# MARCH 2016

# On-Post
# Quarterly Groundwater Monitoring Report

*Prepared For*

**Department of the Army**
**Camp Stanley Storage Activity**
**Boerne, Texas**

**May 2016**

# EXECUTIVE SUMMARY


- Groundwater samples were collected from all five wells scheduled for monitoring in March 2016. An unscheduled sample was also obtained from CS-MW5-LGR to monitor recently increasing VOCs reported in this well since December 2015.
- Following an above-average precipitation year in 2015, the aquifer experienced a moderate drop from December 2015 to March 16, 2016. The weather station (WS) at Area of Concern (AOC)-65 (AOC-65 WS) recorded 2.99 inches of rainfall, and the B-3 weather station recorded 4.68 inches of precipitation for the same time period. The rainfall was consistent with approximately 1 inch falling in January and February, then 1.7" (AOC-65 WS) and 3.04" (B-3 WS) fell in the first half of March.
- At CSSA, the Middle Trinity aquifers' average groundwater elevation in March 2016 decreased 43.11 feet from the elevations measured in December 2015. The average depth to water in the wells was 189.01 feet below top of casing (BTOC) or 1052.53 feet above mean sea level (MSL). As such, the Trinity-Glen Rose Groundwater Conservation District (TGRGCD) remains in Stage 1 Moderate Drought conditions since August 13, 2015. For the adjacent Edwards aquifer, the San Antonio Water System (SAWS) also remains in 'year round watering hours' since December 2, 2015.
- The maximum contaminant level (MCL) was exceeded in monitoring wells CS-MW36-LGR and CS-MW5-LGR for tetrachloroethene (PCE) and trichloroethene (TCE) in March 2016.
- No wells sampled had metal detections above their corresponding MCL, action level (AL), or secondary standard (SS) in March 2016.
- Under the provisions of the groundwater monitoring LTMO recommendations, no zones in the AOC-65 Westbay wells (CS-WB01, CS-WB02, CS-WB03, and CS-WB04) were scheduled for sampling in March 2016. However, these wells were profiled to capture water level readings.
- The data quality objectives (DQOs) and the long term monitoring optimization (LTMO) reports have been submitted to the Texas Commission on Environmental Quality (TCEQ) and United States Environmental Protection Agency (USEPA) for approval. As of March 2016, the regulatory approvals are still pending.

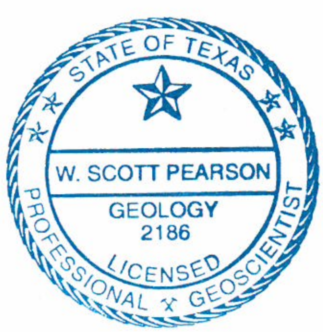
## GEOSCIENTIST CERTIFICATION

## MARCH 2016 ON-POST QUARTERLY GROUNDWATER MONITORING REPORT

**FOR**

**DEPARTMENT OF THE ARMY**
**CAMP STANLEY STORAGE ACTIVITY**
**BOERNE, TEXAS**

I, W. Scott Pearson, Professional Geologist (P.G.), hereby certify that the March 2016 On-Post Quarterly 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 CSSA Environmental Office, laboratory data provided by APPL Laboratories, and field data obtained during groundwater monitoring conducted at the site in March 2016, and is true and accurate to the best of my knowledge and belief.




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

5-31-2016
Date

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# 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 |
| BTOC | below top of casing |
| CC | Cow Creek |
| *cis*-1,2-DCE | *cis*-1,2-Dichloroethene |
| COC | constituents of concern |
| CSSA | Camp Stanley Storage Activity |
| DQO | Data Quality Objectives |
| HSP | Health and Safety Plan |
| 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 |
| NA | Not Available |
| PCE | Tetrachloroethene |
| P.G. | Professional Geologist |
| Parsons | Parsons Government Services, Inc. |
| QAPP | Quality Assurance Project Plan |
| RL | Reporting Limit |
| SAP | Sampling and Analysis Plan |
| SAWS | San Antonio Water System |
| SS | Secondary Standard |
| SWMU | Solid Waste Management Units |
| TCE | Trichloroethene |
| TCEQ | Texas Commission on Environmental Quality |
| TGRGCD | Trinity-Glen Rose Groundwater Conservation District |
| *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 |

# MARCH 2016
# GROUNDWATER MONITORING REPORT
# CAMP STANLEY STORAGE ACTIVITY, TEXAS

## 1.0 INTRODUCTION

This report presents results from the on-post quarterly sampling performed at Camp Stanley Storage Activity (CSSA) in March 2016. Laboratory analytical results are presented along with potentiometric contour maps. Results from all four 2016 quarterly monitoring events (March, June, September, and December) will be described in detail in the 2016 Annual Report. The Annual Report will also provide an interpretation of all analytical results and an evaluation of any temporal or spatial trends observed in the groundwater contaminant plume during investigations. For this specific quarter, groundwater monitoring was performed March 7 through 16, 2016 by Parsons Government Services, Inc. (Parsons).

Current objectives of the groundwater monitoring program 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. **Appendix A** identifies the data quality objectives (DQOs) for CSSA's groundwater monitoring program, along with an evaluation of whether each DQO was attained. The objectives listed in **Appendix A** also reference appropriate sections of the RCRA **§3008(h) Administrative Order on Consent** [§3008(h) Order].

The CSSA groundwater monitoring program follows the provisions of the groundwater monitoring program DQOs as well as the recommendations of the **Three-Tiered Long Term Monitoring Network Optimization (LTMO) Evaluation (Parsons, 2010)** which provided recommendations for sampling based on an 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. An update to the LTMO and DQOs has been submitted as part of the revision of the USEPA §3008(h) Order. The proposed changes/updates were submitted to the TCEQ and USEPA for their approval in January 2016. These changes will be briefed to the public in the 2016 Annual Fact Sheet.

## 2.0 POST-WIDE FLOW DIRECTION AND GRADIENT

After above average rainfall in 2015 and continued steady rain events in early 2016, the San Antonio Water System (SAWS) restrictions remain under ‘year round watering hours’ since December 2, 2015. The Trinity-Glen Rose Groundwater Conservation District (TGRGCD) remains in Stage 1 water restrictions since August 13, 2015.

The 30-year precipitation normal for the San Antonio area is 5.99 inches of rainfall for the three-month period of January through March. Over the 3-month period of record, the weather station (WS) at Area of Concern (AOC)-65 (AOC-65 WS) recorded 2.99 inches of rainfall, and the B-3 weather station (B-3 WS) recorded 4.68 inches of precipitation for the same time period. The rainfall was consistently spaced with a majority of the rain falling at the beginning of March (2.05 inches). One event had greater than one inch of rain on February $23^{rd}$, 1.38 inches at the B-3 WS. The months of January and February recorded just above 1 inch of rainfall each month.

Fifty-five water level measurements were recorded on March 15, 2016 from on- and off-post monitoring wells completed in the Lower Glen Rose (LGR), Bexar Shale (BS), and Cow Creek (CC) formational members of the Middle Trinity Aquifer (**Tables 2.1 and 2.2**). The groundwater potentiometric surface maps illustrating groundwater elevations from the LGR, BS, and CC zones in March 2016 are shown in **Figures 2.1, 2.2, and 2.3**, respectively.

The March 2016 potentiometric surface map for LGR-screened wells **(Figure 2.1)** exhibited a wide range of groundwater elevations, from a minimum of 951.17 feet above mean sea level (MSL) at B3-EXW04 to a maximum of 1128.65 feet above MSL at CS-MW4-LGR. Groundwater elevations are generally higher in the northern and central portions of CSSA, and decrease to the southwest and southeast. As measured in all non-pumping LGR wells, the average groundwater elevation in March 2016 decreased 43.11 feet from the elevations measured in December 2015. This decline in aquifer elevation is expected after the large gains in June and December 2016, as the groundwater elevation is still approximately 28 feet above the 13.25 year average elevation measured in CSSA monitoring wells (**Figure 2.4**).

