

**Monitoring Report for  
CSMRI Site  
Third Quarter 2008**

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## 1. Introduction

This report presents the third quarter (July, August, September) 2008 results for groundwater monitoring and surface water monitoring conducted at the Colorado School of Mines Research Institute (CSMRI) site in Golden, Colorado. The monitoring was conducted by the S.M. Stoller Corporation (Stoller).

## 2. Sampling and Analysis

Stoller obtained quarterly samples of groundwater and surface water on September 24, September 25, and September 26, 2008 from eight groundwater monitoring wells and two surface water sample locations. Groundwater quality samples were obtained on September 24 (CSMRI-1B, CSMRI-2, CSMRI-9, and CSMRI-10), September 25 (CSMRI-1, CSMRI-4, CSMRI-5, and CSMRI-8). Monitor well CSMRI -1B was visited three times in order to provide sufficient volume of water for sampling. Monitor well CSMRI-7B did not provide sufficient volume of water for sampling.

No groundwater samples were collected from monitor wells CSMRI-6B and CSMRI-11 during this quarterly sampling event. These two wells were abandoned in July 2008 due to construction activities associated with the Colorado School of Mines (CSM) soccer field. Monitor well abandonment forms were completed and submitted to the Colorado State Engineers office to document the abandonment procedures. It is anticipated that these two monitor wells will be replaced after the field construction is complete.

Surface water samples were collected on September 24 from SW-2 and on September 25 from SW-1. All aqueous samples were placed in iced coolers and couriered to Paragon Analytics Laboratory, Inc. of Fort Collins, Colorado or to TestAmerica, Inc. of Arvada for analysis.

Figure 1 presents the monitor well and surface water sample locations. The figure also presents the groundwater potentiometric surface elevations based on depth to groundwater relative to the surveyed top-of-casing for the time periods of September 24 and September 25, 2008. The elevations of the groundwater potentiometric surface at the time of sampling are posted adjacent to each monitor well location. Historically the figure indicates a northeasterly component of flow for groundwater located on the bench terrace above the Clear Creek floodplain.

### 2.1 Groundwater Sampling

Water quality samples were collected following the procedures outlined in Appendix A, Groundwater Sampling Procedures. All monitor wells have depth-to-water measured to the nearest 1/100th of a foot (0.01) prior to sample purging. Graphs of water table elevation are presented as Figure 2 for monitor wells CSMRI-1, CSMRI-4, CSMRI-5, and CSMRI-8 and as Figure 3 for monitor well CSMRI-2. The Figure 2 monitor wells are all located adjacent to Clear Creek and present the synchronized changes in elevation due to flow in Clear Creek. Monitor well CSMRI-1 is located upstream of CSMRI-8, CSMRI-4 and CSMRI-5, which accounts for the difference in elevation of the water table between the wells as shown on Figure 2.

The Figure 3 hydrograph of monitor well CSMRI-2, located near the southeast corner of the freshman parking lot on West Campus Drive and the Welch Ditch, initially reflected the use of and leakage from the adjacent irrigation ditch during the summer months in 2005 and 2006 by a

rise in the potentiometric surface. Through 2007 the water level has remained elevated and only recently has declined with the last several rounds of measurements.

Sample collection field forms that record the water quality parameters of the monitor well groundwater as it is purged and the volume removed are provided in Appendix B, Sample Collection Forms. After parameter stabilization, the water samples are filtered through a 0.45 micron ( $\mu$ ) filter, collected in laboratory-provided containers, and preserved in the field as appropriate for the analyte and analytical method.

After conferring with the Colorado Department of Public Health and Environment (CDPHE), CSM was allowed to drop select analytes from the March, September, and December quarterly sampling events. Specific analytes removed from the parameter analytical list included metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver, and vanadium) and radioisotopes (thorium 228, 230, and 232). These parameters will be sampled only once per year during the June (second Quarter) sampling event. Analytes that have been added to the sampling program include anions (bicarbonate, carbonate, chloride, nitrate, nitrite, and sulfate); cations (calcium, magnesium, potassium, and sodium); dissolved organic carbon, and ferrous/ferric iron (flood plain wells).

## **2.2 Surface Water Sampling**

Surface water samples from Clear Creek were collected from two locations: one upstream of the site and one downstream of the site as shown on Figure 1. Samples were collected on September 24 for SW-2 and September 25, 2008 for SW-1. The surface water samples were collected following the procedures outlined in Appendix C, Surface Water Sampling Procedures. Surface water samples are filtered through a 0.45 $\mu$  filter, collected in laboratory-provided containers, and preserved in the field as appropriate for the analyte and analytical method.

As with the groundwater samples described above, sampling for select metals from the surface water sampling program has been reduced to once per year, and the anions, cations, and iron speciation has been added.

Discharge data of stream flow in Clear Creek during the third quarter from July 2008 through September 2008 is presented as Figure 4. Tabular representation of the graph data indicates estimated values of flow of 97 and 98 cubic feet per second (cfs) during the sample dates of September 24 and September 25, respectively, at the USGS Golden, Colorado Clear Creek gauging station (#06719505 USGS Surface Water Online Database).

## **2.3 Analyses**

All samples collected were analyzed using a Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)-certified analytical laboratory. The results received from the laboratory were evaluated based on the following parameters:

- Data completeness
- Holding times and preservation
- Instrument initial calibrations
- Instrument performance checks

- Preparation blanks
- Duplicate sample results
- Laboratory control samples results
- Compound quantization and reporting limits (full validation only)

As a quality control/quality assurance (QA/QC) check, an equipment blank sample was collected in the field by pouring distilled water through a sample bailer and submitting the filtered aqueous sample for the identical analytical parameters as the groundwater and surface water samples. The results of the equipment blank analyses did not identify any interferences or anomalies in the laboratory data.

A copy of the Data Validation Report documenting the reanalysis of the thorium activity is also presented in Appendix D.

### **2.3.1 Groundwater Quality Analyses**

A summary of groundwater results for radioisotopes, metals, and inorganic anion and cations are presented in Table 2-1, Table 2-2, and Table 2-3, respectively. Groundwater parameters are reported as picoCuries per liter (pCi/l) for radioisotopes, micrograms per liter ( $\mu\text{g/l}$ ) for uranium, and milligrams per liter (mg/l) for metals.

Paragon Analytics Laboratory, Inc. and TestAmerica Laboratories conducted laboratory analyses of the aqueous samples. Analytical parameters submitted to Paragon included radium isotopes (Ra-226 and Ra-228), uranium (U), calcium (Ca), potassium (K), magnesium (Mg), sodium (Na), phosphorus (P), chloride (Cl), sulfate ( $\text{SO}_4$ ), carbonate as calcium carbonate ( $\text{CO}_3$ ), bicarbonate as calcium carbonate ( $\text{HCO}_3$ ), dissolved organic carbon (DOC), and total phosphorous.

Groundwater samples were measured onsite for purged volume, temperature, pH, specific conductance, dissolved oxygen (DO), oxygen reduction potential (ORP) and turbidity as nephelometer turbidity units (NTU) during the purging and sampling process. Onsite measurement parameters are presented on the sample collection forms in Appendix B.

Analytical parameters submitted to TestAmerica include nitrate ( $\text{NO}_3$ ), nitrite ( $\text{NO}_2$ ), and ferrous ( $\text{Fe}^{2+}$ ) and ferric ( $\text{Fe}^{3+}$ ) iron. TestAmerica was selected to conduct the short holding time analyses because of their proximity to the CSMRI site.

Since the first quarter of monitoring in February 2005, the concentration of total uranium in micrograms per liter had been analyzed using Paragon method 714R9. In this method, the concentration of uranium is calculated based on the activity of the uranium isotopes U-234, U-235, and U-238. Effective with the first quarter 2007 sampling event, the concentration of uranium is now analyzed using mass spectrometry method EPA 6020, which analyzes for total isotopic uranium and not for the activity of the individual isotopes.

Analytical data from Paragon as an electronic data deliverable (EDD) is presented in Appendix E on a compact disk as a series of Excel spreadsheets. Analytical data from TestAmerica is also

presented in Appendix E as a .pdf printout. Appendix F presents copies of the Chain-of-Custody for the CSMRI samples.

### **2.3.2 Surface Water Analyses**

A summary of Clear Creek surface water results for radioisotopes, metals, and anions and cations are presented in Table 2-4, Table 2-5, and Table 2-6 respectively. Surface water parameters are reported as pCi/l for radioisotopes, µg/l for uranium, and mg/l for metals. Surface water samples were measured onsite for temperature, pH, specific conductance, DO, ORP, and NTU as the sampling was conducted. Onsite measurement parameters are presented on the sample collection forms in Appendix B.

## **2.4 Health and Safety Program**

Stoller developed a program to protect the health and safety of field personnel for implementation of the environmental monitoring at the CSMRI site. This program has been developed in accordance with requirements of 29 CFR 1910.120.

## **3. Results**

Groundwater analytical results from samples collected from the CSMRI site during the third quarter 2008 for radioisotopes, metals, and anions and cations are summarized on Tables 2-1, Table 2-2, and Table 2-3, respectively; and Table 2-4, Table 2-5, and Table 2-6 for surface water, respectively. Table 2-7 presents historical data collected by previous consultants for select contaminants of potential concern in groundwater at the site. The historical uranium data presented in Table 2-7 are presented in pCi/l as “activity” yet recent (2005 through 2008) analytical data are presented in µg/l as “mass concentration.” The December 7, 2000 Federal Register discusses the final uranium maximum contaminant level (MCL) and presents a conversion factor of a geometric average mass:activity ratio of 0.9 pCi/g for values near the National Primary Drinking Water Standards MCL, based on data from the National Inorganics and Radionuclides Survey.

Tables 2-8 and 2-9 present the quarterly historical groundwater radioisotopic and metals sample results, respectively, collected by Stoller since February 2005. Tables 2-10 and 2-11 present the quarterly historical Clear Creek surface water radioisotopic and metals sample results, respectively, collected by Stoller since February 2005.

### **3.1 Groundwater Conditions**

Groundwater monitor wells are located in areas likely to detect impacts, if any, to groundwater emanating from the site as well as locations that represent background water quality. Wells CSMRI-4 and CSMRI-5 are located downgradient from the site in the Clear Creek flood plain. Well CSMRI-1 is located along Clear Creek upstream from the site, and well CSMRI-2 is located offsite on the southeast corner of the freshman parking lot on West Campus Drive.

In February 2007, seven new groundwater monitor wells were installed to assess the effectiveness of the source excavation and stockpile creation that were conducted during the summer of 2006. Monitor well CSMRI-8 is located along Clear Creek within the flood plain

area; and monitor wells CSMRI-1B, CSMRI-6B, CSMRI-7B, CSMRI-9, CSMRI-10, and CSMRI-11 are located on the upland areas and essentially encircle the CSMRI site.

In July 2008, two monitor wells (CSMRI-6B and CSMRI-11) were abandoned due to construction activities at the CSMRI site.

### **3.2 Groundwater Quality**

Groundwater samples were collected from eight monitor wells and tested for the presence of metals and radioisotopes as identified in Section 2.3.1. A groundwater sample was not collected from monitor well CSMRI-7B due to no water in the well at the time of sampling.

The measured activities of Ra-226 and Ra-228 for all sampled groundwater monitor wells were below their respective MCL standards as shown in Table 2-1. Uranium was detected in monitor wells CSMRI-4 (43 µg/l) and CSMRI-8 (890 µg/l) at concentrations exceeding the MCL of 30 µg/l. Uranium was also detected in the remaining six groundwater monitor wells but at concentrations below the MCL.

