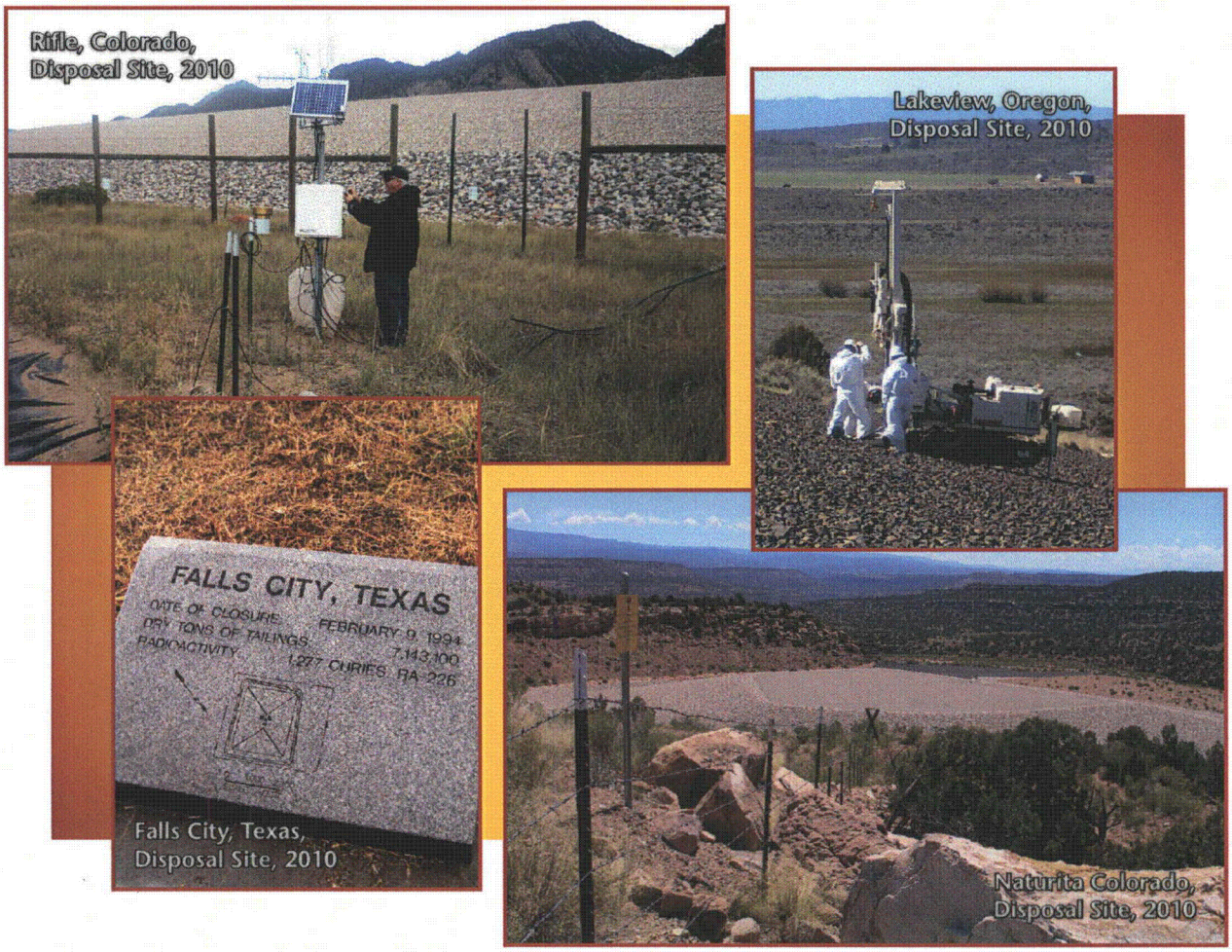
LMS/S06929

U.S. DEPARTMENT OF ENERGY

Legacy Management

2010 Annual Site Inspection and Monitoring Report for Uranium Mill Tailings Radiation Control Act Title I Disposal Sites

January 2011



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Abbreviations

ACL	alternate concentration limit
ATV	all-terrain vehicle
BLM	U.S. Bureau of Land Management
CAA	Custodial Access Agreement
CFR	*Code of Federal Regulations*
cm/s	centimeter(s) per second
D_{50}	mean diameter
DOE	U.S. Department of Energy
EnergySolutions	EnergySolutions Inc.
EPA	U.S. Environmental Protection Agency
GCAP	Groundwater Compliance Action Plan
GPS	global positioning system
LTSP	Long-Term Surveillance Plan
MCL	maximum concentration limit
mg/L	milligram(s) per liter
NECA	Navajo Engineering and Construction Authority
NRC	U.S. Nuclear Regulatory Commission
PL	photograph location
POC	point of compliance
PRB	permeable reactive barrier
Rio Algom	Rio Algom LLC
TDS	total dissolved solids
Umetco	Umetco Minerals Corporation
UMTRCA	Uranium Mill Tailings Radiation Control Act of 1978 (88 USC 7901, *et seq.*)

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Executive Summary

This report, in fulfillment of a license requirement, presents the results of long-term surveillance and maintenance activities conducted by the U.S. Department of Energy (DOE) Office of Legacy Management (LM) in 2010 at 19 uranium mill tailings disposal sites established under Title I of the Uranium Mill Tailings Radiation Control Act (UMTRCA) of 1978.[1] These activities verified that the UMTRCA Title I disposal sites remain in compliance with license requirements.

DOE operates 18 UMTRCA Title I sites under a general license granted by the U.S. Nuclear Regulatory Commission (NRC) in accordance with Title 10 *Code of Federal Regulations* Part 40.27 (10 CFR 40.27). As required under the general license, a long-term surveillance plan (LTSP) for each site was prepared by DOE and accepted by NRC. The Grand Junction, Colorado, Disposal Site, one of the 19 Title I sites, will not be included under the general license until the open, operating portion of the cell is closed. The open portion will be closed either when it is filled or in 2023. This site is inspected in accordance with an interim LTSP.

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

Annual site inspections and monitoring are conducted in accordance with site-specific 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 in accordance with the LTSP. LTSPs and site compliance reports are available on the Internet at http://www.lm.doe.gov/.

All of the sites require some degree of routine monitoring and maintenance, which may include groundwater and surface water monitoring, minor erosion control, vegetation and noxious weed control, fence and gate repairs, sign replacement, and minor trash removal. The following nonroutine activities[2] occurred in 2010:

- Lakeview, Oregon—DOE continued riprap gradation monitoring to ensure that disposal cell erosion protection is adequate. Rock durability monitoring was integrated into the gradation monitoring. Rock samples were also collected for laboratory gradation analysis. A report of the results was integrated into the annual report contained herein.
- Lakeview, Oregon—A geotechnical hole investigation was conducted in May 2010, to assess saturated conditions within the cell and to determine the need for a follow-up inspection. The results of this investigation were reported to NRC under separate cover, dated August 25, 2010.
- Rifle, Colorado—DOE continues to remove and evaporate pore water from the disposal cell that began in 2001 in response to exceeding the LTSP required action level.

[1] Congress directed that the Moab, Utah, Processing Site be remediated under Title I of UMTRCA. This site eventually will become the 20th Title I disposal site.
[2] Nonroutine activities are activities implemented in response to changes in site conditions, regulatory setting, or management structure following a regulatory compliance review.

- Rifle, Colorado—DOE continued the land surveying of settlement plates and standpipes; results indicate that movement in the disposal cell cover is negligible and that down slope movement of the cell is not apparent at this time. An engineering evaluation completed in March 2010 concluded that the disposal cell cover and side slopes are expected to remain stable based on the site seismic conditions and assuming continued transient drainage and pumping of the cell pore fluids.

Results of the annual site inspection, maintenance, and monitoring activities are reported in the site-specific chapters that follow. Actions and issues at each site are summarized in the following table, 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.

2010 Summary of UMTRCA Title I Site Actions and Issues

Site	Chapter	Page	Index No.	Actions and Issues
Burrell, Pennsylvania	2	2–5 2–7	2A 2B	Maintenance: vegetation management plan implemented. Groundwater monitoring.
Canonsburg, Pennsylvania	3	3–5 3–5 3–5 3–5 3–7	3A 3B 3C 3D 3E	Maintenance: Replace erosion control marker EC-4A. Maintenance: noxious weed control and mowing the grass cell cover. Monitoring animal burrows on cell. Maintenance: vegetation management. Groundwater monitoring.
Durango, Colorado	4	4–6	4A	Groundwater monitoring.
Falls City, Texas	5	5–2 5–5 5–5 5–7	5A 5B 5C 5D	Maintenance: minor fence repair. Maintenance: management of the disposal cell's grass cover. Maintenance: control of deep-rooted plants on the disposal cell. Groundwater monitoring.
Grand Junction, Colorado	6	6–2 6–7	6A 6B	Maintenance: sign replacement. Groundwater monitoring.
Green River, Utah	7	7–6	7A	Groundwater monitoring.
Gunnison, Colorado	8	8–2 8–5 8–6	8A 8B 8C	Maintenance: minor fence repair. Maintenance: removing volunteer plant growth. Groundwater monitoring.
Lakeview, Oregon	9	9–6 9–7 9–10	9A 9B 9C	Evaluation: disposal cell cover performance. Evaluation: riprap gradation and durability monitoring and gradation analysis. Groundwater monitoring.
Lowman, Idaho	10	10–5	10A	Maintenance: vegetation management.
Maybell, Colorado	11	11–6	11A	Maintenance: control of deep-rooted plants and noxious weeds.
Mexican Hat, Utah	12	12–2 12–6	12A 12B	Maintenance: perimeter sign replacement. Maintenance: fence repair and damaged signs replaced.
Naturita, Colorado	13	13–2 13–6 13–7	13A 13B 13C	Maintenance: access road boulder removal. Maintenance: vegetation management. Groundwater monitoring.
Rifle, Colorado	14	14–2 14–2 14–6 14–6 14–8	14A 14B 14C 14D 14E	Maintenance: fence repair. Maintenance: replaced missing perimeter sign. Surveying of settlement plates and standpipes. Engineering evaluation addressing slope stability and transient drainage. Monitoring, pumping, and evaporation of disposal cell pore water.
Salt Lake City, Utah	15	15–5 15–5 15–6 15–6	15A 15B 15C 15D	Maintenance: tumbleweeds removed along fence. Maintenance: boundary monuments uncovered. Riprap degradation monitoring. Radiological survey performed as part of inspection.
Shiprock, New Mexico	16	16–2	16A	Maintenance: repair gaps in fence and gate.
Slick Rock, Colorado	17	17–5	17A	Monitoring rills and gullies south of the disposal cell and northwest of the retention pond.
Tuba City, Arizona	19	19–2 19–5 19–6	19A 19B 19C	Maintenance: road repairs. Maintenance: erosion along the diversion channel repaired. Groundwater monitoring.

1.0 Ambrosia Lake, New Mexico, Disposal Site

1.1 Compliance Summary

The Ambrosia Lake, New Mexico, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on August 24, 2010. The disposal cell was in excellent condition. The site access road, owned by Rio Algom Mining LLC (Rio Algom), was temporarily realigned in 2006 to allow for the construction of a waste haul road; waste hauling operations were completed, and the site access road was restored for use in fall 2009. No maintenance needs or cause for a follow-up or contingency inspection was identified.

1.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the Ambrosia Lake Disposal Site are specified in the *Long-Term Surveillance Plan* [LTSP] *for the Ambrosia Lake, New Mexico, Disposal Site* (DOE/AL/62350–211, Rev. 1, U.S. Department of Energy [DOE], July 1996) and in procedures established by DOE to comply with the requirements of Title 10 *Code of Federal Regulations* Part 40.27 (10 CFR 40.27). Table 1–1 lists these requirements.

Table 1–1. License Requirements for the Ambrosia Lake Disposal Site

Requirement	Long-Term Surveillance Plan	This Report
Annual Inspection and Report	Section 6.0	Section 1.3.1
Follow-Up or Contingency Inspections	Sections 6.0 and 7.0	Section 1.3.2
Routine Maintenance and Repairs	Section 8.0	Section 1.3.3
Groundwater Monitoring	Section 5.0	Section 1.3.4
Corrective Action	Section 9.0	Section 1.3.5

Institutional Controls—The 288-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 40.27) in 1998. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, is responsible for the custody and long-term care of the site. Institutional controls at the disposal site, as defined by DOE Policy 454.1, consist of federal ownership of the property, warning/no-trespassing signs along the property boundary, and a locked gate at the entrance to the site access road. Verification of these institutional controls is part of the annual inspection.

Inspectors found no evidence that these institutional controls were ineffective or violated.

1.3 Compliance Review

1.3.1 Annual Inspection and Report

The disposal site, north of Milan, New Mexico, was inspected on August 24, 2010. The results of the inspection are described below. Figure 1–1 shows features and photograph locations (PLs) mentioned in this report.

1.3.1.1 Specific Site-Surveillance Features

Access Road, Entrance Sign, and Perimeter Signs—Access to the Ambrosia Lake Disposal Site is along a gravel road that crosses private property and leads to the site for approximately 1 mile from New Mexico State Highway 509. There is a locked gate across this road where it leaves Highway 509 because the road continues to private mining and grazing interests that lie east of the site. Numerous locks are connected in series to allow other users to pass through the gate. The access road continues through the DOE-owned property along the southern boundary of the site. DOE has been granted permanent access to the disposal site.

Rio Algom temporarily realigned the access road in 2006 to bypass a new waste haul road. Waste hauling operations were completed and restoration of the access road by Rio Algom occurred in fall 2009. Rio Algom, which owns all of the property between Highway 509 and the disposal site, is responsible for reclaiming the temporary road.

The entrance sign and all perimeter signs were in good condition. Posts for perimeter signs P1 through P15 include mining restriction-area warning signs (PL–1).

Site Markers and Monuments—The two granite site markers (PL–2), three combined survey and boundary monuments, and five additional boundary monuments were all undisturbed and in excellent condition.

Monitoring wells—The two monitoring wells on the site (MW–0675 and MW–0678) were in good condition. Gully formation adjacent to monitoring well MW–0678 appears to be stabilizing.

Mine Vents—A mine vent shaft, associated with abandoned underground mine, is within the site boundary in the northern portion of the site. The vent has a casing that rises approximately 3 feet above the ground and a spot-welded cover. The vent was secure at the time of the inspection (PL–3). Inspectors will continue to monitor the condition of the vent to ensure that the closure remains secure.

1.3.1.2 Transects

To ensure a thorough and efficient inspection, the site is divided into four areas referred to as "transects": (1) the riprap-covered top of the disposal cell, (2) the riprap-covered side slopes and apron of the cell, (3) the graded and revegetated area between the disposal cell and the site perimeter, and (4) the outlying area.

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

Top of Disposal Cell—The 91-acre disposal cell was completed in 1994. The basalt riprap-covered top of the disposal cell was in excellent condition. There was no evidence of cracking, slumping, or erosion (PL–4). No deep-rooted shrubs were present at the time of the inspection.

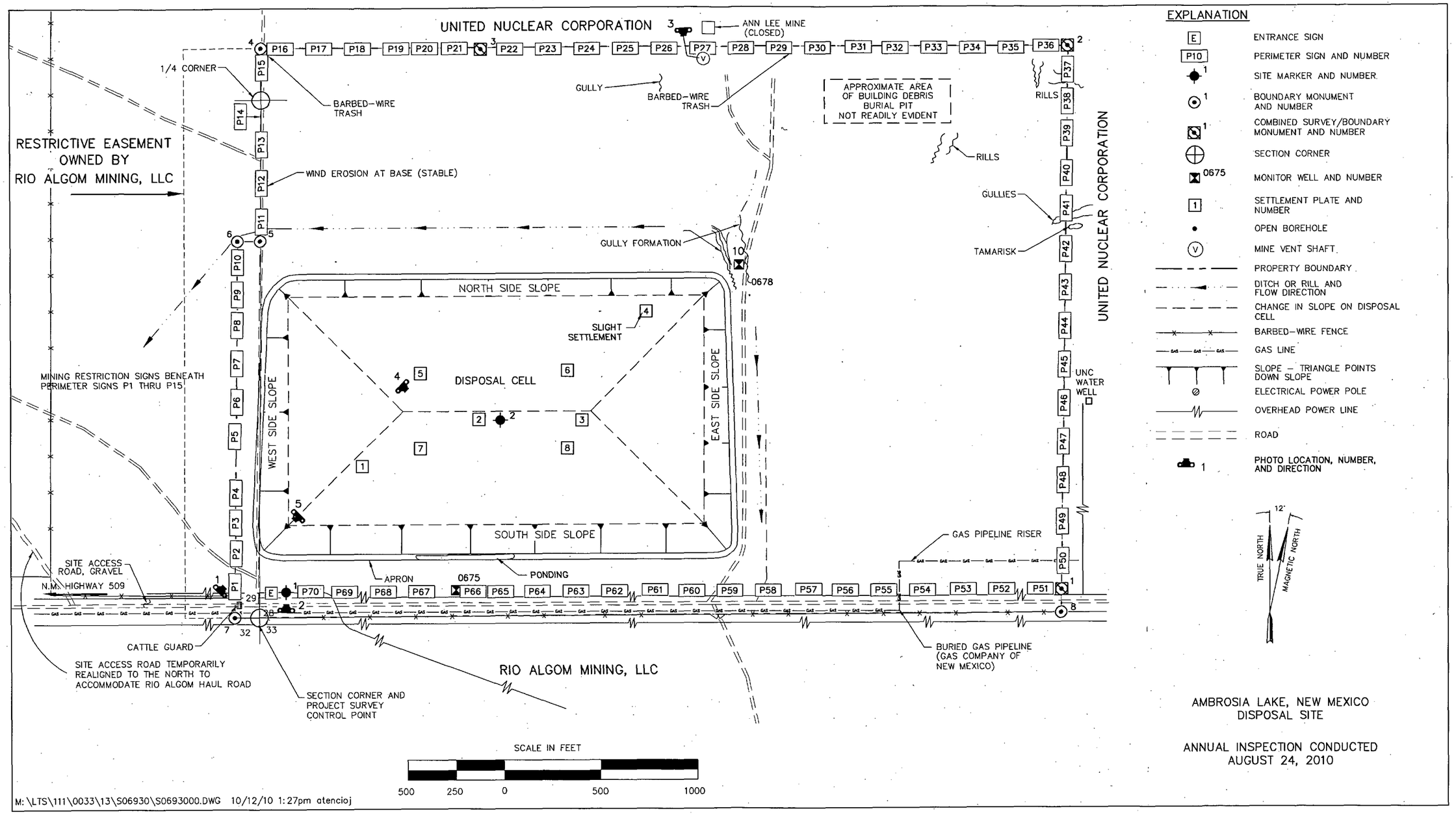

Figure 1–1. 2010 Annual Compliance Drawing for the Ambrosia Lake Disposal Site

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A shallow depression around settlement plate SP–4, near the northeast corner of the disposal cell cover, was first noted during the 1997 inspection and continued to grow in depth and area in subsequent years. The depression was repaired in August 2005. Surveys of the eight settlement plates were conducted in September 2005, September 2006, and September 2007 to monitor for continued settlement at SP–4. The surveys indicated no significant changes at the repaired location. Additional surveys will be conducted only if significant settlement is observed. Visual observations during the 2010 inspection indicate that slight settlement may have occurred since the last inspection. This location will continue to be monitored.

Scattered annual weeds and clumps of grass are growing on the disposal cell cover and are insignificant. Deep-rooted shrubs, such as saltbush, could potentially damage the radon barrier and are periodically cut and treated with herbicide. No shrubs were present on the cell cover at the time of the inspection.

Side Slopes and Apron—The basalt riprap-covered side slopes and apron were in excellent condition and showed no evidence of cracking, settling, slumping, or erosion (PL–5). Ponded water from recent rainfall events was present in the apron along the south side of the disposal cell. In addition to evaporation, this water likely dissipates through infiltration into the underlying alluvium.

Graded and Revegetated Site Area—In general, site vegetation was healthy. Some areas are windswept and have little growth. A local range specialist inspected the site in fall 2009 and reported that site vegetation is not yet adequate to sustain grazing.

Rills and gullies within the DOE property north and east of the disposal cell have been monitored for several years. These erosional features, which appear to be stabilizing, do not threaten the disposal cell's performance or integrity. The features are sufficient distances from the disposal cell, with headward erosion occurring away from the cell and no significant sedimentation.

The access road and a power line cross the site near and parallel to the site's southern boundary. In addition, there is a gas pipeline riser in the southeastern part of the site. This riser is associated with a buried gas pipeline along the southern edge of the site. No changes or disturbances associated with these features were observed.

Outlying Area—The area within 0.25 mile of the site boundary was inspected, and no changes in land use were observed. No activity that would impact the site was identified.

1.3.2 Follow-Up or Contingency 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 or contingency inspections were required in 2010.

1.3.3 Routine Maintenance and Repairs

No routine maintenance or repairs were required in 2010.

1.3.4 Groundwater Monitoring

In accordance with the LTSP, groundwater monitoring is not required at this site because (1) the groundwater is heavily contaminated from underground uranium mining and naturally occurring mineralization, and (2) the uppermost aquifer is of limited use due to its low yield. Consequently, NRC concurred in the application of supplemental standards at the site and the exemption of both compliance and performance groundwater monitoring. However, at the request of the New Mexico Environment Department (NMED), DOE conducts limited monitoring at two locations as a best management practice.

Monitoring well MW–0675 is completed in Mancos Shale alluvium, and monitoring well MW–0678 is completed in a sandstone unit of the Mancos Shale Formation. DOE will sample these locations once every third year for 30 years. The samples are analyzed for molybdenum, nitrate, selenium, sulfate, and uranium.

The next sampling event is scheduled for fall 2010.

1.3.5 Corrective Action

Corrective action is taken to correct out-of-compliance or hazardous conditions that create a potential health and safety problem or that may affect the integrity of the disposal cell or compliance with 40 CFR 192.

No corrective action was required in 2010.

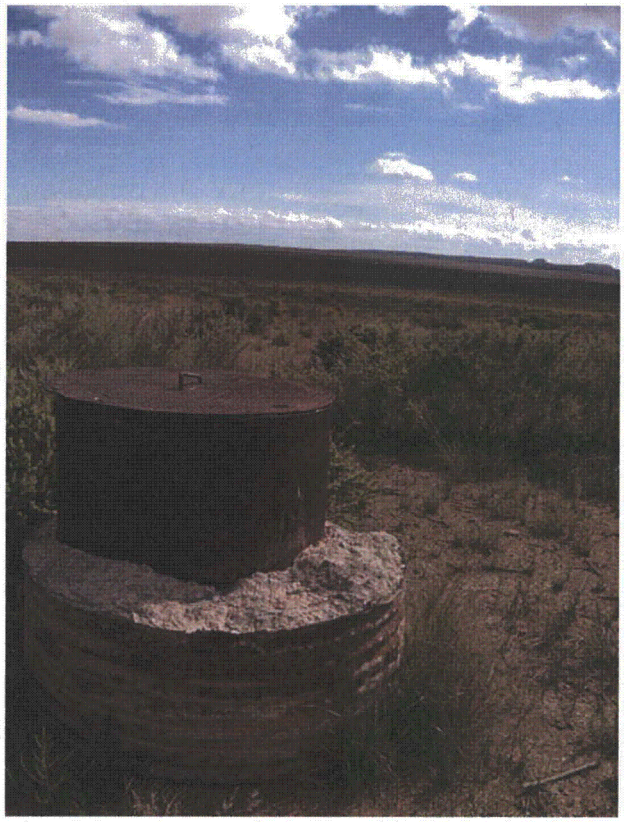
1.3.6 Photographs

Table 1–2. Photographs Taken at the Ambrosia Lake Disposal Site

Photograph Location Number	Azimuth	Description
PL–1	45	Perimeter sign P1 and mining restriction area warning sign.
PL–2	0	Site marker SMK–1.
PL–3	180	Mine vent shaft.
PL–4	135	Southeast view of the disposal cell cover.
PL–5	225	Southwest corner of the disposal cell.

AMB 8/2010. PL–1. Perimeter sign P1 and mining restriction area warning sign.

AMB 8/2010. PL–2. Site marker SMK–1.



AMB 8/2010. PL–3. Mine vent shaft.

AMB 8/2010. PL–4. Southeast view of the disposal cell cover.

AMB 8/2010. PL–5. Southwest corner of the disposal cell.

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2.0 Burrell, Pennsylvania, Disposal Site

2.1 Compliance Summary

The Burrell, Pennsylvania, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site, inspected on October 19, 2010, was in excellent condition. The disposal cell and all associated drainage diversion structures were in good condition and functioning as designed. Deep-rooted plants continue to grow on the disposal cell in accordance with the revised long-term surveillance plan (LTSP) issued in April 2000.

A vegetation management plan was implemented in 2008 to control noxious and invasive plants. Coupled with lessons learned in vegetation management at the site, the plan's implementation has led to continuous and significant improvement of herbaceous cover. In-the-field discussions with site maintenance personnel during annual inspections continue to improve the efficiency and effectiveness of vegetation management activities.

Groundwater monitoring is required every 5 years at the Burrell site. DOE conducted the groundwater sampling in October 2009. Those results were not available in time to be included in the 2009 compliance report, so they are presented in this report. The 2009 samples continue to indicate there is no contamination being released and that the disposal cell is performing as designed.

No cause for a follow-up or contingency inspection was identified.

2.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the Burrell Disposal Site are specified in the *Long-Term Surveillance Plan for the U.S. Department of Energy Burrell Vicinity Property, Blairsville, Pennsylvania* (GJO–2002–331–TAR, U.S. Department of Energy [DOE], revised April 2000) and in procedures established by DOE to comply with the requirements of Title 10 *Code of Federal Regulations* Part 40.27 (10 CFR 40.27). Table 2–1 lists these requirements.

Table 2–1. License Requirements for the Burrell Disposal Site

Requirement	Long-Term Surveillance Plan	This Report
Annual Inspection and Report	Section 3.3	Section 2.3.1
Follow-Up or Contingency Inspections	Section 3.5	Section 2.3.2
Routine Maintenance and Repairs	Section 3.6	Section 2.3.3
Groundwater Monitoring	Section 3.7	Section 2.3.4
Corrective Action	Section 3.6.3	Section 2.3.5

Institutional Controls—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 along the property boundary, and locked gates.

The 72-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 40.27) in 1994. DOE is

the licensee and, in accordance with the requirements for UMTRCA Title I sites, is responsible for the custody and long-term care of the site.

Inspectors found no evidence that these institutional controls were ineffective or violated.

2.3 Compliance Review

2.3.1 Annual Inspection and Report

The site, east of Blairsville, Pennsylvania, was inspected on October 19, 2010. The results of the inspection are described below. Figure 2–1 shows features and photograph locations (PLs) mentioned in this report. 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, Fence, Gates, and Signs—Access to the site is off Strangford Road on an access road that lies within a perpetual right-of-way through private property (Tract 201–E). The access road continues across DOE-leased land and crosses the Norfolk Southern railroad tracks to the entrance gate at the east end of the site. Authorized personnel who need access to the railroad tracks and to the several natural-gas wells nearby also use the road.

The chain-link security fence, replaced in 2007, remains in excellent condition, with the exception of a bent rail on the south fence (PL–1). The top rail was bent when a tree fell across it in the spring of 2010. The tree was safely removed from the fence shortly after being discovered. The top rail, although bent, remains serviceable. A vegetation-free corridor remains established along the fence line (PL–2). The entrance gate and four personnel gates were in good condition. Of the 17 perimeter signs mounted on the security fence, four have been damaged by bullet holes, but they remain serviceable.

Site Markers and Monuments—The site has nine markers (a site marker and eight erosion control markers). Site marker SMK–1 was in excellent condition. All eight erosion control markers were located during the inspection, and seven were in good condition. Erosion control marker E–7 remains damaged and is identified as a minor maintenance item for the site that will be addressed in 2011. Dense vegetation is once again growing around the erosion control markers. The dense vegetation will be targeted for removal in 2011 so that inspectors can safely access the markers.

The site has 10 monuments (three survey monuments and seven boundary monuments). All three survey monuments were in good condition. Of the seven boundary monuments, five were in good condition. Boundary monument BM–4 was missing, and boundary monument BM–5 was damaged. Both are considered to be minor maintenance items that will be addressed in 2011.

Monitoring wells—The site has four pairs of monitoring wells. Each pair consists of a shallow (alluvial) completion and a deeper (bedrock) completion. Monitoring wells were not inspected in 2010. They were last inspected by the water sampling crew in 2009. They will be inspected again when wells are sampled in 2014. All wells encountered during the 2010 site inspection were locked and secured.

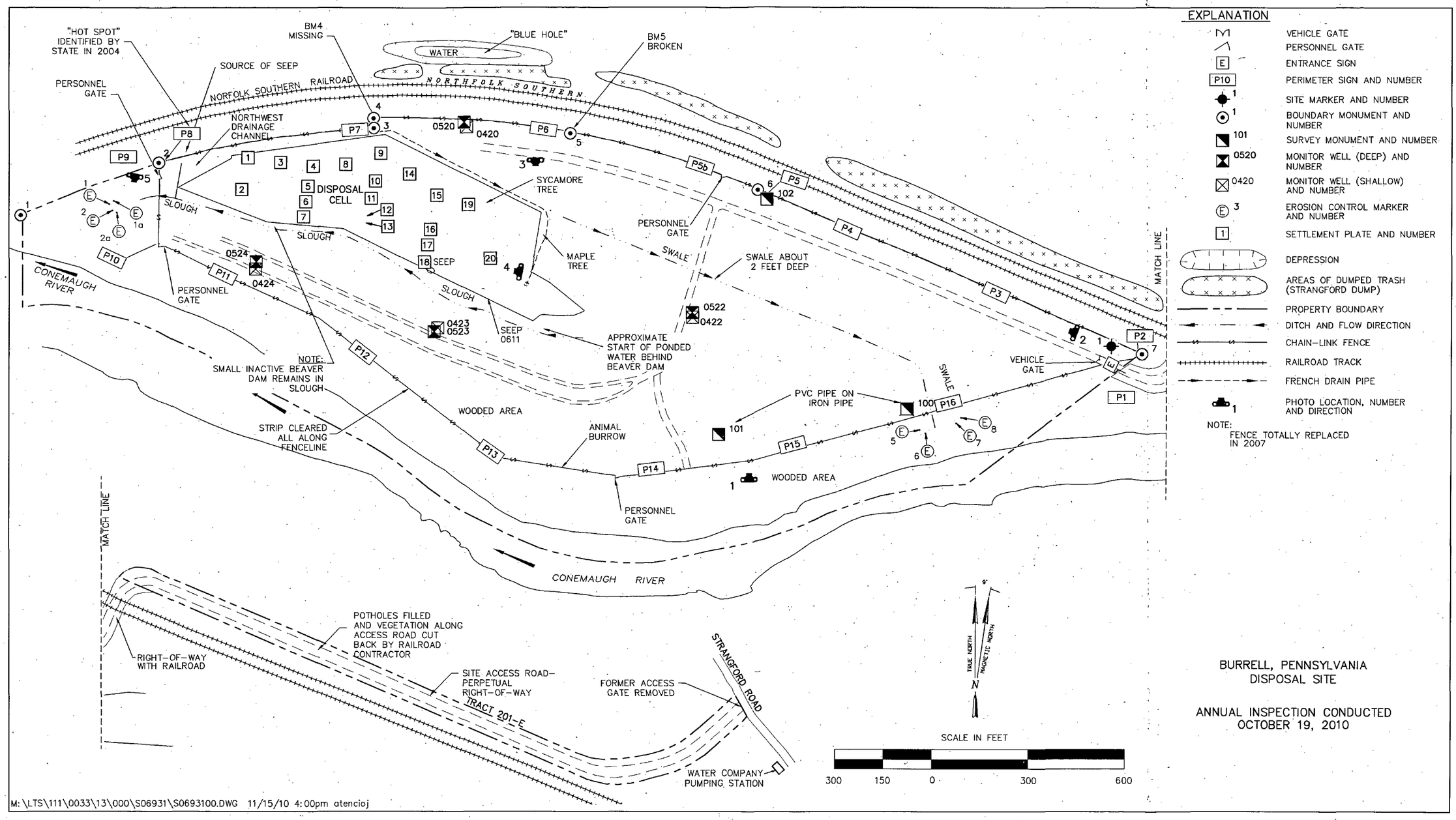

Figure 2–1. 2010 Annual Compliance Drawing for the Burrell Disposal Site

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2.3.1.2 Transects

To ensure a thorough and efficient inspection, inspectors divided the site into four areas called "transects": (1) the disposal cell, (2) the area between the disposal cell and site boundary, (3) the site perimeter, and (4) the outlying area.

The area inside each transect was inspected by walking a series of traverses. Within each transect, the inspectors examined specific site-surveillance features, drainage structures, and vegetation. Inspectors also looked for evidence of settlement, erosion, or other modifying processes that might affect the site's integrity or long-term performance.

Disposal Cell—The riprap-covered disposal cell was in excellent condition (PL–3). There were no indications of cell instability, such as slumping, bulging, or differential settlement. Rock quality was excellent; degradation of the limestone riprap was not evident.

Active control of vegetation on the cell cap has not been required since 2000 (according to the revised LTSP). Past studies at the Burrell Site concluded that deep-rooted plant growth on the cell puts the public and the environment at no greater risk of exposure to contaminants within the disposal cell. Vegetation growth on the cell might actually enhance cover performance through evapotranspiration. These studies further concluded that plant growth would not impede the proper functioning of the radon barrier. NRC concurred in the revised LTSP, which no longer requires active control of deep-rooted vegetation on the cell cover. NRC has suggested that DOE reevaluate the effects of vegetation on cover performance in 10 to 20 years to confirm performance parameters and predictions. The timing for this assessment is therefore between 2007 and 2017.

Although vegetation is allowed to grow on the disposal cell, the cell is sprayed for noxious weeds. The Japanese knotweed infestation on the cell cap is still declining, but continued efforts are needed to reduce stands on the south slope (PL–4). Deep-rooted woody species continue to proliferate on the cell cap (i.e., sycamore, tree of heaven, elm, tulip poplar, black locust, catalpa, and maple). As the trees mature, there is some concern that uprooting could damage the disposal cell cover, which would require repair. Vegetative growth on the disposal cell will continue to be monitored.

No active seeps were found along the south slope of the disposal cell during the site inspection in 2010.

