Department of Energy
Office of Legacy Management

NOV 14 2007

Mr. Gary Janosko, Chief
U.S. Nuclear Regulatory Commission
Fuel Cycle Facilities Branch
Mail Stop: T-8A33
Washington, DC 20555-0001

Subject 2007 Annual Site Inspection and Monitoring Compliance Report for UMTRCA Title II Disposal Sites

Dear Mr. Janosko:

Four copies of the 2007 *Annual Inspection and Monitoring Compliance Report for Uranium Mill Tailings Radiation Control Act Title II Disposal Sites* are enclosed. The report covers the annual inspections of the five Title II disposal sites managed by the U.S. Department of Energy.

This report is submitted in compliance with the reporting requirements set forth in 10 CFR 40.28, and each inspection was conducted in accordance with the inspection and monitoring requirements contained in the Long-Term Surveillance Plan for each site.

Please call me at 970-248-6048 if you have comments or questions.

Sincerely,

Thomas C. Pauling

Thomas C. Pauling
Site Manager

Enclosures

cc w/o enclosure:
R. Plieness, LM-20
D. Johnson, Stoller (e)
File: ADM 535.10(A) (Roberts)

Pauling/2007 UMTRCA Title II Site Inspection

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3610 Collins Ferry Road, P.O. Box 880, Morgantown, WV 26507	☐	626 Cochrans Mill Road, P.O. Box 10940, Pittsburgh, PA 15236
1000 Independence Ave., S.W., Washington, DC 20585	☐	11025 Dover St.,Suite 1000, Westminster, CO 80021
1103 Oakridge Drive, Uno Bldg., Harrison, OH 45030	☐	955 Mound Road, Miamisburg, OH
232 Energy Way, N. Las Vegas, NV 89030	☐	

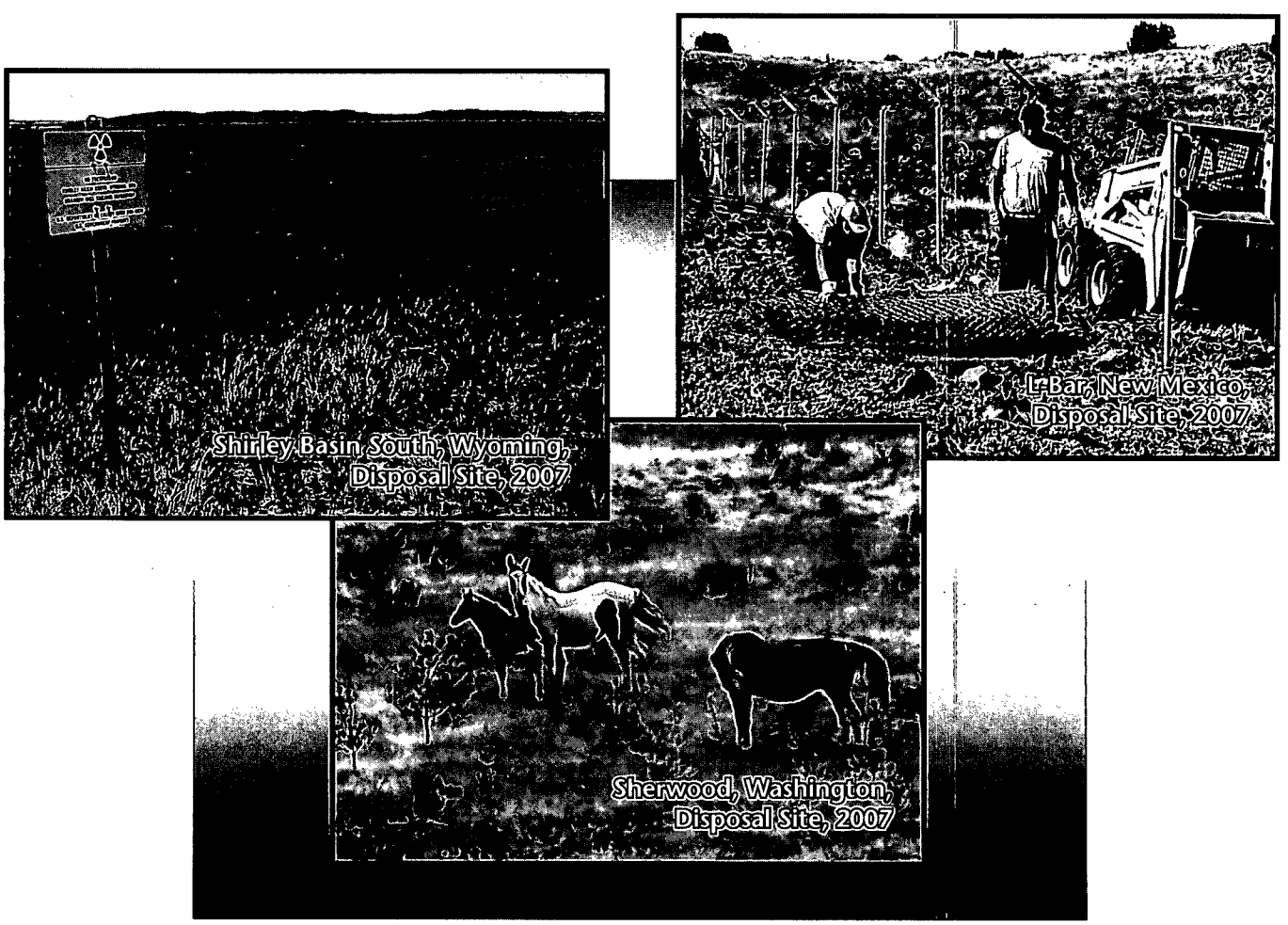
REPLY TO: Grand Junction Office

DOE–LM/1542–2007

U.S. Department of Energy
Office of Legacy Management

2007 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title II Disposal Sites

November 2007



Work Performed by the S.M. Stoller Corporation under DOE Contract No. DE–AC01–02GJ79491 for the U.S. Department of Energy Office of Legacy Management.
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DOE–LM/1542-2007

U.S. Department of Energy
Office of Legacy Management

2007 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title II Disposal Sites

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Table of Contents

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Acronyms

AAS	alternate abatement standard
ACL	alternate concentration limit
BIA	U.S. Bureau of Indian Affairs
BLM	U.S. Bureau of Land Management
CFR	*Code of Federal Regulations*
DOE	U.S. Department of Energy
EMP	erosion monitoring program
LM	Office of Legacy Management
LTSP	Long-Term Surveillance Plan
mg/L	milligram(s) per liter
NRC	U.S. Nuclear Regulatory Commission
PCB	polychlorinated biphenyl(s)
pCi/L	picocurie(s) per liter
PL	photo location
PMF	probable maximum flood
POC	point of compliance
POE	point of exposure
TDS	total dissolved solids
UMTRCA	Uranium Mill Tailings Radiation Control Act of 1978 (88 USC 7901, et seq.)
WDEQ	Wyoming Department of Environmental Quality

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 Office of Legacy Management (DOE–LM) in 2007 at five 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 five UMTRCA Title II disposal sites under a general license granted by the U.S. Nuclear Regulatory Commission established at Title 10 *Code of Federal Regulations* Part 40.28. Reclamation activities continue at additional 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 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 or contingency inspections, or corrective action. LTSPs and site compliance reports are available on the Internet at **www.lm.doe.gov**.

The sites required routine monitoring and maintenance activities in 2007, including ground water monitoring, erosion and vegetation monitoring, vegetation and noxious weed control, and access road and fence repairs. The following nonroutine activities[1] occurred in 2007.

- Bluewater, New Mexico—a depression in the asbestos materials disposal cell cover was repaired.
- L-Bar, New Mexico—three contaminated drain outlets at the base of the containment dam were remediated.
- L-Bar, New Mexico—standpipes that were left on the containment dam were abandoned.
- L-Bar, New Mexico—unneeded chain-link security fence that enclosed the former mill site was removed.
- Shirley Basin South, Wyoming—the ground water alternate concentration limit for radium-228 continued to be exceeded at two monitor wells. The cause for this occurrence has not been determined. Regulatory notifications have been made and a recommended evaluative monitoring program is being conducted in accordance with the requirements of the LTSP.

[1]Nonroutine activities are activities implemented in response to changes in site conditions, regulatory setting, or management structure following an extraordinary event or 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, which includes an index number for each item that can be found in the left margin next to the corresponding text in the respective site chapter.

Table ES–1. 2007 Summary of UMTRCA Title II Site Issues and Actions

Site	Chapter	Page	Index No.	Issues and Actions
Bluewater, New Mexico	1	1–2	1A	Removed accumulated windblown sand from entrance area.
		1–2	1B	Replaced missing perimeter sign at the entrance gate.
		1–8	1C	Repaired a depression on asbestos disposal cell cover.
		1–8	1D	Repaired fences.
		1–8	1E	Repaired damaged perimeter road.
		1–9	1F	Ground water compliance monitoring.
Edgemont, South Dakota	2	2–2	2A	Installed entrance sign on the entrance gate (sign post broken).
		2–5	2B	Sprayed noxious weeds.
L-Bar, New Mexico	3	3–2	3A	Repaired damaged access roads.
		3–2	3B	Closed gaps below fence.
		3–2	3C	Removed unneeded chain-link security fence.
		3–2	3D	Installed entrance signs at three site access points.
		3–6	3E	Remediated contaminated drain outlets.
		3–6	3F	Abandoned standpipes on containment dam.
		3–6	3G	Erosion repair necessary.
		3–7	3H	Revised grazing license to include additional land.
		3–7	3I	Regraded locations excavated by vandals.
		3–7	3J	Removed tamarisk.
		3–8	3K	Ground water compliance monitoring.
		3–10	3L	Measured cell cover erosion and vegetation.
Sherwood, Washington	4	4–6	4A	Conducted dam safety inspection.
		4–6	4B	Logging operations by BIA continued on site; reclamation pending.
		4–7	4C	Sprayed noxious weeds.
		4–7	4D	Measured weed populations.
		4–8	4E	Ground water best management practice monitoring.
Shirley Basin South, Wyoming	5	5–2	5A	Replaced missing perimeter sign.
		5–6	5B	Grazing license established with local rancher.
		5–6	5C	Sprayed noxious weeds.
		5–6	5D	Ground water compliance monitoring.
		5–8	5E	Continued to exceed a ground water alternate concentration limit.

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 29, 2007, and was in excellent condition. Overall, the disposal cells and their cover materials are in excellent condition; however, several shallow depressions exist on the cover along the north edge of the main tailings disposal cell, and they will be surveyed in 2008 to determine if repairs are necessary. Maintenance work conducted at the site in 2007 included repair of the asbestos disposal cell cover, repairs to eroded sections of the site perimeter road, removal of windblown sand from the fences at the site entrance, and fence repairs. These repairs were in good condition at the time of the 2007 inspection. Groundwater monitoring results indicate that all compliance requirements continue to be met. No cause for a follow-up inspection was identified.

1.2 Compliance Requirements

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

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 1.3.1
Follow-up Inspections	Section 3.5	Section 1.3.2
Routine Maintenance and Emergency Measures	Section 3.6	Section 1.3.3
Environmental Monitoring	Section 3.7	Section 1.3.4

Institutional Controls—The 3,300-acre disposal 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 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 disposal site, as defined by DOE Policy 454.1, consist of federal ownership of the property, a site perimeter fence, warning/no trespassing signs placed along the perimeter fence and around the disposal cells, and a locked gate at the site entrance. Verification of these institutional controls is part of the annual inspection. No off-site institutional controls are needed because contaminated groundwater is limited to the area within the federal land boundary.

1.3 Compliance Review

1.3.1 Annual Inspection and Report

The disposal site, located approximately 9 miles northwest of Grants, New Mexico, and 1.5 miles northeast of Bluewater, New Mexico, was inspected on August 29, 2007. Results of the inspection are described below. Features and photograph locations (PLs) mentioned in this report

are shown on Figures 1–1 (south area) and 1–2 (north area). Numbers in the left margin of this report refer to items summarized in the Executive Summary table.

1.3.1.1 Specific Site Surveillance Features

Entrance Gate, Access Road, Site Access Gate, and Signs—Access to the site is directly off of Cibola County Road 334; no private property is crossed to gain site access. The entrance gate (at County Road 334) is a steel, double-swing stock 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 access road leads from the entrance gate to the main site access gate that also is a steel, double-swing stock gate secured by locks. The access road is an all-weather road 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 entrance gate, access road, and access gate were all in good condition. Windblown sand tends to accumulate near the entrance gate and
1A had buried the boundary monuments and portions of the perimeter fence. The sand was moved away from these locations a week prior to the inspection (PL–1).

Fifty-five warning signs, designated as perimeter signs P1 through P52 on the drawings (including perimeter signs P2A, P9A, and P9B), are mounted on steel posts at access points along right-of-way intersections within the site boundary and around the main and carbonate
1B tailings disposal cells. Perimeter sign P1, located at the site entrance, was missing from the entrance gate and a new sign was installed on a metal t-post inside the gate (PL–2). Perimeter sign P3, damaged by a shotgun blast, is still legible. All other signs were in good condition.

Site Marker and Boundary Monuments—A granite site marker is located between the southwest corner of the main tailings disposal cell and the northwest corner of the carbonate tailings disposal cell. The marker was in excellent condition.

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. Due to time constraints, not all of the boundary monuments were verified during the inspection; however, all of the monuments were located during a site maintenance visit in fall 2005. Some monuments tend to get covered by drifting sand, and metal t-posts have been driven at those locations to help locate them during future inspections.

Monitor Wells—The groundwater monitoring network consists of nine wells located inside the site boundary. Five wells are screened in the alluvial aquifer and the other four wells are screened in the San Andres Limestone-Glorieta Sandstone, which is the bedrock aquifer of concern at the site. The well surface casings and locked caps were in good condition.

1.3.1.2 Transects

To ensure a thorough and efficient inspection, the site was divided into four areas referred to as transects: (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 PCB (polychlorinated biphenyl) disposal area, and associated landfills; (3) the region between the disposal structures and the site perimeter; and (4) the site perimeter and outlying area.

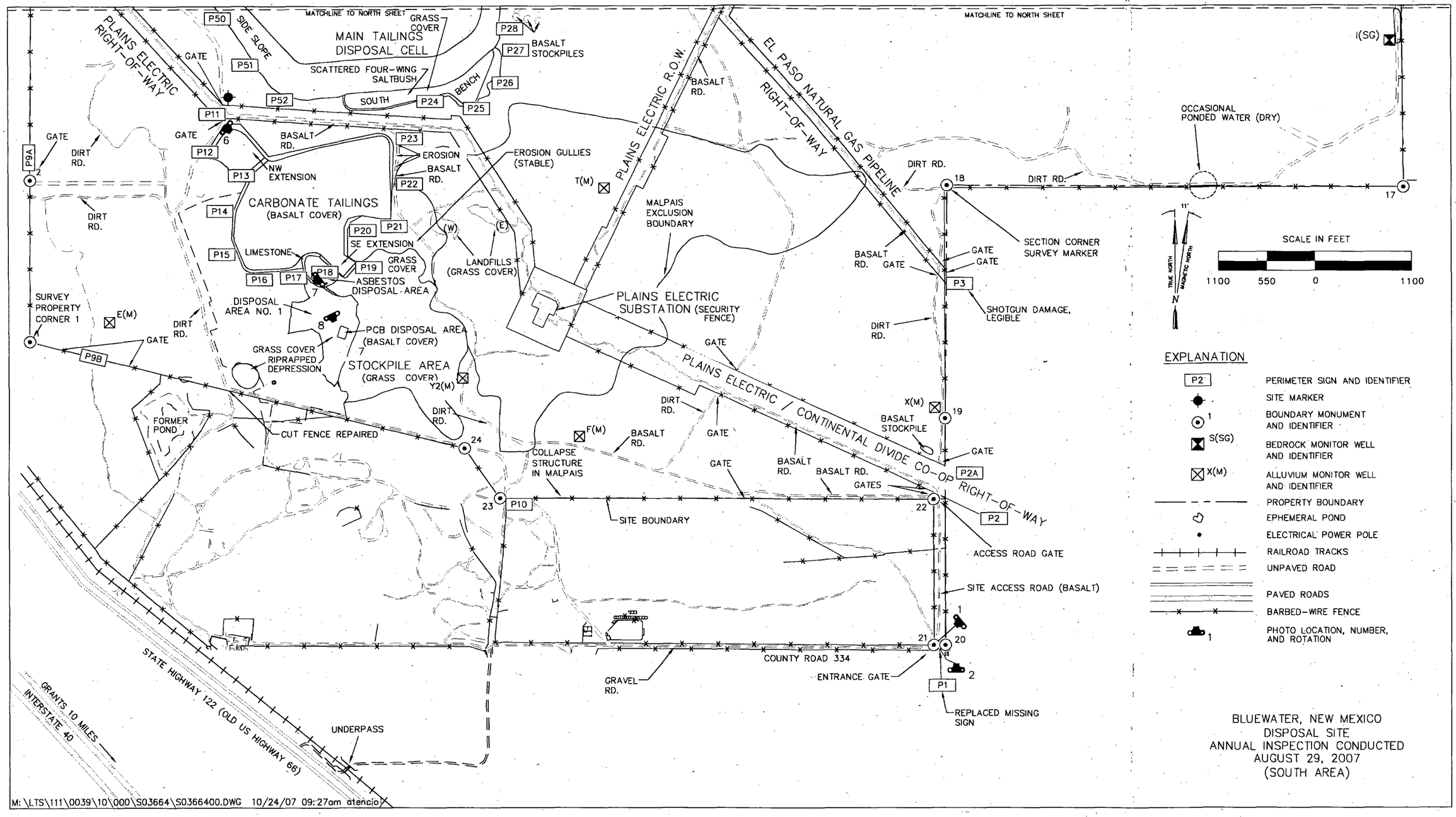


Figure 1–1. 2007 Annual Compliance Drawing for the Bluewater, New Mexico, Disposal Site (South Area)

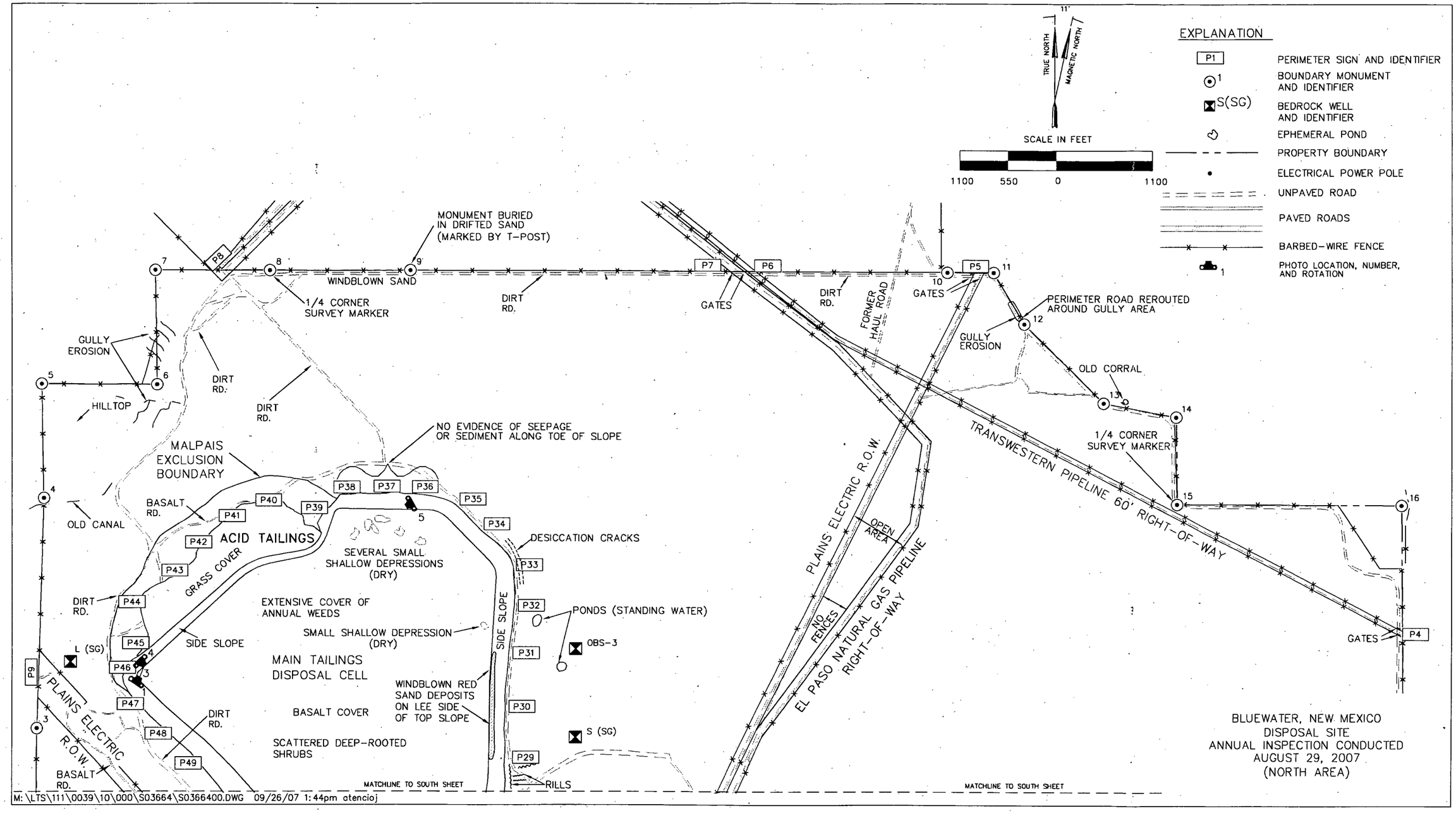


Figure 1–2. 2007 Annual Compliance Drawing for the Bluewater, New Mexico, Disposal Site (North Area)

Within each transect, inspectors examined specific site surveillance features, such as monitor wells, boundary monuments, and signs. Inspectors examined each transect for evidence of erosion, settling, slumping, or other disturbance that might affect site integrity, protectiveness, or the long-term performance of the site.

Main Tailings Disposal Cell, the Acid Tailings Disposal Area, and the South Bench Disposal Area—These three disposal areas are contiguous and together constitute one large disposal area of approximately 320 acres; all were in excellent condition. The main tailings disposal cell is covered with basalt riprap and slopes northward. The top slope grade decreases from 3 to 4 percent at the south end to less than 0.5 percent at the north end. The top slopes of the acid tailings (PL–3) and the south bench disposal areas are essentially flat and covered by healthy grass. The side slopes of the three disposal areas are protected by basalt riprap. The riprap was in excellent condition.

As shown on photo PL–4, the top of the main tailings disposal cell had an extensive cover of annual weeds (primarily Russian thistle, which is not a listed noxious weed in New Mexico), along with some wildflowers and deep-rooted shrubs (rabbitbrush and four-wing saltbush). Patches of annual weeds also were present on the east side slope of the cell. Control of plant encroachment is not required by the LTSP.

Several small shallow depressions exist on the relatively flat north end of the top slope of the main tailings disposal cell (PL–5). Although ponded water has been observed in the past, the depressions have been dry during the last several inspections. Given that evaporation greatly exceeds precipitation in this area, ponding is believed to be infrequent and brief and, therefore, is not considered to be a concern at this time. Slimes from the settling ponds were placed in the northern part of the main tailings disposal cell, and areas containing slimes are more likely to settle than areas containing drier waste materials. The depressions will continue to be monitored for evidence of significant settling or displacement. A survey of the affected area is planned for 2008 to compare the current surface configuration with the design drawings, and the results will be evaluated to determine if repairs to the cover should be considered.

Desiccation cracks are present in the soil adjacent to the northeast corner of the main tailings disposal cell. The features are caused by shrinkage of clay-rich backfill materials and do not impact the stability of the cell. Small ponds often form in an area along the east side of the disposal cell and in other low spots following storm events and provide water for wildlife and wild burros that inhabit or travel through the site. The areas of ponding are far enough from the cell to not impact it.

Carbonate Tailings Disposal Cell, Asbestos and PCB Disposal Areas, and Landfills—The top and side slopes of the carbonate tailings disposal cell are covered by basalt riprap. The top, for the most part, slopes gently eastward. The small northwest and southeast extensions slope in their respective directions. Annual weeds and scattered woody shrubs were present on the cell and its extensions (PL–6). The carbonate tailings disposal cell was in excellent condition.

The asbestos disposal area is a bowl-like feature just south of the carbonate pile. 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. A small depression was located along the south edge of the disposal area. The depression, probably the result of piping or collapse of uncontaminated fill material incompletely compacted during final grading, was first noted during the 1999 annual

inspection but had not been a concern because it does not encroach on asbestos-containing materials. However, to mitigate the potential for encroachment into these materials, the
1C depression was filled with crushed basalt rock during spring 2007. No additional settling had occurred since the repair was completed (PL–7). The asbestos disposal area is in excellent condition.

The small riprap-covered PCB disposal area is in excellent condition (PL–8). The two grass-covered landfill areas east of the carbonate tailings disposal cell also are in excellent condition. Two other disposal areas, Disposal Area Number 1 and the Stockpile Area, are south of the carbonate tailings disposal cell. Both are grass-covered and in excellent condition.

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 parts of the site are inaccessible by vehicle because they are covered by basalt flows.

