



# Long-Term Surveillance and Maintenance Plan for the Grand Junction, Colorado, Site

June 2006



U.S. Department  
of Energy

## Office of Legacy Management

**Long-Term Surveillance and Maintenance Plan  
for the Grand Junction, Colorado, Site**

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Work Performed by S. M. Stoller Under DOE Contract Number DE-AC01-02GJ79491  
for the U. S. Department of Energy Office of Legacy Management, Grand Junction,  
Colorado

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# 1.0 Introduction

## 1.1 Purpose and Scope

This Long-Term Surveillance and Maintenance Plan (LTS&MP) is a technical plan that explains how the U.S. Department of Energy (DOE) will fulfill its long-term surveillance and maintenance (LTS&M) obligations at the Grand Junction, Colorado, site (Grand Junction site).

This LTS&MP will remain in effect until all identified hazardous materials for which DOE is responsible have been remediated to within regulatory limits and the site can be released for unrestricted use and unlimited exposure.

## 1.2 Legal and Regulatory Requirements

DOE holds title to and responsibility for the radioactive and other hazardous materials generated at the site prior to October 1, 2000.

DOE acquired the radioactive materials under authority of the Atomic Energy Act of 1954 (Public Law 83-703). Most of the radioactive materials consisted of uranium mill tailings, which are similar to materials regulated either as residual radioactive material under Title 40 *Code of Federal Regulations* Part 192 (40 CFR 192) or regulated as 11(e)(2) byproduct material under the Atomic Energy Act of 1954, as amended. Other radioactive materials included refined uranium oxide (yellowcake) and incidental laboratory waste. Radioactive materials that were removed from the Grand Junction site were accepted for codisposal with Uranium Mill Tailings Radiation Control Act (UMTRCA) residual radioactive materials at the Grand Junction, Colorado, Disposal Site, in accordance with the Record of Decision (DOE 1989b). Some radioactive materials remain on the site and are managed by DOE.

Regulated nonradiological hazardous materials were removed and disposed of or managed as they were encountered.

The primary relevant and appropriate regulations for the remediation of the Grand Junction site are 40 CFR 192 and DOE Order 5400.5 (DOE 1989a and 1989b).<sup>1</sup> These regulations specify release limits for radium, uranium, and thorium in soil; radon concentration and surface contamination limits in structures; direct gamma exposure; and total effective dose. Site ground water is regulated under State of Colorado Title 5 *Code of Colorado Regulations* Part 1002-41 (5 CCR 1002-41), "The Basic Standards for Ground Water" and 40 CFR 192. Site surface water is regulated under 5 CCR 1002-35, "Classifications and Numerical Standards for the Gunnison and Lower Dolores River Basins."

Consistent with DOE policy (DOE 1995a), remediation of the Grand Junction site was conducted in accordance with the Comprehensive Environmental Response, Compensation and Liability

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<sup>1</sup> While Grand Junction site restoration was under the authority of the Surplus Facilities Management Program (SFMP), the standards conveyed in the *U.S. Department of Energy Guidelines for Residual Radioactive Material at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites* were found to be applicable. These guidelines were superseded by DOE Order 5400.5.

Act of 1980, as amended (CERCLA). A portion of this federal property was transferred to private ownership in accordance with applicable provisions of CERCLA Section 120(h). Some regulated materials remain on the Grand Junction site; these materials are managed by DOE. DOE's responsibilities for this material are defined in Section 1.3, "Role of DOE." The nature of the contamination remaining on the Grand Junction site is described in Section 2.3, "Final Grand Junction Site Conditions."

In 2000, DOE transferred the majority of the site to the Riverview Technology Corporation (RTC). The remainder of the site was transferred to the U.S. Army in 2001. DOE has certain obligations under CERCLA regarding transfer (conveyance) of this property to other entities because the property has a prior history of release and storage of hazardous substances. The following requirements were addressed in the contract between DOE and the RTC (DOE 2000f) and are made a part of the Deed (DOE 2000j):

1. DOE submitted information to the property recipient concerning (1) the type and quantity of hazardous substances that were known to have been released or disposed of or stored for 1 year or more on the property; (2) the time such disposal, release, or storage took place; and (3) a description of remedial action taken that was required under Section 120(h)(1) of CERCLA (42 U.S.C. § 9620(h)(3)(A)(i)).
2. DOE warranted that all remedial action necessary to protect human health and the environment had been taken or was in place before the date of the conveyance, with exceptions noted in the Deed.
3. DOE identified two areas where radioactive contamination remains, identified the protective controls in place to protect human health and the environment, and identified the remediation plan for these areas. These areas of deferred remediation are addressed in a CERCLA 120(h) request for deferred remediation to the State of Colorado.
4. DOE reserved a right of access to all portions of the property for environmental investigation, remediation, or other corrective action. This reservation includes the right of access to and use of available utilities at reasonable cost to DOE. These rights are exercisable in any case in which a remedial action, response action, or corrective action is found to be necessary after the date of the conveyance, or in which access is necessary to carry out a remedial action, response action, or corrective action on adjoining property. Pursuant to this reservation, the United States of America and its respective agencies, officers, agents, employees, contractors, and subcontractors shall have the right to enter upon the property and conduct investigations and surveys, to include drilling, borings, data and records compilations, and other activities related to environmental investigation; and to carry out remedial or removal actions as required or necessary, including but not limited to the installation and operation of monitoring wells, pumping wells, and treatment facilities, and use of other actions deemed necessary by DOE to comply with all federal and state statutes, regulations, or any court order.

This LTS&MP adopts the approach outlined in the draft *Guidance for Implementing the Long-Term Surveillance Program for UMTRCA Title I and Title II Disposal Sites* (DOE 2000b), which defines the content of a site-specific LTS&MP and the general requirements for the long-term custody and care for a typical remediated uranium mill tailings site, as shown in Table 1–1 and Table 1–2.

Table 1–1. Requirements for the Grand Junction Site LTS&MP

Requirement <sup>a</sup>	Location in this LTS&MP
1. Legal description of site	Section 2.1
2. Description of final site conditions	Sections 2.3, 2.4, 2.5, 2.6, and 2.7
3. Description of the long-term surveillance program	Section 3.0
4. Criteria for follow-up inspections	Section 3.4.1
5. Criteria for maintenance and emergency measures	Section 3.5.3

<sup>a</sup>These requirements are specified in *Guidance for Implementing the Long-Term Surveillance Program for UMTRCA Title I and Title II Disposal Sites* (DOE 2000b).

Table 1–2. Requirements for the Long-Term Custodian at the Grand Junction Site

Requirement <sup>a</sup>	Location in this LTS&MP
1. Implementing changes to the LTS&MP	Section 3.0
2. DOE permanent right-of-entry	Sections 1.2 and 3.1

<sup>a</sup>These requirements are specified in *Guidance for Implementing the Long-Term Surveillance Program for UMTRCA Title I and Title II Disposal Sites* (DOE 2000b).

### 1.3 Role of DOE

The DOE mission in Grand Junction is to provide project management, engineering, and scientific support to the Federal Government’s LTS&M and environmental restoration programs. Major programs administered from the DOE office in Grand Junction include the long-term surveillance and maintenance operations for remediated sites assigned to DOE Office of Legacy Management (DOE–LM). The Grand Junction site is one of the remediated sites for which DOE–LM is responsible.

DOE is responsible for managing contamination left on site after site transfer. These occurrences are described in Section 2.3, “Final Grand Junction Site Conditions.” DOE will maintain protectiveness by adhering to the provisions described in Section 3, “Long-Term Surveillance and Maintenance Program.” LTS&M activities include inspections, monitoring, and reporting, as described in that section.

As stipulated in the Request for Deferred Remediation (DOE 2000h), DOE will demolish and remediate the contaminated portion of Building 12 before DOE vacates the building and will remediate the contamination beneath Building 20 when that structure is demolished. DOE has received approval to defer remediation of the regulated materials associated with the buildings, as provided for by State of Colorado Executive Order D013 98, "Evaluation of Requests for Transfer of Contaminated Property" and in accordance with CERCLA Section 120(h) (CDPHE 2001). DOE demolished Building 20 and remediated the contamination beneath it in April of 2006.

## 2.0 Site Background and Status

### 2.1 Description of Site

#### 2.1.1 Location and Property Ownership

The Grand Junction site is located at 2597 B 3/4 Road, Grand Junction, Colorado, approximately 0.6 mile (1.1 kilometers) from Main Street in downtown Grand Junction (Figure 2–1). The property lies in Sections 26 and 27, Township 1 south, Range 1 west, Ute Principal Meridian, in Mesa County, Colorado. The Grand Junction Site occupies approximately 54.17 acres (21.92 hectares) along the Gunnison River, which abuts the property on the north and west sides. Property adjacent to the east side of the site is owned by the Union Pacific Railroad; east of that is a city of Grand Junction municipal cemetery.

The property was acquired by the U.S. War Department in 1943, and subsequently was administered by the Atomic Energy Commission, the Energy Research and Development Administration, and DOE. In 2000, a portion of the property (46.20 acres or 18.70 hectares) was transferred to the RTC, a non-profit business development entity sponsored by Mesa County and the City of Grand Junction. The remainder of the property (7.97 acres or 3.23 hectares) was transferred to the U.S. Army. The legal description of the property is presented in Appendix A.

Directions to the site from Walker Field Airport, in Grand Junction, are presented in Table 2–1.

*Table 2–1. Directions and Mileage from Walker Field Airport to Site*

<b>Mileage</b>	<b>Route</b>
0.0	At the Airport exit, turn left on to H Road
0.5	Turn right on to Horizon Drive; continue through the roundabout on Horizon Drive
5.3	At traffic light, turn left on to 7th Street
9.6	At traffic light, turn right on to Ute Avenue
10.0	At traffic light, turn left on to 5th Street
12.2	At traffic light, turn right on to Canon Street
12.7	Turn right on to B 3/4 Road, follow down hill to the site

The site is accessed from the east using B-3/4 Road, the only public road leading to the Grand Junction site (Figure 2–1).

The site is used for light industrial and commercial activities. Occupants include the Western Colorado Business Development Corporation Small Business Incubator, various small businesses, and DOE. Principal land uses in areas adjacent to and near the site include the municipal cemetery, agriculture, and gravel extraction. The closest residence is within 0.1 mile of the site.

Because of the earthen flood control dike, the Grand Junction site is considered to be out of the 100-year flood plain, but lies within the 1,000-year flood plain.

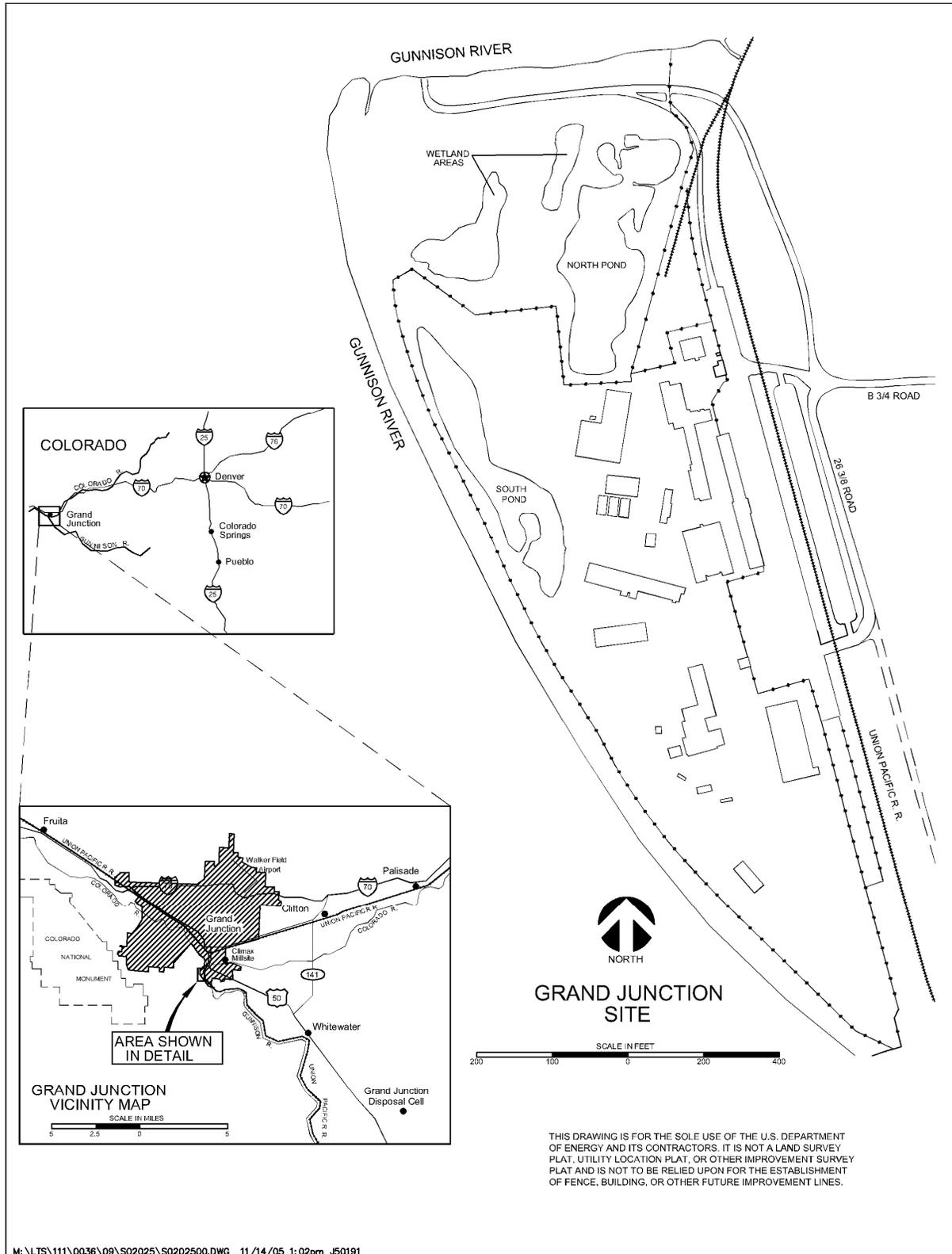


Figure 2-1. Location of the Grand Junction Site

### **2.1.2 Topography and Geology**

The Grand Junction site is located in the Canyonlands portion of the Colorado Plateau physiographic province. Principal structural features in the area include the Grand Valley, which contains the Colorado River drainage; the Uncompahgre Plateau to the south, a broad uplifted area of sedimentary rocks and a Precambrian core; the Grand Mesa to the east, a basalt-capped sedimentary highland with elevations as high as 11,000 feet (3,353 meters) above sea level; and the Book Cliffs to the north, an erosional escarpment that extends into Utah. The Grand Junction site is located at the boundary between the Grand Valley and the Uncompahgre Plateau. Elevation of the site is approximately 4,560 feet (1,390 meters) above mean sea level.

The site is situated within an accretionary bend of the Gunnison River approximately 0.5 mile (800 meters) up stream from its confluence with the Colorado River. At the site, the Gunnison River canyon is 1,500 to 2,200 feet (457 to 671 meters) wide and 60 to 160 feet (18 to 49 meters) deep. The Brushy Basin Member of the Morrison Formation and the overlying Burro Canyon Formation are exposed in the canyon walls. The strata at this location dip approximately 3 degrees northeast as part of local monoclines located at the north edge of the Uncompahgre uplift (Figure 2–2). Several small, local faults occur along the anticlinal hinge of these monoclines. Other faults occur in the sedimentary rocks adjacent to the Grand Junction site; these faults likely will not allow hydraulic communication with lower permeable strata because clays in the Morrison Formation will seal the fault planes.

Sandy loam soil at the site ranges in thickness from several inches to several feet. The soil is underlain by as much as 32 feet (9.8 meters) of Quaternary river alluvium, which rests on top of Brushy Basin Member bedrock.

### **2.1.3 Hydrology**

The alluvial sediments beneath the site comprise an unconfined aquifer consisting of two facies, a silty sand unit overlying a basal unit of poorly sorted, unconsolidated sands and gravels. These units are laterally consistent across the Grand Junction site. This aquifer is in direct hydraulic contact with the Gunnison River. The alluvial aquifer is bounded on the east by Brushy Basin Member silts, shales, and sandstones, and on the west and north by the Gunnison River (Figure 2–3). The alluvial aquifer continues up gradient along the east bank of the river. Brushy Basin strata beneath the alluvial sediments form an aquitard. Depth to ground water ranges from 5 to 10 feet (1.5 to 3 meters) over much of the site.

At the north end of the site, a portion of remediated land was not backfilled, resulting in a depression that is recharged by ground water creating 1.45 acres (3.6 hectares) of jurisdictional wetlands. A portion of this area lies below the low-water level in the river and is inundated or saturated year-round, while other portions of this area dry out during periods of low water.

Aquifer pumping tests indicate that the alluvial aquifer has hydraulic conductivities ranging between 30 and 45 feet (9.1 and 13.7 meters) per day. Specific yield values of approximately 0.05 over a saturated thickness of 14 feet (4.3 meters) were determined by using pump tests. Water level measurements indicate that the general gradient is from south to north.

