protection standard.

Table 6-5. 2014 Groundwater Monitoring Results in the Main Sand Aquifer Wells at the Shirley Basin South, Wyoming, Disposal Site

Analyte (Limit or Standard)	5-DC (POC)	10-DC	19-DC (POC)	110-DC	112-DC	113-DC
Cadmium (0.079 mg/L)	ND	ND	ND	0.00012	ND	ND
Chloride (2,000 mg/L)	220	56	64	210	45	7.2
Chromium (1.83 mg/L)	ND	ND	ND	ND	ND	ND
Lead (0.05 mg/L)	0.00039	0.0011	ND	0.00079	0.00038	0.0002
Nickel (6.15 mg/L)	1.4	ND	0.240	ND	0.0026	ND
Nitrate/Nitrite as N (mg/L)[a]	ND	ND	ND	0.011	ND	ND
Radium-226 (91.3 pCi/L)	4.39	13.9	6.36	**129**[b]	14.1	3.37
Radium-228 (25.7 pCi/L)	12.9	4.11	5.32	6.31	3.77	2.81
Selenium (0.12 mg/L)	0.018	0.000039	ND	0.000066	0.000044	ND
Sulfate (3,000 mg/L)	*8,400*[c]	990	2,100	1,800	1,100	590
Thorium-230 (2,409 pCi/L)	0.504	ND	ND	1.62	0.272	ND
TDS (5,000 mg/L)	*13,000*[c]	1,900	3,300	3,500	1,900	1,100
Uranium (9.2 mg/L)	0.230	0.017	0.0018	0.012	0.060	0.0012

Key: mg/L = milligrams per liter; ND = not detected (below method detection limit); pCi/L = picocuries per liter; POC = point of compliance; TDS = total dissolved solids
[a] No designated limit or standard.
[b] Result exceeds an ACL.
[c] Result exceeds a Wyoming Class III groundwater protection standard.

Wyoming Class III groundwater protection standards (applicable only to chloride, sulfate, and TDS) apply to water quality at the site boundary. The standards were met at the site boundary wells (100-SC, 102-SC, 110-DC, 112-DC, and 113-DC). The standards were exceeded for sulfate and TDS in wells 5-SC, 54-SC, and 5-DC. The 2014 results were within the range of historical measurements for these wells. Chloride concentrations were well below the standard in all wells.

Analytical results from well K.G.S. #3 confirm that the lower sand aquifer is hydraulically isolated from the overlying main sand aquifer. This conclusion is based on substantially lower concentrations of sulfate (230 milligrams per liter [mg/L]) and TDS (500 mg/L) in the lower sand aquifer compared to those in the main sand aquifer.

Figure 6-2. Radium-228 Concentrations in Wells 5-DC and 54-SC Since Completion of the Disposal Cell

