

**FRONTIER HARD CHROME
LONG-TERM MONITORING REPORT
EVENT 17
VANCOUVER, WASHINGTON**

Prepared for

**Washington State Department of Ecology
PO Box 47600
Olympia, Washington 98504**

Authorization/Contract No. 7.1.b.7/10.3

Weston Work Order No. 10799.004.004.0001

December 2011

Prepared by

Weston Solutions, Inc.
190 Queen Anne Avenue North
Suite 200
Seattle, WA 98109

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Approved By:



Greg Stuesse, PE, LG
Senior Project Leader

December 27, 2011

Date

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1. INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

This Long-Term Monitoring Report has been prepared under Authorization/Contract No. 7.1.b.7/10.3 to the State of Washington Department of Ecology (Ecology) for Long-Term Monitoring of the Frontier Hard Chrome (FHC) site located in Vancouver, Washington.

This report describes the sampling activities performed and analytical results obtained during “Event 17” of the Long-Term Groundwater Monitoring program at FHC. Sampling activities for Event 17 were conducted from September 12-16, 2011.

The FHC site was the subject of a remedial action (RA) conducted during the summer of 2003. The purpose of the remedial action was to treat the site’s chromium-contaminated soil and groundwater to cleanup levels specified in the Record of Decision. Long-term monitoring is required to track off-site plume concentrations as well as show that the remedy is maintaining its operational functionality.

The first three FHC groundwater monitoring events (Events 1 through 3) were conducted for the United States Environmental Protection Agency (EPA). In October 2004, responsibility for the site was turned over to Ecology. Ecology contracted Weston Solutions, Inc. (WESTON®) to perform the next two rounds of monitoring (Events 4 and 5) as a result of WESTON’s familiarity with this site and the associated property owners. Ecology amended WESTON’s contract in February 2006 and again in July 2007 to perform 14 additional rounds of quarterly monitoring. In the summer and fall of 2007, EPA conducted a Long-Term Monitoring Optimization (LTMO) study to assess monitoring requirements at the FHC site. As a result of this study, ten wells were deleted from the monitoring program (EPA, 2008). Ecology amended WESTON’s contract to delete the remaining monitoring events except for Event 14, which was completed in September 2008. Event 15 (September, 2009), Event 16 (September, 2010) and Event 17 (September, 2011) were each completed under annually-issued individual Authorization/Contracts.

This report documents the results of sampling under the new individual Authorization/Contract No. 7.1.b.7/10.3 between Ecology and WESTON. All Event 17 work was performed in accordance with the project work plan titled *Frontier Hard Chrome, Long-Term Monitoring Plan* (Weston, 2004).

1.2 BACKGROUND AND PROBLEM DEFINITION

1.2.1 Site Background

The FHC site is located at 113 “Y” Street in southeastern Vancouver, Washington. The site is located in Section 25, Township 2 North, Range 1 East, of the Willamette Meridian in Clark County, Washington. The geographic coordinates for the site are 45° 37’ 18.8” North latitude and 122° 38’ 43.3” West longitude. A site location map is shown in Figure 1.

The site was historically occupied by several metal fabricating businesses. In addition, the site was historically used for storage and as a staging area for adjacent facilities. As of September 2011, there were no buildings or permanent structures located on site. The entirety of the site, as

well as the adjacent parcels to the south and east, were enclosed behind a newly constructed chain link fence and were being used for equipment/vehicle storage and minor maintenance of plumbing equipment. The site encompasses approximately 0.5 acres and is bordered to the north by a scrap metal facility, to the east by a campus of the Northwest Renewable Energy Institute, to the south by the property addressed as 2428 East 1st Street (formerly occupied by the Test-U truck driving school), and to the west by “Y” Street. A site layout map is shown in Figure 2.

The FHC site was historically occupied by chrome plating facilities between approximately 1958 and 1983. The property was first developed in approximately 1958 with the addition of hydraulic dredge fill material and construction rubble. Pioneer Plating operated at the site from approximately 1958 to 1970 and Frontier Hard Chrome operated at the site from approximately 1970 to 1983. Between approximately 1958 and 1976, untreated process wastewater from the facility, which included hexavalent chromium and additional heavy metals, was discharged directly to the City of Vancouver’s sanitary sewer system. In approximately 1976, the City of Vancouver and Ecology requested that the facility cease discharging all chromium-contaminated wastewaters to the system. Subsequent to this request, Frontier Hard Chrome began discharging the untreated chromium-contaminated wastewater to an on-site “dry well,” which continued for approximately seven years. In December 1982, the FHC site was proposed for inclusion on the National Priorities List (NPL) under the Comprehensive Environmental Response, Compensation, and Liabilities Act (CERCLA or Superfund). FHC terminated its operations in January 1983.

Work began on the remedial design for the FHC site in October 2001 and was completed in February 2003. The RA; which consisted of building demolition, treatment of source area soil and groundwater, and installation of an in-situ redox manipulation (ISRM) treatment wall (to treat hexavalent chromium); was completed in September 2003.

1.2.2 Problem Definition

The goal of the RA was to treat source area soil and groundwater to reduce hexavalent chromium concentrations such that groundwater downgradient of the site would attenuate to chromium concentrations less than 50 micrograms per liter ($\mu\text{g/L}$). To demonstrate this, groundwater quality was monitored in two areas. The first area consisted of wells located immediately within and downgradient of the ISRM treatment wall, which were monitored to ensure the continued operational functionality of the ISRM wall. The second area consisted of the historical chromium-contaminated groundwater plume located downgradient of the ISRM wall. This plume, which did not receive treatment during the RA, was monitored to track the long-term expected reduction in chromium concentrations as a result of the elimination of the source of hexavalent chromium and the ISRM wall.

Long-term groundwater monitoring is required by the site’s Record of Decision. Additional information regarding regulatory actions related to the FHC site is available at the EPA Region 10 Cleanup Sites website: <http://yosemite.epa.gov/R10/cleanup.nsf/sites/cleanuplist>.

1.3 MONITORING SCHEDULE

Groundwater sampling and monitoring events were conducted approximately quarterly by EPA for the first year after completion of the RA. Planned events were completed in February, April, and August 2004. The sampling event performed the week of August 16, 2004 concluded monitoring for approximately one year after the RA was completed.

In September/October 2004, monitoring of the FHC site was turned over to Ecology. Sampling of the site groundwater for Ecology occurred in May and December 2005 under the Original Contract with WESTON. In February 2006, Ecology amended WESTON's contract (Amendment #1) to perform six additional rounds of quarterly monitoring that would occur in March 2006, June 2006, September 2006, December 2006, March 2007, and June 2007.

In July 2007, additional funding was received from Ecology for an additional eight quarters of groundwater monitoring (Amendment #3). These additional quarterly monitoring events were scheduled for September 2007, December 2007, March 2008, June 2008, September 2008, December 2008, March 2009, and June 2009.

In June 2008 as a result of the recommendations of the LTMO study (EPA 2008), Ecology issued Amendment #4 to WESTON which removed the remaining rounds of sampling from the contract with the exception of a single event to be completed in September 2008. The work conducted in September 2009 (Event 15) and September 2010 (Event 16) was completed under individual Authorization/Contracts.

This report documents the results of the September 2011 (Event 17) sampling event.

2. SAMPLING ACTIVITIES AND RESULTS

2.1 MONITORING WELL SAMPLING PROCEDURES

Twenty-two wells were sampled in September 2011. These wells consisted of the following:

Shallow "A" Zone Wells:	Deep "B" Zone Wells:
B85-3	RA-MW-12B
B85-4	RA-MW-12C
B87-8	RA-MW-15B
RA-MW-12A	RA-MW-16B
RA-MW-15A	W85-6B
RA-MW-16A	W92-16B
RA-MW-17A	W97-19B
W85-6A	W98-21B
W92-16A	W99-R5B
W97-18A	
W97-19A	
W98-21A	
W99-R5A	

Sampling activities for Event 17 were conducted from September 12 through September 15, 2011 by WESTON staff in accordance with the *Long-Term Monitoring Plan* (Weston 2004). The monitoring wells in the vicinity of the FHC site are shown on Figure 2.

Well purging and sampling were performed according to sampling guidelines and WESTON standard operating procedures (SOPs). The wells were sampled with a peristaltic pump equipped with new dedicated polyethylene tubing deployed to mid-screen depth at each well. The wells were purged prior to sampling until monitored field parameters (turbidity, conductivity, pH, dissolved oxygen, ORP, and temperature) stabilized. The field parameter readings were recorded on field sampling forms.

Based upon the Event 16 (September 2010) analytical results, EPA and Ecology determined that it was no longer necessary to analyze the FHC groundwater samples for the complete list of Priority Pollutant (PP) metals and only chromium was retained for the Event 17 (September 2011) analyses.

All wells were sampled for total chromium. In cases where groundwater turbidity was greater than 10 nephelometric turbidity units (NTUs), samples were passed through a 0.45-micron filter in the field and submitted for dissolved chromium analysis. A total of three field-filtered

groundwater samples submitted for analysis. These samples were collected from wells: RA-MW-12A, which had a turbidity in excess of 10 NTU; RA-MW-15B, which had a turbidity less than 10 NTU but has had anomalously elevated chromium concentrations in unfiltered samples since May 2005; and B87-8, which had a turbidity less than 10 NTU but was observed to have an oily substance suspended in the water column. Total and dissolved chromium concentrations from the 22 collected samples are presented in Table 1.

One well, B87-8, was additionally sampled for hexavalent chromium. This sample, which was not field filtered since the turbidity was less than 10 NTU, was collected and delivered to the laboratory on September 14, 2011.

Selected samples were analyzed for dissolved sulfur (field filtered) and sulfate (unfiltered) to provide an assessment of the distribution of byproducts from the reducing agent used during ISRM treatment wall installation. These samples were collected from wells: W85-6A, W99-R5A, B85-4, and B87-8. Dissolved sulfur and sulfate concentrations, as well as additional measured field parameters are presented in Table 2.

2.2 ANALYTICAL RESULTS

2.2.1 Chromium

Chromium was detected in six of the 22 wells sampled. The reporting limit for chromium was 2 µg/L.

Four of the shallow “A” zone wells exhibited chromium concentrations that exceeded the laboratory reporting limit. These wells included: RA-MW-12A (9 µg/L dissolved chromium), B87-8 (3 µg/L dissolved chromium), W98-21A (3 µg/L total chromium), and W85-6A (3 µg/L total chromium). Unfiltered samples were also collected from wells RA-MW-12A and B87-8, which exhibited total chromium concentrations of 26 µg/L and 4 µg/L, respectively. The shallow “A” zone groundwater chromium concentrations and estimated plume contours are presented in Figure 3. Filtered sample data (when available) were used in preparing Figure 3.

Two of the deeper “B” zone wells exhibited chromium concentrations that exceeded the laboratory reporting limit. These wells included: W98-21B (3 µg/L total chromium) and W97-19B (3 µg/L total chromium). The deeper “B” zone groundwater chromium concentrations and estimated plume contours are presented in Figure 4. Filtered sample data (when available) were used in preparing Figure 4.

Hexavalent chromium was not detected at a concentration greater than the method reporting limit of 50 µg/L in the groundwater sample collected from well B87-8.

Figures showing the chromium concentration trends in groundwater over time are included in Appendix A. Filtered sample data (when available) were used in preparing the figures. Available data from wells sampled during Operational and Functional monitoring in November/December 2003 are included to assist in determining trends. The Event 17 (September 2011) laboratory data sheets for chromium are provided in Appendix B.

2.2.2 Water Quality

Dissolved oxygen (DO) concentrations measured during the Event 17 sampling ranged from a low of 0.18 mg/L to a high of 9.20 mg/L. DO averaged 0.58 mg/L in samples collected from wells within the ISRM treatment wall (RA-MW-12A [1.28 mg/L], RA-MW-12B [0.27 mg/L], RA-MW-12C [0.18 mg/L]). The DO concentrations indicate the wall is still reductive which is necessary for treatment of hexavalent chromium. Samples of groundwater collected downgradient of the ISRM treatment wall had similar concentrations of DO compared to those within the treatment wall.

The groundwater pH measured during the Event 17 sampling ranged from 3.3 to 7.8. The maximum pH was measured in well W85-6B and the minimum pH was measured in well W97-19A.

Groundwater samples were collected from four wells (B85-4, B87-8, W85-6A, and W99-R5A) and submitted for dissolved sulfur (field filtered) and sulfate analysis (unfiltered). Sulfate concentrations ranged from 15.9 mg/L to 38.3 mg/L. Dissolved sulfur concentrations ranged from 5.15 mg/L to 12.6 mg/L. The maximum sulfur and sulfate concentrations were exhibited in the samples collected from well B85-4, which is located downgradient of the ISRM treatment wall along the south side of 1st Street.

2.3 GROUNDWATER FLOW DIRECTION AND ELEVATION

Groundwater surface elevations were determined using the known elevation of the top of each well casing and the depth to groundwater measured in each long-term monitoring well. The depth to groundwater measurements were collected from 18 wells between approximately 12:00 and 14:00 hours on September 12, 2011. Groundwater elevations were not measured in well W85-3A since the well could not be located. Groundwater elevation data is presented in Table 4 and Figure 5.

The calculated groundwater elevations in wells W97-19A and W97-19B have been anomalously low during the last several sampling events. The casing elevations for these two wells, in addition to three other wells, were corrected after completion of the RA due to two different datums having been historically used at the site. The remaining three wells were resurveyed in 2007 due to the development of the shopping center. It is suspected that the correction factor, which was an average based on the relative differences from eight wells, is not appropriately applied to these wells. Based upon this information, data from these wells was not used in groundwater flow direction and elevation calculations.

The Columbia River elevation at the United State Geological Survey (USGS) gauging station 14144700, which is located approximately 1.3 miles west of the FHC site at the northern end of the I-5 Bridge, was obtained for use in determining flow direction. Between 12:00 and 14:00 hours on September 12, 2011, the elevation of the river ranged from 3.37 to 4.67 feet above mean sea level (AMSL) (corrected to NGVD 1929 by adding 1.82 feet to the measured gage height). The daily mean elevation for September 12, 2011 was 4.86 feet AMSL. The river elevation information can be obtained from <http://waterdata.usgs.gov/usa/nwis/uv?14144700>.

Excluding the anomalous data from wells W97-19A and W97-19B, the groundwater surface elevations ranged from 5.71 feet AMSL in well W99-R5A to 6.06 feet AMSL in well W85-3B. Utilizing the depth to groundwater data collected between 12:01 and 13:51 on September 12, 2011, groundwater in the vicinity of the FHC site flows in a southerly direction with a horizontal gradient of approximately 0.0002 feet per foot (ft/ft).

2.4 QUALITY ASSURANCE

Data quality was verified by collecting field duplicate samples. Laboratory duplicates and matrix spike analyses were performed by the analytical laboratory. The quality control results are presented in Table 5.

Field duplicates were collected from three of the sampled wells including: W85-6A (QA-1), RA-MW-15B (QA-2), and RA-MW-12A (QA-3). The duplicate sample collected from W85-6A was analyzed for total chromium (unfiltered) and sulfate. The duplicate sample collected from RA-MW-12A was analyzed for total chromium (unfiltered). The duplicate sample collected from RA-MW-15B was analyzed for dissolved chromium (filtered) and total chromium (unfiltered).

The field duplicate sample, QA-1, collected from well W85-6A had good correlation with the original sample result for both total chromium [0% relative percent difference (RPD)] and sulfate (0% RPD).

The field duplicate sample, QA-2, collected from well RA-MW-15B could not be correlated to the original sample result for either total chromium or dissolved chromium since neither the duplicate nor the original sample exhibited concentrations of these analytes above the laboratory reporting limits.

The field duplicate sample, QA-3, collected from well RA-MW-12A had relatively poor correlation with the original sample result for total chromium (21.3% RPD). Well RA-MW-12A has a relatively slow recharge rate and the groundwater from this well has relatively high turbidity (40.0 NTU). The relatively high RPD between the duplicate and original samples from this well is likely due to variations in the amount of total suspended solids.

2.5 INVESTIGATION-DERIVED WASTES

Investigation-derived waste (IDW) generated during the sampling event consisted of well purge/decontamination water, used PPE, and disposable sampling supplies. During sampling, purge/decontamination water was stored on site in 5-gallon buckets. At the completion of sampling event, the water was transported to the City of Vancouver's operations center and disposed of in accordance with the Special Wastewater Discharge Authorization Number 2010.06, which was issued to WESTON by the City of Vancouver on September 7, 2010 and is valid through September 7, 2015. Approximately 60 gallons of purge/decontamination water was disposed to the City's sanitary sewer system. PPE and other solid IDW were disposed to general refuse.

2.6 DISCUSSION AND CONCLUSIONS

Chromium concentrations were detected above laboratory reporting limits in 4 of the 13 samples collected from within the wells screened in the shallower “A” groundwater zone. The concentrations, which are reported here using dissolved (field-filtered) fractions when available, ranged from 3 micrograms per liter ($\mu\text{g/L}$) to 9 $\mu\text{g/L}$. The maximum concentration was detected in well RA-MW-12A, which is located at the in-situ redox manipulation (ISRM) treatment wall. The remaining three samples with detectable concentrations were collected from wells B87-8, W85-6A, and W98-21A; which are located approximately 135 feet, 550 feet, and 850 feet south (downgradient) of the ISRM, respectively. During the sampling of well RA-MW-12A, groundwater was observed to be relatively turbid throughout the purging process. This relatively high turbidity is thought to be due to the presence of insoluble chromium compound particulates. The sample collected from well B87-8 was additionally analyzed for hexavalent chromium; however, the sample did not exhibit a concentration that exceeded the laboratory reporting limit of 50 $\mu\text{g/L}$. The relative locations of the sampled “A” zone wells are presented in Figure 3.

Chromium concentrations were detected above laboratory reporting limits in 2 of the 9 samples collected from within the wells screened in the deeper “B” groundwater zone. The concentrations of the samples, which are reported here using dissolved (field-filtered) fractions when available, were both reported as 3 $\mu\text{g/L}$. The samples were collected from wells W97-19B and W98-21B, which are located approximately 1,400 feet southwest (cross-to-downgradient) and 850 feet south (downgradient) of the ISRM, respectively. The relative locations of the sampled “B” zone wells are presented in Figure 3.

The exhibited concentrations in samples collected from both the shallow “A” groundwater zone and the deeper “B” groundwater zone were similar to those reported during the previous Event 16 (September 2010) sampling event.

Dissolved oxygen (DO) data collected from the three sampled wells at the ISRM treatment wall; which included RA-MW-12A, RA-MW-12B, and RA-MW-12C; indicates that an area of reducing conditions still exists and therefore that the hexavalent chromium treatment zone is still active. The DO concentrations at these wells ranged from 1.28 milligrams per liter (mg/L) in the shallow well to 0.18 mg/L in the deep well. In addition, the negative oxygen reduction potential (ORP) data collected from these wells, which ranged from -275 millivolts (mV) to -333 mV , implies that reducing conditions are present within the ISRM treatment wall.

Sulfur and Sulfate concentrations in the two sampled wells (B87-8 and B85-4) that are located approximately 200 feet downgradient of the ISRM treatment wall were approximately 65 percent less than the previous Event 16 concentrations. The concentrations in the two sampled wells (W85-6A and W99-R5A) that are located between approximately 550 feet and 2,400 feet downgradient of the ISRM wall were similar to the previous round of sampling.

3. ANALYTICAL METHODS AND DATA VALIDATION

3.1 ANALYTICAL METHODS REQUIREMENTS AND DATA VALIDATION

The laboratory data quality assurance review and validation of analytical results for 25 water samples has been completed (22 field samples and 3 field duplicate samples). Samples were collected between September 12 and 15, 2011 from monitoring wells at the Frontier Hard Chrome site and were analyzed for total recoverable chromium. In addition, three samples were analyzed for dissolved chromium, one sample was analyzed for hexavalent chromium, and four samples were analyzed for both sulfate and dissolved sulfur.

The quality assurance review was performed on the laboratory data sheets and the Ecology memorandum to ensure that the analytical results met data quality objectives for the project. All laboratory quality assurance results as applicable (e.g., holding times, blank sample analysis, matrix spike/duplicate analysis, laboratory control sample analysis) supplied to WESTON for the analyses met acceptance criteria specified in the work plan (Weston 2004), with no exceptions noted.

Samples collected from three wells; RA-MW-12A, RA-MW-15B, and B87-8; were collected both as total recoverable (unfiltered) and dissolved (field-filtered) fractions – with one fraction submitted for total recoverable chromium analysis and the other filtered at the time of collection and submitted for dissolved chromium analysis. An additional sample was collected from wells RA-MW-12A and RA-MW-15B as field duplicates and submitted for total recoverable chromium analysis. Additionally, a field duplicate sample was collected from well RA-MW-15B and submitted for dissolved chromium analyses and a field duplicate sample was collected from well W85-6A and submitted for sulfate analysis. A field duplicate sample was not collected for hexavalent chromium or dissolved sulfur analysis.

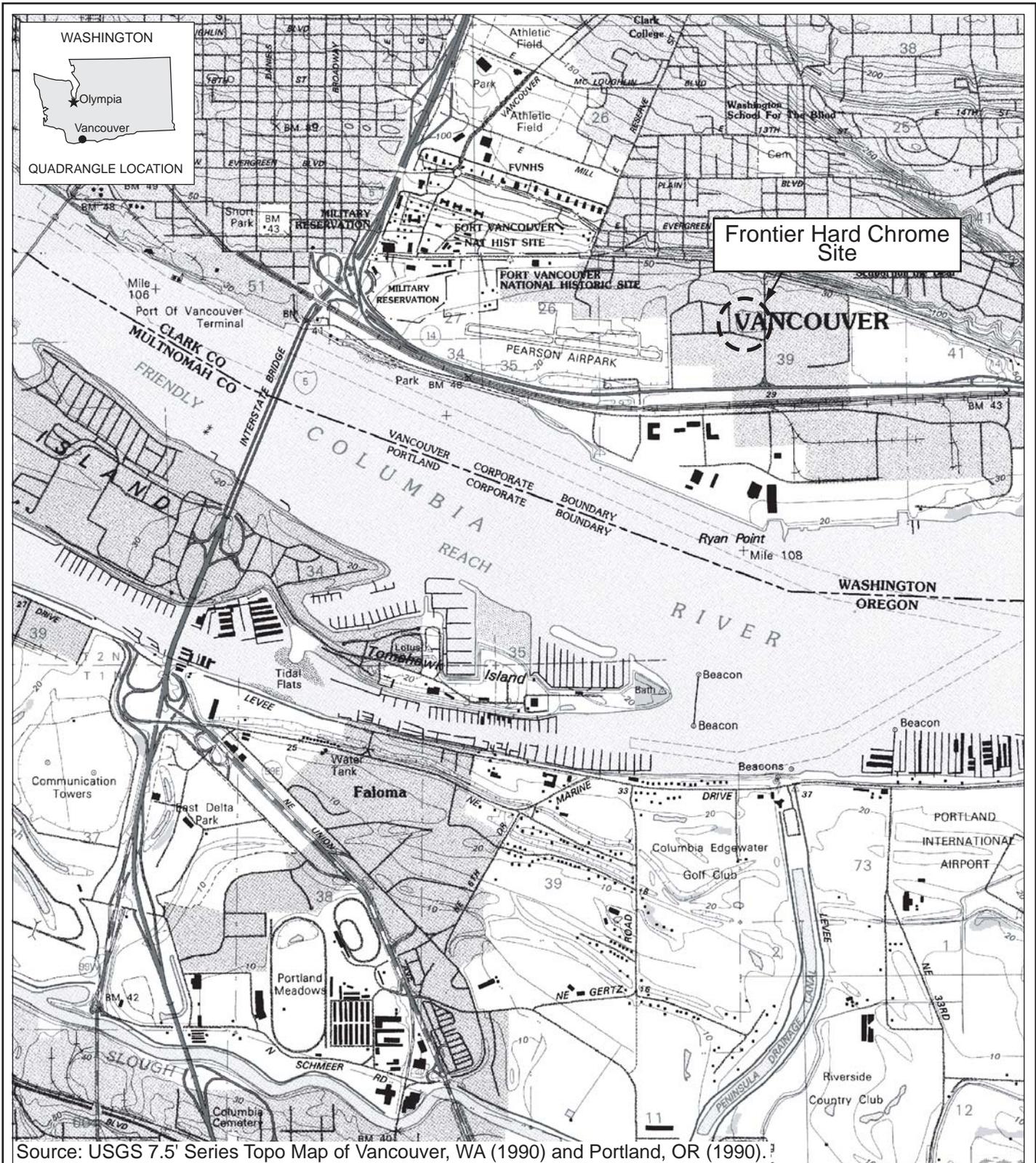
Data validation documentation is provided in Appendix D.

4. REFERENCES

EPA (United States Environmental Protection Agency), 2008. Five Year Review Report for Frontier Hard Chrome Superfund Site. January, 2008.

Weston (Weston Solutions, Inc.), 2004. Frontier Hard Chrome Long-Term Monitoring Plan. Prepared for the United States Environmental Protection Agency, Region 10, Seattle, Washington. February. 2004.