Several utility company rights-of-way cross the site. These rights-of-way are enclosed by stock fences with gates where the rights-of-way intersect one another, cross the site boundary, or cross the perimeter road. Roads along the rights-of-way typically are covered with crushed basalt to provide the utility companies with all-weather access.

Stockpiles of basalt riprap that can be used by DOE for road repairs are in two areas. One stockpile is located north of the access road gate; rock from this pile was used to repair the asbestos cell cover and the perimeter road in 2007. A cluster of three stockpiles is located east of the main tailings disposal cell.

An electric power substation is enclosed by a security fence near the center of the site along the Plains Electric Company right-of-way. Fencing around this station was in good condition.

The vegetation was in good health in several areas of the site. However, due to runoff and wind erosion, a portion of the site northeast of the main tailings disposal cell remains relatively barren. Reuse of the site through controlled grazing of the vegetated areas of the site was considered by DOE. However, the discontinuity of the vegetated areas and the lack of water for livestock made this use unfeasible.

Site Perimeter and Outlying Areas—A local subcontractor has been retained to repair the
1D fencing and periodically check for unauthorized livestock use or trespassing on site property. Grazing is not part of the current management plan for this site and, if livestock are discovered on the site, the subcontractor is authorized to remove the animals. The subcontractor repaired cut fences and replaced a short section of fence in 2007.

The perimeter road consists of a dirt track covered at places with crushed basalt. The road runs along the site boundary in much of the southern and most of the northern and eastern parts of the site. Portions of the road are susceptible to erosion, and large gullies had formed in several areas after record rainfall events in 2006. These sections were repaired during spring 2007 and,
1E overall, were in good condition at the time of the inspection despite several significant rainfall events that had occurred since the repairs were completed.

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, change in land use, or other phenomena that might affect the long-term integrity of the site. None was seen.

1.3.2 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 follow-up inspections were required in 2007.

1.3.3 Routine Maintenance and Emergency Measures

During 2007, the asbestos cell cover, perimeter fence, and the perimeter roads were repaired. Also, windblown sand was removed from the fence near the site entrance gate. The site was checked on a monthly basis by a local subcontractor for evidence of trespassing and to ensure that the perimeter fence is intact.

Emergency measures are corrective actions that DOE will take in response to unusual damage or disruption that threaten or compromise site health and safety, security, integrity, or compliance with 40 CFR 192. No emergency measures were required in 2007.

1.3.4 Environmental Monitoring

1F Groundwater monitoring is required at the Bluewater site. In accordance with the LTSP, the alluvial aquifer background and point-of-compliance (POC) wells are sampled annually for polychlorinated biphenyls (PCBs) and every 3 years for molybdenum, selenium, and uranium (Table 1–2). The bedrock aquifer background and POC wells are sampled every 3 years for selenium and uranium. Alluvial aquifer well MW–X(M) and bedrock aquifer well MW–I(SG), point-of-exposure (POE) wells located along the east (downgradient) property boundary, will be sampled only if specified alternate concentration limits (ACLs) are exceeded at the respective alluvial and bedrock aquifer POC wells (Table 1–3). To date, sampling of the POE wells has not been required because ACLs have not been exceeded at the POC wells.

Only PCBs were sampled for during the November 2006 sampling event. PCBs have never been detected in any of the wells at the site and were not detected during that event. The next 3-year sampling event for all of the parameters is scheduled for November 2007, and the results will be included in the 2008 annual compliance report.

Table 1–2. Groundwater Monitoring Network for the Bluewater, New Mexico, Disposal Site

Monitor Well	Network Application	Analytes	Frequency
MW–E(M)	Alluvial background well	Mo, Se, U, and PCBs	Every 3 years (PCBs annually)
MW–F(M)	Alluvial POC well	Mo, Se, U, and PCBs	Every 3 years (PCBs annually)
MW–T(M)	Alluvial POC well	Mo, Se, U, and PCBs	Every 3 years (PCBs annually)
MW–Y2(M)	Alluvial POC well	PCBs	Annually
MW–X(M)	Alluvial POE well	Mo, Se, U, and PCBs	If alluvial POC ACL exceeded
MW–L(SG)	Bedrock background well	Se and U	Every 3 years
MW–OBS-3	Bedrock POC well	Se and U	Every 3 years
MW–S(SG)	Bedrock POC well	Se and U	Every 3 years
MW–I(SG)	Bedrock POE well	Se and U	If bedrock POC ACL exceeded

Key: ACL = alternate concentration limit; Mo = molybdenum; PCB = polychlorinated biphenyl; POC = point-of-compliance; POE = point-of-exposure; Se = selenium; U = uranium

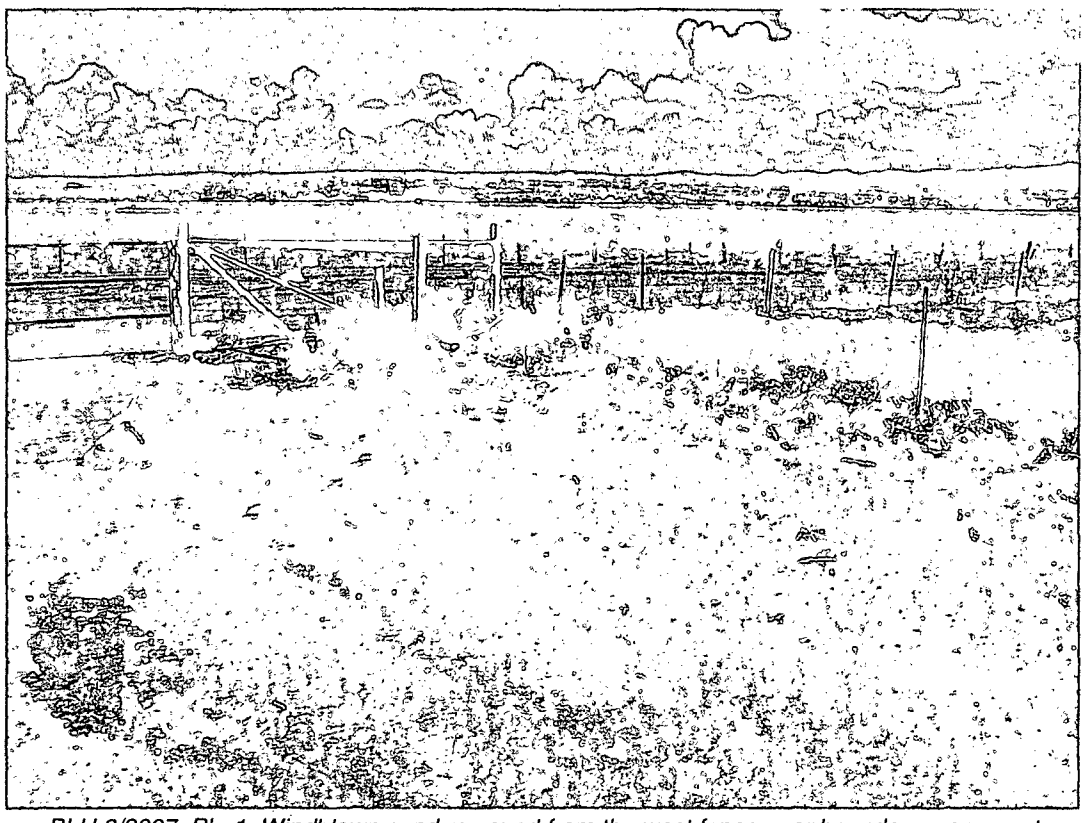
Table 1–3. Groundwater Alternate Concentration Limits for the Bluewater, New Mexico, Disposal Site

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

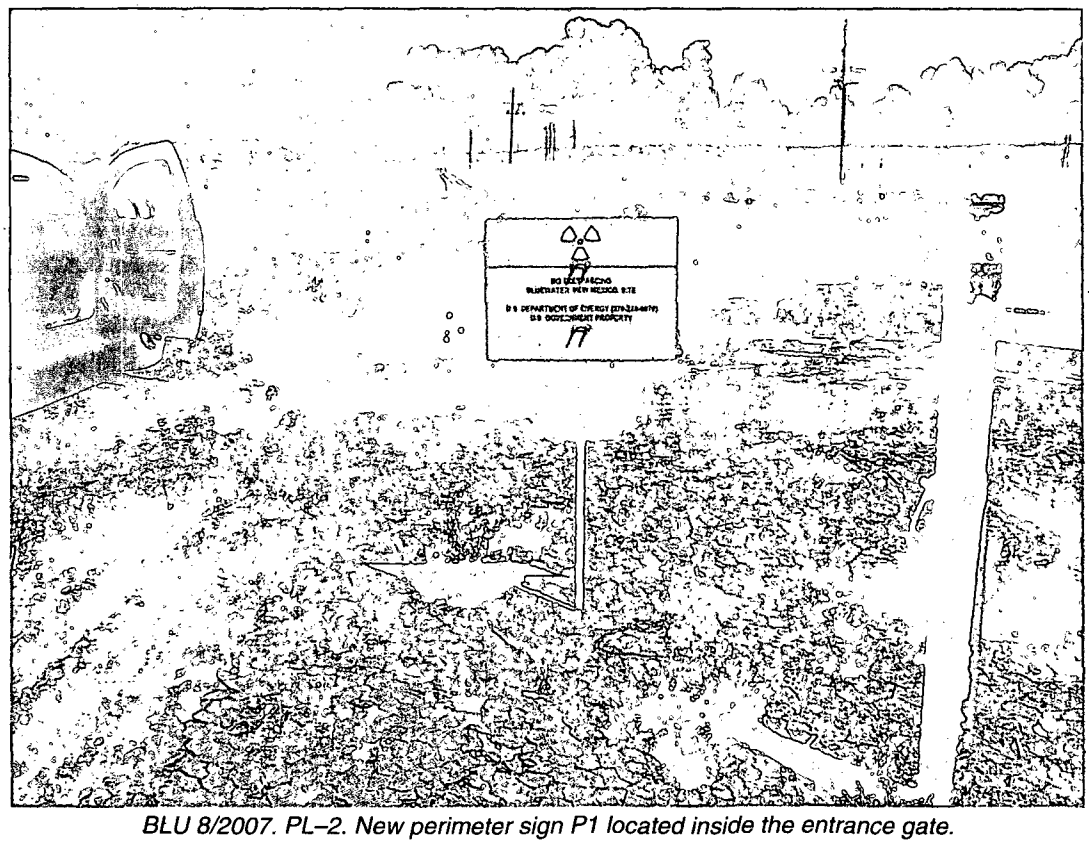
Key: ACL = alternate concentration limit; mg/L = milligrams per liter; POC = point-of-compliance

1.3.5 Photographs

Photograph Location Number	Azimuth	Photograph Description
PL–1	230	Windblown sand removed from the west fence near boundary monument BM–21 at the site entrance.
PL–2	0	New perimeter sign P1 located inside the entrance gate.
PL–3	35	The grass-covered acid tailings disposal cell.
PL–4	135	The southwest edge of the main tailings disposal cell cover.
PL–5	240	Depressions along the north edge of the main tailings disposal cell.
PL–6	130	View across the northwest extension of the carbonate tailings disposal cell.
PL–7	235	Repaired depression in the asbestos disposal cell cover.
PL–8	155	The PCB disposal area cover.

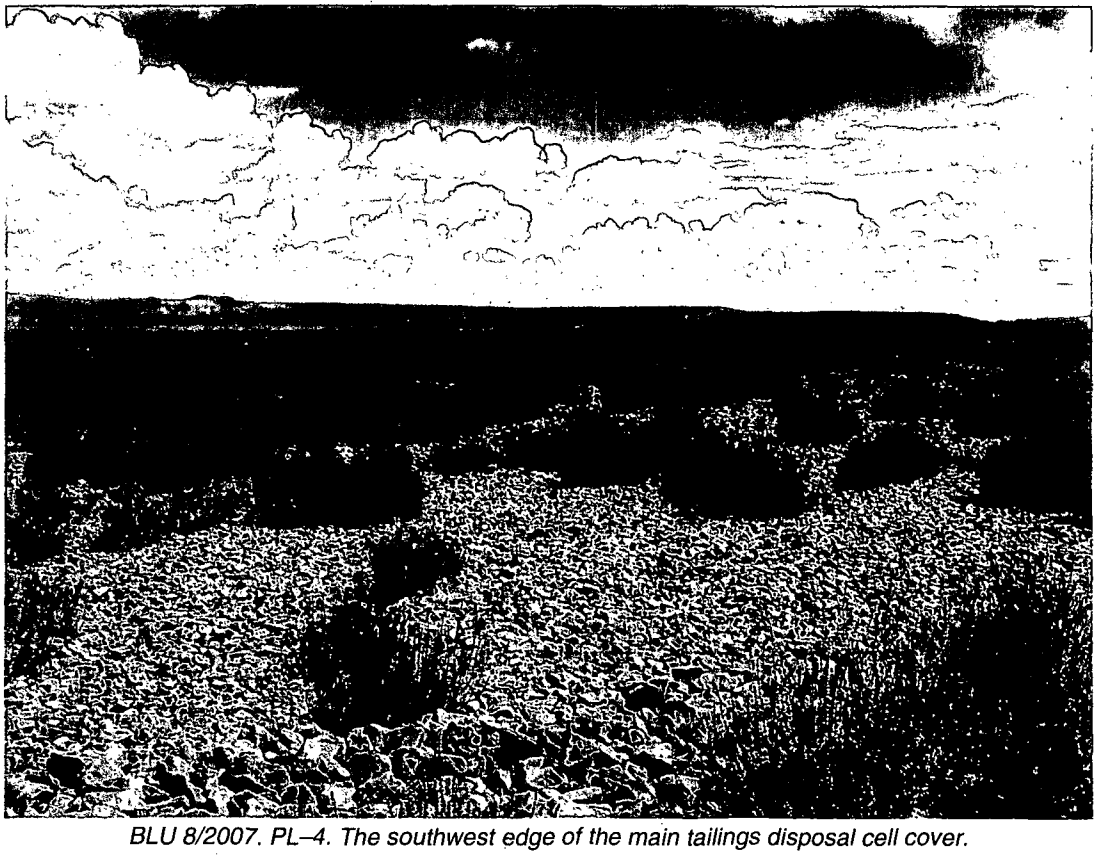


BLU 8/2007. PL–1. Windblown sand removed from the west fence near boundary monument BM-21 t the site entrance.

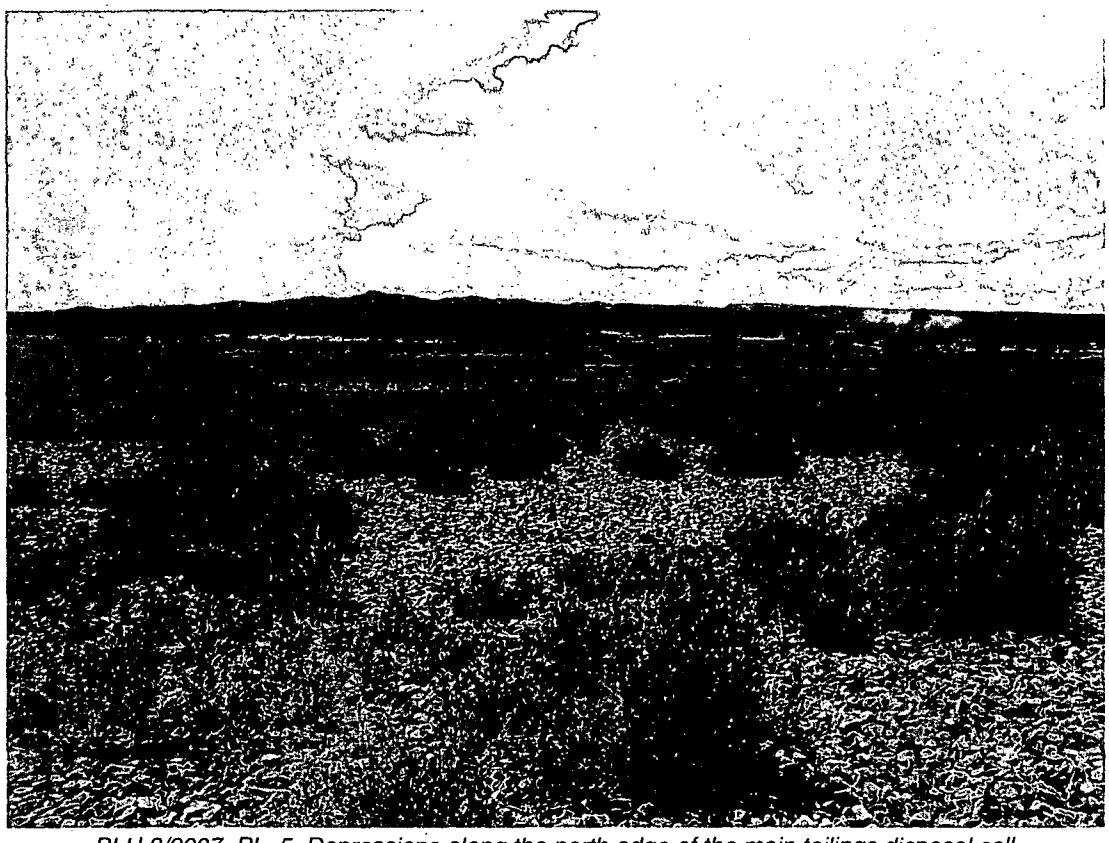


BLU 8/2007. PL–2. New perimeter sign P1 located inside the entrance gate.

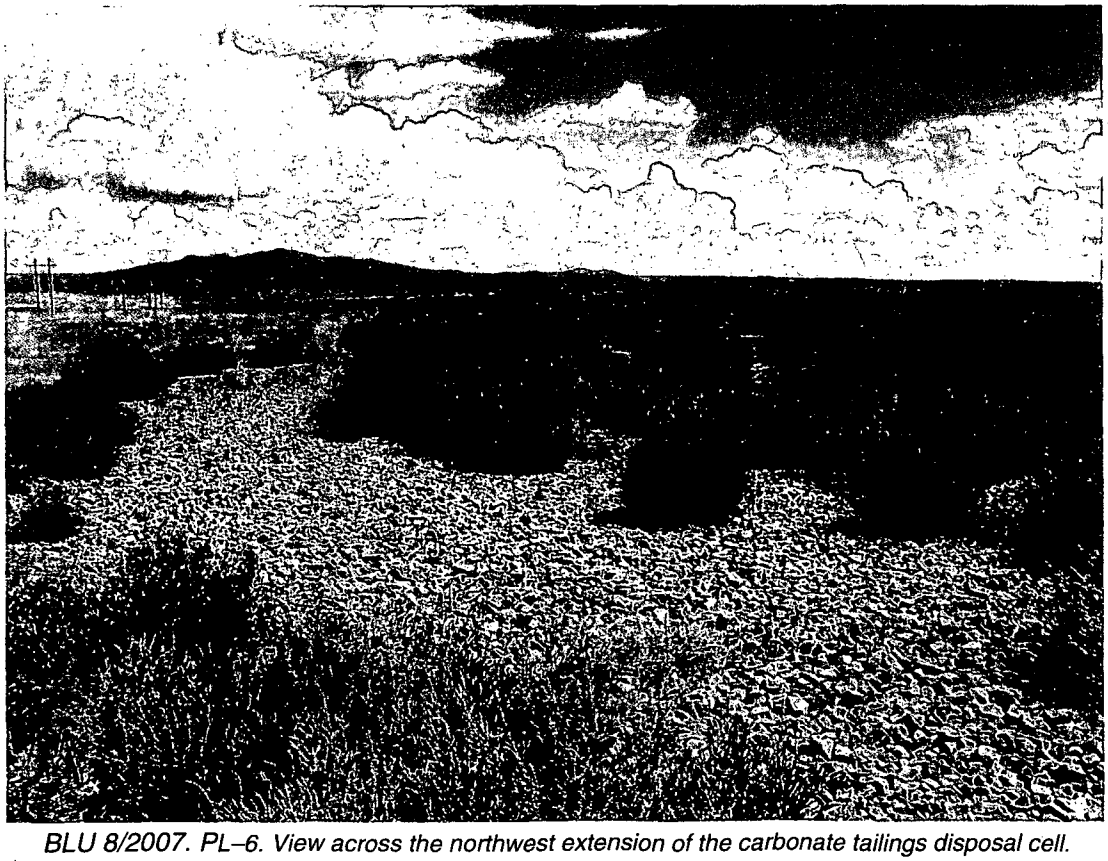
BLU 8/2007. PL–3. The grass-covered acid tailings disposal cell.



BLU 8/2007. PL–4. The southwest edge of the main tailings disposal cell cover.



BLU 8/2007. PL–5. Depressions along the north edge of the main tailings disposal cell.



BLU 8/2007. PL–6. View across the northwest extension of the carbonate tailings disposal cell.

BLU 8/2007. PL–7. Repaired depression in the asbestos disposal cell cover.

BLU 8/2007. PL–8. The PCB disposal area cover.

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 June 12, 2007, and was in excellent condition. The entrance signpost was broken, and the sign was relocated to the entrance gate. The site continues to be grazed by a local rancher in exchange for checking site security and repairing the perimeter fence. Noxious weeds persist on and adjacent to rock-covered surfaces and will require continued monitoring and control. Groundwater monitoring is not required at this site. No cause for a follow-up inspection was identified.

2.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the Edgemont, South Dakota, Disposal Site are specified in the *Long-Term Surveillance Plan* [LTSP] *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 procedures established by DOE to comply with the requirements of Title 10 *Code of Federal Regulations* Part 40.28 (10 CFR 40.28). License requirements for this site are listed in Table 2–1.

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 2.3.1
Follow-up Inspections	Section 3.5	Section 2.3.2
Routine Maintenance and Emergency Measures	Section 3.6	Section 2.3.3
Environmental Monitoring	Section 3.7	Section 2.3.4

Institutional Controls—The 360-acre disposal 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 disposal site, as defined by DOE Policy 454.1, consist of federal ownership of the property, a site perimeter fence, a warning/no trespassing sign placed at the site entrance, and a locked gate at the site entrance. Verification of these institutional controls is part of the annual inspection.

2.3 Compliance Review

2.3.1 Annual Inspection and Report

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 June 12, 2007. Results of the inspection are described below. Features and photograph locations (PLs) mentioned in this report are shown on Figure 2–1. Numbers in the left margin of this report refer to items summarized in the Executive Summary table.

2.3.1.1 Specific Site Surveillance Features

Site Access, Gates, Sign, and Fence—Access to the Edgemont Disposal Site is immediately off County Road 6N and is unimpaired. No private property is crossed to gain access.

A tubular metal entrance gate is secured by a locked chain and was in excellent condition. Two wire gates are also present along the perimeter fence: one at the northwest corner of the property on the north perimeter fence line and one approximately 700 ft north of the southeast corner of the property on the east perimeter fence line. Both were in good condition.

The entrance sign was the only warning/no trespassing sign installed at the site. At the time of the inspection, the signpost was broken and laying on the ground; the damage likely was caused
2A by cattle. The sign was relocated to the entrance gate (PL–1), and will be moved to a new post inside the gate in 2008.

A four-strand barbed wire fence was installed in spring 1999 along the site perimeter boundary to demarcate DOE property and to control grazing on the property. The fence truncates the southeast corner to allow livestock access to a pre-existing stock pond. A grazing license granted by DOE allows a local rancher to graze the site in return for checking site security and maintaining the perimeter fence. Controlled grazing promotes turf vitality, and cattle were on the site at the time of the inspection. An all terrain vehicle was used to inspect the entire site perimeter, and the fence was in excellent condition (PL–2).

Site Marker and Monuments—One unpolished granite site marker identifying the disposal site is located just inside the entrance gate and was in excellent condition. Four boundary monuments, located at each corner of the property, were in excellent condition (PL–3).

Monitor Wells—There are no monitor wells at this site.

2.3.1.2 Transects

To ensure a thorough and efficient inspection, the site was divided into four areas referred to as transects: (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 transect, inspectors examined specific site surveillance features, such as boundary monuments. Each transect was inspected for evidence of erosion, settling, slumping, or other disturbance that might affect site integrity or the long-term performance of the cell.

Top of the Disposal Cell—The 100-acre top of the disposal cell, completed in 1989, is grass-covered and was in excellent condition (PL–4). DOE manages the grass cover through controlled grazing. The grass is well established and was not overgrazed when inspected. Numerous cattle trails are present on the cell top, but there were no indications of erosion, settlement, or other modifying processes that might affect the integrity of the cell.

