2013 ANNUAL GROUNDWATER REPORT

Prepared For

Camp Stanley Storage Activity
Boerne, Texas

Prepared By
PARSONS

Austin, Texas

March 2014

EXECUTIVE SUMMARY

This report provides an evaluation of results from groundwater monitoring conducted in 2013 at Camp Stanley Storage Activity (CSSA). Groundwater monitoring was performed on-post and off-post during the months of March, June, September, and December 2013. The CSSA groundwater monitoring program objectives are to determine groundwater flow direction and elevations, determine groundwater contaminant concentrations for characterization purposes, and identify meteorological and seasonal variations in physical and chemical properties. This report describes the physical and chemical characteristics of the groundwater monitoring results and changes occurring to the program during 2013.

- After enduring one of the most severe droughts in Central Texas history in 2011, followed by average rainfall in 2012 and 2013 the aquifer still remains depleted. Rainfall totals measured at CSSA were 29.20 inches from the AOC-65 Weather Station (WS) and 34.01 inches at the B-3 WS. These totals were approximately 4-9 inches below the 30-year normal of 37.81 inches for the Boerne weather station monitored by the National Weather Service.
- From March to June 2013, the average water level in the underlying aquifer increased 34.90 feet in response to 9.57 inches of rainfall during that timeframe. The aquifer levels receded between June and September 2013, which received only 3.92 inches of rainfall for the 3-month period. By September 2013, the average aquifer elevation had dropped by 43.40 feet. A total of 10.92 inches fell during the remainder of the year, with 6.71 inches coming in October. That end-of-year precipitation resulted in a 15.28 foot increase in the average aquifer elevation. CSSA received near-normal annual precipitation in 2013; the Middle Trinity aquifer sustained a net gain of 4.86 feet in the average aquifer elevation beneath CSSA, but remains more than 65 feet below its 11-year average (2003 through 2013).
- Both on- and off-post groundwater samples were collected quarterly in 2013 (March, June, September, and December) in accordance with the approved CSSA Long-Term Monitoring Optimization (LTMO) program. A key element of the CSSA LTMO program is the "snapshot" event which occurs every nine months. During these events, all on- and off-post wells are sampled to produce an area-wide dataset to describe aquifer contaminant conditions. In 2013, the snapshot event occurred September. Results from March, June, and September 2013 have been reported in previous quarterly reports. December 2013 data is presented in this annual report.
- In 2013, a total of 52 samples were collected from 33 on-post wells. Contaminant concentrations above drinking water standards were detected at 5 on-post wells. Four wells (CS-MW16-LGR, CS-MW16-CC, CS-MW1-LGR, and CS-MW36-LGR) exceeded drinking water standards for volatile organic compounds (VOCs) and one well (CS-MW9-LGR) exceeded drinking water standards for metals.

- A total of 39 samples were collected from 31 Westbay zones in 2013. VOC concentrations above drinking water standards were detected in a total of 14 zones at all four Westbay locations.
- In 2013, a total of 90 samples were collected from 54 off-post wells and 6 granular activated carbon (GAC) wellhead treatment locations. VOC concentrations above drinking water standards were detected at 1 off-post well (RFR-10). RFR-10 had a GAC unit installed at the wellhead in 2001 to remove VOC contamination prior to use. Samples collected after the treatment systems (post-GAC samples) continue to show that all VOC are being removed from those wells, and the treatment is effective. Off-post wells were not sampled for metals content.
- A 36-hour pumping test at future production well CS-13 was completed in June 2013. The pumping test confirmed that the well can sustain 110 gallons per minute (gpm) with a net drawdown of 167 feet below grade. Groundwater sampling did not indicate the presence of VOCs, semivolatile organic compounds (SVOCs), coliforms, or *e. coli*. Metals, cation, and anion concentrations were all below their established regulatory limits.

GEOSCIENTIST CERTIFICATION

2013 Annual Groundwater Monitoring Report

For

Department of the Army
Camp Stanley Storage Activity
Boerne, Texas

I, W. Scott Pearson, P.G., hereby certify that the 2013 Annual Groundwater Monitoring Report for the Camp Stanley Storage Activity installation in Boerne, Texas accurately represents the site conditions of the subject area. This certification is limited only to geoscientific products contained in the subject report and is made on the basis of written and oral information provided by the Camp Stanley Storage Activity Environmental Office, laboratory data provided by APPL, and field data obtained during groundwater monitoring conducted at the site in 2013, and is true and accurate to the best of my knowledge and belief.

W. Scott Pearson

W. Scott Pearson, P.G.
State of Texas
Geology License No. 2186

3-31-2014

Date

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W. Scott Pearson 3-31-2014

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF TABLES

LIST OF FIGURES

ACRONYMS AND ABBREVIATIONS

µg/L	Microgram Per Liter
1,1-DCE	1,1-Dichloroethene
§3008(h) Order	RCRA 3008(h) Administrative Order on Consent
AL	Action Level
AOC	Area of Concern
APPL	Agriculture and Priority Pollutants Laboratories, Inc.
BS	Bexar Shale
CC	Cow Creek
cis-1,2-DCE	*cis*-1,2-Dichloroethene
COC	Contaminants Of Concern
CSSA	Camp Stanley Storage Activity
DCP	Drought Contingency Plan
DQO	Data Quality Objectives
DVR	Data Validation Report
EXW	Extraction Well
GAC	Granular Activated Carbon
GPM	Gallons Per Minute
ISCO	In-Situ Chemical Oxidation
LGR	Lower Glen Rose
LTMO	Long Term Monitoring Optimization
MCL	Maximum Contaminant Level
MDL	Method Detection Limit
MSL	Mean Sea Level
NCDC	National Climatic Data Center
NWS	National Weather Service
PCE	Tetrachloroethene
Plan	CSSA Off-Post Monitoring Program and Response Plan
QAPP	Quality Assurance Program Plan
RCRA	Resource Conservation and Recovery Act
RL	Reporting Limit
SAWS	San Antonio Water Systems
SCADA	Supervisory Control and Data Acquisition
SS	Secondary Standard
SVOC	Semivolatile Organic Compound
SWMU	Solid Waste Management Unit
TCE	Trichloroethene
TCEQ	Texas Commission on Environmental Quality
TGRGCD	Trinity-Glen Rose Groundwater Conservation District

ACRONYMS AND ABBREVIATIONS *(continued)*

trans-1,2-DCE	*trans*-1,2-Dichloroethene
UGR	Upper Glen Rose
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
WS	Weather Station

1.0 INTRODUCTION

This report provides an evaluation of results from groundwater monitoring conducted in 2013 at Camp Stanley Storage Activity (CSSA). Groundwater monitoring was performed on-post and off-post during the months of March, June, September, and December 2013. All wells considered for sampling in 2013 are shown on **Figure 1.1**. This report describes the physical and chemical characteristics of the groundwater monitoring results and changes occurring to the program during 2013.

1.1 On-Post Groundwater Monitoring

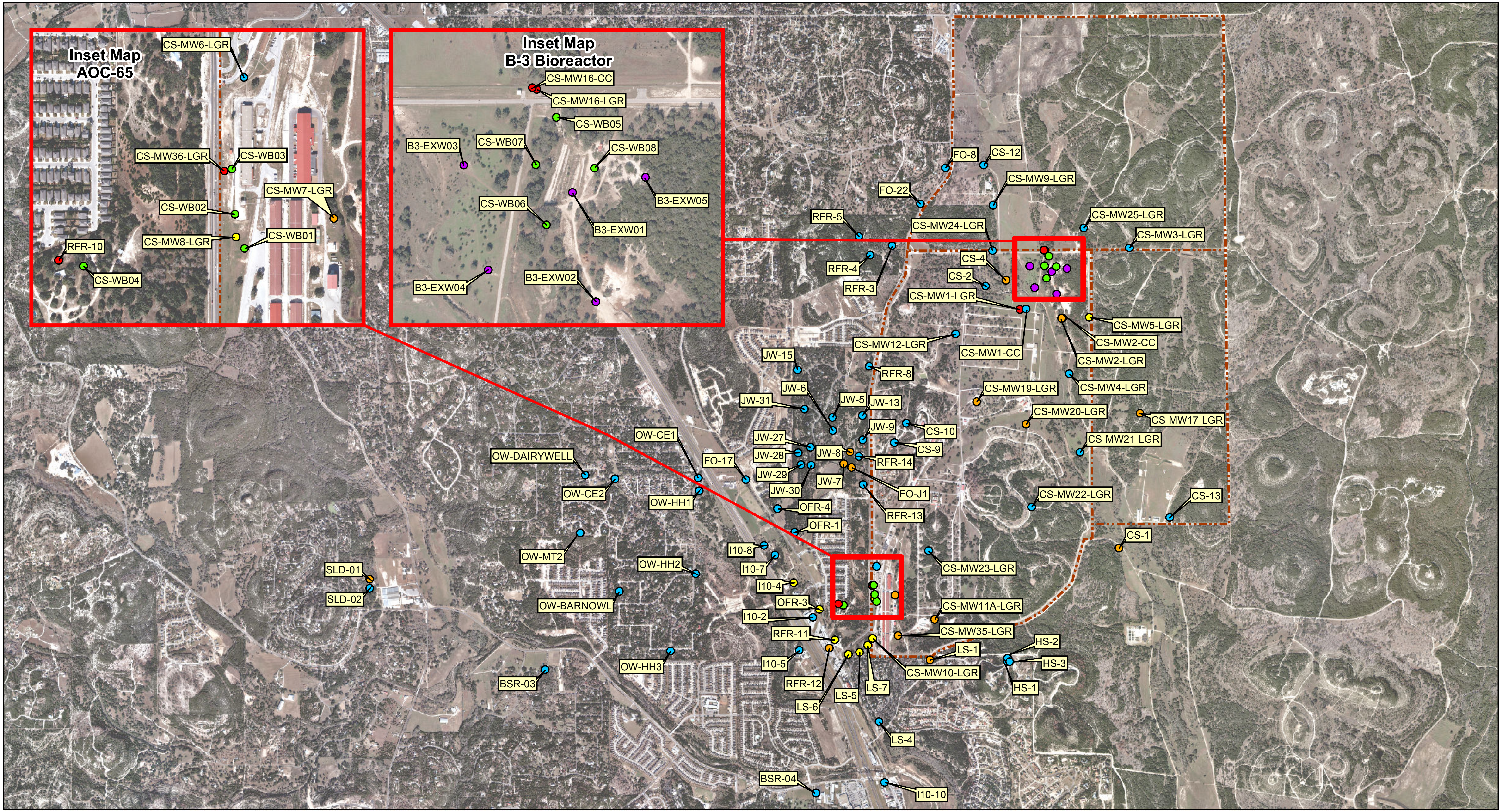
The current objectives of the CSSA on-post groundwater monitoring program are to monitor groundwater flow direction trends and elevations, determine groundwater contaminant concentrations for characterization purposes, and identify meteorological and seasonal variations in physical and chemical properties of the groundwater. The objectives incorporate and comply with the Resource Conservation and Recovery Act (RCRA) §3008(h) Administrative Order on Consent (§3008(h) Order) issued by the United States Environmental Protection Agency (USEPA) on May 5, 1999.

On-post groundwater monitoring was initiated in 1992 in response to volatile organic compound (VOC) contamination detected in CSSA drinking water supply well CS-MW16-LGR and continued periodically until the current CSSA quarterly groundwater monitoring program for on-post wells was initiated in December 1999.

The CSSA groundwater monitoring program follows the provisions of the groundwater monitoring program *Final Data Quality Objectives (DQO) for the Groundwater Monitoring Program* (Parsons 2010a) in **Appendix A**, as well as the recommendations of the *Three-Tiered Long Term Monitoring Network Optimization Evaluation* (Parsons 2010b) which provided recommendations for sampling based on a long-term monitoring optimization (LTMO) study performed for the CSSA groundwater monitoring program. LTMO study sampling frequencies were implemented on-post in December 2005, as approved by the Texas Commission on Environmental Quality (TCEQ) and the United States Environmental Protection Agency (USEPA). The LTMO evaluation was updated in 2010 using groundwater data from monitoring conducted between 2005 and 2009. It has been approved by the TCEQ and USEPA and was implemented on- and off-post in June 2011 (**Appendix J**).

A comprehensive summary of the results from the 2013 on-post groundwater sampling events is presented in **Appendix B**. **Appendices C** and **D** present Westbay analytical results in tabular and graphical format, respectively. Abbreviated tables showing only the detected compounds are included in the groundwater results discussions in Section 2.2.1 of this report. **Appendix E** presents the CSSA Drought Contingency Plan trigger levels, and **Appendix F** includes the potentiometric groundwater maps.

Off-post results for groundwater sampling and Granular Activated Carbon (GAC) maintenance are included as **Appendices G** and **H**. Laboratory data packages for 2013 were submitted to CSSA in electronic format separately from this report. **Appendix I** presents the associated data validation reports (DVR) for the December 2013 analytical package submittals. The March, June, and September DVRs are included with the quarterly



Aerial Photo Date: 2013

N
W E
S

0 0.5 1 2 Miles

- Wells with VOC concentrations > MCL
- Wells with VOC concentrations between RL and MCL
- Wells with VOC concentrations < RL
- Non-detect
- Mulit-port Westbay Wells
- Other wells
- Fence Line

MCL= maximum contaminant level
RL= laboratory analytical reporting limit

Figure 1.1

2013 Sampled On-Post and Off-Post Groundwater Wells
Camp Stanley Storage Activity

PARSONS

C:\CSSA\GIS\ANNUAL_GW_FACT_SHEET\fig1.1_2013_sampled_wells_annual_gw_report.mxd - 2/20/2014 @ 3:20:07 PM groundwater reports. Regulatory transmittal letters regarding the CSSA LTMO approval and VOC isoconcentration mapping are included in **Appendices J** and **K**.

1.2 Off-Post Groundwater Monitoring

The primary objective of the off-post groundwater monitoring program is to determine whether concentrations of VOCs detected in off-post public and private drinking water wells exceed safe drinking water standards. A secondary objective of the off-post groundwater monitoring program is to determine the lateral and vertical extent of the contaminant plumes associated with past releases near Area of Concern (AOC)-65 or from Solid Waste Management Units (SWMU) B-3 and O-1. A third objective of the off-post groundwater monitoring program is to assess whether there are apparent trends in contaminant levels (decreasing or increasing) over time in the sampled wells.

CSSA was required by the §3008(h) Order to identify and locate both privately and publicly owned groundwater wells within ¼-mile of CSSA. The Offsite Well Survey Report (Parsons 2001) was submitted to fulfill this requirement. This survey was updated in 2010 to capture any new wells that have been added in the area and to extend the ¼-mile to ½-mile of CSSA. In total, 97 well locations are identified in the updated 2010 Well Survey. A total of 47 locations (45 active and 2 plugged) were identified within ¼-mile radius, and another 39 locations (33 active and 6 plugged) are believed to exist between ¼ to ½-mile away from CSSA. Finally, a total of 11 locations (10 active and 1 plugged) were identified in a special interest area beyond the ½-mile survey that is considered to be downgradient of the CSSA VOC plumes.

Since the 2010 Well Survey, the USEPA has requested CSSA to identify additional wells beyond the ½-mile border to the south and west of the post. As a result, CSSA has identified five wells that follow the Boerne Stage Road corridor, ranging in distance between 0.75 and 3 miles from CSSA. One of these wells (SLD-01) had a detection below the reporting limit (RL) in September 2013. This well will be sampled quarterly until four consecutive quarters show no detections, in accordance with the DQO's.

Additional background information regarding off-post private and public water supply wells is located in the ***CSSA Environmental Encyclopedia, Volume 5 Groundwater***. Some off-post wells were initially sampled in 1995 and quarterly sampling of off-post wells began in 2001 in accordance with the *Off-Post Monitoring Program and Response Plan* (CSSA 2002a).

Under the Plan, the following criteria are used to determine the action levels for detected VOCs and to determine which off-post wells are sampled:

- If VOC contaminant levels are ≥90 percent of the maximum contaminant levels (MCL) for tetrachloroethene [PCE] and trichloroethene [TCE]) (≥4.5 micrograms per liter [µg/L] based on preliminary data received from the laboratory, and the well is used as a potable water source, the well will be taken offline, bottled water will be supplied within 24 hours after receipt of the data, and a confirmation sample will be collected from the well within 14 days of receipt of the final validated analytical report. If the confirmation sample confirms contaminants of concern (COC) are at or above 90 percent of the MCLs, the well will be evaluated, and either installation of an appropriate method for wellhead treatment or connection to an alternative water source will be performed.

- If VOC contaminant levels are ≥80 but ≤90 percent of the MCL (>4.0 and < 4.5 µg/L for PCE and TCE) during any single monitoring event based on preliminary data from the laboratory, and the well is used as a potable water source, it will be monitored monthly. If the monthly follow-up sampling confirms that COCs are ≥80 but ≤90 percent of the MCL, it will continue to be sampled monthly until the VOC levels fall below the 80 percent value.
- If any COC is detected at levels greater than or equal to the analytical method detection limit (MDL) (historically 0.06 µg/L for PCE and 0.05 µg/L for TCE), and <80 percent of the MCL, the well will be sampled on a quarterly basis. This sampling will be conducted concurrently with on-post sampling events and will be used to develop historical trends in the area. Quarterly sampling will continue for a minimum of 1 year, after which the sampling frequency will be reviewed and may be decreased.
- If COCs are not detected during the initial sampling event (i.e., no VOC contaminant levels above the MDL), further sampling of the well will be reconsidered. A well with no detectable VOCs may be removed from the sampling list. However, if analytical data suggest future plume migration could negatively influence the well, it will be re-sampled as needed. The well owner, USEPA, and TCEQ will be apprised of any re-sampling decisions regarding the non-detect wells.
- For locations where a wellhead treatment system has been installed, post-treatment samples will be collected and analyzed after initial system start-up and at 6-month intervals to confirm the system is effectively removing VOCs.

A comprehensive summary of the results from the 2013 off-post groundwater sampling events is presented in **Appendix G**. Abbreviated tables showing only the detected compounds are included in the groundwater results discussions in Section 2.2.2 of this report. **Appendix H** summarizes pre- and post-granular activated carbon (GAC) filtration system sampling results.

The cumulative historical results from both on- and off-post groundwater monitoring are presented in summary tables located in the Introduction to the *On-Post and Off-Post Quarterly Groundwater Monitoring Program* (Tables 6 through 9), ***CSSA Environmental Encyclopedia, Volume 5 Groundwater.***

2.0 GROUNDWATER MONITORING RESULTS

2.1 Physical Characteristics

2.1.1 Water Level Measurements

Water level measurements were recorded prior to sampling during the March, June, September, and December 2013 events. Water level measurements made at all monitoring wells and drinking water wells listed in **Table 2.1**, a total of 56 wells. Water levels from one off-post well (FO-20) is used to develop the northern perimeter of the gradient maps. Water levels were measured by either e-line indicator or collected from a permanently installed transducer.

Water level elevations and quarterly elevations are summarized in **Table 2.1**. The average groundwater elevation measurements for each of the Lower Glen Rose (LGR), Bexar Shale (BS), and Cow Creek (CC) intervals of the Middle Trinity Aquifer are provided in **Table 2.2**. The averages were calculated using groundwater elevations from wells screened in only one of the three intervals. Water elevations from 8 wells completed with open boreholes over multiple formations were not used. Although an average amount of rain fell in 2013 the water table has still not recovered from the 2011 drought.

The aquifer levels began to recede in 2013 between January and late May 2013, which received 7.21 inches of rainfall for the 5-month period. As a result, quarterly groundwater monitoring showed average aquifer levels decreased by 2.93 feet from December 2012 to March 2013. From May 24-26 four inches of rain fell in that 3 day period. With this rainfall and an additional 2 inches in June the aquifer rebounded 34.90 feet. From June 24th to September 3rd the aquifer dropped 43.40 feet with only 0.63 inches of rainfall in that period. A total of 14.16 inches fell during the remainder of the year, with 11.62 inches coming in September and October. That end-of-year precipitation resulted in a 16.28-foot increase in the average aquifer elevation. Through all the hydrologic cycles in 2013, the overall groundwater levels in the Middle Trinity Aquifer increased 4.86 feet from January through December 2013, as shown in **Table 2.1**.

The total amount of precipitation that fell in 2013 was 29.20 inches at the AOC-65 Weather Station (WS) and 34.01 inches at the B-3 WS, which was similar to the 31.48 inches that fell in 2012. The aquifer is still struggling to recover from the 2011 drought which only recorded 17.24 inches of rainfall, as measured by the CSSA weather stations. According to the National Climatic Data Center (NCDC), the 30-year precipitation normal (1981-2010) for Boerne, TX is 37.81 inches.

Based on 2013 quarterly aquifer level measurements, **Figure 2.1** shows the relationships of the water level in each portion of the aquifer at CSSA cluster wells (CS-MW1, CS-MW2, CS-MW6, CS-MW7, CS-MW8, CS-MW9, CS-MW10, and CS-MW12). The general trend in **Figure 2.1** shows that at an individual location, the head in the LGR well is typically greater than in the CC well. The amount of dissimilarity between water levels within a cluster is a good indicator to the degree of hydraulic separation between the formational units. Theoretically, intervals that are well connected hydraulically will have the same or very similar groundwater elevation.

Table 2.1
Summary of Groundwater Elevations and Changes, 2013

Well ID	TOC elevation (ft MSL)	March 2013 Elevations	June 2013 Elevations	September 2013 Elevations	December 2013 Elevations	Groundwater Elevation Change: December 12 minus March 13	June minus March	September minus June	December minus September	Formations Screened: LGR	BS	CC
CS-1*	**1169.27**	**900.67**	**882.97**	**831.27**	**912.77**	**-2.53**	**-17.70**	**-51.70**	**81.50**		**ALL**	
CS-2	**1237.59**	**980.36**	**981.56**	**979.48**	**980.52**	**0.00**	**1.20**	**-2.08**	**1.04**	**?**	**?**	
CS-3	1240.17	978.70	984.85	973.00	978.84	-0.05	6.15	-11.85	5.84	**X**		
CS-4	**1229.28**	**976.65**	**984.12**	**974.48**	**977.16**	**-0.22**	**7.47**	**-9.64**	**2.68**	**?**	**?**	
CS-9	**1325.31**	**942.70**	**960.94**	**939.11**	**948.59**	**-3.05**	**18.24**	**-21.83**	**9.48**		**ALL**	
CS-10*	**1331.51**	**893.51**	**969.51**	**941.51**	**950.81**	**-58.00**	**76.00**	**-28.00**	**9.30**		**ALL**	
CS-12*	**1274.09**	**982.99**	**991.99**	**973.39**	**982.61**	**0.80**	**9.00**	**-18.60**	**9.22**		**ALL**	
CS-13	**1193.26**	**913.04**	**965.12**	**905.36**	**928.12**	**-6.94**	**52.08**	**-59.76**	**22.76**		**ALL**	
CS-D	1236.03	978.17	981.66	973.35	976.56	1.24	3.49	-8.31	3.21	**X**		
CS-MWG-LGR	1328.14	1015.66	1018.78	1006.52	1009.97	3.75	3.12	-12.26	3.45	**X**		
CS-MWH-LGR	1319.19	1017.01	1020.34	1006.63	1010.01	6.69	3.33	-13.71	3.38	**X**		
CS-I*	1315.20	1009.00	1014.68	1002.78	1008.43	0.85	5.68	-11.90	5.65	**X**		
CS-MW1-LGR	1220.73	975.07	996.01	969.08	980.22	-1.86	20.94	-26.93	11.14	**X**		
CS-MW1-BS	1221.09	977.99	993.76	974.92	978.52	-3.98	15.77	-18.84	3.60		**X**	
CS-MW1-CC	1221.39	954.24	970.74	935.11	948.34	-1.65	16.50	-35.63	13.23			**X**
CS-MW2-LGR	1237.08	971.45	1000.52	966.48	977.66	-0.89	29.07	-34.04	11.18	**X**		
CS-MW2-CC	1240.11	949.77	964.65	931.69	941.41	-1.44	14.88	-32.96	9.72			**X**
CS-MW3-LGR	1334.14	978.67	986.74	975.33	978.59	0.59	8.07	-11.41	3.26	**X**		
CS-MW4-LGR	1209.71	979.64	1098.66	971.63	1033.67	-6.14	119.02	-127.03	62.04	**X**		
CS-MW5-LGR	1340.24	966.97	993.52	963.20	971.32	-0.44	26.55	-30.32	8.12	**X**		
CS-MW6-LGR	1232.25	932.80	980.42	925.51	953.83	-4.95	47.62	-54.91	28.32	**X**		
CS-MW6-BS	1232.67	966.36	998.93	965.94	956.35	-22.85	32.57	-32.99	-9.59		**X**	
CS-MW6-CC	1233.21	919.92	985.02	907.19	936.06	-7.17	65.10	-77.83	28.87			**X**
CS-MW7-LGR	1202.27	921.87	974.73	914.69	941.48	-4.63	52.86	-60.04	26.79	**X**		
CS-MW7-CC	1201.84	909.48	976.80	897.46	927.40	-7.33	67.32	-79.34	29.94			**X**
CS-MW8-LGR	1208.35	926.53	983.36	917.65	950.51	-5.83	56.83	-65.71	32.86	**X**		
CS-MW8-CC	1206.13	911.66	978.94	899.26	929.52	-7.37	67.28	-79.68	30.26			**X**
CS-MW9-LGR	1257.27	988.91	989.88	983.72	987.63	1.24	0.97	-6.16	3.91	**X**		
CS-MW9-BS	1256.73	988.81	999.58	984.73	987.28	0.53	10.77	-14.85	2.55		**X**	
CS-MW9-CC	1255.95	974.62	988.65	954.17	970.10	1.27	14.03	-34.48	15.93			**X**
CS-MW10-LGR	1189.53	893.88	970.63	884.36	918.67	-7.73	76.75	-86.27	34.31	**X**		
CS-MW10-CC	1190.04	885.19	948.57	876.89	902.68	-7.33	63.38	-71.68	25.79			**X**
CS-MW11A-LGR	1204.03	892.38	967.37	880.98	919.44	-9.21	74.99	-86.39	38.46	**X**		
CS-MW11B-LGR	1203.52	995.11	995.45	NA	NA	-0.84	0.34	NA	NA	**X**		
CS-MW12-LGR	1259.07	972.83	984.02	967.10	975.62	-0.84	11.19	-16.92	8.52	**X**		
CS-MW12-BS	1258.37	977.20	1006.38	971.22	977.52	-2.33	29.18	-35.16	6.30		**X**	
CS-MW12-CC	1257.31	967.01	983.99	947.12	963.08	-0.45	16.98	-36.87	15.96			**X**
CS-MW16-LGR*	1244.60	971.88	959.10	973.63	965.10	25.08	-12.78	14.53	-8.53	**X**		
CS-MW16-CC*	1244.51	886.77	899.21	869.64	876.01	-2.24	12.44	-29.57	6.37			**X**
B3-EXW01*	1245.26	973.76	990.34	970.08	977.09	55.50	16.58	-20.26	7.01	**X**		
B3-EXW02*	1249.66	925.46	996.69	967.34	933.86	-3.30	71.23	-29.35	-33.48	**X**		
B3-EXW03*	1235.11	975.52	958.87	938.59	946.05	0.45	-16.65	-20.28	7.46	**X**		
B3-EXW04*	1228.46	962.7	996.24	962.17	962.93	-14.76	33.54	-34.07	0.76	**X**		
B3-EXW05*	1279.46	971.01	983.34	916.04	909.91	-4.59	12.33	-67.30	-6.13	**X**		
CS-MW17-LGR	1257.01	935.59	971.56	934.29	941.86	-0.32	35.97	-37.27	7.57	**X**		
CS-MW18-LGR	1283.61	938.74	962.74	935.79	943.49	-2.05	24.00	-26.95	7.70	**X**		
CS-MW19-LGR	1255.53	954.96	995.26	951.48	970.44	-1.95	40.30	-43.78	18.96	**X**		
CS-MW20-LGR	1209.42	956.03	1012.44	951.85	977.51	-2.39	56.41	-60.59	25.66	**X**		
CS-MW21-LGR	1184.53	934.32	972.43	932.69	940.96	-0.94	38.11	-39.74	8.27	**X**		
CS-MW22-LGR	1280.49	913.59	965.00	909.39	920.70	-3.52	51.41	-55.61	11.31	**X**		
CS-MW23-LGR	1258.20	916.82	970.39	912.02	934.78	-2.92	53.57	-58.37	22.76	**X**		
CS-MW24-LGR	1253.90	980.81	983.70	976.71	980.19	0.43	2.89	-6.99	3.48	**X**		
CS-MW25-LGR	1293.01	985.26	987.14	981.39	984.16	0.96	1.88	-5.75	2.77	**X**		
CS-MW35-LGR	1186.97	893.08	975.68	883.49	920.12	-8.77	82.60	-92.19	36.63	**X**		
CS-MW36-LGR	1218.74	929.25	983.21	920.59	953.10	-5.81	53.96	-62.62	32.51	**X**		
FO-20	**NA**	**1055.09**	**1055.31**	**1032.53**	**1048.37**	**8.19**	**0.22**	**-22.78**	**15.84**		**ALL**	
Average groundwater elevation change (all wells minus pumpers):						**-2.93**	**34.90**	**-43.40**	**16.28**			
Net change in average groundwater elevation since December 2013:						**4.86**						

Notes:

Average groundwater elevation change is calculated from wells screened in only one formation.

Bold wells: CS-1, CS-2, CS-4, CS-9, CS-10, CS-11, CS-12, CS-13, and FO-20 are open boreholes across more than one of the formations and are not included in average groundwater elevation calculations.

* Well is equiped with a submersible pump that cycles on and off.

NA = Data not available or the well is dry (CS-MW11B-LGR is often dry).

?=Exact screening information unknown for this well.

All measurements given in feet.

Table 2.2
Summary of Groundwater Elevation by Formation, 2013

Well ID	TOC elevation	2013 Groundwater Elevations				Formations Screened		
		March	June	September	December	LGR	BS	CC
CS-1*	**1169.27**	**900.67**	**882.97**	**831.27**	**912.77**	**ALL**		
CS-2	**1237.59**	**980.36**	**981.56**	**979.48**	**980.52**	**?**	**?**	
CS-3	1240.17	978.70	984.85	973.00	978.84	X		
CS-4	**1229.28**	**976.65**	**984.12**	**974.48**	**977.16**	**?**	**?**	
CS-9	**1325.31**	**942.70**	**960.94**	**939.11**	**948.59**	**ALL**		
CS-10*	**1331.51**	**893.51**	**969.51**	**941.51**	**950.81**	**ALL**		
CS-12*	**1274.09**	**982.99**	**991.99**	**973.39**	**982.61**	**ALL**		
CS-13	**1193.26**	**913.04**	**965.12**	**905.36**	**928.12**	**ALL**		
CS-D	1236.03	978.17	981.66	973.35	976.56	X		
CS-MWG-LGR	1328.14	1015.66	1018.78	1006.52	1009.97	X		
CS-MWH-LGR	1319.19	1017.01	1020.34	1006.63	1010.01	X		
CS-I*	1315.20	1009.00	1014.68	1002.78	1008.43	X		
CS-MW1-LGR	1220.73	975.07	996.01	969.08	980.22	X		
CS-MW1-BS	1221.09	977.99	993.76	974.92	978.52		X	
CS-MW1-CC	1221.39	954.24	970.74	935.11	948.34			X
CS-MW2-LGR	1237.08	971.45	1000.52	966.48	977.66	X		
CS-MW2-CC	1240.11	949.77	964.65	931.69	941.41			X
CS-MW3-LGR	1334.14	978.67	986.74	975.33	978.59	X		
CS-MW4-LGR	1209.71	979.64	1098.66	971.63	1033.67	X		
CS-MW5-LGR	1340.24	966.97	993.52	963.20	971.32	X		
CS-MW6-LGR	1232.25	932.80	980.42	925.51	953.83	X		
CS-MW6-BS	1232.67	966.36	998.93	965.94	956.35		X	
CS-MW6-CC	1233.21	919.92	985.02	907.19	936.06			X
CS-MW7-LGR	1202.27	921.87	974.73	914.69	941.48	X		
CS-MW7-CC	1201.84	909.48	976.80	897.46	927.40			X
CS-MW8-LGR	1208.35	926.53	983.36	917.65	950.51	X		
CS-MW8-CC	1206.13	911.66	978.94	899.26	929.52			X
CS-MW9-LGR	1257.27	988.91	989.88	983.72	987.63	X		
CS-MW9-BS	1256.73	988.81	999.58	984.73	987.28		X	
CS-MW9-CC	1255.95	974.62	988.65	954.17	970.10			X
CS-MW10-LGR	1189.53	893.88	970.63	884.36	918.67	X		
CS-MW10-CC	1190.04	885.19	948.57	876.89	902.68			X
CS-MW11A-LGR	1204.03	892.38	967.37	880.98	919.44	X		
CS-MW11B-LGR	1203.52	995.11	995.45	NA	NA	X		
CS-MW12-LGR	1259.07	972.83	984.02	967.10	975.62	X		
CS-MW12-BS	1258.37	977.20	1006.38	971.22	977.52		X	
CS-MW12-CC	1257.31	967.01	983.99	947.12	963.08			X
CS-MW16-LGR*	1244.60	971.88	959.10	973.63	965.10	X		
CS-MW16-CC*	1244.51	886.77	899.21	869.64	876.01			X
B3-EXW01*	1245.26	973.76	990.34	970.08	977.09	X		
B3-EXW02*	1249.66	925.46	996.69	967.34	933.86	X		
B3-EXW03*	1235.11	975.52	958.87	938.59	946.05	X		
B3-EXW04*	1228.46	962.7	996.24	962.17	962.93	X		
B3-EXW05*	1279.46	971.01	983.34	916.04	909.91	X		
CS-MW17-LGR	1257.01	935.59	971.56	934.29	941.86	X		
CS-MW18-LGR	1283.61	938.74	962.74	935.79	943.49	X		
CS-MW19-LGR	1255.53	954.96	995.26	951.48	970.44	X		
CS-MW20-LGR	1209.42	956.03	1012.44	951.85	977.51	X		
CS-MW21-LGR	1184.53	934.32	972.43	932.69	940.96	X		
CS-MW22-LGR	1280.49	913.59	965.00	909.39	920.70	X		
CS-MW23-LGR	1258.20	916.82	970.39	912.02	934.78	X		
CS-MW24-LGR	1253.90	980.81	983.70	976.71	980.19	X		
CS-MW25-LGR	1293.01	985.26	987.14	981.39	984.16	X		
CS-MW35-LGR	1186.97	893.08	975.68	883.49	920.12	X		
CS-MW36-LGR	1218.74	929.25	983.21	920.59	953.10	X		
FO-20	**NA**	**1055.09**	**1055.31**	**1032.53**	**1048.37**	**ALL**		
Average groundwater elevation by formation, each event:	**LGR:**	**954.43**	**989.52**	**947.00**	**964.12**	**Average groundwater elevation by formation all of 2013:**		**963.77**
	BS:	**977.59**	**999.66**	**974.20**	**974.92**			**981.59**
	CC:	**933.99**	**974.67**	**918.61**	**939.82**			**941.77**

Notes:

Average groundwater elevation change is calculated from wells screened in only one formation

Bold wells: CS-1, CS-2, CS-4, CS-9, CS-10, CS-11, CS-12, CS-13, and FO-20 are open boreholes across more than one of the formations and are not included in average groundwater elevation calculations.

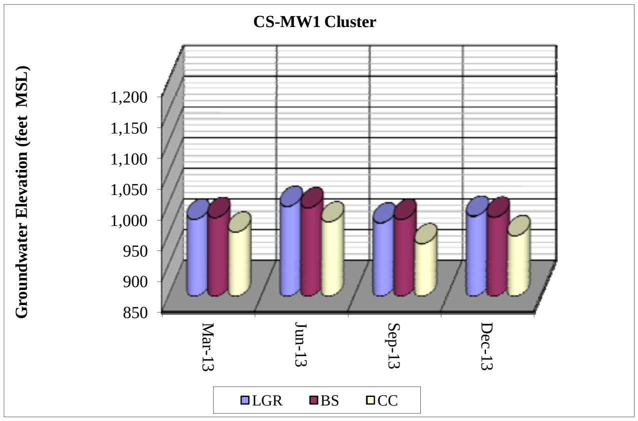
* = Well is equiped with a submersible pump that cycles on and off.

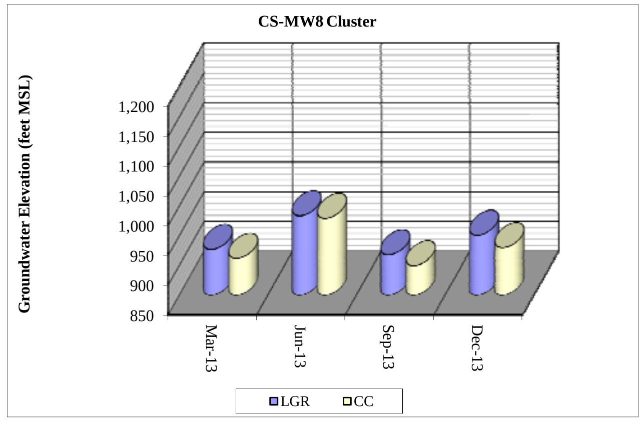
NA = Data not available or the well is dry (CS-MW11B-LGR is often dry).

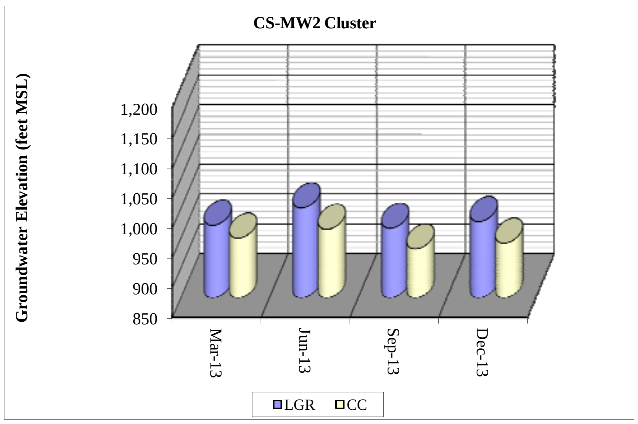
? = Exact screening information unknown for this well.

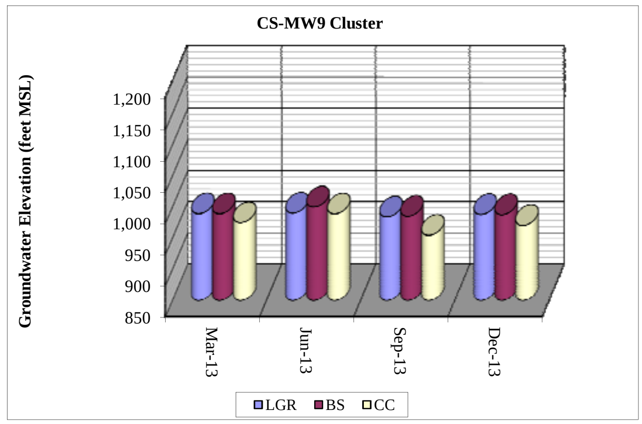
All measurements given in feet.

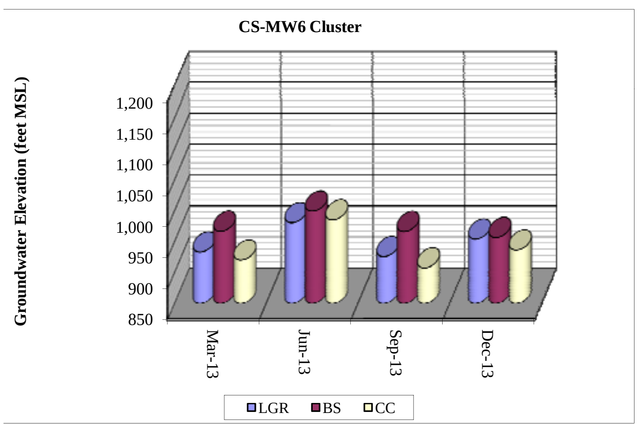
Figure 2.1
Comparison of Groundwater Elevations within Well Clusters

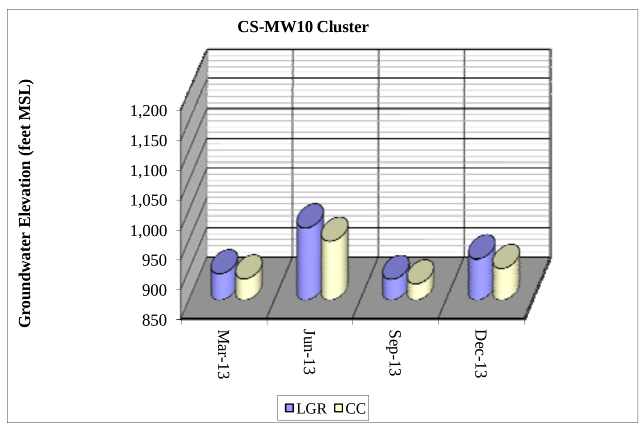


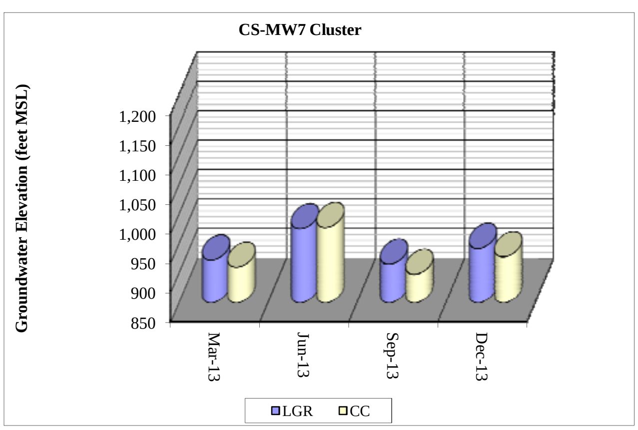


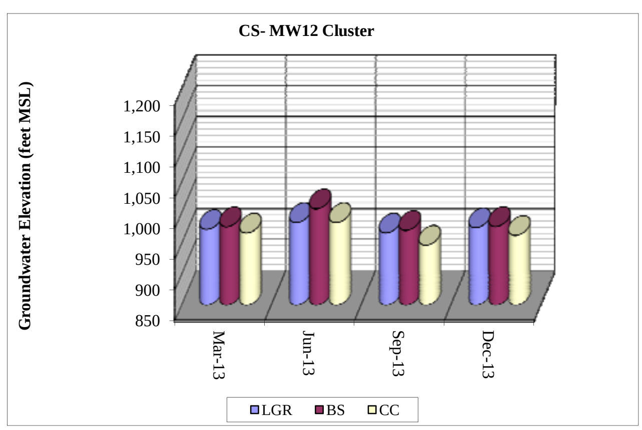












In 2013, well clusters in the southern portion in the post (CS-MW6, CS-MW7, CS-MW8, and CS-MW10) show less hydraulic head separation between the LGR and CC production zones than cluster wells to the north (CS-MW1, CS-MW2, CS-MW9, and CS-MW12. The other notable trend in this graphic is that much more drastic declines in groundwater levels occurred in the southern portion of base (CS-MW6, CS-MW7, CS-MW8, and CS-MW10).

Under more favorable hydrologic conditions, the groundwater elevation in the BS typically falls between the LGR and CC elevations; this was not evident in 2013. As seen in **Figure 2.1**, when water levels decline as they did during the first and third quarters of 2013, the BS groundwater elevation is generally higher than both of its counterparts. This phenomenon has been observed before in the cluster wells, and is attributed to the low draining potential of the less permeable BS matrix during continual aquifer declines. Conversely, during recharge events the groundwater in the BS wells will lag behind the LGR and CC wells, and seems to be typical for the area.

2.1.2 Weather Station and Transducer Data

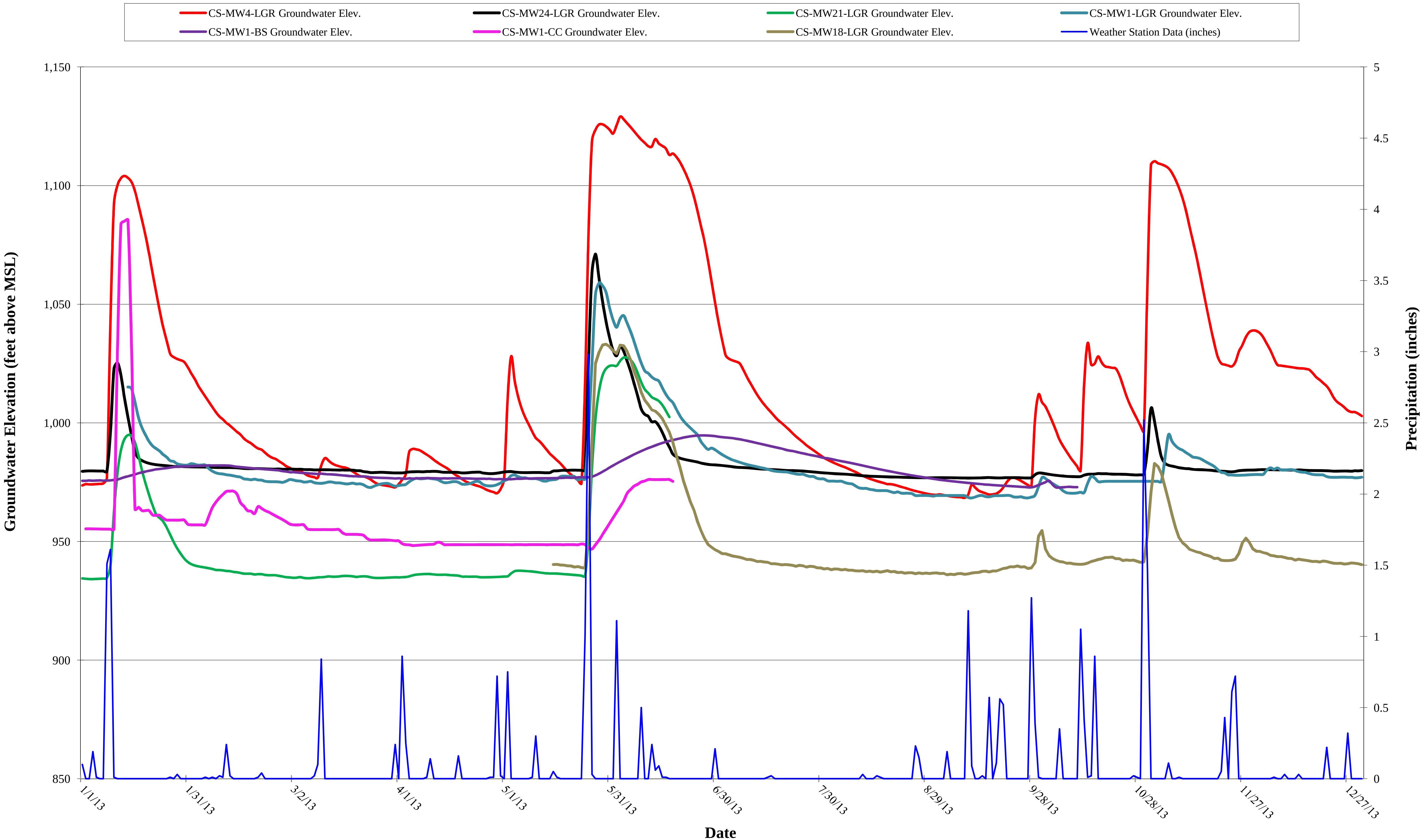
Of the 56 wells listed on **Table 2.1**, 16 are equipped with transducers to continuously log groundwater levels, 13 are providing telemetry directly to the Supervisory Control and Data Acquisition (SCADA) system. The wells with SCADA transducers are still being programmed for SCADA compatibility. Two weather stations are in place at CSSA, B-3 WS is located next to the B3-EXW01 well in the north-central region of CSSA, and AOC-65 WS in the southwest corner of CSSA at AOC-65. A third weather station is in the process of being set up next to CS-MW18-LGR. All weather stations record meteorological data, including precipitation, wind speed, wind direction, temperature, etc. The data are recorded to evaluate whether trends in rainfall and groundwater recharge are apparent.

Continuous aquifer level data (January 1st through December 31st, 2013) collected from five wells screened within the LGR, one well screened within the BS and, one well screened within the CC are presented on **Figure 2.2** as well as the corresponding daily precipitation values. The wells presented in this figure are equipped with transducers set to record water level measurements on a daily basis with increased monitoring during significant rain events. Both CS-MW16-LGR and CS-MW16-CC are omitted from this graphic since they are actively pumping wells for the Bioreactor system, and therefore do not reflect static aquifer conditions. The active drinking water wells and the B3-EXW extraction wells were also omitted for the same reason.

CSSA B-3 WS reported 88 rainfall events with a total precipitation of 34.01 inches. While the CSSA AOC-65 WS reported 84 rainfall events with a total precipitation of 29.20 inches in 2013. In 2012 the AOC-65 weather station recorded 31.48 inches of rainfall in 85 events; the B-3 weather station was installed in October 2012 and did not record a complete set of data for 2012. In 2011, 56 rainfall events were recorded with a total precipitation of 17.24 inches of rain which sent the area into a severe drought.

Rainfall events during 2013 were fairly evenly spaced from January to December. A total of 14.57 inches fell in the first 6 months and 14.63 inches fell in the last 6 months of the year. October reported the highest monthly rainfall amount with 6.71 inches and July had the lowest rainfall total with 0.03 inches recorded. During the same timeframe, 31.59 inches of

Figure 2.2, Selected Wells Groundwater Elevations vs Precipitation Data



J:\CSSA Program\Restoration\Groundwater\GW Monitoring Reports\2013\Annual Report\Figure 2-2 Transducer-WS Data.xlsx rainfall was measured at the San Antonio International Airport, and 25.91 inches of rainfall was measured in Boerne Stage Field Airport, TX.

Based upon 30-year precipitation normals (1981-2010), 2013 rainfall totals at CSSA ended about 3.8 inches (B-3 WS) and 8.61 (AOC-65 WS) inches below the Boerne National Weather Service (NWS) weather station 1981-2010 average of 37.81 inches. The San Antonio NWS weather station reports a 30 year (1981-2010) average of 32.27, which was 3.07 inches above the CSSA AOC-65 WS and 1.74 inches below the CSSA B-3 WS. Bexar County and surrounding areas are under moderate drought conditions and the Trinity Glen Rose Groundwater Conservation District (TGRGCD) remains under Stage 2 severe drought water restrictions, which went into effect June 1, 2011.

Table 2.3 shows the total precipitation received each quarter, average groundwater elevations in each formation, the average groundwater elevation change in each formation, the approximate gradient, and approximate gradient flow direction for all monitoring events. As in the past, the groundwater elevations indicate recharge of the LGR formation immediately after precipitation.

The latter half of 2009 marked the end of a drought cycle that had begun in 2008. Major precipitation events in August and September 2009 recharged the aquifer and began a trend that continued through May 2010. The aquifer surge experienced in the first five months was negated by a summer dry period through August 2010. Rainfall amounts declined September 2010 through September 2011, resulting in regional aquifer level decline of approximately 195 feet. There was an increase in rainfall late in 2011 but due to the already depressed aquifer the drought conditions persisted into 2012. Although an average amount of rain fell in 2012 and 2013, the aquifer rebound was minimal. At this point in the hydrologic cycle, it will take above-average annual precipitation to overcome the aquifer deficit.