Area Between the Disposal Cell and Site Boundary—The area surrounding the disposal cell and inside the security fence was cleared during reclamation and is covered by thick grass and reestablishing hardwood trees. Periodic mowing maintains access to monitoring wells. The area east of the cell remains grassland.

2A Implementation of a new vegetation management plan in 2008 has been successful in controlling noxious and invasive plants across the site. A combination of spot herbicide application and more-frequent mowing continues to be effective and will continue. The plan includes utilizing a woodland right-of-way mix to reduce the resprouting of Japanese knotweed and other noxious weeds in areas cleared by spot herbicide application. A large patch of Japanese knotweed was cleared southwest of the disposal cell and reseeded. Revegetation of the area using the woodland mix was mostly successful along the slope but some additional grass is needed (PL–5). A test-

plot of the woodland right-of-way mix along the south fence is considered to be a success. Use of the woodland mix will be expanded across the site as deemed appropriate.

A French drain was installed along the base of the north side slope of the disposal cell in 1998 to prevent water from ponding next to the cell. Inspection findings dating back to 1998 indicate that, prior to installing the French drain, rainwater and snowmelt would collect off the north side of the disposal cell. Saturated soil and wetland vegetation (cattails and purple loosestrife) were present. At the same time that wetland vegetation was growing on the north slope of the disposal cell, seeps were occurring in the south slope of the disposal cell. It was thought that the source of water for the seeps could be the ponded water north of the cell. No water has been observed flowing from the seeps on the south slope of the disposal cell since the French drain was installed. In the spring of 2010, though, a new seep was observed on the south slope (seep 0611). The seep was sampled. No maximum concentration limit (MCL) exceedances were measured in the sample. Inspectors in 2010 observed cattails and purple loosestrife growing between the north slope of the disposal cell and the location of the French drain, indicating that the area might not be draining efficiently. This area will continue to be monitored to determine if the area of wetlands is expanding. Inspection of the outlet to the French drain indicates that the drain outlet is clear of obstructions.

A small, inactive beaver dam remains within the slough at the base of the south slope of the disposal cell, and water continues to collect behind it. The water level behind the dam is not high enough to saturate the tailings or impact the integrity of the disposal cell and appears unchanged from prior inspection. Therefore, DOE has elected not to remove the dam. Instead, DOE will continue to monitor the dam and its possible impacts on the disposal site.

Site Perimeter—A known seep along the north security fence, about 60 feet east of perimeter sign P8 and west of the disposal cell, was flowing at the time of the 2010 inspection. This area will continue to be monitored for seeps to determine if they threaten the disposal cell's integrity. Conceivably, the seeps also could destabilize the nearby railroad embankment. The water for this seep may be coming from other seeps on the bluffs, above and just north of the railroad tracks.

Outlying Area—The area beyond the site boundary for a distance of 0.25 mile was visually examined for signs of erosion, development, and other changes that might affect the site. North of the site, a dirt road parallels the railroad tracks and provides access to a long, narrow, wooded area that has been used as an illegal dump over the years. In 2010, no new trash was observed. The dump is not a threat to the disposal site but is an indication of the overall level of activity near the disposal site and may be a predictor of vandalism. For this reason, the area will continue to be monitored. All other areas around the site remained unchanged.

2.3.2 Follow-Up or Contingency Inspections

DOE will conduct follow-up inspections if (1) an annual inspection or other site visit reveals a condition that must be reevaluated during a return to the site, or (2) a citizen or outside agency notifies DOE that conditions at the site are substantially changed.

No follow-up or contingent inspections were required in 2010.

2.3.3 Routine Maintenance and Repairs

In 2010, noxious and invasive weed control continued and the routes to the monitoring wells were mowed.

2.3.4 Groundwater Monitoring

2B In accordance with the LTSP, DOE monitors groundwater at this site as a best management practice to evaluate the disposal cell's performance. The revised LTSP stipulates that monitoring be performed every 5 years. DOE conducted groundwater monitoring in October 2009 and results were not available in time to include in the 2009 compliance report; therefore, the 2009 sampling results are presented in this report

The groundwater monitoring network consists of eight wells (in four pairs) that are monitored for four target analytes: lead, molybdenum, selenium, and uranium. In Table 1 to Subpart A of 40 CFR 192, the U.S. Environmental Protection Agency (EPA) has established MCLs for these analytes in groundwater. The wells in the monitoring network are listed in Table 2–2 and MCLs for the four target analytes in Table 2–3. Time-concentration plots, beginning in 1996, for the four analytes are shown on Figures 2–2 through 2–5.

Table 2–2. Groundwater Monitoring Network at the Burrell Disposal Site

Monitor Well	Hydrologic Relationship
MW-0420 & MW-0520	Upgradient, or background
MW-0422 & MW-0522	Crossgradient
MW-0423 & MW-0523	Downgradient
MW-0424 & MW-0524	Downgradient

Table 2–3. Maximum Concentration Limits for Groundwater at the Burrell Disposal Site

Constituent	MCL[a] (mg/L)
Lead	0.05
Molybdenum	0.1
Selenium	0.01
Uranium	0.044

[a]EPA MCLs as listed in 40 CFR 192, Subpart A, Table 1.

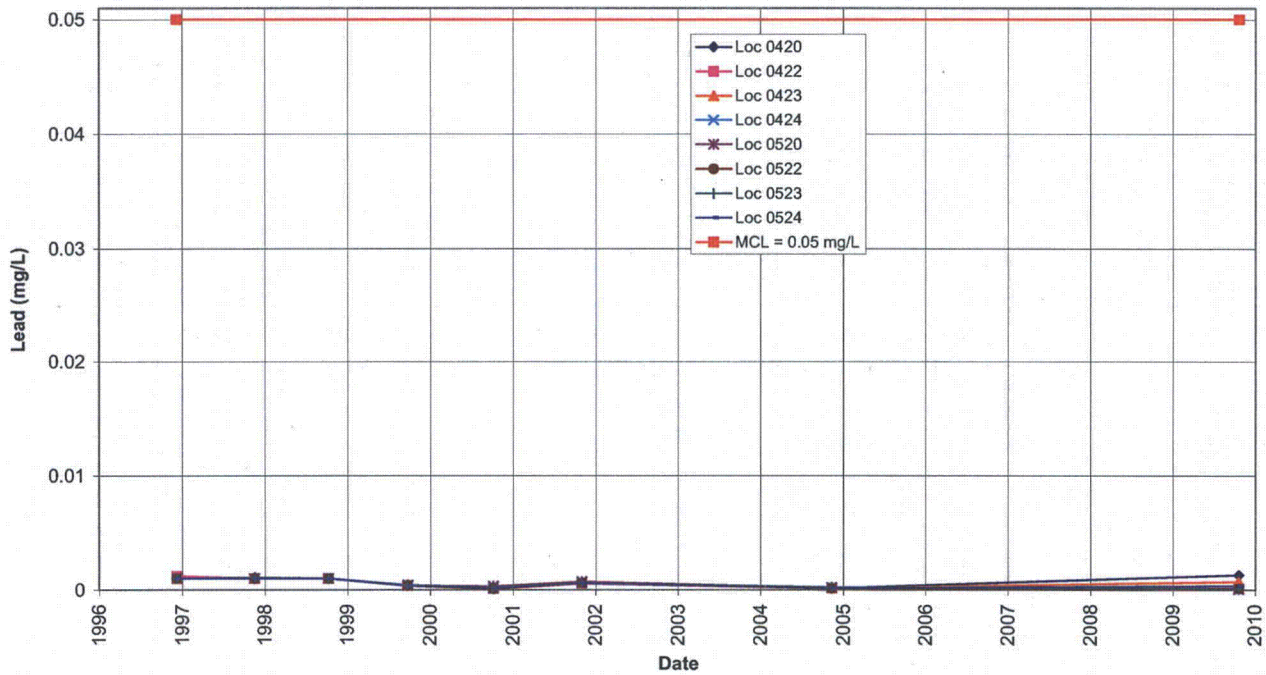

Figure 2–2. Time-Concentration Plot of Lead in Groundwater at the Burrell Disposal Site

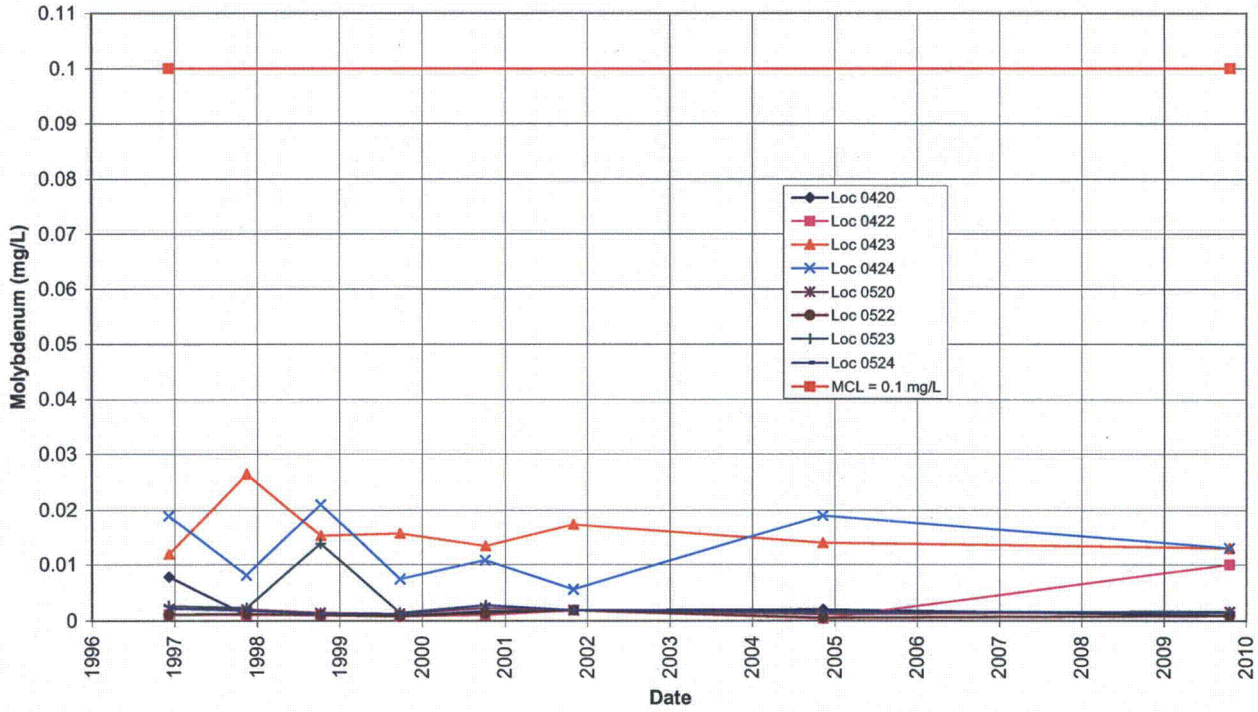

Figure 2–3. Time-Concentration Plot of Molybdenum in Groundwater at the Burrell Disposal Site

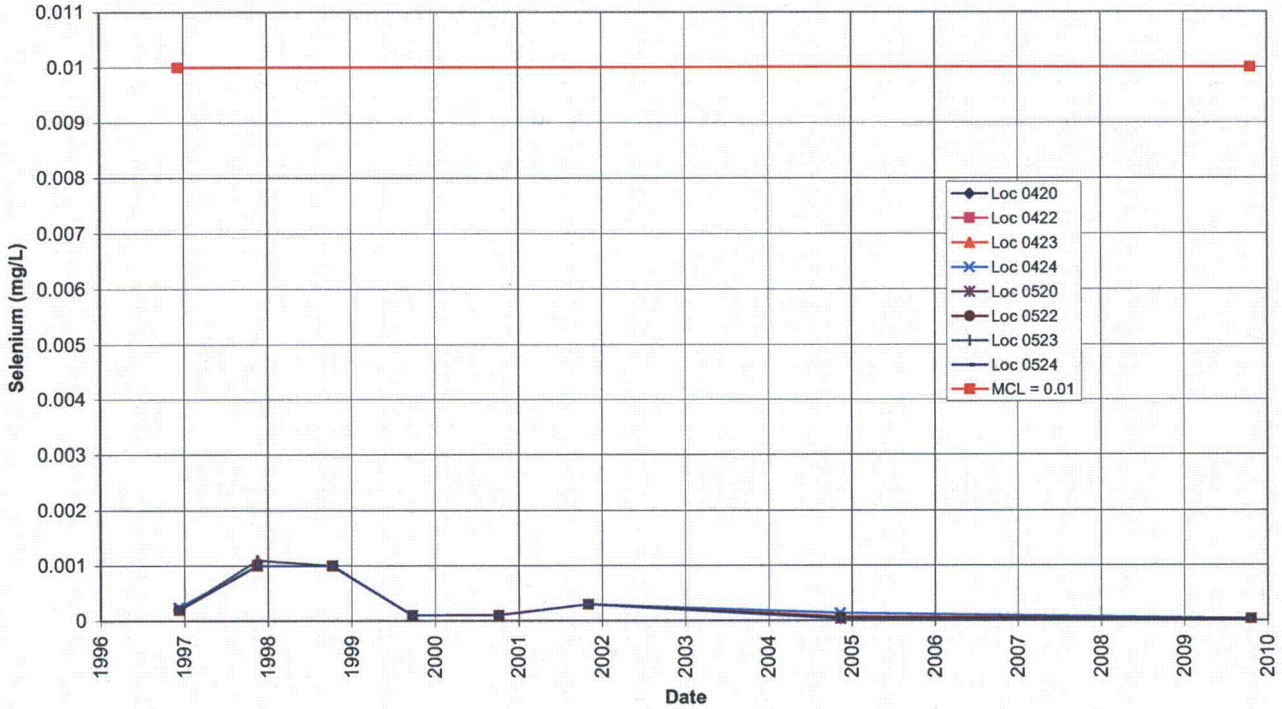

Figure 2–4. Time-Concentration Plot of Selenium in Groundwater at the Burrell Disposal Site

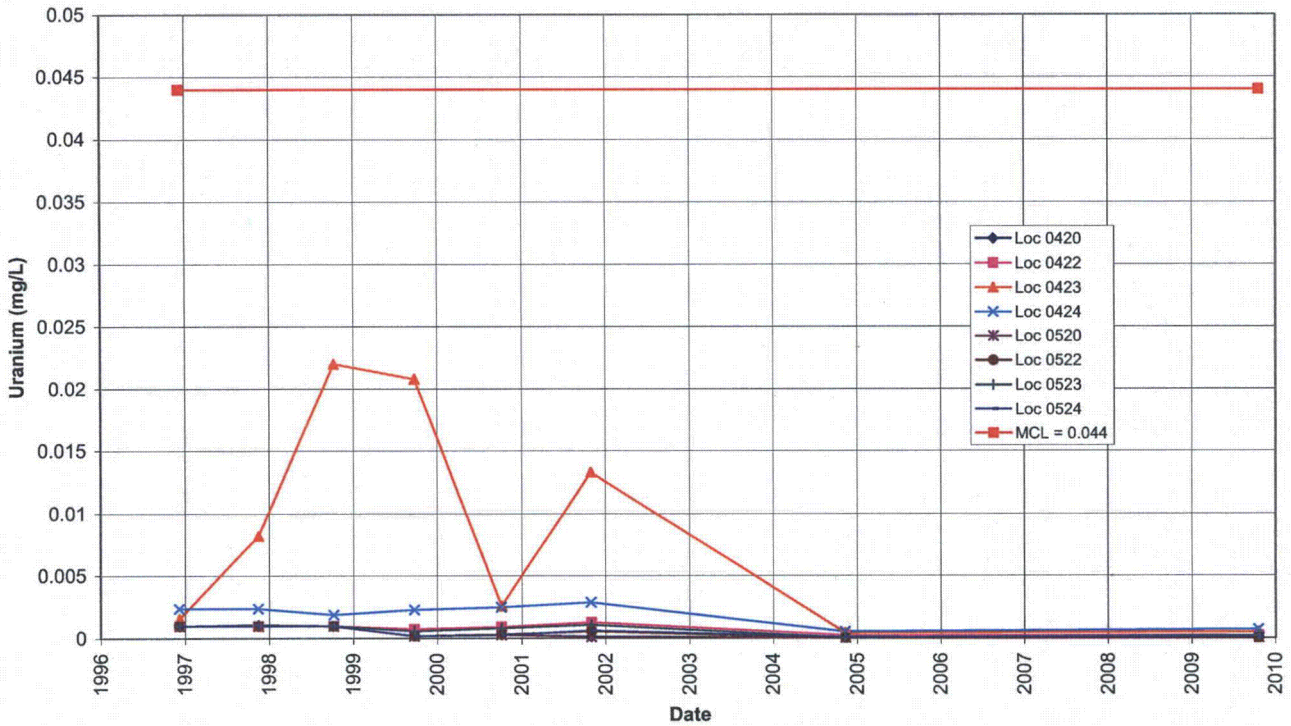

Figure 2–5. Time-Concentration Plot of Uranium in Groundwater at the Burrell Disposal Site

Each pair of wells consists of a shallow well, completed in unconsolidated fill and alluvium (400-series wells); and a deeper well, completed in the shallow bedrock of the Casselman Formation (500-series wells). In addition to the wells, two seeps at the bottom of the south side slope of the disposal cell are also sampled if they yield sufficient water. Samples were not collected from the seeps in 2009 due to insufficient or absent flows.

Concentrations of lead in groundwater in both the shallow alluvial wells (400-series wells) and the deeper bedrock wells (500-series wells) remained well below the MCL. The 2009 results from all locations were more than an order of magnitude below the MCL (Figure 2–2).

Concentrations of molybdenum in groundwater in both the shallow alluvial wells (400-series wells) and the deeper bedrock wells (500-series wells) remained well below the MCL. The 2009 results from all locations (except downgradient wells MW–0422, MW–0423 and MW–0424) were more than an order of magnitude below and at or near the laboratory detection limit. Concentrations in wells MW–0422, MW–0423 and MW–0424 were well below the MCL (Figure 2–3).

Concentrations of selenium in groundwater in both the shallow alluvial wells (400-series wells) and the deeper bedrock wells (500-series wells) remained well below the MCL. The 2009 results from all locations were more than two orders of magnitude below the MCL and approached the laboratory detection limit (Figure 2–4).

Concentrations of uranium in groundwater in both the shallow alluvial wells (400-series wells) and the deeper bedrock wells (500-series wells) remain well below the MCL. The 2009 results from all locations were two orders of magnitude or more below the MCL and approached the laboratory detection limit (Figure 2–5).

Given (1) that the monitoring network is satisfactory for its intended purpose, (2) that the concentration of the four target analytes remain well below the MCL and in most cases at or near the laboratory detection limit, and (3) that groundwater downgradient from the disposal cell is not significantly degraded relative to upgradient or background groundwater, DOE concludes that the disposal cell effectively isolates the contaminated waste from the groundwater environment. As stated in the revised LTSP, DOE has committed to monitor the groundwater on an every-fifth-year basis. After every such monitoring, DOE will review the data for trends or significant changes. DOE also will, from time to time and with NRC concurrence, review the need to continue monitoring and may determine to discontinue monitoring or alter the monitoring frequency.

2.3.5 Corrective Action

Corrective action is taken to correct out-of-compliance or hazardous conditions that create a potential health and safety problem or that may affect the integrity of the disposal cell or compliance with 40 CFR 192.

No corrective action was required in 2010.

2.3.6 Photographs

Table 2–3. Photographs Taken at the Burrell Disposal Site

Photograph Location Number	Azimuth	Description
PL–1	360	Bent rail on top of south perimeter fence.
PL–2	290	View down the inside of the north perimeter fence.
PL–3	180	North side of the disposal cell.
PL–4	280	Japanese knotweed control on south side of the disposal cell.
PL–5	190	Looking south toward seeded slope.

BUR 10/2010. PL–1. Bent rail on top of south perimeter fence.

BUR 10/2010. PL–2. View down the inside of the north perimeter fence.

BUR 10/2010. PL–3. North side of the disposal cell.

BUR 10/2010. PL–4. Japanese knotweed control on south side of the disposal cell.

BUR 10/2010. PL–5. Looking south toward seeded slope.

3.0 Canonsburg, Pennsylvania, Disposal Site

3.1 Compliance Summary

The Canonsburg, Pennsylvania, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on October 20, 2010. The disposal cell and all associated surface water diversion and drainage structures were in excellent condition and functioning as designed. No other maintenance needs or cause for a follow-up or contingency inspection was identified.

Vegetation management continues (including lessons-learned and in-the-field discussion with vegetation management personnel) and vegetation cover at the site is responding with continuous improvement. The combination of spraying and mowing that is conducted at the site has greatly reduced the extent of noxious/invasive weeds.

During 2010, access to an unfenced portion of the site, north of the disposal cell, was improved by the installation of a small footbridge across a riprap-lined diversion ditch. Trees that were planted in 2009 in the same area as the footbridge and that did not survive were replaced with healthy trees in 2010.

DOE conducts groundwater monitoring at Canonsburg annually. October 2009 monitoring results were not available in time to be included in the 2009 compliance report, and they are provided in this report. Results from 2009 monitoring demonstrated continued compliance with established site standards. October 2010 monitoring results are not available for this report and will be provided in the compliance report for 2011. In accordance with the long-term surveillance plan (LTSP), after 2010 the need for continued monitoring will be reevaluated. This evaluation will be made once 2010 monitoring results are available. Any changes made to the monitoring will be done in consultation with the Commonwealth of Pennsylvania and with concurrence of the U.S. Nuclear Regulatory Commission (NRC).

3.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the Canonsburg Disposal Site are specified in the *Long-Term Surveillance Plan for the U.S. Department of Energy Canonsburg Uranium Mill Tailings Disposal Site, Canonsburg, Pennsylvania* (LMS/CAN/S00404-0.0, U.S. Department of Energy [DOE], revised September 22, 2008) and in procedures established by DOE to comply with the requirements of Title 10 *Code of Federal Regulations* Part 40.27 (10 CFR 40.27). Table 3–1 lists these requirements.

Table 3–1. License Requirements for the Canonsburg Disposal Site

Requirement	Long-Term Surveillance Plan	This Report
Annual Inspection and Report	Section 3.3	Section 3.3.1
Follow-Up or Contingency Inspections	Section 3.4	Section 3.3.2
Routine Maintenance and Repairs	Section 3.5	Section 3.3.3
Groundwater and Surface Water Monitoring	Section 3.7	Section 3.3.4
Corrective Action	Section 3.6	Section 3.3.5

Institutional Controls—Institutional controls at the disposal site, as defined by DOE Policy 454.1, consist of federal ownership of the property, a site security fence, warning/no-trespassing signs on the security fence, and a locked gate at the entrance to the site. Verification of these institutional controls is part of the annual inspection.

The 34.2-acre disposal site is owned by the United States of America and was accepted under the NRC general license (10 CFR 40.27) in 1996. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, is responsible for the custody and long-term care of the site.

Institutional controls also apply to Area C and former Tract 117, which are southeast of Strabane Avenue. Area C (3.1 acres) was sold and transferred in 2006, and former Tract 117 (0.431 acre) was sold and transferred in 2009, and the same private party purchased both. DOE and the Commonwealth complied with restrictions on parcel transfers stipulated in UMTRCA and the Cooperative Agreement between DOE and the Commonwealth. The deed for Area C and former Tract 117 establishes restrictions to limit excavation in the areas, prohibits the disturbance of the stream bank, maintains access for monitoring, and prevents the areas from being used for residential purposes.

Inspectors found no evidence that these institutional controls were ineffective or violated.

3.3 Compliance Review

3.3.1 Annual Inspection and Report

The site, between the communities of Canonsburg and Houston, Pennsylvania, was inspected on October 20, 2010. Figure 3–1 shows features and photograph locations (PLs) mentioned in this report. 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, Fence, and Signs—Access to the site is directly from Strabane Avenue, a public right-of-way within the Borough of Canonsburg in Washington County, Pennsylvania. The security fence and all four site gates were in excellent condition. A vegetation-free buffer zone is being maintained around the entire site security fence. The entrance sign and 11 perimeter signs were in good condition.

A small footbridge was installed north of the disposal cell in 2010, improving access to an unfenced portion of the site (PL–1). The footbridge provides a safer way for the public to cross a riprap-lined diversion ditch (PL–2). The footbridge was in excellent condition.

Site Markers and Monuments—The site contains two site markers, eight erosion control markers, three survey monuments, and four boundary monuments.

Both site markers are in excellent condition. Four pairs of erosion control markers were initially installed along the bank of Chartiers Creek. Three pairs are in excellent condition, and the fourth pair requires a replacement. Erosion control marker EC–4A was lost to erosion in 1997. Now

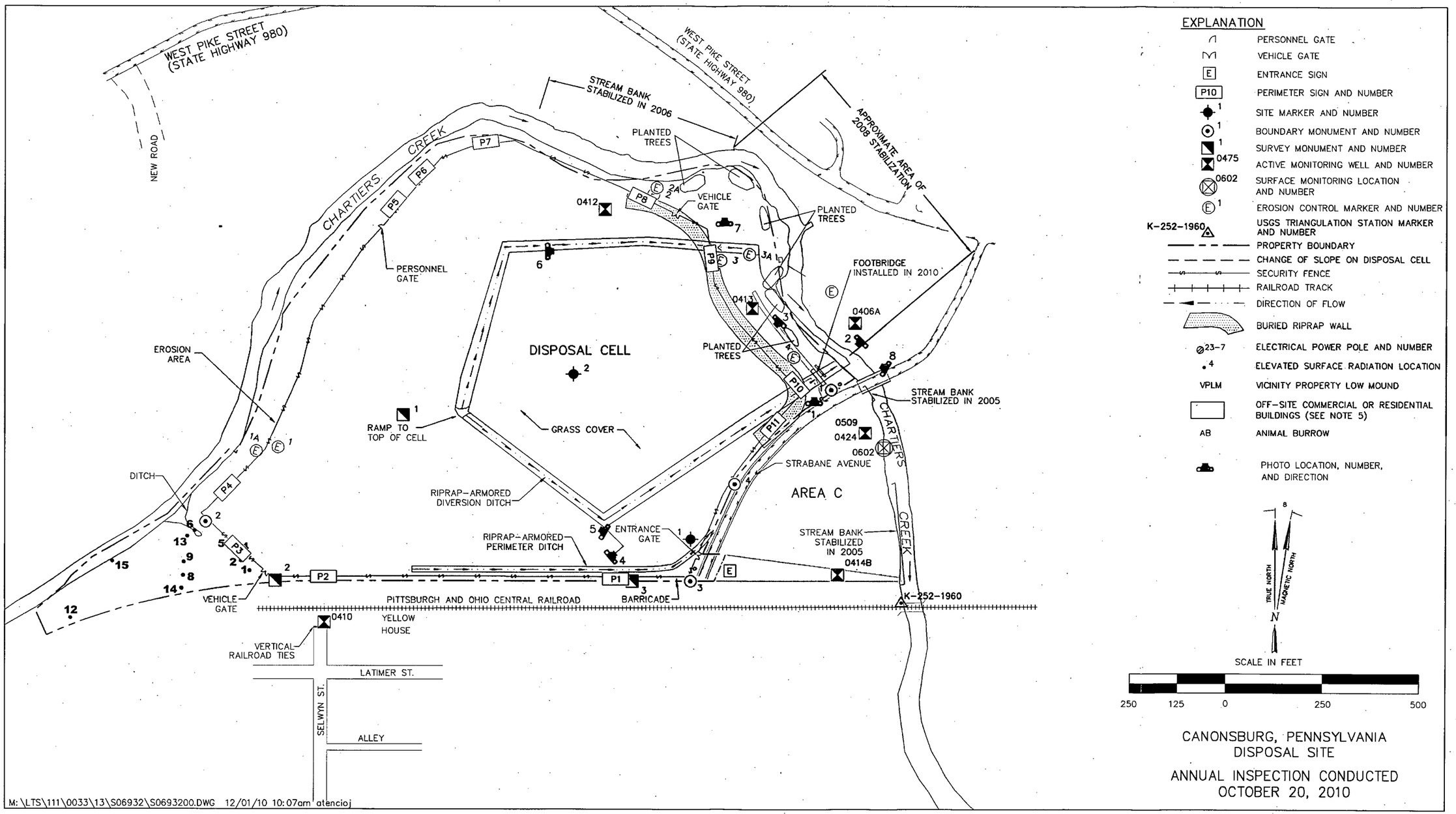

Figure 3–1. 2010 Annual Compliance Drawing for the Canonsburg Disposal Site

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3A that Stream Bank Stabilization in the area is complete, the marker will be replaced. This work will be coordinated with similar work at the Burrell, Pennsylvania, Disposal Site to improve efficiency and reduce costs.

The three survey monuments and four boundary monuments were located and were in excellent condition.

Monitoring Wells—The Canonsburg monitoring well network consists of five wells (MW–0406A, MW–0412, MW–0413, MW–0414B, and MW–0424). The wells are inspected when they are sampled. A few minor maintenance needs were identified this year (e.g., leaning/lose protective bollards, lack of protective bollards, lack of drain holes in the outer protective casing). These minor monitoring well-maintenance needs will be addressed in an upcoming groundwater monitoring evaluation scheduled for 2011. Wells identified in the evaluation as no longer being needed for monitoring purposes at the site will be recommended for plugging and abandonment rather than repaired.

3.3.1.2 Transects

To ensure a thorough and efficient inspection, inspectors divided the site into five areas called "transects": (1) the disposal cell, (2) the diversion channels and perimeter ditch, (3) the other areas on site, (4) the site perimeter, and (5) the outlying area.

The area inside each transect is inspected by walking a series of traverses. Within each transect, the inspectors examine specific site-surveillance features, drainage structures, and vegetation. Inspectors also look for evidence of settlement, erosion, or other modifying processes that might affect the site's integrity or long-term performance.

Disposal Cell—The grass-covered disposal cell surface was in excellent condition (PL–3). There
3B was no evidence of slumping, settling, erosion, or other modifying processes. The grass is mowed and mulched in accordance with the LTSP. DOE continued to successfully control noxious and invasive weeds through a combination of mowing and spot-spraying.

Animal burrows continue to be observed on the cell cover. Because a 36-inch-thick clay layer (radon barrier), an 18-inch-thick rock layer, and a 12-inch-thick topsoil layer overlie the buried
3C tailings at this site, biointrusion into the tailings is unlikely, and such burrows should not pose a risk to the disposal cell's integrity or the public's health. The location, level of activity, and significance of burrows on the cell cover will continue to be monitored.

Diversion Channels and Perimeter Ditch—Diversion channels around the disposal cell, and the perimeter ditch along the south side of the site, are armored with riprap and were in good condition (PL–4, PL–5, and PL–6). No indications of diminished rock durability were noted. Woody vegetation in the diversion ditches continues to be controlled by cutting and spraying.

Other Areas on Site—Thick grass covers the area surrounding the disposal cell. The grass extends beyond the security fence to the north and east as far as the bank of Chartiers Creek. The grass inside the site boundary was in excellent condition. It is mowed and mulched in accordance with the LTSP. Vegetation management continues to be dramatically improved. The
3D combination of spraying and mowing has greatly reduced the extent of noxious and invasive weeds on site. Lessons-learned opportunities in vegetation management are resulting in

continuous improvements to the herbaceous cover at the site. In-the-field discussions with vegetation management personnel during the inspections continue to improve the efficiency and effectiveness of vegetation management activities (PL–7).

Site Perimeter—Chartiers Creek is an active, meandering waterway that abuts the east, north, and west portions of the site. As a result of flooding in past years, particularly in 2004, the creek cut into the bank and required a series of stream bank stabilization efforts. Both the Borough of Canonsburg and DOE funded the work. NRC representatives evaluated the plans and concurred in the work.

In 2001, the Chartiers Creek bank along Area C was reconstructed to stop slumping. In 2004, inspectors found that floodwater eroded the stream bank. Approximately 100 feet of reconstructed stream bank was damaged downstream from the Strabane Avenue Bridge, and 200 feet was damaged upstream from the railroad bridge. Floodwater cut laterally into the bank and scoured behind the riprap and fabric in places. DOE notified NRC, performed a follow-up inspection of the damage, and developed recommendations for creek bank repair along Area C. NRC concurred in the recommendations, and in April 2005 repairs were made (scoured areas along Area C were filled with riprap to restore the creek bank profile). Shrub and forb seed was broadcast to further stabilize the bank with vegetation. In 2006, the area between perimeter signs P7 and P8 was stabilized, and in 2008, the area between perimeter sign P8 and Strabane Avenue Bridge was stabilized. The stabilization work consisted of cutting back the slope of the creek bank and armoring the toe with riprap keyed into bedrock. Geotextile fabric underlies the riprap. Above the riprap, stabilization matting and new plantings of live fascines protect the slope.

In 2009, reseeding and the planting of large (greater than 2-inch diameter saplings took place within the area that was regraded in 2008 as part of a Stream Bank Stabilization Project (PL–8). The trees were planted under a third-party Office of Legacy Management grant. Several of the trees planted in 2009 did not survive and were replaced with healthy trees in 2010.

Outlying Area—The predominant land use near the site is residential and commercial. The area outward, for a distance of approximately 0.25 mile, was visually inspected for development or changes in land use that might affect the safety or security of the site. No new development or changes in land use were observed. Former Tract 117, southeast of Strabane Avenue, was sold and transferred in 2009.

In 2007, DOE conducted a radiological survey on a small portion of the site property that lies outside the perimeter fence southwest of the disposal cell. The survey was conducted to evaluate the potential for releasing this portion of the site for industrial reuse. The survey identified isolated radium-226 contamination in soil that exceeded UMTRCA standards for unrestricted use. DOE retains this portion of the site. Under the current property use, the radiological conditions do not pose unacceptable risk to personnel, and no corrective measures are required. DOE has added monitoring for disturbance of this area to inspection procedures.

3.3.2 Follow-Up or Contingency Inspections

DOE will conduct follow-up inspections if (1) an annual inspection or other site visit reveals a condition that must be reevaluated during a return to the site, or (2) a citizen or outside agency notifies DOE that conditions at the site are substantially changed.

No follow-up or contingency inspections were required in 2010.

3.3.3 Routine Maintenance and Repairs

In 2010, DOE controlled woody growth within the diversion channels, mowed grass on and adjacent to the disposal cell, cleared vegetation from the perimeter fence, sprayed noxious and invasive weeds, and reseeded and planted trees along the stream bank.

