DOE–LM/1301–2006

Verification Monitoring Report for the Durango, Colorado, Processing Site

September 2006

U.S. Department of Energy

Office of Legacy Management

Work Performed Under DOE Contract No. DE–AC01–02GJ79491
for the U.S. Department of Energy Office of Legacy Management.

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Acronyms and Abbreviations

ACL	alternate concentration limit
BLRA	Baseline Risk Assessment
CDPHE	Colorado Department of Public Health and Environment
CG	concentration goal
DOE	U.S. Department of Energy
DWEL	Drinking Water Equivalent Level
EPA	U.S. Environmental Protection Agency
ft	foot (feet)
ft^3/day	cubic feet per day
GCAP	Ground Water Compliance Action Plan
LM	Legacy Management
MCL	maximum concentration limit
mg/L	milligram per liter
NRC	U.S. Nuclear Regulatory Commission
POC	point-of-compliance
SOWP	Site Observational Work Plan
UMTRA	Uranium Mill Tailings Remedial Action (Project)
UMTRCA	Uranium Mill Tailings Radiation Control Act
VMR	Verification Monitoring Report
yr	year

End of current text

1.0 Introduction

The Durango processing site is located in La Plata County, Colorado approximately 0.25 mile southwest of the central business district of Durango, Colorado (Figure 1). The site consists of two separate areas: (1) the mill tailings area, which is the setting of former uranium-ore milling and storage of residual solid wastes (mill tailings), and (2) a raffinate ponds area where liquid process-wastes were impounded during milling operations. The former mill tailings area encompasses about 40 acres on a bedrock-supported river terrace between Smelter Mountain to the west, the Animas River to the east and south, and Lightner Creek to the north (Figure 2). The raffinate ponds area occupies about 20 acres on a separate river terrace located 1,500 feet (ft) south (downstream) of the mill tailings area.

The compliance strategy for ground water cleanup at the former mill tailings area of the Durango site is natural flushing, institutional controls to prevent exposure to contaminated ground water, water quality monitoring, and an alternate concentration limit (ACL) for selenium (DOE 2003). This strategy was based in part on ground water flow and solute transport modeling that predicted acceptable cleanup times for each contaminant, except possibly cadmium, by natural flushing processes at the site, and in part on historical trends of decreasing contaminant concentrations, particularly since the completion of contaminant source removal in 1991. Baseline conditions of contaminant concentration in the model correspond to results of the June 2002 ground water sampling. The ground water model is fully documented in the Site Observational Work Plan (SOWP) (DOE 2002).

The compliance strategy for the raffinate ponds area is no further action in conjunction with supplemental standards and requires no further discussion in this report.

The purpose of this Verification Monitoring Report (VMR) is to evaluate and compare the observed to expected progress of passive ground water restoration at the Durango mill tailings area based on the water quality data through June 2006. The goal is to confirm that natural flushing is progressing and remains a viable compliance strategy for the site.

2.0 Site Conditions

2.1 Hydrogeology

The uppermost aquifer at the mill tailings area consists of alluvial deposits associated with the Animas River and Lightner Creek, and poorly sorted colluvium derived from adjacent Smelter Mountain, rising steeply to the southwest. Approximately 70 ft of colluvium overlies bedrock along the base of the mountain. These deposits thin eastward and transition to sand and gravel deposits up to 15 ft thick closer to the Animas River. The portion of the aquifer underlying the site occupies a narrow fringe, at most about 250 ft wide, along the Animas River. Depth to ground water increases from about 5 ft on the river terrace to about 60 ft near the base of Smelter Mountain. The saturated zone is thin (less than 10 ft), unconfined, and directly underlain by Mancos Shale bedrock. The surficial aquifer is of limited extent and has a low yield. Ground water flow is generally northwest to southeast, parallel to the Animas River, at an average gradient of approximately 0.02 ft/ft. Hydraulic conductivity of the alluvium ranges from 10 to 70 ft/day.

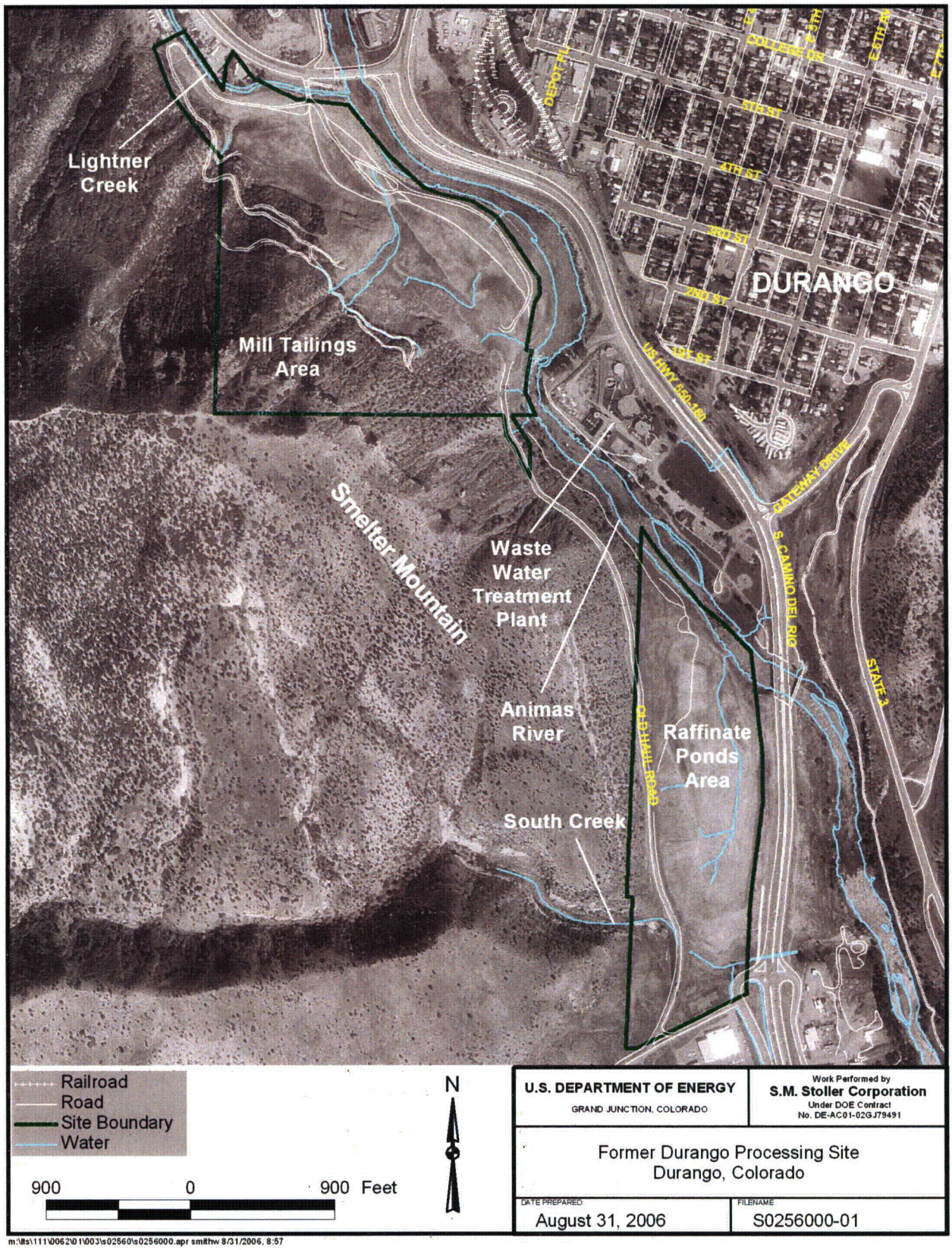

Figure 1. Durango Processing Site

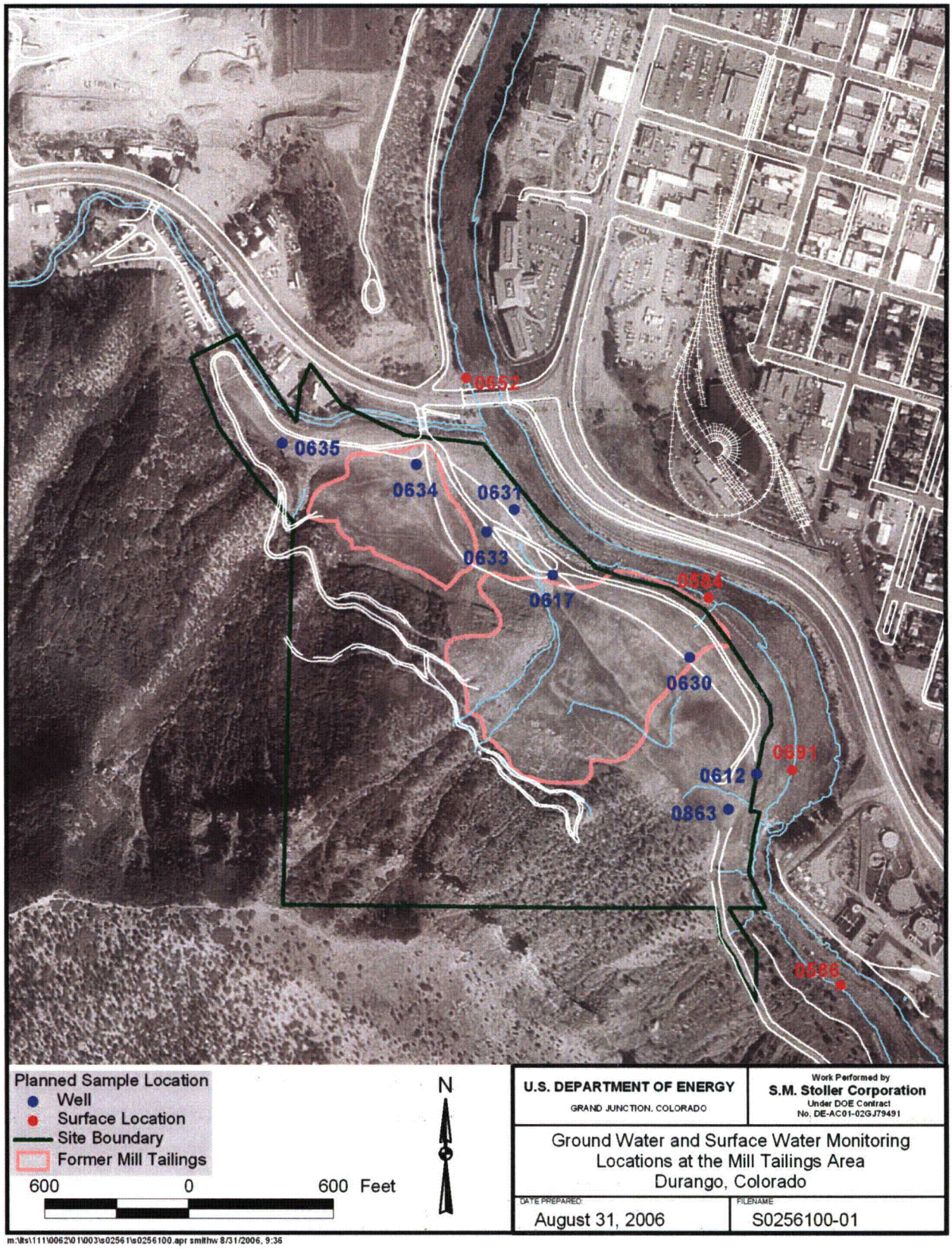

Figure 2. Monitoring Network in the Mill Tailings Area at the Durango Site

The colluvium is recharged primarily by runoff and infiltrating precipitation while the river alluvium receives water from Lightner Creek and from river loss along the upstream reach of the prominent meander. Ground water discharge occurs to the Animas River along the upper and lower thirds of the reach adjacent to the mill tailings area. Under average conditions, the estimated volume of ground water discharge from the mill tailings area is 1,480 cubic feet per day (ft^3/day); approximately 840 ft^3/day enters the Animas River near the mouth of Lightner Creek, and the remaining 640 ft^3/day enters the Animas River east of the former east tailings pile (DOE 2002). The alluvial aquifer pinches out against bedrock cliffs near the southeast corner of the site at which point ground water discharge to the river is complete (DOE 2002).

