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UMTRA
Ground Water Project

Preliminary Final Ground Water Compliance Action Plan for the Slick Rock, Colorado, UMTRA Project Sites

June 2003

Prepared by the
U.S. Department of Energy
Grand Junction Office

Work Performed Under DOE Contract No. DE-AC13-02GJ79491 for the U.S. Department of Energy
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1.0 Introduction

This Ground Water Compliance Action Plan (GCAP) presents the proposed compliance strategy for ground water cleanup at the Slick Rock UMTRA sites located in San Miguel County, Colorado (Figure 1). The Slick Rock sites consist of two former uranium-processing facilities known as the North Continent (NC) site and the Union Carbide (UC) site. These sites are situated along the banks of the Dolores River and are surrounded by steep juniper-covered hillsides and cliffs of the Dolores River canyon (Figure 2). This GCAP is based on U.S. Department of Energy (DOE) evaluation of information included in the Site Observational Work Plan (SOWP) (DOE 2002b). It will serve as a stand-alone modification to the *Remedial Action Plan and Site Design for Stabilization of the Inactive Uranium Mill Tailings Sites at Slick Rock, Colorado* (DOE 1995) to address ground water restoration and compliance with the U.S. Environmental Protection Agency (EPA) ground water cleanup standards for the Uranium Mill Tailings Remedial Action (UMTRA) Project Title I sites. This GCAP will be the U.S. Nuclear Regulatory Commission (NRC) concurrence document for compliance with Subpart B of Title 40 *Code of Federal Regulations* Part 192 (40 CFR 192) for the Slick Rock sites.

The proposed compliance strategy for the Slick Rock sites is based on the compliance strategy selection framework following the steps presented in the *Final Programmatic Environmental Impact Statement for the Uranium Mill Tailings Remedial Action Ground Water Project* (PEIS) (DOE 1996) (Figure 3). National Environmental Policy Act issues and environmental concerns are addressed in the *Environmental Assessment of Ground Water Compliance at the Slick Rock, Colorado, UMTRA Project Sites* (DOE 2002a).

2.0 Ground Water Compliance

To achieve compliance with Subpart B of 40 CFR 192 at the NC site, the DOE proposed action is natural flushing in conjunction with institutional controls (IC) and continued monitoring. Ground water flow and transport modeling has predicted that site-related concentrations of selenium and uranium in ground water in the uppermost aquifer (alluvial aquifer) beneath the NC site will decrease to below the respective maximum concentration limit (MCL) within 100 years (Section 5.3 and Appendix H, DOE 2002b).

At the UC site, the DOE proposed action to achieve compliance with Subpart B of 40 CFR 192 is natural flushing in conjunction with ICs and continued monitoring. Ground water flow and transport modeling has predicted that site-related concentrations of manganese, molybdenum, nitrate, and uranium in ground water in the alluvial aquifer beneath the UC site will decrease to below the respective MCL (background for manganese) within 100 years. However, ground water flow and transport modeling has predicted that selenium will not decrease below the MCL within 100 years; therefore, the human health risk-based benchmark of 0.18 milligrams per liter (mg/L) is proposed as the alternate concentration limit (ACL) for selenium. Ground water flow and transport modeling has predicted that concentrations of selenium in ground water in the alluvial aquifer will decrease to below the ACL within 100 years (Section 6.2, Appendix H, DOE 2002b).

The selenium ACL is a human health risk-based number derived from standard EPA exposure assumptions for a residential drinking water scenario (EPA 1989) and the use of the reference dose for selenium from the EPA's Integrated Risk Information System database (IRIS). The

