7.0 Ground Water Compliance Strategy

The framework defined in the final PEIS for the UMTRA Ground Water Project (DOE 1996) governs selection of the final strategy to achieve compliance with the EPA ground water protection standards. Stakeholder review and acceptance of the final PEIS is documented and supported by the Record of Decision. Presented below is a discussion of how the selection process was used to determine the final ground water compliance strategy at the Durango site and a proposed future ground water sampling and analysis plan to monitor compliance and the effectiveness of the selected remedy.

7.1 Compliance Strategy Selection Process

The PEIS framework used to determine the appropriate ground water compliance strategy for the Durango site is summarized in the flowchart in Figure 7–1. The framework takes into consideration human health and environmental risk, stakeholder input, and cost. A step-by-step approach is followed until one or a combination of three general compliance strategies is selected. The three compliance strategies are:

- ***No remediation*****—**Compliance with the EPA ground water protection standards would be met without altering the ground water or cleaning it up in any way. This strategy could be applied for those contaminants at or below MCLs or background levels or for those contaminants above MCLs or background levels that qualify for supplemental standards or ACLs as defined in Section 2.1.2.

- ***Natural flushing*****—**Allows natural ground water movement and geochemical processes to decrease contaminant concentrations to regulatory limits. The natural flushing strategy could be applied at a site if ground water compliance can be achieved within 100 years, where effective monitoring and institutional controls can be maintained, and where the ground water is not and is not projected to be a source for a public water system.

- ***Active ground water remediation*****—**Requires application of engineered ground water remediation methods such as gradient manipulation, ground water extraction and treatment, and in situ ground water treatment to achieve compliance with the standards.

7.2 Mill Tailings Area Compliance Strategy

To achieve compliance with Subpart B of 40 CFR 192 at the mill tailings area, DOE's proposed action is natural flushing in conjunction with institutional controls (ICs) and continued monitoring. Ground water flow and transport modeling has predicted that site-related concentrations of uranium and molybdenum in the alluvial ground water will decrease to levels below the MCL; manganese and sulfate concentrations will be reduced below risk-based and background concentrations, respectively (Section 5.5). Selenium concentrations exceed the MCL in background wells; therefore, DOE defers to an ACL value of 0.05 mg/L from the EPA's Safe Drinking Water Act. Modeling indicates selenium will decrease below the 0.05 mg/L ACL level within 60 years. Cadmium concentrations will not be reduced to levels below the MCL based on model predictions using concentrations from the one well (0612) where cadmium is elevated. However, cadmium concentrations have been decreasing in well 0612 since surface remediation and the downward trend indicates natural flushing greater than indicated by the ground water model. Concentrations in this well will be monitored during the next 10 years and reevaluated

after additional data are collected. Because ICs will be maintained during the flushing period, this compliance strategy protects human health by eliminating the potential for ground water use. This compliance strategy is also protective of the environment as documented by sampling results from the Animas River, which receives contaminated ground water. This proposed action has been determined by applying the compliance strategy selection framework from the PEIS, consisting of several evaluation steps discussed below (Figure 7–1).

7.2.1 Assessment of Environmental Data

The first step in the decision process was an assessment of both historical and new environmental data collected to characterize hydrogeochemical conditions and the extent of ground water contamination related to uranium-ore processing at the site. Ground water is unconfined in the alluvial aquifer; depth to the water table ranges from 10 to 40 ft. Along the base of Smelter Mountain, the Mancos Shale Bedrock is overlain by up to 25 ft of colluvium. The colluvium consists of poorly sorted, silty soil from Smelter Mountain. Closer to Lightner Creek and the Animas River, deposits of river-laid sand and gravel up to 15 ft thick occur over the shale bedrock. A layer of vitreous lead smelter slag as much as 25 ft thick remains along the Animas River near the southeast corner of the mill tailings area.

Ground water in the alluvial aquifer beneath the mill tailings area was contaminated as the result of uranium processing activities. The former large and small tailings piles and RRM beneath the piles were cleaned up to meet the EPA standards for radium in soil. Supplemental standards were applied to some areas of the slopes of Smelter Mountain and along the banks of the Animas River. Erosion-protective riprap was placed over a uranium-contaminated lens under the lead slag where it surfaces on the Animas River bank.

Ground water in the alluvial aquifer generally flows to the southeast with an average gradient of approximately 0.02 ft/ft. Hydraulic conductivity ranges from 10 to 66 ft/day. Ground water in the colluvium near the base of Smelter Mountain is recharged primarily by runoff from the mountain and by infiltrating precipitation. Sand and gravel deposits receive recharge from Lightner Creek and the Animas River. During spring runoff when the river stage is high, water flows into the aquifer. When the river stage is lower, the ground water flows from the aquifer back into the Animas River.

7.2.2 Ground Water Contaminants

The second step in the decision process was to compare the list of ground water contaminants to MCLs or to concentrations in background ground water. The list of COPCs identified in the 1995 BLRA was reevaluated using data collected since November 2000. Potential risks calculated using the recent data for a residential scenario indicate that the major risk contributors are cadmium, lead, manganese, selenium, sodium, sulfate, and uranium. Uranium poses the greatest risk and is the COPC with concentrations that exceed the MCL in ground water in the greatest number of wells. Concentrations of selenium also exceed the MCL in several locations, and cadmium and molybdenum concentrations exceed their MCL in only one location each. All lead concentrations have been less than the MCL since November 2000 (four sampling events). A discussion of COPCs is presented in Section 6.1.