2.1.3 Potentiometric Data

The groundwater gradient/potentiometric surface figures presented **Appendix F** incorporate measured groundwater elevations from the LGR, BS, and CC screened wells. The drought conditions which began in late 2010 persisted in 2011 and showed little improvement in 2012 and 2013. The 2011 record low yearly rainfall total of 17 inches sent Bexar County and surrounding areas into one of the worst droughts in Texas history. Although an average amount of rain fell in 2013, a more than average amount of rainfall will be needed to allow the aquifers to recover to normal conditions. As shown in **Appendix F**, water levels at CSSA can vary greatly. This variability is associated with several factors:

- A low storage capacity for groundwater within the primary porosity (interstitial voids between grains) of the limestone matrix, which is inherent to carbonate mudstone aquifers These aquifers with lower storage capacities are more susceptible to widely fluctuating groundwater levels (as compared to a well-sorted sand matrix). Within the Middle Trinity aquifer and other regional carbonate aquifers, their groundwater yield is mostly derived from secondary porosity features resulting from faults, fractures, and chemical dissolution of the bedrock (karst).
- Differences in well completion depths and formations screened;

Table 2.3
Precipitation, Groundwater Elevation and Gradient

Quarterly Report (Month, year)	Total Quarterly precipitation (inches) North WS B-3	Total Quarterly precipitation (inches) South WS AOC-65	Average GW elevation Change (feet)	CS-MW18-LGR GW Elevation Change (feet)	in each Formation (ft/MSL)			Approximate gradient (ft/ft)	Approximate gradient flow direction
					Lower Glen Rose	Bexar Shale	Cow Creek		
September-99	7.52	--	-188.4	--	979.80	--	--	0.007	Southwest
December-99	2.84	--	-4.9	--	973.10	--	--	0.004	Southwest
March-00	3.58	--	-9.3	--	970.94	--	--	0.009	South-southeast
June-00	11.1	--	11.77	--	976.27	--	--	0.006	Southeast
September-00	1.96	--	-6.34	--	967.03	--	--	0.006	Southeast
December-00	14.48	--	122.99	--	1118.59	--	--	0.005	South-southeast
March-01	10.13	--	53.19	--	1157.20	--	--	0.0125	Southeast
June-01	6.58	--	-47.5	--	1104.00	1106.85	1093.89	0.007	Southeast
September-01	14.73	--	23.96	--	1140.55	1098.18	1095.75	0.0067	Southeast
December-01	10.16	--	15.46	--	1149.68	1131.36	1125.63	0.0092	Southeast
March-02	2.25	--	-70.97	--	1077.91	1064.46	1059.27	0.0086	Southeast
June-02	4.46	--	-48.29	--	1030.51	1022.51	994.02	0.0137	South-southeast
September-02	30.98	--	104.5	--	1130.87	1129.21	1098.34	0.017	South-southeast
December-02	12.91	--	19.48	-2.84	1143.98	1148.26	1133.11	0.0061	South-southeast
March-03	6.22	6.68	-8.47	-1.99	1135.18	1140.52	1122.95	0.012	South-southeast
June-03	4.67	4.64	-41.08	-40.06	1097.87	1095.36	1069.02	0.0022	South-southwest
September-03	8.05	10.28	-52.85	-54.54	1046.77	1060.39	1025.61	0.0045	South-southwest
December-03	2.79	2.92	-32.85	-40.46	1011.38	1029.39	1002.07	0.0095	South-southwest
March-04	6.35	5.93	22.89	36.7	1043.68	1026.20	1017.98	0.0046	South-southwest
June-04	12.95	12.33	71.91	88.99	1121.80	1101.85	1074.56	0.0012	South-southwest
September-04	14.3	14.57	-8.05	-21.66	1106.43	1110.17	1074.96	0.003	South-southeast
December-04	21.04	23.12	63.07	76.62	1173.98	1159.46	1135.16	0.004	South-southeast
March-05	7.38	6.48	-6.47	-7.11	1168.46	1151.60	1127.58	0.00436	South-southeast
June-05	NA	5.29	-45.93	-61.3	1119.19	1125.27	1082.40	0.0041	South-southeast
September-05	NA	5.93	-61.24	-64.87	1054.88	1077.87	1033.65	0.0068	South-southwest
December-05	NA	2.41	-57.9	-69.24	994.23	1023.45	980.25	0.0054	South-southwest
March-06	2.52	1.11	-24.81	-33.89	974.10	990.23	948.80	0.0084	South-southwest
June-06	7.65	11.18	-9.46	-1.4	966.16	983.47	933.59	0.0104	South-southwest
September-06	3.42	3.12	-6.66	-4.81	961.07	979.78	922.34	0.0099	South
December-06	4.68	5.9	2.48	3.02	958.87	979.73	933.37	0.0099	South
March-07	9.83		14.53	-1.27	969.87	992.53	958.06	0.0079	South
June-07	11.99		182.09	234.13	1162.17	1119.36	1128.32	0.0016	Southeast
September-07	29.4		15.56	0.54	1168.77	1168.14	1154.47	0.0019	South
December-07	1.95		-70.45	-87.12	1095.68	1101.19	1088.93	0.0052	South-southeast
March-08	2.17	2.31	-42.45	-43.22	1050.23	1053.76	1047.78	0.0072	South
June-08	1.9	2.69	-51.71	-52.47	1002.44	1015.93	966.67	0.0047	South
September-08	6.06	6.95	-27.49	-45.80	976.18	991.62	953.41	0.0058	South
December-08	1.69	1.74	-15.48	-5.06	961.10	981.76	934.26	0.0080	South-southeast
March-09	2.58	3.16	-4.25	-2.15	957.48	973.36	916.24	0.0073	South-southeast
June-09	3.77	4.41	1.25	1.53	959.75	971.67	914.68	0.0059	South-southeast
September-09	NA	7.41	-7.76	-5.48	953.49	967.07	903.39	0.0054	South-southeast
December-09	NA	14.63	101.24	114.02	1051.77	1040.48	1026.64	0.00002	South
March-10	9.23	NA	91.51	100.05	1144.36	1128.84	1131.78	0.00052	South-southeast
June-10	NA	10.66	3.97	3.40	1147.52	1145.30	1114.38	0.00078	South-southeast
September-10	NA	10.91	-37.77	-15.95	1126.83	1070.13	1059.82	0.00085	South-southeast
December-10	NA	4.45	-63.93	-97.99	1045.26	1060.79	1011.76	0.00029	South-southeast
March-11	NA	2.57	-41.89	-52.73	997.07	1020.56	994.18	0.00314	South-southeast
June-11	0.91	0.83	-41.80	-46.77	957.42	983.63	917.00	0.00532	South-southeast
September-11	2.29	2.13	-8.81	-3.15	952.98	970.34	900.90	0.00533	South-southeast
December-11	9.85	11.71	14.73	8.05	963.15	972.51	922.89	0.00536	South-southeast
March-12	NA	8.58	57.04	75.20	1021.21	992.83	975.99	0.00066	South-southeast
June-12	NA	5.83	-30.83	-54.76	981.01	1012.98	964.88	0.00326	South-southeast
September-12	NA	9.95	-36.51	-26.02	952.92	975.91	909.63	0.00455	South-southeast
December-12	NA	7.12	8.92	4.15	957.47	984.75	930.15	0.00550	South-southeast
March-13	4.88	4.79	-2.93	-2.05	954.43	977.59	933.99	0.00605	South-southeast
June-13	12.26	9.57	34.90	24.00	989.52	999.66	974.67	0.00350	South-southeast
September-13	5.03	3.92	-43.40	-26.95	947.00	974.20	918.61	0.00541	South-southeast
December-13	11.84	10.92	16.28	7.70	964.12	974.92	939.82	0.00506	South-southeast

GW = groundwater, ft MSL = feet above mean sea level, ft/ft = feet per foot

NA = Data not available due to weather station outage.

2007 precipitation data was combined to fill in data gaps due to multiple weather station outages during SCADA installation.

- Differences in recharge rates due to increased secondary porosity associated with the Salado Creek area;
- Differences in recharge rates due to increased secondary porosity associated with local fault zones;
- Pumping from on- and off-post public and private water supply wells; and
- Locations of major faults or fractures.

2.1.4 Post-wide Flow Direction and Gradient

An overall average 2013 calculated LGR groundwater gradient is to the south-southeast at 0.00501 ft/ft. Depending which quadrant of the post the measurement is taken, the groundwater gradient varied seasonally from 0.00350 ft/ft (June 2013) to 0.00605 ft/ft (March 2013). General groundwater flow directions and average gradients calculated during past monitoring events are provided in **Table 2.3** for comparison.

2.1.5 Lower Glen Rose

The 2013 potentiometric surface maps for LGR-screened wells **(Appendices F.1, F.4, F.7** and **F.10)** exhibited a wide range of groundwater elevations. Groundwater elevations are generally higher in the northern and central portions of CSSA, and decrease to the south. This is consistent with the natural dip of the formations and the greater fault displacement in the southern portion of CSSA. The removal of well CS-G from the gridding process negates mounding effect is present at well CS-G that disrupts the normal southerly and easterly components of the North Pasture. This well, along with CS-D, CS-2, and CS-4 are not fully penetrating into the LGR and therefore are not considered within this map.

As shown in **Figure 2.2**, 2013 started with about 3.5 inches of rain within the first 9 days of January, which recharged the LGR portion of the aquifer an average of about 80 feet. However, almost all of that recharge had been lost by the start of February 2013. A single day rain event of approximately 3 inches followed by another 1 inch of rainfall a week later yet again recharged the LGR by approximately 100 feet, which then dissipated by late-July. The aquifer continued to steadily decline throughout the summer until mid-September 2013. Approximately 11.5 inches of precipitation fell during September and October 2013, again recharging the LGR by approximately 55 feet. For the remainder of 2013, groundwater elevations gradually receded, returning to aquifer elevation to about 10 above the end of December 2012.

A typical feature as seen in **Appendix F.4** and **F.10** is the groundwater mounding effect centered on CS-MW4-LGR in the central portion of the base. This is a typical feature during non-drought conditions when the surrounding groundwater elevation is above approximately 970 feet mean sea level (MSL). Unlike the general trend at CSSA, groundwater flow appears to radiate outward from CS-MW4-LGR. Presumably this region has a strong hydraulic connection to significant perched water either associated with Salado Creek or the hillsides to the east.

Historical data has shown that this mounding effect can either be muted or completely removed under distressed aquifer levels. Such is the case of March and September 2013

(**Appendices F.1 and F.7**); this mounding effect subsides as the average groundwater elevation approaches the elevation of the basal production zone of the aquifer.

A reoccurring trend seen over the years is that the southern third of the post is more susceptible to drought and recharge than the northern third of the post. The changes in groundwater elevation between quarterly events are given in **Table 2.1**. Between June and September 2013, the average decline in groundwater level was 43 feet. However, wells in the northern half of CSSA generally declined by an average of 20 feet over the 3-month period. In contrast, most wells in the southern portion of the base declined by more than 60 feet over the same time period, with CS-MW10-LGR, CS-MW11A-LGR, and CS-MW36-LGR declining by 85 feet or more. Conversely, the wells in the southern portion of the post showed larger increases in groundwater elevation in response to the recharging events of the final quarter of the year. This is an indication that overall storage capacity of the aquifer decreases to the south and southwest, and therefore, is more susceptible to drought and recharge events. This may be related to a change in the stratigraphy and/or porosity, or possibly related to controlling structural features (e.g., faults).

The groundwater drawdown due to the cyclic pumping of CS-16-LGR, B3-EXW01-LGR, B3-EXW02-LGR, B3-EXW03-LGR, B3-EXW04-LGR, B3-EXW05-LGR (Bioreactor System) is a reoccurring feature in the central portion of the post (**Appendices F.1, F.4, F.7,** and **F.10**). As seen in these figures, the resultant groundwater "cone of depression" can vary due to combination of extraction wells actively pumping during the water level gauging effort. But as a collective system, they are effective in maintaining a zone of capture around the remediation system and re-injecting groundwater into the Bioreactor.

Depending on the current pumping rates at the time of measurement, groundwater in the vicinity of the Bioreactor may be depressed by as much as 50 to 70 feet, as measured between a currently active extraction well (EXW) and other surrounding wells (**Appendix F.1)**. Groundwater in the inner cantonment also shows a drawdown effect from the pumping of water supply well CS-10, and is most notable in March 2013 (**Appendix F.1**). A cone of depression in the groundwater surface is also clearly visible at supply well CS-12 in March, September, and December 2013 (**Appendices F.1, F.7,** and **F.10**).

Bexar Shale

Currently, groundwater head information is limited to four data points (CS-MW1-BS, CS-MW6-BS, CS-MW9-BS, and CS-MW12-BS). Given the paucity of well control, at best, the BS groundwater maps should be considered qualitative. The BS appears to have very limited groundwater that is likely associated with fracturing. Fractured bedrock such as this often results in discordant water levels between neighboring points and may not be a true indicator of flow direction. The appropriateness of preparing potentiometric surface maps for the BS is debatable, but these maps have been generated for completeness. Potentiometric maps for the Bexar Shale in 2013 are presented in **Appendices F.2, F.5, F.8** and **F.11**.

Figure 2.2 shows that the BS stratigraphic unit had a similar, but muted response to the precipitation events of 2013. Compared to the LGR, the BS has a delayed response to rainfall and aquifer level changes are less drastic. As an example, the BS only increased approximately 18 feet to the May 25, 2013 rainfall when the LGR increased by as much as 83 feet. For the most part, the BS remained relatively steady in groundwater level throughout the year, only declining by an average of 2 feet at the BS wells located in the CS-MW1, CS-MW9, and CS-MW12 clusters. However, CS-MW6-BS in the southern portion of the post declined by more than 30 feet over the same time period. For a given precipitation event, the BS water level will "peak" anywhere between 15 and 30 days after the LGR and CC has already crested for the same rain event.

In typical fashion, the potentiometric surface maps for BS-screened wells exhibited groundwater flow in multiple directions throughout 2013. The June 2013 measurement (**Appendix F.5**) indicates a predominately easterly flow during a period of aquifer recharge. Conversely, the maps for March, September, and December 2013 (**Appendices F.2, F.8,** and **F.11**) show a gradient flow predominately toward the southwest when the groundwater levels in all four BS wells are less than 990 feet MSL.

Cow Creek

As with the BS, the postwide monitoring of the CC groundwater is limited due to the small number of wells completed only in the CC. Four of the nine CC wells are concentrated in the vicinity of AOC-65. The 2013 potentiometric surface maps for CC-screened wells (**Appendices F.3 F.6, F.9** and **F.12**) exhibited a south-southeasterly flow in all quarters. Although, the June 2013 CC groundwater map (**Appendix F.6**) shows a more easterly flow component in response to May 2013 recharge, similar to the BS map (**Appendix F.5**) for the same month.

Throughout 2013, the effects of continuous pumping of CS-MW16-CC influenced groundwater gradients significantly in the CC interval near the Bioreactor. Prior studies have shown measurable pumping influence within the CC at distances of more than 2,000 feet from a CC pumping well, as measured at CS-MW1-CC. The effects of this pumping are visible in all of the quarterly monitoring events of 2013 (**Appendices F.3, F.6, F.9** and **F.12**) which clearly show the cone of depression surrounding CS-MW16-CC.

In a similar fashion to the BS, the CC stratigraphic unit had a similar, but muted response to the precipitation events of 2013 (**Figure 2.2**). The CC responds almost as quickly as the LGR to a recharge event, presumably because of direct infiltration on the outcrop areas to the north of CSSA. However, the recharge rate is somewhat slower the LGR, and the crest of a precipitation response may come 15 days later than what is observed in the LGR. The aquifer response is significantly less than the LGR as well. For instance, the CS-MW1-CC only increased approximately 28 feet after May 2013 rainfall when CS-MW1-LGR increased by as much as 83 feet.

2.2 Chemical Characteristics

2.2.1 On-Post Analytical Results

The LTMO study implemented in December 2005 and updated in 2010 determines the frequency that on-post wells are sampled. An overview of sampling frequencies for on-post wells only is given in **Table 2.4**. Fifty-seven on-post samples were scheduled to be collected in 2013 (5 in March, 14 in June, 33 in September, and 5 in December). Ten of the 57 samples could not be collected due to low water levels or pump failure (CS-9). Six samples were added to the June event to collect background data prior to bringing new drinking water well

Table 2.4
Overview of the On-Post Monitoring Program

Count	Well ID	*Analytes*	*Last Sample Date*	*Mar-13*	*Jun-13*	*Sep-13 (snapshot)*	*Dec-13*	*Sampling Frequency **
1	CS-MW1-LGR	VOCs & metals (Cr, Cd, Hg, Pb)	Sep-13	NS	S	S	NS	Semi-annual + 9 month snapshot
2	CS-MW1-BS	VOCs & metals (Cr, Cd, Hg, Pb)	Dec-12	NS	NS	NS	NS	Every 18 months
3	CS-MW1-CC	VOCs & metals (Cr, Cd, Hg, Pb)	Jun-13	NS	S	NS	NS	Every 18 months
4	CS-MW2-LGR	VOCs & metals (Cr, Cd, Hg, Pb)	Sep-13	NS	NS	S	NS	Semi-annual + 9 month snapshot
5	CS-MW2-CC	VOCs & metals (Cr, Cd, Hg, Pb)	Jun-13	NS	S	NS	NS	Every 18 months
6	CS-MW3-LGR	VOCs & metals (Cr, Cd, Hg, Pb)	Sep-13	NS	NS	S	NS	Every 9 months
7	CS-MW4-LGR	VOCs & metals (Cr, Cd, Hg, Pb)	Jun-13	NS	S	NSWL	NS	Every 9 months
8	CS-MW5-LGR	VOCs & metals (Cr, Cd, Hg, Pb)	Sep-13	NS	NS	S	NS	Every 9 months
9	CS-MW6-LGR	VOCs & metals (Cr, Cd, Hg, Pb)	Sep-13	NS	NS	S	NS	Every 9 months
10	CS-MW6-BS	VOCs & metals (Cr, Cd, Hg, Pb)	Dec-12	NS	NS	NS	NS	Every 18 months
11	CS-MW6-CC	VOCs & metals (Cr, Cd, Hg, Pb)	Dec-12	NS	NS	NS	NS	Every 18 months
12	CS-MW7-LGR	VOCs & metals (Cr, Cd, Hg, Pb)	Sep-13	NS	NS	S	NS	Every 9 months
13	CS-MW7-CC	VOCs & metals (Cr, Cd, Hg, Pb)	Dec-12	NS	NS	NS	NS	Every 18 months
14	CS-MW8-LGR	VOCs & metals (Cr, Cd, Hg, Pb)	Sep-13	NS	S	S	NS	Semi-annual + 9 month snapshot
15	CS-MW8-CC	VOCs & metals (Cr, Cd, Hg, Pb)	Dec-12	NS	NS	NS	NS	Every 18 months
16	CS-MW9-LGR	VOCs & metals (Cr, Cd, Hg, Pb)	Sep-13	NS	NS	S	NS	Every 18 months
17	CS-MW9-BS	VOCs & metals (Cr, Cd, Hg, Pb)	Dec-12	NS	NS	NS	NS	Every 9 months
18	CS-MW9-CC	VOCs & metals (Cr, Cd, Hg, Pb)	Dec-12	NS	NS	NS	NS	Every 9 months
19	CS-MW10-LGR	VOCs & metals (Cr, Cd, Hg, Pb)	Jun-13	NS	S	NSWL	NS	Semi-annual + 9 month snapshot
20	CS-MW10-CC	VOCs & metals (Cr, Cd, Hg, Pb)	Dec-12	NS	NS	NS	NS	Every 18 months
21	CS-MW11A-LGR	VOCs & metals (Cr, Cd, Hg, Pb)	Sep-13	NS	S	S	NS	Semi-annual + 9 month snapshot
22	CS-MW11B-LGR	VOCs & metals (Cr, Cd, Hg, Pb)	Mar-12	NS	NS	NSWL	NS	Every 9 months
23	CS-MW12-LGR	VOCs & metals (Cr, Cd, Hg, Pb)	Sep-13	NS	NS	S	NS	Every 9 months
24	CS-MW12-BS	VOCs & metals (Cr, Cd, Hg, Pb)	Dec-12	NS	NS	NS	NS	Every 18 months
25	CS-MW12-CC	VOCs & metals (Cr, Cd, Hg, Pb)	Dec-12	NS	NS	NS	NS	Every 18 months
26	CS-MW16-LGR	VOCs & metals (Cr, Cd, Hg, Pb)	Sep-13	NS	NS	S	NS	Every 9 months
27	CS-MW16-CC	VOCs & metals (Cr, Cd, Hg, Pb)	Sep-13	NS	NS	S	NS	Every 9 months
28	CW-MW17-LGR	VOCs & metals (Cr, Cd, Hg, Pb)	Jun-13	NS	S	NSWL	NS	Every 9 months
29	CS-MW18-LGR	VOCs & metals (Cr, Cd, Hg, Pb)	Dec-12	NS	NS	NSWL	NS	Every 9 months
30	CS-MW19-LGR	VOCs & metals (Cr, Cd, Hg, Pb)	Sep-13	NS	NS	S	NS	Every 9 months

Table 2.4
Overview of the On-Post Monitoring Program

31	CS-1	VOCs & metals (As,Ba,Cr,	Dec-13	S	S	S	S	Quarterly
32	CS-2	VOCs & metals (Cr, Cd, Hg, Pb)	Sep-13	NS	NS	S	NS	Every 9 months
33	CS-4	VOCs & metals (Cr, Cd, Hg, Pb)	Jun-13	NS	S	NSWL	NS	Semi-annual + 9 month snapshot
34	CS-9	VOCs & metals (Cr, Cd, Hg, Pb)	Sep-13	S	S	S	NS (pump outage)	Quarterly
35	CS-10	VOCs & metals (As,Ba,Cr,	Dec-13	S	S	S	S	Quarterly
36	CS-12	VOCs & metals (As,Ba,Cr,	Dec-13	S	S	S	S	Quarterly
37	CS-13	VOCs & metals (As,Ba,Cr,	Jun-13	NS	S	NS	NS	installtion in progress
38	CS-D	VOCs & metals (Cr, Cd, Hg, Pb)	Dec-12	NS	NSWL	NSWL	NS	Semi-annual + 9 month snapshot
39	CS-MWG-LGR	VOCs & metals (Cr, Cd, Hg, Pb)	Dec-12	NS	NS	NS	NS	Every 18 months
40	CS-MWH-LGR	VOCs & metals (Cr, Cd, Hg, Pb)	Dec-12	NS	NS	NS	NS	Every 18 months
41	CS-I	VOCs & metals (Cr, Cd, Hg, Pb)	Dec-12	NS	NS	NS	NS	Every 18 months
42	CS-MW20-LGR	VOCs & metals (Cr, Cd, Hg, Pb)	Sep-13	NS	NS	S	NS	Every 9 months
43	CS-MW21-LGR	VOCs & metals (Cr, Cd, Hg, Pb)	Sep-13	NS	S	S	NS	Every 9 months
44	CS-MW22-LGR	VOCs & metals (Cr, Cd, Hg, Pb)	Sep-13	NS	NS	S	NS	Every 9 months
45	CS-MW23-LGR	VOCs & metals (Cr, Cd, Hg, Pb)	Sep-13	NS	NS	S	NS	Every 9 months
46	CS-MW24-LGR	VOCs & metals (Cr, Cd, Hg, Pb)	Sep-13	NS	S	S	NS	Semi-annual + 9 month snapshot
47	CS-MW25-LGR	VOCs & metals (Cr, Cd, Hg, Pb)	Sep-13	NS	NS	S	NS	Every 9 months
48	CS-MW35-LGR	VOCs & metals (Cr, Cd, Hg, Pb)	Sep-13	NS	S	S	NS	Semi-annual + 9 month snapshot
49	CS-MW36-LGR	VOCs & metals (Cr, Cd, Hg, Pb)	Dec-13	S	S	S	S	Quarterly

* New LTMO sampling frequency implemented June 2011
S = Sample
NS = No Sample
NSWL = No Sample due to low water level

CS-13 online. The wells were sampled using either dedicated low-flow pumps, high capacity submersible pumps, or dedicated solar-powered submersible pump. Samples were collected after field parameters (pH, temperature, conductivity) stabilized during well purging. Field parameters were recorded in the field logbook for each sampling event.

Groundwater samples were submitted to Agriculture & Priority Pollutants Laboratories, Inc. (APPL) of Clovis, California for analysis. The analytical program for on-post monitoring wells includes short-list VOC analysis and metals. The short list of VOC analytes included: 1,1-DCE, *cis*-1,2-DCE, *trans*-1,2-DCE, PCE, TCE, and vinyl chloride.

Under the provisions of the groundwater monitoring LTMO study and DQOs, all on-post monitoring wells are sampled for the chromium, cadmium, mercury, and lead. To meet drinking water compliance requirements, drinking water wells are sampled for additional metals arsenic, barium, copper, and zinc.

Each sample is evaluated against either being qualitatively detected in trace amounts above the method detection limit (MDL [F-flagged data]), quantitatively detected above the laboratory reporting limit (RL), or in exceedance of regulatory maximum contaminant level (MCL), action level (AL), or secondary standard (SS) comparison criteria. It is important to note that the RL value is significantly less than the promulgated groundwater standard criteria, and therefore the occurrence of a constituent above the RL does not necessarily indicate that there is an immediate concern, especially with the naturally occurring inorganics (metals) in groundwater. The only exception to this generalization is lead, where the RL (0.025 mg/L) is greater than the AL (0.015 mg/L).

Ten groundwater samples were not collected from 9 wells in 2013. One well, CS-9, was not sampled due to pump failure. Well CS-MW2-LGR was not sampled due to field crew oversight. The other 8 samples [CS-MW4-LGR, CS-MW10-LGR, CS-MW11B-LGR, CS-MW17-LGR, CS-MW18-LGR, CS-4, and CS-D (2 events)] were not collected due to water levels falling below the dedicated low-flow QED pumps. The 6 wells that were added to collect background data prior to bringing new drinking water well CS-13 online were: CS-MW1-CC, CS-MW2-CC, CS-MW4-LGR, CS-MW17-LGR, CS-13, and CS-MW21-LGR.

2.2.1.1 On-Post Monitoring Wells with COC Detections above the MCL

Some wells sampled had concentrations detected that exceeded MCLs. The MCLs for some COCs were exceeded in wells CS-MW16-LGR, CS-MW16-CC, CS-MW1-LGR, CS-MW9-LGR, and CS-MW36-LGR in 2013. The respective comparison criteria (MCLs, SS, or AL) for each compound are included in **Table 2.5**. The detected concentrations are summarized as follows:

- **CS-MW16-LGR** – This well was sampled once in 2013. Concentrations of PCE, TCE, and *cis*-1,2-DCE exceeded their MCLs during the September sampling event. The pump in well CS-MW16-LGR was engaged April 24, 2007 to pump water into the SWMU B-3 Bioreactor. The well has been cycling continuously since the bioreactor injection was initiated in 2007. In 2013 the average gallons pump per day was about 8,750 gallons. The pumping rate was adjusted throughout the year to maximize the cycle lengths and the amount of water extracted from this well.

Table 2.5
2013 On-post Groundwater COCs and Metals Analytical Results

Well ID	Sample Date	Dichloro-ethene, 1,1 (µg/L)	Dichloro-ethene, *cis* -1,2 (µg/L)	Dichloro-ethene, *trans* -1,2 (µg/L)	Tetra-chloroethene (µg/L)	Tri-chloroethene (µg/L)	Vinyl chloride (µg/L)
Maximum Contaminant Level (MCL)		7	70	100	5.0	5.0	2.0
Reporting Limit (RL)		1.2	1.2	0.6	1.4	1.0	1.1
Method Detection Limit (MDL)		0.12	0.07	0.08	0.06	0.05	0.08
CS-1	3/27/2013	--	--	--	--	**0.18F**	--
Duplicate	3/27/2013	--	--	--	--	**0.18F**	--
	6/25/2013	--	--	--	--	--	--
	9/23/2013	--	--	--	--	**0.32F**	--
	12/23/2013	--	--	--	--	**0.20F**	--
CS-2	9/5/2013	--	--	--	--	--	--
Duplicate	9/5/2013	--	--	--	--	--	--
CS-4	6/25/2013	--	--	--	**0.64F**	**0.55F**	--
CS-9	3/4/2013	--	--	--	--	--	--
	6/25/2013	--	--	--	--	--	--
	9/23/2013	--	--	--	--	--	--
CS-10	3/4/2013	--	--	--	--	--	--
	6/25/2013	--	--	--	--	--	--
	9/23/2013	--	--	--	--	--	--
Duplicate	9/23/2013	--	--	--	--	--	--
	12/3/2013	--	--	--	--	--	--
CS-12	3/4/2013	--	--	--	--	--	--
	6/25/2013	--	--	--	--	--	--
Duplicate	6/25/2013	--	--	--	--	--	--
	9/23/2013	--	--	--	--	--	--
	12/3/2013	--	--	--	--	--	--
Duplicate	12/3/2013	--	--	--	--	--	--
CS-13 *	6/17/2013	--	--	--	--	--	--
CS-MW16-LGR	9/5/2013	--	**84.59**	--	**83.04**	**98.38**	--
CS-MW16-CC	9/5/2013	**0.13F**	**16.27**	**6.75**	**0.40F**	**8.89**	--
CS-MW1-LGR	6/17/2013	--	**18.74**	**0.19F**	**13.97**	**30.39**	--
	9/4/2013	--	**14.37**	**0.29F**	**11.92**	**17.69**	--
CS-MW1-CC *	6/17/2013	--	--	--	--	--	--
CS-MW2-LGR	9/4/2013	--	**0.51F**	--	--	--	--
CS-MW2-CC *	6/17/2013	--	--	--	--	--	--
CS-MW3-LGR	9/4/2013	--	--	--	--	--	--
CS-MW4-LGR	6/17/2013	--	--	--	--	--	--
CS-MW5-LGR	9/4/2013	--	**0.76F**	--	**0.96F**	**1.03**	--
CS-MW6-LGR	6/19/2013	--	--	--	--	--	--
	9/17/2013	--	--	--	--	--	--
CS-MW7-LGR	6/19/2013	--	--	--	**0.39F**	--	--
	9/19/2013	--	--	--	**0.68F**	--	--
CS-MW8-LGR	6/19/2013	--	--	--	**2.48**	--	--
Duplicate	6/19/2013	--	--	--	**2.56**	--	--
	9/17/2013	--	--	--	**1.4**	--	--
CS-MW9-LGR	9/19/2013	--	--	--	--	--	--
CS-MW10-LGR	6/18/2013	--	--	--	**2.08**	**0.42F**	--
CS-MW11A-LGR	6/18/2013	--	--	--	**0.81F**	--	--
	9/5/2013	--	--	--	**0.97F**	--	--
CS-MW12-LGR	9/19/2013	--	--	--	--	--	--
CS-MW17-LGR	6/18/2013	--	--	--	**0.48F**	--	--
CS-MW19-LGR	9/5/2013	--	--	--	**0.52F**	--	--
CS-MW20-LGR	9/16/2013	--	--	--	**1.19F**	--	--
CS-MW21-LGR	6/18/2013	--	--	--	--	--	--
	9/16/2013	--	--	--	--	--	--
Duplicate	9/16/2013	--	--	--	--	--	--
CS-MW22-LGR	9/16/2013	--	--	--	--	--	--
CS-MW23-LGR	9/16/2013	--	--	--	--	--	--

Table 2.5
2013 On-post Groundwater COCs and Metals Analytical Results

Well ID	Sample Date	Dichloro-ethene, 1,1 (µg/L)	Dichloro-ethene, *cis* -1,2 (µg/L)	Dichloro-ethene, *trans* -1,2 (µg/L)	Tetra-chloroethene (µg/L)	Tri-chloroethene (µg/L)	Vinyl chloride (µg/L)
Maximum Contaminant Level (MCL)		**7**	**70**	**100**	**5.0**	**5.0**	**2.0**
Reporting Limit (RL)		**1.2**	**1.2**	**0.6**	**1.4**	**1.0**	**1.1**
Method Detection Limit (MDL)		**0.12**	**0.07**	**0.08**	**0.06**	**0.05**	**0.08**
CS-MW24-LGR	6/25/2013	--	--	--	--	--	--
	9/4/2013	--	--	--	--	--	--
CS-MW25-LGR	9/4/2013	--	--	--	--	--	--
CS-MW35-LGR	6/25/2013	--	--	--	**0.79F**	--	--
Duplicate	6/25/2013	--	--	--	**0.84F**	--	--
	9/5/2013	--	--	--	**0.69F**	--	--
CS-MW36-LGR	3/5/2013	--	**1.74**	--	**26.75**	**65.01**	--
	6/19/2013	--	--	--	**7.65**	**6.3**	--
	9/17/2013	--	**0.78F**	--	**16.44**	**29.2**	--
	12/2/2013	--	**0.38F**	--	**11.21**	**14.84**	--

Bold (red)	≥ MCL
Bold (blue)	≥ RL
Bold	≥ MDL

All samples were analyzed by APPL, Inc. using laboratory method SW8260B.
VOC data reported in µg/L & metals data reported in mg/L.

Abbreviations/Notes:

µg/L	micrograms per liter
mg/L	milligrams per liter
Duplicate	Field Duplicate

Data Qualifiers:

F-The analyte was positively identified but the associated numerical value is below the RL.
* Additional analytes were tested from these wells and included in Appendix B.

Table 2.5
2013 On-post Groundwater COCs and Metals Analytical Results

Well ID	Sample Date	Arsenic (mg/L)	Barium (mg/L)	Cadmium (mg/L)	Chromium (mg/L)	Copper (mg/L)	Lead (mg/L)	Mercury (mg/L)	Zinc (mg/L)
Maximum Contaminant Level (MCL)		**0.01**	**2.0**	**0.005**	**0.1**	1.3(AL)	0.015 (AL)	**0.002**	5 (SS)
Reporting Limit (RL)		**0.03**	**0.005**	**0.007**	**0.01**	**0.01**	**0.025**	**0.001**	**0.05**
Method Detection Limit (MDL)		**0.0002**	**0.0003**	**0.0005**	**0.001**	**0.003**	**0.0019**	**0.0001**	**0.008**
CS-1	3/27/2013	--	**0.0334**	--	--	**0.006F**	--	--	**0.288**
Duplicate	3/27/2013	--	**0.0328**	--	--	--	--	--	**0.266**
	6/25/2013	--	**0.0352**	--	--	**0.005F**	--	0.0001M	**0.268**
	9/23/2013	--	**0.0314**	--	--	**0.004F**	--	--	**0.407**
	12/3/2013	--	**0.0378**	--	--	**0.008F**	--	--	**0.334**
CS-2	9/5/2013	NA	NA	--	**0.0011F**	NA	--	--	NA
Duplicate	9/5/2013	NA	NA	--	**0.0011F**	NA	--	--	NA
CS-4	6/25/2013	NA	NA	--	--	NA	--	--	NA
CS-9	3/4/2013	NA	NA	--	--	NA	**0.0040F**	**0.0015**	NA
	6/25/2013	NA	NA	--	--	NA	**0.0093F**	**0.0012**	NA
	9/23/2013	NA	NA	--	**0.0022F**	NA	**0.0124F**	**0.0018**	NA
CS-10	3/4/2013	--	**0.0406**	--	--	**0.004F**	--	--	**0.053**
	6/25/2013	--	**0.0378**	--	--	--	--	--	**0.050**
	9/23/2013	--	**0.0403**	--	--	**0.005F**	--	--	**0.049F**
Duplicate	9/23/2013	--	**0.0397**	--	--	**0.008F**	--	--	**0.067**
CS-12	3/4/2013	--	**0.0331**	--	--	**0.021**	--	--	**0.137**
	6/25/2013	--	**0.0304**	--	--	**0.015**	--	--	**0.125**
Duplicate	6/25/2013	--	**0.0308**	--	--	**0.008F**	--	--	**0.104**
	9/23/2013	--	**0.0305**	--	--	**0.036**	--	--	**0.124**
CS-13 *	6/17/2013	**0.0015F**	**0.0326**	--	--	--	NA	--	**0.48**
CS-MW16-LGR	9/5/2013	NA	NA	--	**0.0011F**	NA	--	--	NA
CS-MW16-CC	9/5/2013	NA	NA	--	**0.0014F**	NA	--	--	NA
CS-MW1-LGR	6/17/2013	NA	NA	--	**0.0011F**	NA	--	--	NA
	9/4/2013	NA	NA	--	**0.0045F**	NA	--	--	NA
CS-MW1-CC *	6/17/2013	NA	NA	--	--	NA	--	--	NA
CS-MW2-LGR	9/4/2013	NA	NA	--	**0.0011F**	NA	--	--	NA
CS-MW2-CC *	6/17/2013	NA	NA	--	--	NA	--	--	NA
CS-MW3-LGR	9/4/2013	NA	NA	--	**0.0035F**	NA	--	--	NA
CS-MW4-LGR	6/17/2013	NA	NA	--	**0.0023F**	NA	--	--	NA
CS-MW5-LGR	9/4/2013	NA	NA	--	**0.0042F**	NA	--	--	NA
CS-MW6-LGR	6/19/2013	NA	NA	--	**0.0052F**	NA	--	--	NA
	9/17/2013	NA	NA	--	**0.0023F**	NA	--	--	NA
CS-MW7-LGR	6/19/2013	NA	NA	--	**0.0015F**	NA	--	--	NA
	9/19/2013	NA	NA	--	**0.0016F**	NA	--	--	NA
CS-MW8-LGR	6/19/2013	NA	NA	--	**0.0012F**	NA	--	--	NA
Duplicate	6/19/2013	NA	NA	--	**0.0013F**	NA	--	--	NA
	9/17/2013	NA	NA	--	**0.0014F**	NA	--	--	NA
CS-MW9-LGR	9/19/2013	NA	NA	--	0.2369	NA	--	--	NA
CS-MW10-LGR	6/18/2013	NA	NA	--	**0.0015F**	NA	--	--	NA
CS-MW11A-LGR	6/18/2013	NA	NA	--	**0.0015F**	NA	--	--	NA
	9/5/2013	NA	NA	--	**0.0022F**	NA	--	--	NA
CS-MW12-LGR	9/19/2013	NA	NA	--	**0.0020F**	NA	--	--	NA
CS-MW17-LGR	6/18/2013	NA	NA	--	**0.0012F**	NA	--	--	NA
CS-MW19-LGR	9/5/2013	NA	NA	--	**0.0027F**	NA	--	--	NA
CS-MW20-LGR	9/16/2013	NA	NA	--	**0.0011F**	NA	--	--	NA
CS-MW21-LGR	6/18/2013	NA	NA	--	--	NA	--	--	NA
	9/16/2013	NA	NA	--	**0.0019F**	NA	--	--	NA
Duplicate	9/16/2013	NA	NA	--	**0.0019F**	NA	--	--	NA

Table 2.5
2013 On-post Groundwater COCs and Metals Analytical Results

Well ID	Sample Date	Arsenic (mg/L)	Barium (mg/L)	Cadmium (mg/L)	Chromium (mg/L)	Copper (mg/L)	Lead (mg/L)	Mercury (mg/L)	Zinc (mg/L)
Maximum Contaminant Level (MCL)		**0.01**	**2.0**	**0.005**	**0.1**	**1.3(AL)**	**0.015 (AL)**	**0.002**	**5 (SS)**
Reporting Limit (RL)		**0.03**	**0.005**	**0.007**	**0.01**	**0.01**	**0.025**	**0.001**	**0.05**
Method Detection Limit (MDL)		**0.0002**	**0.0003**	**0.0005**	**0.001**	**0.003**	**0.0019**	**0.0001**	**0.008**
CS-MW22-LGR	9/16/2013	NA	NA	--	--	NA	--	--	NA
CS-MW23-LGR	9/16/2013	NA	NA	--	**0.0015F**	NA	--	--	NA
CS-MW24-LGR	6/25/2013	NA	NA	--	--	NA	--	--	NA
	9/4/2013	NA	NA	--	**0.0011F**	NA	--	--	NA
CS-MW25-LGR	9/4/2013	NA	NA	--	**0.0098F**	NA	--	--	NA
CS-MW35-LGR	6/25/2013	NA	NA	--	--	NA	--	--	NA
Duplicate	6/25/2013	NA	NA	--	--	NA	--	--	NA
	9/5/2013	NA	NA	--	**0.0025F**	NA	--	--	NA
CS-MW36-LGR	3/5/2013	NA	NA	--	--	NA	--	--	NA
	6/19/2013	NA	NA	--	--	NA	--	--	NA
	9/17/2013	NA	NA	--	--	NA	--	--	NA

Bold (red)	≥ MCL
Bold (blue)	≥ RL
Bold	≥ MDL

All samples were analyzed by APPL, Inc. using laboratory method SW8260B.
VOC data reported in µg/L & metals data reported in mg/L.

Abbreviations/Notes:

µg/L	micrograms per liter
mg/L	milligrams per liter
Duplicate	Field Duplicate
AL	Action Level
SS	Secondary Standard

Data Qualifiers:

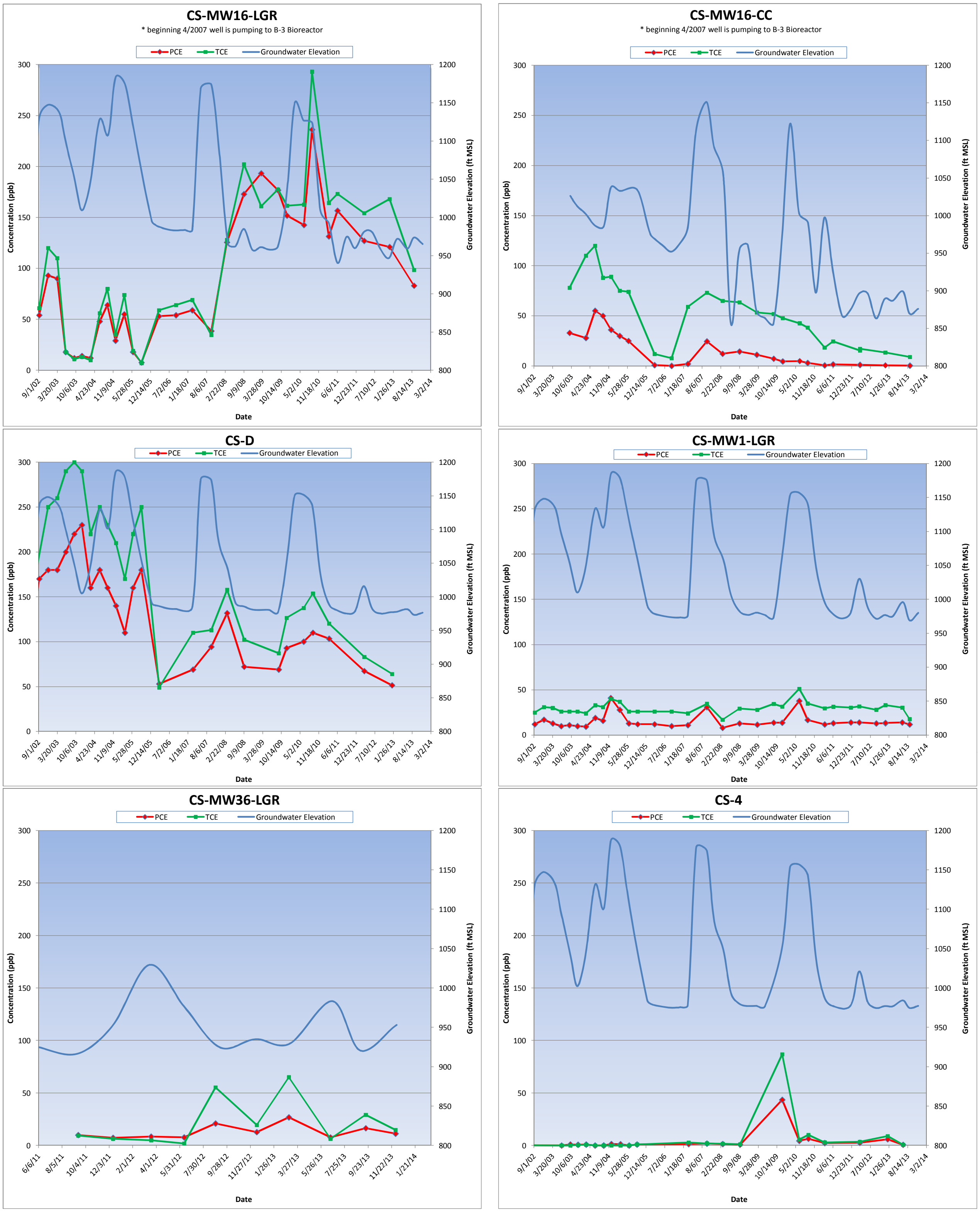
F-The analyte was positively identified but the associated numerical value is below the RL.
M = There was possible interference from the sample itself, the M flagged result is usable and defensible.
U-The analyte was analyzed for, but not detected. The associated numerical value is at or below the MDL.
* Additional analytes were tested from these wells and included in Appendix B.

- **CS-MW16-CC** – This well was sampled once in 2013. Concentrations of TCE exceeded the MCL in September 2013. *Cis*-1,2-DCE and *trans*-1,2-DCE were below their respective MCLs but above the RL in September. PCE and 1,1-DCE were also detected but below the RL in September 2013. Chromium was detected below the RL in September 2013. The pump in well CS-MW16-CC was engaged April 24, 2007 to pump water onto the SWMU B-3 Bioreactor. The well has been cycling continuously along with CS-MW16-LGR since the bioreactor injection began in 2007. In 2013 the average gallons pumped per day was approximately 21,700 gallons. VOC levels in 2013 remain at the low end of the historical concentration range for this well.
- **CS-MW1-LGR** – This well was sampled twice in 2013. PCE and TCE concentrations were above their MCLs in June and September 2013. *Cis*-1,2-DCE was detected below the MCL in both quarters in 2013 and *trans*-1,2-DCE was below the RL in both 2013 events. Chromium was also detected below the applicable MCL in both events in 2013.
- **CS-MW9-LGR** – This well was sampled once in 2013. No VOCs were detected in this well in 2013. Chromium was above the MCL in September 2013. This was the first chromium detection above the MCL in this well.
- **CS-MW36-LGR** – This well was sampled during all four events in 2013. PCE and TCE were above the MCL in all four events. *Cis*-1,2-DCE was also detected below the MCL in March, September and December 2013. No metals were detected in this well in 2013.

Concentration trends are illustrated on **Figure 2.3** for wells CS-MW16-LGR, CS-MW16-CC, CS-D, CS-MW1-LGR, CS-MW36-LGR, and CS-4. These wells were selected because they have historical detections of PCE and TCE that approach and/or exceed MCLs. **Figure 2.3** also includes groundwater elevation data from each respective well to determine if there are correlations between VOC concentrations and water level. This figure suggests that CS-MW1-LGR has the most direct correlation between PCE/TCE concentration and groundwater recharge events. After that, discernable trends are less evident. Quarterly monitoring of CS-MW16-LGR and CS-D seems to indicate that increases in VOC concentrations lag recharge events by roughly six to nine months.

Notable trends in other wells appear to be related more to remedial activities than precipitation/recharge events. Concentrations at CS-MW16-CC decreased between March 2004 and June 2005 during a 15-month pump test of that well. Then concentrations increased in early 2007 during a time that roughly corresponds to the start-up of SWMU B-3 Bioreactor operations. Since that time, groundwater has been continually pumped from CS-MW16-CC and applied to the bioreactor as a remedial alternative. During that timeframe, VOC concentrations have steadily decreased, with little fluctuation attributable to precipitation. CS-MW36-LGR concentrations have seemed only to respond to the in-situ chemical oxidation (ISCO) injections at AOC-65 in August 2012 and May-June 2013. And the singular PCE/TCE peak at CS-4 has been attributed to the SWMU B-3 flood test in September 2009.

Figure 2.3
Cumulative VOC Concentrations vs Groundwater Elevations



NOTE: Sampling dates are indicated by the squares on the trend line.

J:\CSSA Program\Restoration\Groundwater\GW Monitoring Reports\2013\Annual Report\Figure 2-3 2013 On-Post Cumulative Analytical vs water level.xlsx

2.2.1.2 On-Post Monitoring Wells with COC Detections below the MCL

Groundwater monitoring results included wells where COCs were detected at levels below the applicable MCLs, SS, or ALs but above reporting limit (RLs). These included wells CS-MW5-LGR, CS-MW8-LGR, and CS-MW10-LGR. The detections below the MCLs/ALs but above MDLs are summarized as follows:

- **CS-MW5-LGR** – TCE was detected above the RL in September 2013. Concentrations of PCE and *cis*-1,2-DCE were detected below their RLs in September 2013. Low levels of chromium were also detected below the RL in September 2013.
- **CS-MW8-LGR** - PCE was detected in June and September 2013, all detections were above the RL but below the MCL. Low levels of chromium were also detected below the RL in June and September 2013.
- **CS-MW10-LGR** – PCE and TCE concentrations were detected below their MCLs in June 2013. Chromium was reported below the RL in June 2013.

2.2.1.3 On-Post Monitoring Wells with COC Detections below the Reporting Limits

The on-post results include detections in wells for which the analyte is identified, but at a concentration below the RL. These results are assigned an "F" flag under the CSSA Quality Assurance Project Plan (QAPP). In 2013, this included wells CS-2, CS-4, CS-MW2-LGR, CS-MW3-LGR, CS-MW4-LGR, CS-MW6-LGR, CS-MW7-LGR, CS-MW11A-LGR, CS-MW12-LGR, CS-MW17-LGR, CS-MW19-LGR, CS-MW20-LGR, CS-MW21-LGR, CS-MW23-LGR, CS-MW24-LGR, CS-MW25-LGR, and CS-MW35-LGR. The detections below the reporting limit are summarized as follows:

- **CS-2** – No VOCs were detected in this well in 2013. However, chromium was detected below the RL in September 2013.
- **CS-4** – This well was sampled once in 2013. Concentrations of PCE and TCE were detected below their applicable RLs in June 2013. No metals were detected in this well in 2013.
- **CS-MW2-LGR** – This well was sampled once in 2013. *Cis*-1,2-DCE was detected below the RL in September 2013. Chromium was also detected below the RL in 2013.
- **CS-MW3-LGR** – No VOCs were detected in this well 2013. Chromium was detected below the RL in September 2013.
- **CS-MW4-LGR** – This well was sampled once in September 2013. No VOCs were detected in this well in 2013. Chromium was detected below the RL in September 2013.
- **CS-MW6-LGR** – This well was sampled in June and September 2013. No VOC were detected in 2013. Chromium was detected below the RL during both sampling events in 2013.
- **CS-MW7-LGR** – PCE was detected below the RL in June and September 2013. Low levels of chromium were also detected in both of these events in 2013.
- **CS-MW11A-LGR** – PCE was detected below the RL in June and September 2013. Chromium was also detected below the RL in both 2013 events.

- **CS-MW12-LGR** – No VOCs were detected in this well 2013. Chromium was detected below the RL in September 2013.
- **CS-MW17-LGR** – PCE was detected below the RL in June 2013. Chromium was also detected below the RL in June 2013.
- **CS-MW19-LGR** – PCE was detected below the RL in September 2013. Chromium was also detected below the RL in September 2013.
- **CS-MW20-LGR** – Concentrations of PCE were detected below the RL in September 2013. Chromium was detected below the RL in September 2013.
- **CS-MW21-LGR** – No VOCs were detected in this well in June or September 2013. However, chromium was detected below the RL in September 2013.
- **CS-MW23-LGR** – Chromium was detected in this well in September 2013 below the RL.
- **CS-MW24-LGR** – This well was sampled in June and September 2013. Chromium was detected in this well in September 2013, below the RL.
- **CS-MW25-LGR** – Chromium was detected in this well in September 2013 below the RL.
- **CS-MW35-LGR** – PCE was detected below the RL in June and September 2013. Chromium was detected below the RL in September 2013.

2.2.1.4 On-Post Monitoring Wells with No COC Detections

Of the 33 monitoring wells sampled in 2013, 30 wells reported COC detections. A total of 3 wells (CS-MW1-CC, CS-MW2-CC, and CS-MW22-LGR) reported no VOC or metals detections. One well was not sampled in June 2013 due to the water level falling below the pump depth (CS-D) and one well was not sampled due to field crew oversight. Seven wells were not sampled in September 2013 due to low water levels (CS-MW4-LGR, CS-MW10-LGR, CS-MW11B-LGR, CS-MW17-LGR, CS-MW18-LGR, CS-4, and CS-D). One well (CS-9) was not sampled in December 2013 due to pump failure. Details on the RL, MDLs, field duplicates, MCLs, etc., are described in the tables of detections (**Table 2.5**) and in **Appendix B**.

2.2.1.5 Drinking Water Supply Well Results

Three active CSSA drinking water supply wells CS-1, CS-10, and CS-12 were analyzed for VOCs and the 8 metals (arsenic, barium, cadmium, chromium, copper, lead, mercury, and zinc) in 2013. One future supply well (CS-13) was analyzed for additional analytes (**Appendix B**). Well CS-9 is only to be used in emergency situations and not for drinking water use. Under the LTMO study, the drinking water supply wells are scheduled to be sampled quarterly (**Table 2.4**). The detections are summarized as follows:

- **CS-1 –**Concentrations of TCE were detected below the RL in March, September, and December 2013. Barium and zinc were above their applicable RLs in all four quarters in 2013 and copper was below the RL in 2013.
- **CS-10** – No VOCs were detected during the 4 quarterly events in 2013. Barium and zinc were detected above the RL in 2013. Copper was also detected below the RL in 2013.

- **CS-12** –No VOCs were detected in this well in 2013. Barium, copper, and zinc were detected below their applicable MCLs in 2013.
- **CS-13** – No VOCs were detected in this well in June 2013. Aluminum, arsenic, barium, iron, manganese, and zinc were all detected below their applicable MCL’s.
- **CS-9** – No VOCs were detected in this well in 2013. Chromium, lead, and mercury were detected below their applicable MCLs in 2013. Well CS-9 remains offline, since June 2007, due to historical elevated lead and mercury detections. Continued sampling in 2013 has shown that lead and mercury have fallen below the groundwater standards. Well CS-9 will continue to be an inactive component of the CSSA distribution system and only operational for non potable emergency situations.

CSSA is in the process of revising its postwide Drought Contingency Plan (DCP). The basic premise of the DCP is to adopt the Trinity-Glen Rose Groundwater Conservation District (TGRGCD) rules and regulations for the conservation of the local groundwater resource. The proposed CSSA DCP adopts the trigger levels and water use restrictions set forth by the TGRGCD agency. In addition, CSSA has created its own trigger levels and additional site-specific water-use restrictions to better manage the resource and maintain the overall mission of the facility.

Specifically, the water level trigger levels specific to a TGRGCD index well, FO-20, have been “best fit” to corresponding water levels at production wells CS-1, CS-10, and CS-12; as well as monitoring well CS-MW18-LGR. Over the coming year, these proposed trigger levels will be monitored and adjusted accordingly to match the timeframe at which the TGRGCD declare specific drought stage levels. These proposed DCP triggers and water-use restrictions are included in **Appendix E**.

