U.S. DEPARTMENT OF ENERGY | Legacy Management

Monument Valley, Arizona, Processing Site

FACT SHEET

This fact sheet provides information about the Uranium Mill Tailings Radiation Control Act of 1978 Title I processing site at Monument Valley, Arizona. This site is managed by the U.S. Department of Energy Office of Legacy Management.

Site Description and History

The Monument Valley processing site is located on the Navajo Nation in northeastern Arizona, about 15 miles south of Mexican Hat, Utah. A uranium-ore-processing mill operated at the site from 1955 to 1968 on property leased from the Navajo Nation. The mill closed in 1968, and control of the site reverted to the Navajo Nation. Most of the mill buildings were removed shortly thereafter. The milling process produced radioactive mill tailings, a predominantly sandy material.

From 1955 until 1964, ore at the site was processed by mechanical milling using an upgrader, which crushed the ore and separated it by grain size. The finer-grained material, which was higher in uranium content, was shipped to other mills for chemical processing. Coarser-grained material was stored on site.

These source materials and other site-related contamination were removed during surface remediation at the site from 1992 through 1994. All contaminated materials from the Monument Valley processing site were encapsulated in the Mexican Hat disposal cell about 10 miles north of the Monument Valley site. However, analyses of subpile soil samples (samples collected beneath the "footprint" of the former tailings piles) indicate contaminants in these soils may be a continuing source of groundwater contamination. Ammonium in the subpile soil appears to be contributing to nitrate contamination in groundwater.

Regulatory Setting

Congress passed the Uranium Mill Tailings Radiation Control Act (UMTRCA) in 1978 (Public Law 95-604), and DOE remediated 22 inactive uranium-ore-processing sites under the Uranium Mill Tailings Remedial Action Project in accordance with standards promulgated by the U.S. Environmental Protection Agency in Title 40 *Code of Federal Regulations* (CFR) Part 192. Subpart B of 40 CFR 192 regulated cleanup of contaminated groundwater at the processing sites. The radioactive materials were encapsulated in U.S. Nuclear Regulatory Commission–approved

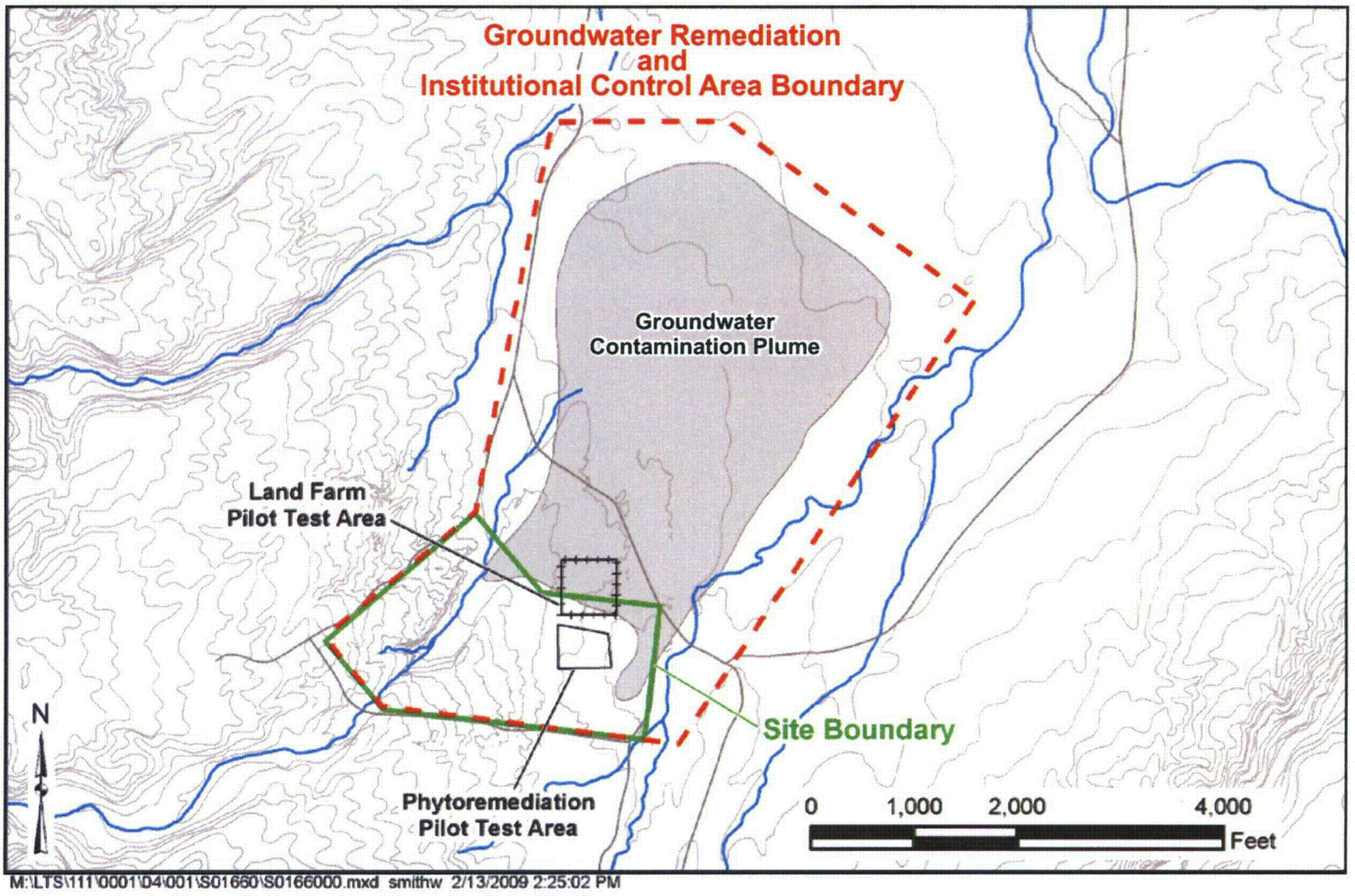
Location of the Monument Valley Processing Site