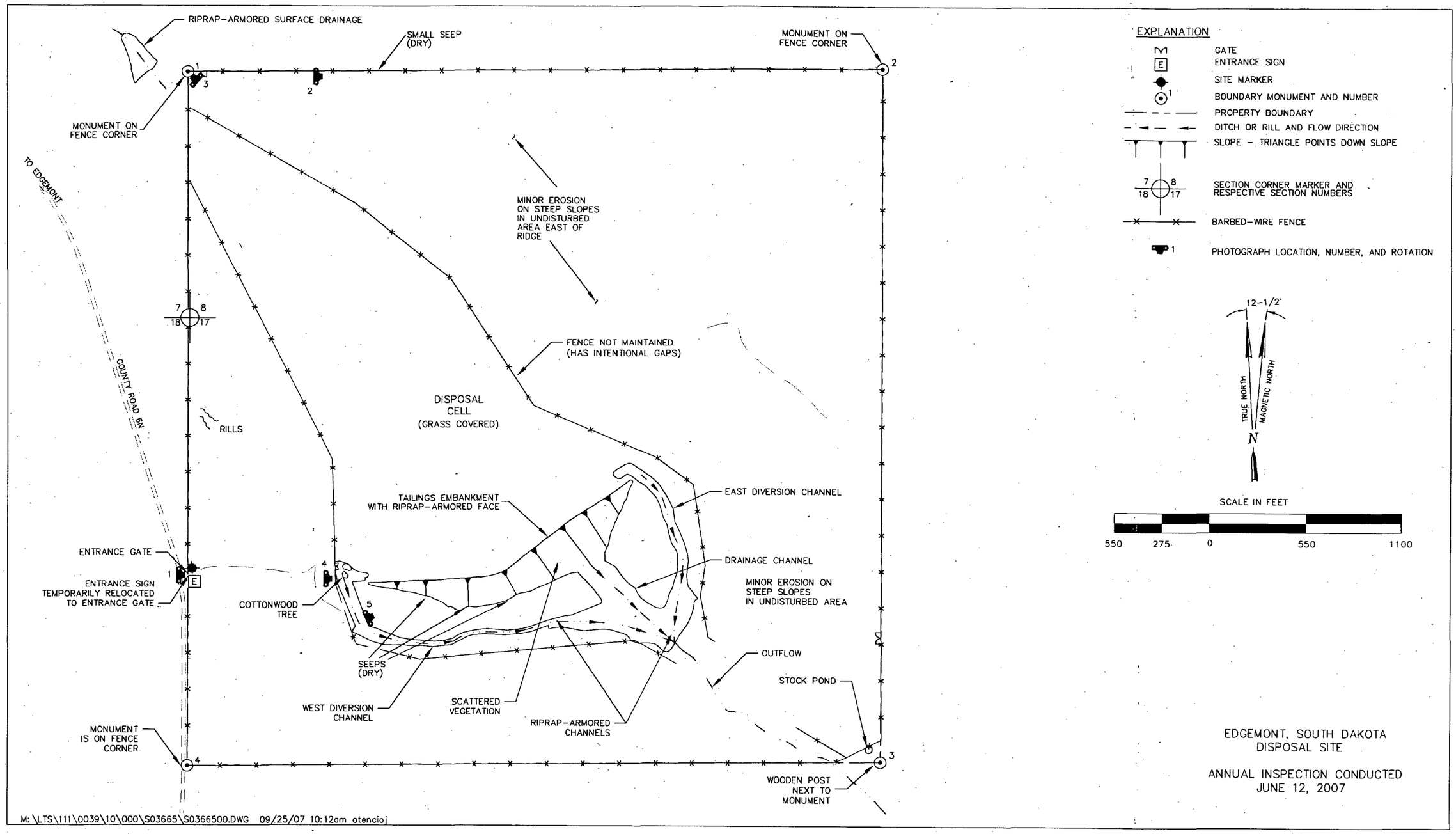


Figure 2–1. 2007 Annual Compliance Drawing for the Edgemont, South Dakota, Disposal Site

Embankment Face and Drainage and Diversion Channels—The embankment face, the steepest man-made slope on site, is covered with riprap. The slope is stable, and the riprap showed no signs of degradation. Scattered plants, mostly grass and annual weeds, grow in the riprap (PL–5). These plants do not pose a threat to the stability or function of the embankment face.

Diversion and drainage channels are grass-covered on their upgradient portions (these are gentle swales on each side of the disposal cell) and riprap-armored on their downgradient portions and on steeper slopes. Grass in the vegetated portions of the channels is dense and healthy, and there was no evidence of erosion. Minor amounts of vegetation occur in the riprap (PL–4). The vegetation density does not appear to have increased significantly in the last few years and does not pose a threat to the function of the channels. The riprap-armored surface drainage channel just outside the northwest corner of the property, designed to prevent headward erosion onto the disposal site, was also stable and in good condition (PL–3).

DOE has retained the Fall River County weed control agent to spray Canada thistle, a noxious weed persisting on the site, since 1998. The thistle usually has been found growing on and along the edges of the riprap-armored surfaces. Numerous patches were present at the time of the
2B inspection. These patches subsequently were sprayed with herbicide by the county.

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 grasses and shrubs and formerly disturbed areas covered primarily with grasses. Although some areas of minor natural erosion are occurring on the steep shale slopes in the undisturbed areas, the erosion does not threaten the integrity of the stabilized tailings. Overall, this region of the site is in excellent condition.

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. The town of Edgemont operates a municipal landfill north-northwest of the site, and minor amounts of windblown trash have been observed on site or along the fences; however, landfill trash was insignificant at the site this year. There was no evidence of activity or change in land use that could affect the site.

2.3.2 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 follow-up inspections were required in 2007.

2.3.3 Routine Maintenance and Emergency Measures

Noxious weeds were sprayed with herbicide in 2007. No other maintenance or repairs were required.

Emergency measures are corrective actions that DOE will take in response to unusual damage or disruption that threaten or compromise site health and safety, security, integrity, or compliance with 40 CFR 192. No emergency measures were required in 2007.

2.3.4 Environmental Monitoring

Groundwater monitoring is not required at this site, as stipulated in the LTSP, due to the presence of a 300- to 700-foot-thick layer of competent unweathered shale bedrock lying between the disposed 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.

2.3.5 Photographs

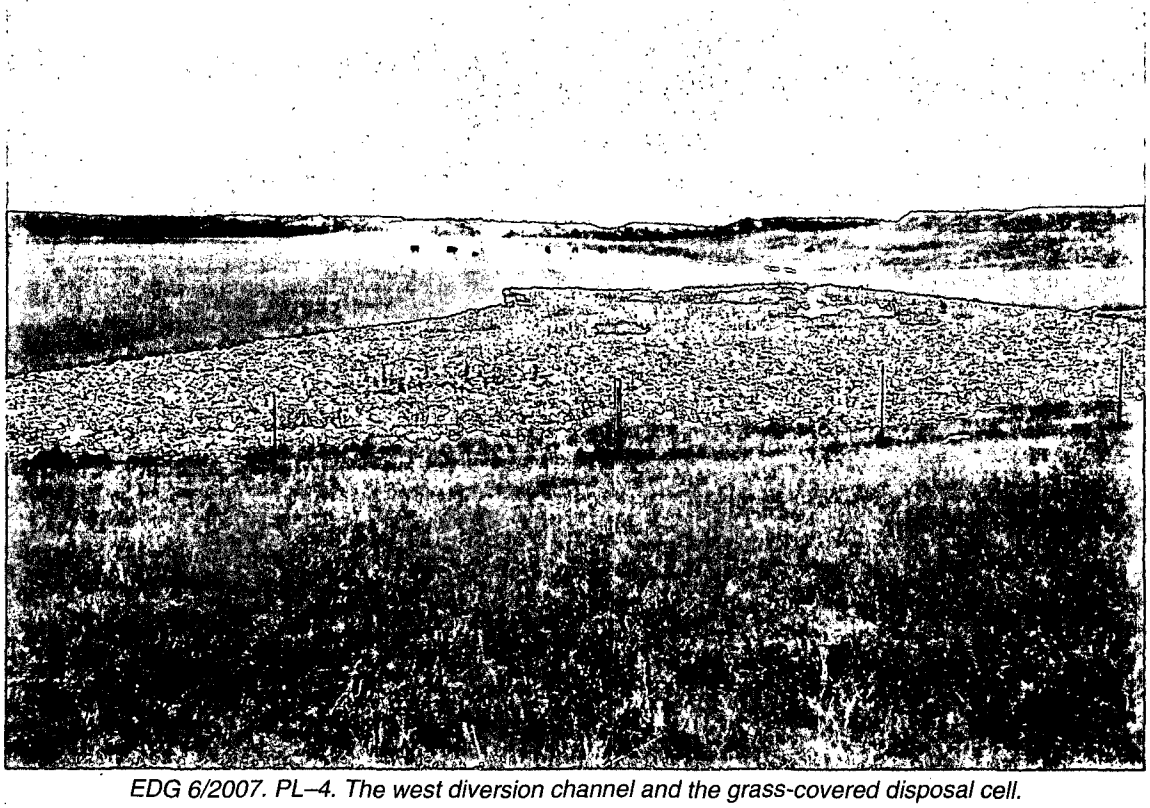
Table 2–2. Photographs Taken at the Edgemont, South Dakota, Disposal Site

Photograph Location Number	Azimuth	Description
PL–1	90	Entrance sign relocated to the entrance gate.
PL–2	90	Perimeter fence along the north property boundary.
PL–3	310	Boundary monument BM–1; riprap-armored surface drainage northwest of the site in background.
PL–4	90	The west diversion channel and the grass-covered disposal cell.
PL–5	65	The face of the tailings embankment and cattle on the disposal cell top.

EDG 6/2007. PL–1. Entrance sign relocated to the entrance gate.

EDG 6/2007. PL–2. Perimeter fence along the north property boundary.

EDG 6/2007. PL–3. Boundary monument BM–1; riprap-armored surface drainage northwest of the site in background.



EDG 6/2007. PL–4. The west diversion channel and the grass-covered disposal cell.

EDG 6/2007. PL–5. The face of the tailings embankment and cattle on the disposal cell top.

End of current text

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 28, 2007. Overall, the site was in good condition. Erosion is active in several areas of the site but does not currently impact the tailings impoundment or the function of the diversion structures. However, these erosion areas will be revisited and evaluated in late 2007, and erosion repairs are planned for 2008. Site maintenance activities conducted during the past year included remediation of contaminated materials at three abandoned drain outlets located along the toe of the containment dam, abandonment of several standpipes located on the containment dam, removal of most of the former mill site chain-link fence, repair of erosion-damaged roads on the site, and removal of mature tamarisk from the drainage features. Tamarisk plants found on the impoundment cover at the time of the annual inspection were cut and treated with herbicide. Erosion and vegetation measurements to monitor the condition of the impoundment cover indicated that no erosion is occurring and, overall, the foliar cover of the vegetation is increasing.

3.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the L-Bar, New Mexico, Disposal Site are specified in the *Long-Term Surveillance Plan* [LTSP] *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 requirements of Title 10 *Code of Federal Regulations* Part 40.28 (10 CFR 40.28). Table 3–1 lists license requirements for this site.

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 3.3.1
Follow-up Inspections	Section 3.5	Section 3.3.2
Routine Maintenance and Emergency Measures	Section 3.6	Section 3.3.3
Environmental Monitoring	Section 3.7	Section 3.3.4

Institutional Controls—The 738-acre disposal 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 disposal site, as defined by DOE Policy 454.1, consist of federal ownership of the property, a perimeter fence around the impoundment and associated structures, warning/no trespassing signs placed along the perimeter fence, and a locked gate at the site entrance. Verification of these institutional controls is part of the annual inspection. No off-site institutional controls are needed because contaminated groundwater is limited to the area within the federal land boundary.

3.3 Compliance Review

3.3.1 Annual Inspection and Report

The disposal site, located approximately 10 miles north of Laguna, New Mexico, and 2 miles east of Seboyeta, New Mexico, was inspected on August 28, 2007. Results of the inspection are described below. Features and photograph locations (PLs) mentioned in this report are shown on Figure 3–1. Numbers in the left margin of this report refer to items summarized in the Executive Summary table.

3.3.1.1 Specific Site Surveillance Features

Access, Gates, Fences, and Perimeter Signs—Access to the site is via an all-weather 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
3A Quitclaim Deed for the disposal site. Portions of the site are accessed via dirt roads. Erosion damage to several sections of these roads was repaired in April 2007.

The site entrance gate is a tubular metal stock gate located along a barbed-wire perimeter fence (PL–1). The entrance gate was locked and in excellent condition.

A five-strand barbed wire stock fence encompasses the tailings impoundment and associated drainage structures, and is intended to prohibit trespassing and livestock use on the disposal cell structures (PL–2). 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. The fence was in excellent
3B condition. In spring 2007, metal t-posts and additional wire were installed at locations where gullies or gaps below the bottom strand could allow livestock to enter the site. Additional modifications are planned for 2008.

3C A significant portion of the chain-link security fence that encompassed the former mill site was removed in July 2007. The chain-link fence was not included in the LTSP as a site surveillance feature; it had been left in place to serve as a second barrier for site security but was not intended to be maintained. The fence was removed because of vandalized and missing gates, damage caused by storm runoff, and general deterioration. Two segments of the fence were left in place where they closely parallel the barbed-wire perimeter fence; these segments are partially buried with silt, and removal would reactivate erosion of the slopes in those areas (PL–3).

Thirty perimeter warning/no trespassing signs are attached to the barbed-wire fence at approximately 500-foot intervals (PL–4). The perimeter signs were in excellent condition. Three
3D entrance signs were installed on steel posts set in concrete at former chain-link fence gate locations along the site boundary after the inspection.

Site Markers and Boundary Monuments—The granite site marker, located immediately inside the access gate, was in excellent condition. Due to wet terrain, not all of the eight flush-mounted boundary monuments installed at property tract corners were inspected; those that were inspected were in excellent condition. Metal t-posts were installed after the 2005 inspection to help inspectors find the monuments.

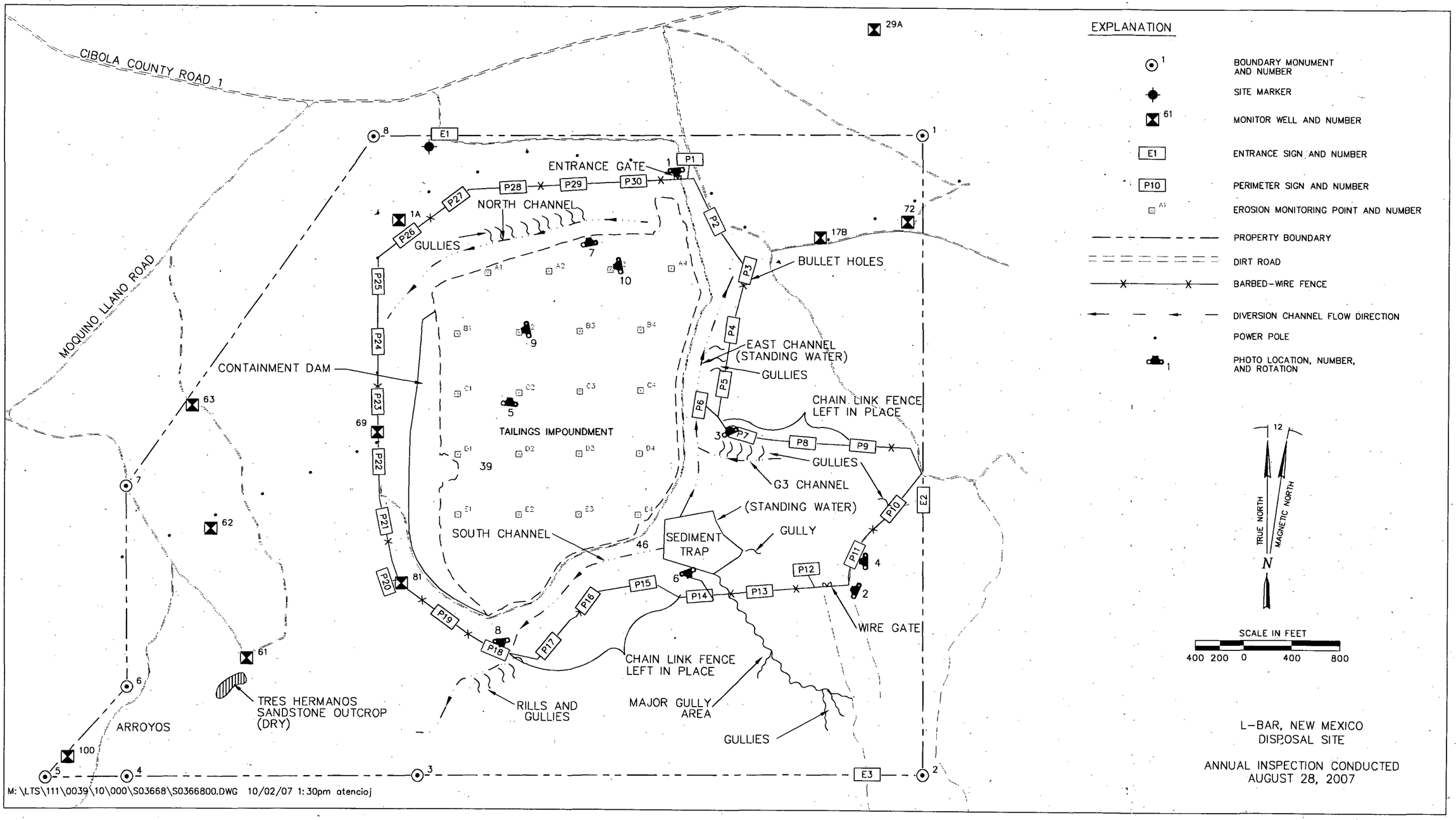


Figure 3–1. 2007 Annual Compliance Drawing for the L-Bar, New Mexico, Disposal Site

Monitor Wells—The site groundwater monitoring network consists of ten wells. Nine of the wells are located on the DOE site; background monitor well MW–29A is located outside the northeast corner of the site. A missing lock on well MW–63 was replaced; otherwise, the wells were secure and in good condition (MW–100 was not inspected due to wet road conditions). Some well locations do not have established access roads or tracks but are accessible by 4-wheel drive vehicle as long as the ground is dry.

3.3.1.2 Transects

To ensure a thorough and efficient inspection, the site was divided into four areas referred to as transects: (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 transect, inspectors examined specific site surveillance features, such as monitor wells, boundary monuments, and signs. Each transect was inspected for evidence of erosion, settling, slumping, or other disturbance that might affect site integrity, protectiveness, or the long-term performance of the site.

Cover of the Tailings Impoundment—The tailings impoundment, completed in 2000, occupies approximately 100 acres. The cover consists of a compacted clay layer overlain by clay-rich soil and ranges from 6 to 10 feet thick. 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. The cover was not seeded; 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 mitigate precipitation and runoff infiltration to the radon barrier.

Due to rainfall the previous day, the surface of the impoundment cover was wet. Several low areas on the surface tend to accumulate runoff after storm events; however, there was no standing water at the time of the inspection. The low areas, which are no more than a couple of inches below the surrounding grade, most likely resulted from wind erosion and/or minor settling shortly after the impoundment cover was completed. Wind-deposited, elongate mounds of fine-grained soil formed immediately downwind of old stalks from sunflower and kochia plants. The mounds are stable, and vegetation continues to establish on them. The ephemeral pools of water and windblown deposits do not impair the function of the cover materials.

Cracks were noted in the surface soil over much of the cell cover (PL–5). They ranged up to 20 inches deep and 3 inches wide, and are confined to the cover soil and do not extend into the radon barrier. The cracks may be the result of drying of the gypsum-rich cover soil after being saturated for an extended period of time in 2006. Although they are expected to heal as perennial vegetation continues to establish, the cracks will be monitored and evaluated to ensure that the underlying radon barrier is not compromised.

In accordance with the LTSP, erosion and vegetation are monitored on the impoundment cover. A description of the monitoring program and the results to date are presented in Section 3.3.4.2.

Containment Dam—The tailings impoundment was constructed by damming the upper portion 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. Native vegetation is encroaching on the face, which is desirable for increasing the erosion protection of the surface. There were no

indications of erosion, settlement, seepage, or other modifying processes that might affect the integrity of the dam.

During the 2005 inspection, discolored rock and soil were noted where a small polyvinyl chloride (PVC) pipe exited the base of the containment dam. A subsequent investigation of site records indicated that a network of eight PVC drainage systems was installed during reclamation to collect leachate from the tailings stored behind the dam. The leachate was then pumped back to an evaporation pond in the impoundment area. The drains were grouted in 1996 after leachate discharge apparently ceased. In May 2006, the site was revisited to measure the radioactivity and collect a sample of the discolored material. The other drain outlets were found, and two of them also had discolored rock and soil. Surface scans indicated that the material was radioactive, and analytical results of the samples indicated that all three locations contained elevated levels of radiological constituents representative of the impounded tailings. It appears that three of the grouted drains leaked for an unknown period of time after decommissioning and that leachate
3E residue accumulated on the rock and bedding materials at the outlet locations. Remediation of the three contaminated areas was conducted in December 2006.

Several PVC standpipes formerly used for monitoring moisture levels during reclamation activities were left in place on the dam but were no longer active and were not surveillance
3F features. The standpipes were filled with grout and the casings were cut off below grade in April 2007.

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 the watershed upgradient 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 riprap-armored dike. A tributary channel, the G3 Channel, was constructed to divert runoff from a smaller watershed into the East Channel. Standing water was present in the sediment trap (PL–2 and PL–4) and in a portion of the East Channel at the time of the inspection.

Storm runoff is expected to drop a significant portion of its sediment load in a sediment trap constructed at the base of the watershed before overtopping the trap and entering the East Channel. The sediment trap is designed to function for 600 years prior to needing to be excavated. Runoff from several significant storm events in 2005 and 2006 caused deep gullies to form in the soft soils and fill materials upgradient of the sediment trap (PL–6), resulting in a
3G substantial amount of sediment deposition in the sediment trap. Repairs are planned for 2008 to reduce the erosion and the amount of sediment being transported to the sediment trap.

Gullies have also formed along the north slope of the G3 Channel. The erosion is not degrading the function of the channel, but gullies are encroaching the perimeter fence in that area. This area will be evaluated for the need to retard the erosion and conduct erosion repairs.

Runoff water from the area north of the tailings impoundment is captured by the North Channel. The water is diverted away from the site to the west. Erosion is occurring on the south-facing slope of the channel but is not degrading the function of the channel or affecting the integrity of

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

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

[a]Background value.

Key: AAS = alternate abatement standard; ACL = alternate concentration limit; mg/L = milligrams per liter; N/A = not applicable; TDS = total dissolved solids

Annual groundwater monitoring was conducted in November 2006, and the results are provided in Table 3–4 (the Moquino wells could not be accessed for sampling). The intent of the annual monitoring is to determine the effect of discontinuing the barrier well pumping on groundwater quality at the site. If annual monitoring results demonstrate that seepage from the impoundment is under control (i.e., no significant upward trends in wells MW–61, MW–62, and MW–63), after 3 years the sampling frequency will be reduced to once every 3 years in accordance with the LTSP. Groundwater monitoring will continue as long as a New Mexico Standard (Table 3–3) is exceeded in any well.

Table 3–4. November 2006 Groundwater Monitoring Results at the L-Bar, New Mexico, Disposal Site

Monitor Well	Analyte (mg/L)					
	Chloride	Nitrate	Selenium	Sulfate	TDS	Uranium
MW–1A	330	0.068	0.000029	3,400	5,800	0.0014
MW–17B	360	340	0.16	5,200	11,000	0.028
MW–29A	160	0.037	ND	4,400	6,800	0.000087
MW–61	110	0.05	ND	3,300	5,000	0.00025
MW–62	49	0.014	ND	570	1,500	0.000063
MW–63	49	0.019	ND	540	1,400	0.000072
MW–69	850	46	0.008	9,500	16,000	5.3
MW–72	180	3.9	0.012	4,200	6,300	0.0062
MW–81	150	13	0.043	5,100	7,800	0.016
MW–100	34	0.48	0.000035	2,600	4,000	0.0012

Key: mg/L = milligrams per liter; ND = Not Detected (below detection limit); TDS = total dissolved solids

If an ACL or AAS is exceeded in the specified wells (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.

No ACL or AAS Source Zone levels were exceeded in any of the POC wells, and no AAS Affected Area levels were exceeded in MW–62. Therefore, the groundwater at the site is in compliance with the LTSP requirements. At least one New Mexico Standard is exceeded in six of the DOE wells, including background well MW–29A (sulfate and TDS), so groundwater monitoring at the site is expected to continue indefinitely.

3.3.4.2 Erosion Monitoring Program

As required by the LTSP, an erosion monitoring program (EMP) was developed to address
3L potential erosion of the tailings impoundment cover over time. 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 L-Bar 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 cover, completed in 2000, was not seeded, so revegetation is occurring naturally with locally occurring annual and perennial plant species. Vegetation is expected to help mitigate wind and water erosion.

The EMP consists of two parts: (1) measuring erosion and (2) measuring the progress of revegetation. Measurements were made during the annual site inspection on August 28, 2007.

Erosion Monitoring—In accordance with the EMP, a grid of 20 evenly spaced monitoring points was installed on the cover in November 2003 by the former licensee. These points are shown on Figure 3–1. The locations were measured in December 2003 to provide a baseline data set.

Each monitoring point consists of a rebar surrounded by three metal t-posts that were installed to help locate the rebar and provide orientation for the measurements. A 5-foot-long piece of half-inch-diameter epoxy-coated rebar was driven at each point such that approximately 1 foot remained above the cover surface. Each rebar has an attached metal tag indicating the point location number. The t-posts are set approximately 6 feet from the rebar and form an equilateral triangle, with one point of the triangle due east from the rebar. As an additional identification aid, the t-posts have been sprayed with orange anti-rust enamel paint.