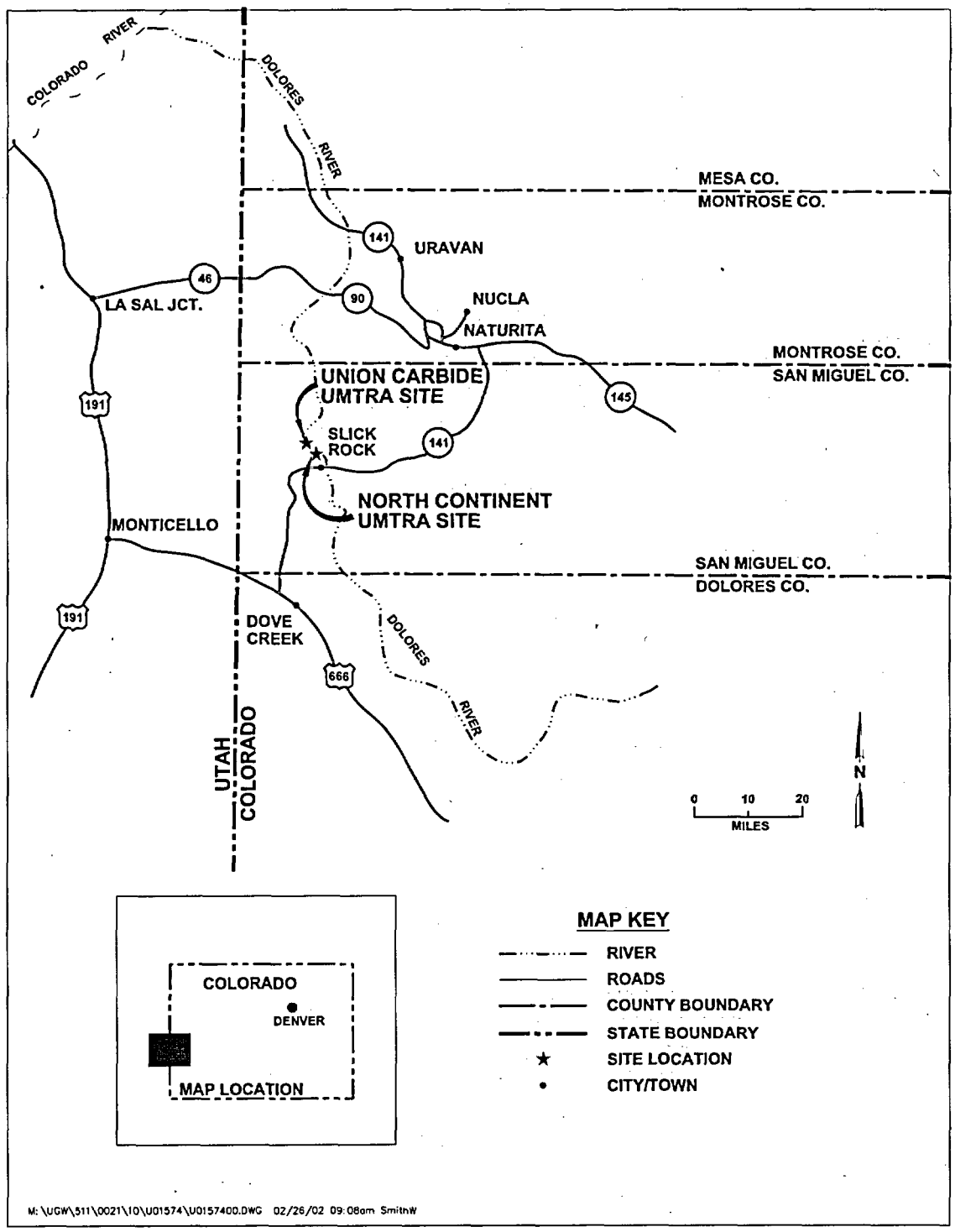

Figure 1. Site Location Map

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Figure 2. Recent Aerial Photograph of the Slick Rock Sites