disposal cells. The U.S. Nuclear Regulatory Commission general license for UMTRCA Title I sites is established in 10 CFR 40.27. Tailings and other contaminated materials from the Monument Valley processing site are encapsulated in the Mexican Hat disposal cell.

The Mexican Hat disposal site was included under the general license in 1997 and transferred to DOE at that time.

Processing Site

Groundwater at the former processing site is present in three aquifers: the alluvial (uppermost) aquifer, the underlying Shinarump aquifer, and the De Chelly aquifer, the deepest of the three. Only the alluvial and De Chelly aquifers show evidence of milling-related contamination. Contamination in the De Chelly is limited to a small, isolated area where the uranium concentrations in samples collected from one well



Institutional Control Boundary, Groundwater Contaminant Plume, and Phytoremediation Areas at the Monument Valley, Arizona, Processing Site

slightly exceed the standard in 40 CFR 192. Historically, water from the De Chelly was used to supply water for the milling operation. Pumping the De Chelly drew uranium contamination from the overlying alluvium into the De Chelly aquifer. Uranium in the alluvial aquifer is also limited to this same isolated area.

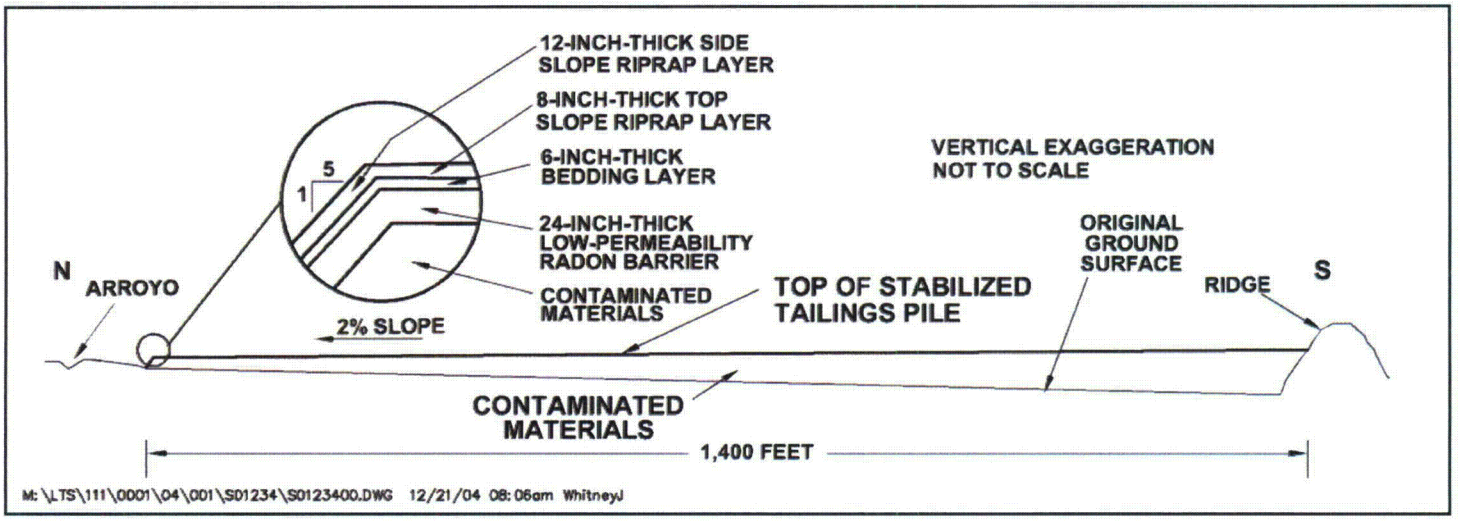
Approximately 540 million gallons of water are contaminated in the alluvial aquifer. Ammonium, nitrate, and sulfate are the contaminants of concern in the groundwater. Nitrate contamination in alluvial groundwater has migrated more than 4,500 feet north of the former mill site.

Compliance Strategy

Compliance strategies for both the De Chelly and alluvial aquifers include natural flushing, monitoring, and institutional controls. Natural flushing includes a variety of natural physical, chemical, and biological processes that reduce the concentration of contaminants in soil or groundwater. Provisions in 40 CFR 192 allow for natural flushing as a compliance strategy if contaminant concentrations will decrease to acceptable levels within 100 years. Monitoring will consist of collecting and analyzing groundwater samples semiannually from monitoring wells screened in the De Chelly and alluvial aquifers.