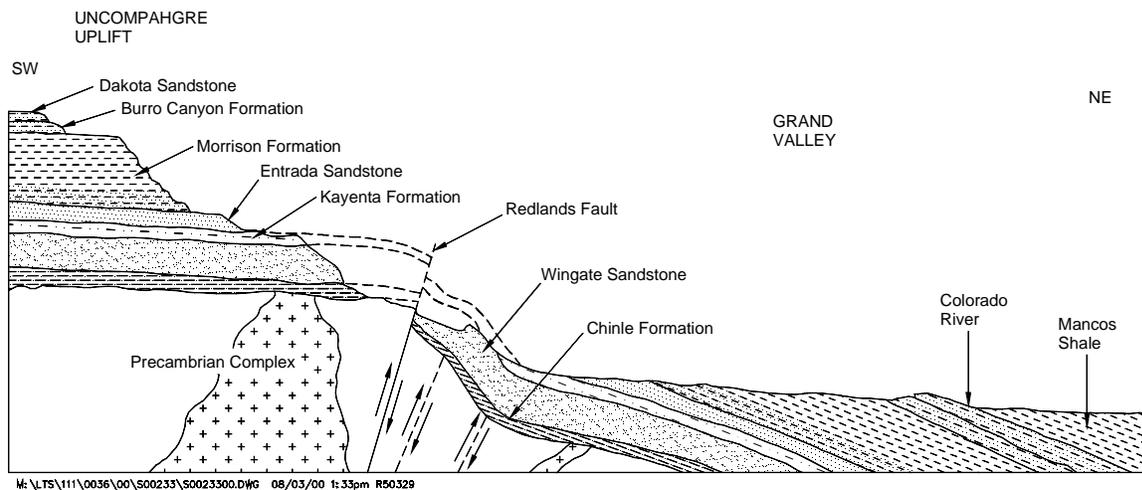


Figure 2-2. Geological Cross Section of the Grand Valley Region

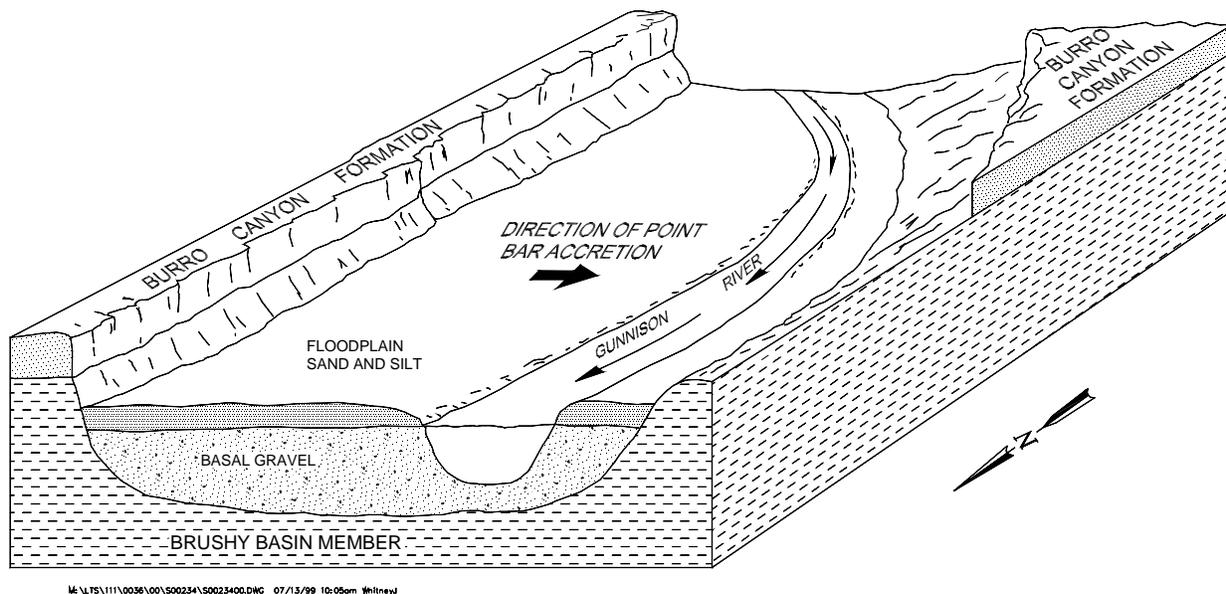


Figure 2-3. Block Diagram of the Hydrologic System at the Grand Junction Site

The aquifer was modeled during preparation of the Remedial Investigation (DOE 1989a). Field observations indicated that a simple depositional model would adequately represent the aquifer. The basal sands and gravels were deposited as the Gunnison River migrated from east to west. This process resulted in erosion of older alluvial sediments to the west and deposition of newer sediments behind the river channel. The migration process resulted in a laterally consistent layer of imbricated gravel, sand, and silt. Periodic over-bank flooding resulted in deposition of finer sediments on top of the coarser channel fill deposits (Figure 2-3). The confining canyon walls caused swift flows, resulting in generally coarse, high-energy deposits of basal gravel.

The ground water flow regimen, as defined through observation and modeling, was used to predict contaminant fate and transport. The water level in the alluvial aquifer responds to the water level in the Gunnison River. River water levels fluctuate seasonally, reaching their highest levels in late spring as mountain snow melt in the upper watersheds feeds the river. Flow rates are lowest in late winter. This annual fluctuation results in a regular surging of ground water through the alluvial aquifer. As water levels rise in the spring, ground water levels increase at the north and west aquifer boundaries and move perpendicular to the river channel towards the center of the aquifer. As water levels in the river subside in the late summer, site ground water flow direction reverses and ground water discharges to the river. Ground water flow is generally northward during normal flow periods. Site drainage causes precipitation to flow into the South Pond and the North Pond, resulting in minor aquifer recharge.

#### **2.1.4 Climate and Vegetation**

The climate at the Grand Junction site is semiarid with an annual average of 8.8 inches (22.4 cm) of precipitation annually. Precipitation is characterized by brief, sometimes heavy, summer thunderstorms and light winter snowfalls. Winds measured at Walker Field Airport flow predominantly from east-southeast or northwest at an average velocity of approximately 5 miles per hour [2.5 meters per second (m/s)]; local topographical features influence wind direction. Temperatures range from average highs of 92 degrees Fahrenheit (33 degrees Celsius) in the summer to average lows of 16 degrees Fahrenheit (-9 degrees Celsius) in the winter.

Almost the entire Grand Junction site has been disturbed as a result of conducting remedial action, constructing improvements, or historical agricultural and gravel extraction activities. Approximately 23.6 acres (9.6 hectares) of the 61.14-acre (24.74 hectare) site have been landscaped or are covered with gravel or asphalt. The unlandscaped areas have been revegetated with native and adapted species.

Riparian, wetland, and semiarid grassland plant ecology zones are present at the site. The riparian areas support cottonwood trees, silver buffaloberry, skunkbush sumac, willow, Russian olive, Siberian elm, and several grasses. Plant species in wetland areas include tamarisk, cattail, willow, sedge, bulrush, creeping spikerush, and alkali grass. The semiarid grassland vegetation is dominated by crested wheatgrass, inland saltgrass, Indian ricegrass, blue grama, galleta grass, and several perennial wildflowers.

## **2.2 Site History**

### **2.2.1 Operations History**

The Grand Junction site was used for agriculture and gravel extraction prior to acquisition by the Federal Government.

The site was acquired by the U.S. War Department in 1943 for use by the Manhattan Engineer District. A refinery was operated on the site from 1943 to 1946 to treat and concentrate uranium oxide, a byproduct of vanadium production in the area. As much as 2,360,000 pounds (1,070 metric tons) of uranium oxide and a comparable amount of vanadium oxide concentrate were produced and shipped off site for further processing. Wastes from this refinery included dust losses, a few hundred tons of alumina cake, and liquid discharges (DOE 1987).

In late 1947, the U.S. Atomic Energy Commission (AEC) established the Colorado Raw Materials Office on site to manage the domestic uranium procurement program. An exploration office also was located in the city of Grand Junction, which led to the combination of procurement and exploration functions within the AEC Grand Junction Operations Office. This office was responsible for receipt, sampling, and analysis of uranium and vanadium concentrates purchased from ore processing operations in the western United States. AEC operated a uranium-concentrate sampling plant and assay laboratory on site until 1974. Between 1948 and 1971, a total of approximately 345,000,000 pounds (16,000 metric tons) of uranium oxide and 29,000,000 pounds (13,200 metric tons) of vanadium oxide passed through the Grand Junction site in steel drums. The remaining stockpile of vanadium and uranium was shipped off site in 1967 and 1975, respectively (DOE 1987).

A research program to test experimental uranium-ore milling techniques was initiated at the site in 1953. Operations were conducted in a small pilot mill from 1953 to 1954 near the present location of Building 46. In 1954, a larger pilot mill commenced operations on the southern end of the property. Milling operations ceased in 1958, after approximately 30,000 tons (27,200 metric tons) of ore had been processed (DOE 1987). Most of the small pilot plant and the structures associated with the large pilot mill complex were demolished during remedial action.

The pilot milling operations were the primary source of contaminated materials buried at the Grand Junction site. Other potential sources of contamination include former laboratory and vehicle maintenance activities and activities related to sampling and stockpiling uranium oxide concentrates.

Surplus uranium ore, uranium mill tailings, and contaminated equipment were disposed of on site. Historical data indicate that tailings and other waste from the pilot mills and sampling plant were disposed of to the west of the original pilot plant (near Building 46) and in the vicinity of the large mill buildings. Nonhazardous waste materials were buried in the landfill area northwest of Building 7. The drains from the analytical laboratory discharged into the South Pond, and storm water runoff drained into the North Pond. An estimated 100,000 cubic yards (76,500 cubic meters) of tailings and contaminated soils were stabilized on site, and another 300 cubic yards (230 cubic meters) of contaminated process equipment was buried at the Grand Junction site. Nearly 18 acres (7 hectares) of the site was assessed as contaminated. Leaching of stockpiled and buried tailings resulted in ground water contamination.

### **2.2.2 Remedial Action History**

The Grand Junction site was accepted into the Surplus Facilities Management Program (SFMP) in 1984. In 1988, the site was transferred to the Defense Decontamination and Decommissioning (D&D) Program. In 1990, remediation authority and responsibility for the site was transferred to the DOE Office of Environmental Restoration.

Site surveys for radiological contamination were conducted in 1980 and 1981. Ground water monitor wells were installed in 1982, 1984, 1985, 1987, 1994, and 2001. Remedial action site investigations and characterization studies formally commenced in 1984 when the Grand Junction site was accepted into the SFMP. The resulting data were analyzed in preparation for development of a National Environmental Policy Act (NEPA)-compliant Environmental Assessment. With the passage of the Superfund Amendments and Reauthorization Act in 1986 and the subsequent implementation of Executive Order 12580, "Superfund Implementation," the

site was evaluated in accordance with CERCLA. Although the resulting Hazard Ranking System score was below the value required for inclusion on the National Priorities List, remediation of the Grand Junction site followed the CERCLA process in accordance with DOE policy (DOE 1995). A Finding of No Significant Impact was issued by DOE in 1990 (DOE 1990). The remediation was referred to as the Grand Junction Office Remedial Action Program (GJORAP).

Site ground water was characterized and modeled in the CERCLA-compliant Remedial Investigation. Modeling results indicate that the ground water will flush clean of contaminants in 50 to 80 years (DOE 1989a), which is within the 100 year compliance period specified in 40 CFR 192. The compliance period began with the signing of the ROD in 1989 (DOE 1989b).

The selected remedial action alternative was removal of contaminated soils and building debris and codisposal with residual radioactive material from Grand Junction-area UMTRCA Title I activities, and remediation of the ground water contamination through natural flushing (DOE 1989b). Remediation of the Grand Junction site commenced in 1986. Remediation of assessed contamination in exterior land areas was completed in 1994. Remediation of affected portions of Buildings 12 and 20 was deferred, as described in Section 1.3. Remediation of remaining site buildings is complete.

## 2.3 Final Grand Junction Site Conditions

Site ground water and surface water contain contaminants in concentrations exceeding regulatory limits. Institutional controls<sup>2</sup> have been established as part of the remedy to prevent use of and exposure to contaminated water.

Buildings at the site have been radiologically surveyed. Minor quantities of radioactive materials that remain in one building have been deregulated. Building 2 (the original shower and change room) has known deposits of uranium oxide within the building. This building was released on the basis of excessive cost for remediation of contamination that poses no risk to occupants, the public, or the environment (DOE 1997 and DOE 2000g). This determination complies with DOE policy to keep exposures as low as reasonably achievable.

In addition, uranium and radium contamination remains in soils and on subgrade structures beneath portions of Building 12.

A concrete slab believed to be the remains of a support structure associated with the original uranium refinery exists beneath the south end of Building 12. Portions of the slab and underlying soil outside the building footprint were removed and found to contain radium-226, thorium-230, and uranium in excess of regulatory limits. A trench was defined beneath the east end of the slab that contained soil with a uranium concentration of 1,430 picocuries per gram (pCi/g) (DOE 2000d); this trench appears to continue beneath the building. A concrete sump integral to the Building 12 foundation has fixed surface contamination as high as 50,000 disintegrations per minute per square centimeter. Preliminary investigations identified soil with elevated concentrations of uranium within the building footprint (DOE 2000c).

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<sup>2</sup>The term "institutional controls" refers to non-engineering measures—usually, but not always, legal controls—designed to prevent or limit exposure to hazardous substances left in place at a site or to assure effectiveness of the remedy (EPA 2004).

A release survey conducted in Building 12 indicated that gamma exposure rates and beta-gamma activity did not exceed background, and the average radon decay-product concentration for this building was 0.006 working level, which is below the 0.020 working level guideline. These measurements indicate that the mill slab and underlying soil do not pose any increased health risk to occupants of Building 12.

The contamination beneath Building 12 was left in place to preserve the structural integrity of the building. Remediation of this building will be scheduled when use of the computer infrastructure is no longer needed, which will allow a cost effective remediation. Contaminated soils beneath Building 12 will be removed and soil within the building footprints will be verified to comply with regulatory limits. DOE will dispose of contaminated soil and building debris in a licensed or permitted facility. Debris and building materials from the unaffected portions of Building 12 and from the remaining buildings are released for unrestricted use, disposal, or recycling, unless regulated nonradiological materials (e.g., asbestos) are encountered.

Exterior land areas have been remediated and comply with applicable clean up standards (DOE 1995b). These areas are released for unrestricted use.

A decommissioned borehole containing radium foil remains on site. The radium-foil borehole was used for calibrating down-hole logging instrumentation. A metal plaque marks the location of the decommissioned borehole, provides details of the activity of the radium foil, and provides a warning to not disturb the borehole without contacting CDPHE. Although it has been decommissioned and its use has been discontinued, DOE does not plan on removing or remediating the structure.

Asbestos has been identified in buildings, and may be associated with abandoned underground steam lines or incidental occurrences of asbestos-containing-material such as mastic and floor tile (DOE 1995c). Polychlorinated biphenyls (PCBs) have been identified in fluorescent light ballasts (DOE 1995d). DOE has disclosed the existence of these substances to the new owner and has no further obligation for management or disposal of these substances.

## **2.4 Ground Water Conditions**

Ground water occurs under unconfined conditions in the alluvial aquifer (uppermost aquifer) beneath the site. Depth to ground water ranges from 5 to 10 feet (1.5 to 3 meters) beneath the surface, and generally flows to the north. Ground water has been monitored regularly to determine compliance with Federal and state ground-water quality regulations.

Ground water at the Grand Junction site must comply with limits established for potentially useable water in 40 CFR 192 and 5 CCR 1002-41, "The Basic Standards for Ground Water."

### **2.4.1 Background Ground Water Characteristics**

Water samples were collected from the alluvial aquifer up gradient from the Grand Junction site. Historical results from analysis of ground water samples collected from upgradient wells are shown in Table 2-2. These results indicate that the unaffected water quality in the alluvial aquifer is similar to that of the Gunnison River, although major cation concentrations increase with residence time.

Table 2–2. Comparison of Federal and State Ground Water Quality Standards to 2005 Maximum Concentrations in the Alluvial Aquifer

Constituent	Standard <sup>a,b</sup>	Maximum Historical Upgradient Concentrations	Maximum 2005 On-Site Concentrations	Maximum 2005 Downgradient Concentrations
Nitrate as Nitrogen	10	1.5	6	<0.01 <sup>d</sup>
Total dissolved solids	2,444	2,180	5,400*	1,500
Arsenic	0.05	0.0114	0.0097	0.010
Chromium (total)	0.05	0.010	<0.00065	<0.00033
Molybdenum	0.1	0.023	0.180*	0.088
Selenium	0.01	0.0025	0.077*	0.00008
Net alpha <sup>c</sup>	15	71.02*	0 <sup>e</sup>	0 <sup>e</sup>
Uranium	0.044	0.034	0.400*	0.170*

<sup>a</sup>All concentrations expressed in mg/L except gross alpha, which is expressed in pCi/L.

<sup>b</sup>Standards found at 5 CCR 1002-41 (“Domestic Use-Quality”) or 40 CFR 192.

<sup>c</sup>Does not include radon or uranium.

<sup>d</sup>A < indicates the result is below detection.

<sup>e</sup>Uranium value was greater than the gross alpha value.

An asterisk (\*) indicates the standard was exceeded.

## 2.4.2 Ground Water Contamination

Site ground water was contaminated by leaching of uranium mill tailings before the tailings were removed from the property. Historically, contaminants exceeding Federal or State ground water standards included nitrate, total dissolved solids, arsenic, molybdenum, radium-226 + radium-228, selenium, gross alpha, and uranium. In 2005, only molybdenum, selenium, total dissolved solids, and uranium exceeded ground water standards.

## 2.5 Surface-Water Conditions

Surface water exists at the Grand Junction site in the North Pond, South Pond, wetlands, and the adjacent Gunnison River. These bodies are monitored regularly for comparison to State surface water quality standards. Site surface water is in direct hydraulic contact with site ground water and the three bodies of water within the Grand Junction site boundary exhibit contaminant levels that reflect ground water contamination. Monitoring Gunnison River water serves the additional purpose of determining if ground water flushing is adversely affecting river water quality.