Erosion measurement is accomplished by placing a 4-foot level centered at the base of the rebar such that the east end of the level points to the easternmost t-post (PL–9). 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, in accordance with 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. The decision point for considering erosion "excessive" will be reached when 2 feet of erosion is noted at greater than 50 percent 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 2007 measurements are presented in Table 3–5. Baseline measurements are included for comparison. As indicated in Table 3–5, the surface elevation has increased at all of the monitoring points except D2 when compared to the baseline measurements, with increases ranging up to 1.438 inches. At monitoring point D2, the surface elevation is 0.125 inch below the baseline elevation. These results indicate that the surface of the disposal cell is not eroding. The soil cover includes weathered Mancos Shale, which often contains high concentrations of swelling clay and gypsum. When the surface is dry, it is characterized by cracked and fluffy soil, often resulting in minor fluctuations in surface elevation of the cover. Also, the amount of vegetation on the cover has increased substantially since 2003, which may be raising the surface elevation through root growth, accumulation of organic materials in the surface soil, and/or trapping of windblown sediment derived from locations upwind of the tailings impoundment.

Table 3–5. Erosion Monitoring Measurements on the L-Bar, New Mexico, Tailings Impoundment Cover

Monitoring Point	Length of Rebar Above Surface (inches)				Change in Surface Elevation[a] Baseline to Present (inches)
	2003 (Baseline)		2007		
	(fraction)	(decimal)	(fraction)	(decimal)	
A1	12 10/16	12.625	11 3/16	11.188	1.438
A2	12 7/16	12.438	11 9/16	11.563	0.875
A3	12 15/16	12.938	11 9/16	11.563	1.375
A4	12 6/16	12.375	11 6/16	11.375	1.000
B1	12 10/16	12.625	11 11/16	11.688	0.938
B2	12 8/16	12.500	12 2/16	12.125	0.375
B3	13	13.000	12 2/16	12.125	0.875
B4	12 15/16	12.938	12	12.000	0.938
C1	12 8/16	12.500	11 10/16	11.625	0.875
C2	13 1/16	13.063	12 15/16	12.938	0.125
C3	12 2/16	12.125	11 5/16	11.313	0.813
C4	12 6/16	12.375	11 12/16	11.750	0.625
D1	12 7/16	12.438	11 7/16	11.438	1.000
D2	12 12/16	12.750	12 14/16	12.875	-0.125
D3	12 3/16	12.188	11 4/16	11.250	0.938
D4	12 12/16	12.750	12 9/16	12.563	0.188
E1	13 1/16	13.063	12 3/16	12.188	0.875
E2	12 14/16	12.875	12 4/16	12.250	0.625
E3	12 9/16	12.563	12 1/16	12.063	0.500
E4	12 15/16	12.938	12 7/16	12.438	0.500

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

Vegetation Monitoring—Ten vegetation monitoring locations were established in accordance with the EMP. 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, the three t-posts were used to form three corners of the plot; the fourth point was projected south of the easternmost t-post to form a parallelogram covering approximately 100 square feet.

The primary requirement is to measure the percentage of the foliar cover (canopy) of all live vegetation (annual and perennial plants together) within the plot. Percent foliar cover represents the approximate total area under the maximum circumference of each of the live plants within the plot.

The average foliar cover of live vegetation in the vicinity of the L-Bar disposal site, according to the U.S. Department of Agriculture, 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 foliar cover. If a significant reduction in plant density is noted during an annual site inspection, then the plots will be measured again. And, if the plant coverage is less than 20 percent, annual vegetation monitoring will be reinstated until the termination criterion has again been satisfied.

Vegetation types, percentage of foliar cover, litter (organic detritus often consisting of dead annual plants), rock, and bare ground were recorded at each monitoring location (PL–10). Annual or biennial plant species noted at the plots during the 2007 monitoring event included kochia, Russian thistle, annual sunflower, curly-cup gumweed, aster, southern goldeneye, chenopodium, and white sweet clover. Perennial plant species included Nelson's globemallow, silverleaf nightshade, bottlebrush squirreltail, sand dropseed, broom snakeweed, rubber rabbitbrush, and four-wing saltbush.

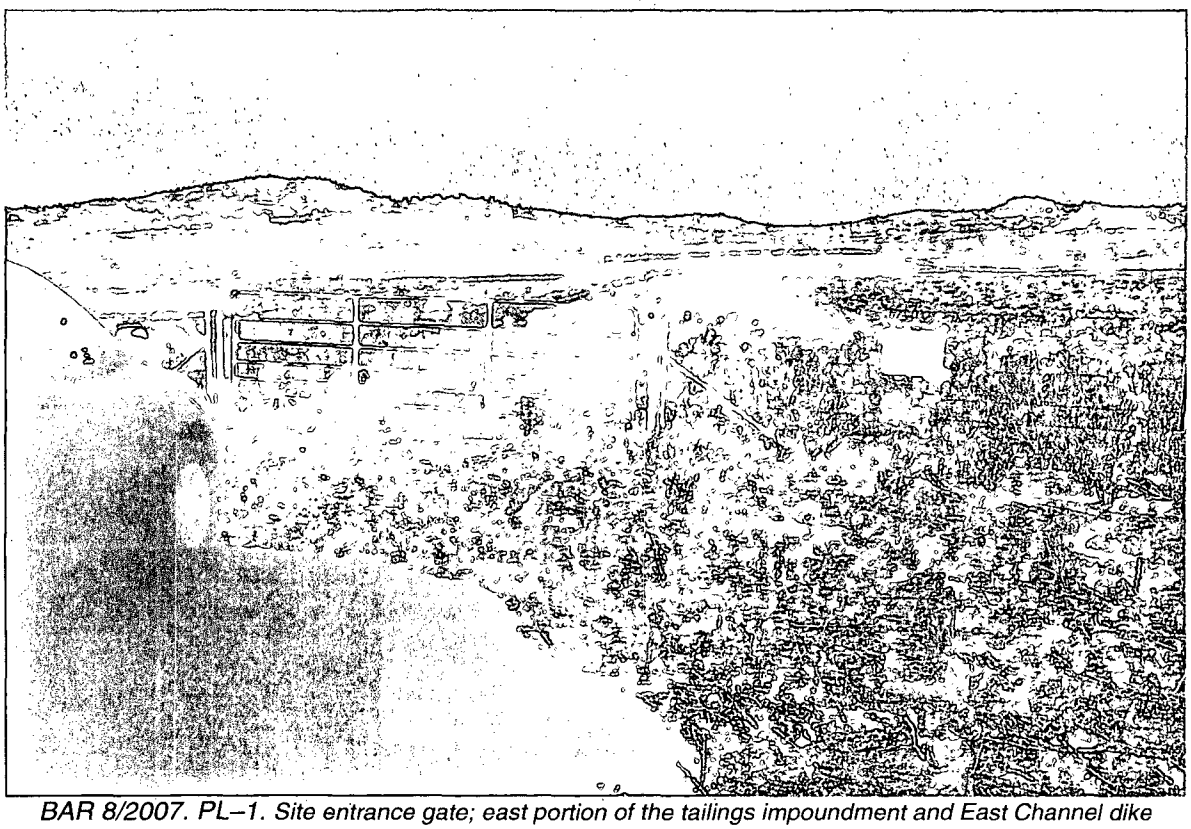
Table 3–6 compares perennial plant foliar cover between 2005 and 2007. Only three of the ten vegetation monitoring plots had 20 percent or greater foliar cover in 2005, and four of them had 20 percent or greater in 2007. Overall, perennial plant foliar cover has increased in eight of the ten plots from 2005 to 2007. Most of the plots containing little or no perennial vegetation are in areas that seasonally become ponded. Monitoring will continue until at least five of the plots meet or exceed the 20 percent foliar cover requirement based on perennial plant measurements.

Table 3–6. Perennial Plant Foliar Cover on the L-Bar, New Mexico, Tailings Impoundment Cover

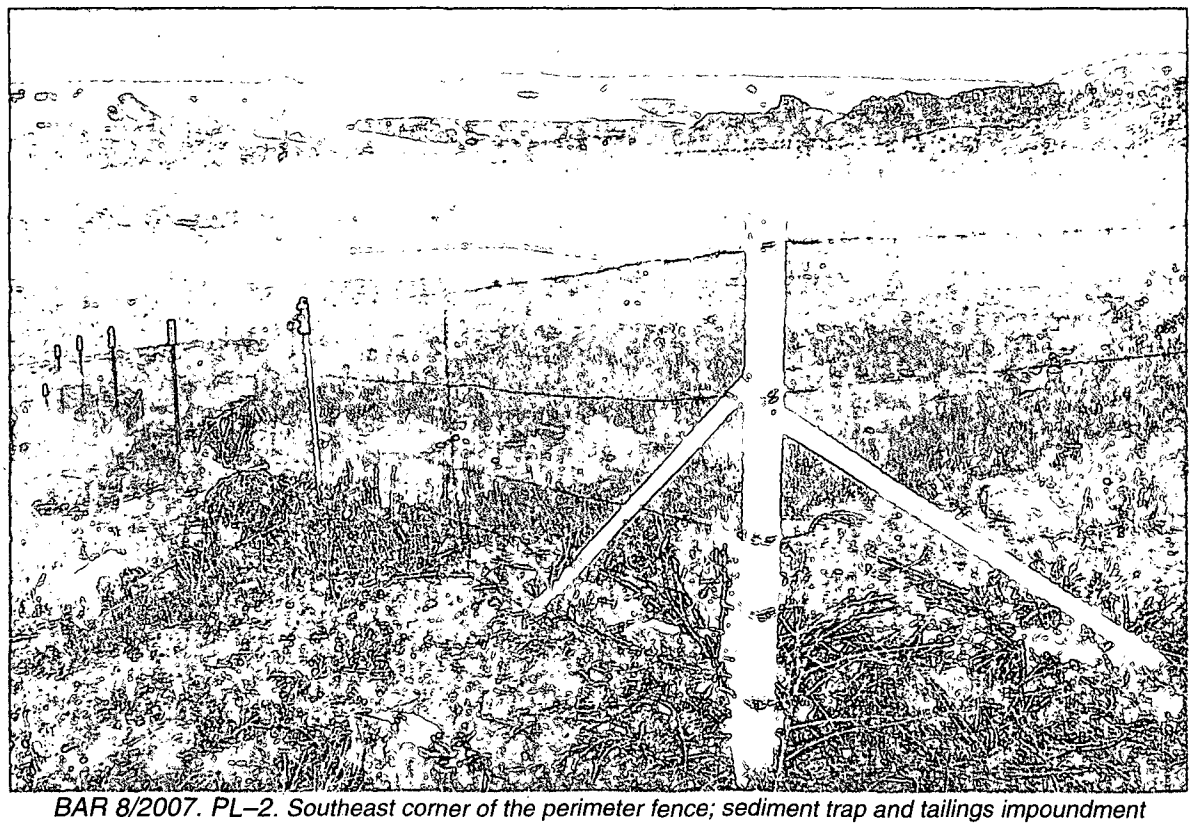
Plot Location	Percent Perennial Plant Foliar Cover in 100-ft^2 Plots	
	2005	2007
A1	57	58
A3	11	16
B2	0	0
B4	20	42
C1	22	24
C3	0	2
D2	2	0
D4	0	2
E1	2	8
E3	8	20

3.3.5 Photographs

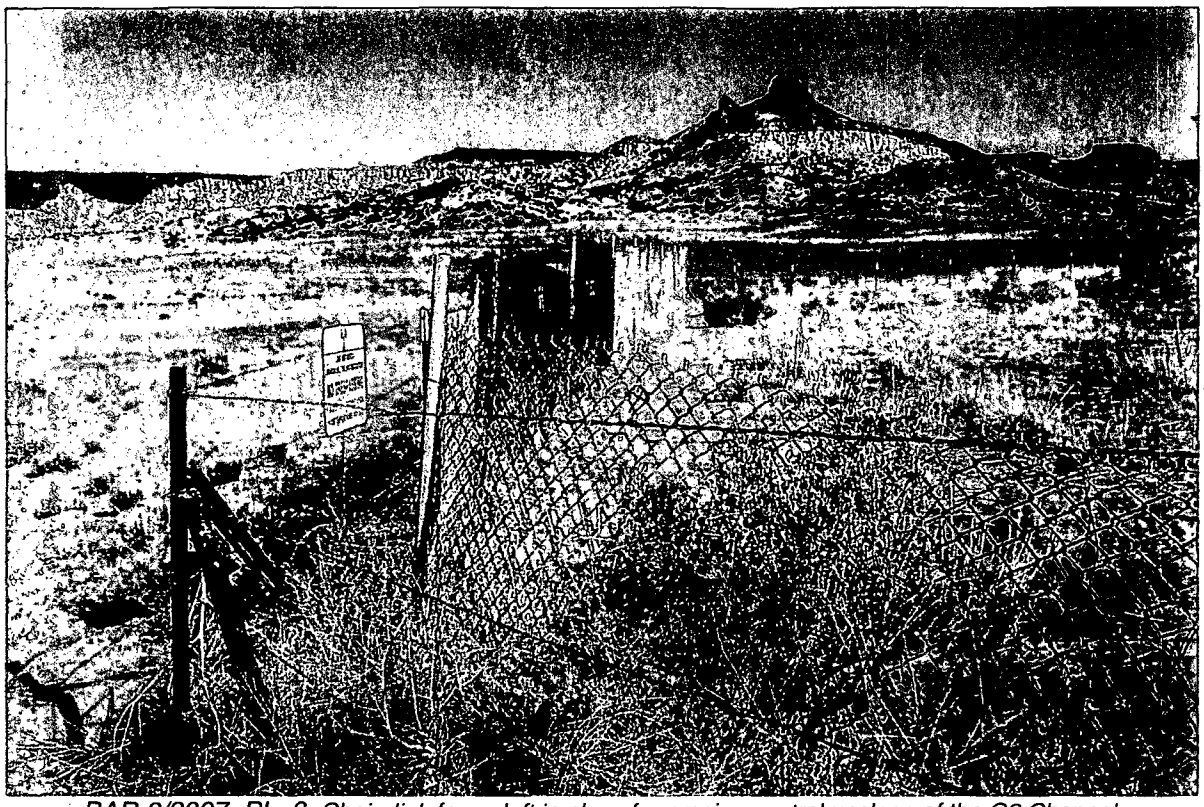
Photograph Location Number	Azimuth	Description
PL–1	175	Site entrance gate; east portion of the tailings impoundment and East Channel dike in the background.
PL–2	295	Southeast corner of the perimeter fence; sediment trap and tailings impoundment in the background.
PL–3	335	Chain-link fence left in place for erosion control upslope of the G3 Channel.
PL–4	270	The site viewed from perimeter sign P11.
PL–5	5	Cracks in the tailings impoundment cover soil near erosion monitoring point C2.
PL–6	160	Gully upgradient of the sediment trap.
PL–7	350	Gullies along the North Channel.
PL–8	175	Riprap apron for erosion control on the south slope of the South Channel.
PL–9	260	Erosion monitoring point and vegetation plot B2; note level at the rebar.
PL–10	260	Vegetation at erosion monitoring point and vegetation plot A3.



BAR 8/2007. PL–1. Site entrance gate; east portion of the tailings impoundment and East Channel dike in the background.

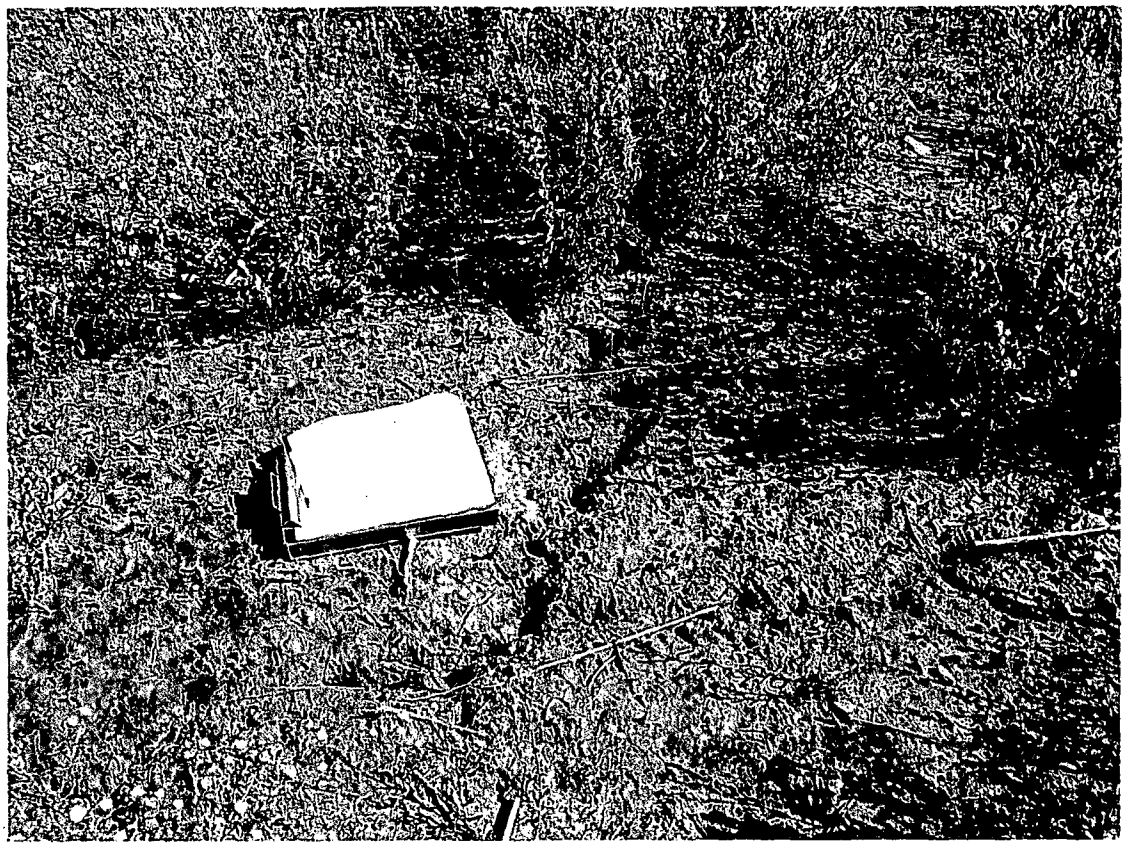


BAR 8/2007. PL–2. Southeast corner of the perimeter fence; sediment trap and tailings impoundment in the background.

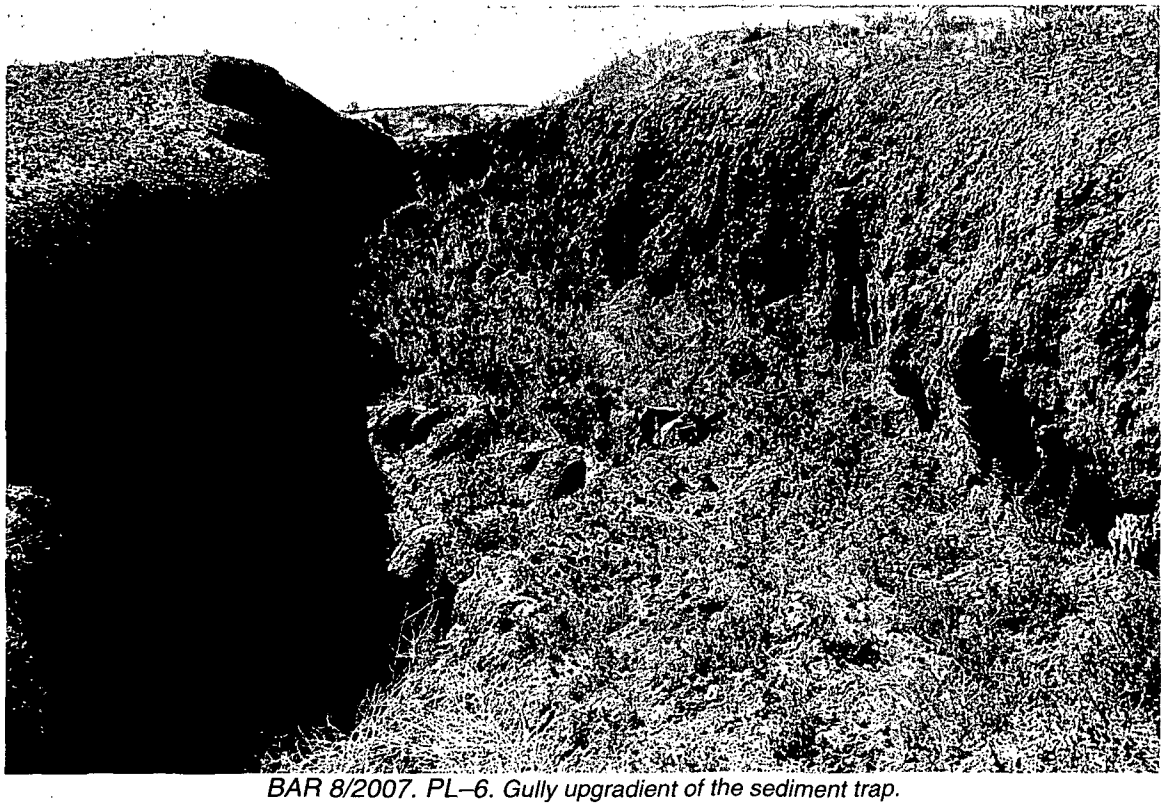


BAR 8/2007. PL–3. Chain-link fence left in place for erosion control upslope of the G3 Channel.

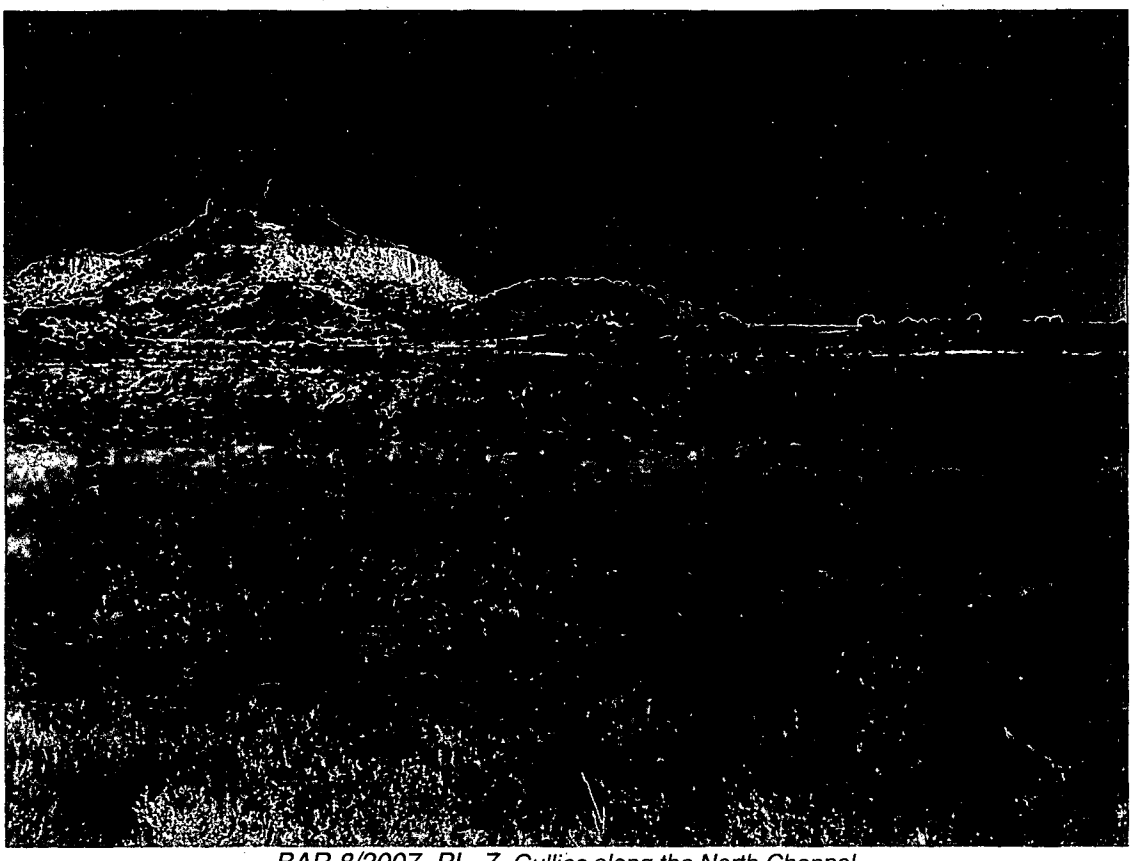
BAR 8/2007. PL–4. The site viewed from perimeter sign P11.



BAR 8/2007. PL–5. Cracks in the tailings impoundment cover soil near erosion monitoring point C2.