FIGURES



Source: USGS 7.5' Series Topo Map of Vancouver, WA (1990) and Portland, OR (1990).

Frontier Hard Chrome Vancouver, Washington Vicinity Map

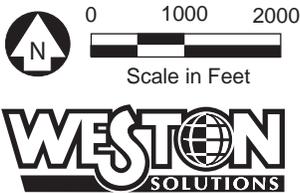
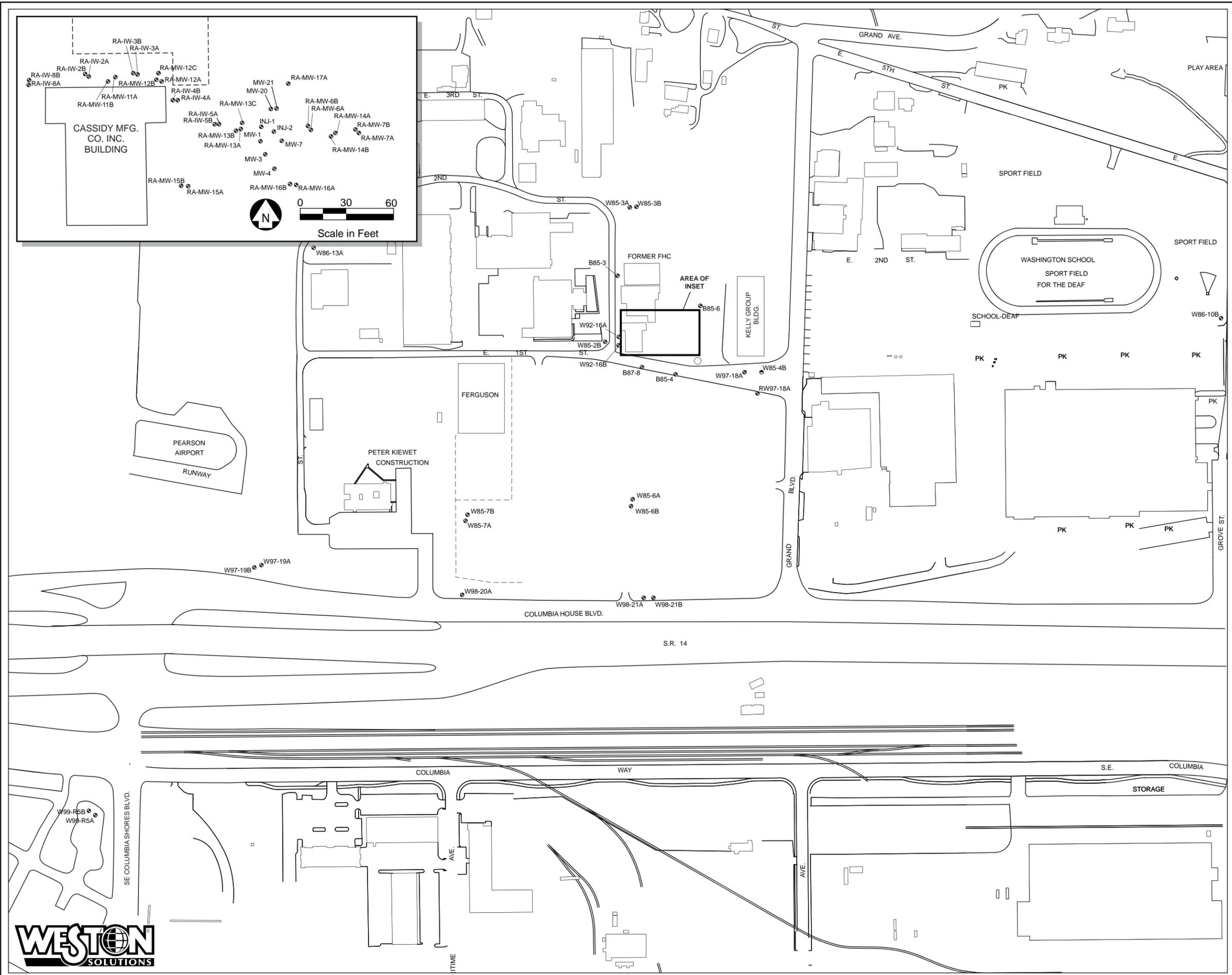


Figure
1



LEGEND

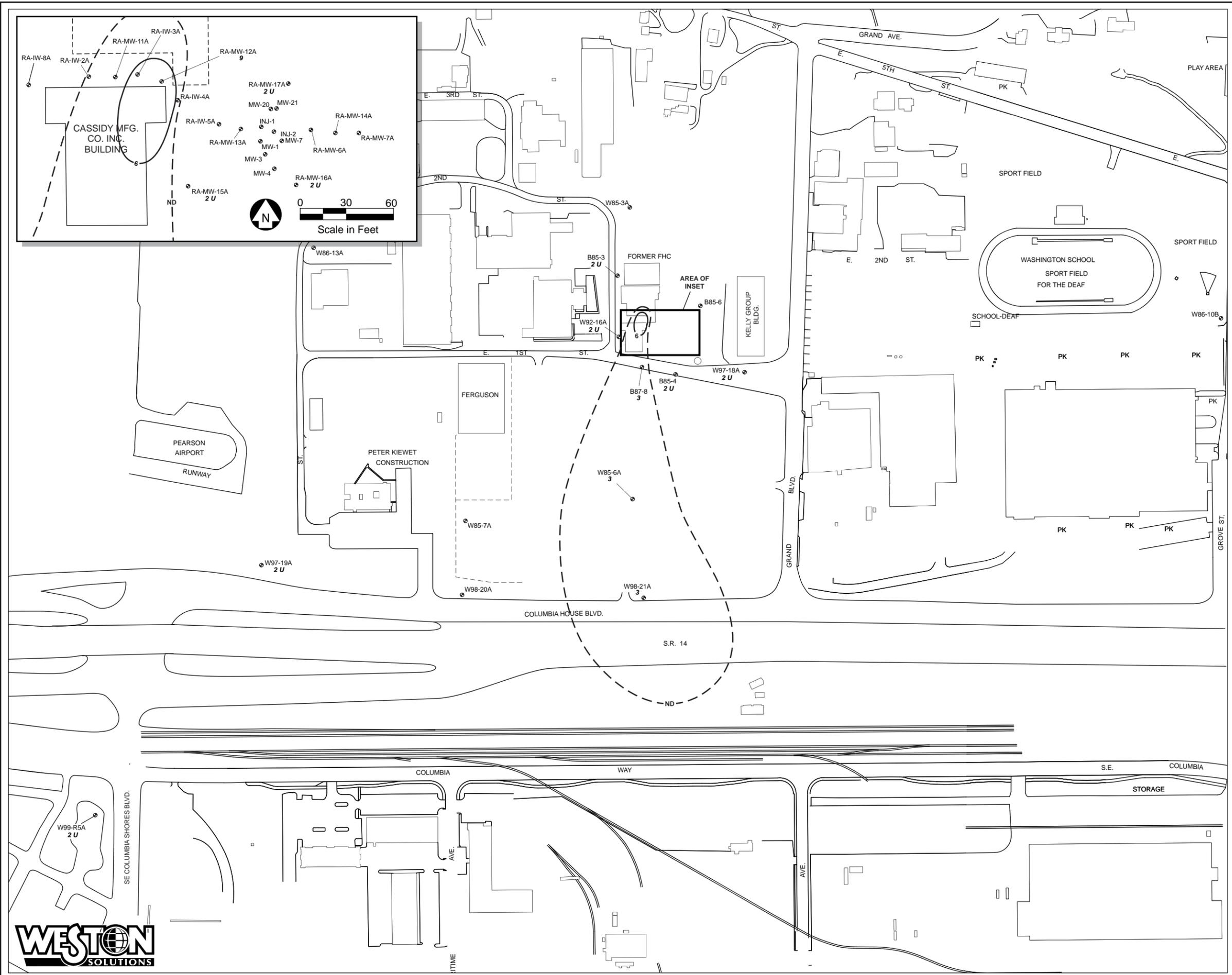
- W85-5B ● Monitoring Well Location and ID
- W85-4B ● Abandoned Well Location and ID
- Fence

0 150 300
Scale in Feet

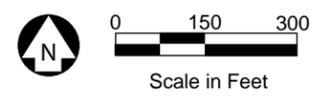
**Frontier Hard Chrome
Vancouver, Washington
Monitoring Well Locations**

Figure
2



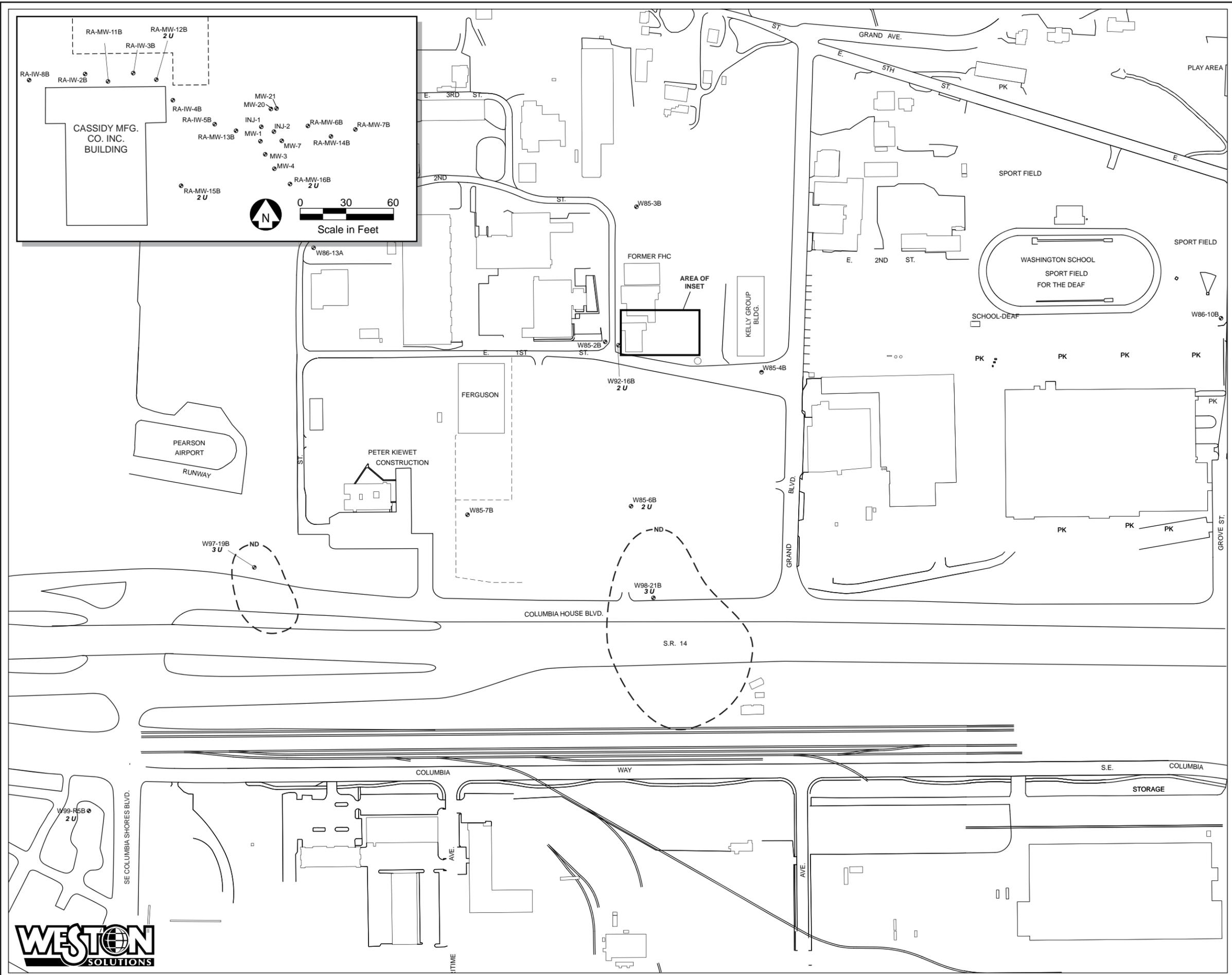


- LEGEND**
- W85-7A Monitoring Well Location and ID
 - 3 Chromium Concentration (µg/L)
 - 6 Concentration Contour (µg/L) - line dashed where estimated
 - U Analyte not detected at given concentration

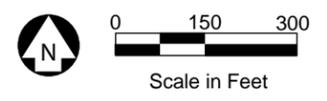


Frontier Hard Chrome
 Vancouver, Washington
 Chromium Concentrations
 in Zone A Groundwater
 September 2011



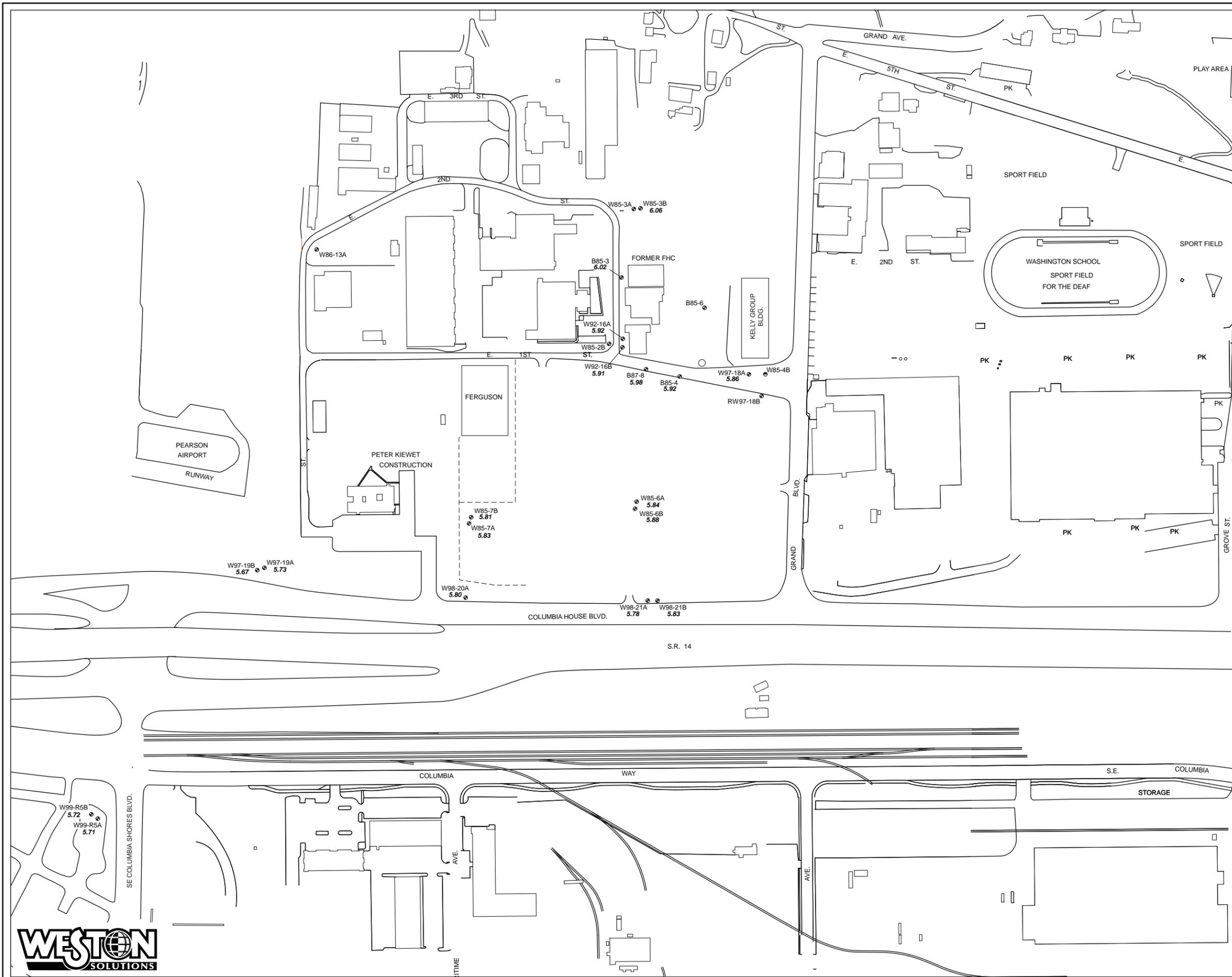


- LEGEND**
- W85-7A Monitoring Well Location and ID
 - W85-4B Abandoned Well Location and ID
 - 3 Chromium Concentration (µg/L)
 - 6 Concentration Contour (µg/L) - line dashed where estimated
 - U Analyte not detected at given concentration



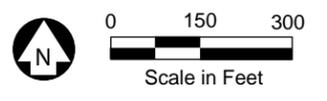
**Frontier Hard Chrome
Vancouver, Washington
Chromium Concentrations
in Zone B Groundwater
September 2011**





LEGEND

- W85-7A ● Monitoring Well Location and ID
- W85-4B ● Abandoned Well Location and ID
- 3.93 Groundwater Elevation (ft. AMSL)
- Not Measured



Frontier Hard Chrome
Vancouver, Washington
Groundwater Elevations
September 12, 2011



TABLES

Table 1: Frontier Hard Chrome - Event 17 Chromium Results

Well Number ¹	Concentration (µg/L)		Sample Observations
	Total	Dissolved	
B85-3	2 U	—	Slightly yellow; no significant odor or sheen
B85-4	2 U	—	Clear; no significant odor or sheen
B87-8	4	3	Clear; no sheen; slight sulfur odor
RA-MW-12A	26	9	Slightly yellow; no sheen; strong sulfur odor
RA-MW-12B	2 U	—	Clear; no sheen; moderate sulfur odor
RA-MW-12C	2 U	—	Clear; no sheen; slight sulfur odor
RA-MW-15A	2 U	—	Clear; no significant odor or sheen
RA-MW-15B	2 U	2 U	Clear; no significant odor or sheen
RA-MW-16A	2 U	—	Clear; no significant odor or sheen
RA-MW-16B	2 U	—	Clear; no significant odor or sheen
RA-MW-17A	2 U	—	Clear; no significant odor or sheen
W85-6A	3	—	Clear; no significant odor or sheen
W85-6B	2 U	—	Clear; no significant odor or sheen
W92-16A	2 U	—	Clear; no significant odor or sheen
W92-16B	2 U	—	Clear; no significant odor or sheen
W97-18A	2 U	—	Clear; no significant odor or sheen
W97-19A	2 U	—	Clear; no significant odor or sheen
W97-19B	3	—	Clear; no significant odor or sheen
W98-21A	3	—	Clear; no significant odor or sheen
W98-21B	3	—	Clear; no significant odor or sheen
W99-R5A	2 U	—	Clear; no significant odor or sheen
W99-R5B	2 U	—	Clear; no significant odor or sheen

— = Not Analyzed

U = analyte not detected above laboratory reporting limit

µg/L = micrograms per liter

1 = Only the 22 wells that were proposed to be sampled during Event 17 are included.

Table 2: Frontier Hard Chrome - Event 17 Monitoring Field Parameters¹

Well Number ²	Temp (°C)	Specific Cond. (mS/cm)	DO (mg/L)	pH	ORP (mV)	Dissolved Sulfur ³ (mg/L)	Sulfate ³ (mg/L)	Turbidity (NTU)
B85-3	14.00	0.651	0.62	5.82	-49.8	—	—	1.51
B85-4	14.87	0.335	0.55	5.20	479.1	12.60	38.3	1.11
B87-8	14.59	0.313	0.62	6.14	41.7	11.70	35.4	2.54
RA-MW-12A	14.45	2.550	1.28	6.58	-332.7	—	—	40.00
RA-MW-12B	14.04	0.782	0.27	6.43	-308.2	—	—	0.99
RA-MW-12C	14.48	0.544	0.18	6.68	-275.3	—	—	0.68
RA-MW-15A	14.33	0.891	0.56	5.80	68.1	—	—	2.46
RA-MW-15B	14.29	0.325	0.54	6.33	406.5	—	—	0.95
RA-MW-16A	14.21	0.825	0.65	4.35	315.4	—	—	1.05
RA-MW-16B	14.11	0.497	0.36	5.43	489.5	—	—	0.85
RA-MW-17A	13.83	0.960	0.45	5.57	53.7	—	—	1.12
W85-6A	15.23	0.224	3.51	6.07	328.4	7.27	21.8	0.51
W85-6B	15.00	0.175	9.20	7.80	356.8	—	—	0.54
W92-16A	15.12	0.355	0.48	5.47	413.3	—	—	0.47
W92-16B	14.95	0.265	8.21	5.93	459	—	—	1.90
W97-18A	14.50	0.161	0.66	5.20	504.5	—	—	0.88
W97-19A	14.92	0.236	3.67	3.30	608.5	—	—	0.70
W97-19B	15.00	0.242	4.06	4.94	561.7	—	—	0.54
W98-21A	14.49	0.224	3.52	5.62	453.3	—	—	0.59
W98-21B	14.69	0.199	7.13	5.34	485.8	—	—	0.61
W99-R5A	14.82	0.222	5.13	5.60	403.1	5.15	15.9	0.54
W99-R5B	14.43	0.233	4.55	5.95	414	—	—	0.90

- = Not Analyzed
 mg/L = milligrams per liter
 mV = millivolts
 NTU = nephelometric turbidity unit
 mS/cm = milliSiemens per centimeter
 1 = Parameters recorded after measurements stabilized
 2 = Only the 22 wells that were proposed to be sampled during Event 17 are included
 3 = Sulfur and Sulfate data obtained from laboratory analysis

Table 3: Comparison of Conventional Parameters

Well Number	Temperature (°C)																
	Feb-04	Apr-04	Aug-04	May-05	Dec-05	Mar-06	Jun-06	Sep-06	Dec-06	Mar-07	Jun-07	Sep-07	Dec-07	Sep-08	Sep-09	Sep-10	Sep-11
B85-3	14.6	14.8	15.2	15.8	14.4	14.1	13.6	14.6	12.4	12.5	13.6	13.7	13.1	8.0	14.0	13.2	14.0
B85-4	14.1	14.4	15.1	14.4	13.9	13.5	14.3	14.5	13.8	14.6	14.4	—	13.5	8.7	14.7	17.0	14.9
B87-8	14.5	14.7	15.8	15.2	14.7	14.4	14.5	14.4	13.8	14.4	14.3	14.5	13.6	8.8	14.3	13.7	14.6
RA-MW-12A	14.9	15.9	17.9	15.2	14.9	14.6	14.3	14.9	13.9	14.0	13.9	14.4	13.8	8.7	15.5	13.5	14.5
RA-MW-12B	14.4	16.6	16.7	15.6	14.3	14.9	14.4	14.5	13.4	14.3	14.1	14.4	13.3	8.5	14.2	13.7	14.0
RA-MW-12C	14.4	16.5	16.6	15.1	14.2	14.3	14.2	14.2	13.1	13.3	14.1	14.1	13.2	8.5	14.4	13.2	14.5
RA-MW-15A	14.3	14.5	15.0	15.0	14.7	14.8	14.7	15.1	14.7	15.3	15.1	14.7	13.6	9.0	14.6	14.1	14.3
RA-MW-15B	13.9	14.4	15.4	14.7	14.1	14.0	14.5	17.2	14.1	14.8	14.9	14.3	13.4	8.8	14.6	14.0	14.3
RA-MW-16A	14.3	14.9	16.0	14.9	15.1	13.3	13.4	14.8	13.8	14.0	13.9	14.1	—	8.6	14.2	13.8	14.2
RA-MW-16B	14.3	14.6	16.0	14.7	13.9	13.7	13.8	15.2	13.4	14.3	13.8	14.1	—	8.8	14.4	14.0	14.1
RA-MW-17A	14.3	15.3	16.7	15.1	14.5	13.7	—	13.9	13.4	13.1	14.1	13.8	13.4	8.5	13.7	13.8	13.8
W85-6A	14.1	14.1	15.5	14.0	—	—	13.7	15.3	13.9	13.2	13.6	14.1	13.2	8.7	15.7	14.4	15.2
W85-6B	13.6	13.8	16.3	13.7	—	—	13.8	15.1	13.1	13.1	13.8	15.0	12.9	8.6	16.6	14.5	15.0
W92-16A	14.2	15.6	16.1	15.3	14.0	13.8	14.1	15.5	13.6	13.3	14.5	14.5	13.3	8.6	14.8	14.3	15.1
W92-16B	14.1	14.7	16.2	15.2	13.7	13.7	13.8	15.4	13.1	13.3	14.4	14.6	13.0	8.7	14.6	14.0	15.0
W97-18A	11.3	11.0	15.0	12.7	13.9	12.0	—	13.8	13.0	11.6	12.5	13.2	13.0	7.8	13.7	13.6	14.5
W97-19A	12.5	13.3	16.0	14.3	13.8	12.9	—	15.3	13.9	13.8	14.1	14.3	13.3	8.7	14.9	14.3	14.9
W97-19B	12.7	13.3	15.9	15.3	13.3	12.4	—	15.2	13.0	14.2	14.4	14.5	12.9	8.8	14.1	14.2	15.0
W98-21A	13.1	14.3	14.2	13.8	13.9	13.8	13.7	15.0	13.7	13.7	14.0	14.5	12.3	8.4	17.1	14.1	14.5
W98-21B	13.1	13.6	14.0	13.8	13.7	13.0	13.7	14.7	13.4	13.5	14.2	14.5	13.2	8.5	16.7	13.8	14.7
W99-R5A	14.2	14.9	15.7	14.8	14.8	14.7	15.1	—	13.9	13.9	15.5	15.4	14.1	10.0	14.7	14.3	14.8
W99-R5B	13.9	14.4	15.6	14.4	14.5	13.9	14.7	—	13.5	13.5	15.0	15.2	13.6	9.5	15.1	14.2	14.4
RA-MW-11A	15.7	16.5	17.4	15.7	15.0	15.1	15.1	14.9	13.7	13.8	14.0	14.0	13.5	—	—	—	—
RA-MW-11B	14.9	16.3	17.0	15.6	14.9	14.7	14.7	14.7	13.4	13.6	14.1	14.3	13.2	—	—	—	—
RA-MW-13A	15.0	14.6	15.7	14.9	14.5	14.3	13.7	14.1	12.8	13.8	14.3	14.3	13.2	—	—	—	—
RA-MW-13B	14.8	14.7	15.4	14.9	14.2	14.3	14.1	14.2	13.0	13.9	14.2	13.8	13.2	—	—	—	—
RA-MW-13C	14.2	15.0	14.9	14.5	14.3	13.8	13.8	14.1	12.4	13.9	14.0	14.0	12.9	—	—	—	—
RA-MW-14A	13.9	14.3	15.3	14.6	14.7	10.8	—	13.6	12.7	10.8	13.0	13.2	12.9	—	—	—	—
RA-MW-14B	14.0	14.9	15.5	14.5	14.1	12.3	—	14.0	12.8	11.3	13.8	13.5	12.9	—	—	—	—
W85-7A	11.4	12.6	14.9	13.9	14.5	12.3	13.7	15.9	13.4	12.7	13.4	—	14.5	—	—	—	—
W85-7B	12.1	13.0	14.5	13.6	14.1	12.8	13.4	14.4	13.0	13.0	13.4	—	13.4	—	—	—	—
W97-18B	11.4	12.4	14.4	13.5	13.0	10.7	—	13.8	12.6	12.0	13.6	—	—	—	—	—	—
W98-20A	13.8	12.5	15.4	14.3	14.3	13.1	—	15.3	14.0	13.1	13.6	—	13.2	—	—	—	—