3.3.4 Groundwater and Surface Water Monitoring

3E DOE monitors groundwater and surface water at the Canonsburg site to comply with the requirements in the revised LTSP. The revised LTSP combines the objectives of both the original LTSP (issued in 1995) and the *Ground Water Compliance Action Plan and Application for Alternative Concentration Limits for the Canonsburg, Pennsylvania, UMTRA Project Site* (U0035901, DOE, February 2000). Monitoring prescribed in the original LTSP was a best management practice because NRC determined that cell performance monitoring to ensure compliance with remedial actions discussed under Subpart A of 40 CFR 192 was not required since the disposal cell's design was adequate to provide long-term protection of human health and the environment. The groundwater compliance action plan (GCAP) required monitoring for a period of no less than 5 years (through 2004) and up to 30 years (through 2029, which is the estimated time for any contamination to naturally attenuate). This monitoring period was established to ensure compliance with Subpart B of 40 CFR 192, which applies to contamination related to legacy uranium-processing sites. The Subpart B protection strategy is no remediation in conjunction with the application of an alternate concentration limit (ACL) for uranium.

The objectives of groundwater monitoring under the revised LTSP are to (1) evaluate downgradient contaminant trends in groundwater in the shallow unconsolidated materials and in surface water, (2) demonstrate that concentrations of uranium at point-of-compliance (POC) locations are decreasing as predicted and that the system remains in compliance with the GCAP, and (3) ensure that remedial actions at the disposal site and Area C continue to protect human health, safety, and the environment. The ACL for uranium is 1.0 milligram per liter (mg/L) at POC wells (MW–0412, MW–0413, and MW–0414B). The U.S. Environmental Protection Agency maximum concentration limit (MCL) for uranium is 0.044 mg/L (40 CFR 192, Subpart A, Table 1). The uranium limit established for the point of exposure in Chartiers Creek is 0.01 mg/L (location SW–0602).

The monitoring network consists of five wells (MW–0406a, MW–0412, MW–0413, MW–0414B, and MW–0424) completed in the uppermost aquifer (shallow unconsolidated materials), and one surface water location in Chartiers Creek (SW–0602). Routine field measurements are collected, water levels measured, and uranium concentrations determined. Monitoring was performed annually through 2010. After 2010, the need for annual monitoring will be reevaluated. Any changes made to the monitoring will be done in consultation with the Commonwealth and with NRC concurrence.

DOE conducted groundwater monitoring in October 2009 and results were not available in time to be included in the 2009 compliance report. Therefore, the results from 2009 are presented in this report. DOE also conducted groundwater monitoring in October 2010. Results from October 2010 are not available for this report, and they will be provided in the 2011 compliance report and in the upcoming groundwater monitoring evaluation discussed above.

Monitoring Results—Analytical results for groundwater and surface water monitoring are presented below. Time-concentration plots for uranium, from 1995 through 2009, are shown in Figure 3–2 for groundwater and in Figure 3–3 for surface water. The results of the 2009 monitoring demonstrate continued compliance with established site standards.

Groundwater—Uranium concentrations in 2009 were considerably below the established ACL (Figure 3–2). With the exception of monitoring well MW–0412 and monitoring well MW–0413, uranium concentrations in 2009 were also below the MCL.

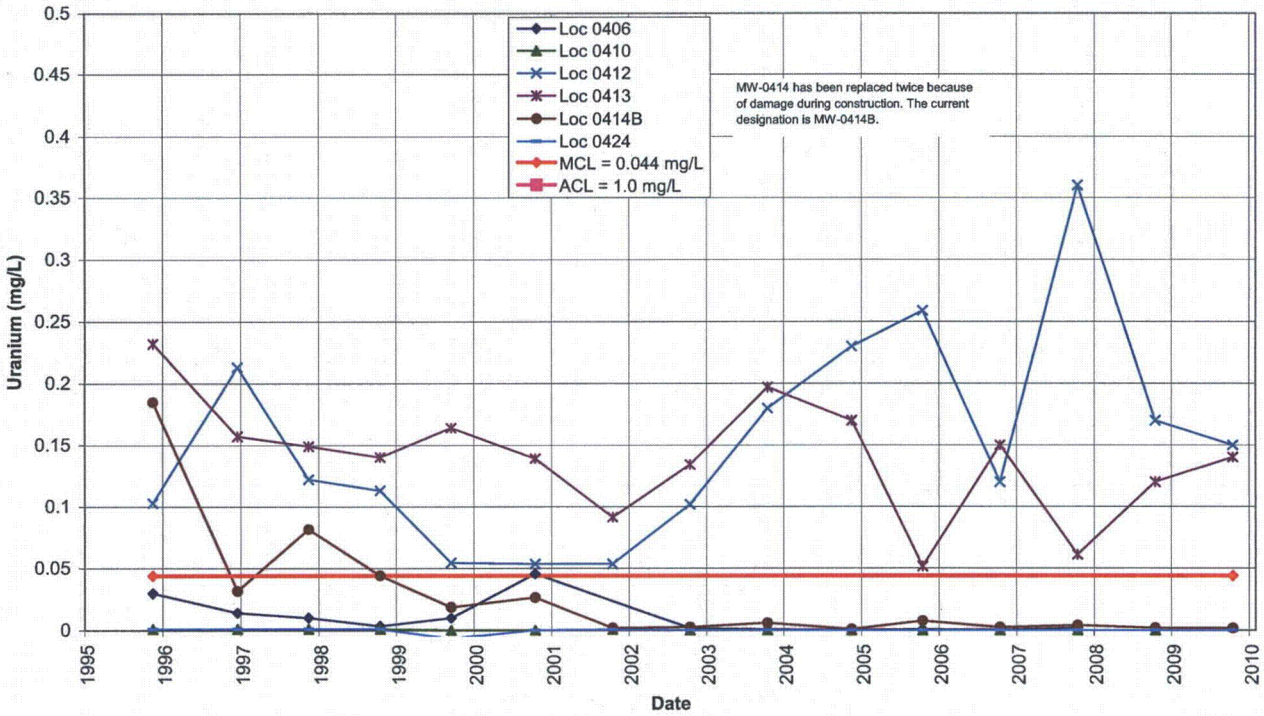

Figure 3–2. Time-Concentration Plot of Uranium in Groundwater at the Canonsburg Disposal Site

Surface Water—Only one surface water location (SW–0602) is sampled under the revised LTSP. The uranium concentration of surface water at location SW–0602 in 2009 remained below the target concentration of 0.01 mg/L (Figure 3–3).

DOE continues to consider the risk associated with uranium in groundwater within the unconsolidated materials and shallow bedrock (defined as the uppermost aquifer for regulatory purposes) beneath the site to be negligible because neither is considered a viable aquifer from a water resource perspective, even though the zone is capable of discharging to surface water (Appendix A to 10 CFR Part 40). Because the materials are not ideal for aquifer formation and because the source of recharge to the shallow units is minimal, sustained yield to a well from these units would be limited. The shallow groundwater is not used as a drinking water source in the area, although some domestic water is derived from a few private wells that extend deeper than 100 feet.

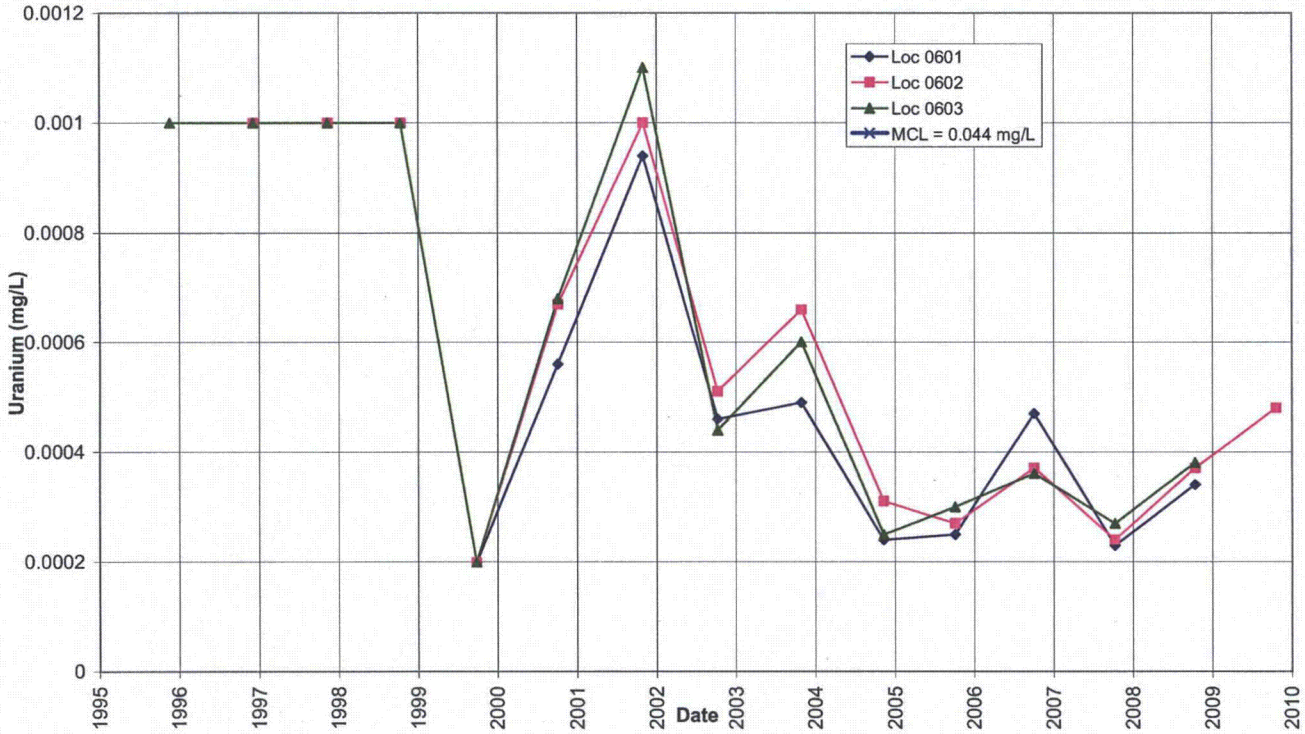

Figure 3–3. Time-Concentration Plot of Uranium in Surface Water at the Canonsburg Disposal Site

Institutional controls, in the form of government ownership of the site, prevent access to the groundwater directly beneath the site. NRC concurred in deleting groundwater use restrictions for Area C in 2003. Most of the residents in the area are connected to a municipal water system, which is supplied by surface water reservoirs upgradient from the site. Chartiers Creek, the discharge point for the shallow groundwater beneath the site, is not a source of potable water. Additionally, uranium concentrations reported from samples collected from the creek are near the detection limit. Therefore, site-related concentrations do no pose an unacceptable risk to human health and the environment.

3.3.5 Corrective Action

Corrective action is taken to correct out-of-compliance or hazardous conditions that create a potential health and safety problem or that may affect the integrity of the disposal cell or compliance with 40 CFR 192.

No corrective action was required in 2010.

3.3.6 Photographs

Table 3–2. Photographs Taken at the Canonsburg Disposal Site

Photograph Location Number	Azimuth	Photograph Description
PL–1	360	Newly installed footbridge across a riprap armored diversion ditch.
PL–2	225	Footbridge across a riprap armored diversion ditch.
PL–3	225	North side slope of disposal cell.
PL–4	50	Riprap armored diversion ditch.
PL–5	300	Riprap armored diversion ditch.
PL–6	90	Looking down channel of a riprap armored diversion ditch.
PL–7	NA	In-the-field lessons-learned session.
PL–8	300	Riprap armored stream bank along floodplain area.

CAN 10/2010. PL–1. Newly installed footbridge across a riprap armored diversion ditch.

CAN 10/2010. PL–2. Footbridge across a riprap armored diversion ditch.

CAN 10/2010. PL–3. North side slope of disposal cell.

CAN 10/2010. PL–4. Riprap armored diversion ditch.

CAN 10/2010. PL–5. Riprap armored diversion ditch.

CAN 10/2010. PL–6. Looking down channel of a riprap armored diversion ditch.

CAN 10/2010. PL–7. In-the-field lessons-learned session.

CAN 10/2010. PL–8. Riprap armored stream bank along floodplain area.

4.0 Durango, Colorado, Disposal Site

4.1 Compliance Summary

The Durango, Colorado, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on June 15, 2010. The disposal cell and all associated surface water diversion and drainage structures were in good condition and functioning as designed. The water level in the disposal cell has dropped, which satisfies criteria for the permanent closure of the transient drainage water collection and treatment system. Vandalism, primarily theft and damage to signs, continues at the site. The bases of perimeter signs P41 and P44 have been undercut by erosion but remain stable. Infestations of noxious weeds and deep-rooted plants on the disposal cell continue to be monitored and controlled with herbicide. No other maintenance needs or cause for a follow-up or contingency inspection was identified.

4.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the Durango Disposal Site are specified in the *Long-Term Surveillance Plan* [LTSP] *for the Bodo Canyon Disposal Site, Durango, Colorado* (DOE/AL/62350–77, Rev. 2, DOE, September 1996) and in procedures established by DOE to comply with the requirements of Title 10 *Code of Federal Regulations* Part 40.27 (10 CFR 40.27). Table 4–1 lists these requirements. A revised LTSP was prepared in May 2010 and has been submitted to NRC and CDPHE for concurrence.

Table 4–1. License Requirements for the Durango Disposal Site

Requirement	Long-Term Surveillance Plan	This Report
Annual Inspection and Report	Section 6.0	Section 4.3.1
Follow-Up or Contingency Inspections	Section 7.0	Section 4.3.2
Routine Maintenance and Repairs	Section 8.0	Section 4.3.3
Groundwater Monitoring	Section 5.0	Section 4.3.4
Corrective Action	Section 5.0	Section 4.3.5

Institutional Controls—Institutional controls at the disposal site, as defined by DOE Policy 454.1, consist of federal ownership of the property, warning/no-trespassing signs (entrance and perimeter signs) along the property boundary, and a locked gate at the entrance to the site. The 121-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 40.27) in 1996. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, is responsible for the custody and long-term care of the site.

Inspectors found no evidence that these institutional controls were ineffective or violated.

4.3 Compliance Review

4.3.1 Annual Inspection and Report

The site, southwest of Durango, Colorado, was inspected on June 15, 2010. The results of the inspection are described below. Figure 4–1 shows features and photograph locations (PLs) discussed in this report. 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 Road, Entrance Gates, Entrance Sign, and Perimeter Signs—Access to the site is by La Plata County Road 212, which is a dedicated public right-of-way that crosses the southwest corner of the DOE property. The entrance gate and guardrails along the county road, and the original entrance gate closer to the cell, were in good condition.

Perimeter sign P1 was replaced in 2009. Numerous other perimeter signs have bullet holes but remain legible. Perimeter sign P2 has been stolen many times, but because adjacent signs are within sight, it is no longer being replaced. The 81 remaining perimeter signs delineate the site sufficiently. The bases of perimeter signs P41 (PL–1) and P44 are being undercut by erosion but currently remain stable.

Trespassing and vandalism have been difficult to control at the site. Although DOE has implemented various engineered, institutional, and administrative controls at the site, including increased patrols by County sheriff officers, vandalism continues to be an ongoing concern and maintenance issue. Impacts of the construction of the Animas–La Plata Project nearby and increased recreational use in the area will continue to be monitored.

Site Markers and Monuments—All site markers, survey monuments, and boundary monuments were in excellent condition except for site marker SMK–1 and boundary monuments BM–3, BM–4, and BM–6. Site marker SMK–1, near the entrance gate, is superficially pocked from gunfire but remains legible. Boundary monument BM–3 and two of its reference monuments are in a small gully and are threatened by erosion; however, the monuments are currently stable. Several years ago, one of the reference monuments for boundary monument BM–4 was bent to the ground, and the cap was removed, but BM–4 itself is intact. Before the 2004 inspection, boundary monument BM–6 was destroyed when a pipeline was constructed near the site. A decision was made not to replace it because both of its witness corners remained in good condition.

Monitoring wells and Other Wells—Monitoring wells were locked and in good condition. The cap on one of the disposal cell's transient drainage collection system vent wells, PVC–1, is cracked but remains functional.

4.3.1.2 Transects

To ensure a thorough and efficient inspection, inspectors divided the site into six areas called "transects": (1) the top of the disposal cell, (2) the side slopes of the disposal cell, (3) the drainage ditches, (4) the treatment cells and holding pond, (5) the site boundary, and (6) the outlying area.

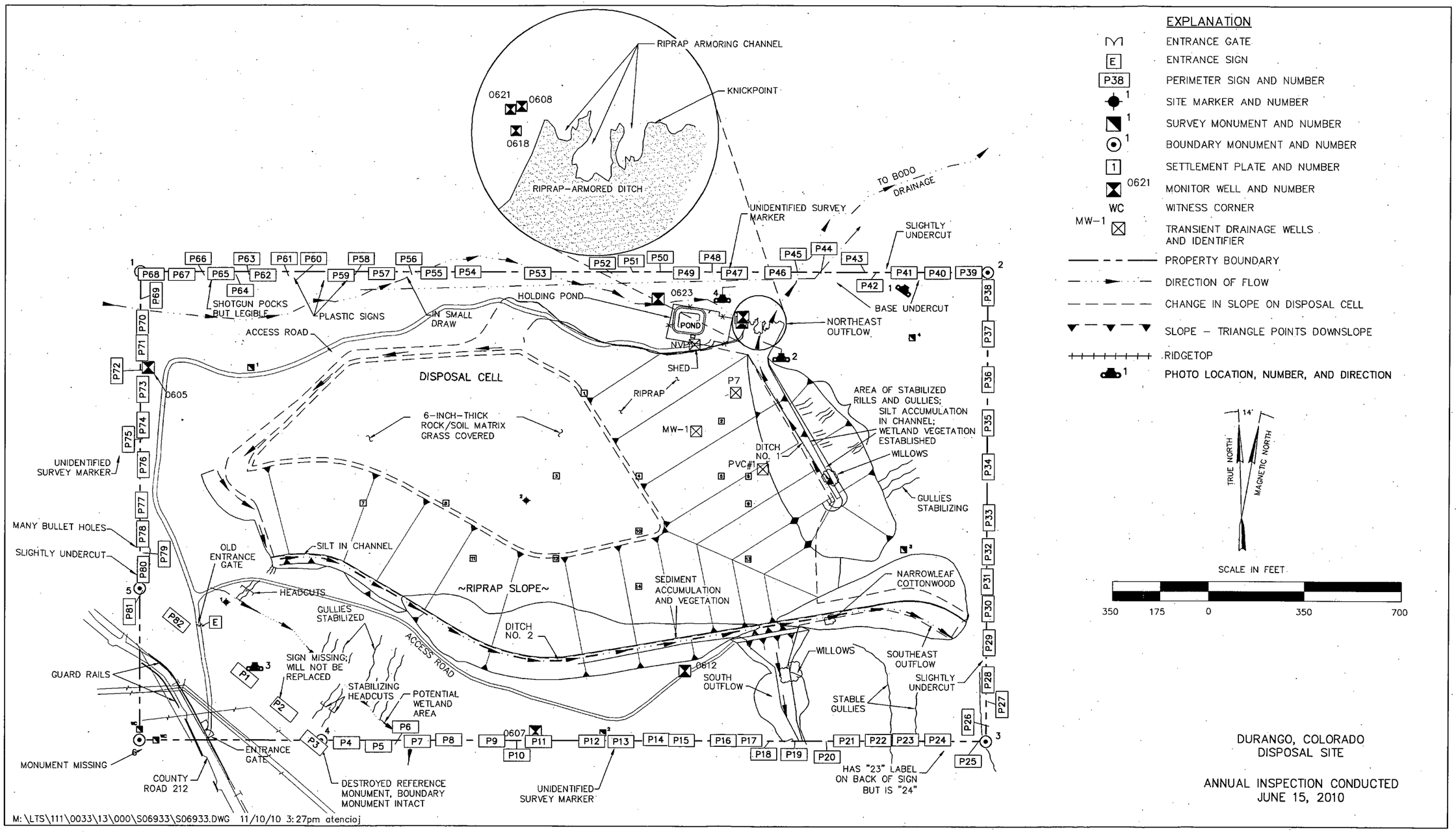

Figure 4–1. 2010 Annual Compliance Drawing for the Durango Disposal Site

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The area inside each transect was inspected by walking a series of traverses. Within each transect, the inspectors examined specific site-surveillance features, drainage structures, and vegetation, along with other features. Inspectors also looked for evidence of settlement, erosion, or other modifying processes.

Top of the Disposal Cell—The top of the disposal cell was vegetated and in excellent condition. No evidence of settling, slumping, or erosion was observed.

Vegetation on the rock/soil matrix cover remains healthy. Plant cover consists primarily of seeded grass species and several "volunteer" species, including deep-rooted woody shrubs (e.g., dryland alfalfa).

In accordance with the LTSP, deep-rooted woody plants must be removed from the disposal cell when the plant's shoot height equals or exceeds 3.5 feet (1.1 meters) from the base; this height criterion is based on an assumed root-to-shoot ratio of 1 to 1. Although the aboveground height of the dryland alfalfa growing on the cell top will never exceed the 3.5-foot criterion listed in the LTSP for woody species, it is known to be a deep-rooted plant. This species is now being controlled with herbicide on the disposal cell cover.

Side Slopes of the Disposal Cell—The riprap-covered side slopes of the disposal cell were in good condition. There was no evidence of subsidence, rock deterioration, or slope failure.

Deep-rooted woody shrubs and trees were treated with herbicide in 2006, and woody species observed on the cell in 2010 were all shorter than the 3.5-foot criterion. Two noxious weed species—musk thistle and Canada thistle—continue to populate the side slopes. A commercial applicator has treated these plants with herbicide since 2002, and the plants' populations have decreased significantly. They were most recently treated in September 2010.

Drainage Ditches—Rock-armored drainage ditches beneath the toe of the side slope on the northwest, south, and east sides of the disposal cell direct runoff into natural drainages that carry storm water away from the disposal site. Past erosion and sloughing in Ditch No. 1 have allowed wetland vegetation, including willows, to take root in areas where moist sediments have accumulated. In other places, trees as tall as 15 feet grow in the drainage ditches. The sediment deposits and vegetation currently will not compromise the drainage ditches' performance in a large storm. Should colluvial deposits or excessive vegetation dam a drainage ditch so as to impound water, the deposits or vegetation will be removed.

The riprap-covered outflow of Ditch No. 1 was designed to erode back to a rock-filled trench and self-armor in the process. No significant erosion has occurred in Ditch No. 1 since it was last surveyed in 1999 (PL–2).

Treatment Cells and Retention Pond—The retention pond northeast of the disposal cell collects pore water that drains from the wet tailings encapsulated within the disposal cell (i.e., transient drainage). A solar-powered water management system installed in 2007 distributes water collected in the retention pond through drip lines and onto the lined pond side slopes to enhance evaporation. A security fence surrounds the treatment cells and retention pond, and a shed contains instrumentation to measure the transient drainage flow from the collection gallery. Both the fence and the shed were secure and in good condition at the time of the inspection.

No discharge from the retention pond occurred during 2010. The Colorado Pollutant Discharge Elimination System (CPDES) permit for discharge from the pond was allowed to expire on January 31, 2009.

In June 2006, the criteria for the permanent closure of the toe drain and the water collection and treatment system, as described in the LTSP, were met.

Site Boundary—The site is not fenced. Missing and damaged perimeter signs indicate continued trespassing and vandalism. However, before the guardrail and gate along County Road 212 were installed in 2000, the public used the area between the county road and the original entrance gate quite heavily. Since the installation of the guardrail, use of this area has been minimal except for the destruction and theft of perimeter signs.

Historical rill and gully erosion has occurred at various locations on site, but most rills and gullies are stabilizing, and none are currently threatening the performance of the disposal cell or its associated surface water diversion structures. The establishment of vegetation and the exposure of resistant bedrock in the gullies are preventing further erosion in most of the gullies (PL–3). DOE will continue to monitor the site for active erosion.

Numerous areas along the site boundary are infested with State-listed noxious weeds (PL–4). These areas were treated with herbicide in September 2010.

Outlying Area—The area beyond the site boundary for a distance of 0.25 mile was visually inspected for signs of erosion, development, or other disturbances that might impact the integrity of the site. The land surrounding the site is primarily used for recreation and wildlife habitat. The U.S. Bureau of Reclamation continues to construct the Animas–La Plata Project, a surface water diversion system. The DOE disposal site is immediately adjacent to the northern Ridges Basin Reservoir area boundary. Recreational use of the outlying area is expected to increase substantially upon completion of the reservoir project. Currently, there is no concern regarding the outlying area.

4.3.2 Follow-Up or Contingency Inspections

DOE will conduct follow-up inspections if (1) an annual inspection or other site visit reveals a condition that must be reevaluated during a return to the site, or (2) a citizen or outside agency notifies DOE that conditions at the site are substantially changed.

No follow-up or contingency inspections were required in 2010.

4.3.3 Routine Maintenance and Repairs

In 2010, noxious weeds were treated with herbicide.

4.3.4 Groundwater Monitoring

4A In accordance with the LTSP, groundwater is monitored at the Durango Site to verify the initial performance of the disposal cell. The monitoring network consists of seven wells (Table 4–2 and Figure 4–1). Four wells are completed in the uppermost aquifer (bedrock of the Cliff House Sandstone and the Menefee Formation), including one upgradient background well (MW–0605)

and three downgradient point-of-compliance (POC) wells (MW–0607, MW–0612, and MW–0621). Three wells are completed in the alluvium, one upgradient (MW–0623) and one downgradient (MW–0608) of the disposal cell. The third alluvial well, monitoring well MW–0618 (screened to the bottom of the alluvial aquifer), was installed adjacent to well MW–0608 (screened to 10 feet above the base of the alluvial aquifer) and added to the monitoring network in 2002, as a best management practice, because it intercepts the full saturated zone of the alluvial aquifer.

Table 4–2. Groundwater Monitoring Network at the Durango Disposal Site

Monitoring well	Well Compliance Type	Hydrologic Relationship
MW–0605	Background	Upgradient (uppermost aquifer)
MW–0607	Point-of-Compliance	Downgradient (uppermost aquifer)
MW–0612	Point-of-Compliance	Downgradient (uppermost aquifer)
MW–0621	Point-of-Compliance	Downgradient (uppermost aquifer)
MW–0623	Background	Upgradient (alluvial aquifer)
MW–0608	Best Management Practice	Downgradient (alluvial aquifer)
MW–0618	Best Management Practice	Downgradient (alluvial aquifer)

Groundwater samples are collected annually and analyzed for three indicator parameters: molybdenum, selenium, and uranium. To monitor the increased uranium observed in well 0618, wells MW–0608, MW–0618, and MW–0621 have been increased to monthly sampling as weather permits. The site-specific standards used for the three indicator parameters are the respective maximum observed background concentrations reported in groundwater samples collected from wells completed in the bedrock aquifer as identified in Table 5–4 of the LTSP. These site-specific standards are provided below in Table 4–3. Time-concentration plots for uranium, selenium, and molybdenum monitoring results are included as Figures 4–2, 4–3, and 4–4, respectively.

Table 4–3. Site-Specific Groundwater Standards for the Durango Disposal Site Based on Background

Constituent	STD (mg/L)
Molybdenum	0.22
Selenium	0.042
Uranium	0.077

STD = standard
mg/L = milligrams per liter
Note: Site-specific groundwater standards represent the maximum observed background concentrations reported in samples collected from wells completed in the bedrock aquifer (LTSP, Table 5–4).

Uranium concentrations in monitoring well MW–0618 have decreased since 2009 and are back below the standard though there was an increase observed between the May and June sampling events; concentrations in well MW–0608 decreased and remained consistent between May and June events. Selenium concentrations decreased in both of these wells, and molybdenum remained steady. Analytical results from all other locations are on trend with previous results.

In 2009, the most significant groundwater monitoring result reported was the uranium concentration in well MW–0618. The uranium concentration of 0.11 milligram per liter reported in this well in November 2009 is consistent with the increasing trend that began in 2005, and exceeded site-specific standard of 0.077 mg/L. In fall 2009, well MW–0618 was redeveloped, and the purging method and pump materials were evaluated. The uranium levels have decreased back below the standard in 2010. All other concentrations of uranium, along with all concentrations of both selenium and molybdenum, remain on trend and well below their respective standards.

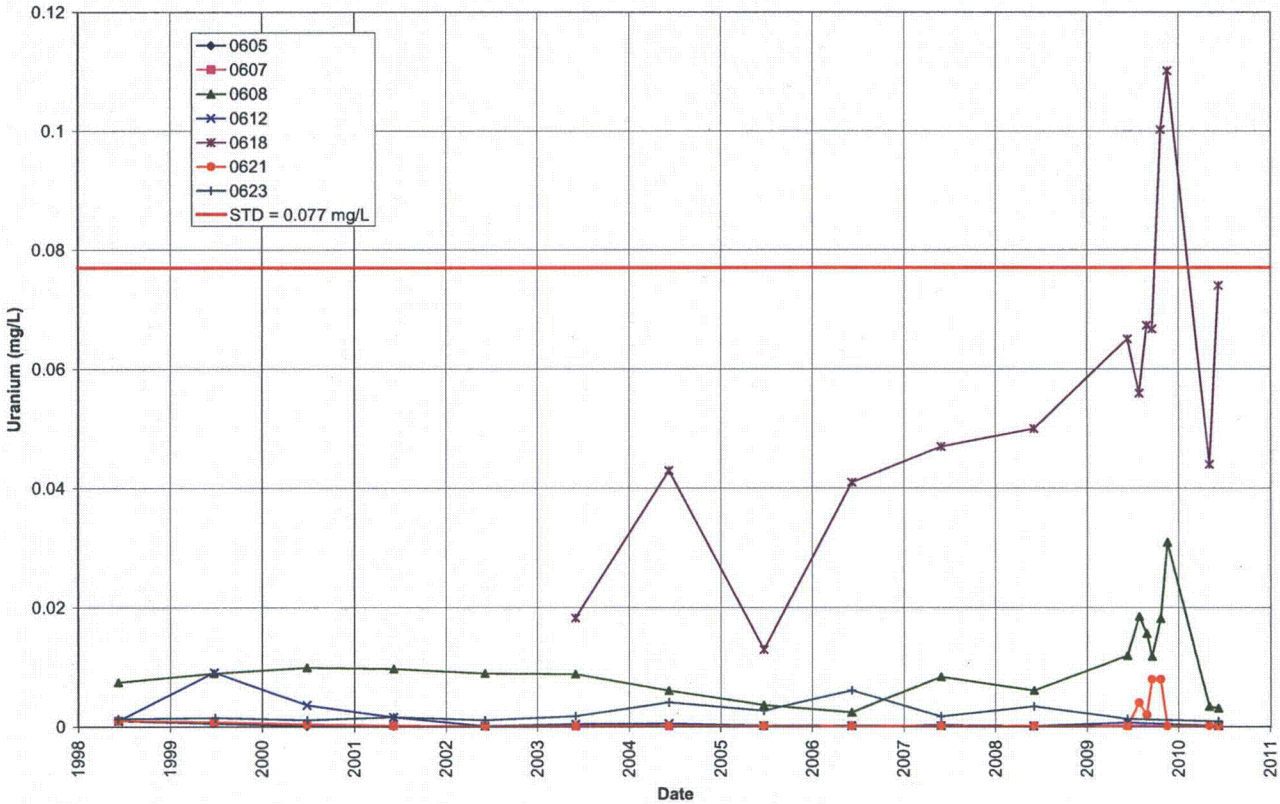


Figure 4–2. Time-Concentration Plot of Uranium in Groundwater at the Durango Disposal Site

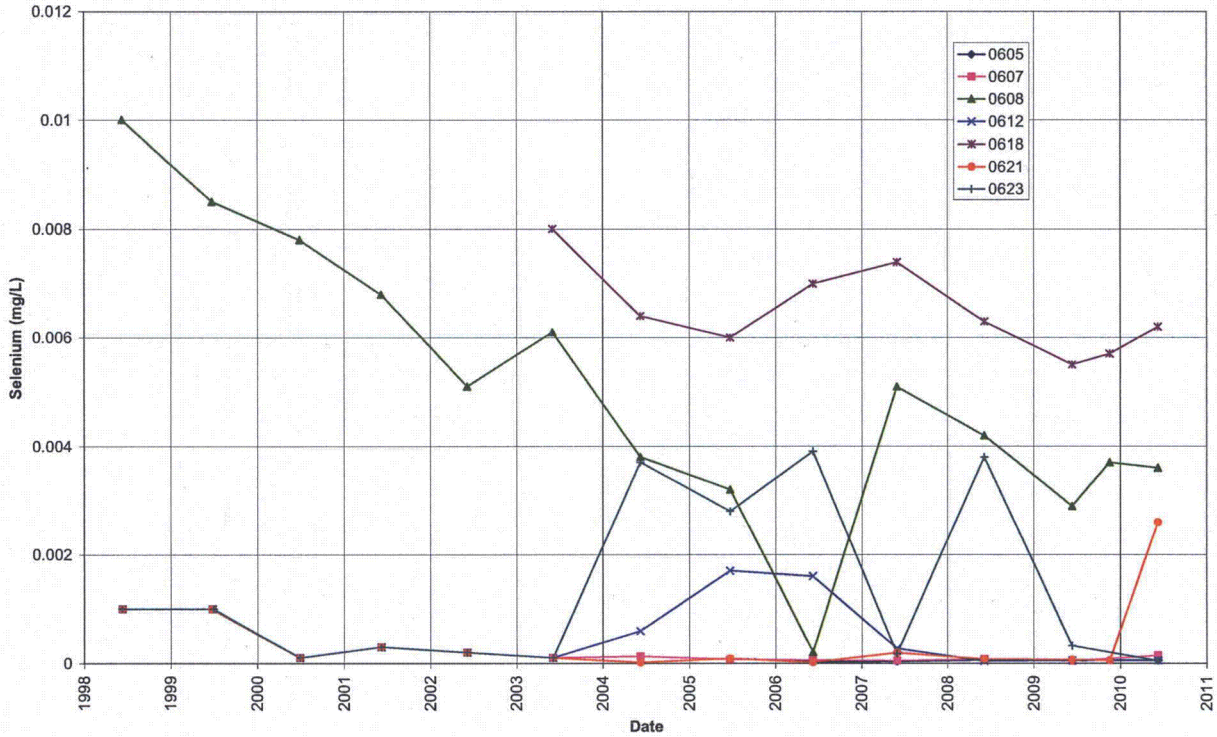


Figure 4–3. Time-Concentration Plot of Selenium in Groundwater at the Durango Disposal Site

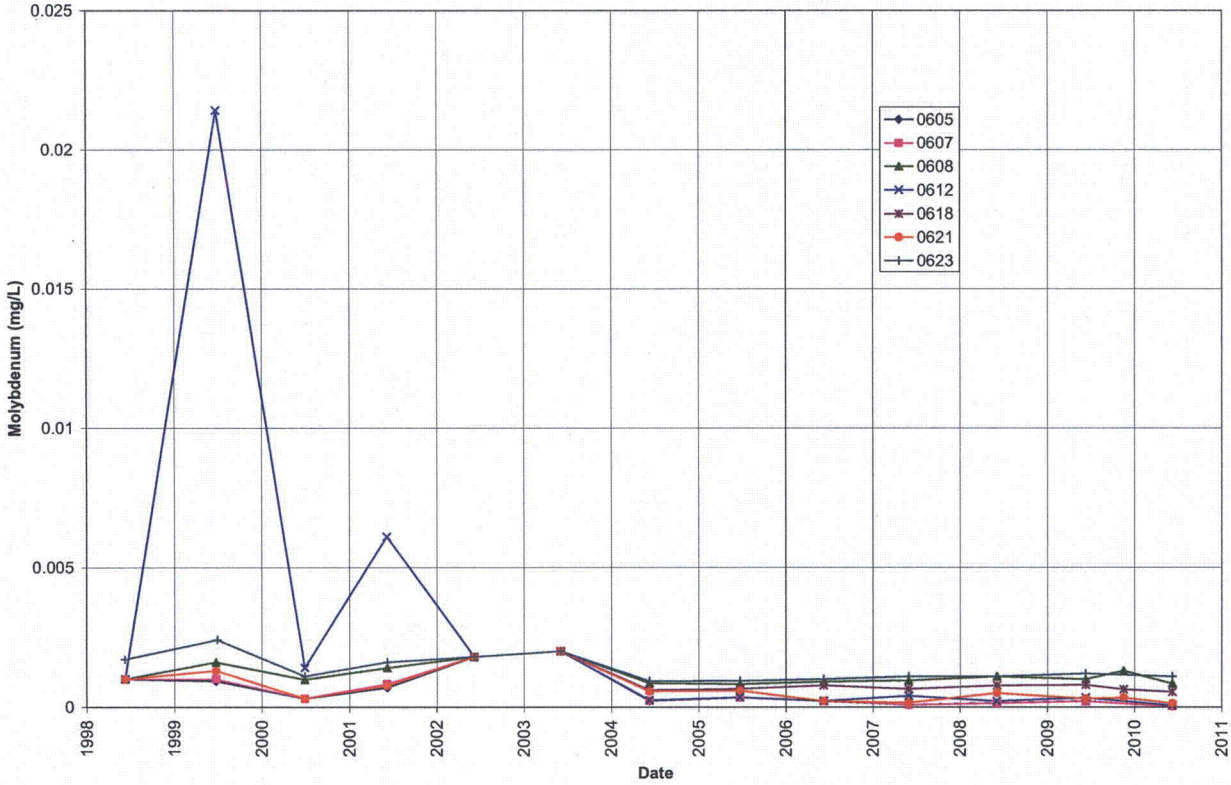


Figure 4–4. Time-Concentration Plot of Molybdenum in Groundwater at the Durango Disposal Site

4.3.5 Corrective Action

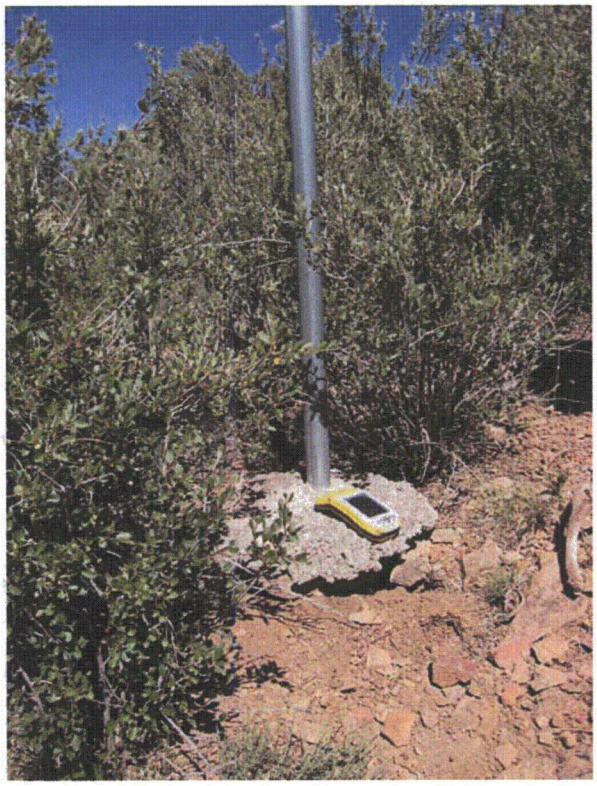
Corrective action is taken to correct out-of-compliance or hazardous conditions that create a potential health and safety problem or that may affect the integrity of the disposal cell or compliance with 40 CFR 192.