2.2 Water Quality

Ground water in the alluvial aquifer is contaminated as a result of uranium-ore processing and tailings storage at the mill tailings area. Although the primary source of ground water contamination (mill tailings) was removed from the site by 1991, concentrations of arsenic, cadmium, lead, molybdenum, net alpha, radium-226+228, selenium, and uranium in the underlying aquifer remained in excess of Uranium Mill Tailings Remedial Action (UMTRA) Project maximum concentration limits (MCL). Concentrations of arsenic, lead, and radium have since decreased to levels below the MCLs, and net alpha was detected only sporadically in a few wells. Monitoring for arsenic, lead, radium, and net alpha was discontinued in 2002 in accordance with provisions of the Ground Water Compliance Action Plan (GCAP) (DOE 2003).

Table 1 compares the maximum concentrations of the remaining site contaminants detected in June 2006 to the corresponding compliance goals. The compliance goals for cadmium, molybdenum, and uranium are UMTRA Project MCLs. The compliance goal for selenium (0.05 mg/L) is adopted from the U.S. Environmental Protection Agency (EPA) Safe Drinking Water Act as an ACL (the MCL is 0.01 mg/L). An ACL was established for selenium because of naturally abundant selenium in ground water above the MCL. There are no MCLs for manganese and sulfate. The compliance goal for manganese is the EPA Drinking Water Equivalent Level (DWEL). This is a lifetime exposure concentration protective of adverse, non-cancer health effects, that assumes all of the exposure to a contaminant is from drinking water (EPA 2004). The sulfate goal is equivalent to its average background concentration in ground water.

Table 1. Current Ground Water Contaminants and Compliance Goals

Contaminant of Concern	Compliance Goal (mg/L)	Compliance Goal Source	Maximum Concentration Observed in June 2006 (mg/L)
Cadmium	0.01	UMTRA Project MCL	0.046
Manganese	1.6	DWEL (EPA 2004)	5.7
Molybdenum	0.1	UMTRA Project MCL	0.110
Selenium	0.05	ACL (DOE 2002)	0.016
Sulfate	1,276	Average background (DOE 2002)	3,600
Uranium	0.044	UMTRA Project MCL	1.700

Current monitoring of the Animas River verifies previous findings in the Baseline Risk Assessment (BLRA) (DOE 1995) that past milling operations have negligible effect on surface water quality. Historical results indicate that constituent concentrations adjacent and downstream of the mill tailings area are indistinguishable from background.

2.3 Surface Remediation Activities

DOE began surface cleanup of the mill tailings and raffinate ponds areas in November 1986 to meet the EPA standards for radium in soil. A total of 2.5 million cubic yards of contaminated material was relocated to the Bodo Canyon disposal cell several miles southwest of the Durango site. Supplemental cleanup standards were applied to steep slopes of Smelter Mountain and two regions along the banks of the Animas River. In addition, a small lens of uranium ore was left in place at the mill tailings area below layers of slag along portions of the river. The slag deposits, which are 10 to 15 ft thick in some areas (including the location of well 0612) are associated with a lead smelter that operated on the site from 1880 to 1930. To restore the site, approximately 230,000 cubic yards of uncontaminated soil was backfilled, contoured, and seeded. Rip-rap was placed in some sensitive areas along the Animas River to prevent erosion. Remedial action was completed in May 1991.

2.4 Water and Land Use

The primary water source for the city of Durango is the Florida River upstream of its confluence with the Animas River. Additional water is withdrawn from the Animas River during high-demand periods (usually during the summer) from a location approximately 2 miles upstream of the mill tailings area. The Animas River bordering the mill tailings area of the Durango site is popular for seasonal boating and fishing. Development plans for the mill tailings area include municipal but not residential use (DOE 2002).

2.5 Institutional Controls

As part of the compliance strategy, public health will be protected during the natural flushing period through an environmental covenant between the State of Colorado and the City of Durango (landowner) that restricts access to contaminated alluvial ground water. Additionally, deed restrictions (which serve as a notice to the public) for the mill tailings area prohibit access to ground water without written permission from the U.S. Department of Energy (DOE) and the Colorado Department of Public Health and Environment (CDPHE).

3.0 Monitoring Program

Annual ground water and surface water monitoring will continue through the first 5 years following U.S. Nuclear Regulatory Commission (NRC) concurrence with the GCAP (DOE 2003). Monitoring for cadmium will continue annually for the first 10 years following concurrence because of the greater uncertainty of this constituent to naturally flush within the allotted 100-year period under the regulations. Monitoring data obtained through the initial 5-year period will measure the actual progress of natural flushing of the constituents listed in Table 1. After the 5-year annual monitoring period, the scope of subsequent monitoring will be addressed in a Long-Term Management Plan.

Monitor wells 0612, 0617, 0630, 0631, 0633, 0634, 0635, and 0863 have been established as point-of-compliance (POC) wells that will be used to monitor the progress of natural flushing in ground water in the alluvial aquifer (Figure 2). In accordance with provisions of the GCAP

(DOE 2003), natural flushing for a given analyte is complete when its concentration no longer exceeds the respective compliance goal at the compliance wells for three consecutive annual sampling events. Monitoring for that constituent may then be discontinued.

Surface water locations 0652, 0584, 0691, and 0586, located along the Animas River, will be monitored on schedule with ground water monitoring to verify continued protection of the aquatic environment (Figure 2). Compliance monitoring requirements and rationale are summarized in Table 2.

Table 2. Annual Ground Water and Surface Water Compliance Monitoring Requirements

Sampling Location	Monitoring Purpose	Analytes	Location
Ground Water Monitoring			
0617, 0630, 0631, 0633, 0634, 0635	Point of compliance/verify natural flushing	Manganese Molybdenum Selenium Sulfate Uranium	On site
0612, 0863	Point of compliance/verify natural flushing; verify cadmium flushing	Cadmium Manganese Molybdenum Selenium Sulfate Uranium	On site downgradient
Surface Water Monitoring			
0652	Surface water background	Cadmium Molybdenum Selenium Uranium	Off site upstream
0584, 0691	Verify no site-related increase above background		Off site; site ground water discharge area
0586	Verify no site-related increase above background		Off site; downstream of site ground water discharge

4.0 Results of 2006 Monitoring

Table 3 summarizes the model-predicted times for natural flushing to achieve the compliance goal for cadmium, manganese, molybdenum, selenium, sulfate, and uranium in ground water. The progress of each, based on water quality data through June 2006, is addressed separately in the following subsections. Important reference dates for comparing observed to model-predicted concentration trends include water quality monitoring since 1992 (after removal of the primary source of ground water contamination between 1986 and 1991) and June 2002 as the ground water model baseline condition (time zero) for contaminant transport. The predicted compliance times listed in Table 3 differ because the contaminants initially were not distributed evenly and vary in degree of contamination above the respective compliance goal, and because each contaminant varies in its mobility in ground water in the aquifer.

Table 3. Model-Predicted Ground Water Restoration Times

Analyte	Compliance Goal (mg/L)	Predicted Compliance Time (yr)[a]	Predicted Compliance Date[b]
Cadmium	0.01	>>100	>>2102
Manganese	1.6	70	2072
Molybdenum	0.1	5	2007
Selenium	0.05	60	2062
Sulfate	1,276	100	2102
Uranium	0.044	80	2082

[a]Source: DOE 2002, Appendix G, Table 18.
[b]Model time zero (baseline) is June 2002.

Plots of predicted compliance time based on modeling show mixed results with the 2006 sampling data with variation in some concentrations being above the modeling predictions. Variation in concentrations in ground water is to be expected on an annual basis and the success of natural flushing needs to be assessed over an extended period of time. Even with some of the observed increases in concentrations for several of the constituents in 2006, linear trends of measured data since 1992 show that concentrations of all constituents except sulfate at some locations will naturally flush within the 100 year timeframe allotted under the EPA regulations.

4.1 Ground Water

Ground water was sampled from the eight POC locations (Figure 2) and analyzed for constituents shown in Table 2. Sampling results for 2006 are provided in Appendix A and are discussed below by constituent.

4.1.1 Cadmium

Figure 3 is a map view of the site showing the concentration of cadmium in ground water at the compliance wells in June 2006. Figure 4 shows observed cadmium concentrations versus time at the compliance wells since completion of remedial action in 1992. Historically and in June 2006, cadmium in excess of the MCL occurs only at well 0612 (increasing to 0.046 mg/L in 2006) while the remaining monitor wells contained only trace levels of this constituent. Ground water modeling predicted a flushing period of about 500 years for cadmium (Figure 5). This result is not consistent with historical trending at well 0612, which if projected linearly from 1992 beyond June 2006, implies compliance for cadmium by about year 2017, or 15 years from the model baseline (Figure 5). This linear projection takes into account the increase in concentration observed during the 2006 sampling event. Projecting this trend too far into the future may underestimate the actual restoration period because of non-linear effects that lead to concentration tailing, particularly at later times, that is commonly observed in nature and predicted by the solute transport models. Natural flushing of cadmium however remains a potential strategy because of its very limited distribution at the site and the observed net decrease in concentration over time. Since it is early in the 100-year natural flushing timeframe, DOE will continue to monitor cadmium concentrations in ground water, and will re-evaluate the strategy of a later time if required.