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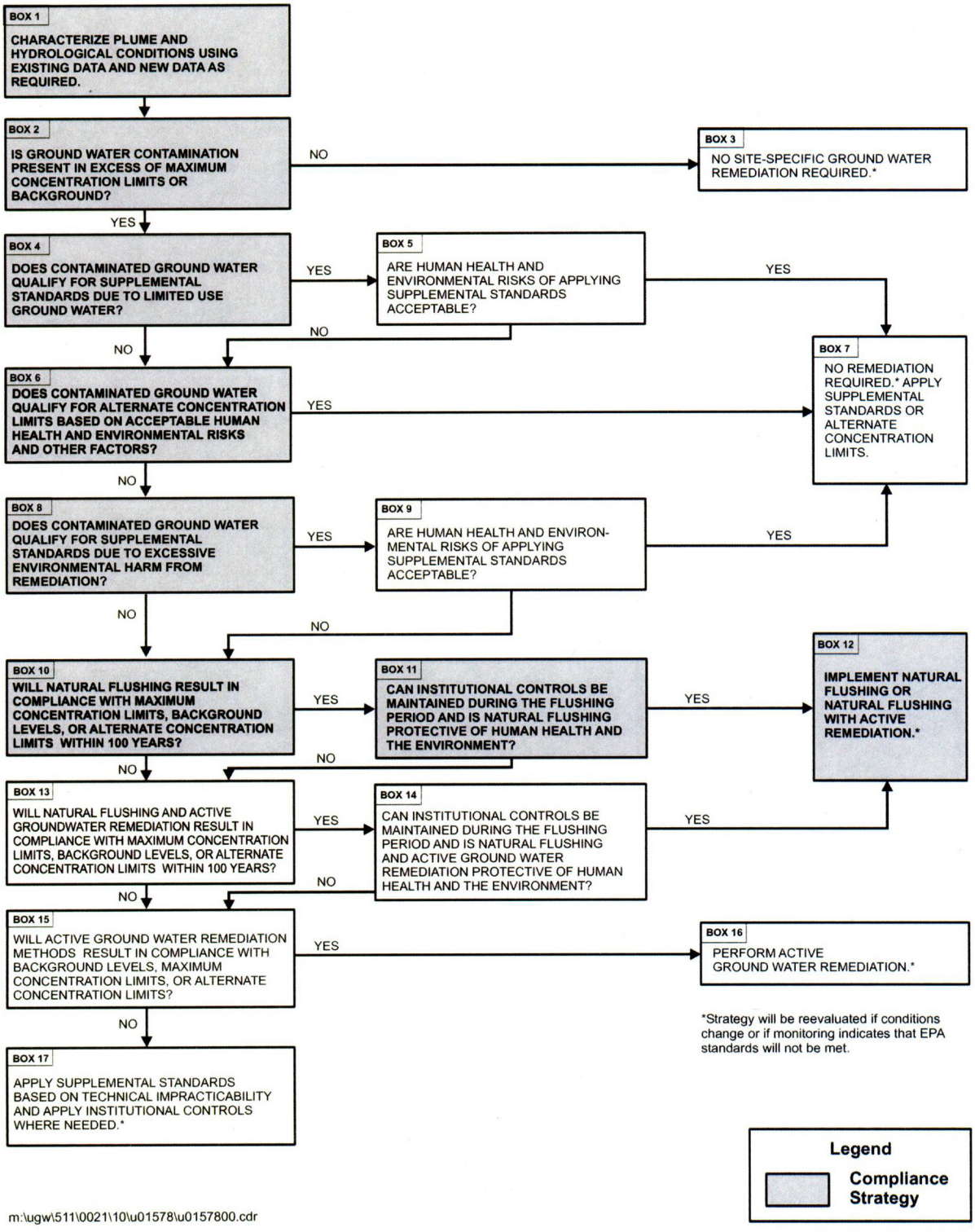

Figure 3. Ground Water Compliance Strategy Flowchart for the Slick Rock Sites

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0.18 mg/L concentration would result in a Hazard Quotient of 1 for a residential drinking water scenario.

The ACL for selenium is comparable to the Drinking Water Equivalent Level (DWEL) of 0.20 mg/L that was established with the drinking water MCL (EPA 2000). The DWEL represents a lifetime exposure concentration protective of adverse non-cancer health effects that assumes all exposure to a contaminant is from drinking water.

Although modeling results indicate the human health risk from consumption of ground water from the uppermost aquifer will be acceptable within 100 years, the ground water in the uppermost aquifer will likely exceed the State of Colorado agricultural standard for selenium of 0.02 mg/L. However, the agricultural risk from exposure to ground water from the uppermost aquifer is considered minimal because of an incomplete pathway. Because of the hydraulic characteristics, the uppermost aquifer will not yield enough water to be used as an effective irrigation source. Although the uppermost aquifer will provide enough water to fill a stock tank, the Dolores River adjacent to the site provides an easier alternative for stock watering than drilling a well, with superior water quality. Even though use of the uppermost aquifer for agricultural use is unlikely, the proposed environmental covenant will restrict agricultural use of ground water from the uppermost aquifer until concentrations are below the agricultural standard.