Well CS-MW4-LGR, located in the central portion of CSSA, typically has one of the highest groundwater elevations of LGR-screened wells. Under average and above-average aquifer elevations, the groundwater level is 20 to 30 feet higher than the nearest comparable wells (CS-MW2-LGR and CS-MW5-LGR), creating a pronounced groundwater mound in the central portion of the facility. In March 2016 this mounding effect was observable as the elevation in CS-MW4-LGR was 73 feet and 75 feet higher than CS-MW2-LGR and CS-MW5-LGR, respectively. Long-term monitoring has ascertained that when groundwater in the vicinity of CS-MW4-LGR rises above about 970 feet MSL, the mounding effect is evident. As measured in March 2016, the water elevation at CS-MW4-LGR was 1128.65 feet MSL, and the typical mounding effect was quite pronounced.

It should be noted that well pumping on and around CSSA affects the potentiometric surface. On-post wells CS-MW16-LGR, CS-MW16-CC, B3-EXW01, B3-EXW02, B3-EXW03, B3-EXW04, and B3-EXW05 are cyclically pumped as part of the Bioreactor remediation system at Solid Waste Management Unit (SWMU) B-3. These remediation wells provide groundwater to the Bioreactor system, and are automatically operated based upon water level within each well and availability within the storage tanks. Influences from the pumping of the Bioreactor wells

## Table 2.1
## Measured Groundwater Elevation
## March 2016

| Well ID: | TOC elevation (ft MSL) | Depth to Groundwater (ft BTOC) | Groundwater Elevation (ft MSL) | Formations Screened LGR | BS | CC | Date |
|---|---|---|---|---|---|---|---|
| CS-1 | 1169.27 | 157.70 | 1011.57 | X | | | 3/15/2016 |
| **CS-2** | **1237.59** | **186.58** | **1051.01** | X | ? | | 3/15/2016 |
| CS-3 | 1240.17 | 188.21 | 1051.96 | X | | | 3/15/2016 |
| CS-4 | 1229.28 | 179.03 | 1050.25 | X | | | 3/15/2016 |
| **CS-10** | **1331.51** | **283.68** | **1047.83** | ALL | | | 3/17/2016 |
| **CS-12** | **1274.09** | **225.10** | **1048.99** | ALL | | | 3/15/2016 |
| **CS-13** | **1193.26** | **156.21** | **1037.05** | ALL | | | 3/15/2016 |
| CS-D | 1236.03 | 189.96 | 1046.07 | X | | | 3/15/2016 |
| CS-MWG-LGR | 1328.14 | 264.84 | 1063.30 | X | | | 3/15/2016 |
| CS-MWH-LGR* | 1319.19 | 312.58 | 1006.61 | X | | | 3/15/2016 |
| CS-I | 1315.20 | 255.87 | 1059.33 | X | | | 3/15/2016 |
| CS-MW1-LGR | 1220.73 | 165.87 | 1054.86 | X | | | 3/15/2016 |
| CS-MW1-BS | 1221.09 | 167.49 | 1053.60 | | X | | 3/15/2016 |
| CS-MW1-CC | 1221.39 | 185.04 | 1036.35 | | | X | 3/15/2016 |
| CS-MW2-LGR | 1237.08 | 181.00 | 1056.08 | X | | | 3/15/2016 |
| CS-MW2-CC | 1240.11 | 209.30 | 1030.81 | | | X | 3/15/2016 |
| CS-MW3-LGR | 1334.14 | 282.20 | 1051.94 | X | | | 3/15/2016 |
| CS-MW4-LGR | 1209.71 | 81.06 | 1128.65 | X | | | 3/15/2016 |
| CS-MW5-LGR | 1340.24 | 286.33 | 1053.91 | X | | | 3/15/2016 |
| CS-MW6-LGR | 1232.25 | 184.96 | 1047.29 | X | | | 3/15/2016 |
| CS-MW6-BS | 1232.67 | 162.72 | 1069.95 | | X | | 3/15/2016 |
| CS-MW6-CC | 1233.21 | 167.80 | 1065.41 | | | X | 3/15/2016 |
| CS-MW7-LGR | 1202.27 | 147.18 | 1055.09 | X | | | 3/15/2016 |
| CS-MW7-CC | 1201.84 | 154.26 | 1047.58 | | | X | 3/15/2016 |
| CS-MW8-LGR | 1208.35 | 145.23 | 1063.12 | X | | | 3/15/2016 |
| CS-MW8-CC | 1206.13 | 158.04 | 1048.09 | | | X | 3/15/2016 |
| CS-MW9-LGR | 1257.27 | 203.85 | 1053.42 | X | | | 3/15/2016 |
| CS-MW9-BS | 1256.73 | 210.26 | 1046.47 | | X | | 3/15/2016 |
| CS-MW9-CC | 1255.95 | 211.42 | 1044.53 | | | X | 3/15/2016 |
| CS-MW10-LGR | 1189.53 | 138.50 | 1051.03 | X | | | 3/15/2016 |
| CS-MW10-CC | 1190.04 | 143.53 | 1046.51 | | | X | 3/15/2016 |
| CS-MW11A-LGR | 1204.03 | 172.39 | 1031.64 | X | | | 3/15/2016 |
| CS-MW11B-LGR | 1203.52 | 187.84 | 1015.68 | X | | | 3/15/2016 |
| CS-MW12-LGR | 1259.07 | 201.95 | 1057.12 | X | | | 3/15/2016 |
| CS-MW12-BS | 1258.37 | 206.60 | 1051.77 | | X | | 3/15/2016 |
| CS-MW12-CC | 1257.31 | 212.23 | 1045.08 | | | X | 3/15/2016 |
| CS-MW16-LGR | 1244.60 | 198.95 | 1045.65 | X | | | 3/15/2016 |
| CS-MW16-CC | 1244.51 | 211.83 | 1032.68 | | | X | 3/15/2016 |
| B3-EXW01 | 1245.26 | 203.67 | 1041.59 | X | | | 3/15/2016 |
| B3-EXW02* | 1249.66 | 293.90 | 955.76 | X | | | 3/15/2016 |
| B3-EXW03* | 1235.11 | 216.72 | 1018.39 | X | | | 3/15/2016 |
| B3-EXW04* | 1228.46 | 277.29 | 951.17 | X | | | 3/15/2016 |
| B3-EXW05* | 1279.46 | 297.88 | 981.58 | X | | | 3/15/2016 |
| CS-MW17-LGR | 1257.01 | 200.95 | 1056.06 | X | | | 3/15/2016 |
| CS-MW18-LGR | 1283.61 | 227.91 | 1055.70 | X | | | 3/15/2016 |
| CS-MW19-LGR | 1255.53 | 183.73 | 1071.80 | X | | | 3/15/2016 |
| CS-MW20-LGR | 1209.42 | 131.41 | 1078.01 | X | | | 3/15/2016 |
| CS-MW21-LGR | 1184.53 | 126.63 | 1057.90 | X | | | 3/15/2016 |
| CS-MW22-LGR | 1280.49 | 229.00 | 1051.49 | X | | | 3/15/2016 |
| CS-MW23-LGR | 1258.20 | 213.35 | 1044.85 | X | | | 3/15/2016 |
| CS-MW24-LGR | 1253.90 | 203.08 | 1050.82 | X | | | 3/15/2016 |
| CS-MW25-LGR | 1293.01 | 240.00 | 1053.01 | X | | | 3/15/2016 |
| CS-MW35-LGR | 1186.97 | 139.33 | 1047.64 | X | | | 3/15/2016 |
| CS-MW36-LGR | 1218.74 | 154.86 | 1063.88 | X | | | 3/15/2016 |
| **FO-20** | **NA** | **NA** | 1082.72 | ALL | | | 3/15/2016 |
| Number of wells screened in each formation. | | | | **38** | **4** | **9** | |
| Average groundwater elevation in each formation given in feet (non pumping wells). | | | | **1055.33** | **1055.45** | **1045.55** | |

**Notes:**

**Bold wells**: CS-2, CS-9, CS-10, CS-12, CS-13, and FO-20 are open boreholes across more than one formational u

? = Exact screening information unknown for this well.