Water quality standards for the Gunnison River are found at 5 CCR 1002-35, “Classifications and Numerical Standards for the Gunnison and Lower Dolores River Basins,” on the basis of the following four use classifications: (1) Recreation, Class I, (2) Cold Water Aquatic Life, Class I, (3) Domestic Water Supply, and (4) Agriculture (Table 2–3). Some of the limits are derived from background surface-water quality measurement results.

Table 2–3. Comparison of State Surface Water Standards to 2005 Surface Water Analytical Results

Constituent	Standard <sup>a,b</sup>	Gunnison River			On-Site Surface Water		
		Upstream	Adjacent to Site	Down-stream	North Pond	South Pond	Wetland Area
Chloride	250	12	11	11	470*	82	850*
Nitrate as Nitrogen	10	0.72	0.74	0.66	<0.01	<0.01	<0.01
Sulfate	480	350	350	330	3,800*	1,300*	9,000*
pH	6.5-9.0	8.39	8.31	8.38	7.79	8.23	8.05
Arsenic	0.05	0.0006	0.0006	0.0006	0.0022	0.0005	0.0056
Chromium	0.011	<0.0003 <sup>c</sup>	<0.0003	<0.0003	<0.0006	<0.0003	<0.0016
Manganese	0.05	0.026	0.027	0.031	0.210*	0.017	0.220*
Selenium	0.008	0.0036	0.0036	0.0035	0.0035	0.0005	0.0013
Uranium <sup>d</sup>	40	4.95	5.02	4.95	302.3*	226.7*	1,030*

<sup>a</sup>All concentrations presented in mg/L except uranium, which is pCi/L, and pH, which is unitless.

<sup>b</sup>Standards are found at 5 CCR 1002-35.

<sup>c</sup>A < indicates the result is below detection.

<sup>d</sup>Uranium concentrations were converted from mg/L to pCi/L using a conversion factor of 687 pCi/mg. An asterisk (\*) indicates the standard was exceeded.

## 2.5.1 Background Surface Water Characteristics

Historically, background surface-water quality samples were collected from the upstream Gunnison River sampling location and analyzed for metals, major cations, major anions, radionuclides, and total dissolved solids. Surface measurements of alkalinity, turbidity, pH, conductivity, and temperature were made at the time of collection. Uranium concentrations in the Gunnison River samples have been generally constant for all sampling locations, and all historical results were below the standard of 40 pCi/L. Background water quality data from the 2005 sampling event are presented as upstream sample location results in Table 2–3.

## 2.5.2 Surface-Water Contamination

In 2005, surface water in the North Pond, South Pond, and wetland areas exceeded State standards for one or more of the following constituents: chloride, manganese, sulfate, and uranium (Table 2–3). No standards were exceeded in samples collected from the Gunnison River adjacent to and downstream of the site.

## 2.6 Institutional Controls

Institutional controls have been applied to the Grand Junction site to prevent inadvertent exposure to contaminated media. The controls include:

- Restrictions on the use of ground water, surface water, and aquatic life in the ponds and wetland areas;
- Controls to prevent disturbing the well containing radium foil; and
- Controls to prevent disturbing soil and structures associated with identified contamination beneath Building 12.

The controls and obligations of involved parties are defined in deed restrictions that are attached to the Deed and title and recorded in the Records of Mesa County. These controls will survive subsequent property transfers. These institutional controls will be monitored by DOE and enforced by the State of Colorado Department of Public Health and Environment (CDPHE) through CERCLA authorities, as specified in the sale and transfer agreements (see section 3.7). These controls are presented in Appendix E.

## **2.7 Specific Site-Surveillance Features**

Building 12, warning signs, a warning monument, a survey monument, surface waters, and monitor wells comprise the specific site-surveillance features at the Grand Junction site. These features are shown on Figure 2–4.

### **2.7.1 Warning Signs**

DOE has installed and will maintain warning signs around the South Pond, North Pond, and wetland areas. These signs inform the public that surface waters are contaminated and that swimming in, taking fish from, extracting, and drinking the surface waters is prohibited. DOE will inspect these signs until processing-related contaminants have flushed out of surface waters and the State of Colorado concurs that surface waters are safe for unrestricted use. Warning signs present the 24-hour telephone number ((970) 248-6070).

A ground-level monument was installed over the well containing the radium foil.

### **2.7.2 Monitor Wells**

The ground water monitor well network consists of 8 monitor wells located inside or adjacent to the Grand Junction site property (Figure 2–4). These wells are completed in the alluvial aquifer. Construction details and lithologic logs for the wells are archived in the site records. Sampling frequency and analytes for the wells are summarized in Section 3.6, “Environmental Monitoring.”

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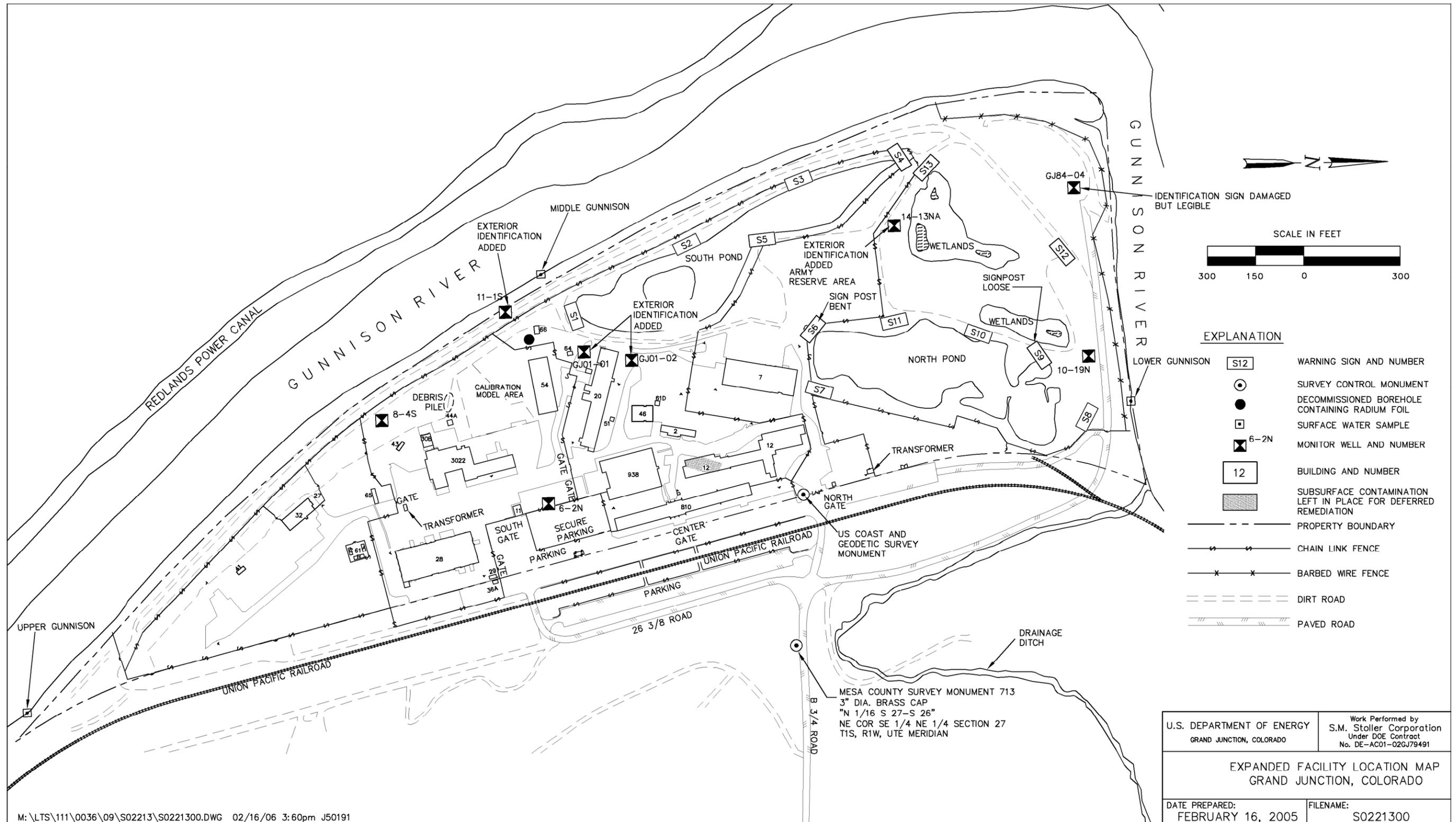


Figure 2-4. Grand Junction, Colorado, Office Facility Site Base Map

## 3.0 Long-Term Surveillance and Maintenance Program

### 3.1 Long-Term Surveillance and Maintenance Overview

DOE will conduct stewardship activities at the Grand Junction site to protect human health and the environment, and to comply with applicable regulations and DOE policy. DOE owns and is responsible for the regulated radiological substances and the contaminants in ground and surface water that remain at the site. The State of Colorado, as regulator, has authority to oversee DOE LTS&M activities at this site and will concur in changes to this LTS&MP. DOE retains the right of access to the site to conduct stewardship activities for the duration of these activities. This right is established in the transfer agreement (DOE 2000f).

DOE will monitor ground water and surface water at the site to ensure compliance with State of Colorado and Federal regulations. Existing ground water and surface water conditions are described in Sections 2.4 and 2.5. The compliance strategy for site ground water is presented in Section 3.6.1, along with details of the monitoring program. Surface water monitoring is discussed in Section 3.6.2.

DOE will manage radiological contamination left in place beneath Building 12. Management is accomplished through inspections and maintaining access controls and other institutional controls.

DOE will monitor institutional controls and take necessary action to ensure the effectiveness of or to enforce those controls. Institutional controls in effect at the site are described in Section 2.6, "Institutional Controls."

Specific LTS&M requirements are presented in Table 3–1.

*Table 3–1. Long-Term Stewardship Requirements*

Requirement	Section
Routine site inspection	3.2
Routine Inspection report	3.3
Follow-up inspections and inspection reports, as necessary	3.4
Routine site maintenance, as necessary	3.5
Emergency measures	3.5
Environmental monitoring	3.6
Institutional controls monitoring	3.7
Regulatory compliance monitoring	3.8

### 3.2 Routine Site Inspections

#### 3.2.1 Frequency of Inspections

The Grand Junction site will be inspected by DOE to confirm that institutional controls remain effective and to determine if maintenance or monitoring is needed.

Site inspections will be conducted annually. The date of the inspection may vary from year to year to enable inspectors to observe the site in different seasons. Variation to this inspection frequency will be explained in the inspection report. DOE will notify CDPHE and the site owner of the inspection at least 30 days before the scheduled inspection date.

### 3.2.2 Inspection Procedure

For the purposes of inspection, the site will be divided into sections called transects. Each transect will be inspected individually. Transects for the inspection of the site are presented in Table 3–2.

*Table 3–2. Transects Used During Inspection of the Grand Junction Site*

Transect	Description
Site Interior (inside RTC property boundary).	Includes the South Pond, North Pond, wetland areas, the affected portions of Building 12, monitor wells, and the radium foil well. The Army Reserve Area is excluded.
Areas beyond Grand Junction site boundary.	Includes one survey monument and outlying areas up to 0.25 mi (0.4 km) beyond the Grand Junction site.

The site interior transect will be inspected for evidence of ground water and surface water use. Within each transect, the condition of specific site-surveillance features (Section 2.7), such as warning signs and monitor wells will be inspected for change, deterioration, and other effects such as vandalism. Inspectors will physically inspect the affected portions of Building 12 and note any indication that the floor has been penetrated. Inspectors will note changes to the area surrounding the site, especially within 0.25 mi (0.4 km) of the site perimeter. Significant changes within this area could include development or expansion of gravel extraction, human habitation, erosion, or road building.

It may be necessary to document some observations with photographs. Such observations may be evidence of vandalism or water use. An example Field Photograph Log is included in Appendix C.

### 3.2.3 Inspection Checklist

The inspection is guided by the inspection checklist. An example of the site-specific inspection checklist for the site is presented in Appendix D. The inspection checklist addresses preparation for the inspection and performance of the inspection. Health and safety issues are covered in the Project Safety Plan (DOE 2005). Inspectors also will have the drafted site inspection map from the previous inspection. The map graphically depicts the locations of noted observations from previous inspections and is used to record field notes, photograph locations, and other annotations of inspection findings. The field map becomes a part of the permanent site record.

The checklist is reviewed and revised as necessary prior to each routine inspection. At the conclusion of a routine site inspection, inspectors will note revisions to the checklist in anticipation of the next routine site inspection. Revisions to the checklist may include inspection instructions addressing new discoveries or changes in site conditions or updated telephone numbers and directions to local medical facilities.

### **3.2.4 Personnel**

Typically, annual inspections will be performed by two inspectors. Inspectors will be experienced engineers or scientists who have the required knowledge, skills, and abilities to evaluate site conditions and recognize imminent or actual problems.

Inspectors will be assigned for a given inspection episode of the Grand Junction site on the basis of site conditions and inspector expertise. Areas of expertise include civil, geotechnical, and geological engineering; geology, hydrology, biology, and environmental science (e.g., ecology, soils, or range management). If conditions warrant, more than two inspectors may be assigned to the inspection to evaluate serious or unusual problems and make appropriate recommendations.

### **3.3 Routine Inspection Reports**

Results of routine site inspections will be reported to DOE program management, CDPHE, the Army, and the Riverfront Technology Corporation. The report also will address monitoring results for the previous 12 months.

### **3.4 Follow-up Inspections**

Follow-up inspections are unscheduled inspections that are conducted in response to threatening or unusual site conditions.

#### **3.4.1 Criteria**

Criteria for follow-up inspections of the Grand Junction site are adopted from 10 CFR 40.28 (b)(4). DOE will conduct follow-up inspections if the following occurs:

1. A condition is identified during the routine site inspection, or other site visit, that requires personnel with specific expertise to return to the site to evaluate the condition; or
2. DOE is notified by a citizen, employee, or federal, state, or local agency that conditions at the site are substantially changed.

Once a condition or concern is identified at the site, DOE will evaluate the information and decide whether to respond with a follow-up inspection.

Specific conditions that may necessitate a follow-up inspection include intrusion, violation of institutional controls, vandalism, or the need to revisit the site to evaluate, define, or conduct maintenance tasks. Conditions that may require a more immediate follow-up inspection include extreme weather or seismic events and disclosure of deliberate human activity that threatens the integrity of institutional controls. DOE will act responsibly but will exercise flexibility and will evaluate risk when scheduling follow-up inspections. Urgency of the follow-up inspection will be in proportion to the seriousness of the condition.

In the event of an incident or activity that threatens or compromises institutional controls or poses a risk of exposure to or release of known contaminants, DOE may, as appropriate, notify CDPHE, begin the DOE occurrence notification process (DOE Order 232.1), respond with an

immediate follow-up inspection, or begin emergency measures (Section 3.5.2) to contain or prevent dispersion of hazardous materials from the Grand Junction site. At any time, DOE may request the assistance of local authorities to confirm the seriousness of a condition at the site before scheduling a follow-up inspection or initiating other action.

Arrangements have been made for these government agencies to notify DOE in the event of human intrusion or unusual-to-catastrophic natural events in the vicinity of the site: the Mesa County Sheriff's Department in Grand Junction and the U.S. Geological Survey National Earthquake Information Center in Denver, Colorado. These agencies will contact DOE should an event occur that might affect the control of known contaminants or condition of site surveillance features at the Grand Junction site.

To facilitate DOE notification and to address citizen concerns, warning signs posted near contaminated surface waters display a 24-hour DOE–GJO telephone number [(970)248-6070]. The public may use the 24-hour number to request information about the site or to advise DOE of problems at the site. DOE may conduct follow-up inspections in response to information provided by the public.

### **3.4.2 Personnel**

Inspectors assigned to follow-up inspections will be selected on the same basis as for routine site inspections. (See Section 3.2.4.)

### **3.4.3 Reports of Follow-up Inspections**

Results of follow-up inspections will be included in the next annual inspection report (Section 3.4). Separate reports will not be prepared unless DOE determines it advisable to notify CDPHE or another outside agency of a problem at the site.

If follow-up inspections are required for more serious or emergency reasons, DOE will submit to CDPHE a preliminary report of the follow-up inspection within 60 days.

## **3.5 Routine Site Maintenance and Emergency Measures**

### **3.5.1 Routine Site Maintenance**

Assessed contaminated materials were removed from the Grand Junction site except as noted previously. DOE will maintain site access controls for DOE-leased portions of the site as part of DOE operations. DOE will conduct any required well maintenance and abandonment. Other maintenance tasks might include sign replacement.

### **3.5.2 Emergency Measures**

Emergency measures are the actions DOE will take in response to an incident that may result in exposure to or release of known contamination for which DOE is responsible.

### **3.5.3 Criteria for Routine Site Maintenance and Emergency Measures**

Criteria for triggering a given DOE response for each progressively more serious level of intervention are not easily defined because the nature and scale of all potential problems cannot be foreseen. The difference between routine maintenance and emergency responses is primarily one of urgency and degree of threat or risk.

### **3.5.4 Reporting Maintenance and Emergency Measures**

Routine maintenance completed during the previous 12 months will be summarized in the next routine inspection report. Although the probability of such an occurrence is low, DOE will notify the CDPHE within 4 hours of discovery of any potential or actual exposure to or release of regulated hazardous materials. The Colorado 24-hour Emergency Response Line phone number is 1-877-518-5608 and is included in the Inspection Checklist (Appendix D).

## **3.6 Environmental Monitoring**

Environmental monitoring results will be reported annually in the data validation report. An evaluation report of the environmental monitoring program including a presentation of monitoring data and an evaluation of the progress of natural flushing of the alluvial aquifer will be produced every 5 years. DOE will conduct the next evaluation in 2010. The 2005 evaluation is presented in Appendix F.