(Table 3 continued)

Well Number	Specific Conductivity (mS/cm)																
	Feb-04	Apr-04	Aug-04	May-05	Dec-05	Mar-06	Jun-06	Sep-06	Dec-06	Mar-07	Jun-07	Sep-07	Dec-07	Sep-08	Sep-09	Sep-10	Sep-11
B85-3	0.99	0.90	0.98	0.81	0.54	0.74	0.64	0.72	0.97	0.84	0.68	0.77	0.90	0.81	0.77	0.72	0.65
B85-4	0.41	1.17	0.51	0.71	0.28	0.74	0.33	0.56	0.92	739.00	0.60	—	0.43	0.63	0.58	0.55	0.34
B87-8	0.26	0.55	0.36	0.29	0.24	0.38	0.27	0.36	0.44	0.39	0.19	0.33	0.36	0.27	0.32	0.45	0.31
RA-MW-12A	6.01	5.40	4.00	3.32	2.52	2.47	2.37	2.26	2.95	0.85	1.11	1.98	2.34	2.55	2.92	2.59	2.55
RA-MW-12B	2.25	1.19	1.52	2.56	2.47	1.34	1.39	1.19	2.12	1.12	0.89	1.55	1.49	1.55	1.74	1.11	0.78
RA-MW-12C	2.18	1.34	1.13	0.68	1.09	0.69	0.88	0.53	1.05	0.65	0.49	0.58	0.81	0.80	0.97	0.72	0.54
RA-MW-15A	1.88	1.04	1.08	1.30	1.42	1.53	1.44	1.27	1.74	1.10	1.06	1.06	1.28	1.03	1.04	0.99	0.89
RA-MW-15B	0.47	0.86	0.68	0.64	0.91	0.92	0.80	0.46	1.60	1.16	0.49	0.81	1.22	0.93	0.85	0.49	0.33
RA-MW-16A	2.95	1.46	2.00	1.70	1.07	1.04	1.01	0.80	1.13	1.02	0.83	0.91	—	0.93	1.04	0.89	0.83
RA-MW-16B	2.42	1.19	1.40	1.81	0.92	0.67	0.51	0.43	1.34	1.05	0.32	0.48	—	0.74	0.66	0.49	0.50
RA-MW-17A	1.80	1.80	1.80	1.39	1.18	1.30	—	1.18	1.30	1.04	1.03	1.16	1.47	1.46	1.43	1.23	0.96
W85-6A	0.11	0.33	0.34	299.00	—	—	0.23	0.24	0.24	0.36	0.27	0.32	0.30	0.27	0.24	0.26	0.22
W85-6B	0.31	0.41	0.33	0.26	—	—	0.10	0.11	0.17	0.24	0.19	0.20	0.26	0.32	0.22	0.19	0.18
W92-16A	0.33	0.25	0.27	0.23	0.24	0.28	0.28	0.37	0.47	0.57	0.47	0.53	0.64	0.61	0.48	0.36	0.36
W92-16B	1.17	1.37	0.95	0.66	0.09	0.34	0.42	0.32	0.61	0.57	0.25	0.44	0.60	0.50	0.15	0.21	0.27
W97-18A	0.11	0.09	0.11	0.08	0.10	0.19	—	0.15	0.16	0.16	0.10	0.14	0.18	0.23	0.21	0.19	0.16
W97-19A	0.25	0.26	0.28	0.23	0.23	0.19	—	0.21	0.26	0.24	0.19	0.22	0.26	0.30	0.30	0.26	0.24
W97-19B	0.26	0.26	0.29	0.22	0.06	0.19	—	0.20	0.28	0.23	0.19	0.21	0.25	0.30	0.09	0.26	0.24
W98-21A	0.16	0.23	0.29	0.45	0.19	0.19	0.22	0.25	0.29	0.29	0.27	0.27	0.09	0.29	0.30	0.28	0.22
W98-21B	0.24	0.27	0.27	0.25	0.18	0.22	0.21	0.24	0.32	0.31	0.21	0.26	0.27	0.29	0.26	0.30	0.20
W99-R5A	0.24	0.25	0.24	0.22	0.21	0.20	0.20	—	0.27	0.22	0.21	0.21	0.20	0.27	0.28	0.26	0.22
W99-R5B	0.26	0.26	0.27	0.23	0.22	0.22	0.22	—	0.28	0.24	0.21	0.22	0.26	0.29	0.27	0.25	0.23
RA-MW-11A	1.67	1.89	2.02	1.48	1.82	2.01	1.46	1.70	2.21	1.75	1.22	1.62	1.99	—	—	—	—
RA-MW-11B	1.49	2.08	2.02	1.72	2.25	1.17	0.94	1.10	1.50	1.21	0.77	1.05	1.59	—	—	—	—
RA-MW-13A	5.21	2.42	3.29	2.83	2.49	2.17	1.66	1.13	2.33	1.34	1.23	1.47	1.69	—	—	—	—
RA-MW-13B	3.73	1.38	2.15	2.41	2.16	0.81	0.82	0.50	2.22	1.23	0.50	0.98	1.34	—	—	—	—
RA-MW-13C	3.07	1.82	1.41	1.28	0.71	0.79	0.82	0.57	1.36	0.93	0.51	0.60	0.93	—	—	—	—
RA-MW-14A	1.43	1.71	1.96	1.08	0.88	0.87	—	0.92	0.77	0.87	0.74	0.89	0.95	—	—	—	—
RA-MW-14B	1.56	1.21	0.98	1.08	1.00	0.78	—	0.69	0.89	0.87	0.68	0.85	1.02	—	—	—	—
W85-7A	0.13	0.14	0.21	0.12	0.11	0.10	0.16	0.16	0.13	219.00	0.11	—	0.27	—	—	—	—
W85-7B	0.28	0.31	0.32	0.01	0.01	0.01	0.02	0.01	0.03	0.01	0.02	—	0.02	—	—	—	—
W97-18B	0.26	0.24	0.27	0.22	0.19	0.19	—	0.19	0.28	0.23	0.17	—	-	—	—	—	—
W98-20A	0.16	0.15	0.23	0.12	0.12	0.13	—	0.18	0.25	0.18	0.16	—	0.26	—	—	—	—

(Table 3 continued)

Well Number	Dissolved Oxygen (mg/L)																
	Feb-04	Apr-04	Aug-04	May-05	Dec-05	Mar-06	Jun-06	Sep-06	Dec-06	Mar-07	Jun-07	Sep-07	Dec-07	Sep-08	Sep-09	Sep-10	Sep-11
B85-3	1.11	0.16	1.57	4.50	0.12	2.97	0.22	1.04	0.80	0.02	0.24	0.15	0.21	0.18	0.39	0.27	0.62
B85-4	0.65	1.37	1.50	0.33	0.20	0.22	0.52	1.61	0.30	0.03	0.27	—	0.24	0.26	0.40	0.34	0.55
B87-8	0.13	1.03	1.06	0.35	0.28	0.53	0.37	0.52	0.25	0.01	7.00	0.19	0.11	0.24	0.40	0.17	0.62
RA-MW-12A	0.24	0.09	0.20	0.13	0.04	0.00	52.70	17.00	56.41	0.00	0.00	-0.47	0.00	0.00	0.51	1.96	1.28
RA-MW-12B	0.27	0.07	0.27	0.07	0.05	1.26	45.10	12.16	73.22	0.00	9.82	-0.39	0.00	0.00	0.40	0.23	0.27
RA-MW-12C	0.20	0.14	0.42	0.25	0.07	1.10	5.16	4.93	3.33	0.01	0.40	0.23	0.00	0.28	0.53	0.20	0.18
RA-MW-15A	0.33	0.21	1.53	0.47	0.15	8.34	0.47	2.89	0.29	0.04	0.19	0.48	0.10	0.32	0.48	0.32	0.56
RA-MW-15B	0.22	0.10	0.74	0.44	0.18	0.79	0.30	1.25	0.30	0.06	0.15	0.18	0.12	0.30	0.60	0.26	0.54
RA-MW-16A	0.73	0.27	1.39	1.60	0.11	5.40	0.54	0.49	0.31	0.05	0.36	0.31	—	0.15	0.43	0.31	0.65
RA-MW-16B	0.75	0.15	0.86	0.75	0.33	1.85	0.27	0.27	0.21	0.05	0.24	0.16	—	0.19	0.33	0.25	0.36
RA-MW-17A	0.60	0.19	1.99	0.60	0.20	3.69	—	0.74	0.35	0.11	0.14	0.22	0.10	0.19	0.51	0.32	0.45
W85-6A	4.92	0.43	0.85	4.90	—	—	1.86	2.06	2.63	0.09	0.51	0.93	2.52	2.08	4.01	2.97	3.51
W85-6B	3.46	6.13	6.54	5.50	—	—	7.87	3.83	5.15	0.05	4.96	5.95	6.10	4.87	13.98	10.48	9.20
W92-16A	0.98	0.13	2.49	3.10	0.28	0.15	0.45	0.32	0.33	0.13	0.32	0.22	0.11	0.15	0.54	0.28	0.48
W92-16B	0.14	0.53	1.97	3.40	5.40	1.02	0.54	2.12	0.23	0.80	4.16	1.60	0.11	1.31	14.02	10.90	8.21
W97-18A	1.27	0.74	1.09	0.50	1.10	4.00	—	1.45	0.90	0.90	0.67	0.69	0.69	0.64	0.33	0.19	0.66
W97-19A	4.72	1.79	22.73	4.60	0.97	3.51	—	3.50	9.37	1.00	3.74	3.57	4.69	3.92	6.56	2.42	3.67
W97-19B	1.81	1.31	2.60	2.60	1.10	2.99	—	3.43	4.13	0.52	2.83	3.55	3.44	3.01	9.81	1.67	4.06
W98-21A	1.29	1.49	3.03	13.30	1.20	1.05	3.26	2.59	4.97	0.07	0.80	2.44	2.53	2.58	3.18	2.81	3.52
W98-21B	1.24	3.29	2.82	17.70	3.90	1.08	3.37	2.42	4.90	0.02	3.52	1.98	2.73	2.58	8.21	2.60	7.13
W99-R5A	4.72	4.26	5.60	5.30	3.30	1.83	5.10	—	6.26	4.90	4.53	4.55	5.38	5.40	6.33	5.10	5.13
W99-R5B	3.97	2.71	4.70	5.10	1.90	2.03	4.20	—	4.90	3.40	3.49	3.86	4.66	4.34	5.76	5.03	4.55
RA-MW-11A	0.32	0.10	0.66	6.69	0.16	0.00	24.20	22.50	1.80	0.00	0.13	-0.12	0.00	—	—	—	—
RA-MW-11B	0.19	0.15	0.50	0.14	0.10	0.19	26.60	4.44	2.50	0.00	0.81	0.15	0.00	—	—	—	—
RA-MW-13A	1.63	0.17	1.13	0.53	0.11	0.38	0.27	1.00	0.00	0.04	0.24	0.20	0.11	—	—	—	—
RA-MW-13B	0.73	0.16	0.73	0.51	0.21	0.45	0.35	0.49	0.00	0.09	0.14	0.51	0.09	—	—	—	—
RA-MW-13C	0.22	0.15	0.43	1.40	2.98	0.96	0.41	0.80	0.00	0.06	0.46	0.26	0.07	—	—	—	—
RA-MW-14A	0.89	0.22	5.96	0.51	0.22	6.74	—	0.88	1.75	0.60	0.21	0.17	0.11	—	—	—	—
RA-MW-14B	1.08	0.10	2.77	0.42	0.12	2.58	—	0.52	1.73	0.90	0.13	0.20	0.10	—	—	—	—
W85-7A	4.05	3.17	2.18	4.30	2.20	6.70	5.89	3.09	2.39	0.18	3.29	—	2.60	—	—	—	—
W85-7B	2.78	5.11	6.10	8.70	4.00	10.30	10.96	3.77	0.06	0.10	8.79	—	7.85	—	—	—	—
W97-18B	2.01	5.56	4.52	4.90	2.00	1.17	—	4.25	4.59	1.09	4.72	—	—	—	—	—	—
W98-20A	4.92	3.76	5.50	5.00	3.20	5.10	—	3.63	9.14	5.70	3.03	—	4.87	—	—	—	—

(Table 3 continued)

Well Number	pH																
	Feb-04	Apr-04	Aug-04	May-05	Dec-05	Mar-06	Jun-06	Sep-06	Dec-06	Mar-07	Jun-07	Sep-07	Dec-07	Sep-08	Sep-09	Sep-10	Sep-11
B85-3	6.49	6.68	6.91	6.39	6.70	6.64	6.42	6.33	6.73	6.68	6.66	6.88	7.02	6.88	6.74	6.85	5.82
B85-4	6.14	6.26	6.53	6.22	6.51	6.49	6.21	6.28	6.47	6.53	6.53	—	7.21	6.62	6.28	6.41	5.20
B87-8	6.55	6.31	6.73	6.54	6.68	6.57	6.35	6.61	6.71	6.71	6.89	6.99	7.44	6.90	6.90	6.63	6.14
RA-MW-12A	8.86	8.73	8.86	8.98	8.41	8.19	8.46	8.54	7.59	7.86	7.97	7.97	8.53	7.16	7.64	7.79	6.58
RA-MW-12B	7.77	7.83	7.92	8.30	8.68	8.16	7.76	7.83	8.06	7.94	7.55	7.79	8.28	7.75	7.25	7.31	6.43
RA-MW-12C	8.13	7.92	8.09	7.95	8.14	7.89	7.92	7.90	7.74	7.80	7.79	8.14	8.57	7.99	7.81	7.70	6.68
RA-MW-15A	6.35	6.37	6.74	6.20	6.30	6.47	6.28	6.09	6.53	6.61	6.50	6.68	7.19	6.63	6.53	6.51	5.80
RA-MW-15B	6.35	6.83	7.18	6.39	6.39	6.51	6.26	6.61	6.39	6.48	6.84	6.73	7.18	6.66	6.52	7.01	6.33
RA-MW-16A	6.61	6.61	6.75	6.42	6.44	6.62	6.44	5.96	6.68	6.71	6.64	6.82	—	6.74	6.62	6.56	4.35
RA-MW-16B	6.42	7.12	7.09	6.31	7.12	7.06	6.85	6.09	6.62	6.78	7.27	7.41	—	7.11	7.18	7.28	5.43
RA-MW-17A	6.55	6.43	6.61	6.20	6.39	6.50	—	6.42	6.66	6.59	6.47	6.69	7.26	6.65	6.68	6.55	5.57
W85-6A	6.23	6.22	6.40	6.36	—	—	6.25	5.47	6.63	6.47	6.50	6.77	6.85	6.71	6.24	6.52	6.07
W85-6B	6.40	6.42	6.68	6.62	—	—	8.93	7.16	8.05	6.83	6.76	7.15	7.09	6.87	8.50	9.12	7.80
W92-16A	6.42	6.42	6.72	6.60	6.56	6.60	6.67	5.87	6.59	6.52	6.44	6.75	7.41	6.61	6.40	6.56	5.47
W92-16B	7.51	7.58	7.63	7.59	6.88	7.54	7.38	6.35	7.46	7.62	7.51	7.70	8.23	7.21	7.22	7.17	5.93
W97-18A	5.83	5.96	6.19	6.17	6.78	6.57	—	5.08	6.29	6.32	6.23	6.54	7.07	6.33	6.33	6.30	5.20
W97-19A	6.35	6.24	6.28	6.35	6.59	6.41	—	5.53	6.55	6.58	6.57	6.91	7.33	6.51	6.35	6.53	3.30
W97-19B	6.68	6.49	6.30	6.47	6.68	6.68	—	5.89	6.83	6.76	6.72	6.95	7.50	6.65	7.14	6.78	4.94
W98-21A	5.92	6.07	6.68	6.18	6.30	6.25	6.11	4.80	6.16	6.43	6.34	6.53	6.81	6.48	6.07	6.25	5.62
W98-21B	6.04	6.07	6.90	6.24	6.64	6.36	6.07	5.55	6.38	6.39	6.46	6.48	7.08	6.44	6.19	6.38	5.34
W99-R5A	6.03	5.98	6.28	6.21	6.22	6.28	6.23	—	6.40	6.30	6.18	6.58	6.73	6.31	6.52	6.35	5.60
W99-R5B	6.20	6.23	6.55	6.33	6.63	6.55	6.26	—	6.62	6.63	6.54	6.90	6.92	6.54	6.66	6.67	5.95
RA-MW-11A	7.51	7.53	7.00	6.52	6.64	6.64	6.46	6.48	6.43	6.69	6.68	6.86	7.26	—	—	—	—
RA-MW-11B	7.66	7.90	7.20	6.70	6.73	7.00	6.69	6.85	6.86	7.01	6.94	7.17	7.61	—	—	—	—
RA-MW-13A	7.15	7.15	7.03	6.70	6.86	6.82	6.82	6.96	7.02	7.08	6.95	7.11	7.21	—	—	—	—
RA-MW-13B	7.23	7.56	7.30	6.86	6.99	7.15	6.95	7.52	7.04	7.06	7.43	7.35	7.27	—	—	—	—
RA-MW-13C	7.36	7.35	7.44	7.33	7.48	7.25	7.25	7.45	7.45	7.44	7.53	7.81	7.62	—	—	—	—
RA-MW-14A	6.64	6.81	6.99	6.50	6.60	6.60	—	5.98	6.76	6.65	6.62	6.89	6.85	—	—	—	—
RA-MW-14B	6.90	7.14	7.33	6.75	6.78	6.87	—	6.40	6.98	6.82	6.89	7.06	7.04	—	—	—	—
W85-7A	6.24	6.04	6.26	6.20	6.30	6.35	6.24	5.69	6.45	6.33	6.40	—	6.61	—	—	—	—
W85-7B	6.63	6.51	6.71	5.91	6.18	6.14	6.37	5.39	6.57	6.23	6.30	—	6.71	—	—	—	—
W97-18B	6.57	6.35	6.67	6.41	6.60	6.16	—	6.25	6.55	6.61	6.68	—	—	—	—	—	—
W98-20A	6.01	5.91	6.32	5.97	6.29	6.18	—	4.90	6.26	6.41	6.19	—	7.02	—	—	—	—

(Table 3 continued)

Well Number	ORP (mV)																
	Feb-04	Apr-04	Aug-04	May-05	Dec-05	Mar-06	Jun-06	Sep-06	Dec-06	Mar-07	Jun-07	Sep-07	Dec-07	Sep-08	Sep-09	Sep-10	Sep-11
B85-3	-7	-107	-37	-47	-93	-62	-43	-53	-59	-43	-66	-30	-52	-39	27	-61	-50
B85-4	10	41	59	218	-26	75	86	179	161	182	90	—	123	108	162	220	479
B87-8	-8	31	17	199	2	73	86	160	167	170	87	95	106	96	107	12	42
RA-MW-12A	-468	-466	-430	-417	-403	-393	-363	-311	-373	-324	-374	-369	-396	-310	-154	-304	-333
RA-MW-12B	-363	-321	-315	-415	-414	-345	-327	-355	-374	-313	-363	-361	-379	-318	-215	-283	-308
RA-MW-12C	-282	-179	-154	-239	-314	-234	-191	-164	-217	-137	-129	-235	-289	-219	-167	-233	-275
RA-MW-15A	-47	4	39	10	-12	-137	-28	-52	-24	13	-58	41	7	47	93	50	68
RA-MW-15B	-5	28	15	17	-11	16	34	76	32	48	-15	64	29	82	122	75	407
RA-MW-16A	-94	-45	-58	-156	-103	-160	-93	-125	-125	-112	-109	-21	—	-30	120	96	315
RA-MW-16B	-57	-70	-60	-85	-130	-131	-66	-155	-113	-88	-112	-43	—	-46	29	21	490
RA-MW-17A	-91	-40	-7	-5	-27	-89	—	-106	-34	-128	-79	74	-25	-11	-6	-39	54
W85-6A	17	57	86	163	—	—	107	356	123	172	168	240	176	218	200	144	328
W85-6B	19	76	72	159	—	—	79	340	70	164	161	236	177	229	165	117	357
W92-16A	1	-14	30	110	110	-32	61	129	127	76	100	98	112	113	154	118	413
W92-16B	-116	-61	-60	73	119	-103	30	253	113	71	60	116	114	121	152	151	459
W97-18A	32	57	67	103	58	137	—	317	192	119	135	133	130	147	60	140	505
W97-19A	71	94	72	218	69	149	—	311	96	71	156	233	128	205	127	155	609
W97-19B	56	86	56	52	76	142	—	295	88	74	153	240	121	193	138	163	562
W98-21A	28	69	79	182	113	160	114	484	157	-55	165	243	135	228	183	196	453
W98-21B	33	72	47	202	121	161	117	471	148	111	161	249	140	226	188	194	486
W99-R5A	58	96	97	153	123	197	116	—	131	100	81	237	186	226	134	174	403
W99-R5B	58	78	74	201	92	204	111	—	122	92	90	239	180	213	167	162	414
RA-MW-11A	-384	-391	-316	-110	-241	-246	-216	-294	-671	-260	-263	-258	-259	—	—	—	—
RA-MW-11B	-394	-393	-332	-296	-289	-301	-278	-317	-303	-261	-287	-276	-313	—	—	—	—
RA-MW-13A	-155	-102	-97	-94	-204	-176	-93	-153	-121	-125	-144	-69	-101	—	—	—	—
RA-MW-13B	-129	-123	-104	-105	-125	-197	-85	-152	-125	-144	-166	-79	-99	—	—	—	—
RA-MW-13C	-136	-126	-116	-142	-33	-175	-112	-135	-137	-133	-143	-100	-140	—	—	—	—
RA-MW-14A	-77	-41	-54	-75	-82	-136	—	-80	-64	-104	-154	-25	-14	—	—	—	—
RA-MW-14B	-112	-95	-102	-112	-134	-133	—	-98	-144	-141	-129	-57	-64	—	—	—	—
W85-7A	68	83	57	197	116	113	127	246	131	186	160	—	175	—	—	—	—
W85-7B	59	73	66	215	132	146	167	259	141	187	161	—	189	—	—	—	—
W97-18B	57	63	60	188	83	152	—	233	187	123	118	—	—	—	—	—	—
W98-20A	52	116	84	219	116	171	—	366	143	91	166	—	153	—	—	—	—

(Table 3 continued)

Well Number	Sulfur (mg/L)																
	Feb-04	Apr-04	Aug-04	May-05	Dec-05	Mar-06	Jun-06	Sep-06	Dec-06	Mar-07	Jun-07	Sep-07	Dec-07	Sep-08	Sep-09	Sep-10	Sep-11
B85-4	23	150	31	87	20	103	21	59	67	59	75	—	23	39	32	33	12.6
B87-8	9	52	22	17	23	48	21	42	31	34	43	28	24	14	17	35	11.7
W85-6A	—	15	14	18	—	—	12	15	7	26	19	19	10	9	6	7	7.27
W98-21A	—	—	—	—	8	10	—	—	—	—	—	—	—	—	—	—	—
W99-R5A	5	6	4	5	6	7	6	5	5	5	5	5	6	6	6	5	5.15
RA-MW-11A	286	296	304	285	460	448	322	402	342	311	304	311	345	—	—	—	—
RA-MW-13A	743	246	324	372	363	310	213	111	207	107	130	148	122	—	—	—	—
RA-MW-14A	189	228	214	136	122	158	124	140	72	107	117	113	103	—	—	—	—
W85-7A	3	4	5	4	4	3	5	6	3	10	4	—	7	—	—	—	—
	Sulfate (mg/L)																
B85-4	58	410	104	222	50	253	75	169	212	201	195	—	60	107	95	97	38
B87-8	21	137	73	170	63	125	74	117	98	113	120	87	61	39	54	102	35
W85-6A	5	36	44	44	—	—	35	41	21	85	51	59	27	20	19	20	22
W98-21A	—	—	—	—	19	25	—	—	—	—	—	—	—	—	—	—	—
W99-R5A	12	12	13	15	13	15	18	14	14	16	14	15	16	17	19	15	16
RA-MW-11A	620	751	1040	736	1200	3040	993	1170	1120	954	795	995	989	—	—	—	—
RA-MW-13A	1960	712	1056	985	971	1980	682	323	657	362	331	451	342	—	—	—	—
RA-MW-14A	477	635	697	357	351	429	396	400	225	358	283	347	284	—	—	—	—
W85-7A	6	9	15	13	8	8	18	16	7	30	10	—	18	—	—	—	—
—	= Not Analyzed																
mg/L	= milligrams per liter																
mV	= millivolts																
mS/cm	= milliSiemens per centimeter																

Table 4: Frontier Hard Chrome - Event 17 Ground Water Elevations - 12 September 2011

Well Number	Time	Casing Elevation (ft AMSL)	Depth to Water (ft)	Water level Elevation (ft AMSL)
W85-3A	—	26.40	—	—
W85-3B	1248	26.77	20.71	6.06
W97-18A ¹	1304	24.66	18.80	5.86
B85-4 ¹	1300	25.13	19.21	5.92
B87-8 ¹	1257	25.79	19.81	5.98
W92-16B	1250	25.51	19.60	5.91
W92-16A	1251	25.62	19.70	5.92
B85-3 ³	1254	24.90	18.88	6.02
W85-7A ¹	1227	26.22	20.39	5.83
W85-7B ¹	1228	26.41	20.60	5.81
W97-19A	1213	22.45 ²	16.72	5.73
W97-19B	1214	21.72 ²	16.05	5.67
W98-20A ¹	1222	26.62	20.82	5.80
W85-6A ¹	1351	25.90	20.06	5.84
W85-6B ¹	1241	25.85	19.97	5.88
W98-21B ¹	1235	27.05	21.22	5.83
W98-21A ¹	1234	26.79	21.01	5.78
W99-R5A	1201	32.26	26.55	5.71
W99-R5B	1204	32.33	26.61	5.72
USGS 14144700 ³	Daily Average for 9/12/2011			4.86

¹ = Casing elevation surveyed by Minister-Glaeser Surveying Inc, on November 30, 2007

² = Two different elevation datum's have been used at Frontier Hard Chrome. Weston (12/03) Long-Term Monitoring plan has applied a correction factor (+3.76 feet) using the City of Vancouver's benchmark #108 located near FHC site.