Shaded wells are routinely pumped for either domestic, livestock, or environmental remediation purposes, and therefore are not used in calculating statistics.

CS-1, CS-9, CS-10, CS-12, and CS-13 are current, inactive, or future drinking water wells.

CS-MW16-LGR, CS-MW16-CC, B3-EXW01 through B3-EXW05 pumps are cycling continuously to feed the B-3 Bioreactor.

* = submersible pump running at time of water level measurement.

Formational average groundwater elevation is calculated from non-pumping wells screened in only one format

All measurements given in feet.

NA = Data not available

# Table 2.2
# Change in Groundwater Elevation from Previous Quarter
# March 2016

| Well ID | Dec. 2015 Elevations | Mar. 2016 Elevations | GW elevation change (Mar. minus Dec.) | Formations Screened | | |
|---|---|---|---|---|---|---|
| | | | | LGR | BS | CC |
| CS-1 | 1025.97 | 1011.57 | **-14.40** | X | | |
| **CS-2** | **1096.16** | **1051.01** | **-45.15** | X | ? | |
| CS-3 | 1095.19 | 1051.96 | -43.23 | X | | |
| CS-4 | 1091.68 | 1050.25 | -41.43 | X | | |
| **CS-10** | **1099.71** | **1047.83** | -51.88 | ALL | | |
| **CS-12** | **1101.29** | **1048.99** | -52.30 | ALL | | |
| **CS-13** | **1075.42** | **1037.05** | -38.37 | ALL | | |
| CS-D | 1083.64 | 1046.07 | -37.57 | X | | |
| CS-MWG-LGR | 1112.94 | 1063.30 | -49.64 | X | | |
| CS-MWH-LGR* | 1119.87 | 1006.61 | -113.26 | X | | |
| CS-I | 1108.17 | 1059.33 | -48.84 | X | | |
| CS-MW1-LGR | 1090.07 | 1054.86 | -35.21 | X | | |
| CS-MW1-BS | 1054.87 | 1053.60 | -1.27 | | X | |
| CS-MW1-CC | 1063.41 | 1036.35 | -27.06 | | | X |
| CS-MW2-LGR | 1087.87 | 1056.08 | -31.79 | X | | |
| CS-MW2-CC | 1047.08 | 1030.81 | -16.27 | | | X |
| CS-MW3-LGR | 1089.98 | 1051.94 | -38.04 | X | | |
| CS-MW4-LGR | 1155.77 | 1128.65 | -27.12 | X | | |
| CS-MW5-LGR | 1087.39 | 1053.91 | -33.48 | X | | |
| CS-MW6-LGR | 1104.45 | 1047.29 | -57.16 | X | | |
| CS-MW6-BS | 1094.48 | 1069.95 | -24.53 | | X | |
| CS-MW6-CC | 1098.53 | 1065.41 | -33.12 | | | X |
| CS-MW7-LGR | 1098.82 | 1055.09 | -43.73 | X | | |
| CS-MW7-CC | 1096.87 | 1047.58 | -49.29 | | | X |
| CS-MW8-LGR | 1102.91 | 1063.12 | -39.79 | X | | |
| CS-MW8-CC | 1097.63 | 1048.09 | -49.54 | | | X |
| CS-MW9-LGR | 1100.40 | 1053.42 | -46.98 | X | | |
| CS-MW9-BS | 1107.93 | 1046.47 | -61.46 | | X | |
| CS-MW9-CC | 1090.25 | 1044.53 | -45.72 | | | X |
| CS-MW10-LGR | 1095.20 | 1051.03 | -44.17 | X | | |
| CS-MW10-CC | 1091.06 | 1046.51 | -44.55 | | | X |
| CS-MW11A-LGR | 1083.42 | 1031.64 | -51.78 | X | | |
| CS-MW11B-LGR | 1076.73 | 1015.68 | -61.05 | X | | |
| CS-MW12-LGR | 1102.05 | 1057.12 | -44.93 | X | | |
| CS-MW12-BS | 1094.42 | 1051.77 | -42.65 | | X | |
| CS-MW12-CC | 1085.91 | 1045.08 | -40.83 | | | X |
| CS-MW16-LGR | 1041.29 | 1045.65 | 4.36 | X | | |
| CS-MW16-CC | 955.04 | 1032.68 | 77.64 | | | X |
| B3-EXW01 | 956.26 | 1041.59 | 85.33 | X | | |
| B3-EXW02* | 997.26 | 955.76 | -41.50 | X | | |
| B3-EXW03* | 1095.41 | 1018.39 | -77.02 | X | | |
| B3-EXW04* | 956.86 | 951.17 | -5.69 | X | | |
| B3-EXW05 | 1010.11 | 981.58 | -28.53 | X | | |
| CS-MW17-LGR | 1097.49 | 1056.06 | -41.43 | X | | |
| CS-MW18-LGR | 1102.74 | 1055.70 | -47.04 | X | | |
| CS-MW19-LGR | 1114.49 | 1071.80 | -42.69 | X | | |
| CS-MW20-LGR | 1119.57 | 1078.01 | -41.56 | X | | |
| CS-MW21-LGR | 1102.00 | 1057.90 | -44.10 | X | | |
| CS-MW22-LGR | 1097.27 | 1051.49 | -45.78 | X | | |
| CS-MW23-LGR | 1093.92 | 1044.85 | -49.07 | X | | |
| CS-MW24-LGR | 1095.07 | 1050.82 | -44.25 | X | | |
| CS-MW25-LGR | 1093.64 | 1053.01 | -40.63 | X | | |
| CS-MW35-LGR | 1093.52 | 1047.64 | -45.88 | X | | |
| CS-MW36-LGR | 1103.89 | 1063.88 | -40.01 | X | | |
| **FO-20** | **1132.24** | **1082.72** | -49.52 | ALL | | |
| Average groundwater elevation change (all wells minus pumping wells) | | | **-43.11** | | | |
| Average groundwater elevation change in each formation (non pumping wells) | | | | **-45.07** | **-32.48** | **-38.30** |

**Notes:**

**Bold wells**: CS-2, CS-9, CS-10, CS-12, CS-13, and FO-20 are open boreholes across more than one formational unit

? = Exact screening information unknown for this well.

Shaded wells are routinely pumped for either domestic, livestock, or environmental remediation purposes, and therefore are not used in calculating statistics.

CS-1, CS-9, CS-10, CS-12, and CS-13 are current, inactive, or future drinking water wells.