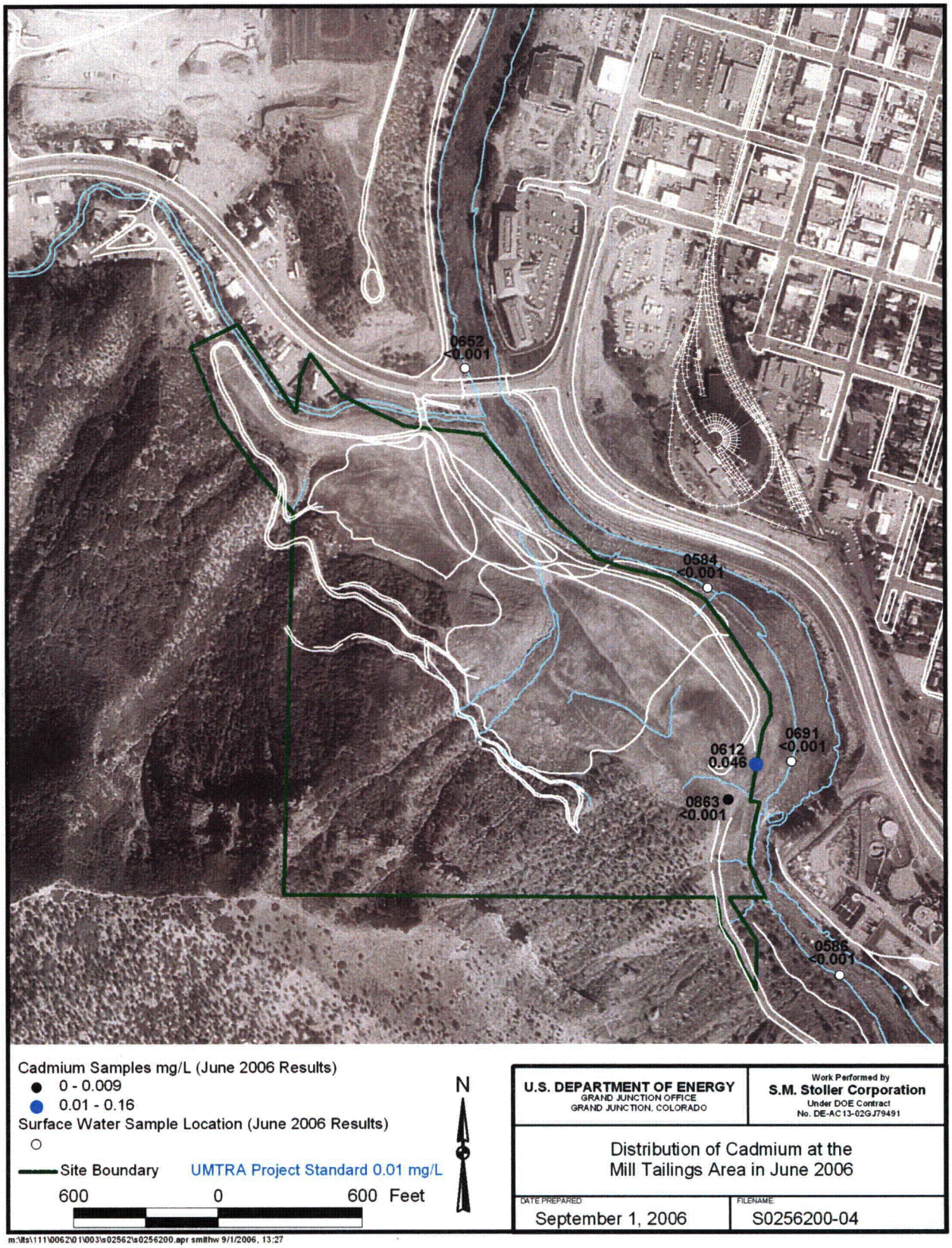

Figure 3. Distribution of Cadmium at the Durango Site

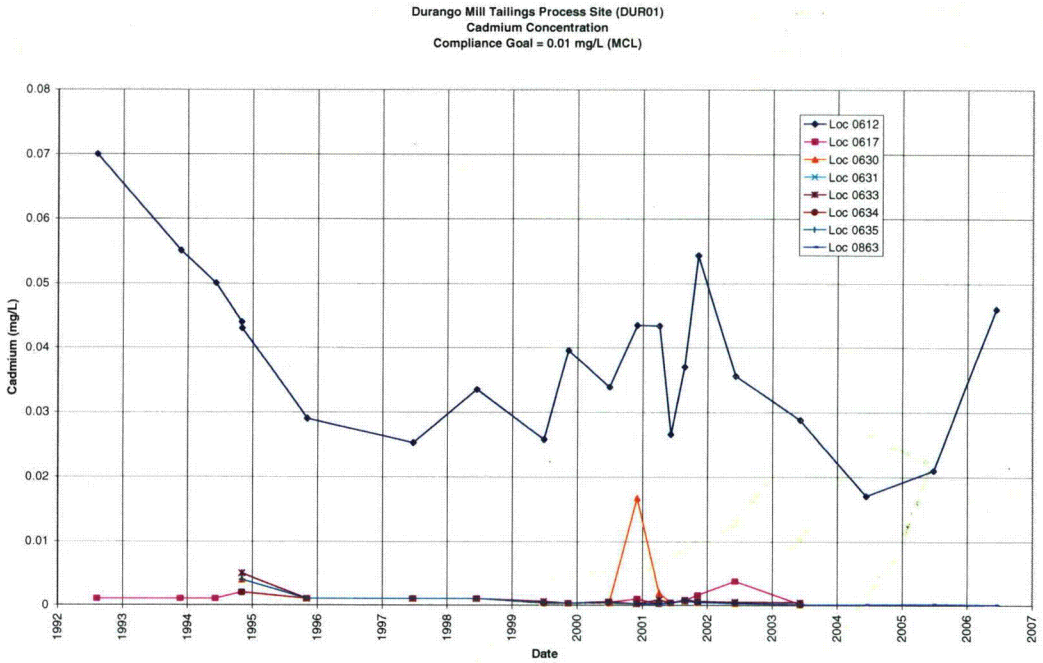

Figure 4. Historical Cadmium Concentrations in Ground Water at the Durango Site

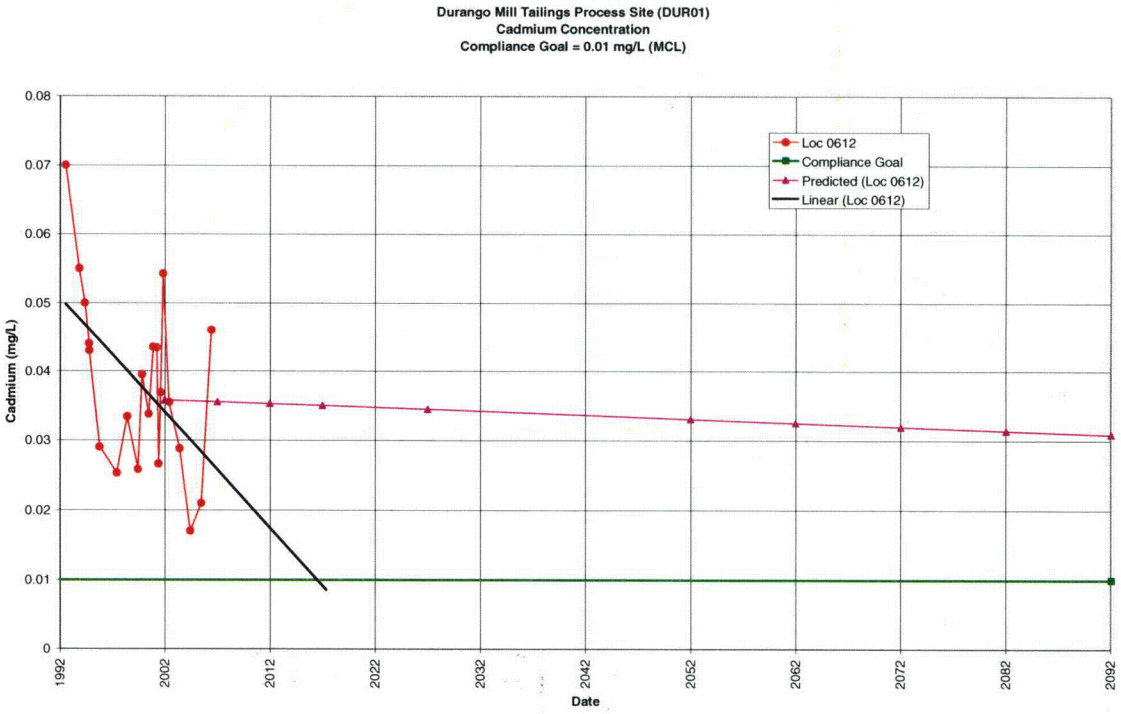

Figure 5. Predicted and Measured Cadmium Concentrations at the Durango Site

4.1.2 Manganese

Figure 6 and Figure 7, respectively, illustrate the distribution of manganese concentrations in ground water in June 2006 and the variation over time of manganese concentrations at the compliance wells. The June 2006 results are typical for manganese in that the compliance goal was exceeded only at well 0612 (Figure 7). Projecting the observed concentration linear trend at well 0612 since 1992 implies that natural flushing will be complete at that location in about the year 2041, well within the 100 year time allotment and in close agreement with the model prediction (Figure 8). The net variation in the concentration of manganese observed through the relatively brief period since 2002 is not inconsistent with the model prediction for this location. Because well 0612 is very close to the downgradient discharge boundary of the aquifer, contaminant migration from that area will not affect other regions of the aquifer. The flushing period corresponding to well 0612 therefore represents a site-wide maximum for manganese because the compliance goal is not exceeded at any other location. Concentrations of manganese in well 0630 have been below the compliance goal since 2003.

4.1.3 Molybdenum

Molybdenum concentrations in June 2006 were less than the compliance goal of 0.1 mg/L at all locations except at well 0612, which increased slightly above the compliance goal again this year (Figure 9 and Figure 10). Since completion of the remedial action at the site, molybdenum in excess of the compliance goal has been limited to well 0612 (Figure 10). The linear trend of observed concentrations at well 0612 forecast molybdenum flushing complete in about the year 2008 (Figure 11). This takes into account the slight increase in concentration above the compliance goal for 2006.

4.1.4 Selenium

Figure 12 shows in map view that the compliance goal for selenium (0.05 mg/L) was not exceeded in June 2006 at any compliance wells. Selenium concentrations commonly exceeded the compliance goal at wells 0617 and 0633 since 1992 (Figure 13). To date, concentrations at well 0617 exhibit a net decline since completion of remedial action in 1992 (Figure 13). Extrapolating the linear trend implies that natural flushing was complete at well 0617 in about year 2002. The compliance goal was met in 1999 and 2000 at this location, but concentrations have increased slightly since then until 2006, when concentrations are very low and below the compliance goal. Given the marginal level of contamination and historical trend (since 1992), selenium flushing in the area of well 0617 is likely to occur within the model-predicted time (Figure 14). At well 0633 a consistent trend has not yet been established for selenium (Figure 13). Model-predicted selenium concentrations drop below the ACL by the year 2017 at this location, and the linear trend of measured data indicate reaching the compliance goal by about the year 2009 (Figure 14). Well 0633 is screened 90 percent in Mancos Shale, a recognized source of readily mobilized selenium (DOE 2002). The low-level selenium contamination at the site may in part be site-related; however, some contribution from natural sources is likely, as evidenced by concentrations greater than 0.01 mg/L at background well 0622 (not shown in figures) (see DOE 2002).