³ = Stage height of the Columbia River corrected to the NGVD 1929 (add 1.82 feet) for September 12, 2011

AMSL = Above Mean Sea Level

ft = feet

USGS = United States Geological Survey

— = Could not measure water level elevation due to obstruction covering well.

Table 5: Quality Assurance Sample Results

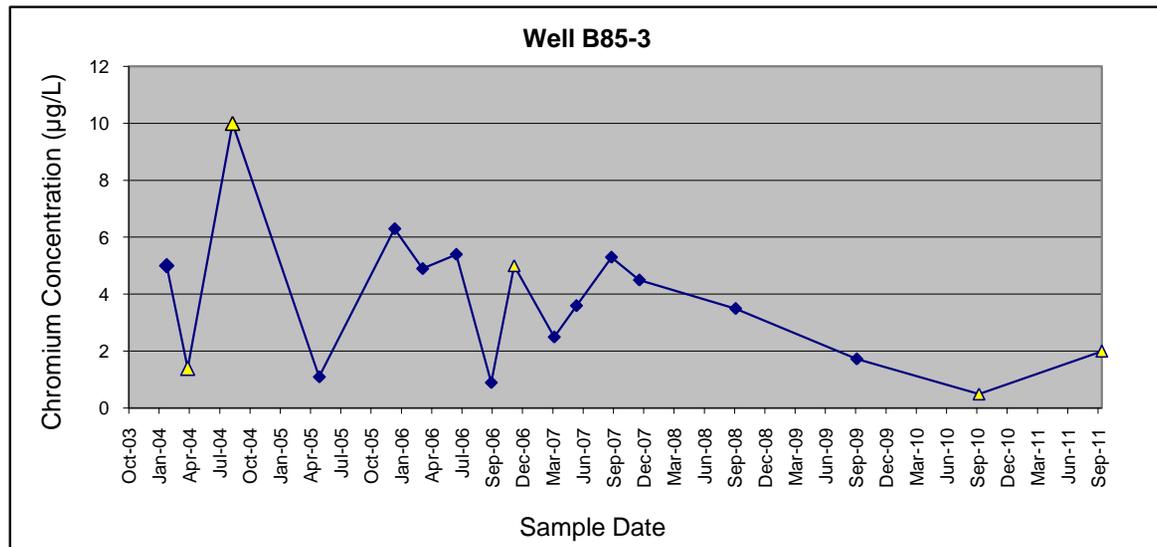
Well Number	Duplicate Sample ID	Original Sample Concentration	Duplicate Sample Concentration	Relative Percent Difference
Total Chromium ($\mu\text{g/L}$) (unfiltered)				
W85-6A	QA-1	3	3	0
RA-MW-15B	QA-2	2 U	2 U	—
RA-MW-12A	QA-3	26	21	21.3
Dissolved Chromium ($\mu\text{g/L}$) (field filtered)				
RA-MW-15B	QA-2	2 U	2 U	—
Sulfate (mg/L)				
W85-6A	QA-1	21.8	21.8	0

mg/L = milligrams per liter
 U = analyte not detected above laboratory reporting limit
 $\mu\text{g/L}$ = micrograms per liter
 — = not applicable

APPENDIX A
GROUNDWATER CHROMIUM CONCENTRATION TRENDS

Well B85-3

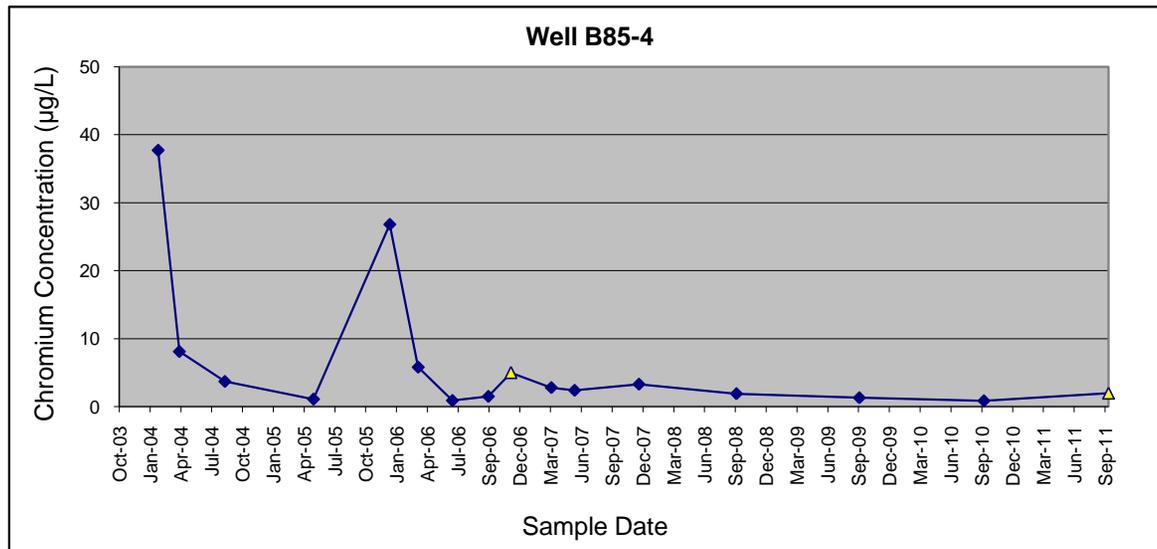
<u>Sample Number</u>	<u>Matrix</u>	<u>Sample Date</u>	<u>Analyte</u>	<u>Conc.</u>	<u>Units</u>	<u>Qualifier</u>	<u>Station Location</u>	<u>Notes</u>	<u>NTU</u>
MJ2AH0	Water	05-Feb-04	Chromium	5	µg/L	J	B85-3	Total	1.00
MJ2BJ6	Water	07-Apr-04	Chromium	1.4	µg/L	U	B85-3	Total	3.00
MJ4732	Water	18-Aug-04	Chromium	10	µg/L	U	B85-3	Total	0.00
184232	Water	03-May-05	Chromium	1.1	µg/L		B85-3	Total	2.80
05504298	Water	13-Dec-05	Chromium	6.3	µg/L		B85-3	Total	8.10
104235	Water	06-Mar-06	Chromium	4.9	µg/L		B85-3	Total	7.00
244311	Water	14-Jun-06	Chromium	5.4	µg/L		B85-3	Total	6.00
394197	Water	26-Sep-06	Chromium	0.9	µg/L		B85-3	Total	1.00
494094	Water	03-Dec-06	Chromium	5	µg/L	U	B85-3	Total	7.00
134266	Water	01-Apr-07	Chromium	2.5	µg/L		B85-3	Total	5.10
234092	Water	06-Jun-07	Chromium	3.6	µg/L		B85-3	Total	4.00
384551	Water	18-Sep-07	Chromium	5.3	µg/L		B85-3	Total	9.00
504141	Water	10-Dec-07	Chromium	4.5	µg/L		B85-3	Total	7.70
8394092	Water	21-Sep-08	Chromium	3.5	µg/L		B85-3	Total	7.10
90906513	Water	16-Sep-09	Chromium	1.73	µg/L		B85-3	Total	2.34
1009065-10	Water	14-Sep-10	Chromium	0.5	µg/L	U	B85-3	Total	0.55
1009064-11	Water	14-Sep-11	Chromium	2	µg/L	U	B85-3	Total	1.51



Note: Where a dissolved concentration is used, the NTU value listed is the pre-filtering value.

Well B85-4

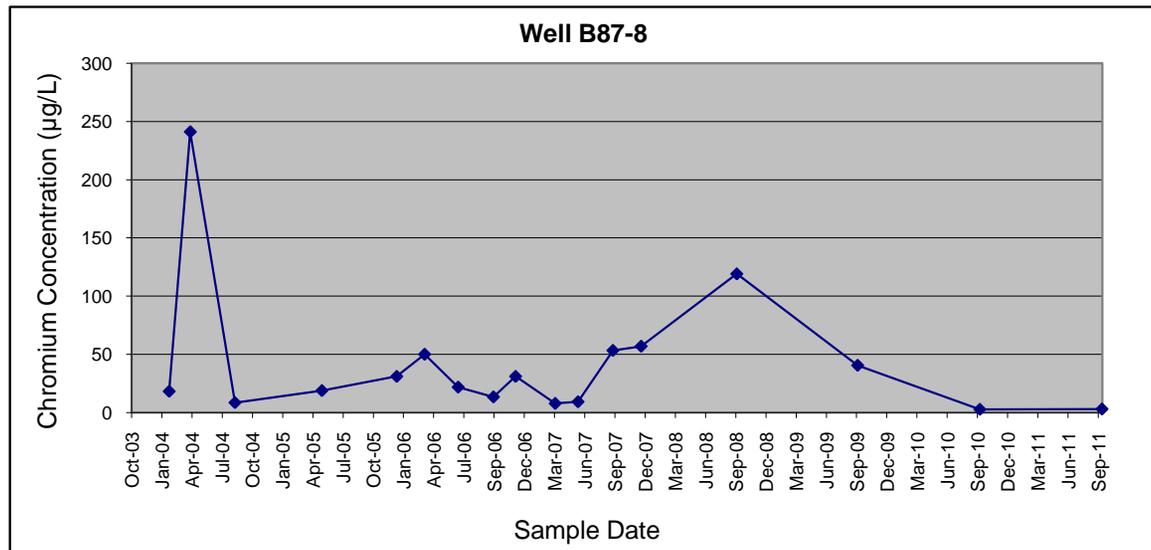
<u>Sample Number</u>	<u>Matrix</u>	<u>Sample Date</u>	<u>Analyte</u>	<u>Conc.</u>	<u>Units</u>	<u>Qualifier</u>	<u>Station Location</u>	<u>Notes</u>	<u>NTU</u>
MJ2AH4	Water	05-Feb-04	Chromium	37.7	µg/L		B85-4	Total	1.00
MJ2BK1	Water	07-Apr-04	Chromium	8.1	µg/L	J	B85-4	Total	0.00
MJ4738	Water	18-Aug-04	Chromium	3.7	µg/L	J	B85-4	Total	4.00
184246	Water	04-May-05	Chromium	1.1	µg/L		B85-4	Total	2.00
05504296	Water	13-Dec-05	Chromium	26.8	µg/L		B85-4	Total	5.70
104237	Water	06-Mar-06	Chromium	5.8	µg/L		B85-4	Total	3.90
244310	Water	14-Jun-06	Chromium	0.9	µg/L		B85-4	Total	0.30
394207	Water	27-Sep-06	Chromium	1.5	µg/L		B85-4	Total	1.00
494084	Water	02-Dec-06	Chromium	5	µg/L	U	B85-4	Total	0.00
134252	Water	30-Mar-07	Chromium	2.8	µg/L		B85-4	Total	1.40
234091	Water	06-Jun-07	Chromium	2.4	µg/L		B85-4	Total	2.10
504143	Water	11-Dec-07	Chromium	3.3	µg/L		B85-4	Total	1.40
8394097	Water	21-Sep-08	Chromium	1.9	µg/L		B85-4	Total	3.30
90906517	Water	15-Sep-09	Chromium	1.31	µg/L		B85-4	Total	0.71
1009065-08	Water	14-Sep-10	Chromium	0.86	µg/L		B85-4	Total	0.25
1009064-08	Water	13-Sep-11	Chromium	2	µg/L	U	B85-4	Total	1.11



Note: Where a dissolved concentration is used, the NTU value listed is the pre-filtering value.

Well B87-8

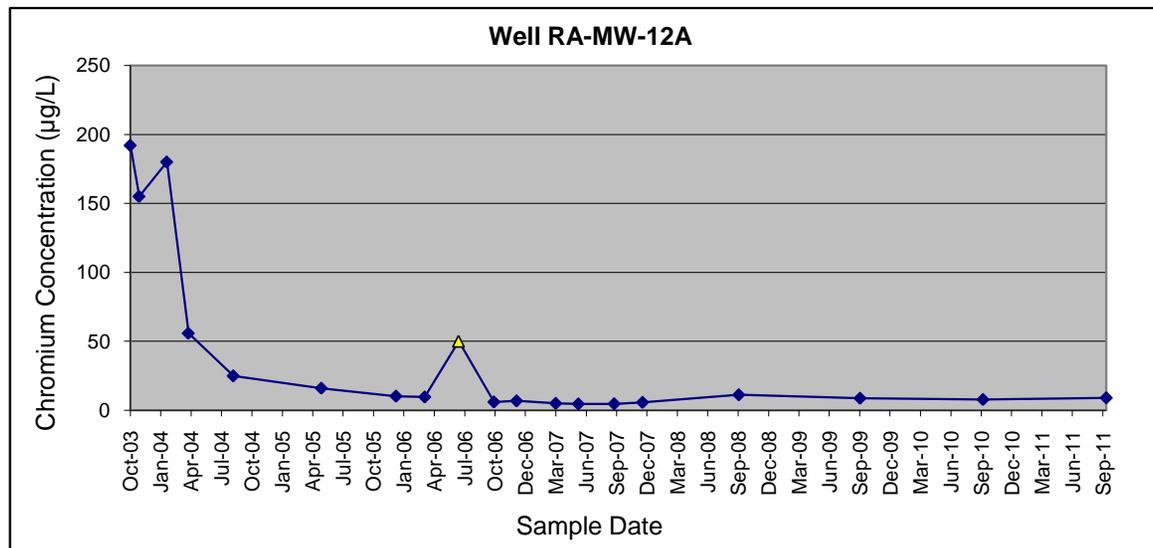
<u>Sample Number</u>	<u>Matrix</u>	<u>Sample Date</u>	<u>Analyte</u>	<u>Conc.</u>	<u>Units</u>	<u>Qualifier</u>	<u>Station Location</u>	<u>Notes</u>	<u>NTU</u>
MJ2AG9	Water	04-Feb-04	Chromium	18.2	µg/L		B87-8	Total	2.00
MJ2BK0	Water	07-Apr-04	Chromium	241	µg/L		B87-8	Total	8.00
MJ4737	Water	18-Aug-04	Chromium	8.5	µg/L	J	B87-8	Dissolved	36.00
184247	Water	04-May-05	Chromium	18.8	µg/L		B87-8	Total	6.50
05504297	Water	13-Dec-05	Chromium	31	µg/L		B87-8	Total	5.10
104236	Water	06-Mar-06	Chromium	50	µg/L		B87-8	Total	8.00
244308	Water	14-Jun-06	Chromium	21.8	µg/L		B87-8	Total	3.00
394204	Water	27-Sep-06	Chromium	13.4	µg/L		B87-8	Dissolved	13.00
494082	Water	02-Dec-06	Chromium	31	µg/L		B87-8	Total	0.10
134251	Water	30-Mar-07	Chromium	7.8	µg/L		B87-8	Dissolved	11.00
234089	Water	06-Jun-07	Chromium	9.2	µg/L		B87-8	Dissolved	0.90
384552	Water	18-Sep-07	Chromium	53.3	µg/L		B87-8	Dissolved	2.10
504144	Water	11-Dec-07	Chromium	56.9	µg/L		B87-8	Dissolved	8.40
8394098	Water	21-Sep-08	Chromium	119	µg/L		B87-8	Dissolved	13.00
90906520	Water	16-Sep-09	Chromium	40.5	µg/L		B87-8	Dissolved	16.70
1009065-20	Water	15-Sep-10	Chromium	2.71	µg/L		B87-8	Dissolved	6.60
1009064-10	Water	14-Sep-11	Chromium	3	µg/L		B87-8	Dissolved	2.54



Note: Where a dissolved concentration is used, the NTU value listed is the pre-filtering value.

Well RA-MW-12A

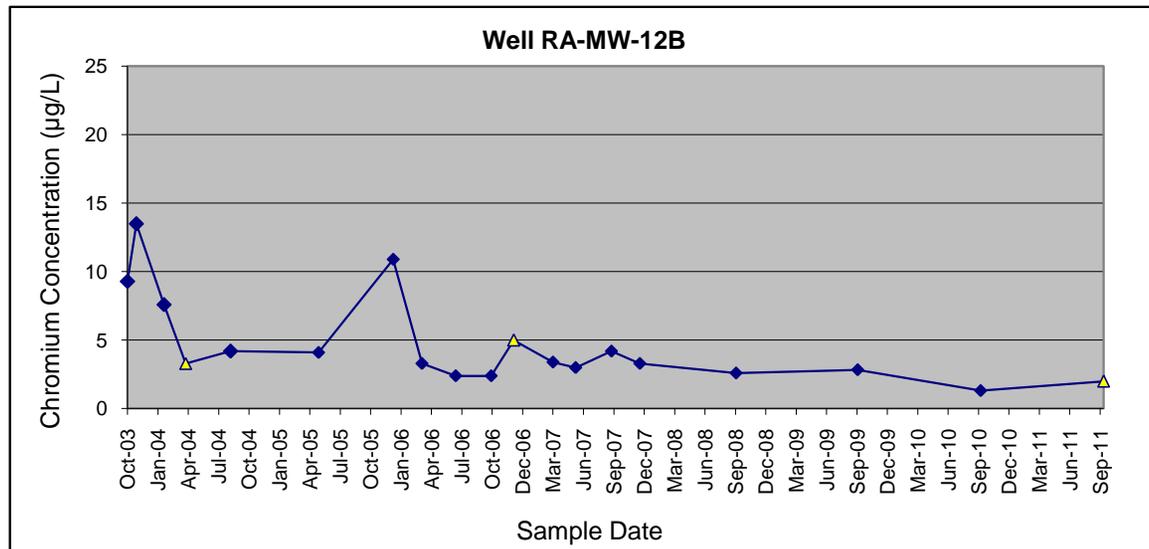
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MJ2524	Water	17-Oct-03	Chromium	192	µg/L		RA-MW-12A	Dissolved	>10
MJ27F5	Water	12-Nov-03	Chromium	155	µg/L		RA-MW-12A	Dissolved	>10
MJ2AF0	Water	02-Feb-04	Chromium	180	µg/L		RA-MW-12A	Total	7.00
MJ2BH9	Water	06-Apr-04	Chromium	55.8	µg/L		RA-MW-12A	Dissolved	17.00
MJ4725	Water	17-Aug-04	Chromium	24.9	µg/L		RA-MW-12A	Dissolved	12.00
184253	Water	05-May-05	Chromium	16	µg/L		RA-MW-12A	Dissolved	32.00
05504282	Water	12-Dec-05	Chromium	10.2	µg/L		RA-MW-12A	Dissolved	86.00
104243	Water	07-Mar-06	Chromium	9.6	µg/L		RA-MW-12A	Dissolved	60.00
244313	Water	15-Jun-06	Chromium	50	µg/L	U	RA-MW-12A	Dissolved	47.00
394218	Water	28-Sep-06	Chromium	6.0	µg/L		RA-MW-12A	Dissolved	80.00
494110	Water	04-Dec-06	Chromium	6.8	µg/L		RA-MW-12A	Dissolved	12.00
134255	Water	30-Mar-07	Chromium	5.0	µg/L		RA-MW-12A	Dissolved	85.00
234081	Water	05-Jun-07	Chromium	4.6	µg/L		RA-MW-12A	Dissolved	55.00
384560	Water	19-Sep-07	Chromium	4.7	µg/L		RA-MW-12A	Dissolved	11.00
504161	Water	12-Dec-07	Chromium	5.7	µg/L		RA-MW-12A	Dissolved	60.00
8394103	Water	22-Sep-08	Chromium	11.2	µg/L		RA-MW-12A	Dissolved	200.00
90906523	Water	16-Sep-09	Chromium	8.68	µg/L		RA-MW-12A	Dissolved	102.00
1009065-25	Water	15-Sep-10	Chromium	7.77	µg/L		RA-MW-12A	Dissolved	>10
1009064-24	Water	15-Sep-11	Chromium	9	µg/L		RA-MW-12A	Dissolved	40.00



Note: Where a dissolved concentration is used, the NTU value listed is the pre-filtering value.