The Entrada Sandstone underlies the alluvium at the UC site. Molybdenum, nitrate, and selenium have been detected in samples collected from Entrada Sandstone wells in concentrations above the respective standards; however, these elevated concentrations are considered a product of drilling and installing the wells through the contaminated alluvial aquifer. The contamination is considered to be isolated to the vicinity around the well and not indicative of widespread aquifer contamination. As a best management practice, these wells will be monitored until concentrations are below the respective standards.

ICs will be maintained and verified until no longer required at the Slick Rock sites. Therefore, this compliance strategy will be protective of human health by eliminating the potential for ground water use. ICs will provide an added measure of protection by restricting agricultural use of the ground water until selenium concentrations are below the State of Colorado agricultural standard of 0.02 mg/L. This compliance strategy is also protective of the environment as documented by sampling results from the Dolores River. Future monitoring of ground water and the river will be conducted to verify the progression and completion of natural flushing and verify protection of the environment. This proposed action has been determined by applying the compliance strategy selection framework from the PEIS (Figure 3), consisting of several evaluative steps that are discussed below.

2.1 Assessment of Environmental Data

The first step in the decision process was a review of historical data and identification of data gaps, which led to the production of the *Summary of Site Conditions and Work Plan, Slick Rock, Colorado* (DOE 2000). This plan specified additional characterization work required to obtain data necessary to make decisions regarding remediation of the contaminated ground water. The characterization data were used to formulate the conceptual site model that was used as the foundation for the development of the ground water flow and transport model.

Characterization data also were used to assess risk to human health and the environment posed by contaminants from the former uranium processing sites. The additional characterization work, conceptual site model, ground water flow and transport modeling, and the updated baseline risk assessment are detailed in the SOWP (DOE 2002b).

2.2 Ground Water Contaminants

2.2.1 NC Site

Ground water in the alluvial aquifer beneath the NC site was contaminated by the former uranium processing activities. Uranium is the primary contaminant of potential concern (COPC) in the alluvial ground water, with concentrations up to 1.3 mg/L beneath the middle of the site. In the farthest downgradient portion of the site, uranium concentrations are an order of magnitude greater than the uranium MCL of 0.044 mg/L. Downgradient and across the river from the site, uranium concentrations are near the MCL, which indicates hydraulic connection of the alluvial aquifer on either side of the Dolores River. Selenium also is a COPC at the NC site; however, the selenium contamination is isolated to one onsite well with concentrations slightly above the selenium MCL of 0.01 mg/L. The distribution of uranium concentrations at the NC site is shown in Figure 4.

2.2.2 UC Site

Ground water beneath the UC site also was contaminated by the former uranium processing activities. COPCs in the ground water at the UC site include manganese, molybdenum, nitrate, selenium, uranium, radium-226, radium-228, benzene, and toluene. All of these COPCs are found in concentrations greater than their respective MCL or background levels (manganese) in the alluvial aquifer. Contaminant plumes in the alluvial aquifer are all contained onsite, and the radium-226, radium-228, benzene, and toluene contamination is isolated to one well. Manganese and uranium contamination is present in several wells, but concentrations are generally less than 2 times the background level or MCL, respectively. The primary contaminants in the alluvial aquifer are molybdenum, nitrate, and selenium, with concentrations one (molybdenum) to two (nitrate and selenium) orders of magnitude greater than their respective MCL. The distribution of molybdenum, nitrate, and selenium concentrations in the alluvial aquifer at the UC site are displayed in Figures 5, 6, and 7, respectively.