2.2.1.6 Westbay®-equipped Well Results

Eight wells equipped with the Westbay multi-port interval sampling equipment have been installed at CSSA. Four wells (CS-WB05, CS-WB06, CS-WB07, and CS-WB08) are sampled as part of the SWMU B-3 bioreactor treatability study and are not addressed in this report. The remaining four wells (CS-WB01, CS-WB02, CS-WB03, and CS-WB04) are part of the basewide groundwater monitoring program and are included in this report. Under the provisions of the groundwater monitoring DQOs and the 2010 updated LTMO study, the schedule for sampling CS-WB01, CS-WB02, and CS-WB03 is every 9 months with 3 additional LTMO selected zones sampled with the 9 month snapshot event. The schedule for sampling CS-WB04 Upper Glen Rose (UGR), LGR, BS, and CC zones is every 18 months with 7 of those zones sampled every 9 months and an additional 5 LTMO selected zones sampled with the 9 month snapshot event. An overview of sampling frequencies for Westbay wells only is given in **Table 2.6**.

Samples were collected from the 8 LTMO selected zones in September 2013 with the 9 month snapshot event. All zones with water, with the exception of the BS and CC zones at WB04, were sampled in June 2013. In March and December 2013 no Westbay samples were collected. Samples were analyzed for PCE, TCE, *cis*-1,2-DCE, *trans*-1,2-DCE, 1,1-DCE, vinyl chloride and analyzed by APPL. Per the DQOs, the Westbay data are used for screening purposes only, and therefore no quality assurance/quality control samples are

Table 2.6 Westbay Sampling Frequency

Westbay Interval	Last Sample Date	Mar-13	Jun-13	Sep-13 (snapshot)	Dec-13	LTMO Sampling Frequency (as of June '11)
CS-WB01-UGR-01	Dec-04	NS	NSWL	NS	NS	Every 9 months
CS-WB01-LGR-01	Jun-13	NS	S	NS	NS	Every 9 months
CS-WB01-LGR-02	Jun-13	NS	S	NS	NS	Every 9 months
CS-WB01-LGR-03	Jun-13	NS	S	NS	NS	Every 9 months
CS-WB01-LGR-04	Jun-13	NS	S	NS	NS	Every 9 months
CS-WB01-LGR-05	Jun-13	NS	S	NS	NS	Every 9 months
CS-WB01-LGR-06	Jun-13	NS	S	NS	NS	Every 9 months
CS-WB01-LGR-07	Jun-13	NS	S	NS	NS	Every 9 months
CS-WB01-LGR-08	Jun-13	NS	S	NS	NS	Every 9 months
CS-WB01-LGR-09	Sep-13	NS	S	S	NS	Every 9 months + snapshot
CS-WB02-UGR-01	Dec-04	NS	NSWL	NS	NS	Every 9 months
CS-WB02-LGR-01	Jun-13	NS	S	NS	NS	Every 9 months
CS-WB02-LGR-02	Mar-10	NS	NSWL	NS	NS	Every 9 months
CS-WB02-LGR-03	Jun-13	NS	S	NS	NS	Every 9 months
CS-WB02-LGR-04	Jun-13	NS	S	NS	NS	Every 9 months
CS-WB02-LGR-05	Jun-13	NS	S	NS	NS	Every 9 months
CS-WB02-LGR-06	Jun-13	NS	S	NS	NS	Every 9 months
CS-WB02-LGR-07	Jun-13	NS	S	NS	NS	Every 9 months
CS-WB02-LGR-08	Jun-13	NS	S	NS	NS	Every 9 months
CS-WB02-LGR-09	Sep-13	NS	S	S	NS	Every 9 months + snapshot
CS-WB03-UGR-01	Jun-13	NS	S	NS	NS	Every 9 months
CS-WB03-LGR-01	Sep-10	NS	NSWL	NS	NS	Every 9 months
CS-WB03-LGR-02	Oct-07	NS	NSWL	NS	NS	Every 9 months
CS-WB03-LGR-03	Jun-13	NS	S	NS	NS	Every 9 months
CS-WB03-LGR-04	Jun-13	NS	S	NS	NS	Every 9 months
CS-WB03-LGR-05	Jun-13	NS	S	NS	NS	Every 9 months
CS-WB03-LGR-06	Jun-13	NS	S	NS	NS	Every 9 months
CS-WB03-LGR-07	Jun-13	NS	S	NS	NS	Every 9 months
CS-WB03-LGR-08	Jun-13	NS	S	NS	NS	Every 9 months
CS-WB03-LGR-09	Sep-13	NS	S	S	NS	Every 9 months + snapshot
CS-WB04-UGR-01	Mar-04	NS	NSWL	NS	NS	Every 9 months
CS-WB04-LGR-01	Sep-12	NS	NS	NS	NS	Every 18 months
CS-WB04-LGR-02	Mar-10	NS	NS	NS	NS	Every 18 months
CS-WB04-LGR-03	Sep-12	NS	NS	NS	NS	Every 18 months
CS-WB04-LGR-04	Sep-12	NS	NS	NS	NS	Every 18 months
CS-WB04-LGR-06	Sep-13	NS	S	S	NS	Every 9 months + snapshot
CS-WB04-LGR-07	Sep-13	NS	S	S	NS	Every 9 months + snapshot
CS-WB04-LGR-08	Sep-12	NS	S	NS	NS	Every 9 months
CS-WB04-LGR-09	Sep-13	NS	S	S	NS	Every 9 months + snapshot
CS-WB04-LGR-10	Sep-13	NS	S	S	NS	Every 9 months + snapshot
CS-WB04-LGR-11	Sep-13	NS	S	S	NS	Every 9 months + snapshot
CS-WB04-BS-01	Sep-12	NS	NS	NS	NS	Every 18 months
CS-WB04-BS-02	Sep-12	NS	NS	NS	NS	Every 18 months
CS-WB04-CC-01	Sep-12	NS	NS	NS	NS	Every 18 months
CS-WB04-CC-02	Sep-12	NS	NS	NS	NS	Every 18 months
CS-WB04-CC-03	Sep-12	NS	NS	NS	NS	Every 18 months

Profiling performed quarterly, in conjunction with post wide water levels.
S = Sample
NS = No Sample
NSWL = No sample due to low water level.

collected with the Westbay samples. All intervals with detections of COCs are presented in **Table 2.7**. Full analytical results are presented in **Appendix C**. **Appendix D** illustrates the historical contaminant concentrations and groundwater elevations for each Westbay zone.

Additional samples were collected from the Westbay wells apart from the normal groundwater monitoring in 2013. An ISCO treatability study was conducted at AOC-65 in May-June 2013. As part of that study, baseline samples were obtained in April 2013, and periodic monitoring samples followed the injection effort through December 2013. The results of this effort are currently being tabulated and will be reported in a separate treatability study document.

Due to a decrease in groundwater elevations, certain zones (CS-WB01-UGR-01, CS-WB02-UGR-01, CS-WB02-LGR-02, CS-WB03-LGR-01, CS-WB03-LGR-02, and CS-WB04-UGR-01) could not be sampled in June because they were dry. CS-WB04-LGR-05 was not sampled due to a non-operational sampling port. The remaining 31 zones scheduled for sampling contained water and were sampled. The Westbay-equipped wells are sampled using Westbay Instruments, Inc., equipment and sampling methods.

The following Westbay intervals (shown in their general stratigraphic position) reported detections of PCE and/or TCE above the MCL in 2013.

CS-WB01	CS-WB02	CS-WB03	CS-WB04
-	-	• UGR-01	-
-	-	-	-
• LGR-02	-	-	-
• LGR-03	-	• LGR-03	-
-	• LGR-04	• LGR-04	-
-	-	• LGR-05	-
-	-	-	• LGR-06
• LGR-07	-	-	• LGR-07
• LGR-08	-	-	-
• LGR-09	• LGR-09	-	• LGR-09

Figures 2.4 and **2.5** present the vertical distribution of the VOC plume within the multi-port wells for the most pervasive contaminants, PCE and TCE. The contaminant conditions in the profiles occurred as water levels were finishing their decline after a total of approximately 5 inches of rain fell in late March and early June. This sampling event represents conditions in a depleted aquifer. The following discussion presents general observations that have been noted since the inception of Westbay monitoring at AOC-65.

In 2013, the VOC plume originating from AOC-65 is generally similar in concentration and distribution as in prior years. Near the source area (CS-WB03 and –WB02), the solvent contamination is persistent throughout the entire thickness of the LGR, with the greatest concentrations near the land surface. As the plume disperses to the south and west, the contaminants seem to preferentially migrate in stratified lobes (LGR-01, -02, and -03), (LGR-06 and -07) and LGR-09.

Table 2.7
2013 Westbay® Groundwater COCs Analytical Results

Well ID	Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	TCE	PCE	Vinyl Chloride
Method Detection Limit	**MDL**	**0.3**	**0.16**	**0.19**	**0.16**	**0.15**	**0.23**
Current Reporting Limit	**RL**	**1.2**	**1.2**	**0.6**	**1.0**	**1.4**	**1.1**
Max. Contaminant Level	**MCL**	**7.0**	**70**	**100**	**5.0**	**5.0**	**2.0**
CS-WB01-UGR-01	13-Jun-13	Dry	Dry	Dry	Dry	Dry	Dry
CS-WB01-LGR-01	13-Jun-13	--	--	--	**0.28F**	**2.79**	--
CS-WB01-LGR-02	13-Jun-13	--	--	--	**2.76**	**9.29**	--
CS-WB01-LGR-03	13-Jun-13	--	--	--	**9.77**	**2.54**	--
CS-WB01-LGR-04	13-Jun-13	--	**0.11F**	--	**0.13F**	--	--
CS-WB01-LGR-05	13-Jun-13	--	--	--	--	**0.33F**	--
CS-WB01-LGR-06	13-Jun-13	--	**0.55F**	--	**0.82F**	**0.29F**	--
CS-WB01-LGR-07	13-Jun-13	--	**0.21F**	--	**11.51**	**11.25**	--
CS-WB01-LGR-08	13-Jun-13	--	**1.59**	--	**9.45**	**5.57**	--
CS-WB01-LGR-09	13-Jun-13	--	**0.53F**	--	**12.24**	**8.57**	--
	23-Sep-13	--	**0.40F**	--	**11.49**	**6.97**	--
CS-WB02-UGR-01	12-Jun-13	Dry	Dry	Dry	Dry	Dry	Dry
CS-WB02-LGR-01	12-Jun-13	--	--	--	**0.36F**	**2.38**	--
CS-WB02-LGR-02	12-Jun-13	Dry	Dry	Dry	Dry	Dry	Dry
CS-WB02-LGR-03	12-Jun-13	--	--	--	**1.91**	**4.73**	--
CS-WB02-LGR-04	12-Jun-13	--	--	--	**8.79**	**4.18**	--
CS-WB02-LGR-05	12-Jun-13	--	--	--	**2.66**	**2.58**	--
CS-WB02-LGR-06	12-Jun-13	--	**0.23F**	**0.21F**	**3.37**	**3.04**	--
CS-WB02-LGR-07	12-Jun-13	--	**0.32F**	--	**0.72F**	**2.13**	--
CS-WB02-LGR-08	12-Jun-13	--	**1.96**	**0.54F**	**0.73F**	**4.05**	--
CS-WB02-LGR-09	12-Jun-13	--	**0.32F**	--	**11.04**	**105.84***	--
	18-Sep-13	--	**0.27F**	--	**11.11**	**259.55***	--
CS-WB03-UGR-01	12-Jun-13	--	--	--	**70.67***	**8678.10***	--
CS-WB03-LGR-01	12-Jun-13	Dry	Dry	Dry	Dry	Dry	Dry
CS-WB03-LGR-02	12-Jun-13	Dry	Dry	Dry	Dry	Dry	Dry
CS-WB03-LGR-03	12-Jun-13	--	**0.15F**	--	**7.21**	**13.32**	--
CS-WB03-LGR-04	12-Jun-13	--	--	--	**5.86**	**11.96**	--
CS-WB03-LGR-05	12-Jun-13	--	--	--	**5.35**	**13.88**	--
CS-WB03-LGR-06	12-Jun-13	--	**0.75F**	--	**1.16**	**1.62**	--
CS-WB03-LGR-07	12-Jun-13	--	**9.77**	--	**1.89**	**0.48F**	--
CS-WB03-LGR-08	12-Jun-13	--	**4.46**	--	**0.96F**	**0.21F**	**0.42F**
CS-WB03-LGR-09	12-Jun-13	--	**8.93**	--	**2.07**	**1.59**	--
	18-Sep-13	--	**9.56**	--	**2.2**	**1.32F**	--
CS-WB04-UGR-01	20-Jun-13	Dry	Dry	Dry	Dry	Dry	Dry
CS-WB04-LGR-06	20-Jun-13	--	**3.54**	**0.40F**	**12.62**	**39.18**	--
	23-Sep-13	--	**2.72**	**0.25F**	**9.41**	**27.52**	--
CS-WB04-LGR-07	20-Jun-13	--	**2.51**	**0.23F**	**7.02**	**19.07**	--
	23-Sep-13	--	**2.08**	**0.18F**	**7.02**	**20.11**	--
CS-WB04-LGR-08	20-Jun-13	--	--	--	**0.98F**	**0.39F**	--
CS-WB04-LGR-09	20-Jun-13	--	--	--	**5.86**	**6.05**	--
	23-Sep-13	--	--	--	**8.31**	**8.42**	--
CS-WB04-LGR10	20-Jun-13	--	--	--	**0.73F**	**1.37F**	--
	23-Sep-13	--	--	--	**0.58F**	**1.25F**	--
CS-WB04-LGR-11	20-Jun-13	--	--	--	--	**0.24F**	--
	23-Sep-13	--	--	--	--	**0.27F**	--

Data Qualifiers:
F-The analyte was positively identified but the associated numerical value is below the RL.
* dilution was performed for this sample.
All values are reported in µg/L.
All samples were analyzed by APPL, Inc. as screening data.
DCE - Dichloroethene
TCE - Trichloroethene
PCE - Tetrachloroethene
UGR - Upper Glen Rose
LGR - Lower Glen Rose

Bold (red)	≥ MCL
Bold (blue)	≥ RL
Bold	≥ MDL

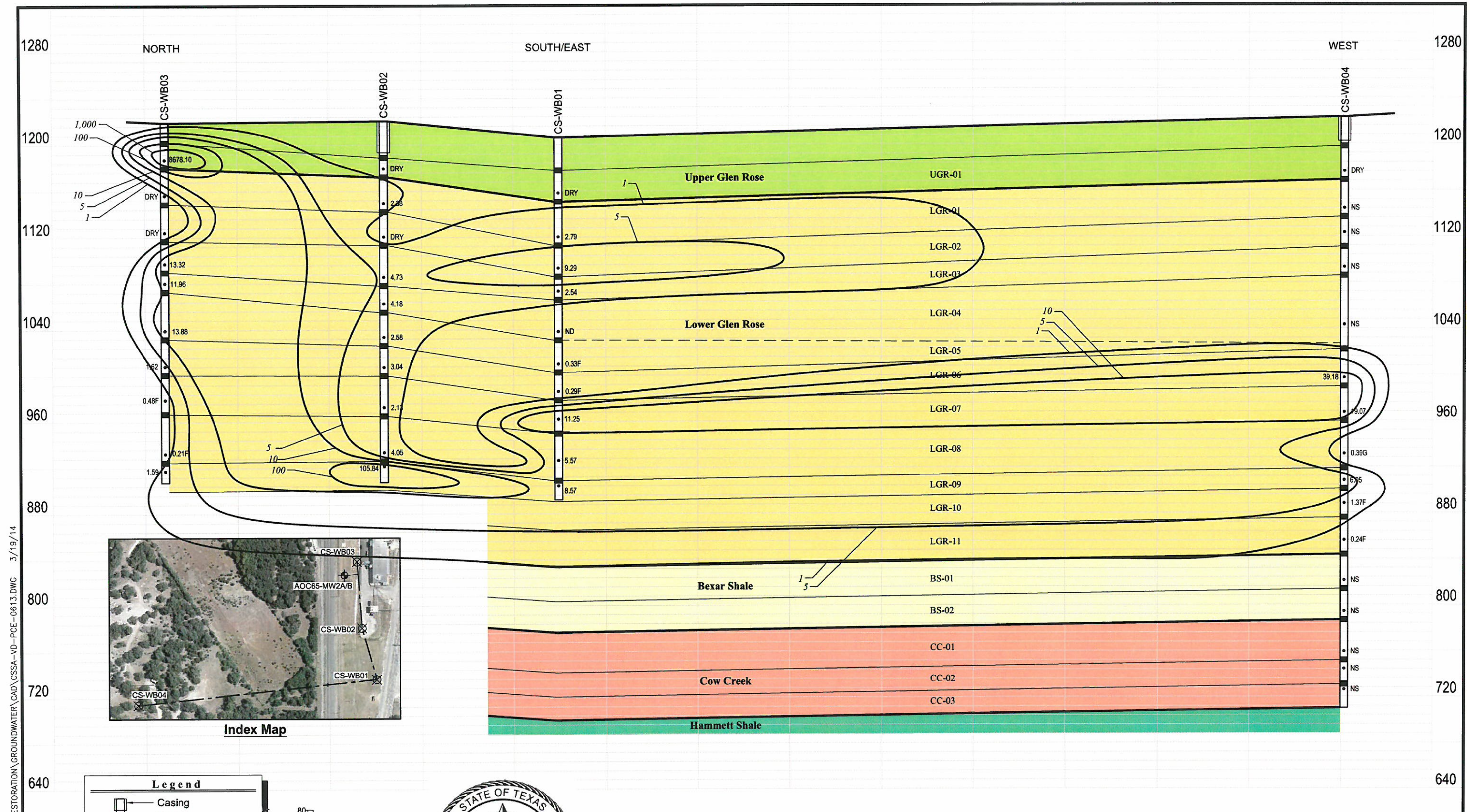


Figure 2.4

Vertical Distribution of PCE within Multi-port Wells - June 2013

Camp Stanley Storage Activity, Texas

PARSONS

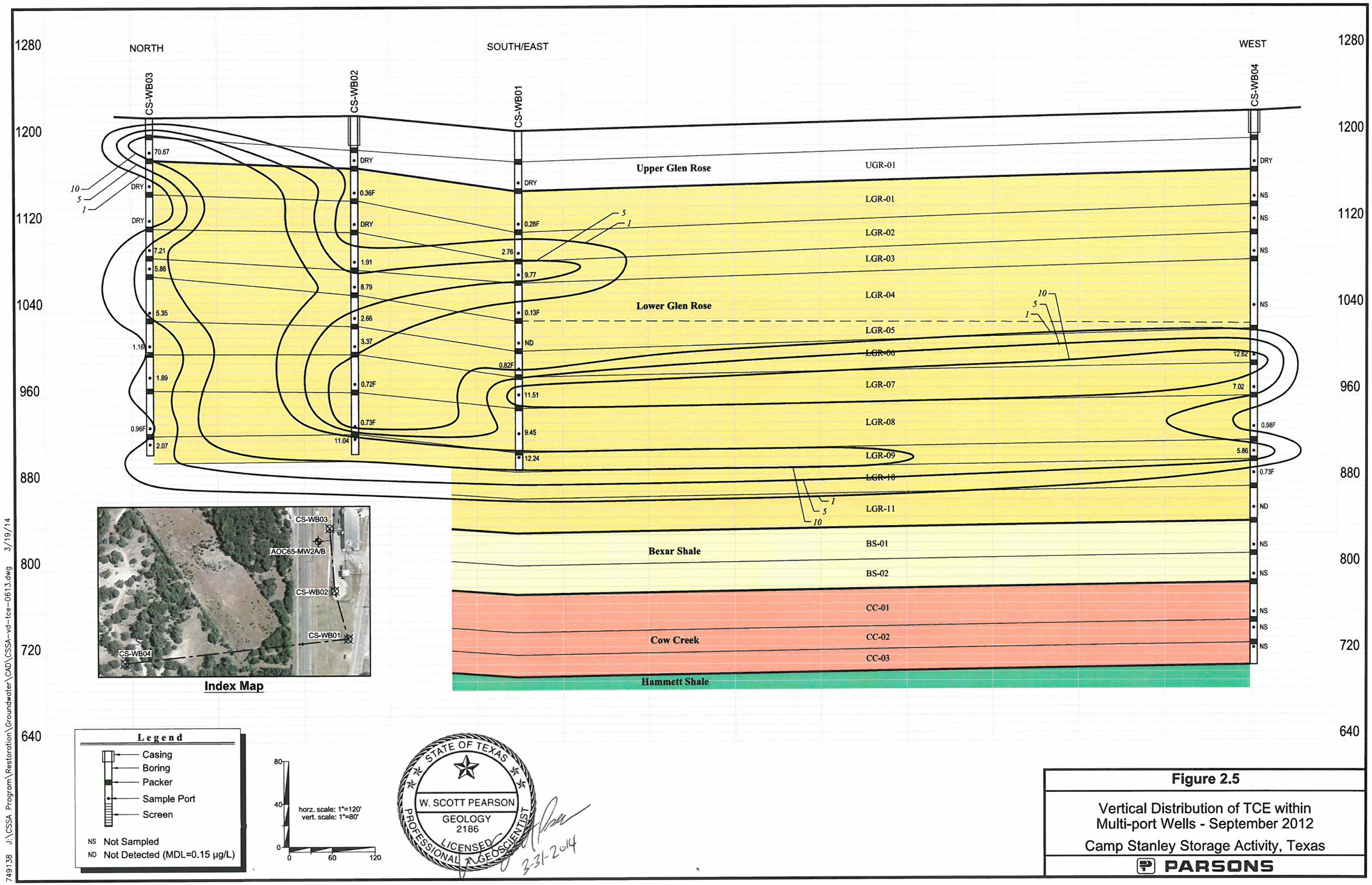


Figure 2.5

Vertical Distribution of TCE within Multi-port Wells - September 2012

Camp Stanley Storage Activity, Texas

The BS and CC zones at CS-WB04 are sampled every 18 months; such that no samples were collected from these zones in 2013. However, in prior years the BS and CC zones at CS-WB04 generally have little to no contamination present. In 2011, only trace detections of *cis*-1,2-DCE was reported in CS-WB04-BS-02 and –CC01 intervals. But in 2012, the trace detections also included PCE in all five BS (2) and CC (3) zones. The contention is that the trace contamination in the BS and CC at CS-WB04 is the result of the vertical mixing of contaminated LGR water within the nearby RFR-10 wellbore under a naturally downward vertical gradient. The last time VOCs have been seen distributed across most of the BS and CC zones was March 2009, when the aquifer was in a similar depressed condition.

CS-WB03 is located closest to the Building 90 source area, and consistently records the highest concentrations of contaminants (**Appendix D.3**). The upper zones (CS-WB03-LGR-01 and -LGR-02) are typically dry and only have water after significant rain. Because of frequent droughts and set sampling schedules, these zones have been sampled only a handful of times. In 2013, only the UGR zone contained water in the uppermost intervals of CS-WB03, with the underlying LGR-01 and LGR-02 zones being dry. Significant contamination is still present in the UGR zone (8,678 µg/L), but is approximately four times less than it was in March 2008 (30,000 µg/L). Between February 2005 and September 2010, no *cis*-1,2-DCE had been reported in CS-WB03-LGR-09. Beginning in March 2011, a trace detection was reported, followed by seven consecutive sampling events that ranged in concentration between 8.93 µg/L and 45.73 µg/L. Also, TCE detections have fallen and stayed below the MCL. Since March 2012 PCE has dropped below the MCL and has showed a steady decline. The reason for this change is likely a result of a biodegradation mechanism.

Historical results indicate that a persistent source of contamination still exists, and that periodic flushing by intense rainfall can mobilize these perched contaminants that are probably otherwise bound to the matrix during the rest of the year. Likewise, preliminary indications from the In-situ Chemical Oxidation (ISCO) treatability study show that significant contamination was mobilized/oxidized as a result of the study. Baseline samples in the UGR zone were less than 6 µg/L in July 2012. Thirty days after the initial injection, PCE concentrations were above 6,000 µg/L, and persisted at least through October 2012.

CS-WB02 was installed nearly 300 feet south of CS-WB03 and the Building 90 source area. In general most zones in 2013 showed a slight increase in PCE and decrease in TCE (**Appendix D.2**). With the exception of the –LGR-09 zone, that showed a significant increase in PCE from 13.55 µg/L (September 2012) to 119.71 µg/L (December 2012) to 105.84 µg/L (June 2013) and 259.55 µg/L (September 2013). These changes are likely a result of the ISCO injections performed in August 2012 and May/June of 2013. The result is interesting because it may implicate that there is a vertical conduit between the shallower ISCO injection zones (trench gallery and injection wells) and the deeper strata of CS-WB02-LGR-09.

Multi-port well CS-WB01 is located approximately 500 ft south of CS-WB03 and the Building 90 source area. Once again, for the zones that are normally saturated, historical PCE and TCE are present at concentrations less than 35 µg/L. Since mid-2005, there has been a general trend of increasing contaminant concentrations in zones CS-WB01-LGR02, -LGR07, and -LGR09. These noted increases seem to correspond with increases observed in several upgradient CS-WB02 zones, and may be associated with a "flushing" event in which a slug of contaminated groundwater is moving downgradient away from the source zone

(**Appendix D.1**). At CS-WB01, the trend has been that TCE concentrations generally exceed PCE for most zones. The zone with the relatively highest concentration is typically -LGR09. The results of CS-WB01 indicate that the contamination becomes preferentially stratified such that greater contamination is found above and below zones LGR-04 and -05, to the south and west. No discernable affect from the ISCO treatability study has been ascertained at CS-WB01.

Off-post at CS-WB04, trace detections of less than 1 µg/L PCE are generally reported in the LGR-01, LGR-02, LGR-03, LGR-04, and LGR-08 zones. WB04-LGR-05 was not sampled due to a sample port malfunction. Since September 2006, TCE has been reported above the MCL in zones LGR-06 and LGR-07 at concentrations less than 16 µg/L and even lesser detections of PCE. In 2009, the concentration of PCE in both LGR-06 and LGR-07 more than doubled compared to September 2008 while the TCE concentrations slightly increased (**Appendix D.4**). In 2010, PCE in LGR-06 decreased from 33 µg/L to 11 µg/L while the LGR-07 PCE concentration has decreased from 19 µg/L to 1.7 µg/L. But in 2011, the PCE concentration in LGR-06 has increased to 28.76 µg/L PCE, and zone LGR-07 also increased its PCE concentration to 24.41 µg/L. In June 2013, the increasing trend continued with PCE reaching a historical high of 39.18 µg/L in LGR-06 but in September 2013 this level dropped to 27.52 µg/L. The levels in LGR-07 dropped slightly in 2013 and the levels remained similar in June and September 2013. These trends in LGR-06 and -07 are evident on the graphs presented in **Appendix D**. These two zones have been the most dynamic in change of all the multiport zones monitored in this program, and are an indication that contaminant mass is migrating westward in these intervals.

Historically, the off-post zone with the most persistent contamination is CS-WB04-LGR-09. Nearly equivalent levels of PCE and TCE are found at concentrations that generally range above the MCL between 8 µg/L and 14 µg/L. Below this depth, any solvent contamination in the remainder of the LGR, BS, and CC are at concentrations less than 1.5 µg/L. Prior to 2012, only isolated minimal detections of PCE have been reported in the LGR-11 zone once the borehole had stabilized. However, trace detections of PCE and TCE were reported in this zone in March 2012. The trace detections of PCE persisted in September 2012 then again in June and September 2013.

The BS and CC zones are sampled on an 18-month schedule and were not sampled in 2013. These zones will be sampled again in June 2014 in accordance with the LTMO recommendations. But historically, the BS zones have essentially been contaminant-free, except for a single occurrence of *cis*-1,2-DCE (0.25 µg/L) in October 2007 and PCE (0.18 µg/L) in March 2009. However, trace detections of PCE and *cis*-1,2-DCE were reported in both BS zones in September 2012. *Cis*-1,2-DCE is consistently reported in interval CC-01, otherwise isolated PCE detections below 2.71 µg/L have been detected in either CC-02 or CC-03. At zone CC-03, the September 2012 PCE concentration of 2.71 µg/L is the first report of PCE in that zone since January 2005. Recent detections of TCE in several zones appear to be the result of the MDL being lowered from 0.6 µg/L to 0.16 µg/L in 2007.

2.2.2 Off-Post Analytical Results

The frequencies for sampling off-post wells in 2013 were determined by the updated *Three-Tiered Long Term Monitoring Network Optimization Evaluation* (Parsons 2010), compliance with *The Plan*, and *DQOs for the Groundwater Monitoring Program* (Parsons 2010). An overview of sampling frequencies for off-post wells is given in **Table 2.8**. Fifty-four off-post wells were sampled during the 2013 quarterly monitoring events, and their locations are illustrated on **Figure 1.1**. In June 2011 the LTMO study was implemented to sample frequencies off-post. The TCEQ and EPA approval for implementing the LTMO off-post was received in February 2011 (see **Appendix J)**.

Off-post wells sampled during the quarterly monitoring events were selected based on previous sampling results and proximity to both the CSSA boundary and wells with detections of PCE and TCE. Public and private supply wells located west and south of CSSA were selected for these events. Samples were also collected from the off-post well granular activated carbon (GAC) filtration systems after treatment during the March and September events.

Off-post wells sampled in 2013 include (see **Figure 1.1** for well locations):

- Four public supply wells in the Fair Oaks area (FO-J1, FO-8, FO-17, and FO-22);
- Three public wells in the Hidden Springs Estates subdivision (HS-1, HS-2 and HS-3);
- Five wells used by the general public (I10-2, I10-5, I10-7, I10-8, & I10-10) and one privately-owned well in the Interstate I-10 area (I10-4);
- Twelve privately-owned wells in the Jackson Woods subdivision (JW-5, JW-6, JW-7, JW-8, JW-9, JW-13, JW-15, JW-27, JW-28, JW-29, JW-30, and JW-31);
- Five wells in the Leon Springs Villa area (two public supply wells removed from service: LS-1, and LS-4; and three privately-owned wells: LS-5, LS-6, and LS-7);
- Three privately-owned wells on Old Fredericksburg Road (OFR-1, OFR-3, and OFR-4);
- Nine privately-owned wells in the Ralph Fair Road area (RFR-3, RFR-4, RFR-5, RFR-8, RFR-10, RFR-11, RFR-12, RFR-13, and RFR-14);
- Eight public supply wells from The Oaks Water Supply System (OW-HH1, OW-HH2, OW-HH3, OW-CE1, OW-CE2, OW-MT2, OW-BARNOWL, OW-DAIRYBARN);
- Two public supply wells in the Scenic Loop Drive area, SLD-01 and SLD-02; and
- One privately owned well along Boerne Stage Road (BSR-03) and one public supply well (BSR-04).

All wells were sampled from a tap located as close to the wellhead as possible. Most taps were installed by CSSA to obtain a representative groundwater sample before pressurization, storage, or the water supply distribution system. Water was purged to engage the well pump prior to sample collection. Conductivity, pH, and temperature readings were recorded to confirm adequate purging while the well was pumping. Purging measurements were recorded in the field logbook for each sampling event.

All groundwater samples were submitted to APPL for analysis. Groundwater samples were analyzed for the short list of VOCs (*cis*-1,2-DCE, *trans*-1,2-DCE, 1,1-DCE, PCE, TCE, and vinyl chloride) using SW-846 Method 8260B. Off-post wells are not analyzed for metals as part of the groundwater monitoring program.

Table 2-8
2013 Off-Post Groundwater Sampling Rationale

Well ID	2013 Mar	June	Sept	Dec	Sampling Frequency
BSR-03	NS	NS		NS	9-month (snapshot)
BSR-04	NS	NS		NS	9-month (snapshot)
FO-8	NS	NS		NS	9-month (snapshot)
FO-17	NS	NS		NS	9-month (snapshot)
FO-22	NS	NS		NS	9-month (snapshot)
FO-J1	NS	NS		NS	9-month (snapshot)
HS-1	NS	NS		NS	9-month (snapshot)
HS-2	NS	NS		NS	9-month (snapshot)
HS-3	NS	NS		NS	9-month (snapshot)
I10-2	NS	NS		NS	9-month (snapshot)
I10-4					Quarterly
I10-5	NS	NS		NS	9-month (snapshot)
I10-7	NS	NS		NS	9-month (snapshot)
I10-8	NS	NS		NS	9-month (snapshot)
I10-10	agreement received			NS	One time sample
JW-5	NS	NS		NS	9-month (snapshot)
JW-6	NS	NS		NS	9-month (snapshot)
JW-7	NS	NS		NS	9-month (snapshot)
JW-8	NS	NS		NS	9-month (snapshot)
JW-9	NS	NS		NS	9-month (snapshot)
JW-13	NS	NS		NS	9-month (snapshot)
JW-14	NS	NS	NA	NS	9-month (snapshot)
JW-15	NS	NS		NS	9-month (snapshot)
JW-26	NS	NS	NA	NS	9-month (snapshot)
JW-27	NS	NS		NS	9-month (snapshot)
JW-28	NS	NS		NS	9-month (snapshot)
JW-29	NS	NS		NS	9-month (snapshot)
JW-30	NS	NS		NS	9-month (snapshot)
JW-31	NS	NS		NS	9-month (snapshot)
LS-1	NS	NS		NS	9-month (snapshot)
LS-4	NS	NS		NS	9-month (snapshot)
LS-5					Quarterly
LS-5-A2		NS		NS	Biannually (Mar & Sept)
LS-6					Quarterly
LS-6-A2		NS		NS	Biannually (Mar & Sept)
LS-7					Quarterly
LS-7-A2		NS		NS	Biannually (Mar & Sept)
OFR-1	NS	NS		NS	9-month (snapshot)
OFR-3		NA	NA	NA	Quarterly
OFR-3-A2		NS	NA	NS	Biannually (Mar & Sept)
OFR-4	NS	NS		NS	9-month (snapshot)
OW-HH1	NS	NS		NS	9-month (snapshot)
OW-HH2				NS	Quarterly
OW-CE1	NS	NS		NS	9-month (snapshot)
OW-CE2	NS	NS		NS	9-month (snapshot)
OW-MT2	NS	NS		NS	9-month (snapshot)
OW-BARNOWL				NS	Quarterly
OW-DAIRYBARN	NS	NS		NS	9-month (snapshot)
OW-HH3	NS	NS		NS	9-month (snapshot)
RFR-3	NS	NS		NS	9-month (snapshot)
RFR-4	NS	NS		NS	9-month (snapshot)
RFR-5	NS	NS		NS	9-month (snapshot)
RFR-8	NS	NS		NS	9-month (snapshot)
RFR-9	NS	NS	NA	NS	9-month (snapshot)
RFR-10					Quarterly
RFR-10-A2		NS		NS	Biannually (Mar & Sept)
RFR-10-B2		NS		NS	Biannually (Mar & Sept)
RFR-11					Quarterly
RFR-11-A2		NS		NS	Biannually (Mar & Sept)
RFR-12	NS	NS		NS	9-month (snapshot)
RFR-13	NS	NS		NS	9-month (snapshot)
RFR-14	NS	NS		NS	9-month (snapshot)
SLD-01	NS	NS			Quarterly
SLD-02	NS	NS		NS	9-month (snapshot)

VOCs detected are greater than 90% of the MCL. Sample monthly; quarterly after GAC installation.

VOCs detected are greater than 80% of the MCL. The well will be placed on a monthly sampling schedule until GAC installation then quarterly sampling after GAC installation.

VOCs detected are less than 80% of the MCL (<4.0 ppb and >0.06 ppb for PCE & <4.0 ppb >0.05 ppb for TCE). After four quarters of stable results the well can be removed from quarterly sampling.

This well has a GAC filtration unit installed by CSSA. Post GAC samples are collected every six months.
A1 - after GAC canister #1
A2 - after GAC canister #2

NS Not sampled for that event.

No VOCs detected. Sample on an as needed basis.

NA Not applicable, sample could not be collected due to pump outage or well access conflict.

The data packages containing the analytical results for the 2013 sampling events were reviewed and verified according to the guidelines outlined in the CSSA QAPP. After the data packages were received by Parsons, quarterly data verification reports were submitted to CSSA as an attachment in the Quarterly Groundwater Reports.

Based on historical detections, the lateral extent of VOC contamination extends approximately 3.0 miles beyond the south and west boundaries of CSSA (well SLD-01 to the west and LS-4 to the south). Information such as well depth, pump depth, and other pertinent data necessary to characterize the vertical extent of migration is not readily available for most off-post wells. However, the typical well construction for the area is open borehole completions that penetrate the full thickness of the Middle Trinity aquifer (LGR, BS, and CC).

Concentrations of VOCs detected in 2013 are presented in **Table 2.9**. Full analytical results from the 2013 sampling events are presented in **Appendix G**. Concentration trends are illustrated on **Figure 2.6** for wells LS-5, LS-6, LS-7, OFR-3, RFR-10, and RFR-11 for PCE and TCE. These wells were selected because they have had detections of PCE and TCE that approach and/or exceed MCLs. **Figure 2.6** also includes precipitation data from the weather stations located at CSSA, AOC-65 WS and B-3 WS. This figure suggests VOC concentrations in OFR-3 and RFR-10 are very sensitive to significant rain events and that VOC concentrations in LS-5, LS-6, and LS-7 are less sensitive to rainfall.

Data from RFR-11 presents a mixed picture. From October 2001 through December 2007, RFR-11 VOC concentration peaks showed a good correlation to significant rainfall events, but after 2007, this correlation is less pronounced. It may be coincidental, but the changes in rainfall/VOC concentration correlations in RFR-11 happened when the San Antonio Water System (SAWS) abandoned pumping of the Bexar Met public supply wells in Leon Springs Villas (LS-1, LS-2, LS-3, LS-4). **Figure 2.7** shows PCE and TCE concentrations with monthly water usage at each off-post well. The off-post GAC systems are equipped with flowmeters that track the gallons of water treated by the units. Data in this figure suggests little correlation between VOC concentrations and well pumping volumes.

2.2.2.1 Off-Post Wells with COC Detections above the MCL

During 2013, only off-post well RFR-10 had raw water (pre-GAC) concentrations exceeding the MCL. Well RFR-10 concentrations exceeded the MCL for PCE and TCE during the June and December events, and only PCE exceeded the MCL during the March and September events. An evaluation of concentration trends through 2013 are included in **Figures 2.6 and 2.7**.

2.2.2.2 GAC Filtration Systems

All off-post drinking water wells that historically exceeded or approached MCLs have already been equipped with GAC filtration systems. These wells, and the date the filtration system was installed, are listed in **Table 2.10**. CSSA maintains and operates these GAC filtration systems at no cost or inconvenience to the well owners.

Table 2.9
2013 Off-Post Groundwater COCs Analytical Results

Well ID	Sample Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	TCE	Vinyl Chloride
BSR-03	9/13/2013	--	--	--	--	--	--
BSR-04	9/12/2013	--	--	--	--	--	--
FO-8	9/9/2013	--	--	--	--	--	--
FO-17	9/9/2013	--	--	--	--	--	--
FO-22	9/9/2013	--	--	--	--	--	--
FO-J1	9/13/2013	--	--	--	**0.24F**	--	--
HS-1	9/11/2013	--	--	--	--	--	--
HS-2	9/11/2013	--	--	--	--	--	--
HS-3	9/11/2013	--	--	--	--	--	--
I10-2	9/9/2013	--	--	--	--	--	--
I10-4	3/12/2013	--	--	--	**4.77**	**2.0**	--
	6/26/2013	--	--	--	**3.88**	**1.6**	--
	9/9/2013	--	--	--	**3.36**	**1.7**	--
	12/9/2013	--	--	--	**4.04**	**1.6**	--
I10-5	9/9/2013	--	--	--	--	--	--
I10-7	9/9/2013	--	--	--	--	--	--
I10-8	9/10/2013	--	--	--	--	--	--
Duplicate	9/10/2013	--	--	--	--	--	--
I10-10	9/11/2013	--	--	--	--	--	--
JW-5	9/10/2013	--	--	--	--	--	--
JW-6	9/10/2013	--	--	--	--	--	--
Duplicate	9/10/2013	--	--	--	--	--	--
JW-7	9/10/2013	--	--	--	**0.32F**	--	--
JW-8	9/11/2013	--	--	--	**0.26F**	--	--
JW-9	9/13/2013	--	--	--	--	--	--
JW-13	9/11/2013	--	--	--	--	--	--
JW-15	9/11/2013	--	--	--	--	--	--
JW-27	9/11/2013	--	--	--	--	--	--
JW-28	9/11/2013	--	--	--	--	--	--
JW-29	9/11/2013	--	--	--	--	--	--
JW-30	9/12/2013	--	--	--	--	--	--
JW-31	9/12/2013	--	--	--	--	--	--
LS-1	9/11/2013	--	--	--	**0.72F**	--	--
LS-4	9/11/2013	--	--	--	--	--	--
LS-5	3/11/2013	--	--	--	**0.80F**	**2.67**	--
	6/19/2013	--	--	--	**0.84F**	**2.34**	--
	9/17/2013	--	--	--	**0.95F**	**2.67**	--
Duplicate	9/17/2013	--	--	--	**1.01F**	**2.7**	--
	12/9/2013	--	--	--	**0.95F**	**2.53**	--
LS-5-A2	3/11/2013	--	--	--	--	--	--
	9/17/2013	--	--	--	--	--	--
LS-6	3/11/2013	--	--	--	**0.87F**	**2.7**	--
	6/19/2013	--	--	--	**0.68F**	**2.97**	--
	9/17/2013	--	--	--	**0.68F**	**2.12**	--
	12/9/2013	--	--	--	**0.84F**	**2.72**	--
LS-6-A2	3/11/2013	--	--	--	--	--	--
	9/17/2013	--	--	--	--	--	--

Table 2.9
2013 Off-Post Groundwater COCs Analytical Results

Well ID	Sample Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	TCE	Vinyl Chloride
LS-7	3/11/2013	--	--	--	**2.04**	**0.41F**	--
	6/19/2013	--	--	--	**1.68**	**0.24F**	--
	9/17/2013	--	--	--	**1.87**	**0.19F**	--
	12/9/2013	--	--	--	**2.15**	**0.23F**	--
LS-7-A2	3/11/2013	--	--	--	--	--	--
	9/17/2013	--	--	--	--	--	--
OFR-1	9/13/2013	--	--	--	--	--	--
Duplicate	9/13/2013	--	--	--	--	--	--
OFR-3	3/11/2013	--	--	--	**3.18**	**2.87**	--
OFR-4	9/13/2013	--	--	--	--	--	--
OFR-3-A2	3/11/2013	--	--	--	--	--	--
Duplicate	3/11/2013	--	--	--	--	--	--
OW-BARNOWL	3/12/2013	--	--	--	--	--	--
Duplicate	3/12/2013	--	--	--	--	--	--
	6/26/2013	--	--	--	--	--	--
	9/10/2013	--	--	--	--	--	--
OW-CE1	9/10/2013	--	--	--	--	--	--
OW-CE2	9/10/2013	--	--	--	--	--	--
OW-HH1	9/10/2013	--	--	--	--	--	--
OW-HH2	3/12/2013	--	--	--	--	--	--
	6/26/2013	--	--	--	--	--	--
	9/10/2013	--	--	--	--	--	--
Duplicate	9/10/2013	--	--	--	--	--	--
OW-HH3	9/10/2013	--	--	--	--	--	--
OW-DAIRYWELL	9/10/2013	--	--	--	--	--	--
OW-MT2	9/10/2013	--	--	--	--	--	--
RFR-3	9/12/2013	--	--	--	--	--	--
RFR-4	9/12/2013	--	--	--	--	--	--
RFR-5	9/12/2013	--	--	--	--	--	--
Duplicate	9/12/2013	--	--	--	--	--	--
RFR-8	9/12/2013	--	--	--	--	--	--
RFR-10	3/11/2013	--	--	--	**8.44**	**3.21**	--
	6/19/2013	--	**0.28F**	--	**12.82**	**8.73**	--
	9/17/2013	--	--	--	**7.41**	**2.26**	--
	12/9/2013	--	**0.16F**	--	**13.7**	**6.42**	--
RFR-10-A2	3/11/2013	--	--	--	--	--	--
	9/17/2013	--	--	--	--	--	--
RFR-10-B2	3/11/2013	--	--	--	--	--	--
	9/17/2013	--	--	--	--	--	--
RFR-11	3/11/2013	--	--	--	**0.59F**	**2.32**	--
	6/19/2013	--	--	--	**0.64F**	**2.32**	--
	9/17/2013	--	--	--	**0.65F**	**2.12**	--
	12/9/2013	--	--	--	--	**2.52**	--
RFR-11-A2	3/11/2013	--	--	--	--	--	--
	9/17/2013	--	--	--	--	--	--
RFR-12	9/9/2013	--	--	--	--	**0.52F**	--
RFR-13	9/13/2013	--	--	--	--	--	--
RFR-14	9/12/2013	--	--	--	--	--	--

Table 2.9
2013 Off-Post Groundwater COCs Analytical Results

Well ID	Sample Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	TCE	Vinyl Chloride
SLD-01	9/11/2013	--	--	--	**0.24F**	--	--
	12/3/2013	--	--	--	--	--	--
SLD-02	9/11/2013	--	--	--	--	--	--

BOLD (white)	≥ MDL
BOLD (blue)	≥ RL
BOLD (red)	≥ MCL

All samples were analyzed by APPL, Inc.
VOC data reported in ug/L.
Abbreviations/Notes:

Duplicate	Field Duplicate
TCE	Trichloroethene
PCE	Tetrachloroethene
DCE	Dichloroethene

Data Qualifiers
U-The analyte was analyzed for, but not detected. The associated numerical value is at or below the MDL.
F-The analyte was positively identified but the associated numerical value is below the RL.

Figure 2.6
PCE and TCE Concentration Trends and Precipitation

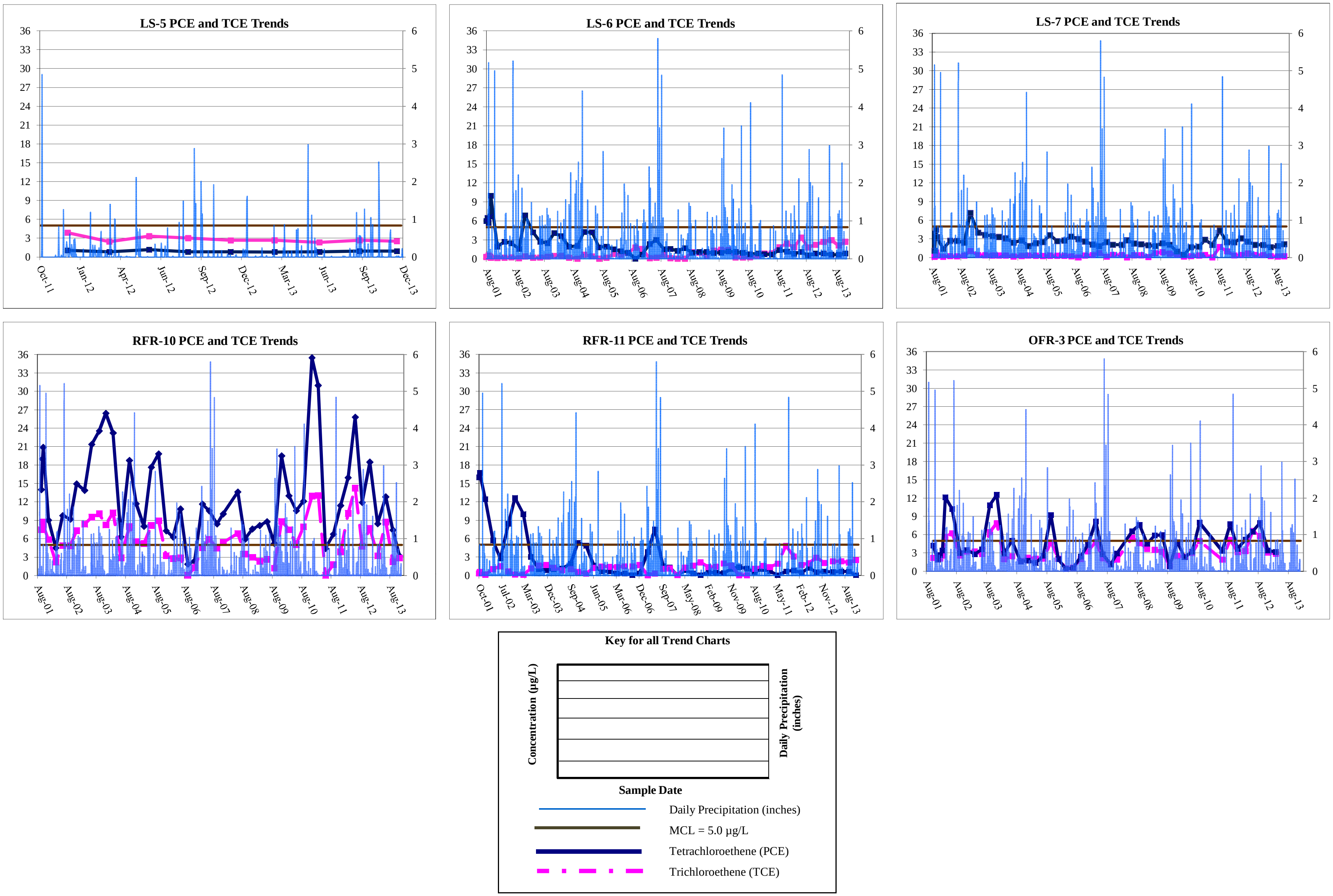


Figure 2.7
PCE and TCE Concentration Trends and Monthly Water Usage

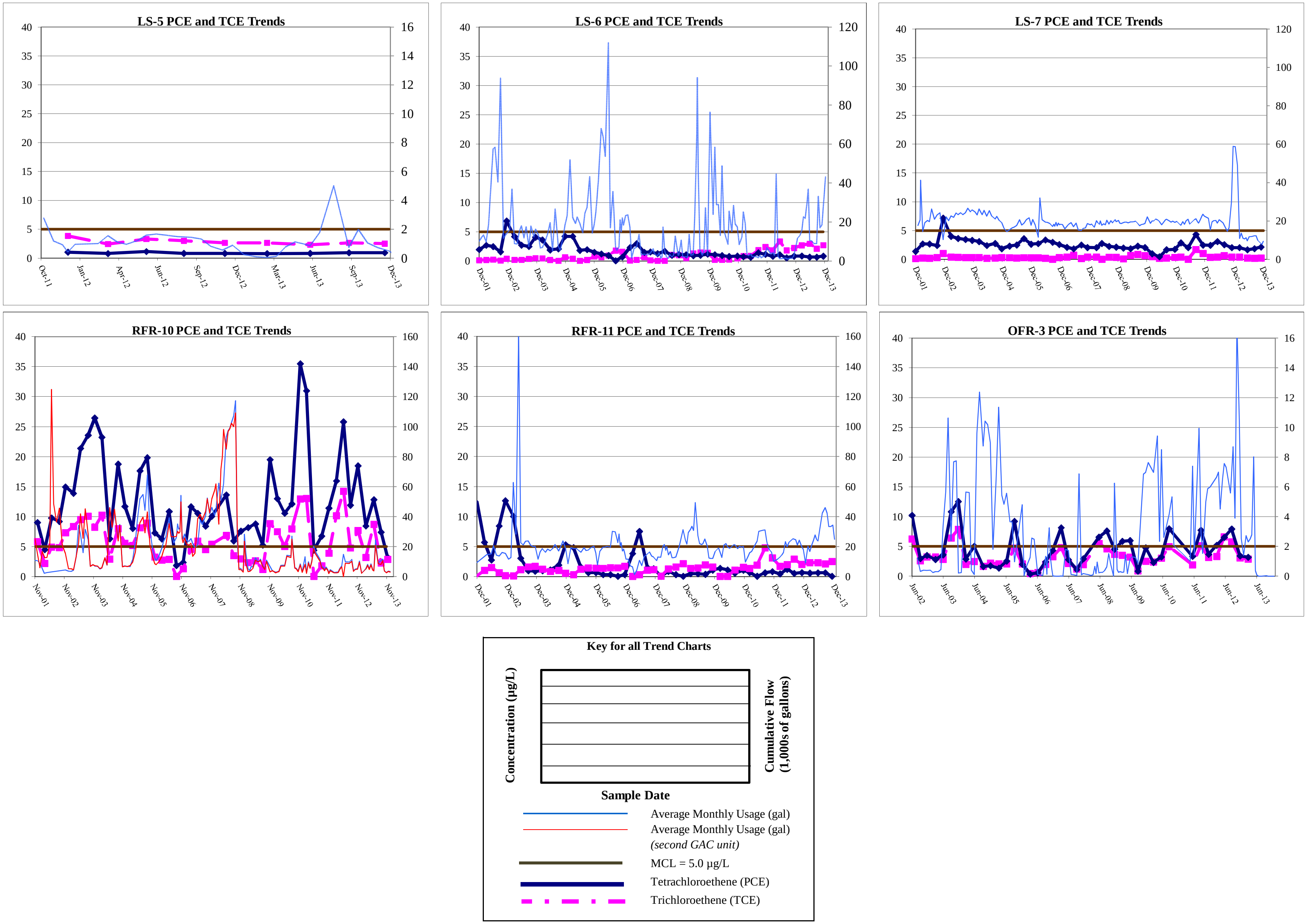


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Table 2.10 GAC Filtration Systems Installed

Well	Date Installed
LS-6	August 2001
LS-7	August 2001
OFR-3	April 2002
RFR-10	October 2001
RFR-11	October 2001
LS-5	October 2011

Semi-annual post-GAC confirmation samples are collected from all wells equipped with GAC filtration systems (**Appendix H**). The samples confirm that the GAC filtration systems are working effectively and that VOCs are reduced to concentrations below the applicable drinking water MCLs.