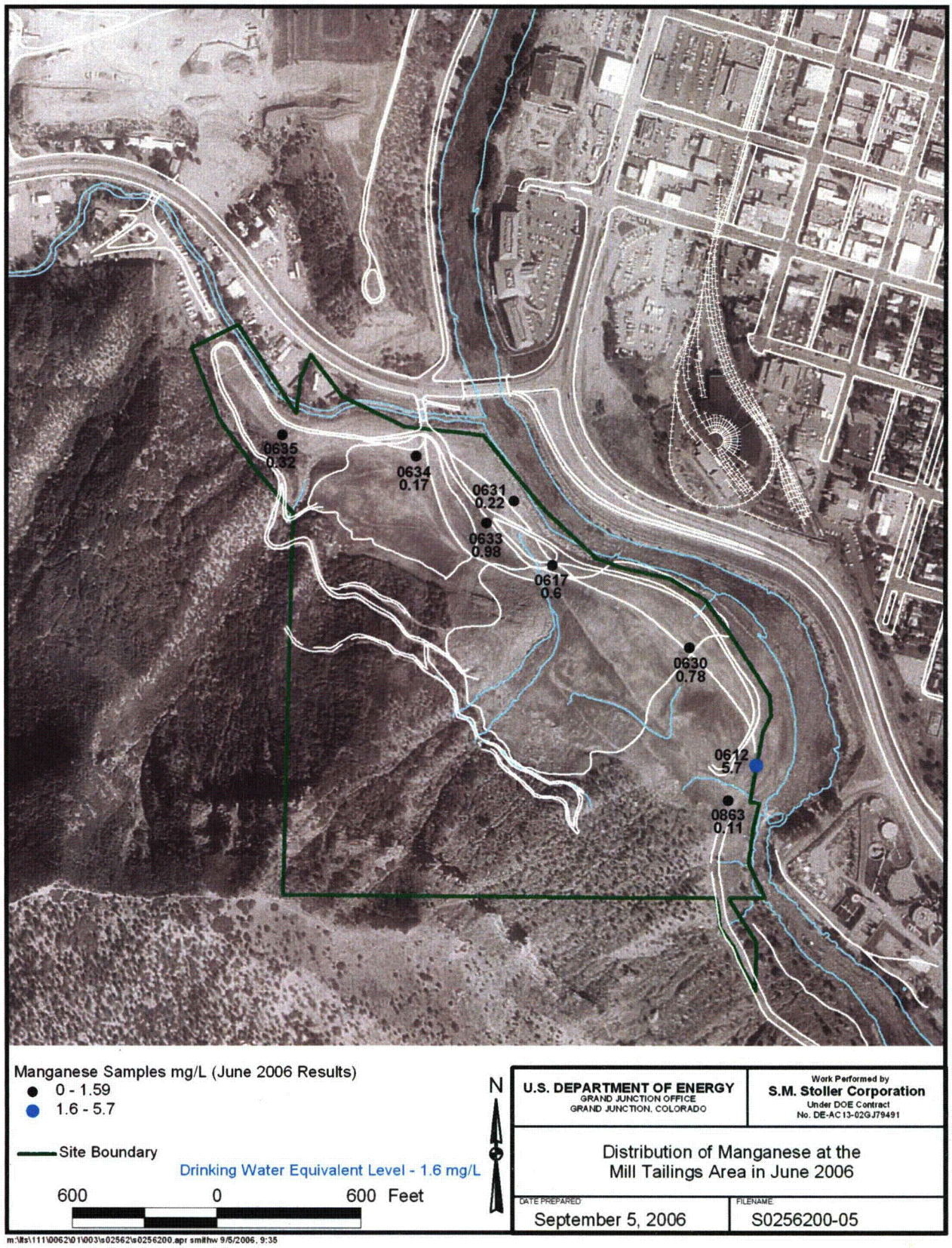

Figure 6. Distribution of Manganese at the Durango Site

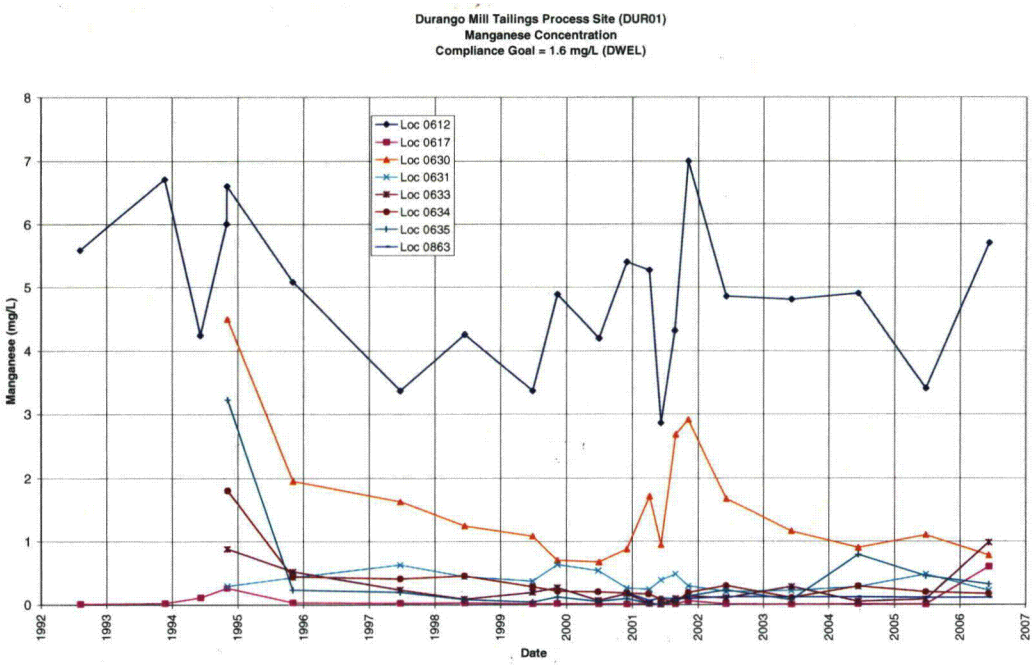

Figure 7. Historical Manganese Concentrations in Ground Water at the Durango Site

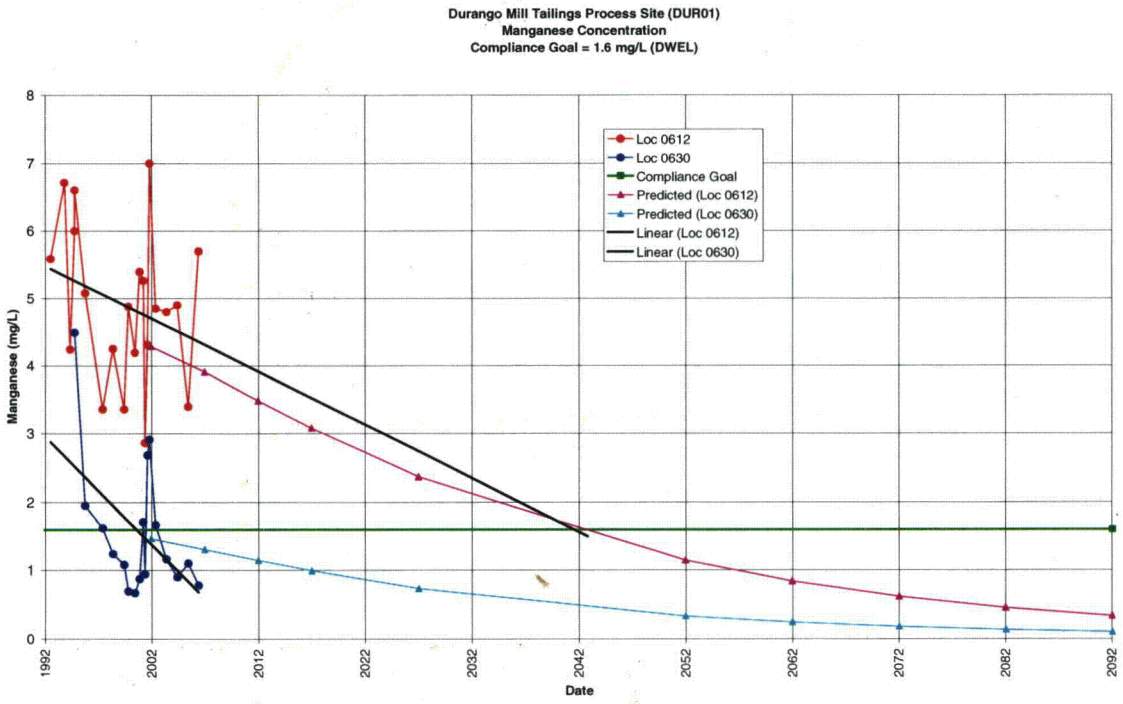

Figure 8. Predicted and Measured Manganese Concentrations at the Durango Site

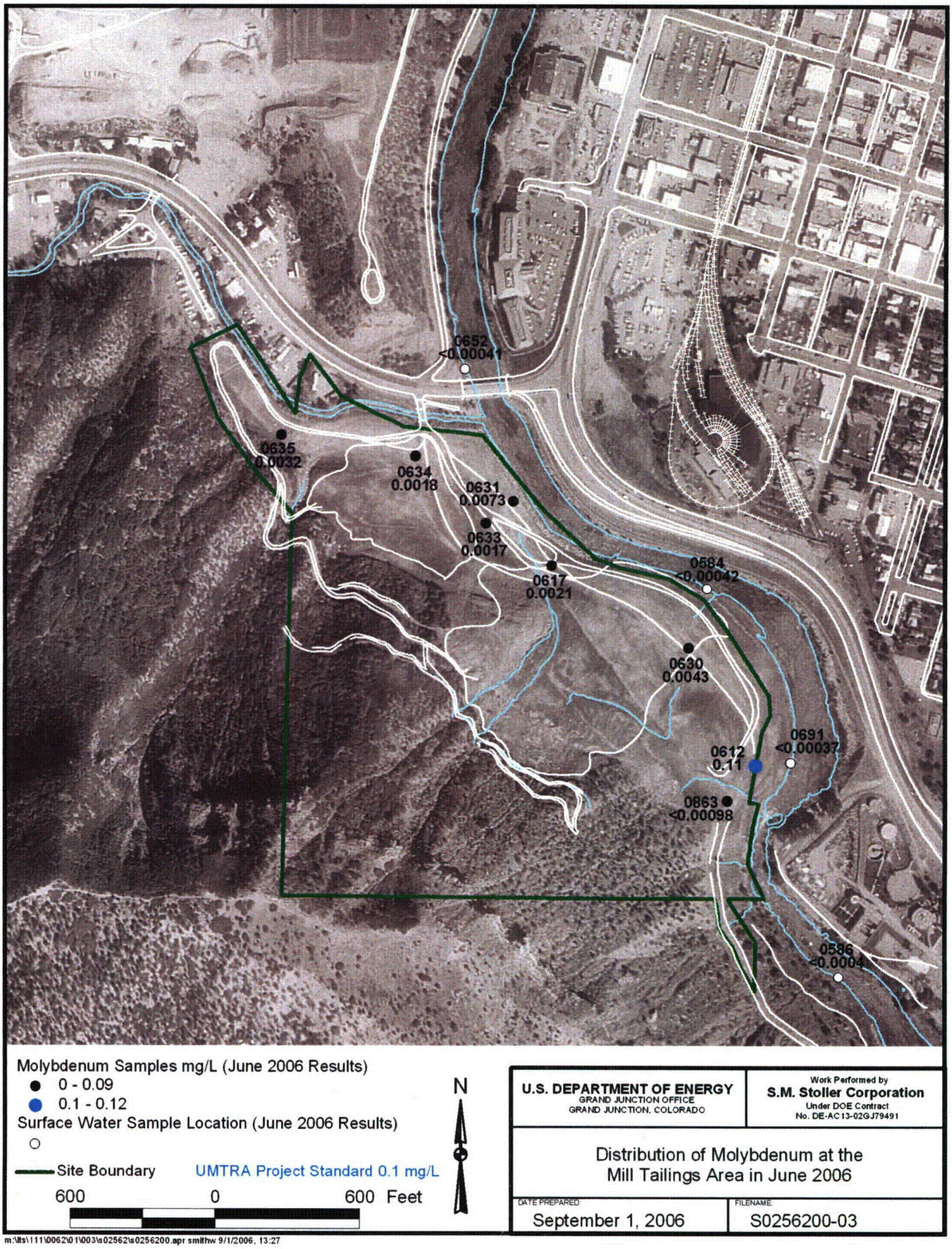

Figure 9. Distribution of Molybdenum at the Durango Site

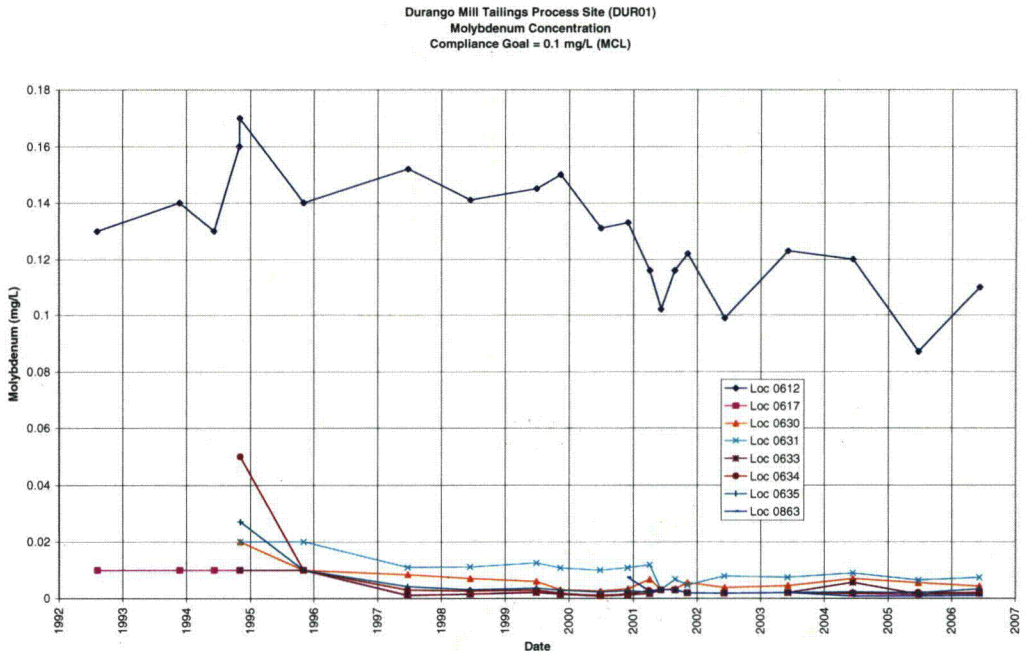

Figure 10. Historical Molybdenum Concentrations in Ground Water at the Durango Site