Well RA-MW-12B

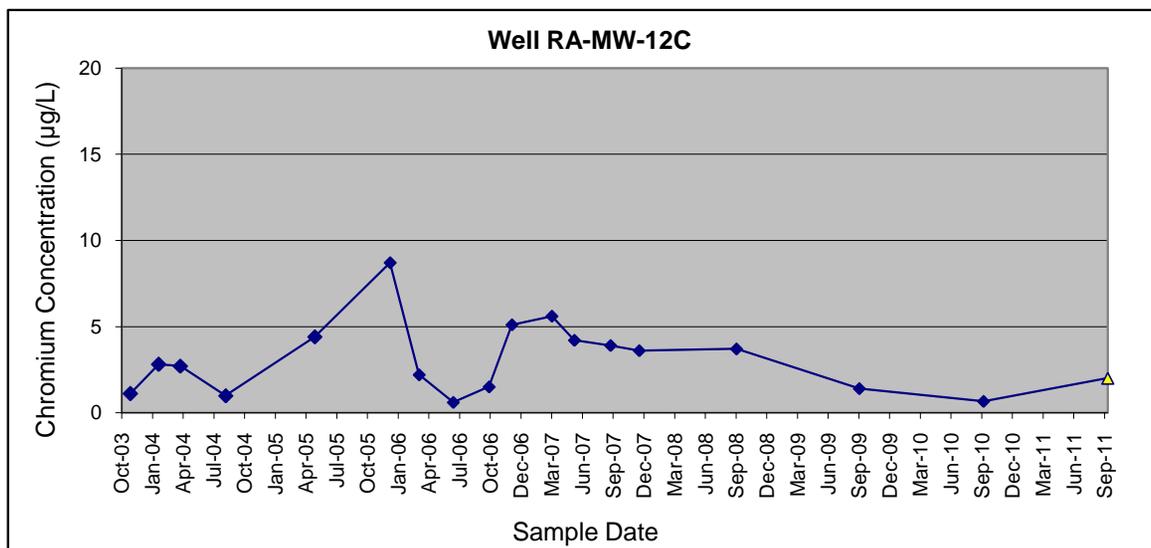
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MJ2526	Water	17-Oct-03	Chromium	9.3	µg/L	BJ	RA-MW-12B	Dissolved	>10
MJ27F7	Water	12-Nov-03	Chromium	13.5	µg/L		RA-MW-12B	Dissolved	>10
MJ2AF1	Water	02-Feb-04	Chromium	7.6	µg/L	J	RA-MW-12B	Total	6.00
MJ2BJ0	Water	06-Apr-04	Chromium	3.3	µg/L	U	RA-MW-12B	Total	0.00
MJ4726	Water	17-Aug-04	Chromium	4.2	µg/L	J	RA-MW-12B	Total	2.00
184254	Water	05-May-05	Chromium	4.1	µg/L		RA-MW-12B	Total	4.50
05504283	Water	12-Dec-05	Chromium	10.9	µg/L		RA-MW-12B	Total	8.00
104242	Water	07-Mar-06	Chromium	3.3	µg/L		RA-MW-12B	Total	1.70
244315	Water	15-Jun-06	Chromium	2.4	µg/L		RA-MW-12B	Total	14.00
394216	Water	28-Sep-06	Chromium	2.4	µg/L		RA-MW-12B	Total	1.00
494108	Water	04-Dec-06	Chromium	5	µg/L	U	RA-MW-12B	Total	2.00
134253	Water	30-Mar-07	Chromium	3.4	µg/L		RA-MW-12B	Total	2.20
234082	Water	05-Jun-07	Chromium	3.0	µg/L		RA-MW-12B	Total	1.10
384562	Water	19-Sep-07	Chromium	4.2	µg/L		RA-MW-12B	Total	0.80
504162	Water	12-Dec-07	Chromium	3.3	µg/L		RA-MW-12B	Total	0.60
8394105	Water	22-Sep-08	Chromium	2.6	µg/L		RA-MW-12B	Total	0.90
90906524	Water	17-Sep-09	Chromium	2.84	µg/L		RA-MW-12B	Total	0.97
1009065-24	Water	16-Sep-10	Chromium	1.32	µg/L		RA-MW-12B	Total	<10
1009064-22	Water	15-Sep-11	Chromium	2	µg/L	U	RA-MW-12B	Total	0.99



Note: Where a dissolved concentration is used, the NTU value listed is the pre-filtering value.

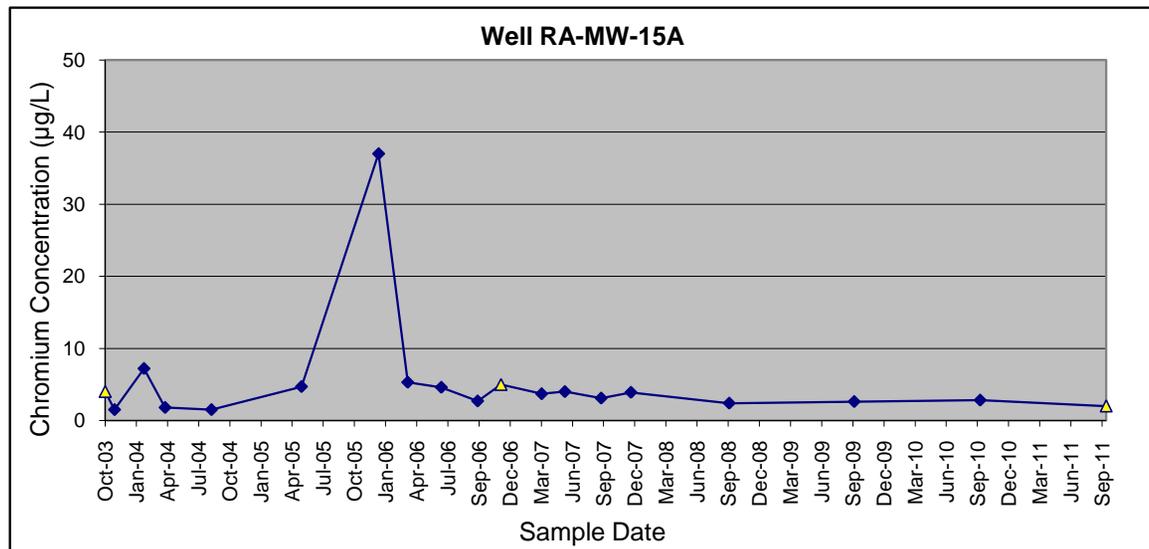
Well RA-MW-12C

<u>Sample Number</u>	<u>Matrix</u>	<u>Sample Date</u>	<u>Analyte</u>	<u>Conc.</u>	<u>Units</u>	<u>Qualifier</u>	<u>Station Location</u>	<u>Notes</u>	<u>NTU</u>
MJ2528	Water	17-Oct-03	Chromium	3.3	µg/L	BJ	RA-MW-12C	Dissolved	>10
MJ27F9	Water	12-Nov-03	Chromium	1.1	µg/L	BJ	RA-MW-12C	Dissolved	>10
MJ2AF2	Water	03-Feb-04	Chromium	2.8	µg/L	J	RA-MW-12C	Total	1.00
MJ2BJ1	Water	06-Apr-04	Chromium	2.7	µg/L	J	RA-MW-12C	Total	0.00
MJ4727	Water	17-Aug-04	Chromium	0.98	µg/L	J	RA-MW-12C	Total	2.00
184255	Water	5-May-05	Chromium	4.4	µg/L		RA-MW-12C	Total	5.20
05504284	Water	12-Dec-05	Chromium	8.7	µg/L		RA-MW-12C	Total	3.00
104245	Water	7-Mar-06	Chromium	2.2	µg/L		RA-MW-12C	Total	1.00
244317	Water	15-Jun-06	Chromium	0.6	µg/L	J	RA-MW-12C	Total	0.30
394215	Water	28-Sep-06	Chromium	1.5	µg/L		RA-MW-12C	Total	0.40
494117	Water	4-Dec-06	Chromium	5.1	µg/L		RA-MW-12C	Total	3.00
134256	Water	31-Mar-07	Chromium	5.6	µg/L		RA-MW-12C	Total	3.40
234079	Water	5-Jun-07	Chromium	4.2	µg/L		RA-MW-12C	Total	1.90
384563	Water	19-Sep-07	Chromium	3.9	µg/L		RA-MW-12C	Total	2.90
504163	Water	12-Dec-07	Chromium	3.6	µg/L		RA-MW-12C	Total	3.30
8394106	Water	22-Sep-08	Chromium	3.7	µg/L		RA-MW-12C	Total	1.90
90906525	Water	17-Sep-09	Chromium	1.4	µg/L		RA-MW-12C	Total	1.55
1009065-23	Water	16-Sep-10	Chromium	0.66	µg/L		RA-MW-12C	Total	<10
1009064-23	Water	15-Sep-11	Chromium	2	µg/L	U	RA-MW-12C	Total	0.68



Well RA-MW-15A

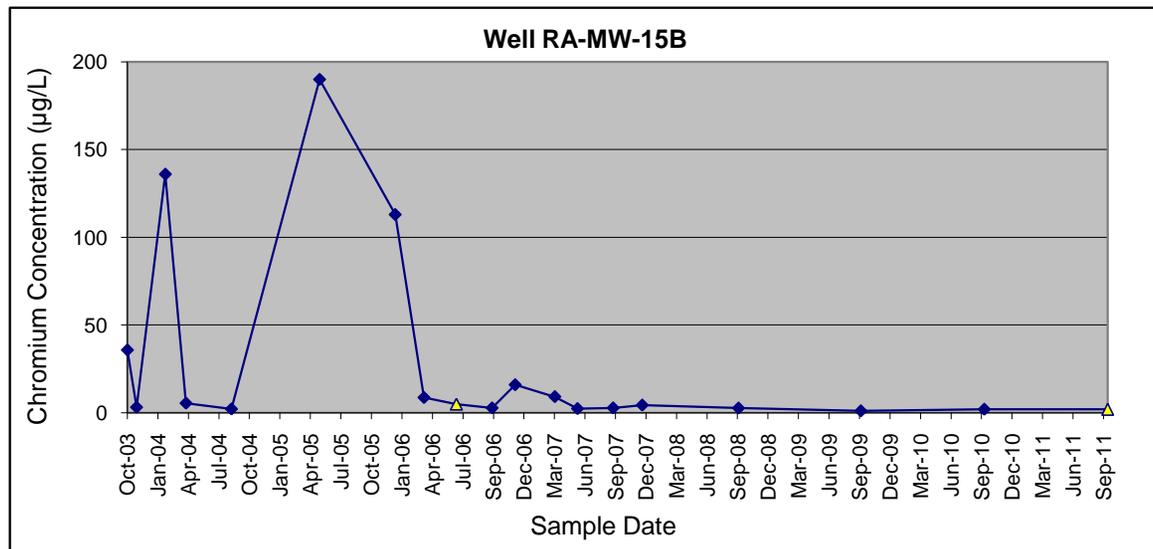
<u>Sample Number</u>	<u>Matrix</u>	<u>Sample Date</u>	<u>Analyte</u>	<u>Conc.</u>	<u>Units</u>	<u>Qualifier</u>	<u>Station Location</u>	<u>Notes</u>	<u>NTU</u>
MJ2506	Water	15-Oct-03	Chromium	4	µg/L	U	RA-MW-15A	Total	<10
MJ27E8	Water	11-Nov-03	Chromium	1.5	µg/L	BJ	RA-MW-15A	Total	<10
MJ2AG7	Water	04-Feb-04	Chromium	7.2	µg/L	J	RA-MW-15A	Total	1.00
MJ2BH1	Water	05-Apr-04	Chromium	1.8	µg/L	J	RA-MW-15A	Total	0.00
MJ4722	Water	17-Aug-04	Chromium	1.5	µg/L	J	RA-MW-15A	Total	0.00
184248	Water	04-May-05	Chromium	4.7	µg/L		RA-MW-15A	Total	2.00
05504290	Water	13-Dec-05	Chromium	37	µg/L		RA-MW-15A	Total	1.30
104251	Water	07-Mar-06	Chromium	5.3	µg/L		RA-MW-15A	Total	0.00
244290	Water	12-Jun-06	Chromium	4.6	µg/L		RA-MW-15A	Total	0.60
394192	Water	25-Sep-06	Chromium	2.7	µg/L		RA-MW-15A	Total	0.20
494090	Water	02-Dec-06	Chromium	5.0	µg/L	U	RA-MW-15A	Total	2.00
134241	Water	29-Mar-07	Chromium	3.7	µg/L		RA-MW-15A	Total	0.30
234068	Water	04-Jun-07	Chromium	4.0	µg/L		RA-MW-15A	Total	0.50
384541	Water	17-Sep-07	Chromium	3.1	µg/L		RA-MW-15A	Total	0.40
504153	Water	12-Dec-07	Chromium	3.9	µg/L		RA-MW-15A	Total	1.10
8394093	Water	21-Sep-08	Chromium	2.4	µg/L		RA-MW-15A	Total	0.30
90906514	Water	17-Sep-09	Chromium	2.62	µg/L		RA-MW-15A	Total	1.32
1009065-19	Water	16-Sep-10	Chromium	2.82	µg/L		RA-MW-15A	Total	<10
1009064-16	Water	15-Sep-11	Chromium	2	µg/L	U	RA-MW-15A	Total	2.46



Note: Where a dissolved concentration is used, the NTU value listed is the pre-filtering value.

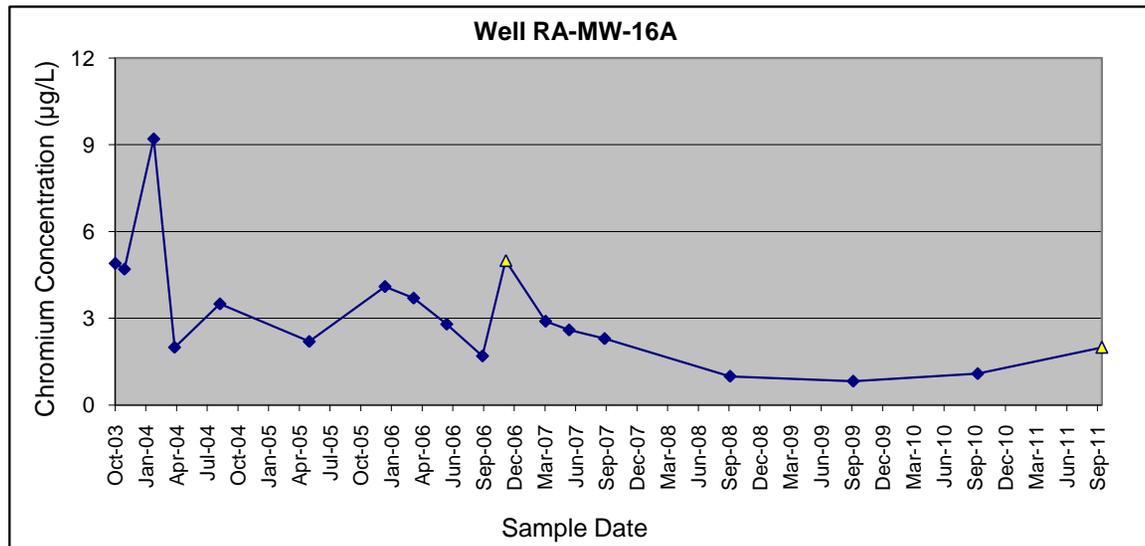
Well RA-MW-15B

<u>Sample Number</u>	<u>Matrix</u>	<u>Sample Date</u>	<u>Analyte</u>	<u>Conc.</u>	<u>Units</u>	<u>Qualifier</u>	<u>Station Location</u>	<u>Notes</u>	<u>NTU</u>
MJ2507	Water	15-Oct-03	Chromium	35.8	µg/L		RA-MW-15B	Total	<10
MJ27E9	Water	11-Nov-03	Chromium	3.2	µg/L	BJ	RA-MW-15B	Total	<10
MJ2AG8	Water	04-Feb-04	Chromium	136	µg/L		RA-MW-15B	Total	2.00
MJ2BH2	Water	05-Apr-04	Chromium	5.5	µg/L	J	RA-MW-15B	Total	0.00
MJ4723	Water	17-Aug-04	Chromium	2.2	µg/L	J	RA-MW-15B	Total	1.00
184249	Water	04-May-05	Chromium	190	µg/L		RA-MW-15B	Total	9.70
05504288	Water	13-Dec-05	Chromium	113	µg/L		RA-MW-15B	Total	3.50
104252	Water	08-Mar-06	Chromium	8.7	µg/L		RA-MW-15B	Dissolved	5.00
244292	Water	12-Jun-06	Chromium	5	µg/L	U	RA-MW-15B	Dissolved	4.00
394190	Water	25-Sep-06	Chromium	2.8	µg/L		RA-MW-15B	Dissolved	4.00
494092	Water	02-Dec-06	Chromium	16	µg/L		RA-MW-15B	Dissolved	7.00
134243	Water	29-Mar-07	Chromium	9.2	µg/L		RA-MW-15B	Dissolved	2.40
234069	Water	04-Jun-07	Chromium	2.4	µg/L		RA-MW-15B	Dissolved	3.40
384543	Water	17-Sep-07	Chromium	2.8	µg/L		RA-MW-15B	Dissolved	2.60
504155	Water	12-Dec-07	Chromium	4.4	µg/L		RA-MW-15B	Dissolved	4.50
8394094	Water	21-Sep-08	Chromium	2.7	µg/L		RA-MW-15B	Dissolved	1.30
90906515	Water	17-Sep-09	Chromium	1.13	µg/L		RA-MW-15B	Dissolved	0.32
1009065-21	Water	16-Sep-10	Chromium	2.02	µg/L		RA-MW-15B	Dissolved	<10
1009064-17	Water	15-Sep-11	Chromium	2	µg/L	U	RA-MW-15B	Dissolved	0.95



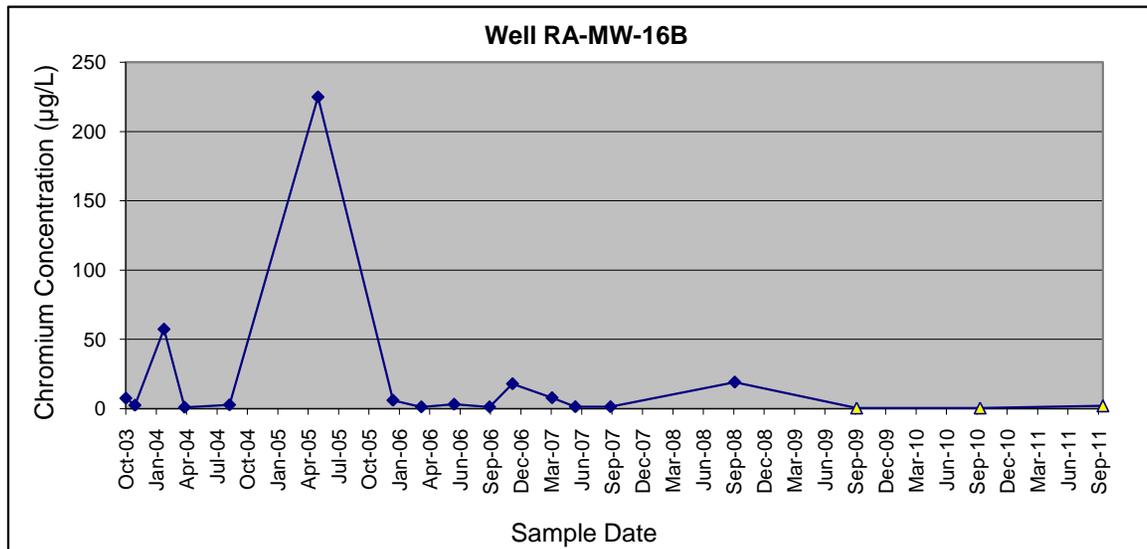
Well RA-MW-16A

<u>Sample Number</u>	<u>Matrix</u>	<u>Sample Date</u>	<u>Analyte</u>	<u>Conc.</u>	<u>Units</u>	<u>Qualifier</u>	<u>Station Location</u>	<u>Notes</u>	<u>NTU</u>
MJ2502	Water	14-Oct-03	Chromium	4.9	µg/L	BJ	RA-MW-16A	Total	<10
MJ27E0	Water	10-Nov-03	Chromium	4.7	µg/L	BJ	RA-MW-16A	Total	<10
MJ2AG5	Water	04-Feb-04	Chromium	9.2	µg/L	J	RA-MW-16A	Total	1.00
MJ2BG8	Water	05-Apr-04	Chromium	2	µg/L	J	RA-MW-16A	Total	1.00
MJ4716	Water	16-Aug-04	Chromium	3.5	µg/L	J	RA-MW-16A	Total	2.00
184257	Water	05-May-05	Chromium	2.2	µg/L		RA-MW-16A	Total	8.50
05504293	Water	13-Dec-05	Chromium	4.1	µg/L		RA-MW-16A	Total	1.20
104238	Water	07-Mar-06	Chromium	3.7	µg/L		RA-MW-16A	Total	1.70
244304	Water	12-Jun-06	Chromium	2.8	µg/L		RA-MW-16A	Total	1.00
394189	Water	25-Sep-06	Chromium	1.7	µg/L		RA-MW-16A	Total	1.00
494087	Water	02-Dec-06	Chromium	5	µg/L	U	RA-MW-16A	Total	0.10
134236	Water	29-Mar-07	Chromium	2.9	µg/L		RA-MW-16A	Total	1.70
234085	Water	06-Jun-07	Chromium	2.6	µg/L		RA-MW-16A	Total	1.00
384538	Water	18-Sep-07	Chromium	2.3	µg/L		RA-MW-16A	Total	0.70
8394088	Water	20-Sep-08	Chromium	1	µg/L		RA-MW-16A	Total	1.30
90906509	Water	16-Sep-09	Chromium	0.83	µg/L		RA-MW-16A	Total	0.48
1009065-17	Water	16-Sep-10	Chromium	1.09	µg/L		RA-MW-16A	Total	<10
1009064-19	Water	15-Sep-11	Chromium	2	µg/L	U	RA-MW-16A	Total	1.05



Well RA-MW-16B

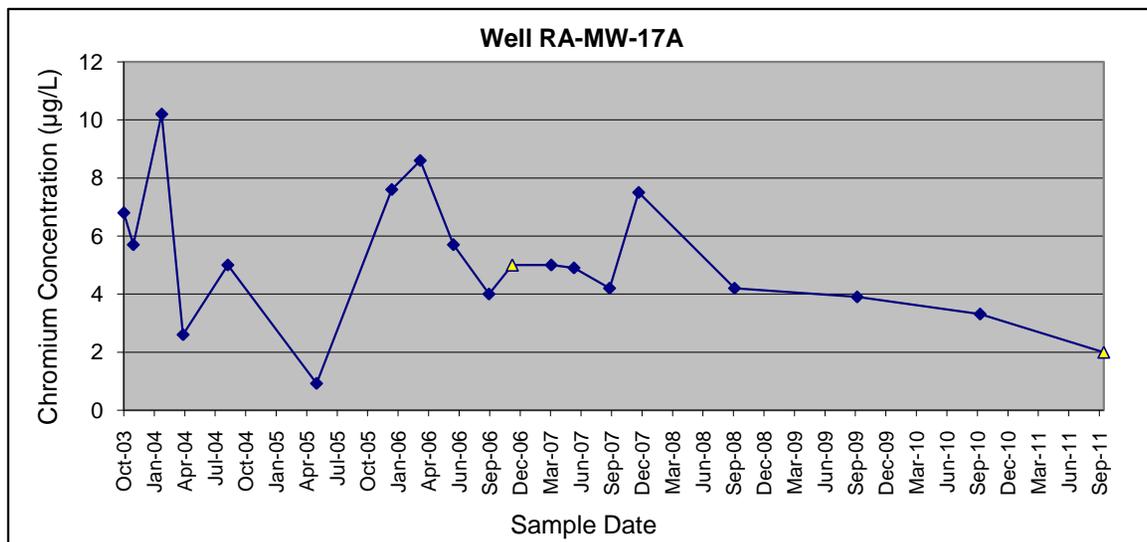
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MJ2503	Water	14-Oct-03	Chromium	7.6	µg/L	BJ	RA-MW-16B	Total	<10
MJ27E1	Water	10-Nov-03	Chromium	2.5	µg/L	BJ	RA-MW-16B	Total	<10
MJ2AG6	Water	04-Feb-04	Chromium	57.4	µg/L	BJ	RA-MW-16B	Total	1.00
MJ2BH0	Water	05-Apr-04	Chromium	1	µg/L	J	RA-MW-16B	Dissolved	0.00
MJ4717	Water	16-Aug-04	Chromium	2.8	µg/L	J	RA-MW-16B	Total	3.60
184256	Water	05-May-05	Chromium	225	µg/L		RA-MW-16B	Total	5.70
05504291	Water	13-Dec-05	Chromium	6.1	µg/L		RA-MW-16B	Dissolved	3.90
104239	Water	07-Mar-06	Chromium	1.3	µg/L		RA-MW-16B	Total	0.00
244305	Water	12-Jun-06	Chromium	3.2	µg/L		RA-MW-16B	Total	0.30
394187	Water	25-Sep-06	Chromium	1.3	µg/L		RA-MW-16B	Dissolved	0.70
494089	Water	02-Dec-06	Chromium	18	µg/L		RA-MW-16B	Dissolved	0.20
134238	Water	29-Mar-07	Chromium	7.9	µg/L		RA-MW-16B	Dissolved	3.70
234087	Water	06-Jun-07	Chromium	1.4	µg/L		RA-MW-16B	Dissolved	0.30
384540	Water	18-Sep-07	Chromium	1.4	µg/L		RA-MW-16B	Dissolved	3.00
8394089	Water	20-Sep-08	Chromium	19.2	µg/L		RA-MW-16B	Total	0.30
90906510	Water	16-Sep-09	Chromium	0.5	µg/L	U	RA-MW-16B	Total	0.85
1009065-18	Water	16-Sep-10	Chromium	0.5	µg/L	U	RA-MW-16B	Total	<10
1009064-20	Water	15-Sep-11	Chromium	2	µg/L	U	RA-MW-16B	Total	0.85



Note: Where a dissolved concentration is used, the NTU value listed is the pre-filtering value.