To date, no COCs have been detected above RLs in the GAC-filtered samples. These samples were collected during the March and September 2013 events in accordance with project DQOs. See **Appendix H** for pre- and post-GAC sample comparisons.

Regular GAC maintenance/inspection occurs every 3 weeks. This task includes changing pre-filters and troubleshooting problems occurring with the systems. On January 23, 2013 and July 29, 2013 the carbon in the GAC filtration systems (LS-5, LS-6, LS-7, OFR-3, RFR-10, and RFR-11) was changed out.

2.2.2.3 Off-Post Wells with COC Detections below the MCL

Detections from all wells sampled off-post are presented in **Table 2.9** and complete 2013 results are included in **Appendix G**. The groundwater monitoring results include wells where COCs were detected at levels below applicable MCLs. These detections occurred in wells I10-4, LS-5, LS-6, LS-7 OFR-3, and RFR-11. The detections below the MCL and above the RL are summarized as follows:

- **I10-4** – Well I10-4 is not in service and the property is currently for sale. Although the electricity and pump have been removed from the well, samples are collected using a bailer sampling device. PCE and TCE were above their applicable RL's in all four quarterly events in 2013. PCE was above the MCL in past sampling events, normally a GAC filtration system would have been installed on this well. However, since the well is not being used as a drinking water source a GAC unit is not installed at this time. If at any point the status of the well changes appropriate action will be taken to ensure that the landowner receives drinking water that meets EPA drinking water standards. In January 2014 CSSA was contacted by a contractor working at the property where I10-4 is located. CSSA was informed that this well will be plugged and abandoned in order to install a detention pond as part of planned commercial development for this property.
- **LS-5** – Concentration of TCE exceeded the RL in March, June, September, and December 2013. PCE was also detected below the RL during these sampling events. This well is equipped with a GAC filtration system.

- **LS-6** – Concentrations of TCE exceeded the RL in March, June, September, and December 2013. PCE was detected each quarter as well but below the RL. This well is equipped with a GAC filtration system.
- **LS-7** – Concentrations of PCE exceeded the RL in all four quarterly sampling events. Concentrations of TCE were also present in every event but below the RL. This well is equipped with a GAC filtration system.
- **OFR-3** - Well OFR-3 had PCE and TCE above the RL in March 2013. This well was not sampled in June, September, and December 2013 due to the property being sold and the electricity being shut off. Several attempts were made to contact the new well owner but no phone calls were returned. The access agreement was signed and returned October 20, 2013. In December 2013 CSSA was contacted by an environmental contractor working at the OFR-3 property. They were inquiring about information on the well pump in OFR-3 in order to do a feasibility study on this well supporting a mixed use retail development. CSSA did not provide any pump information because it is unknown. This well will likely be plugged and abandoned in the future as the property is developed and connected to SAWS.
- **RFR-11** - Concentration of TCE exceeded the RL in all four quarterly sampling events. PCE was also detected below the RL in the March, June, and September sampling events. This well is equipped with a GAC filtration system.

2.2.2.4 Off-Post Wells with COC Detections below the Reporting Limits

The off-post results include detections in wells for which the analyte is identified, but at a concentration below the RL. These results are assigned an "F" flag under the CSSA QAPP. In 2013, this included wells FO-J1, JW-7, JW-8, LS-1, RFR-12, and SLD-01. The detections below the reporting limit are summarized as follows:

- **FO-J1** – Concentrations of PCE detected below the RL in September 2013.
- **JW-7** – Concentrations of PCE detected below the RL in September 2013.
- **JW-8** – Concentrations of PCE detected below the RL in September 2013.
- **LS-1** – Concentrations of PCE detected below the RL in September 2013.
- **RFR-12** – Concentrations of TCE detected below the RL in September 2013.
- **SLD-01** – Concentrations of PCE detected below the RL in September 2013. This was the first detection in this well. In December 2013 there were no detections in this well.

2.2.3 Isoconcentration Mapping

2.2.3.1 PCE, TCE, and cis-1,2-DCE

In annual reports prior to 2010, the maximum concentration detected during any quarterly event in the LGR wells (on-post and off-post) were contoured into isoconcentration contour maps for PCE, TCE, and *cis*-1,2-DCE. The reason for creating these "composite" maps resulted from the LTMO sampling frequency enacted in 2005. No single quarterly event included all of the wells in the sampling program. The LTMO program was updated in 2010 to include a "snapshot" sampling event in which all on- and off-post wells were sampled during the same event. These snapshot events began in September 2010, and now occur every

9 months. Annual reports now only include isoconcentration maps of contaminants collected during a single sampling event.

Another new development in the representation of contamination in groundwater came in March 2012. At the direction of the USEPA (**Appendix K**), isoconcentration maps depicting groundwater contamination will no longer present isoconcentration contour lines below the laboratory RL, which is considered quantifiable data. Trace detections of contamination (F-flagged data) reported by the lab are considered qualitative results and therefore are not suitable for demonstrating the extent of contaminant plumes. Results below the RL are still presented on the maps, but are not contained within an isoconcentration contour line. For the compounds reported, the RL (and lowest isoconcentration line) are as follows: *cis*-1,2-DCE (1.2 µg/L), PCE (1.4 µg/L), and TCE (1.0 µg/L).

To better represent the plume source areas, data from deepest LGR zone of the Westbay wells were also composited into the isoconcentration maps. The LGR-09 zone from Westbay wells CS-WB01 through CS-WB04 were sampled in September 2013 and are included in the maps to help delineate Plume 2. The LGR04 zone of Westbay wells CS-WB05 through CS-WB08 were sampled in October 2013 as part of the SWMU B-3 Bioreactor operations, and assist in delineating the central portion of Plume 1. These isoconcentration maps are provided for September 2013 (**Figures 2.8, 2.9, and 2.10)** to illustrate the extent of contamination as measured and inferred from analytical results.

The 2013 extent of COCs above the RL (approximately 1 µg/L) for each of PCE, TCE and cis-1,2-DCE can be determined by reviewing the figures. September 2013 PCE concentrations above 1.4 µg/L are detected on-post in wells CS-MW1-LGR, CS-MW8-LGR, CS-MW10-LGR, CS-MW16-LGR, CS-MW36-LGR, B3-EXW01 through B3-EXW05. Additionally, the LGR-09 zone from CS-WB01 through CS-WB03 and the LGR-04 zones from CS-WB05 through CS-WB08 are all above the PCE RL of 1.4 µg/L (**Figure 2.8**). Off-post detections of PCE above 1.4 µg/L include I10-4, LS-7, RFR-10, and CS-WB04-LGR-09.

TCE follows a similar pattern in September 2013, and has been detected above 1.0 µg/L in Plume 1 wells CS-MW1-LGR, CS-MW5-LGR, CS-MW16-LGR, CS-MW36-LGR, and B3-EXW01 through B3-EXW05. Additionally, the LGR-04 zones from CS-WB05 through CS-WB08 are all above 1.0 µg/L TCE (**Figure 2.9**). The LGR-09 zone for the on-post Westbay wells CS-WB01 through CS-WB03 within Plume 2 were all above 1.0 µg/L TCE during 2013. Off-post wells with a TCE concentration reported above 1.0 µg/L include wells I10-4, LS-5, LS-6, RFR-10, RFR-11, and CS-WB04-LGR-09.

In September 2013, *cis*-1,2-DCE was not detected off-post above the RL of 1.2 µg/L; however, it was reported at levels above 1.2 µg/L in on-post wells CS-MW1-LGR, CS-MW5-LGR, CS-MW16-LGR, CS-MW36-LGR, CS-WB03-LGR-09, CS-EXW01 through CS-EXW05 and the LGR-04 zones of CS-WB05 through CS-WB08 (**Figure 2.10**).

Isoconcentration maps have also been prepared based on analytical data collected in 2006 through 2012. Those isoconcentration maps are available for review in the ***CSSA Environmental Encyclopedia, Volume 5 Groundwater***, in the *2006 through 2012 Annual Groundwater Reports*. In general, the 2013 plume extent and geometry is consistent with 2012 data.

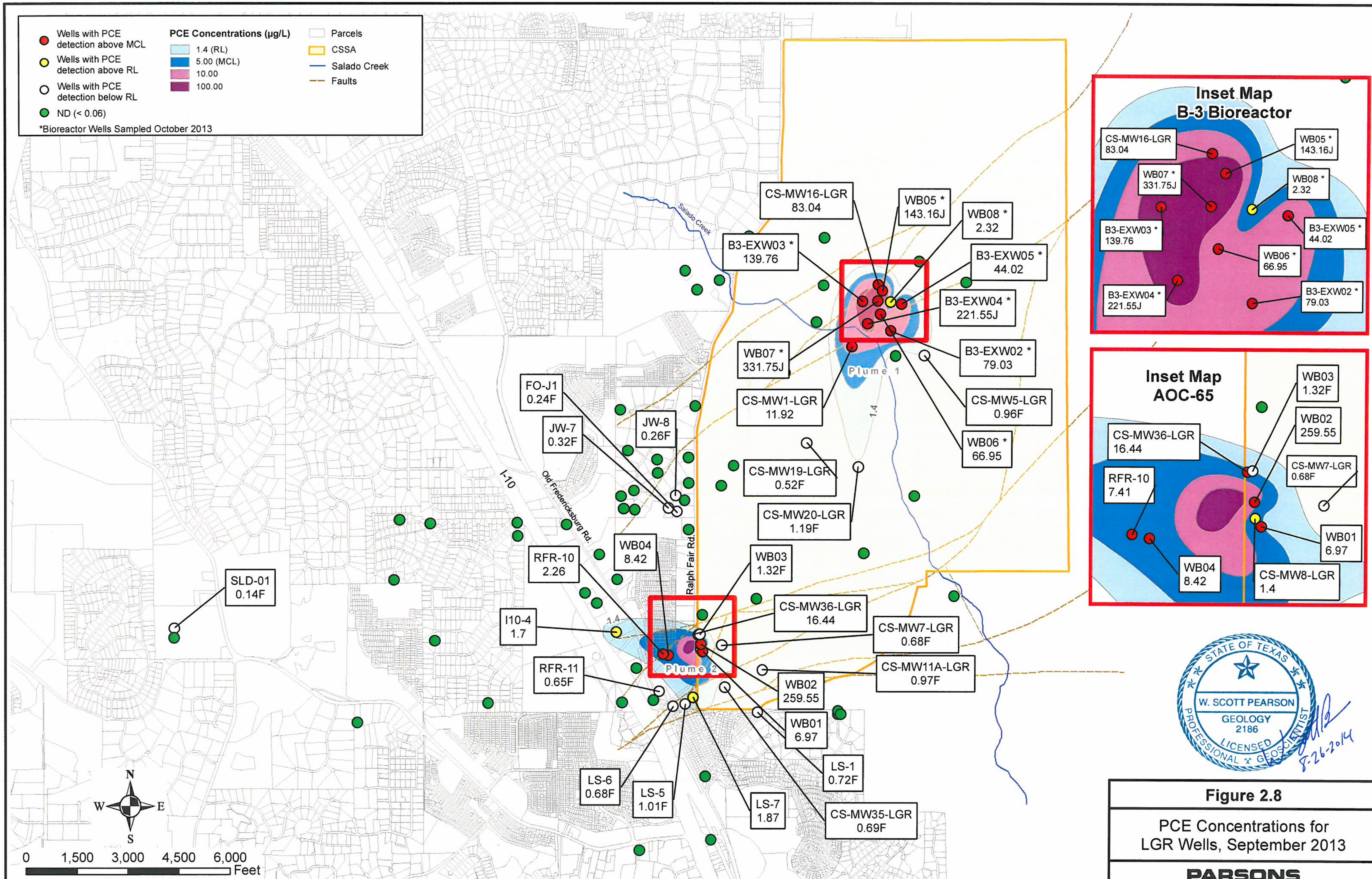

Figure 2.8

PCE Concentrations for LGR Wells, September 2013

PARSONS

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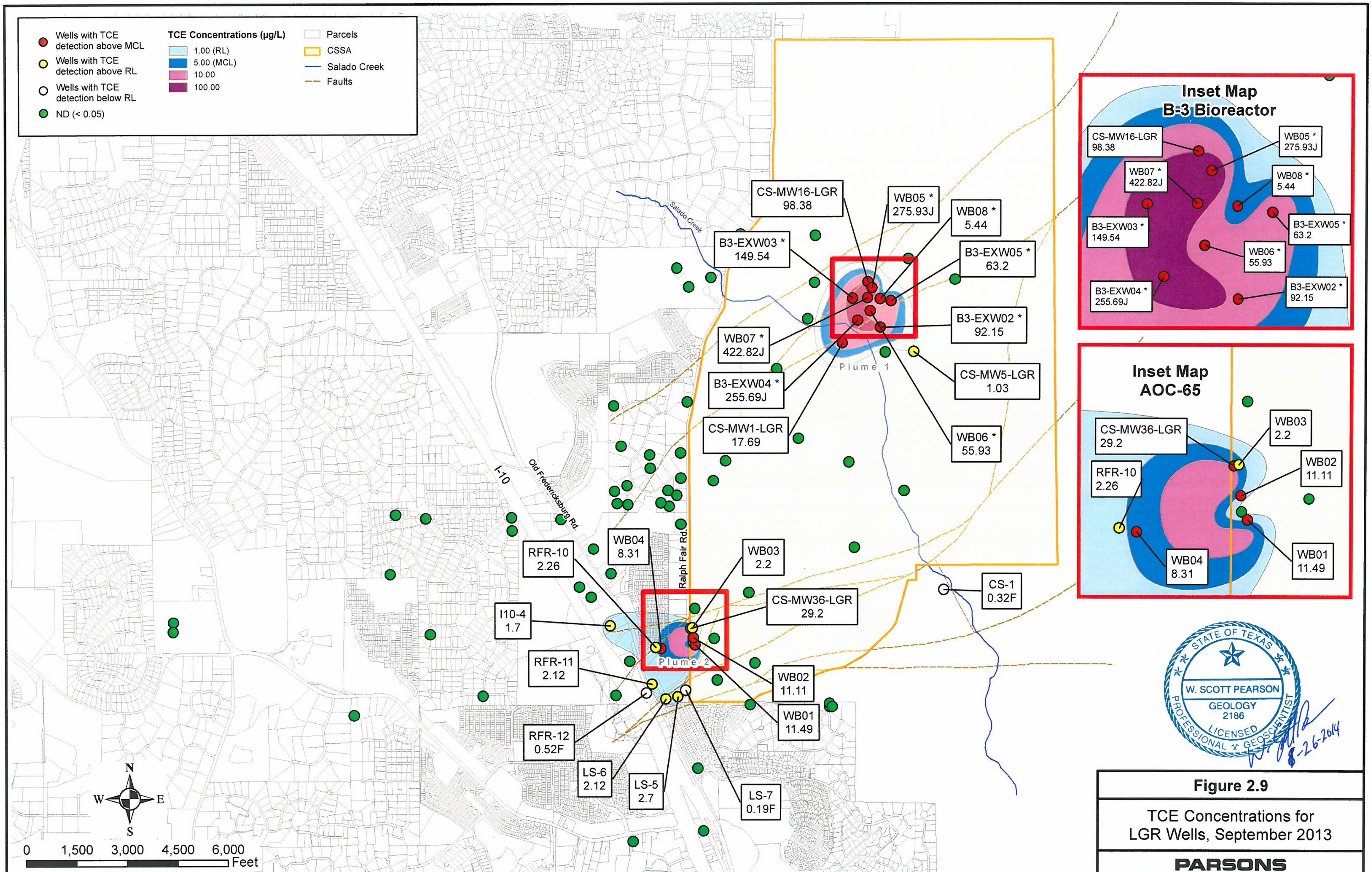

Figure 2.9

TCE Concentrations for LGR Wells, September 2013

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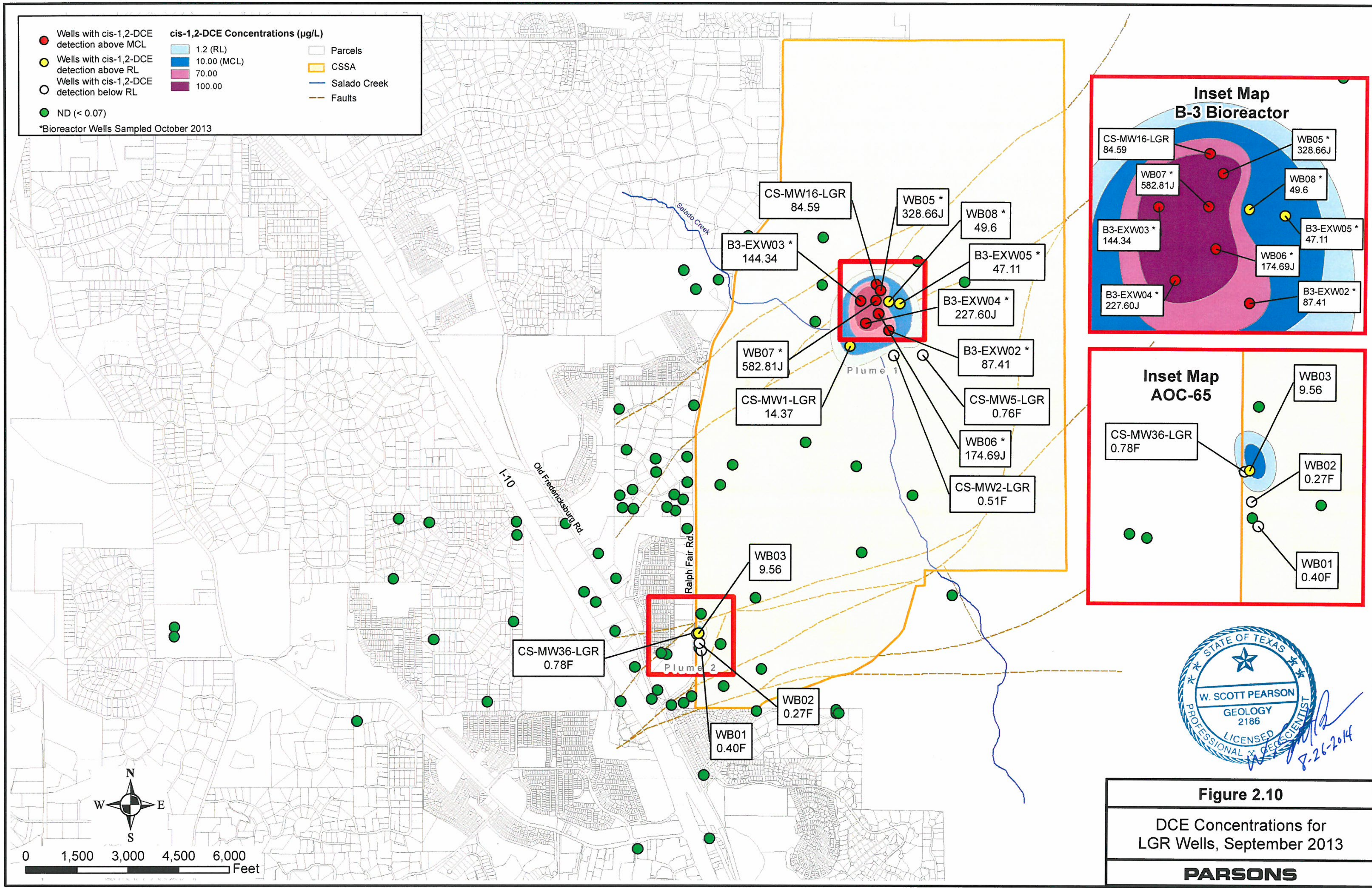


Figure 2.10

DCE Concentrations for LGR Wells, September 2013

PARSONS

Finally, the maximum annual concentrations detected near the plume centers are generally lower than in 2012. See **Table 2.11** for comparison of the 2012 and 2013 data near the plume centers.

Table 2.11 Comparison of 2012 & 2013 PCE, TCE, and cis-1,2-DCE Max. Levels

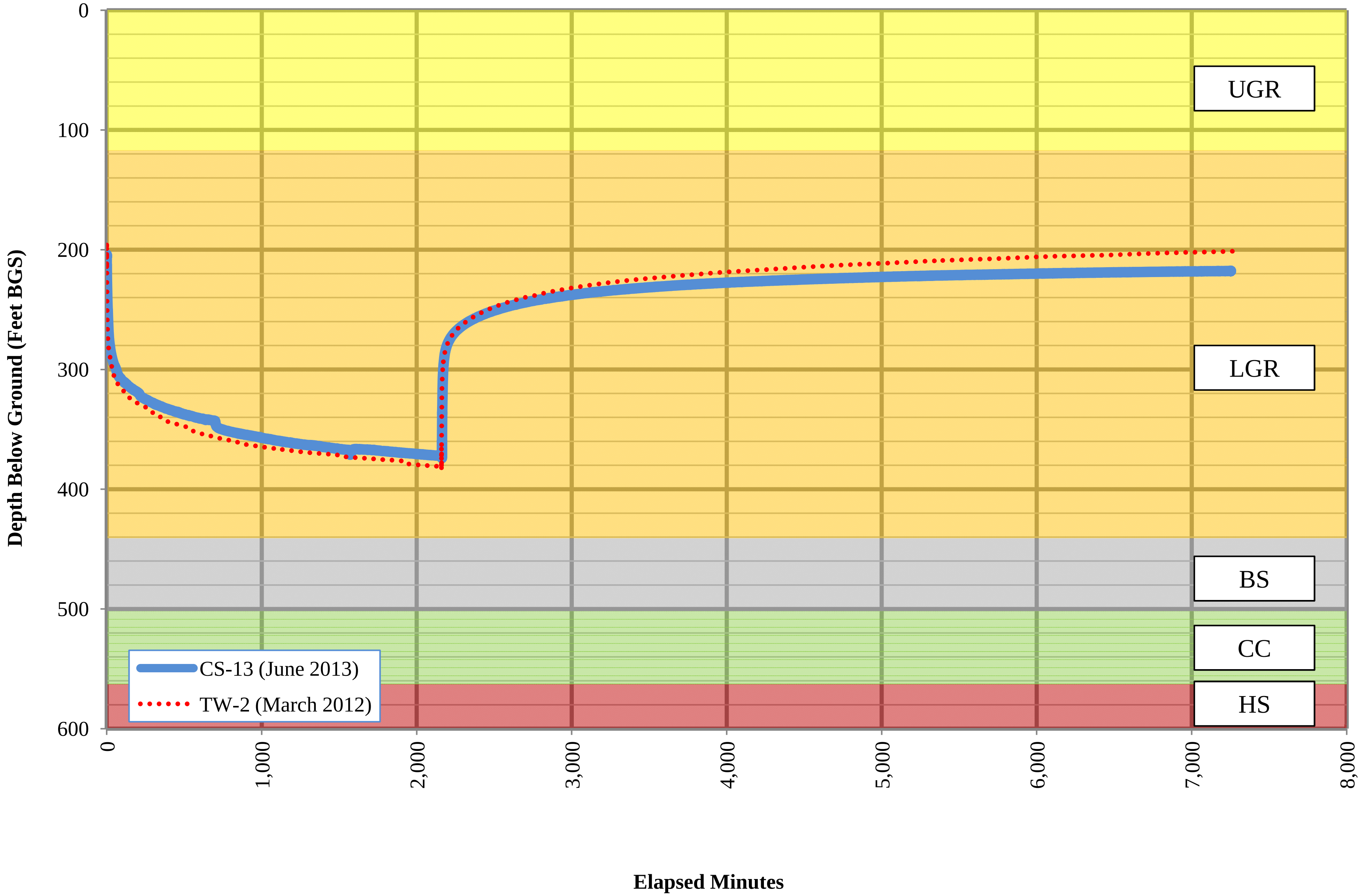
	PCE		TCE		*cis*-1,2-DCE	
	2012	*2013*	*2012*	*2013*	*2012*	*2013*
B-3 Plume 1						
CS-MW16-LGR	126.98	83.04	154.26	98.38	132	84.59
CS-D	67.27	NS	83	NS	70.06	NS
CS-MW1-LGR	13.93	13.97	33.15	30.39	19.8	18.74
CS-4	5.91	0.64	8.82	0.55	4.6	ND
AOC-65 Plume 2						
RFR-10	25.80	12.82	14.24	8.73	0.49	0.28
OFR-3	7.92	3.18	6.61	2.87	0.17	ND
I10-4	5.2	4.77	2.54	2.0	ND	ND

2.3 CS-13 Pumping Test

In compliance with TCEQ regulations, a 36-hour pumping test was performed at CS-13 after its final construction and pumping equipment had been installed. Beginning June 12, 2013, the well was pumped for 36-hours at its designed flowrate of 110 gallons per minute (gpm). Groundwater level measurements were continuously collected with a datalogging pressure transducer deployed within the well. At the end of 36 hours, the well had maintained the 110 gpm flowrate with a maximum water level drawdown of 167.85 feet below static water level. In comparison to the original pumping test conducted in the test well (TW-2) in March 2012, the well drawdown was approximately 14 feet less for the same discharge rate. The increase in efficiency can be attributed to the 2-inch well diameter increase in the final completed well.

Upon completion of the 36-hour pumping phase, the recovery period was logged by the downhole transducer for 3.5 days. Surprisingly, the water level recovery is quite slow considering its ample production rate of 110 gpm. After 3.5 days, the water level was still approximately 13 feet below its initial static level. The same prolonged recovery period was also noted during the pumping test in the test well in March 2012. It is likely that the groundwater system declined regionally over the course of five days, but that data may also suggest that groundwater is being “mined” from a localized groundwater system with a finite storage capacity. **Figure 2.11** shows the hydrograph from the pumping and recovery tests performed in June 2013. The measured data from the March 2012 pumping test of TW-2 is also included for comparison.

Figure 2.11
CS-13 Drawdown and Recovery Test (110 GPM)
June 12-17, 2013



3.0 GROUNDWATER MONITORING PROGRAM CHANGES

3.1 Access Agreements Obtained in 2013

Access agreements are signed by off-post well owners to grant permission to CSSA to collect groundwater samples from each well. Based on a request from the EPA regulator, an additional well to the south of CSSA was identified in 2013 as a possible sample location. The Compass Bank south of CSSA (designated as I10-10) was contacted in 2012; the signed agreement was received September 3rd, 2013.

3.2 Wells Added to or Removed From Program

Well I10-4 will be removed from the program in 2014 due to forthcoming development of the property. A contractor of the well owner informed CSSA this well will be plugged and abandoned in order to build a detention pond in the area. Of the three outstanding access agreements mailed out in 2011, additional attempts were made in 2012-13 to contact these well owners. One agreement was received from the Compass Bank, well I10-10. No interest or attempts to return our calls/letters was shown by the two other well owners.

The property at well OFR-3 was sold in May 2013. The new property owner has shut off the electricity making the well inoperable for sampling. After several attempts to contact the OFR-3 well owner, no calls were returned however the access agreement was signed and returned to CSSA. In December 2013 CSSA was contacted by an environmental contractor working at the OFR-3 property. They were inquiring about information on the well pump in OFR-3 in order to do a feasibility study on this well supporting a mixed use retail development. CSSA did not provide any pump information because it is unknown. This well will likely be plugged and abandoned in the future as the property is developed and connected to SAWS.

4.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the evaluation of the on- and off-post groundwater monitoring program data collected in 2013, the following conclusions and recommendations can be made:

- On-post wells CS-MW16-LGR, CS-MW16-CC, CS-MW1-LGR, and CS-MW36-LGR all exceeded VOC MCLs in 2013 and should remain on the sampling schedule in the future.
- CS-MW9-LGR had a MCL exceedance for chromium in September 2013. This was the first and only metals exceedance throughout the history of sampling this well. CS-MW9-LGR should remain on the 18 month sampling schedule.
- Continue with the initiative to collect a "snapshot" event from all on- and off-post wells as well as selected Westbay zones. The current recommendation is to collect a snapshot event every 9 months so that the changes in the plume can be monitored seasonally.
- Fourteen Westbay intervals had detections above the MCL in 2013. These intervals should remain on the 9-month sampling schedule in the future as recommended in the LTMO study.
- The Westbay wells at AOC-65 continue to indicate the strong presence of contamination near the source area (CS-WB03). Significant contamination above the MCLs continues to exist near-surface and in the lower-yielding upper strata of aquifer. The concentrations in the upper WB03-UGR-01 zone increased significantly in September 2012, likely due to the ISCO injection into the AOC-65 trench performed in August 2012. In May-June 2013. a larger scale ISCO injection was performed and the levels in this upper zone remained elevated. In most cases throughout the post, VOC contamination in the main portion of aquifer remains at concentrations below the MCLs.
- Off-post well RFR-10 exceeded the MCL for PCE and TCE in 2013. Wells OFR-3, RFR-10, LS-5, LS-6, LS-7, and RFR-11, are equipped with a GAC filtration system and should remain on the quarterly sampling schedule in the future. The GAC filtration systems will continue to be maintained by CSSA. Well I10-4 is unused and does not contain a pump. The well owner has been notified that if this well is ever put back on-line a GAC filtration system will need to be installed.
- Well I10-4 is scheduled to be plugged and abandoned as part of development in the area. This well was removed from the sampling schedule in December 2013.
- Well I10-10, a newly added well ¾ mile south of CSSA, was sampled once in September 2013. No VOCs were detected in this well. This well should be sampled in the future on an as needed basis.
- The 8 active supply wells operated by The Oaks Water Supply Corporation (TOWSC) were sampled once in 2013. Two of these wells (OW-BARNOWL & OW-HH2) which reported low levels of PCE in March 2011 were sampled in March, June, and September 2013. No VOCs were detected in these wells in 2013. In accordance with the Groundwater DQOs, the sampling frequency for these 2 wells should be adjusted to

the 9-month schedule with sampling results of 4 consecutive sampling events having no detections.

- For future sampling events, off-post wells where no VOCs were detected will be sampled as needed, depending on historical detections, or during the 9-month ‘snapshot’ event.
- Although production well CS-9 did not show metals detections above regulatory standards in 2013 past detections have lead CSSA to discontinue using this well. CS-9 should be physically removed from the public water supply system but it will be used exclusively for monitoring and firefighting emergencies.
- Analytical data indicates CS-MW16-CC remains at the low end of historical VOC contamination levels for this well. This data suggests nearly continuous pumping of CS-MW16-CC to the SWMU B-3 Bioreactor is having a positive impact on Cow Creek aquifer restoration and that seals between LGR and CC zones in the CS-MW16 vicinity are effective.
- **Figure 2.6** shows VOC concentrations in RFR-10 and OFR-3 are very sensitive to rainfall events while VOC concentrations in LS-5, LS-6, LS-7; and RFR-11 show less fluctuations after significant precipitation. This observation suggests RFR-10 and OFR-3 may be located along a fracture pattern that ties into the AOC-65 source area.
- A 36-hour pumping test of the final completion of future supply well CS-13 resulted in the well sustaining 110 gpm with 167 feet of drawdown. The testing result is consistent with the findings conducted in March 2012 on the original test well, TW-2.

5.0 REFERENCES

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APPENDIX A

ON- AND OFF-POST EVALUATION OF DATA QUALITY OBJECTIVES ATTAINMENT

Appendix A. On-Post Evaluation of Data Quality Objectives Attainment

Activity	Objectives	Action	Objective Attained?	Recommendations
Field Sampling	Conduct field sampling in accordance with procedures defined in the project work plan, SAP, QAPP, and HSP.	All sampling was conducted in accordance with the procedures described in the project plans.	Yes.	NA
Characterization of Environmental Setting (Hydrogeology)	Prepare water-level contour and/or potentiometric maps for each formation of the Middle Trinity Aquifer (3.5.3).	Potentiometric surface maps were prepared based on water levels measured in each of CSSA's wells screened in three formations in 2013.	To the extent possible with data available. Due to the limited data available and the fact that wells are completed across multiple water-bearing units, potentiometric maps should only be used for regional water flow direction, not local. Ongoing pumping in the CSSA area likely affects the natural groundwater flow direction.	As additional wells are installed screened in distinct formations, future evaluations will eliminate reliance on wells screened across multiple formations.
	Describe the flow system, including the vertical and horizontal components of flow (2.1.9).	Potentiometric maps were created using 2013 water level data, and horizontal flow direction was tentatively identified. Insufficient data are currently available to determine vertical component of flow.	As described above, due to the lack of aquifer-specific water level information, potentiometric surface maps should only be used as an estimate of regional flow direction.	Same as above.
	Define formation(s) in the Middle Trinity Aquifer are impacted by the VOC contaminants (2.1.3).	Quarterly groundwater monitoring provides information on Middle Trinity Aquifer impacts. Monitoring wells equipped with Westbay® - multi-port samplers are sampled every 9 months with additional samples collected during the "snapshot" event. Selected zones from these wells were sampled in 2013.	Yes.	Continue sampling.

Activity	Objectives	Action	Objective Attained?	Recommendations
	Identify any temporal changes in hydraulic gradients due to seasonal influences (2.1.5).	Downloaded data from continuous-reading transducer in wells: CS-1, CS-10, CS-12, CS-MW1-LGR, CS-MW1-BS, CS-MW1-CC, CS-MW4-LGR, CS-MW16-LGR, CS-MW16-CC, CS-MW18-LGR, and CS-MW24-LGR. Data was also downloaded from the northern and southern continuous-reading weather stations B-3 WS and AOC-65 WS. Water levels will be graphed from selected wells against precipitation through 2013 and will be included in this annual groundwater report.	Yes.	Continue collection of transducer data and possibly install transducers in other cluster wells.
Contamination Characterization (Groundwater Contamination)	Characterize the horizontal and vertical extent of any immiscible or dissolved plume(s) originating from the Facility (3.1.2).	Samples for laboratory analysis were collected from 33 of 49 CSSA wells. Of the 57 samples scheduled to be collected in 2013 46 samples were actually collected. Eight of the 10 samples not collected were due to the water levels falling below the dedicated pumps. Well CS-9 was not sampled in December 2013 due to a pump outage and CS-MW2-LGR was not sampled in June 2013 due to field crew oversight. In June 2013 six wells were added to the sampling schedule to collect background data prior to bringing new drinking water well CS-13 online.	The horizontal and vertical extent of groundwater contamination is continuously monitored.	Continue groundwater monitoring and construct additional wells as necessary.
	Determine the horizontal and vertical concentration profiles of all constituents of concern (COCs) in the groundwater that are measured by USEPA-approved procedures (3.1.2). COCs are those chemicals that have been detected in groundwater in the past and their daughter (breakdown) products.	Samples were analyzed for the selected VOCs using USEPA method SW8260B and metals (Cd, Cr, Pb, Hg). Drinking water wells were also sampled for additional metals (As, Ba, Cu, Zn). Analyses were conducted in accordance with the AFCEE QAPP and approved variances. All RLs were below MCLs, as listed below: **ANALYTE** / **RL (µg/L)** / **MCL (µg/L)** 1,1-DCE / 1.2 / 7 *cis*-1,2-DCE / 1.2 / 70 *trans*-1,2-DCE / 0.6 / 100 Vinyl Chloride / 1.1 / 2 PCE / 1.4 / 5 TCE / 1.0 / 5	Yes.	Continue sampling.

Activity	Objectives	Action	Objective Attained?	Recommendations
Contamination Characterization (Groundwater Contamination) (Continued)		**ANALYTE** **RL (µg/L)** **MCL (µg/L)** Arsenic 5 10 Barium 5 2000 Chromium 10 100 Copper 10 1300 Zinc 50 5000 (SS) Cadmium 1 5 Lead 5 15 (AL) Mercury 1 2		
	Meet AFCEE QAPP quality assurance requirements.	Samples were analyzed in accordance with the CSSA QAPP and approved variances. Parsons chemists verified all data and performed data validation according to the CSSA QAPP and approved variances.	Yes.	NA
		All data flagged with a "U," "J," "M," and "F" are usable for characterizing contamination. All "R" flagged data are considered unusable.	Yes.	NA
		An MDL study for arsenic, cadmium, and lead was not performed within a year of the analyses, as required by the AFCEE QAPP.	The laboratory performed new MDL studies in February 2001 for these metals and the new MDL values were found to be almost identical to the previous MDLs and all met the associated AFCEE QAPP requirements. MDLs for these three metals are well below MCLs. In addition, the laboratory performed daily calibrations and RL verifications for these metals, both of which demonstrate the laboratory's ability to detect and quantitate these metals at RL levels. These daily analyses also indicate that concentrations above the laboratory RL for these compounds were not affected by the expired MDL study.	Use results for groundwater characterization purposes.

Activity	Objectives	Action	Objective Attained?	Recommendations
Remediation	Determine goals and create cost-effective and technologically appropriate methods for remediation (2.2.1).	Continued data collection will provide analytical results for accomplishing this objective.	Ongoing.	Continue sampling and evaluation, including quarterly groundwater monitoring teleconferences to address remediation.
	Determine placement of new wells for monitoring (2.3.1, 3.6)	Sampling frequency and sample locations to be monitored (including any new wells) will be based on trend data from monitoring event(s) (3.1.5).	Ongoing.	Continue quarterly groundwater teleconferences to discuss sampling frequency and placement of new monitor wells.
Project schedule/ Reporting	Produce a quarterly monitoring project schedule as a road map for sampling, analysis, validation, verification, reviews, and reports.	Prepare schedules and sampling guidelines prior to each quarterly sampling event.	Yes.	Continue sampling schedule preparation each quarter.

Appendix A Off-Post Evaluation of Data Quality Objectives Attainment

Activity	Objectives	Action	Objective Attained?	Recommendations
Field Sampling	Conduct field sampling in accordance with procedures defined in the project work plan, SAP, QAPP, and HSP.	All sampling was conducted in accordance with the procedures described in the project plans.	Yes	NA
Contamination Characterization (Groundwater Contamination)	Determine the potential extent of off-post contamination (§2.3.1 of the DQOs for the Groundwater Contamination Investigation, revised November 2010).	Samples for laboratory analysis were collected from selected off-post public and private wells, which are located within a ½ mile radius of CSSA. Also, selected wells outside the ½ mile radius were sampled at the request of the EPA.	Partially	Replace wells where no VOCs were detected with wells that may be identified in the future, located to the west and southwest of AOC-65 to provide better definition of plume 2. Continue sampling of wells to the west of plume 1 (Fair Oaks and Jackson Woods) to confirm any detections possibly related to plume 1.
	Meet CSSA QAPP quality assurance requirements.	Samples were analyzed in accordance with the CSSA QAPP and approved variances. Parsons chemists verified all data and performed data validation according to the CSSA QAPP and approved variances.	Yes	NA
		All data flagged with a "U", "M", and "J" are usable for characterizing contamination.	Yes	NA

Activity	Objectives	Action	Objective Attained?	Recommendations
	Evaluate CSSA monitoring program and expand as necessary (§2.3.1 of the DQOs for the Groundwater Contamination Investigation, revised November 2010). Determine locations of future monitoring locations.	Evaluation of data collected is ongoing and is reported in this annual groundwater report and will be reported in future quarterly groundwater reports. Additional information covering the CSSA monitoring program is available in Volume 5, CSSA Environmental Encyclopedia.	Yes	Continue data evaluation and quarterly teleconferences for evaluation of the monitoring program. Each teleconference/planning session covers expansion of the quarterly monitoring program, if necessary.
Project schedule/ Reporting	The quarterly monitoring project schedule shall provide a schedule for sampling, analysis, validation, verification, reviews, and reports for monitoring events off-post.	A schedule for sampling, analysis, validation, verification, data review and reports is provided in this annual groundwater report and will be reported in future quarterly groundwater reports. Additional information covering the CSSA monitoring program is available in Volume 5, CSSA Environmental Encyclopedia.	Yes	Continue quarterly and annual reporting to include a schedule for sampling, analysis, validation, verification, data review and data reports.

Activity	Objectives	Action	Objective Attained?	Recommendations
Remediation	Evaluate the effectiveness of GACs (§3.2.3) and install as needed (§3.2.5 both of the DQOs for the Groundwater Contamination Investigation, revised November 2010).	Perform maintenance as needed. Install new GACs as needed.	Yes	Maintenance to the off-post GAC systems to be continued by Parsons' personnel approximately every 3 weeks. Semi annual (or as needed) maintenance to the off-post GAC systems by additional subcontractors to continue. Evaluations of future sampling results for installation of new GAC systems will occur as needed.

APPENDIX B

2013 QUARTERLY ON-POST GROUNDWATER ANALYTICAL RESULTS

Appendix B
2013 Quarterly On-Post Groundwater Monitoring Analytical Results

Well ID	Sample Date	Dichloro-ethene, 1,1 (µg/L)	Dichloro-ethene, *cis* - 1,2 (µg/L)	Dichloro-ethene, *trans* - 1,2 (µg/L)	Tetra-chloroethene (µg/L)	Tri-chloroethene (µg/L)	Vinyl chloride (µg/L)	pH	Temp. (deg. C)	Conductivity (mS)
Maximum Contaminant Level (MCL)		**7**	**70**	**100**	**5.0**	**5.0**	**2.0**			
Reporting Limit (RL)		**1.2**	**1.2**	**0.6**	**1.4**	**1.0**	**1.1**			
Method Detection Limit (MDL)		0.12	0.07	0.08	0.06	0.05	0.08	**Field Measurements**		
CS-1	3/27/2013	0.12U	0.07U	0.08U	0.06U	**0.18F**	0.08U	7.13	22.20	0.666
Duplicate	3/27/2013	0.12U	0.07U	0.08U	0.06U	**0.18F**	0.08U	7.13	22.20	0.666
	6/25/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U	7.38	23.1	0.697
	9/23/2013	0.12U	0.07U	0.08U	0.06U	**0.32F**	0.08U	6.91	22.5	0.605
	12/23/2013	0.12U	0.07U	0.08U	0.06U	**0.20F**	0.08U	6.80	21.8	0.630
CS-2	9/5/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U	6.80	21.4	0.870
Duplicate	9/5/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U	6.80	21.4	0.870
CS-4	1/10/2013	0.12U	**4.6**	**0.28F**	**5.91**	**8.82**	0.08U	6.92	20.90	0.787
	6/25/2013	0.12U	0.07U	0.08U	**0.64F**	**0.55F**	0.08U	7.14	21.4	0.675
CS-9	3/4/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U	6.99	22.90	0.661
	6/25/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U	7.01	23.6	0.755
	9/23/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U	6.67	23.0	0.716
CS-10	3/4/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U	7.16	23.30	0.616
	6/25/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U	7.26	24.4	0.736
	9/23/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U	6.72	23.6	0.685
Duplicate	9/23/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U	6.72	23.6	0.685
	12/3/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U	7.07	22.1	0.691
CS-12	3/4/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U	7.13	21.80	0.537
	6/25/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U	7.25	22.3	0.637
Duplicate	6/25/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U	7.25	22.3	0.637
	9/23/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U	6.83	22.3	0.614
	12/3/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U	6.91	21.8	0.616
Duplicate	12/3/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U	6.91	21.8	0.616
CS-MW16-LGR	9/5/2013	0.12U	**84.59**	0.08U	**83.04**	**98.38**	0.08U	7.27	23.0	0.667
CS-MW16-CC	9/5/2013	**0.13F**	**16.27**	**6.75**	**0.40F**	**8.89**	0.08U	7.26	23.8	0.808
CS-MW1-LGR	6/17/2013	0.12U	**18.74**	**0.19F**	**13.97**	**30.39**	0.08U	6.52	22.2	0.698
	9/4/2013	0.12U	**14.37**	**0.29F**	**11.92**	**17.69**	0.08U	6.85	22.1	0.705
CS-MW1-CC	6/17/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U	7.07	22.2	0.883
CS-MW2-LGR	9/4/2013	0.12U	**0.51F**	0.08U	0.06U	0.05U	0.08U	7.47	22.2	0.658
CS-MW2-CC	6/17/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U	7.27	21.9	0.904
CS-MW3-LGR	9/4/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U	6.97	23.1	0.621
CS-MW4-LGR	6/17/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U	6.54	21.70	0.813
CS-MW5-LGR	9/4/2013	0.12U	**0.76F**	0.08U	**0.96F**	**1.03**	0.08U	6.93	22.5	0.639
CS-MW6-LGR	6/19/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U	7.19	23.0	0.716
	9/17/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U	7.11	23.4	0.677
CS-MW7-LGR	6/19/2013	0.12U	0.07U	0.08U	**0.39F**	0.05U	0.08U	6.90	21.5	0.820
	9/19/2013	0.12U	0.07U	0.08U	**0.68F**	0.05U	0.08U	6.69	21.7	0.772
CS-MW8-LGR	6/19/2013	0.12U	0.07U	0.08U	**2.48**	0.05U	0.08U	6.86	22.2	0.809
Duplicate	6/19/2013	0.12U	0.07U	0.08U	**2.56**	0.05U	0.08U	6.86	22.2	0.809
	9/17/2013	0.12U	0.07U	0.08U	**1.4**	0.05U	0.08U	6.90	22.8	0.774
CS-MW9-LGR	9/19/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U	6.68	22.0	0.751
CS-MW10-LGR	6/18/2013	0.12U	0.07U	0.08U	**2.08**	**0.42F**	0.08U	6.42	22.4	0.820
CS-MW11A-LGR	6/18/2013	0.12U	0.07U	0.08U	**0.81F**	0.05U	0.08U	6.60	22.1	0.709
	9/5/2013	0.12U	0.07U	0.08U	**0.97F**	0.05U	0.08U	6.94	22.7	0.692
CS-MW12-LGR	9/19/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U	7.88	23.6	0.656
CS-MW17-LGR	6/18/2013	0.12U	0.07U	0.08U	**0.48F**	0.05U	0.08U	6.71	21.6	0.784
CS-MW19-LGR	9/5/2013	0.12U	0.07U	0.08U	**0.52F**	0.05U	0.08U	6.69	22.1	0.735
CS-MW20-LGR	9/16/2013	0.12U	0.07U	0.08U	**1.19F**	0.05U	0.08U	6.93	22.2	0.722
CS-MW21-LGR	6/18/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U	6.76	21.6	0.714
	9/16/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U	7.10	21.8	0.668
Duplicate	9/16/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U	7.10	21.8	0.668
CS-MW22-LGR	9/16/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U	7.20	21.9	0.684
CS-MW23-LGR	9/16/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U	7.17	22.0	0.646

Appendix B
2013 Quarterly On-Post Groundwater Monitoring Analytical Results

Well ID	Sample Date	Dichloro-ethene, 1,1 (µg/L)	Dichloro-ethene, *cis* -1,2 (µg/L)	Dichloro-ethene, *trans* -1,2 (µg/L)	Tetra-chloroethene (µg/L)	Tri-chloroethene (µg/L)	Vinyl chloride (µg/L)			
CS-MW24-LGR	6/25/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U	7.09	21.9	0.685
	9/4/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U	6.93	23.7	0.675
CS-MW25-LGR	9/4/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U	6.94	23.3	0.617
CS-MW35-LGR	6/25/2013	0.12U	0.07U	0.08U	**0.79F**	0.05U	0.08U	6.75	22.0	0.783
Duplicate	6/25/2013	0.12U	0.07U	0.08U	**0.84F**	0.05U	0.08U	6.75	22.0	0.783
	9/5/2013	0.12U	0.07U	0.08U	**0.69F**	0.05U	0.08U	10.60	23.3	0.783
CS-MW36-LGR	3/5/2013	0.12U	**1.74**	0.08U	**26.75**	**65.01**	0.08U	7.01	22.00	0.651
	6/19/2013	0.12U	0.07U	0.08U	**7.65**	**6.3**	0.08U	6.98	22.8	0.798
	9/17/2013	0.12U	**0.78F**	0.08U	**16.44**	**29.2**	0.08U	6.92	22.9	0.735
	12/2/2013	0.12U	**0.38F**	0.08U	**11.21**	**14.84**	0.08U	7.12	22.3	0.743

Bold (shaded)	≥ MCL
Bold (boxed)	≥ RL
Bold	≥ MDL

All samples were analyzed by APPL, Inc. using laboratory method SW8260B.
VOC data reported in µg/L & metals data reported in mg/L.

Abbreviations/Notes:

mS	millisiemans
µg/L	micrograms per liter
mg/L	milligrams per liter
deg. C	degrees Celsius
FD	Field Duplicate

Data Qualifiers:

F-The analyte was positively identified but the associated numerical value is below the RL.
U-The analyte was analyzed for, but not detected. The associated numerical value is at or below the MDL.

Appendix B
2013 Quarterly On-Post Groundwater Monitoring Analytical Results

Well ID	Sample Date	Arsenic (mg/L)	Barium (mg/L)	Cadmium (mg/L)	Chromium (mg/L)	Copper (mg/L)	Lead (mg/L)	Mercury (mg/L)	Zinc (mg/L)
Maximum Contaminant Level (MCL)		**0.01**	**2.0**	**0.005**	**0.1**	**1.3(AL)**	**0.015 (AL)**	**0.002**	**5 (SS)**
Reporting Limit (RL)		**0.03**	**0.005**	**0.007**	**0.01**	**0.01**	**0.025**	**0.001**	**0.05**
Method Detection Limit (MDL)		0.0002	0.0003	0.0005	0.001	0.003	0.0019	0.0001	0.008
CS-1	3/27/2013	0.0002U	**0.0334**	0.0005U	0.0010U	**0.006F**	0.0019U	0.0001U	**0.288**
Duplicate	3/27/2013	0.0002U	**0.0328**	0.0005U	0.0010U	0.003U	0.0019U	0.0001U	**0.266**
	6/25/2013	0.0002U	**0.0352**	0.0005U	0.0010U	**0.005F**	0.0019U	0.0001M	**0.268**
	9/23/2013	0.0002U	**0.0314**	0.0005U	0.0010U	**0.004F**	0.0019U	0.0001U	**0.407**
CS-2	9/5/2013	NA	NA	0.0005U	**0.0011F**	NA	0.0019U	0.0001U	NA
Duplicate	9/5/2013	NA	NA	0.0005U	**0.0011F**	NA	0.0019U	0.0001U	NA
CS-4	6/25/2013	NA	NA	0.0005U	0.0010U	NA	0.0019U	0.0001U	NA
CS-9	3/4/2013	NA	NA	0.0005U	0.0010U	NA	**0.0040F**	**0.0015**	NA
	6/25/2013	NA	NA	0.0005U	0.0010U	NA	**0.0093F**	**0.0012**	NA
	9/23/2013	NA	NA	0.0005U	**0.0022F**	NA	**0.0124F**	**0.0018**	NA
CS-10	3/4/2013	0.0002U	**0.0406**	0.0005U	0.0010U	**0.004F**	0.0019U	0.0001U	**0.053**
	6/25/2013	0.0002U	**0.0378**	0.0005U	0.0010U	0.003U	0.0019U	0.0001U	**0.050**
	9/23/2013	0.0002U	**0.0403**	0.0005U	0.0010U	**0.005F**	0.0019U	0.0001U	**0.049F**
Duplicate	9/23/2013	0.0002U	**0.0397**	0.0005U	0.0010U	**0.008F**	0.0019U	0.0001U	**0.067**
CS-12	3/4/2013	0.0002U	**0.0331**	0.0005U	0.0010U	**0.021**	0.0019U	0.0001U	**0.137**
	6/25/2013	0.0002U	**0.0304**	0.0005U	0.0010U	**0.015**	0.0019U	0.0001U	**0.125**
Duplicate	6/25/2013	0.0002U	**0.0308**	0.0005U	0.0010U	**0.008F**	0.0019U	0.0001U	**0.104**
	9/23/2013	0.0002U	**0.0305**	0.0005U	0.0010U	**0.036**	0.0019U	0.0001U	**0.124**
CS-MW16-LGR	9/5/2013	NA	NA	0.0005U	**0.0011F**	NA	0.0019U	0.0001U	NA
CS-MW16-CC	9/5/2013	NA	NA	0.0005U	**0.0014F**	NA	0.0019U	0.0001U	NA
CS-MW1-LGR	6/17/2013	NA	NA	0.0005U	**0.0011F**	NA	0.0019U	0.0001U	NA
	9/4/2013	NA	NA	0.0005U	**0.0045F**	NA	0.0019U	0.0001U	NA
CS-MW1-CC	6/17/2013	NA	NA	0.0005U	0.0010U	NA	0.0019U	0.0001U	NA
CS-MW2-LGR	9/4/2013	NA	NA	0.0005U	**0.0011F**	NA	0.0019U	0.0001U	NA
CS-MW2-CC	6/17/2013	NA	NA	0.0005U	0.0010U	NA	0.0019U	0.0001U	NA
CS-MW3-LGR	9/4/2013	NA	NA	0.0005U	**0.0035F**	NA	0.0019U	0.0001U	NA
CS-MW4-LGR	6/17/2013	NA	NA	0.0005U	**0.0023F**	NA	0.0019U	0.0001U	NA
CS-MW5-LGR	9/4/2013	NA	NA	0.0005U	**0.0042F**	NA	0.0019U	0.0001U	NA
CS-MW6-LGR	6/19/2013	NA	NA	0.0005U	**0.0052F**	NA	0.0019U	0.0001U	NA
	9/17/2013	NA	NA	0.0005U	**0.0023F**	NA	0.0019U	0.0001U	NA
CS-MW7-LGR	6/19/2013	NA	NA	0.0005U	**0.0015F**	NA	0.0019U	0.0001U	NA
	9/19/2013	NA	NA	0.0005U	**0.0016F**	NA	0.0019U	0.0001U	NA
CS-MW8-LGR	6/19/2013	NA	NA	0.0005U	**0.0012F**	NA	0.0019U	0.0001U	NA
Duplicate	6/19/2013	NA	NA	0.0005U	**0.0013F**	NA	0.0019U	0.0001U	NA
	9/17/2013	NA	NA	0.0005U	**0.0014F**	NA	0.0019U	0.0001U	NA
CS-MW9-LGR	9/19/2013	NA	NA	0.0005U	**0.2369**	NA	0.0019U	0.0001U	NA
CS-MW10-LGR	6/18/2013	NA	NA	0.0005U	**0.0015F**	NA	0.0019U	0.0001U	NA
CS-MW11A-LGR	6/18/2013	NA	NA	0.0005U	**0.0015F**	NA	0.0019U	0.0001U	NA
	9/5/2013	NA	NA	0.0005U	**0.0022F**	NA	0.0019U	0.0001U	NA
CS-MW12-LGR	9/19/2013	NA	NA	0.0005U	**0.0020F**	NA	0.0019U	0.0001U	NA
CS-MW17-LGR	6/18/2013	NA	NA	0.0005U	**0.0012F**	NA	0.0019U	0.0001U	NA
CS-MW19-LGR	9/5/2013	NA	NA	0.0005U	**0.0027F**	NA	0.0019U	0.0001U	NA
CS-MW20-LGR	9/16/2013	NA	NA	0.0005U	**0.0011F**	NA	0.0019U	0.0001U	NA
CS-MW21-LGR	6/18/2013	NA	NA	0.0005U	0.0010U	NA	0.0019U	0.0001U	NA
	9/16/2013	NA	NA	0.0005U	**0.0019F**	NA	0.0019U	0.0001U	NA
Duplicate	9/16/2013	NA	NA	0.0005U	**0.0019F**	NA	0.0019U	0.0001U	NA

Appendix B
2013 Quarterly On-Post Groundwater Monitoring Analytical Results

Well ID	Sample Date	Arsenic (mg/L)	Barium (mg/L)	Cadmium (mg/L)	Chromium (mg/L)	Copper (mg/L)	Lead (mg/L)	Mercury (mg/L)	Zinc (mg/L)
CS-MW22-LGR	9/16/2013	NA	NA	0.0005U	0.0010U	NA	0.0019U	0.0001U	NA
CS-MW23-LGR	9/16/2013	NA	NA	0.0005U	**0.0015F**	NA	0.0019U	0.0001U	NA
CS-MW24-LGR	6/25/2013	NA	NA	0.0005U	0.0010U	NA	0.0019U	0.0001U	NA
	9/4/2013	NA	NA	0.0005U	**0.0011F**	NA	0.0019U	0.0001U	NA
CS-MW25-LGR	9/4/2013	NA	NA	0.0005U	**0.0098F**	NA	0.0019U	0.0001U	NA
CS-MW35-LGR	6/25/2013	NA	NA	0.0005U	0.0010U	NA	0.0019U	0.0001U	NA
Duplicate	6/25/2013	NA	NA	0.0005U	0.0010U	NA	0.0019U	0.0001U	NA
	9/5/2013	NA	NA	0.0005U	**0.0025F**	NA	0.0019U	0.0001U	NA
CS-MW36-LGR	3/5/2013	NA	NA	0.0005U	0.0010U	NA	0.0019U	0.0001U	NA
	6/19/2013	NA	NA	0.0005U	0.0010U	NA	0.0019U	0.0001U	NA
	9/17/2013	NA	NA	0.0005U	0.0010U	NA	0.0019U	0.0001U	NA

Bold	≥ MCL
Bold	≥ RL
Bold	≥ MDL

All samples were analyzed by APPL, Inc. using laboratory method SW8260B.
VOC data reported in µg/L & metals data reported in mg/L.