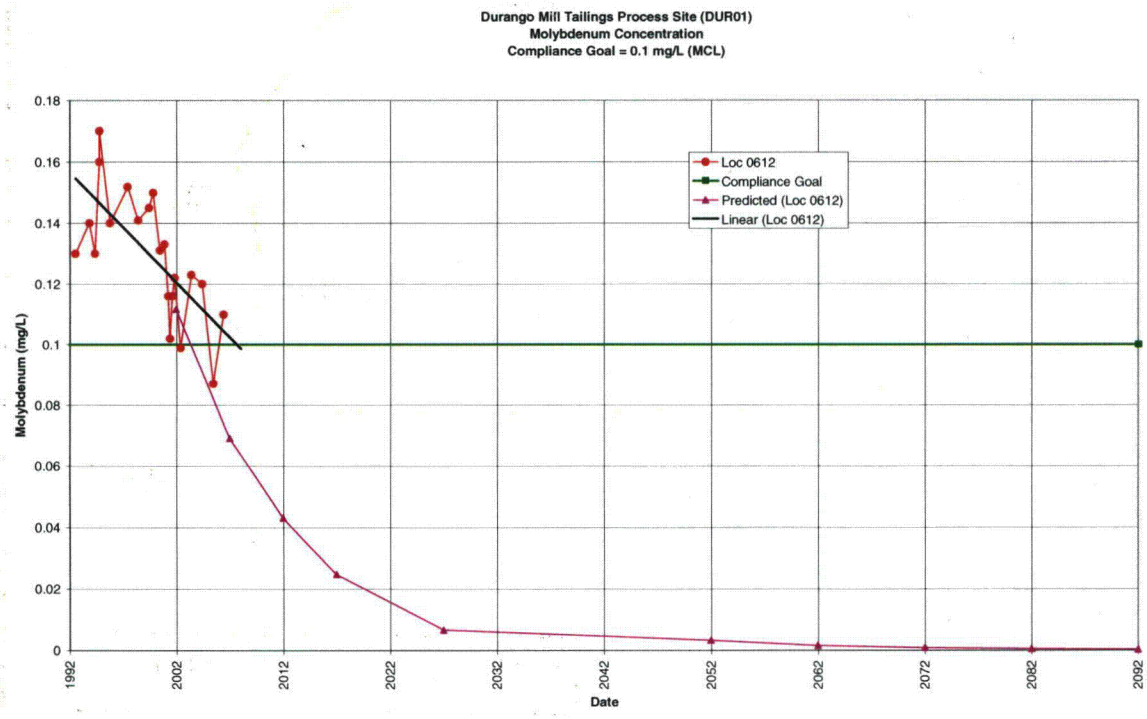

Figure 11. Predicted and Measured Molybdenum Concentrations at the Durango Site

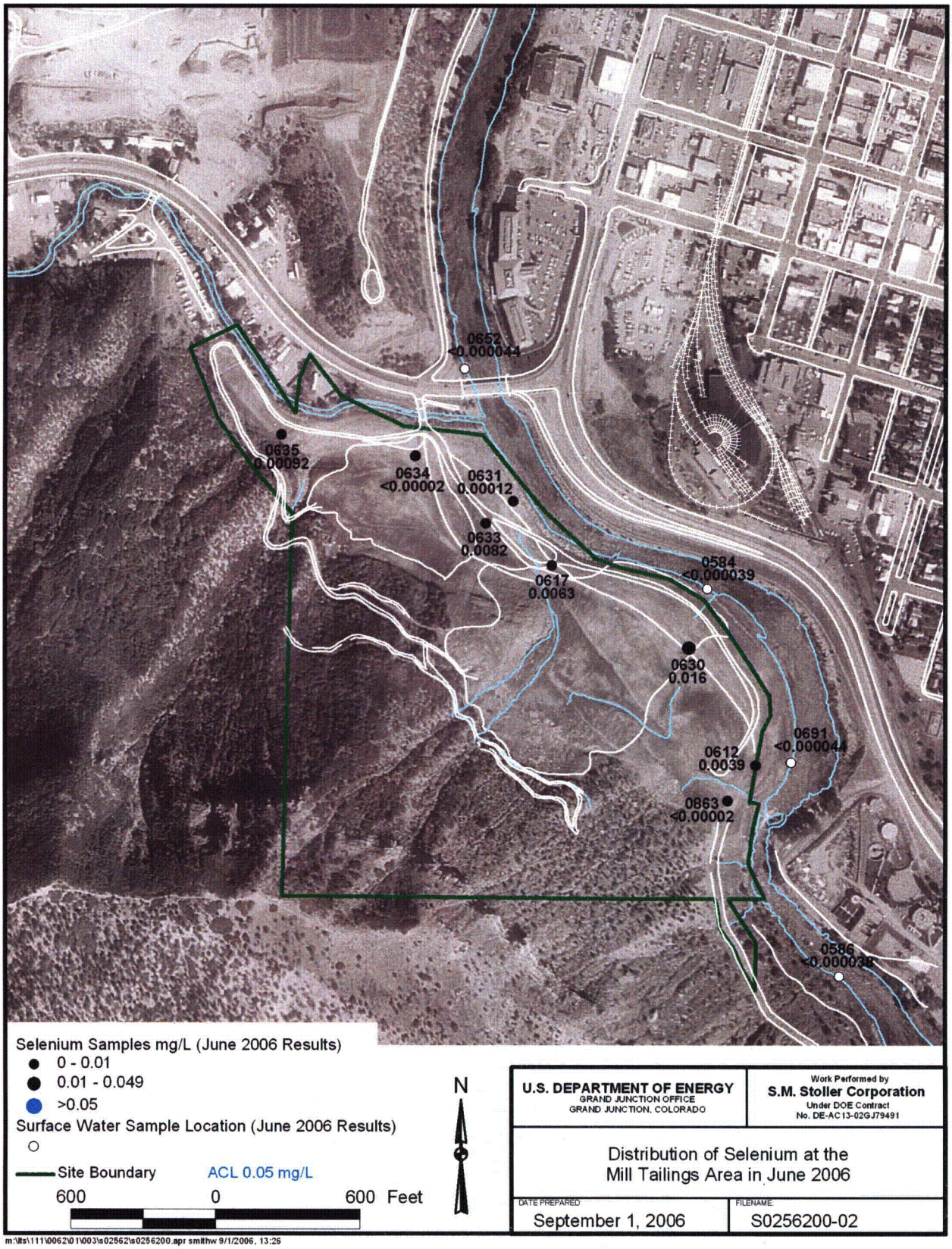

Figure 12. Distribution of Selenium at the Durango Site

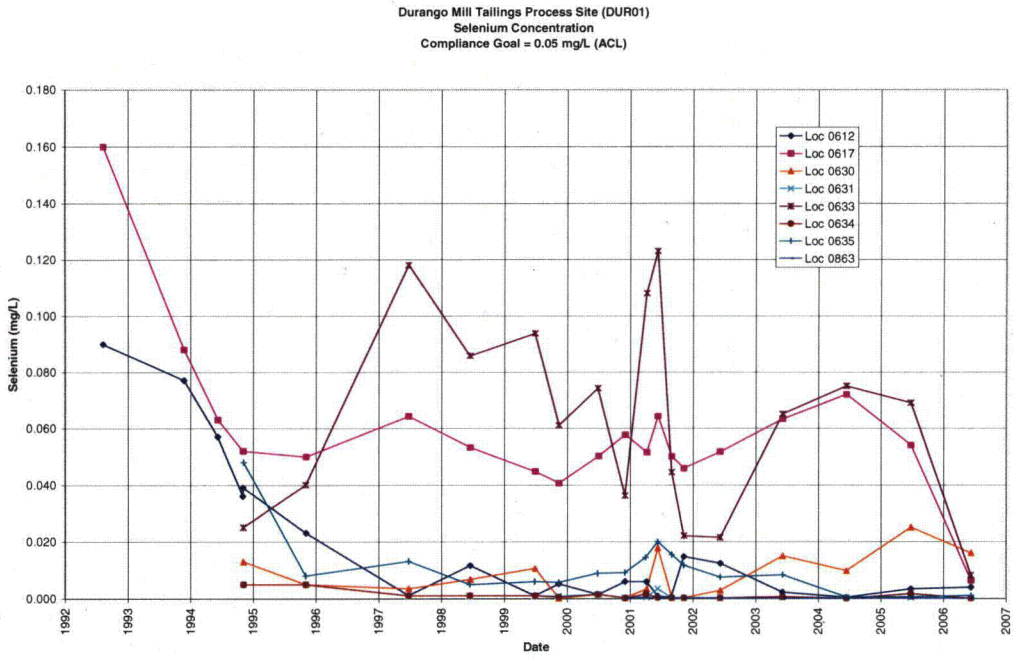

Figure 13. Historical Selenium Concentrations in Ground Water at the Durango Site

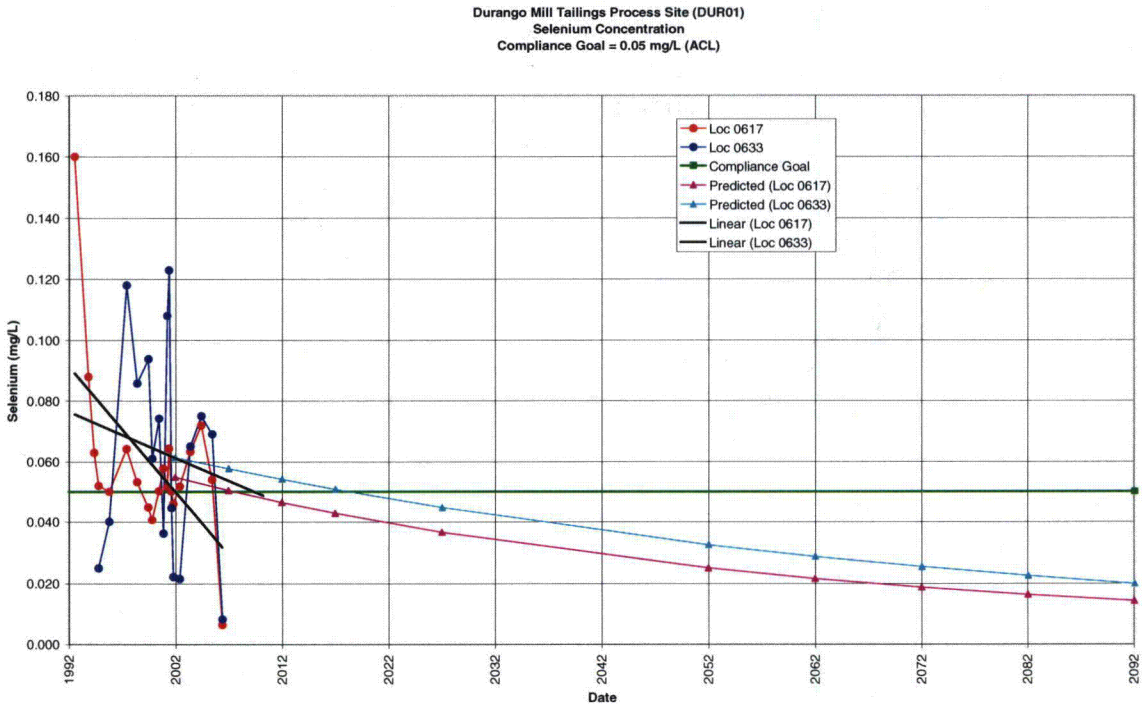

Figure 14. Predicted and Measured Selenium Concentrations at the Durango Site

4.1.5 Sulfate

Sulfate concentrations that exceed background levels are related to the former use of sulfuric acid in the milling process. In June 2006, sulfate exceeded the average background concentration at each compliance well except wells 0631 and 0863 (Figure 15), typically by a factor of two or less. Observed concentrations since 1992 fluctuate considerably at a given well but generally without obvious trending (Figure 16). However, projecting best-fit lines to the data reveals that sulfate flushing will be complete at most locations by about 2092. Linear trend projection of measured data from well 0612 show that concentrations should be below the compliance goal by about the year 2014 (Figure 17). Model predicted sulfate concentrations decrease linearly throughout the flushing period.