The compliance strategy for the alluvial aquifer addresses three areas of concern: subpile soils, shallow alluvial groundwater, and deep alluvial groundwater. Natural flushing is proposed for the deeper portions of the aquifer. The compliance strategies for subpile soils and shallow portions of the aquifer are a combination of natural flushing and phytoremediation. Phytoremediation relies on the deep roots of plants to uptake water and convert nutrients to plant growth. Ammonium and nitrate, constituents of concern in the alluvial aquifer, are nutrients that enhance plant growth. Preliminary estimates indicate that phytoremediation could potentially reduce the time required to clean up the alluvial nitrate plume.

DOE is currently conducting a series of pilot studies of the alluvial aquifer to evaluate the effectiveness of phytoremediation and other natural flushing processes such as enhanced attenuation and bioremediation. Enhanced attenuation involves initiating or augmenting natural and sustainable attenuation processes. The goal is to increase the magnitude of attenuation by



North-South Cross Section of the Mexican Hat Disposal Cell

natural processes beyond that which occurs without intervention. Bioremediation relies on microbial denitrification to reduce concentrations of nitrate in the source area and plume.

To date, results of these studies confirm that the natural attenuation of nitrate is occurring at the site and that natural and enhanced phytoremediation and bioremediation may be viable options for reducing nitrate and sulfate levels in the alluvial aquifer and at the plume source. Planting and irrigating the source area has been effective in removing nitrate from the soil by microbial denitrification, and the pilot studies have shown that natural attenuation is occurring in the plume. Additionally, modeling suggests that the injection of ethanol as a substrate for denitrification could substantially increase denitrification rates and shorten the cleanup time.