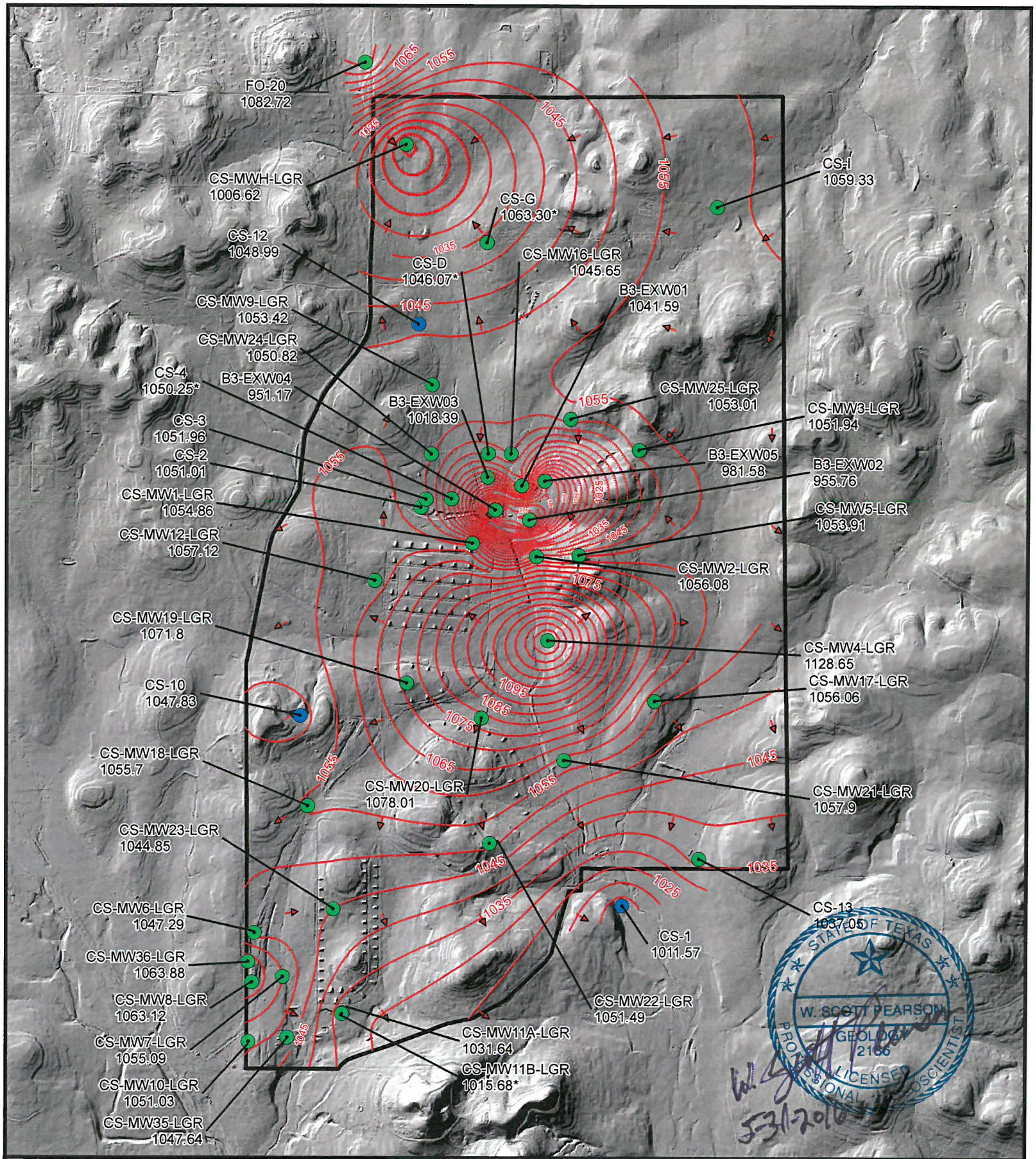
CS-MW16-LGR, CS-MW16-CC, B3-EXW01 through B3-EXW05 pumps are cycling continuously to feed the B-3 Bioreactor.

* = submersible pump running at time of water level measurement.

Formational average groundwater elevation change is calculated from non-pumping wells screened in only one formation.

All measurements given in feet.

NA = Data not available




N

0 0.5 Miles

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

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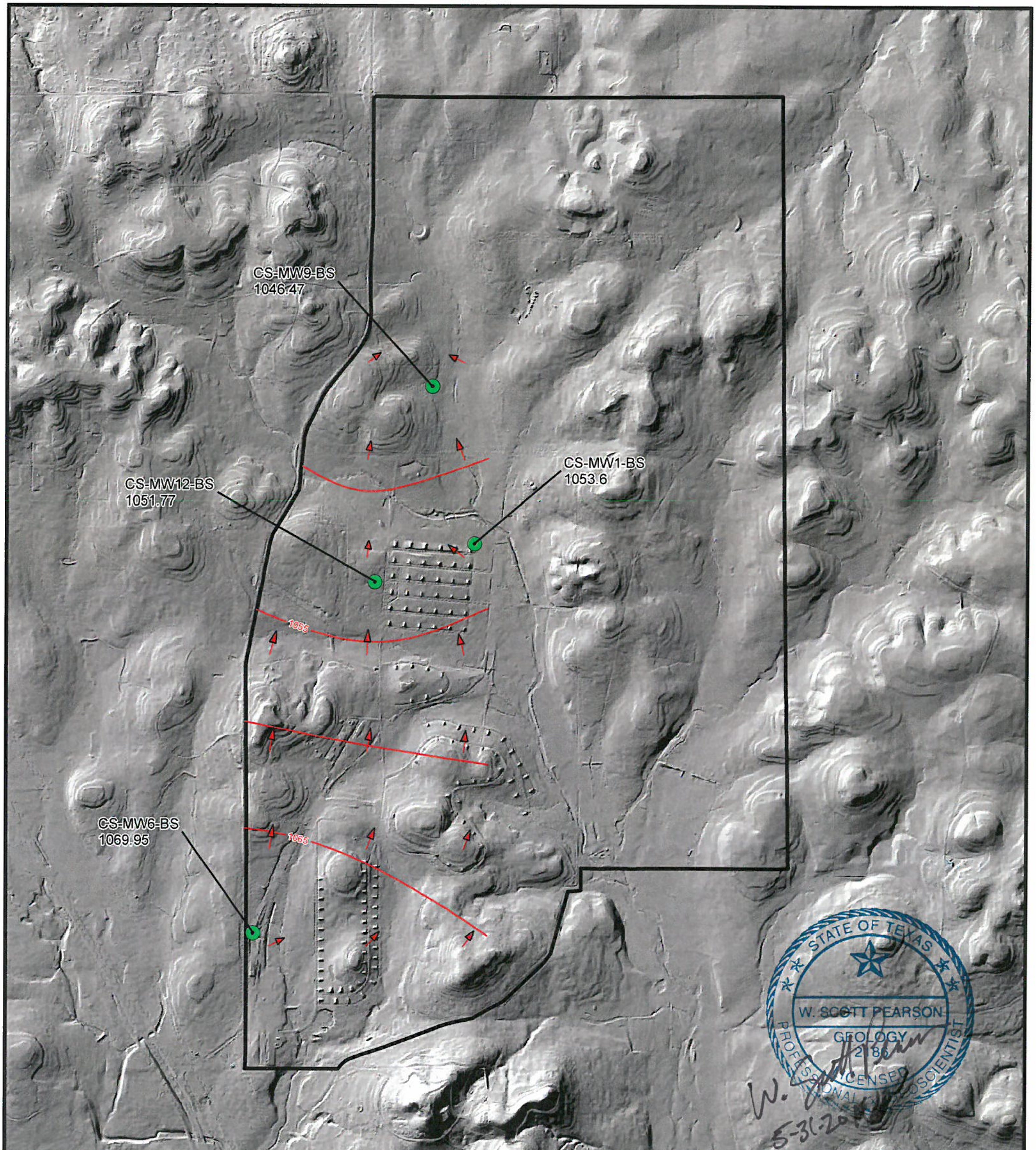
**Figure 2.1**

**March 2016 Potentiometric Surface Map, LGR Wells**

**Camp Stanley Storage Activity**

**PARSONS**




N

0 0.5 Miles

Flow direction

Outer fence

BS Groundwater Contours

BS Wells and groundwater elevation (ft above msl)