4.1.6 Uranium

The uranium compliance goal was exceeded at each location except wells 0635 and 0863 in June 2006 (Figure 18). This outcome is consistent with previous monitoring results except that concentrations at well 0634 were occasionally below the compliance goal (Figure 19). Well 0612 has historically contained the highest uranium concentration of any well at the site. Similar to well 0612, concentration trends are decreasing at the remaining wells where uranium contamination is greatest (wells 0617, 0631, and 0633) following source removal. Uranium concentrations at remaining locations (wells 0630 and 0634) are relatively steady at or slightly above the compliance goal. Ground water model predictions indicate that site-wide uranium flushing will be complete within about 80 years after June 2002. To date, observed concentrations at the two wells having the greatest uranium concentrations (wells 0612 and 0633), which are widely separated in the aquifer, are in close agreement with the model results (Figure 20). The predicted flushing period for these two wells (about 45 years from June 2002) differs from the predicted, site-wide flushing time because the last area to flush is south of the downgradient-most monitor well (well 0612). Linear projection of the observed concentration trends implies site-wide uranium flushing by about year 2040. The model predicts similar rates of flushing through that time to concentrations that only slightly exceed the compliance goal (Figure 20), followed by a period of much less rapid flushing and marginal levels of contamination (concentration tailing) until the goal is attained.

4.2 Surface Water

Surface water was sampled from four locations in the Animas River during June 2006 and analyzed for cadmium, molybdenum, selenium, and uranium (Figure 2 and Table 2). Concentrations of constituents at all locations were well below the respective compliance goals and remain indistinguishable from background levels (Appendix B).

5.0 Natural Flushing Assessment

As of June 2006, the observed rate of contaminant flushing is generally consistent with ground water model predictions, given that the validation period to date (June 2002 to June 2006) is short compared to predicted flushing periods (60 to 100 years) for the various contaminants. Only cadmium was identified in the modeling as potentially incapable of flushing to acceptable levels within 100 years. However, at the single location (well 0612) where cadmium is present