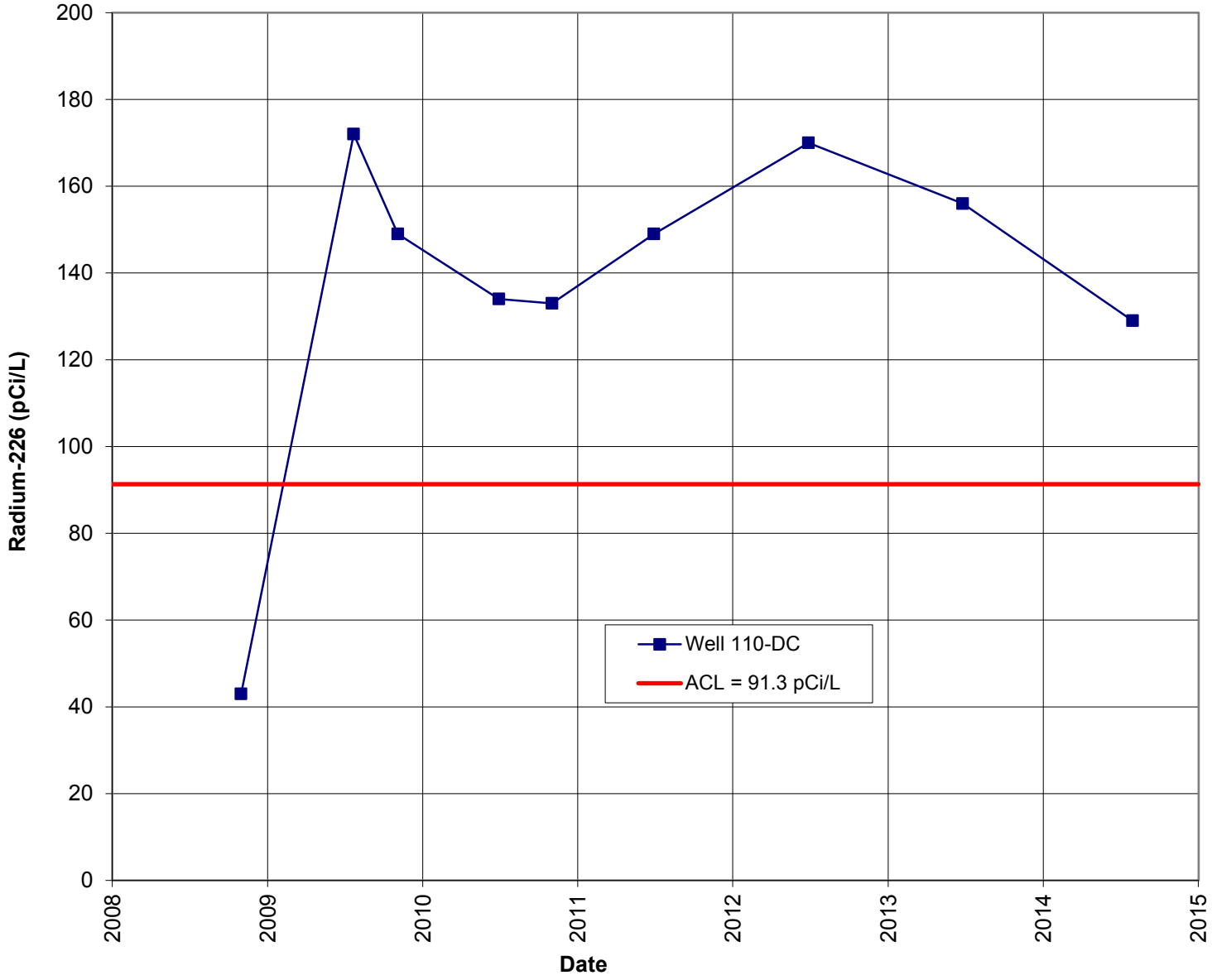

Figure 6-3. Radium-226 Concentrations in Well 110-DC

The LTSP specifies that this report provide iso-concentration maps for uranium and sulfate in each aquifer. However, the well network does not provide sufficient data points to develop contour maps of the contaminant plumes. Instead, 2014 concentrations for uranium in the two aquifers are shown on Figures 6-4 and 6-5, and concentrations for sulfate are shown on Figures 6-6 and 6-7. Uranium and sulfate concentrations remain lower than concentrations predicted by the former licensee.

The LTSP also specifies that this report provide groundwater contour maps. However, the well network does not provide sufficient data points to develop contour maps. Regional groundwater flows reportedly were to the north-northeast for the upper sand aquifer and to the east for the main sand aquifer prior to mining activities. The upper sand unit and the main sand unit coalesced and formed the main ore body at the Pit 4 location. Pit 4 was partially backfilled with overburden materials during reclamation, with the bottom of the pit being raised to an elevation above the projected recovered surface of the upper sand aquifer. The backfill material does not represent the hydrogeologic characteristics of the original formation, and the aquifers are no longer confined at Pit 4. It is likely that the bottom of Pit 4 is a groundwater recharge area during periods of rainfall and snowmelt and may be an evaporation area during dry periods. Both recharge and evaporation would tend to alter groundwater chemistry. Therefore, mining and reclamation activities permanently altered the local groundwater conditions for the upper and main sand aquifers at the site.

Water level elevations for the upper sand aquifer are shown on Figure 6-8. Water levels are increasing in wells 100-SC and 102-SC, but are remaining constant in the other upper sand aquifer wells. The apparent flow direction is to the northeast, along the formation dip and toward Pit 4. The dry wells (51-SC and 101-SC) indicate that the upper sand aquifer has not recovered in the vicinity of Pit 4. Because the aquifer is no longer confined at the Pit 4 location, it may never recover to its pre-mining elevations.

Main sand aquifer water elevations, shown on Figure 6-9, have been gradually rising at all wells since 2000, with an average rate of approximately 0.7 foot per year since DOE began monitoring water levels in 2005 (Figure 6-10). Water level measurements collected in wells 5-DC and 19-DC in 2014 may have been incorrect and are not included in this report. The rising levels indicate a gradual recovery of the aquifer. However, the altered conditions at Pit 4 may prevent a return to pre-mining elevations. Also, the water surface elevation of the downgradient pit lake on Ur-Energy property may control the surface elevation of the aquifers on the Shirley Basin South site. Flow direction in the main sand aquifer cannot be determined at this time because water level measurements indicate an essentially flat potentiometric surface at the site.