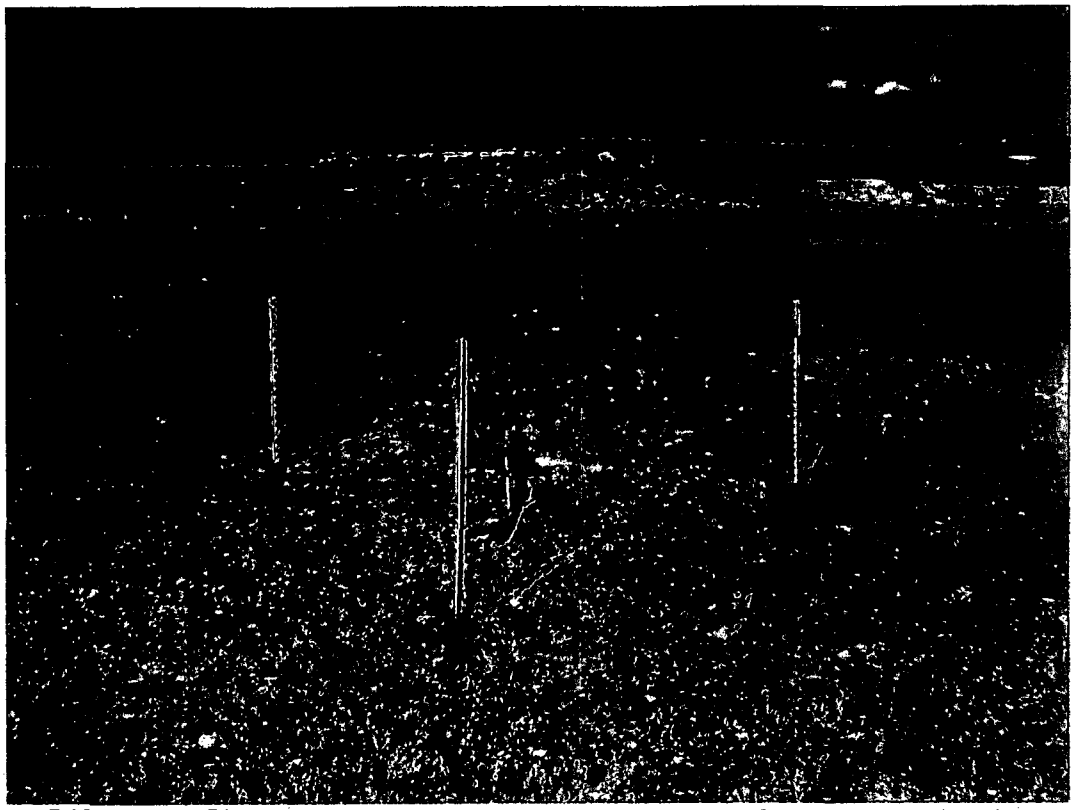


BAR 8/2007. PL–6. Gully upgradient of the sediment trap.

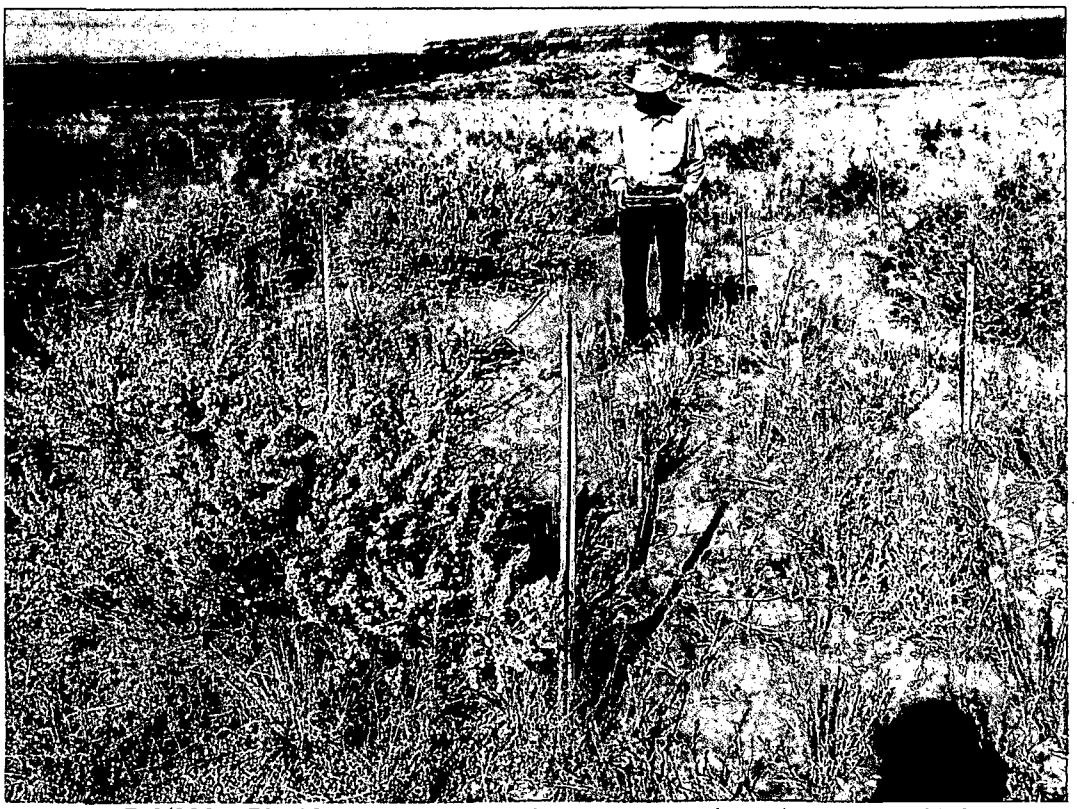


BAR 8/2007. PL–7. Gullies along the North Channel.

BAR 8/2007. PL–8. Riprap apron for erosion control on the south slope of the South Channel.



BAR 8/2007. PL–9. Erosion monitoring point and vegetation plot B2; note level at the rebar.



BAR 8/2007. PL–10. Vegetation at erosion monitoring point and vegetation plot A3.

4.0 Sherwood, Washington, Disposal Site

4.1 Compliance Summary

The Sherwood, Washington, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title II Disposal Site was inspected on July 18, 2007, and was in good condition. The tailings impoundment, dam, and diversion channel were in good condition. Forest thinning is continuing adjacent to the site, and reclamation of damaged areas along the site perimeter will occur upon completion of logging activities. The dam inspection and associated piezometer water level measurements verified that the tailings embankment is functioning as designed. Vegetation monitoring continues in an effort to evaluate the effectiveness of biological control of noxious weeds at the site. Groundwater monitoring, performed as a best management practice, showed constituent concentrations were significantly less than State of Washington water quality criteria. No cause for a follow-up inspection was identified.

4.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the Sherwood, Washington, Disposal Site are specified in the *Long-Term Surveillance Plan* [LTSP] *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 requirements of Title 10 *Code of Federal Regulations* Part 40.28 (10 CFR 40.28). License requirements for this site are listed in Table 4–1.

Table 4–1. 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 4.3.1
Follow-up Inspections	Section 3.5	Section 4.3.2
Routine Maintenance and Emergency Measures	Section 3.6	Section 4.3.3
Environmental Monitoring	Section 3.7	Section 4.3.4

Institutional Controls—The United States of America, in trust for the Spokane Tribe of Indians, owns the 380-acre disposal 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 located on the Spokane Indian Reservation, no agreement of transfer was necessary for conveying the property rights to DOE. However, an agreement for long-term surveillance, maintenance, and permanent right of access, which allows DOE to fulfill its custodial responsibilities required for UMTRCA Title II sites, was executed between the tribe and DOE. The agreement does not prohibit the future use of the site for activities related to uranium mining and milling.

Institutional controls at the disposal site, as defined by DOE Policy 454.1, consist of federal ownership of the property, and warning/no trespassing signs placed along the property boundary; the site is not fenced. Verification of these institutional controls is part of the annual inspection.

4.3 Compliance Review

4.3.1 Annual Inspection and Report

The site, located near Wellpinit, Washington, was inspected on July 18, 2007. Features and photograph locations (PLs) mentioned in this report are shown on Figure 4–1. Results of the inspection are described below. Numbers in the left margin of this report refer to items summarized in the Executive Summary table.

4.3.1.1 Specific Site Surveillance Features

Access, Gates, and Signs—The disposal site and adjacent lands are part of the Spokane Indian Reservation. The U.S. Bureau of Indian Affairs (BIA) maintains the all-weather site road over which DOE has permanent right-of-access. A double-swing steel gate across the road controls access to the Sherwood mine area and tribe-owned facilities near the disposal site. A chain with several locks (both DOE and BIA) secures the gate. As in the past several site visits, the gate was open at the time of the inspection, apparently to accommodate activities by the tribe in the vicinity of the disposal site.

Six perimeter signs, designated P1 through P6, are placed at likely access points around the site property. The signs are attached at a height of about 5 feet above ground to steel posts set in concrete. Perimeter sign P4 is on a fence line north of the actual site boundary on an old two-track road that is used by groundwater samplers to access the site. Perimeter sign P6 has several bullet holes but remains legible; otherwise, the signs are in excellent condition.

Site Markers and Monuments—One inscribed 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.

Six boundary monuments, designated BM–1, BM–2, BM–3, BM–3A, BM–4, and BM–5 define the site boundary. Boundary monument BM–3A is bent but does not require any repairs; all other monuments were in excellent condition. Because surrounding vegetation had made it difficult to locate some of the monuments, metal t-posts have been installed at each monument location.

Monitor Wells—Three monitor wells are located on the Sherwood site and are designated MW–2B, MW–4, and MW–10. The wells were secure and in good condition.

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

4.3.1.2 Transects

To ensure a thorough and efficient inspection, the site was divided into three areas referred to as transects: (1) the cover of the tailings impoundment; (2) the diversion channel and impoundment dam face; and (3) the area between diversion channel and site boundary, and the outlying area.

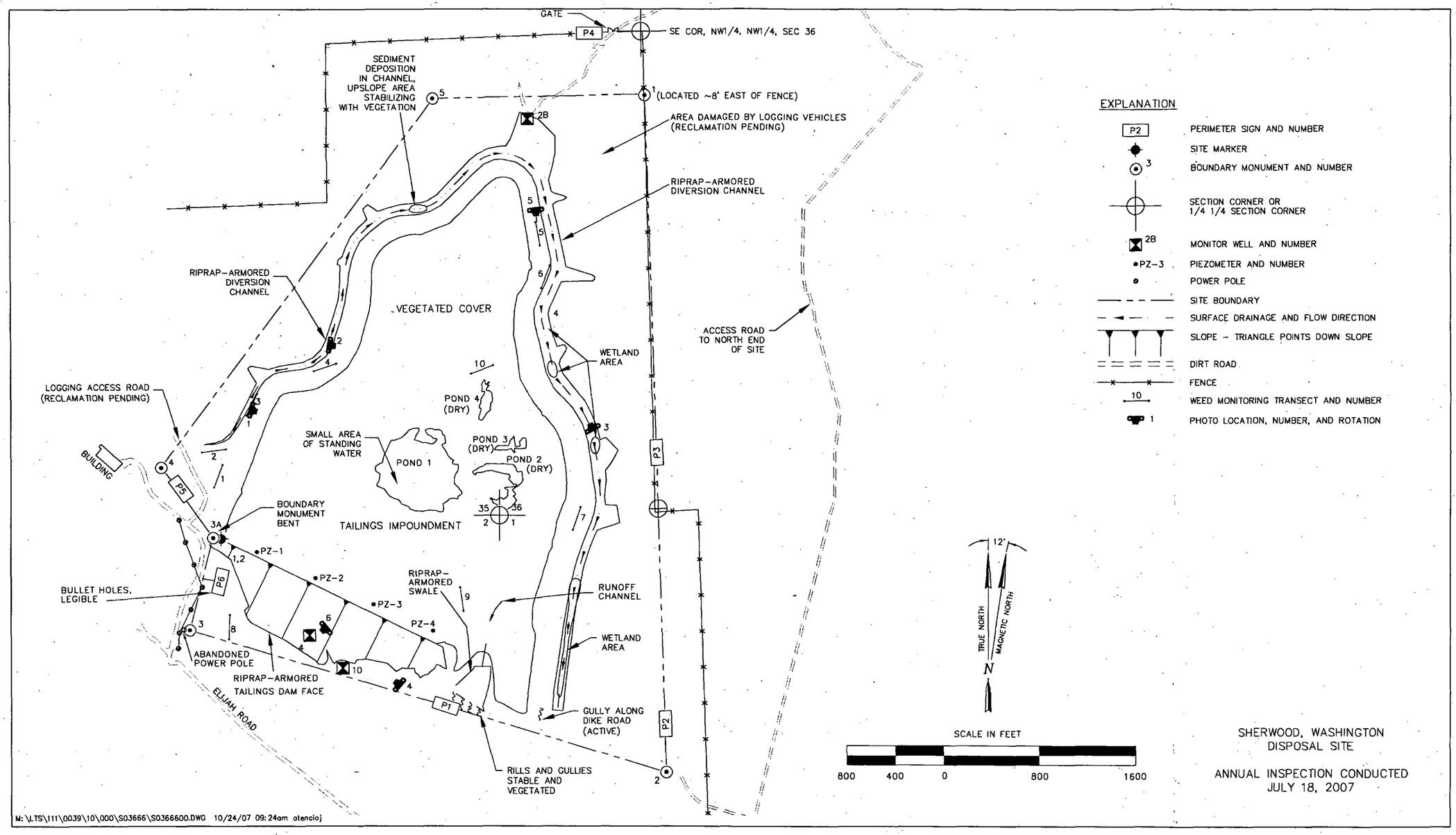


Figure 4–1. 2007 Annual Compliance Drawing for the Sherwood, Washington, Disposal Site

Within each transect, inspectors examined specific site surveillance features, such as monitor wells, boundary monuments, signs, and site markers. Inspectors examined each transect for evidence of erosion, settling, slumping, or other disturbance that might affect site integrity or the long-term performance of the site.

Tailings Impoundment Cover—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 healthy vegetative cover is needed to provide necessary protection and evapotranspiration of the cover in order to limit infiltration of meteoric water into the impoundment. Reclamation has been successful, as a healthy stand of vegetation is now established. A small, shallow channel developed by runoff from the cell top is present near the southeast corner of the cell. The channel discharges into a riprap-armored swale located east of the tailings dam. The channel is not over an area containing tailings and is stable (it has scoured down to quartz monzonite bedrock).

Designers of the cell predicted that some settlement would continue to occur after placement of the uncompacted cover and that it would be self-healing with regard to impacts from freeze-thaw, biointrusion, and settlement (LTSP, page 2–14). The largest area of settlement is now referred to as Pond 1. Some standing water was present in Pond 1 at the time of the inspection, and the plant species present indicate there is year-round moisture below the surface throughout the approximately 7.7-acre pond area (PL–1). Other minor depressions designated as Ponds 2, 3, and 4, with a total area of approximately 2 acres, did not contain standing water. The shallow ponds are considered to be favorable features on the cell top, but DOE will continue to monitor the cover surface for unusual settlement features such as sinkholes or differential displacement to verify cell cover integrity and ensure that the impoundment is performing as designed.

Vegetation in the area of Pond 1 is composed primarily of native wetland species; the other pond areas contain primarily riparian vegetation. The ponds provide habitat for small mammals, birds, amphibians, and reptiles and provide an important water source for larger mammals such as wild horses, deer, elk, bears, and buffalo. Buffalo and horses were on the disposal cell during the time of the inspection (PL–2).

Diversion Channel and Impoundment Dam Face—Inspectors walked the length of the riprap-armored diversion channel. Volunteer plant intrusion within the diversion channel, including trees, is evident in most areas of the channel. The channel was designed to allow trees to grow and stabilize the surfaces, and their presence in the channel is not expected to impact the function of the channel in conveying designed flows. The condition of the riprap cover is good and is the same as that observed during earlier inspections. Sediment deposition is evident in places on the west side of the diversion channel, but does not interfere with the channel's design function; upslope areas that have contributed to the sedimentation are becoming stabilized with vegetation. Two permanent wetland areas have formed along the bottom of the east side of the channel. They provide habitat for a variety of small mammals and birds. In previous years, several pools of standing water have been observed throughout the wetland areas. During the 2007 inspection, only one pool of surface water was present (PL–3). The lack of visible surface water may be indicative of the hotter and drier weather in this area in 2007.

Adjacent to the eastern end of the dam face is a steep slope that is underlain by rock and covered with soil. Rills and gullies noted during previous annual inspections were inspected on this slope

at the base of the riprap-armored swale. No new rills were identified at this location, and the existing rills and gullies are stable. A new small gully was noted adjacent to the dike access road near the outlet of the diversion channel. This gully will be monitored to ensure that sediment does not run off the site.

The tailings dam face was designed to allow a vegetative cover, including mature trees, to establish and stabilize the surface and prevent erosion. Consequently, the presence of this vegetation does not negatively affect the function of the dam, and the dam will not be compromised if the rock cover eventually degrades. To out-compete undesirable weeds that were establishing on the face of the dam, seeding with desirable species occurred in fall 2004. Extensive vegetative cover, including Ponderosa pine trees ranging in size from seedlings to 15 feet tall, was observed on the dam face (PL–4). Many seeded species also were observed.

4A 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 Federal Dam Safety Act. The impoundment dam face was inspected in accordance with the attached Dam Inspection Checklist. No evidence of seepage, slumping, erosion, or instability was observed. The rock cover, consisting primarily of highly durable quartz monzonite, is in excellent condition and is effectively preventing erosion of the dam face until vegetation is well established.

Water level measurements in the four piezometers were taken at the time of the annual groundwater sampling. These annual measurements, collected since the piezometers were installed in 2000, provide a direct means of determining moisture conditions in the dam. Significant increases would trigger an investigation of the performance of the dam. Standing water levels in 2007 were consistent with previous years, with no water in piezometers PZ–1, PZ–3, and PZ–4, and 3.05 feet of water in PZ–2. The results verify that moisture conditions in the dam remain constant and that the dam is performing as designed.

Area Between Diversion Channel and Site Boundary, and Outlying Area—Ponderosa pine forest comprises most of the area outside of the diversion channel. The surrounding lands are part of the Spokane Indian Reservation and are used for timber and wildlife habitat. No residences are located within 0.25 mile of the site boundary.

During the summer of 2005, the BIA proposed to construct a portion of an access road across the southwest corner of the property. The road would follow a reclaimed former mining road and not encroach upon the tailings impoundment, and would be used only for logging operations planned for fall 2005. DOE agreed with the proposal and stipulated requirements to reclaim the road and any other areas on the site damaged by logging operations. Logging operations apparently were completed at the time of the 2006 inspection, but no reclamation activities had occurred. DOE subsequently sent a letter to BIA clarifying the need for site reclamation.

No reclamation was evident at the time of the 2007 inspection. The inspectors met with the BIA
4B representative and members of the tribe involved with the logging activities to discuss reclamation requirements as requested by DOE. The tribal members indicated that forest thinning adjacent to the site was still in process and was expected to be complete in fall 2007. When finished, the logging access road will be reclaimed, and the entrance to the southwest corner of the site will be closed to discourage trespassing on the site. Surface damage (deep ruts)

caused by logging vehicles in the forested area in the northeast portion of the site will be reclaimed, and strands of downed barbed-wire fence in that area will be removed to eliminate the hazard to inspectors and wildlife.

4.3.1.3 Noxious Weeds

4C Several patches of Canada thistle, a Washington State noxious weed, were treated with herbicide after the 2006 inspection, and all were dead at the time of the 2007 inspection. One new patch was found this year, and it was subsequently treated with herbicide.

Significant populations of two noxious weed species, diffuse knapweed and dalmatian toadflax, occur throughout and around the Sherwood site, particularly along the diversion channel, its berm, and the access road. The widespread nature and inaccessibility of these noxious weed infestations make chemical control difficult, if not impossible. Therefore, a biological control program was initiated in spring 2003 with the release of six species of insects. The program was continued in 2004 with the release of additional insects by both DOE and Stevens County. The insects attack the target plants in a number of ways, through external feeding of foliage, internal feeding of seed-producing organs by adults and larvae, and internal mining of central taproots. Future applications of insects by DOE will depend on the success of biological control efforts.

4D To monitor the progress of the biological weed control efforts, inspectors counted live noxious weeds along ten permanent weed-monitoring transects established during the 2004 inspection (PL–5). The *Methodology for Conducting Annual Monitoring of Noxious Weeds at the Sherwood, Washington, Disposal Site* (GJO–2004–553–TAC, January 2004) describes the monitoring procedure.

The 2007 monitoring data indicate that the number of diffuse knapweed plants along the transects has decreased dramatically from 2004 and decreased somewhat from 2006 (primarily in transects WM–8 and WM–10). It is believed that the released insects are responsible for this change, as weevils were found on most of the remaining plants.

In contrast, the number of dalmation toadflax plants along the transects steadily increased or stayed about the same from 2004 through 2006. In 2007, however, decreases in plant numbers were observed at transects WM–2, WM–4, WM–6, WM–7, and WM–10, although increases were observed at transects WM–5 and WM–8. Throughout the site, inspectors noted that most dalmation toadflax plants were visibly stressed, as indicated by the yellow color of the plants' leaves and stalks. This stressed condition was caused either by the released insects or recent drought. Also, the dalmation toadflax plants appeared to be smaller throughout the site, with mostly immature plants at transects WM–7 and WM–8. The lack of maturation may have been indicative of the drier and hotter weather this year or a result of insect damage. A period of 5 to 7 years is typically needed before significant changes in dalmation toadflax populations occur.

4.3.2 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 follow-up inspections were required in 2007.

4.3.3 Routine Maintenance and Emergency Measures

A patch of Canada thistle was sprayed with herbicide in 2007. No other maintenance or repairs were required.

Emergency measures are corrective actions that DOE will take in response to unusual damage or disruption that threaten or compromise site health and safety, security, integrity, or compliance with 40 CFR 192. No emergency measures were required in 2007.

4.3.4 Environmental Monitoring

4E 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, identified as MW–2B, and two point-of-compliance (POC) wells, identified as MW–4 and MW–10. Samples are analyzed for sulfate, chloride, and total dissolved solids. Sulfate and chloride are the primary indicator parameters.

Monitoring results will be 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 (mg/L) for either parameter, DOE will conduct confirmatory sampling of the POC wells. If the confirmatory sampling verifies the exceedance, DOE will develop an evaluative monitoring work plan, in consultation with the tribe and BIA, 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 the same day as the inspection (PL–6), and the results are presented in Table 4–2. Groundwater constituent concentrations were consistent with previous years and continue to be significantly less than the action levels for confirmatory sampling.

Table 4–2. 2007 Groundwater Quality Summary for the Sherwood, Washington, Disposal Site

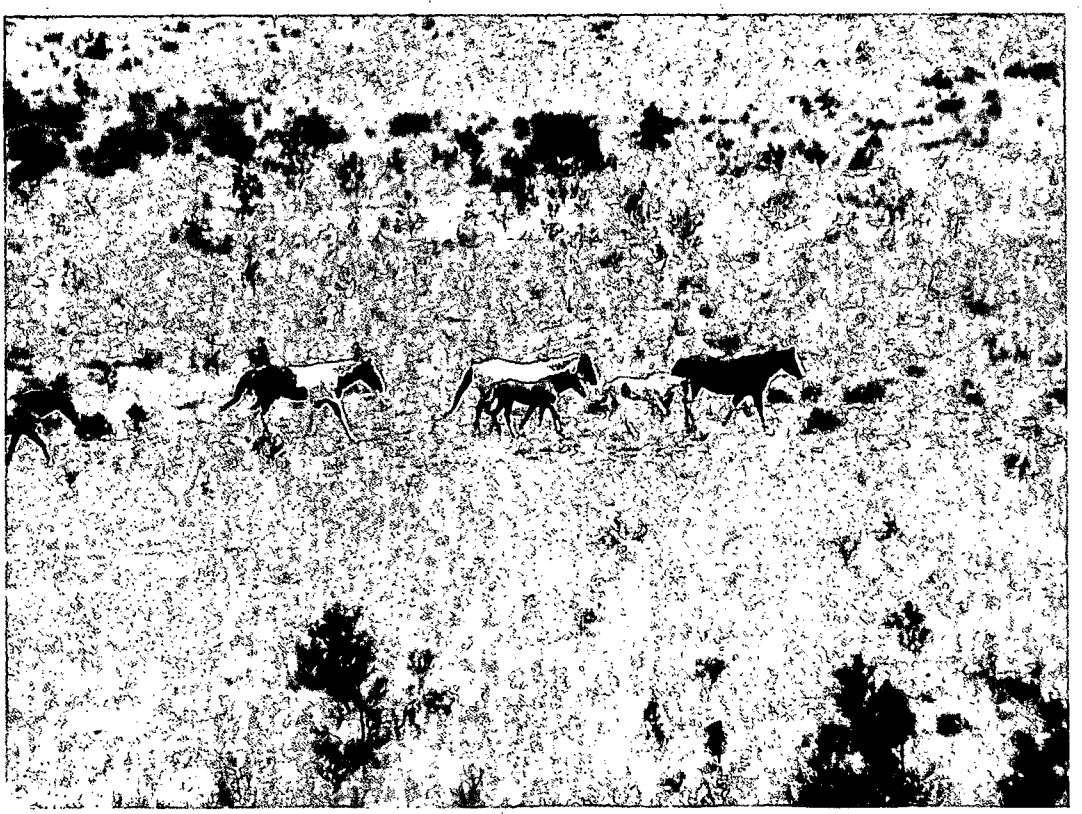
Constituent	Water Quality Criterion	Background Well MW–2B	POC Well MW–4	POC Well MW–10
Chloride, mg/L	250	2.1	5.3	2.4
Sulfate, mg/L	250	3.0	26	28
TDS, mg/L	N/A	210	570	660

Key: mg/L = milligrams per liter; POC = point of compliance; TDS = total dissolved solids
Note: State of Washington water quality criteria used as action levels.