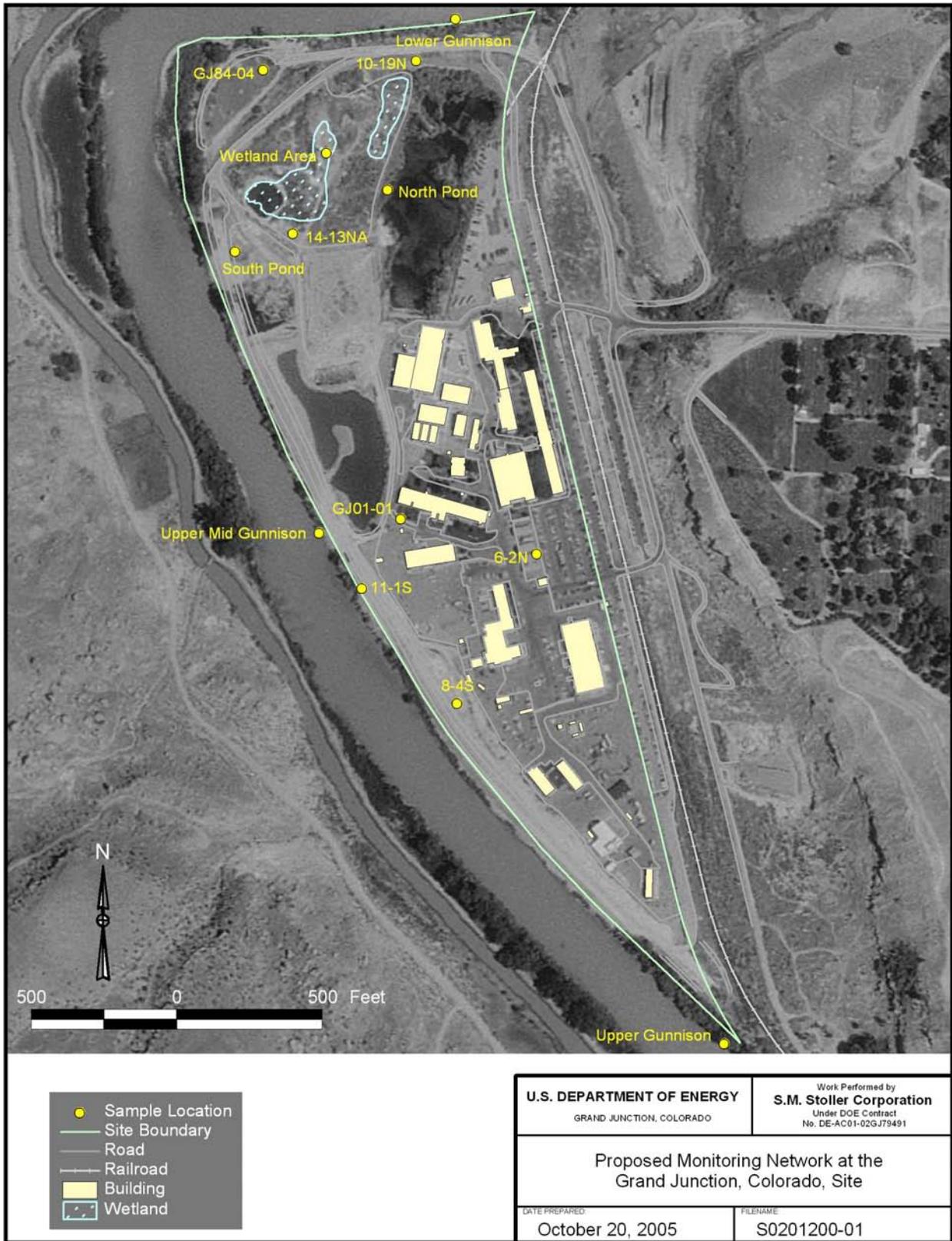
### **3.6.1 Ground Water Monitoring**

The compliance strategy to meet the more stringent of applicable Federal and State of Colorado ground water protection standards is natural flushing in conjunction with continued monitoring and institutional controls. Ground water flow and transport modeling predicted that cleanup of ground water in the uppermost (alluvial) aquifer will occur within a 50 to 80 year timeframe (DOE 1989a). This strategy is described in the Record of Decision (DOE 1989b) and evaluated in *Evaluation of Ground Water and Surface Water Monitoring for the Grand Junction Office Facility* (DOE 2000a).

The State of Colorado is the primary regulator for ground water and surface water compliance at the Grand Junction site. Ground water quality must comply with the basic standards for ground water found in 5 CCR 1002-41, and also with ground water standards specified in 40 CFR 192.

An evaluation of the ground water monitoring program is provided in Appendix F. This evaluation, modified with CDPHE input, provides the basis for the monitoring program described in this LTS&MP. The ground water monitoring network consists of 7 monitor wells (8-4S, 11-1S, 6-2N, 14-13NA, GJ84-04, 10-19N, and GJ01-01) that are distributed onsite and along the downgradient edges of the facility near the Gunnison River (Figure 3-1 and Figure 2-4).

Based on a consideration of ground water standards and potential human health and ecological risk (DOE 2000i), the evaluation in Appendix F, and CDPHE input, analytes for the ground water monitoring program are manganese, molybdenum, selenium, sulfate, and uranium. In addition to these analytes, standard water quality indicators (pH, alkalinity, conductivity, temperature, and turbidity) will be measured during each sampling event.



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Figure 3-1. Ground Water and Surface Water Monitoring Locations

Ground water monitoring at the Grand Junction site will be conducted annually, in late winter, for a period of 5 years (through 2010). At the end of this period, DOE will evaluate monitoring results in consultation with the State of Colorado to determine the requirements for future monitoring at the site. This will include a statistical evaluation of contaminant concentration trends. Criteria for modifying or terminating ground water and surface water monitoring will include (1) continued decrease in concentrations of constituents of concern as predicted and observed, (2) compliance with regulatory limits, and (3) no unacceptable risks to human health and the environment resulting from site-related contamination. DOE will receive approval from the State of Colorado prior to modification or termination of monitoring (DOE 2001).

### **3.6.2 Surface Water Monitoring**

The compliance strategy for surface waters at the Grand Junction site also is natural flushing in conjunction with continued monitoring and institutional controls. Monitoring and evaluation for surface waters will be the same as for ground water with the exception of manganese, which will not be included because current concentrations in surface water do not pose a potential risk. Though the human health and ecological risk assessments for the site indicated that risks were minimal (DOE 2000i), monitoring will be conducted as a best management practice.

The surface-water monitoring network includes three locations in the Gunnison River, and one location each in the North Pond, South Pond, and the wetland areas (Figure 3–1 and Figure 2–4). Surface water quality must comply with the water quality standards for the Gunnison River found at 5 CCR 1002-35. The frequency and duration of surface-water monitoring will be the same as for the ground water monitoring.

### **3.6.3 Sediment Monitoring**

Sediment was collected from the pond and wetland areas in 2001 and analyzed for a number of constituents. Data are presented in Appendix G. The results showed that some site-related contamination may be present in the sediments at concentrations higher than background. Concentrations at some locations exceed sediment quality benchmarks. However, this does not mean that any adverse effects are actually present. The data set provides a baseline to determine if sediments are accumulating site-related contaminants as natural flushing proceeds. Once ground water remediation is determined to be completed, it may be prudent to do some additional sediment sampling and conduct a more site-specific evaluation of potential residual site risks.

## **3.7 Institutional Controls Monitoring**

As described previously, institutional controls have been applied to the Grand Junction site to prevent inadvertent exposure to contaminated media. These controls are as follows:

**Surface Water and Ground Water**—To prevent exposure to contaminated ground and surface water, the DOE will notify owners through deed restrictions and annual reports of water quality and of prohibitions against water use; maintain warning signs around the ponds and wetland areas; and inspect the site annually and access state records for well permit information.

Controls prohibiting use of site ground water and surface water will remain in effect until water quality complies with regulatory limits; these controls must survive any subsequent property transfers.

**Well Containing Radium Foil**—To ensure that the radium foil remains sealed and isolated, DOE will notify owners through deed restrictions and annual reports of the presence of the sealed well and of prohibitions against causing subsurface disturbances in the area, and will maintain a warning plaque at the ground surface above the well.

Controls prohibiting disturbance of the radium foil in the sealed well will remain in effect in perpetuity.

**Contamination Beneath Building 12**—To prevent exposure to contaminated soil and subgrade structures, the DOE will notify owners through deed restrictions and annual reports; control access to Building 12 and demolish the affected portion of the building upon vacation; and inspect the site annually. Controls prohibiting disturbance of soils and structures associated with the contaminated portions of Building 12 will be enforced by DOE until contaminated materials have been removed and the affected area has been verified to comply with regulatory limits.

Property records have been annotated to document the DOE right of access; the history of site operations, the nature of site contaminants, the remedial actions conducted by DOE; and use restrictions imposed on property owners. Property record annotations will also include a covenant warranting that remedial action is complete or has been deferred, and if additional remedial action is found to be necessary after site transfer, it will be conducted by the United States of America (see 42 USC 9620(h) and DOE 1998). Site remedial action records will be maintained by DOE at least until the site can be released for unrestricted use and unlimited exposure.

At the time of the routine site inspection, and at other times as necessary, DOE will evaluate institutional controls applied to the Grand Junction site and will take appropriate action if those controls are found to not fully protect human health and the environment. The evaluation will include the following:

- Inspect the site for evidence of ground or surface water use;
- Inspect the affected portions of Building 12 for evidence of construction or demolition; and
- Contact the Colorado State Engineer's Office for a report of well permit applications for the site.

DOE will take appropriate action on the basis of the results of this monitoring to ensure that the regulated materials for which DOE is responsible are controlled. The results of this monitoring will be presented in the routine inspection report.

### **3.8 Regulatory Compliance Monitoring**

The routine site inspection will demonstrate that DOE remains in compliance with regulations governing LTS&M activities at the Grand Junction site. Those regulations are specified in Section 1.2, "Legal and Regulatory Requirements."

An evaluation of regulatory compliance may be required at other times, as well, in response to unusual or nonroutine occurrences. The results of this monitoring will be presented in the routine inspection report. Instances of noncompliance will be reported to regulators in accordance with the procedures set forth in Section 3.5.4, "Reporting Maintenance and Emergency Measures."

## **3.9 Site Drawings and Photographs**

At the completion of remedial action, Grand Junction site conditions were documented with as-built drawings and maps. Aerial photographs are taken regularly of the site. These documents are included in the site records.

### **3.9.1 Site Map**

The Grand Junction Site map (Figure 2–4) shows the approximate site property boundary, fences, structures, roads inside and near the property boundary, monitor wells, survey monuments, section, township, range, and principal meridian. The map has a scale of 1 in. = 100 ft (1:1,200). Map data are maintained in a geographical information system database.

The site map data will be used to generate a base map for site inspections. After each inspection, a new inspection map will be prepared that shows the location of items of interest noted during previous inspections. Each site inspection map will indicate the year of the inspection and inspection purpose.

### **3.9.2 Site As-Built Drawings and Maps**

As reclamation progressed, as-built conditions at the site were documented in as-built drawings and maps. These drawings and maps are included in the final remediation reports (listed in Appendix B), which are archived in the permanent site file. The as-built map data will comprise the initial site base map data.

### **3.9.3 Site Baseline Photographs**

Photographs taken during various phases of Grand Junction site remediation and a photographic record of final site conditions are maintained in the site records. These photographs provide a visual record to complement the as-built drawings and maps. The site was photographed during the orientation inspection of the site. This initial set of photographs will serve as site baseline photographs.

### **3.9.4 Site Aerial Photographs**

Aerial photographs of the Grand Junction site (in black and white or color) have been taken numerous times during operation of the mills and during reclamation of the Grand Junction site. The photographs provide a continuous record for monitoring changing conditions (e.g., erosion, vegetation, and land use) over time and are preserved in the permanent site file.

### **3.9.5 Site Inspection Photographs**

Photographs will also be taken during subsequent annual site inspections to document current conditions, especially new or changed conditions, at the site. Comparison of current photographs with the baseline set of photographs will be useful to document steady or changing conditions at the site over time.

### 3.10 Records

DOE–LM maintains records at their office in Grand Junction, Colorado, to support post closure maintenance of the closure site. These records are being maintained by LM because they contain critical information required to protect human health and the environment, manage land and assets, protect legal interests of the Department and the public and mitigate community impacts resulting from the cleanup of legacy waste. DOE–LM will include records generated during site operations in the LM site collection. Inactive or retired site records will be stored in a federal records center. The records are managed in accordance with the following requirements.

- Title 44, United States Code (U.S.C.), Chapter 29, Records Management by the Archivist of the United States and by the Administrator of General Services, Chapter 31, “Records Management by Federal Agencies;” and Chapter 33, “Disposal of Records.”
- Title 36 *Code of Federal Regulations* Chapter 12, Subchapter B, “Records Management.”
- DOE G 1324.5B, *Implementation Guide*.
- *LM Information and Records Management Transition Guidance*.

### 3.11 Quality Assurance

The long-term custody of the Grand Junction site and all activities related to the annual surveillance and maintenance of the site will comply with DOE Order 414.1A, *Quality Assurance*, the DOE contractor’s *Long-Term Surveillance and Maintenance Program Quality Assurance Program Plan* (DOE 1999), and the draft *Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs* (ASQC 1994).

### 3.12 Health and Safety

Health and safety requirements and procedures for DOE–LM activities are consistent with DOE Orders, federal regulations, and applicable codes and standards. The DOE Integrated Safety Management process serves as the basis for the Contractor’s Health and Safety Program.

Specific guidance is contained in the *Office of Legacy Management Project Safety Plan* (DOE 2006). This project safety plan identifies specific hazards associated with the anticipated scope of work and provides direction for the control of these hazards. During the pre-inspection briefing, personnel are required to review the plan to ensure that they have an understanding of the potential hazards and the health and safety requirements associated with the work to be performed.

## 4.0 References

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———, 1999. *Long-Term Surveillance and Maintenance Program, Quality Assurance Program Plan*, MAC-2152, Grand Junction Office, Grand Junction, Colorado, November.

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———, 2000b. *Guidance for Implementing the Long-Term Surveillance Program for UMTRCA Title I and Title II Disposal Sites* (draft), Grand Junction Office, Grand Junction, Colorado, February.

———, 2000c. *Building 12A, GJORAP, Site Transition, Summary of Remediation Options*, Grand Junction Office, Grand Junction, Colorado, April 18.

———, 2000d. Grand Junction Office Analytical Laboratory, Requisition 17002, Grand Junction Office, Grand Junction, Colorado, May 22.

———, 2000e. *Building 20, GJORAP, Site Transition, Summary of Remediation Options for Soil beneath the West End of Building 20 and Order-of-Magnitude Cost Estimates*, Grand Junction Office, Grand Junction, Colorado, July 31.

———, 2000f. “Offer to Purchase and Acceptance,” [sales contract conveying the Grand Junction site from DOE to the Riverview Technology Corporation, including Terms and Conditions for Sale No. 7-B-CO-463 B], Grand Junction Office, Grand Junction, Colorado, not finalized.

———, 2000g. *Technical Basis for Radiological Release of Grand Junction Office Building 20*, Grand Junction Office, Grand Junction, Colorado, not finalized.

———, 2000h. “Request for Deferred Remediation,” submitted to the Colorado Department of Public Health and Environment by the U.S. Department of Energy Grand Junction Office, Grand Junction, Colorado, not finalized.

———, 2000i. *Request for Deferral of Remedial Action*, (includes a human health and ecological risk assessment), U.S. Department of Energy Grand Junction Office, Grand Junction, Colorado, draft.

———, 2000j. Deed for the portion of the Grand Junction Office facility transferred by DOE to the Riverview Technology Corporation, not yet executed.

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———, 2006. *Office of Legacy Management Project Safety Plan*, Rev. 0, U. S. Department of Energy Office of Legacy Management, Grand Junction, Colorado, DOE-LM/GJ1116-2006, February.

U.S. Environmental Protection Agency (EPA), 2004. *Strategy to Ensure Institutional Control Implementation at Superfund Sites*, OSWER No. 9355.0-106, September.

### **DOE Orders**

- Order 232.1, “Occurrence Reporting and Processing of Operations Information,”  
October 30, 1995.  
Order 414.1A, “Quality Assurance”  
Order 5400.5, “Radiation Protection of the Public and the Environment,” June 5, 1990

### **Code of Federal Regulations**

- 10 CFR 40, “Domestic Licensing of Source Material”  
40 CFR 192, “Health and Environmental Protection Standards for Uranium and Thorium Mill  
Tailings”

### **Colorado Code of Regulations**

- 5CCR 1002-35, “Classifications and Numeric Standards for Gunnison and Lower Dolores  
River Basins”  
5 CCR 1002-41, “The Basic Standards for Ground Water”

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## **Appendix A**

### **Legal Description of the Grand Junction site and Real Estate Documentation**

The property transferred by DOE to the Riverview Technology Corporation by quit claim deed (Records of Mesa County, Book 2938, Page 153) is described as follows:

All that portion of Lot 1 lying West of the right-of-way of the Denver and Rio Grande Western Railroad Company, and all of lots 6 and 7, subject to right-of-way of the Denver and Rio Grande Western Railroad Company, all being in Section 27, Township 1 South, Range 1 West, Ute Meridian, Mesa County, Colorado containing 55.71 acres of land more or less, together with the private railroad spur thereon, and all rights and appurtenance thereto, also all water and water rights used thereon or appurtenant thereto, including the private line from artesian well, and all rights in connection therewith, and all buildings and improvements thereon as recorded in Book 415, Page 405;

And, that portion of G.L.O. Lot 1, Section 26, Township 1 South, Range 1 West, Ute Principal Meridian, Mesa County, Colorado lying west of the right-of-way of the Denver and Rio Grande Western Railroad Company containing 1.14 acres of land more or less, as recorded in Book 668, Page 202;

Except: Parcel 1, located in G.L.O. Lot 7 of Section 27, Township 1 South, Range 1 West, Ute Principal Meridian, Mesa County, Colorado containing 2.68 acres of land more or less as conveyed to A. N. Applebaum and recorded in Book 1606, Page 986; and

Except that portion to be reserved to the United States and called the Army Reserve Tract: containing 7.97 acres more or less;

This parcel then contains 46.20 acres calculated as follows: 55.71 acres (1943 Deed in Book 415, Page 405) plus 1.14 acres (Deed in Book 668, Page 202) - minus - 2.68 acres (Deed in Book 1606, Page 986) - minus - 7.97 acres (Army Reserve Tract to be recorded) equals 46.20 acres of land more or less.