# Figure 2.2

March 2016 Potentiometric Surface Map, BS Wells

Camp Stanley Storage Activity

**PARSONS**

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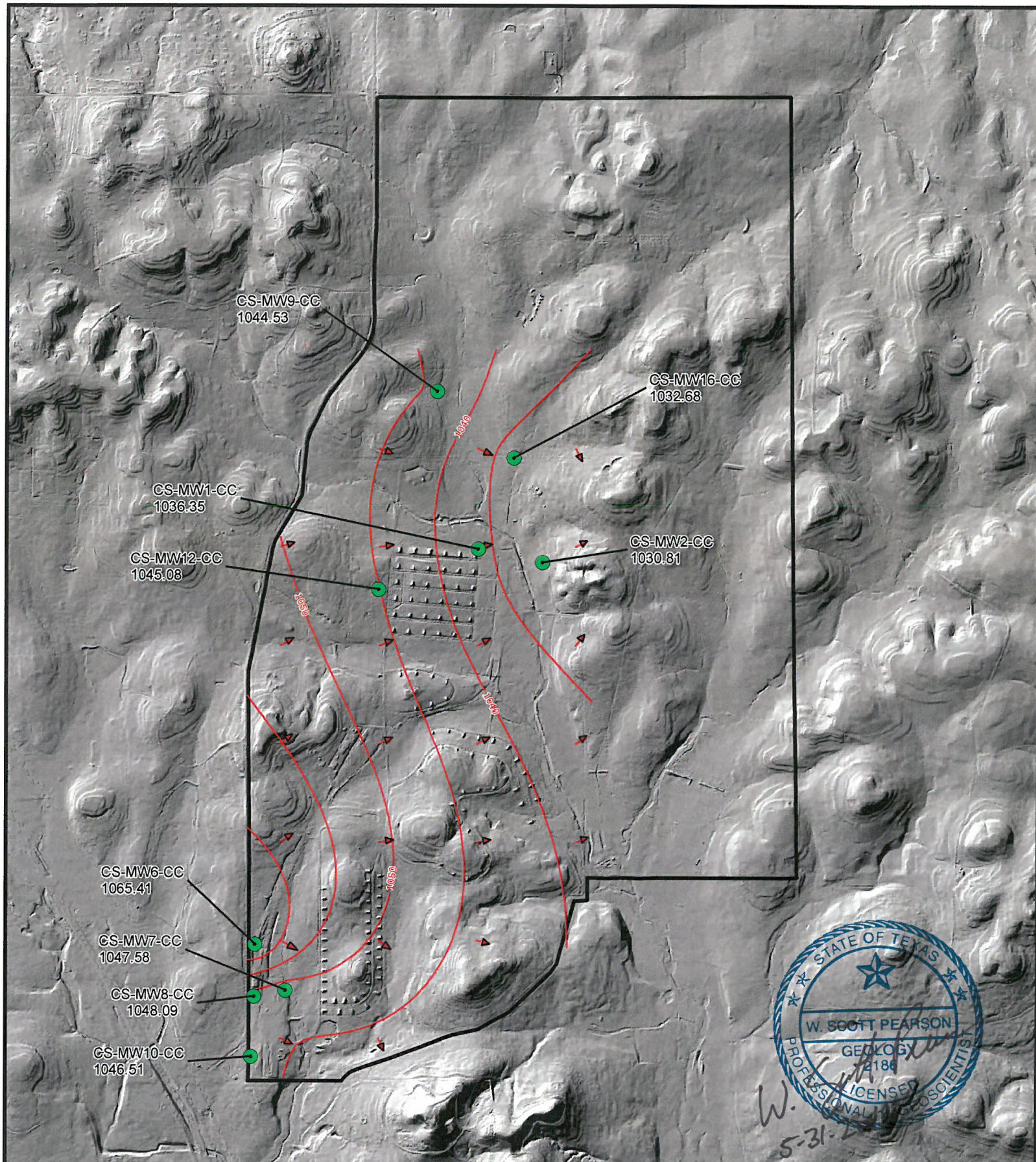


N

0 0.5 Miles

Flow direction

Outer fence

CC Groundwater Contours

CC Wells and groundwater elevation (ft above msl)

Figure 2.3

March 2016 Potentiometric Surface Map, CC Wells

Camp Stanley Storage Activity

**PARSONS**

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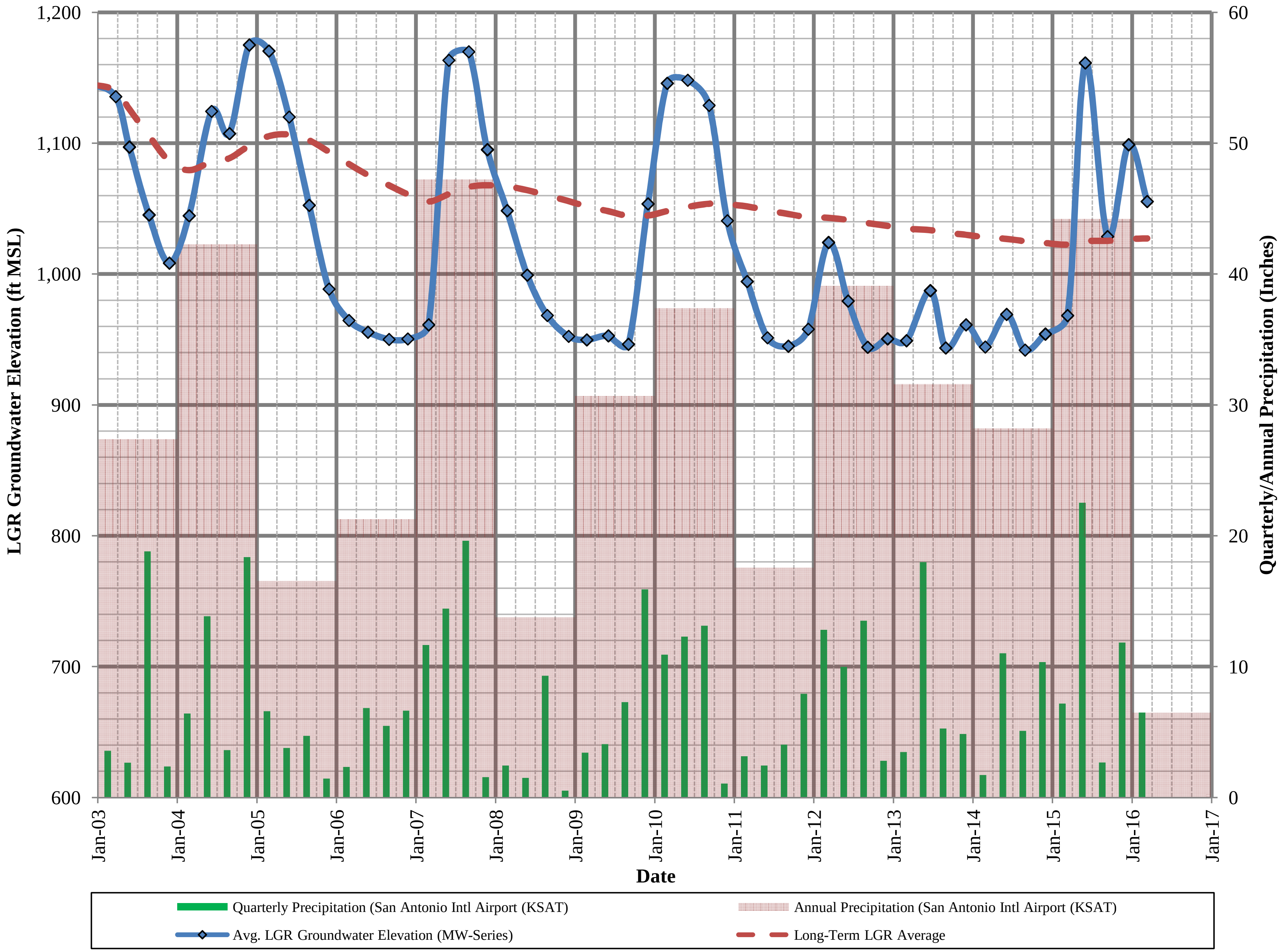
## Figure 2.4 - Average LGR Groundwater Elevations and Quarterly/Annual Precipitation