No corrective action was required in 2010.

4.3.6 Photographs

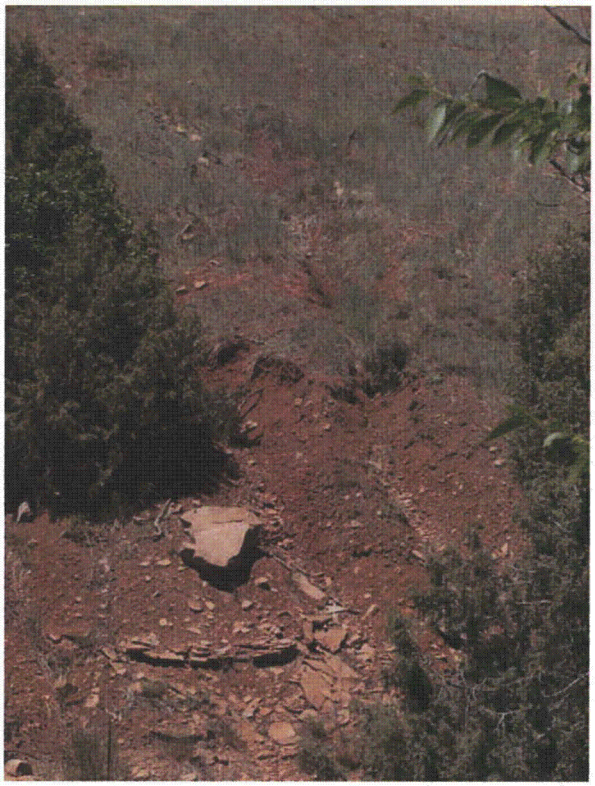
Table 4–4. Photographs Taken at the Durango Disposal Site

Photograph Location Number	Azimuth	Description
PL–1	35	Undercutting at perimeter sign P41.
PL–2	360	Northeast outflow; no new erosion.
PL–3	360	Headcuts of gullies below SW corner of disposal cell; no change from 2009.
PL–4	NA	Houndstongue, a noxious weed.



DUR 6/2010. PL–1. Undercutting at perimeter sign P41.

DUR 6/2010. PL–2. Northeast outflow; no new erosion



DUR 6/2010. PL–3. Headcuts of gullies below SW corner of disposal cell; no change from 2009

DUR 6/2010. PL–4. Houndstongue, a noxious weed.

5.0 Falls City, Texas, Disposal Site

5.1 Compliance Summary

The Falls City, Texas, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on January 13, 2010. The disposal cell and all associated surface water diversion and drainage structures were in excellent condition and functioning as designed.

Groundwater was sampled in April 2010 in accordance with the *Long-Term Surveillance Plan for the U.S. Department of Energy Falls City Uranium Mill Tailings Disposal Site, Falls City, Texas* (DOE–LM/1602–2008, U.S. Department of Energy [DOE], March 2008). Uranium concentrations at monitoring well MW–0891 (completed in the Dilworth aquifer) increased again in 2010 and are currently elevated when compared to the historical range for the well, but not for the historical range of the aquifer. The new maximum uranium concentration measured at monitoring well MW–0891 in 2010, 2.1 milligrams per liter (mg/L), is below the maximum concentration reported for the aquifer in the area of the site, which is also the value used in the risk assessment for the Dilworth aquifer (3.04 mg/L). Since the 2010 measured groundwater concentrations are within historical ranges for the aquifer, DOE concludes there is no indication that legacy groundwater contamination is degrading downgradient groundwater. Water levels measured in 2010 were consistent with past years.

Grass continues to be cut and baled on site, including on the disposal cell cover, resulting in a successful beneficial reuse of the site. Undesirable vegetation on the disposal cell and in the rock-lined drainage ditches continues to be controlled as well. In-the-field discussions with vegetation/site management personnel during the annual inspection continue to be utilized to improve the efficiency and effectiveness of site maintenance activities.

County Road 202, directly northwest of the site, was slated to be opened to the public in 2009. However, inspectors learned in 2010 that the road remains closed to the public because that earlier decision was reversed.

No other maintenance needs or cause for a follow-up or contingency inspection was identified.

5.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the Falls City Disposal Site are specified in the long-term surveillance plan (LTSP) and in procedures established by DOE to comply with the general license requirements at Title 10 *Code of Federal Regulations* Part 40.27 (10 CFR 40.27). Table 5–1 lists these requirements.

Table 5–1. License Requirements for the Falls City Disposal Site

Requirement	Long-Term Surveillance Plan	This Report
Annual Inspection and Report	Section 3.3	Section 5.3.1
Follow-Up or Contingency Inspections	Section 3.4	Section 5.3.2
Routine Maintenance and Repairs	Section 3.5	Section 5.3.3
Groundwater Monitoring	Section 3.7	Section 5.3.4
Corrective Action	Sections 3.6	Section 5.3.5

Institutional Controls—Institutional controls at the disposal site, as defined by DOE Order 454.1, consist of federal ownership of the property, a site perimeter fence, warning/no-trespassing signs along the property boundary, and locked gates in the perimeter fence.

The 231-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 40.27) in 1998. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, is responsible for the custody and long-term care of the site.

Evidence of a possible trespass was observed during the site inspection this year (i.e., some riprap blocks were displaced on one of the side slopes of the disposal cell). The trespass did not compromise the integrity of the disposal cell and is considered to be minor in nature. Inspectors found no other evidence that site institutional controls were ineffective or violated.

5.3 Compliance Review

5.3.1 Annual Inspection and Report

The site, southwest of Falls City, Texas, was inspected on January 13, 2010. The results of the inspection are described below. Figure 5–1 shows features and photograph locations (PLs) mentioned in this report. 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 Road, Entrance Gate, Fence, and Signs—Access to the site is through a vehicle gate directly off of a public right-of-way (Farm-to-Market Road [FM] 1344). The main entrance gate (replaced in 2006) and the vehicle gate at the north corner of the site were locked and functional.

The five-strand barbed-wire perimeter fence that surrounds the site property boundary and the entrance sign next to the main entrance gate were in good condition.

5A In the west corner of the site, the fence contains a 16-foot long panel (PL–1). This panel can be opened with minimal effort, so it will be replaced with barbed wire consistent with the rest of the fence to provide added site security.

Site Markers and Monuments—The two site markers, SMK–1 at the entrance gate and SMK–2 on top of the disposal cell, were in excellent condition.

Three survey monuments and two boundary monuments, situated at the corners of the site, were undisturbed and in excellent condition.

Monitoring Wells—There are seven monitoring wells in the cell performance network and five wells in the groundwater compliance network. All monitoring wells were inspected when they were sampled in April 2010 and were secure and in excellent condition.

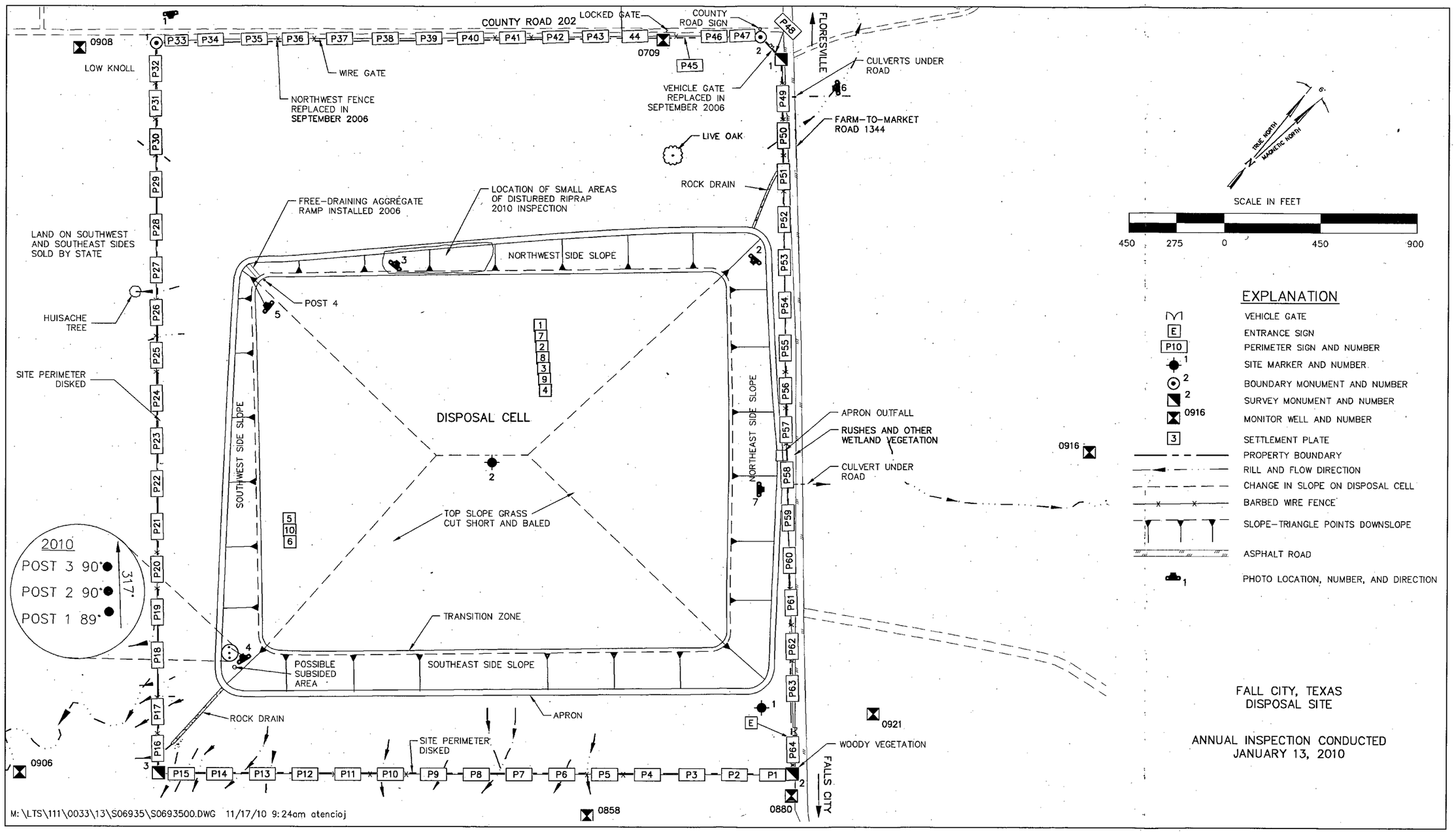


Figure 5–1. 2010 Annual Compliance Drawing for the Falls City Disposal Site

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5.3.1.2 Transects

To ensure a thorough and efficient inspection, inspectors divided the site into three areas called "transects": (1) the top and side slopes of the disposal cell, (2) the site perimeter, and (3) the outlying area.

The area inside each transect was inspected by walking a series of traverses. Within each transect, inspectors examined specific site-surveillance features, drainage structures, and vegetation. Inspectors also looked for evidence of settlement, erosion, or other modifying processes.

Top and Side Slopes of the Disposal Cell—The top of the disposal cell is grass covered and in excellent condition; there was no indication of settlement, rock degradation, erosion, or other sign of instability. A local rancher cuts and bales hay from the disposal site each year, including the top of the cell, resulting in a beneficial reuse of the site. Grass on top of the disposal cell is
5B cut and baled for livestock and is kept cut short to control the risk of fire. In past inspections small desiccation cracks were present in the surface of the soil on the top and upper edges of the disposal cell. Desiccation cracks near the surface of a soil profile are common, especially in clayey or loamy soils when soil conditions are dry. A large amount of precipitation fell in the area in late 2009, and soil conditions during the inspection were not dry.

Vegetation management on the disposal cell was excellent. Deep-rooted vegetation that
5C encroaches on the disposal cell is controlled in accordance with the LTSP. Deep-rooted vegetation is of concern because it can penetrate the radon barrier. Deep-rooted vegetation on the cell will continue to be cut and treated with herbicide

The side slopes of the disposal cell are covered with riprap and are in excellent condition (PL–2). No evidence of riprap degradation was found. An access ramp to the cell top on the west corner of the side slope is in excellent condition. A couple of minor riprap disturbances (small depressions) were observed on the northwest side slope of the disposal cell (PL–3). The site maintenance contractor first observed the riprap disturbances after a large rainfall event in the fall of 2009 (4.95 inches over 3 days). The 2009 rainfall event was well below the design maximum precipitation criterion for the disposal cell (19.2 inches in 1 hour). The minor riprap disturbances do not adversely impact the protectiveness of the side slope but will be monitored in future inspections. It is possible that the disturbed riprap was a result of trespass for unknown reasons.

In 2007, inspectors noted a slight low spot in the riprap at the toe of the southwest corner of the side slope. Although this spot is likely an artifact of construction, particular attention is paid to this area during inspections to determine if movement or subsidence can be observed. In 2008, three t-posts were installed in a straight line running at an orientation of 317 degrees (PL–4). Each post has a vertical pitch of 90 degrees. These posts provide reference points to assess possible movement. A level is used to measure the vertical pitch of the posts. If a post moves out of line with the others or changes pitch, it indicates possible movement. No movement was detected in 2010.

An access ramp is located at the west corner of the side slope to facilitate access by maintenance equipment to the top of the disposal cell (PL–5). The ramp was installed in 2006 and constructed with clean angular riprap of progressively smaller sizes to provide a free draining and stable

driving surface that does not encourage vegetation encroachment. The ramp was in excellent condition but will probably need an additional layer of small gravel in the next few years.

Site Perimeter—The area between the perimeter fence and the toe of the disposal cell is covered with well-established grass. The grass-covered areas between the disposal cell and the property line are cut short to reduce the risk of fire. During most years these areas are cut and baled two or three times. In 2009 the areas were cut and bailed only once due to dry conditions up until August.

In past inspections, wild hog burrows have been observed under the fence line in some areas. These burrows are filled in as they are located. Although it is possible that the burrows could compromise the fence's integrity, they are considered a minor nuisance at this time.

No water was flowing in the north or south rock drains, and the drains appeared to be functioning as designed. Vegetation in the apron outfall, midway along the northeast side slope, is being properly managed. No evidence of erosion was observed. No willows were noted in the south rock drain, but some thick vegetation at the end of the drain is present. Grass in the ends of the rock drains serves to help dissipate the energy of site runoff and is therefore desirable.

Outlying Area—The area outward from the disposal site for a distance of 0.25 mile was visually inspected. No development or disturbance that could affect site integrity was observed.

County Road 202 (which runs just outside the northwest perimeter fence) was slated to be open to the public in 2009, in accordance with a Karnes County public-access agreement. This would have allowed the public access along the northwest side of the site. The agreement was not carried out and the road remains closed to the public. Inspectors will continue to monitor this area for vandalism and trespassing.

An area of off-property erosion was identified during the 2009 inspection at the culvert that runs under FM 1344 near site perimeter sign P49. On the day of the 2010 inspection, the Texas Department of Transportation added some fill soil and graded the area (PL–6). The state also made improvements to the area around the culvert that runs under FM 1344 near site perimeter sign P58 (PL–7).

5.3.2 Follow-Up or Contingency Inspections

DOE will conduct follow-up inspections if (1) an annual inspection or other site visit reveals a condition that must be reevaluated during a return to the site, or (2) a citizen or outside agency notifies DOE that conditions at the site are substantially changed.

No follow-up or contingency inspections were required in 2010.

5.3.3 Routine Maintenance and Repairs

In 2010, DOE made minor repairs to the perimeter fence and a few perimeter signs, controlled deep-rooted vegetation on the disposal cell, and cut and baled the grass on the disposal cell top slope and in the area between the toe of the side slopes and the site perimeter.

5.3.4 Groundwater Monitoring

Groundwater monitoring was conducted at the site in April 2010. As prescribed in the revised
5D LTSP issued in March 2008, groundwater monitoring at the Falls City site as a best management practice has two components:

1) Monitor groundwater to demonstrate the initial performance of the disposal cell (40 CFR 192, Subpart A), and

2) Monitor groundwater for plume movement to demonstrate that potential users of groundwater downgradient from the site are not exposed to former-processing-site-related contamination (40 CFR 192, Subpart B).

Because narrative supplemental standards apply to the uppermost aquifer at this site, no concentration limits or points of compliance (POCs) have been established. Groundwater in the uppermost aquifer beneath the site has an EPA designation of "limited use" (Class III) because it is not currently or potentially a source of drinking water due to widespread ambient contamination that cannot be cleaned up using methods reasonably employed by public water supply systems. Background groundwater quality varies by orders of magnitude in the area because the uppermost aquifer is in a location where uranium mineralization is naturally redistributed. For these reasons, the NRC general license does not require groundwater monitoring at the site.

Two aquifers of interest underlie the site: the shallow Deweesville/Conquista aquifer and the deeper Dilworth aquifer. Because the two aquifers are hydraulically connected, they constitute the uppermost aquifer for regulatory purposes. The Dilworth aquifer is underlain by the Manning Clay, a 300-foot-thick aquitard that isolates the uppermost aquifer from better-quality groundwater in deeper aquifers. Groundwater samples at the site are collected from both the Deweesville/Conquista aquifer and the underlying Dilworth aquifer.

The disposal cell performance monitoring network consists of five monitoring wells (MW–0709, MW–0858, MW–0880, MW–0906, and MW–0921) that are completed in the uppermost aquifer and sampled as specified in the revised LTSP. Two additional cell performance monitoring wells (MW–0908 and MW–0916), also completed in the uppermost aquifer, are designated for water-level measurements only.

The groundwater compliance monitoring network consists of five monitoring wells (MW–0862, MW–0886, MW–0891, MW–0924, and MW–0963) that are completed in the uppermost aquifer and sampled annually as specified in the revised LTSP. Figure 5–2 shows the monitoring well networks.

The revised LTSP prescribes continued annual monitoring of the current network of wells through 2010 as a best management practice and reduces the analyte list to total uranium and field measurements of temperature, pH, conductivity, turbidity, alkalinity, dissolved oxygen, and oxidation-reduction potential.

The revised LTSP (which incorporates the Ground Water Compliance Action Plan) identifies low pH levels in groundwater as an indicator of extent and movement of the legacy groundwater

plumes. Changes in the baseline geochemical conditions may also indicate leachate movement from the disposal cell into the uppermost aquifer. Tailings pore fluids were lower in pH than background groundwater. However, because pH levels and other signature contaminants in tailings pore fluids are essentially indistinguishable from processing-related contamination, it is difficult to determine if contamination comes from the disposal cell or from legacy processing activities.

DOE has determined that pH and uranium concentrations do not co-vary. This is an indication that other factors contribute to uranium distribution in the uppermost aquifer, such as natural redistribution of uranium in this active ore-forming environment. Therefore, increasing uranium levels at a monitoring location without an attendant drop in pH probably does not indicate movement of processing-related contamination. Groundwater chemistry at monitoring locations near the formation subcrop may also be influenced by residence time as a response to precipitation or changes in oxidation state within the formation. If increases in uranium are sporadic and not accompanied by decreases in pH, DOE concludes that the elevated uranium is naturally occurring. Time-concentration plots for pH and uranium from 1996 through April 2010 are included as Figures 5–3 through 5–6.

Groundwater Quality Monitoring Results—This report considers groundwater monitoring results through April 2010. In 2010, monitoring wells were sampled for uranium and field parameters. Water levels were also measured.

At the cell performance monitoring wells, pH levels have historically been higher than the pH in tailings pore fluids, with no significant upward or downward trends. In 2010, the pH levels for the cell performance wells remained within the historical range (Figure 5–3).

At the groundwater compliance monitoring wells, pH levels have historically been higher than the pH in the plumes of groundwater contaminated by processing activities, with no significant upward or downward trends, except that the pH at MW–0963 has historically been lower than at the other locations. In 2010, the pH levels for the compliance monitoring wells remained within the historical range, with the exception of monitoring well MW–0891. The previous high of 6.12 standard units (s.u.) in 2003 was surpassed in 2006 with a new high of 6.37 s.u. (Figure 5–4).

In 2010, the uranium concentrations in the cell performance network remained relatively stable and within the historical range, approximately 1.2 mg/L or less, with one exception. At well MW–0880, uranium has varied from a low concentration of 1.38 mg/L in 2008 to a high concentration of 14 mg/L in 2004 (Figure 5–5). Over time, the concentration of uranium in this well has been variable and, until 2008, substantially greater than the uranium concentrations at the other cell performance wells. The pH at this location is lower than and has varied more than at other locations in the cell performance monitoring network (Figure 5–3). Water levels are also generally falling at MW–0880 (see the following section, "Groundwater Level Monitoring Results"). These results suggest that the interaction between the disposal cell, the legacy groundwater mound, and processing plumes is still equilibrating. However, monitoring results do not indicate the disposal cell is contributing to degradation of the uppermost aquifer. Because the groundwater in the uppermost aquifer is not used as a potable water source near the Falls City site, the site remains protective.

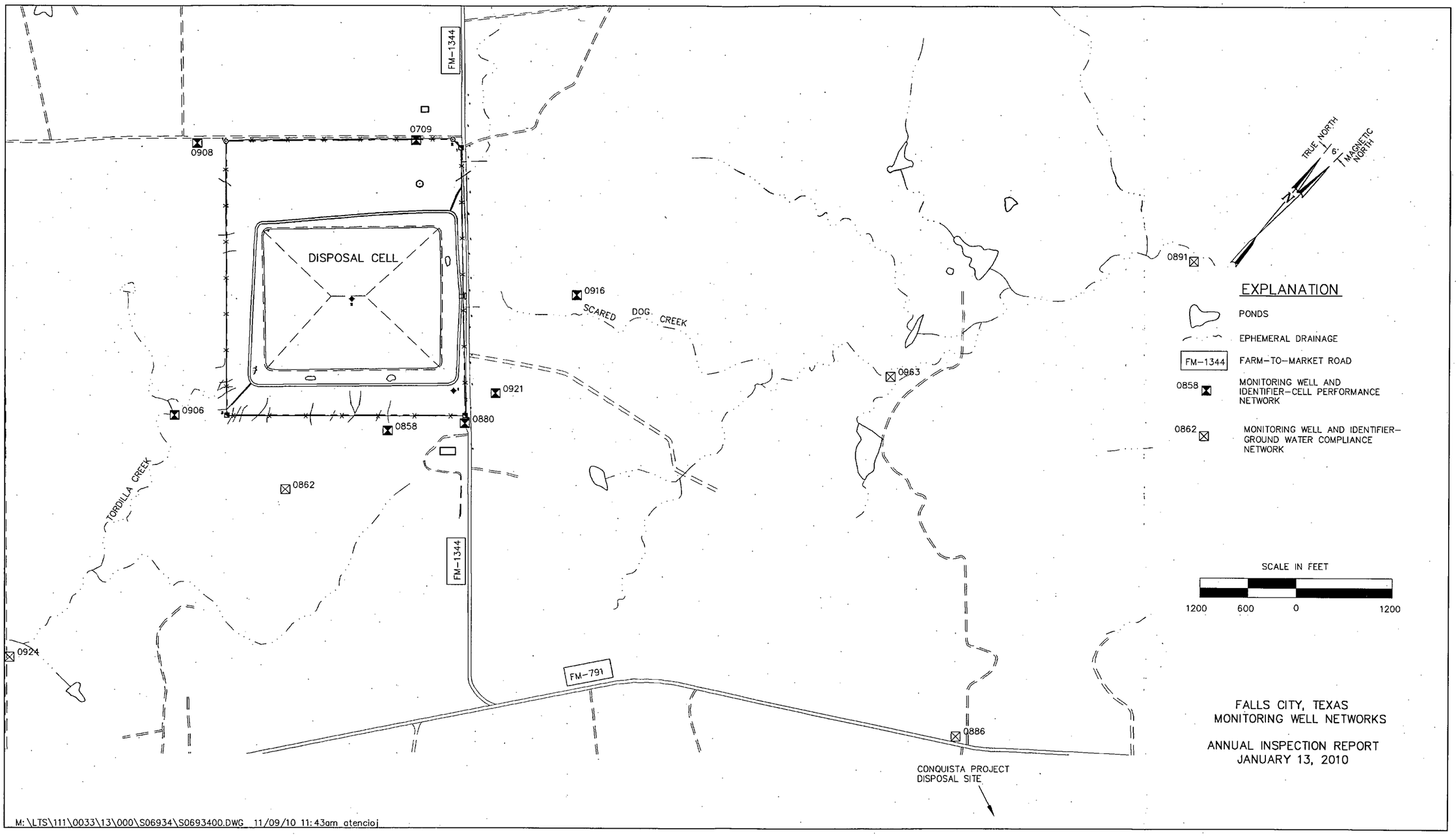

Figure 5–2. Combined Monitoring Well Network at the Falls City Disposal Site

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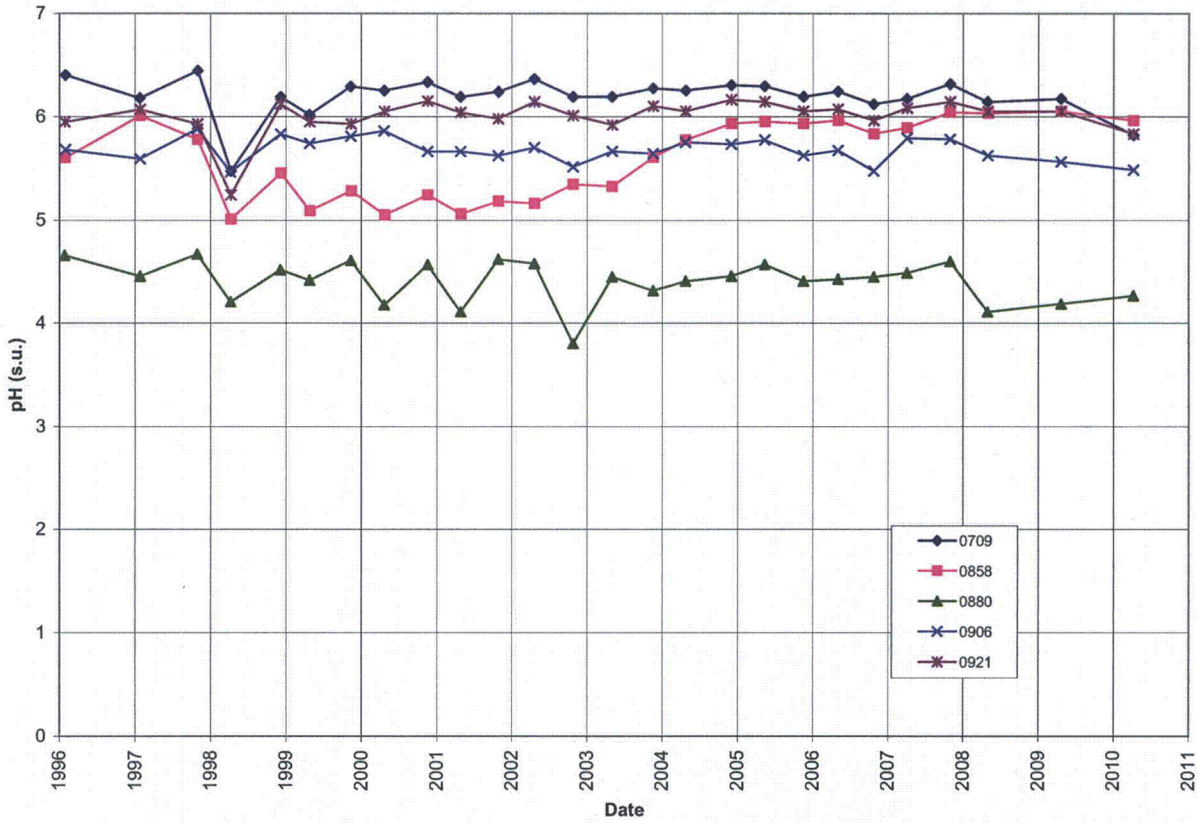

Figure 5–3. pH in Groundwater at Cell Performance Monitoring Locations at the Falls City Disposal Site

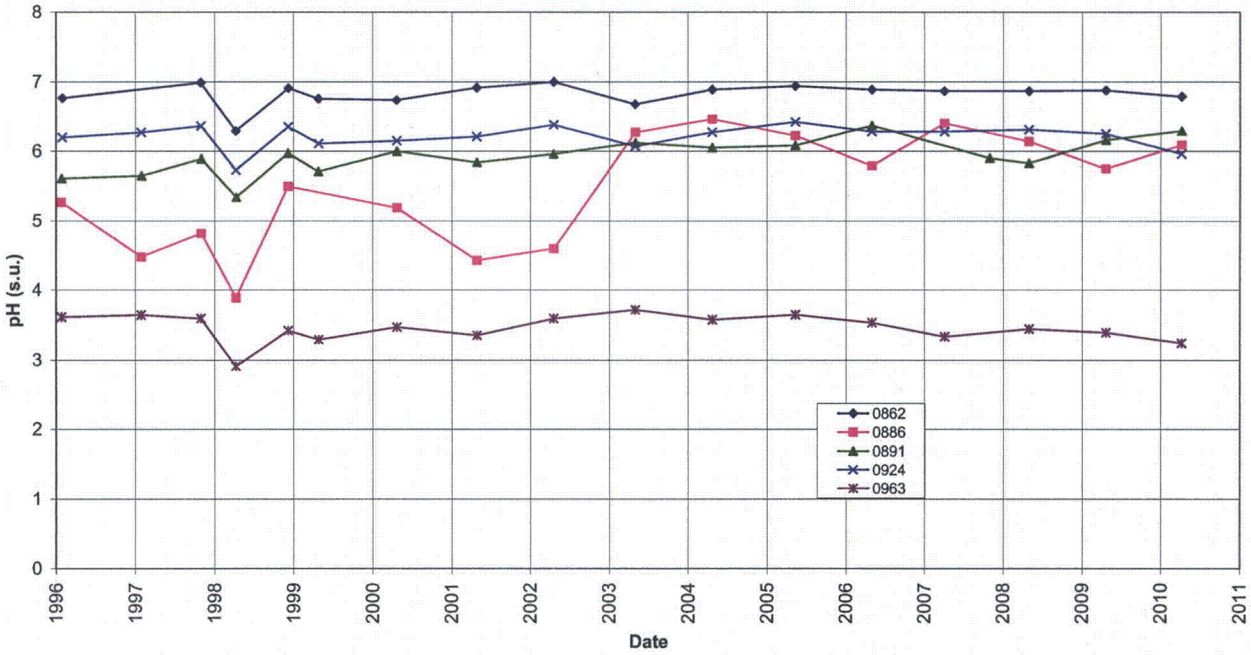

Figure 5–4. pH in Groundwater at Compliance Monitoring Locations at the Falls City Disposal Site

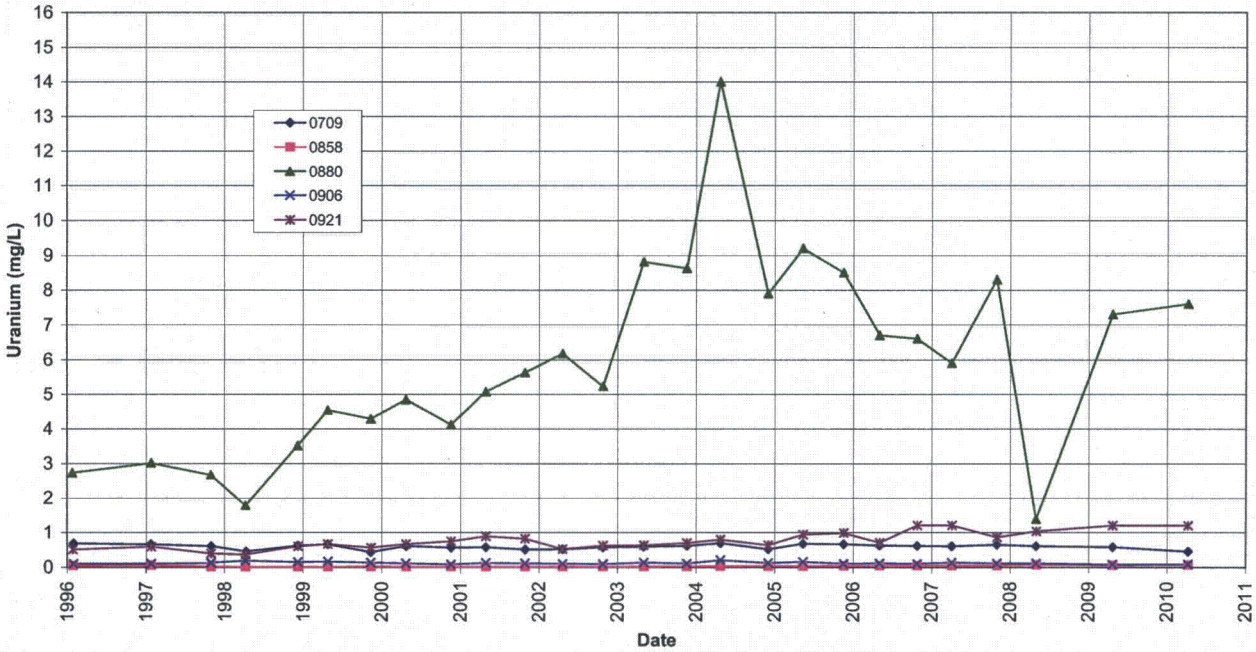

Figure 5–5. Uranium in Groundwater at Cell Performance Monitoring Locations at the Falls City Disposal Site

The concentration of uranium in groundwater within the compliance monitoring network shows that the uranium concentration trends at monitoring wells MW–0862, MW–0886, and MW–0963 remain stable at low levels (<0.2 mg/L) (Figure 5–6). The increasing uranium concentration trend at well MW–0924 appears to be leveling off between 0.5 mg/L and 0.6 mg/L. The uranium concentration measured at well MW–0891 in 2009 (1.7 mg/L) and 2010 (2.1 mg/L) are anomalously high compared to historical measurements at the well, but not for the aquifer.