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**Appendix B**

**Grand Junction Office Remedial Action Program  
Final Reports**

*Final Report of the Decontamination and Decommissioning of the Exterior Land Areas at the Grand Junction Projects Office Facility, DOE/ID/12584-220, GJPO-GJ-13, Grand Junction Projects Office, Grand Junction, Colorado, September 1995.*

*Final Report of the Decontamination and Decommissioning of Building 1 at the Grand Junction Projects Office Facility, DOE/ID/12584-276, GJPO-GJ-36, Grand Junction Projects Office, Grand Junction, Colorado, August 1996.*

*Technical Basis for Radiological Release of Grand Junction Office Building 2, GJO-97-12-FOS, GJO-GJ-45, Grand Junction Projects Office, Grand Junction, Colorado, July 1997.*

*Final Report of the Decontamination and Decommissioning of Building 6 at the Grand Junction Projects Office Facility, DOE/ID/12584-254, GJPO-GJ-25, Grand Junction Projects Office, Grand Junction, Colorado, July 1996.*

*Closeout Report of the Decontamination and Decommissioning of the South Bay (Phase I) of Building 7 at the Grand Junction Office Facility, GJO-99-98-FOS, Grand Junction Office, Grand Junction, Colorado, April 1999.*

*Closeout Report of the Decontamination and Decommissioning of the Center and North Sections (Phase II) of Building 7 at the Grand Junction Office Facility, GJO-99-119-FOS, Grand Junction Office, Grand Junction, Colorado, December 1999.*

*Final Report of the Radiological Release Survey of Building 11 at the Grand Junction Office Facility, GJO-97-15-FOS, GJO-GJ-46, Grand Junction Projects Office, Grand Junction, Colorado, September 1997.*

*Final Report of the Decontamination and Decommissioning of Building 18 at the Grand Junction Projects Office Facility, DOE/ID/12584-278, GJPO-GJ-39, Grand Junction Projects Office, Grand Junction, Colorado, September 1996.*

*Final Report of the Radiological Release Survey of Building 19 at the Grand Junction Office Facility, GJO-97-16-FOS, GJO-GJ-47, Grand Junction Projects Office, Grand Junction, Colorado, September 1997.*

*Closeout Report of the Radiological Release Survey of Building 26 at the Grand Junction Office Facility, GJO-99-82-FOS, Grand Junction Office, Grand Junction, Colorado, January 1999.*

*Radiological Survey Map, Building 27, Grand Junction Office, Grand Junction, Colorado, March 1, 2000.*

*Closeout Report of the Decontamination and Decommissioning of Building 28 at the Grand Junction Office Facility, GJO-99-83-FOS, Grand Junction Office, Grand Junction, Colorado, January 1999.*

*Final Report of the Radiological Release Survey of Building 29 at the Grand Junction Office Facility, GJO-97-17-FOS, GJO-GJ-48, Grand Junction Projects Office, Grand Junction,*

Colorado, September 1997. (A final radiological release survey will be required when DOE–GJO vacates this building.)

*Closeout Report of the Radiological Release Survey of Building 30 at the Grand Junction Office Facility*, GJO-99-84-FOS, Grand Junction Office, Grand Junction, Colorado, January 1999.

*Final Report of the Radiological Release Survey of Building 30B at the Grand Junction Office Facility*, GJO-97-18-FOS, GJO-GJ-49, Grand Junction Projects Office, Grand Junction, Colorado, September 1997. (A final radiological release survey will be required when DOE–GJO vacates this building).

*Final Report of the Decontamination and Decommissioning of Building 31 at the Grand Junction Projects Office Facility*, DOE/ID/12584-257, GJPO-GJ-28, Grand Junction Projects Office, Grand Junction, Colorado, July 1996.

*Closeout Report of the Decontamination and Decommissioning of Building 31A at the Grand Junction Office Facility*, GJO-99-107-FOS, Grand Junction Office, Grand Junction, Colorado, September 1999.

*Closeout Report of the Decontamination and Decommissioning of Building 32 at the Grand Junction Office Facility*, GJO-2000-150-FOS, Grand Junction Office, Grand Junction, Colorado, July 2000. (A final radiological release survey will be required when DOE–GJO vacates this building.)

*Closeout Report of the Decontamination and Decommissioning of Building 33 at the Grand Junction Office Facility*, GJO-99-108-FOS, Grand Junction Office, Grand Junction, Colorado, September 1999.

*Final Report of the Decontamination and Decommissioning of Building 34 at the Grand Junction Projects Office Facility*, DOE/ID/12584-274, GJPO-GJ-34, Grand Junction Projects Office, Grand Junction, Colorado, August 1996.

*Closeout Report of the Decontamination and Decommissioning of Building 35 at the Grand Junction Office Facility*, GJO-99-109-FOS, Grand Junction Office, Grand Junction, Colorado, September 1999.

*Final Report of the Decontamination and Decommissioning of Building 36 at the Grand Junction Projects Office Facility*, DOE/ID/12584-275, GJPO-GJ-35, Grand Junction Projects Office, Grand Junction, Colorado, August 1996.

*Closeout Report of the Decontamination and Decommissioning of Building 37 at the Grand Junction Office Facility*, Grand Junction Office, Grand Junction, Colorado, July 1999.

*Final Report of the Decontamination and Decommissioning of Building 39 at the Grand Junction Projects Office Facility*, DOE/ID/12584-258, GJPO-GJ-29, Grand Junction Projects Office, Grand Junction, Colorado, July 1996.

*Closeout Report of the Radiological Release Survey of Building 40 at the Grand Junction Office Facility*, GJO-99-120-FOS, Grand Junction Office, Grand Junction, Colorado, November 1999.

*Closeout Report of the Radiological Release Survey of Building 41 at the Grand Junction Office Facility*, GJO-99-121-FOS, Grand Junction Office, Grand Junction, Colorado, November 1999.

*Closeout Report of the Radiological Release Survey of Building 43 at the Grand Junction Office Facility*, GJO-99-122-FOS, Grand Junction Office, Grand Junction, Colorado, November 1999.

*Final Report of the Decontamination and Decommissioning of Building 44 at the Grand Junction Projects Office Facility*, DOE/ID/12584-260, GJPO-GJ-30, Grand Junction Projects Office, Grand Junction, Colorado, July 1996.

*Radiological Survey Map*, Building 44A, DOE Grand Junction Office, Grand Junction, Colorado, January 19, 2000.

*Closeout Report of the Decontamination and Decommissioning of Building 46 at the Grand Junction Office Facility*, GJO-99-85-FOS, Grand Junction Office, Grand Junction, Colorado, January 1999.

*Closeout Report of the Radiological Release Survey of Building 51 at the Grand Junction Office Facility*, GJO-99-123-FOS, Grand Junction Office, Grand Junction, Colorado, November 1999.

*Final Report of the Decontamination and Decommissioning of Building 52 at the Grand Junction Projects Office Facility*, DOE/ID/12584-261, GJPO-GJ-31, Grand Junction Projects Office, Grand Junction, Colorado, September 1996.

Building 53C is occupied by Oak Ridge National Laboratory, which will be responsible for documenting that the structure can be released for unrestricted use.

*Final Report of the Radiological Release Survey of Building 54 at the Grand Junction Office Facility*, GJO-97-19-FOS, GJO-GJ-50, Grand Junction Projects Office, Grand Junction, Colorado, September 1997.

Building 55 is occupied by Oak Ridge National Laboratory, which will be responsible for documenting that the structure can be released for unrestricted use.

*Final Report of the Radiological Release Survey of Building 56 at the Grand Junction Office Facility*, GJO-97-20-FOS, GJO-GJ-51, Grand Junction Projects Office, Grand Junction, Colorado, September 1997.

*Closeout Report of the Radiological Release Survey of Buildings 61A, 61B, and 61C at the Grand Junction Office Facility*, GJO-2000-151-FOS, Grand Junction Office, Grand Junction, Colorado, July 2000. (A final radiological release survey will be required when DOE–GJO vacates these buildings).

*Radiological Survey Map*, Building 61D, DOE Grand Junction Office, Grand Junction, Colorado, January 19, 2000.

*Radiological Survey Map*, Building 64, DOE Grand Junction Office, Grand Junction, Colorado, January 19, 2000.

*Radiological Survey Map*, Building 65, Grand Junction Office, Grand Junction, Colorado, December 30, 1999.

*Radiological Survey Map*, Building 66, Grand Junction Office, Grand Junction, Colorado, December 29, 1999.

*Closeout Report of the Radiological Release Survey of Building 810 at the Grand Junction Office Facility*, GJO-2000-135-FOS, Grand Junction Office, Grand Junction, Colorado, January 2000.

*Closeout Report of the Decontamination and Decommissioning of Building 938 at the Grand Junction Office Facility*, GJO-2000-134-FOS, Grand Junction Office, Grand Junction, Colorado, January 2000.

*Closeout Report of the Decontamination and Decommissioning of the Abandoned Septic Tanks at the Grand Junction Office Facility*, GJO-2000-149-FOS, Grand Junction Office, Grand Junction, Colorado, June 2000.

*Closeout Report of the Decontamination and Decommissioning of the Buried Utilities and Soil Under Pavement at the Grand Junction Office Facility*, GJO-99-131-FOS, Grand Junction Office, Grand Junction, Colorado, July 2000.

## **Appendix C**

### **Field Photograph Log**



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## **Appendix D**

### **Routine Site Inspection Checklist**

## Inspection Closeout Summary

A. At the end of the inspection and before leaving the site, the inspection team should:

1. Be satisfied that it has sufficient information (photographs, notes, measurements, sketches, etc.) to describe and evaluate findings and observations for the site inspection report.
2. Summarize, in the field notes or elsewhere, the following information:
  - Serious problems or threatening factors that require immediate attention or follow-up action;
  - Actual or potential problems not requiring immediate attention but that require further observation possibly including a follow-up inspection; and
  - Changes recommended for this checklist before the next inspection.

B. If serious problems are identified during the inspection, the inspection team should:

1. Immediately notify the DOE–GJO Project Manager (248-6091) and the Contractor LM Project Manager (248-6588).
2. Follow GJO procedures for compliance with DOE Order 232.1, “Occurrence Reporting and Processing of Operations Information.”

C. Reporting

Describe pertinent changes to site conditions, results of institutional controls evaluation, and evaluation of regulatory requirements for this site. Note that table value standards are derived on the basis of background water analysis results, and that other water quality limits can change frequently. LTSM Program personnel reviewing water analysis results are advised to confirm current water quality standards.

## 2005 INSPECTION CHECKLIST

### GRAND JUNCTION OFFICE, COLORADO, SITE

Status of Site Inspections

Date of this Revision:

February 2, 2005

Last Annual Inspection:

February 25, 2004

Inspectors:

Johnson

Next Annual Inspection (Planned):

February 16, 2005

Scheduled Inspector:

Widdop and Campbell

No.	ITEM	ISSUE	ACTION
1	Access	<p>The site is owned by the Riverview Technology Corporation (RTC) and the U.S. Army Reserve. Access to the Army Reserve portion is restricted but is not required; observe land use from the boundary fence.</p> <p>Access to the computer room and storage vault in Building 12 is restricted. No other buildings need to be inspected.</p>	<p>None.</p> <p>Contact Tom Bachtell for access to Building 12.</p>
2	Site activity	DOE leases several buildings from the RTC. The Army Reserve owns Building 7; personnel are offsite on military assignment. The Small Business Incubator leases the remaining buildings from RTC.	Be alert for vehicular traffic through the South Gate and around the Small Business Incubator buildings.
3	Tailgate safety meeting	Lead inspector will conduct a brief safety meeting prior to working on the site.	All inspection participants must sign the safety meeting form.
4	Specific site surveillance features	Two survey monuments; 13 warning signs around North Pond, South Pond, and wetlands area; 8 monitor wells; and a borehole with radium foil that was decommissioned in place require inspection.	Check the condition of the features and the security of the monitor wells.
5	Interior portions of the site	<p>Contaminated materials remain under portions of Building 12. The materials will be remediated when DOE demolishes the building.</p> <p>Warning signs are posted around the North Pond, the South Pond, and the wetland areas due to contaminated water.</p> <p>The alluvial aquifer underlying the facility is contaminated and is being remediated by natural flushing. Excavations that could expose the ground water require pre-approval by DOE and CDPHE.</p> <p>A DOE in-ground calibration facility is located on site. The facility is not a required part of the inspection but it is checked for security and general condition as a best-management practice.</p>	<p>Verify that no construction has occurred in the rooms overlying the contamination or adjacent to the building outside the areas of contamination.</p> <p>Check for signs of trespass, vandalism, and fishing or other uses of the water. Evaluate sign condition.</p> <p>Check for signs of excavation.</p> <p>Check the facility and fill out a status report.</p>
6	Outlying area	The site is surrounded by private and municipal property.	Check for signs of activity, development, or land use changes adjacent to the site that could affect the natural flushing of the aquifer.

## Emergency Information

Emergency contacts and phone numbers for the Grand Junction site are as follows:

- Emergency Medical Service/Ambulance  
911
- Fire  
911
- Sheriff/Police  
(970) 242-6707 Mesa County Sheriff  
(970) 248-7277 or 911 for Colorado State Police
- Colorado Department of Public Health and Environment  
(970) 248-7164
- Colorado 24-hour Emergency Response Line is 1-877-518-5608

Inspectors should locate the nearest telephone before commencing inspection activities.

Directions from the site to St. Mary's Hospital are as follows:

- From the Grand Junction site proceed up the hill past the cemetery, follow the road around to the left to the traffic light at Highway 50.
- Turn left and cross the Colorado River and the railroad tracks, continue straight on 5th Street through downtown and across North Avenue, past the High School to the stop sign at Orchard Avenue.
- Turn right onto Orchard Avenue, proceed to the traffic light at 7th Street.
- Turn left onto 7th Street, look for the sign about 3 blocks up on the left indicating the emergency entrance to the hospital.

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## **Appendix E**

### **Institutional Controls**

The following institutional controls were included in the transfer documents conveying a portion of the Grand Junction site to the Riverview Technology Corporation. Institutional controls addressing water use restrictions on the Army Reserve area will be added when those agreements are finalized.

## 1. Contamination in Ground Water and Surface Expressions of Ground Water

*Contamination:* The ground water underlying the site and the surface expressions of the ground water (the North Pond, South Pond, and Wetlands areas) are known by both parties to be contaminated with elevated levels of certain constituents resulting from the historical stockpiling of uranium ore and the disposal of process wastes from milling and concentrating activities. Following removal of the source of contamination, the accepted remedial action for eliminating the contamination is the natural flushing of the ground water over a period of 50 to 80 years (anticipate to be within regulatory standards between the years 2050 and 2080). Risk assessments performed concluded that the contaminants posed a threat to human health only if ingested by drinking the water.

*Restriction:* Grantee shall not engage in any disturbance or use of any untreated ground water underlying the Property, including the drilling of wells, the excavation of soils that expose ground water, or the diversion of ground water through any means without express written consent of the State of Colorado Department of Public Health and Environment (CDPHE) and the Grantor, its successors or assigns. This also includes, but is not limited to, restrictions on excavation of the underlying soils for their gravel content. Any request for consent to disturb or use any untreated ground water underlying the Property must include water quality data and a human health and ecological risk evaluation.

Grantor will construct signs at the South Pond, North Pond, and Wetlands area to notify the public that no swimming, fishing, or drinking of the waters is permitted. Grantee and successors must maintain the signs until the State of Colorado approves the removal of the notification signs. Grantor will continue to monitor the water quality of the ponds and, when the water quality meets State standards, request the State to approve removal of the notification signs.

Grantee shall not engage in any use of the surface expressions of ground water that might result in accidental consumption of the water, fish, or other aquatic species. This includes, but is not limited to, restrictions on fishing, swimming, activities that result in prolonged human contact with the water, hatchery operations for production of fish or other aquatic species for human consumption, and other recreational uses.

## 2. Building 12 Soil Contamination

*Contamination:* Grantor acknowledges that there is known contamination on the Property underlying the south end of Building 12 (see Exhibit D); and covenants to remain solely responsible for the complete decontamination of these conditions, as well as any later-discovered contamination. The contamination, believed to be the residue of a stockpile of uranium ores, poses a potential threat of radioactive exposure to individuals excavating the soils. There is no threat to persons occupying the building and conducting routine business activities, nor is there any indication the residual contamination is impacting the ground water.

*Restriction:* Grantee shall not, under any circumstances, without express written permission of CDPHE and the Grantor, engage in any activity that would result in the disturbance of soils or structures underlying the south end of Building 12. Grantor is required to remediate all contamination under and around Building 12 prior to termination of Grantor's lease of the building. Grantee accepts that the remediation will include demolition of Building 12 as the most cost-effective process to complete the remedial action and hereby agrees to accept this remediation approach. Grantor will not be responsible to rebuild the building or otherwise compensate the Grantee for the loss of the building.