The detected concentration of uranium in CSMRI-9 at 28 µg/l will be monitored since initial sampling at this location in February 2007 indicated a concentration of 7.9 µg/l. The concentration of uranium then spiked to 35 µg/l but has fluctuated slightly above 20 µg/l in the past four quarterly sampling events. This monitor well is located at the top of the bench terrace that rises above the flood plain.

In the flood plain area, uranium was detected in monitor wells CSMRI-4 at 43 µg/l, CSMRI-5 at 10 µg/l, and CSMRI-8 at 890 µg/l. Uranium in monitor well CSMRI-4 has historically had elevated concentrations of uranium, but the values had been declining since 1991 until the last several quarterly sampling events. Figure 5 illustrates the decreasing concentration of uranium in CSMRI-4 since 1991. Historically, the concentration of uranium in this monitor well has spiked; once in 1999 and then again in 2003. The spike in the concentration of uranium in 2003 was attributed to precipitation effects at the CSMRI site and removal of the site asphalt and concrete as discussed in Section 4.2.2 of the New Horizons RI-FS (New Horizons 2004). Soil remediation activities in the flood plain area in December 2006 may have affected the recent rise in the concentration of uranium in this monitor well; this is commonly observed after soil remediation activities.

Figure 6 presents the uranium concentration and the elevation of the water table from 2005 through the third quarter (September) 2008 at monitor well CSMRI-4. The figure indicates the concentration of uranium had previously been fluctuating seasonally slightly above to slightly below the MCL of 30 µg/l for seven quarterly sampling events in 2005 and 2006. An ice chest from the fourth quarter 2007 (December) sampling event was lost by the courier service resulting in a gap in the analytical data for CSMRI-4.

Uranium was detected at a concentration of 10 µg/l in monitor well CSMRI-5. Historical data from Tables 2-7 and 2-8 indicate concentrations of uranium between 2 µg/l and 4 µg/l. Beginning in September 2007, the concentration increased to a high of 11 µg/l. The slight

increase can be attributed to the soil remediation efforts within the flood plain in the vicinity of CSMRI-5. The current value of 10 µg/l is still well below the MCL of 30 µg/l.

The concentration of uranium detected in CSMRI-8 increased to 890 µg/l from a previous quarterly value of 770 µg/l. Monitor well CSMRI-8 was installed in February 2007, and quarterly monitoring will be continued to document seasonal variability and trends in the concentration of uranium at this location.

The groundwater at the CSMRI site will be monitored on a quarterly basis and the exceedances of uranium in monitoring wells CSMRI-4 and CSMRI-8 will continue to be evaluated as more data are made available. The relationship between the seasonal stream flow of Clear Creek and the exceedances of uranium for the monitor wells located on the flood plain will be assessed.

### **3.2.1 Ionic Balance Evaluation**

Groundwater and surface water samples were collected and tested for major anions, cations, and dissolved organic carbon, and at select locations (CSMRI-1, CSMRI-4, CSMRI-5, and CSMRI-8) ferric and ferrous iron. Analytical results for these parameters are presented in Table 2-3 for groundwater and Table 2-6 for surface water, respectively. Ionic balance analyses indicate close balances between anions and cations at all monitor well and surface water sample locations except for the SW-2 analytical results. At this downstream surface water location, both sulfate and chloride analytical results are over 4.5 times higher when compared to the upstream surface water sample SW-1. The elevated sulfate and chloride anions resulted in an ionic balance of greater than 50 percent. This large value may suggest an error in laboratory procedures or a major ionic species is present but not being tested. Additionally, the surface water samples were sampled on two different yet consecutive days. The downstream Clear Creek sample SW-2 was sampled on September 24<sup>th</sup> and the upstream sample SW-1 was sampled on September 25<sup>th</sup>.

Sampling for major ions and balance calculations will be continued at all locations and the elevated sulfate and chloride anions at SW-2 will be monitored. Both surface water samples will be collected on the same day to reduce any variability due to significant changes in stream flow.

### **3.2.2 Comparison of Upgradient and Downgradient Groundwater Quality**

Wells CSMRI-4, CSMRI-5, and CSMRI-8 are downgradient from the site and are located on the Clear Creek flood plain. Monitor wells CSMRI-7B and CSMRI-9 are located downgradient of the CSMRI site at the top of a topographical slope above the flood plain; and CSMRI-11 is upgradient to cross-gradient from the site.

Metals concentrations that are above detection limits vary widely regarding upgradient versus downgradient wells. The analytical data indicates the influence of Clear Creek to CSMRI-1 where Ca was detected in SW-1, SW-2, and CSMRI-1 at concentrations of 23 mg/l, 23 mg/l, and 30 mg/l, respectively. The analytical results indicate the presence of Ca at a concentration of 230 mg/l in monitor well CSMRI-8, over twice the concentration of most of the other monitor wells. The same observation for elevated concentrations of K, Na, and sulfate in monitor well CSMRI-8 applies when compared to other monitor well analytical data.

Uranium was detected in monitor well CSMRI-4 at a concentration of 43 µg/l and in CSMRI-8 at a concentration of 890 µg/l, which exceed the MCL of 30 µg/l. As shown on Figure 5, until the



last several rounds of sampling, there appeared to be a seasonal correlation between fluctuations of the water table elevation and the concentration of uranium in monitor well CSMRI-4. The recent slight rise in the concentration of uranium in CSMRI-4 will continue to be monitored to assess the variability of uranium in this monitor well and the interaction with the seasonal fluctuations of Clear Creek.

### **3.2.3 Comparison with Previous Groundwater Quality Analyses**

Table 2-7 presents groundwater analytical results from past sampling events dating back to 1991 for radioisotopes of concern. The data indicate a slight decreasing trend in contaminant concentrations over time, indicating improving groundwater quality.

As additional data are collected and trends become more defined, graphs of concentration versus time will be produced and presented. This analytical data will be incorporated to show longer-term trends and correlation between the detected concentration of uranium in groundwater, the fluctuating water table, and seasonal variability if present.

### **3.2.4 Comparison with Colorado Groundwater Standards**

The statewide dissolved concentration standard of 5 pCi/l for the sum of Ra-226 and Ra-228 in drinking water was not exceeded in any of the sampled monitoring wells. No exceedances of the MCL for tested metals were identified in any of the groundwater and surface water samples.

The MCL for uranium in drinking water was exceeded in monitor wells CSMRI-4 at 43 µg/l and CSMRI-8 at 890 µg/l. In January 2008, CDPHE WQC Commission adopted the surface water quality standard of 30 µg/l as the groundwater quality standard in an effort to keep both uranium standards consistent.

The spike in the concentration of uranium in CSMRI-4 shown in Figure 5 may be attributed to the increased precipitation during the months of December 2006 through February 2007. This monitor well exhibited the same trend in 2003 during a prolonged high precipitation time period and when the asphalt cover and buildings associated with CSMRI had been removed.

The concentration of uranium at 890 µg/l at monitoring well CSMRI-8 may be due to:

- The well contains residual uranium from the former pond area on the flood plain.
- Uranium was disturbed and introduced into the monitor well during installation.
- The well contains residual uranium from the former Building 101 area at the top of the slope above the flood plain.
- Uranium is naturally occurring in the Fox Hills bedrock formation.
- The well is located in a zone where strong mixing between Clear Creek water and groundwater occurs, and the oxidizing conditions associated with creek water causes uranium to dissolve more readily.

Monitoring well CSMRI-8 will continue to be sampled on a quarterly basis along with the other site wells, and the reason for the elevated level of uranium will be evaluated.

### **3.3 Surface Water Quality**

Surface water samples are collected from two locations at the site. Location SW-1 is located upstream from the site and the second location, SW-2, is downstream from the site. The metals detected above their respective detection limits include: Ca, K, Mg, and Na. The upstream and downstream surface-water concentrations of all metals and radionuclides detected at the CSMRI site from stations SW-1 and SW-2 are similar. No established MCLs were exceeded.

### **4. Activities for Third Quarter 2008**

Third quarter 2008 activities at the site include the abandonment of monitor wells CSMRI-6B and CSMRI-11 on July 11, 2008. The abandonment was conducted due to construction activities associated with the CSM soccer field. Abandonment forms from the Colorado State Engineers office were completed and submitted for the closure of the two monitor wells. Replacement groundwater monitor wells to continue monitoring ground water quality at the CSMRI site are proposed to be installed during the fourth quarter 2008.

### **5. References**

Colorado Department of Public Health and Environment, Water Quality Control Commission, Regulation No. 41, *The Basic Standards for Ground Water*. Amended: January 14, 2008, Effective: May 31, 2008.

New Horizons Environmental Consultants, Inc. Remedial Investigation/Feasibility Study and Proposed Plan, Colorado School of Mines Research Institute Site, Golden, CO, January 21, 2004.

Stoller, Final Site Characterization Work Plan, May 2006.

USGS Surface Water website: <http://nwis.waterdata.usgs.gov>

**Table 2-1  
Summary of Radioisotopes in Groundwater**

Sample Station	Sample Date	Ra-226 (pCi/l)		Ra-228 (pCi/l)		Th-228 (pCi/l)		Th-230 (pCi/l)		Th-232 (pCi/l)		Total U (µg/l)
		Result	Uncertainty	Result	Uncertainty	Result	Uncertainty	Result	Uncertainty	Result	Uncertainty	Result
CSMRI-1	9/25/08	0.26	0.31	0.88	0.47	NT	NT	NT	NT	NT	NT	0.96
CSMRI-1B	9/24/08	0.05	0.31	0.3	0.39	NT	NT	NT	NT	NT	NT	4
CSMRI-2	9/24/08	0.97	0.38	1.41	0.57	NT	NT	NT	NT	NT	NT	0.69
CSMRI-4	9/25/08	0.32	0.26	0.8	0.45	NT	NT	NT	NT	NT	NT	43
CSMRI-5	9/25/08	2.87	0.86	0.47	0.42	NT	NT	NT	NT	NT	NT	10
CSMRI-6B	Not Sampled	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
CSMRI-7B	9/24/08	DRY	DRY	DRY	DRY	NT	NT	NT	NT	NT	NT	NT
CSMRI-8	9/25/08	1.5	0.6	1.02	0.47	NT	NT	NT	NT	NT	NT	890
CSMRI-9	9/24/08	0.11	0.2	0.48	0.36	NT	NT	NT	NT	NT	NT	28
CSMRI-10	9/24/08	0.21	0.18	0.48	0.36	NT	NT	NT	NT	NT	NT	11
CSMRI-11	Not Sampled	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
MCL*		Total Ra = 5				NE		Th 230 + Th 232 = 60**				30