The new maximum uranium concentration measured at monitoring well MW–0891 in 2010 (2.1 mg/L) is below the maximum concentration reported for the aquifer, which is also the value used in the risk assessment for the Dilworth groundwater (3.04 mg/L). Since the 2010 measured groundwater concentrations are within historical ranges for the aquifer, there is no evidence that legacy contaminated groundwater contamination is degrading downgradient groundwater.

Groundwater-Level Monitoring Results—Water levels measured in 2010 in the disposal cell performance network were consistent with previous measured levels (Figure 5–7). Since 1996, groundwater levels in the disposal cell performance network wells have slightly fallen. The water level in monitoring well MW–0906 has fluctuated more than the other wells over the years. Monitoring well MW–0906 is directly down slope of the disposal cell, and the historical fluctuation may be the result of the infiltration of water shed by and conveyed away from the disposal cell, reflecting variations in annual precipitation. Other contributors that may influence local groundwater levels include (1) the dissipation of the processing-site-related groundwater mound beneath the disposal cell, and (2) the dissipation of transient drainage from the disposal cell.

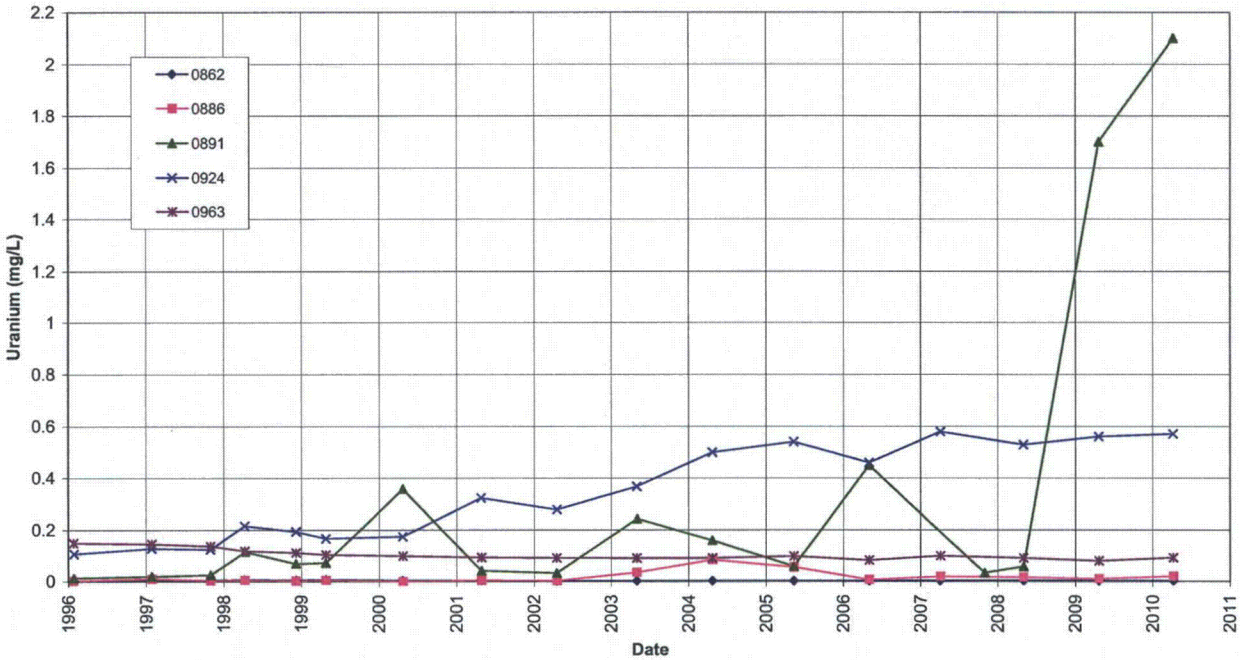

Figure 5–6. Uranium in Groundwater at Compliance Monitoring Locations at the Falls City Disposal Site

Two cell performance monitoring wells, MW–0908 and MW–0916, are not shown in Figure 5–7. These wells, designated for groundwater-level monitoring only, are completed in the unsaturated zone of the Conquista Sandstone and have been dry since 1996.

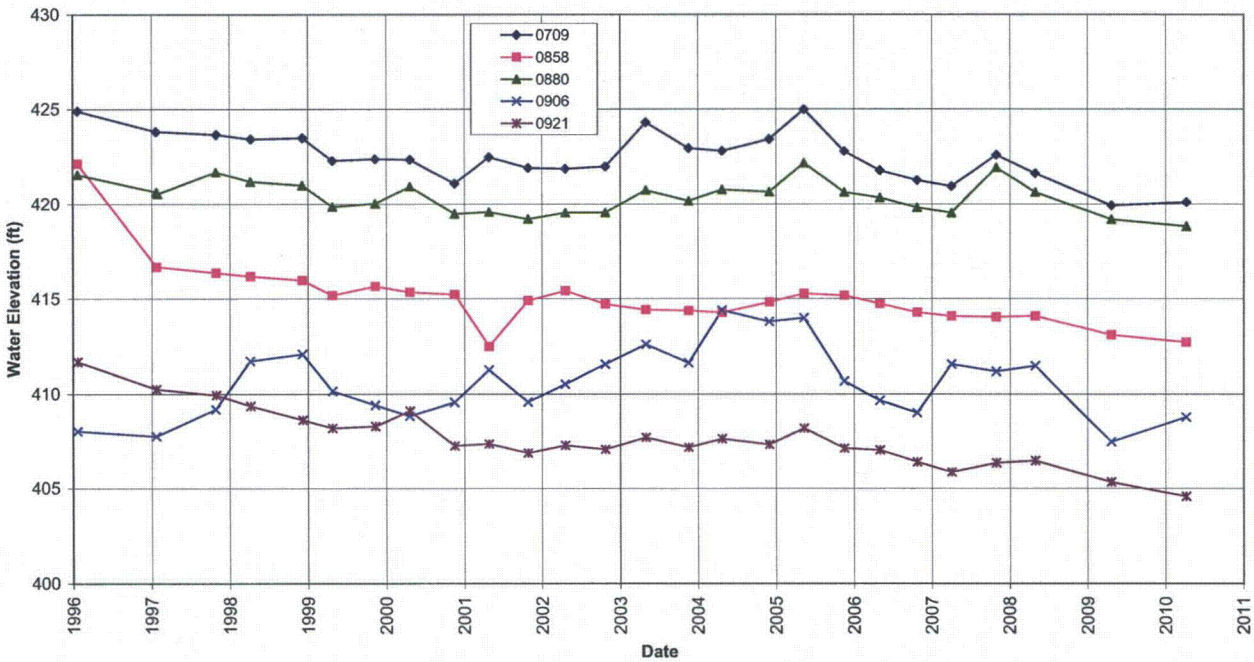

Figure 5–7. Water-Level Measurements at Cell Performance Monitoring Locations at the Falls City Disposal Site

In contrast, water levels in the groundwater compliance monitoring network wells have all increased slightly between 1996 and 2010 (Figure 5–8).

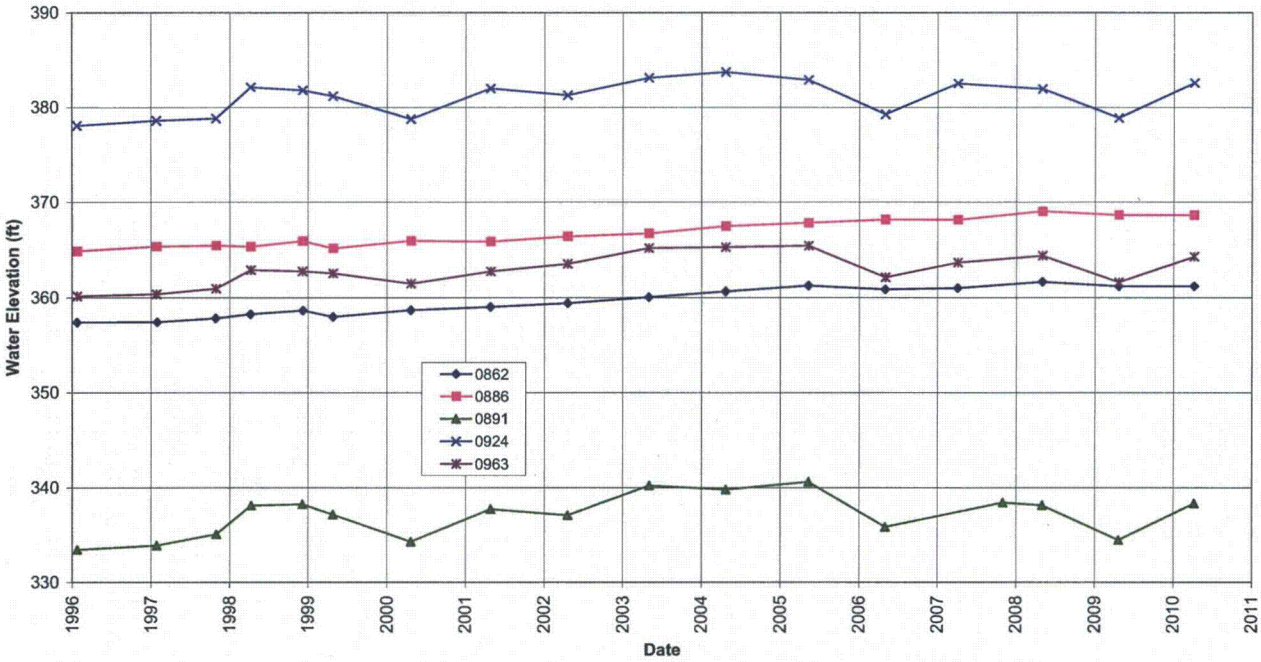

Figure 5–8. Water-Level Measurements at Compliance Monitoring Locations at the Falls City Disposal Site

Evaluation of Groundwater Monitoring—In 2006, DOE evaluated the groundwater monitoring program at the site, as required every 5 years by the LTSP, to evaluate plume movement and disposal cell performance.

The evaluation concluded that monitoring for the designated suite of analytes in groundwater does not appear to be an effective means to assess the performance of the disposal cell because groundwater in the uppermost aquifer beneath the cell has been impacted by processing activities, including secondary acid leaching of tailings in the mined-out open pits. Water that might leach from the disposal cell, either through transient drainage or from the infiltration of precipitation through the cover, will be chemically similar to, and perhaps indistinguishable from, groundwater in the legacy plume. Results for 2010 continue to support this conclusion.

Currently, site-related contamination poses no risk because there is no local use of the groundwater, and the groundwater in the uppermost aquifer beneath the site has an EPA designation of "limited use" (Class III). Potable (domestic) water is produced locally from the Carrizo Sandstone that lies 2,000 feet below the surface near the disposal site. Since the 2010 measured groundwater concentrations are within historical ranges for the aquifer, there is no evidence that legacy groundwater contamination is degrading downgradient groundwater.

Based on the 2006 evaluation, DOE revised the LTSP to continue monitoring for 5 years as a best management practice, reduce the analyte list to total uranium only, and continue performing

field measurements of temperature, pH, conductivity, turbidity, alkalinity, dissolved oxygen, and oxidation-reduction potential. With the completion of sampling in 2010, DOE is in the process of performing another 5-year evaluation of the monitoring effort. Results of the evaluation will be made available in 2011, along with a DOE recommendation on how to best proceed with the groundwater monitoring effort at the Falls City site.

5.3.5 Corrective Action

Corrective action is taken to correct out-of-compliance or hazardous conditions that create a potential health and safety problem or that may affect the integrity of the disposal cell or compliance with 40 CFR 192.

No corrective action was required in 2010.

5.3.6 Photographs

Table 5–2. Photographs Taken at the Falls City Disposal Site

Photograph Location Number	Azimuth	Photograph Description
PL–1	135	Fence panel in west corner of perimeter fence.
PL–2	180	Top of north corner of disposal cell.
PL–3	NA	Red ribbon delineates riprap disturbance on the northwest side slope.
PL–4	290	Three posts installed in possible subsided area on south corner of the riprap side slope of the disposal cell.
PL–5	270	Base of aggregate ramp installed in 2006.
PL–6	225	Off-property culvert along FM 1344, near perimeter sign P49.
PL–7	45	Repairs being made to off-property culvert near perimeter sign P58 by Texas Department of Transportation to address erosion and drainage in culvert next to FM 1344.

FCT 1/2010. PL–1. Fence panel in west corner of perimeter fence.

FCT 1/2010. PL–2. Top of north corner of disposal cell.

FCT 1/2010. PL–3. Red ribbon delineates riprap disturbance on the northwest side slope.

FCT 1/2010. PL–4. Three posts installed in possible subsided area on south corner of the riprap side slope of the disposal cell.

FCT 1/2010. PL–5. Base of aggregate ramp installed in 2006.

FCT 1/2010. PL–6. Off-property culvert along FM 1344, near perimeter sign P49.

FCT 1/2010. PL–7. Repairs being made to off-property culvert near perimeter sign P58 by Texas Department of Transportation to address erosion and drainage in culvert next to FM 1344.

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6.0 Grand Junction, Colorado, Disposal Site

6.1 Compliance Summary

The Grand Junction, Colorado, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on March 22 and 25, 2010. The disposal cell and all associated surface water diversion and drainage structures were in good condition and functioning as designed. A portion of the disposal cell remains open and is operated by the U.S. Department of Energy (DOE) to receive additional low-level radioactive waste materials from various sources. The annual inspection requirement applies only to the closed and completed portion of the disposal cell and the surrounding disposal site.

Groundwater monitoring was performed as a best management practice. Several warning signs are faded and will be replaced during the next inspection. No cause for a follow-up inspection was identified.

6.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the Grand Junction Disposal Site are specified in the *Interim Long-Term Surveillance Plan for the Cheney Disposal Site Near Grand Junction, Colorado* (DOE/AL/62350–243, Rev. 1, DOE, April 1998) and in procedures established by DOE to comply with the requirements of Title 10 *Code of Federal Regulations* Part 40.27 (10 CFR 40.27). Table 6–1 lists these requirements.

Table 6–1. License Requirements for the Grand Junction Disposal Site

Requirement	Long-Term Surveillance Plan	This Report
Annual Inspection and Report	Section 3.0	Section 6.3.1
Follow-Up or Contingency Inspections	Section 3.4	Section 6.3.2
Routine Maintenance and Repairs	Sections 2.7.3 and 4.0	Section 6.3.3
Groundwater Monitoring	Section 2.6	Section 6.3.4
Corrective Action	Section 5.0	Section 6.3.5

Institutional Controls—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 along the property boundary, and a locked gate at the entrance to the site access road.

The United States of America owns the 360-acre disposal site. DOE will operate the disposal site until final closure. Only closed and completed parts of the disposal cell and the area surrounding the disposal site are addressed during the annual inspection. Approximately 21 acres in the center of the disposal cell are active to receive residual radioactive material and other authorized radioactive waste. The active area, the temporary structures associated with its operation, and the temporary contaminated material stockpile areas are not part of the annual inspection except as they may affect the long-term safety and performance of the closed portion of the disposal cell.

Inspectors found no evidence that the institutional controls were ineffective or violated.

6.3 Compliance Review

6.3.1 Annual Inspection and Report

The site, south of Grand Junction, Colorado, was inspected on March 22 and 25, 2010. The results of the inspection are described below. Figure 6–1 shows features and photograph locations (PLs) mentioned in this report. Numbers in the left margin of this report refer to items summarized in the "Executive Summary" table.

Weekly environmental and security inspections of the entire site are performed to verify that the site is secure, and radon is monitored continuously to ensure that the open portion of the cell protects human health and the environment. This portion of the disposal cell is scheduled to remain open until 2023, or until filled to its design capacity, at which time it will be closed in accordance with design criteria. Once the U.S. Nuclear Regulatory Commission (NRC) concurs in the final closure of the open portion of the cell and the final version of the long-term surveillance plan (LTSP), the site will be accepted under the NRC general license (10 CFR 40.27). DOE will then become the licensee and, in accordance with the requirements for UMTRCA Title I sites, be responsible for the custody and long-term care of the site. The open and active portion of the disposal cell within the closed but unlicensed portion of the disposal cell makes the Grand Junction Disposal Site unique among the 19 UMTRCA Title I disposal sites.

6.3.1.1 Specific Site-Surveillance Features

Site Access Gate, Access Road, Entrance Gate, and Fence—A double swing stock gate, at the U.S. Highway 50 right-of-way fence, and a double swing chain-link gate, 1.7 miles east at the site entrance, control access to the site. The DOE locks, chains, and gates were in excellent condition.

A paved all-weather access road extends approximately 1.7 miles east from U.S. Highway 50 along DOE's perpetual right-of-way across federal land administered by the U.S. Bureau of Land Management (BLM). No erosion problems were observed along the access road.

A standard four-strand barbed-wire stock fence runs along the access road right-of-way corridor and also surrounds the disposal area. The fence is secure, and remains in good condition.

Entrance and Perimeter Signs—An entrance sign is at the entrance gate, and 29 perimeter signs are at regular intervals along the DOE property boundary. The signs are installed on galvanized steel posts set in concrete. All of the signs were in excellent condition.

Additional warning signs are posted on the wire perimeter fence and are associated with the operation of the open cell. Metal controlled-area signs and yellow plastic no-trespassing signs
6A are secured to the fence in pairs. There are 75 warning signs, each about 200 feet apart along the site boundary. Several "Controlled Area" signs are substantially faded or rusted and were replaced in 2010.

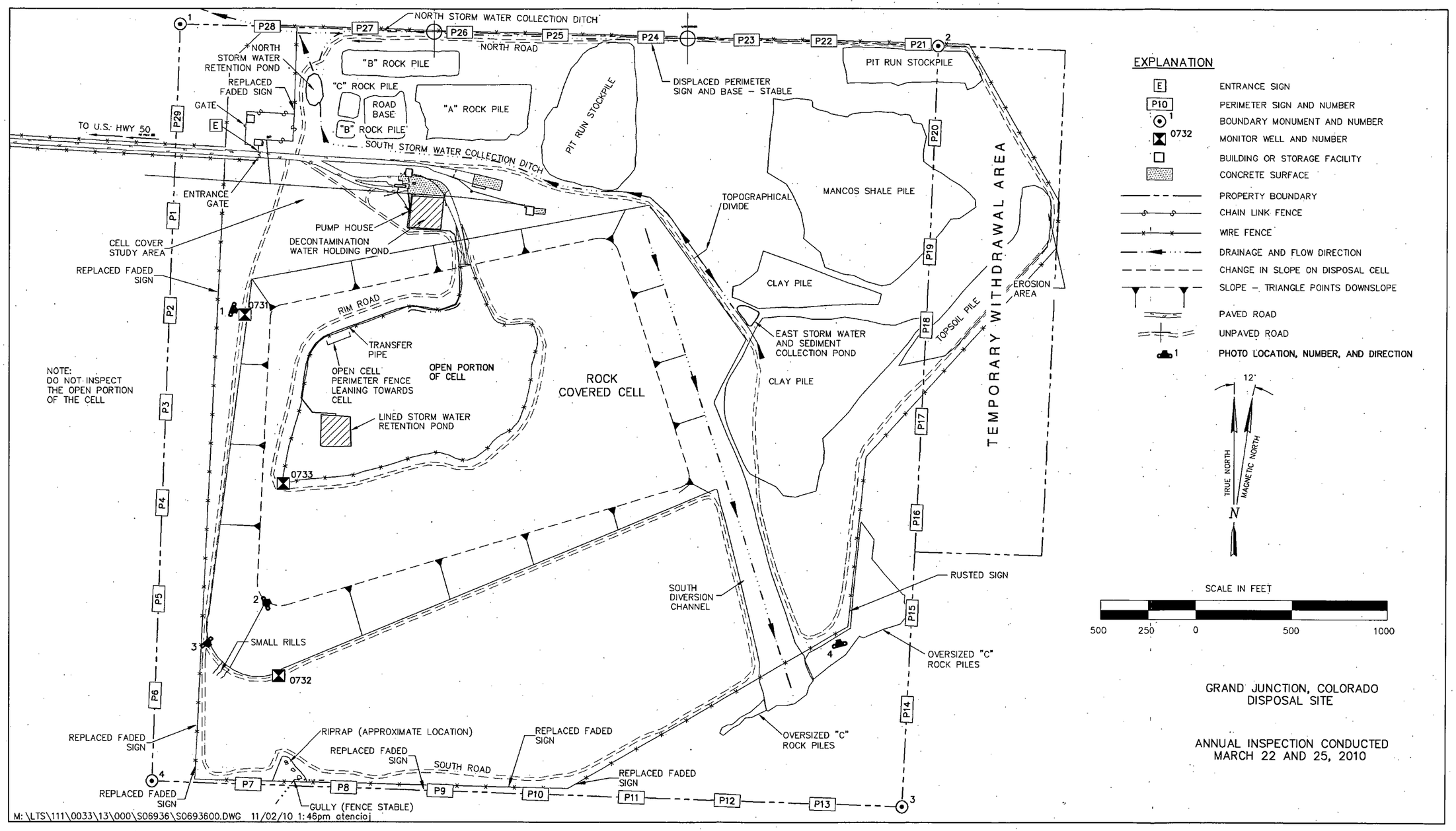

Figure 6–1. 2010 Annual Compliance Drawing for the Grand Junction Disposal Site

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Site Markers and Monuments—Granite site markers similar to those installed at other sites will not be installed at this site until the disposal cell is closed.

The site has four permanent boundary monuments, one at each of the four corners. The monuments mark the exact location of the site corners. All of the boundary monuments were in excellent condition.

Monitoring wells—The groundwater monitoring network consists of three monitoring wells. All three are inside the site boundary. The wells were secure and in excellent condition (PL–1).

6.3.1.2 Transects

To ensure a thorough and efficient inspection, inspectors divided the site into five areas called "transects": (1) the closed portion of the disposal cell, (2) the diversion structures and drainage channels, (3) the area between the disposal cell and the site boundary, (4) the site perimeter, and (5) the outlying area.

The area inside each transect was inspected by walking a series of traverses. Within each transect, the inspectors examined specific site-surveillance features, drainage structures, and vegetation, along with other features. Inspectors also looked for evidence of settlement, erosion, slumping, or other phenomena that might affect the site's integrity or long-term performance.

Closed Portion of the Disposal Cell—Basalt riprap covers the top and side slopes of the disposal cell. The rock is durable and in excellent condition. There is no evidence of slope instability, and very little plant encroachment is occurring on the side slopes. The cover was in excellent condition with no evidence of settling or erosion (PL–2).

Some large basalt boulders in the apron at the toe of the southwest corner of the disposal cell have shifted, and minor erosion had recently occurred on the site road at that location. It is assumed that these conditions are attributable to freeze-thaw actions and runoff from melting snow and ice. The disposal cell side slope at this location is stable, and there is no concern regarding the integrity or function of the disposal cell.

Grasses and weeds grow on most of the cell cover, and scattered deep-rooted vegetation (primarily shrubs) has persisted on the cover. The grasses and weeds have shallow root systems and do not degrade cell cover performance. Historically, deep-rooted shrubs have been considered to pose a potential threat to the long-term integrity of the radon barrier and were periodically removed or treated with herbicide. However, recent studies by DOE and the U.S. Environmental Protection Agency have indicated that evapotranspiration cover designs perform significantly better than the conventional rock-covered compacted soil layer designs (as used at this site) in terms of limiting permeability and percolation of moisture into the cells. Therefore, as part of DOE's Renovated Evapotranspiration Cover Assessment Project, a test facility consisting of two lysimeters was constructed at the site in 2007 to compare the performance of the existing cover design with a renovated evapotranspiration design. The results from this study will be used by DOE in making long-term surveillance and maintenance decisions at this and similar sites.

Diversion Structures and Drainage Channels—The south diversion channel is a large riprap-armored structure that conveys runoff from the disposal cell southeast into a natural drainage that flows away from the site to the southwest. The diversion channel is in excellent condition. Some plant growth, including grasses, weeds, and deep-rooted shrubs, exists within the channel. However, there is not enough growth to impede water flow within the channel. Erosional features at the outfall of the channel are self-armoring with large riprap boulders and are stable.

Other drainage features at the site include north and south storm water collection ditches, the north storm water retention pond, and a storm water and sediment collection pond on the east side of the south diversion channel (PL–3). These small drainage features control storm water runoff primarily from the various cover materials stockpiled on the northern and eastern portions of the disposal site property. The north storm water collection ditch also captures storm water run-on from a large catchment area north and east of the disposal site. The ditches and ponds are functioning as designed.

Area Between the Disposal Cell and the Site Boundary—There are 12 discrete stockpiles of rock and soil between the disposal cell and the site boundary on the north and east sides of the disposal cell. These materials eventually will be used to cover and close the open cell. Natural vegetation is generally well established and is protecting the stockpiles from significant erosion.

On the south and west sides of the disposal site, between the disposal cell and the perimeter fence, the ground is relatively flat and covered with native vegetation that consists primarily of perennial grasses and small shrubs. No erosion was observed in the undisturbed areas south and west of the disposal cell.

Site Perimeter—A location of active erosion near the southeast corner of the perimeter fence was repaired in 2009. The area was regraded, basalt boulders were installed to reduce erosion, and a drainage ditch to redirect runoff was constructed. No new erosion was apparent (PL–4). A gully is present along the south perimeter fence (near perimeter sign P8) on the fringe of a riprap-armored drainage area. It does not appear to be actively eroding at this time. At some point the gully may erode beneath one or more of the line posts; however, the fence and posts were taut and stable at the time of the inspection.

Outlying Area—The area outward from the disposal site for a distance of 0.25 mile was visually inspected. No development or disturbance that could affect the disposal site was observed. Most of the land surrounding the site is rangeland administered by BLM. The land is covered by native grass and shrubs, and is used primarily for cattle grazing.

Directly east of the site, just beyond the site boundary, there is a 40-acre temporary withdrawal area of federal land administered by BLM. The temporary withdrawal area is not included in the interim LTSP and, therefore, is not formally inspected. DOE uses the temporary withdrawal area to stockpile cover materials for the eventual closure of the open portion of the cell.

6.3.2 Follow-Up or Contingency Inspections

DOE will conduct follow-up inspections if (1) an annual inspection or other site visit reveals a condition that must be reevaluated during a return to the site, or (2) a citizen or outside agency notifies DOE that conditions at the site are substantially changed.

No follow-up or contingency inspections were required in 2010.

6.3.3 Routine Maintenance and Repairs

Several faded or rusted "Controlled Area" signs were replaced in 2010. No other routine maintenance or repairs were required in 2010.

6.3.4 Groundwater Monitoring

Because narrative supplemental standards apply (40 CFR Part 192.21 [g]), groundwater in the uppermost aquifer (Dakota Sandstone) beneath the disposal site need not be monitored. The
6B basis for supplemental standards is that the groundwater is designated "limited use" because the total dissolved solids (TDS) content exceeds 10,000 milligrams per liter (mg/L) (40 CFR Part 192.11 [e]). Confined groundwater in the uppermost aquifer lies approximately 750 feet below the existing ground surface and is hydrogeologically isolated from the tailings material by mudstones and shales of the Mancos Shale.

In lieu of monitoring groundwater in the uppermost aquifer, DOE voluntarily monitors groundwater as a best management practice from two monitoring wells completed in (or very near) buried alluvial paleochannels adjacent to the disposal cell (MW–0731 and MW–0732) and one monitoring well in the disposal cell (MW–0733) (Table 6–2). This best-management-practice monitoring is done to assess the disposal cell's performance and to ensure that seepage (transient drainage) from the disposal cell is not impacting any groundwater in the paleochannels. The paleochannel wells are along the west (downgradient) edge of the disposal cell and are screened at the interface between the alluvium and shallow Mancos Shale. The third well is in the southwest corner of the open portion of the disposal cell and is used primarily for the measurement of water levels in the deepest part of the disposal cell to demonstrate that the groundwater elevation directly beneath the cell has not risen enough to move laterally into the paleochannels.

Table 6–2. Groundwater Monitoring Network at the Grand Junction Disposal Site

Monitoring well	Hydrologic Relationship
MW–0731	Paleochannel, downgradient, edge of cell, north side
MW–0732	Paleochannel, downgradient, edge of cell, south side
MW–0733	Disposal cell, deepest location, downgradient, center

Groundwater-Level Monitoring—Static water-level measurements are obtained from each well before water quality samples are collected (Figure 6–2). In September 2006, a datalogger was installed in each well to obtain continuous water-level measurements (at a 4-hour interval).

Since 1998, the water level in disposal cell well MW–0733 has risen approximately 2.5 feet and has remained significantly lower than the water levels in the two paleochannels wells (MW–0731 and MW–0732) (Figure 6–2). Water levels within the two paleochannels at wells MW–0731 and MW–0732 are approximately equal to 1998 levels. The trends for wells MW–0731 and MW–0732 has been a slightly decreasing trend with level fluctuations that range from 2 ft to 5 ft. Given these elevations, groundwater at the base of the disposal cell at well MW–0733 has no potential to migrate to the paleochannels at wells MW–0731 and MW–0732.