Underlying the alluvial aquifer at the UC site is the Entrada Sandstone. Historically, concentrations of molybdenum (well 0317), nitrate (well 0324), and selenium (well 0324) exceeded their respective MCL in samples collected from the Entrada Sandstone wells on the floodplain. However, these concentrations are considered a product of drilling and installing these wells through the contaminated alluvial aquifer. This hypothesis is supported by hydrologic data that indicate there is a slight upward vertical gradient between the alluvial and Entrada aquifers and that the hydraulic conductivity in the alluvial aquifer is two orders of magnitude greater than the Entrada aquifer. These hydrologic conditions inhibit ground water from flowing vertically from the alluvial aquifer into the Entrada aquifer. Water chemistry data, in part, also support this hypothesis. Time versus concentration graphs for nitrate and selenium (Figures 8 and 9) in well 0324 show that concentrations have been declining and are currently below their respective standard. Molybdenum concentrations in well 0317, however, have been consistent over the short term (Figure 10).

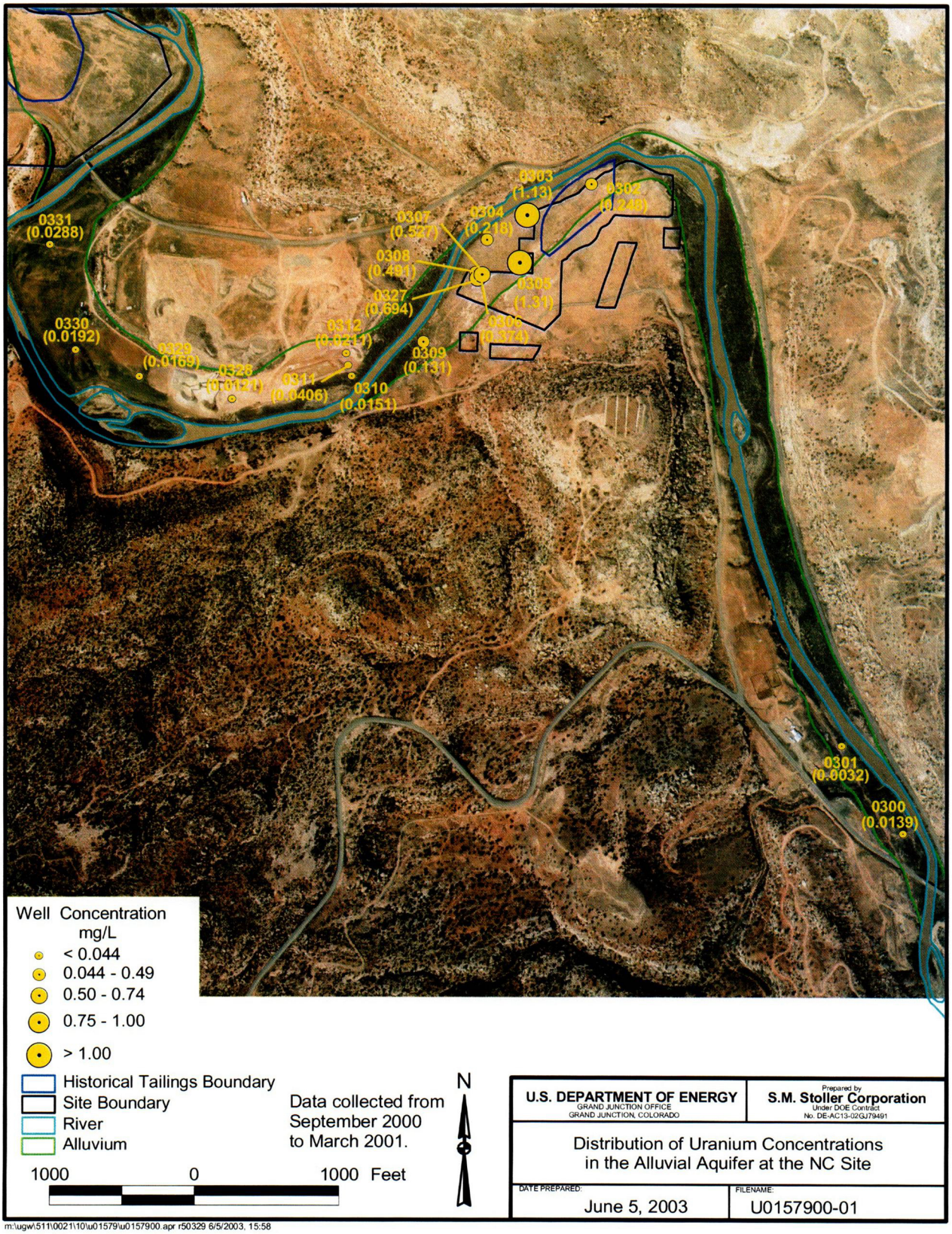

Figure 4. Distribution of Uranium Concentrations in the Alluvial Aquifer at the NC Site