### 3. Building 20 Soil Contamination

*Contamination:* Grantor acknowledges that there is known contamination on the Property beneath the southwest corner of Building 20 (see Exhibit D); and covenants to remain solely responsible for the complete decontamination of the soils. The contamination, believed to be from mill tailings used as fill material to raise the elevation of a pond bank prior to erection of the building, poses a potential threat to individuals excavating the soils from exposure to radioactive materials. There is no threat to persons occupying the building and conducting routine business activities, nor is there any indication the residual contamination is impacting the ground water.

*Restriction:* Grantee and its assigns shall not, under any circumstances, without express written permission of CDPHE and the Grantor, engage in any activity that would result in disturbance of soils or structures underlying the south end of Building 20. Prior to altering the structural integrity of the floor at the south end of Building 20, such permission must be obtained. Grantor reserves the right to periodically inspect activities conducted in Building 20 to assure that floor integrity is maintained in the south end. If Grantee determines within three (3) years of the date of sale that the analytical laboratory should be demolished, Grantor will demolish Building 20 and will remediate all contamination.

After year three (3), if Building 20 is vacant for longer than six (6) months, Grantee will demolish Building 20 within an additional six (6) months and Grantor will remediate all contamination under and around the structure.

### 4. Foil Sources in Abandoned Well

*Contamination:* Grantee acknowledges that there is known contamination in the form of two foil radium sources encased in an abandoned well at the site (see Exhibit D for location). The well was abandoned in accordance with State of Colorado requirements and the sources were encased in the well with the approval of the state.

*Restrictions:* Grantee shall not engage in any activity that disturbs the seal on the well encasement or the well itself without the express written consent of CDPHE and the Grantor.

### 5. Enforceable Agreement

Grantor has entered into an enforceable agreement with CDPHE in accordance with State of Colorado Executive Order D.013.98 and CERCLA 120(h). The agreement establishes the Grantor's clean-up plans for the above (with the exception of C.4 [the well with radium foil sources]), reiterates the land use controls placed upon the Grantee and successors, specifies the

monitoring of contaminated areas by the Grantor, and provides a funding mechanism for the Grantor to reimburse CDPHE for oversight activities.

#### 6. Grantee's Responsibilities

Grantee is responsible for assuring that the restrictions and Grantor's rights of access related to the above and stated in this Agreement and in the Deed, are stated in the instrument of conveyance if Grantee passes ownership to another entity. Grantee is responsible for notifying Grantor's Long Term Surveillance and Maintenance Program of such transfer. Grantee acknowledges its landlord responsibilities to monitor tenants' activities to assure protection of Building 12 and 20 floors, to allow for safe soil excavation on the Property, to protect the abandoned well identified above, and to be protective of Grantee's remaining ground water monitoring wells.

Grantee acknowledges that planned use of the Property is for a mixture of commercial, industrial, office space, and open space, as stated in Grantee's reuse plan. Grantee's planned use is not restricted except as herein noted.

End of current text

## **Appendix F**

### **Evaluation of the Ground Water and Surface Water Monitoring Program at the Grand Junction, Colorado, Site**

## **Introduction**

The *Long Term Surveillance Plan for the U. S. Department of Energy Grand Junction, Colorado, Office Facility (LTSP)* (DOE 2001c) requires a review of the ground water monitoring program at the end of a five-year monitoring period. The current monitoring period ends in 2005. As stated in the LTSP, “DOE will evaluate monitoring results in consultation with the State of Colorado to determine the requirements for future monitoring at the site,” and the evaluation “will include a statistical evaluation of contaminant concentration trends.” The purpose of this paper is to present an evaluation of monitoring results, propose a revised monitoring program based on the evaluation, and present the results of a statistical evaluation on the progress of natural flushing in the alluvial aquifer. The LTSP will be updated to reflect the proposed changes.

## **General Considerations**

The LTSP specifies conducting annual ground water and surface water sampling in late winter. DOE proposes to continue sampling on an annual basis to provide sufficient data to continue evaluation on the progress of natural flushing in the alluvial aquifer. Also, DOE proposes to continue sampling in late winter to be consistent with the current schedule, which will enhance comparability of data by minimizing the effects of seasonal variation.

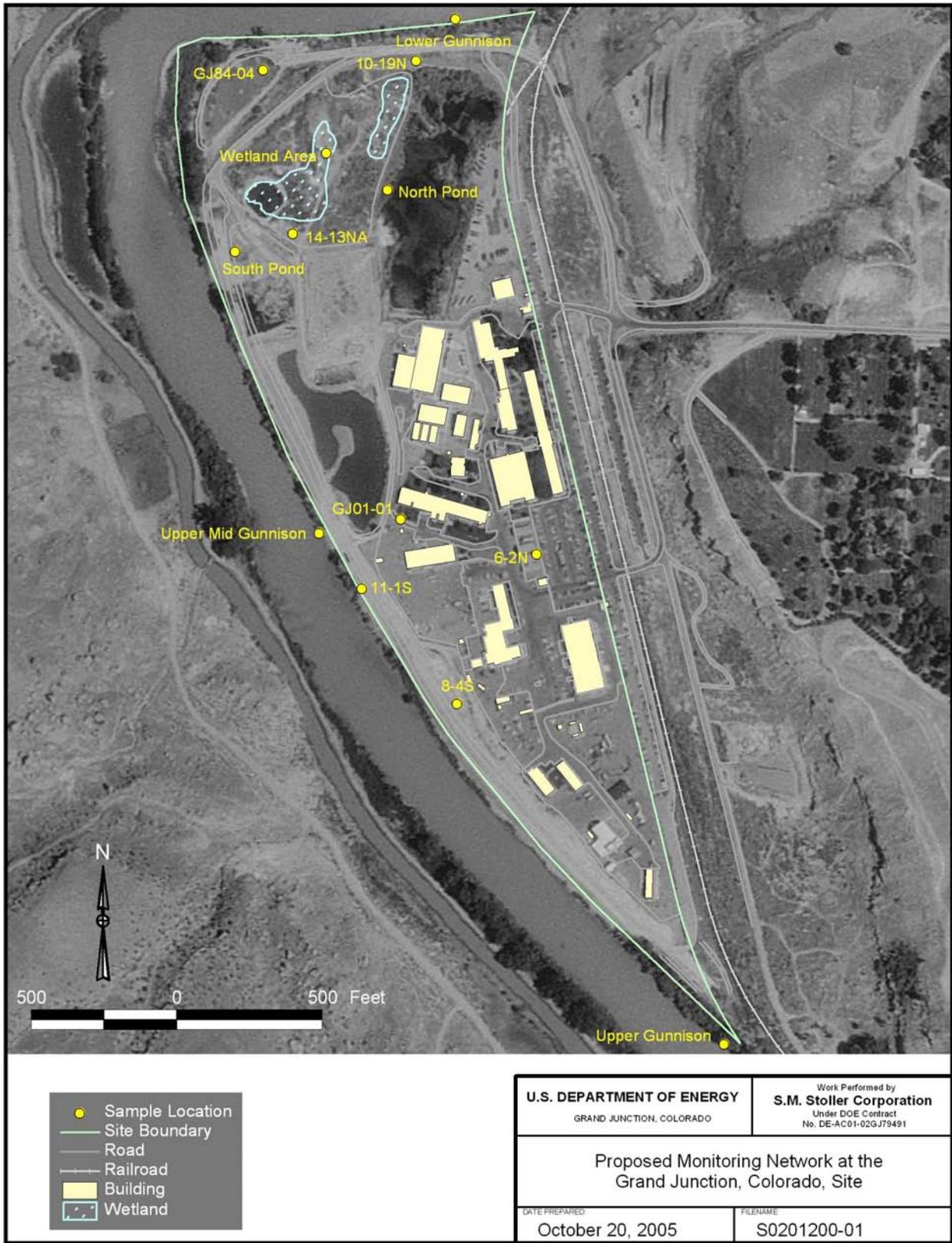
DOE has been analyzing ground water and surface water samples for the same constituents during the monitoring period. The analyte list was developed based on a consideration of water quality standards (ground water and surface water), potential human health and ecological risks, general water quality indicators, and historic site monitoring results. The analyte list in the LTSP included: arsenic, chloride, chromium, gross alpha, manganese, molybdenum, nitrate, selenium, sulfate, total dissolved solids (TDS), and uranium. These analytes are reevaluated here for both ground water and surface water based on the more recent sampling results.

According to the compliance action plan for the site (DOE 2001b), “criteria for modifying or terminating ground water and surface water monitoring will be (1) continued decrease in concentrations of COCs as predicted and observed, (2) compliance with regulatory limits, and (3) no unacceptable risks to human health and the environment resulting from site-related contamination. Modification may include changing or adding additional sample locations or changing the suite of analytes.” These criteria will be used to reevaluate monitoring requirements based on more recent sampling results.

## **Ground Water**

### *Ground Water Monitoring Network*

The ground water monitoring network specified in the LTSP consists of six monitor wells (8-4S, 11-1S, 6-2N, 14-13NA, GJ84-04, and 10-19N). These wells are distributed throughout the site (Figure F-1) and have an extensive monitoring history; therefore, it is proposed that these wells be retained in the ground-water monitoring network to verify aquifer restoration.



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Figure F-1. Proposed Monitoring Network at the Grand Junction, Colorado, Site

Two monitor wells were installed and included in the monitoring network after the LTSP was issued. Monitor wells GJ01-01 and GJ01-02 were installed upgradient and downgradient, respectively, of remaining soil contamination under Building 20 to determine if the soil contamination was impacting ground water quality. Monitoring conducted since 2002 has shown that concentrations of molybdenum, selenium, TDS, and uranium in samples collected from GJ01-01 have been consistently higher than those collected from GJ01-02. These results indicate that there is no significant impact from the soil contamination because GJ01-01 is upgradient of GJ01-02. Future impacts from the soil contamination are not expected because: (1) the soil contamination is shallow and contact with ground water is not expected, and (2) the soil contamination will be remediated during the demolition of Building 20, which is scheduled for 2006. Therefore, DOE recommends that GJ01-01 be retained in the long-term monitoring program to monitor the progress of natural flushing in this portion of the aquifer, and discontinue monitoring of GJ01-02 because of the close proximity to and lower analyte concentrations than GJ01-01. The proposed ground water monitoring network is shown on Figure F-1.

### Ground Water Analytes

Ground water monitoring results were evaluated to determine if any regulatory standards were exceeded and, if so, whether this presented any unacceptable risk. A summary of analyte concentrations in the alluvial over the past five years is presented in Table F-1.

Table F-1. Summary of Analyte Concentrations<sup>a</sup> in the Alluvial Aquifer from 2001 to 2005

Analyte	Standard <sup>b</sup>	Range	D <sup>c</sup> /N <sup>d</sup>	N Exceeding Standard
Arsenic	0.05	<0.006-0.012	36/38	0
Chloride	250	3.9-410	38/38	5
Chromium	0.05	NA <sup>e</sup>	0/38	0
Gross Alpha <sup>f</sup>	15	31.6-526.27	38/38	0
Manganese	0.05	0.0098-4.31	38/38	37
Molybdenum	0.10	0.0197-0.270	38/38	16
Nitrate as N	10	<0.01-6	5/8	0
Nitrate as NO <sub>3</sub>	44.27	<0.044-40.8	19/25	0
Selenium	0.01	<0.0003-0.116	35/38	13
Sulfate	250	250-3,200	38/38	38
TDS	2,210	583-5,400	38/38	18
Uranium	0.044	0.063-0.668	38/38	38

<sup>a</sup>Units are in mg/L, except for gross alpha, which is in pCi/L.

<sup>b</sup>Standards from 40 CFR 192 and CDPHE Water Quality Control Commission 5 CCR 1002-41, Regulation No. 41, The Basic Standards for Ground Water.

<sup>c</sup>Number of observations above the detection limit (excludes duplicates).

<sup>d</sup>Number of observations (excludes duplicates).

<sup>e</sup>NA = not applicable.

<sup>f</sup>Gross alpha standard excludes uranium, concentrations displayed include uranium.

**Arsenic.** Arsenic has been below the Uranium Mill Tailings Radiation Control Act (UMTRCA) ground water standard (40 CFR 192) for the last 5 years in all monitoring wells as shown. Eliminate from monitoring requirements.

**Chloride.** Samples from one monitoring well have exceeded the Federal and State secondary drinking water standard. However, the standard is not enforceable and is based on aesthetic

concerns. Furthermore, institutional controls prevent use of untreated ground water for drinking water purposes. Eliminate from monitoring requirements.

Chromium. Chromium has been below the detection limit in all wells for the last five years. Eliminate from monitoring requirements.

Gross alpha. Gross alpha concentrations were below the standard (which excludes uranium) in all wells in 2005. Gross alpha activity measured in samples is attributable to uranium. Eliminate from monitoring requirements.

Manganese. Manganese has exceeded the Federal and State secondary drinking water standard in several wells and has also exceeded a risk-based concentration for drinking water. However, institutional controls prevent use of untreated ground water for drinking water purposes. Ground water has been at or below the benchmark for plant toxicity used in the ecological risk assessment for the last several years. Eliminate from monitoring requirements.

Molybdenum. Molybdenum concentrations slightly exceeded the UMTRCA ground water standard in two wells during 2005. Concentrations have been steadily decreasing during the monitoring period. Continue monitoring for molybdenum until next reevaluation.

Nitrate. Nitrate has been below the UMTRCA ground water standard in all wells over the last 5 years. Eliminate from monitoring requirements.

Selenium. Selenium in two wells have exceeded the UMTRCA ground water standard, though only one well exceeded the State ground water standard. Continue monitoring until next reevaluation.

Sulfate. Samples from several wells have exceeded the Federal and State secondary drinking water standard. However, the standard is not enforceable and is based on aesthetic concerns. Furthermore, institutional controls prevent use of untreated ground water for drinking water purposes. Eliminate from monitoring requirements.

TDS. Samples from several wells have exceeded the site-specific State standard. However, TDS can be estimated using specific conductance measurements. Eliminate from monitoring requirements until next reevaluation.

Uranium. All wells exceed the UMTRCA ground water. Continue monitoring for uranium until acceptable levels are achieved.

## **Surface Water**

### *Surface Water Monitoring Network*

The surface-water monitoring network specified in the LTSP consists of six locations including two Gunnison River locations, two wetlands locations, the North Pond, and the South Pond. DOE proposes to retain the Gunnison River and Pond locations, add an additional Gunnison River location, and modify the wetlands locations. The Upper Middle Gunnison location, Lower Gunnison location, North Pond, and South Pond will be retained as established monitoring locations with extensive historical data. After completion of the LTSP, the Upper Gunnison location was added to the sampling network to monitor background river water quality in order to better assess concentrations of constituents of concern in samples collected adjacent to and

downstream of the site. This location should remain in the surface-water monitoring program. Monitoring of the onsite wetlands should be accomplished by sampling the Wetland Area sampling location. This location was excavated below the average low ground water elevation and was, therefore, designed to contain water year round. This established location has extensive historical data and is typically the only area in the wetlands that has water in the late winter when sampling is scheduled. The proposed surface-water monitoring network is shown on Figure F-1.

### *Surface Water Analytes*

Any site-related contamination present in surface water is the result of ground water discharge to the surface. It is assumed that constituents in ground water that meet regulatory standards are also not of concern in surface water and can be eliminated from further monitoring. These constituents include arsenic, chromium, gross alpha, and nitrate. Of the remaining analytes, all but molybdenum and uranium were selected based on unenforceable secondary drinking water standards. Additionally, background water quality in the Gunnison River has exceeded surface water quality standards for manganese, selenium, and sulfate. Based on the previously completed risk assessments, human health and ecological risks associated with current and potential uses of surface water were determined to be minimal. Concentrations of most constituents have decreased since that time. Because molybdenum, selenium, and uranium are the only constituents of concern in ground water, it is recommended that, as a best management practice, these analytes be monitored in surface water as well. A summary of concentrations in onsite ponds and the Gunnison River is presented in Table F-2.

### **Statistical Analysis**

Ground water modeling has predicted that the alluvial aquifer will naturally flush to below applicable standards in 50 to 80 years after removal of soil contamination (DOE 1989). Soil remediation commenced in 1989 with the signing of the Record of Decision. Source control was achieved in 1994 and signaled the beginning of the natural flushing period, therefore, 12 years have elapsed in the 50 to 80 year timeframe predicted by the model. As stated in the LTSP, a statistical evaluation of contaminant concentrations is required to assess the progress of natural flushing.

To meet this objective, a trend analysis using the Mann-Kendall test (Gilbert 1987) was performed to assess contaminant concentrations. Uranium was selected as the indicator parameter because: (1) it is widespread throughout the aquifer; (2) it exceeded the standard at all wells in the monitoring network in 2005; (3) historic concentrations are up to two orders of magnitude above the standard; and (4) uranium was the constituent that was modeled. Only data collected during the winter months (if available) was used in the statistical analysis to avoid seasonal variation. The Mann-Kendall test determines if an upward trend, downward trend, or no trend exists. As shown in Table F-3, based on this test, seven out of the eight wells in the current monitoring network have a downward trend.