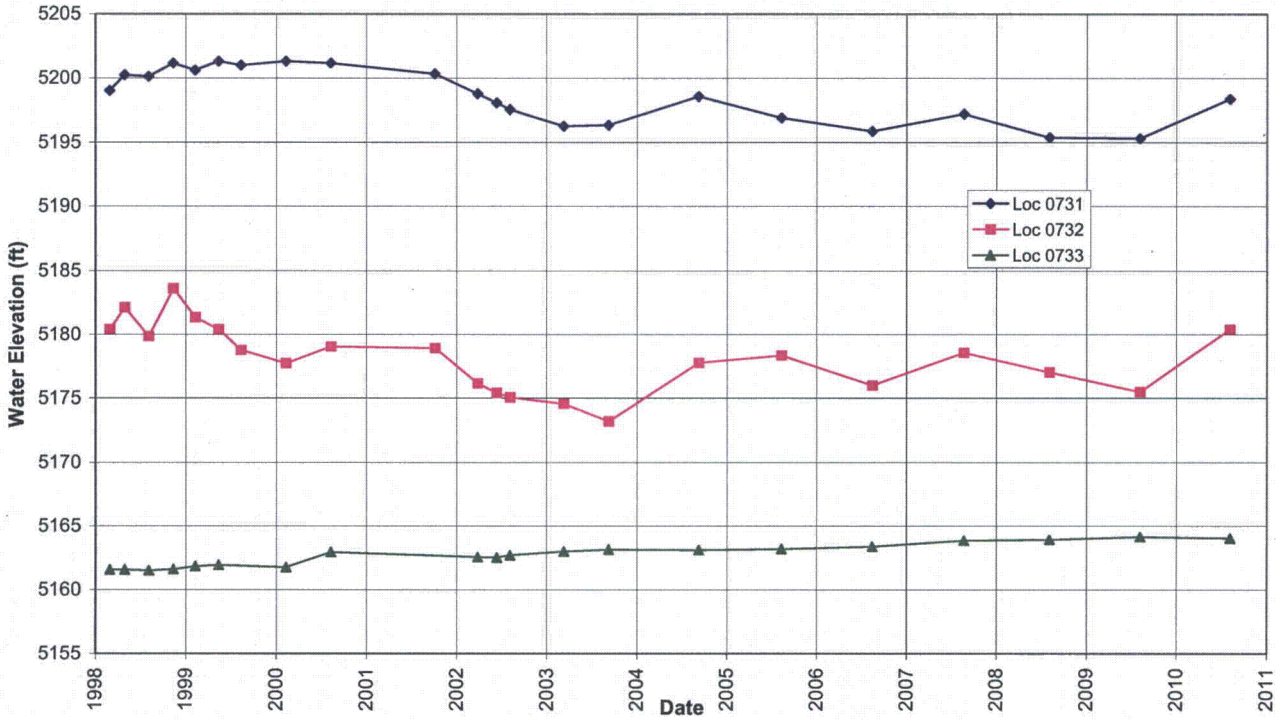

Figure 6–2. Water-Level Measurements at the Grand Junction Disposal Site

Groundwater Quality Monitoring—Groundwater samples are analyzed for standard field parameters and the following indicator analytes: molybdenum, nitrate, selenium, sulfate, TDS, uranium, vanadium, and polychlorinated biphenyls. Key indicator analytes are molybdenum, nitrate, selenium, and uranium. At 40 CFR 192, Subpart A, Table 1, EPA has established maximum concentration limits (MCLs) for these analytes in groundwater (Table 6–3). Time-concentration plots, from 1998 through 2009, for three key indicator analytes—nitrate (as nitrogen), selenium, and uranium—are shown on Figures 6–3 through 6–5.

Table 6–3. Maximum Concentration Limits for Groundwater at the Grand Junction Disposal Site

Constituent	MCL[a] (mg/L)
Molybdenum	0.1
Nitrate (as Nitrogen)	10
Selenium	0.01
Uranium	0.044

[a]U.S. Environmental Protection Agency MCLs as listed in 40 CFR 192, Subpart A, Table 1.
MCL = maximum concentration limit.
mg/L = milligrams per liter.

Nitrate (as nitrogen) concentrations in groundwater continued to exceed the MCL of 10 mg/L in the paleochannel monitoring wells (MW–0731 and MW–0732) through 2010 (Figure 6–3). Concentrations in well MW–0731, following an initial steep downward trend, remained below the MCL from 2000 through 2004. In 2005, and continuing through 2010concentrations steadily increased and remain above the MCL. Concentrations in well MW–0732, though varied, have consistently remained above the MCL since 1998. Concentrations in well MW–0733 continued a

significant downward trend, dropping below the MCL in 2006, and reaching a low of 4.6 mg/L in 2010. Historically, the highest concentration of nitrate (96 mg/L) occurred in 1998 from disposal cell well MW−0733. In 2010, the concentration of nitrate has decreased and is very close in range for both paleochannel monitoring wells with 26 mg/L in MW−0731 and 27 mg/L in MW−0732.

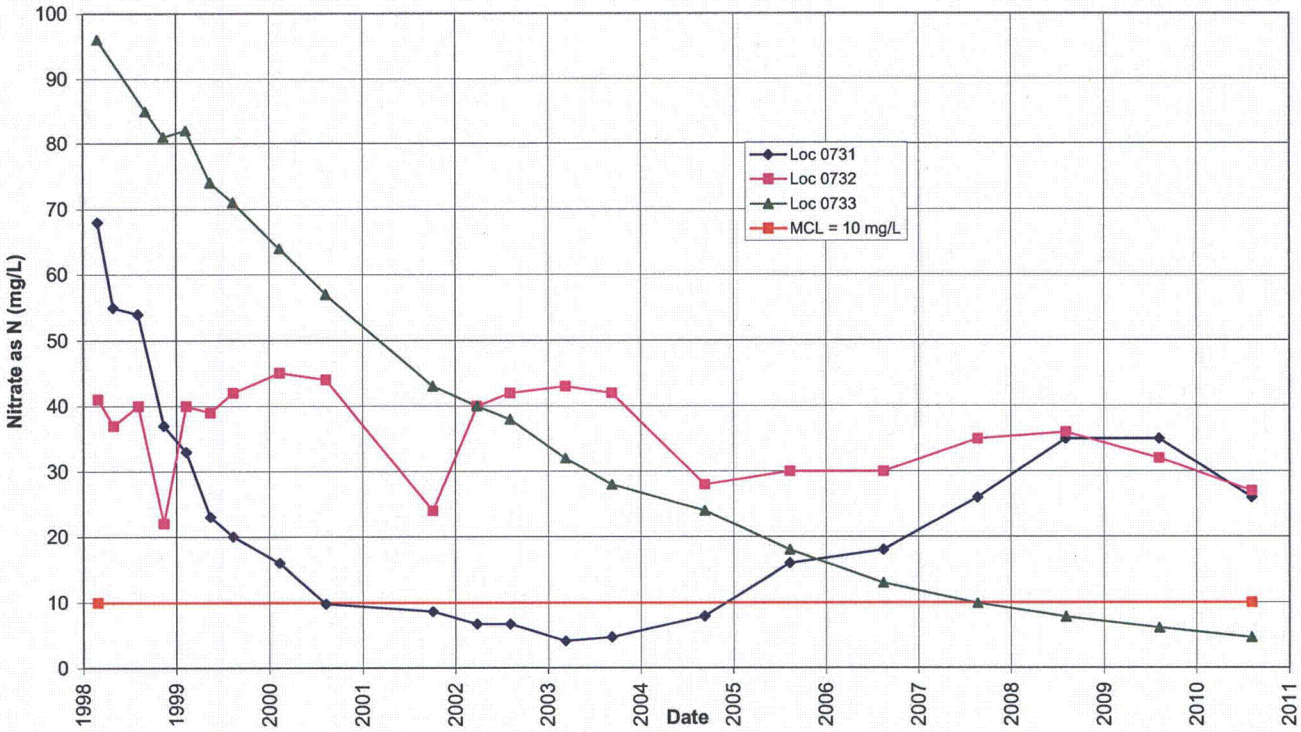

Figure 6–3. Time-Concentration Plots of Nitrate (as Nitrogen) in Groundwater at the Grand Junction Disposal Site

Selenium occurs naturally in the Mancos Shale deposits that underlie the disposal cell, and may be the cause of the elevated concentrations reported in both paleochannel monitoring wells (MW−0731 and MW−0732). Selenium concentrations continued to exceed the MCL of 0.01 mg/L in the paleochannel wells (Figure 6–4). Concentrations in well MW−0731 displayed a sharp decreasing trend, and the decreasing trend continued until 2003, when a slight upward trend began. In 2010, selenium concentrations in well MW−0731 have decreased slightly. Concentrations in well MW−0732 continue to display no trend. In well MW−0733, the selenium concentration of 0.0028 mg/L remained well below the standard, with no trend evident. In 2010, the highest concentration of selenium, 0.54 mg/L, occurred in paleochannel well MW−0731.

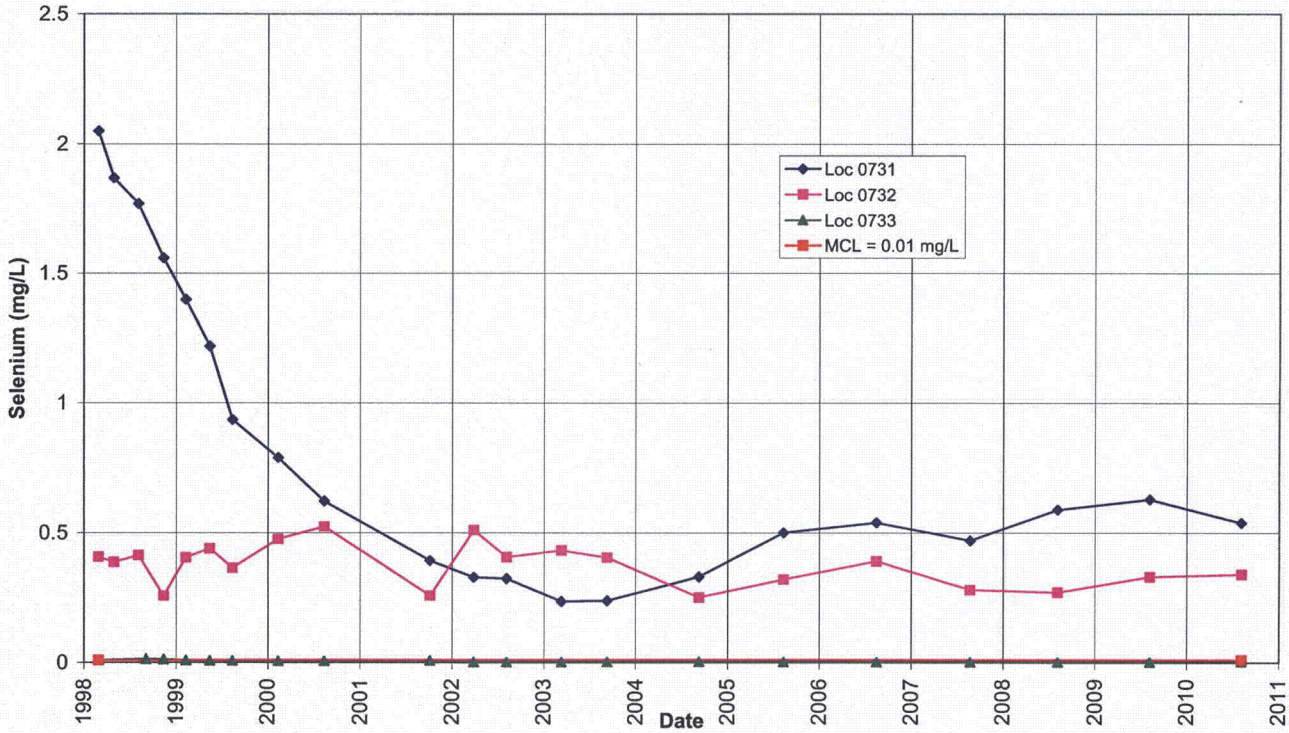

Figure 6–4. Time-Concentration Plots of Selenium in Groundwater at the Grand Junction Disposal Site

Uranium concentrations in groundwater were below the MCL of 0.044 mg/L in samples from paleochannel wells MW–0731 and MW–0732, but were above the MCL in well MW–0733 (0.11 mg/L) for the fourth consecutive time (Figure 6–5). Concentrations in well MW–0731, after an initial increase above the MCL, have displayed a decreasing trend that continued in 2010. Concentrations in wells MW–0732 and MW–0733 remained relatively consistent through 2003, at which time an upward trend began in both wells; the upward trend continues in well MW–0733 and has leveled off in MW–0732.

The elevated uranium in well MW–0733 poses no risk to human health or the environment because the disposal cell is situated on a thick aquiclude overlying "limited use" groundwater that is not for any purpose.

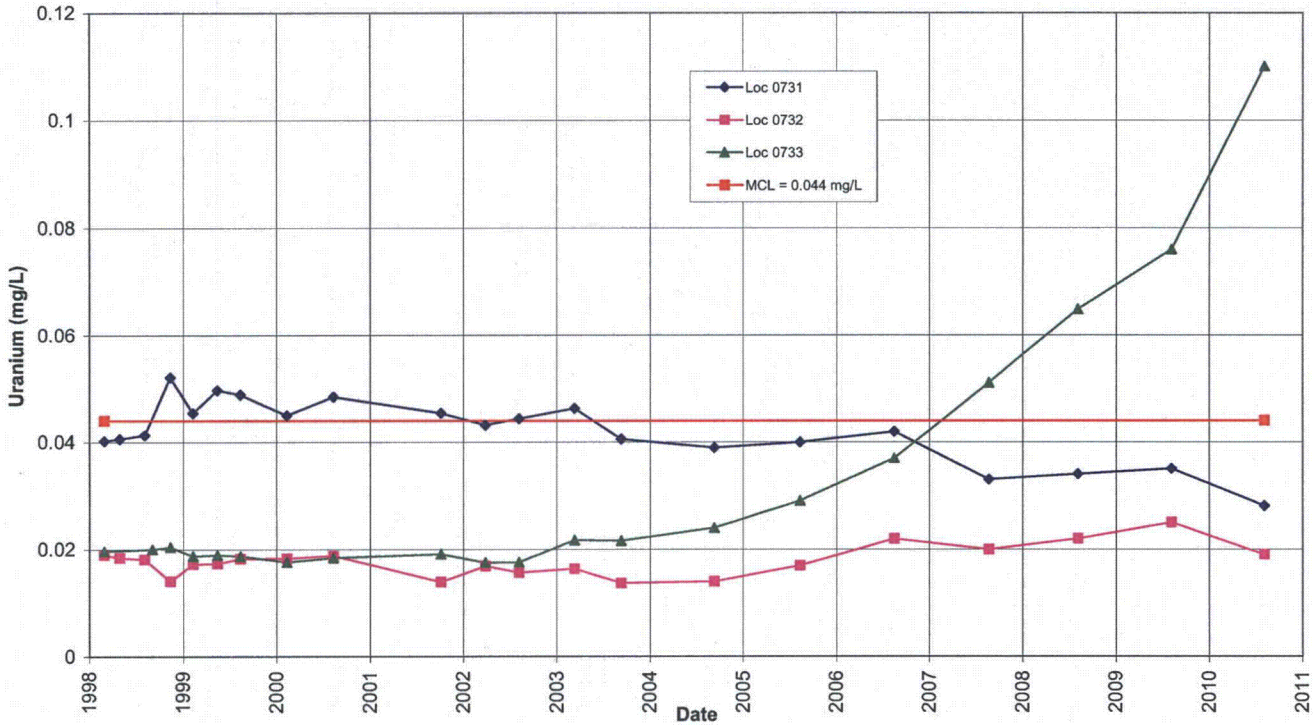

Figure 6–5. Time-Concentration Plots of Uranium in Groundwater at the Grand Junction Disposal Site

6.3.5 Corrective Action

Corrective action is taken to correct out-of-compliance or hazardous conditions that create a potential health and safety problem or that may affect the integrity of the disposal cell or compliance with 40 CFR 192.

No corrective action was required in 2010.

6.3.6 Photographs

Table 6–4. Photographs Taken at the Grand Junction Disposal Site

Photograph Location Number	Azimuth	Photograph Description
PL–1	110	Monitoring well 0731.
PL–2	65	South side of the disposal cell cover.
PL–3	140	Apron at the southwest corner of the disposal cell.
PL–4	345	Repaired erosion area in the southeast corner of the site.

GRJ 3/2010. PL–1. Monitoring well 0731.

GRJ 3/2010. PL–2. South side of the disposal cell cover.

GRJ 3/2010. PL–3. Apron at the southwest corner of the disposal cell.

GRJ 3/2010. PL–4. Repaired erosion area in the southeast corner of the site.

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7.0 Green River, Utah, Disposal Site

7.1 Compliance Summary

The Green River, Utah, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on March 16, 2010. The disposal cell was in excellent condition. Groundwater monitoring continued for the purpose of evaluating cell performance; no constituents of concern exceeded their respective proposed alternate concentration limits (ACLs). No additional maintenance needs or cause for a follow-up or contingency inspection was identified.

7.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the Green River Disposal Site are specified in the *Long-Term Surveillance Plan* [LTSP] *for the Green River, Utah, Disposal Site* (DOE/AL/62350–89, Rev. 2, U.S. Department of Energy [DOE], July 1998) and in procedures established by DOE to comply with the requirements of Title 10 *Code of Federal Regulations* Part 40.27 (10 CFR 40.27). Table 7–1 lists these requirements.

Table 7–1. License Requirements for the Green River Disposal Site

Requirement	Long-Term Surveillance Plan	This Report
Annual Inspection and Report	Section 6.0	Section 7.3.1
Follow-Up or Contingency Inspections	Section 7.0	Section 7.3.2
Routine Maintenance and Repairs	Section 8.0	Section 7.3.3
Groundwater Monitoring	Section 5.2	Section 7.3.4
Corrective Action	Section 9.0	Section 7.3.6

Institutional Controls—The 25-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 40.27) in 1998. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, is responsible for the custody and long-term care of the site. Institutional controls at the disposal site, as defined by DOE Policy 454.1, consist of federal ownership of the property, a disposal cell perimeter security fence, warning/no-trespassing signs along the property boundary, and a locked gate at the entrance to the site. Verification of these institutional controls is part of the annual inspection.

Inspectors found no evidence that these institutional controls were ineffective or violated.

7.3 Compliance Review

7.3.1 Annual Inspection and Report

The site, southeast of Green River, Utah, was inspected on March 16, 2010. The results of the inspection are described below. Figure 7–1 shows features and photograph locations (PLs) mentioned in this report. Numbers in the left margin of this report refer to items summarized in the "Executive Summary" table.

7.3.1.1 Specific Site-Surveillance Features

Access Road, Entrance Gate, Fence, and Signs—The site can be accessed either from the Town of Green River or from U.S. Interstate Highway 70 via a paved road. The access route crosses State land and U.S. Army property. Perpetual access has been granted to DOE through right-of-way agreements with both agencies.

Entrance to the site is through a locked steel gate in the access road right-of-way fence. Past this gate, a short track leads across State land to the disposal cell, which is enclosed within a chain-link security fence. The chain-link fence is set back between 50 and 250 feet from the site boundary. Two vehicle access gates are installed in this fence at the south and east corners of the fence line. A personnel gate is at the north corner of the fence line. The security fence and gates were in excellent condition (PL–1).

One entrance sign and 17 perimeter signs are positioned on posts set along the unfenced site boundary. Perimeter sign P12 has a bullet dent but is legible. The other signs were in excellent condition.

Site Markers and Monuments—Two granite site markers are on site, and both were in good condition (PL–2). The concrete base of site marker SMK–1 has several cracks, but there is no need for repairs at this time. Eleven boundary monuments and three survey monuments are along the site perimeter. All of the monuments were in excellent condition.

Monitoring wells—The twenty-two groundwater monitoring wells were secure and in excellent condition at the time of the inspection. Section 7.3.4 describes the groundwater monitoring and its results.

7.3.1.2 Transects

To ensure a thorough and efficient inspection, the site is divided into three transects: (1) the disposal cell and adjacent area inside the security fence, (2) the site perimeter between the security fence and the site boundary, and (3) the outlying area.

Within each transect, the inspectors examined specific site-surveillance features, vegetation, and other features. Inspectors also looked for evidence of settlement, erosion, or other modifying processes.

Disposal Cell and Adjacent Area Inside the Security Fence—The 6-acre disposal cell was completed in 1989. The slopes of the disposal cell cover are armored with basalt rock. No evidence of any disturbance of the cell surfaces was observed. No vegetation was present on the cell. The quality of the rock is excellent, and the disposal cell cover was in excellent condition (PL–1 and PL–2).

A basalt boulder-filled trench, referred to as an apron, surrounds the disposal cell. The apron collects all runoff water from the cell, and the water is reduced by evaporation, evapotranspiration through deep-rooted shrubs that grow along the apron, and infiltration into the underlying bedrock and aquifer through the sides and bottom of the apron. The apron was in excellent condition.

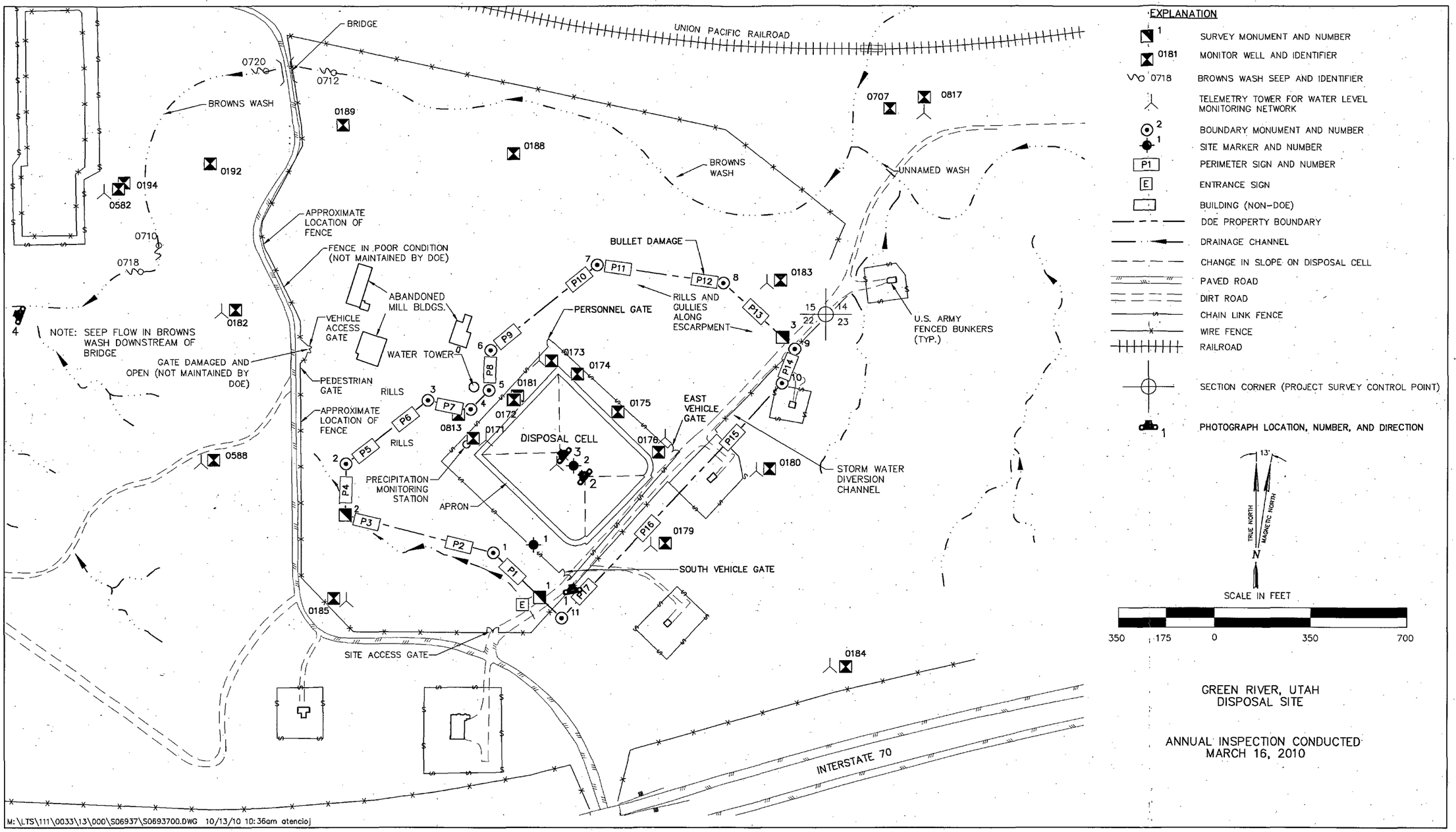

Figure 7–1. 2010 Annual Compliance Drawing for the Green River Disposal Site

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Site Perimeter Between the Security Fence and the Site Boundary—Rills and gullies are present on the west side of the property but do not encroach on disposal cell structures and currently are not affecting any site surveillance features. Rills and gullies are also present along the escarpment northeast of the disposal cell in the area between boundary monument BM–7 and survey monument SM–3. Maximum gully depth in this area is approximately 3 feet. The rill and gully erosion does not encroach on disposal cell structures but could eventually damage perimeter signs and boundary monuments; therefore, the erosion features in this area will continue to be monitored.

Trespassing occurs on the site from several access points through state land. The barbed-wire stock fence on the surrounding state-owned property provides only minimal security; the fence west of the site is in poor condition and a gate providing access to the former mill buildings and the DOE site is broken off its hinges. The site is also accessible through remote open access points north and east of the property. DOE property will continue to be monitored for adverse public use indicated by trash, tire ruts, and vandalism.

Outlying Area—The area extending outward from the site for a distance of 0.25 mile was checked for signs of erosion, development, or other disturbance that might affect site security or integrity. Areas of erosion noted during recent and previous inspections include the natural drainage southwest of the site, and rills and gullies northwest of the water tower. Minor erosion continues but currently does not threaten the integrity of the disposal cell or site-surveillance features.

Abandoned buildings and a water tower associated with the former milling activities at the Green River Processing Site are northwest and upwind of the DOE property (PL–3). The buildings are in a severe state of disrepair, and debris (e.g., roofing materials, siding, trash) tends to be blown from the buildings onto the DOE property. Accumulation of materials blown onto DOE property was not significant, but will continue to be monitored; debris will be removed as necessary.

Browns Wash conditions were observed during the inspection. Minor flow was occurring in the channel between the road bridge and the backwater area near the confluence with the Green River. The streambed upstream of the bridge had no flowing water but was moist from snowmelt and a recent runoff event; therefore, most of the flow downstream of the bridge probably was from seeps. Browns Wash seeps have been identified as potential discharge locations for the middle sandstone unit aquifer of the Cedar Mountain Formation (the aquifer is contaminated under the disposal cell). However, the middle sandstone unit is not present under the principal seep area (seep location 0718), and the source of the seep water has not been determined.

The backwater area near the mouth of Browns Wash was investigated because of its potential as a fish spawning location. The backwater area was nearly filled with sediment, with minimal standing water (PL–4). The conditions of Browns Wash channel and the backwater area change substantially after each runoff event as sediment is either scoured or deposited along the channel bottom.

7.3.2 Follow-Up or Contingency 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 or contingency inspections were required in 2010.

7.3.3 Routine Maintenance and Repairs

No maintenance or repairs were conducted in 2010.

7.3.4 Groundwater Monitoring

7A In compliance with 40 CFR 192, Subpart A, the LTSP stipulates a cell-performance groundwater monitoring network of four point-of-compliance (POC) wells (MW–0171, MW–0172, MW–0173, and MW–0813). Because of poor well completion characteristics, MW–0172 is no longer being sampled, and a newer well adjacent to it (MW–0181) is being monitored instead. Based on a draft of the February 2008 *Preliminary Final Groundwater Compliance Action Plan* [GCAP] *for the Green River, Utah, Disposal Site* and discussions with the State of Utah, DOE is monitoring wells MW–0176 and MW–0179 as POC wells also. Groundwater levels are monitored in the two Cedar Mountain Formation aquifers of concern (in the middle sandstone and basal sandstone units).

The draft GCAP includes both the disposal site and the former processing site, so it addresses compliance to Subparts A and B of 40 CFR 192. Therefore, the monitoring network includes non-POC wells completed in the Browns Wash alluvium for best-management-practice monitoring (MW–0188, MW–0189, MW–0192, and MW–0194). These wells are in, and downgradient of, an area where tailings had been stored on the alluvial plane. The low-yield groundwater in the alluvium was contaminated during processing and tailings-storage activities, and it is recommended for application of supplemental standards based on a classification of "limited use" groundwater. The wells are sampled as a best management practice to track contaminants migration out of the alluvium. Following concurrence of the GCAP by the NRC and the State of Utah, the LTSP will be revised to reflect the final compliance strategy.

The purpose of monitoring the POC wells is to evaluate the disposal cell's performance. In accordance with the draft GCAP, groundwater samples are collected annually (beginning in June 2007) and are monitored for four target analytes: arsenic, nitrate, selenium, and uranium. Nitrate and uranium are indicator constituents, and arsenic and selenium are monitored because concentrations at some locations exceed U.S. Environmental Protection Agency (EPA) maximum concentration limits (MCLs)—provided in 40 CFR 192, Subpart A, Table 1—and State of Utah groundwater quality standards (Rule R317–6–2, Table 1). Sulfate is no longer analyzed because there is currently no primary drinking water standard for that constituent.

Based on the evaluation of several years of analytical data and associated risk, the ACLs listed in Table 7–2 have been proposed to NRC and the State of Utah in the draft GCAP. If accepted, these proposed ACLs will be applicable to all POC wells.

Table 7–2. Proposed Alternate Concentration Limits for Point-of-Compliance Wells at the Green River Disposal Site

Constituent	Standard (mg/L)	Proposed ACL (mg/L)
Arsenic	0.05[a]	5.0
Nitrate + Nitrite as Nitrogen	10[a]	1,000
Selenium	0.05[b]	5.0
Uranium	0.044[a]	4.4

[a] U.S. Environmental Protection Agency maximum concentration limit (40 CFR 192, Table 1).
[b] State of Utah groundwater quality standard (Rule R317–6–2, Table 1).
Key: ACL = alternate concentration limit; mg/L = milligrams per liter

Samples were collected quarterly for 3 years beginning in 1998, with the provision that monitoring requirements would be reevaluated in 2001 to determine if contamination in the groundwater decreased to levels that existed before the disposal cell's construction. The evaluation report concluded that contaminant concentrations were within a reasonable range of compliance relative to the proposed concentration limits provided in the LTSP. However, it is understood that the presence of preexisting processing-related groundwater contamination in the vicinity of the disposal cell complicates the assessment of disposal cell performance. In addition, as a result of this preexisting contamination, concentration levels at the site may change for reasons unrelated to the disposal cell's performance.

Quarterly monitoring of the original four POC wells continued through June 2007. Through the development of the draft GCAP, risk analyses have determined that there is no unacceptable risk to human health and the environment as a result of site-related contamination in groundwater near the disposal site because the groundwater is not used and because site contaminants do not affect river water quality. Therefore, DOE determined that there was no health or cost benefit associated with continuing quarterly monitoring. Annual monitoring has been implemented instead.

Cell Performance Monitoring—Table 7–3 provides the analytical results for the June 2010 sampling event at the proposed POC wells. Time-concentration plots for the four target analytes—arsenic, nitrate, selenium, and uranium—are shown on Figures 7–2 through 7–5.

Table 7–3. 2010 Analytical Results for Point-of-Compliance Wells at the Green River Disposal Site

Monitoring well	Arsenic (mg/L)		Nitrate[a] (mg/L)		Selenium (mg/L)		Uranium (mg/L)	
	ACL	Sample Result	ACL	Sample Result	ACL	Sample Result	ACL	Sample Result
0171	5.0	0.0015	1,000	47	5.0	0.19	4.4	0.096
0173	5.0	0.0016	1,000	270	5.0	0.13	4.4	0.016
0176	5.0	0.00030	1,000	75	5.0	0.61	4.4	0.0026
0179	5.0	0.00068	1,000	32	5.0	0.42	4.4	0.13
0181	5.0	0.0048	1,000	64	5.0	0.0063	4.4	0.011
0813	5.0	0.082	1,000	ND	5.0	0.00087	4.4	0.016

[a] Nitrate = nitrate plus nitrite as nitrogen
Key: ACL = proposed alternate concentration limit; mg/L = milligrams per liter; ND = not detected (below laboratory detection limit)

Arsenic concentrations in groundwater remain below the EPA MCL of 0.05 mg/L in all POC wells except well MW–0813, and remain considerably below the proposed ACL of 5.0 mg/L in all POC wells. In well MW–0813, levels continue to exceed the MCL as shown on Figure 7–2, but are substantially below the proposed ACL. The results for this well indicate that arsenic concentrations have trended downward since 2004.

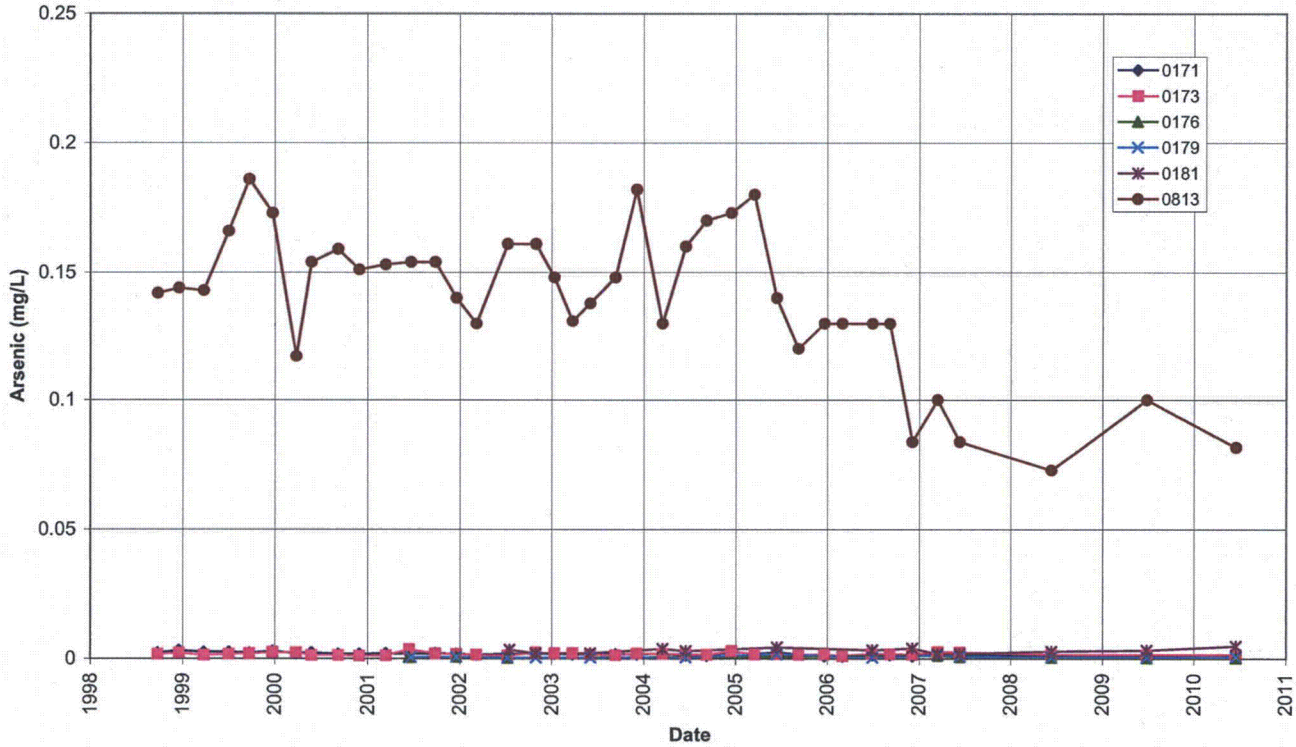

Figure 7–2. Time-Concentration Plots of Arsenic in Groundwater at the Green River Disposal Site

Nitrate concentrations have been measured as nitrate plus nitrite as nitrogen since early 2004 (before then, nitrate was measured as NO_3). Concentrations have continued above the EPA MCL of 10 mg/L in all POC wells except well MW–0813, but they are considerably below the proposed ACL of 1,000 mg/L in all wells (Figure 7–3). Nitrate concentrations in well MW–0813 continue to be below the laboratory detection limit. Nitrate concentrations in the other wells are similar to previous measurements and no trends are apparent.