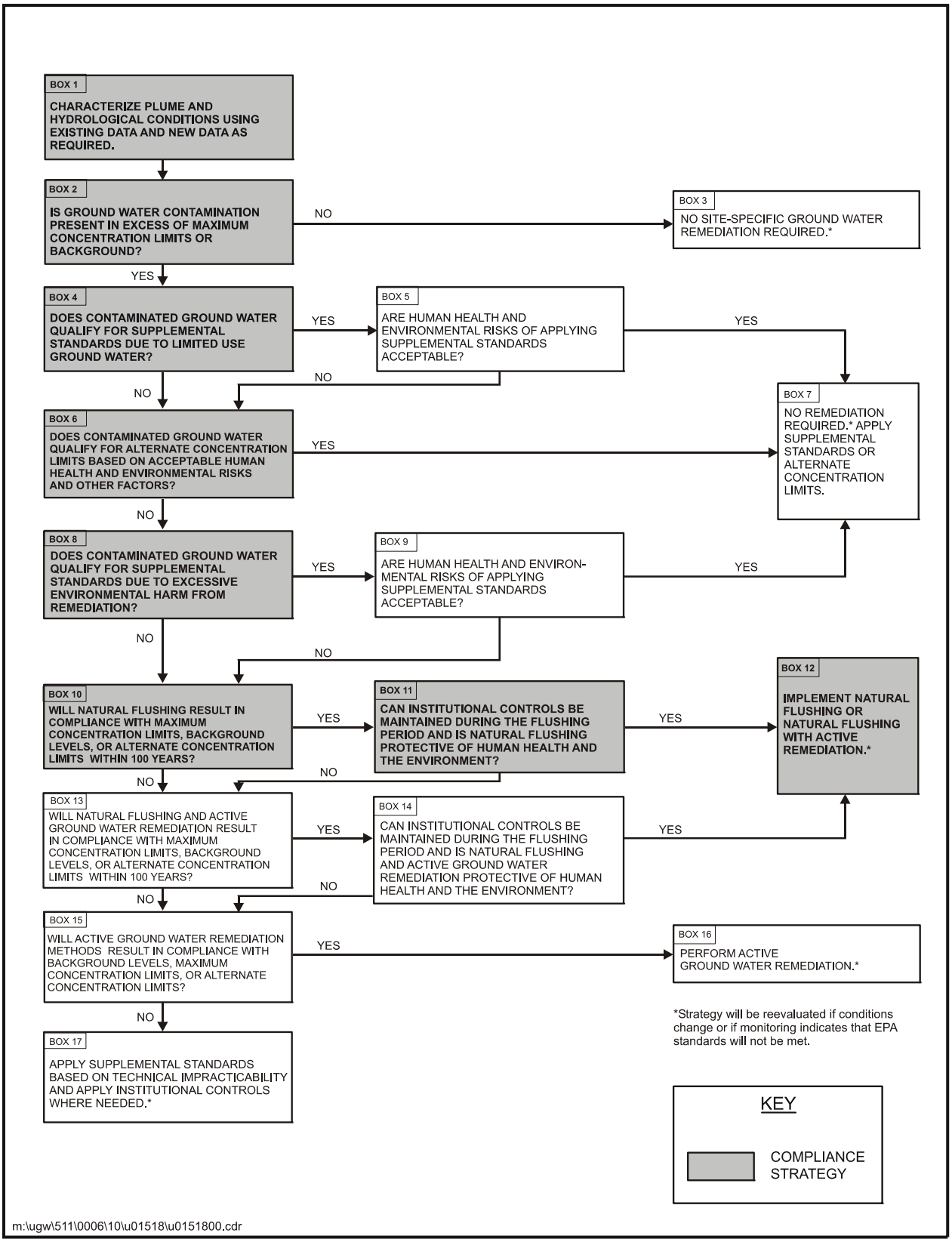

Figure 7–1. Summary of the Mill Tailings Area Ground Water Compliance Selection Framework

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7.2.3 Applicability of Natural Flushing

Results of ground water contaminant transport modeling are presented in Section 5.5 and Appendix G. Predicted concentrations of cadmium, manganese, molybdenum, selenium, sulfate, and uranium after 100 years of natural flushing are provided. Of these contaminants, molybdenum and uranium maximum average concentrations are predicted by the ground water model to decrease below UMTRA Project standards. Molybdenum concentration is predicted to decrease below the UMTRA Project standard within 5 years and uranium concentration is predicted to decrease to levels below the UMTRA Project standard after a period of 80 years. Modeling results also predict that concentrations of manganese and sulfate will decrease below their risk-based and background levels, respectively (there are no UMTRA Project standards for manganese and sulfate). Manganese concentration will decrease below the risk-based level prior to 70 years. Sulfate concentrations will decrease below background levels prior to 100 years. Results of selenium and cadmium modeling warrant further discussion.

Selenium

Ground water samples collected from background wells have selenium in concentrations up to 0.0148 mg/L, which is above the MCL of 0.01 mg/L. On-site, maximum selenium concentrations over the past four sampling periods (from November 2000 to August 2001) have averaged 0.078 mg/L. Ground water modeling of selenium was completed to determine if concentrations will naturally flush below the MCL of 0.01 mg/L on site.

Based on stochastic modeling results, maximum average selenium concentrations after 100 years are expected to decrease from 0.078 to 0.025 mg/L. Although the initial concentrations are not exceedingly high, the rather high K_d range associated with this contaminant (from 6.3 to 50.6 mL/g) prevents selenium from naturally flushing below the MCL. Therefore, the compliance standard for selenium will be the ACL of 0.05 mg/L from the EPA's Safe Drinking Water Act.

Cadmium

Based on the ground water modeling all contaminants except cadmium will flush naturally to the MCL, ACL or risk-based level. Cadmium concentration exceeds the MCL in only one well (0612); concentrations in all other onsite wells (0617, 0622, 0630, 0631, 0633, 0634, 0635, and 0859) are at or near the detection limit. As part of the natural flushing compliance strategy, monitoring of cadmium in well 0612 will continue, and the risks associated with cadmium at this one location will be reevaluated after 10 years.

Stochastic model simulations indicate that the concentration will not flush naturally below the MCL (0.01 mg/L) or the risk-based standard of 0.018 mg/L. Ground water modeling results estimate the cadmium concentrations will decrease only 0.0039 mg/L (from an initial concentration of 0.0369 mg/L to 0.033 mg/L) after 100 years of natural flushing. As with selenium, a high K_d influences the limited transport of this contaminant. The measured K_d range for cadmium is from 17 to 418mL/g, with an average of 60.4 mL/g.

The modeling was completed using conservative input parameter estimates. Two of the key input parameters regarding modeling are the K_d and initial concentration values.

The published literature indicates the K_d for cadmium is much lower compared to the range of values measured on site. Reported cadmium K_d values range from 1.3 to 27 mL/g, and average 1.9 mL/g (Baes and Sharp 1983). Stochastic modeling of cadmium using this different K_d range with the same initial concentration distribution indicates the average maximum cadmium concentration will decrease below the 0.018 mg/L risk-based standard between 90 and 100 years of natural flushing. The maximum average concentration does not drop below the 0.01 MCL until after 150 years.

The procedure used to determine the initial concentration distribution for the stochastic modeling is presented in Appendix G. As described in this appendix, the initial concentration for the modeled contaminant was based on the average concentration detected in samples collected from the monitor wells over the past four sampling events (from November 2000 through August 2001).