Well RA-MW-17A

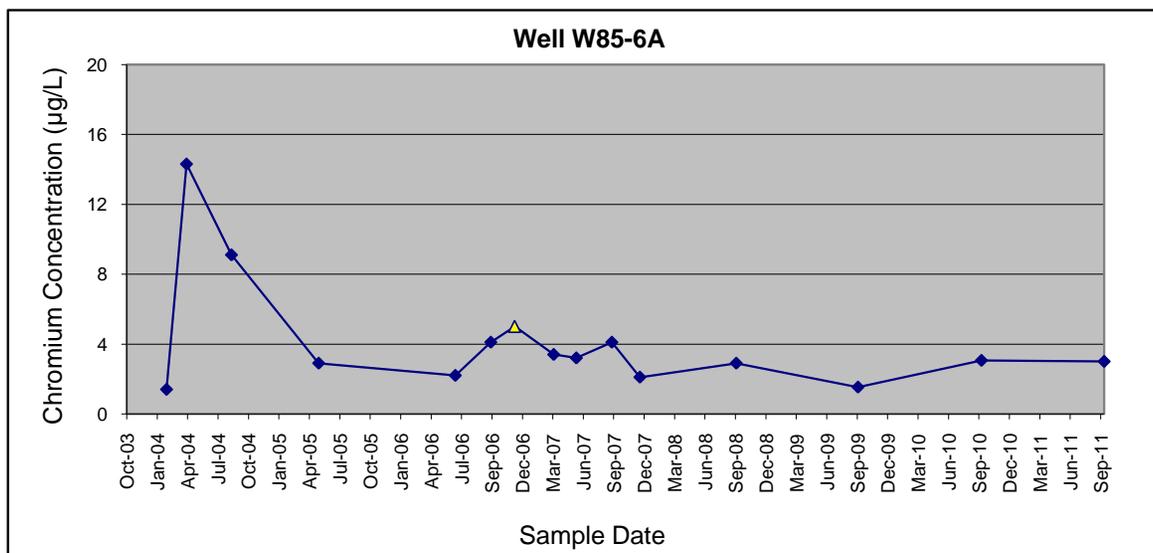
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MJ2501	Water	14-Oct-03	Chromium	6.8	UG/L	BJ	RA-MW-17A	Total	<10
MJ27E5	Water	11-Nov-03	Chromium	5.7	UG/L	BJ	RA-MW-17A	Total	<10
MJ2AG0	Water	03-Feb-04	Chromium	10.2	UG/L	J	RA-MW-17A	Total	1.00
MJ2BH7	Water	06-Apr-04	Chromium	2.6	UG/L	J	RA-MW-17A	Total	0.00
MJ4715	Water	16-Aug-04	Chromium	5	UG/L	J	RA-MW-17A	Total	1.00
184260	Water	05-May-05	Chromium	0.92	UG/L		RA-MW-17A	Total	10.00
05504299	Water	13-Dec-05	Chromium	7.6	UG/L		RA-MW-17A	Total	3.10
104240	Water	07-Mar-06	Chromium	8.6	UG/L		RA-MW-17A	Total	7.00
244293	Water	13-Jun-06	Chromium	5.7	UG/L		RA-MW-17A	Total	1.00
394193	Water	26-Sep-06	Chromium	4.0	UG/L		RA-MW-17A	Total	1.00
494105	Water	04-Dec-06	Chromium	5.0	UG/L	U	RA-MW-17A	Total	0.80
134232	Water	29-Mar-07	Chromium	5.0	UG/L		RA-MW-17A	Total	1.20
234064	Water	04-Jun-07	Chromium	4.9	UG/L		RA-MW-17A	Total	2.70
384532	Water	17-Sep-07	Chromium	4.2	UG/L		RA-MW-17A	Total	1.70
504157	Water	12-Dec-07	Chromium	7.5	UG/L		RA-MW-17A	Total	0.90
8394090	Water	20-Sep-08	Chromium	4.2	UG/L		RA-MW-17A	Total	1.60
90906511	Water	17-Sep-09	Chromium	3.9	UG/L		RA-MW-17A	Total	0.57
1009065-15	Water	15-Sep-10	Chromium	3.31	UG/L		RA-MW-17A	Total	1.10
1009064-21	Water	15-Sep-11	Chromium	2	µg/L	U	RA-MW-17A	Total	1.12



Note: Where a dissolved concentration is used, the NTU value listed is the pre-filtering value.

Well W85-6A

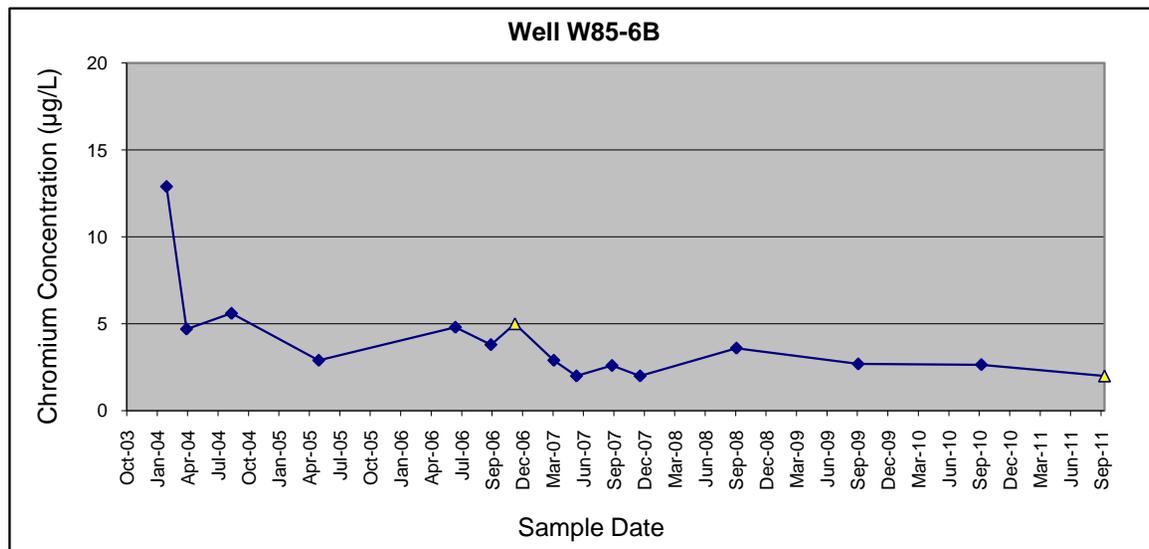
<u>Sample Number</u>	<u>Matrix</u>	<u>Sample Date</u>	<u>Analyte</u>	<u>Conc.</u>	<u>Units</u>	<u>Qualifier</u>	<u>Station Location</u>	<u>Notes</u>	<u>NTU</u>
MJ2AJ8	Water	09-Feb-04	Chromium	1.4	µg/L	J	W85-6A	Total	No Data
MJ2BL0	Water	08-Apr-04	Chromium	14.3	µg/L		W85-6A	Total	0.00
MJ4747	Water	19-Aug-04	Chromium	9.1	µg/L	J	W85-6A	Total	<10
184235	Water	04-May-05	Chromium	2.9	µg/L		W85-6A	Total	1.00
244284	Water	12-Jun-06	Chromium	2.2	µg/L		W85-6A	Total	0.70
394182	Water	25-Sep-06	Chromium	4.1	µg/L		W85-6A	Total	0.10
494113	Water	05-Dec-06	Chromium	5	µg/L	U	W85-6A	Total	2.00
134245	Water	30-Mar-07	Chromium	3.4	µg/L		W85-6A	Total	0.50
234072	Water	05-Jun-07	Chromium	3.2	µg/L		W85-6A	Total	0.20
384545	Water	18-Sep-07	Chromium	4.1	µg/L		W85-6A	Total	0.60
504132	Water	10-Dec-07	Chromium	2.1	µg/L		W85-6A	Total	0.50
8394083	Water	20-Sep-08	Chromium	2.9	µg/L		W85-6A	Total	0.20
90906501	Water	15-Sep-09	Chromium	1.53	µg/L		W85-6A	Total	0.64
1009065-03	Water	15-Sep-10	Chromium	3.06	µg/L		W85-6A	Total	0.15
1009064-03	Water	13-Sep-11	Chromium	3	µg/L		W85-6A	Total	0.61



Note: Where a dissolved concentration is used, the NTU value listed is the pre-filtering value.

Well W85-6B

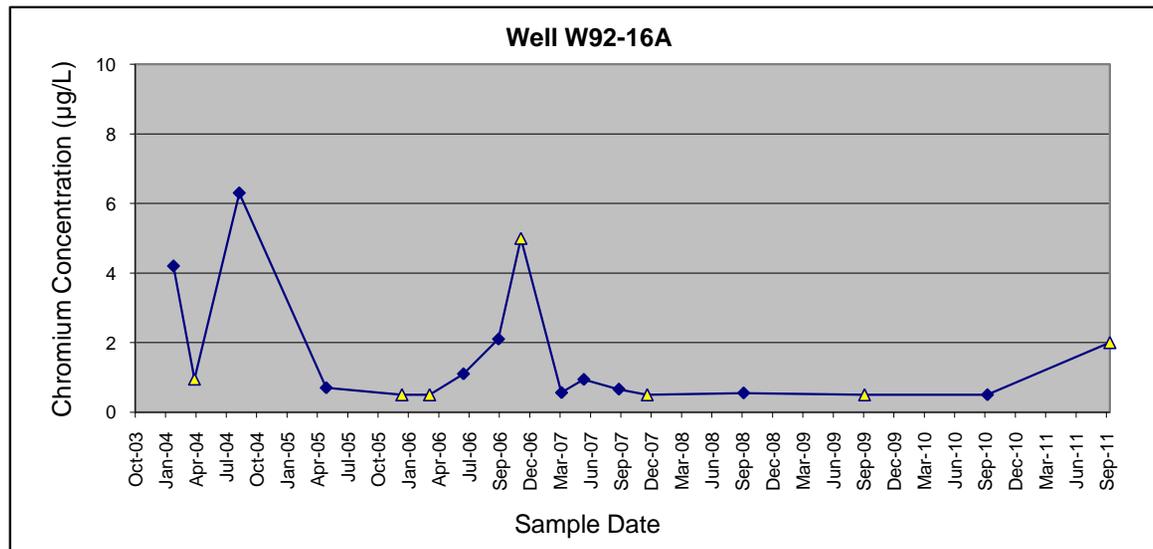
<u>Sample Number</u>	<u>Matrix</u>	<u>Sample Date</u>	<u>Analyte</u>	<u>Conc.</u>	<u>Units</u>	<u>Qualifier</u>	<u>Station Location</u>	<u>Notes</u>	<u>NTU</u>
MJ2AJ9	Water	09-Feb-04	Chromium	12.9	µg/L		W85-6B	Total	No Data
MJ2BL1	Water	08-Apr-04	Chromium	4.7	µg/L	J	W85-6B	Total	0.00
MJ4748	Water	19-Aug-04	Chromium	5.6	µg/L	J	W85-6B	Total	5.00
184236	Water	04-May-05	Chromium	2.9	µg/L		W85-6B	Total	1.00
244286	Water	12-Jun-06	Chromium	4.8	µg/L		W85-6B	Total	49.00
394183	Water	25-Sep-06	Chromium	3.8	µg/L		W85-6B	Total	14.00
494114	Water	05-Dec-06	Chromium	5	µg/L	U	W85-6B	Total	9.00
134246	Water	30-Mar-07	Chromium	2.9	µg/L		W85-6B	Total	4.60
234073	Water	05-Jun-07	Chromium	2.0	µg/L		W85-6B	Total	1.80
384546	Water	18-Sep-07	Chromium	2.6	µg/L		W85-6B	Total	1.30
504133	Water	10-Dec-07	Chromium	2	µg/L		W85-6B	Total	0.30
8394081	Water	20-Sep-08	Chromium	3.6	µg/L		W85-6B	Total	0.20
90906502	Water	15-Sep-09	Chromium	2.69	µg/L		W85-6B	Total	0.35
1009065-05	Water	14-Sep-10	Chromium	2.65	µg/L		W85-6B	Total	0.30
1009064-05	Water	13-Sep-11	Chromium	2	µg/L	U	W85-6B	Total	0.54



Note: Where a dissolved concentration is used, the NTU value listed is the pre-filtering value.

Well W92-16A

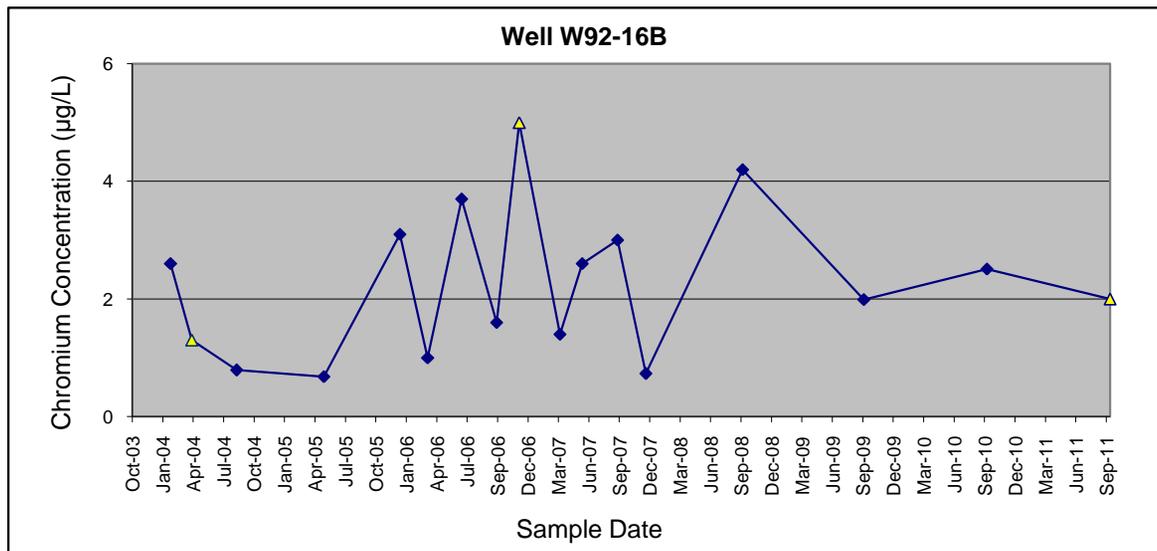
<u>Sample Number</u>	<u>Matrix</u>	<u>Sample Date</u>	<u>Analyte</u>	<u>Conc.</u>	<u>Units</u>	<u>Qualifier</u>	<u>Station Location</u>	<u>Notes</u>	<u>NTU</u>
MJ2AH1	Water	05-Feb-04	Chromium	4.2	µg/L	J	W92-16A	Total	2.00
MJ2BJ7	Water	07-Apr-04	Chromium	0.95	µg/L	U	W92-16A	Total	0.00
MJ4734	Water	18-Aug-04	Chromium	6.3	µg/L	J	W92-16A	Total	0.00
184234	Water	03-May-05	Chromium	0.7	µg/L		W92-16A	Total	0.70
05504311	Water	14-Dec-05	Chromium	0.5	µg/L	U	W92-16A	Total	0.70
104234	Water	06-Mar-06	Chromium	0.5	µg/L	U	W92-16A	Total	0.70
244304	Water	14-Jun-06	Chromium	1.1	µg/L		W92-16A	Total	2.00
394200	Water	26-Sep-06	Chromium	2.1	µg/L		W92-16A	Total	4.00
494085	Water	02-Dec-06	Chromium	5	µg/L	U	W92-16A	Total	0.10
134267	Water	01-Apr-07	Chromium	0.56	µg/L		W92-16A	Total	2.50
234093	Water	06-Jun-07	Chromium	0.94	µg/L		W92-16A	Total	1.80
384549	Water	18-Sep-07	Chromium	0.66	µg/L		W92-16A	Total	1.30
504152	Water	11-Dec-07	Chromium	0.5	µg/L	U	W92-16A	Total	0.40
8394091	Water	22-Sep-08	Chromium	0.55	µg/L		W92-16A	Total	1.50
90906521	Water	16-Sep-09	Chromium	0.5	µg/L	U	W92-16A	Total	0.48
1009065-12	Water	15-Sep-10	Chromium	0.5	µg/L	U	W92-16A	Total	0.50
1009064-12	Water	14-Sep-11	Chromium	2	µg/L	U	W92-16A	Total	0.47



Note: Where a dissolved concentration is used, the NTU value listed is the pre-filtering value.

Well W92-16B

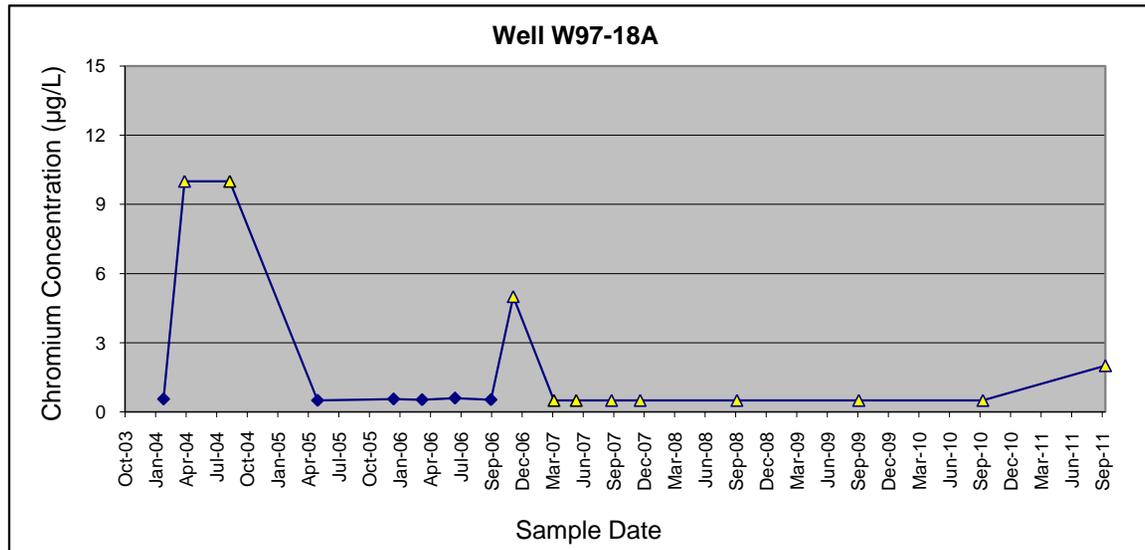
<u>Sample Number</u>	<u>Matrix</u>	<u>Sample Date</u>	<u>Analyte</u>	<u>Conc.</u>	<u>Units</u>	<u>Qualifier</u>	<u>Station Location</u>	<u>Notes</u>	<u>NTU</u>
MJ2AH3	Water	05-Feb-04	Chromium	2.6	µg/L	J	W92-16B	Total	7.00
MJ2BJ8	Water	07-Apr-04	Chromium	1.3	µg/L	U	W92-16B	Total	2.00
MJ4735	Water	18-Aug-04	Chromium	0.79	µg/L	J	W92-16B	Total	<10
184233	Water	03-May-05	Chromium	0.68	µg/L		W92-16B	Total	3.90
05504312	Water	14-Dec-05	Chromium	3.1	µg/L		W92-16B	Total	5.10
104233	Water	06-Mar-06	Chromium	1	µg/L		W92-16B	Total	8.70
244305	Water	14-Jun-06	Chromium	3.7	µg/L		W92-16B	Total	7.00
394201	Water	26-Sep-06	Chromium	1.6	µg/L		W92-16B	Total	0.70
494086	Water	02-Dec-06	Chromium	5	µg/L	U	W92-16B	Total	1.00
134268	Water	01-Apr-07	Chromium	1.4	µg/L		W92-16B	Total	6.80
234094	Water	06-Jun-07	Chromium	2.6	µg/L		W92-16B	Total	0.60
384550	Water	18-Sep-07	Chromium	3.0	µg/L		W92-16B	Total	2.20
504151	Water	11-Dec-07	Chromium	0.73	µg/L		W92-16B	Total	2.20
8394092	Water	22-Sep-08	Chromium	4.2	µg/L		W92-16B	Total	3.80
90906522	Water	16-Sep-09	Chromium	1.99	µg/L		W92-16B	Total	0.85
1009065-11	Water	15-Sep-10	Chromium	2.51	µg/L		W92-16B	Total	0.55
1009064-13	Water	14-Sep-11	Chromium	2	µg/L	U	W92-16B	Total	1.90



Note: Where a dissolved concentration is used, the NTU value listed is the pre-filtering value.

Well W97-18A

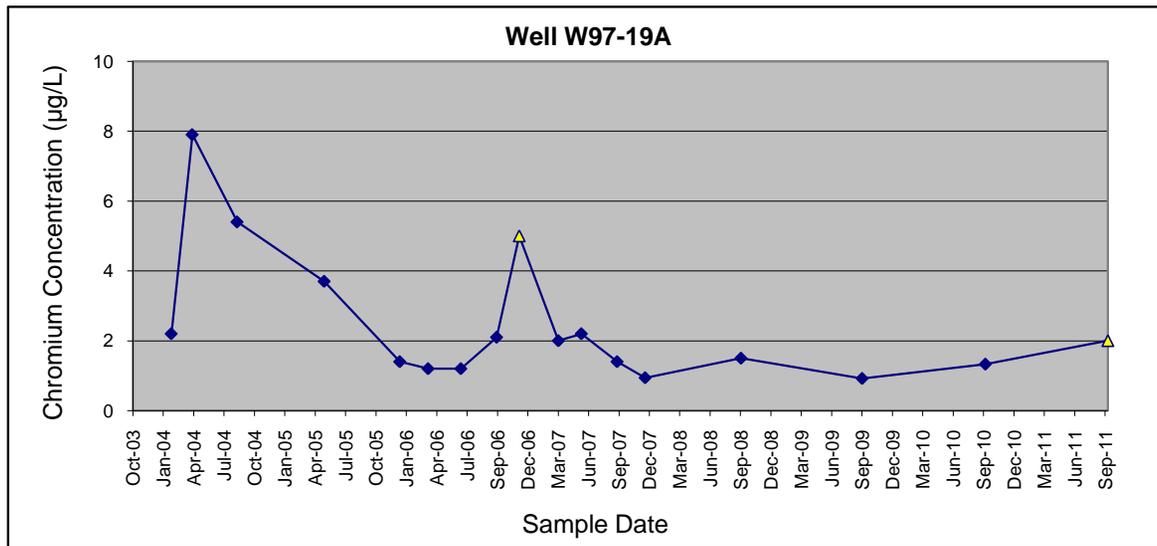
<u>Sample Number</u>	<u>Matrix</u>	<u>Sample Date</u>	<u>Analyte</u>	<u>Conc.</u>	<u>Units</u>	<u>Qualifier</u>	<u>Station Location</u>	<u>Notes</u>	<u>NTU</u>
MJ2AH5	Water	05-Feb-04	Chromium	0.56	µg/L	J	W97-18A	Total	14.00
MJ2BK2	Water	07-Apr-04	Chromium	10	µg/L	U	W97-18A	Total	0.00
MJ4739	Water	18-Aug-04	Chromium	10	µg/L	U	W97-18A	Total	5.00
184244	Water	04-May-05	Chromium	0.5	µg/L		W97-18A	Total	1.00
05504300	Water	14-Dec-05	Chromium	0.56	µg/L		W97-18A	Total	4.00
104256	Water	08-Mar-06	Chromium	0.53	µg/L		W97-18A	Total	0.00
244298	Water	13-Jun-06	Chromium	0.6	µg/L		W97-18A	Total	9.00
394209	Water	27-Sep-06	Chromium	0.53	µg/L		W97-18A	Total	6.00
494080	Water	02-Dec-06	Chromium	5	µg/L	U	W97-18A	Total	1.00
134269	Water	01-Apr-07	Chromium	0.5	µg/L	U	W97-18A	Total	8.50
234095	Water	06-Jun-07	Chromium	0.5	µg/L	U	W97-18A	Total	0.60
384555	Water	18-Sep-07	Chromium	0.5	µg/L	U	W97-18A	Total	7.70
504142	Water	11-Dec-07	Chromium	0.5	µg/L	U	W97-18A	Total	3.10
8394097	Water	21-Sep-08	Chromium	0.5	µg/L	U	W97-18A	Total	0.90
90906512	Water	16-Sep-09	Chromium	0.5	µg/L	U	W97-18A	Total	0.35
1009065-16	Water	16-Sep-10	Chromium	0.5	µg/L	U	W97-18A	Total	<10
1009064-09	Water	13-Sep-11	Chromium	2	µg/L	U	W97-18A	Total	0.88



Note: Where a dissolved concentration is used, the NTU value listed is the pre-filtering value.