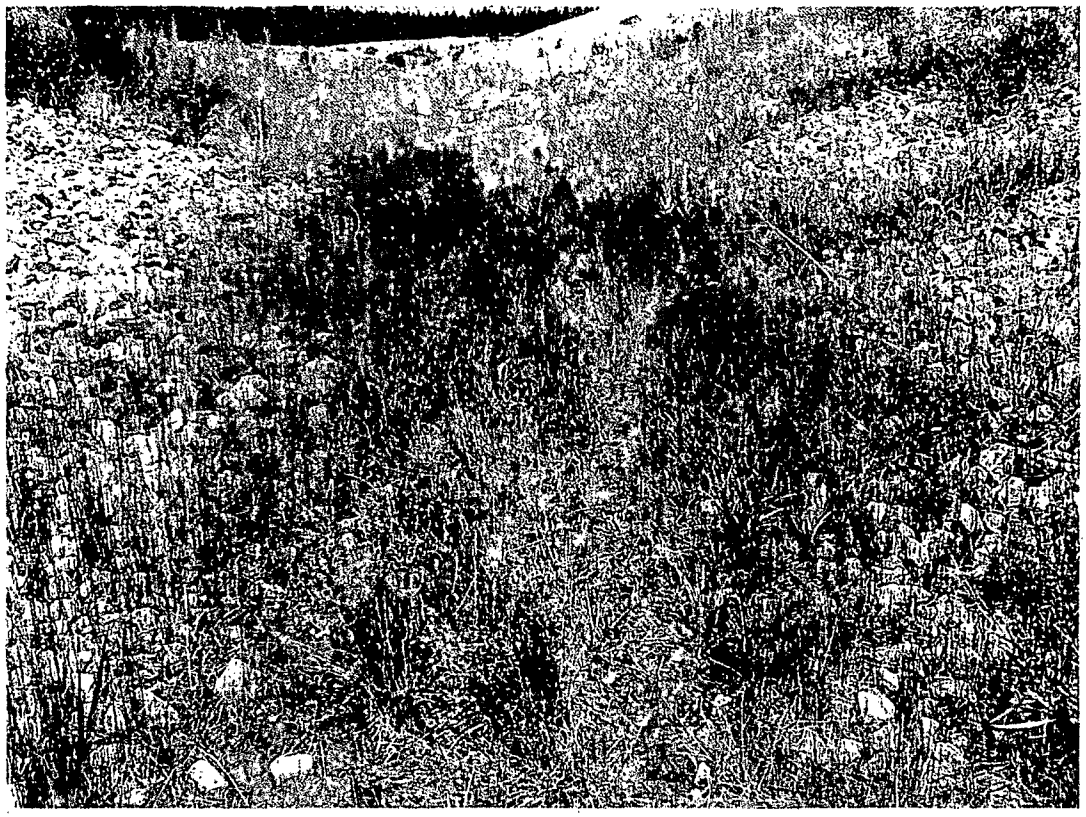
4.3.5 Photographs

Photograph Location Number	Azimuth	Description
PL–1	105	Pond 1 on the tailings impoundment.
PL–2	100	Wild horses on the tailings impoundment.
PL–3	330	Wetland area within the armored diversion channel containing visible surface water.
PL–4	310	Vegetation on the face of the tailings dam.
PL–5	175	Weed monitoring transect WM–5.
PL–6	230	Groundwater samplers at monitor well MW–4.

SHE 7/2007. PL–1. Pond 1 on the tailings impoundment.



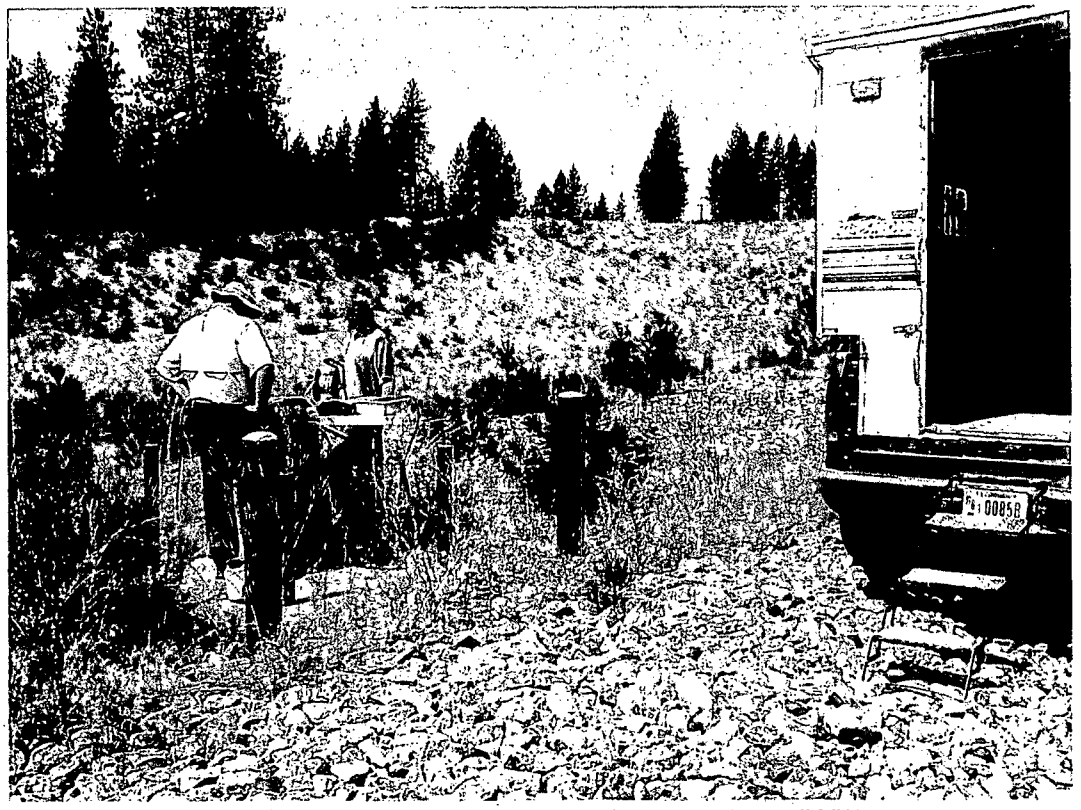
SHE 7/2007. PL–2. Wild horses on the tailings impoundment.



SHE 7/2007. PL–3. Wetland area within the armored diversion channel containing visible surface water.

SHE 7/2007. PL–4. Vegetation on the face of the tailings dam.

SHE 7/2007. PL–5. Weed monitoring transect WM–5.



SHE 7/2007. PL–6. Groundwater samplers at monitor well MW–4.

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

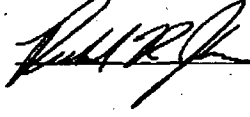
Date of Inspection: July 18, 2007

Inspector	Organization
R. K. Johnson	S.M. Stoller Corp.

Piezometer PZ-1 current year water depth: (Previous year depth: dry)	Dry
Piezometer PZ-2 current year water depth: (Previous year depth: 3.04')	3.05'
Piezometer PZ-3 current year water depth: (Previous year depth: dry)	Dry
Piezometer PZ-4 current year water depth: (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:	No

DOE Project Manager (202) 586-5881
NRC Operations Center (301) 951-0550
Spokane Tribal Police/Sheriff (509) 258-4400
State Department of Ecology—Dam Safety (360) 407-6625

Note: Piezometer water levels measured during sampling trip on July 18, 2007.

Inspector Signature:  Date: 7/27/07

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5.0 Shirley Basin South, Wyoming, Disposal Site

5.1 Compliance Summary

The Shirley Basin South, Wyoming, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title II Disposal Site, inspected on June 14, 2007, was in excellent condition. The perimeter sign at the entrance gate was missing and has been replaced with another nearby sign. The grazing licensee had begun grazing operations at the site; some vehicle ruts were present, and the licensee was notified to prohibit the establishment of new roads or tracks on the site. Infestations of Canada thistle, a state-listed noxious weed found during the inspection, were sprayed with herbicide. No other maintenance needs were identified. The third annual groundwater sampling event indicated that radium-228 continues to exceed its alternate concentration limit at two wells; the cause for the increase has not been determined. No cause for a follow-up inspection was identified.

5.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the Shirley Basin South, Wyoming, Disposal Site are specified in the *Long-Term Surveillance Plan* [LTSP] *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* Part 40.28 (10 CFR 40.28). Table 5–1 lists license requirements for this site.

Table 5–1. 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 5.3.1
Follow-up Inspections	Section 3.5	Section 5.3.2
Routine Maintenance and Emergency Measures	Section 3.6	Section 5.3.3
Environmental Monitoring	Section 3.7	Section 5.3.4

Institutional Controls—The 1,512-acre disposal 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 disposal site, as defined by DOE Policy 454.1, consist of federal ownership of the property, a site perimeter fence, warning/no trespassing signs placed along the property boundary, and a locked gate at the site entrance. Verification of these institutional controls is part of the annual inspection. No off-site institutional controls are needed because contaminated groundwater is limited to the area within the federal land boundary.

5.3 Compliance Review

5.3.1 Annual Inspection and Report

The disposal site, located approximately 35 miles south of Casper, Wyoming, was inspected on June 14, 2007. Results of the inspection are described below. Features and photograph locations

(PLs) mentioned in this report are shown on Figure 5–1. Numbers in the left margin of this report refer to items summarized in the Executive Summary table.

5.3.1.1 Specific Site Surveillance Features

Access, Gates, Fences, and Perimeter Signs—Access to the Shirley Basin South Disposal Site is immediately off of Carbon County Road 2 and is unimpaired; no private property is crossed to gain access. A wire entrance gate is secured by a locked chain and was in excellent condition.

A four-strand barbed wire perimeter fence encompasses the site. The perimeter fence was inspected with the use of an all-terrain vehicle and, except for a damaged portion crossing the north end of Pit 4, was in excellent condition. The damaged portion will be difficult to maintain because of steep slopes and recurring snow damage. The grazing licensee (see Section 5.3.1.2), in cooperation with the adjacent property owner (Pathfinder Mines Corporation), erected an electric fence around the north rim of Pit 4 to bypass the damaged section and to allow cattle access to each side of the pit (PL–1). Sections along the north perimeter that were open at the time of the 2005 inspection remained closed with temporary wire fence at the time of the 2007 inspection. These sections are used by Pathfinder Mines Corporation (Pathfinder) to gain access to a topsoil stockpile area on the DOE site (PL–2). Additional information regarding this activity is provided in Section 5.3.1.2.

Property ownership/warning signs (perimeter signs) are positioned around the disposal cell at 25 locations, and another 9 signs are located along the site perimeter at potential points of access. Perimeter sign P26, located near the site entrance, was missing and has been replaced with the
5A sign from P3. A replacement sign for P3 will be installed during the next inspection. Otherwise, the signs are in excellent condition.

Site Marker and Boundary Monuments—The granite site marker, located at the site entrance, was in excellent condition. All 27 boundary monuments delineating DOE property were located and were in excellent condition (PL–3).

Monitor Wells—The site groundwater monitoring network consists of eight wells, and all of them are located on the site. Each well was inspected and was in excellent condition and secured with a DOE lock (PL–4). The wells are accessible by vehicle along reclaimed former mine roads.

5.3.1.2 Transects

To ensure a thorough and efficient inspection, the site was divided into three areas referred to as transects: (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 transect, inspectors examined specific site surveillance features. Each transect was inspected for evidence of erosion, settling, slumping, or other disturbances that might affect site integrity or the long-term performance of the cell.

Cover of the Tailings Impoundment—The tailings impoundment, completed in 2000, is approximately 142 acres and has a grass cover. The cell surface is constructed at two elevations separated by a riprap-armored slope. The slope is in excellent condition (PL–5). The eastern

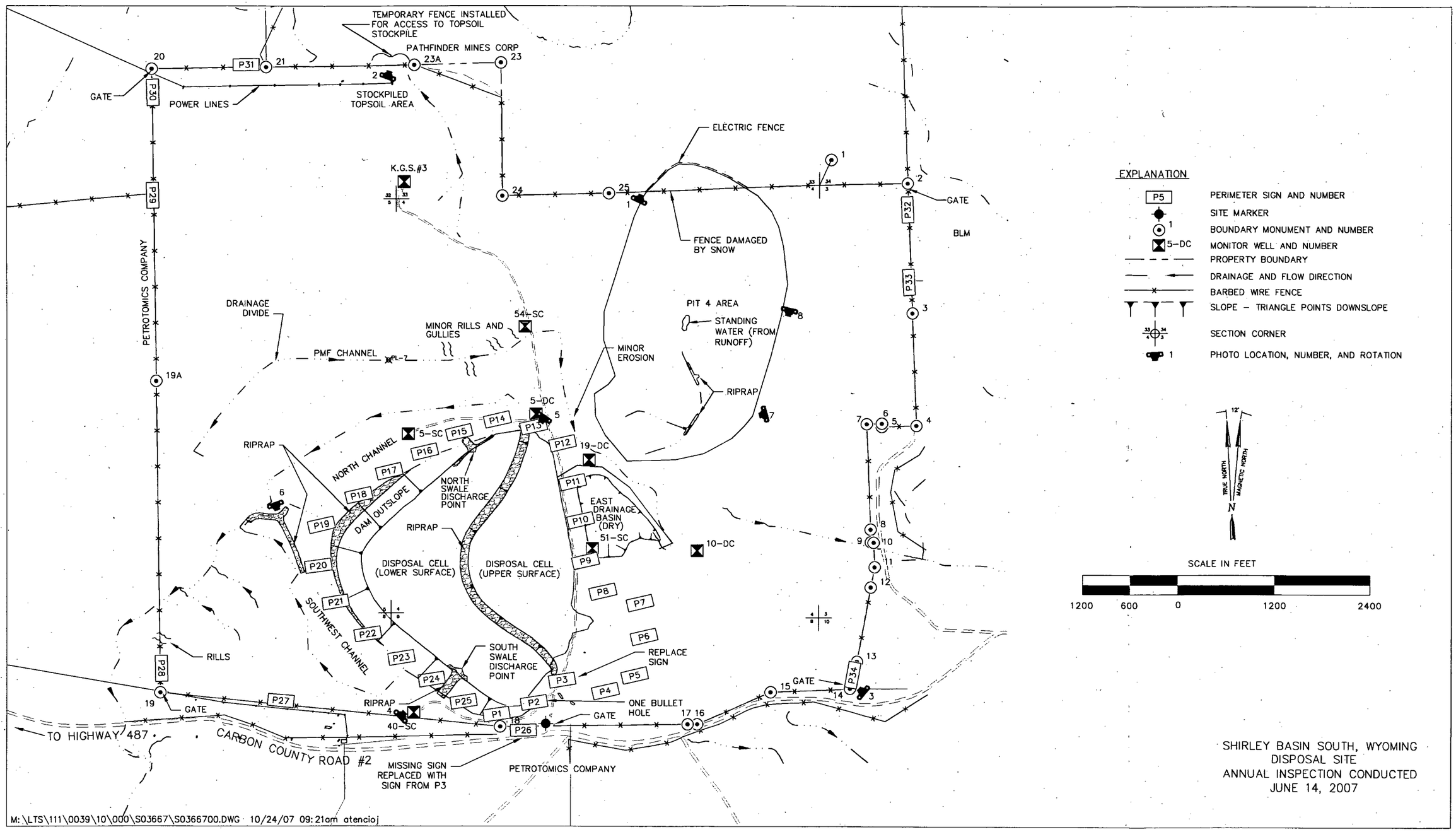


Figure 5–1. 2007 Annual Compliance Drawing for the Shirley Basin South, Wyoming, Disposal Site

(upper) surface is contoured to drain into a basin east of the cover 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 grass is well established and in excellent condition. The grazing licensee is allowed to graze his cattle on the grass cover and to cut it for hay. There were no indications of erosion, settlement, or other modifying processes that might affect the integrity of the cell. A couple of animal burrows were observed, apparently dug by badgers. The approximately 5-foot-thick cover will continue to be monitored for burrowing activity to ensure that tailings are not brought to the surface.

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, with the north and south swale discharge points and the steeper sections (5:1 slope) of the dam protected by riprap (PL–4). 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 but does not affect the function of the erosion protection features.

The surface water diversion system consists of a combination of contoured surfaces and drainage and collection channels. Riprap armor was placed on the steeper slopes and flow concentration points where design flow velocities would have the potential to erode surfaces and possibly impact the tailings dam and impoundment (PL–6). A probable maximum flood (PMF) channel was constructed north of the tailings impoundment. Part of the PMF channel drains to the southwest and discharges to a small closed basin. A larger drainage area is captured by the portion of the PMF channel that flows eastward and discharges into the East Drainage Basin. These closed drainage basins are large enough to accommodate the PMF water volumes. The diversion channels were in excellent condition and indicated no signs of active erosion in the channels. Minor erosion is occurring at locations on the uphill and downhill slopes along the PMF channel but is not affecting the function of the channel.

Balance of the Site and the Site Perimeter—The other major feature on the site is reclaimed Pit 4 located in the northeast portion of the site. 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 (PL–7). Vegetation is well established, and no areas of active erosion were observed from the rim of the excavation. A small area of standing water, apparently from storm runoff, was present at the bottom of the pit. Besides evidence of cattle grazing, wildlife including pronghorn antelope (PL–8) and sage grouse was observed during the inspection.

The site is surrounded by private property and public land administered by the U.S. Bureau of Land Management (BLM). Land on three sides is used primarily for livestock grazing. Pathfinder is the property owner north of the site and is in the process of completing the UMTRCA Title II Shirley Basin North disposal site. Pathfinder's access to and use of stockpiled topsoil on the DOE site is in accordance with an agreement between Petrotomics Company, the former owner of the Shirley Basin South site, and Pathfinder. In accordance with the agreement, 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 and requires that Pathfinder reclaim the disturbed area, including fence replacement, when finished removing topsoil from the stockpile. This activity is not adversely affecting the security of the site, and no evidence of recent topsoil removal was observed.

DOE established a grazing license with a local rancher in 2007. The license allows the rancher to graze the site with his livestock, mow the grass on the disposal cell, and use water from well MW–K.G.S. #3 for stock-watering purposes (at the request of DOE, the State of Wyoming changed the permitted use of the well from monitoring only to monitoring and stock water use). Well MW–K.G.S. #3 is completed in the Lower Sand Aquifer of the Wind River Formation and is hydraulically isolated from the upper contaminated aquifers. The licensee plans to install a solar pump in well MW–K.G.S. #3 in addition to a nearby storage tank and stock-watering tank. In exchange for these uses of the site, the rancher will be responsible for maintaining the perimeter fence and notifying DOE of observed trespassing, vandalism, erosion, or other problems at the site.

5B

At the time of the inspection, rutted tracks caused by vehicle access when the ground surface was wet were observed along the west side of Pit 4. DOE subsequently notified the licensee to avoid development of new tracks or roads on the site in accordance with the terms of the grazing license and requested that the licensee avoid driving vehicles on the site when ground surfaces are wet.

5.3.1.3 Noxious Weeds

Infestations of Canada thistle, a state-listed noxious weed, were found at several locations on the site during the 2006 inspection and subsequently were sprayed with herbicide. New thistle plants were growing in some of the treated areas, and other untreated patches were found; these weeds were sprayed in June and September 2007. Canada thistle infestations will continue to be sprayed with herbicide in an effort to prevent the spread of the weeds and eventually eradicate them.

5C

5.3.2 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 follow-up inspections were required in 2007.

5.3.3 Routine Maintenance and Emergency Measures

A missing perimeter sign near the site entrance was replaced, and noxious weeds were sprayed with herbicide in 2007. No other maintenance or repairs were required.

Emergency measures are corrective actions that DOE will take in response to unusual damage or disruption that threaten or compromise site health and safety, security, integrity, or compliance with 40 CFR 192. No emergency measures were required in 2007.

5.3.4 Environmental Monitoring

Groundwater monitoring is required at the Shirley Basin South site. The monitoring network consists of eight DOE wells completed in aquifers of the Wind River Formation (Table 5–2). Water level, pH, and electrical conductivity will be measured at the time of sampling, and the samples will be analyzed for uranium, radium-226, radium-228, thorium-230, cadmium, chromium, lead, nickel, selenium, chloride, nitrate, sulfate, and total dissolved solids (TDS). Analytical results will be compared to the alternate concentration limits (ACLs) and groundwater

5D

protection standards provided in Table 5–3. There are no applicable limits or standards for nitrate at this site; it will be measured as 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.

Table 5–2. Groundwater Monitoring Network at the Shirley Basin South, Wyoming, Disposal Site

Monitor 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	Upper Sand Aquifer
5–DC	POC well; Main Sand Aquifer
10–DC	Main Sand Aquifer
19–DC	POC well; Main Sand Aquifer
K.G.S. #3	Lower Sand Aquifer

Key: POC = point-of-compliance

Table 5–3. Alternate Concentration Limits and Groundwater Protection Standards for the Shirley Basin South, Wyoming, Disposal Site

Analyte	ACL	Groundwater Protection Standard[a]
Uranium (mg/L)	9.2	N/A
Radium-226 (pCi/L)	91.3	N/A
Radium-228 (pCi/L)	25.7	N/A
Thorium-230 (pCi/L)	2409	N/A
Cadmium (mg/L)	0.079	N/A
Chromium (mg/L)	1.83	N/A
Lead (mg/L)	0.05	N/A
Nickel (mg/L)	6.15	N/A
Selenium (mg/L)	0.12	N/A
Chloride (mg/L)	N/A	2,000
Sulfate (mg/L)	N/A	3,000
TDS (mg/L)	N/A	5,000

[a]Wyoming Class III Groundwater Protection Standards for livestock use are applicable to this site.
Key: ACL = alternate concentration limit; mg/L = milligrams per liter; pCi/L = picocuries per liter; TDS = total dissolved solids

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 trends indicate 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.

The results for cadmium in POC well MW–5–SC and radium-228 in POC well MW–5–DC for the initial sampling by DOE in July 2005 exceeded their respective ACL. The 2005 radium-228 concentration in non-POC well MW–54–SC also was substantially above the ACL. Therefore, confirmatory sampling and analysis for cadmium and radium-228 at the three wells was conducted in November 2005, and the results confirmed the initial findings. When compared with historical results provided by the previous site owner, the results for cadmium in well MW–5–SC were within the range of historical measurements with no apparent upward or downward trend. The 2005 results for radium-228 in well MW–5–DC were substantially above historical measurements, and data indicate that radium-228 has equaled or exceeded the ACL on all but four semiannual sampling events beginning in 1995. This analytical information was provided to NRC and WDEQ with a recommendation to continue annual monitoring and perform an evaluation after 5 years of results to determine if corrective action is necessary.

5E The cadmium concentration in MW–5–SC dropped below the ACL in 2006, but radium-228 increased in both MW–5–DC and MW–54–SC. Analytical results for the 2007 sampling event conducted in August 2007 are provided in Table 5–4. The concentration for cadmium in MW–5–SC remained below the ACL and was lower than the 2006 result (Figure 5–2). However, radium-228 continued above the ACL in an upward trend in both MW–5–DC and MW–54–SC (Figure 5–3). No other ACLs were exceeded.