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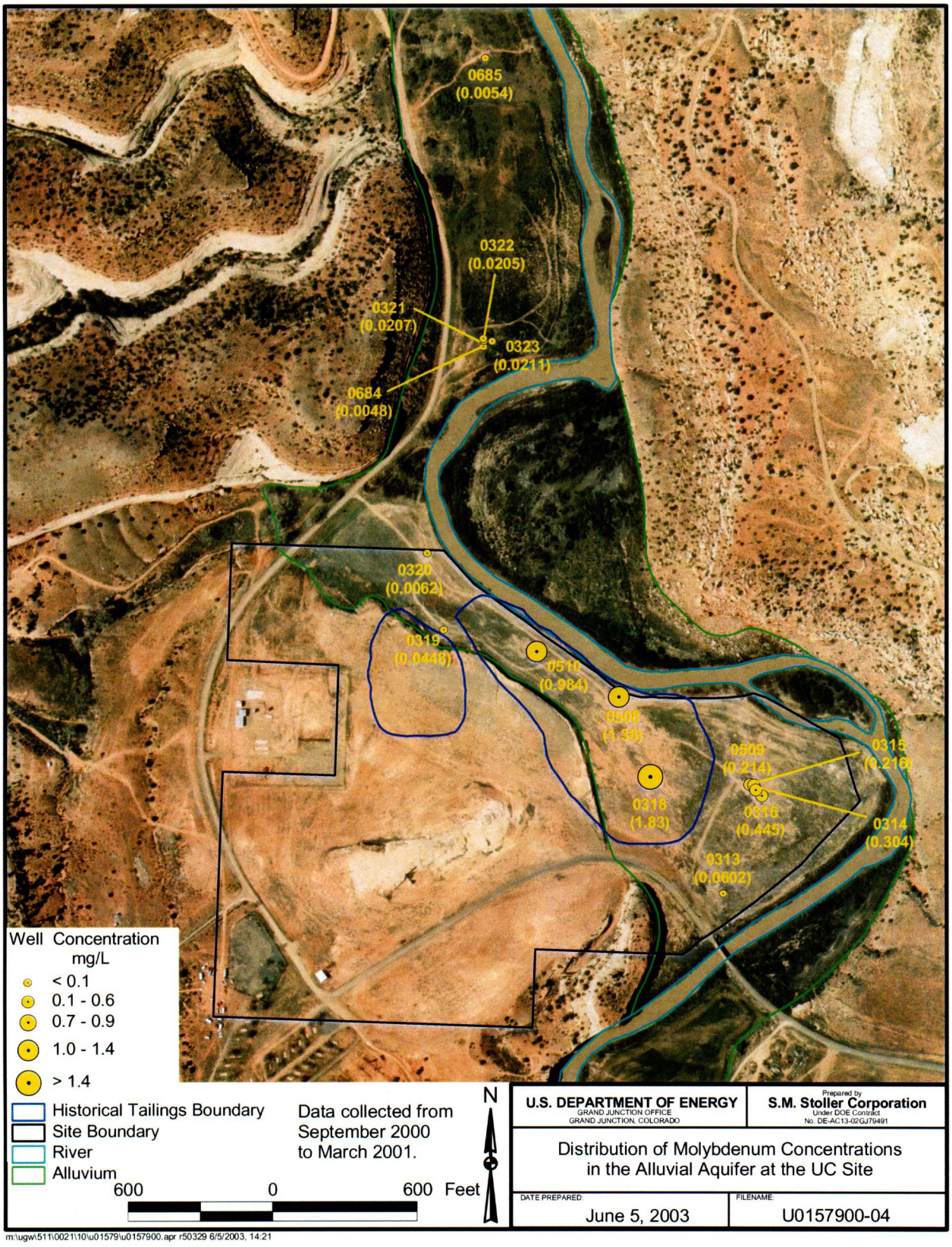