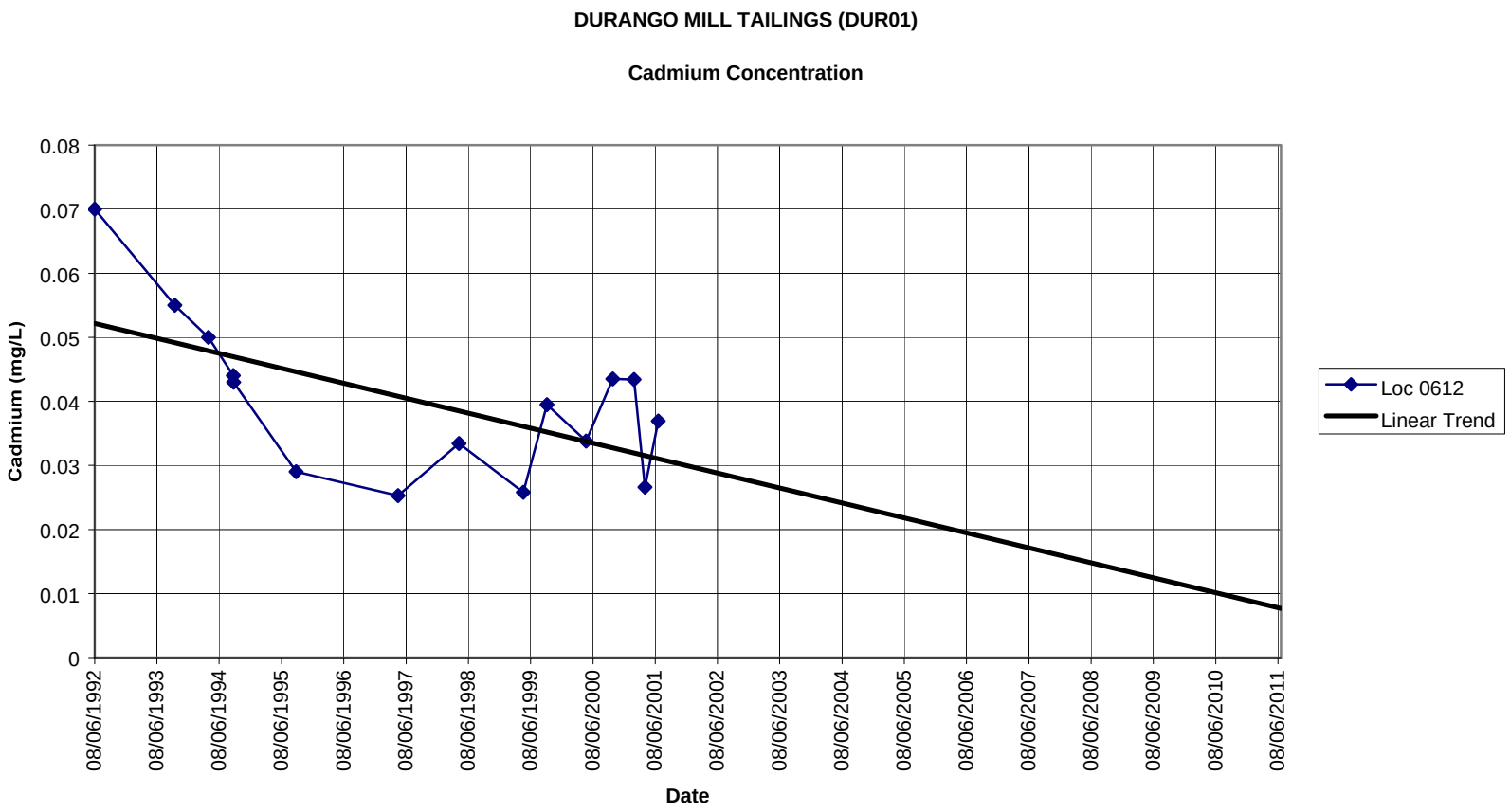
There is considerable variability in the cadmium results from well 0612. A review of historical data for the past 10 years (surface remediation was completed in 1991) suggests a lower initial concentration compared to the value used for the modeling. Historical data also indicate a downward trend that is greater than would be predicted by the model using average estimated site-specific K_ds. A regression line plotted through the data (Figure 7–2) indicates the initial concentration associated with well 0612 is approximately 0.032 mg/L (as opposed to 0.0369 mg/L, which is the maximum initial concentration assigned to the model). Extending this regression line out another 10 years, this initial concentration is expected to be low enough to allow natural flushing of cadmium within 100 years below the 0.01 mg/L UMTRA standard.

Because of the variability in the cadmium results from this one well, additional time to observe the trend in this well will be useful. No unacceptable human health or ecological risks are expected to be posed by the cadmium concentrations in the ground water during the next 10 years for the following reasons:

- Using the worst-case residential scenario for this site, cadmium only accounts for 6 percent of the total site risks, and the hazard quotient is less than 1. The UCL_{95}, based on the current plume, is less than the MCL. If the point of exposure were to occur at any on-site wells other than well 0612, the contribution to total risks drops below 1 percent.

- The most likely scenario for this site is that no ground water exposures will occur (i.e., no risks to human health) because of the existing institutional controls and the availability of municipal water as a drinking water source and river water for other potential uses such as irrigation. However, if a less conservative exposure scenario was assumed, such as occupational exposure to contaminated ground water, risks associated with the current cadmium concentrations in well 0612 would be protective of human health within the 100-year natural flushing time frame.

- The volume of plume water exceeding the MCL is considered to be so small that ground water is not expected to increase ecological risks. Cadmium values in the closest Animas River surface water sampling location (0691) have not exceeded the maximum observed background value (0.00053 mg/L) since the completion of surface remediation; the vast majority of samples had concentrations below the detection limit.



7–2. Durango Mill Tailings Area Cadmium Concentration in Well 0612

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7.2.4 Institutional Controls

ICs are restrictions that effectively protect public health and the environment by limiting access to a contaminated medium, such as the alluvial ground water at the Durango Mill Tailings site. ICs typically depend on an administrative legal action, such as zoning, ordinances, and laws to ensure that protection is effective and enforceable. For the UMTRA Ground Water Project, ICs reduce exposure to or reduce health risks by (1) preventing intrusion into contaminated ground water, or (2) restricting access to or use of contaminated ground water for unacceptable purposes. The EPA standards permit the use of ICs at sites where natural flushing will return the ground water to regulatory levels within 100 years.

The EPA standards require that ICs have a high degree of permanence, protect human health and the environment, satisfy beneficial uses of ground water, are enforceable by administrative or judicial branches of government entities, and can be effectively maintained and verified.

The need for, and duration of, ICs depends on the compliance strategy selected for a site, the level of risk to humans and the environment, and existing site conditions. Movement of contaminated ground water may require restrictions over an extended period of time. As risks decrease over time, so should the restrictiveness of ICs. Therefore, to ensure protection of human health and the environment, and beneficial uses the water could have satisfied, it is important the effectiveness of ICs be verified and modified as necessary.

ICs are mandated to be effective for a period of 100 years during which the ground water contaminant levels will reach EPA standards. Current data indicate that contamination on the former mill tailings area property will naturally flush in that time frame. The ground water contamination created by past ore-processing activities is contained within the former millsite boundaries. Therefore, any ICs deemed necessary need only apply to that parcel of property.