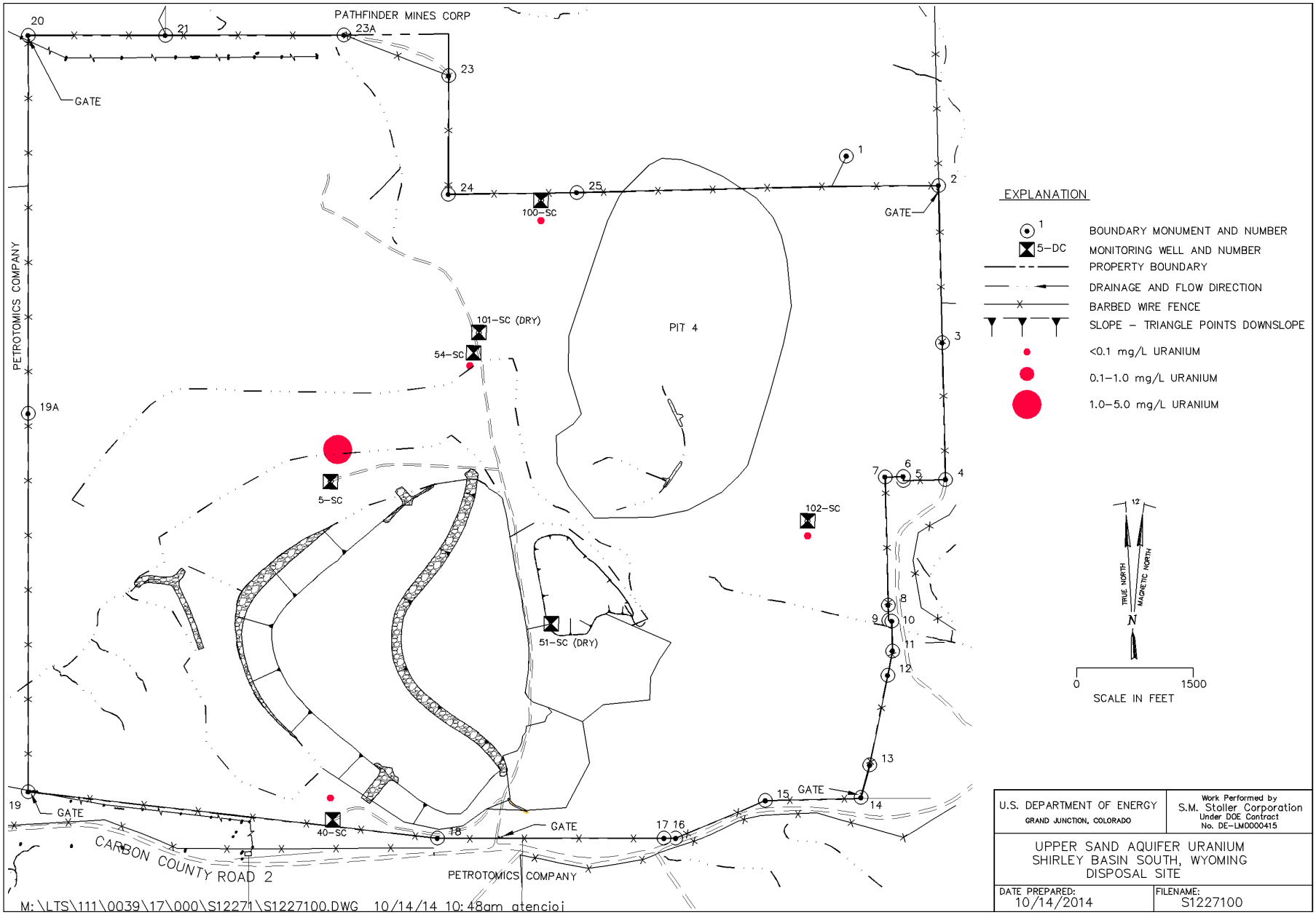

Figure 6-4. July 2014 Uranium Concentrations in the Upper Sand Aquifer at the Shirley Basin South, Wyoming, Disposal Site