Table F-2. Summary of Analyte Concentrations<sup>a</sup> in Surface Water from 2001 to 2005

Analyte	Range				D <sup>b</sup> /N <sup>c</sup>			
	North Pond	South Pond	Wetland Area	Gunnison River	North Pond	South Pond	Wetland Area	Gunnison River
Arsenic	0.0004-0.0022	0.0005-0.0096	0.0008-0.0113	<0.0006-0.001	4/4	4/4	5/5	11/12
Chloride	242-775	82-115	368-3,010	7.34-18.3	4/4	4/4	5/5	12/12
Chromium	NA <sup>d</sup>	NA	NA	NA	0/4	0/4	0/5	0/12
Gross Alpha	76.8-22.39	128.35-199.67	563-,820	<5.14-9.94	4/4	4/4	5/5	10/12
Manganese	0.0071-0.210	0.0085-0.0687	0.0065-0.250	0.026-0.100	4/4	4/4	5/5	12/12
Molybdenum	0.0081-0.0248	0.0791-0.101	0.450-0.700	<0.0015-0.0037	4/4	4/4	5/5	9/12
Nitrate as N	NA	NA	NA	<0.0-0.74	0/1	0/1	0/1	1 /2
Nitrate as NO <sub>3</sub>	<01374-0.491	0.147-1.07	<0.044-0.541	3.97-7.4	1 /2	2/2	2/3	7/7
Selenium	0.0035-0.0085	0.0004-0001	0.0013-0.0231	0.0035-0.017	4/4	4/4	5/5	12/12
Sulfate	1,630-7,300	1,220-1,500	2,970-34,700	291-530	4/4	4/4	5/5	12/12
TDS	2,920-12,300	2,000-2,480	6,950-57,600	605-1,000	4/4	4/4	5/5	12/12
Uranium	0.113-0.554	0.261-0.365	1.5-2.5	0.0072-0.0148	4/4	4/4	5/5	12/12

<sup>a</sup>Units are in mg/L, except for gross alpha, which is in pCi/L.

<sup>b</sup>Number of observations above the detection limit (excludes duplicates).

<sup>c</sup>Number of observations (excludes duplicates).

<sup>d</sup>NA = not applicable.

Table F-3. Trend Analyses of Uranium Concentrations in Wells at the Grand Junction Site

Well ID	Trend <sup>a</sup>	N <sup>b</sup>	Curve Type	Curve Correlation (r <sup>c</sup> )	Estimated Completion (Years)
10-19N	Downward	16	Power	0.909	55
11-1S	Downward	16	Exponential	0.925	11
14-13NA	Downward	15	Power	0.639	253
6-2N	Downward	10	Power	0.826	33
8-4S	Downward	16	Exponential	0.624	27
GJ84-04	Downward	16	Exponential	0.895	18
GJ01-01	Downward	4	NA	NA	NA
GJ01-02	None	4	NA	NA	NA

<sup>a</sup>Data collected from 1990 to 2005.

<sup>b</sup>N=number of observations

<sup>c</sup>r=Correlation coefficient – a value of 1 represents a perfect correlation.

To assess the progress of natural flushing and determine if ground water is flushing according to model predictions, additional data analysis was conducted. If a downward trend was indicated for uranium (with a minimum of 10 data points), then a best-fit curve was drawn using Excel to approximate the actual data as shown in Figures F-2 through F-7. Though not shown on the figures, the curve was extrapolated to the point where it intercepts the uranium standard. The corresponding time when the curve meets the standard provides an estimate of flushing time.

Curves described by an exponential equation or a power equation were selected based on their correlation coefficient (r). If a significant difference in the r values existed, the curve with the highest r value was selected. Estimates of flushing time are displayed in Table F-3. With the exception of well 14-13NA (which has a low r value), estimated flushing times are within the range predicted by the ground water model of 50 to 80 years.

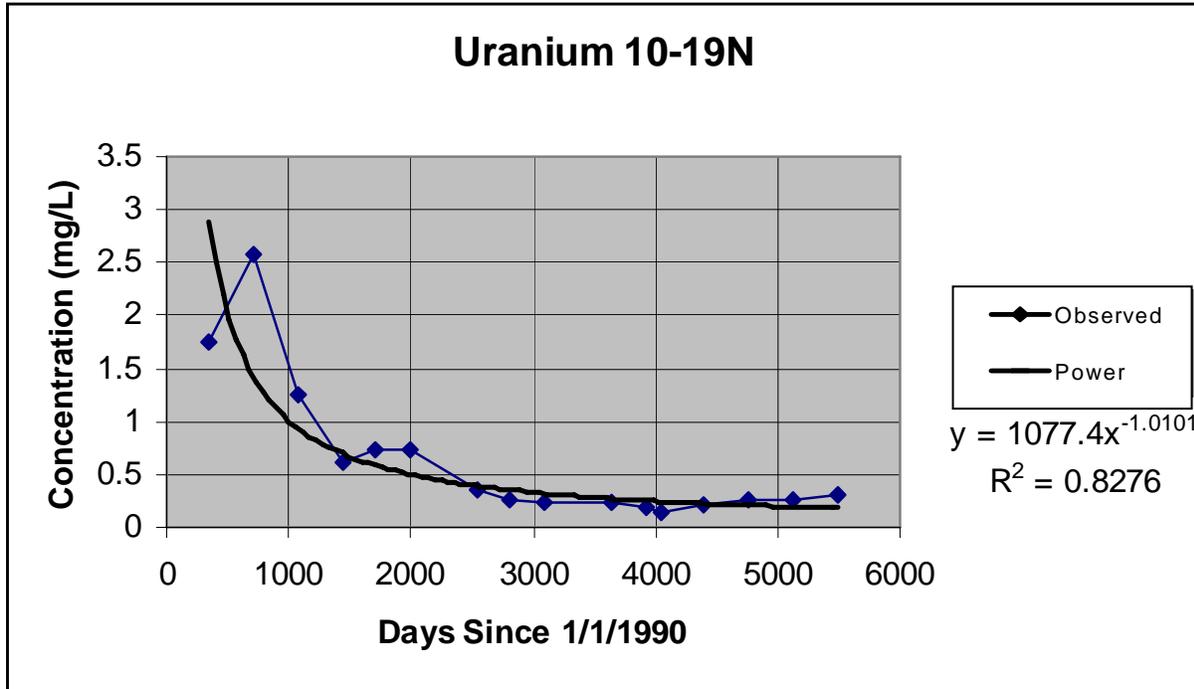


Figure F-2

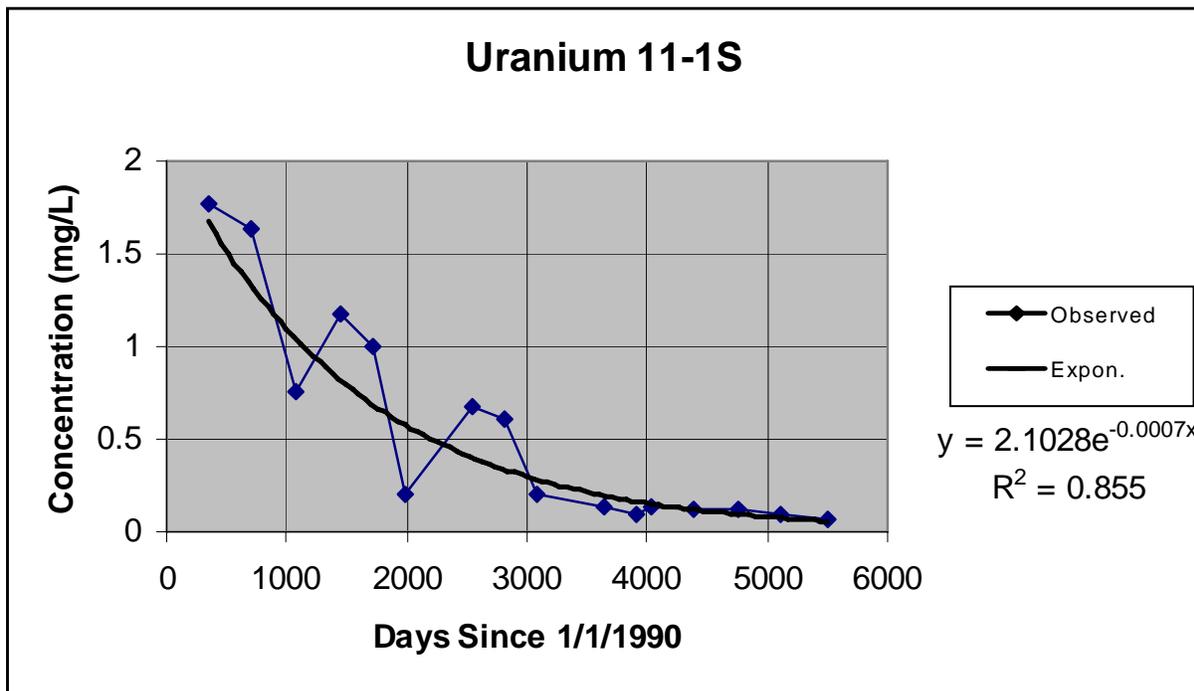


Figure F-3

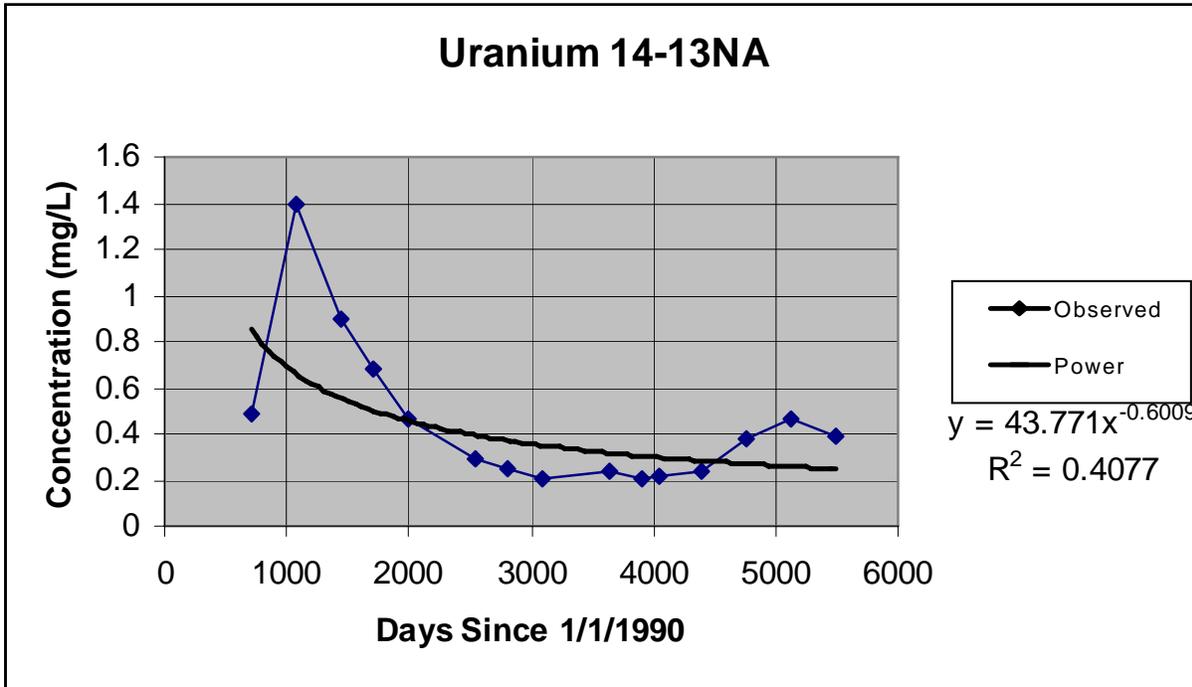


Figure F-4

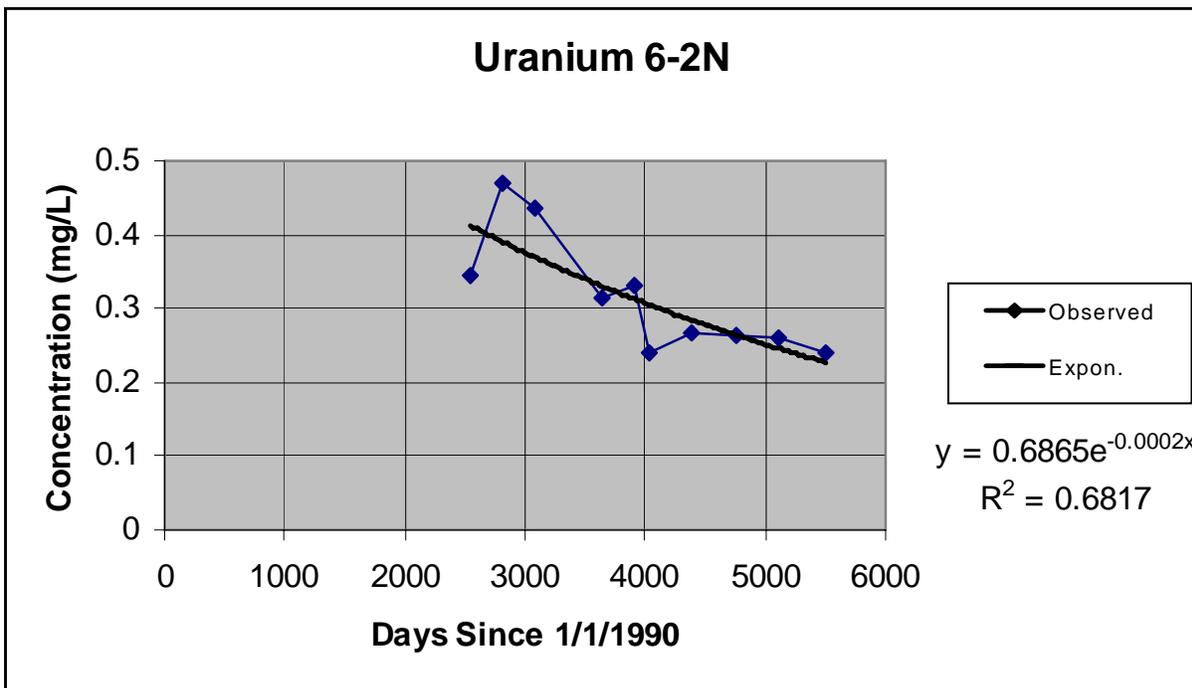


Figure F-5

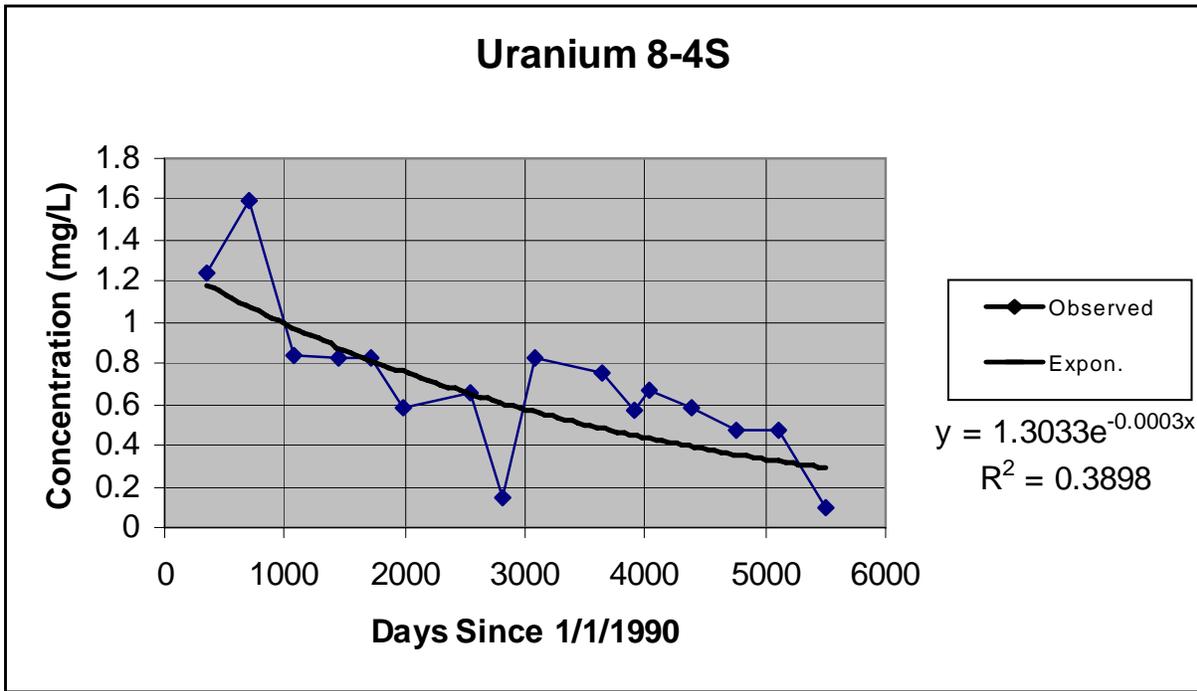


Figure F-6

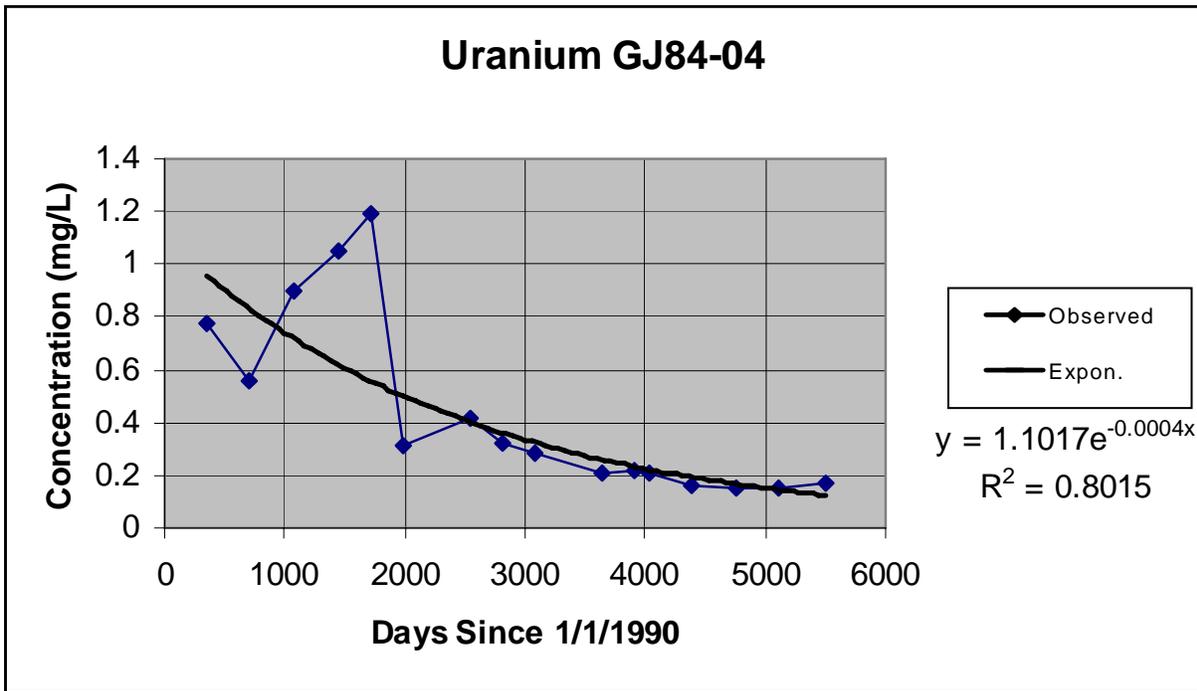


Figure F-7

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## **Appendix G**

### **Sediment Sampling and Analysis Report for the Grand Junction, Colorado, Site**

## 1.0 Introduction

In September 2001, the U.S. Department of Energy (DOE) transferred its Grand Junction Site from federal to private ownership. A key element of the site transition was compliance with Colorado Executive Order D 013-98, which allows federal property that still has contamination on site to be transferred to the private sector under certain conditions, provided a deferral application is approved by the State of Colorado (DOE 2000).