In January 2000, the Durango millsite was conveyed to the City of Durango by quitclaim deed. The deed contains the following language:

“Grantee [City of Durango] covenants …(ii) not to use ground water from the site for any purpose, and not to construct wells or any means of exposing ground water to the surface unless prior written approval for such use is given by the Grantor [Colorado Department of Public Health and the Environment] and the U.S. Department of Energy.”

This language is recorded with the deed and ensures that any future landowner is subject to the same restrictions. This language fulfills the requirements for degree of permanence and enforceability by government entities.

7.2.5 Monitoring Compliance Strategy

The monitoring strategy for the alluvial aquifer is designed to determine progress of the natural flushing process in meeting compliance standards for site COPCs. Standards for molybdenum and uranium are their UMTRA MCLs of 0.1 mg/L and 0.044 mg/L, respectively. The cleanup goal for selenium is the ACL of 0.05 mg/L. Monitoring for these three contaminants will continue annually to verify modeling results, that is, that concentrations are decreasing. Monitoring for cadmium will continue on an annual basis and focus on observing trends in well 0612 and establishing a larger database to support future modeling efforts. Cadmium will be

analyzed in samples on a site wide basis to ensure concentrations are not detected in any locations other than well 0612 and that human health risks remain minimal. Cadmium will also be analyzed in samples from Animas River surface water locations adjacent to the site and downgradient, to verify that there continues to be no ecological risks in the Animas River.

Wells 0612, 0617, 0630, 0631, 0633, 0634, and 0635 have been established as appropriate for monitoring progress of natural flushing in the alluvial aquifer. Concentrations of cadmium, molybdenum, selenium, and uranium were detected above MCLs in these wells during the most recent sampling. In addition, wells 0859 and 0863 will be sampled because these locations are downgradient of the plume and should be adequate for tracking the progress of natural flushing. Well 0633 (downgradient of the former small tailings pile) and well 0612 (downgradient of the former large tailings pile) had the highest concentrations of uranium detected in samples collected in the most recent sampling event, suggesting that the center of this plume has already migrated downgradient. Well 0612 sample results will also be used to verify that cadmium concentrations continue to decrease as expected. Background wells 0857 and 0866 will also continue to be sampled to establish a larger database of background ground water concentrations for statistical analysis, should future modeling for cadmium be necessary. The proposed monitoring locations are shown on Figure 7–3.

Surface water locations 0650 and 0651 along Lightner Creek, and locations along 0515, 0652, 0690, 0583, 0584, 0691, and 0586 along the Animas River will be monitored to verify the natural flushing strategy is protective of the environment.

Monitoring will take place on an annual basis for the first 10 years. At that time the monitoring strategy will be reevaluated and adjusted as appropriate based on current results. To accommodate the specification of observing concentrations of COPCs at or below the compliance standards for 3 consecutive years before discontinuing monitoring for that constituent, a different monitoring frequency will be determined after the first 10 years. Monitoring requirements are summarized in Table 7–1.

Table 7–1. Summary of Ground Water and Surface Water Monitoring Requirements at the Mill Tailings Area

Sampling Location	Monitoring Purpose	Analytes	Location
0612, 0617, 0630, 0631, 0633, 0634, 0635	Monitor plume migration on site for molybdenum, selenium, and uranium. Verify decrease in concentrations of cadmium in well 0612.	Cadmium Molybdenum Selenium Uranium	On site - Downgradient
0859, 0863	Downgradient concentrations; leading edge of plume	Cadmium Moylbdenum Selenium Uranium	On site - Downgradient
0857, 0866	Background for the mill tailings area	Cadmium Moylbdenum Selenium Uranium	Off site - Upgradient
0515, 0650, 0652	Surface water background	Cadmium Moylbdenum Selenium Uranium	Off site - Upgradient
0583, 0584, 0586, 0651, 0690, 0691	Downgradient surface water concentrations	Cadmium Moylbdenum Selenium Uranium	Off site - Downgradient

All other monitor wells at the mill tailings area no longer needed for compliance monitoring will be abandoned in the near future in accordance with UMTRA Project procedures and applicable State of Colorado regulations.

7.3 Raffinate Ponds Area Compliance Strategy

To achieve compliance with Subpart B of 40 CFR 192 at the raffinate ponds area, DOE's proposed action is no remediation and application of supplemental standards based on the criteria for limited use ground water (40 CFR 192.21 [g]). For ground water to be classified as limited use, at least one of three criteria must be met:

- TDS concentrations are at least 10,000 mg/L.
- Widespread ambient contamination not due to ore-processing activities exists that cannot be cleaned up using treatment methods reasonably employed in public water systems.
- The quantity of water reasonably available for sustained continuous use is less than 150 gallons per day.

The TDS concentrations in the background ground water locations at the raffinate ponds area are all less than 10,000 mg/L, and therefore the first criterion would not apply to the raffinate ponds area.

The quantity of ground water available from wells completed in the Point Lookout and Menefee Formations at the site meets the criteria for limited use, with the exception of wells completed in the Bodo fault and fractured coal beds (there is no alluvial ground water at the raffinate ponds area; it occurs in only one small, isolated spot). However, ground water flow at the raffinate ponds area is predominantly through joints, open bedding planes, and fractures; wells completed across these specific features can sustain greater than 150 gallons per day.

The second criterion applies to bedrock ground water at the Durango raffinate ponds area and is the basis for the classification of limited use (Figure 7–4). The raffinate ponds area bedrock ground water has elevated selenium concentrations that are not due to the former mill processing activities. Ground water in bedrock formations at the raffinate ponds area is not a current or potential source of drinking water.

7.3.1 Assessment of Environmental Data

Two bedrock units, both members of the Mesaverde Group, underlie the raffinate ponds area separated by a fault dissecting the site (Plate 2). The Point Lookout Sandstone is the basal formation of the Mesaverde Group and is divided into two members: a lower transitional member consisting of interbedded lenticular sandstones and shales, and an upper massive sandstone member. The Menefee Formation consists of massive sandstone and shale, with beds of carbonaceous shale and coal. The Bodo Fault (a normal fault) juxtaposes the Point Lookout Sandstone and the Menefee Formation and has down dropped the Point Lookout Sandstone approximately 200 ft. The Bodo fault trends northeast and dips to the southeast at approximately 55 degrees.

Ground water in the raffinate ponds area is assumed to be unconfined. It is recharged by infiltration of precipitation and runoff and by horizontal inflow from Smelter Mountain. Water enters the flow system at the intersection of the Bodo Fault with South Creek. This influx is intermittent because South Creek is an ephemeral stream. Hydraulic conductivity data indicate the Point Lookout Sandstone is the least conductive material. In addition, the lower member (predominantly shale and siltstone) of the Point Lookout Sandstone is apparently an aquitard. The Menefee Formation consists of mostly low-conductivity sandstone, but is relatively permeable where fractures or lenticular coal beds are present. The greatest hydraulic conductivity at the raffinate ponds area is found in the Bodo Fault and in the coal beds.