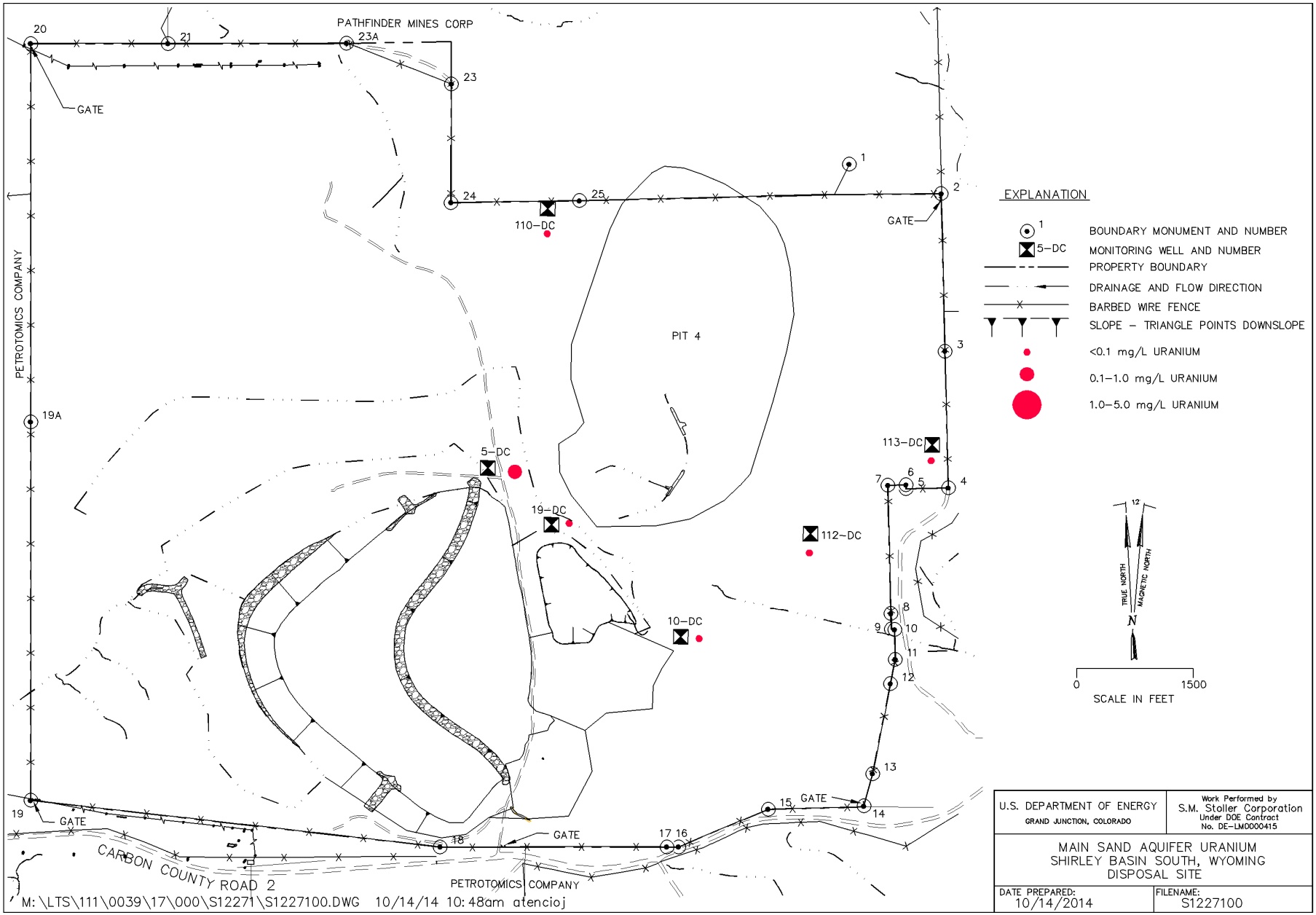

Figure 6-5. July 2014 Uranium Concentrations in the Main Sand Aquifer at the Shirley Basin South, Wyoming, Disposal Site