The Grand Junction Site is located in Mesa County immediately south and west of the Grand Junction city limits and about 0.5 mile south of the confluence of the Gunnison and Colorado Rivers. Sampling and analysis of surface water, ground water, and air at the site began in 1984 and continued after remediation of surface areas, which was completed in 1994. Sampling locations and analytical results have been documented in accordance with DOE policy and procedures in the annual site environmental reports, which are available to the public.

Primary ecological areas are the Gunnison River, which borders the site to the west, two ponds (the North and South Ponds), and a jurisdictional wetland within the Grand Junction Site boundary.

Sediment samples were collected in the North and South Ponds, the wetland area, and the river upstream of the Grand Junction Site in August 2001 to provide a baseline characterization of on-site sediments and nearby background samples. Because of their fine-grained texture and high organic content, site sediments have the potential to adsorb and retain contaminants. The ponds and wetland area could have accumulated contaminants from residual soil contamination, contaminated dust, and contaminated ground water or surface water. The purpose of the sampling was to provide baseline data for future comparison, to compare site results to results from a background reference area, and to provide data for comparison with ecological risk assessment guidelines.

## 2.0 Methods

Thirty-nine samples were collected from 15 locations at the South Pond, North Pond, wetland, and Gunnison River upstream of the Grand Junction Site on August 20, 21, and 30, 2001. Figure G-1 shows the sampling locations, which were established using Global Positioning System equipment. Three subsamples were collected at each location, using a stainless steel soil auger inserted approximately 1 foot into the sediment. The subsamples from each location were composited in a stainless steel bowl at the time of sampling, placed in glass or high-density polyethylene sample bottles, and kept in a cooler on ice until arrival at the laboratory. Two of the samples were split after compositing for quality control duplicate analyses.

Sediment samples were analyzed for gross alpha, gross beta, arsenic, chloride, total chromium, iron, magnesium, manganese, molybdenum, nitrate, selenium, sulfate, elemental uranium, and isotopic uranium. These constituents are present in elevated concentrations in surface water or ground water and pose potential ecological or human health risks.

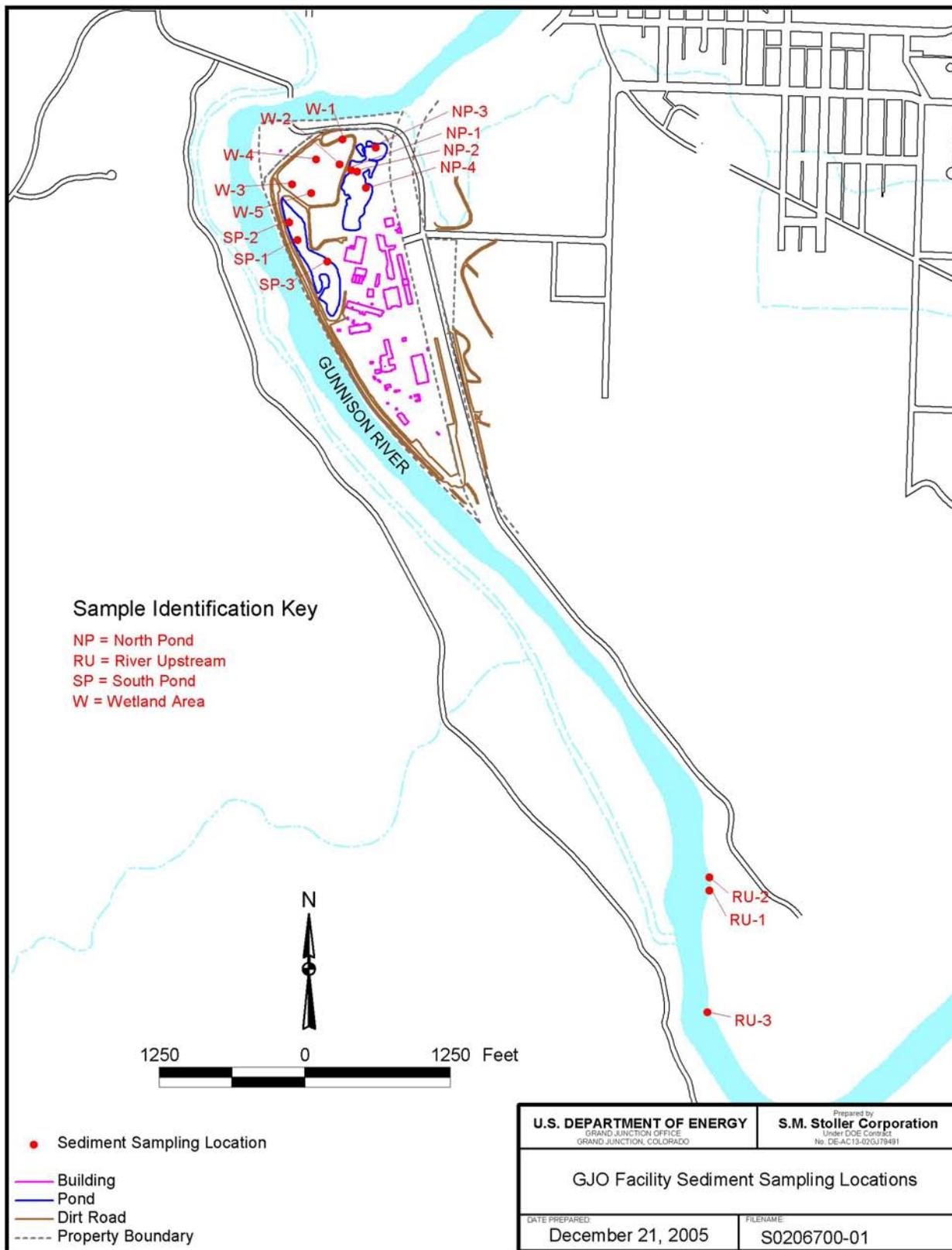


Figure G-1. Grand Junction Site Sediment Sampling Locations

The Grand Junction Site Analytical Laboratory used 0.5 gram of each sample to perform microwave-assisted acid digestion based on the U.S. Environmental Protection Agency's Manual SW-846, Method 3051. Analyses of laboratory spikes and duplicates were performed following laboratory quality control guidelines. Gross alpha and gross beta were analyzed by gas proportional counting on 0.1 gram of sample, and isotopic uranium was analyzed by alpha spectrometry on 1 gram of sample.

### **3.0 Results and Discussion**

Table G-1 summarizes analytical results for the sediment samples. Results for the three background samples taken upstream (RU-1, RU-2, RU-3) were compared to the site sample results. Theoretically, any higher concentrations in site samples would be attributable to Grand Junction Site contamination. However, the background samples are from a moving water system, whereas the site samples are from closed systems. There were no suitable closed water systems in the vicinity for reference. Evaporation rates, pH, salinity, organic levels, and temperature regimes can vary greatly between open and closed systems. However, soil and vegetation types are similar between the background area and the on-site locations, and these reference area samples should provide an estimate of background analyte levels.

Concentrations of all analytes were above background in at least a few of the site samples; constituents of potential concern when compared to sediment screening criteria are arsenic, manganese, molybdenum, and selenium. Constituents with concentrations that are noticeably elevated but have no screening criteria for sediment are gross alpha, gross beta, chloride, sulfate, uranium, and vanadium. Overall, the North Pond had the highest levels of contaminants, the wetland area the next highest, and the South Pond the lowest levels.

The screening criteria used are conservative estimates of ecological risk thresholds and are based on direct exposure to sediment by benthic receptors. Sediment threshold effect levels (TEL) referenced below are from Buchman (1999) (arsenic and manganese) and MacDonald (1994) (molybdenum and selenium). TEL values represent the concentration below which adverse effects in benthic communities are expected to occur only rarely. Potential effects on higher order receptors (e.g., birds) are not predicted by TELs; these evaluations require more complex models and assumptions. Additionally, numerous other sediment benchmarks exist (e.g., EPA's sediment effect concentrations; Jones et al., 1997) based on different types of endpoints. Exceedence of the benchmarks in Table G-2 does not indicate that a problem exists. These are provided for comparison purposes only.

#### **3.1 Arsenic**

Background concentrations of arsenic in river sediments ranged from 4.8 to 8.0 milligrams per kilogram (mg/kg), and the site concentrations ranged from 7.3 to 19.9 mg/kg. Arsenic is a site-related contaminant but also occurs naturally in area soils, giving it a high background level. The sediment TEL is 5.9 mg/kg. Arsenic is not a highly mobile contaminant and tends to be bound in the nonsoluble phase of the aquifer, which consists of particulates that can appear in the sediments. Arsenic concentrations are also elevated in some ground water and surface water locations at the Grand Junction Site. Because of its presence in background soils and water in the area, there is no conclusive indication that arsenic detected in the sediment samples is from mill-related activities.

Table 1. Sediment Sampling Analytical Results

Analyte	Sample No.																
	RU-1	RU-2	RU-3	SP-1	SP-2	SP-3	SP-4	SP-5	NP-1	NP-2	NP-3	NP-4	W-1	W-2	W-3	W-4	W-5
%solids	87.7	72.3	60.0	71.1	67.9	77.4	78.1	72.6	50.3	71.6	69.0	43.7	87.1	82.6	82.6	83.2	78.4
As	5.5	4.8	8	8.3	9.3	10.8	10	9.5	19.9	11.9	12.3	16.2	10.3	7.3	8.1	7.5	8.9
Cl	5.1	4.6	6	58	72.2	114	102	56.9	1,110	565	1,380	828	1,870	448	395	1,420	378
Cr	7.2	6.5	9.5	8.3	11	8	7.8	7.2	10.7	10.3	3.8	7.1	22.4	12.8	21.1	11.8	10.2
Gross Alpha	5.8	7.5	12.2	13.1	19.6	13.3	19.1	13.6	40.2	14.9	30	55.6	6.6	15.9	10.8	10.4	16.3
Gross Beta	16.2	14	21.5	25.2	27.8	22.9	22.8	23	42.4	28.9	35.5	66.1	18.1	24.2	20.3	22	29
Fe	11,700	9,650	13,700	10,400	12,800	10,000	9,930	10,400	15,300	18,000	8,250	11,600	17,200	13,800	16,200	12,900	11,900
Mg	5,090	4,400	7,470	5,020	8,590	5,270	4,900	5,360	7,930	6,010	3,970	5,560	9,270	6,570	7,740	9,100	9,620
Mn	345	293	472	278	330	261	210	264	1,060	501	480	1,060	285	291	259	364	338
Mo	0.5	0.43	0.5	3.8	5.5	3.4	2.6	3.3	5.4	1.7	7.4	15.3	2.6	4.4	4.4	6.7	7.8
NO <sub>3</sub>	0.4	0.43	0.52	1.3	1	0.81	0.9	0.4	1.6	1	0.9	0.9	1	0.9	2.5	3.1	2.8
Se	1.9	1.94	2.83	1.1	2.1	1.7	1.5	1.8	14.5	3.6	8.1	16	1.3	1.8	2.2	1.9	2.2
SO <sub>4</sub>	1,290	279	358	6,320	8,810	18,300	18,700	8,870	8,610	5,390	11,700	7,320	22,000	6,320	15,600	28,000	14,000
U	1	0.83	1.2	17	24.3	11.8	10.6	16.5	79.1	20.8	75.8	128	3.9	6.8	4.2	23.2	13.6
V	19.5	14.7	20.5	30	39.9	27.4	27.9	28.6	84.3	43.3	22.6	118	60.8	42.5	71.8	38.2	33.7

Table 2. Summary of Sample Analyses and Comparison With Screening Criteria

	Background <sup>a</sup>	Range <sup>b</sup>	Screening Criterion <sup>c</sup>	Locations Exceeding Screening Criterion (average concentration, mg/Kg)
As	6.1	7.3–19.9	5.9 <sup>d</sup>	SP (9.6), NP (15.1), W (8.4)
Cl	5.2	58–1,870	NA	
Cr	7.7	3.8–22.4	36.3 <sup>d</sup>	
Gross Alpha	8.5	6.6–55.6	NA	
Gross Beta	17.2	20.3–66.1	NA	
Fe	11,700	8,250–17,200	18,800 <sup>d</sup>	
Mg	5,650	3,970–9,620	NA	
Mn	370	210–1,060	630 <sup>d</sup>	NP (775)
Mo	0.48	1.7–15.3	4.0 <sup>e</sup>	SP (3.72), NP (7.5), W (5.2)
NO <sub>3</sub>	0.45	0.81–3.1	NA	
Se	2.22	1.1–14.5	5 <sup>e</sup>	NP (10.5)
SO <sub>4</sub>	644	5,390–28,000	NA	
U	1.01	4.2–128	150 <sup>f</sup>	
V	18.2	22.6–118	50 <sup>d</sup>	NP (67), W (49)

Notes: RU = river upstream (background), SP = South Pond, NP = North Pond, W = wetland

All concentrations are in milligrams per kilogram except those gross alpha and gross beta, which are in picocuries per gram

<sup>a</sup>average of RU-1, RU-2, and RU-3.

<sup>b</sup>range for all on-site samples

<sup>c</sup>sediment screening criteria from various sources

<sup>d</sup>Buchman 1999

<sup>e</sup>MacDonald 1994

<sup>f</sup>DOE 1994

## 3.2 Manganese

Manganese concentrations exceed background levels only in the North Pond samples. Background concentrations ranged from 293 to 472 mg/kg, and North Pond concentrations ranged from 480 to 1,060 mg/kg. Only two of the four North Pond samples had manganese levels that exceeded the sediment TEL of 630 mg/kg for this constituent.

## 3.3 Molybdenum

Background molybdenum levels ranged from 0.43 to 0.5 mg/kg, and site concentrations ranged from 1.7 to 15.3 mg/kg. Molybdenum is a mill-related constituent that typically has had elevated concentrations in ground water and surface water samples (DOE 2001) and was retained as an ecological constituent of potential concern for surface water at the site. Eight of the site samples had molybdenum concentrations that exceeded the sediment TEL of 4.0 mg/kg.

## 3.4 Selenium

The average background concentration of selenium ranged from 1.0 to 2.83 mg/kg, and only North Pond samples had concentrations that exceeded this, with levels of 3.6 to 16.0 mg/kg. Three of the four North Pond samples had concentrations that exceeded the TEL of 5.0 mg/kg. Selenium may be another mill-related constituent that historically has been elevated in ground water and surface water at the site (DOE 2001) but also has typically high levels in the Gunnison River drainage due to selenic soils.

## 3.5 Other Analytes

Uranium is the only one of the other analytes present in elevated concentrations that has regulatory limits, although no TEL has been established for uranium in sediments. Sediment background concentrations ranged from 0.83 to 1.2 mg/kg, and concentrations on the site range from 4.2 to 128 mg/kg. The Grand Junction Site soil cleanup standard of 106 picocuries per gram is equivalent to 150 mg/kg, which compares favorably to the sediment results. Because of its high mobility, uranium appears frequently in site soils, sediments, and water. In the context of ecological risk, there are no guidelines for sediment uranium concentrations.

Other constituents present in concentrations above background levels in the sediment samples include gross alpha, gross beta, chloride, nitrate, sulfate, and vanadium. No sediment screening criteria could be found for these analytes. For vanadium, the background concentrations at the reference area ranged from 14.7 to 20.5 mg/kg, and site concentrations ranged from 22.6 to 118 mg/kg.

## 4.0 Conclusions and Recommendations

This study shows that some site-related contamination may be present in the sediments at concentrations higher than background. Concentrations at some locations exceed sediment quality benchmarks for benthic organisms. This does not mean that any adverse effects are actually present. The data set provides a baseline to determine if sediments are accumulating site-related contaminants as natural flushing proceeds. Once natural flushing is completed, it may be prudent to do some additional sediment sampling and conduct a more site-specific evaluation of potential residual site risks.

## 5.0 References

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