\*Maximum Contaminant Level – National Primary Drinking Water Regulations

\*\*5 CCR 1002-41 Reg 41 – Colorado Groundwater Standards

NE - Not Established

NT – Not Tested

**Table 2-2  
Summary of Metals in Groundwater**

Sample Station	Sample Date	Ag	As	Ca	Cd	Cr	Hg	K	Mg	Mo	Na	Pb	Se	V	Zn
CSMRI-1	9/25/08	NT	NT	30	NT	NT	NT	3	9	NT	18	NT	NT	NT	NT
CSMRI-1B	9/24/08	NT	NT	92	NT	NT	NT	7.3	39	NT	38	NT	NT	NT	NT
CSMRI-2	9/24/08	NT	NT	74	NT	NT	NT	6.4	34	NT	19	NT	NT	NT	NT
CSMRI-4	9/25/08	NT	NT	130	NT	NT	NT	13	55	NT	50	NT	NT	NT	NT
CSMRI-5	9/25/08	NT	NT	160	NT	NT	NT	5.5	61	NT	59	NT	NT	NT	NT
CSMRI-7B	DRY	NT	NT		NT	NT	NT			NT		NT	NT	NT	NT
CSMRI-8	9/25/08	NT	NT	230	NT	NT	NT	17	68	NT	70	NT	NT	NT	NT
CSMRI-9	9/24/08	NT	NT	110	NT	NT	NT	5.8	54	NT	50	NT	NT	NT	NT
CSMRI-10	9/24/08	NT	NT	100	NT	NT	NT	4.6	42	NT	41	NT	NT	NT	NT
Detection Limits		0.01	0.01	1	0.005	0.01	0.0002 (B)	1	1	0.01	1	0.003	0.005	0.01	0.02
MCL*		NE	0.010	NE	0.005	0.1	0.002 (B)	NE	NE	NE	NE	0.015	0.05	NE	NE

\*Maximum Contaminant Level – National Primary Drinking Water Regulations

\*\*5 CCR 1002-41 Reg 41 – Colorado Groundwater Standards

NE - Not Established

NT – Not Tested – Scheduled for June only (2<sup>nd</sup> Quarter)

**Table 2-3**  
**Summary of Anions and Cations in Groundwater**

Sample Station	Sample Date	Bicarbonate as CaCO <sub>3</sub> (mg/l)	Carbonate as CaCO <sub>3</sub> (mg/l)	Total Alkalinity as CaCO <sub>3</sub> (mg/l)	Chloride (mg/l)	Dissolved Organic Carbon (mg/l)	Ferric Iron (mg/l)	Ferrous Iron (mg/l)	Total Iron (ug/l)	Nitrate (mg/l)	Nitrite (mg/l)	Total Phosphorous (mg/l)	Sulfate (mg/l)
		Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
CSMRI-1	9/25/08	53	5	53	47	1	ND	ND	ND	ND	ND	ND	44
CSMRI-1B	9/24/08	150	20	150	210	1.7	NT	NT	NT	3.6	ND	ND	70
CSMRI-2	9/24/08	290	20	290	19	1	NT	NT	NT	ND	ND	ND	69
CSMRI-4	9/25/08	210	20	210	170	2.7	ND	ND	ND	2.0	ND	0.08	230
CSMRI-5	9/25/08	190	20	190	240	1.5	ND	ND	ND	2.6	ND	ND	270
CSMRI-8	9/25/08	300	20	300	220	3.9	ND	ND	ND	3.0	ND	ND	420
CSMRI-9	9/24/08	210	20	210	190	1.8	NT	NT	NT	9.2	ND	ND	170
CSMRI-10	9/24/08	200	20	200	160	1.6	NT	NT	NT	4.1	ND	ND	110
Reporting Limits		20	20	20	2 or 4	1	0.20	0.20	100	100	0.50	0.05	10 or 20

ND = Not Detected at or above the Reporting Limits  
NT = Not Tested

**Table 2-4**  
**Summary of Radioisotopes in Surface Water**

Sample Station	Sample Date	Ra-226 (pCi/l)		Ra-228 (pCi/l)		Th-228 (pCi/l)		Th-230 (pCi/l)		Th-232 (pCi/l)		Total U (µg/l)
		Result	Uncertainty	Result	Uncertainty	Result	Uncertainty	Result	Uncertainty	Result	Uncertainty	Result
SW-1	9/25/08	0.18	0.2	-0.01	0.36	NT	NT	NT	NT	NT	NT	1.1
SW-2	9/24/08	-0.16	0.22	-0.02	0.31	NT	NT	NT	NT	NT	NT	0.99
MCL*		Total Ra = 5				NE		Th 230 + Th 232 = 60**				30

\*Maximum Contaminant Level – National Primary Drinking Water Regulations  
\*\*5 CCR 1002-31 Reg 31 – Colorado Surface Water Standards  
NE – Not Established

**Table 2-5**  
**Summary of Metals in Surface Water**  
(All results in milligrams per liter)

Sample Station	Sample Date	Ag	As	Ba	Ca	Cd	Cr	Hg	K	Mg	Mo	Na	Pb	Se	V	Zn
SW-1	9/25/08	NT	NT	NT	23	NT	NT	NT	1.9	5.1	NT	9	NT	NT	NT	NT
SW-2	9/24/08	NT	NT	NT	23	NT	NT	NT	1.9	5.1	NT	9	NT	NT	NT	NT
Detection Limits		0.01	0.01	0.1	1	0.005	0.01	0.0002	1	1	0.01	1	0.003	0.005	0.01	0.02
MCLs*		0.01	0.010	2	NE	0.005	0.1	0.002	NE	NE	NE	NE	0.015	0.05	NE	NE

\*Maximum Contaminant Level – National Primary Drinking Water Regulations  
ND – Non Detect  
NE – Not Established  
NT = Not Tested - Scheduled for June only (2<sup>nd</sup> Quarter)

**Table 2-6**  
**Summary of Anions and Cations in Surface Water**

Sample Station	Sample Date	Bicarbonate as CaCO <sub>3</sub> (mg/l)	Carbonate as CaCO <sub>3</sub> (mg/l)	Total Alkalinity as CaCO <sub>3</sub> (mg/l)	Chloride (mg/l)	Dissolved Organic Carbon (mg/l)	Ferric Iron (mg/l)	Ferrous Iron (mg/l)	Total Iron (mg/l)	Nitrate (mg/l)	Nitrite (mg/l)	Total Phosphorous (mg/l)	Sulfate (mg/l)
		Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
SW-1	9/25/08	38	5	38	13	1.6	NT	NT	NT	ND	ND	ND	49
SW-2	9/24/08	36	5	36	64	1.3	NT	NT	NT	ND	ND	ND	230
Reporting Limits		5	5	5	1	1				0.50	0.50	0.05	5

ND = Not Detected at or above the Reporting Limits  
NT = Not Tested

**Table 2-7**  
**CSMRI Historical Groundwater Data (Previous Consultants)**  
(All results in picoCuries per liter)

Well ID (d)	Analyte	1/1991 (a)	6/1991 (a)	3/1999 (b)	6/1999 (b)	6/1999 (b)	10/1999 (b)	2/2003 (c)	4/2003 (c)	7/2003 (c)	10/2003 (c)
CSMRI-1	Ra-226			0.1	0.3	0.3	0.2	<0.55	<0.45	ND (<0.38)	ND (<0.31)
	U Total			2.09	2.59	2.59	1.44	2.4	2.9	0.87	1.4
	Th-230			0.4	0.2	0.2	0.2	<0.19	0.21	ND (<0.13)	<0.15
CSMRI-2	Ra-226		1.9	1.9	1.4	1.4	1.4	1.4	2.8	2.1	1.7
	U Total	11	5.7	0.55	1.46	1.46	0.71	1.5	1.3	1.9	1.3
	Th-230		0	0.1	0.1	0.1	0.9	<0.17	0.43	0.20	0.31
CSMRI-3	Ra-226		0.6	1.5	1.2	1.2	1.6	<0.75	<0.81	ND (<0.49)	<0.98
	U Total	17	10.4	8.41	12.4	12.4	10	12	12	9	10
	Th-230		0	0.3	0.3	0.3	1.1	<0.12	ND (<0.15)	ND (<0.17)	ND (<0.14)
CSMRI-4	Ra-226		1	<0.4	0.6	0.6	0.4	<0.85	<0.42	<0.32	ND (<0.64)
	U Total	86	57.3	23.4	58.6	58.6	33.7	16	34.2	53	19
	Th-230		0	0.7	0.3	0.3	0.4	<0.099	ND (<0.15)	ND (<0.17)	ND (<0.12)
CSMRI-5	Ra-226		0.6	2.4	3.3	3.3	2.7	ND (<0.49)	1.1	2.6	1.59
	U Total	14	16.8	3.6	3.6	3.6	4	2.8	2.3	2.7	3.3
	Th-230		0	0.2	0.2	0.2	1.4	0.062	ND (<0.14)	ND (<0.19)	ND (<0.13)

Notes: ND = Not Detected

a - Samples collected by Grant and Associates and analyzed by Barringer Labs

b - Samples collected by URS Greiner Woodward Clyde and analyzed by CORE Labs

c - Samples collected by New Horizons Environmental Consultants and analyzed by Paragon Analytics; Total U activity (pCi/l) calculated from concentration (µg/l) reported by Paragon.

d - Well Identification numbers changed from the 1991 data to the 1999 data. Data presented account for this change

**Table 2-8**  
**Historical Summary of Radioisotopes in Groundwater (Stoller)**

Sample Station	Sample Date	Ra-226 (pCi/l)	Ra-228 (pCi/l)	Th-228 (pCi/l)	Th-230 (pCi/l)	Th-232 (pCi/l)	U-234 (pCi/l)	U-235 (pCi/l)	U-238 (pCi/l)	Total U (µg/l)
CSMRI-1	2/25/05	-0.11	0.81	0.007	0.07	0.01	0.77	0.043	0.53	1.61
	6/14/05	0.16	0.44	0.018	-0.021	0.012	0.43	0.011	0.217	0.64
	9/7/05	0.1	0.63	0.068	0.167	0.114	0.85	0.053	0.43	1.3
	12/20/05	-0.19	0.59	-0.045	0.32	0.014	0.94	0.073	0.46	1.41
	3/15/06	-0.15	0.58	0.025	0.032	-0.004	1.76	0.11	0.92	2.8
	6/14/06	0.42	0.05	0.15	-0.06	0.062	0.18	0.18	0.08	0.31
	9/13/06	0.25	0.34	0.11	-0.079	0.027	0.45	0.051	0.25	0.77
	3/1/07	0.32	0.78	0.052	-0.031	0.012	NT	NT	NT	1.2
	6/27/07	0.51	0.91	0.17	0.064	-0.005	NT	NT	NT	0.88
	9/11/07	-0.3	0.53	-0.031	0.019	0.001	NT	NT	NT	0.72
	11/27/07	-0.2	0.72	0.71	0.101	0.02	NT	NT	NT	1.2
	2/27/08	0.2	0.85	0.035	0.032	0.011	NT	NT	NT	1.5
4/18/08	-0.02	0.66	-0.03	-0.004	0.01	NT	NT	NT	1.9	
CSMRI-1B	3/8/07	0.13	1.19	-0.03	-0.09	0.02	NT	NT	NT	2.7
	6/26/07	0.09	0.3	0.001	0.002	0.012	NT	NT	NT	5
	9/11/07	-0.13	0.65	0.019	0.012	0.001	NT	NT	NT	6.3
	11/27/07	0.11	1.16	0.004	0.06	0.016	NT	NT	NT	6.9
	2/28/08	0.32	0.61	0.01	0.058	0.033	NT	NT	NT	6.5
	4/18/08	0.03	0.72	-0.004	-0.046	0	NT	NT	NT	6
CSMRI-2	2/25/05	0.8	1.85	0.07	-0.02	0.01	0.6	0.05	0.16	0.53
	6/14/05	1.47	3.0	0.14	0.003	0.026	0.68	0.025	0.299	0.89
	9/7/05	1.78	2.71	0.162	0.108	0.049	0.65	0.050	0.31	0.94
	12/20/05	1.35	1.62	0.108	0.285	0.024	0.83	0.002	0.35	1.06
	3/15/06	1.25	2.53	0.03	0.204	0.012	0.83	0.066	0.45	1.36
	6/14/06	0.99	1.79	0.25	0.22	0.049	0.69	0.04	0.25	0.76
	9/13/06	1.01	2.35	0.088	-0.039	-0.008	0.46	0.014	0.28	0.85
	3/8/07	0.76	2.15	0.022	-0.01	0.011	NT	NT	NT	0.72
	6/28/07	1.4	3.2	-0.075	-0.01	-0.007	NT	NT	NT	2
	9/11/07	0.78	3.2	0.016	0.101	0.014	NT	NT	NT	0.98
	11/27/07	0.45	2.05	0.037	0.035	0.006	NT	NT	NT	1
	2/28/08	1.37	2.26	0.043	0.085	0.044	NT	NT	NT	0.68
4/17/08	1.08	1.89	0.041	-0.021	0.008	NT	NT	NT	0.89	
CSMRI-4	2/25/05	-0.03	0.16	0.019	-0.009	0.013	9.7	0.53	8.2	24.7
	6/14/05	0.26	0.34	0.013	0.014	0.005	11.4	0.49	10.6	31.4
	9/7/05	0.17	0.78	-0.013	0.164	0.086	6.4	0.33	6.4	19.3
	12/20/05	0.13	0.1	0.033	0.311	0.012	11.5	0.61	11.4	34.3
	3/15/06	0	0.38	0.004	0.174	0.007	9	0.43	9	27.1
	6/15/06	0.41	0.39	0.11	0.17	0.061	9.2	0.4	8.9	26.8
	9/13/06	-0.05	0.79	0.056	-0.015	0.007	6.5	0.35	6	17.9
	3/8/07	0.09	0.37	-0.034	-0.037	0.013	NT	NT	NT	48