7.3.2 Ground Water Contaminants

The list of COPCs identified in the 1995 BLRA was reevaluated using data collected since November 2000. Potential risks calculated using the recent data for a residential scenario indicated the major risk contributors were chloride, lead, manganese, selenium, sodium, sulfate, and uranium. At the raffinate ponds area, risks are dominated by selenium with quantifiable contributions from manganese and uranium. Selenium and uranium are the only COPCs with concentrations that exceed MCLs. Although there is no consensus as to what concentration of sulfate is acceptable in drinking water, concentrations detected in the raffinate ponds area ground water are sufficiently high to be of probable concern. A discussion of COPCs is presented in Section 6.1.

Concentrations of some constituents are elevated in the background monitor wells. Background selenium values for the raffinate ponds area average 0.0136 mg/L (the MCL is 0.01 mg/L). Selenium concentrations are high in background well 0599 and are not detected in others. The population is bimodal; if the nondetect values are assumed to be the detection limits, the average of 0.0136 mg/L is above the MCL of 0.01 mg/L. The ORP is oxidizing in well 0599; in other background wells the ORP is negative (reducing conditions), preventing selenium from being mobilized into the ground water.

Ground water in some of the background wells (and many of the on-site wells) has a black discoloration and a strong odor of hydrogen sulfide gas. Samples were not routinely collected for sulfide analysis from on site wells, but a limited number were collected from the background well locations. Sulfide at or above the risk-based default value in drinking water of 0.11 mg/L was detected in several background wells. In background well 0592 the concentrations were extremely elevated at 45 mg/L.