B3-EXW01 through B3-EXW05 are manifested as "cones of depression" in **Figure 2.1**. The Bioreactor cone of depression is induced into the aquifer to extract contaminated water within its direct zone of influence, and otherwise retard the flow of the groundwater that cannot be directly captured by the extraction wells away from the site. CSSA drinking water wells CS-1, CS-10, and CS-12 are also cycled on and off to maintain the drinking water system currently in place at CSSA. Off-post water supply wells along Ralph Fair Road may also exert a subtle influence to gradients along the western and southern boundaries of the post.

Notable for March 2016 is the cone of depression in the North Pasture that is resulting from well pumping at CS-MWH-LGR at the time of measurement. Occasionally, wells CS-MWH-LGR and CS-I are pumped to maintain water levels in surface water impoundments in the North Pasture. Typically, the flow gradient in the North Pasture is strongly southward. However, during this monitoring event a depressed water elevation (1,006.62 feet MSL) was measured in well CS-MWH-LGR, thereby creating a localized groundwater depression in the northwest corner of CSSA. Normally, the groundwater elevation is slightly higher than well CS-I, which had a recorded elevation of 1,059.33 feet MSL.

Historical groundwater monitoring at CSSA has demonstrated that the aquifer gradient typically slopes in a south-southeast direction (**Figure 2.1**); however, variable aquifer levels and well-pumping scenarios can affect the localized and regional gradients. In particular, pumping action at wells CS-1, CS-10, CS-MW16-LGR/CC, B3-EXW01 through B3-EXW05, CS-MWH-LGR, CS-I, and even off-post wells (Fair Oaks Ranch) can significantly alter the LGR groundwater gradient. Normally, the regional gradient calculation, an overall groundwater gradient averaged across CSSA, is measured from CS-MWH-LGR to CS-MW21-LGR. However because of the CS-MWH-LGR pumping activity, this standard measurement is erroneous for March 2016, resulting in a countersloped northerly gradient of 0.00038 ft/ft. Localized gradients of 0.00819 ft/ft to west were measured between CS-I and CS-MWH-LGR in the North Pasture and 0.0145 ft/ft to the south between CS-MW21-LGR and CS-1. In the interim, a basewide gradient of 0.00012 ft/ft was calculated between CS-I and CS-MW21-LGR.

Under normal conditions, the potentiometric surface in both the BS and CC members of the aquifer generally trend in a southerly direction, like the LGR. However, the BS potentiometric surface has a distinctly northerly gradient towards CS-MW9-BS (**Figure 2.2**), with an average groundwater elevation of 1,055.45 feet MSL. The last time the BS had a northerly gradient was in September 2015 with an identical average groundwater elevation of 1,055.29 feet MSL. Prior to that, it had been since December 2010/March 2011 since a northerly gradient had been observed in the BS. Not surprisingly, the December 2010, March 2011, and September 2015 events also experienced a similar aquifer decline following a rapid recharge event. The hydrologic conditions in the BS are nearly identical to September 2015, with similar hydrologic results.

The CC potentiometric surface (**Figure 2.3**) shows a strong easterly gradient in March 2016, with an average groundwater elevation of 1,044.12 feet MSL. A review of historical data has shown that the CC potentiometric surface develops a predominantly easterly gradient when the average CC groundwater elevation is higher than 995 feet MSL. Below that elevation, the gradient resumes a more southerly direction. Prior to the 2015 monitoring events, an easterly gradient has not been observed in the CC since December 2010. Notable for March 2016 is the lack of well-developed cone of depression around the Bioreactor extraction well, CS-MW16-CC.

Normally this well is pumping during the quarterly groundwater level measurement event, and results in an area-wide alteration of the natural groundwater gradient. In March 2016, the pump was not active during the measurement period, resulting in a potentiometric map that is indicative to the true groundwater gradient at the time.

Groundwater elevations have been measured and recorded since 1992. Previous droughts resulted in water levels decreasing substantially in 1996, 1999, 2000, 2006, 2008, 2009, 2011 through 2014. In 2015, approximately 44 inches of rainfall in the San Antonio area ended the drought cycle, resulting in a net gain of 145 feet in aquifer level over the course of the year. By March 2016, the basewide average level in the LGR wells declined by 43 feet from December 2015. Despite this drop in level, the March 2016 LGR groundwater average elevation (1,055.5 feet MSL) is still 28.2 feet above the long-term (13.25 year) average groundwater elevation (1,027.26 feet MSL).

It is worth noting that, based on more than 13 years of program history, the basewide LGR groundwater level has declined by 118 feet (see **Figure 2.4**). As can be expected with sparse data sets, the largest rate of change/decline (90 feet) came during the initial 4 years of the groundwater monitoring program. Over the past 9 years, the average decline rate has subdued, losing an additional 30 feet of average groundwater elevation over 7 years of prolonged drought (with the exception of 2010). However, the past four monitoring events (June, September, December 2015 and March 2016) have shown above-average aquifer levels. Above average groundwater elevations have been recorded only eight times in the past 26 monitoring events (6.5 years). Prior to June 2015, the LGR had not been above the long-term "average" water elevation since September 2010.

# 3.0 MARCH ANALYTICAL RESULTS

## 3.1 Monitoring Wells

Under the provisions of the groundwater monitoring DQOs and the 2010 LTMO evaluation, the schedule for sampling on-post in March 2016 included five wells. The samples included three production wells (CS-1, CS-10, and CS-12), one future production well (CS-13), and one on-post monitoring well (see **Table 3.1)**. In conjunction with the off-post monitoring initiative (under a separate report) the March 2016 groundwater sampling constituted a "quarterly" event in which selected wells are sampled every quarter.

All wells scheduled for monitoring in March 2016 were sampled. Additional samples were collected as part of the AOC-65 in-situ chemical oxidation (ISCO) Treatability Study; these results will be reported in a separate treatability study report. **Tables 3.1** and **3.2** provide a sampling overview for March 2016 and the schedule under the LTMO recommendations. The above-listed monitoring well was sampled using a dedicated low-flow gas-operated bladder pump. Wells CS-1, CS-10, CS-12, and CS-13 were sampled using dedicated electric submersible pumps. **Figure 3.1** shows well sampling locations.

Wells sampled by low-flow pumps were purged until the field parameters of pH, temperature, and conductivity stabilized. The on-post monitoring wells were sampled in March 2016 for the short list of volatile organic compounds (VOC) and metals (chromium, cadmium, lead, and mercury). Active and future drinking water wells CS-1, CS-10, CS-12, and CS-13 were analyzed for the short list of VOCs and metals (arsenic, barium, chromium, copper, zinc, cadmium, mercury, and lead).

Samples were analyzed by Agriculture & Priority Pollutant Laboratories (APPL) in Clovis, California. All detected concentrations of VOCs and metals are presented in **Table 3.3**. Full analytical results are presented in **Appendix B**.