Well W97-19A

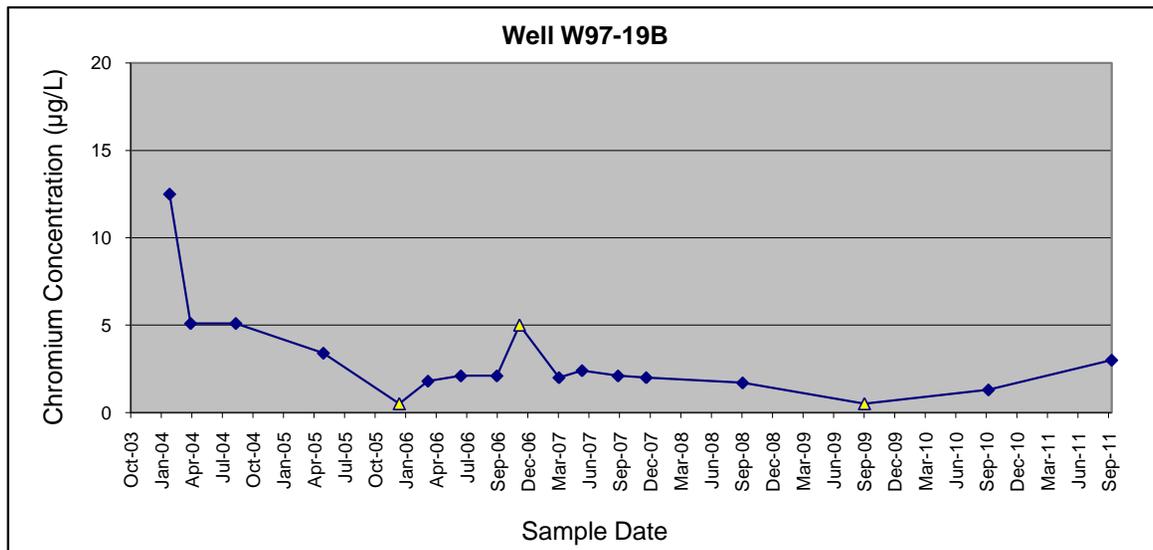
<u>Sample Number</u>	<u>Matrix</u>	<u>Sample Date</u>	<u>Analyte</u>	<u>Conc.</u>	<u>Units</u>	<u>Qualifier</u>	<u>Station Location</u>	<u>Notes</u>	<u>NTU</u>
MJ2AJ0	Water	06-Feb-04	Chromium	2.2	µg/L	J	W97-19A	Total	7.00
MJ2BK4	Water	08-Apr-04	Chromium	7.9	µg/L	J	W97-19A	Total	2.00
MJ4749	Water	19-Aug-04	Chromium	5.4	µg/L	J	W97-19A	Total	8.00
184242	Water	04-May-05	Chromium	3.7	µg/L		W97-19A	Total	1.80
05504303	Water	14-Dec-05	Chromium	1.4	µg/L		W97-19A	Total	0.00
104259	Water	08-Mar-06	Chromium	1.2	µg/L		W97-19A	Total	1.00
244296	Water	13-Jun-06	Chromium	1.2	µg/L		W97-19A	Total	1.00
394211	Water	27-Sep-06	Chromium	2.1	µg/L		W97-19A	Total	0.40
494095	Water	03-Dec-06	Chromium	5.0	µg/L	U	W97-19A	Total	1.00
134239	Water	29-Mar-07	Chromium	2.0	µg/L		W97-19A	Total	3.30
234077	Water	05-Jun-07	Chromium	2.2	µg/L		W97-19A	Total	1.80
384556	Water	19-Sep-07	Chromium	1.4	µg/L		W97-19A	Total	1.90
504149	Water	11-Dec-07	Chromium	0.94	µg/L		W97-19A	Total	1.00
8394084	Water	20-Sep-08	Chromium	1.5	µg/L		W97-19A	Total	1.90
90906505	Water	14-Sep-09	Chromium	0.92	µg/L		W97-19A	Total	3.23
1009065-01	Water	14-Sep-10	Chromium	1.33	µg/L		W97-19A	Total	3.00
1009064-01	Water	12-Sep-11	Chromium	2	µg/L	U	W97-19A	Total	0.70



Note: Where a dissolved concentration is used, the NTU value listed is the pre-filtering value.

Well W97-19B

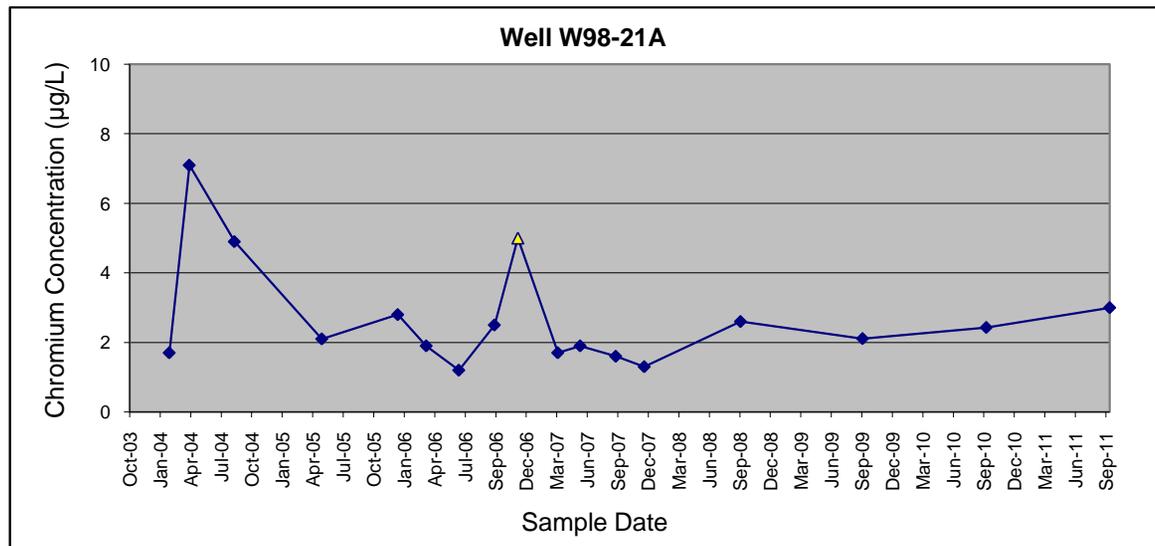
<u>Sample Number</u>	<u>Matrix</u>	<u>Sample Date</u>	<u>Analyte</u>	<u>Conc.</u>	<u>Units</u>	<u>Qualifier</u>	<u>Station Location</u>	<u>Notes</u>	<u>NTU</u>
MJ2AJ1	Water	06-Feb-04	Chromium	12.5	µg/L	J	W97-19B	Total	0.00
MJ2BK5	Water	08-Apr-04	Chromium	5.1	µg/L	J	W97-19B	Total	1.00
MJ4750	Water	19-Aug-04	Chromium	5.1	µg/L	J	W97-19B	Total	3.00
184243	Water	04-May-05	Chromium	3.4	µg/L		W97-19B	Total	1.00
05504304	Water	14-Dec-05	Chromium	0.5	µg/L	U	W97-19B	Total	0.00
104260	Water	08-Mar-06	Chromium	1.8	µg/L		W97-19B	Total	5.00
244297	Water	13-Jun-06	Chromium	2.1	µg/L		W97-19B	Total	0.50
394212	Water	27-Sep-06	Chromium	2.1	µg/L		W97-19B	Total	1.00
494096	Water	03-Dec-06	Chromium	5.0	µg/L	U	W97-19B	Total	1.00
134240	Water	29-Mar-07	Chromium	2.0	µg/L		W97-19B	Total	6.90
234078	Water	05-Jun-07	Chromium	2.4	µg/L		W97-19B	Total	1.90
384557	Water	19-Sep-07	Chromium	2.1	µg/L		W97-19B	Total	0.20
504150	Water	11-Dec-07	Chromium	2.0	µg/L		W97-19B	Total	4.70
8394085	Water	20-Sep-08	Chromium	1.7	µg/L		W97-19B	Total	0.20
90906506	Water	14-Sep-09	Chromium	0.5	µg/L	U	W97-19B	Total	0.50
1009065-02	Water	14-Sep-10	Chromium	1.3	µg/L		W97-19B	Total	0.20
1009064-02	Water	12-Sep-11	Chromium	3	µg/L		W97-19B	Total	0.54



Note: Where a dissolved concentration is used, the NTU value listed is the pre-filtering value.

Well W98-21A

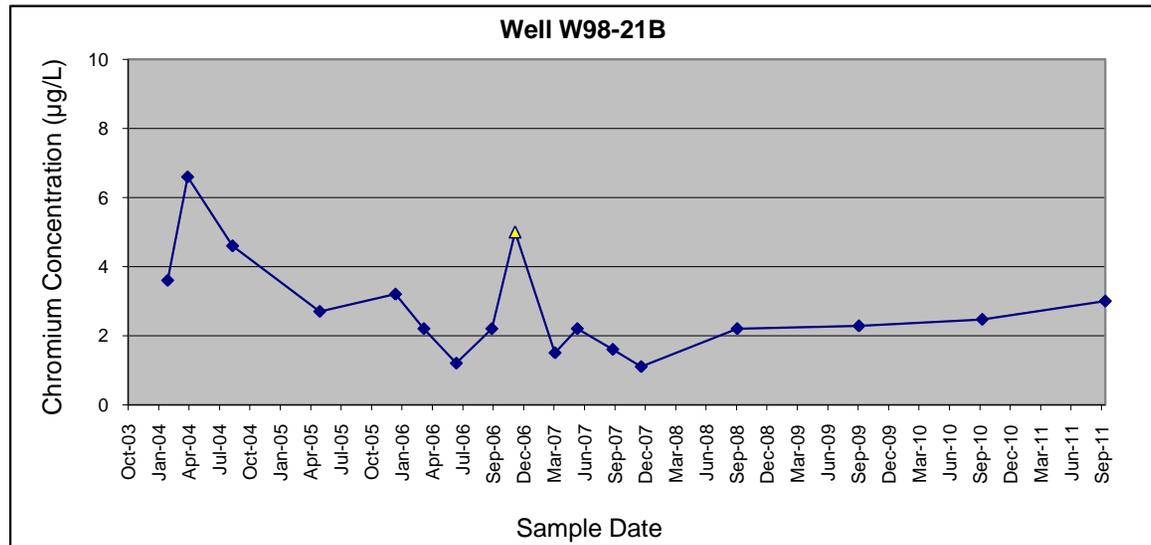
<u>Sample Number</u>	<u>Matrix</u>	<u>Sample Date</u>	<u>Analyte</u>	<u>Conc.</u>	<u>Units</u>	<u>Qualifier</u>	<u>Station Location</u>	<u>Notes</u>	<u>NTU</u>
MJ2AJ6	Water	09-Feb-04	Chromium	1.7	µg/L	J	W98-21A	Total	No Data
MJ2BK8	Water	08-Apr-04	Chromium	7.1	µg/L	J	W98-21A	Total	0.00
MJ4743	Water	19-Aug-04	Chromium	4.9	µg/L	J	W98-21A	Total	0.00
184237	Water	04-May-05	Chromium	2.1	µg/L		W98-21A	Total	1.30
05504309	Water	14-Dec-05	Chromium	2.8	µg/L		W98-21A	Total	0.10
104261	Water	08-Mar-06	Chromium	1.9	µg/L		W98-21A	Total	0.00
244282	Water	12-Jun-06	Chromium	1.2	µg/L		W98-21A	Total	0.30
394185	Water	25-Sep-06	Chromium	2.5	µg/L		W98-21A	Total	0.20
494098	Water	03-Dec-06	Chromium	5	µg/L	U	W98-21A	Total	0.10
134261	Water	31-Mar-07	Chromium	1.7	µg/L		W98-21A	Total	0.20
234074	Water	05-Jun-07	Chromium	1.9	µg/L		W98-21A	Total	0.90
384547	Water	18-Sep-07	Chromium	1.6	µg/L		W98-21A	Total	0.20
504146	Water	11-Dec-07	Chromium	1.3	µg/L		W98-21A	Total	2.60
8394082	Water	20-Sep-08	Chromium	2.6	µg/L		W98-21A	Total	0.10
90906503	Water	15-Sep-09	Chromium	2.11	µg/L		W98-21A	Total	0.72
1009065-13	Water	15-Sep-10	Chromium	2.43	µg/L		W98-21A	Total	0.15
1009064-14	Water	14-Sep-11	Chromium	3	µg/L		W98-21A	Total	0.59



Note: Where a dissolved concentration is used, the NTU value listed is the pre-filtering value.

Well W98-21B

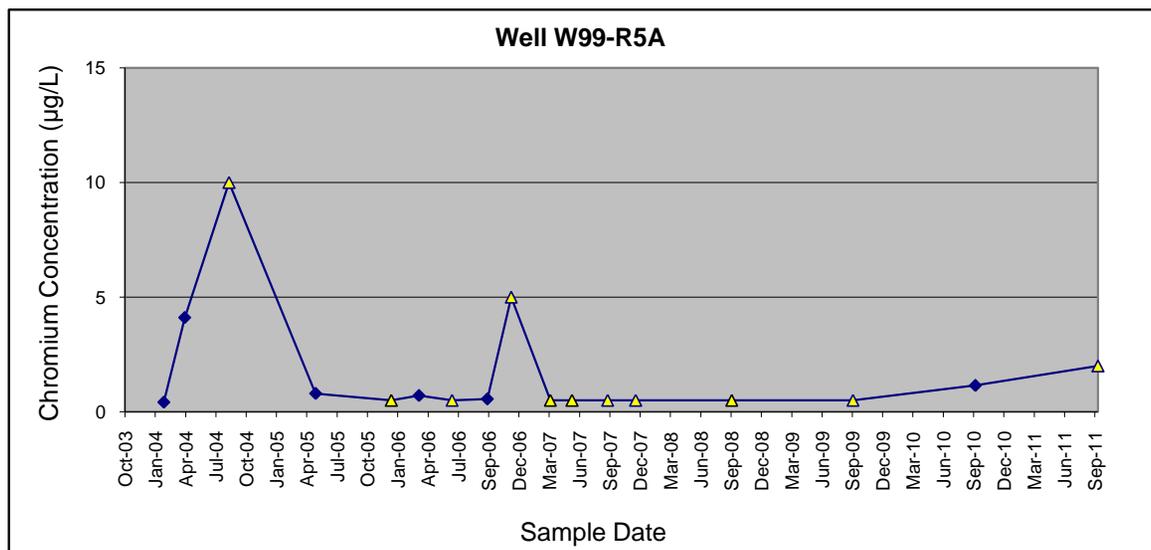
<u>Sample Number</u>	<u>Matrix</u>	<u>Sample Date</u>	<u>Analyte</u>	<u>Conc.</u>	<u>Units</u>	<u>Qualifier</u>	<u>Station Location</u>	<u>Notes</u>	<u>NTU</u>
MJ2AJ7	Water	09-Feb-04	Chromium	3.6	µg/L	J	W98-21B	Total	No Data
MJ2BK9	Water	08-Apr-04	Chromium	6.6	µg/L	J	W98-21B	Total	0.00
MJ4744	Water	19-Aug-04	Chromium	4.6	µg/L	J	W98-21B	Total	5.00
184238	Water	04-May-05	Chromium	2.7	µg/L		W98-21B	Total	0.50
05504310	Water	14-Dec-05	Chromium	3.2	µg/L		W98-21B	Total	0.00
104262	Water	08-Mar-06	Chromium	2.2	µg/L		W98-21B	Total	0.00
244283	Water	12-Jun-06	Chromium	1.2	µg/L		W98-21B	Total	0.30
394186	Water	25-Sep-06	Chromium	2.2	µg/L		W98-21B	Total	0.10
494099	Water	03-Dec-06	Chromium	5	µg/L	U	W98-21B	Total	0.20
134262	Water	31-Mar-07	Chromium	1.5	µg/L		W98-21B	Total	0.10
234075	Water	05-Jun-07	Chromium	2.2	µg/L		W98-21B	Total	0.20
384548	Water	18-Sep-07	Chromium	1.6	µg/L		W98-21B	Total	0.20
504147	Water	11-Dec-07	Chromium	1.1	µg/L		W98-21B	Total	1.70
8394083	Water	20-Sep-08	Chromium	2.2	µg/L		W98-21B	Total	0.40
90906504	Water	15-Sep-09	Chromium	2.28	µg/L		W98-21B	Total	0.76
1009065-14	Water	15-Sep-10	Chromium	2.47	µg/L		W98-21B	Total	0.45
1009064-15	Water	14-Sep-11	Chromium	3	µg/L		W98-21B	Total	0.61



Note: Where a dissolved concentration is used, the NTU value listed is the pre-filtering value.

Well W99-R5A

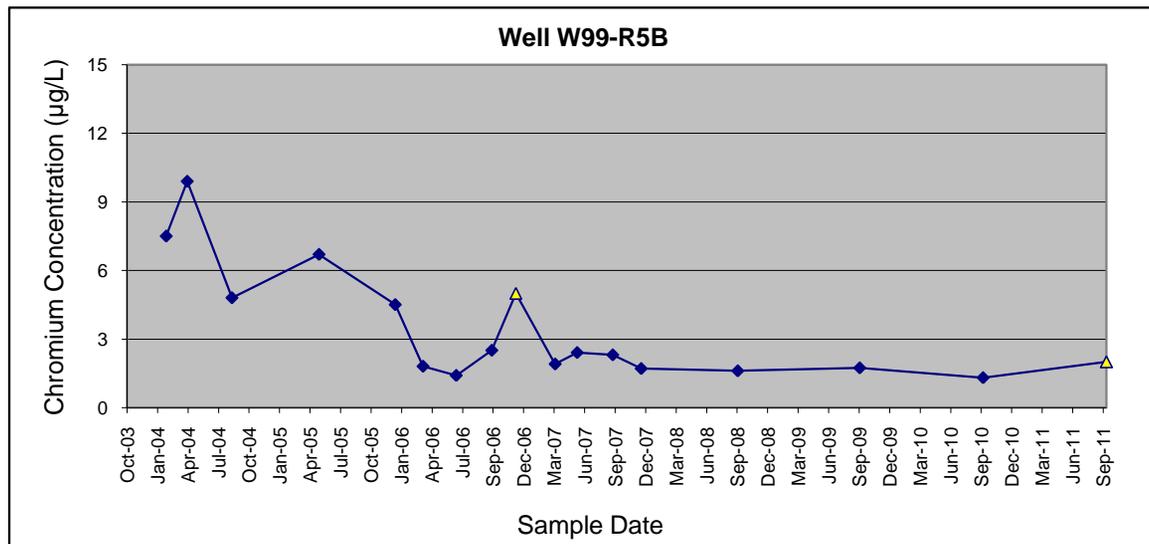
<u>Sample Number</u>	<u>Matrix</u>	<u>Sample Date</u>	<u>Analyte</u>	<u>Conc.</u>	<u>Units</u>	<u>Qualifier</u>	<u>Station Location</u>	<u>Notes</u>	<u>NTU</u>
MJ2AJ3	Water	07-Feb-04	Chromium	0.41	µg/L	J	W99-R5A	Total	0.00
MJ2BL3	Water	09-Apr-04	Chromium	4.1	µg/L	J	W99-R5A	Total	0.00
MJ4745	Water	19-Aug-04	Chromium	10	µg/L	U	W99-R5A	Total	10.00
184230	Water	03-May-05	Chromium	0.79	µg/L		W99-R5A	Total	1.00
05504305	Water	14-Dec-05	Chromium	0.5	µg/L	U	W99-R5A	Total	0.00
104230	Water	06-Mar-06	Chromium	0.7	µg/L		W99-R5A	Total	0.00
244280	Water	12-Jun-06	Chromium	0.5	µg/L	U	W99-R5A	Total	1.00
394180	Water	25-Sep-06	Chromium	0.55	µg/L		W99-R5A	Total	1.00
494115	Water	05-Dec-06	Chromium	5	µg/L	U	W99-R5A	Total	1.00
134264	Water	31-Mar-07	Chromium	0.5	µg/L	U	W99-R5A	Total	0.30
234060	Water	04-Jun-07	Chromium	0.5	µg/L	U	W99-R5A	Total	0.40
384530	Water	17-Sep-07	Chromium	0.5	µg/L	U	W99-R5A	Total	1.00
504130	Water	10-Dec-07	Chromium	0.5	µg/L	U	W99-R5A	Total	0.50
8394086	Water	20-Sep-08	Chromium	0.5	µg/L	U	W99-R5A	Total	0.40
90906507	Water	15-Sep-09	Chromium	0.5	µg/L	U	W99-R5A	Total	0.22
1009065-07	Water	14-Sep-10	Chromium	1.14	µg/L		W99-R5A	Total	0.10
1009064-07	Water	13-Sep-11	Chromium	2	µg/L	U	W99-R5A	Total	0.54



Note: Where a dissolved concentration is used, the NTU value listed is the pre-filtering value.

Well W99-R5B

<u>Sample Number</u>	<u>Matrix</u>	<u>Sample Date</u>	<u>Analyte</u>	<u>Conc.</u>	<u>Units</u>	<u>Qualifier</u>	<u>Station Location</u>	<u>Notes</u>	<u>NTU</u>
MJ2AJ5	Water	07-Feb-04	Chromium	7.5	µg/L	J	W99-R5B	Total	0.00
MJ2BL4	Water	09-Apr-04	Chromium	9.9	µg/L	J	W99-R5B	Total	0.00
MJ4746	Water	19-Aug-04	Chromium	4.8	µg/L	J	W99-R5B	Total	8.00
184231	Water	03-May-05	Chromium	6.7	µg/L		W99-R5B	Total	2.30
05504306	Water	14-Dec-05	Chromium	4.5	µg/L		W99-R5B	Total	2.10
104231	Water	06-Mar-06	Chromium	1.8	µg/L		W99-R5B	Total	0.00
244281	Water	12-Jun-06	Chromium	1.4	µg/L		W99-R5B	Total	3.00
394181	Water	25-Sep-06	Chromium	2.5	µg/L		W99-R5B	Total	1.00
494116	Water	05-Dec-06	Chromium	5	µg/L	U	W99-R5B	Total	1.00
134265	Water	31-Mar-07	Chromium	1.9	µg/L		W99-R5B	Total	10.00
234061	Water	04-Jun-07	Chromium	2.4	µg/L		W99-R5B	Total	0.70
384531	Water	17-Sep-07	Chromium	2.3	µg/L		W99-R5B	Total	1.60
504130	Water	10-Dec-07	Chromium	1.7	µg/L		W99-R5B	Total	2.00
8394087	Water	20-Sep-08	Chromium	1.6	µg/L		W99-R5B	Total	0.80
90906508	Water	15-Sep-09	Chromium	1.73	µg/L		W99-R5B	Total	0.24
1009065-06	Water	14-Sep-10	Chromium	1.3	µg/L		W99-R5B	Total	0.20
1009064-06	Water	13-Sep-11	Chromium	2	µg/L	U	W99-R5B	Total	0.90



APPENDIX B
LABORATORY DATA SHEETS:
CHROMIUM

Manchester Environmental Laboratory
7411 Beach Drive E, Port Orchard, Washington 98366

Case Narrative

October 3, 2011

Project: Metals Frontier Hardchrome-2011

Work Order: 1109064

Project

Manager: Barrett, Guy

By: Dean Momohara

Dr

Summary

The laboratory digested and analyzed the samples following EPA 200.7.

The analysis requested was evaluated by established regulatory quality assurance guidelines.

Sample Information

The samples were received at the Manchester Laboratory on 9/16/2011. The samples were received in good condition and were properly preserved. Twenty five samples were received and assigned laboratory identification numbers 1109064-01 to 1109064-25.

Holding Times

The laboratory performed the analysis within its hold time.

Calibration

The instrument was calibrated following the appropriate method. All initial and continuing calibration verification checks were within the acceptance limits. All initial and continuing calibration verification and blank checks were within the acceptance limits. The instrument was calibrated with a NIST traceable standard and verified to be in calibration with a second source NIST traceable standard.

Method Blanks

No analytically significant levels of analyte were detected in the method blanks associated with these samples.

Laboratory Control Samples

All laboratory control sample recoveries were within the acceptance limits.

Replicates

All associated duplicate relative percent differences of samples with concentrations greater than 5 times the reporting limit were within the acceptance limits.

Matrix Spikes

All matrix spike recoveries were within the acceptance limits.

Internal Standards

All internal standard recoveries were within the acceptance limits.

Other Quality Assurance Measures and Issues

U - The analyte was not detected at or above the reported result.

bold - The analyte was present in the sample. (Visual Aid to locate detected compounds on report sheet.)