**Table 2-8  
Historical Summary of Radioisotopes in Groundwater (Stoller)**

Sample Station	Sample Date	Ra-226 (pCi/l)	Ra-228 (pCi/l)	Th-228 (pCi/l)	Th-230 (pCi/l)	Th-232 (pCi/l)	U-234 (pCi/l)	U-235 (pCi/l)	U-238 (pCi/l)	Total U (µg/l)
CSMRI-4	6/27/07	0.07	0.87	0.011	0.035	0.004	NT	NT	NT	66
	9/11/07	0.99	1.12	0.024	0.112	0.021	NT	NT	NT	49
	11/26/07	0.33	0.73	0.029	0.149	0.016	NT	NT	NT	48
	2/27/08	0.24	0.78	0.011	0.038	0.014	NT	NT	NT	58
	4/17/08	0.11	0.71	0.017	-0.019	0.002	NT	NT	NT	62
CSMRI-5	2/25/05	1.06	0.53	0.009	0.007	0.034	1.22	0.056	0.93	2.8
	6/14/05	2.51	0.44	-0.018	0.039	0.011	1.51	0.086	1.2	3.57
	9/7/05	2.50	0.76	0.06	1.25	0.051	1.85	0.051	1.47	4.4
	12/20/05	1.97	0.52	0.032	0.126	0.01	1.45	0.066	1.21	3.63
	3/15/06	0.57	0.45	0.038	0.144	0.019	1.81	0.058	1.38	4.1
	6/15/06	2.13	0.87	0.145	0.08	0.043	1.03	0.13	0.92	2.8
	9/13/06	2.29	0.56	0.053	-0.053	0.005	3.18	0.17	2.32	7
	3/8/07	1.78	0.39	-0.012	-0.061	0	NT	NT	NT	5.8
	6/27/07	2.22	0.86	0.008	-0.023	0.013	NT	NT	NT	10
	9/11/07	1.91	1.2	0.091	0.003	0.006	NT	NT	NT	11
	11/26/07	1.52	0.49	0.004	-0.008	0.01	NT	NT	NT	6.6
	2/27/08	1.05	0.17	-0.011	0.02	0.051	NT	NT	NT	6.6
4/17/08	1.37	0.64	0.068	0.029	0.017	NT	NT	NT	6.7	
CSMRI-6B	2/27/07	NT	NT	NT	NT	NT	NT	NT	NT	NT
	6/26/07	0.46	0.63	-0.009	-0.006	0.024	NT	NT	NT	17
	9/10/07	0.15	0.91	0.046	0.025	0.023	NT	NT	NT	11
	11/27/07	-0.02	0.77	-0.002	0.069	0.004	NT	NT	NT	8.2
	2/28/08	0.26	1	-0.009	0.022	0.022	NT	NT	NT	4.7
	4/18/08	0.36	0.88	-0.005	-0.022	0.021	NT	NT	NT	5
CSMRI-7B	2/27/07	NT	NT	NT	NT	NT	NT	NT	NT	NT
	6/26/07	0.65	0.22	0.036	0.054	0.027	NT	NT	NT	68
	9/10/07	NT	NT	NT	NT	NT	NT	NT	NT	NT
		NT	NT	NT	NT	NT	NT	NT	NT	NT
		NT	NT	NT	NT	NT	NT	NT	NT	NT
CSMRI-8	3/8/07	0.7	1.06	0.072	-0.031	0.016	NT	NT	NT	1,100
	6/27/07	0.8	0.4	0.039	0.046	0.008	NT	NT	NT	810
	9/10/07	1.31	0.9	0.031	0.05	0.009	NT	NT	NT	630
	11/27/07	1.27	1.2	-0.02	0.074	-0.003	NT	NT	NT	1300
	2/27/08	1.19	1.38	0.089	0.1	0.043	NT	NT	NT	1,200
	4/17/08	0.39	0.71	-0.015	-0.053	0.009	NT	NT	NT	770
CSMRI-9	2/27/07	0.12	0.53	-0.017	0.04	0.027	NT	NT	NT	7.9
	6/26/07	0.22	0.37	0.018	0.004	-0.015	NT	NT	NT	32
	9/10/07	0.5	1.01	0.04	-0.043	0.012	NT	NT	NT	35
	11/26/07	0.25	0.27	0.023	0.003	0.003	NT	NT	NT	28
	2/27/08	0.11	0.24	0.047	0.037	0.041	NT	NT	NT	24

**Table 2-8**  
**Historical Summary of Radioisotopes in Groundwater (Stoller)**

Sample Station	Sample Date	Ra-226 (pCi/l)	Ra-228 (pCi/l)	Th-228 (pCi/l)	Th-230 (pCi/l)	Th-232 (pCi/l)	U-234 (pCi/l)	U-235 (pCi/l)	U-238 (pCi/l)	Total U (µg/l)
	4/15/08	0.27	0.65	-0.004	0.015	0.022	NT	NT	NT	22
CSMRI-10	3/1/07	0.19	0.63	0.014	-0.004	0.018	NT	NT	NT	7.8
	6/26/07	0.26	0.43	-0.008	0.03	-0.005	NT	NT	NT	8.8
	9/10/07	-0.04	0.48	0.103	0.05	0.005	NT	NT	NT	9.9
	11/26/07	-0.05	0.57	0.068	0.141	0.031	NT	NT	NT	10
	2/26/08	0.12	0.44	0.094	0.011	0.019	NT	NT	NT	9.2
	4/15/08	0.03	0.56	-0.006	-0.05	0.005	NT	NT	NT	8.7
CSMRI-11	3/1/07	0.16	0.46	0.051	0.085	0.007	NT	NT	NT	4.8
	6/26/07	0.37	0.43	0.084	0	0.008	NT	NT	NT	8.4
	9/10/07	-0.26	0.52	0.012	0.006	0.016	NT	NT	NT	10
	11/26/07	0.16	0.87	0.089	0.099	-0.012	NT	NT	NT	11
	2/26/08	0.28	-0.03	0.044	0.044	0.074	NT	NT	NT	8.7
	4/15/08	0.35	0.75	-0.032	0.004	0.016	NT	NT	NT	7.6
MCL*		Total Ra = 5		NE	Th 230 + Th 232 = 60**		NE	NE	NE	30