Tetrachloroethene (PCE) and Trichloroethene (TCE) were detected above the Maximum Contaminant Level (MCL) of 5 micrograms per liter (µg/L) in two on-post wells sampled this quarter: CS-MW36-LGR and CS-MW5-LGR. A comparison of VOC concentrations versus water level for select wells is presented in **Figure 3.2**. The overall trend for CS-MW36-LGR sampled in March 2016 was an increase in VOC concentrations coupled with a decrease in groundwater elevation. CS-MW5-LGR has been sampled since 2001, but it has just recently (December 2015) shown concentrations of PCE and TCE above the MCL. In March these detections remained above the MCL. No metals were detected above the MCL/AL/SS for wells sampled in March 2016.

Results from on-post monitoring wells are considered definitive data and are subject to data validation and verification under provisions of the CSSA Quality Assurance Project Plan (QAPP). Parsons data packages numbered 810000-#116, -#124 containing the analytical results from this sampling event, were received by Parsons March 25 through April 13, 2016. Data validation was conducted and the data validation reports are presented in **Appendix C**.

## 3.2 Westbay-equipped Wells

Under the provisions of the groundwater monitoring LTMO recommendations, no zones in the AOC-65 Westbay wells (CS-WB01, CS-WB02, CS-WB03, and CS-WB04) were scheduled

**Table 3.1**
**Overview of the On-Post Monitoring Program**

| Count | Well ID | *Analytes* | *Last Sample Date* | *Jun-15* | *Sep-15* | *Dec-15 (18 mo. snapshot)* | *Mar-16* | *Sampling Frequency ** |
|---|---|---|---|---|---|---|---|---|
| | CS-MW1-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-15 | S | NS | S | NS | Semi-annual + 9 month snapshot |
| | CS-MW1-BS | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-12 | NS | NS | NS | NS | sampled on an as needed basis |
| | CS-MW1-CC | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-15 | NS | NS | S | NS | Every 18 months |
| | CS-MW2-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-15 | S | NS | S | NS | Semi-annual + 9 month snapshot |
| | CS-MW2-CC | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-15 | NS | NS | S | NS | Every 18 months |
| | CS-MW3-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-15 | NS | NS | S | NS | Every 9 months |
| | CS-MW4-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-15 | NS | NS | S | NS | Every 9 months |
| add | CS-MW5-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-15 | NS | NS | S | NS | Every 9 months |
| ISCO | CS-MW6-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-15 | NS | NS | S | NS | Every 9 months |
| | CS-MW6-BS | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-12 | NS | NS | NS | NS | sampled on an as needed basis |
| | CS-MW6-CC | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-15 | NS | NS | S | NS | Every 18 months |
| ISCO | CS-MW7-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-15 | NS | NS | S | NS | Every 9 months |
| | CS-MW7-CC | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-15 | NS | NS | S | NS | Every 18 months |
| ISCO | CS-MW8-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-15 | S | NS | S | NS | Semi-annual + 9 month snapshot |
| | CS-MW8-CC | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-15 | NS | NS | S | NS | Every 18 months |
| | CS-MW9-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-15 | NS | NS | S | NS | Every 9 months |
| | CS-MW9-BS | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-12 | NS | NS | NS | NS | sampled on an as needed basis |
| | CS-MW9-CC | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-15 | NS | NS | S | NS | Every 18 months |
| | CS-MW10-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-15 | S | NS | S | NS | Semi-annual + 9 month snapshot |
| | CS-MW10-CC | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-15 | NS | NS | S | NS | Every 18 months |
| | CS-MW11A-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-15 | S | NS | S | NS | Semi-annual + 9 month snapshot |
| | CS-MW11B-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-15 | NS | NS | S | NS | Every 9 months |
| | CS-MW12-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-15 | NS | NS | S | NS | Every 9 months |
| | CS-MW12-BS | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-12 | NS | NS | NS | NS | sampled on an as needed basis |
| | CS-MW12-CC | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-15 | NS | NS | S | NS | Every 18 months |
| | CS-MW16-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-15 | NS | NS | S | NS | Every 9 months |
| | CS-MW16-CC | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-15 | NS | NS | S | NS | Every 9 months |
| | CW-MW17-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-15 | NS | NS | S | NS | Every 9 months |
| | CS-MW18-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-15 | NS | NS | S | NS | Every 9 months |
| | CS-MW19-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-15 | NS | NS | S | NS | Every 9 months |
| 1 | CS-1 | VOCs & metals (As,Ba,Cr, Cu,Cd,Hg,Pb,Zn) | Dec-15 | S | S | S | S | Quarterly |
| | CS-2 | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-15 | NS | NS | S | NS | Every 9 months |
| | CS-4 | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-15 | S | NS | S | NS | Semi-annual + 9 month snapshot |
| 2 | CS-10 | VOCs & metals (As,Ba,Cr, Cu,Cd,Hg,Pb,Zn) | Dec-15 | S | S | S | S | Quarterly |
| 3 | CS-12 | VOCs & metals (As,Ba,Cr, Cu,Cd,Hg,Pb,Zn) | Dec-15 | S | S | S | S | Quarterly |
| 4 | CS-13 | VOCs & metals (As,Ba,Cr, Cu,Cd,Hg,Pb,Zn) | Dec-15 | S | S | S | S | Quarterly |
| | CS-D | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-15 | S | NS | S | NS | Semi-annual + 9 month snapshot |
| | CS-MWG-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-15 | NS | NS | S | NS | Every 18 months |
| | CS-MWH-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-15 | NS | NS | S | NS | Every 18 months |
| | CS-I | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-15 | NS | NS | S | NS | Every 18 months |
| | CS-MW20-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-15 | NS | NS | S | NS | Every 9 months |
| | CS-MW21-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-15 | NS | NS | S | NS | Every 9 months |
| | CS-MW22-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-15 | NS | NS | S | NS | Every 9 months |
| | CS-MW23-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-15 | NS | NS | S | NS | Every 9 months |
| | CS-MW24-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-15 | S | NS | S | NS | Semi-annual + 9 month snapshot |
| | CS-MW25-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-15 | NS | NS | S | NS | Every 9 months |
| | CS-MW35-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-15 | S | NS | S | NS | Semi-annual + 9 month snapshot |
| 5/ISCO | CS-MW36-LGR | VOCs & metals (Cr, Cd, Hg, Pb) | Dec-15 | 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
ISCO = well sampled as part of treatability study