Selenium concentrations in wells MW–0181 and MW–0813 remain below the Utah standard of 0.05 mg/L. Concentrations in the other wells continue to be above the Utah standard but are substantially below the proposed ACL of 5.0 mg/L (Figure 7–4). Selenium concentrations appear to be trending downward in well MW–0176; no trends are apparent in the other wells.

Uranium concentrations in groundwater remain below the EPA MCL of 0.044 mg/L in all POC wells except wells MW–0171 and MW–0179, and remain considerably below the proposed ACL of 4.4 mg/L in all POC wells. The highest uranium concentrations continue to occur in well MW–0179 (0.13 mg/L), which is upgradient of the disposal cell. The reason for the elevated concentration of uranium in well MW–0179 has not been determined but may be due to natural causes. At well MW–0171, concentrations exceed the MCL and indicate an upward trend since 1998 (Figure 7–5). Because uranium is the only constituent of concern that has indicated an upward trend in well MW–0171, no conclusions regarding the cause of the trend have been reached.

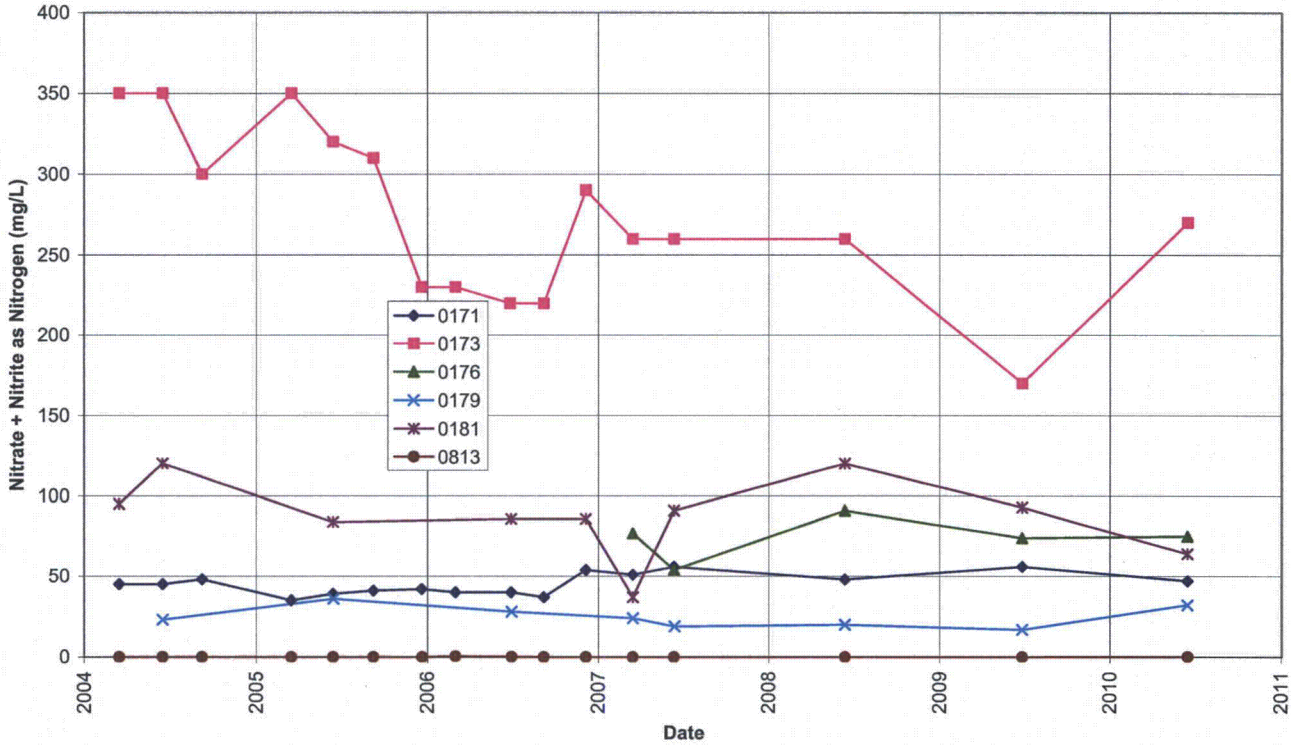

Figure 7–3. Time-Concentration Plots of Nitrate in Groundwater at the Green River Disposal Site

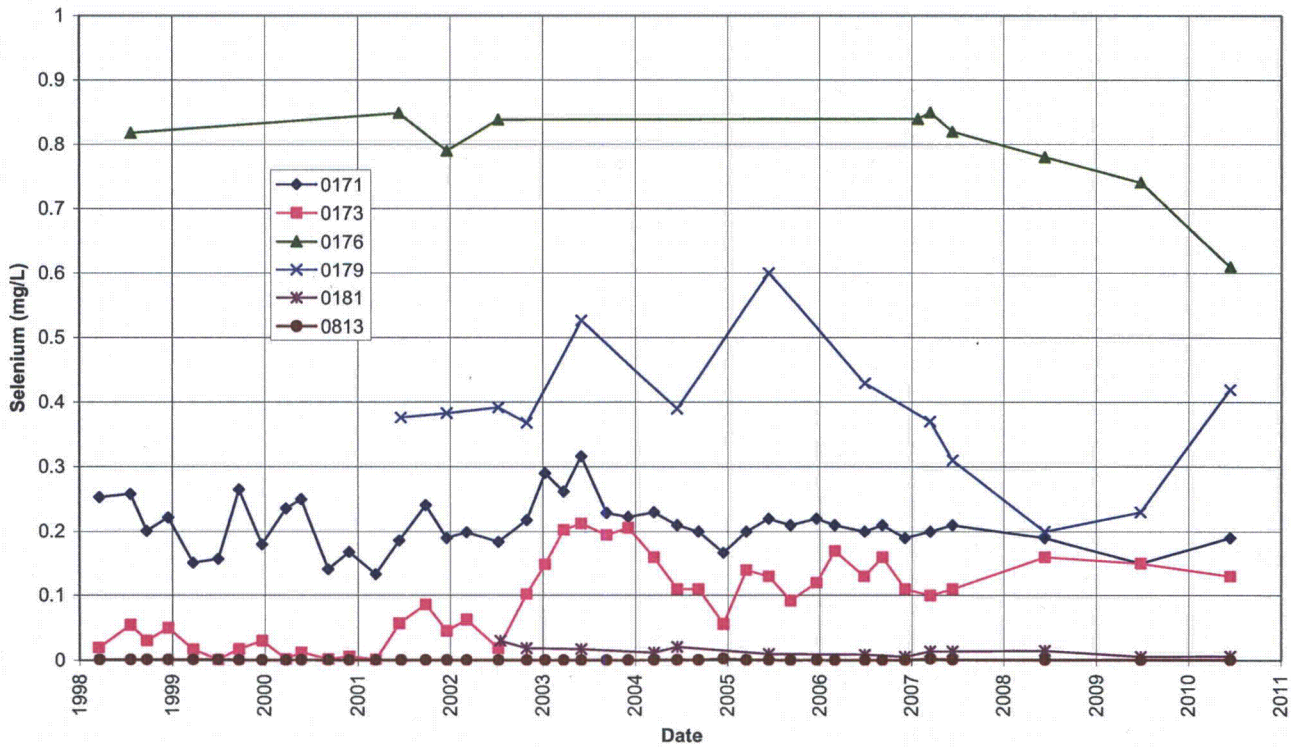

Figure 7–4. Time-Concentration Plot of Selenium in Groundwater at the Green River Disposal Site

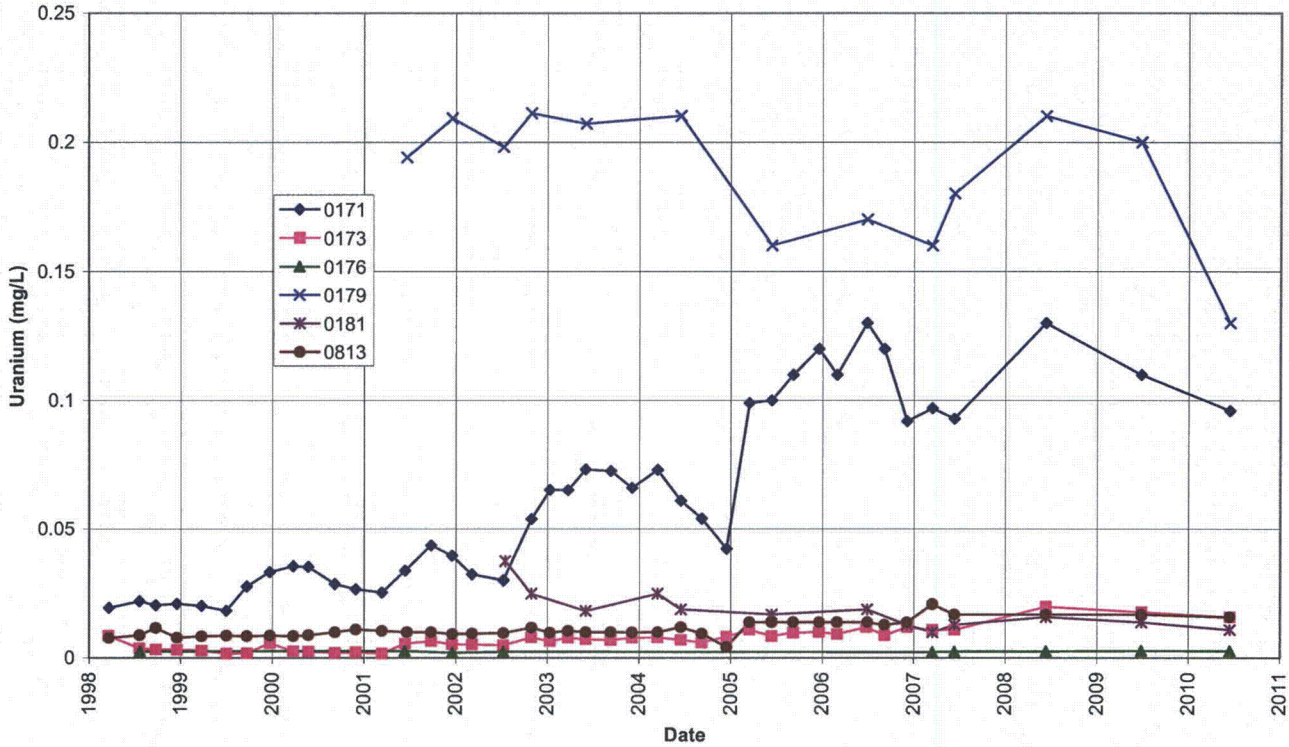

Figure 7–5. Time-Concentration Plot of Uranium in Groundwater at the Green River Disposal Site

Groundwater Level Monitoring—Groundwater levels in several monitoring wells adjacent to the disposal cell have been measured manually since 1991, and continuously with down-hole dataloggers since 1999. Thirteen wells currently have dataloggers, and a telemetry system was installed in 2007 to transmit the continuous water level monitoring data to the DOE Grand Junction Office. The purpose of continuous monitoring is to evaluate the hydraulic gradient and flow directions in the two Cedar Mountain Formation aquifers near the disposal cell.

Water level hydrographs of the POC wells, completed in the middle sandstone aquifer, indicate that the groundwater elevation decreased approximately 3 feet overall from 1998 through 2004, and then increased approximately 8 feet between 2004 and 2007. Water levels have decreased approximately 2–3 feet since 2007, although slight increases occurred in 2010 (Figure 7–6). Manual measurements were false on several occasions, probably because of equipment problems (continuous measurements indicated essentially no change at those times). Figure 7–6 does not show the false measurements.

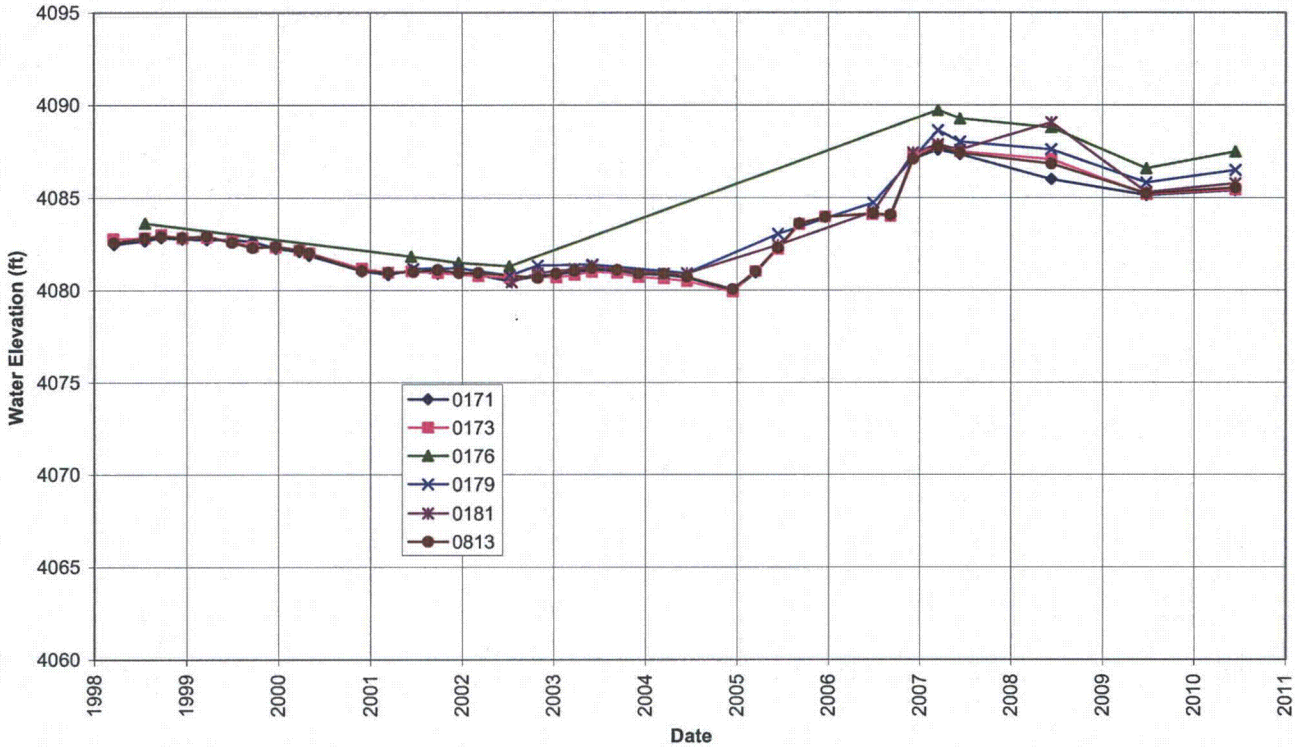

Figure 7–6. Groundwater Elevations at the Green River Disposal Site

The monitoring well locations in the two Cedar Mountain aquifers are not ideal (i.e., no nested well pairs in the upper and lower aquifers) to define both the groundwater flow directions and the hydraulic gradient between the aquifers. However, groundwater elevation data derived from the existing well network are adequate to determine that flow direction in the upper aquifer is toward the west-northwest, while flow direction in the lower aquifer is toward the southwest. The data also suggest that there is a neutral gradient between the two aquifers, therefore neither inducing nor retarding contaminant migration from the contaminated upper aquifer to the uncontaminated lower aquifer.

Browns Wash Alluvium Well Monitoring—Analytical results for the June 2010 sampling event at the wells completed in the Browns Wash alluvium are provided in Table 7–4. Because of the proposed application of supplemental standards, ACLs do not apply to the alluvium groundwater. Contaminants are expected to eventually be flushed out of the alluvium as the groundwater migrates toward the Green River alluvium aquifer and the Green River. Monitoring well MW–0194 is farthest downgradient of the former tailings storage area on the alluvial plane and the closest well to the Green River alluvium aquifer.

Table 7–4. 2010 Analytical Results for the Browns Wash Alluvium Wells at the Green River Disposal Site

Monitoring well	Arsenic (mg/L)	Nitrate[a] (mg/L)	Selenium (mg/L)	Uranium (mg/L)
0188	0.00033	10	0.024	0.083
0189	0.00055	40	0.064	0.27
0192	0.00029	100	0.095	0.44
0194	0.0032	570	0.016	3.9

[a]Nitrate = nitrate plus nitrite as nitrogen
Key: mg/L = milligrams per liter

Concentrations of arsenic, nitrate, and uranium have been steady in wells MW–0188 and MW–0192, but variable in wells MW–0189 and MW–0194. As in 2009, the highest arsenic, nitrate, and uranium concentrations were in well MW–0194. The highest and most variable selenium concentrations have been occurring in well MW–0192. Generally, the groundwater quality degrades from east (upgradient) to west (downgradient). This condition may be indicating that the alluvium groundwater is gradually being flushed out.

7.3.5 Surface Water Monitoring

According to the site conceptual model, the ultimate point of exposure for the groundwater in the middle sandstone unit of the Cedar Mountain Formation is the Green River via seepage through vertical fractures in the overlying formations. Seeps confirm that groundwater is discharging into Browns Wash and its alluvium. Therefore, the locations of potential risk have been considered to be in a backwater area at the mouth of Browns Wash and the Green River itself. Risk analyses have determined, however, that there are no unacceptable risks to potential receptors (human or ecological) at these locations. As a best management practice, DOE monitors the surface water at these two locations to verify that any contaminated groundwater would not harm ecological receptors near the confluence of Browns Wash and the Green River. Table 7–5 provides proposed surface water standards in accordance with Utah Rule R317–2, Table 2.14.2.

Table 7–5. Proposed Surface Water Standards for the Browns Wash and Green River Sampling Locations

Constituent	Surface Water Standard (mg/L)
Ammonia as nitrogen	About 0.5 to 1.0 (pH- and temperature-dependent)
Arsenic	0.150 (4-day)
Nitrate + nitrite as nitrogen	4
Selenium	0.0046 (4-day)
Uranium	No standard

Key: mg/L = milligrams per liter

A location in the Green River immediately downstream of the mouth of Browns Wash (SW–0846) and a location in the backwater area of Browns Wash (SW–0847) are sampled annually. Analytical results for the June 2010 sampling event are provided in Table 7–6. To date, no surface water sample results have exceeded the standards, and there is no indication that disposal site contamination has degraded the surface water quality at these locations.

Table 7–6. 2010 Analytical Results for the Surface Water Locations at the Green River Disposal Site

Location	Ammonia as Nitrogen (mg/L)	Arsenic (mg/L)	Nitrate[a] (mg/L)	Selenium (mg/L)	Uranium (mg/L)
0846 (Green River)	ND	0.0012	ND	0.00048	0.0011
0847 (Backwater)	ND	0.0012	ND	0.00047	0.0012

[a]Nitrate = nitrate plus nitrite as nitrogen
Key: mg/L = milligrams per liter; ND = not detected (below laboratory detection limit)

7.3.6 Corrective Action

Corrective action is taken to correct out-of-compliance or hazardous conditions that create a potential health and safety problem or that may affect the integrity of the disposal cell or compliance with 40 CFR 192.

No corrective action was required in 2010.

7.3.7 Photographs

Table 7–7. Photographs Taken at the Green River Disposal Site

Photograph Location Number	Azimuth	Description
PL–1	350	Disposal cell and security fence; south vehicle gate is in foreground.
PL–2	310	Site marker SMK–2 on the disposal cell top.
PL–3	310	Abandoned mill structures.
PL–4	290	Green River backwater area in Browns Wash.

GRN 3/2010. PL–1. Disposal cell and security fence; south vehicle gate is in foreground.

GRN 3/2010. PL–2. Site marker SMK–2 on the disposal cell top.

GRN 3/2010. PL–3. Abandoned mill structures.

GRN 3/2010. PL–4. Green River backwater area in Browns Wash.

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8.0 Gunnison, Colorado, Disposal Site

8.1 Compliance Summary

The Gunnison, Colorado, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected on June 10, 2010. The disposal cell and all associated surface water diversion and drainage structures were in excellent condition and functioning as designed. Six riprap test areas on the cell apron and diversion ditches were visually inspected; no apparent rock degradation was noted when compared to previous photos. A broken fence strand was repaired, and cottonwood tree saplings were removed from the disposal cell top. No other maintenance needs or cause for a follow-up or contingency inspection were identified.

8.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the Gunnison Disposal Site are specified in the *Long-Term Surveillance Plan* [LTSP] *for the Gunnison, Colorado, Disposal Site* (DOE/AL/62350–222, Rev. 2, U.S. Department of Energy [DOE], April 1997) and in procedures established by DOE to comply with the requirements of Title 10 *Code of Federal Regulations* Part 40.27 (10 CFR 40.27). Table 8–1 lists these requirements.

Table 8–1. License Requirements for the Gunnison Disposal Site

Requirement	Long-Term Surveillance Plan	This Report
Annual Inspection and Report	Section 3.0	Section 8.3.1
Follow-Up or Contingency Inspections	Section 3.5	Section 8.3.2
Routine Maintenance and Repairs	Section 5.0	Section 8.3.3
Groundwater Monitoring	Section 4.1	Section 8.3.4
Corrective Action	Section 6.0	Section 8.3.5

Institutional Controls—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 along the property boundary, and locked gates on the site perimeter. The 92-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 40.27) in 1997. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, is responsible for the custody and long-term care of the site.

Inspectors found no evidence that these institutional controls were ineffective or violated.

8.3 Compliance Review

8.3.1 Annual Inspection and Report

The site, southeast of Gunnison, Colorado, was inspected on June 10, 2010. The results of the inspection are described below. Figure 8–1 shows features and photograph locations (PLs) mentioned in this report. Numbers in the left margin of this report refer to items summarized in the "Executive Summary" table.

8.3.1.1 Specific Site-Surveillance Features

Access Road, Entrance Gate, Signs, and Fence—Access to the site is off Gunnison County Road 42 onto U.S. Bureau of Land Management (BLM) Road 3068 to the site entrance gate. The road to the site is an all-weather gravel road maintained by BLM and was in good condition.

The entrance gate is a simple barbed-wire gate in the stock fence that surrounds the site. The entrance gate, located along the south portion of the perimeter fence, was secured by a padlock and chain to the adjoining post and was in good condition. Two other locked barbed-wire gates—one on the north fence line and the other on the east fence line—provide monitoring well access. The gates were locked and in excellent condition.

8A A three-strand, barbed-wire fence delineates the site; most of it is set along the property boundary. A broken strand near the site entrance was repaired; otherwise, the fence was in good condition.

The entrance sign, at the south entrance gate, was in good condition. Forty-five perimeter signs are bolted to the perimeter fence posts and were in good condition.

Site Markers and Monuments—Both granite site markers, SMK–1 (just inside the south entrance gate) and SMK–2 (on top of the disposal cell), were in good condition. Combined survey/boundary monuments (SM–1/BM–1, SM–2/BM–2, and SM–3/BM–3) and eight additional boundary monuments (BM–4 through BM–11) also were in good condition.

Monitoring wells—Sixteen wells constitute the groundwater monitoring network at the disposal site. Six of the wells are for monitoring cell performance, two are for monitoring background groundwater quality, and eight are for water level measurements. The wells were secure and in good condition (PL–1).

8.3.1.2 Transects

To ensure a thorough and efficient inspection, inspectors divided the site into four areas called "transects": (1) the riprap-covered disposal cell; (2) the riprap-covered side slopes, apron, and diversion ditches; (3) the area between the disposal cell and the site boundary; and (4) the outlying area.

The area inside each transect was inspected by walking a series of traverses. Within each transect the inspectors examined specific site-surveillance features, drainage structures, and vegetation, along with other features. Inspectors also looked for evidence of settlement, erosion, or other modifying processes that might affect the site's integrity or long-term performance.

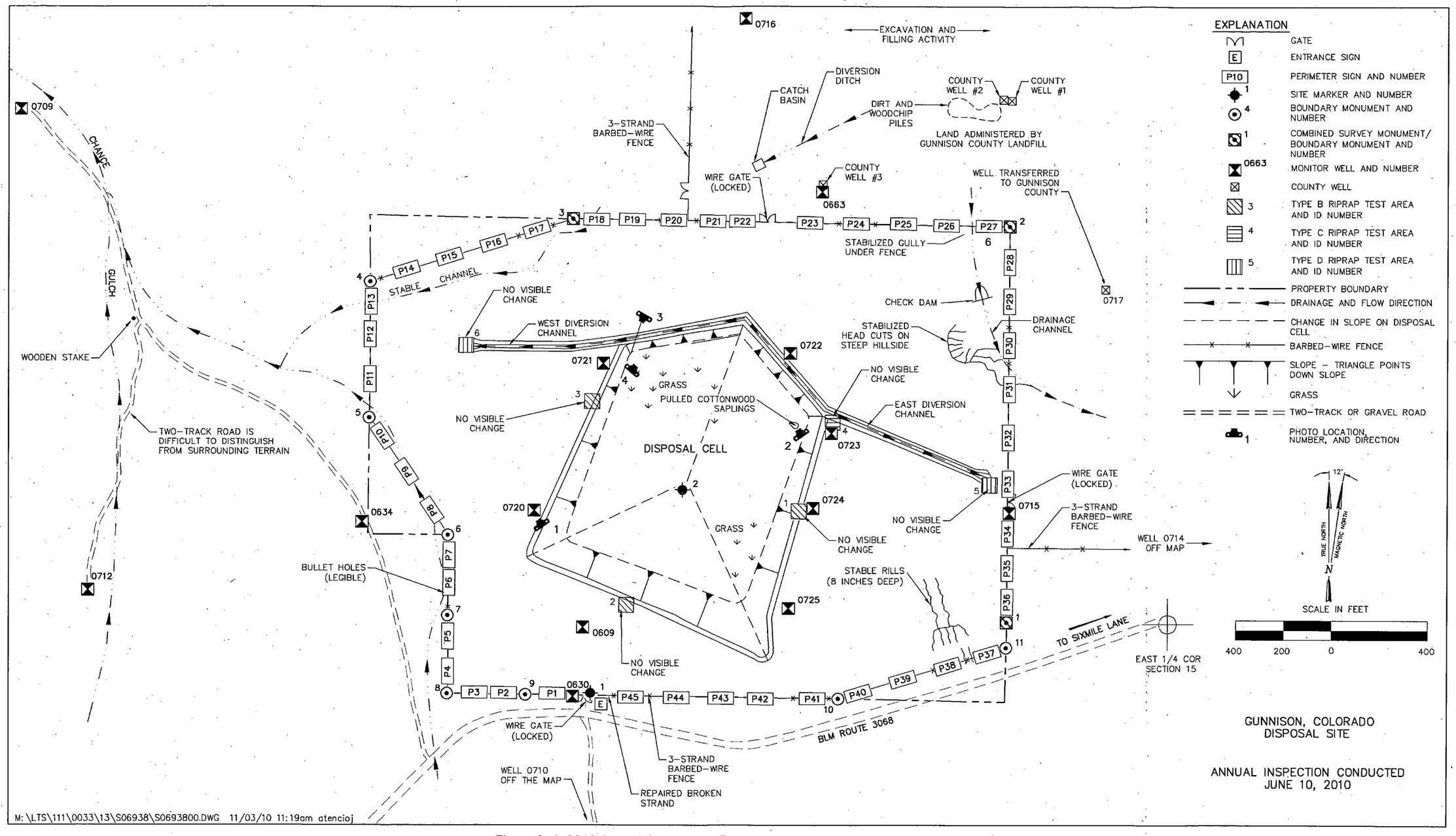

Figure 8–1. 2010 Annual Compliance Drawing for the Gunnison Disposal Site

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Top of the Disposal Cell—The top of the disposal cell was in excellent condition. There was no evidence of erosion, settling, slumping, or rock degradation. Several isolated patches of grass are randomly distributed over the disposal cell cover; however, these shallow-rooted plants are not a cause for concern. Four small cottonwood tree saplings were pulled out (PL–2); no other deep-rooted plants were observed on the disposal cell top.

8B

Side Slopes, Apron, and Diversion Ditches—The riprap-covered side slopes, apron, and diversion ditches were in good condition (PL–3). No evidence of slumping, settling, rock degradation, or encroachment of vegetation was observed.

The condition of the riprap in six monitoring test areas was visually inspected. The test areas, each roughly 1 square meter in area, are in critical flow path locations in the apron and diversion channels. The corners of each monitoring plot are marked with orange paint; new paint was applied during the inspection. The riprap in all the test areas was in excellent condition. When the rocks were compared to the photos taken of them in 2007, there was no evidence that individual rocks had split or otherwise been degraded. As outlined in the LTSP, annual photographing and comparing of these test areas was performed through 2002; after that, the LTSP requires the test areas to be photographed every 5 years (through 2017). The next photos will be taken in 2012.

At the southeast corner of the cell apron, water draining off of the cell occasionally ponds in a low-lying area along the edge of the riprap. The riparian-type vegetation that has become established in this area indicates that the area retains moisture much of the time. Water collection in this area does not pose a problem because the cell is designed to drain to the southeast, and any water that ponds there is below the elevation of the entombed tailings material. This location was dry at the time of the inspection.

Area Between the Disposal Cell and the Site Boundary—There are reclaimed and undisturbed areas between the disposal cell and the site perimeter. Both types of areas are in excellent condition. In general, reclaimed areas have good vegetation coverage, mostly grass. As expected, shrubs and forbs are much less abundant and less diverse in reclaimed areas than they are in undisturbed areas. Overall, however, the vegetation at the site is very healthy.

Several locations in areas of steep topography had been susceptible to erosion in the past. Snowmelt runoff caused minor rill erosion and sediment deposition in 2008 at a location near the southeast corner of the site. This area appeared stable at the time of the inspection. All other areas were stable, with no evidence of new erosion.

Outlying Area—Gunnison County owns the land that adjoins the disposal site boundary to the north and east, and uses the land for a municipal landfill. In 2001, the County installed several fences and monitoring wells in these areas. The monitoring wells are identified as County Wells 1, 2, and 3 on Figure 8–1. DOE transferred monitoring well MW–0717 to the County in 2001. Gates installed in the County fence for access to the wells remain unlocked.

Landfill operations have encroached to within approximately 400 feet of the northeast corner of the DOE property boundary (PL–4). A diversion ditch and catchment basin were constructed on landfill property north of the site. These features were constructed to control runoff and sediment transport onto landfill property. Although landfill activities do not appear to threaten the DOE

disposal site, future inspections will continue to monitor the level of activity occurring near the DOE property boundaries and site-surveillance features (e.g., fences, monitoring wells).

8.3.2 Follow-Up or Contingency Inspections

DOE will conduct follow-up inspections if (1) an annual inspection or other site visit reveals a condition that must be reevaluated during a return to the site, or (2) a citizen or outside agency notifies DOE that conditions at the site are substantially changed.

No follow-up or contingency inspections were required in 2010.

8.3.3 Routine Maintenance and Repairs

A broken fence strand was repaired, and cottonwood tree saplings were removed from the disposal cell top.

8.3.4 Groundwater Monitoring

8C DOE monitors groundwater at the Gunnison Disposal Site to demonstrate compliance with U.S. Environmental Protection Agency groundwater protection standards in 40 CFR 192.03 and to demonstrate that the disposal cell is performing as designed. The monitoring network consists of 16 wells, including six point-of-compliance wells to monitor cell performance, two background wells, and eight wells for water level measurements (Table 8–2).

In accordance with the LTSP, groundwater was sampled and water levels were measured annually from 1998 through 2001. Following the 2001 sampling event, the monitoring frequency changed to once every 5 years. Monitoring last occurred in 2006. The indicator analyte for cell performance is uranium. Uranium concentrations at monitoring locations have not exceeded background levels, indicating that the disposal cell is performing as designed. No groundwater sampling or measurements were required in 2010. The next sampling event is scheduled for 2011.

Table 8–2. Active Monitoring wells at the Gunnison Disposal Site

Point-of-Compliance and Background Wells	Water Level Wells
MW–0720 (point-of-compliance)	MW–0630
MW–0721 (point-of-compliance)	MW–0634
MW–0722 (point-of-compliance)	MW–0663
MW–0723 (point-of-compliance)	MW–0709
MW–0724 (point-of-compliance)	MW–0710
MW–0725 (point-of-compliance)	MW–0712
MW–0609 (background)	MW–0714
MW–0716 (background)	MW–0715

8.3.5 Corrective Action

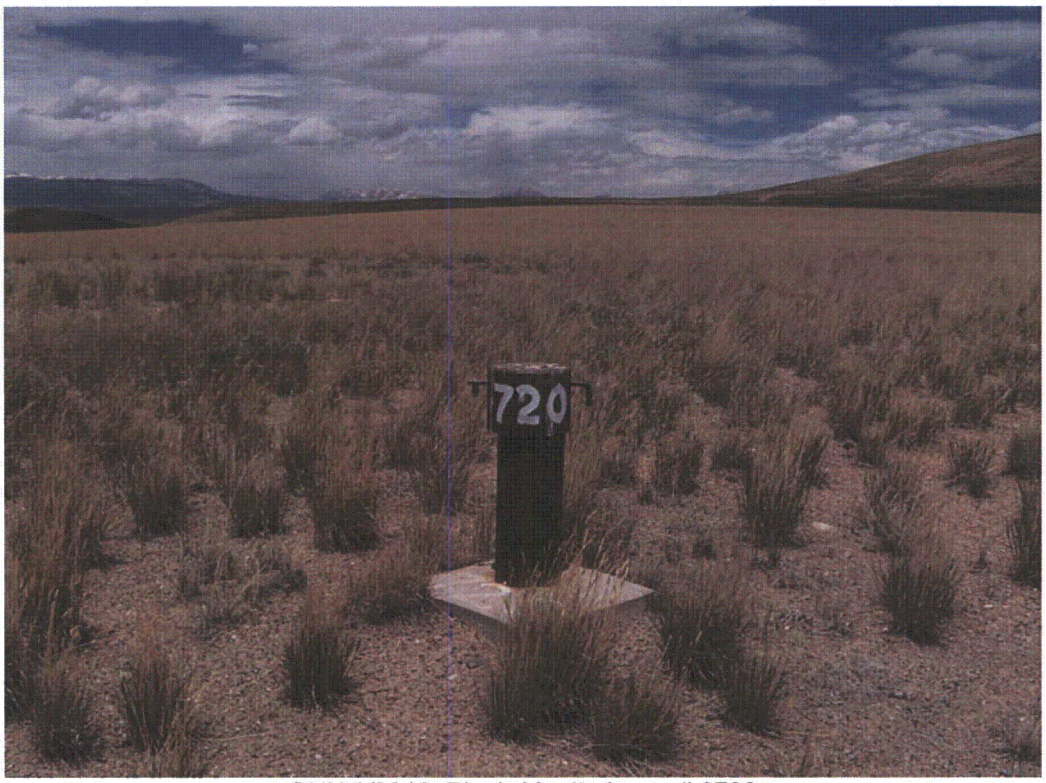
Corrective action is taken to correct out-of-compliance or hazardous conditions that create a potential health and safety problem or that may affect the integrity of the disposal cell or compliance with 40 CFR 192.