\*Maximum Contaminant Level – National Primary Drinking Water Regulations

\*\*5 CCR 1002-41 Reg 41 – Colorado Groundwater Standards

pCi/l - picocuries per liter

NE – Not Established

NT – not tested

µg/l – micrograms per liter



**Table 2-9**  
**Historical Summary of Metals in Groundwater (Stoller)**  
**(All results in milligrams per liter)**

Sample Station	Sample Date	Ag	As	Ba	Ca	Cd	Cr	Hg	K	Mg	Mo	Na	Pb	Se	V	Zn
CSMRI-1	2/25/05	ND	ND	ND	28	ND	ND	ND	2.8	9.4	ND	29	ND	ND	ND	0.032
	6/14/05	ND	ND	ND	17	ND	ND	ND	2.3	5.1	ND	16	ND	ND	ND	0.032
	9/7/05	ND	ND	0.055 (B)	21	ND	ND	ND	2.9	6.3	0.0021 (B)	25	ND	0.0041 (B)	ND	.034
	12/20/05	ND	ND	0.067 (B)	32	ND	ND	0.000034 (B)	2.9	10	ND	26	ND	ND	ND	0.052
	3/15/06	ND	ND	0.064 (B)	33	ND	ND	0.00002 (B)	2.6	10	0.0013 (B)	24	ND	ND	ND	0.049
	6/14/06	ND	ND	0.031 (B)	10	ND	ND	ND	1.9	3	0.0051 (B)	9.2	ND	0.0035 (B)	ND	0.015 (B)
	9/13/06	ND	ND	0.061 (B)	20	ND	0.041 (B)	ND	2.7	6	0.0038 (B)	14	ND	ND	ND	0.03
	3/1/07	ND	ND	0.081 (B)	39	0.00045 (B)	0.00063 (B)	0.000017 (B)	3	12	0.0059 (B)	26	ND	0.0066	ND	0.048
	6/27/07	ND	ND	0.063 (B)	23	ND	ND	0.0000073 (B)	2.4	9	ND	21	ND	ND	ND	0.017 (B)
	9/11/07	ND	ND	0.065 (B)	23	ND	0.00061 (B)	0.000011 (B)	2.5	7.2	0.002 (B)	14	ND	ND	ND	0.038
	11/27/07	ND	ND	0.075 (B)	31	ND	ND	0.000029 (B)	2.5	9.7	0.0014 (B)	18	ND	ND	ND	0.049
2/27/08	ND	ND	0.08 (B)	36	ND	ND	ND	2.5	12	0.0013 (B)	22	ND	ND	ND	0.048	
4/18/08	ND	ND	0.081 (B)	36	ND	ND	ND	2.7	11	0.0015 (B)	22	ND	ND	ND	0.057	
CSMRI-1B	3/1/07	ND	ND	0.098 (B)	130	ND	0.00014 (B)	0.000017 (B)	52	47	0.17	91	ND	0.0058	0.0009 (B)	ND
	6/26/07	ND	ND	0.071 (B)	83	ND	ND	0.0000072 (B)	10	38	0.029	35	ND	ND	ND	ND
	9/11/07	ND	ND	0.1	93	ND	ND	0.0000094 (B)	8.4	43	0.031	36	ND	ND	ND	0.0012 (B)
	11/27/07	ND	ND	0.11	100	ND	ND	0.000029 (B)	9.4	46	0.024	42	ND	ND	0.00073 (B)	0.0039 (B)
	2/28/08	ND	ND	0.11	97	ND	0.0015 (B)	ND	9.3	45	0.029	41	ND	0.0039 (B)	ND	0.0033 (B)
4/18/08	ND	ND	0.11	93	ND	ND	ND	9.1	43	0.027	39	ND	ND	0.00065 (B)	ND	
CSMRI-2	2/25/05	ND	ND	0.11	72	ND	ND	ND	7.1	32	ND	19	ND	ND	ND	0.02
	6/14/05	ND	ND	0.1	76	ND	ND	ND	6.3	32	ND	18	ND	ND	ND	ND
	9/7/05	ND	ND	0.11	81	ND	ND	ND	7.1	35	ND	19	ND	ND	ND	0.011 (B)
	12/20/05	ND	ND	0.098 (B)	76	ND	ND	0.000031 (B)	6.7	33	ND	18	ND	ND	ND	0.0043 (B)
	3/15/06	ND	ND	0.09 (B)	74	ND	ND	0.000023 (B)	6.1	31	ND	17	ND	ND	ND	0.0059 (B)
	6/14/06	ND	ND	0.093 (B)	70	ND	ND	ND	6.3	31	0.0048 (B)	17	ND	0.0031 (B)	ND	0.0092 (B)
	9/13/06	ND	ND	0.11	81	ND	ND	ND	6.7	35	0.0014 (B)	19	ND	ND	ND	0.0092 (B)
	3/8/07	ND	0.0058 (B)	0.12	88	ND	ND	ND	8.3	39	ND	21	ND	0.03	ND	0.0011 (B)
	6/28/07	ND	ND	0.11	97	ND	ND	0.0000056 (B)	7.9	49	ND	26	ND	ND	0.002 (B)	0.0041 (B)
	9/11/07	ND	ND	0.1	91	ND	ND	0.000016 (B)	7.2	43	ND	23	ND	ND	0.00086 (B)	0.0082 (B)
	11/27/07	ND	ND	0.093 (B)	83	ND	ND	0.000023 (B)	7	38	ND	22	ND	ND	0.001 (B)	0.0075 (B)
2/28/08	ND	ND	0.094 (B)	81	ND	0.0018 (B)	ND	6.6	38	ND	21	ND	ND	0.0017 (B)	0.0073 (B)	
4/17/08	ND	ND	0.092 (B)	78	ND	ND	ND	6.6	36	ND	20	ND	ND	0.0014 (B)	0.0055 (B)	
CSMRI-4	2/25/05	ND	ND	ND	72	ND	ND	ND	5.1	31	0.017	29	ND	ND	ND	0.12
	6/14/05	ND	ND	ND	86	ND	ND	ND	6.6	34	0.038	34	ND	0.0063	ND	0.068
	9/7/05	ND	0.0035 (B)	0.055 (B)	82	ND	ND	ND	7.6	33	0.035	31	ND	0.0049 (B)	ND	0.097
	12/20/05	ND	ND	0.056 (B)	100	ND	ND	0.000045 (B)	6.8	43	0.024	34	ND	ND	ND	0.18
	3/15/06	ND	ND	0.042 (B)	81	ND	ND	0.000034 (B)	5	35	0.021	29	ND	ND	0.00056 (B)	0.21
	6/15/06	ND	0.0031 (B)	0.055 (B)	89	0.00085 (B)	ND	0.0000049 (B)	8.3	37	0.03	31	ND	ND	0.0011 (B)	0.11
	9/13/06	ND	ND	0.043 (B)	66	ND	ND	0.000016 (B)	8.3	27	0.038	30	ND	ND	ND	0.082
3/8/07	ND	0.0057 (B)	0.072 (B)	120	0.00023 (B)	ND	0.000018 (B)	11	49	0.015	47	ND	0.019	ND	0.088	

**Table 2-9**  
**Historical Summary of Metals in Groundwater (Stoller)**  
**(All results in milligrams per liter)**

Sample Station	Sample Date	Ag	As	Ba	Ca	Cd	Cr	Hg	K	Mg	Mo	Na	Pb	Se	V	Zn
	6/27/07	ND	ND	0.067 (B)	110	ND	ND	0.000022 (B)	11	46	0.04	47	ND	ND	0.00073 (B)	0.14
	9/11/07	ND	0.0045 (B)	0.089 (B)	120	0.0011 (B)	0.0014 (B)	0.000037 (B)	12	49	0.05	41	ND	ND	0.0012 (B)	0.17
	11/26/07	ND	ND	0.081 (B)	110	0.00049 (B)	ND	0.000035 (B)	10	50	0.024	43	ND	ND	0.0011 (B)	0.1
	2/27/08	ND	ND	0.073 (B)	130	ND	ND	0.000016 (B)	8.2	58	0.015	45	ND	0.0034 (B)	ND	0.069
	4/17/08	ND	0.0063 (B)	0.089 (B)	150	0.00047 (B)	ND	0.000016 (B)	10	66	0.014	53	ND	ND	0.00078 (B)	0.087
CSMRI-5	2/25/05	ND	ND	ND	54	ND	ND	ND	3.4	22	ND	27	ND	ND	ND	0.067
	6/14/05	ND	ND	ND	63	ND	ND	ND	3.3	23	ND	28	ND	ND	ND	0.047
	9/7/05	ND	ND	0.085 (B)	85	ND	ND	ND	4.2	31	0.0042 (B)	35	ND	0.0037 (B)	0.0018 (B)	0.089
	12/20/05	ND	ND	0.072 (B)	79	0.00071 (B)	ND	0.000048 (B)	4.1	30	0.002 (B)	31	ND	ND	0.0012 (B)	0.17
	3/15/06	ND	ND	0.058 (B)	70	0.00037 (B)	ND	0.000029 (B)	3.5	26	0.0031 (B)	29	ND	0.0035 (B)	0.00067 (B)	0.11
	6/15/06	ND	ND	0.052 (B)	51	ND	ND	0.000012 (B)	3.6	19	0.0028 (B)	26	ND	ND	ND	0.055
	9/13/06	ND	ND	0.087 (B)	110	ND	0.0022 (B)	ND	4.5	41	0.0027 (B)	50	ND	ND	0.001 (B)	0.11
	3/8/07	ND	0.0037 (B)	0.063 (B)	80	ND	ND	ND	4.5	31	0.0019 (B)	34	ND	0.015	ND	0.083
	6/27/07	ND	ND	0.066 (B)	98	ND	ND	0.0000091 (B)	4.5	40	0.006 (B)	40	ND	ND	0.0017 (B)	0.025
	9/11/07	ND	ND	0.13	110	ND	0.00082 (B)	0.000023 (B)	4.9	44	0.0042 (B)	47	ND	ND	0.0015 (B)	0.054
	11/26/07	ND	ND	0.087 (B)	110	ND	0.00089 (B)	0.000032 (B)	4.5	42	ND	47	ND	ND	0.0012 (B)	0.12
2/27/08	ND	ND	0.073 (B)	100	ND	ND	ND	4.3	40	ND	42	ND	ND	ND	0.094	
4/17/08	ND	ND	0.078 (B)	100	ND	ND	0.000018 (B)	4.6	40	0.0011 (B)	41	ND	ND	0.0011 (B)	0.093	
CSMRI-6B	2/27/08	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
	6/26/07	ND	ND	0.12	100	ND	ND	0.0000059 (B)	5.9	56	0.004 (B)	41	ND	ND	ND	ND
	9/10/07	ND	0.0046 (B)	0.15	110	ND	0.00088 (B)	0.000013 (B)	4.8	48	0.0022 (B)	46	ND	ND	0.00081 (B)	0.0051 (B)
	11/27/07	ND	0.0048 (B)	0.17	110	ND	ND	0.000025 (B)	6	49	0.0028 (B)	57	ND	0.0051	0.00066 (B)	ND
	2/28/08	ND	ND	0.17	100	ND	ND	ND	5.8	43	0.004 (B)	49	ND	ND	ND	0.0048
	4/18/08	ND	ND	0.17	96	ND	ND	ND	6.1	40	0.0059 (B)	45	ND	ND	0.0013 (B)	0.0099 (B)
CSMRI-7B	2/27/07	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
	6/26/07	ND	ND	0.056 (B)	70	ND	ND	0.000006 (B)	5.5	37	0.024	53	ND	ND	0.00061 (B)	0.0041 (B)
	9/10/07	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
	DRY--	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
	2/27/08	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
	DRY	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
CSMRI-8	3/8/07	ND	0.0053 (B)	0.068 (B)	230	ND	ND	ND	23	72	0.094	74	ND	0.034	ND	0.0024 (B)
	6/27/07	ND	ND	0.053 (B)	190	ND	ND	0.0000099 (B)	19	55	0.043	52	ND	ND	ND	0.069
	9/10/07	ND	0.0069 (B)	0.076 (B)	160	ND	0.00074 (B)	0.000027 (B)	15	49	0.034	54	0.0018 (B)	ND	ND	0.025
	11/27/07	ND	ND	0.091 (B)	230	ND	ND	0.000024 (B)	15	67	0.026	70	ND	0.0046 (B)	0.001 (B)	0.011 (B)
	2/27/08	ND	0.036 (B)	0.07 (B)	270	ND	ND	ND	15	82	0.019	100	ND	ND	ND	0.038
	4/17/08	ND	ND	0.046 (B)	210	ND	0.0011 (B)	ND	13	63	0.016	73	ND	ND	ND	0.032
CSMRI-9	2/27/07	ND	ND	0.08 (B)	69	ND	0.0011 (B)	0.000024 (B)	12	31	0.045	33	ND	0.011	0.001 (B)	ND
	6/26/07	ND	ND	0.049 (B)	160	ND	ND	0.000002 (B)	8.5	77	0.0028	150	ND	0.0049 (B)	0.00096 (B)	0.0096 (B)
	9/10/07	ND	0.004 (B)	0.059 (B)	100	ND	0.0009 (B)	0.000016 (B)	6	51	0.0037 (B)	49	ND	ND	0.00071 (B)	0.0097 (B)
	11/26/07	ND	ND	0.078 (B)	110	0.00051 (B)	0.0011 (B)	0.000031 (B)	5.9	56	0.0023 (B)	52	ND	0.0054	0.0012 (B)	0.015 (B)

**Table 2-9**  
**Historical Summary of Metals in Groundwater (Stoller)**  
**(All results in milligrams per liter)**

Sample Station	Sample Date	Ag	As	Ba	Ca	Cd	Cr	Hg	K	Mg	Mo	Na	Pb	Se	V	Zn
	2/27/08	ND	ND	0.079 (B)	110	ND	ND	ND	5.4	56	ND	49	ND	0.0033 (B)	ND	0.011
	4/15/08	ND	ND	0.077 (B)	100	ND	ND	0.000013 (B)	5	52	0.0017 (B)	46	ND	ND	0.00077 (B)	0.0079 (B)
CSMRI-10	3/1/07	0.00051 (B)	ND	0.064 (B)	79	ND	0.0013 (B)	0.000024 (B)	7.3	33	0.01	36	ND	0.01	0.0011 (B)	ND
	6/26/07	ND	ND	0.079 (B)	100	ND	ND	0.0000063 (B)	4.7	44	ND	37	ND	0.0044 (B)	0.00055 (B)	ND
	9/10/07	ND	0.0039 (B)	0.071 (B)	89	ND	0.0012 (B)	0.00002 (B)	4.2	38	0.0014 (B)	36	ND	ND	0.00099 (B)	0.0042 (B)
	11/26/07	ND	ND	0.085 (B)	110	ND	ND	0.000026 (B)	4.7	43	ND	41	ND	ND	ND	ND
	2/26/08	ND	ND	0.09 (B)	110	ND	ND	ND	4.6	46	ND	41	ND	ND	ND	0.0052
	4/15/08	ND	ND	0.088 (B)	100	ND	0.0044 (B)	ND	4.5	44	ND	40	ND	ND	0.00059 (B)	0.0018 (B)
CSMRI-11	2/27/07	ND	ND	0.073 (B)	75	ND	0.00013 (B)	0.000023 (B)	9.7	29	0.033	33	ND	0.013	0.00073 (B)	0.0023 (B)
	6/26/07	ND	ND	0.096 (B)	110	ND	0.0012 (B)	0.0000071 (B)	5.4	44	0.0014 (B)	39	ND	0.0064	0.00059 (B)	ND
	9/10/07	ND	0.004 (B)	0.071 (B)	96	ND	0.00083 (B)	0.000016 (B)	4.5	39	0.0016 (B)	44	ND	ND	0.00078(B)	0.0033 (B)
	11/26/07	ND	ND	0.11	110	ND	ND	0.000028 (B)	4.9	44	0.0012 (B)	40	ND	ND	0.0013 (B)	ND
	2/26/08	ND	ND	0.11	110	ND	ND	ND	4.6	42	ND	44	ND	ND	ND	0.0048
	4/15/08	ND	ND	0.12	100	ND	ND	ND	4.7	41	ND	44	ND	ND	ND	ND
Detection Limits		0.01	0.01	0.1	1	0.005	0.01	0.0002	1	1	0.01	1	0.003	0.005	0.01	0.02
MCL*		NE	0.01	2	NE	0.005	0.1	0.002	NE	NE	NE	NE	0.015	0.05	NE	NE