Abbreviations/Notes:

mS	millisiemans
µg/L	micrograms per liter
mg/L	milligrams per liter
deg. C	degrees Celsius
FD	Field Duplicate
AL	Action Level
SS	Secondary Standard

Data Qualifiers:

F-The analyte was positively identified but the associated numerical value is below the RL.
M = There was possible interference from the sample itself, the M flagged result is usable and defensible.
U-The analyte was analyzed for, but not detected. The associated numerical value is at or below the MDL.

Appendix B
2013 Quarterly On-Post Groundwater Monitoring Analytical Results

SAMPLE ID:		CS-13		CS-MW1-CC		CS-MW2-CC	
DATE SAMPLED:		6/17/2013		6/17/2013		6/17/2013	
	Units						
Coliforms - A9223							
E. Coli	F/NF	NF	U	NF	U	NF	U
Total Coliforms	F/NF	NF	U	NF	U	NF	U
Volatile Organics - SW8260B							
1,1,1,2-Tetrachloroethane	µg/L	0.090	U				
1,1,1-Trichloroethane	µg/L	0.030	U				
1,1,2,2-Tetrachloroethane	µg/L	0.070	U				
1,1,2-Trichloroethane	µg/L	0.060	U				
1,1-Dichloroethane	µg/L	0.070	U				
1,1-Dichloroethene	µg/L	0.12	U				
1,1-Dichloropropene	µg/L	0.10	U				
1,2,3-Trichlorobenzene	µg/L	0.24	U				
1,2,3-Trichloropropane	µg/L	0.17	U				
1,2,4-Trichlorobenzene	µg/L	0.16	U				
1,2,4-Trimethylbenzene	µg/L	0.040	U				
1,2-Dibromo-3-chloropropane	µg/L	0.76	U				
1,2-Dibromoethane (EDB)	µg/L	0.060	U				
1,2-Dichlorobenzene	µg/L	0.020	U				
1,2-Dichloroethane	µg/L	0.050	U				
1,2-Dichloropropane	µg/L	0.060	U				
1,3,5-Trimethylbenzene (Mesityler	µg/L	0.040	U				
1,3-Dichlorobenzene	µg/L	0.030	U				
1,3-Dichloropropane	µg/L	0.050	U				
1,4-Dichlorobenzene	µg/L	0.070	U				
1-Chlorohexane	µg/L	0.040	U				
2,2-Dichloropropane	µg/L	0.10	U				
2-Chlorotoluene	µg/L	0.040	U				
4-Chlorotoluene	µg/L	0.040	U				
Benzene	µg/L	0.070	U				
Bromobenzene	µg/L	0.060	U				
Bromochloromethane	µg/L	0.11	U				
Bromodichloromethane	µg/L	0.060	U				
Bromoform	µg/L	0.13	U				
Bromomethane	µg/L	0.080	U				
Carbon tetrachloride	µg/L	0.060	U				
Chlorobenzene	µg/L	0.040	U				
Chloroethane	µg/L	0.070	U				
Chloroform	µg/L	0.060	U				
Chloromethane	µg/L	0.16	U				

Appendix B
2013 Quarterly On-Post Groundwater Monitoring Analytical Results

SAMPLE ID:		CS-13		CS-MW1-CC	CS-MW2-CC
DATE SAMPLED:		6/17/2013		6/17/2013	6/17/2013
	Units				
cis-1,2-Dichloroethene	µg/L	0.070	U		
cis-1,3-Dichloropropene	µg/L	0.030	U		
Dibromochloromethane	µg/L	0.060	U		
Dibromomethane	µg/L	0.060	U		
Dichlorodifluoromethane	µg/L	0.11	U		
Ethylbenzene	µg/L	0.050	U		
Hexachlorobutadiene	µg/L	0.17	U		
Isopropylbenzene	µg/L	0.040	U		
m,p-Xylene	µg/L	0.070	U		
Methylene chloride	µg/L	0.35	U		
Naphthalene	µg/L	0.070	U		
n-Butylbenzene	µg/L	0.17	U		
n-Propylbenzene	µg/L	0.030	U		
o-Xylene	µg/L	0.060	U		
p-Cymene (p-Isopropyltoluene)	µg/L	0.050	U		
sec-Butylbenzene	µg/L	0.050	U		
Styrene	µg/L	0.080	U		
tert-Butylbenzene	µg/L	0.040	U		
Tetrachloroethene (PCE)	µg/L	0.060	U		
Toluene	µg/L	0.060	U		
trans-1,2-Dichloroethene	µg/L	0.080	U		
trans-1,3-Dichloropropene	µg/L	0.040	U		
Trichloroethene (TCE)	µg/L	0.050	U		
Trichlorofluoromethane	µg/L	0.070	U		
Vinyl chloride	µg/L	0.080	U		
Semi-Volatile Organics - SW8270C					
1,2,4-Trichlorobenzene	µg/L	1.5	U		
1,2-Dichlorobenzene	µg/L	1.6	U		
1,3-Dichlorobenzene	µg/L	1.2	U		
1,4-Dichlorobenzene	µg/L	1.6	U		
2,4,5-Trichlorophenol	µg/L	1.9	U		
2,4,6-Trichlorophenol	µg/L	1.8	U		
2,4-Dichlorophenol	µg/L	1.6	U		
2,4-Dimethylphenol	µg/L	1.2	U		
2,4-Dinitrophenol	µg/L	1.6	U		
2,4-Dinitrotoluene	µg/L	1.7	U		
2,6-Dinitrotoluene	µg/L	2.1	U		
2-Chloronaphthalene	µg/L	2.0	U		
2-Chlorophenol	µg/L	1.1	U		

Appendix B
2013 Quarterly On-Post Groundwater Monitoring Analytical Results

SAMPLE ID:		CS-13		CS-MW1-CC	CS-MW2-CC
DATE SAMPLED:		6/17/2013		6/17/2013	6/17/2013
	Units				
2-Methyl-4,6-dinitrophenol	µg/L	2.0	U		
2-Methylnaphthalene	µg/L	1.1	U		
2-Methylphenol	µg/L	1.4	U		
2-Nitroaniline	µg/L	2.0	U		
2-Nitrophenol	µg/L	1.9	U		
3,3'-Dichlorobenzidine	µg/L	2.6	U		
3-Nitroaniline	µg/L	2.4	U		
4-Bromophenyl phenyl ether	µg/L	2.0	U		
4-Chloro-3-methyl phenol	µg/L	1.4	U		
4-Chloroaniline	µg/L	3.0	U		
4-Chlorophenyl phenyl ether	µg/L	1.9	U		
4-Methylphenol (p-cresol)	µg/L	1.1	U		
4-Nitroaniline	µg/L	2.4	U		
4-Nitrophenol	µg/L	1.1	U		
Acenaphthene	µg/L	1.8	U		
Acenaphthylene	µg/L	1.4	U		
Anthracene	µg/L	2.2	U		
Benzo(a)anthracene	µg/L	1.7	U		
Benzo(a)pyrene	µg/L	1.9	U		
Benzo(b)fluoranthene	µg/L	3.1	U		
Benzo(g,h,i)perylene	µg/L	2.5	U		
Benzoic acid	µg/L	2.4	U		
Benzyl alcohol	µg/L	1.2	U		
Benzyl butyl phthalate	µg/L	1.7	U		
bis(2-Chloroethoxy)methane	µg/L	1.3	U		
bis(2-Chloroethyl)ether	µg/L	1.4	U		
bis(2-Chloroisopropyl)ether	µg/L	1.1	U		
bis(2-Ethylhexyl) phthalate	µg/L	1.7	U		
Chrysene	µg/L	1.6	U		
Dibenzo(a,h)anthracene	µg/L	2.5	U		
Dibenzofuran	µg/L	1.6	U		
Diethyl phthalate	µg/L	1.8	U		
Dimethyl phthalate	µg/L	1.9	U		
Di-n-butyl phthalate	µg/L	2.2	U		
Di-n-octyl phthalate	µg/L	1.8	U		
Fluoranthene	µg/L	2.3	U		
Fluorene	µg/L	1.8	U		
Hexachlorobenzene	µg/L	1.8	U		
Hexachlorobutadiene	µg/L	1.7	U		

Appendix B
2013 Quarterly On-Post Groundwater Monitoring Analytical Results

SAMPLE ID:		CS-13		CS-MW1-CC	CS-MW2-CC
DATE SAMPLED:		6/17/2013		6/17/2013	6/17/2013
	Units				
Hexachlorocyclopentadiene	µg/L	1.1	U		
Hexachloroethane	µg/L	1.5	U		
Indeno(1,2,3-cd)pyrene	µg/L	2.4	U		
Isophorone	µg/L	1.3	U		
Naphthalene	µg/L	1.9	U		
Nitrobenzene	µg/L	1.6	U		
n-Nitrosodi-n-propylamine	µg/L	1.9	U		
n-Nitrosodiphenylamine	µg/L	5.2	U		
Pentachlorophenol	µg/L	2.7	U		
Phenanthrene	µg/L	2.0	U		
Phenol	µg/L	0.79	U		
Pyrene	µg/L	1.5	U		
Metals -SW6010B					
Aluminum	mg/L	**0.03**	F		
Antimony	mg/L	0.0018	U		
Arsenic	mg/L	**0.0015**	F		
Barium	mg/L	**0.0326**			
Beryllium	mg/L	0.00020	U		
Cadmium	mg/L	0.00050	U		
Chromium	mg/L	0.0010	U		
Copper	mg/L	0.0030	U		
Iron	mg/L	**0.08**	F		
Manganese	mg/L	**0.005**			
Mercury	mg/L	0.00010	U		
Selenium	mg/L	0.0032	U		
Silver	mg/L	0.0010	U		
Thallium	mg/L	0.0010	U		
Zinc	mg/L	**0.48**			
Anions - SW9056					
Chloride	mg/L	**18.23**			
Fluoride	mg/L	**1.2**			
Nitrate as N	mg/L	0.030	U		
Nitrite as N	mg/L	0.040	U		
Sulfate	mg/L	**84.18**			
TDS - E160.1					
Total Dissolved Solids	mg/L	**386**			

Appendix B
2013 Quarterly On-Post Groundwater Monitoring Analytical Results

SAMPLE ID:		CS-13		CS-MW1-CC	CS-MW2-CC
DATE SAMPLED:		6/17/2013		6/17/2013	6/17/2013
	Units				
Gross Alpha/Beta - E900					
Alpha, Gross	PCI/L	**2.81 ± 0.89**	LT		
Beta, Gross	PCI/L	**5.8 ± 1.3**			
Radium-228 - E904.0					
Radium-228	PCI/L	0.14 ± 0.20	U		

Abbreviations/Notes:
NA - Not analyzed for this parameter
NF - Not Found
F - Found
µg/L - micrograms per liter
mg/L - milligrams per liter
PCI/L - picocuries per liter
Data Qualifiers/Flags:
No Flag & **Bold** = Confirmed identification
U-The analyte was analyzed for, but not detected. The associated numerical value is at or below the MDL.
F-The analyte was positively identified but the associated numerical value is below the RL.

APPENDIX C

2013 WESTBAY® ANALYTICAL RESULTS

Appendix C
2013 Westbay® Analytical Results

Well ID	Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	TCE	PCE	Vinyl Chloride
Method Detection Limit	**MDL**	**0.3**	**0.16**	**0.19**	**0.16**	**0.15**	**0.23**
Current Reporting Limit	**RL**	**1.2**	**1.2**	**0.6**	**1.0**	**1.4**	**1.1**
Max. Contaminant Level	**MCL**	**7.0**	**70**	**100**	**5.0**	**5.0**	**2.0**
CS-WB01-UGR-01	13-Jun-13	Dry	Dry	Dry	Dry	Dry	Dry
CS-WB01-LGR-01	13-Jun-13	<0.12	<0.07	<0.08	**0.28F**	**2.79**	<0.08
CS-WB01-LGR-02	13-Jun-13	<0.12	<0.07	<0.08	**2.76**	**9.29**	<0.08
CS-WB01-LGR-03	13-Jun-13	<0.12	<0.07	<0.08	**9.77**	**2.54**	<0.08
CS-WB01-LGR-04	13-Jun-13	<0.12	**0.11F**	<0.08	**0.13F**	<0.06	<0.08
CS-WB01-LGR-05	13-Jun-13	<0.12	<0.07	<0.08	<0.05	**0.33F**	<0.08
CS-WB01-LGR-06	13-Jun-13	<0.12	**0.55F**	<0.08	**0.82F**	**0.29F**	<0.08
CS-WB01-LGR-07	13-Jun-13	<0.12	**0.21F**	<0.08	**11.51**	**11.25**	<0.08
CS-WB01-LGR-08	13-Jun-13	<0.12	**1.59**	<0.08	**9.45**	**5.57**	<0.08
CS-WB01-LGR-09	13-Jun-13	<0.12	**0.53F**	<0.08	**12.24**	**8.57**	<0.08
	23-Sep-13	<0.12	**0.40F**	<0.08	**11.49**	**6.97**	<0.08
CS-WB02-UGR-01	12-Jun-13	Dry	Dry	Dry	Dry	Dry	Dry
CS-WB02-LGR-01	12-Jun-13	<0.12	<0.07	<0.08	**0.36F**	**2.38**	<0.08
CS-WB02-LGR-02	12-Jun-13	Dry	Dry	Dry	Dry	Dry	Dry
CS-WB02-LGR-03	12-Jun-13	<0.12	<0.07	<0.08	**1.91**	**4.73**	<0.08
CS-WB02-LGR-04	12-Jun-13	<0.12	<0.07	<0.08	**8.79**	**4.18**	<0.08
CS-WB02-LGR-05	12-Jun-13	<0.12	<0.07	<0.08	**2.66**	**2.58**	<0.08
CS-WB02-LGR-06	12-Jun-13	<0.12	**0.23F**	**0.21F**	**3.37**	**3.04**	<0.08
CS-WB02-LGR-07	12-Jun-13	<0.12	**0.32F**	<0.08	**0.72F**	**2.13**	<0.08
CS-WB02-LGR-08	12-Jun-13	<0.12	**1.96**	**0.54F**	**0.73F**	**4.05**	<0.08
CS-WB02-LGR-09	12-Jun-13	<0.12	**0.32F**	<0.08	**11.04**	**105.84***	<0.08
	18-Sep-13	<0.12	**0.27F**	<0.08	**11.11**	**259.55***	<0.08
CS-WB03-UGR-01	12-Jun-13	<3.00*	<1.75*	<2.00*	**70.67***	**8678.10***	<2.00*
CS-WB03-LGR-01	12-Jun-13	Dry	Dry	Dry	Dry	Dry	Dry
CS-WB03-LGR-02	12-Jun-13	Dry	Dry	Dry	Dry	Dry	Dry
CS-WB03-LGR-03	12-Jun-13	<0.12	**0.15F**	<0.08	**7.21**	**13.32**	<0.08
CS-WB03-LGR-04	12-Jun-13	<0.12	<0.07	<0.08	**5.86**	**11.96**	<0.08
CS-WB03-LGR-05	12-Jun-13	<0.12	<0.07	<0.08	**5.35**	**13.88**	<0.08
CS-WB03-LGR-06	12-Jun-13	<0.12	**0.75F**	<0.08	**1.16**	**1.62**	<0.08
CS-WB03-LGR-07	12-Jun-13	<0.12	**9.77**	<0.08	**1.89**	**0.48F**	<0.08
CS-WB03-LGR-08	12-Jun-13	<0.12	**4.46**	<0.08	**0.96F**	**0.21F**	**0.42F**
CS-WB03-LGR-09	12-Jun-13	<0.12	**8.93**	<0.08	**2.07**	**1.59**	<0.08
	18-Sep-13	<0.12	**9.56**	<0.08	**2.2**	**1.32F**	<0.08
CS-WB04-UGR-01	20-Jun-13	Dry	Dry	Dry	Dry	Dry	Dry
CS-WB04-LGR-06	20-Jun-13	<0.12	**3.54**	**0.40F**	**12.62**	**39.18**	<0.08
	23-Sep-13	<0.12	**2.72**	**0.25F**	**9.41**	**27.52**	<0.08
CS-WB04-LGR-07	20-Jun-13	<0.12	**2.51**	**0.23F**	**7.02**	**19.07**	<0.08
	23-Sep-13	<0.12	**2.08**	**0.18F**	**7.02**	**20.11**	<0.08
CS-WB04-LGR-08	20-Jun-13	<0.12	<0.07	<0.08	**0.98F**	**0.39F**	<0.08
CS-WB04-LGR-09	20-Jun-13	<0.12	<0.07	<0.08	**5.86**	**6.05**	<0.08
	23-Sep-13	<0.12	<0.07	<0.08	**8.31**	**8.42**	<0.08
CS-WB04-LGR10	20-Jun-13	<0.12	<0.07	<0.08	**0.73F**	**1.37F**	<0.08
	23-Sep-13	<0.12	<0.07	<0.08	**0.58F**	**1.25F**	<0.08
CS-WB04-LGR-11	20-Jun-13	<0.12	<0.07	<0.08	<0.05	**0.24F**	<0.08
	23-Sep-13	<0.12	<0.07	<0.08	<0.05	**0.27F**	<0.08

Data Qualifiers:
F-The analyte was positively identified but the associated numerical value is below the RL.
* dilution was performed for this sample.
All values are reported in µg/L.
All samples were analyzed by APPL, Inc. as screening data.
DCE - Dichloroethene
TCE - Trichloroethene
PCE - Tetrachloroethene
UGR - Upper Glen Rose
LGR - Lower Glen Rose

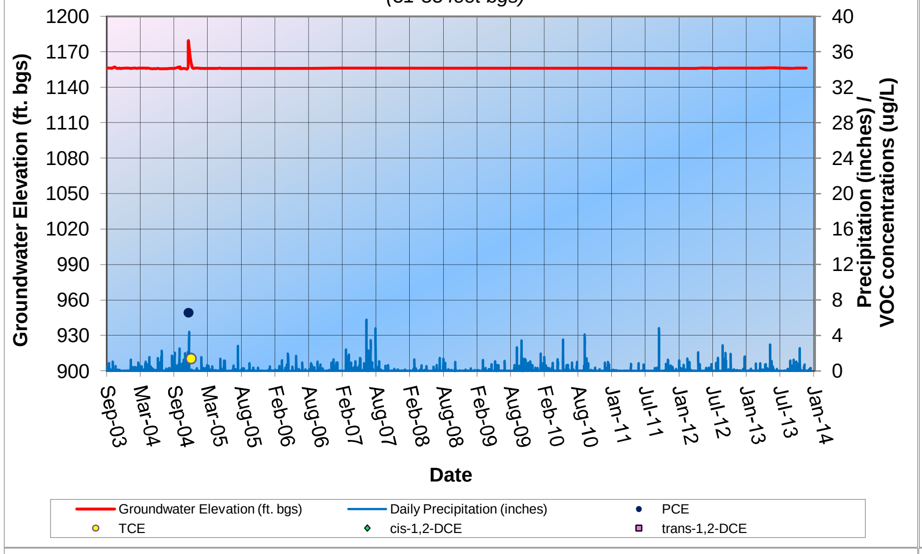
Bold (shaded, boxed)	≥ MCL
Bold (boxed)	≥ RL
Bold	≥ MDL

APPENDIX D

CUMULATIVE WESTBAY® ANALYTICAL GRAPHS

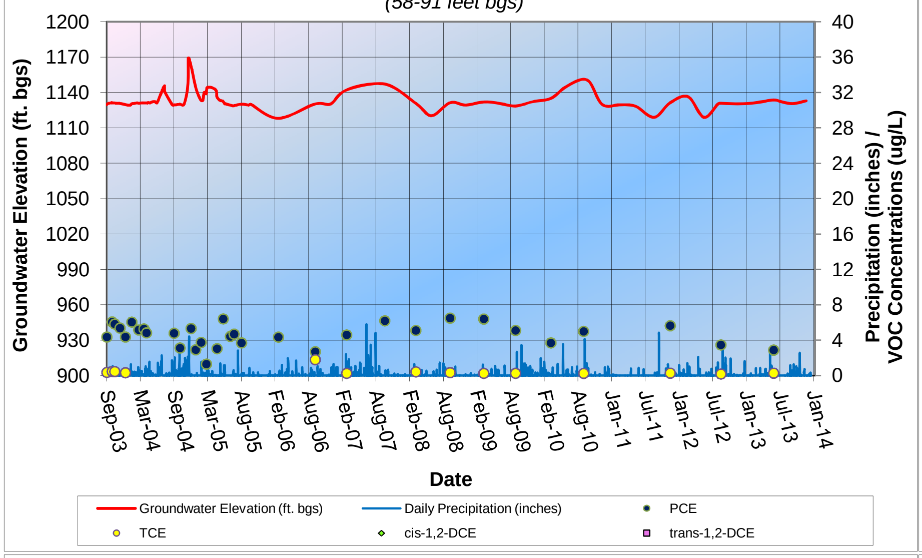
WB01-UGR01

(31-53 feet bgs)



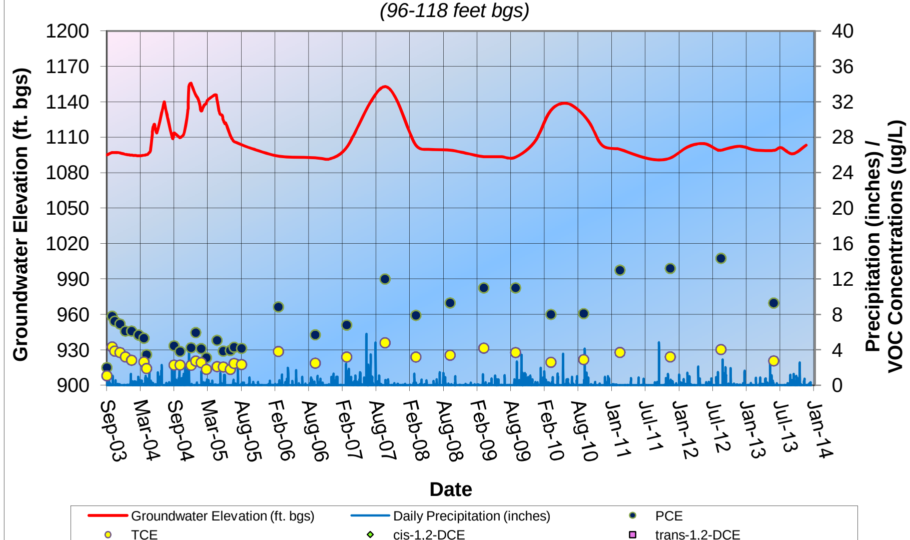
WB01-LGR01

(58-91 feet bgs)



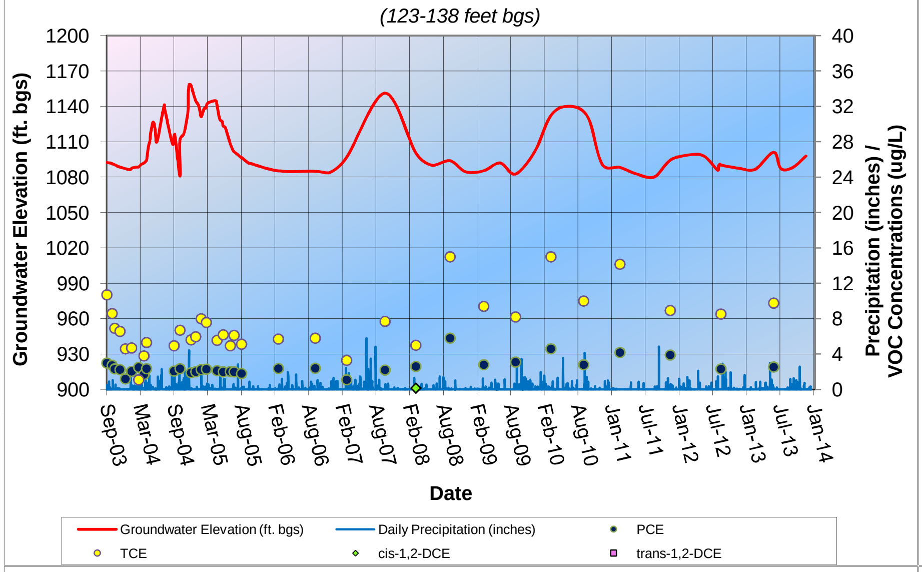
WB01-LGR02

(96-118 feet bgs)



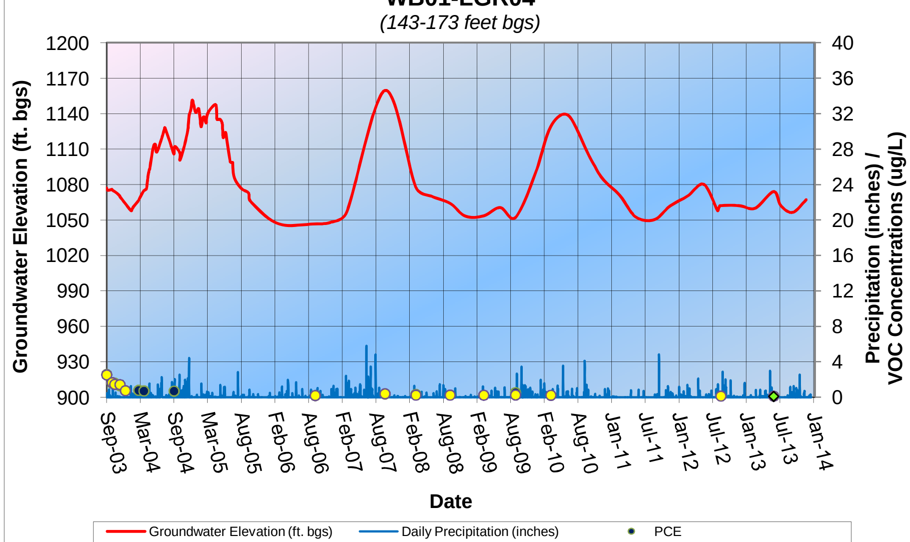
WB01-LGR03

(123-138 feet bgs)



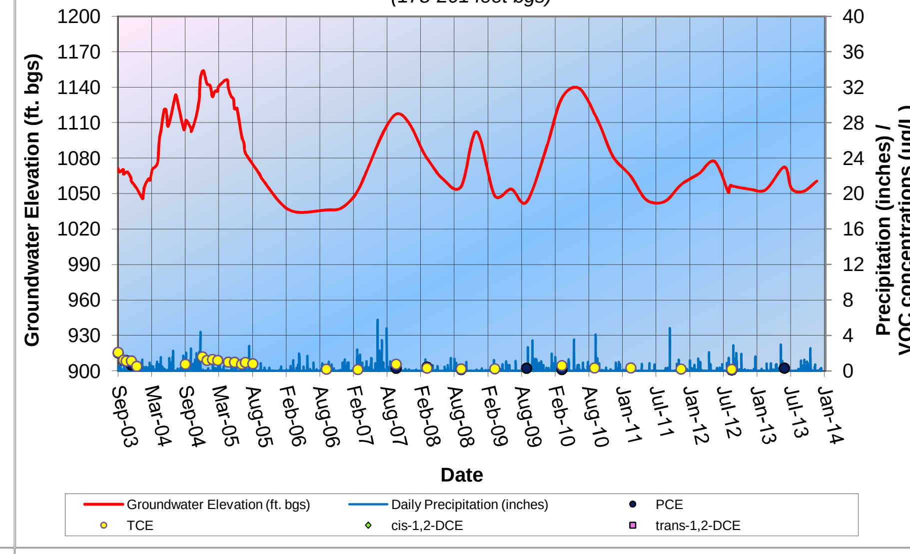
WB01-LGR04

(143-173 feet bgs)



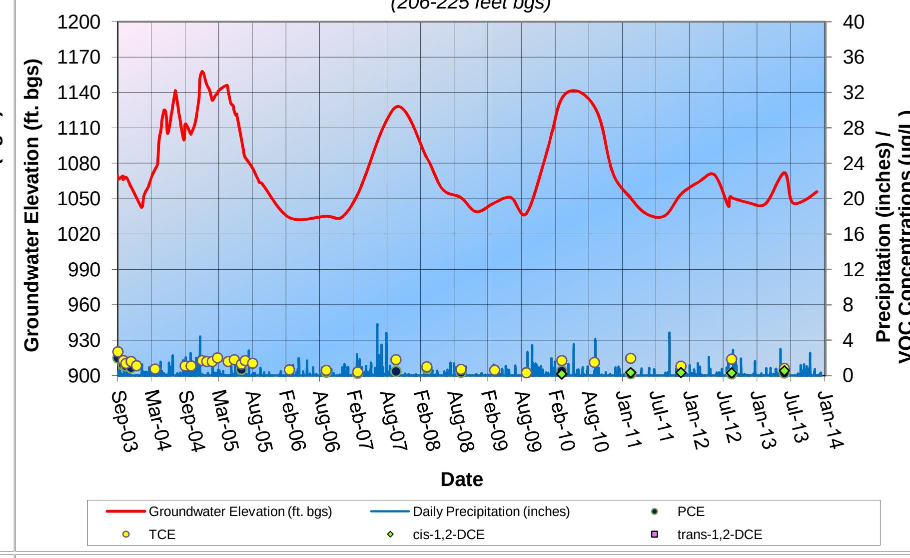
WB01-LGR05

(178-201 feet bgs)



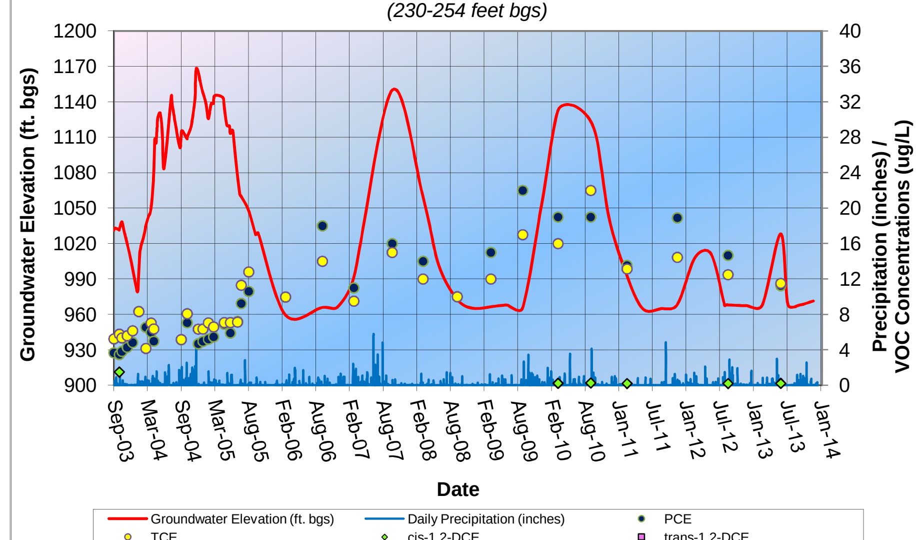
WB01-LGR06

(206-225 feet bgs)



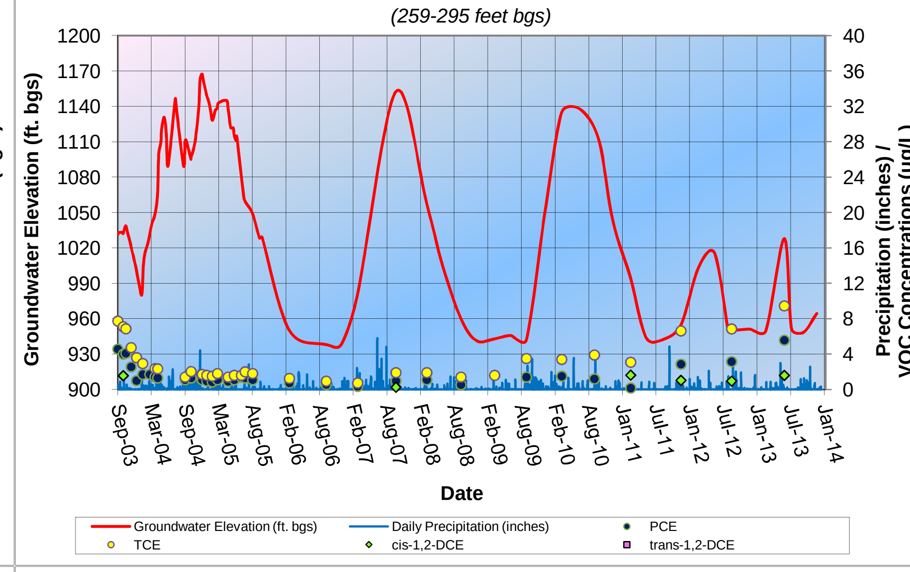
WB01-LGR07

(230-254 feet bgs)



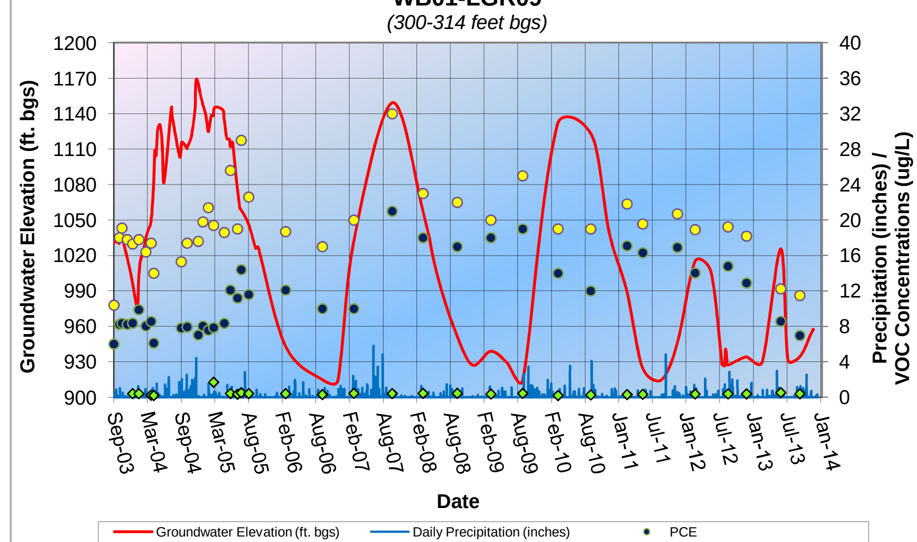
WB01-LGR08

(259-295 feet bgs)



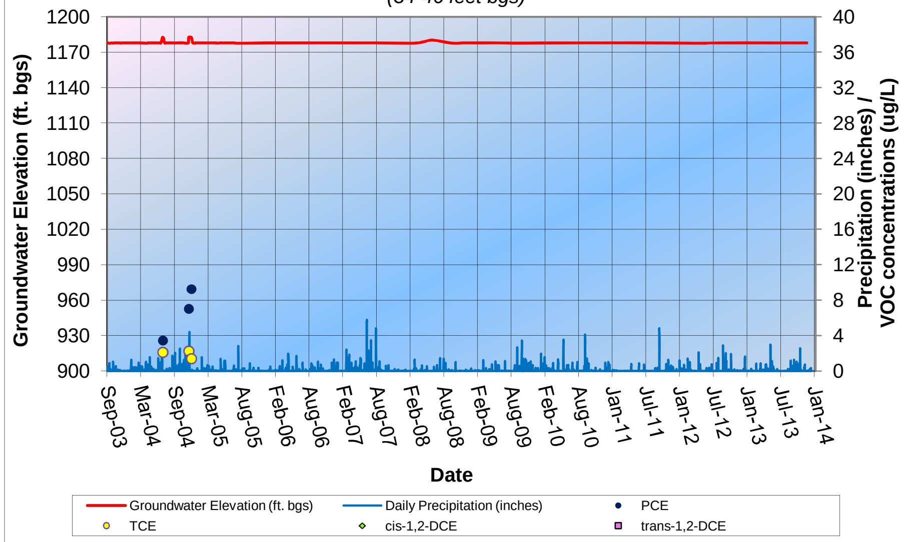
WB01-LGR09

(300-314 feet bgs)

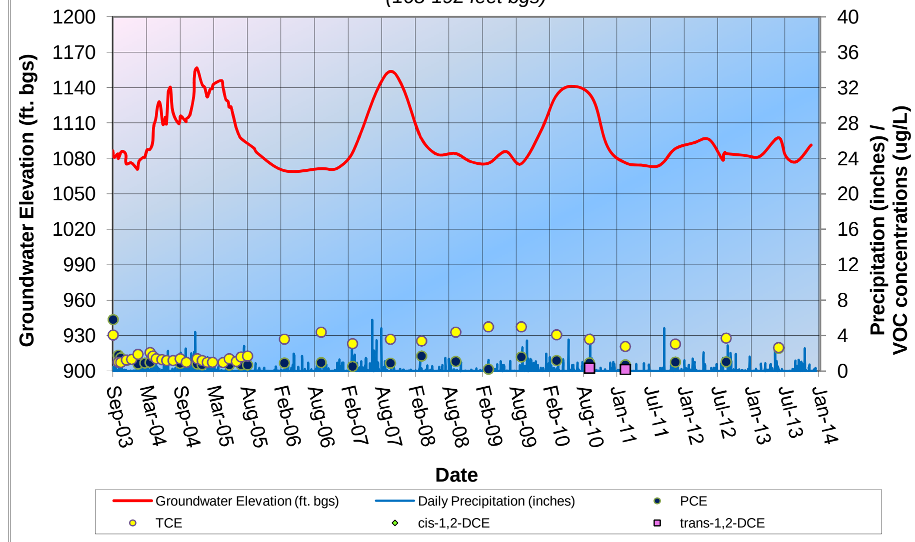


J:\CSSA Program\Restoration\Groundwater\GW Monitoring Reports\2013\Annual Report\Appendix D Cumulative Westbay Graphs_ug_L.xlsx

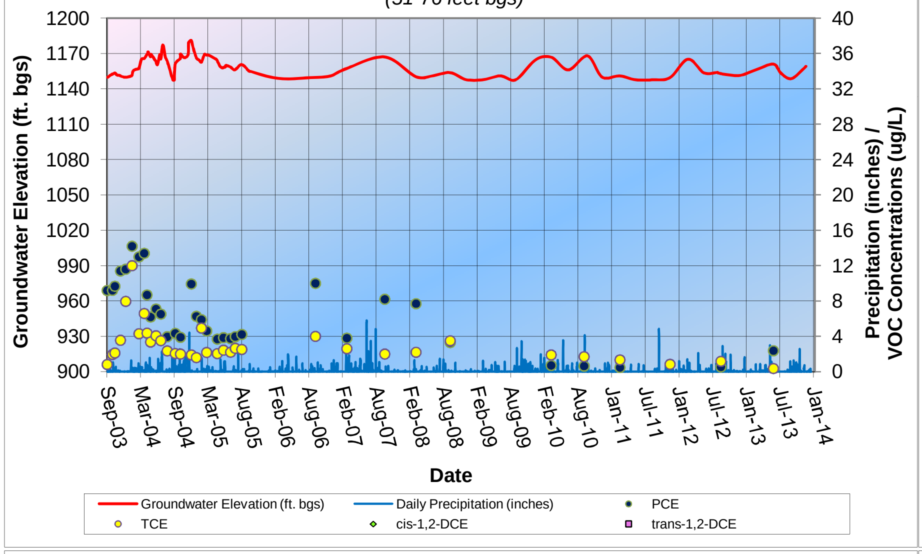
WB02-UGR01
(34-46 feet bgs)



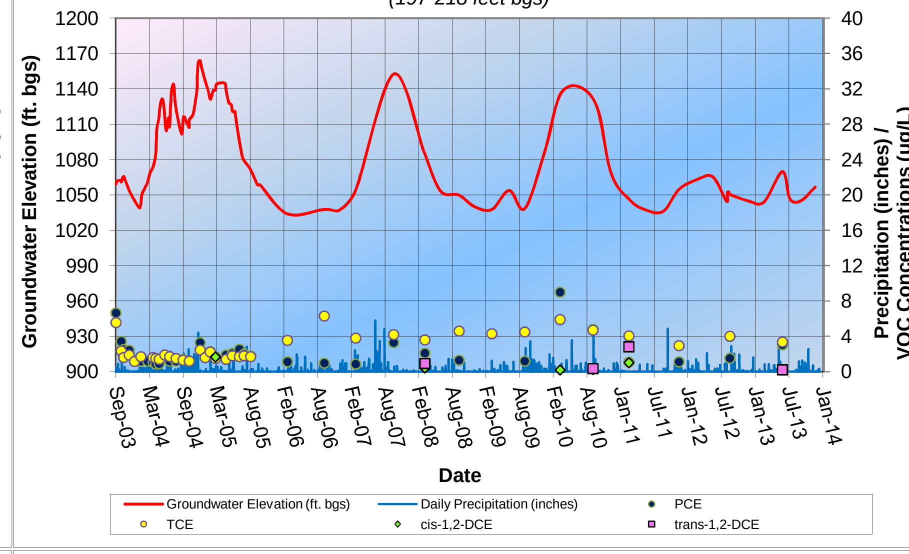
WB02-LGR05
(168-192 feet bgs)



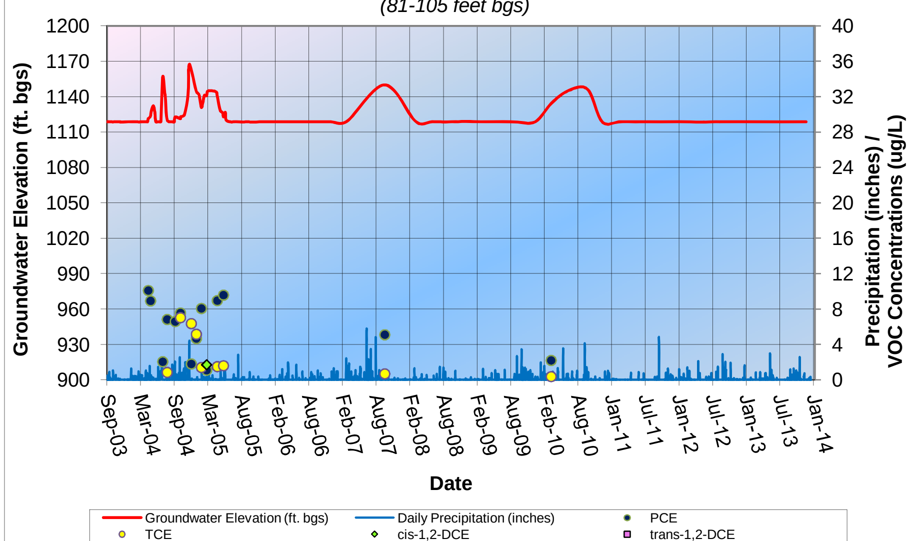
WB02-LGR01
(51-76 feet bgs)



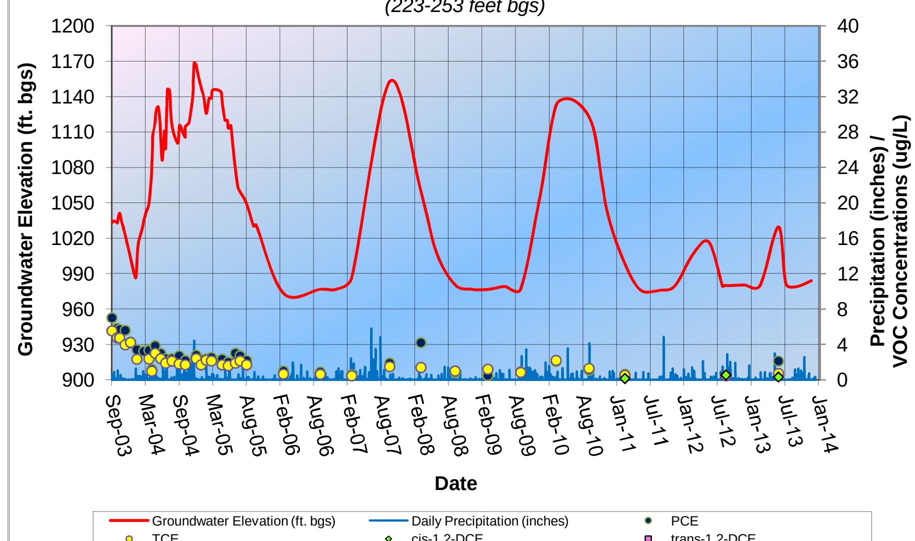
WB02-LGR06
(197-218 feet bgs)



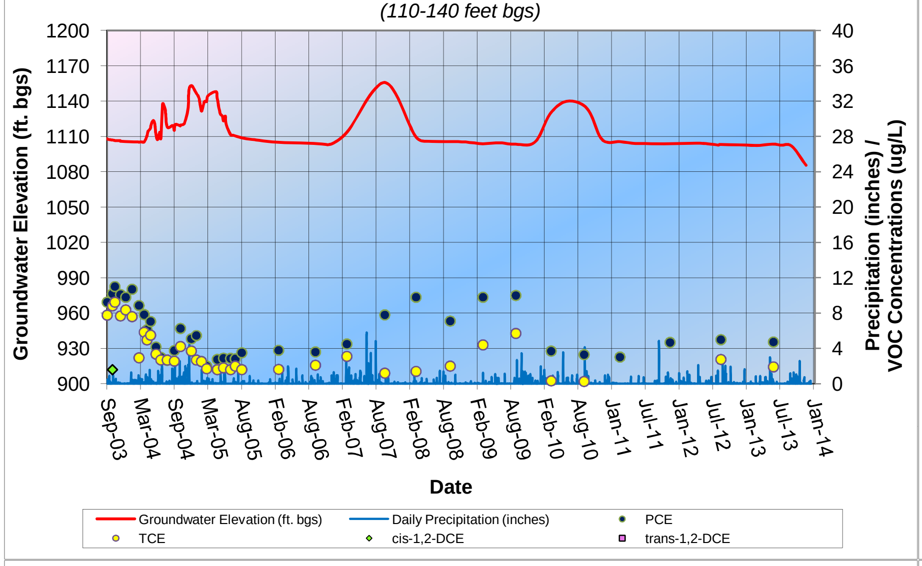
WB02-LGR02
(81-105 feet bgs)



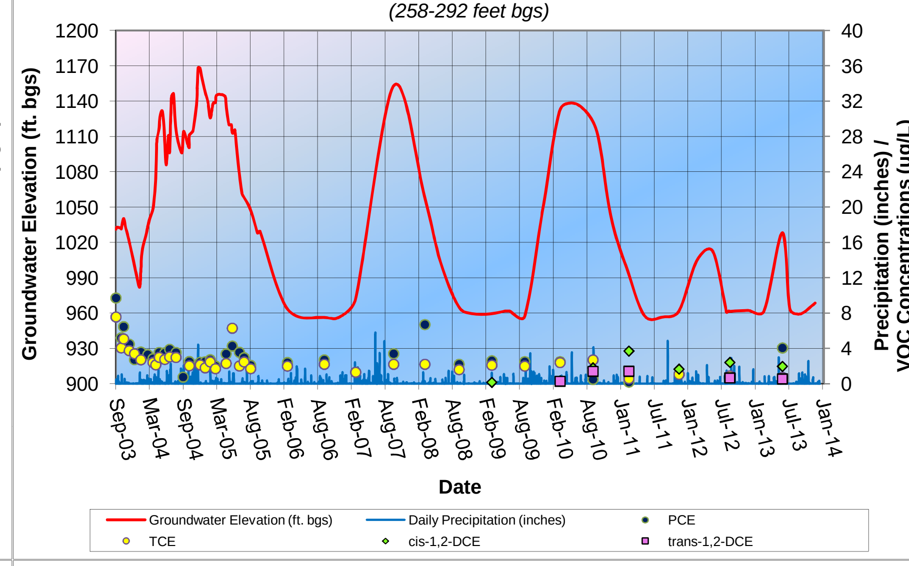
WB02-LGR07
(223-253 feet bgs)



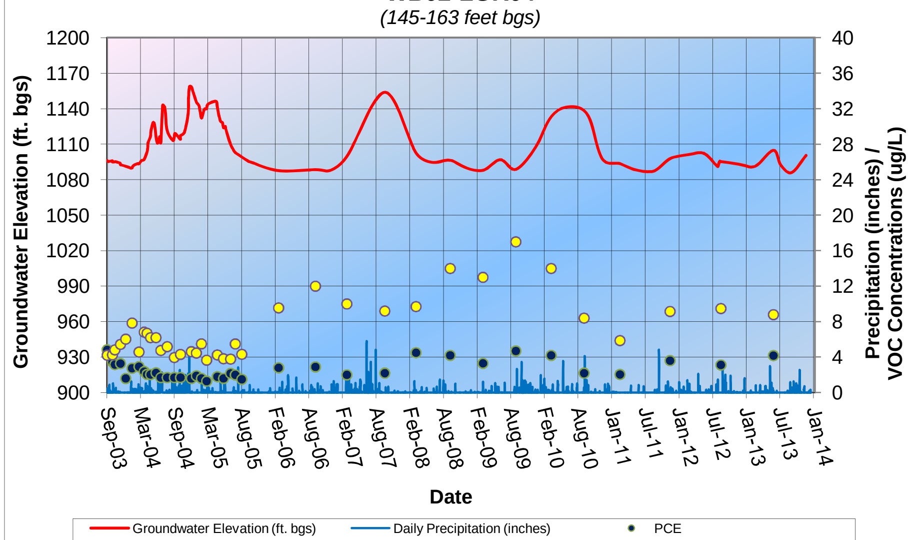
WB02-LGR03
(110-140 feet bgs)