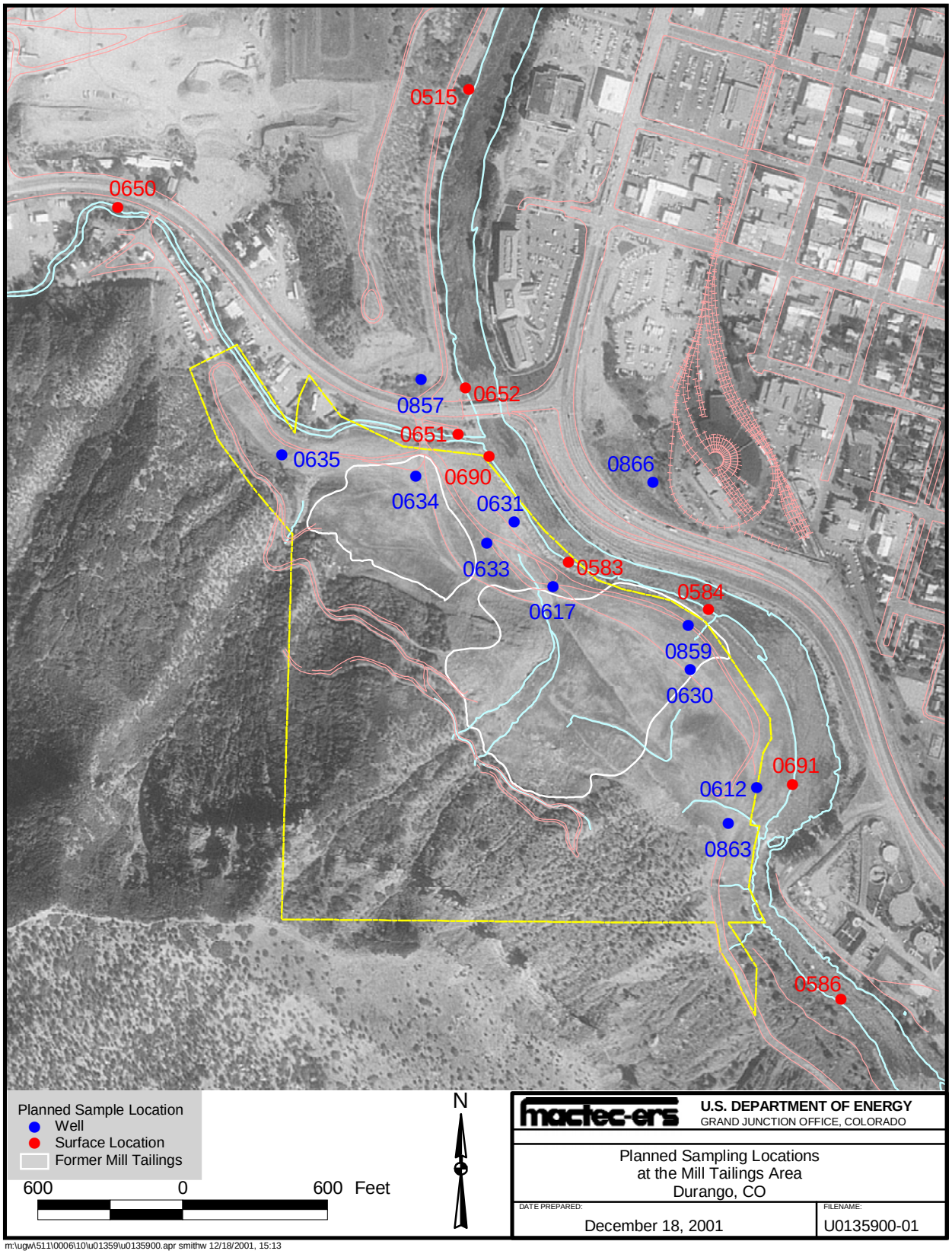

Figure 7–3. Proposed Monitoring Locations for the Mill Tailings Area

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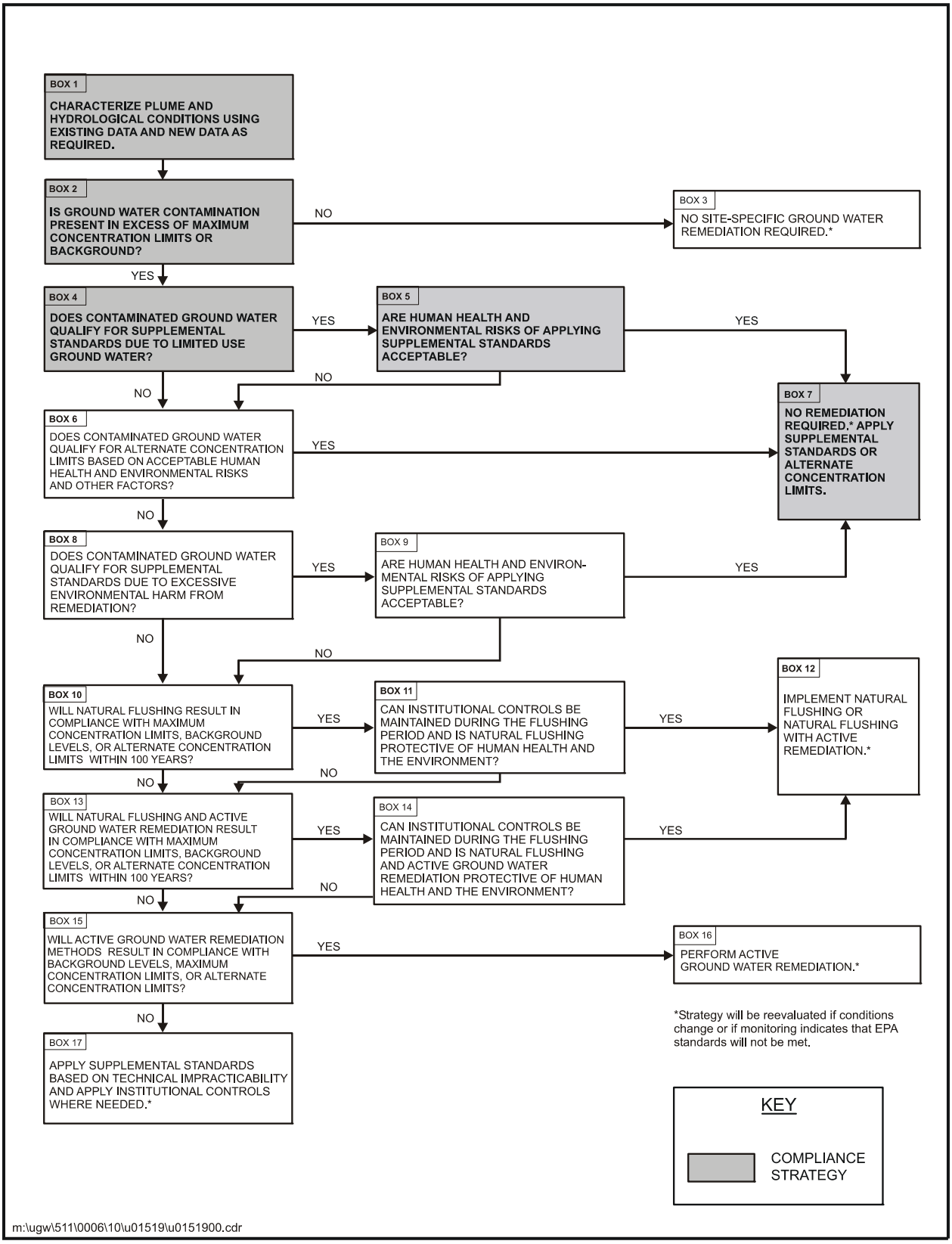

Figure 7–4. Summary of the Raffinate Ponds Area Ground Water Compliance Selection Framework

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7.3.3 Applicability of Supplemental Standards

Bedrock ground water at the raffinate ponds area qualifies for supplemental standards on the basis of limited use ground water. Ground water in the bedrock is of limited use because of widespread, elevated concentrations of naturally occurring selenium.

- Selenium concentrations exceeds the MCL at background monitor well 0599. In the August 2001 sampling event, the selenium concentration in this well exceeded the MCL by a factor of nearly nine.

- Historical data indicate high concentrations of selenium were not released from the processing operations at the raffinate ponds area. Tsivoglou and others (1960) reported that less than 0.01 mg/L of selenium was detected in the raffinate produced from the solvent extraction process. This process was used until the operations at the raffinate area ceased in 1963. Prior to that time, raffinate was discharged directly to the Animas River and could not have been as a source of ground water contamination. Therefore, it appears the milling operations were not a source of selenium in ground water.

- Selenium occurs naturally in the western United States and in the Durango area in sufficient concentrations to be a source of ground water contamination under certain conditions. Coals, which occur throughout the raffinate ponds area, can also have elevated selenium concentrations. For example, Naftz and Rice (1989) reported total selenium values of 0.5 to 2 mg/kg for early Tertiary sandstones associated with coal seams from the Powder River Basin in Wyoming. Valkovic (1983) also noted selenium may be the most enriched trace element in coal. Coleman and Delevaux (1957) found selenium to occur naturally in galena, chalcopyrite, arsenopyrite, sphalerite, pyrite, and pyrrhotite within the Colorado Plateau. Pyrite is commonly found in the bedrock units under the raffinate ponds area. The widespread distribution of potential natural sources of selenium at the raffinate site could account, in part, for the high variable selenium concentrations in ground water. Moreover, high selenium in isolated wells such as 0884 and the lack of a clear selenium plume implies that selenium sources are variable and isolated.

- Selenium is released to ground water under oxidizing conditions (Masscheleyn and others 1990). The variability in the historical well data for selenium indicate changing redox conditions at the site (see Section 5.4). One indication of changing redox conditions is the change in iron concentrations that occurred in the 1980s at well 0607 (Figure 5–21). The surface remediation completed in 1991 also may have increased the oxidizing conditions at the site by the removal of 20 to 30 ft of overburden. Figure 5–24 shows the increase in selenium concentrations since remediation in monitor well 0607. Site-specific factors that could influence the rates of release and transport of selenium were not fully determined by the field investigation. The travel time of selenium in the ground water, the weathering rates of host rock, and how selenium is bound up in the various bedrock units and surface soils influence selenium concentrations in the ground water. The inherent variability is expected to continue with changes in water levels, precipitation events, and other influences on the redox conditions.

- Several contaminants are known to be site related. Uranium is the best example of a contaminant linked to past millsite activities. As expected, uranium concentrations have decreased across the site since surface remediation was completed. In contrast, selenium concentrations have increased in several wells (Figure 7–5 shows concentration changes over time for selenium and uranium for well 0607, which was in place before remediation), implying influences from other sources and processes.

- Selenium concentrations in ground water increased after surface disturbances at other locations, which allowed for changes in redox conditions when natural selenium has been available. At the former uranium-ore processing mill in Monticello, Utah, (under the CERCLA program) selenium levels began to increase dramatically in downgradient wells following remediation; where contaminated soil was removed above the Mancos Shale and Dakota Sandstone. Like the Point Lookout Sandstone and Menefee Formation, the Dakota Sandstone has an abundance of coal, carbonaceous shale, and pyrite. However, it has also been shown that disturbance of surface material is not required for mobilizing naturally occurring selenium. The National Irrigation Water Quality Program (NIWQP) has extensively surveyed naturally occurring selenium in the western United States. The USGS analyzed data collected by the NIWQP and concluded that areas having local geologic sources of selenium, application of water to the soil mobilizes the selenium; the degree of contamination resulting from mobilization of selenium by irrigation water depends greatly on the aridity and hydrology of the area; and selenium concentrations in water are elevated in all but 1 of the12 NIWQP study areas where irrigated areas are on or adjacent to Upper Cretaceous marine sedimentary rocks (USGS 1999).