Please call Deans Momohara at (360) 871-8808 to further discuss this project.

cc: Project File

**Washington State Department of Ecology
Manchester Environmental Laboratory
Final Analysis Report for
Dissolved Chromium**

Project Name: Frontier Hardchrome-2011
Work Order: 1109064
Project Officer: Barrett, Guy

Date Collected: 09/14/2011
Date Analyzed: 09/30/2011

Analyte: Chromium
Method: EPA200.7
Matrix: Water
Units: mg/L

Sample #	Sample ID	Result	Qualifier	RL	MDL	Collected	Analyzed	Batch ID
1109064-10	B87-8	0.003		0.002	0.0007	09/14/11	09/30/11	B111209
1109064-17	RA-MW-15B	0.002	U	0.002	0.0007	09/14/11	09/30/11	B111209
1109064-18	QA-2	0.002	U	0.002	0.0007	09/14/11	09/30/11	B111209
1109064-24	RA-MW-12A	0.009		0.002	0.0007	09/15/11	09/30/11	B111209

QC Results for Batch ID: B111209

Method Blank	Sample ID	Result	Qualifier	RL	Analyzed
B111209-BLK1	Blank	0.002	U	0.002	09/30/11

Sample #	QC Sample	Result	Spike Level	Source Sample	Source Result	%Rec	%Rec Limits	RPD	RPD Limit
B111209-BS1	LCS	3.94	4			99	85-115		

Authorized by: _____

Dm

Release Date: _____

10/3/11

**Washington State Department of Ecology
Manchester Environmental Laboratory
Final Analysis Report for
Chromium**

Project Name: Frontier Hardchrome-2011
Work Order: 1109064
Project Officer: Barrett, Guy

Date Collected: 09/12/2011
Date Analyzed: 09/29/2011

Analyte: Chromium
Method: EPA200.7
Matrix: Water
Units: mg/L

Sample #	Sample ID	Result	Qualifier	RL	MDL	Collected	Analyzed	Batch ID
1109064-01	W97-19A	0.002	U	0.002	0.0007	09/12/11	09/29/11	B111176
1109064-02	W97-19B	0.003		0.002	0.0007	09/12/11	09/29/11	B111176
1109064-03	W85-6A	0.003		0.002	0.0007	09/13/11	09/29/11	B111176
1109064-04	QA-1	0.003		0.002	0.0007	09/13/11	09/29/11	B111176
1109064-05	W85-6B	0.002	U	0.002	0.0007	09/13/11	09/29/11	B111176
1109064-06	W99-R5B	0.002	U	0.002	0.0007	09/13/11	09/29/11	B111176
1109064-07	W99-R5A	0.002	U	0.002	0.0007	09/13/11	09/29/11	B111176
1109064-08	B85-4	0.002	U	0.002	0.0007	09/13/11	09/29/11	B111176
1109064-09	W97-18A	0.002	U	0.002	0.0007	09/13/11	09/29/11	B111176
1109064-10	B87-8	0.004		0.002	0.0007	09/14/11	09/29/11	B111176
1109064-11	B85-3	0.002	U	0.002	0.0007	09/14/11	09/29/11	B111176
1109064-12	W92-16A	0.002	U	0.002	0.0007	09/14/11	09/29/11	B111176
1109064-13	W92-16B	0.002	U	0.002	0.0007	09/14/11	09/29/11	B111176

QC Results for Batch ID: B111176

Method Blank	Sample ID	Result	Qualifier	RL	Analyzed
B111176-BLK1	Blank	0.002	U	0.002	09/29/11

Sample #	QC Sample	Result	Spike Level	Source Sample	Source Result	%Rec	%Rec Limits	RPD	RPD Limit
B111176-BS1	LCS	3.85	4			96	85-115		
B111176-MS1	Matrix Spike	3.83	4	1109064-01	0.002	96	75-125		
B111176-MSD1	Matrix Spike Dup	3.89	4	1109064-01	0.002	97	75-125	2	20

Authorized by: DM

Release Date: 10/3/11

**Washington State Department of Ecology
Manchester Environmental Laboratory
Final Analysis Report for
Chromium**

Project Name: Frontier Hardchrome-2011
Work Order: 1109064
Project Officer: Barrett, Guy

Date Collected: 09/14/2011
Date Analyzed: 09/30/2011

Analyte: Chromium
Method: EPA200.7
Matrix: Water
Units: mg/L

Sample #	Sample ID	Result	Qualifier	RL	MDL	Collected	Analyzed	Batch ID
1109064-14	W98-21A	0.003		0.002	0.0007	09/14/11	09/30/11	B111209
1109064-15	W98-21B	0.003		0.002	0.0007	09/14/11	09/30/11	B111209
1109064-16	RA-MW-15A	0.002	U	0.002	0.0007	09/14/11	09/30/11	B111209
1109064-17	RA-MW-15B	0.002	U	0.002	0.0007	09/14/11	09/30/11	B111209
1109064-18	QA-2	0.002	U	0.002	0.0007	09/14/11	09/30/11	B111209
1109064-19	RA-MW-16A	0.002	U	0.002	0.0007	09/15/11	09/30/11	B111209
1109064-20	RA-MW-16B	0.002	U	0.002	0.0007	09/15/11	09/30/11	B111209
1109064-21	RA-MW-17A	0.002	U	0.002	0.0007	09/15/11	09/30/11	B111209
1109064-22	RA-MW-12B	0.002	U	0.002	0.0007	09/15/11	09/30/11	B111209
1109064-23	RA-MW-12C	0.002	U	0.002	0.0007	09/15/11	09/30/11	B111209
1109064-24	RA-MW-12A	0.026		0.002	0.0007	09/15/11	09/30/11	B111209
1109064-25	QA-3	0.021		0.002	0.0007	09/15/11	09/30/11	B111209

QC Results for Batch ID: B111209

Method Blank	Sample ID	Result	Qualifier	RL	Analyzed				
B111209-BLK1	Blank	0.002	U	0.002	09/30/11				

Sample #	QC Sample	Result	Spike Level	Source Sample	Source Result	%Rec	%Rec Limits	RPD	RPD Limit
B111209-BS1	LCS	3.94	4			99	85-115		
B111209-MS1	Matrix Spike	3.79	4	1109064-14	0.003	95	75-125		
B111209-MSD1	Matrix Spike Dup	3.82	4	1109064-14	0.003	95	75-125	0.8	20

Authorized by: _____

DM

Release Date: _____

10/3/11

COLUMBIA ANALYTICAL SERVICES, INC.

Client: Washington State Department of Ecology Service Request No.: K1108608
Project: Frontier Hard Chrome-Event 17 Date Received: 9/14/11
Sample Matrix: Water

CASE NARRATIVE

All analyses were performed consistent with the quality assurance program of Columbia Analytical Services, Inc. (CAS). This report contains analytical results for samples designated for Tier IV validation deliverables including summary forms and all of the associated raw data for each of the analyses. When appropriate to the method, method blank results have been reported with each analytical test.

Sample Receipt

Four water samples were received for analysis at Columbia Analytical Services on 9/14/11. The samples were received in good condition and consistent with the accompanying chain of custody form. The samples were stored in a refrigerator at 4°C upon receipt at the laboratory.

General Chemistry Parameters

No anomalies associated with the analysis of these samples were observed.

Total Metals

No anomalies associated with the analysis of these samples were observed.

Approved by Howard Holm Date 10-25-11

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: Washington State Department of Ecology
Project: Frontier Hard Chrome - Event 17/Ecology/MEL:1109064
Sample Matrix: Water

Service Request: K1108608
Date Collected: 9/14/11
Date Received: 9/14/11

Analysis Method: 7196A

Units: mg/L
Basis: NA

Chromium, Hexavalent

Sample Name	Lab Code	Result	Q	MRL	MDL	Dilution Factor	Date Extracted	Date Analyzed	Note
1109064-10	K1108608-004	ND	U	0.050	0.004	1	NA	9/14/11 17:15	
Method Blank	K1108608-MB	ND	U	0.050	0.004	1	NA	9/14/11 17:15	

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: Washington State Department of Ecology
Project: Frontier Hard Chrome - Event 17/Ecology/MEL:1109064
Sample Matrix: Water

Service Request: K1108608
Date Collected: 9/14/11
Date Received: 9/14/11
Date Analyzed: 9/14/11

**Replicate Sample Summary
 General Chemistry Parameters**

Sample Name: 1109064-10
Lab Code: K1108608-004

Units: mg/L
Basis: NA

Analyte Name	Method	MRL	MDL	Sample Result	1109064-10DUP Duplicate Sample		RPD	RPD Limit
					K1108608-004DUP Result	Average		
Chromium, Hexavalent	7196A	0.050	0.004	ND U	ND U	NC	NC	20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: Washington State Department of Ecology
Project: Frontier Hard Chrome - Event 17/Ecology/MEL:1109064
Sample Matrix: Water

Service Request: K1108608
Date Collected: 9/14/11
Date Received: 9/14/11
Date Analyzed: 9/14/11

**Matrix Spike Summary
 General Chemistry Parameters**

Sample Name: 1109064-10
Lab Code: K1108608-004

Units: mg/L
Basis: NA

Analytical Method: 7196A

Analyte Name	Sample Result	1109064-10MS Matrix Spike K1108608-004MS			1109064-10DMS Duplicate Matrix Spike K1108608-004DMS			% Rec Limits	RPD	RPD Limit
		Result	Spike Amount	% Rec	Result	Spike Amount	% Rec			
Chromium, Hexavalent	ND	0.455	0.400	114	0.439	0.400	110	75 - 125	4	20

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: Washington State Department of Ecology
Project: Frontier Hard Chrome - Event 17/Ecology/MEL:1109064
Sample Matrix: Water

Service Request: K1108608
Date Analyzed: 9/14/11

**Lab Control Sample Summary
General Chemistry Parameters**

Units: mg/L
Basis: NA

Analyte Name	Method	Lab Control Sample		% Rec	% Rec Limits
		Result	Spike Amount		
Chromium, Hexavalent	7196A	0.761	0.742	103	80 - 120

Results flagged with an asterisk (*) indicate values outside control criteria.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Columbia Analytical Services

- Cover Page -

INORGANIC ANALYSIS DATA PACKAGE

Client: Washington State Department of Ecology
Project Name: Frontier Hard Chrome - Event 17
Project No.: Ecology/MEL:1109064

Service Request: K1108608

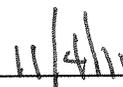
<u>Sample Name:</u>	<u>Lab Code:</u>
<u>1109064-03</u>	<u>K1108608-001DISS</u>
<u>1109064-07</u>	<u>K1108608-002DISS</u>
<u>1109064-08</u>	<u>K1108608-003DISS</u>
<u>1109064-10</u>	<u>K1108608-004DISS</u>
<u>Method Blank</u>	<u>K1108608-MB</u>
<u>Batch QC1D</u>	<u>K1108909-001D</u>
<u>Batch QC1S</u>	<u>K1108909-001S</u>

Comments:

Approved By: _____



Date: _____



METALS

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: Washington State Department of E Service Request: K1108608
Project No.: Ecology/MEL:1109064 Date Collected: 09/13/11
Project Name: Frontier Hard Chrome - Event 17 Date Received: 09/14/11
Matrix: WATER Units: ug/L
Basis: NA

Sample Name: 1109064-03 Lab Code: K1108608-001DISS

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Sulfur	200.7	50.0	1.0	10/06/11	10/12/11	7270		

% Solids: 0.0

Comments:

METALS

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: Washington State Department of E Service Request: K1108608
Project No.: Ecology/MEL:1109064 Date Collected: 09/13/11
Project Name: Frontier Hard Chrome - Event 17 Date Received: 09/14/11
Matrix: WATER Units: ug/L
Basis: NA

Sample Name: 1109064-07

Lab Code: K1108608-002DISS

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Sulfur	200.7	50.0	1.0	10/06/11	10/12/11	5150		

% Solids: 0.0

Comments:

METALS

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: Washington State Department of E Service Request: K1108608
Project No.: Ecology/MEL:1109064 Date Collected: 09/13/11
Project Name: Frontier Hard Chrome - Event 17 Date Received: 09/14/11
Matrix: WATER Units: ug/L
Basis: NA

Sample Name: 1109064-08 Lab Code: K1108608-003DISS

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Sulfur	200.7	50.0	1.0	10/06/11	10/12/11	12600		

% Solids: 0.0

Comments:

METALS

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: Washington State Department of E Service Request: K1108608
Project No.: Ecology/MEL:1109064 Date Collected: 09/14/11
Project Name: Frontier Hard Chrome - Event 17 Date Received: 09/14/11
Matrix: WATER Units: ug/L
Basis: NA

Sample Name: 1109064-10

Lab Code: K1108608-004DISS

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Sulfur	200.7	50.0	1.0	10/06/11	10/12/11	11700		

% Solids: 0.0

Comments:

METALS

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

Client: Washington State Department of E Service Request: K1108608
Project No.: Ecology/MEL:1109064 Date Collected:
Project Name: Frontier Hard Chrome - Event 17 Date Received:
Matrix: WATER Units: ug/L
Basis: NA

Sample Name: Method Blank Lab Code: K1108608-MB

Analyte	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	C	Q
Sulfur	200.7	50.0	1.0	10/06/11	10/12/11	50.0	U	

% Solids: 0.0

Comments:

METALS

- 7 -

LABORATORY CONTROL SAMPLE

Client: Washington State Department of E Service Request: K1108608

Project No.: Ecology/MEL:1109064

Project Name: Frontier Hard Chrome - Event 17

Aqueous LCS Source: Inorganic Ventures

Solid LCS Source:

Analyte	Aqueous: ug/L			Solid: mg/kg				
	True	Found	%R	True	Found	C	Limits	%R
Sulfur	10000	10000	100.0					

Manchester Environmental Laboratory
7411 Beach Drive E, Port Orchard, Washington 98366

Case Narrative

September 21, 2011

Project: General Chemistry Frontier Hardchrome-2011

Work Order: 1109064

Project

Manager: Barrett, Guy

By: Dean Momohara
pr

Summary

The laboratory analyzed the samples following EPA 300.0 for sulfate (SO₄).

The analysis requested was evaluated by established regulatory quality assurance guidelines.

Sample Information

The samples were received at the Manchester Laboratory on 9/16/2011. The cooler was received within the proper temperature range of 0°C - 6°C. The samples were received in good condition. Five samples were received and assigned laboratory identification numbers 1109064-03, 1109064-04, 1109064-07, 1109064-08 and 1109064-10.

Holding Times

The laboratory performed the analysis within its hold time.

Calibration

The instrument was calibrated following the appropriate method. All initial and continuing calibration verification checks were within the acceptance limits. All initial and continuing blank checks were within the acceptance limits. The r-value was within the acceptance limits. All standard residuals were within acceptance limits. The instrument was calibrated with a NIST traceable standard and verified to be in calibration with a second source NIST traceable standard.

Method Blanks

No analytically significant level of analyte was detected in the method blank associated with these samples.

Laboratory Control Samples

The laboratory control sample recovery was within the acceptance limits.

Replicates

The associated duplicate relative percent difference of samples with concentrations greater than 5 times the reporting limit was within the acceptance limits.

Matrix Spikes

The matrix spike recoveries were within the acceptance limits.

Other Quality Assurance Measures and Issues

U - The analyte was not detected at or above the reported result.

bold - The analyte was present in the sample. (Visual Aid to locate detected compounds on report sheet.)

Please call Deans Momohara at (360) 871-8808 to further discuss this project.

cc: Project File

**Washington State Department of Ecology
Manchester Environmental Laboratory
Final Analysis Report for
Sulfate**

Project Name: Frontier Hardchrome-2011
Work Order: 1109064
Project Officer: Barrett, Guy

Date Collected: 09/13/2011
Date Analyzed: 09/21/2011

Analyte: Sulfate
Method: EPA300.0
Matrix: Water
Units: mg/L

Sample #	Sample ID	Result	Qualifier	RL	MDL	Collected	Analyzed	Batch ID
1109064-03	W85-6A	21.8		0.30	0.09	09/13/11	09/21/11	B111152
1109064-04	QA-1	21.8		0.30	0.09	09/13/11	09/21/11	B111152
1109064-07	W99-R5A	15.9		0.30	0.09	09/13/11	09/21/11	B111152
1109064-08	B85-4	38.3		0.30	0.09	09/13/11	09/21/11	B111152
1109064-10	B87-8	35.4		0.30	0.09	09/14/11	09/21/11	B111152

QC Results for Batch ID: B111152

Method Blank	Sample ID	Result	Qualifier	RL	Analyzed				
B111152-BLK1	Blank	0.30	U	0.30	09/20/11				

Sample #	QC Sample	Result	Spike Level	Source Sample	Source Result	%Rec	%Rec Limits	RPD	RPD Limit
B111152-BS1	LCS	5.21	5			104	90-110		
B111152-DUP1	Duplicate	2.54		1109071-13	2.60			2	20
B111152-MS1	Matrix Spike	26.9	5	1109064-04	21.8	102	75-125		
B111152-MS2	Matrix Spike	27.1	5	1109064-03	21.8	106	75-125		

Authorized by: DM

Release Date: 9/21/11



APPENDIX C
RECONSTRUCTED MONITORING WELL ELEVATIONS

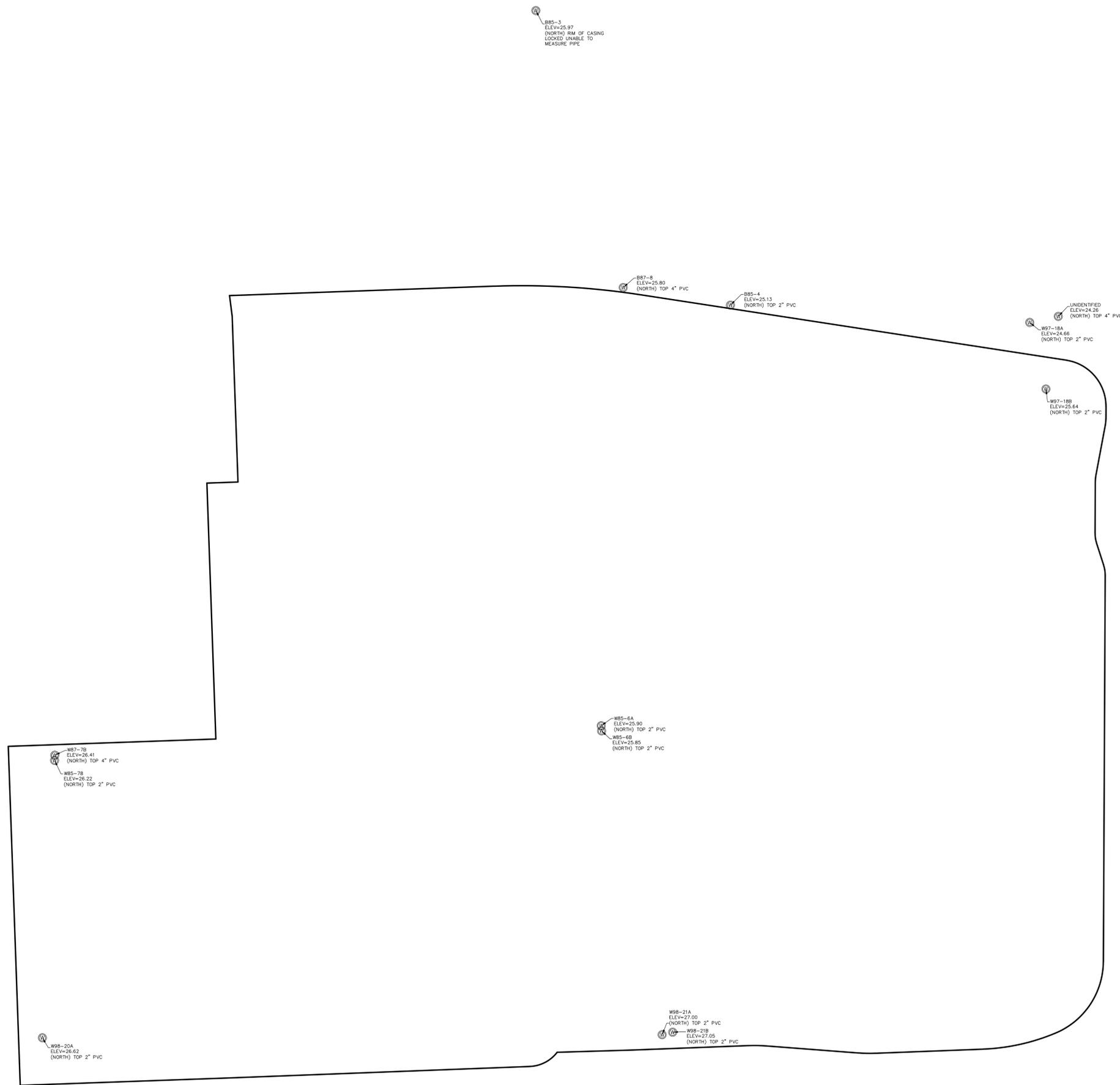
MONITORING WELL ASBUILT

FOR
"GRAND CENTRAL"

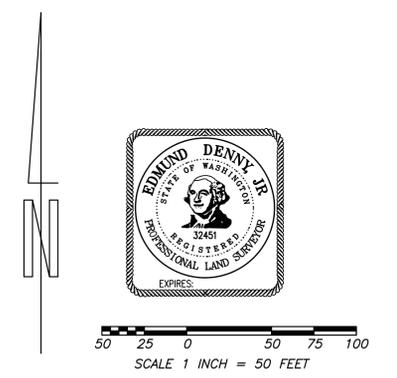
JOB NO.: 07-231
DATA COLLECT: 11-30-07
DRAWING DATE: 12-06-07

LEGEND:

Ⓜ INDICATES MONITORING WELL



BENCH MARK:
VERTICAL DATUM IS CITY OF VANCOUVER BENCH MARK 108, A BRASS DISC ON THE NORTHEAST CURB AT THE INTERSECTION OF E. 5TH STREET AND GRAND BOULEVARD.
ELEVATION = 53.76 (NAVD 29)



The logo for Minister-Glaeser Surveying Inc. features a circle with 'M' and 'S' and a central 'G'. To the right of the logo is the company name and address: MINISTER-GLAESER SURVEYING INC., 2200 E. EVERGREEN BLVD., VANCOUVER, WA 98661, (360) 694-3313.

APPENDIX D
DATA VALIDATION MEMORANDUM

APPENDIX D
EXCEPTION SUMMARY FOR LABORATORY
DATA QUALITY ASSURANCE REVIEW

DATA SUMMARY

The laboratory data quality assurance review and validation of analytical results for 25 water samples, Project Number 1109064, collected between September 12 and 15, 2011 from the Frontier Hard Chrome site has been completed. This review incorporates sample results for other metals for assessment purposes, but applies only to the following analyses:

- Total and dissolved chromium by Washington State Department of Ecology's (Ecology) Manchester Environmental Laboratory (MEL), of Port Orchard, Washington, following EPA Method 200.7 – inductively-coupled plasma/atomic emission spectrometry (ICP-AES).
- Sulfate by Ecology's MEL of Port Orchard, Washington, following EPA Method 300.0 – determination of inorganic anions by ion chromatography.
- Hexavalent chromium by Columbia Analytical Services (CAS) of Kelso, Washington, following EPA SW-846 Method 7196A – DPC colorimetry.

Quality assurance/quality control (QA/QC) reviews of laboratory procedures were performed on an ongoing basis by MEL. A data review was performed by MEL's QA section on laboratory quality control results to ensure they met method quality objectives for the project. Data review followed the format outlined in the *National Functional Guidelines for Inorganic Data Review* (EPA 2004), modified to include specific criteria specified in the *Frontier Hard Chrome Long-Term Monitoring Plan* (Work Plan; Weston 2004). Raw laboratory data including calibrations, sample login forms, sample preparation logs and bench sheets, mass spectral tuning data, and raw instrument data were not available for this review.

This is an exception summary. All laboratory quality assurance results as applicable (e.g., holding times; blank sample analysis, matrix spike/duplicate spike analysis, and laboratory control sample analysis results) supplied to WESTON for the analyses met acceptance criteria specified in the Work Plan (Weston 2004), with no exceptions.

A field duplicate was not collected for hexavalent chromium analysis. Laboratory duplicate, matrix spike/duplicate spike analysis, and laboratory control sample analysis results met acceptance criteria.

Precision was evaluated as relative percent differences (RPD) between duplicate and total/dissolved chromium concentrations and sulfate concentrations. Samples 1109064-17 (collected from monitoring well RA-MW-15B) and 1109064-24 (collected from monitoring well RA-MW-12A), were analyzed for both total recoverable and dissolved chromium. Sample 1109064-03 (collected from monitoring well W85-6A) was analyzed for total chromium and sulfate. Field duplicates for total recoverable chromium were collected from monitoring wells RA-MW-12A, RA-MW-15B, and W85-6A. Field duplicates were collected for dissolved

chromium samples from monitoring well RA-MW-15B. A field duplicate was collected monitoring well W85-6A and analyzed for sulfate. Acceptance criteria specified in the QAPP were met for all duplicate analyses.

Sample 1109064-17 (collected from monitoring well RA-MW-15B) results and the associated duplicate sample 1109064-18 (QA-2) results for total and dissolved chromium were not detected above the laboratory reporting limit. Therefore, the RPD between these samples was not calculable. Additionally, the RPD between sample 1109064-17 total chromium and dissolved chromium results was not calculable. The RPD between total recoverable and dissolved chromium results for sample 1109064-24 (collected from monitoring well RA-MW-12A) was 97%.

DATA QUALIFICATION

No QA/QC exceptions were noted in the data review associated with the analysis of total recoverable, dissolved, and hexavalent chromium. Upon consideration of the data qualifications noted above and the project data quality objectives specified in the QAPP, the data are ACCEPTABLE for use.

DATA QUALIFIERS

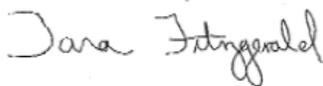
If required, any data qualifiers applied by the laboratory have been removed from the data summary sheets and superseded by data validation qualifiers.

No data validation qualifiers were used to modify the data quality and usefulness of individual analytical results.

DATA ASSESSMENT

Data review was performed by an experienced quality assurance chemist independent of the analytical laboratory and not directly involved in the project.

This is to certify that I have examined the analytical data and based on the information provided to me by the laboratory, in my professional judgment the data are acceptable for use except where qualified with qualifiers that modify the usefulness of those individual values.



Tara Fitzgerald
Project Chemist

November 22, 2011

Date