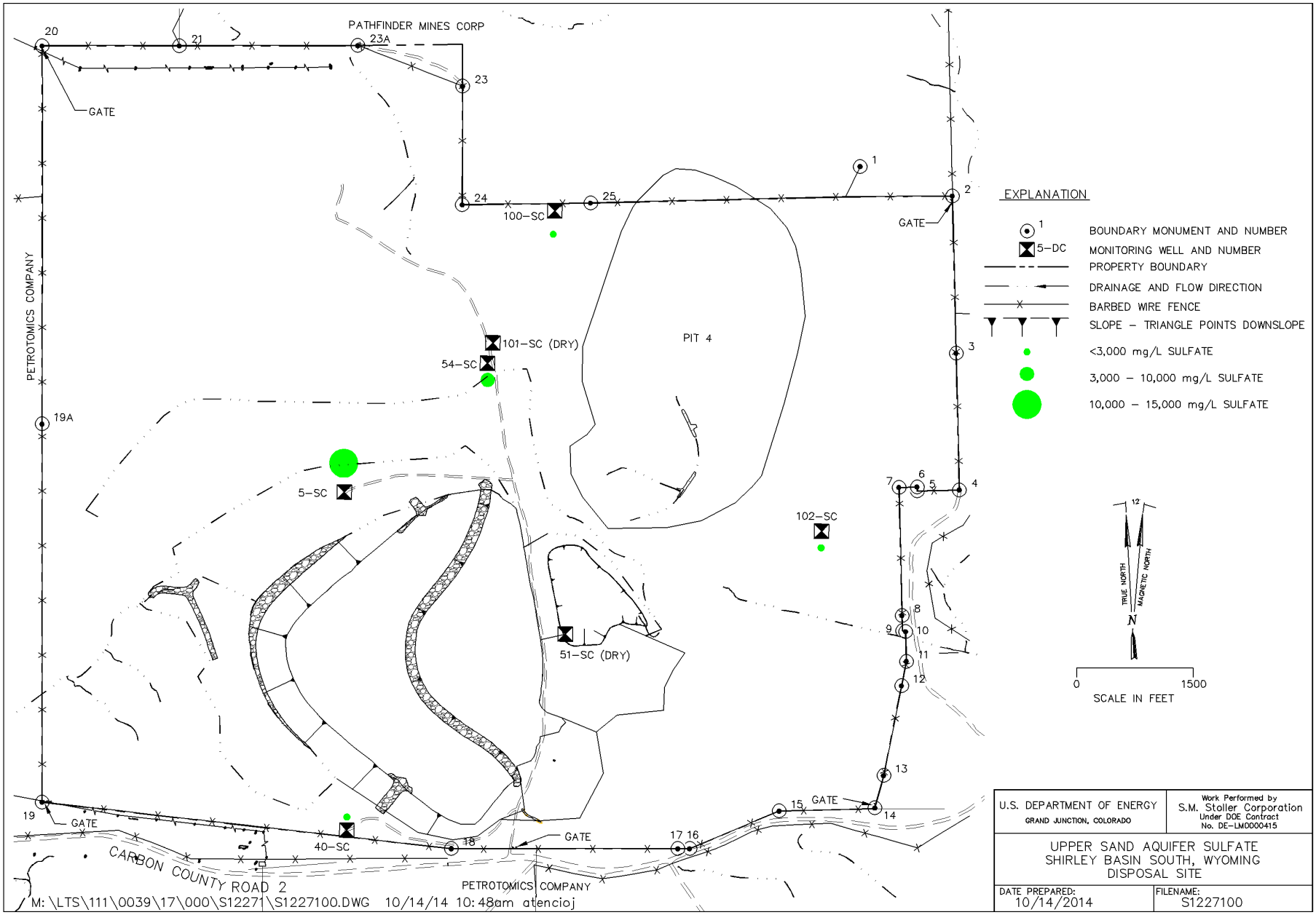

Figure 6-6. July 2014 Sulfate Concentrations in the Upper Sand Aquifer at the Shirley Basin South, Wyoming, Disposal Site