The pilot studies are scheduled to be completed by the fall of 2011, and DOE will issue a final report summarizing the results and recommendations for long-term compliance strategies at the site in 2012. DOE intends to prepare a final Groundwater Compliance Action Plan and National Environmental Policy Act documentation to begin implementing long-term compliance strategies in 2014.

An additional pilot study is evaluating land farming, a form of active phytoremediation whereby groundwater from deeper portions of the contaminated alluvial aquifer will be pumped to the surface and will be used to fertilize plants to provide fodder for livestock or native plant seed that could be marketed (e.g., for mine land reclamation).

Institutional Controls

Institutional controls at the site will include fencing around the phytoremediation areas to prevent grazing by livestock and wildlife and maximize plant growth. DOE plans to work with the Navajo Nation to restrict access to contaminated groundwater during the remediation period and has provided a treated water supply to local residents for domestic use.

Mexican Hat, Utah, Disposal Site

About 1.3 million tons of tailings and associated waste were hauled from the Monument Valley processing site and placed with tailings from the Mexican Hat processing site in the Mexican Hat disposal cell.

The cell contains 4.4 million dry tons (about 3.1 million cubic yards) of contaminated material with a total activity of 1,800 curies of radium-226. Information about the Mexican Hat disposal site is available at http://www.lm.doe.gov/Mexican_Hat/mexhat-factsheet.pdf.

Disposal Cell Design

The cell occupies an area of 68 acres on the 119-acre site. It abuts a rock outcrop on the south and rises 50 feet above the surrounding land on the other sides. A posted wire fence surrounds the cell. The cover of the disposal cell is a multicomponent system designed to encapsulate and protect the contaminated materials. The cover comprises (1) a low-permeability radon barrier (first layer placed over compacted tailings), (2) a bedding layer of sand and gravel placed as a capillary break, and (3) a rock (riprap) erosion protection layer. The cell design promotes rapid runoff of precipitation to minimize leachate. Runoff water flows down the 20-percent side slopes into the surrounding rock apron.

The site location and design were selected to minimize the potential for erosion from onsite runoff or storm water flow. All surrounding remediated areas were regraded and reseeded with native species. Existing gullies in the vicinity of the cell were armored with riprap that was keyed into competent rock to control erosion. Riprap-protected diversion ditches were installed to channel runoff water away from the cell.

Legacy Management Activities

DOE's Office of Legacy Mangement (LM) will conduct pilot studies at the Monument Valley processing site and will continue with the strategy of phytoremediation, groundwater monitoring, and enforcement of institutional controls until contaminant concentrations have decreased to acceptable levels. LM manages the Monument Valley processing site according to a site-specific Long-Term Management Plan. LM manages the Mexican Hat disposal site according to a site-specific Long-Term Surveillance Plan to ensure that the disposal cell systems continue to prevent release of contaminants to the environment. Under provisions of this plan, LM conducts annual inspections of the site to evaluate the condition of surface features, performs site maintenance as necessary, and monitors groundwater to verify the continued integrity of the disposal cell.

In accordance with 40 CFR 192.32, the disposal cell is designed to be effective for 1,000 years to the extent reasonably achievable, and, in any case, for at least 200 years. However, the general license has no expiration date, and LM's responsibility for the safety and integrity of the Mexican Hat disposal cell will last indefinitely.

Contacts

Documents related to the Monument Valley processing site and the Mexican Hat disposal site are available on the LM website at http://www.lm.doe.gov/monvalley/Sites.aspx and http://www.lm.doe.gov/mexican_hat/Sites.aspx.

For more information about LM activities at the Monument Valley and Mexican Hat sites, contact