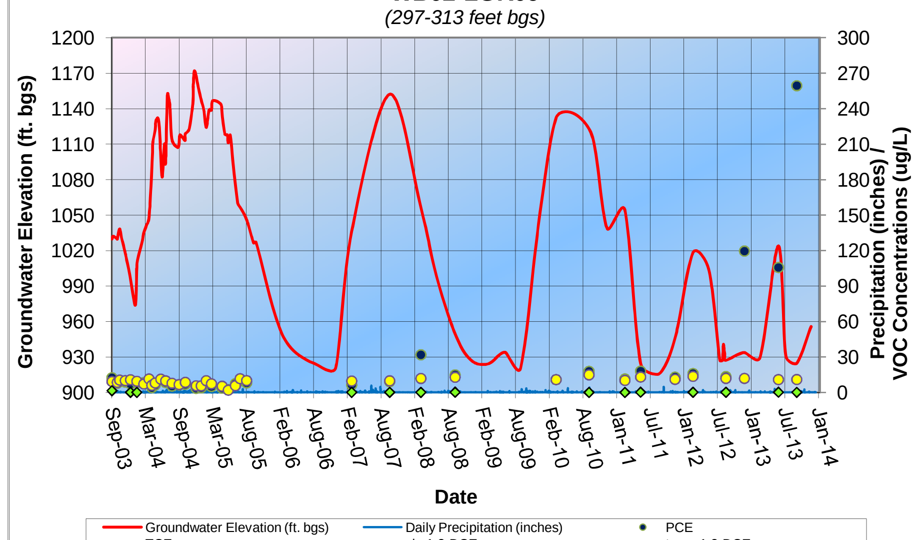
WB02-LGR08
(258-292 feet bgs)

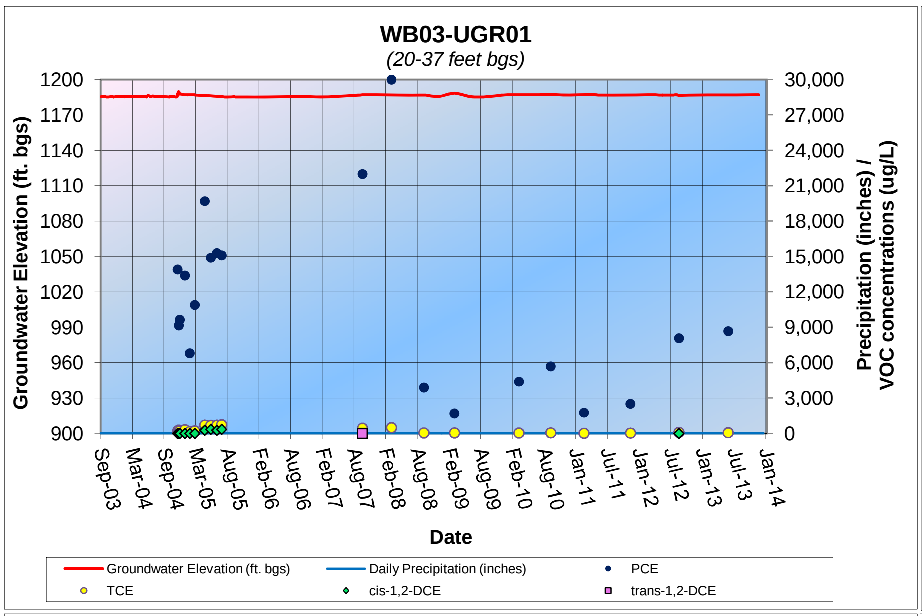


WB02-LGR04
(145-163 feet bgs)

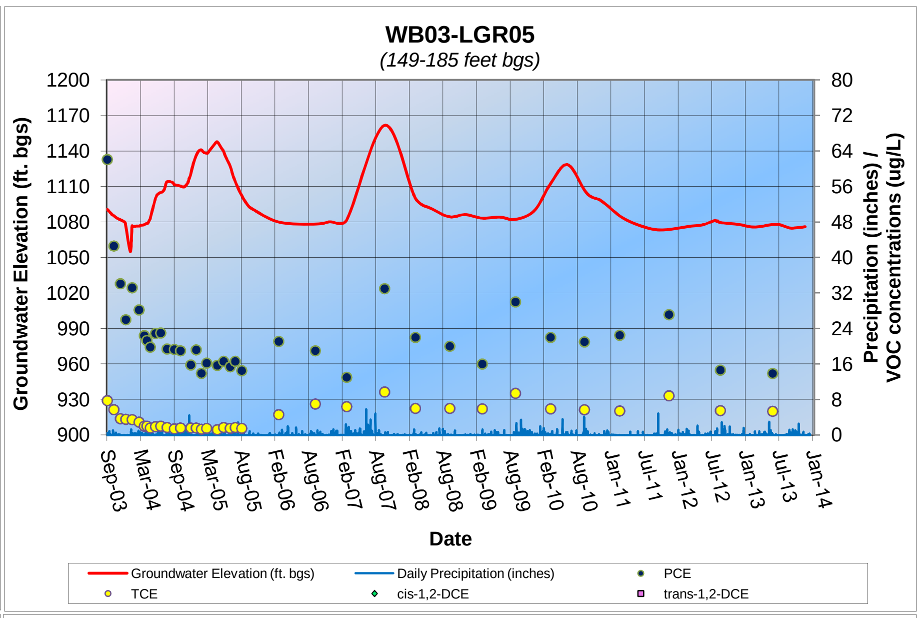


WB02-LGR09
(297-313 feet bgs)

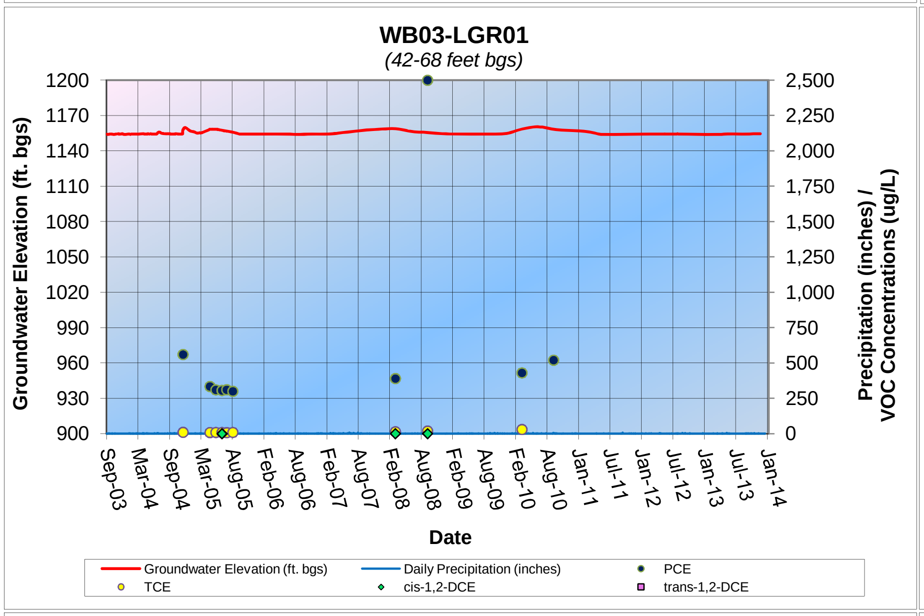




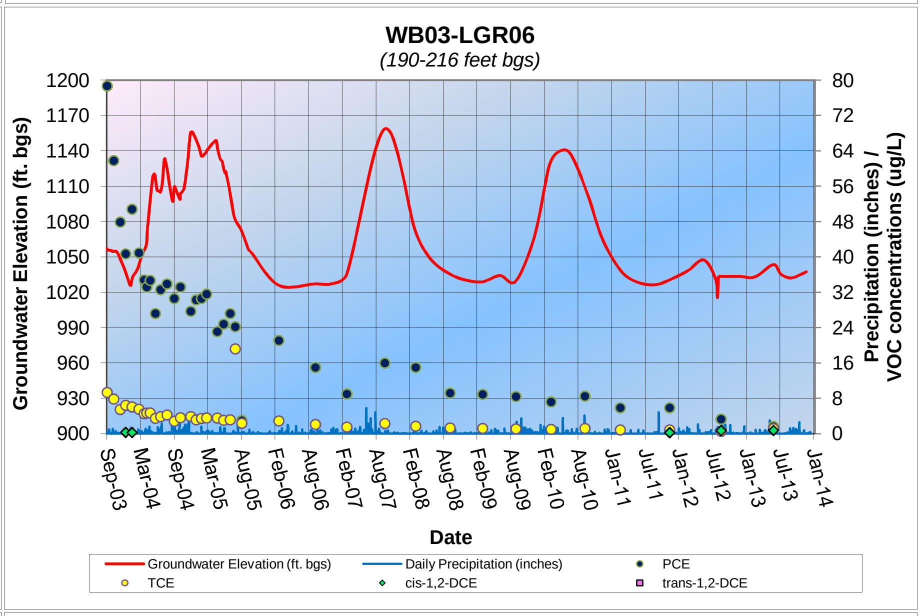
WB03-UGR01
(20-37 feet bgs)
Groundwater Elevation (ft. bgs)
Precipitation (inches) / VOC concentrations (ug/L)
Date
Groundwater Elevation (ft. bgs)
Daily Precipitation (inches)
PCE
TCE
cis-1,2-DCE
trans-1,2-DCE



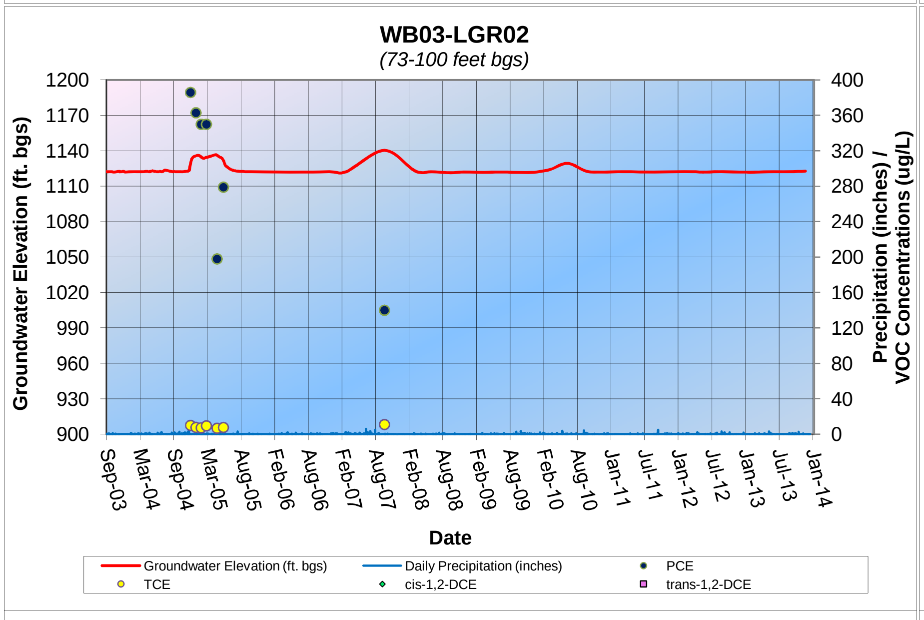
WB03-LGR05
(149-185 feet bgs)
Groundwater Elevation (ft. bgs)
Precipitation (inches) / VOC concentrations (ug/L)
Date
Groundwater Elevation (ft. bgs)
Daily Precipitation (inches)
PCE
TCE
cis-1,2-DCE
trans-1,2-DCE



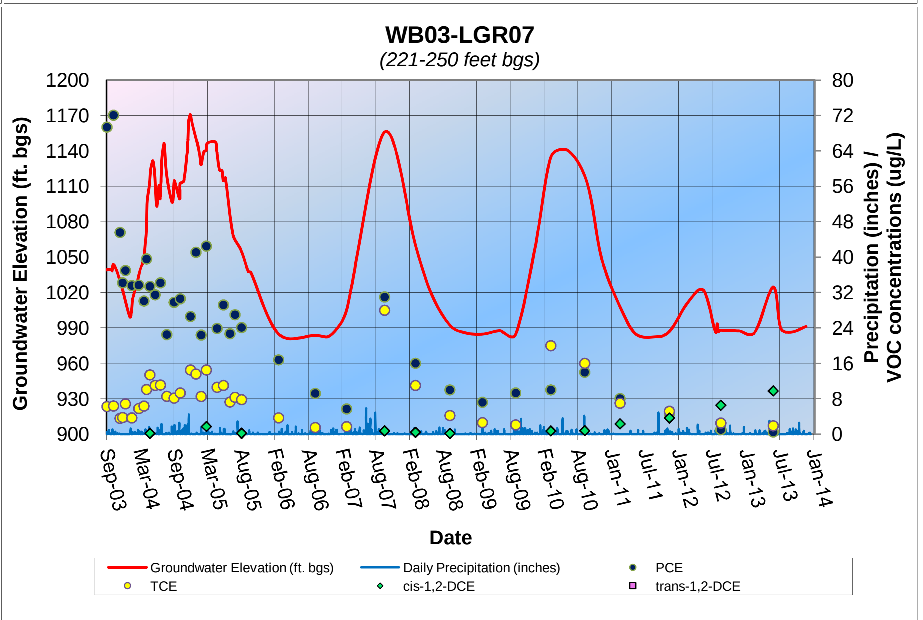
WB03-LGR01
(42-68 feet bgs)
Groundwater Elevation (ft. bgs)
Precipitation (inches) / VOC Concentrations (ug/L)
Date
Groundwater Elevation (ft. bgs)
Daily Precipitation (inches)
PCE
TCE
cis-1,2-DCE
trans-1,2-DCE



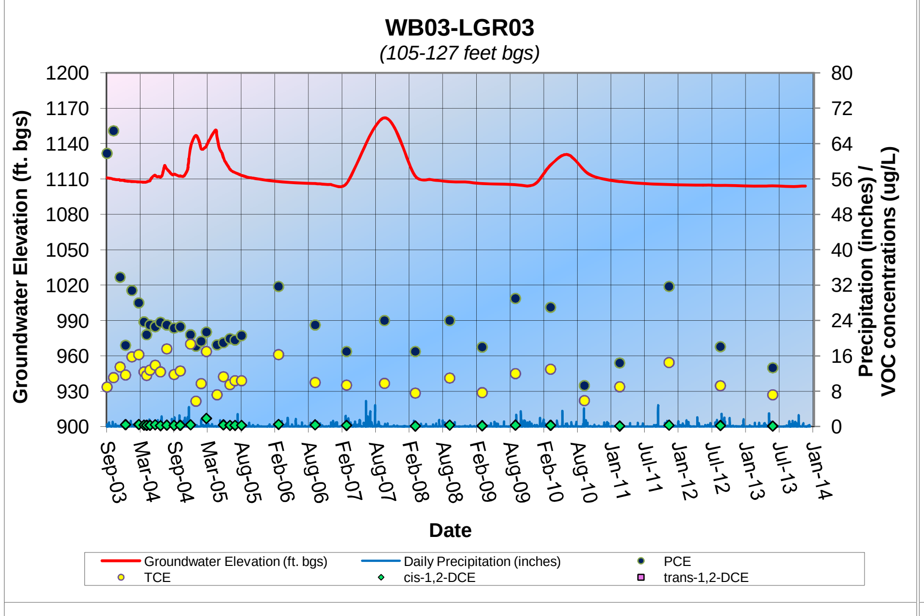
WB03-LGR06
(190-216 feet bgs)
Groundwater Elevation (ft. bgs)
Precipitation (inches) / VOC Concentrations (ug/L)
Date
Groundwater Elevation (ft. bgs)
Daily Precipitation (inches)
PCE
TCE
cis-1,2-DCE
trans-1,2-DCE



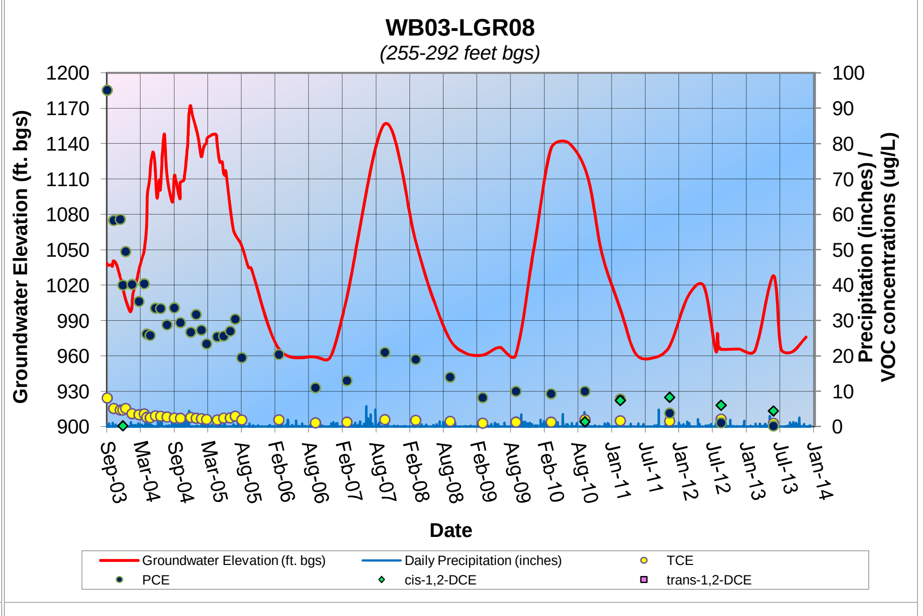
WB03-LGR02
(73-100 feet bgs)
Groundwater Elevation (ft. bgs)
Precipitation (inches) / VOC Concentrations (ug/L)
Date
Groundwater Elevation (ft. bgs)
Daily Precipitation (inches)
PCE
TCE
cis-1,2-DCE
trans-1,2-DCE



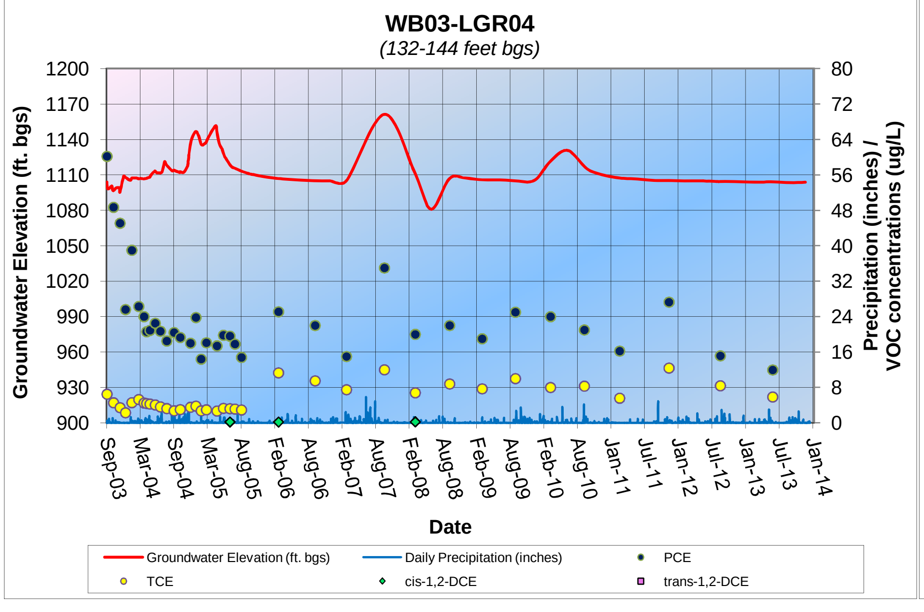
WB03-LGR07
(221-250 feet bgs)
Groundwater Elevation (ft. bgs)
Precipitation (inches) / VOC concentrations (ug/L)
Date
Groundwater Elevation (ft. bgs)
Daily Precipitation (inches)
PCE
TCE
cis-1,2-DCE
trans-1,2-DCE



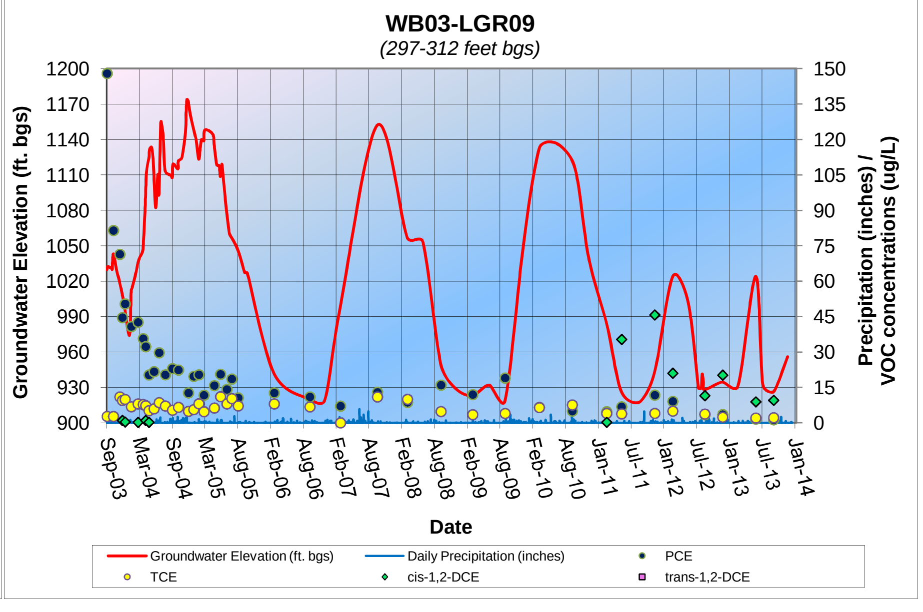
WB03-LGR03
(105-127 feet bgs)
Groundwater Elevation (ft. bgs)
Precipitation (inches) / VOC concentrations (ug/L)
Date
Groundwater Elevation (ft. bgs)
Daily Precipitation (inches)
PCE
TCE
cis-1,2-DCE
trans-1,2-DCE



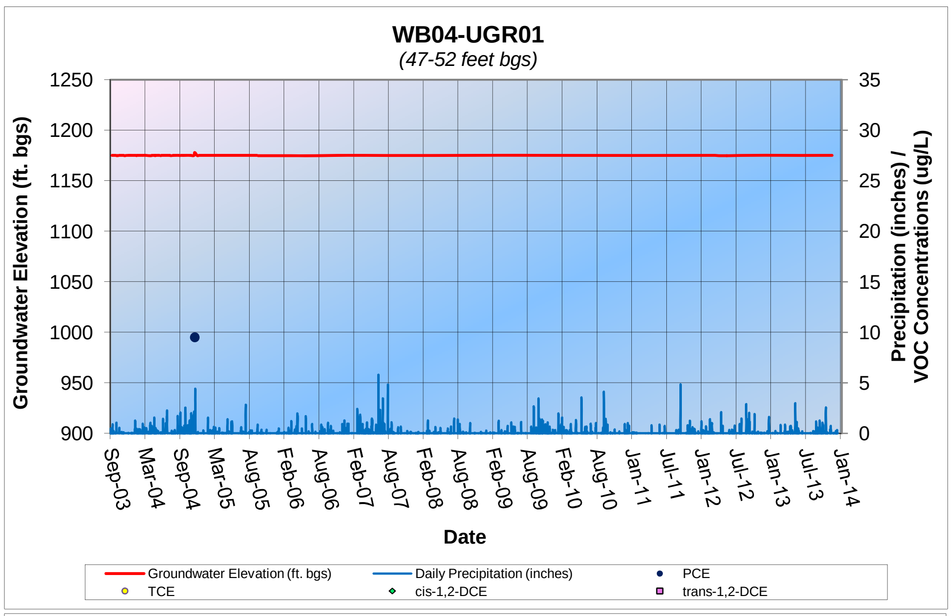
WB03-LGR08
(255-292 feet bgs)
Groundwater Elevation (ft. bgs)
Precipitation (inches) / VOC concentrations (ug/L)
Date
Groundwater Elevation (ft. bgs)
Daily Precipitation (inches)
TCE
PCE
cis-1,2-DCE
trans-1,2-DCE

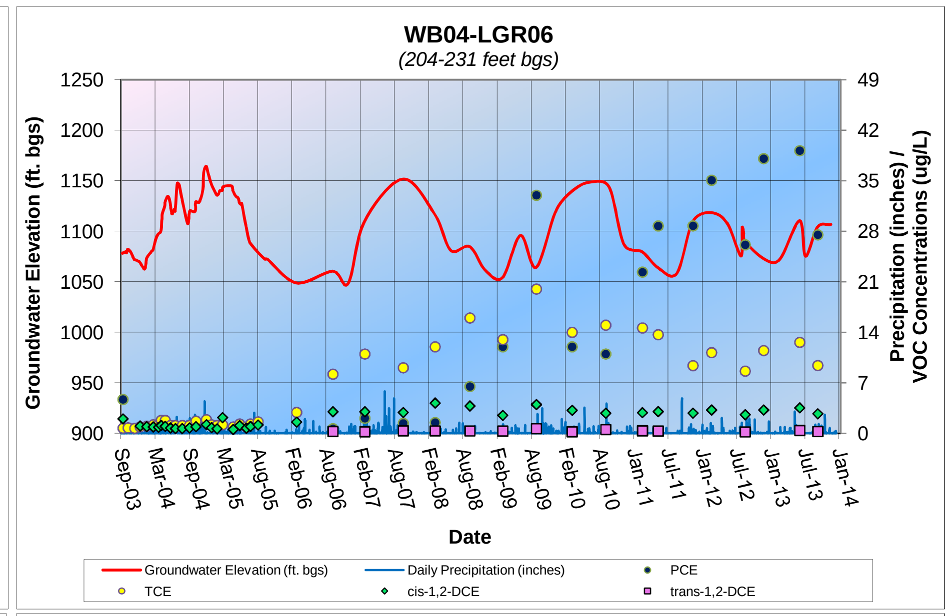


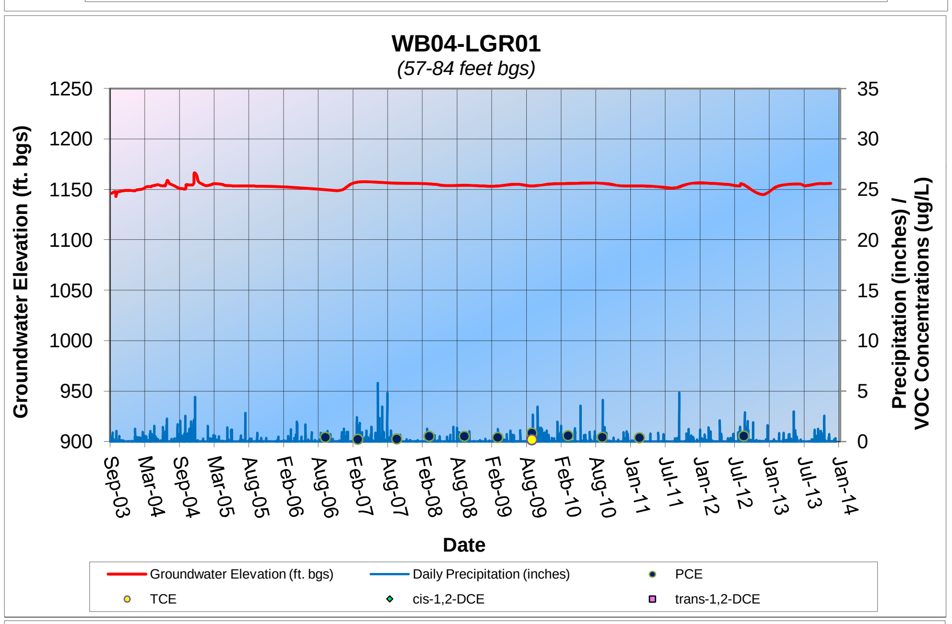
WB03-LGR04
(132-144 feet bgs)
Groundwater Elevation (ft. bgs)
Precipitation (inches) / VOC concentrations (ug/L)
Date
Groundwater Elevation (ft. bgs)
Daily Precipitation (inches)
PCE
TCE
cis-1,2-DCE
trans-1,2-DCE

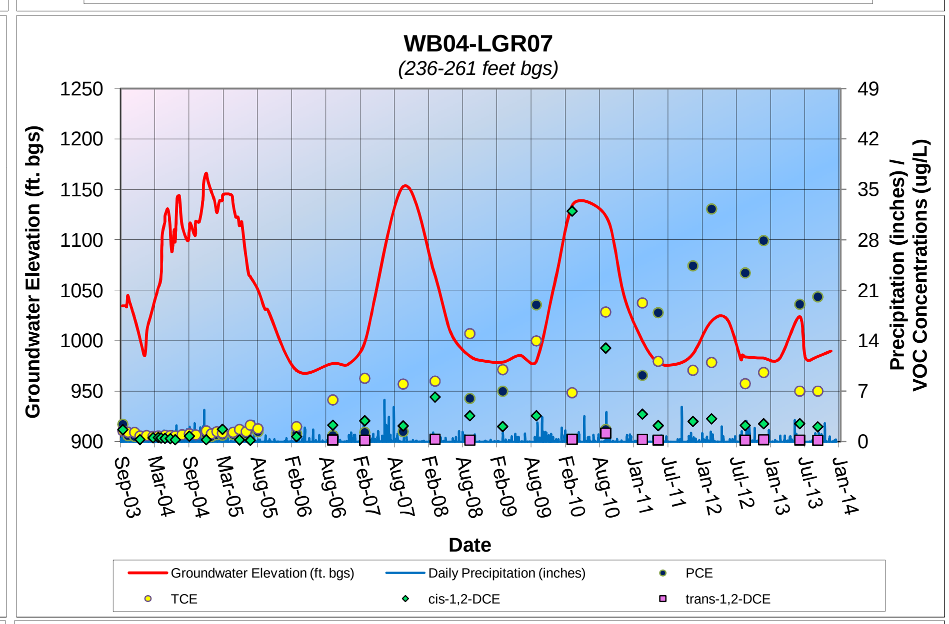


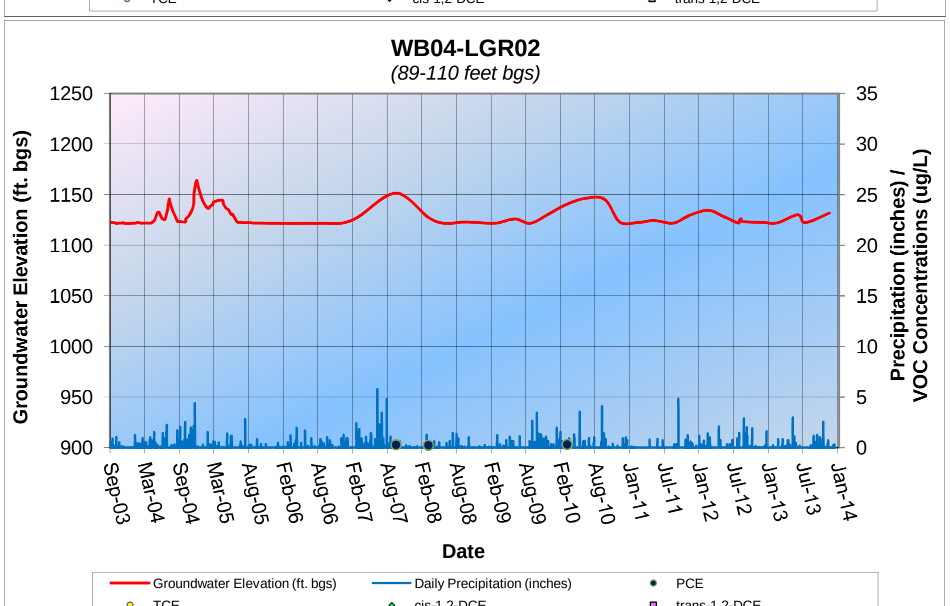
WB03-LGR09
(297-312 feet bgs)
Groundwater Elevation (ft. bgs)
Precipitation (inches) / VOC concentrations (ug/L)
Date
Groundwater Elevation (ft. bgs)
Daily Precipitation (inches)
PCE
TCE
cis-1,2-DCE
trans-1,2-DCE

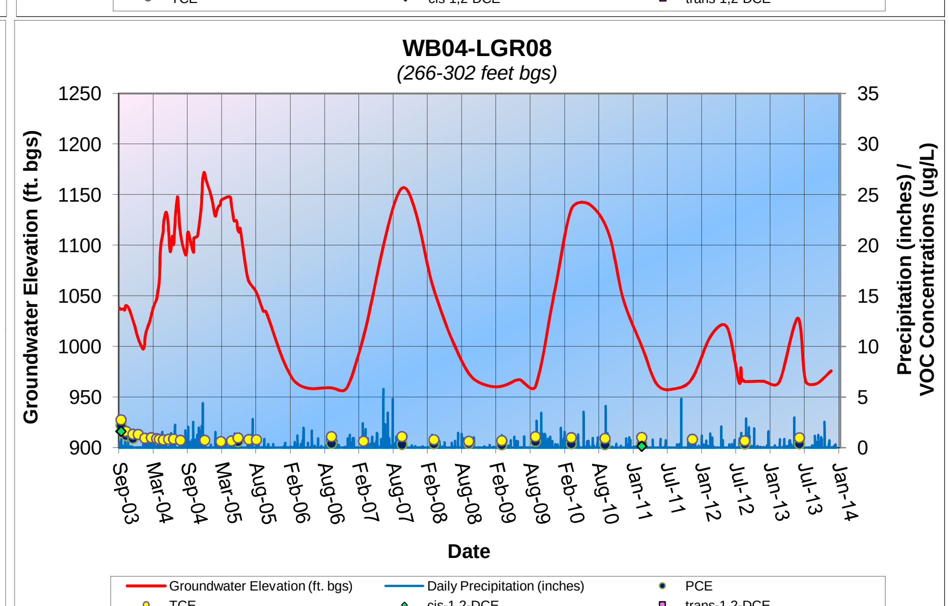

WB04-UGR01
(47-52 feet bgs)
Groundwater Elevation (ft. bgs)
Precipitation (inches) / VOC Concentrations (ug/L)
Date
Groundwater Elevation (ft. bgs)
Daily Precipitation (inches)
PCE
TCE
cis-1,2-DCE
trans-1,2-DCE

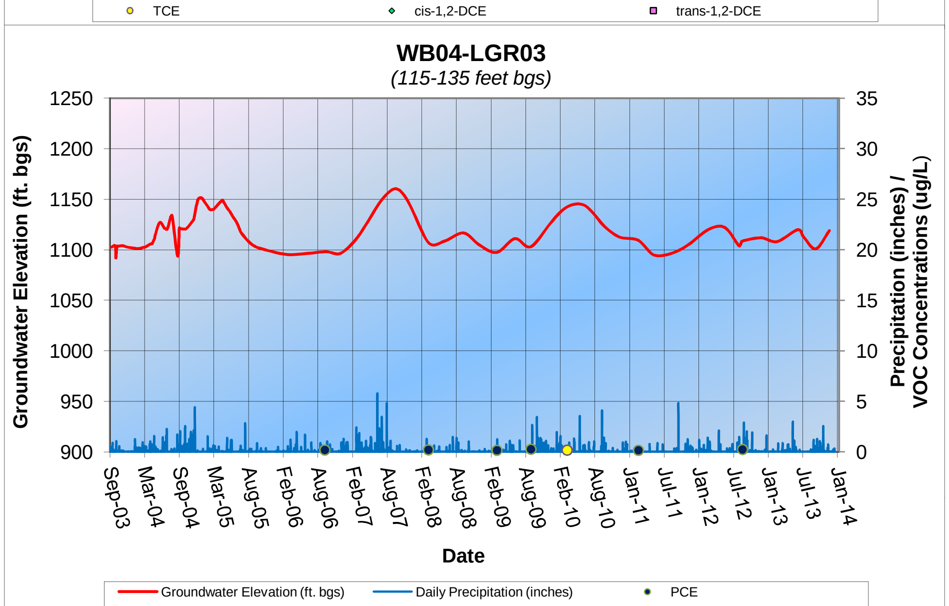

WB04-LGR06
(204-231 feet bgs)
Groundwater Elevation (ft. bgs)
Precipitation (inches) / VOC Concentrations (ug/L)
Date
Groundwater Elevation (ft. bgs)
Daily Precipitation (inches)
PCE
TCE
cis-1,2-DCE
trans-1,2-DCE

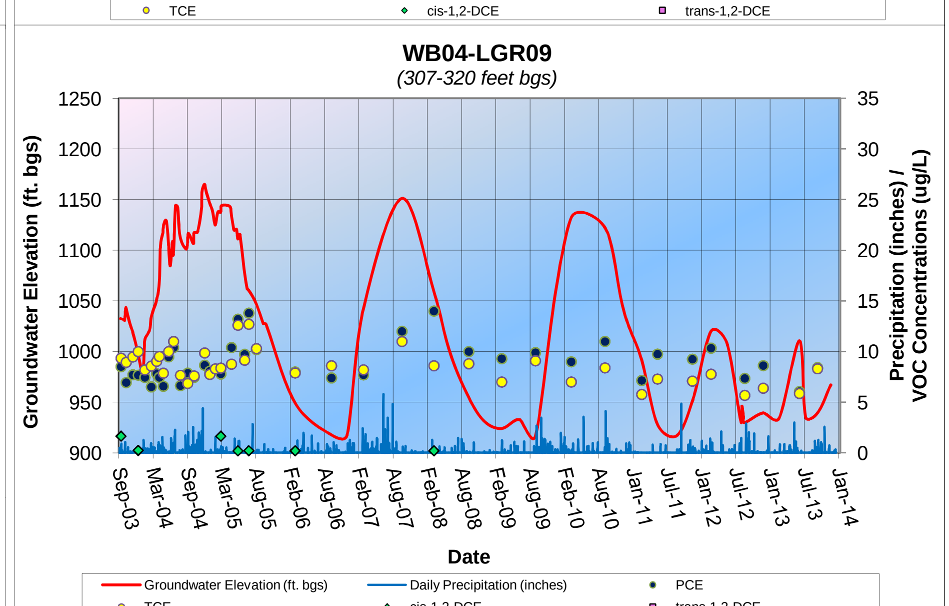

WB04-LGR01
(57-84 feet bgs)
Groundwater Elevation (ft. bgs)
Precipitation (inches) / VOC Concentrations (ug/L)
Date
Groundwater Elevation (ft. bgs)
Daily Precipitation (inches)
PCE
TCE
cis-1,2-DCE
trans-1,2-DCE

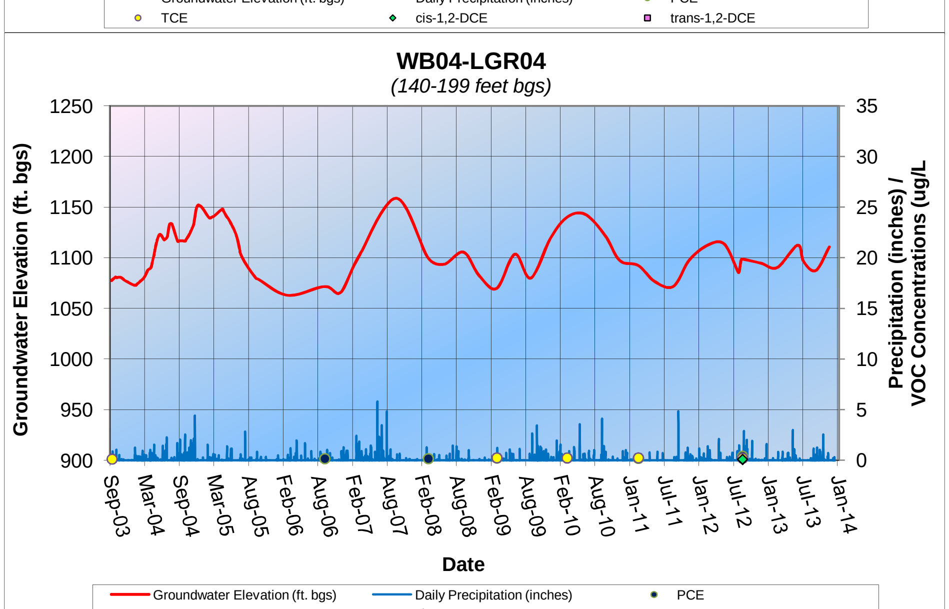

WB04-LGR07
(236-261 feet bgs)
Groundwater Elevation (ft. bgs)
Precipitation (inches) / VOC Concentrations (ug/L)
Date
Groundwater Elevation (ft. bgs)
Daily Precipitation (inches)
PCE
TCE
cis-1,2-DCE
trans-1,2-DCE

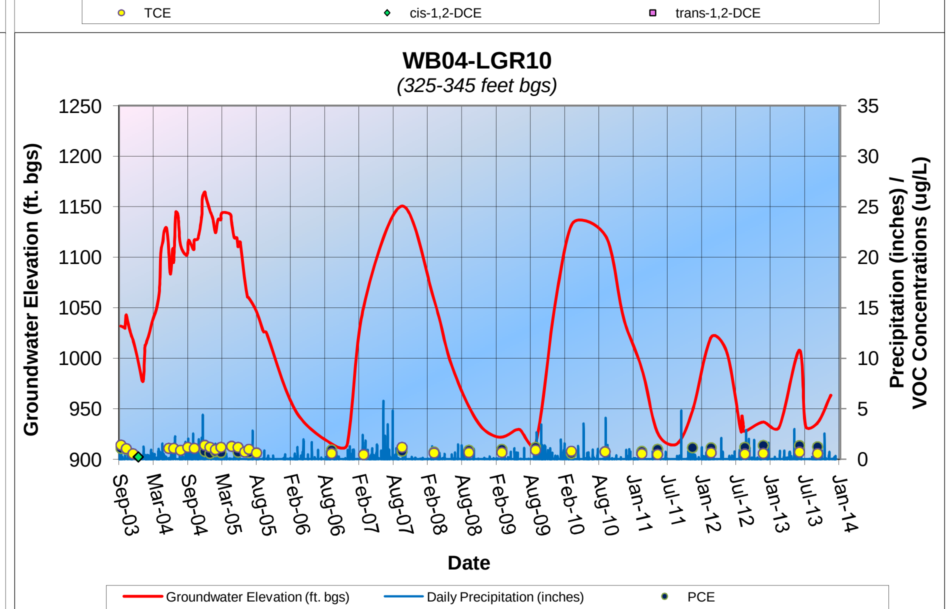

WB04-LGR02
(89-110 feet bgs)
Groundwater Elevation (ft. bgs)
Precipitation (inches) / VOC Concentrations (ug/L)
Date
Groundwater Elevation (ft. bgs)
Daily Precipitation (inches)
PCE
TCE
cis-1,2-DCE
trans-1,2-DCE

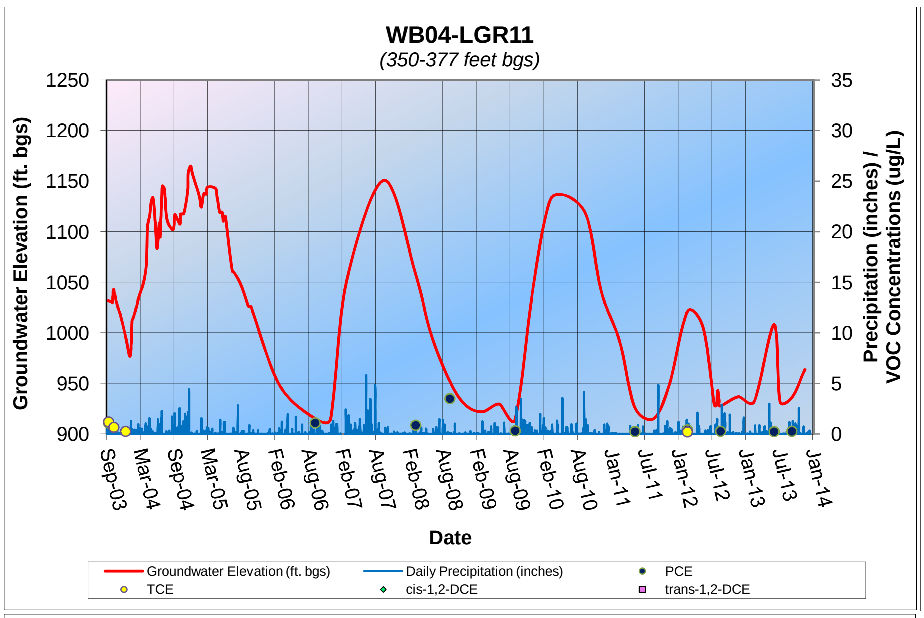

WB04-LGR08
(266-302 feet bgs)
Groundwater Elevation (ft. bgs)
Precipitation (inches) / VOC Concentrations (ug/L)
Date
Groundwater Elevation (ft. bgs)
Daily Precipitation (inches)
PCE
TCE
cis-1,2-DCE
trans-1,2-DCE

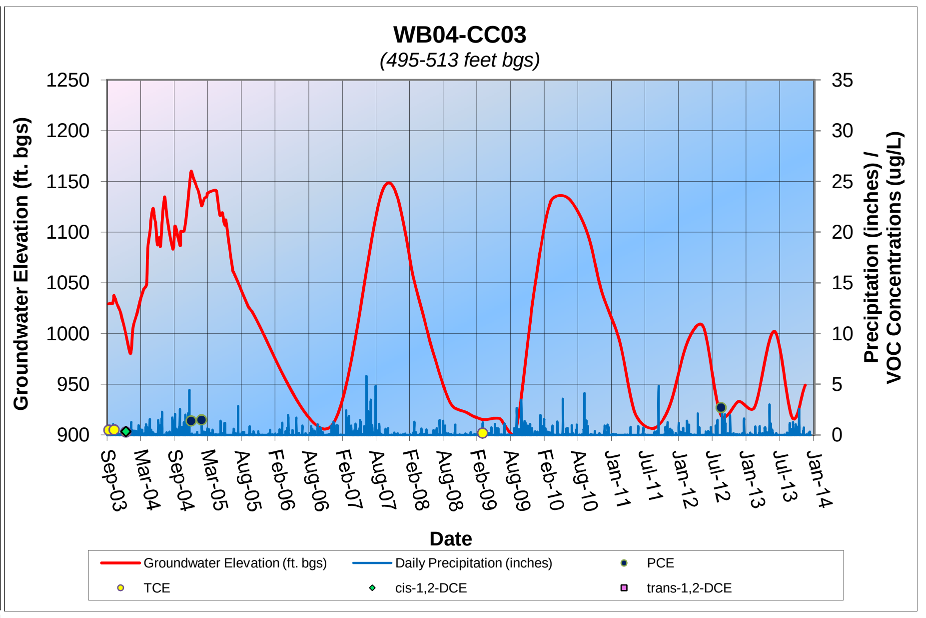

WB04-LGR03
(115-135 feet bgs)
Groundwater Elevation (ft. bgs)
Precipitation (inches) / VOC Concentrations (ug/L)
Date
Groundwater Elevation (ft. bgs)
Daily Precipitation (inches)
PCE
TCE
cis-1,2-DCE
trans-1,2-DCE

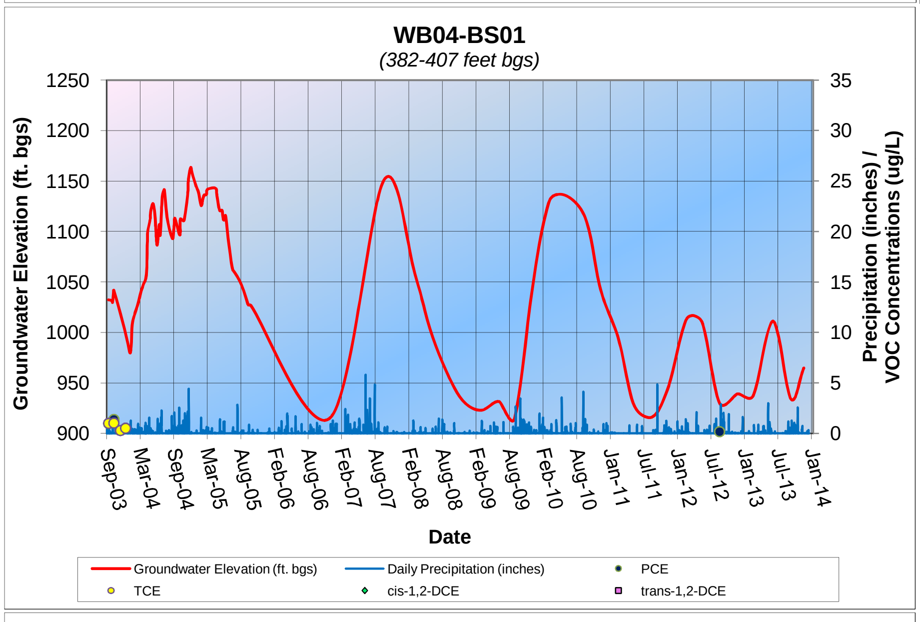

WB04-LGR09
(307-320 feet bgs)
Groundwater Elevation (ft. bgs)
Precipitation (inches) / VOC Concentrations (ug/L)
Date
Groundwater Elevation (ft. bgs)
Daily Precipitation (inches)
PCE
TCE
cis-1,2-DCE
trans-1,2-DCE

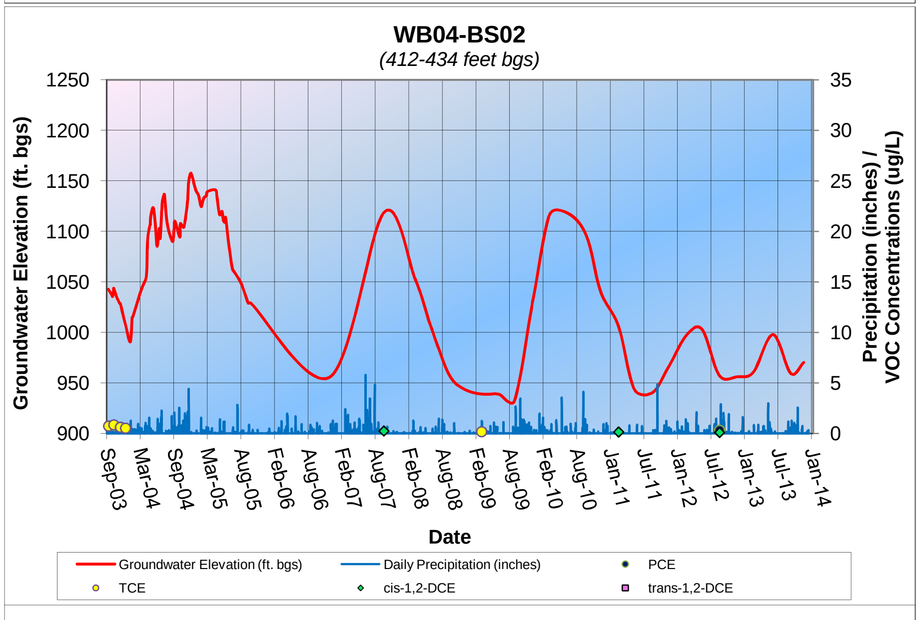

WB04-LGR04
(140-199 feet bgs)
Groundwater Elevation (ft. bgs)
Precipitation (inches) / VOC Concentrations (ug/L)
Date
Groundwater Elevation (ft. bgs)
Daily Precipitation (inches)
PCE
TCE
cis-1,2-DCE
trans-1,2-DCE

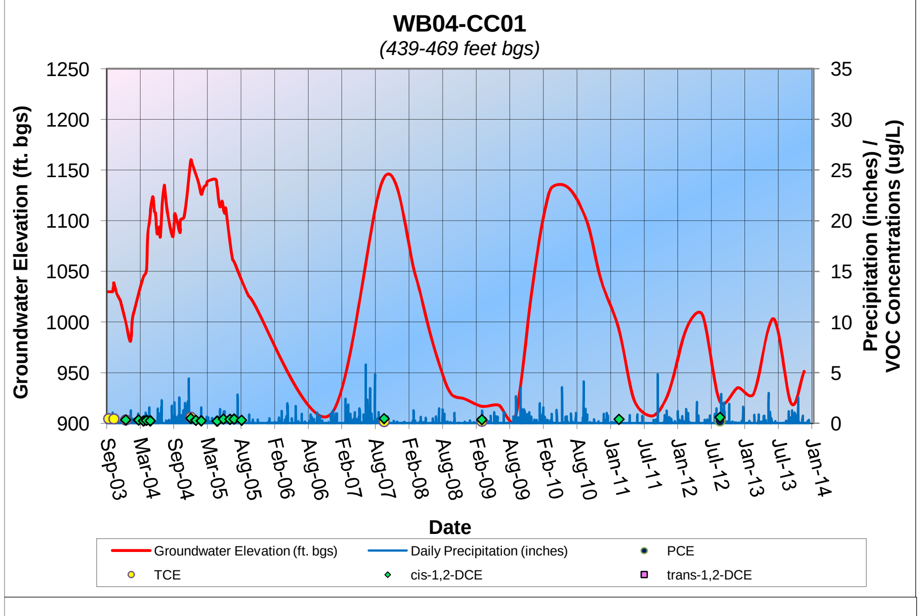

WB04-LGR10
(325-345 feet bgs)
Groundwater Elevation (ft. bgs)
Precipitation (inches) / VOC Concentrations (ug/L)
Date
Groundwater Elevation (ft. bgs)
Daily Precipitation (inches)
PCE
TCE
cis-1,2-DCE
trans-1,2-DCE

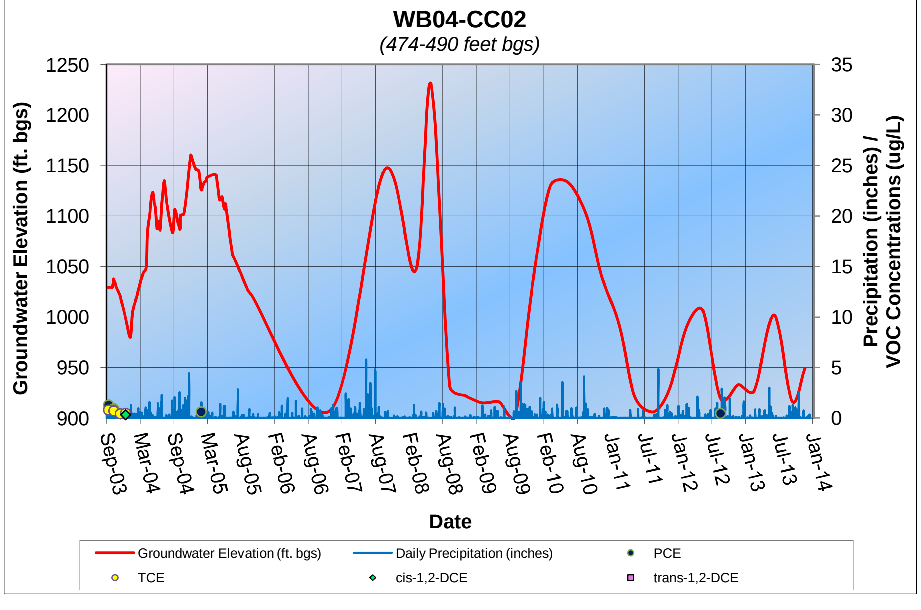

WB04-LGR11
(350-377 feet bgs)
Groundwater Elevation (ft. bgs)
Precipitation (inches) / VOC Concentrations (ug/L)
1250
1200
1150
1100
1050
1000
950
900
35
30
25
20
15
10
5
0
Sep-03 Mar-04 Sep-04 Mar-05 Aug-05 Feb-06 Aug-06 Feb-07 Aug-07 Feb-08 Aug-08 Feb-09 Aug-09 Feb-10 Aug-10 Jan-11 Jul-11 Jan-12 Jul-12 Jan-13 Jul-13 Jan-14
Date
Groundwater Elevation (ft. bgs)
Daily Precipitation (inches)
PCE
TCE
cis-1,2-DCE
trans-1,2-DCE


WB04-CC03
(495-513 feet bgs)
Groundwater Elevation (ft. bgs)
Precipitation (inches) / VOC Concentrations (ug/L)
1250
1200
1150
1100
1050
1000
950
900
35
30
25
20
15
10
5
0
Sep-03 Mar-04 Sep-04 Mar-05 Aug-05 Feb-06 Aug-06 Feb-07 Aug-07 Feb-08 Aug-08 Feb-09 Aug-09 Feb-10 Aug-10 Jan-11 Jul-11 Jan-12 Jul-12 Jan-13 Jul-13 Jan-14
Date
Groundwater Elevation (ft. bgs)
Daily Precipitation (inches)
PCE
TCE
cis-1,2-DCE
trans-1,2-DCE


WB04-BS01
(382-407 feet bgs)
Groundwater Elevation (ft. bgs)
Precipitation (inches) / VOC Concentrations (ug/L)
1250
1200
1150
1100
1050
1000
950
900
35
30
25
20
15
10
5
0
Sep-03 Mar-04 Sep-04 Mar-05 Aug-05 Feb-06 Aug-06 Feb-07 Aug-07 Feb-08 Aug-08 Feb-09 Aug-09 Feb-10 Aug-10 Jan-11 Jul-11 Jan-12 Jul-12 Jan-13 Jul-13 Jan-14
Date
Groundwater Elevation (ft. bgs)
Daily Precipitation (inches)
PCE
TCE
cis-1,2-DCE
trans-1,2-DCE


WB04-BS02
(412-434 feet bgs)
Groundwater Elevation (ft. bgs)
Precipitation (inches) / VOC Concentrations (ug/L)
1250
1200
1150
1100
1050
1000
950
900
35
30
25
20
15
10
5
0
Sep-03 Mar-04 Sep-04 Mar-05 Aug-05 Feb-06 Aug-06 Feb-07 Aug-07 Feb-08 Aug-08 Feb-09 Aug-09 Feb-10 Aug-10 Jan-11 Jul-11 Jan-12 Jul-12 Jan-13 Jul-13 Jan-14
Date
Groundwater Elevation (ft. bgs)
Daily Precipitation (inches)
PCE
TCE
cis-1,2-DCE
trans-1,2-DCE


WB04-CC01
(439-469 feet bgs)
Groundwater Elevation (ft. bgs)
Precipitation (inches) / VOC Concentrations (ug/L)
1250
1200
1150
1100
1050
1000
950
900
35
30
25
20
15
10
5
0
Sep-03 Mar-04 Sep-04 Mar-05 Aug-05 Feb-06 Aug-06 Feb-07 Aug-07 Feb-08 Aug-08 Feb-09 Aug-09 Feb-10 Aug-10 Jan-11 Jul-11 Jan-12 Jul-12 Jan-13 Jul-13 Jan-14
Date
Groundwater Elevation (ft. bgs)
Daily Precipitation (inches)
PCE
TCE
cis-1,2-DCE
trans-1,2-DCE


WB04-CC02
(474-490 feet bgs)
Groundwater Elevation (ft. bgs)
Precipitation (inches) / VOC Concentrations (ug/L)
1250
1200
1150
1100
1050
1000
950
900
35
30
25
20
15
10
5
0
Sep-03 Mar-04 Sep-04 Mar-05 Aug-05 Feb-06 Aug-06 Feb-07 Aug-07 Feb-08 Aug-08 Feb-09 Aug-09 Feb-10 Aug-10 Jan-11 Jul-11 Jan-12 Jul-12 Jan-13 Jul-13 Jan-14
Date
Groundwater Elevation (ft. bgs)
Daily Precipitation (inches)
PCE
TCE
cis-1,2-DCE
trans-1,2-DCE

APPENDIX E

DROUGHT CONTINGENCY PLAN TRIGGERS

CSSA Trigger Levels

CSSA's trigger levels will be implemented when more than one well meets the stage condition requirements for three (3) consecutive days.