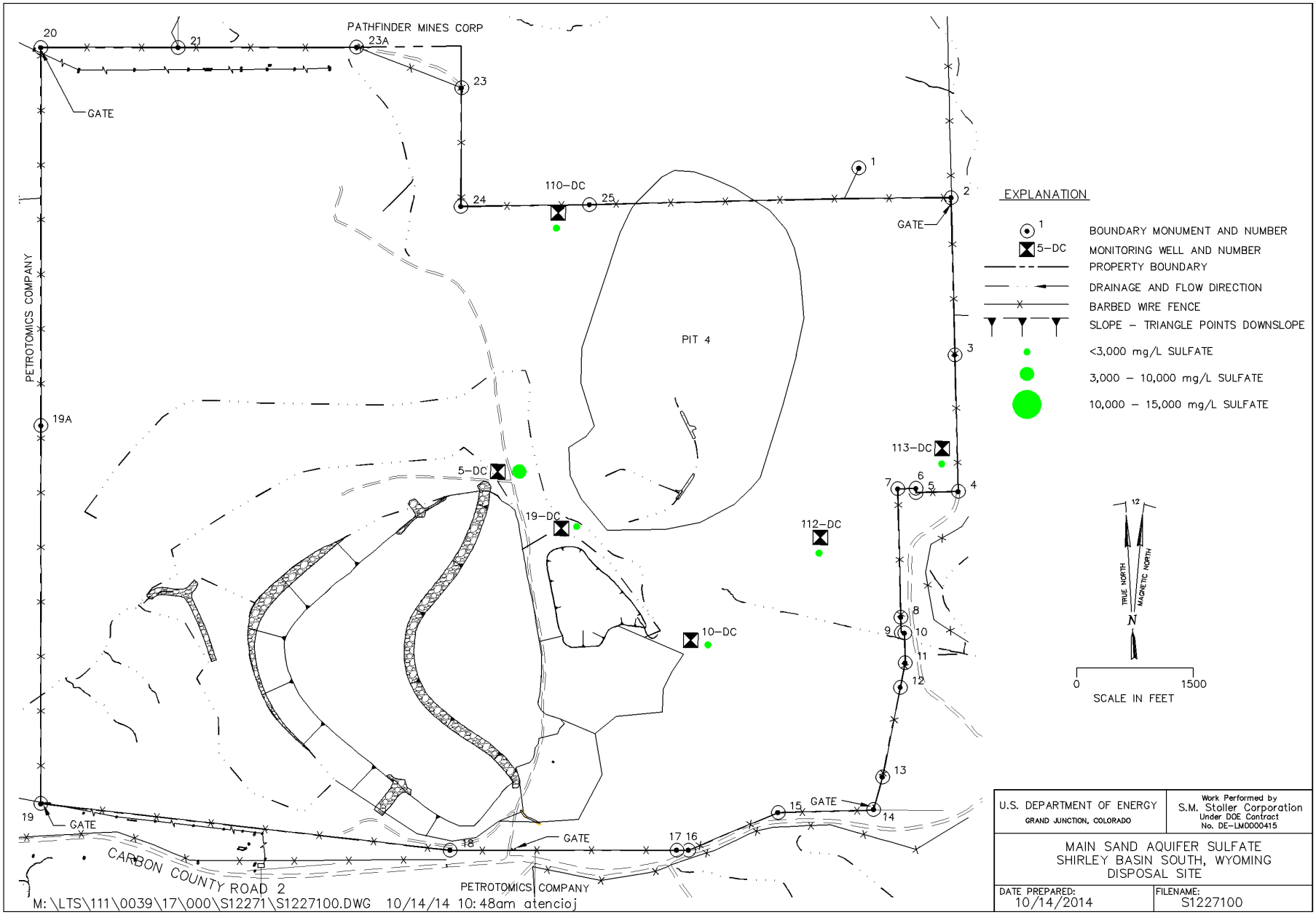

Figure 6-7. July 2014 Sulfate Concentrations in the Main Sand Aquifer at the Shirley Basin South, Wyoming, Disposal Site

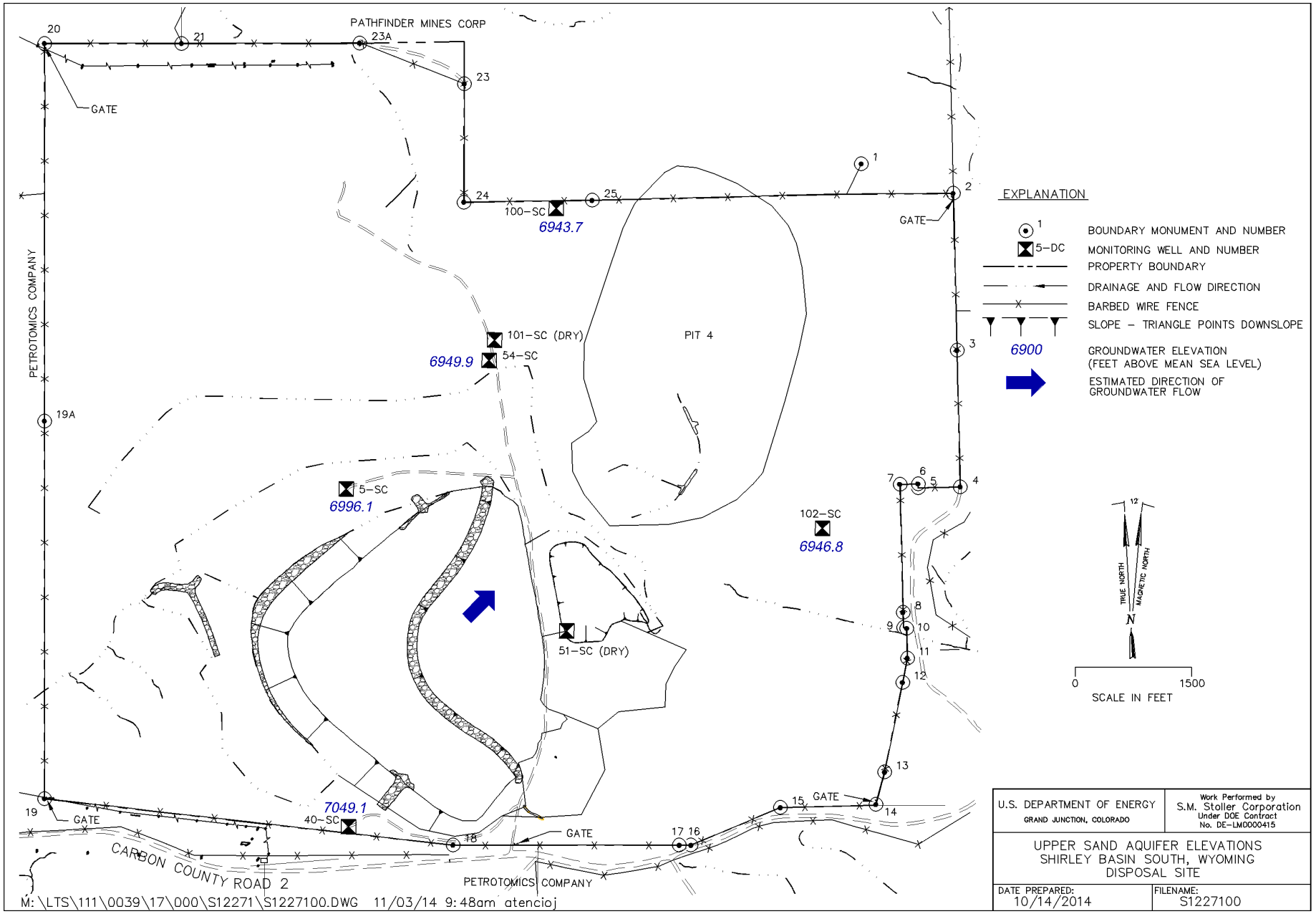

Figure 6-8. July 2014 Groundwater Elevations in the Upper Sand Aquifer at the Shirley Basin South, Wyoming, Disposal Site