Figure 5. Distribution of Molybdenum Concentrations in the Alluvial Aquifer at the UC Site

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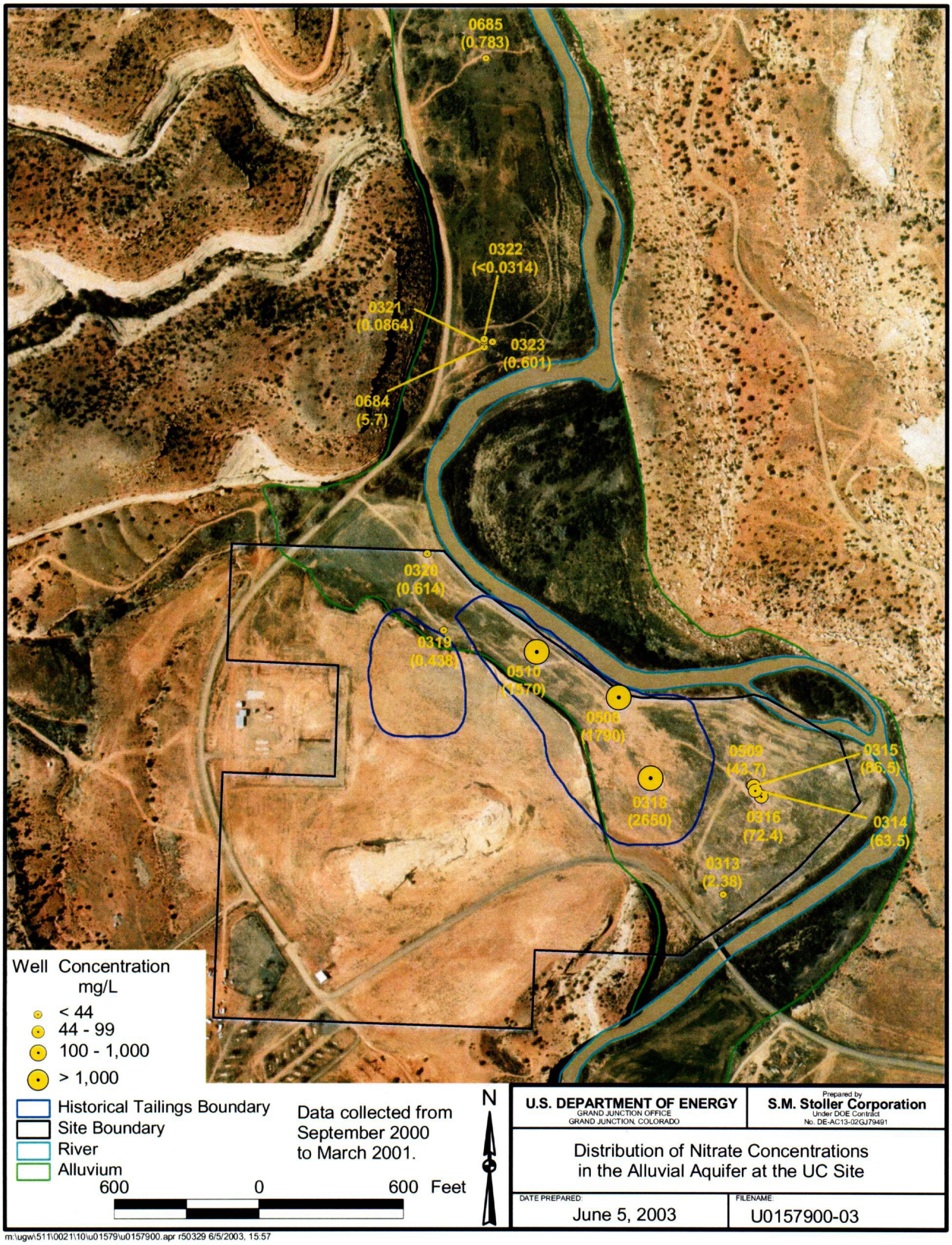

Figure 6. Distribution of Nitrate Concentrations in the Alluvial Aquifer at the UC Site

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Figure 7. Distribution of Selenium Concentrations in the Alluvial Aquifer at the UC Site

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