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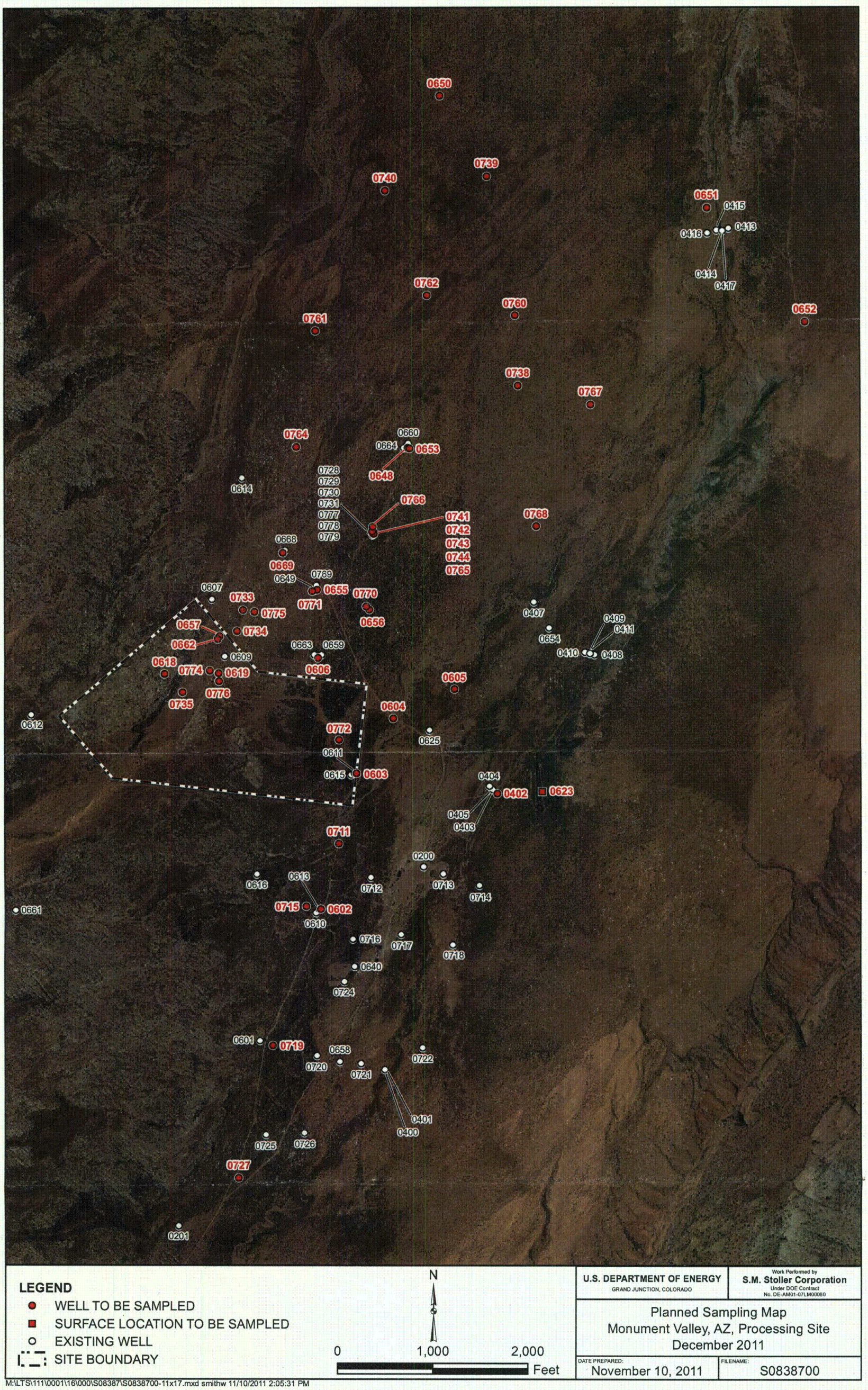
2597 Legacy Way, Grand Junction, CO 81503

(970) 248-6070 (monitored continuously), or
(877) 695-5322 (toll-free)



LEGEND

- WELL TO BE SAMPLED
- SURFACE LOCATION TO BE SAMPLED
- EXISTING WELL
- SITE BOUNDARY

N

0 1,000 2,000 Feet

U.S. DEPARTMENT OF ENERGY GRAND JUNCTION, COLORADO	Work Performed by S.M. Stoller Corporation Under DOE Contract No. DE-AM01-07LM00060
Planned Sampling Map Monument Valley, AZ, Processing Site December 2011	
DATE PREPARED: November 10, 2011	FILENAME: S0838700

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Monument Valley, Arizona, Processing Site Sample Locations

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