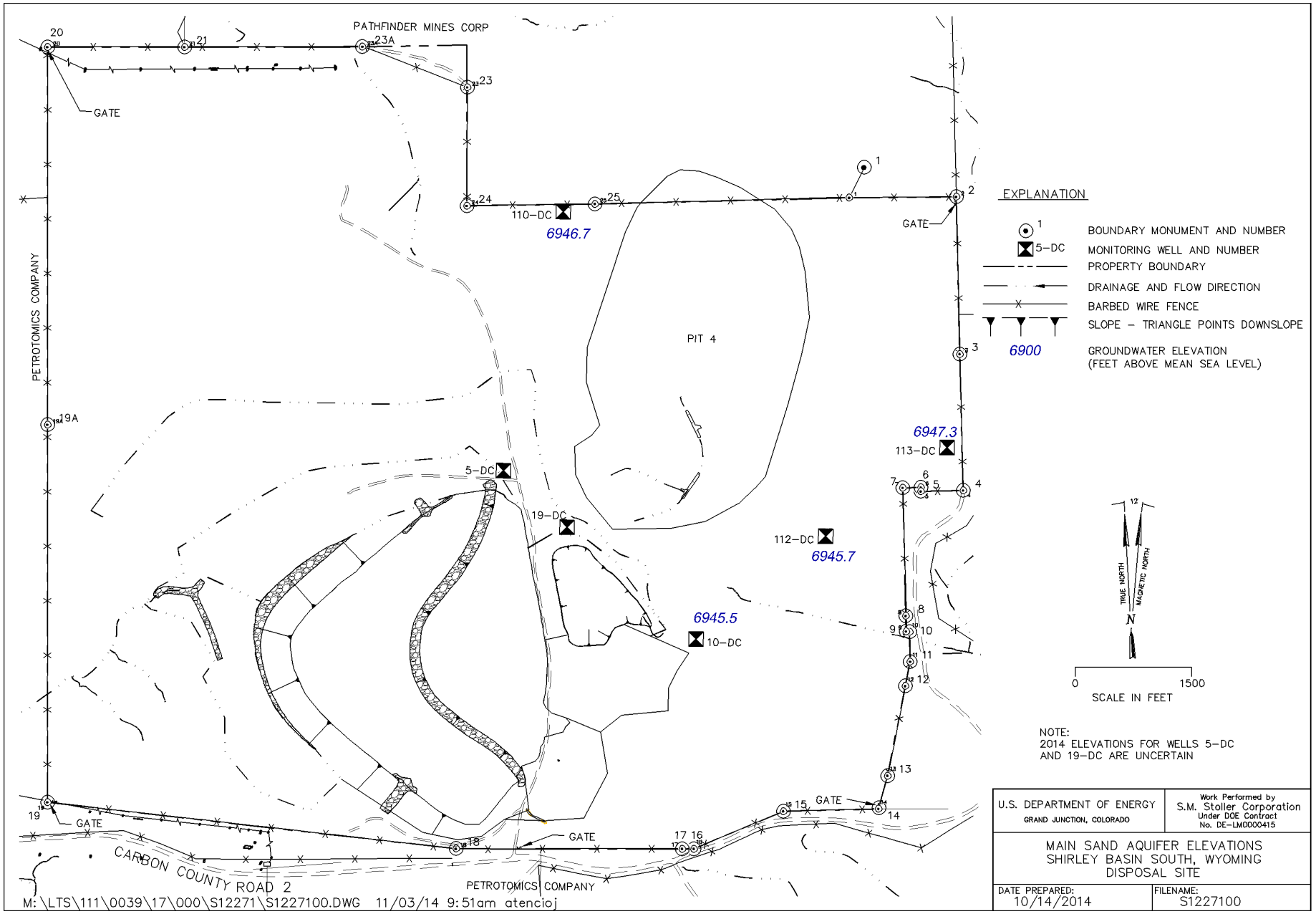

Figure 6-9. July 2014 Groundwater Elevations in the Main Sand Aquifer at the Shirley Basin South, Wyoming, Disposal Site