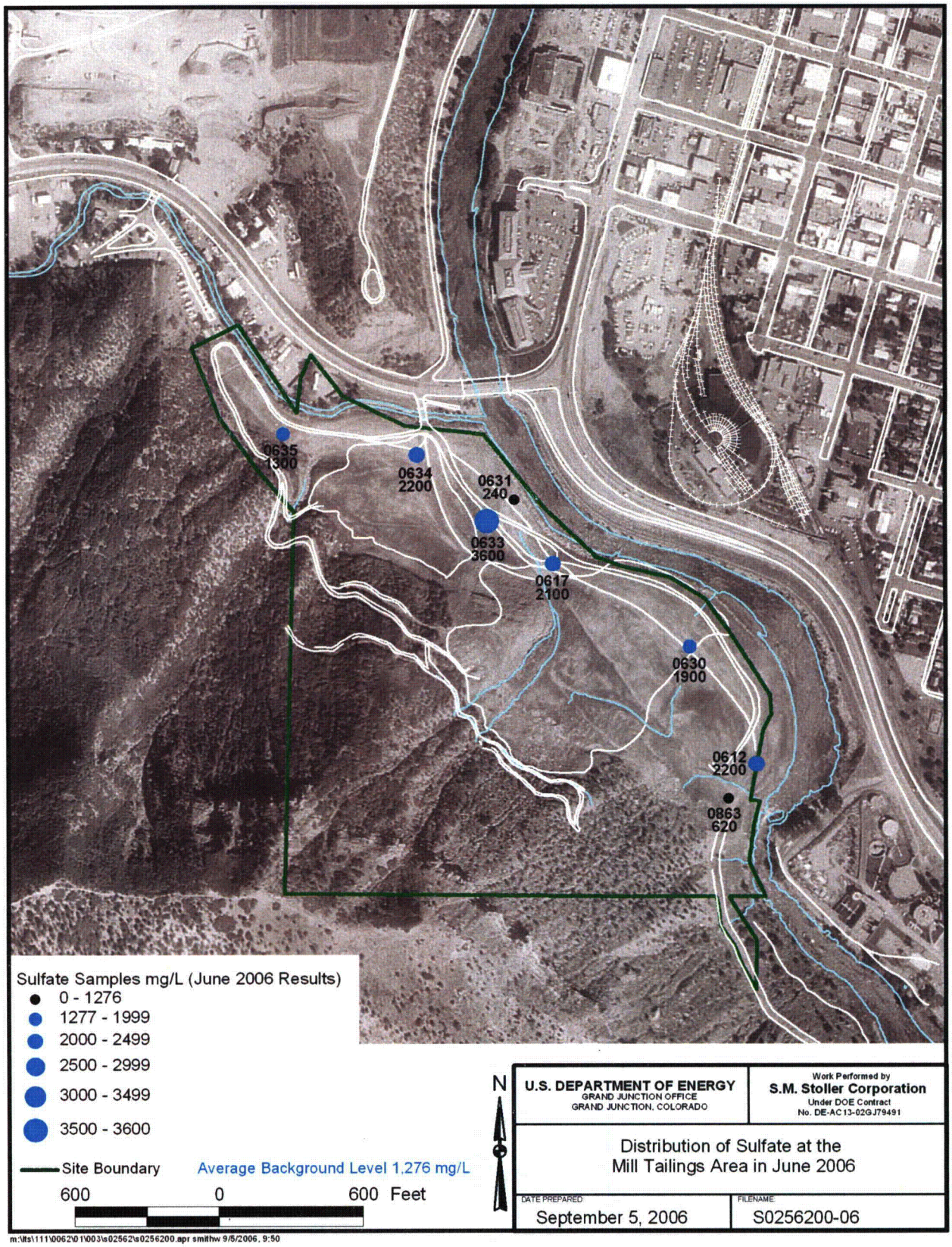

Figure 15. Distribution of Sulfate at the Durango Site

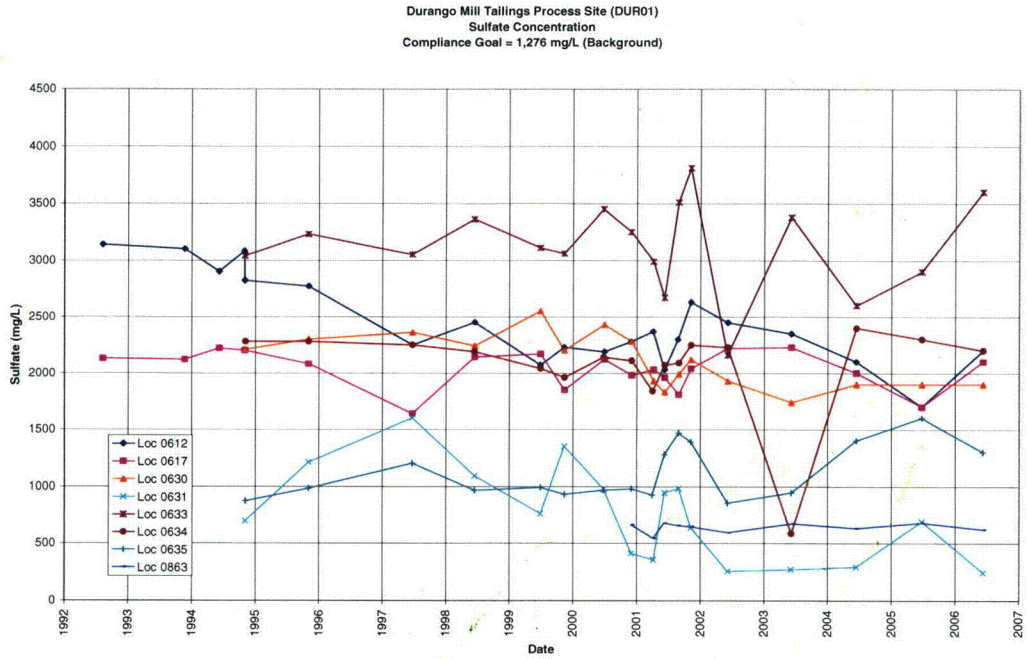

Figure 16. Historical Sulfate Concentrations in Ground Water at the Durango Site

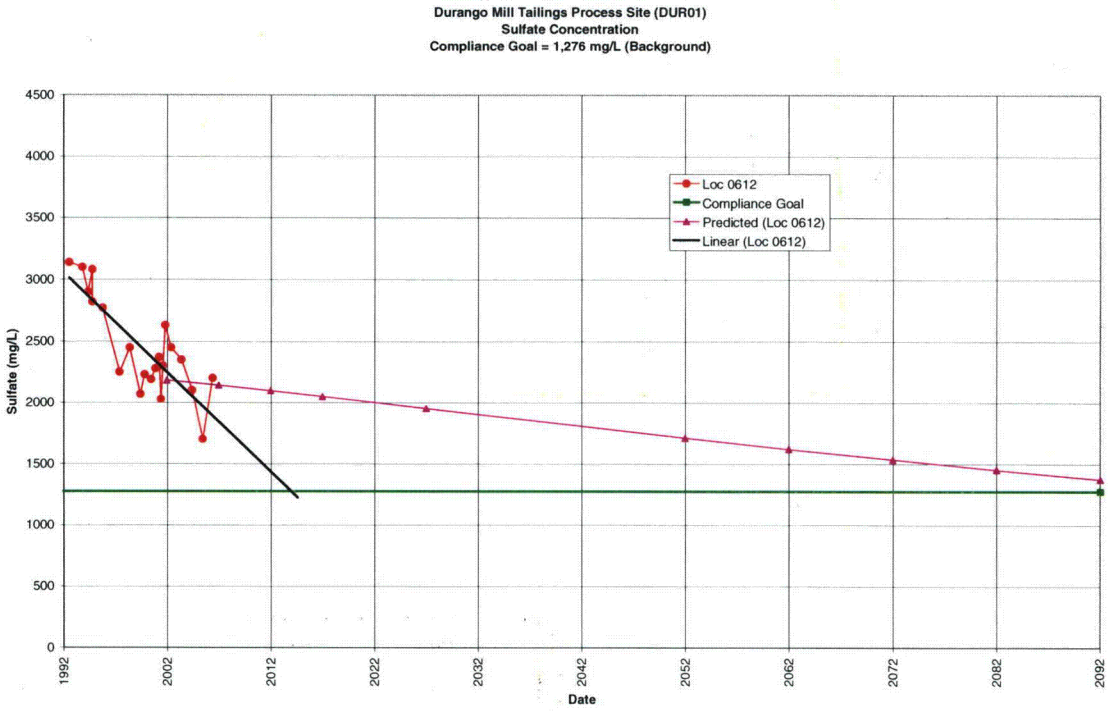

Figure 17. Predicted and Measured Sulfate Concentrations at the Durango Site

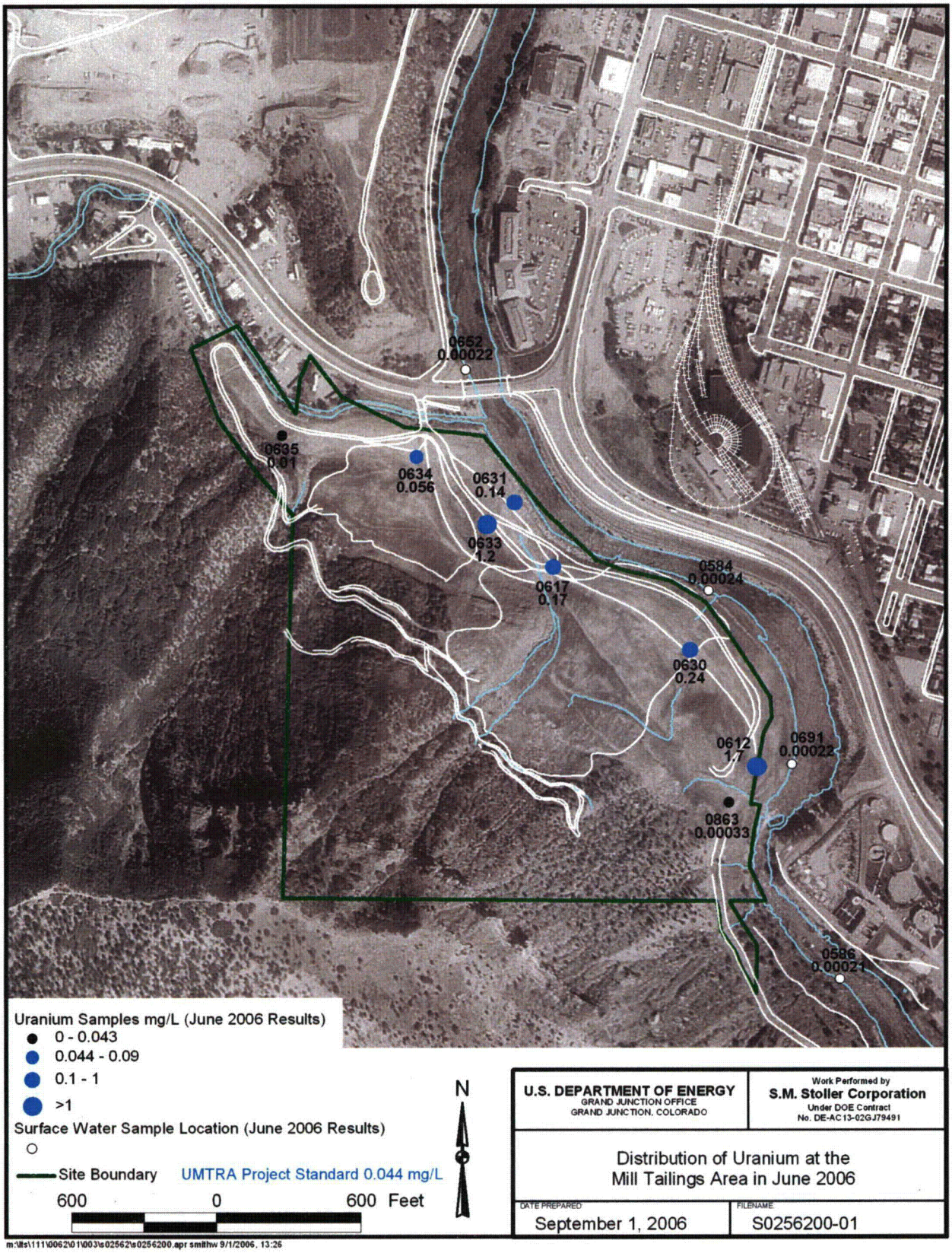

Figure 18. Distribution of Uranium at the Durango Site

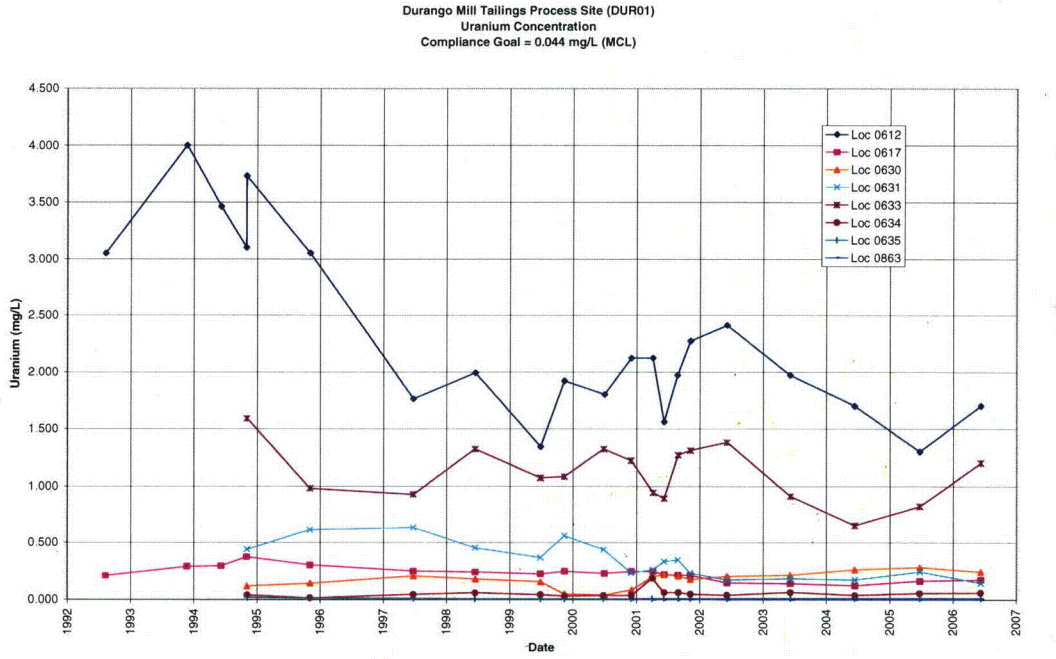

Figure 19. Historical Uranium Concentrations in Ground Water at the Durango Site

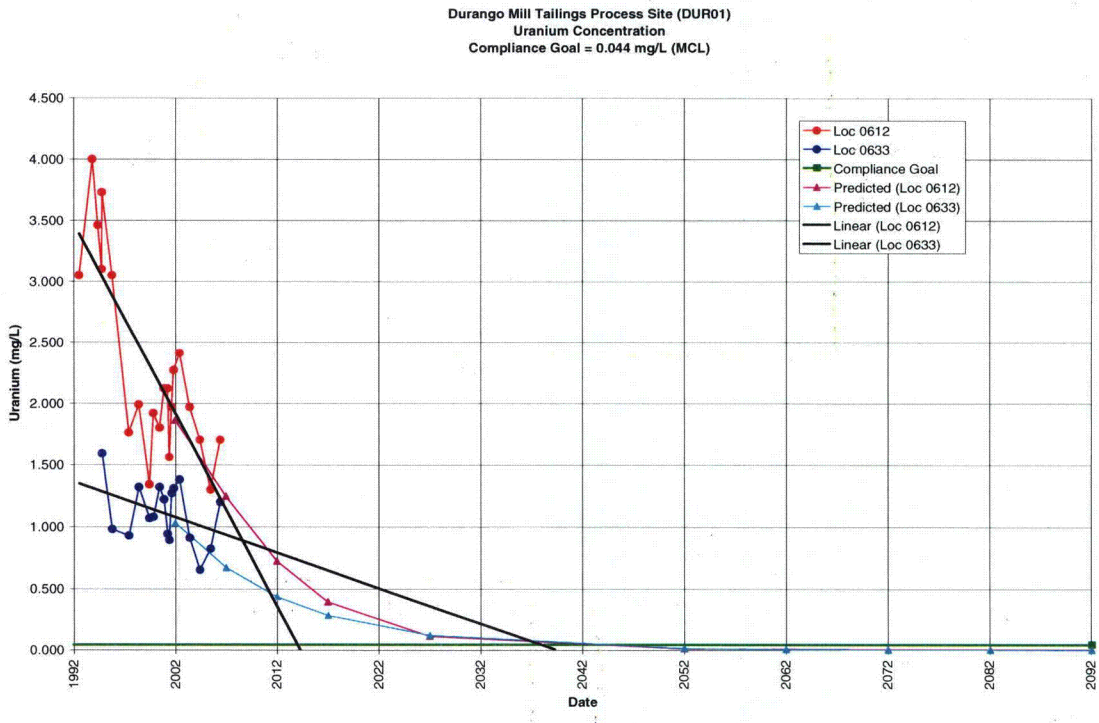

Figure 20. Predicted and Measured Uranium Concentrations at the Durango Site

above the compliance goal (0.01 mg/L), concentrations have decreased more rapidly than predicted by the model, and the linear trend suggests the compliance goal will be reached by about year 2017. For the remaining contaminants (with the possible exception of sulfate), modeling predictions and concentration trends imply that the respective compliance goals will likely be attained within 100 years and, therefore, natural flushing remains a valid compliance strategy for these constituents as well. The impact on surface water quality from site-related contamination remains negligible.

6.0 Conclusions

Based on assessment of the June 2006 water sampling data at the mill tailings area of the Durango site, observed concentration trends, particularly since the completion of source removal, confirm that natural flushing is measurably reducing contaminant concentrations in ground water at the site. Overall, it is too early in the 100-year natural flushing timeframe to draw definitive conclusions.

Based on these results, recommendations for ongoing monitoring at the Durango site include:

- Continued monitoring of ground water and surface water quality at the currently established compliance network.
- Analysis of all water samples for the same suite of constituents for each sampling event to assist in evaluating contaminant migration trends.
- Cessation of monitoring at well 0863 – there is no evidence of site-related contamination at this location past or present – concentrations of contaminants of concern at this location are indicative of background conditions.