Drought Stages Based on CS-MW18-LGR		
Stage 0	Well water level <250' as measured from top of the well	**<250'**
Stage I	Well water level at or below 250' as measured from top of well	**250'**
Stage II	Well water level at or below 345' as measured from top of well	**345'**
Stage III	Well water level at or below 355' as measured from top of well	**355'**
Stage IV	Not a potable water well – Stage IV not established	**N/A**

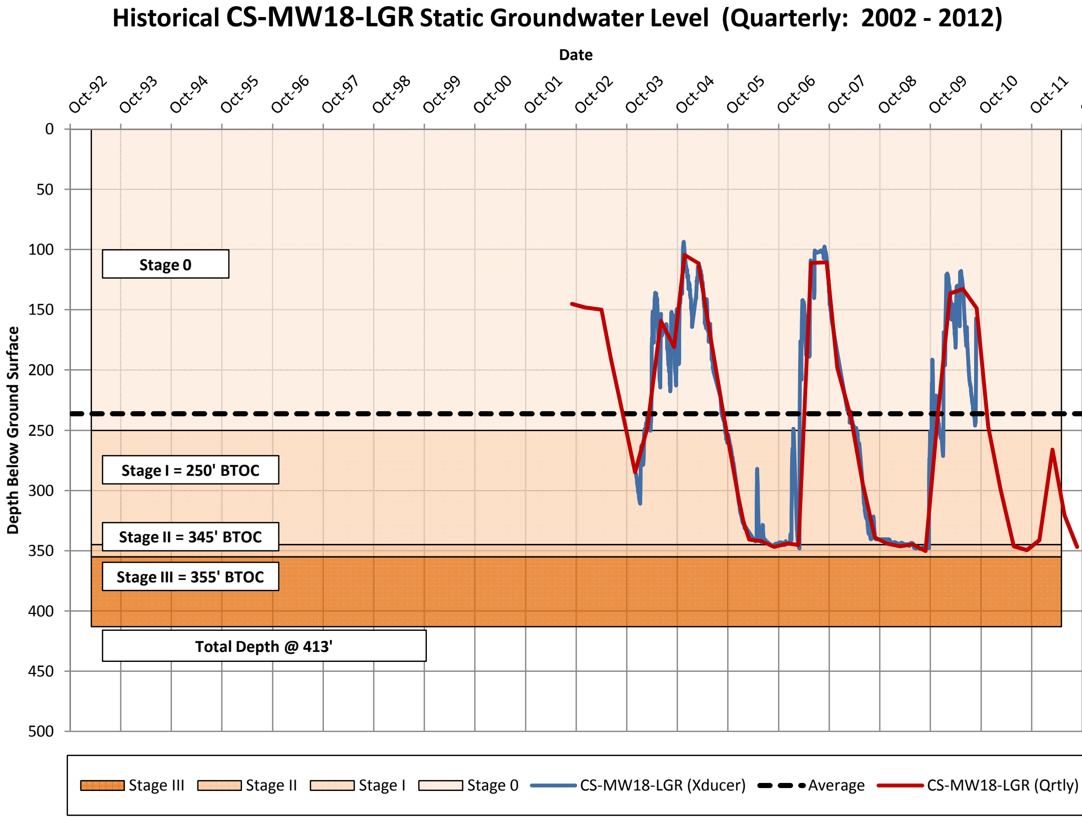
Drought Stages Based on Well 1		
Stage 0	Well water level <165' as measured from top of the well	**<165'**
Stage I	Well water level at or below 165' as measured from top of well	**165'**
Stage II	Well water level at or below 186' as measured from top of well	**186'**
Stage III	Well water level at or below 270' as measured from top of well	**270'**
Stage IV	Well water level 30' above the pump – **Critical Water Level**	**370'**
Pump		**400'**

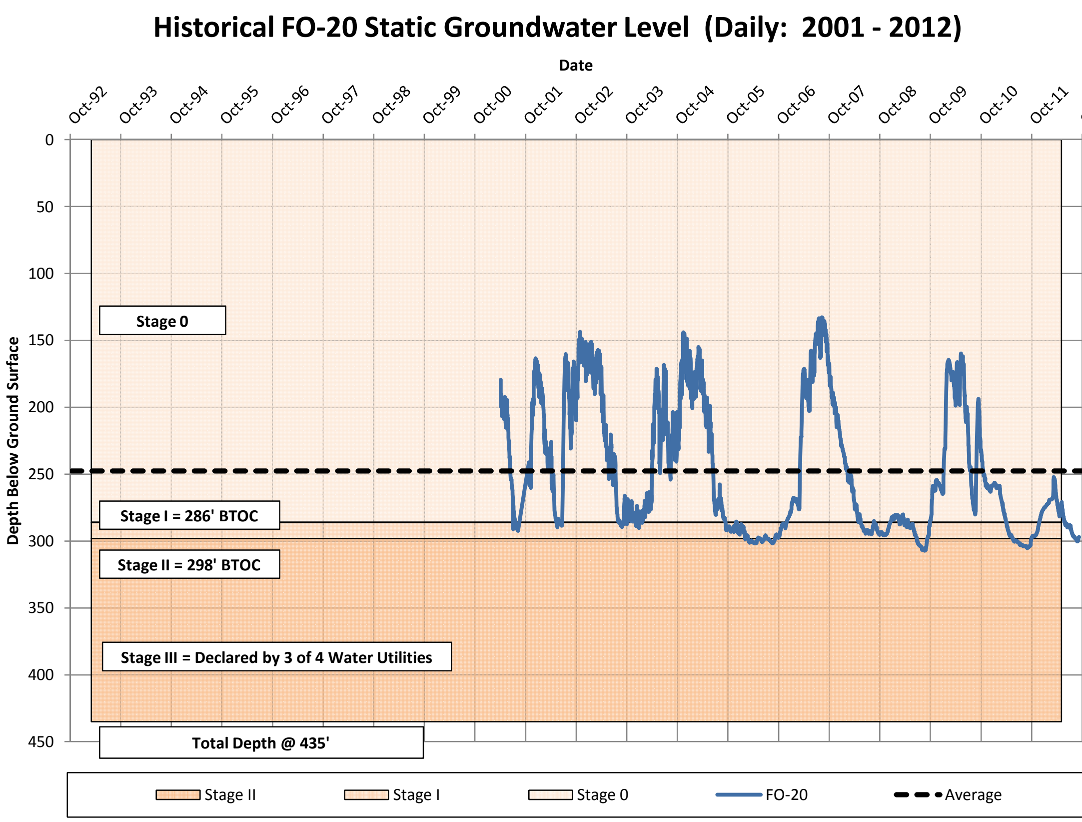
Drought Stages Based on Well 10		
Stage 0	Well water level <322' as measured from top of the well	**<322'**
Stage I	Well water level at or below 322' as measured from top of well	**322'**
Stage II	Well water level at or below 357' as measured from top of well	**357'**
Stage III	Well water level at or below 397' as measured from top of well	**397'**
Stage IV	Well water level 30' above the pump – **Critical Water Level**	**524'**
Pump		**554'**

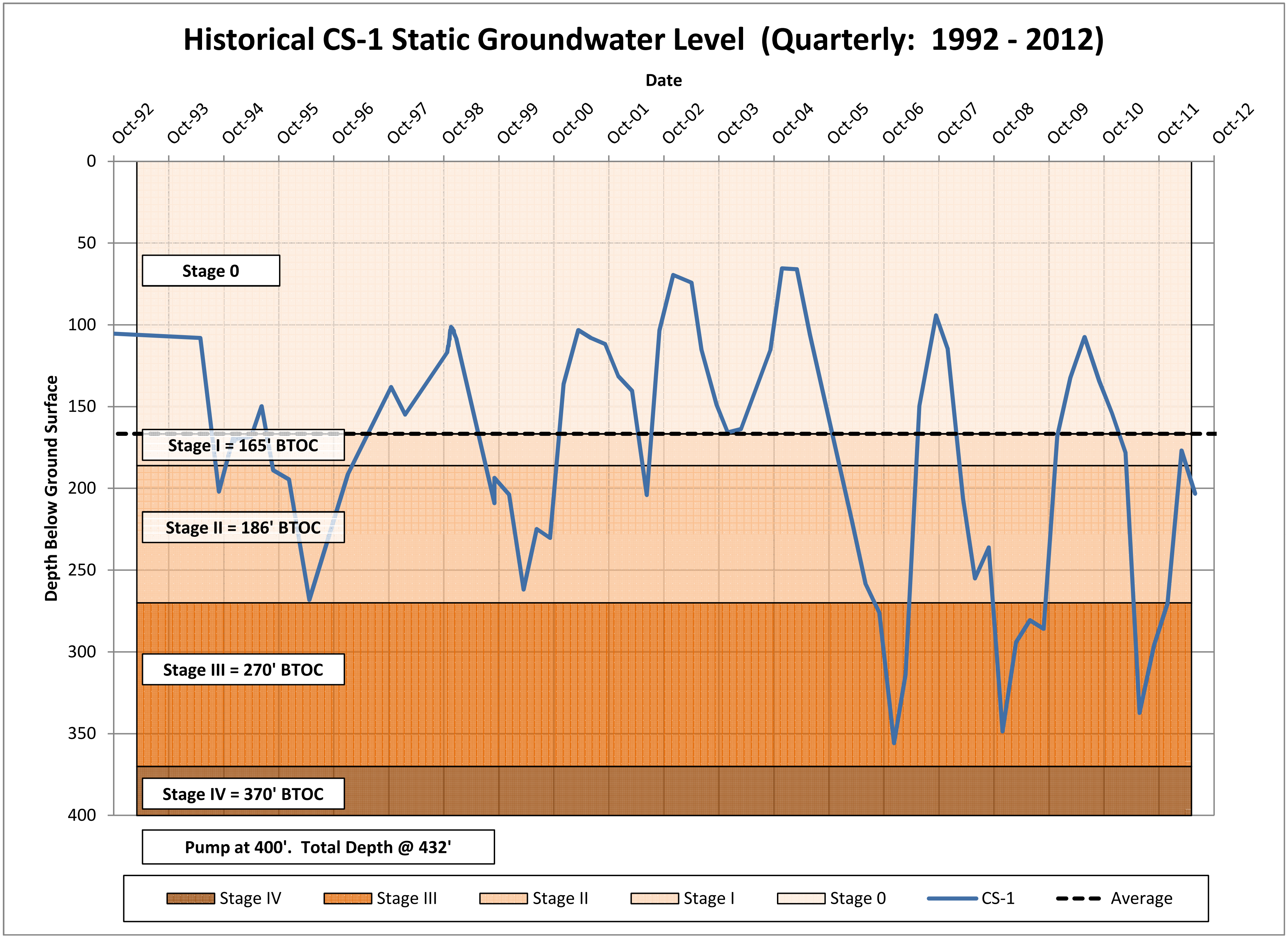
Drought Stages Based on Well 12		
Stage 0	Well water level <230' as measured from top of the well	**<230'**
Stage I	Well water level at or below 230' as measured from top of well	**230'**
Stage II	Well water level at or below 251' as measured from top of well	**251'**
Stage III	Well water level at or below 290' as measured from top of well	**290'**
Stage IV	Well water level 30' above the pump – **Critical Water Level**	**415'**
Pump		**445'**

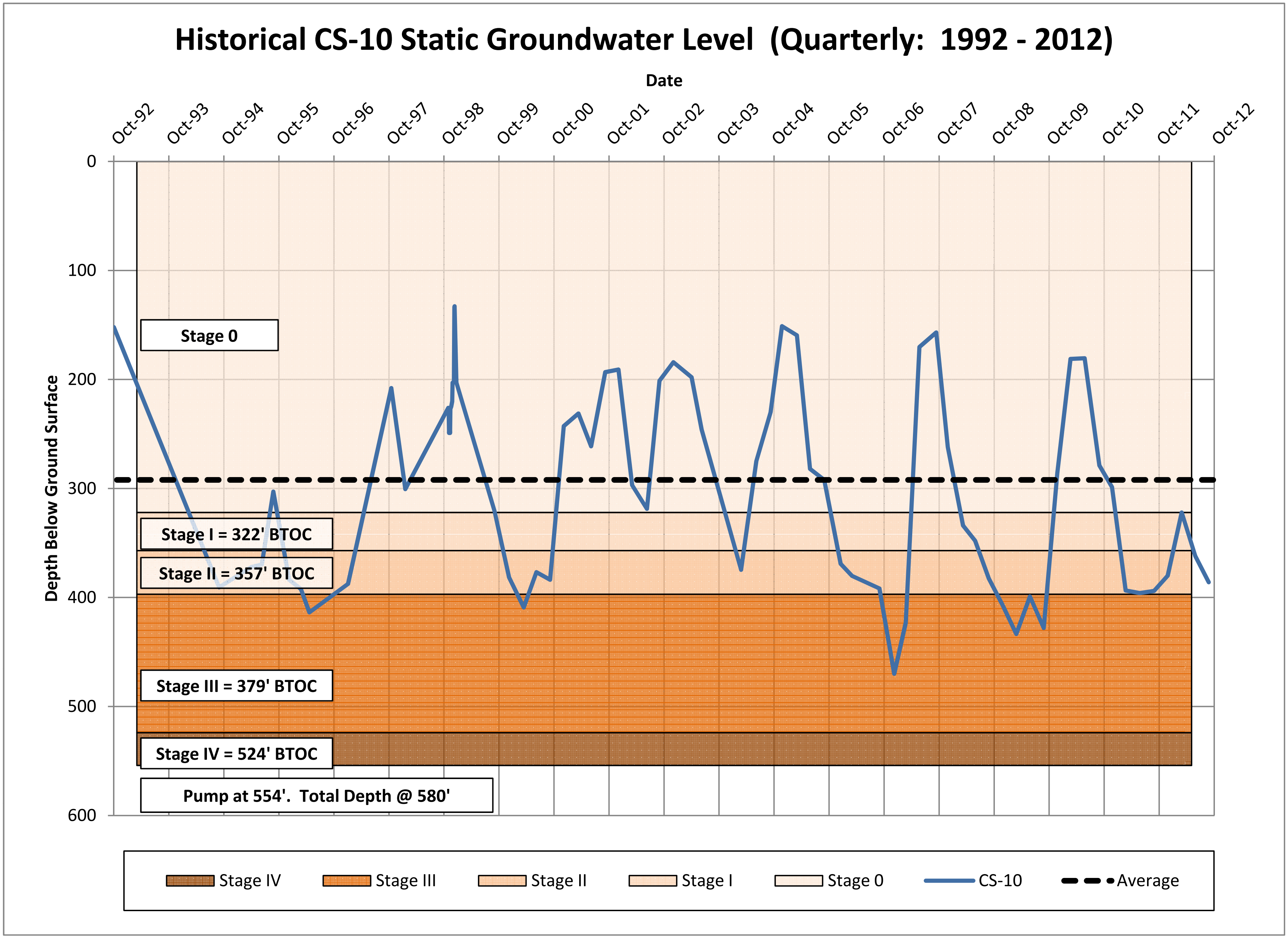
Drought Stages Based on Reservoir		
Stage IV	Storage Capacity of Reservoir Drops below 80% – **Critical Water Level**	**<80% of Full**

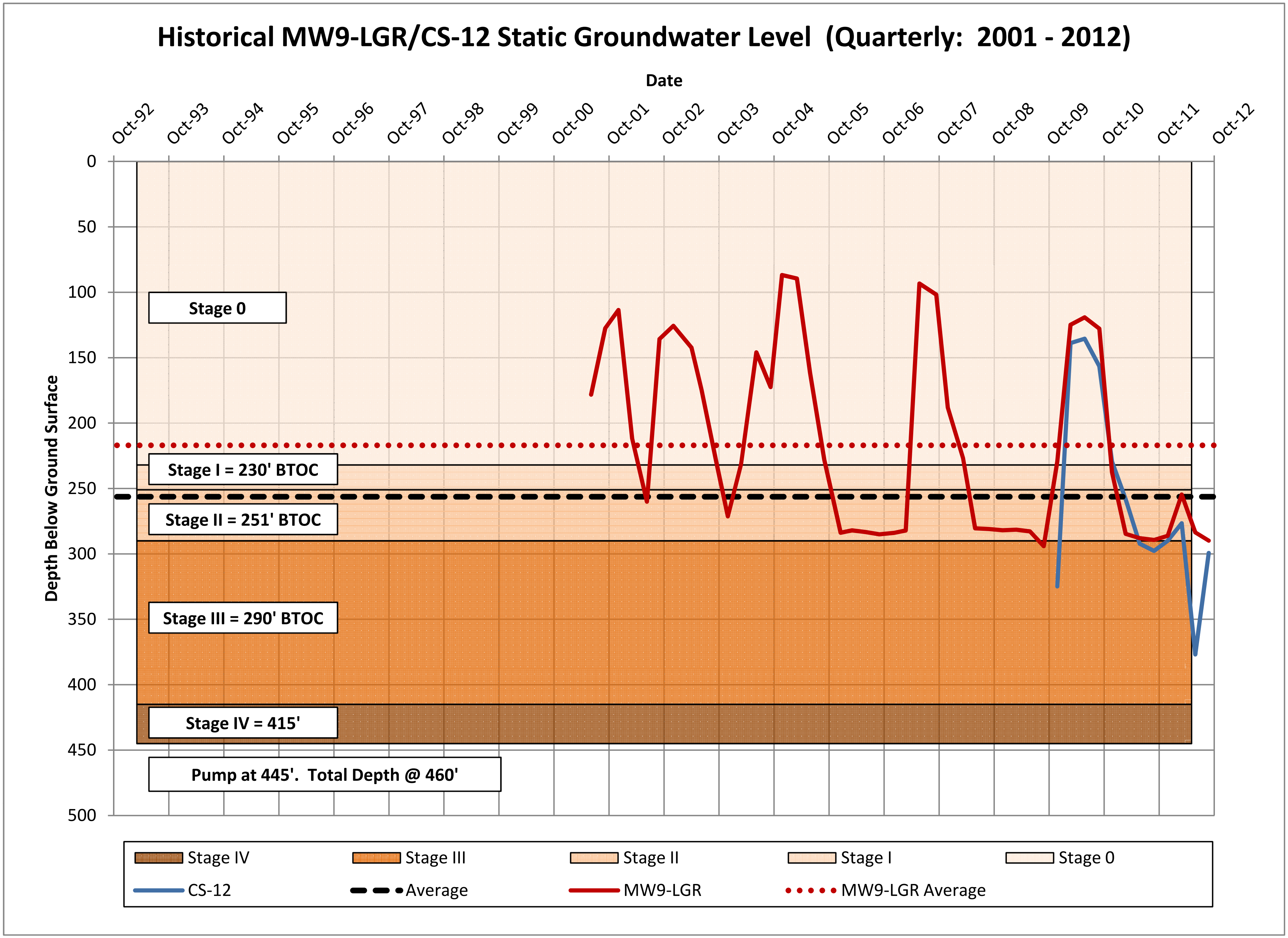
Comparison of Drought Trigger Levels
CSSA CS-MW18-LGR vs. Fair Oaks #20 (TGRGCD)






Historical CS-1 Static Groundwater Level (Quarterly: 1992 - 2012)
Date
Oct-92
Oct-93
Oct-94
Oct-95
Oct-96
Oct-97
Oct-98
Oct-99
Oct-00
Oct-01
Oct-02
Oct-03
Oct-04
Oct-05
Oct-06
Oct-07
Oct-08
Oct-09
Oct-10
Oct-11
Oct-12
Depth Below Ground Surface
0
50
100
150
200
250
300
350
400
Stage 0
Stage I = 165' BTOC
Stage II = 186' BTOC
Stage III = 270' BTOC
Stage IV = 370' BTOC
Pump at 400'. Total Depth @ 432'
Stage IV
Stage III
Stage II
Stage I
Stage 0
CS-1
Average


Historical CS-10 Static Groundwater Level (Quarterly: 1992 - 2012)
Date
Oct-92
Oct-93
Oct-94
Oct-95
Oct-96
Oct-97
Oct-98
Oct-99
Oct-00
Oct-01
Oct-02
Oct-03
Oct-04
Oct-05
Oct-06
Oct-07
Oct-08
Oct-09
Oct-10
Oct-11
Oct-12
Depth Below Ground Surface
0
100
200
300
400
500
600
Stage 0
Stage I = 322' BTOC
Stage II = 357' BTOC
Stage III = 379' BTOC
Stage IV = 524' BTOC
Pump at 554'. Total Depth @ 580'
Stage IV
Stage III
Stage II
Stage I
Stage 0
CS-10
Average



Historical MW9-LGR/CS-12 Static Groundwater Level (Quarterly: 2001 - 2012)
Date
Oct-92
Oct-93
Oct-94
Oct-95
Oct-96
Oct-97
Oct-98
Oct-99
Oct-00
Oct-01
Oct-02
Oct-03
Oct-04
Oct-05
Oct-06
Oct-07
Oct-08
Oct-09
Oct-10
Oct-11
Oct-12
Depth Below Ground Surface
0
50
100
150
200
250
300
350
400
450
500
Stage 0
Stage I = 230' BTOC
Stage II = 251' BTOC
Stage III = 290' BTOC
Stage IV = 415'
Pump at 445'. Total Depth @ 460'
Stage IV
Stage III
Stage II
Stage I
Stage 0
CS-12
Average
MW9-LGR
MW9-LGR Average

CSSA Drought Stage Requirements

STAGE I: MODERATE DROUGHT

Water Use Restrictions: Persons using groundwater are encouraged to follow these water use restrictions:

1. Watering with an irrigation system or sprinkler should be limited to only once a week before 10 a.m. or after 8 p.m. on the designated watering day as determined by address (**at CSSA the last digit of the quarters number will be used to determine the date**):

Last Digit of Residence	Day
0 or 1	Monday
2 or 3	Tuesday
4 or 5	Wednesday
6 or 7	Thursday
8 or 9	Friday

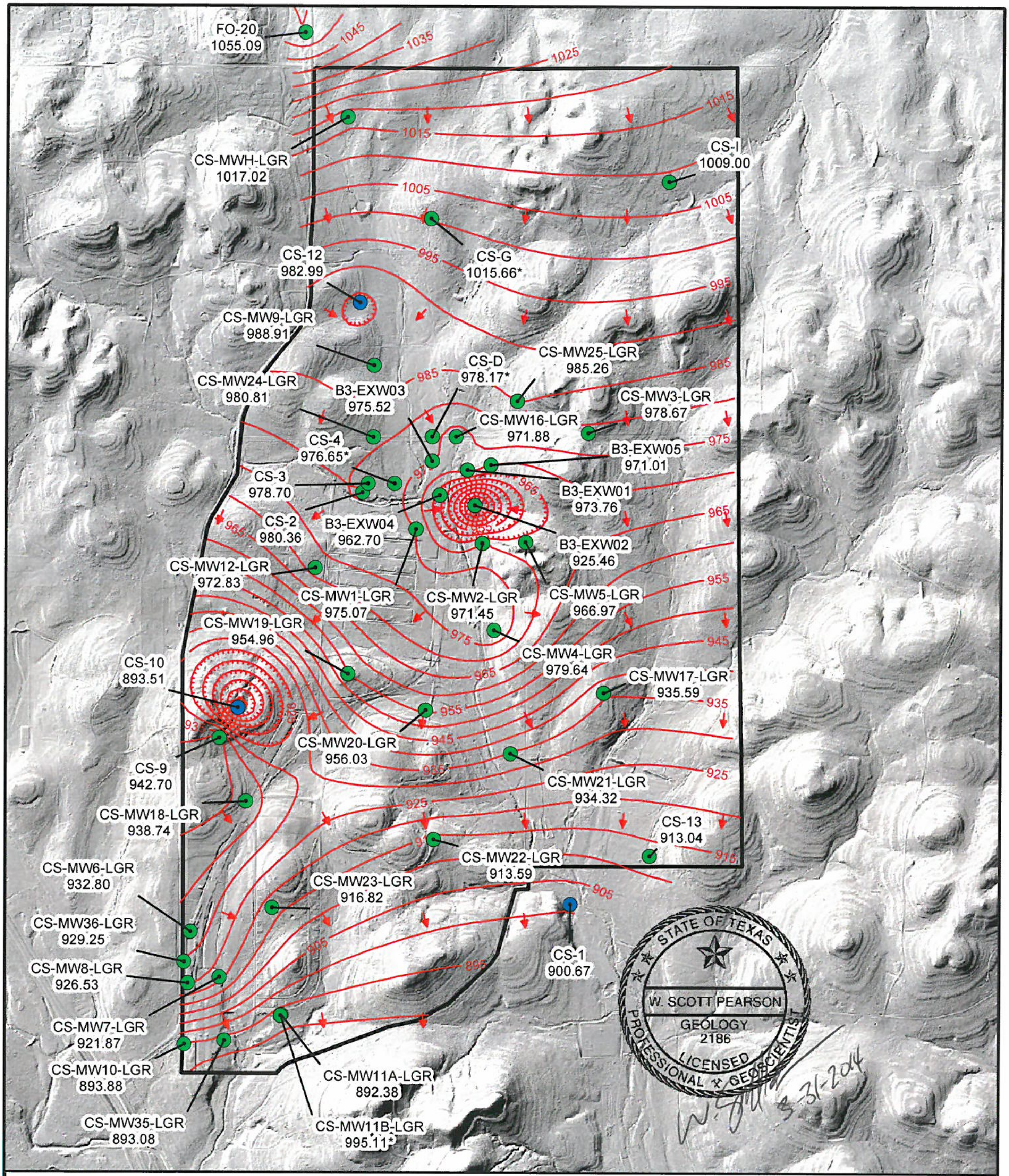
2. Areas such as medians and common areas (Gate 2), which are not represented by an address, shall water only once a week before 10 a.m. or after 8 p.m. on Wednesdays.
3. Users shall reduce their water usage by 5% of the same calendar month during the previous calendar year. Reduction will be based on reported monthly usage for the prior year's same month.
4. The swimming pool should have a minimum of 25 percent of the surface area covered with evaporation screens when not in use. Inflatable pool toys or floating decorations may be used.
5. Hand watering with a hand-held hose, soaker hose, drip irrigation, bucket or watering can is encouraged any time and any day.
6. Washing impervious cover such as parking lots, driveways, streets or sidewalks is prohibited if the water is allowed to run into the street or enter a drain or drainage channel.
7. Residential washing of vehicles or other equipment should be done only on assigned watering days and times. A hose with an automatic shut-off nozzle or bucket of five gallons or less should be used. Water should not be allowed to run into the street or drain.
8. The use of commercial car wash facilities that recycle water is encouraged.

STAGE II: SEVERE DROUGHT
Water Use Restrictions: All requirements of Stage I should remain in effect during Stage II with the following modifications applicable to persons using groundwater:
1. Aesthetic fountains are discouraged, unless an alternative source of water other than groundwater is used. 2. Watering with a hand-held hose or drip irrigation during the hours of 3 a.m. to 8 a.m. and 8 p.m. to 10 p.m. any day is encouraged. 3. Watering with an irrigation system or sprinkler permitted only once a week on the designated watering day during the hours of 3 a.m. to 8 a.m. and 8 p.m. to 10 p.m. is encouraged: Designated watering days will be determined by the last digit of the address (**at CSSA the last digit of the quarters number will be used to determine the date**). The designated watering day chart is identified in Stage I of this plan. 4. Areas such as medians and common areas, which are not represented by an address, shall water only once a week before during the hours of 3 a.m. to 8 a.m. and 8 p.m. to 10 p.m. on Wednesdays. 5. Users shall reduce their water usage by 10% of the same calendar month during the previous calendar year. Reduction will be based on reported monthly usage for the prior year's same month. 6. Residential, commercial, industrial, and agricultural Trinity Aquifer water users should use common sense and best practices to avoid water waste and to practice water conservation and to minimize or discontinue use of water for non-essential purposes.
STAGE III: EXTREME DROUGHT
Water Use Restrictions: All requirements of Stage I and II should remain in effect during Stage III with the following modifications applicable to persons using groundwater:
1. Users shall reduce their water usage by 15% of the same calendar month during the previous calendar year. Reduction will be based on reported monthly usage for the prior year's same month. 2. Watering with an irrigation system is discouraged. 3. Aesthetic fountains are discouraged, unless an alternative source of water other than groundwater is used. 4. Irrigation with a soaker hose, hose-end sprinkler beginning should be limited to the hours between 3:00 a.m. to 8:00 a.m. and 8:00 p.m. to 10:00 p.m. Handheld hose, drip irrigation system or 5 gallon bucket on Tuesdays, Thursdays, and Saturdays during Stage III hours is encouraged. 5. Watering newly planted landscapes permitted only with a variance from the D/AMMA.

STAGE IV: CRITICAL DROUGHT
Target: **Achieve a 50 percent reduction in daily demand.** ***Water Use Restrictions: All requirements of Stage I,II2, and III should remain in effect during Stage IV with the following modifications applicable to persons using groundwater:***
1. CSSA shall visually inspect lines and repair leaks on a daily basis. 2. Flushing is prohibited except for dead end mains and only between the hours of 9:00 p.m. and 3:00 a.m. 3. Emergency interconnects or alternative supply arrangements shall be initiated. 4. All meters shall be read as often as necessary to insure compliance with this program for the benefit of all the customers. 5. Only mission essential activities involving live fire and testing will be conducted. 6. Water usage for construction activities will cease. 7. Irrigation of landscaped areas is absolutely prohibited. 8. Use of water to wash any motor vehicle, motorbike, boat, trailer, airplane or other vehicle is absolutely prohibited. 9. Filling of the swimming pool is prohibited. 10. No filling of surface impoundments (reservoirs/tanks) or wildlife troughs. 11. Use of water to wash down any sidewalks, walkways, driveways, parking lots, tennis courts, or other hard-surfaced areas except for the protection of public health, safety and welfare. 12. Use of water to wash down buildings or structures for purposes other than immediate fire protection or for the protection of public health, safety and welfare.

APPENDIX F

POTENTIOMETRIC MAPS FOR MARCH, JUNE, SEPTEMBER, DECEMBER 2013



N
W E
S

0 1,200 2,400 3,600 4,800 Feet

Flow direction

Outer fence

LGR Groundwater Contours

LGR Wells and groundwater elevation (ft above msl)

Drinking water wells (may be completed in LGR, BS, and/or CC)

* Not a fully penetrating well into LGR. Groundwater elevation not used in contouring

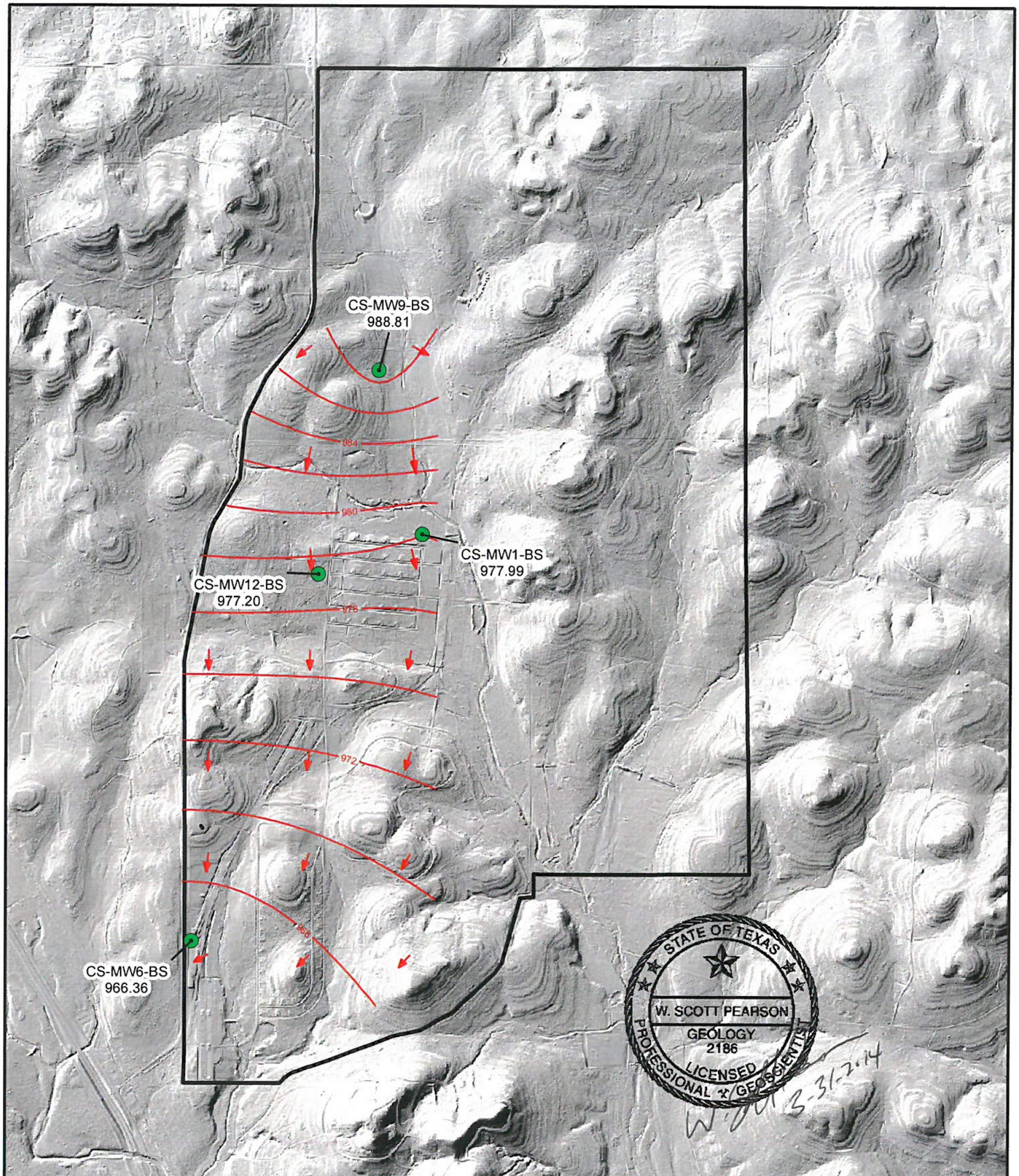
Figure F.1

March 2013 Potentiometric Surface Map, LGR Wells

Camp Stanley Storage Activity

PARSONS

J:\CSSA\GIS\Groundwater\Maps\csm_figs\Mar13_potentiometric_lgr.mxd - 7/15/2013 @ 3:26:18 PM



N

W E

S

0 1,200 2,400 3,600 4,800
Feet

Flow direction

BS Groundwater Contours

Outer fence

BS Wells and groundwater elevation (ft above msl)

Figure F.2

March 2013 Potentiometric Surface Map, BS Wells

Camp Stanley Storage Activity

PARSONS

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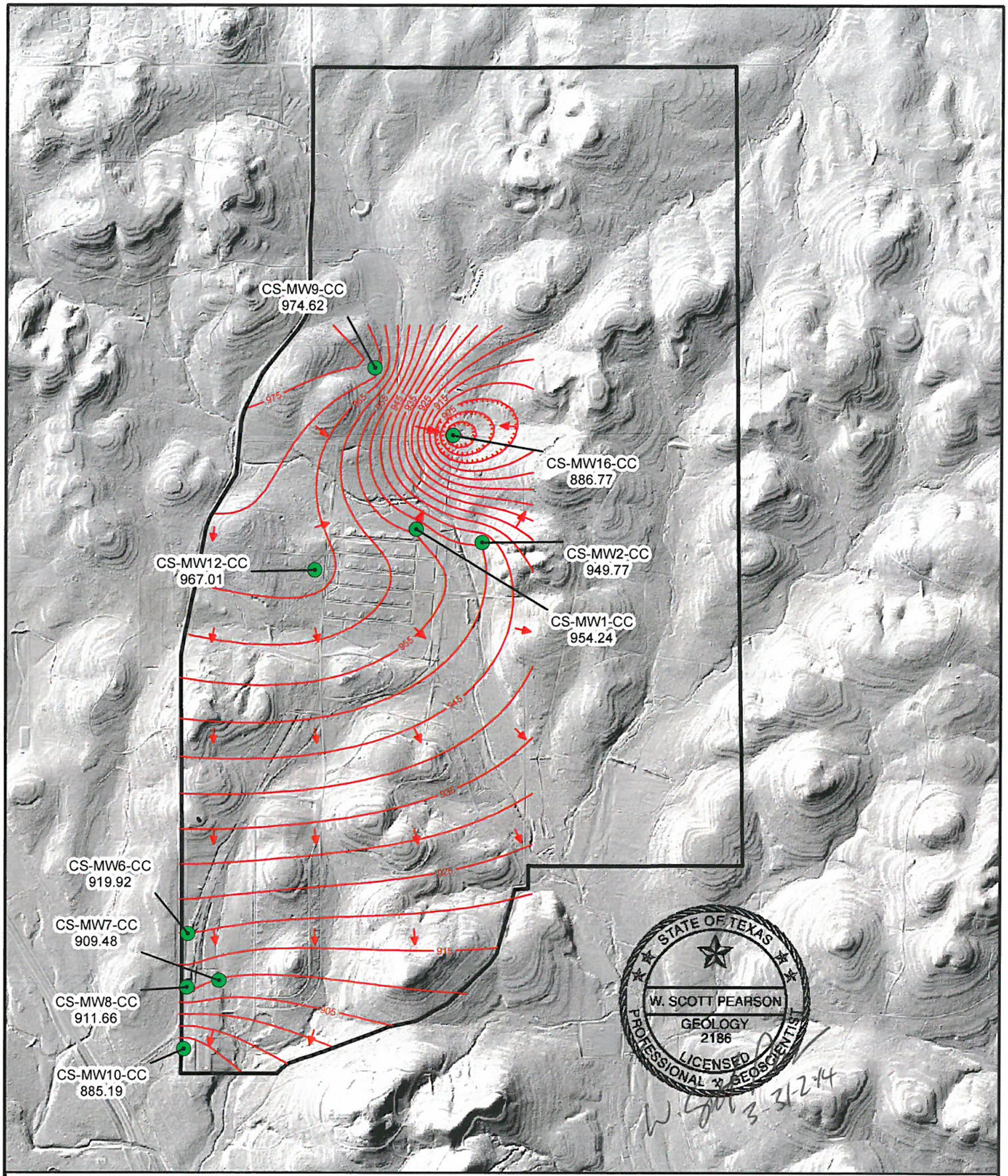

Figure F.3

March 2013 Potentiometric Surface Map, CC Wells

Camp Stanley Storage Activity

PARSONS

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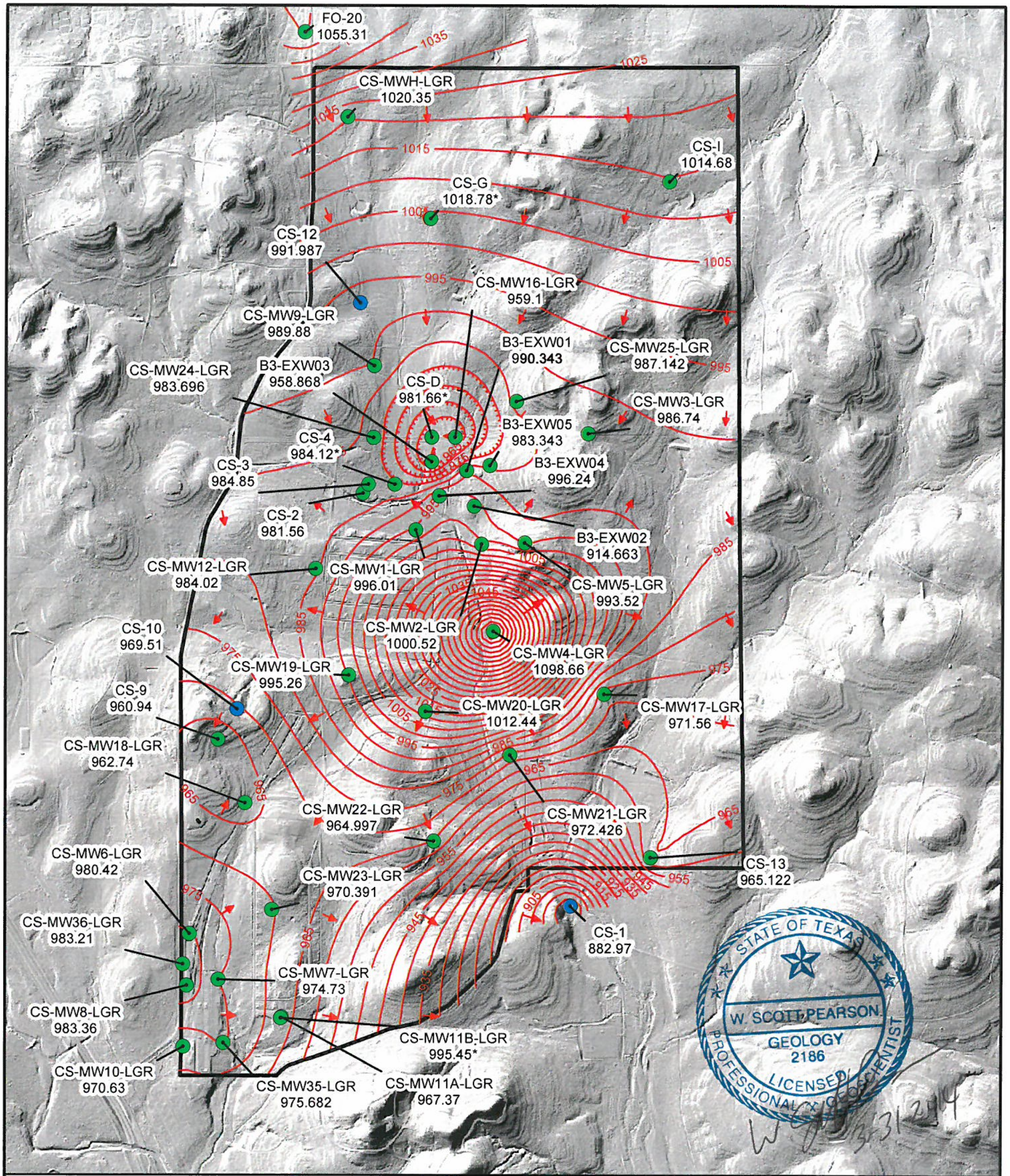

N
W E
S

0 1,200 2,400 3,600 4,800 Feet

Flow direction

Outer fence

LGR Groundwater Contours

LGR Wells and groundwater elevation (ft above msl)

Drinking water wells (may be completed in LGR, BS, and/or CC)

* Not a fully penetrating well into LGR. Groundwater elevation not used in contouring

Figure F.4

June 2013 Potentiometric Surface Map, LGR Wells

Camp Stanley Storage Activity

PARSONS

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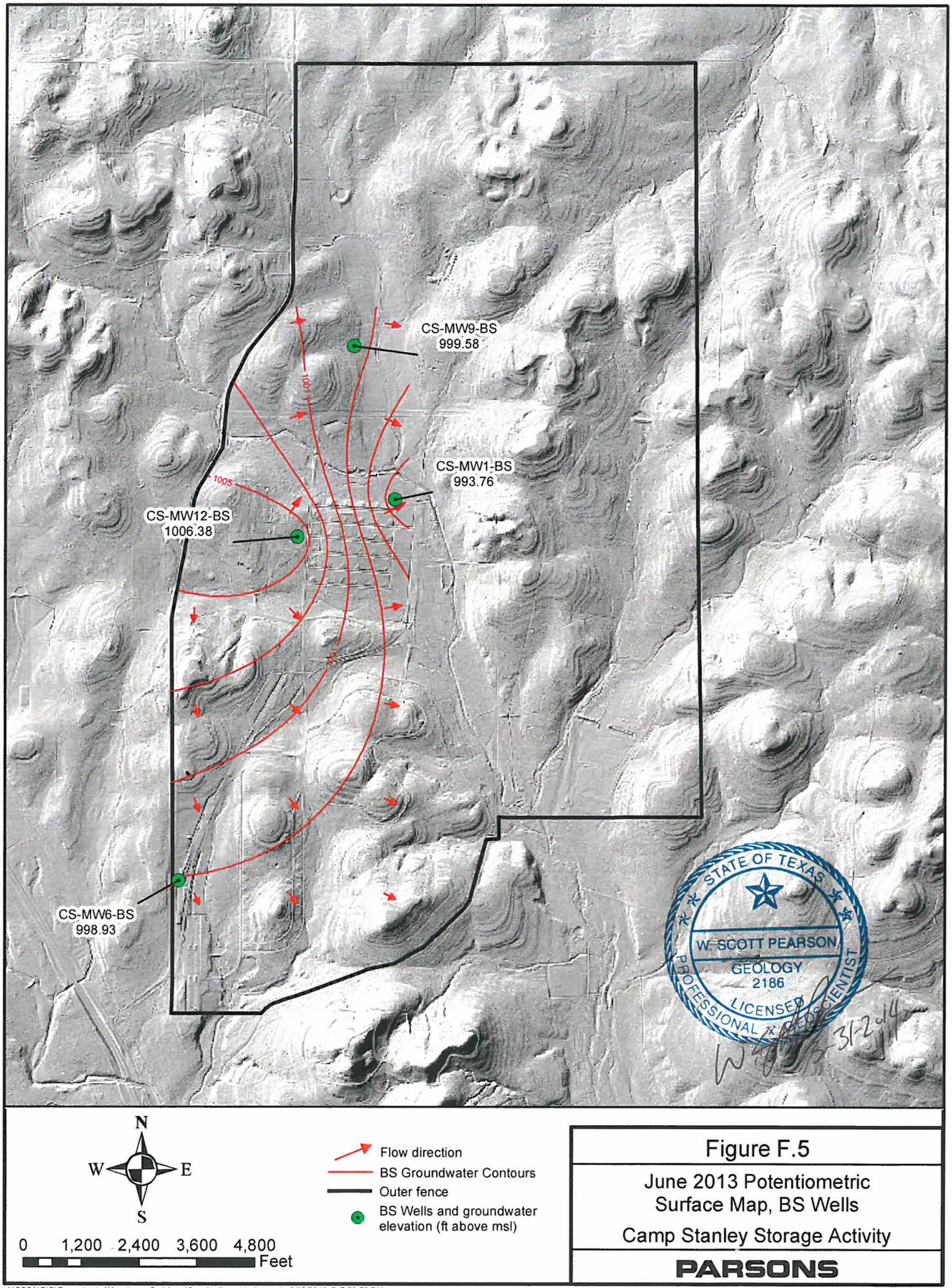