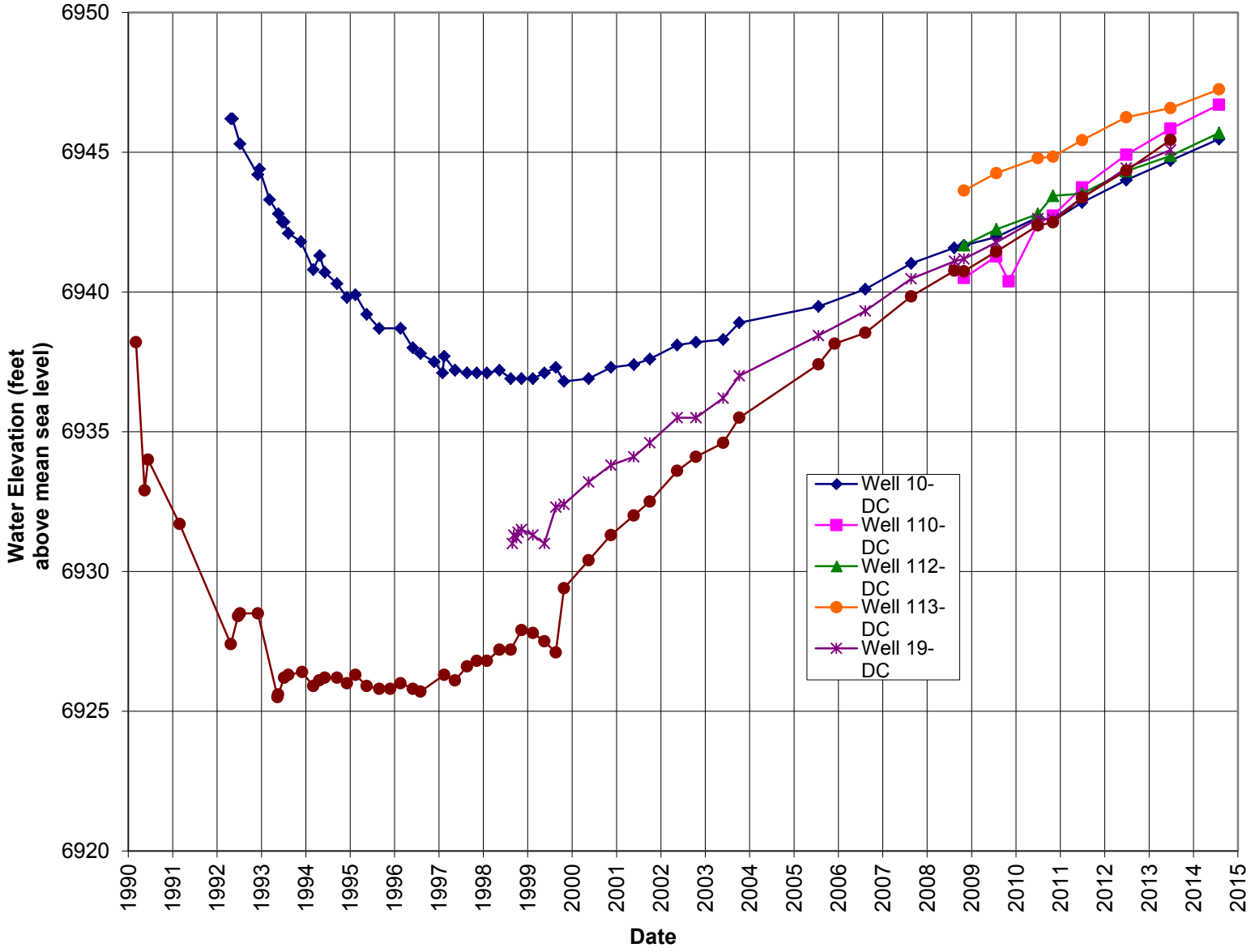

Figure 6-10. Hydrographs for Main Sand Aquifer Wells at the Shirley Basin South, Wyoming, Disposal Site

6.8 Photographs

Photograph Location Number	Azimuth	Description
PL-1	0	Perimeter sign P26 at site entrance.
PL-2	340	Site marker at site entrance.
PL-3	240	Boundary monument BM-18.
PL-4	40	Monitoring well 100-SC.
PL-5	225	Lower surface of disposal cell.
PL-6	330	Riprap-armored slope between disposal cell upper and lower surfaces.
PL-7	40	South swale discharge point.
PL-8	30	Outlet of riprap-armored drainage channel.
PL-9	210	Pond in east drainage basin.
PL-10	345	North portion of reclaimed Pit 4.
PL-11	40	Ur-Energy exploration drill rig on adjacent property.
PL-12	12	Cattle at southeast corner of site.

SBS 7/2014. PL-1. Perimeter sign P26 at site entrance.

SBS 7/2014. PL-2. Site marker at site entrance.

SBS 7/2014. PL-3. Boundary monument BM-18.

SBS 7/2014. PL-4. Monitoring well 100-SC.

SBS 7/2014. PL-5. Lower surface of disposal cell.

SBS 7/2014. PL-6. Riprap-armored slope between disposal cell upper and lower surfaces.

SBS 7/2014. PL-7. South swale discharge point.

SBS 7/2014. PL-8. Outlet of riprap-armored drainage channel.

SBS 7/2014. PL-9. Pond in east drainage basin.

SBS 7/2014. PL-10. North portion of reclaimed Pit 4.

SBS 7/2014. PL-11. Ur-Energy exploration drill rig on adjacent property.

SBS 7/2014. PL-12. Cattle at southeast corner of site.

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