- The highest concentrations of selenium in ground water have occurred in monitor well 0628. The August 2001 results from this well are almost 10 times higher than the concentrations in any other well. As noted in Section 5.4, this well is screened to within 2 ft of the surface (enhanced oxidizing conditions), and it is screened directly below a coal seam (likely source of natural selenium). In addition, concentrations in nearby wells are much lower indicating the high value in monitor well 0628 is isolated. If the analytical results for selenium in well 0628 are excluded from the statistical calculations, the on-site selenium concentrations are closer to concentrations in the wells designated as background for the site (Table 7–2).

Table 7–2. Selenium Concentrations at the Raffinate Ponds Area

	Background Selenium Concentrations	**On-site Selenium Concentrations Including Well 0628**	**On-site Selenium Concentrations Excluding Well 0628**
Maximum	0.087	19.4	3.08
Mean	<0.0136	<1.1	0.36
95 Percent UCL	NA	2.17	0.62

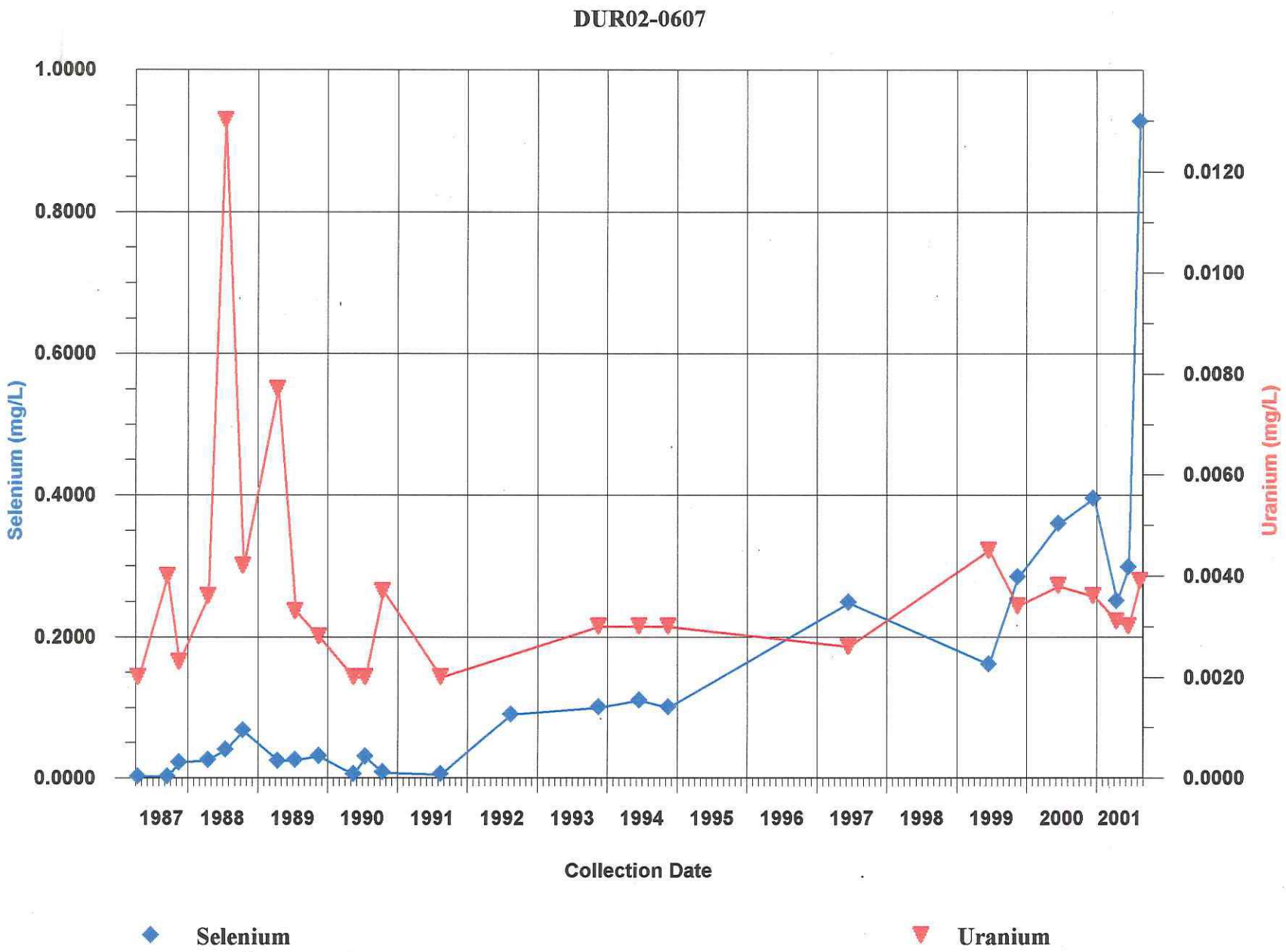

Figure 7–5. Concentrations of Selenium and Uranium in Well 0607 at the Raffinate Ponds Area

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7.3.4 Reasonableness of Ground Water Treatment

Ground water from the bedrock formations beneath the raffinate ponds area is not a current or potential source of drinking water. Potable water is readily available from the municipal water system in the vicinity of the site. Based on historical records from the Colorado Division of Water Resources, the nearest known downgradient well is across U.S. Highway 550, approximately 0.2 mile southeast of the site, on the west side of the Animas River. However, this well is located under a building and has never been used because of a black discoloration of the water (DOE 1995a). Future use of ground water from the bedrock aquifer is unlikely based on the planned future development of a pumping plant at the raffinate ponds area. Therefore, the current and reasonably projected uses of site-affected ground water would be preserved with the application of supplemental standards.

However, should the future development plans for the site change, ground water would still not be considered as a source for the municipal water supply. The City of Durango does not consider that ground water could be reasonably treated for drinking water purposes because the bedrock aquifer does not produce water in usable quantities (Rogers 2001). Additionally, water in the area is considered of poor quality with high hardness, iron, and manganese levels (DOE 1995a), as well as black discoloration and the strong odor associated with hydrogen sulfide gas. Prior to any development on the site, the property would be annexed by the City of Durango and the city would not allow use of the ground water for drinking water purposes (Rogers 2001).

7.3.5 Public Involvement Plan

In 1992, DOE began preparation of a Programmatic Environmental Impact Statement (PEIS) for the UMTRA Ground Water Project (DOE 1996). The PEIS presents analyses of the potential effects of four alternatives for implementing the entire UMTRA Ground Water Project: no action, the proposed action, active remediation to regulatory levels, and passive remediation. A public meeting was held at the Durango City Hall on June 8, 1995. Comments and responses from the Durango meeting are listed in Volume II of the PEIS. Nine public hearings and a 120-day comment period followed the issuance of the draft PEIS in April 1995. The final document was distributed to the public in October 1996.