\*Maximum Contaminant Level – National Primary Drinking Water Regulations

ND – non detect

NE – not established

NT – not tested

(B) – Detected above Instrument Detection Level but below Reported Detection Level

**Table 2-10**  
**Historical Summary of Radioisotopes in Surface Water (Stoller)**

Sample Station	Sample Date	Ra-226 (pCi/l)	Ra-228 (pCi/l)	Th-228 (pCi/l)	Th-230 (pCi/l)	Th-232 (pCi/l)	U-234 (pCi/l)	U-235 (pCi/l)	U-238 (pCi/l)	Total U (µg/l)
SW-1	2/25/05	0	0.58	0.018	-0.026	-0.001	0.89	0.083	0.65	1.97
	6/14/05	0.14	0.05	0.05	-0.025	0.016	0.246	0.021	0.251	0.75
	9/7/05	0.18	0.42	0.041	0.25	0.102	0.35	0.031	0.35	1.04
	12/20/05	-0.31	0.47	0.028	0.197	-0.005	0.64	0.041	0.7	2.11
	3/15/06	-0.16	0.35	0.059	0.125	0.005	0.6	0.029	0.53	1.59
	6/14/06	0.13	0.45	0.16	0.53	0.062	0.11	0.08	0.19	0.61
	9/13/06	-0.03	0.25	-0.019	-0.035	0.01	0.37	-0.005	0.34	1
	3/1/07	-0.1	0.25	-0.038	0.15	0.026	NT	NT	NT	1.7
	6/27/07	0.13	0.77	0.006	0.016	0.014	NT	NT	NT	0.6
	9/11/07	0.15	0.74	0.063	0.088	0.012	NT	NT	NT	0.94
	11/27/07	0.2	0.24	0.026	0.049	0.025	NT	NT	NT	1.8
	2/27/08	0.1	0.48	0.014	0.002	0.024	NT	NT	NT	2
4/18/08	0.06	-0.07	-0.023	-0.026	0.012	NT	NT	NT	1.9	
SW-2	2/25/05	0.45	0.06	0.011	-0.016	0.033	0.8	0.066	0.42	1.29
	6/14/05	0.04	0.29	0.071	-0.028	0.007	0.259	0.032	0.23	0.69
	9/7/05	-0.08	0.24	-0.013	0.107	0.051	0.54	0.014	0.54	1.62
	12/20/05	0.09	0.07	-0.003	0.126	0	0.71	0.067	0.49	1.5
	3/15/06	-0.04	-0.15	0.009	0.184	0.01	0.79	0.004	0.51	1.52
	6/14/06	0.03	0.04	0.172	0.24	0.1	0.39	0	0.48	1.44
	9/13/06	0.11	0.35	0.009	-0.03	0.01	0.43	-0.006	0.3	0.89
	3/8/07	0.12	0.73	0.047	-0.055	0	NT	NT	NT	1.7
	6/28/07	0.02	0.78	0.028	0.014	0	NT	NT	NT	0.57
	9/11/07	0.1	0.27	0.066	0.068	0.002	NT	NT	NT	0.97
	11/26/07	0.11	0.36	0.007	0	0.012	NT	NT	NT	1.7
	2/26/08	0.1	0	-0.01	0.113	0.011	NT	NT	NT	2
4/18/08	0.13	0.58	0.015	0.24	0.024	NT	NT	NT	1.8	
MCL*		Total Ra = 5		NE	Th 230 + Th 232 = 60**		NE	NE	NE	30

\*Maximum Contaminant Level – National Primary Drinking Water Regulations

\*\*5 CCR 1002-31 Reg 31 – Colorado Surface Water Standards

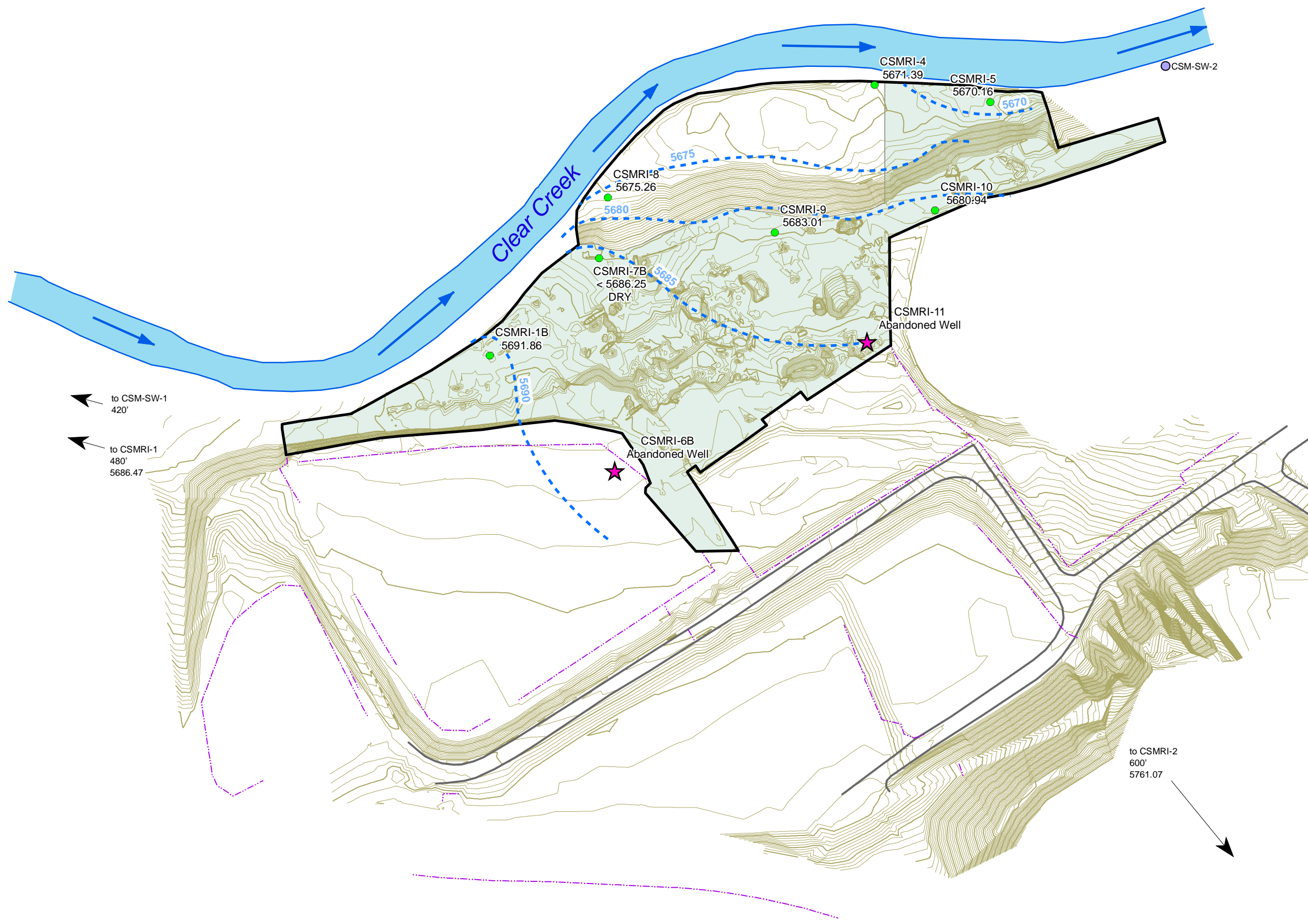
pCi/l - picoCuries per liter

µg/l – micrograms per liter

**Table 2-11**  
**Historical Summary of Metals in Surface Water (Stoller)**  
(All results in milligrams per liter)

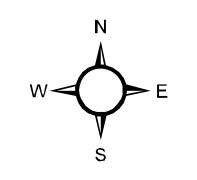
Sample Station	Sample Date	Ag	As	Ba	Ca	Cd	Cr	Hg	K	Mg	Mo	Na	Pb	Se	V	Zn
SW-1	2/25/05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
	6/14/05	ND	ND	ND	11	ND	ND	ND	1.1	2.8	ND	5.2	ND	ND	ND	0.09
	9/7/05	ND	0.0037 (B)	0.029 (B)	20	ND	ND	ND	2.2	4.4	0.0044 (B)	8.5	ND	0.0045 (B)	ND	0.063
	12/20/05	ND	ND	0.042 (B)	35	0.00057 (B)	ND	0.000034 (B)	3.7	7.6	0.004 (B)	19	ND	ND	ND	0.22
	3/15/06	ND	ND	0.04 (B)	37	0.00084 (B)	0.00047 (B)	0.000024 (B)	3.7	8.5	0.0048 (B)	23	ND	ND	0.00067 (B)	0.19
	6/14/06	0.0012 (B)	0.0032 (B)	0.011 (B)	8.2	ND	ND	ND	1	1.9	0.0042 (B)	3.1	ND	ND	ND	0.029
	9/13/06	ND	ND	0.03 (B)	21	ND	ND	ND	2.1	4.4	0.0049 (B)	8.6	ND	ND	ND	0.053
	3/1/07	ND	ND	0.049 (B)	44	0.0011 (B)	0.00092 (B)	0.000023 (B)	4.3	11	0.0046 (B)	26	ND	ND	ND	0.22
	6/27/07	ND	ND	0.018 (B)	10	ND	ND	0.000068 (B)	0.93 (B)	2.5	0.0017 (B)	3.2	ND	ND	ND	0.067
	9/11/07	ND	ND	0.032 (B)	21	ND	ND	0.000019	1.7	5	0.0029 (B)	7.4	ND	ND	ND	0.078
	11/27/07	ND	ND	0.042 (B)	33	0.00076 (B)	ND	0.00027 (B)	2.8	8.2	0.0032 (B)	15	ND	ND	ND	0.18
2/27/08	ND	ND	0.042 (B)	36	ND	ND	ND	3.3	9.6	0.0022 (B)	19	ND	ND	ND	0.15	
4/18/08	ND	ND	0.044 (B)	35	0.00044 (B)	ND	ND	3.4	9	0.0034 (B)	23	ND	ND	ND	0.13	
SW-2	2/25/05	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.17
	6/14/05	ND	ND	ND	11	ND	ND	ND	1.1	2.8	ND	4.8	ND	ND	ND	0.085
	9/7/05	ND	ND	0.028 (B)	20	ND	ND	ND	2.1	4.4	0.0037 (B)	8.7	ND	0.0037 (B)	ND	0.051
	12/20/05	ND	ND	0.042 (B)	35	0.00043 (B)	ND	0.000034 (B)	3.8	8	0.0038 (B)	19	ND	ND	ND	0.21
	3/15/06	ND	ND	0.042 (B)	39	0.00053 (B)	0.00055 (B)	0.000022 (B)	3.8	8.9	0.0046 (B)	25	ND	ND	0.00053 (B)	0.2
	6/14/06	ND	0.0022 (B)	0.011 (B)	8.4	ND	ND	ND	1	1.9	0.0045 (B)	3	ND	ND	ND	0.031
	9/13/06	ND	ND	0.03 (B)	21	ND	ND	ND	2.1	4.4	0.0048 (B)	8.5	ND	ND	ND	0.04
	3/8/07	ND	0.0053 (B)	0.049 (B)	39	0.00064 (B)	ND	ND	4.2	9.8	0.0014 (B)	22	ND	ND	ND	0.17
	6/28/07	ND	ND	0.019 (B)	10	ND	ND	0.0000056 (B)	0.93 (B)	2.6	ND	3.3	ND	ND	ND	0.075
	9/11/07	ND	ND	0.033 (B)	21	ND	ND	0.00001	1.7	5.1	0.0035 (B)	7.5	ND	ND	ND	0.084
	11/26/07	ND	ND	0.044 (B)	35	0.0005 (B)	ND	0.00027 (B)	2.9	8.6	0.0027 (B)	15	ND	ND	ND	0.19
2/26/08	ND	ND	0.051	35	0.0005 (B)	ND	ND	3.1	9.2	0.0023 (B)	21	ND	ND	ND	0.15	
4/18/08	ND	ND	0.045 (B)	35	0.0005 (B)	ND	ND	3.4	9.1	0.0031 (B)	23	ND	ND	ND	0.14	
Detection Limits		0.01	0.01	0.1	1	0.005	0.01	0.0002	1	1	0.01	1	0.003	0.005	0.01	0.02
MCL*		0.01	0.01	2	NE	0.005	0.1	0.002	NE	NE	NE	NE	0.015	0.05	NE	NE