Table 5–4. 2007 Groundwater Monitoring Results at the Shirley Basin South, Wyoming, Disposal Site

Analyte (Limit or Standard)	Upper Sand Aquifer Wells				Main Sand Aquifer Wells			Lower Sand Aquifer Well
	5–SC (POC)	40–SC	51–SC (POC)	54–SC	5–DC (POC)	10–DC	19–DC (POC)	KGS #3
Cadmium (0.079 mg/L)	0.034	0.00011	0.0014	0.0014	0.00011	ND	0.00005	ND
Chloride (2,000 mg/L)	290	94	340	320	180	54	79	13
Chromium (1.83 mg/L)	0.34	ND	0.43	0.26	0.028	0.00097	ND	ND
Lead (0.05 mg/L)	0.00011	ND	ND	0.00037	0.00015	0.00004	ND	0.000053
Nickel (6.15 mg/L)	2.9	0.017	2.6	3.2	0.97	0.0022	0.12	ND
Nitrate/Nitrite as N (mg/L)	ND	0.37	ND	ND	ND	ND	ND	0.025
Radium-226 (91.3 pCi/L)	0.289	ND	ND	12.5	8.95	15.3	5.65	ND
Radium-228 (25.7 pCi/L)	2.5	1.42	ND	113	55.4	4.73	10.5	0.828
Selenium (0.12 mg/L)	0.02	0.0054	0.00056	0.00026	0.00015	ND	0.000063	ND
Sulfate (3,000 mg/L)	6,300	2,100	9,500	7,500	5,400	990	2,500	220
Thorium-230 (2,409 pCi/L)	472	ND	9.87	5.62	1.48	ND	ND	ND
TDS (5,000 mg/L)	20,000	3,500	16,000	12,000	8,900	1,800	4,100	440
Uranium (9.2 mg/L)	3.9	0.00035	0.041	0.05	0.073	0.012	0.00019	0.00001
Water Elev. (feet)	6992.7	7050.1	7000.3	6946.8	6935.8	6937.4	6937.8	6929.6

Key: mg/L = milligrams per liter; ND = not detected (below detection limit); pCi/L = picocuries per liter; POC = point-of-compliance well; TDS = total dissolved solids

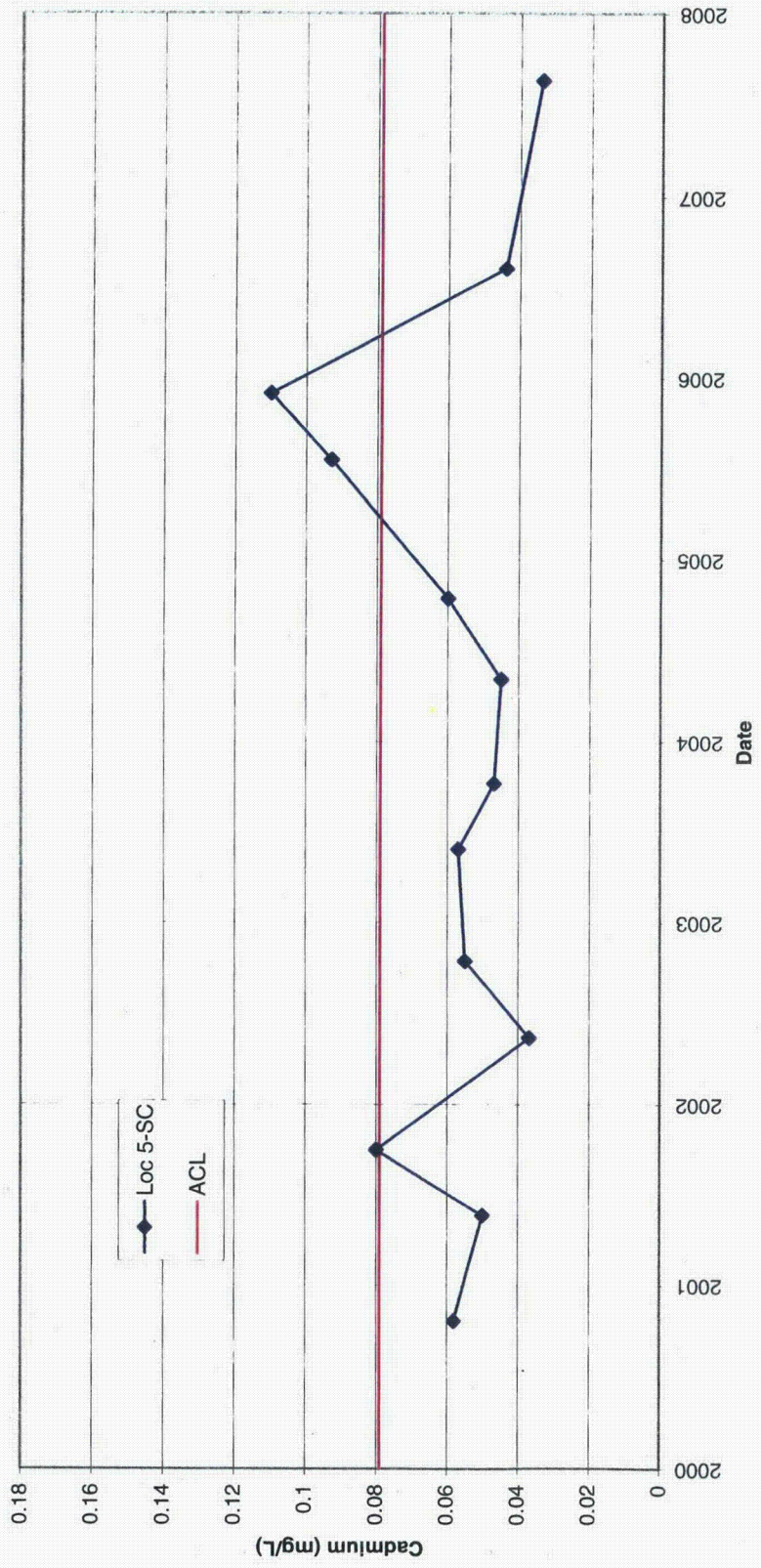


Figure 5–2. Cadmium Concentration in Well MW–5-SC Since Completion of the Disposal Cell

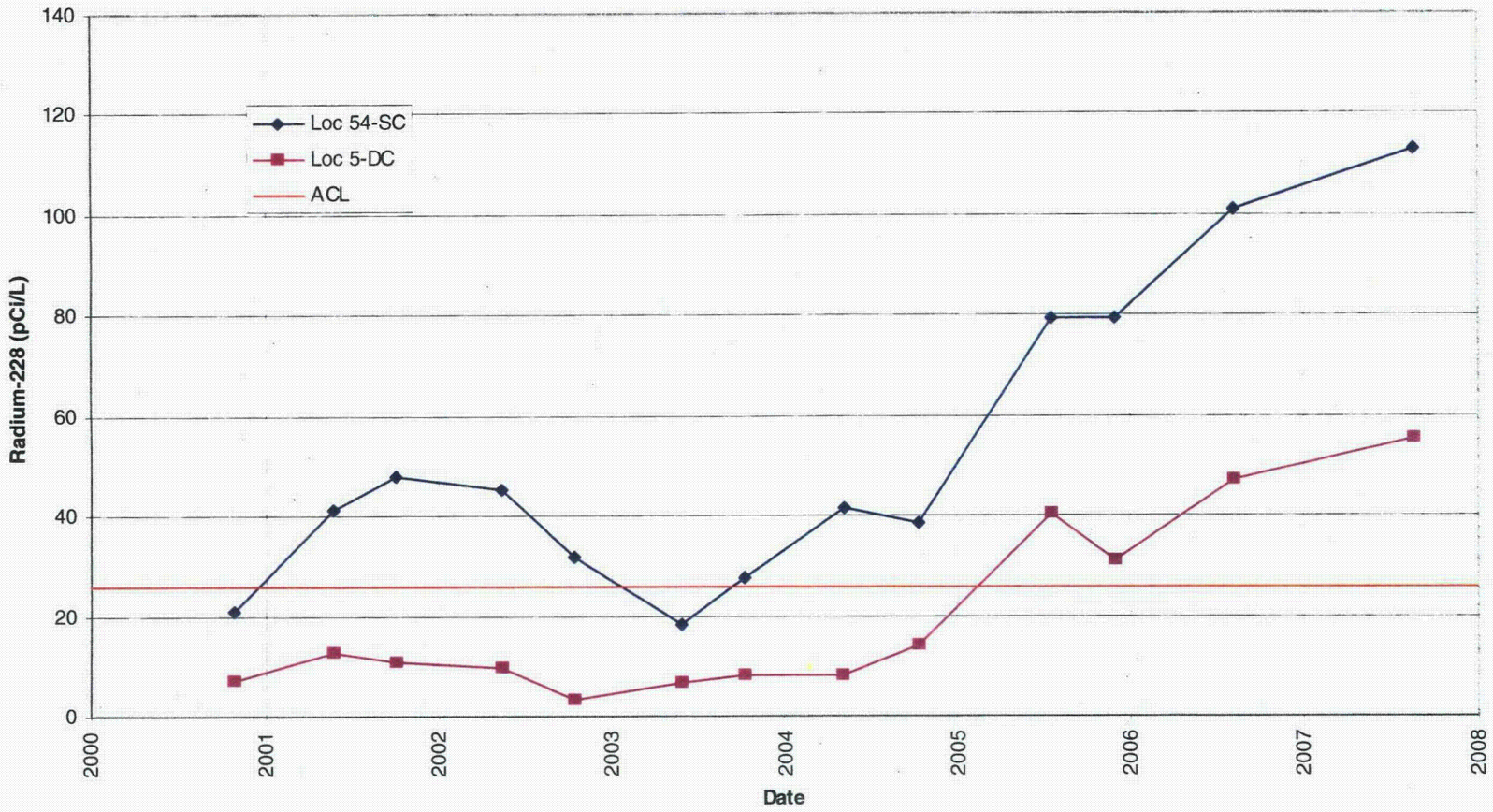


Figure 5–3. Radium-228 Concentrations in Wells MW–5–DC and MW–54–SC Since Completion of the Disposal Cell

The cause for the upward trend for radium-228 has not been determined. An upward trend has occurred for nickel in MW–54–SC since 1996, and TDS has increased in both MW–5–DC and MW–54–SC since measurements were initiated in 2004. However, the concentrations for the other constituents in these wells are remaining steady or are decreasing.

Although groundwater protection standards (applicable only to chloride, sulfate, and TDS) apply to water quality at the site boundary, the values were exceeded for sulfate and TDS in wells MW–5–SC, 51–SC, 54–SC, and 5–DC. When compared with previous DOE data and historical results provided by the previous site owner, the 2007 results were within the range of historical measurements. Also, there are no upward trends in any of the wells that would indicate groundwater protection standards may be exceeded at the site boundary.

Analytical results from well MW–K.G.S. #3 confirm that the Lower Sand Aquifer is hydraulically isolated from the upper aquifers. This conclusion is based on significantly lower concentrations of chloride, sulfate, TDS, and uranium in the Lower Sand Aquifer when compared with the upper aquifers.

The LTSP specifies that this report provide iso-concentration maps for uranium and sulfate. However, the four wells in the Upper Sand Aquifer and the three wells in the Main Sand Aquifer do not provide sufficient data points to develop contour maps of the contaminant plumes. Instead, 2007 concentrations for uranium in the two aquifers are shown on Figures 5–4 and 5–5, and concentrations for sulfate are shown on Figures 5–6 and 5–7. There were no significant changes in uranium concentrations from 2006 to 2007, and there are no apparent trends in any of the wells. Sulfate concentrations decreased from 2006 to 2007 in all wells except MW–K.G.S. #3, which was unchanged; concentrations indicate apparent downward trends in wells MW–5–SC (upgradient of cell) and MW–51–SC (downgradient of cell).

Groundwater contour maps are also specified in the LTSP; however, insufficient data points are provided through the existing well network to develop them. Regional (pre-mining) groundwater flows are generally to the north-northeast for the Upper Sand Aquifer and to the east for the Main Sand Aquifer. However, local flow directions were altered by mining and dewatering activities at Pit 4 on the site and Pathfinder Pit 33 north of the site. Water elevations in the Upper Sand Aquifer wells, based on 2007 measurements, continue to indicate a northeast groundwater flow direction (Figure 5–8). This direction is comparable to the flow direction predicted for the year 2010 in the Petrotomics Company ACL application prepared in 1996. Water elevations in the three Main Sand Aquifer wells, all located on the same line, are essentially equal and do not provide a means to determine flow direction. The estimated northeast flow direction shown on Figure 5–9 is the predicted 2010 flow direction included in the ACL application and likely represents current site conditions.

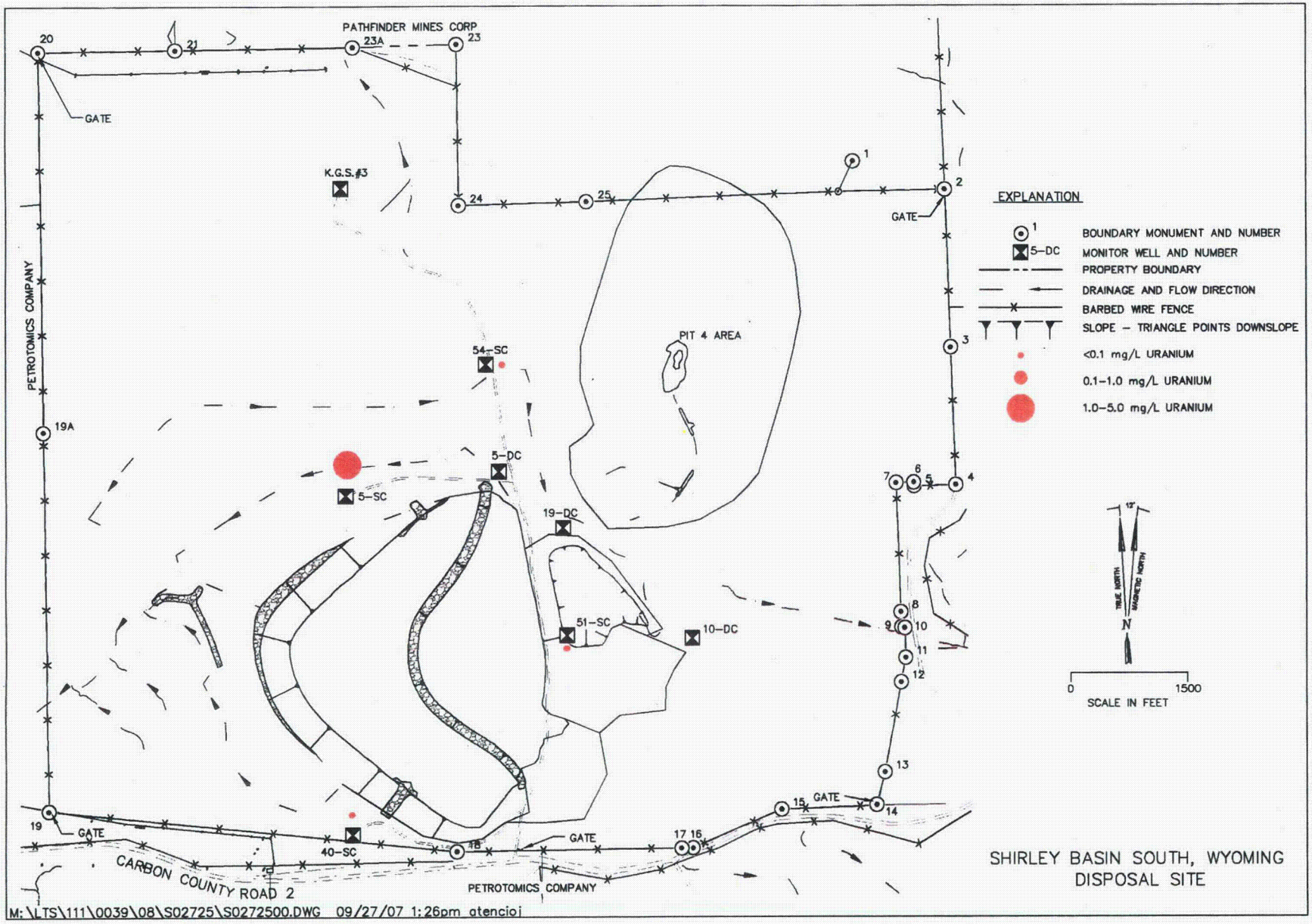


Figure 5–4. August 2007 Uranium Concentrations in the Upper Sand Aquifer at the Shirley Basin South, Wyoming, Disposal Site

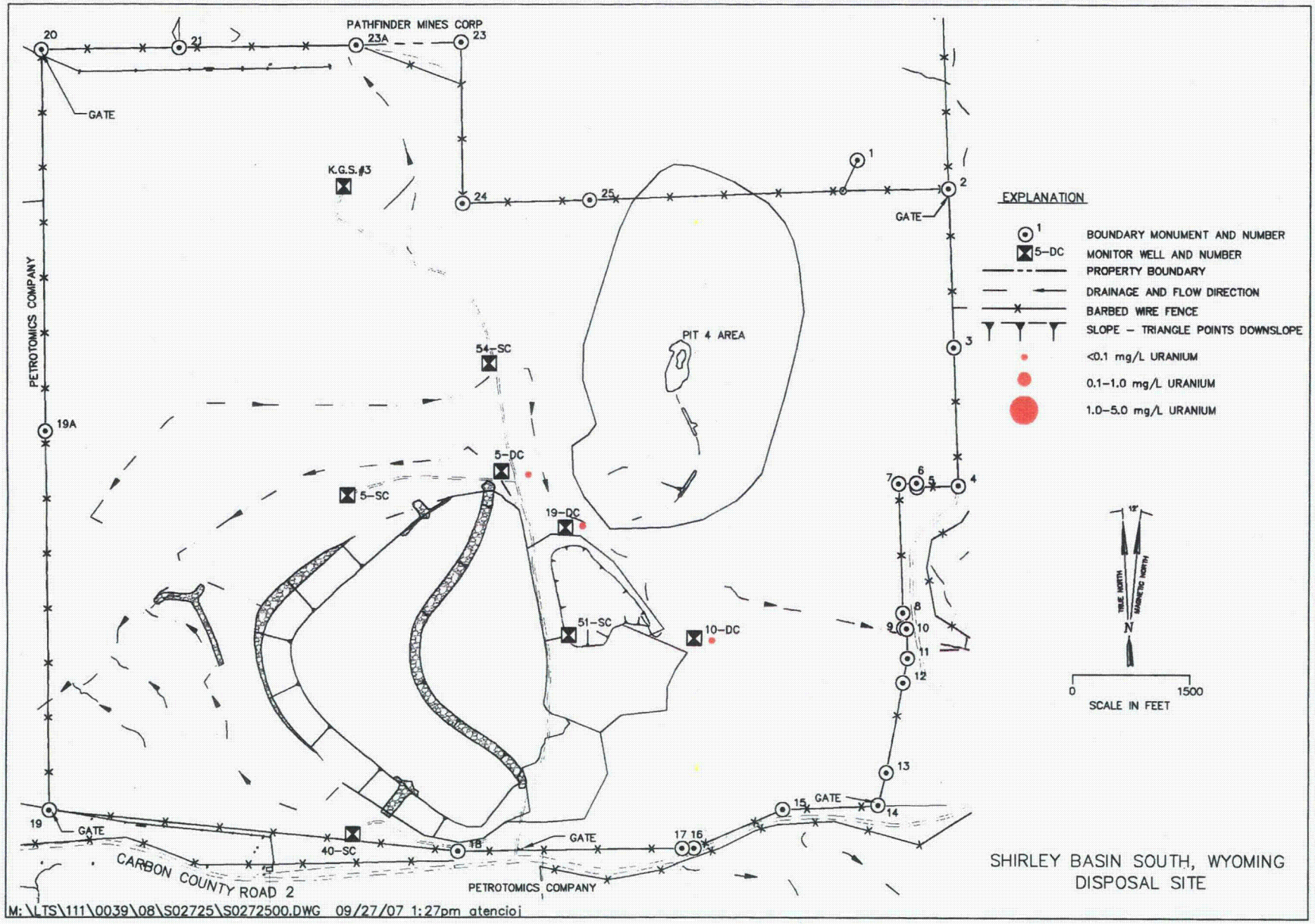


Figure 5–5. August 2007 Uranium Concentrations in the Main Sand Aquifer at the Shirley Basin South, Wyoming, Disposal Site

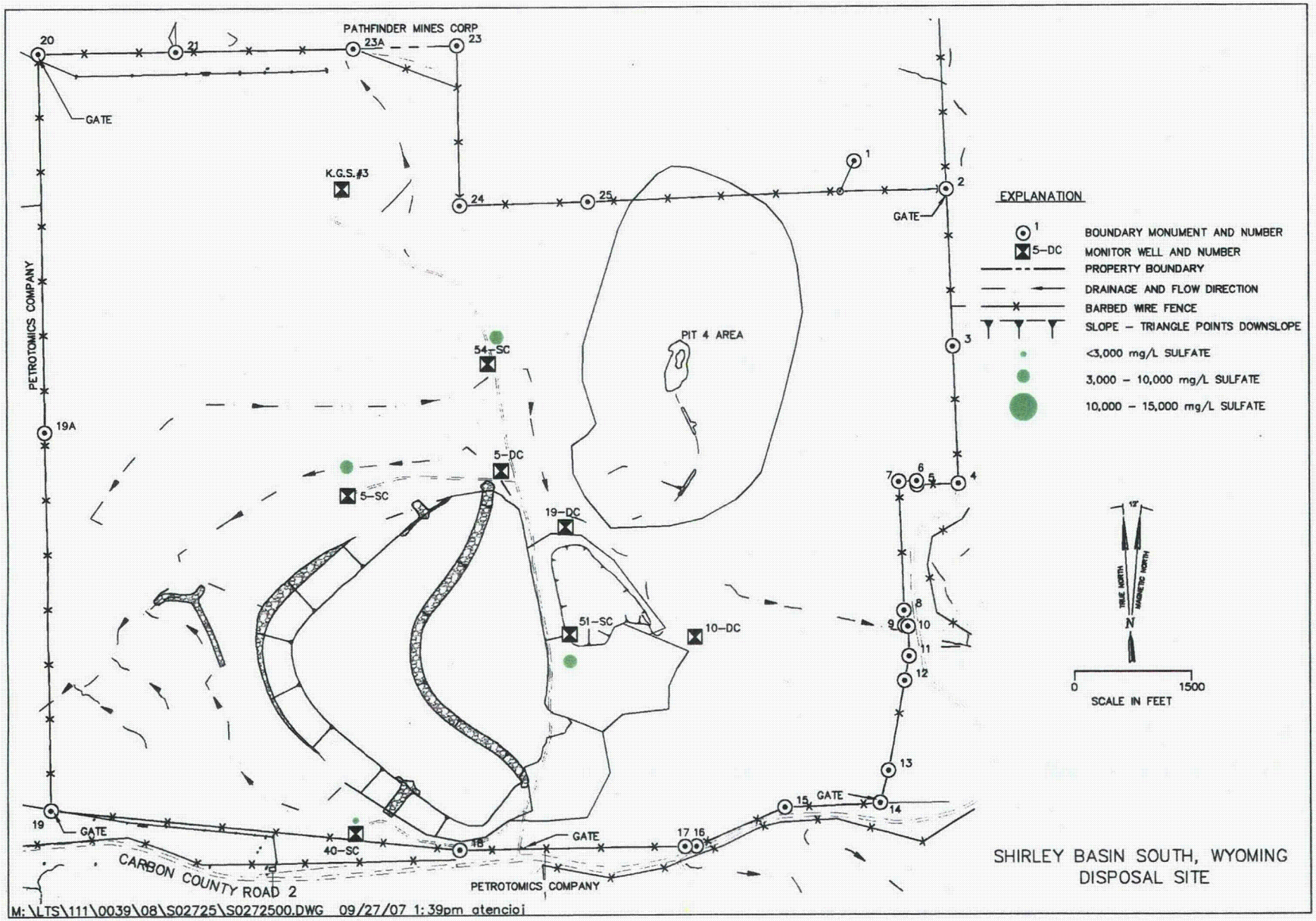


Figure 5–6. August 2007 Sulfate Concentrations in the Upper Sand Aquifer at the Shirley Basin South, Wyoming, Disposal Site

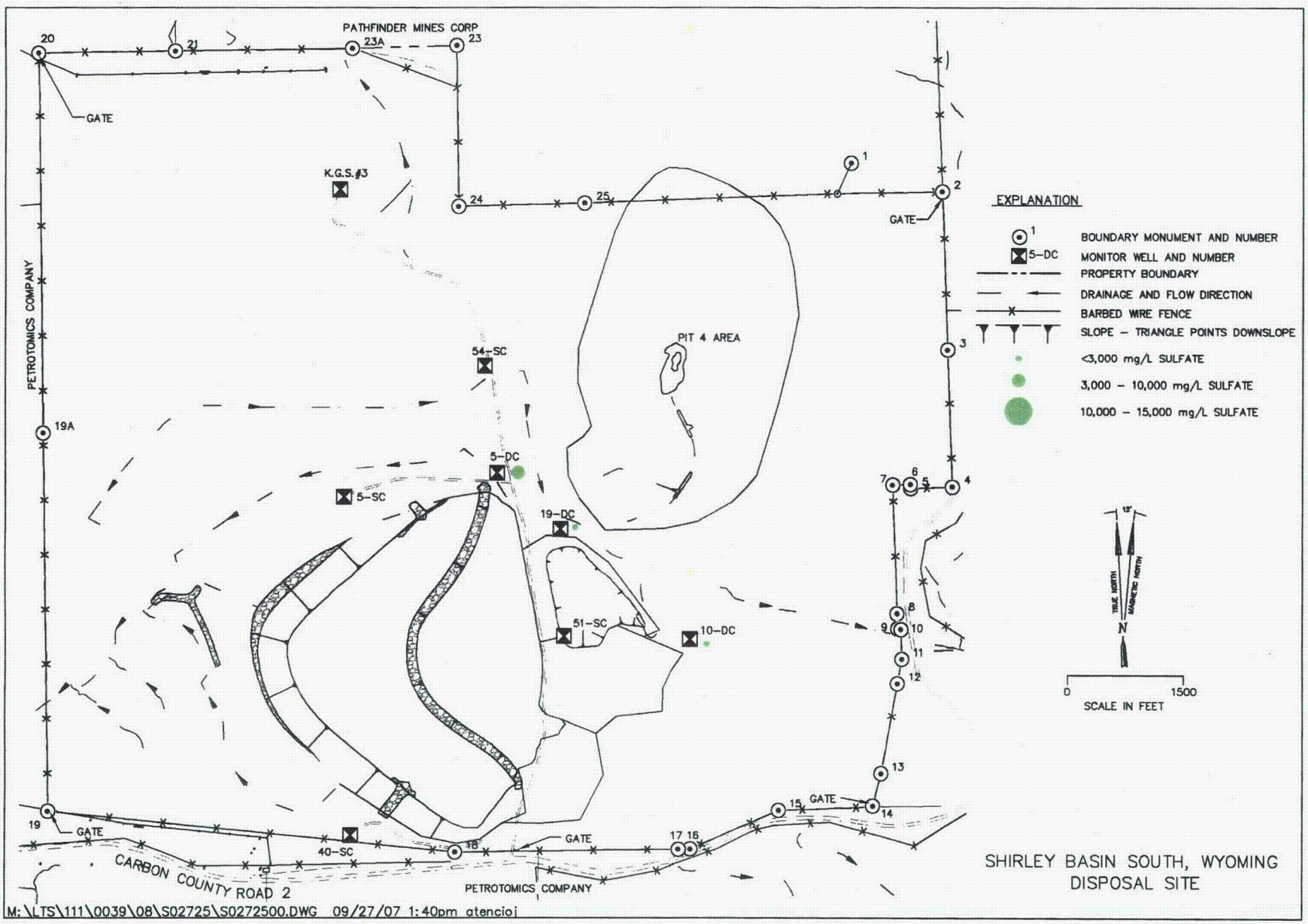


Figure 5–7. August 2007 Sulfate Concentrations in the Main Sand Aquifer at the Shirley Basin South, Wyoming, Disposal Site