Figure F.5

June 2013 Potentiometric Surface Map, BS Wells

Camp Stanley Storage Activity

PARSONS

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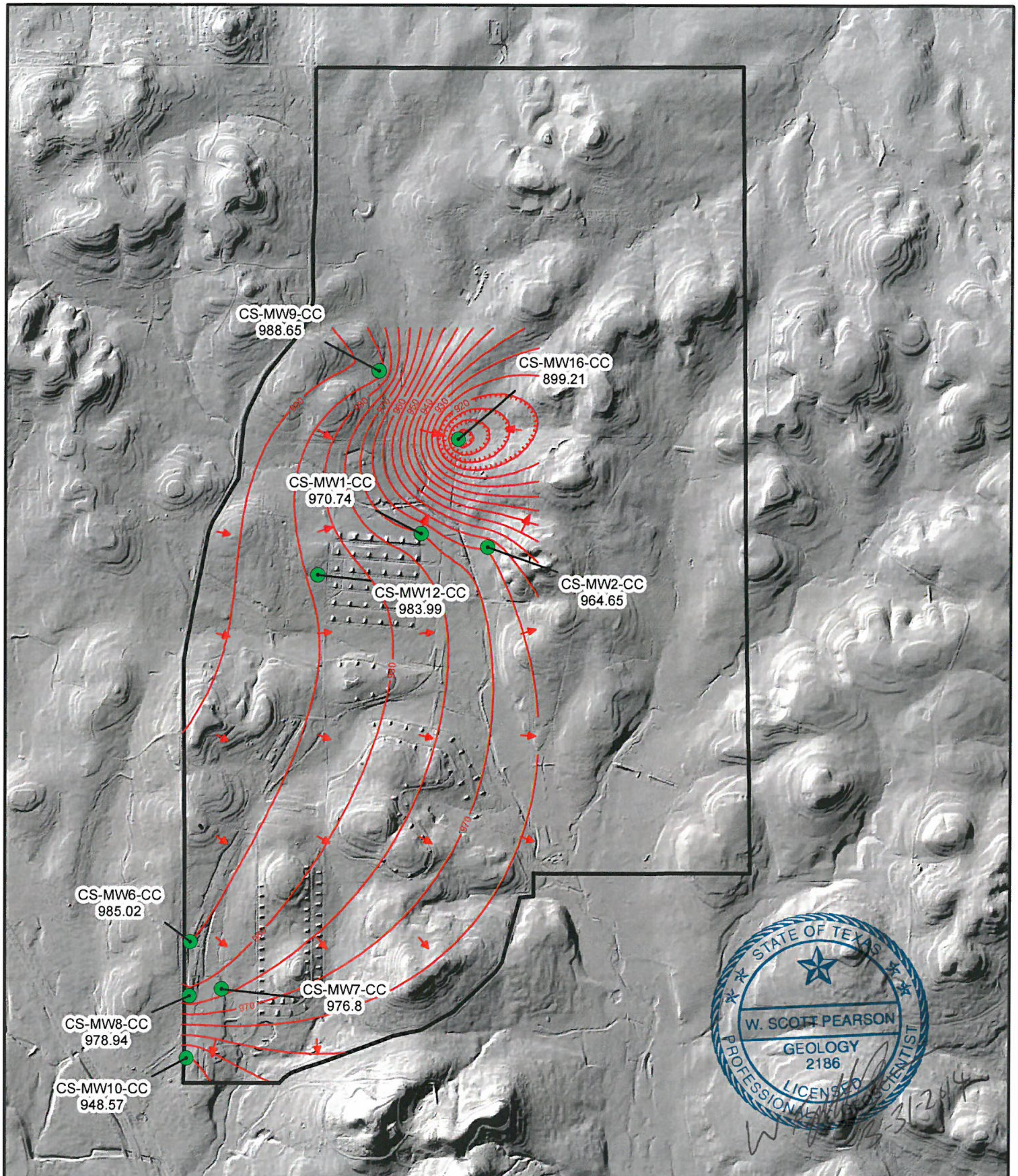


N
W E
S

0 1,200 2,400 3,600 4,800
Feet

- Flow direction
- CC Groundwater Contours
- Outer fence
- CC Wells and groundwater elevation (ft above msl)

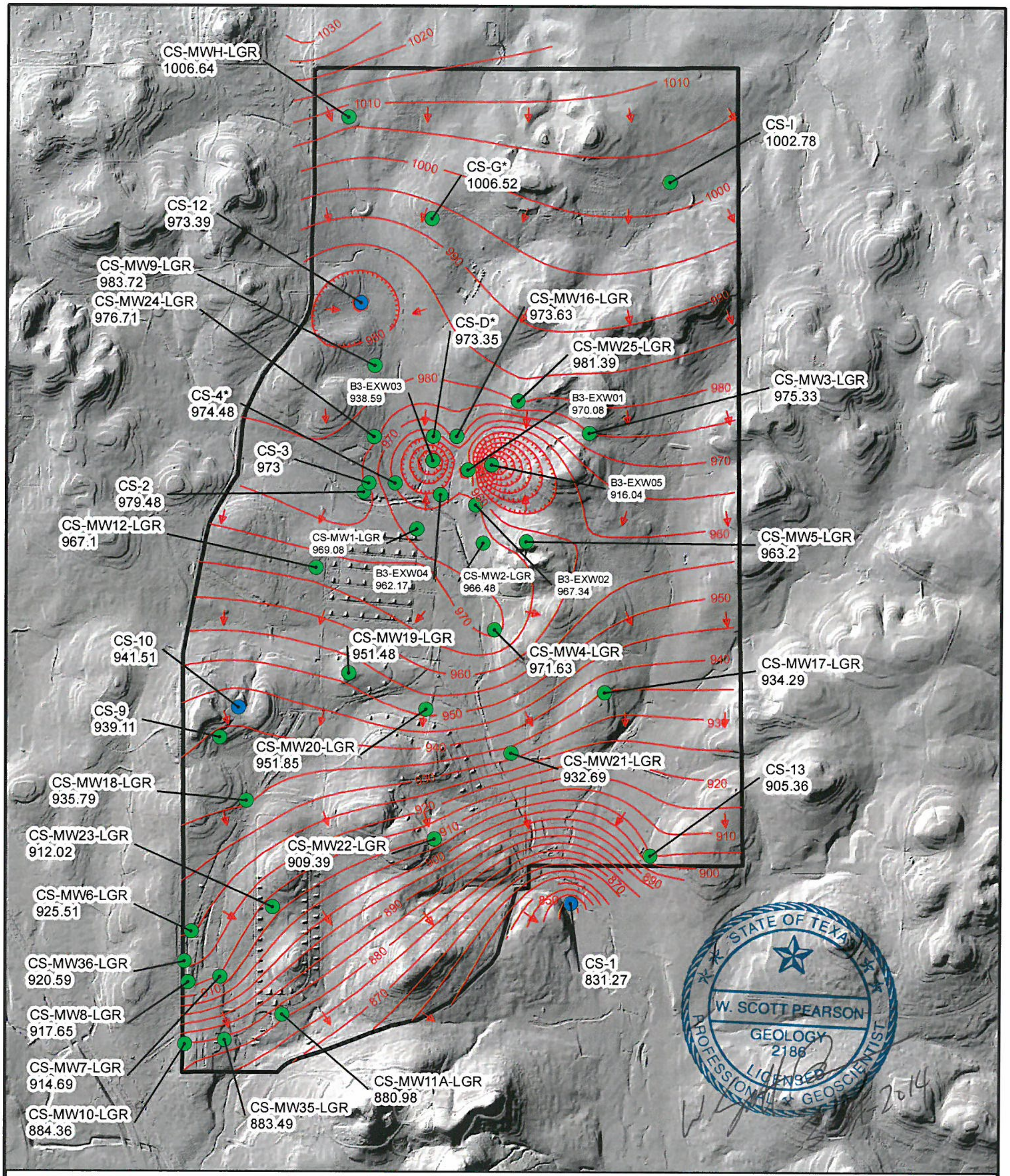
Figure F.6

June 2013 Potentiometric Surface Map, CC Wells

Camp Stanley Storage Activity

PARSONS

J:\CSSA\GIS\Groundwater\Maps\csm_figs\June13_potentiometric_cc.mxd - 3/21/2014 @ 9:50:58 AM



N
W E
S

0 1,200 2,400 3,600 4,800 Feet

Flow direction — LGR Groundwater Contours

Outer fence — LGR Wells and groundwater elevation (ft above msl)

Drinking water wells (may be completed in LGR, BS, and/or CC)

* Not a fully penetrating well into LGR. Groundwater elevation not used in contouring

Figure F.7

September 2013 Potentiometric Surface Map, LGR Wells

Camp Stanley Storage Activity

PARSONS

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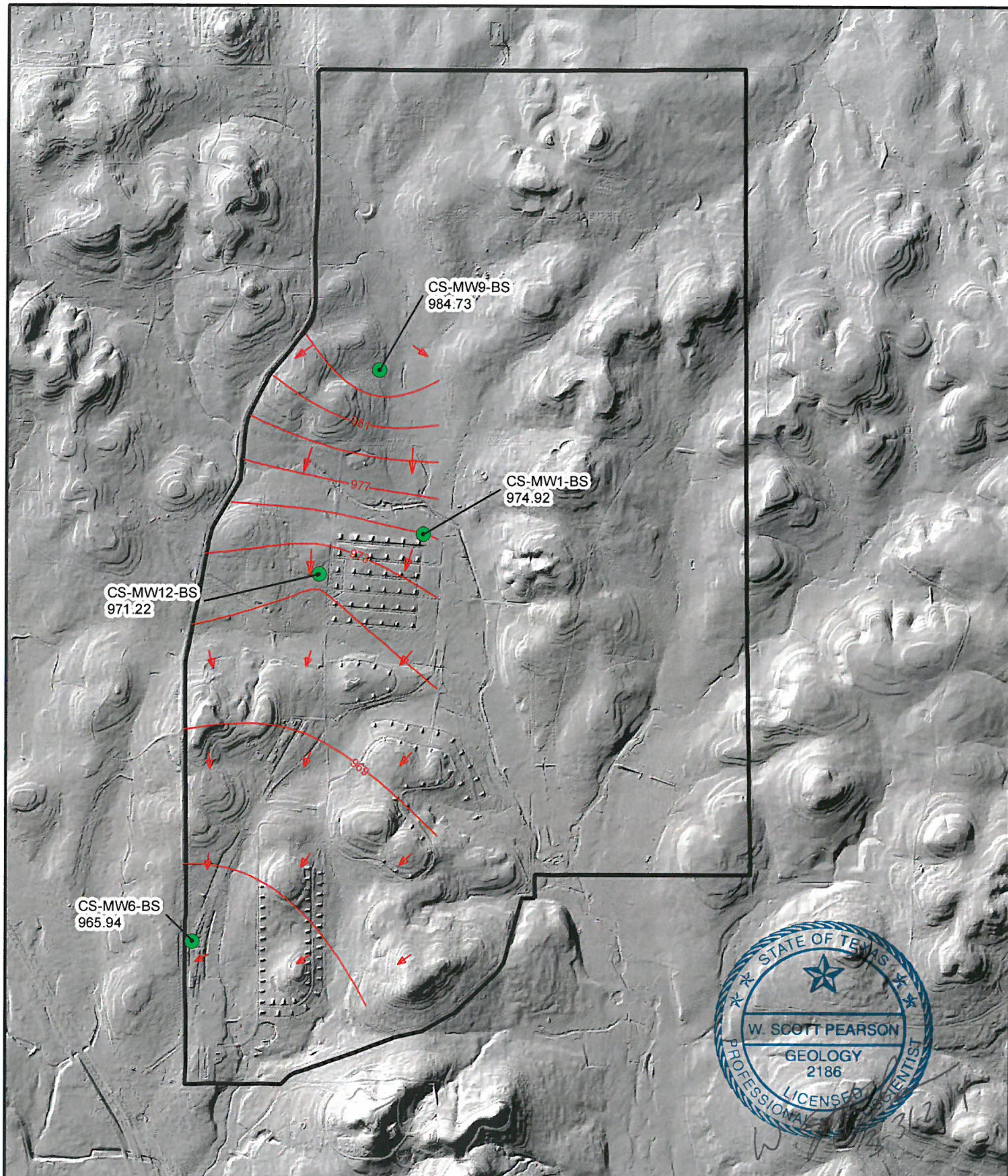

N
W E
S

0 1,200 2,400 3,600 4,800
Feet

Flow direction
BS Groundwater Contours
Outer fence
BS Wells and groundwater elevation (ft above msl)

Figure F.8

September 2013 Potentiometric Surface Map, BS Wells

Camp Stanley Storage Activity

PARSONS

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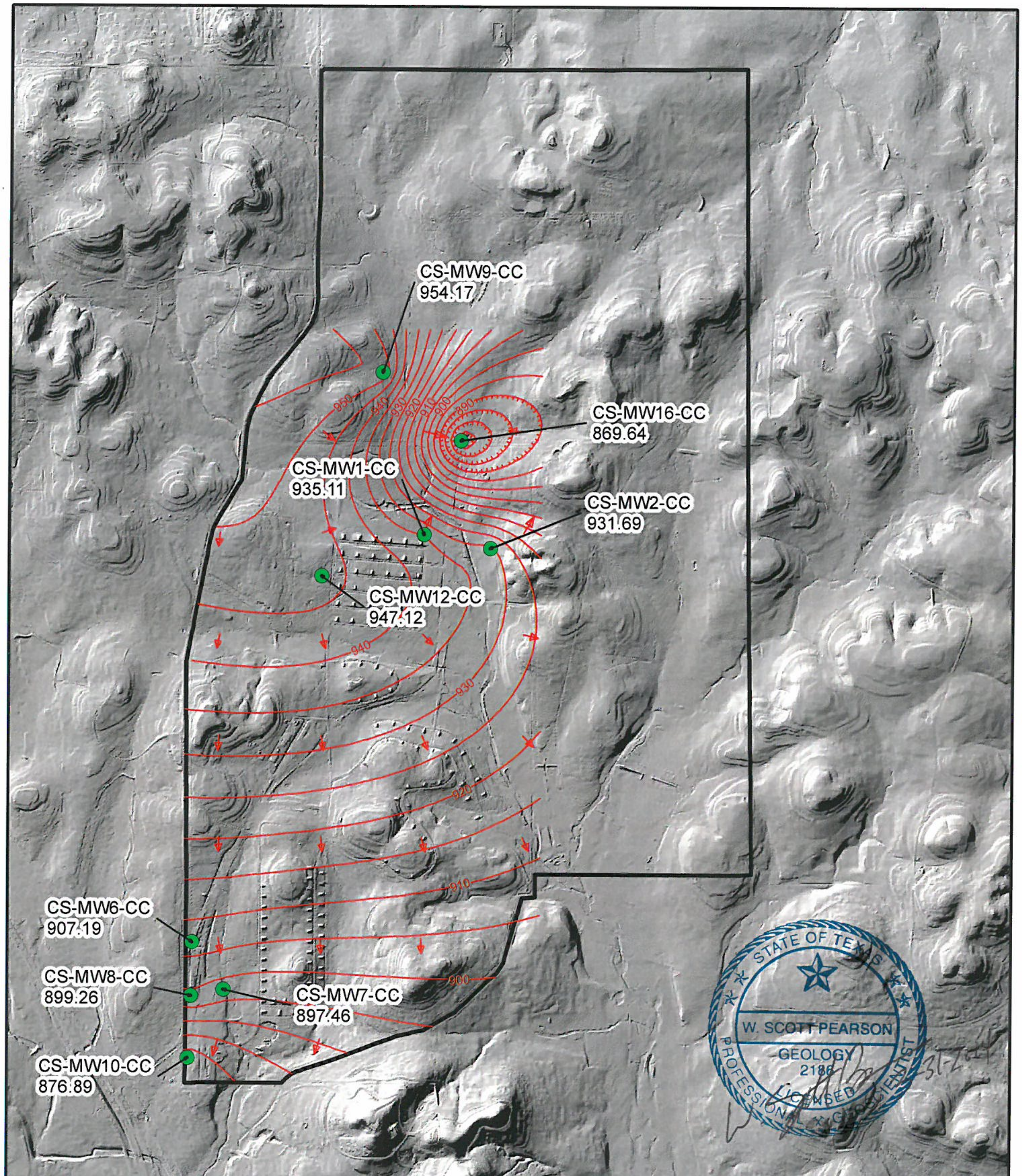

N
W E
S

0 1,200 2,400 3,600 4,800 Feet

- Flow direction
- CC Groundwater Contours
- Outer fence
- CC Wells and groundwater elevation (ft above msl)

Figure F.9

September 2013 Potentiometric Surface Map, CC Wells

Camp Stanley Storage Activity

PARSONS

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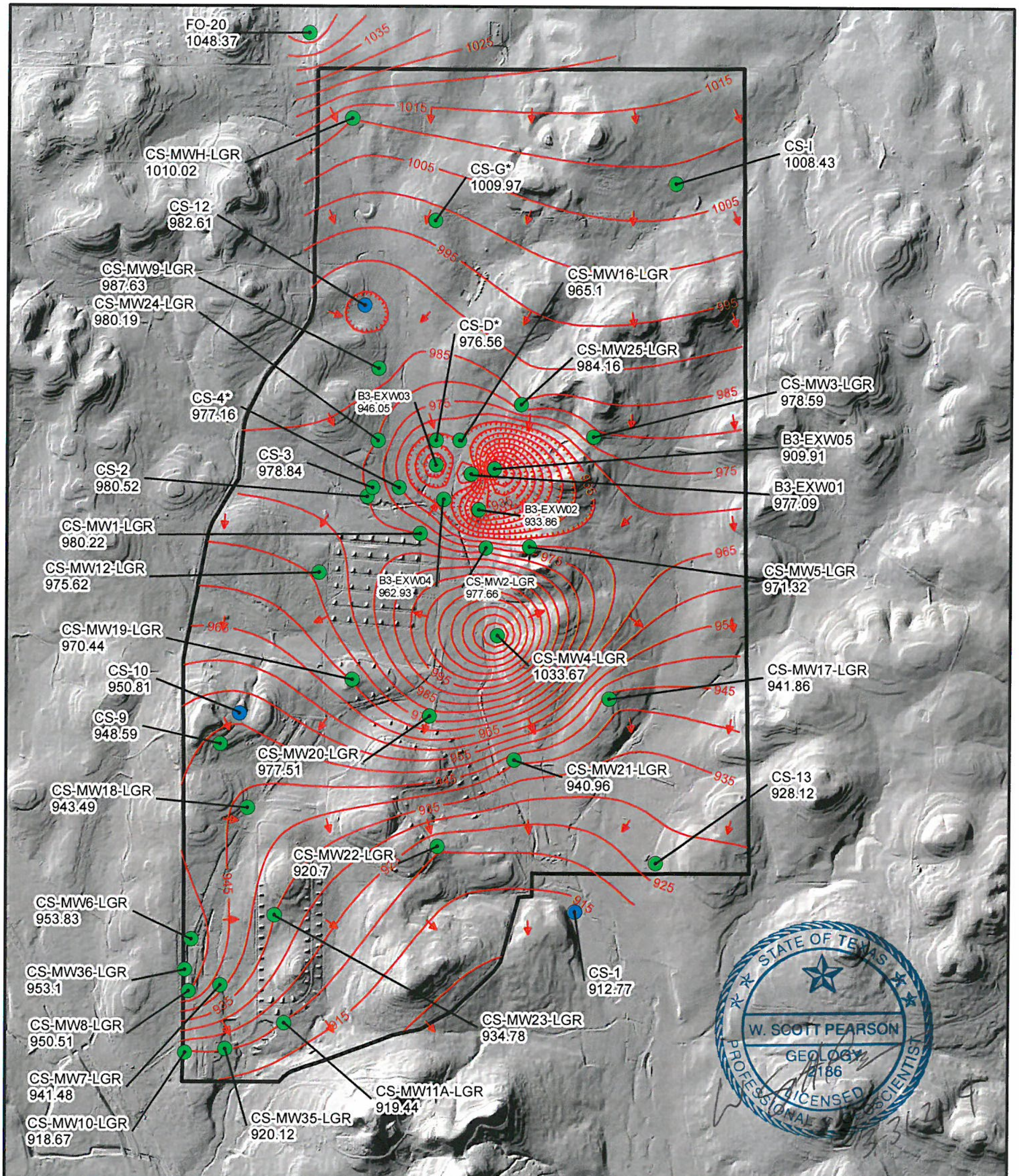


N
W E
S

0 1,200 2,400 3,600 4,800 Feet

Flow direction — LGR Groundwater Contours

Outer fence — LGR Wells and groundwater elevation (ft above msl)

Drinking water wells (may be completed in LGR, BS, and/or CC)

* Not a fully penetrating well into LGR. Groundwater elevation not used in contouring

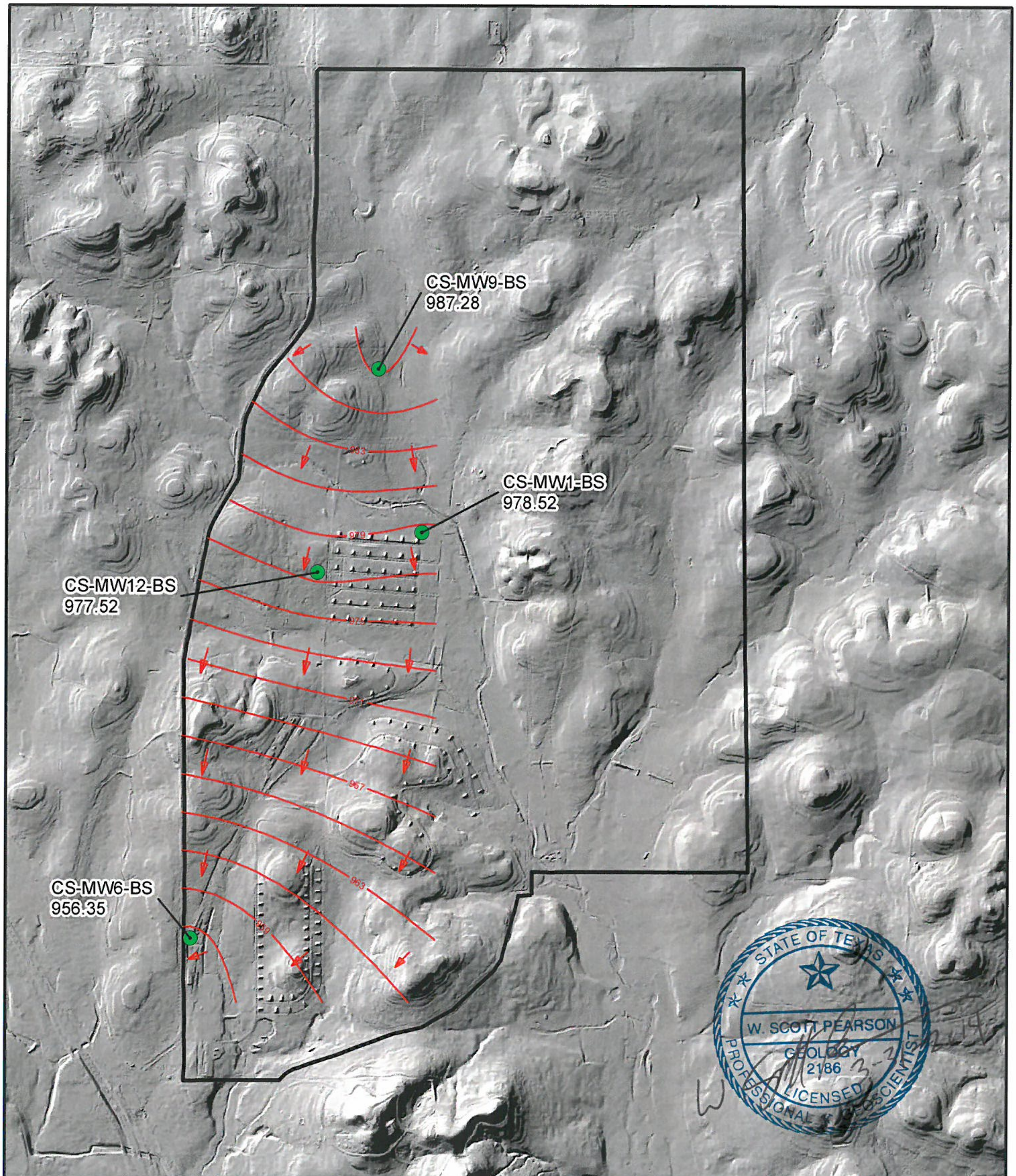
Figure F.10

December 2013 Potentiometric Surface Map, LGR Wells

Camp Stanley Storage Activity

PARSONS

C:\CSSA\GIS\GW_POTENTIOMETRIC\DEC2013\Dec13_potentiometric_lgr_local.mxd - 3/19/2014 @ 2:23:29 PM



N
W E
S

0 1,200 2,400 3,600 4,800
Feet

Flow direction
BS Groundwater Contours
Outer fence
BS Wells and groundwater elevation (ft above msl)

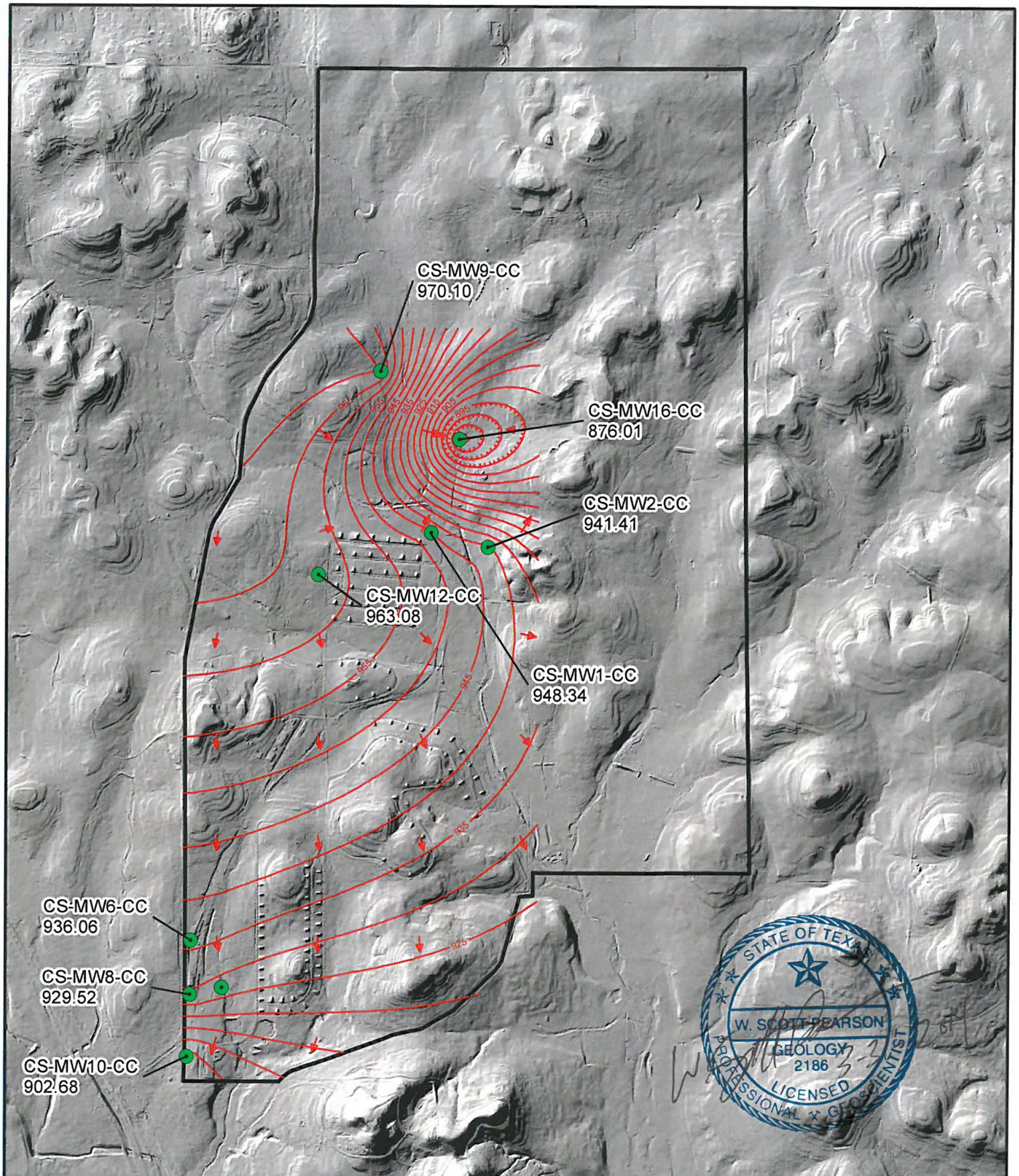
Figure F.11

December 2013 Potentiometric Surface Map, BS Wells

Camp Stanley Storage Activity

PARSONS

C:\CSSA\GIS\GW_POTENTIOMETRIC\DEC2013\Dec13_potentiometric_bs.mxd - 3/19/2014 @ 3:16:18 PM



N
W E
S

0 1,200 2,400 3,600 4,800 Feet

Flow direction
CC Groundwater Contours
Outer fence
CC Wells and groundwater elevation (ft above msl)

Figure F.12

December 2013 Potentiometric Surface Map, CC Wells

Camp Stanley Storage Activity

PARSONS

C:\CSSA\GIS\GW_POTENTIOMETRIC\DEC2013\Dec13_potentiometric_cc.mxd - 3/19/2014 @ 3:53:33 PM

APPENDIX G

2013 QUARTERLY OFF-POST GROUNDWATER ANALYTICAL RESULTS

Appendix G
2013 Quarterly Off-Post Groundwater Monitoring Analytical Results

Well ID	Sample Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	TCE	Vinyl Chloride
BSR-03	9/13/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
BSR-04	9/12/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
FO-8	9/9/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
FO-17	9/9/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
FO-22	9/9/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
FO-J1	9/13/2013	0.12U	0.07U	0.08U	**0.24F**	0.05U	0.08U
HS-1	9/11/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
HS-2	9/11/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
HS-3	9/11/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
I10-2	9/9/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
I10-4	3/12/2013	0.12U	0.07U	0.08U	**4.77**	**2.0**	0.08U
	6/26/2013	0.12U	0.07U	0.08U	**3.88**	**1.6**	0.08U
	9/9/2013	0.12U	0.07U	0.08U	**3.36**	**1.7**	0.08U
	12/9/2013	0.12U	0.07U	0.08U	**4.04**	**1.6**	0.08U
I10-5	9/9/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
I10-7	9/9/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
I10-8	9/10/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
Duplicate	9/10/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
I10-10	9/11/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
JW-5	9/10/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
JW-6	9/10/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
Duplicate	9/10/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
JW-7	9/10/2013	0.12U	0.07U	0.08U	**0.32F**	0.05U	0.08U
JW-8	9/11/2013	0.12U	0.07U	0.08U	**0.26F**	0.05U	0.08U
JW-9	9/13/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
JW-13	9/11/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
JW-15	9/11/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
JW-27	9/11/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
JW-28	9/11/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
JW-29	9/11/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
JW-30	9/12/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
JW-31	9/12/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
LS-1	9/11/2013	0.12U	0.07U	0.08U	**0.72F**	0.05U	0.08U
LS-4	9/11/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
LS-5	3/11/2013	0.12U	0.07U	0.08U	**0.80F**	**2.67**	0.08U
	6/19/2013	0.12U	0.07U	0.08U	**0.84F**	**2.34**	0.08U
	9/17/2013	0.12U	0.07U	0.08U	**0.95F**	**2.67**	0.08U
Duplicate	9/17/2013	0.12U	0.07U	0.08U	**1.01F**	**2.7**	0.08U
	12/9/2013	0.12U	0.07U	0.08U	**0.95F**	**2.53**	0.08U
LS-5-A2	3/11/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	9/17/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
LS-6	3/11/2013	0.12U	0.07U	0.08U	**0.87F**	**2.7**	0.08U
	6/19/2013	0.12U	0.07U	0.08U	**0.68F**	**2.97**	0.08U
	9/17/2013	0.12U	0.07U	0.08U	**0.68F**	**2.12**	0.08U
	12/9/2013	0.12U	0.07U	0.08U	**0.84F**	**2.72**	0.08U
LS-6-A2	3/11/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	9/17/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U

Appendix G
2013 Quarterly Off-Post Groundwater Monitoring Analytical Results

Well ID	Sample Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	TCE	Vinyl Chloride
LS-7	3/11/2013	0.12U	0.07U	0.08U	**2.04**	**0.41F**	0.08U
	6/19/2013	0.12U	0.07U	0.08U	**1.68**	**0.24F**	0.08U
	9/17/2013	0.12U	0.07U	0.08U	**1.87**	**0.19F**	0.08U
	12/9/2013	0.12U	0.07U	0.08U	**2.15**	**0.23F**	0.08U
LS-7-A2	3/11/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	9/17/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
OFR-1	9/13/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
Duplicate	9/13/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
OFR-3	3/11/2013	0.12U	0.07U	0.08U	**3.18**	**2.87**	0.08U
OFR-3-A2	3/11/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
Duplicate	3/11/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
OFR-4	9/13/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
OW-BARNOWL	3/12/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
Duplicate	3/12/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	6/26/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	9/10/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
OW-CE1	9/10/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
OW-CE2	9/10/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
OW-HH1	9/10/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
OW-HH2	3/12/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	6/26/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	9/10/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
Duplicate	9/10/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
OW-HH3	9/10/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
OW-DAIRYWELL	9/10/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
OW-MT2	9/10/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
RFR-3	9/12/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
RFR-4	9/12/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
RFR-5	9/12/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
Duplicate	9/12/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
RFR-8	9/12/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
RFR-10	3/11/2013	0.12U	0.07U	0.08U	**8.44**	**3.21**	0.08U
	6/19/2013	0.12U	**0.28F**	0.08U	**12.82**	**8.73**	0.08U
	9/17/2013	0.12U	0.07U	0.08U	**7.41**	**2.26**	0.08U
	12/9/2013	0.12U	**0.16F**	0.08U	**13.7**	**6.42**	0.08U
RFR-10-A2	3/11/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	9/17/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
RFR-10-B2	3/11/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	9/17/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
RFR-11	3/11/2013	0.12U	0.07U	0.08U	**0.59F**	**2.32**	0.08U
	6/19/2013	0.12U	0.07U	0.08U	**0.64F**	**2.32**	0.08U
	9/17/2013	0.12U	0.07U	0.08U	**0.65F**	**2.12**	0.08U
	12/9/2013	0.12U	0.07U	0.08U	0.06U	**2.52**	0.08U
RFR-11-A2	3/11/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
	9/17/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
RFR-12	9/9/2013	0.12U	0.07U	0.08U	0.06U	**0.52F**	0.08U
RFR-13	9/13/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
RFR-14	9/12/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U

Appendix G
2013 Quarterly Off-Post Groundwater Monitoring Analytical Results

Well ID	Sample Date	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	PCE	TCE	Vinyl Chloride
SLD-01	9/11/2013	0.12U	0.07U	0.08U	**0.24F**	0.05U	0.08U
	12/3/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U
SLD-02	9/11/2013	0.12U	0.07U	0.08U	0.06U	0.05U	0.08U

BOLD	≥ MDL
BOLD	≥ RL
BOLD	≥ MCL

All samples were analyzed by APPL, Inc.
VOC data reported in ug/L.

Abbreviations/Notes:

Duplicate	Field Duplicate
TCE	Trichloroethene
PCE	Tetrachloroethene
DCE	Dichloroethene

Data Qualifiers

U-The analyte was analyzed for, but not detected. The associated numerical value is at or below the MDL.
F-The analyte was positively identified but the associated numerical value is below the RL.

APPENDIX H

PRE- AND POST-GAC SAMPLE COMPARISONS FOR WELLS LS-5, LS-6, LS-7, RFR-10, RFR-11 AND OFR-3

APPENDIX H

PRE- AND POST-GAC SAMPLE COMPARISONS FOR WELLS LS-5, LS-6, LS-7, RFR-10, RFR-11 AND OFR-3

LS-5				
	PCE (µg/L)		TCE (µg/L)	
Date	Pre	Post	Pre	Post
3/11/2013	0.80F	ND	2.67	ND
6/19/2013	0.84F	ND	2.34	ND
9/17/2013	0.95F	ND	2.67	ND
9/17/2013 FD	1.01F	NA	2.7	NA
12/9/2013	0.95F	NA	2.53	NA

LS-6				
	PCE (µg/L)		TCE (µg/L)	
Date	Pre	Post	Pre	Post
3/11/2013	0.87F	ND	2.7	ND
6/19/2013	0.68F	ND	2.97	ND
9/17/2013	0.68F	ND	2.12	ND
12/9/2013	0.84F	NA	2.72	NA

LS-7				
	PCE (µg/L)		TCE (µg/L)	
Date	Pre	Post	Pre	Post
3/11/2013	2.04	ND	0.41F	ND
6/19/2013	1.68	ND	0.24F	ND
9/17/2013	1.87	ND	0.19F	ND
12/9/2013	2.15	NA	0.23F	NA

RFR-10				
	PCE (µg/L)		TCE (µg/L)	
Date	Pre	Post	Pre	Post
3/11/2013	8.44	ND/ND	3.21	ND/ND
6/19/2013	12.82	ND/ND	8.73	ND/ND
9/17/2013	7.41	ND/ND	2.26	ND/ND
12/9/2013	13.7	NA	6.42	NA

RFR-11				
	PCE (µg/L)		TCE (µg/L)	
Date	Pre	Post	Pre	Post
3/11/2013	0.59F	ND	2.32	ND
6/19/2013	0.64F	ND	2.32	ND
9/17/2013	0.65F	ND	2.12	ND
12/9/2013	ND	NA	2.52	NA

OFR-3				
	PCE (µg/L)		TCE (µg/L)	
Date	Pre	Post	Pre	Post
3/11/2013	3.18	ND	2.87	ND
3/11/2013 FD	NA	ND	NA	ND
6/19/2013	NA	NA	NA	NA
9/17/2013	NA	NA	NA	NA
12/9/2013	NA	NA	NA	NA

NA – not applicable (post-GAC not sampled during this event) ND – indicates analyte was not detected at or above the MDL.

APPENDIX I

DECEMBER 2013
DATA VERIFICATION REPORTS

SDG 72284
SDG 72250

DATA VERIFICATION SUMMARY REPORT

for on- and off-post samples collected from

CAMP STANLEY STORAGE ACTIVITY

BOERNE, TEXAS

Data Verification by: Tammy Chang
Parsons - Austin

INTRODUCTION

The following data verification summary report covers groundwater samples and the associated field quality control (QC) samples collected from on and off-post Camp Stanley Storage Activity (CSSA) on December 2 and 3, 2013. The samples were assigned to the following Sample Delivery Group (SDG) and were analyzed for volatile organic compounds (VOCs) and metals including arsenic, barium, cadmium, chromium, copper, lead, zinc and mercury. Not all samples were analyzed for the complete list of metals.

72250

The field QC samples associated with this SDG were one set of parent/field duplicate (FD), one set of matrix spike/matrix spike duplicate (MS/MSD) and a trip blank (TB). TB was analyzed for VOC only. No ambient blanks were collected. During the initiation of this project, it was determined that ambient blanks were not necessary due to the absence of a source at these sites.

All samples were collected by Parsons and analyzed by APPL, Inc. following the procedures outlined in the Statement of Work and CSSA QAPP, Version 1.0. The samples in this SDG were shipped to the laboratory in one cooler. The cooler was received by the laboratory at a temperature of 2.0ºC, which was within the 2-6ºC range recommended by the CSSA QAPP.

EVALUATION CRITERIA

The data submitted by the laboratory has been reviewed and verified following the guidelines outlined in the CSSA QAPP, Version 1.0. Information reviewed in the data package included sample results; field and laboratory quality control samples; calibrations; case narratives; raw data; chain-of-custody (COC) forms and the sample receipt checklist. The findings presented in this report are based on the reviewed information, and whether the guidelines in the CSSA QAPP, Version 1.0, were met.

VOLATILES

General

The volatiles portion of this data package consisted of nine (9) samples, including four (4) on-site groundwater samples, one (1) off-site groundwater samples, one (1) FD, one pair of MS/MSD and one (1) TB. All samples were collected on September 2 and 3, 2013 and analyzed for a reduced list of VOCs which included: 1,1-dichloroethene, *cis*-1,2-dichloroethene, tetrachloroethene, *trans*-1,2-dichloroethene, trichloroethene, and vinyl chloride.

The VOC analyses were performed using United States Environmental Protection Agency (USEPA) SW846 Method 8260B. The samples were analyzed in one batch (#183385) under one set of initial calibration (ICAL). All samples were analyzed following the procedures outlined in the CSSA QAPP and were prepared and analyzed within the holding time required by the method. All analyses were performed undiluted.

Accuracy

Accuracy was evaluated using the percent recovery (%R) obtained from the laboratory control spike (LCS) sample, one set of MS/MSD, and the surrogate spikes. Sample CS-1 was designated as the parent sample for the MS/MSD analyses on the chain of custody.

All LCS, MS/MSD, and surrogate spike recoveries were within acceptance criteria.

Precision

Precision was evaluated based on the relative percent difference (%RPD) of MS/MSD and the pair of parent/FD samples. Samples CS-12 was collected in duplicate.

Since none of the target compounds had concentrations greater than the reporting limits (RLs) in the parent/FD samples, the %RPD calculations were not applicable.

All %RPDs of MS/MSD were compliant.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing the COC procedures to those described in the CSSA QAPP;
- Comparing actual analytical procedures to those described in the CSSA QAPP;
- Evaluating holding times; and
- Examining trip and laboratory blanks for cross contamination of samples during transit or analysis.

All samples in this data package were analyzed following the COC and the analytical procedures described in the CSSA QAPP, Version 1.0. All samples were prepared and analyzed within the holding time required by the method.

- All instrument performance check criteria were met.
- All initial calibration criteria were met for both sets of curves.
- The LCS was prepared using a secondary source. All second source verification criteria were met.
- All initial calibration verification (ICV) criteria were met.
- All continuing calibration verification (CCV) criteria were met.
- All internal standard criteria were met.

There were one method blank and one TB associated with the VOC analyses in this SDG. Both blanks were non-detect for all target VOCs. No target VOC was detected at or above the associated MDL in the blanks.

Completeness

Completeness has been evaluated in accordance with the CSSA QAPP. The number of usable results has been divided by the number of possible individual analyte results and expressed as a percentage to determine the completeness of the data set.

All VOC results for the samples in this SDG were considered usable. The completeness for this SDG is 100%, which meets the minimum acceptance criteria of 95%.

ICP-AES METALS

General

The ICP-AES portion of this SDG consisted of seven (7) on-post groundwater samples including one FD and one set of MS/MSD which were collected on September 2 and 3, 2013 and were analyzed for arsenic, barium, cadmium, chromium, copper, lead, and zinc. Sample CS-MW36-LGR was only analyzed for cadmium, chromium, and lead.

The ICP-AES metals analyses were performed using USEPA SW846 Method 6010B. These on-post well samples were analyzed following the procedures outlined in the CSSA QAPP and were prepared and analyzed within the holding time required by the method.

The samples for ICP-AES metals were digested in batch #183614. All analyses were performed undiluted.

Accuracy

Accuracy was evaluated using the percent recovery obtained from the LCS, MS, and MSD. Sample CS-1 was designated as the parent sample for the MS/MSD analyses.

All LCS, MS, and MSD recoveries were within acceptance criteria.

Precision

Precision was evaluated based on the %RPDs of the parent/FD set of sample CS-12 and the MS/MSD results.

All %RPDs of MS/MSD were compliant.

Only barium and zinc were detected at or above the reporting limit in the parent/FD samples, therefore, the %RPD calculation was only applied to these two metal results.

CS-12

Metals	Parent, mg/L	FD, mg/L	%RPD	Criteria, %RPD
Barium	0.0316	0.0342	7.9	≤ 20
Zinc	0.102	0.068	40	

"J" flags were applied to the zinc result of both parent and FD samples.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing the COC procedures to those described in the CSSA QAPP;
- Comparing actual analytical procedures to those described in the CSSA QAPP;
- Evaluating preservation and holding times; and
- Examining laboratory blank for cross contamination of samples during analysis.

All samples were analyzed following the COC and the analytical procedures described in the CSSA QAPP, Version 1.0, prepared and analyzed within the holding time required by the method.

- All initial calibration criteria were met.
- All second source verification criteria were met. The ICV was prepared using a secondary source.
- All CCV criteria were met.
- All interference check (ICSA/ICSAB) criteria were met.
- No dilution test was required, as per the CSSA QAPP.

One method blank and several calibration blanks were analyzed in association with the ICP-AES analyses in this SDG. All blanks were free of target metals at or above the RL.

Completeness

Completeness has been evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All ICP-AES metals results for the samples in this SDG were considered usable.

The completeness for the ICP metals portion of this SDG is 100%, which meets the minimum acceptance criteria of 95%.

MERCURY

General

The ICP-AES portion of this SDG consisted of seven (7) on-post groundwater samples including one FD and one set of MS/MSD which were collected on September 2 and 3, 2013 and were analyzed for mercury.

The mercury analyses were performed using USEPA SW846 Method 7470A. These on-post well samples were analyzed following the procedures outlined in the CSSA QAPP, prepared and analyzed within the holding time required by the method.

The mercury samples were prepared in batch #183467. The analyses were performed undiluted.

Accuracy

Accuracy was evaluated using the percent recovery obtained from the LCS, MS, and MSD.

The LCS, MS and MSD recoveries were within acceptance criteria.

Precision

Precision was evaluated based on the %RPDs of the parent/FD samples and MS/MSD. Sample CS-12 was collected in duplicate.

Mercury was not detected above the RL in both parent and FD samples.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing the COC procedures to those described in the CSSA QAPP;
- Comparing actual analytical procedures to those described in the CSSA QAPP;
- Evaluating holding times; and
- Examining laboratory blanks for cross contamination of samples during analysis.

All samples were analyzed following the COC and the analytical procedures described in the CSSA QAPP, prepared and analyzed within the holding times required by the method.

- All initial calibration criteria were met.
- All second source verification criteria were met. The ICV was prepared using a secondary source.
- All calibration verification criteria were met.

There was one method blank and several calibration blanks associated with the mercury analyses in this SDG. All blanks were free of mercury at or above the RL.

Completeness

Completeness has been evaluated by comparing the total number of samples collected with the total number of samples with valid analytical data.

All mercury result for the samples in this SDG was considered usable. The completeness for the mercury portion of this SDG is 100%, which meets the minimum acceptance criteria of 90%.

DATA VERIFICATION SUMMARY REPORT

for off-post samples collected from

CAMP STANLEY STORAGE ACTIVITY

BOERNE, TEXAS

Data Verification by: Tammy Chang
Parsons - Austin

INTRODUCTION

The following data verification summary report covers groundwater samples and the associated field quality control (QC) sample collected from off-post Camp Stanley Storage Activity (CSSA) on December 9, 2013. The samples were assigned to the following Sample Delivery Group (SDG) and were analyzed for volatile organic compounds (VOCs).

72284

The field QC sample associated with this SDG was a trip blank (TB). No ambient blanks were collected. During the initiation of this project, it was determined that ambient blanks were not necessary due to the absence of a source at these sites.

All samples were collected by Parsons and analyzed by APPL, Inc. following the procedures outlined in the Statement of Work and CSSA QAPP, Version 1.0. The samples in this SDG were shipped to the laboratory in one cooler. The cooler was received by the laboratory at a temperature of 1.0ºC, which was slightly below the 2-6ºC range recommended by the CSSA QAPP. All water samples were received without any indication of frozen, therefore, no impact to data quality.

EVALUATION CRITERIA

The data submitted by the laboratory has been reviewed and verified following the guidelines outlined in the CSSA QAPP, Version 1.0. Information reviewed in the data package included sample results; field and laboratory quality control samples; calibrations; case narratives; raw data; chain-of-custody (COC) forms and the sample receipt checklist. The findings presented in this report are based on the reviewed information, and whether the guidelines in the CSSA QAPP, Version 1.0, were met.

VOLATILES

General

The volatiles portion of this data package consisted of seven (7) samples, including six (6) off-site groundwater samples and one (1) TB. All samples were collected on December 9, 2013 and analyzed for a reduced list of VOCs which included: 1,1-dichloroethene, *cis*-1,2-dichloroethene, tetrachloroethene, *trans*-1,2-dichloroethene, trichloroethene, and vinyl chloride.

The VOC analyses were performed using United States Environmental Protection Agency (USEPA) SW846 Method 8260B. The samples were analyzed in analytical batch (#183530) under one set of initial calibration (ICAL). All samples were analyzed following the procedures outlined in the CSSA QAPP and were prepared and analyzed within the holding time required by the method. All analyses were performed undiluted.

Accuracy

Accuracy was evaluated using the percent recovery (%R) obtained from the laboratory control spike (LCS) samples and the surrogate spikes.

All LCS and surrogate spike recoveries were within acceptance criteria.

Precision

Precision could not be measured due to the lack of duplicate analyses in this SDG.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents actual site conditions. Representativeness has been evaluated by:

- Comparing the COC procedures to those described in the CSSA QAPP;
- Comparing actual analytical procedures to those described in the CSSA QAPP;
- Evaluating holding times; and
- Examining trip and laboratory blanks for cross contamination of samples during transit or analysis.

All samples in this data package were analyzed following the COC and the analytical procedures described in the CSSA QAPP, Version 1.0. All samples were prepared and analyzed within the holding time required by the method.

- All instrument performance check criteria were met.
- All initial calibration criteria were met.
- The LCS was prepared using a secondary source. All second source verification criteria were met.
- All initial calibration verification (ICV) criteria were met.
- All continuing calibration verification (CCV) criteria were met.

- All internal standard criteria were met.

There were one method blank and one TB associated with the VOC analyses in this SDG. All blanks were non-detect for all target VOCs. No target VOC was detected at or above the associated MDL in all blanks.

Completeness

Completeness has been evaluated in accordance with the CSSA QAPP. The number of usable results has been divided by the number of possible individual analyte results and expressed as a percentage to determine the completeness of the data set.

All VOC results for the samples in this SDG were considered usable. The completeness for this SDG is 100%, which meets the minimum acceptance criteria of 95%.

APPENDIX J

USEPA LTMO APPROVAL LETTER

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
PERMITTING DIVISION
1445 Ross Avenue
Dallas, Texas 75202

Transmitted via e-mail

February 16, 2011

Camp Stanley Storage Activity
ATTN: Mr. Gabriel Moreno-Fergusson
25800 Ralph Fair Road
Boerne, Texas 78015-4800

Re: *Three-Tiered Long Term Monitoring Network Optimization Evaluation*
Data Quality Objectives for the Groundwater Monitoring Program
Camp Stanley Storage Activity

Dear Gabe:

The U.S. Environmental Protection Agency (EPA) has reviewed the *Three-Tiered Long Term Monitoring Network Optimization (LTMO) Evaluation* and the *Data Quality Objectives (DQOs) for the Groundwater Monitoring Program* for the Camp Stanley Storage Activity (CSSA). Pursuant to, and in accordance with, the final Resource Conservation and Recovery Act (RCRA) Section 3008(h) Administrative Order on Consent (Order) for CSSA, Docket No. RCRA-VI 002(h)99-H FY99, dated May 5, 1999, the EPA approves the LTMO evaluation recommendations and the DQOs. Upon TCEQ approval, the recommendations of the LTMO and DQOs may be implemented in the groundwater monitoring program.

If you have any questions, please feel free to contact me at (214) 665-8317 or via e-mail at *lyssy.gregory@epa.gov*.

Sincerely,

/s/ Greg J. Lyssy 2-16-2011

Greg J. Lyssy
Senior Project Manager
Federal Facilities Section

cc: Kirk Coulter, TCEQ, Austin
Jorge Salazar, TCEQ, San Antonio
Scott Pearson, Parsons
Julie Burdey, Parsons
Ken Rice, Parsons

Pearson, William Scott

From: Burdey, Julie
Sent: Monday, March 21, 2011 12:34 PM
To: Gabriel Moreno-Fergusson
Cc: Schoepflin, Shannon; Pearson, William Scott
Subject: FW: FW: LTMO and DQO approval letter

Please see email correspondence with Kirk below. He approves the LTMO recommendations, but I have asked him to send a formal letter.

-----Original Message-----
From: Burdey, Julie
Sent: Monday, March 21, 2011 8:19 AM
To: 'Kirk Coulter'
Subject: RE: FW: LTMO and DQO approval letter

Hi Kirk-

I guess we would feel better with a letter primarily because the last time we did the optimization which recommended reductions (over 5 years ago), Sonny wrote a letter saying it was ok to implement the reductions on-post, but not off-post.

Thanks much!!
Julie

-----Original Message-----
From: Kirk Coulter [mailto:Kirk.Coulter@tceq.texas.gov]
Sent: Monday, March 21, 2011 7:54 AM
To: Burdey, Julie
Subject: Re: FW: LTMO and DQO approval letter

Julie

I did look at it and did not have any questions with the report or Greg's letter. I did not send a letter because I know Greg is the primary authority; however, if you need s letter from me, I will send one. Let me know if this E-Mail will work as an approval or not

APPENDIX K

USEPA CONSTITUENT CONCENTRATION MAPS LETTER

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 Ross Avenue, Suite 1200
Dallas, Texas 75202-2733

Transmitted via e-mail

February 13, 2012

MEMORANDUM

FROM: *Greg J. Lyssy*
Senior Project Manager
Federal Facilities Section (6PD-F)

TO: Gabriel Moreno-Ferguson
CSSA

CC: Kirk Coulter
TCEQ

RE: **CSSA Constituent Concentration Maps**

This Memo is written pursuant to our meeting on January 24, 2012, and as a follow-up to the discussions on the graphical depiction of analytical data in groundwater plume maps, and in accordance with the final Resource Conservation and Recovery Act (RCRA), Section 3008(h) Administrative Order on Consent (Order) for Camp Stanley Storage Activity (CSSA), Docket No. RCRA-VI 002(h)99-H FY99, dated May 5, 1999.

Historically, CSSA has created groundwater plume delineation maps utilizing all analytical data, including historical data points as well as data points that are near or at the method detection limit of the constituents. Preparing plume maps utilizing data points that are in the part per trillion range (and several orders of magnitude below the Maximum Contaminant Levels (MCLs)) may create a misleading graphical representation of the actual plume size.

In order to have consistency on plume maps across different facilities, it is my recommendation that CSSA create a groundwater plume map at the MCL (or appropriate regulatory level if there is not an MCL) for the constituents of concern (COCs). In addition, CSSA should also create a groundwater plume map that depicts isoconcentrations at 20% of the MCL.

If desired, CSSA may create a ***base*** groundwater plume map using data near the method detection limit, but that map ***must*** contain qualifying information on the data that was used to create the map.

Groundwater monitoring of the plume at CSSA is required, and will continue to be required, as long as the Order is in place and there are COCs in the groundwater.

If CSSA, or your technical consultants, have any questions regarding this Memo, please do not hesitate to call me at 214.665.8317, or I may be contacted via e-mail at *lyssy.gregory@epa.gov*.