Regulations governing implementation of supplemental standards codified at 40 CFR 192.22 (c) state that when remediation is proposed for supplemental standards “..the Department of Energy shall inform any private owners and occupants of the affected location and solicit their comments." DOE will use the UMTRA Ground Water Public Participation Plan (DOE 2000d) to select the appropriate mechanisms to distribute information to affected parties. In addition, DOE will distribute all documents defining and proposing remedial decisions and actions to the owners of affected properties and will actively solicit their input.

7.3.6 Monitoring Compliance Strategy

Limited monitoring of ground water in the bedrock at the raffinate ponds area is proposed for uranium and selenium as a best management practice. The proposed monitoring locations are shown on Figure 7–6. On-site wells 0879 and 0880 have been established as appropriate for monitoring concentrations of selenium and uranium in the upper portions of the bedrock. In addition, wells 0598, 0887, and 0888 will be sampled to continue monitoring the concentrations of selenium and uranium associated with water within the Bodo Fault zone.

Downgradient wells 0882, 0884, 0889, and 0902 will be sampled to monitor off-site migration and upgradient well 0607 will be sampled to provide an indication of the quality of water coming into the site. Background wells 0592 and 0903 will also continue to be sampled to establish a larger database of background ground water concentrations for statistical comparison.

Surface water location 0588, on South Creek upgradient of the site, will also be sampled to assess the quality of water entering the site. In addition, surface water locations 0654, 0656, and 0657, along the Animas River will continue to be monitored to verify that the supplemental standards strategy is protective of the environment.

Monitoring will take place on an annual basis for the first 5 years. After that time, the monitoring strategy will be reevaluated and adjusted as appropriate based on current results. The monitoring requirements are summarized in Table 7–3.

Table 7–3. Summary of Monitoring Requirements at the Raffinate Ponds Area

Sampling Location	Monitoring Purpose	Analytes	Location
0879, 0880	Monitor concentrations in ground water in the shallow bedrock	Selenium Uranium	On site
0598, 0887, 0888	Monitor concentrations in ground water in the deep bedrock and Bodo Fault zone	Selenium Uranium	On site
0882, 0884, 0889, 0902	Monitor off-site downgradient concentrations and migration	Selenium Uranium	Off site - Downgradient
0607	Water quality entering the raffinate ponds area	Selenium Uranium	On site - Upgradient
0592, 0599, 0903	Background ground water quality	Selenium Uranium	Off site - Upgradient
0588	Surface water quality entering the site	Selenium Uranium	Off site - Upgradient
0654, 0656, 0657	Downgradient surface water concentrations	Selenium Uranium	Off site - Downgradient

All other monitor wells at the Durango raffinate ponds area no longer needed for monitoring will be abandoned in the near future in accordance with UMTRA Project procedures and applicable State of Colorado regulations.

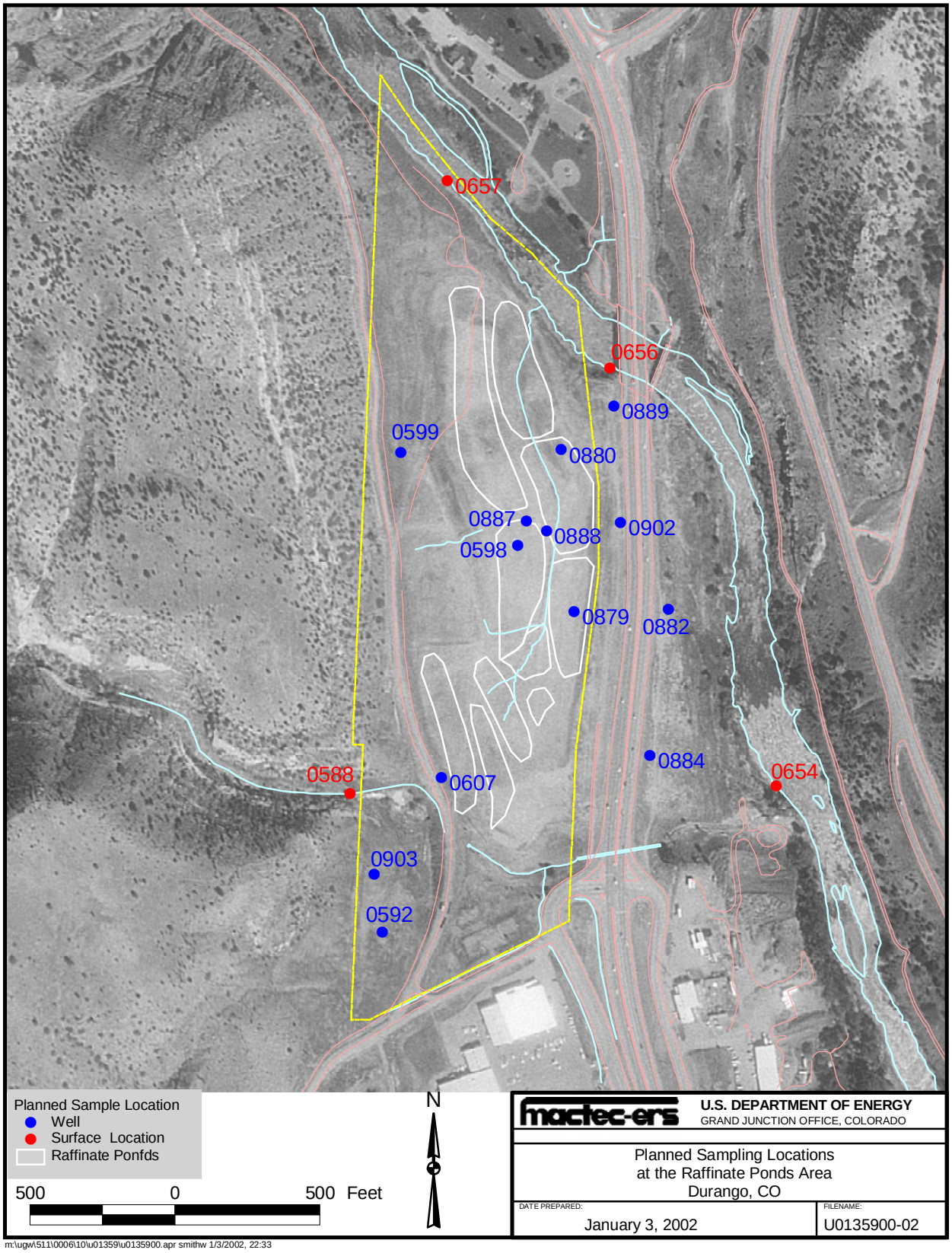

Figure 7–6. Proposed Monitoring Locations for the Raffinate Ponds Area

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