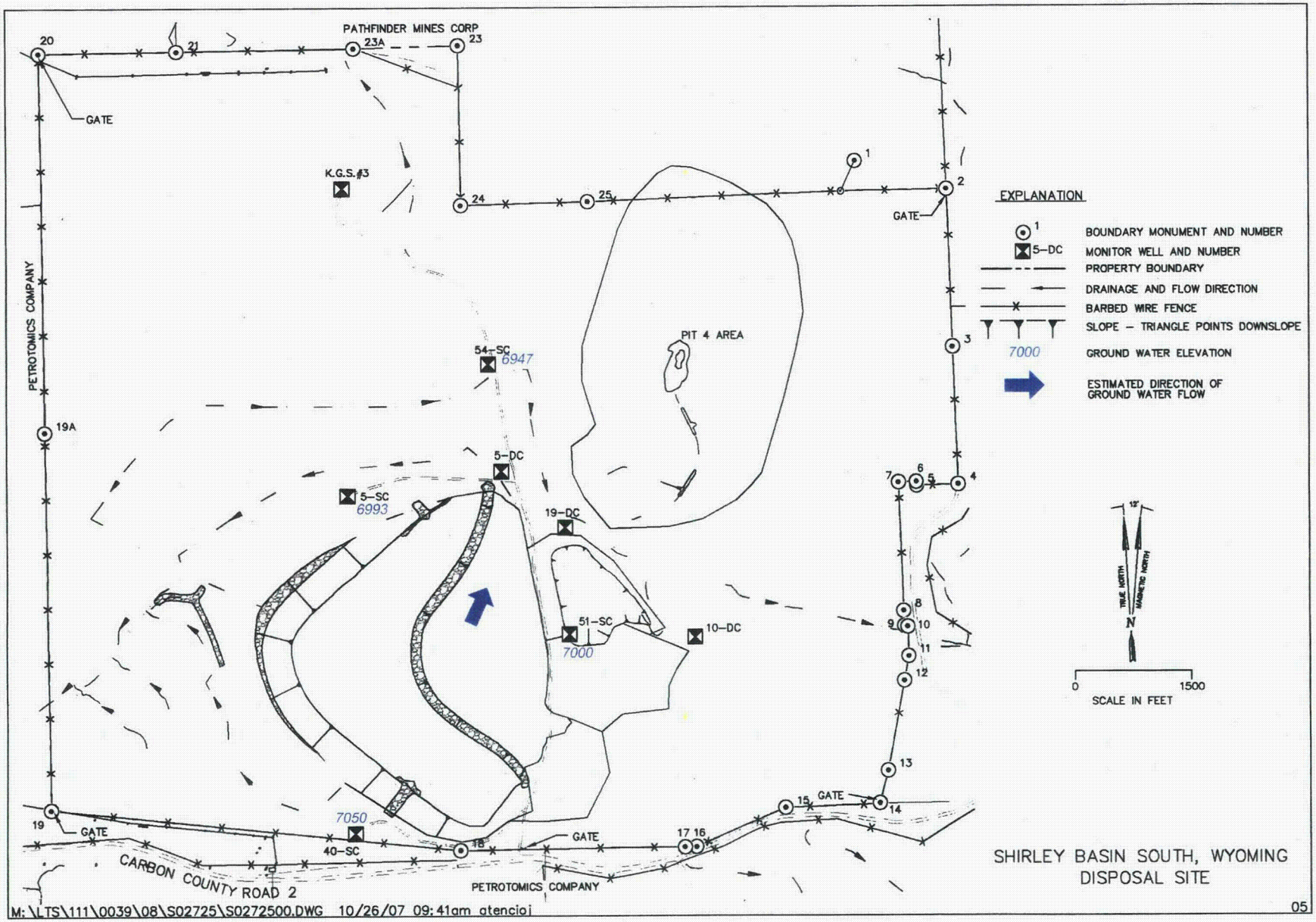


Figure 5–8. Groundwater Elevations and Estimated Flow Direction in the Upper Sand Aquifer at the Shirley Basin South, Wyoming, Disposal Site

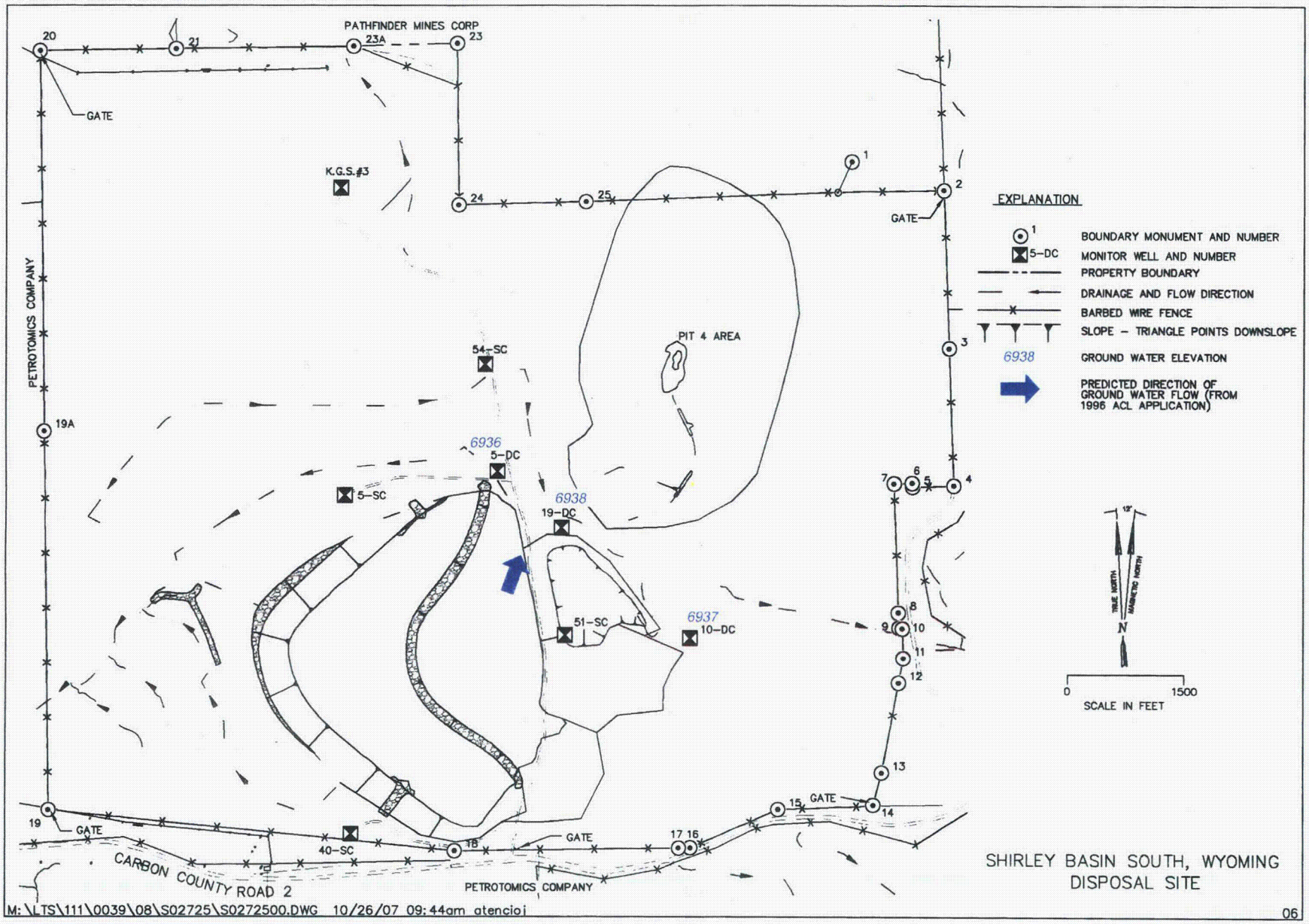


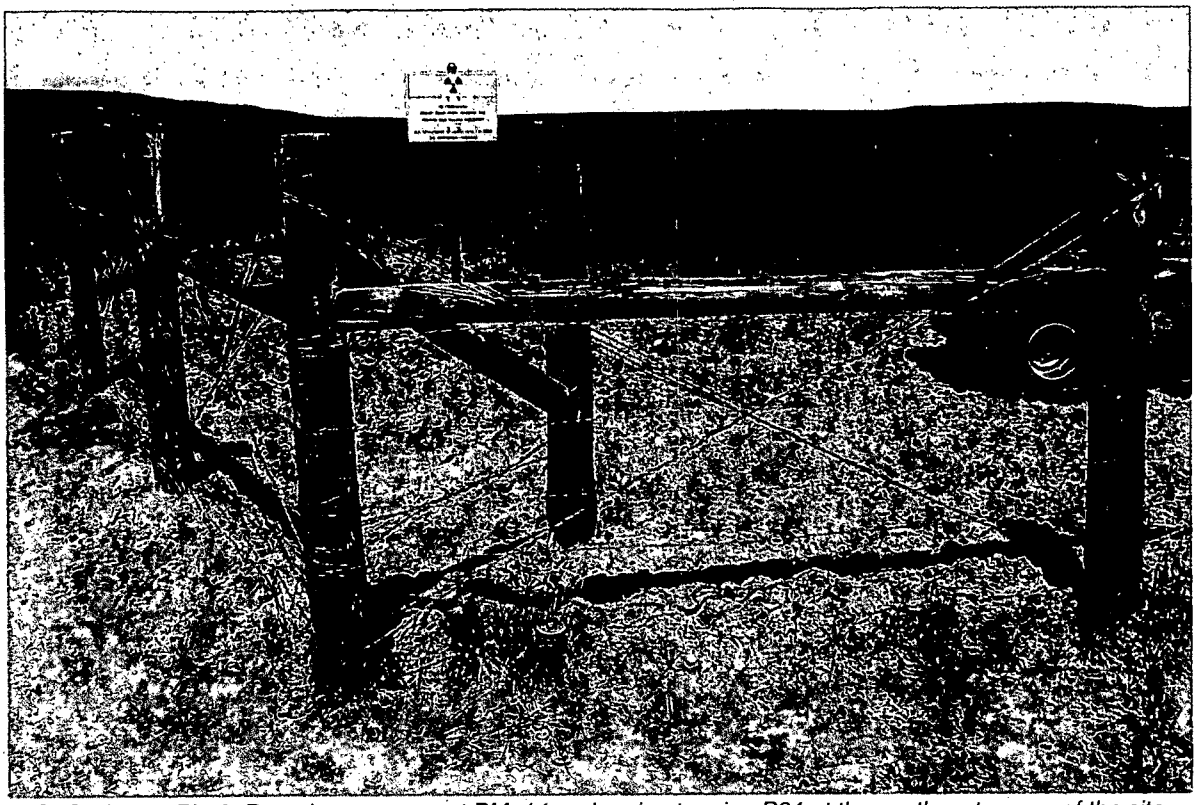
Figure 5–9. Groundwater Elevations and Estimated Flow Direction in the Main Sand Aquifer at the Shirley Basin South, Wyoming, Disposal Site

5.3.5 Photographs

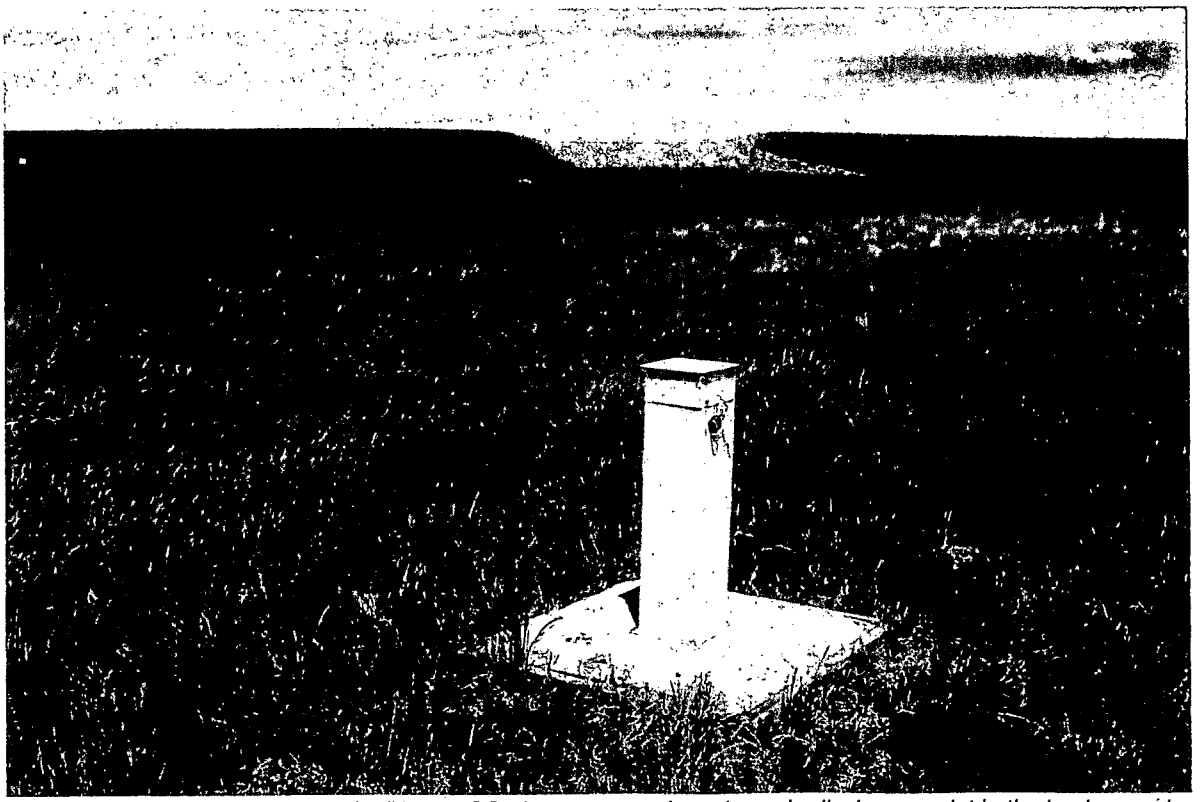
Photograph Location Number	Azimuth	Description
PL–1	25	North end of Pit 4 showing grazing licensee's electric fence.
PL–2	20	Pathfinder's access point (temporary fence) in the north perimeter fence to the on-site topsoil stockpile.
PL–3	310	Boundary monument BM–14 and perimeter sign P34 at the southeast corner of the site.
PL–4	45	Monitor well MW–40–SC; riprap-armored south swale discharge point in the background.
PL–5	215	The rock-armored slope separating the upper and lower surfaces of the disposal cell.
PL–6	160	Rock-armored erosion control structure west of the disposal cell.
PL–7	255	Riprap-armored drainage feature on the south flank of Pit 4.
PL–8	195	Pronghorn antelope along the east edge of Pit 4.

SBS 6/2007. PL–1 North end of Pit 4 showing grazing licensee's electric fence.

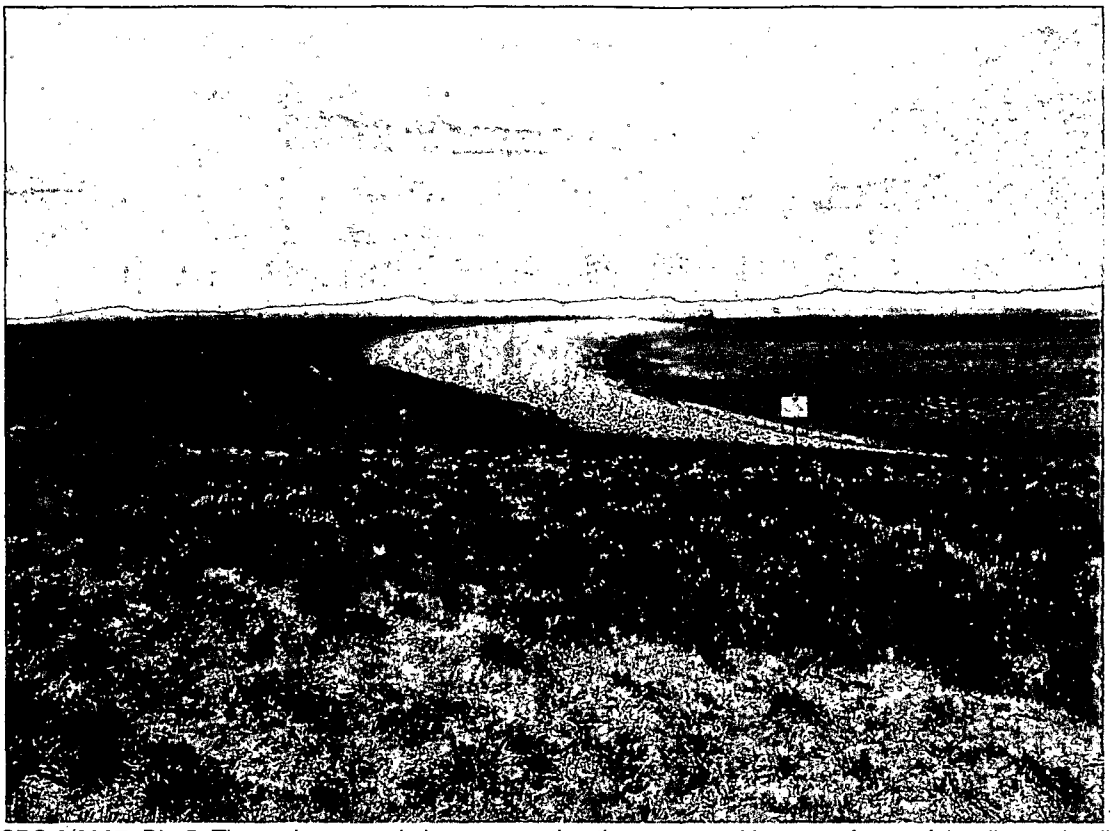
SBS 6/2007. PL–2. Pathfinder's access point (temporary fence) in the north perimeter fence to the on-site topsoil stockpile.



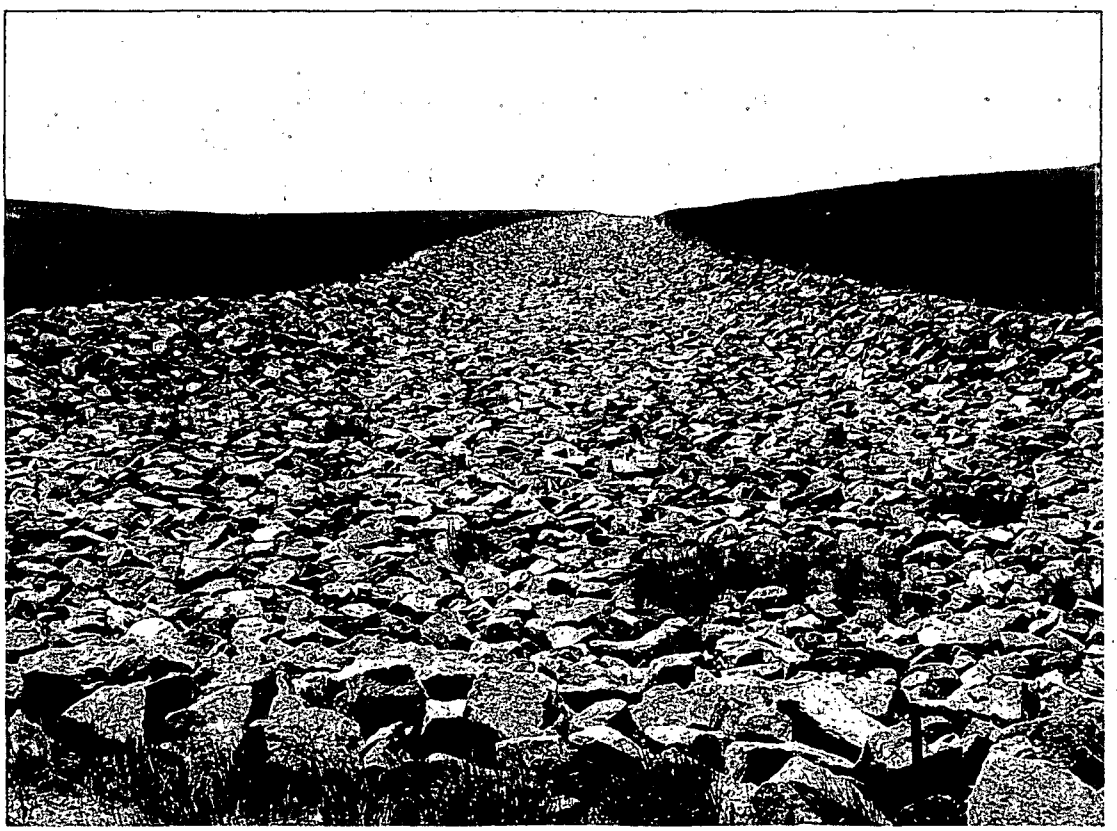
SBS 6/2007. PL–3. Boundary monument BM–14 and perimeter sign P34 at the southeast corner of the site.



SBS 6/2007. PL–4. Monitor well MW–40–SC; riprap-armored south swale discharge point in the background.

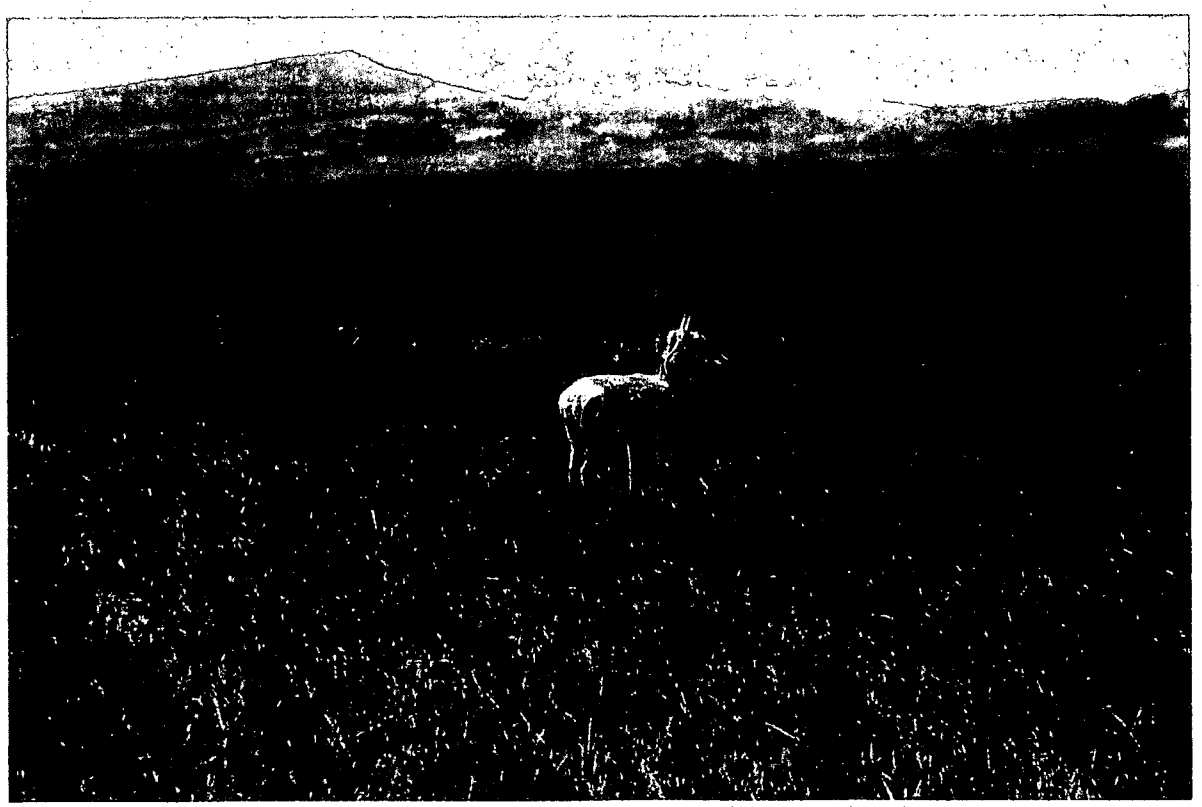


SBS 6/2007. PL–5. The rock-armored slope separating the upper and lower surfaces of the disposal cell.



SBS 6/2007. PL–6. Rock-armored erosion control structure west of the disposal cell.

SBS 6/2007. PL–7. Riprap-armored drainage feature on the south flank of Pit 4.



SBS 6/2007. PL–8. Pronghorn antelope along the east edge of Pit 4.