\*Maximum Contaminant Level – National Primary Drinking Water Regulations  
 ND – Non Detect  
 NE – Not Established  
 (B) – Detected above Instrument Detection Level but below Reported Detection Level

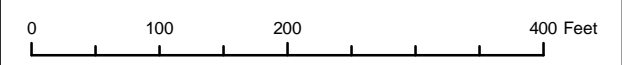


**Explanation**

- Monitor Well
- ★ Abandoned Monitor Well (July 2008)
- Surface Water Sample Location
- - - Potentiometric Surface Contours (5 Ft.)
- CSMRI Site
- · - · - Fences
- Roads
- Topography (5 ft Intervals)
- Topography (1 ft Intervals)
- Site Areas



Scale: 1" = 150'



**Figure 1**

**Groundwater Potentiometric  
Elevation Map - September 2008**

**CSMRI  
November 2008  
Quarterly Report**



Figure 2  
Hydrographs  
CSMRI-1, CSMRI-4, CSMRI-5, and CSMRI-8

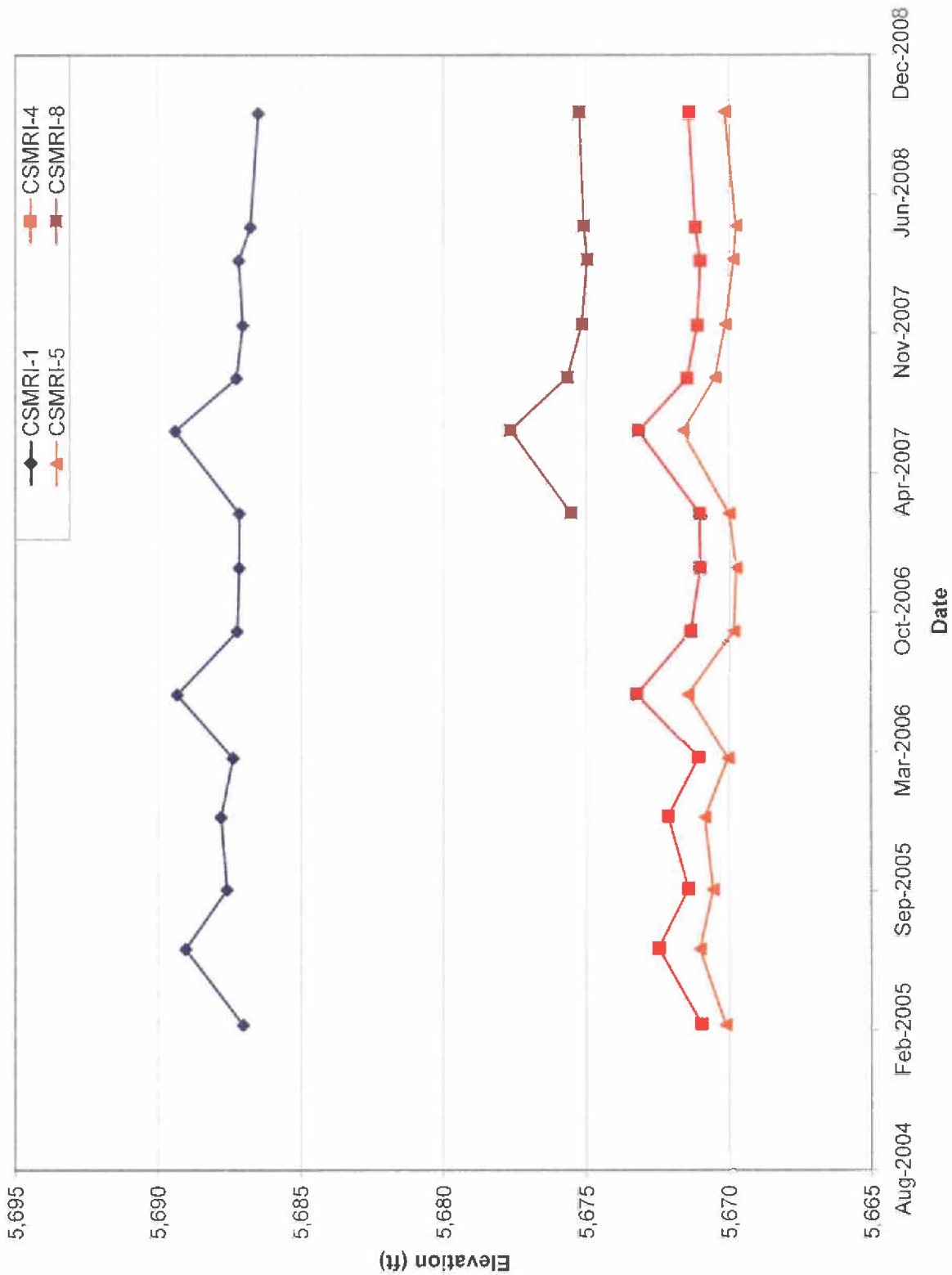


Figure 3  
Hydrograph  
CSRMI-2

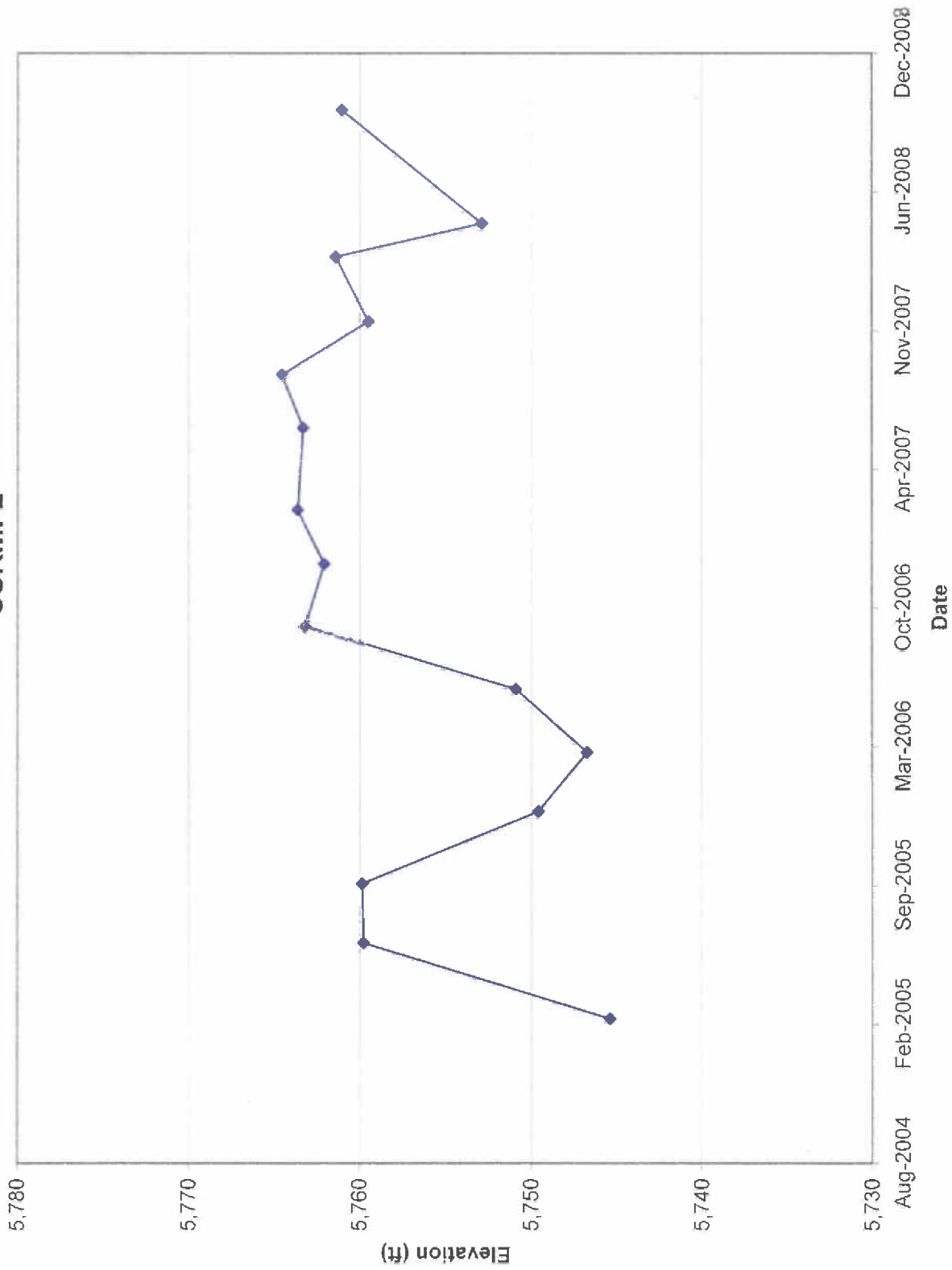
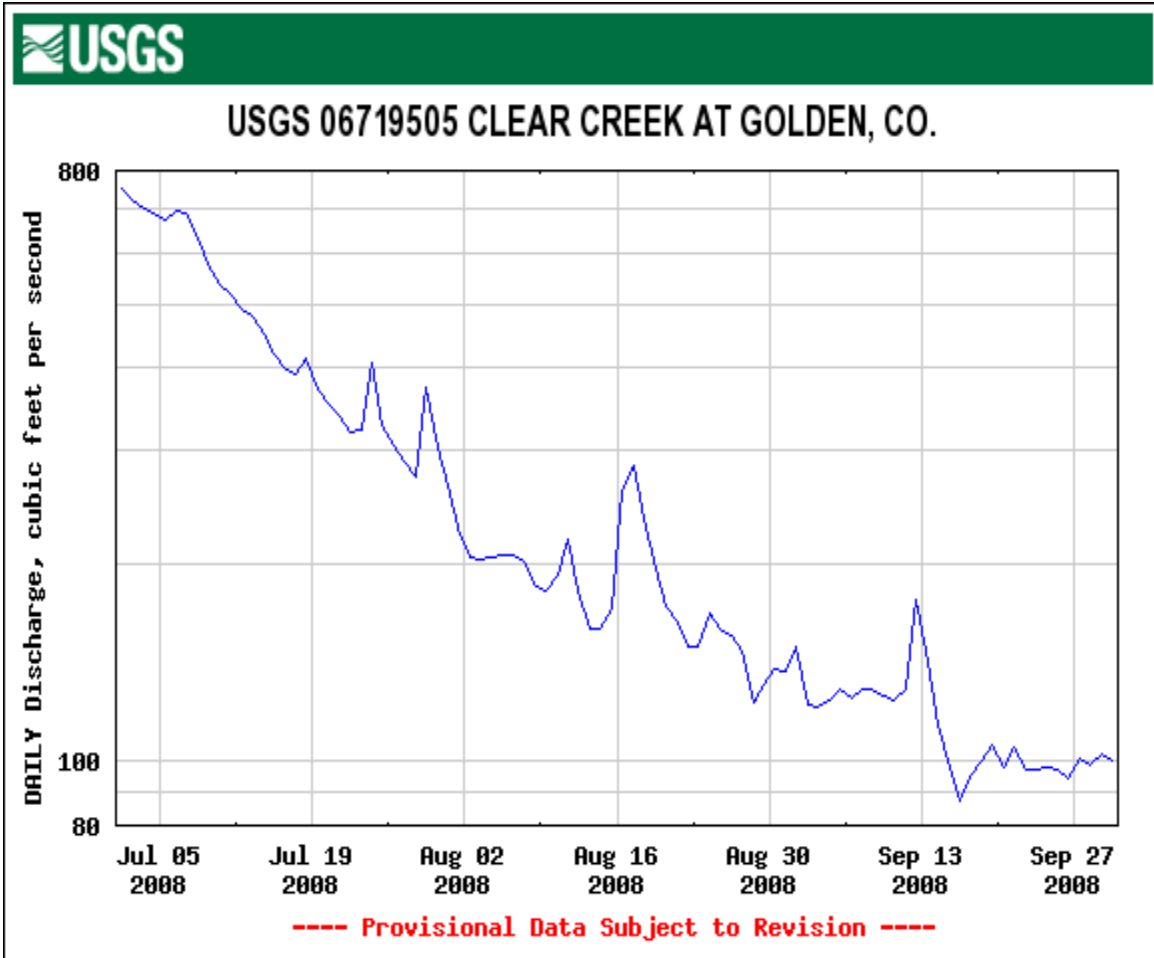
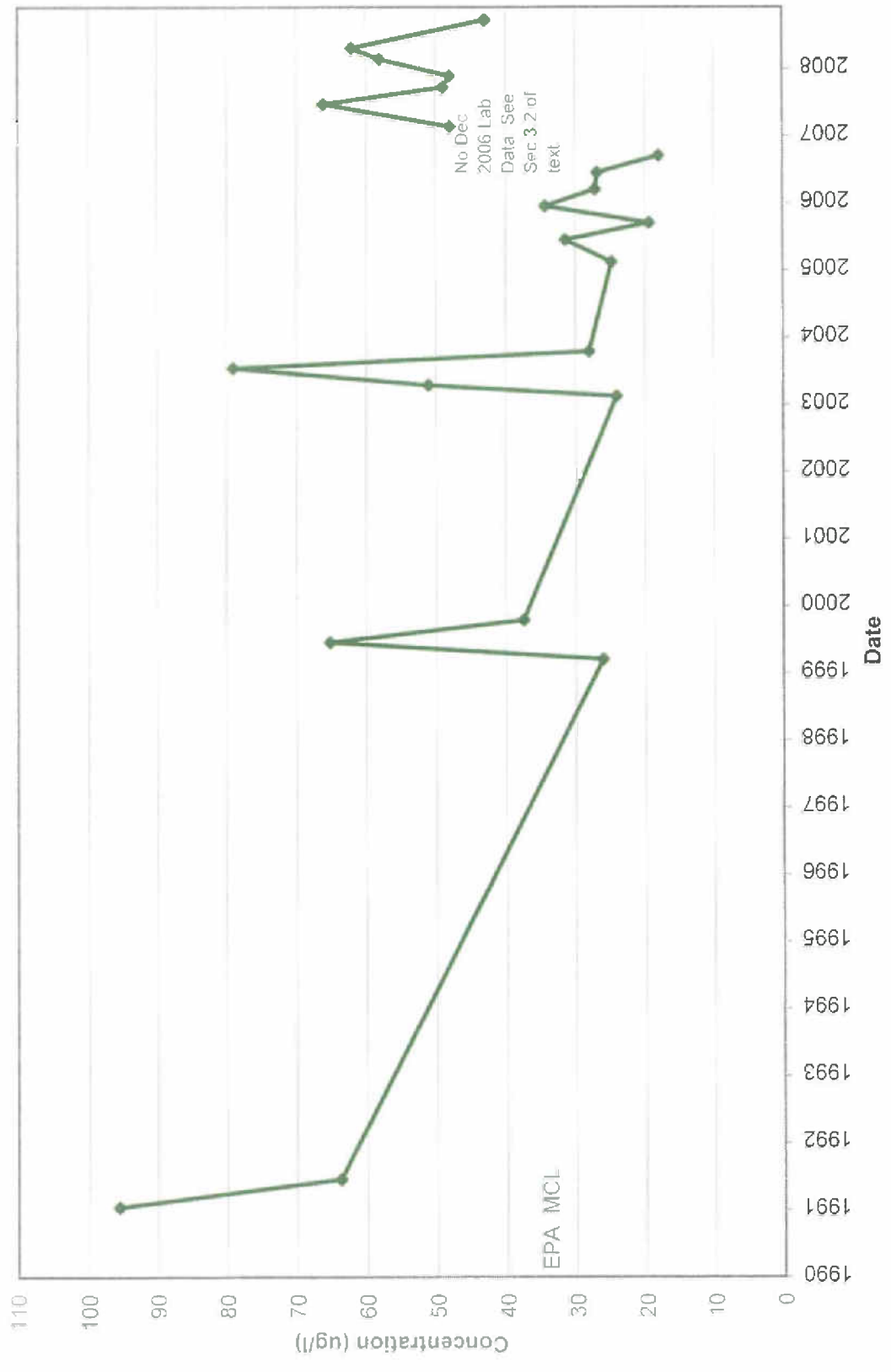




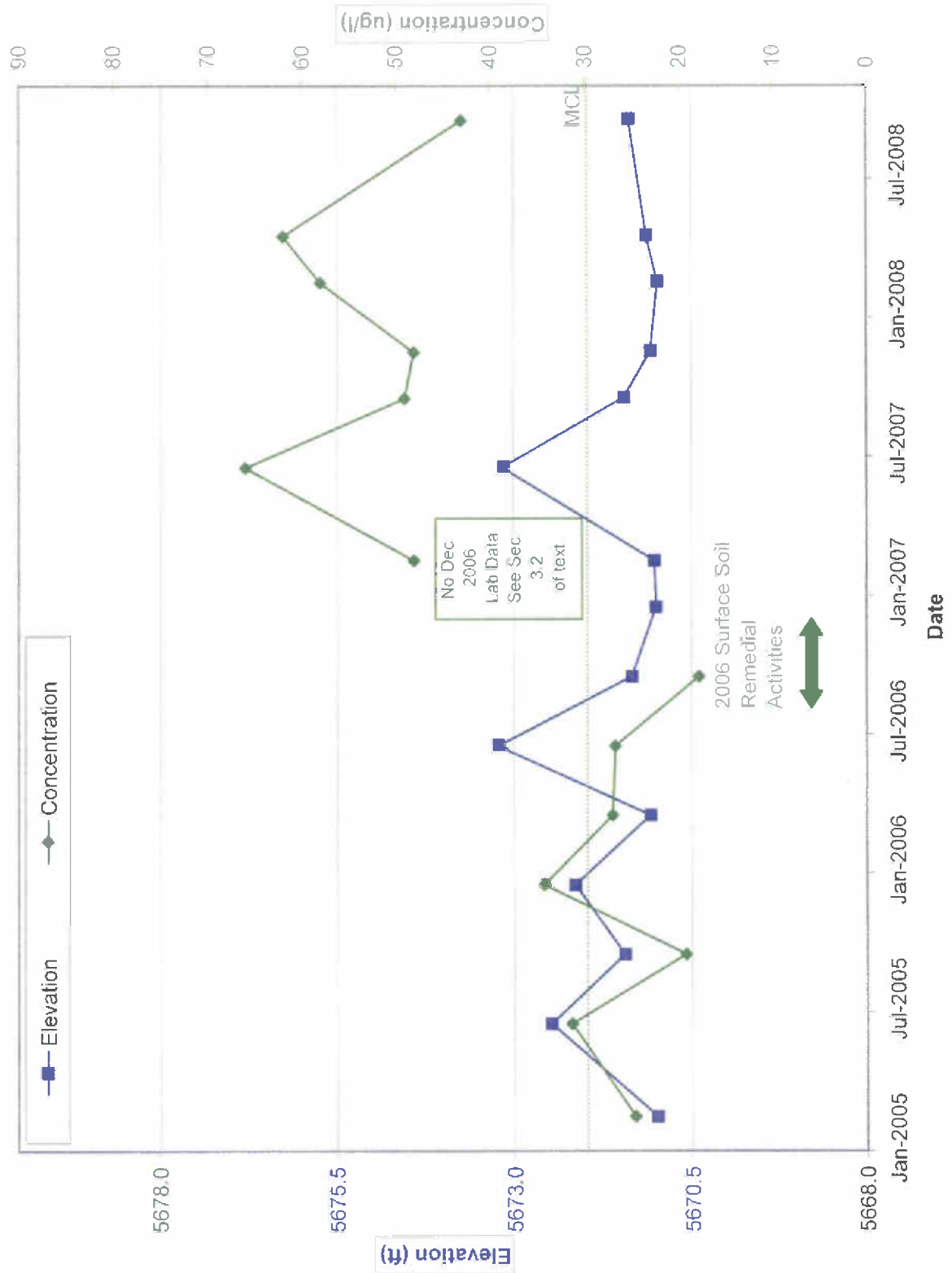
Figure 4  
Clear Creek Gauging Graph



**Figure 5**  
**CSMRI-4**  
**Historical Total Uranium Concentration**



**Figure 6**  
**CSMRI-4**  
**Total Uranium Concentration and Potentiometric Elevation**



# **Appendix A**

## **Groundwater Sampling Procedures**

**Appendix B**  
**Sample Collection Forms**

# **Appendix C**

## **Surface Water Sampling Procedures**

# **Appendix D**

## **Data Validation Reports**

**Appendix E**  
**Results of Analyses CD**



# **Appendix F**

## **Chains of Custody**