7.0 References

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End of current text

Appendix A

Ground Water Quality Data by Parameter

CLASSIC GROUND WATER QUALITY DATA BY PARAMETER WITH ZONE (USEE201) FOR SITE DUR01, Durango Mill Tailings Process Site
REPORT DATE: 8/21/2006 10:07 am

PARAMETER	UNITS	LOCATION ID	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Cadmium	mg/L	0612	WL	06/07/2006	0001	AL	D	0.046		F	#	0.0001	-
	mg/L	0863	WL	06/07/2006	0001	CV		0.00009	B	UF	#	0.00002	-
Manganese	mg/L	0612	WL	06/07/2006	0001	AL	D	5.700		F	#	0.00069	-
	mg/L	0612	WL	06/07/2006	0002	AL	D	5.400		F	#	0.00046	-
	mg/L	0617	WL	06/07/2006	0001	AL	D	0.600		F	#	0.00046	-
	mg/L	0630	WL	06/07/2006	0001	AL	D	0.780		F	#	0.00046	-
	mg/L	0631	WL	06/07/2006	0001	AL	D	0.220		F	#	0.00023	-
	mg/L	0633	WL	06/06/2006	0001	KM	D	0.980		F	#	0.00069	-
	mg/L	0634	WL	06/06/2006	0001	AL	D	0.170		FQ	#	0.00069	-
	mg/L	0635	WL	06/06/2006	0001	AL	D	0.320		FQ	#	0.00046	-
	mg/L	0863	WL	06/07/2006	0001	CV		0.110		F	#	0.00046	-
Molybdenum	mg/L	0612	WL	06/07/2006	0001	AL	D	0.110		F	#	0.001	-
	mg/L	0612	WL	06/07/2006	0002	AL	D	0.100		F	#	0.001	-
	mg/L	0617	WL	06/07/2006	0001	AL	D	0.0021		F	#	0.00021	-
	mg/L	0630	WL	06/07/2006	0001	AL	D	0.0043		F	#	0.00021	-
	mg/L	0631	WL	06/07/2006	0001	AL	D	0.0073		F	#	0.00021	-
	mg/L	0633	WL	06/06/2006	0001	KM	D	0.0017		F	#	0.00021	-
	mg/L	0634	WL	06/06/2006	0001	AL	D	0.0018		FQ	#	0.00021	-
	mg/L	0635	WL	06/06/2006	0001	AL	D	0.0032		FQ	#	0.00021	-
	mg/L	0863	WL	06/07/2006	0001	CV		0.00098	B	UF	#	0.00021	-
Selenium	mg/L	0612	WL	06/07/2006	0001	AL	D	0.0039		F	#	0.00002	-
	mg/L	0612	WL	06/07/2006	0002	AL	D	0.0036		F	#	0.00002	-
	mg/L	0617	WL	06/07/2006	0001	AL	D	0.0063		F	#	0.00002	-
	mg/L	0630	WL	06/07/2006	0001	AL	D	0.016		F	#	0.00002	-
	mg/L	0631	WL	06/07/2006	0001	AL	D	0.00012		F	#	0.00002	-
	mg/L	0633	WL	06/06/2006	0001	KM	D	0.0082		F	#	0.00002	-

CLASSIC GROUND WATER QUALITY DATA BY PARAMETER WITH ZONE (USEE201) FOR SITE DUR01, Durango Mill Tailings Process Site
REPORT DATE: 8/21/2006 10:07 am

PARAMETER	UNITS	LOCATION ID	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Selenium	mg/L	0634	WL	06/06/2006	0001	AL	D	0.00002	U	FQ	#	0.00002	-
	mg/L	0635	WL	06/06/2006	0001	AL	D	0.00092		FQ	#	0.00002	-
	mg/L	0863	WL	06/07/2006	0001	CV		0.00002	U	F	#	0.00002	-
Sulfate	mg/L	0612	WL	06/07/2006	0001	AL	D	2200		F	#	50	-
	mg/L	0612	WL	06/07/2006	0002	AL	D	2100		F	#	25	-
	mg/L	0617	WL	06/07/2006	0001	AL	D	2100		F	#	25	-
	mg/L	0630	WL	06/07/2006	0001	AL	D	1900		F	#	25	-
	mg/L	0631	WL	06/07/2006	0001	AL	D	240		F	#	10	-
	mg/L	0633	WL	06/06/2006	0001	KM	D	3600		F	#	50	-
	mg/L	0634	WL	06/06/2006	0001	AL	D	2200		FQ	#	25	-
	mg/L	0635	WL	06/06/2006	0001	AL	D	1300		FQ	#	25	-
	mg/L	0863	WL	06/07/2006	0001	CV		620		F	#	25	-
Uranium	mg/L	0612	WL	06/07/2006	0001	AL	D	1.700		F	#	0.00017	-
	mg/L	0612	WL	06/07/2006	0002	AL	D	1.700		F	#	0.00017	-
	mg/L	0617	WL	06/07/2006	0001	AL	D	0.170		F	#	1.7E-05	-
	mg/L	0630	WL	06/07/2006	0001	AL	D	0.240		F	#	1.7E-05	-
	mg/L	0631	WL	06/07/2006	0001	AL	D	0.140		F	#	1.7E-05	-
	mg/L	0633	WL	06/06/2006	0001	KM	D	1.200		F	#	0.00017	-
	mg/L	0634	WL	06/06/2006	0001	AL	D	0.056		FQ	#	3.4E-06	-
	mg/L	0635	WL	06/06/2006	0001	AL	D	0.010		FQ	#	3.4E-06	-
	mg/L	0863	WL	06/07/2006	0001	CV		0.00033	E	F	#	3.4E-06	-

CLASSIC GROUND WATER QUALITY DATA BY PARAMETER WITH ZONE (USEE201) FOR SITE DUR01, Durango Mill Tailings Process Site
REPORT DATE: 8/21/2006 10:07 am

PARAMETER	UNITS	LOCATION ID	LOCATION TYPE	SAMPLE: DATE	ID	ZONE COMPL	FLOW REL.	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY

RECORDS: SELECTED FROM USEE200 WHERE site_code='DUR01' AND location_code in('0612','0617','0630','0631','0633','0634','0635','0863') AND (data_validation_qualifiers IS NULL OR data_validation_qualifiers NOT LIKE '%N%' AND data_validation_qualifiers NOT LIKE '%R%' AND data_validation_qualifiers NOT LIKE '%X%') AND cas in('07440-43-9','07439-96-5','07439-98-7','07782-49-2','SULFATE','07440-61-1') AND DATE_SAMPLED between #1/1/2006# and #1/1/2007#

SAMPLE ID CODES: 000X = Filtered sample (0.45 µm). N00X = Unfiltered sample. X = replicate number.

LOCATION TYPES: WL WELL

ZONES OF COMPLETION:

AL ALLUVIUM CV COLLUVIUM KM MANCOS SHALE

FLOW CODES: D DOWN GRADIENT

LAB QUALIFIERS:

- * Replicate analysis not within control limits.
- + Correlation coefficient for MSA < 0.995.
- > Result above upper detection limit.
- A TIC is a suspected aldol-condensation product.
- B Inorganic: Result is between the IDL and CRDL. Organic & Radiochemistry: Analyte also found in method blank.
- C Pesticide result confirmed by GC-MS.
- D Analyte determined in diluted sample.
- E Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
- H Holding time expired, value suspect.
- I Increased detection limit due to required dilution.
- J Estimated
- M GFAA duplicate injection precision not met.
- N Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compund (TIC).
- P > 25% difference in detected pesticide or Arochlor concentrations between 2 columns.
- S Result determined by method of standard addition (MSA).
- U Analytical result below detection limit.
- W Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
- X Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
- Y Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
- Z Laboratory defined (USEPA CLP organic) qualifier, see case narrative.

DATA QUALIFIERS:

- F Low flow sampling method used.
- G Possible grout contamination, pH > 9.
- J Estimated value.
- L Less than 3 bore volumes purged prior to sampling.
- N Presumptive evidence that analyte is present. The analyte is "tentatively identified".
- Q Qualitative result due to sampling technique
- R Unusable result.
- U Parameter analyzed for but was not detected.
- X Location is undefined.

QA QUALIFIER: # = validated according to Quality Assurance guidelines.

Appendix B

Surface Water Quality Data by Parameter

SURFACE WATER QUALITY DATA BY PARAMETER (USEE800) FOR SITE DUR01, Durango Mill Tailings Process Site
REPORT DATE: 8/21/2006 10:14 am

PARAMETER	UNITS	LOCATION ID	SAMPLE: DATE	ID	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY
Cadmium	mg/L	0584	06/07/2006	0001	0.0002	B	U	#	0.00002	-
	mg/L	0586	06/06/2006	0001	0.0002	B	U	#	0.00002	-
	mg/L	0652	06/07/2006	0001	0.0002	B	U	#	0.00002	-
	mg/L	0691	06/07/2006	0001	0.0003			#	0.00002	-
Molybdenum	mg/L	0584	06/07/2006	0001	0.0004	B	U	#	0.00021	-
	mg/L	0586	06/06/2006	0001	0.0004	B	U	#	0.00021	-
	mg/L	0652	06/07/2006	0001	0.0004	B	U	#	0.00021	-
	mg/L	0691	06/07/2006	0001	0.0003	B	U	#	0.00021	-
Selenium	mg/L	0584	06/07/2006	0001	0.0000	B	U	#	0.00002	-
	mg/L	0586	06/06/2006	0001	0.0000	B	U	#	0.00002	-
	mg/L	0652	06/07/2006	0001	0.0000	B	U	#	0.00002	-
	mg/L	0691	06/07/2006	0001	0.0000	B	U	#	0.00002	-
Uranium	mg/L	0584	06/07/2006	0001	0.0002			#	3.4E-06	-
	mg/L	0586	06/06/2006	0001	0.0002			#	3.4E-06	-
	mg/L	0652	06/07/2006	0001	0.0002			#	3.4E-06	-
	mg/L	0691	06/07/2006	0001	0.0002			#	3.4E-06	-

SURFACE WATER QUALITY DATA BY PARAMETER (USEE800) FOR SITE DUR01, Durango Mill Tailings Process Site
REPORT DATE: 8/21/2006 10:14 am

PARAMETER	UNITS	LOCATION ID	SAMPLE: DATE	ID	RESULT	QUALIFIERS: LAB	DATA	QA	DETECTION LIMIT	UN-CERTAINTY

RECORDS: SELECTED FROM USEE800 WHERE site_code='DUR01' AND location_code in('0584','0586','0652','0691') AND (data_validation_qualifiers IS NULL OR data_validation_qualifiers NOT LIKE '%N%' AND data_validation_qualifiers NOT LIKE '%R%' AND data_validation_qualifiers NOT LIKE '%X%') AND cas in('07440-43-9','07439-98-7','07782-49-2','07440-61-1') AND DATE_SAMPLED between #1/1/2006# and #1/1/2007#

SAMPLE ID CODES: 000X = Filtered sample (0.45 µm). N00X = Unfiltered sample. X = replicate number.

LAB QUALIFIERS:

- * Replicate analysis not within control limits.
- + Correlation coefficient for MSA < 0.995.
- > Result above upper detection limit.
- A TIC is a suspected aldol-condensation product.
- B Inorganic: Result is between the IDL and CRDL. Organic & Radiochemistry: Analyte also found in method blank.
- C Pesticide result confirmed by GC-MS.
- D Analyte determined in diluted sample.
- E Inorganic: Estimate value because of interference, see case narrative. Organic: Analyte exceeded calibration range of the GC-MS.
- H Holding time expired, value suspect.
- I Increased detection limit due to required dilution.
- J Estimated
- M GFAA duplicate injection precision not met.
- N Inorganic or radiochemical: Spike sample recovery not within control limits. Organic: Tentatively identified compund (TIC).
- P > 25% difference in detected pesticide or Arochlor concentrations between 2 columns.
- S Result determined by method of standard addition (MSA).
- U Analytical result below detection limit.
- W Post-digestion spike outside control limits while sample absorbance < 50% of analytical spike absorbance.
- X Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
- Y Laboratory defined (USEPA CLP organic) qualifier, see case narrative.
- Z Laboratory defined (USEPA CLP organic) qualifier, see case narrative.

DATA QUALIFIERS:

- F Low flow sampling method used.
- G Possible grout contamination, pH > 9.
- J Estimated value.
- L Less than 3 bore volumes purged prior to sampling.
- N Presumptive evidence that analyte is present. The analyte is "tentatively identified".
- Q Qualitative result due to sampling technique
- R Unusable result.
- U Parameter analyzed for but was not detected.
- X Location is undefined.

QA QUALIFIER: # = validated according to Quality Assurance guidelines.