No corrective action was required in 2010.

8.3.6 Photographs

Table 8–3. Photographs Taken at the Gunnison Disposal Site

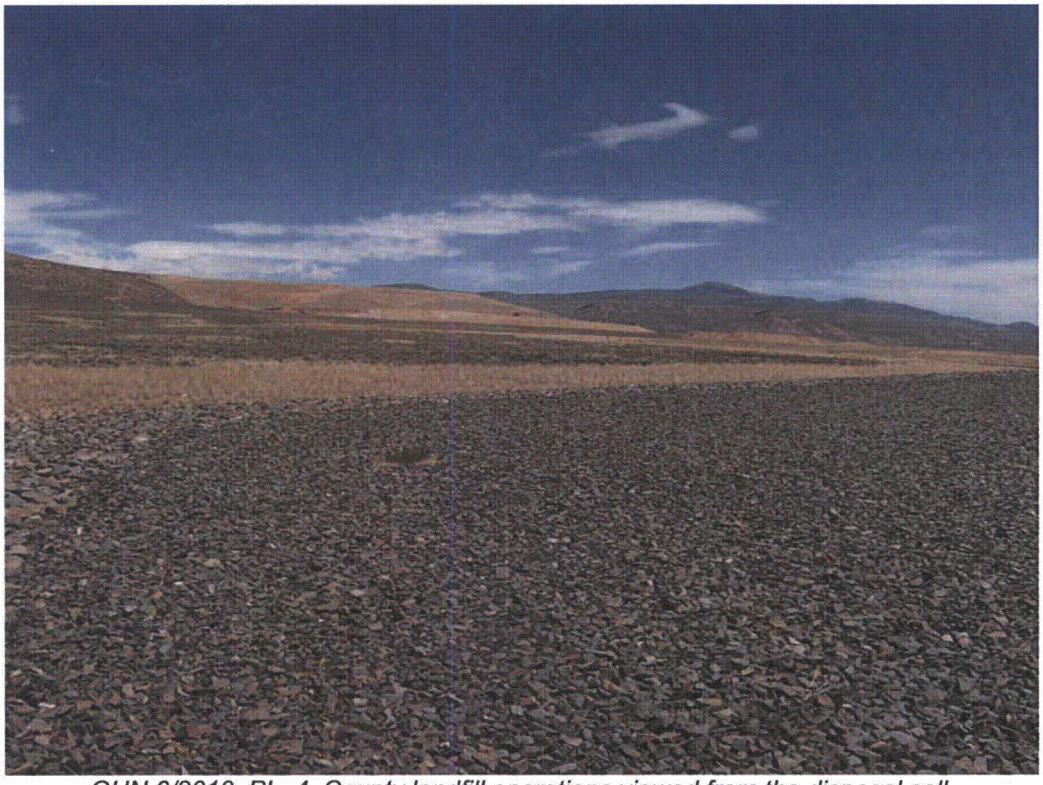
Photo Location Number	Azimuth	Description
PL–1	325	Monitoring well 0720.
PL–2	325	Cottonwood tree saplings prior to removal.
PL–3	210	Northwest side slope of the disposal cell.
PL–4	40	County landfill operations viewed from the disposal cell.



GUN 6/2010. PL–1. Monitoring well 0720.

GUN 6/2010. PL–2. Cottonwood tree saplings prior to removal.

GUN 6/2010. PL–3. Northwest side slope of the disposal cell.



GUN 6/2010. PL–4. County landfill operations viewed from the disposal cell.

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9.0 Lakeview, Oregon, Disposal Site

9.1 Compliance Summary

The Lakeview, Oregon, Uranium Mill Tailings Radiation Control Act (UMTRCA) Title I Disposal Site was inspected by the U.S. Department of Energy (DOE) on August 30–31, 2010, and was in good condition. Monitoring was conducted during the annual inspection to further assess the degradation of erosion control rock riprap on the west side slope of the cell. A geotechnical hole investigation was conducted in May 2010 to assess saturated conditions within the disposal cell. Flux meter monitoring continued at the site during 2010. The monitoring and geotechnical investigation are discussed in Section 9.3.1. Excluding the rock degradation concerns, the cell appears to be in good condition. No cause for a follow-up inspection was identified.

9.2 Compliance Requirements

Requirements for the long-term surveillance and maintenance of the Lakeview Disposal Site are specified in the *Long-Term Surveillance Plan for the Collins Ranch Disposal Site, Lakeview, Oregon* (DOE/AL/62350–19F, Rev. 3, DOE, August 1994, as revised) and in procedures established by DOE to comply with the requirements of Title 10 *Code of Federal Regulations* Part 40.27 (10 CFR 40.27). These requirements are listed in Table 9–1.

Table 9–1. License Requirements for the Lakeview Disposal Site

Requirement	Long-Term Surveillance Plan	This Report
Annual Inspection and Report	Section 6.1	Section 9.3.1
Follow-Up or Contingency Inspections	Section 7.0	Section 9.3.2
Routine Maintenance and Repairs	Section 8.0	Section 9.3.3
Groundwater Monitoring	Section 5.3	Section 9.3.4
Corrective Action	Section 9.0	Section 9.3.5

Institutional Controls—The 40-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 40.27) in 1995. DOE is the licensee and, in accordance with the requirements for UMTRCA Title I sites, is responsible for the custody and long-term care of the site. Institutional controls 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 along the property boundary, and a locked gate at the entrance to the site. Inspectors found no evidence that these institutional controls were ineffective or violated.

9.3 Compliance Review

9.3.1 Annual Inspection and Report

The site, northwest of Lakeview, Oregon, was inspected on August 30–31, 2010. The results of the inspection are described below. Figure 9–1 shows features and the photograph locations (PLs) mentioned in this report. Numbers in the left margin of this report refer to items summarized in the "Executive Summary" table.

Seismic Activity—The Lakeview Disposal Site is in a seismically active region. The United States Geological Survey National Earthquake Information Center notifies DOE when earthquakes of magnitude 3.0 or greater occur within 0.3 degrees (about 20 miles) of a disposal cell and when earthquakes of magnitude 5.0 or greater occur within 1.0 degree (about 70 miles) of a disposal cell. No seismic activity at or exceeding the reporting threshold occurred in 2010.

9.3.1.1 Specific Site-Surveillance Features

Access Road, Entrance Gate, Fence, and Signs—Access to the site is gained by traveling a gravel road that heads west off County Road 2-16B. DOE was granted a perpetual easement on the 1.2-mile access road between the County road and the DOE property boundary. A locked gate across the access road on the adjacent privately owned land limits access to the site. The access road is in good condition. The site gate and the pedestrian gate were locked and in good condition.

The site entrance sign and the 12 perimeter signs were in good condition. The site boundary fence is generally in good condition, but some loose wire strands were noted along the southwest and southeast fence line; tightening of the fence in these areas will be needed within the next few years as will some pruning of vegetation near the fence line.

Site Markers and Monuments—The two site markers, three survey monuments, and three boundary monuments are in good condition.

Monitoring wells—The groundwater monitoring network is comprised of eight point-of-compliance wells (four monitoring well pairs: MW–0602/MW–0609, MW–0603/MW–0608, MW–0604/MW–0607, and MW–0605/MW–0606) located east and south of the cell and one up-gradient compliance well (MW–0515) located west of the disposal site. All nine wells were inspected and found locked and in good condition.

Seven additional DOE-owned monitoring wells (MW–0513, MW–0514, MW–0516, MW–0520, MW–0521, MW–0522, and MW–0523) exist near the site but are not part of the compliance monitoring network. These wells were not inspected during the 2010 annual inspection, but were in good condition during the 2009 inspection.

9.3.1.2 Transects

To ensure a thorough and efficient inspection, inspectors divided the site into three areas called "transects": (1) the top of disposal cell; (2) the side slopes of the disposal cell and adjacent drainage channel, aprons, and trench drains; and (3) other on-site areas, the site perimeter, and outlying area.

The area inside each transect was inspected by walking a series of traverses. Within each transect, the inspectors examined specific site-surveillance features, drainage structures, vegetation, and other features. Inspectors also looked for evidence of settlement, erosion, or other modifying processes that might affect the site's integrity or long-term performance.

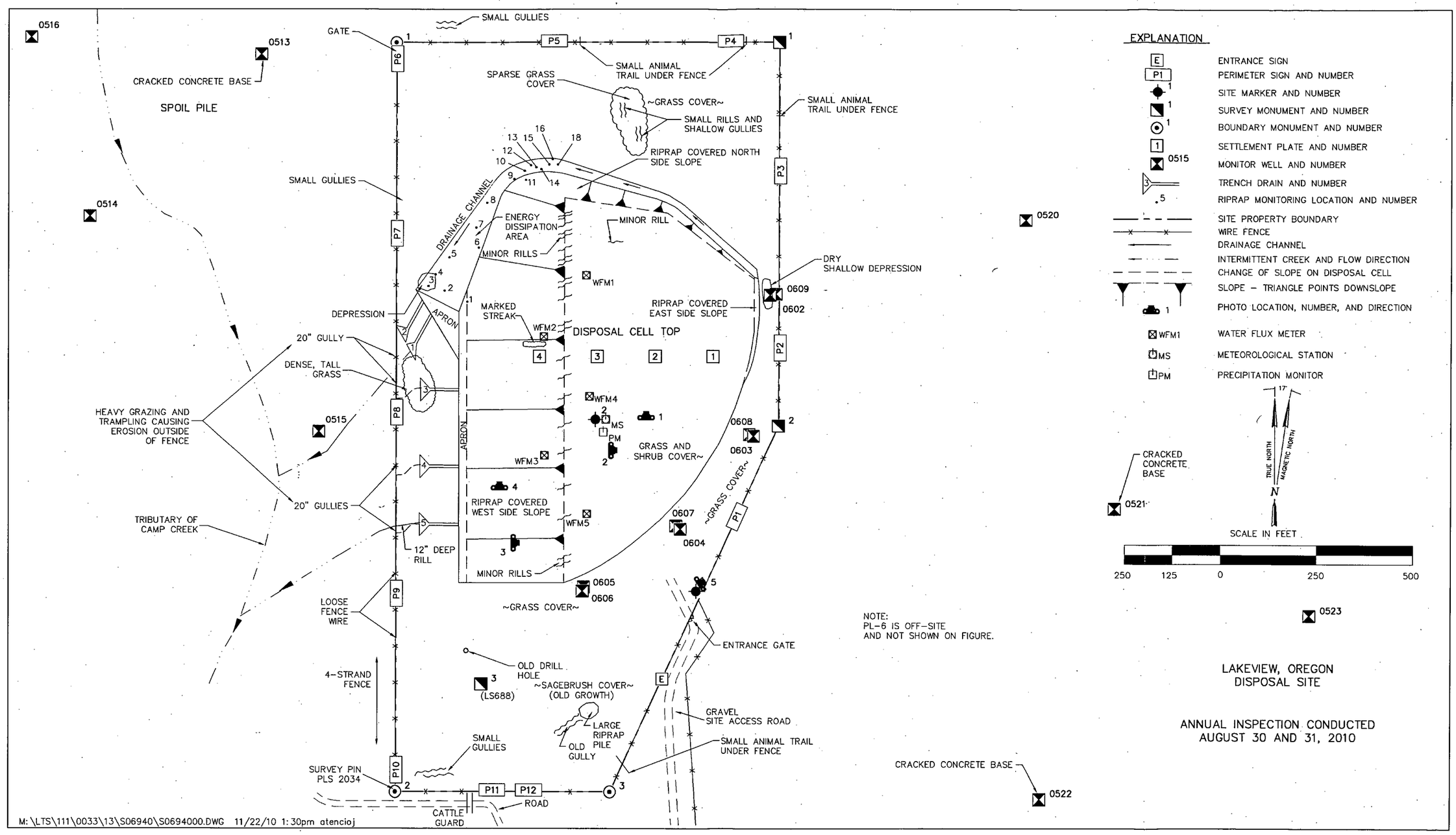

Figure 9–1. 2010 Annual Compliance Drawing for the Lakeview Disposal Site

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Top of the Disposal Cell—The top-slope cover shows no sign of cell settlement, displacement, or slumping. At the time of cell construction, the entire cell top slope was covered in 12 inches of Type A riprap with 4 inches of soil placed over the riprap. The soil was included to allow for a grass cover to be established, which would help minimize the visual impacts of the cell. The design for the top of the disposal cell has created conditions that favor the growth of deep-rooted plants. The growth of shrubs is favored by movement of precipitation through the riprap, bedding, and compacted soil (radon barrier) layers. Grasses and forbs (rabbitbrush, sagebrush, and bitterbrush plants) growing on the top of the disposal cell have gradually increased over the years and areas of deeper-rooted wheatgrasses have spread. Some sparsely vegetated areas still exist on the top of the disposal cell, but to a lesser extent than was observed during the 2009 inspection.

Riprap was observed through the soil on the top slope in numerous small areas during the inspection. The areas ranged in size from approximately 4 inches to 1.5 feet. These areas are likely caused by the infilling of the soil into the riprap void spaces. No structural or cell performance concerns are associated with the riprap becoming visible on the top slope. A photograph of riprap showing through top-slope cover soil is shown in PL–1. Some minor rilling was also noted on the north portion of the top slope. This area should be monitored, but it does not signify a potential problem because it is underlain by riprap.

The contact boundary between the cell top and side slopes was inspected. No evidence of erosion was observed along the north contact. However, approximately 25 areas with minor erosion rills were observed in the top-slope soil cover along the west contact. No substantial change in these rills was noted compared to the 2009 inspection. At a few locations, dispersed soil was deposited as delta formations in the rock riprap adjacent to where the rill channels entered the side slope, showing how the water contacted the rock and became dispersed and fanned out. These delta formations indicate that flow channelization does not occur when runoff water enters the side slope. The riprap rock cover is continuously present beneath the top-slope soil cover and the slope crest, and continues as the side slope. No structural or cell performance concerns are associated with the presence of the rills, but they will continue to be monitored during future annual inspections.

Disposal Cell Cover Performance Evaluation—Past field investigations at the site indicate that a combination of soil development and root intrusion by the deep-rooted shrubs has increased the hydraulic conductivity of the radon barrier in the cell cover, allowing meteoric water to percolate into the underlying tailings.

Encroachment by deep-rooted shrubs was observed shortly after the construction of the disposal cell was completed in 1989. As designed and constructed, the cover is a favorable habitat for deep-rooted plants. Root intrusion and soil development have increased the permeability of the radon barrier. In situ tests have shown that the saturated hydraulic conductivity of the radon barrier ranges between 1×10^{-6} and 1×10^{-4} centimeters per second (cm/s). The design target was 1×10^{-7} to 1×10^{-8} cm/s.

In 2005, LM began an evaluation of a new device called a water fluxmeter, a passive wicking lysimeter, to directly measure percolation flux through the Lakeview disposal cell cover. Three water fluxmeters installed in holes augered through the top slope of the cover and into tailings capture percolation just below the compacted soil layer in the cover. Monitoring results showed

significant percolation through the cover. Cumulative percolation averaged 996 millimeters during 2006, 186 millimeters during 2007, 444 millimeters during 2008, and 155 millimeters during 2009. These values are assumed to be greater than the mean percolation for the cover because the three water fluxmeters were intentionally placed in downslope locations where water accumulates in the sand drainage layers. The evaluation also included monitoring moisture content in the tailings. Tailings beneath the side slope of the disposal cell remained saturated during the entire 5-year period.

To address concerns about the potential for high percolation flux and saturated tailings to leach contaminants into groundwater and the potential for seismic activity to render the disposal cell slope unstable, the DOE conducted an investigation on May 12–14, 2010 (PL–2). The investigation followed the *Geotechnical Hole Field Plan* (April 2010), which was concurred
9A upon by the NRC. Information obtained during the field activities and determinations made as a result of the investigation were submitted to NRC in a Summary of Results letter dated August 25, 2010. Results of this investigation concluded that widespread saturated conditions did not exist within the cell and that a special follow-up inspection was not warranted with respect to slope stability.

Side Slopes of the Disposal Cell and Adjacent Drainage Channel, Aprons, and Trench Drains—No evidence of settlement, displacement, or slumping was observed in these areas during the inspection. Concerns about the size and durability of the riprap are discussed below under "Riprap Condition Evaluation."

Grass has encroached on the riprap on the north side slope, on the upper (eastern) part of the drainage channel, on the energy dissipation area (EDA) at the lower end of the drainage channel, and on the western apron area. Localized grasses in these areas are now well established but they do not degrade the function of the erosion control protection system.

Riprap Condition Evaluation—Degradation of erosion control basalt rock riprap, observed at the site since the mid-1990s, has been monitored as part of the annual inspections, as identified in the long-term surveillance plan (LTSP), to determine the mean diameter (D_{50}) value of the riprap on the west side slope. The rock deterioration is likely due to physical weathering and chemical processes. It is an ongoing concern because the riprap was sized to withstand the erosive energy of precipitation events. The percentage of crumbling rocks on the surface appears to have increased since the mid-1990s and rock degradation continues to be observed.

A revision to the LTSP required that DOE annually determine the D_{50} value of the west side slope riprap through gradation monitoring to ensure that the riprap is large enough to protect the disposal cell from a major precipitation event. This gradation monitoring method measures the number of rocks retained per sieve size. In 2010 the monitoring was performed for the 14th consecutive year (PL–3). An additional sieve size (less than 1 inch) was added to the procedure during the 2009 monitoring and was included again in the 2010 monitoring. Sampling locations are randomly selected prior to each monitoring event. Data was collected at 20 random locations, and approximately 25 rocks were sampled at each location. An evaluation of the rock size measurement data from 2010 indicates that the west side slope riprap D_{50} is 2.43 inches with a 95 percent confidence interval between 2.27 and 2.59 inches.

Results of the 2010 gradation monitoring, including a graph showing the results since 1997, are provided as Appendix A. The 2010 D_{50} value is 0.04 inch less than the value of 2.47 inches measured during the 2009 monitoring. As shown on the graph, the downward curve of D_{50} values

is becoming more level over the past eight years, which may indicate that the degradation rate of the riprap has slowed. Prior results indicated a gradual overall decrease in the cover rock D_{50} size by about 20 percent.

DOE collected rock samples during the 2010 inspection at ten of the monitoring locations for gradation analysis by a third-party geotechnical laboratory to further monitor the riprap degradation and to evaluate whether corrective actions are required, as specified in the LTSP. Each sample was collected from the entire riprap profile (PL–4). The samples were analyzed by Budinger & Associates, Inc., using American Society for Testing and Materials Method D5519, "Standard Test Methods for Particle Size Analysis of Natural and Man-Made Riprap Materials." Sieves used in the testing included 6-, 5-, 4-, 3-, 2-, and 1-inch sizes. The determined D_{50} by weight value is 2.24 inches. This value possesses a 95 percent confidence interval limit of 1.96 to 2.52 inches within a range of 1.22 to 2.72 inches. The results of the laboratory gradation monitoring are provided as Appendix B.

9B As specified in the LTSP, the original cell design required a D_{50} design range envelope of 2.7 to 3.9 inches for Type B side slope riprap gradation to ensure that the cell is protected from erosion. Because both the 2010 D_{50} values (by rock count retained on the sieve and by weight) are less than this size, DOE is currently considering D_{50} recalculations using more current site hydrology information and other options to ensure continued long-term erosion protection for the cell.

At the request of NRC, the DOE performed rock durability monitoring during the 2009 inspection and again in 2010 to further monitor the riprap degradation and to evaluate whether corrective actions are required, as specified in the LTSP. The durability monitoring followed a draft procedure that NRC reviewed and a revised rock classification, which is shown in Table 9–2. The table identifies the rock types, provided rock descriptions, and assigned a durability class and code (ranging from "highly durable" to "nondurable – crumbled/rubblized"), and is representative of the rocks found on the side slopes. The Table 9–2 durability classes were assigned by a geologist/mineralogist's examination of the rocks and are not based on laboratory durability testing standards. Each rock used for the gradation monitoring was classified during the durability monitoring into one of eight durability classes (A, B, Ca, Cb, Da, Db, E, and F). As requested by the NRC, for the 2010 monitoring the Durability Class A rock was divided into 4 subclasses: unfractured (Au), hairline fractured (Ah*, where the * indicated the number of fractures present; e.g., Ah3), open fractured (Ao*, where the * indicated the number of fractures present; e.g., Ao3), and a rock that had split since placement on the cell (As).

The durability monitoring was conducted in conjunction with the gradation monitoring, using the same rocks. After the size of a rock was determined, the rock was handed to the project geologist/mineralogist for rock type identification. The associated durability class (or subclass) code was then recorded under the appropriate rock size column for that sample location.

Results of the durability monitoring, provided in the 2010 Durability Summary Table in Appendix A, show that most of the rocks (67.4 percent) are classified as having a durability class of "highly durable" or "durable." The majority of the rocks are Durability Class A (47.2 percent) with a durability class of "highly durable," followed by Class B (20.2 percent) with a durability class of "durable," and Class Ca (14.4 percent) with a durability class of "moderately durable". The final four durability classes (Classes Cb, Da, Db, and E) comprise single digit percentages of the total number of rocks classified (494) and have durability classes ranging from "moderately durable" to "nondurable-crumbled/rubblized." No Class F rock was identified. Of the Class A

rock, 27.7 percent are Subclass Au, 13.8 percent are Subclass Ah with 1 to 4 hairline fractures, 4.8 percent are Subclass Ao with 1 to 5 open fractures, and 0.8 percent are Subclass As.

Table 9–2. Rock Type and Durability Class

Rock Type Identification Number	Rock Type Description	Durability Class	Durability Class Code	Durability Subclass Code
1	Dense, hard, very fine-grained, dark gray basalt with no joints, fractures, white deposits, or alteration.	Highly Durable	A	Au
	As above in Au, except with tight, hairline fracture(s). Asterisk indicates the number of tight, hairline fractures.		A	Ah*
	As above in Au, except with open fracture(s). Asterisk indicates the number of open fractures in the rock that are ready to split.		A	Ao*
	As above in Au, except that the rock has split along fractures since placement on the cover, but the rocks are still in place.[1]		A	As
2	Dense, hard, dark gray to grayish brown, olivine basalt. No joints or white deposits; olivine phenocrysts have altered to amber and brown material representing various minerals such as iddingsite, antigorite, chlorite, and nontronite. On some exposed surfaces, altered olivine phenocrysts have weathered out to give a vesicular appearance.	Durable	B	----
3a	Dense, fine-grained, grayish brown to brown basalt with hairline fractures. Basalt is slightly altered and fractured outer surfaces have a brown, limonite-like coating.	Moderately Durable	Ca	----
3b	Greenish gray to green, dense basalt with hairline fractures. Some fractures may have white or light brown coatings. Deuteric and hydrothermal alteration have imparted a distinctive greenish cast to the basalt resulting from alteration of calcic plagioclase to the more sodic plagioclase, albite-oligoclase.	Moderately Durable	Cb	----
4a	Fine-grained, highly fractured gray to greenish gray basalt. Hairline to open fractures are mostly coated with white to pink calcite and commonly with the zeolite mineral, analcime.	Susceptible to Near-Term Degradation	Da	----
4b	Greenish gray to grayish brown olivine basalt that is highly fractured. Olivine phenocrysts have altered to brown material, possibly nontronite.	Susceptible to Near-Term Degradation	Db	----
5	Fine- to medium-grained, soft, grayish green, highly altered basalt. Rock has a granular appearance, has relatively low specific gravity, is probably highly chloritized, and it has commonly disintegrated (rubblized) into pieces smaller than 1 inch in diameter.	Nondurable - Crumbled/ Rubblized	E	----
6	Non-basaltic rocks such as sandstone or quartzite.	Highly Durable to Nondurable	F	----

[1] "As" must be determined while the rocks are still in place on the side slope before the rocks are picked up for gradation monitoring. The size of the monitored rock reflects the size of the selected/marked split piece, not the size of the pre-split rock.

The results of the 2010 durability monitoring are similar to those determined in 2009 with a greater percentage of the rock classified in 2010 being Durability Class A and a lesser percentage being Class Ca.

The Durability Summary Table (Appendix A) also shows the correlation between rock size and rock class. Of rocks larger than 3 inches, the greatest percentage were Class B "durable" rock. Specifically, 65.4 percent of the 4-inch rock and 31.7 percent of the 3-inch rock were Class B "durable" rock. The data indicate the majority of the rocks (37.7 percent) are retained on the 1.5 inch sieve. Of these rocks, approximately 35 percent are Subclass Au (unfractured Class A rock). A majority (56.3 percent) of the 1 inch rock is also Class Au rock. These data may indicate that although the Class A rock is the most resistant, it has weathered into smaller sizes (less than 2.5 inches in diameter) since being placed on the disposal cell. Class B rocks have remained the largest rocks; however, all rocks have weathered and have become smaller than the original design sizes.

No significant changes in the amount or sizes of "streaks" (defined as areas with smaller-sized rocks generally elongated down the slope) on the west side slope was noted during the inspection. Examination of the "streak" that was marked with paint during the 2009 inspection showed no expansion.

The annual photographic monitoring of the 18 photograph points for long-term rock monitoring was conducted in the EDA. Photographs of locations 6 and 11 were not obtained during this inspection due to camera malfunctions. Minor rock degradation has been observed since monitoring began at the original ten photographic locations established in 1997 and at the eight additional locations established in 2000. The rock type used in the EDA and drainage channel areas was much more homogeneous than the varied rock types on the side slopes and appeared to be predominantly Class B rock in good condition.

Water previously observed at times in the large depression in the EDA at the lower end of the drainage channel was absent. Water is potentially a concern because inundation may accelerate deterioration of the large riprap by the freeze-thaw process, although the Class B rock is apparently not as susceptible to freeze-thaw as other rock types present on the cell.

Site Perimeter and Outlying Area—This transect includes the seeded grass area extending from the disposal cell to the site boundary, the site fence, and the native shrub and grass communities within 0.25 mile surrounding the site.

An area (approximately 50 feet by 15 feet) located up-gradient of the drainage channel, near monitoring wells MW–0602 and MW–0609, was observed as a shallow depression. The area was dry but showed evidence of previously ponded water (with a maximum depth of approximately 6 inches). The depression has been noted in the last two inspection reports and does not appear significant. No maintenance is recommended at this time.

Gullies that formed in seeded areas extending west of trench drains 1 through 5 were filled with rock in 2000. Although the rock has generally arrested the head cutting that was proceeding from the Byers property onto the DOE property, some minor head cutting has continued to develop. Several small gullies have formed in heavily grazed areas downslope of the fence line onto the Byers property and were identified during previous inspections. No indication of recent erosion

was observed. Although no repairs are warranted at this time, the area will likely need minor maintenance in the next few years.

Small gullies were identified in past years along the southern side of the site inside the fence. These gullies are located downhill of an inclined road that intersects the fence line near a cattle guard and probably represent overflow along the road during rain events. This area has not shown evidence of recent erosion. No maintenance is required in this area.

Several small rills and shallow gullies were also observed on-site in the area north of the cell where grass reestablishment has been limited. Although no maintenance is required in this area, this area should be watched to ensure that conditions do not degrade.

DOE installed fence flags along various portions of the site fence during August and November 2010 to make the fence more visible to deer and to reduce incidents of deer mortality as a result of entanglement in the fence (PL–5).

Some changes were observed in the areas adjacent to the site. A residential structure is being constructed on private property adjacent to the site access road gate. Unimproved roadways had been bladed on the private property adjacent to the access road fence line. The new road (PL–5) extends along the fence at the east side of the site (north of the site entrance gate), and along the north fence. This road appears to have been placed to provide better vehicular access to grazing cattle. Additionally, a small structure, which appeared to be a clubhouse or observation hut, was being constructed on top of Augur Hill, which is adjacent to the site to the north (PL–6).

9.3.2 Follow-Up or Contingency Inspections

DOE will conduct follow-up inspections if (1) an annual inspection or other site visit reveals a condition that must be reevaluated during a return to the site, or (2) a citizen or outside agency notifies DOE that conditions at the site are substantially changed.

No follow-up or contingency inspections were required in 2010.

9.3.3 Routine Maintenance and Repairs

No routine maintenance or repairs were performed at the site in 2010.

9.3.4 Groundwater Monitoring

9C DOE monitors groundwater quality in the uppermost aquifer at this site once every 5 years to demonstrate that the disposal cell is not leaching contaminants. No groundwater monitoring was performed in 2010. The most recent sampling event was performed in 2009. Constituents analyzed every 5 years include arsenic, cadmium, and uranium. Maximum concentration limits (MCLs), established by the U.S. Environmental Protection Agency (EPA) in Table 1 to Subpart A of 40 CFR 192, are 0.05 milligrams per liter (mg/L) for arsenic, 0.01 mg/L for cadmium, and 0.044 mg/L for uranium. Concentrations of these constituents were well below their respective limits in 2009. They also were consistent with sampling results from 2004 and remained within the historical range. Based on the monitoring results to date, there is no indication of any degradation of groundwater in the vicinity of the site. The next cell performance monitoring is scheduled for 2014.

9.3.5 Corrective Action

Corrective action is taken to correct out-of-compliance or hazardous conditions that create a potential health and safety problem or that may affect the integrity of the disposal cell or compliance with 40 CFR 192.

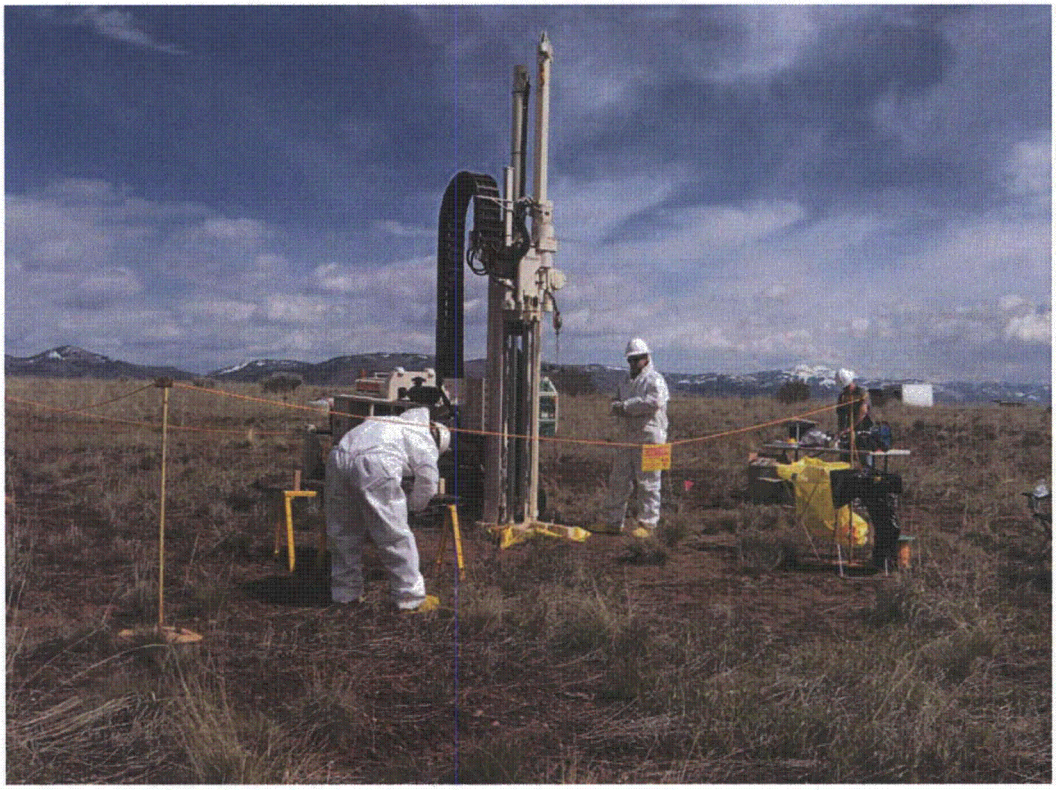
No corrective action was required in 2010.

9.3.6 Photographs

Table 9–3. Photographs Taken at the Lakeview Disposal Site

Photo Location Number	Azimuth	Photograph Description
PL–1	NA	Disposal cell top cover with some riprap showing through the soil.
PL–2	90	May 2010 Geoprobe investigation into cell cover.
PL–3	90	Using grid to mark rocks to be used for gradation and durability monitoring on west side slope.
PL–4	NA	Collecting rock samples from beneath the monitored area for laboratory gradation analysis. Rock profile is collected down to bedding layer for each sample. Sampling in progress.
PL–5	30	New road adjacent to east site fence. Road is not on disposal site. White fence flag shown on fence.
PL–6	190	View south of new structure being constructed on top of Augur Hill. Shows NRC, Oregon, and S.M. Stoller Corporation representatives.

LKV 8/2010. PL–1. Disposal cell top cover with some riprap showing through the soil.



LKV 8/2010. PL–2. May 2010 Geoprobe investigation into cell cover.

LKV 8/2010. PL–3. Using grid to mark rocks to be used for gradation and durability monitoring on west side slope.

LKV 8/2010. PL–4. Collecting rock samples from beneath the monitored area for laboratory gradation analysis. Rock profile is collected down to bedding layer for each sample. Sampling in progress.

LKV 8/2010. PL–5. New road adjacent to east site fence. Road is not on disposal site. White fence flag shown on fence.

LKV 8/2010. PL–6. View south of new structure being constructed on top of Augur Hill. Shows NRC, Oregon, and S.M. Stoller Corporation representatives.