**Table 3.2 Westbay Sampling Frequency**

| Westbay Interval | Last Sample Date | Jun-15 | Sep-15 (18 month) | Dec-15 (snapshot) | Mar-16 | LTMO Sampling Frequency (as of June '11) | ISCO sample zones |
|---|---|---|---|---|---|---|---|
| CS-WB01-UGR-01 | Dec-04 | NS | NSWL | NS | NS | Every 9 months | ISCO |
| CS-WB01-LGR-01 | Sep-15 | NS | S | NS | NS | Every 9 months | ISCO |
| CS-WB01-LGR-02 | Sep-15 | NS | S | NS | NS | Every 9 months | |
| CS-WB01-LGR-03 | Sep-15 | NS | S | NS | NS | Every 9 months | |
| CS-WB01-LGR-04 | Sep-15 | NS | S | NS | NS | Every 9 months | |
| CS-WB01-LGR-05 | Sep-15 | NS | S | NS | NS | Every 9 months | |
| CS-WB01-LGR-06 | Sep-15 | NS | S | NS | NS | Every 9 months | |
| CS-WB01-LGR-07 | Sep-15 | NS | S | NS | NS | Every 9 months | |
| CS-WB01-LGR-08 | Sep-15 | NS | S | NS | NS | Every 9 months | |
| CS-WB01-LGR-09 | Dec-15 | NS | S | S | NS | Every 9 months + snapshot | ISCO |
| CS-WB02-UGR-01 | Dec-04 | NS | NSWL | NS | NS | Every 9 months | ISCO |
| CS-WB02-LGR-01 | Dec-14 | NS | NSWL | NS | NS | Every 9 months | ISCO |
| CS-WB02-LGR-02 | Mar-10 | NS | NSWL | NS | NS | Every 9 months | |
| CS-WB02-LGR-03 | Sep-15 | NS | S | NS | NS | Every 9 months | |
| CS-WB02-LGR-04 | Sep-15 | NS | S | NS | NS | Every 9 months | |
| CS-WB02-LGR-05 | Sep-15 | NS | S | NS | NS | Every 9 months | |
| CS-WB02-LGR-06 | Sep-15 | NS | S | NS | NS | Every 9 months | |
| CS-WB02-LGR-07 | Sep-15 | NS | S | NS | NS | Every 9 months | |
| CS-WB02-LGR-08 | Sep-15 | NS | S | NS | NS | Every 9 months | |
| CS-WB02-LGR-09 | Dec-15 | NS | S | S | NS | Every 9 months + snapshot | ISCO |
| CS-WB03-UGR-01 | Sep-15 | NS | S | NS | NS | Every 9 months | ISCO |
| CS-WB03-LGR-01 | Sep-15 | NS | S | NS | NS | Every 9 months | ISCO |
| CS-WB03-LGR-02 | Oct-07 | NS | NSWL | NS | NS | Every 9 months | |
| CS-WB03-LGR-03 | Sep-15 | NS | S | NS | NS | Every 9 months | |
| CS-WB03-LGR-04 | Sep-15 | NS | S | NS | NS | Every 9 months | |
| CS-WB03-LGR-05 | Sep-15 | NS | S | NS | NS | Every 9 months | |
| CS-WB03-LGR-06 | Sep-15 | NS | S | NS | NS | Every 9 months | |
| CS-WB03-LGR-07 | Sep-15 | NS | S | NS | NS | Every 9 months | |
| CS-WB03-LGR-08 | Sep-15 | NS | S | NS | NS | Every 9 months | |
| CS-WB03-LGR-09 | Dec-15 | NS | S | S | NS | Every 9 months + snapshot | ISCO |
| CS-WB04-UGR-01 | Mar-04 | NS | NSWL | NS | NS | Every 9 months | ISCO |
| CS-WB04-LGR-01 | Sep-15 | NS | S | NS | NS | Every 18 months | ISCO |
| CS-WB04-LGR-02 | Mar-14 | NS | NSWL | NS | NS | Every 18 months | |
| CS-WB04-LGR-03 | Sep-15 | NS | S | NS | NS | Every 18 months | |
| CS-WB04-LGR-04 | Sep-15 | NS | S | NS | NS | Every 18 months | |
| CS-WB04-LGR-06 | Dec-15 | NS | S | S | NS | Every 9 months + snapshot | |
| CS-WB04-LGR-07 | Dec-15 | NS | S | S | NS | Every 9 months + snapshot | |
| CS-WB04-LGR-08 | Sep-15 | NS | S | NS | NS | Every 9 months | |
| CS-WB04-LGR-09 | Dec-15 | NS | S | S | NS | Every 9 months + snapshot | |
| CS-WB04-LGR-10 | Dec-15 | NS | S | S | NS | Every 9 months + snapshot | |
| CS-WB04-LGR-11 | Dec-15 | NS | S | S | NS | Every 9 months + snapshot | ISCO |
| CS-WB04-BS-01 | Sep-15 | NS | S | NS | NS | Every 18 months | |
| CS-WB04-BS-02 | Sep-15 | NS | S | NS | NS | Every 18 months | |
| CS-WB04-CC-01 | Sep-15 | NS | S | NS | NS | Every 18 months | |
| CS-WB04-CC-02 | Sep-15 | NS | S | NS | NS | Every 18 months | |
| CS-WB04-CC-03 | Sep-15 | NS | S | NS | NS | Every 18 months | |

Profiling performed quarterly, in conjunction with post wide water levels.


Figure 3.1

On-Post and Off-Post Well Sampling Locations for March 2016

Camp Stanley Storage Activity

PARSONS

## Table 3.3
## March 2016 On-Post Quarterly Groundwater Results, Detected Analytes

| Well ID | Sample Date | Arsenic | Barium | Cadmium | Chromium | Copper | Lead | Zinc | Mercury |
|---|---|---|---|---|---|---|---|---|---|
| CS-MW5-LGR | 3/8/2016 | NA | NA | -- | -- | NA | -- | NA | -- |
| CS-MW36-LGR | 3/8/2016 | NA | NA | -- | **0.0131** | NA | -- | NA | -- |
| **CSSA Drinking Water Well System** | | | | | | | | | |
| CS-1 | 3/16/2016 | **0.0067F** | **0.0344** | -- | -- | **0.005F** | -- | **0.208** | -- |
| CS-10 | 3/16/2016 | **0.0027F** | **0.0402** | -- | -- | **0.007F** | -- | **0.751** | **0.0002F** |
| CS-10 FD | 3/16/2016 | **0.0045F** | **0.0389** | -- | -- | **0.006F** | -- | **0.708** | **0.0002F** |
| CS-12 | 3/16/2016 | **0.0048F** | **0.0308** | -- | -- | **0.006F** | -- | **0.049F** | -- |
| CS-13 | 3/16/2016 | **0.0067F** | **0.0297** | -- | -- | **0.005F** | -- | **0.247** | -- |
| **Comparison Criteria** | | | | | | | | | |
| **Method Detection Limit (MDL)** | | **0.00022** | **0.0003** | **0.0005** | **0.001** | **0.003** | **0.0019** | **0.008** | **0.0001** |
| **Reporting Limit (RL)** | | **0.03** | **0.005** | **0.007** | **0.01** | **0.01** | **0.025** | **0.05** | **0.001** |
| **Max. Contaminant Level (MCL)** | | **0.01** | **2** | **0.005** | **0.1** | **AL=1.3** | **AL=0.015** | **SS=5.0** | **0.002** |

| Well ID | Sample Date | 1,1-DCE | cis-1,2-DCE | trans-1,2-DCE | PCE | TCE | Vinyl Chloride |
|---|---|---|---|---|---|---|---|
| CS-MW5-LGR | 3/8/2016 | -- | **16.94** | **0.44F** | **6.99** | **18.68** | -- |
| CS-MW36-LGR | 3/8/2016 | -- | **0.28F** | -- | **8.26** | **7.86** | -- |
| **CSSA Drinking Water Well System** | | | | | | | |
| CS-1 | 3/16/2016 | -- | -- | -- | -- | -- | -- |
| CS-10 | 3/16/2016 | -- | -- | -- | -- | -- | -- |
| CS-10 FD | 3/16/2016 | -- | -- | -- | -- | -- | -- |
| CS-12 | 3/16/2016 | -- | -- | -- | -- | -- | -- |
| CS-13 | 3/16/2016 | -- | -- | -- | -- | -- | -- |
| **Comparison Criteria** | | | | | | | |
| **Method Detection Limit (MDL)** | | **0.12** | **0.07** | **0.08** | **0.06** | **0.05** | **0.08** |
| **Reporting Limit (RL)** | | **1.2** | **1.2** | **0.6** | **1.4** | **1** | **1.1** |
| **Max. Contaminant Level (MCL)** | | **7** | **70** | **100** | **5** | **5** | **2** |

| | |
|---|---|
| **BOLD** | ≥ MDL |
| **BOLD** (blue) | ≥ RL |
| **BOLD** (red) | ≥ MCL |

| Precipitation per Quarter: | Mar-16 |
|---|---|
| AOC-65 Weather Station (AOC-65 WS): | 2.99 |
| B-3 Weather Station (B-3 WS): | 4.68 |

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

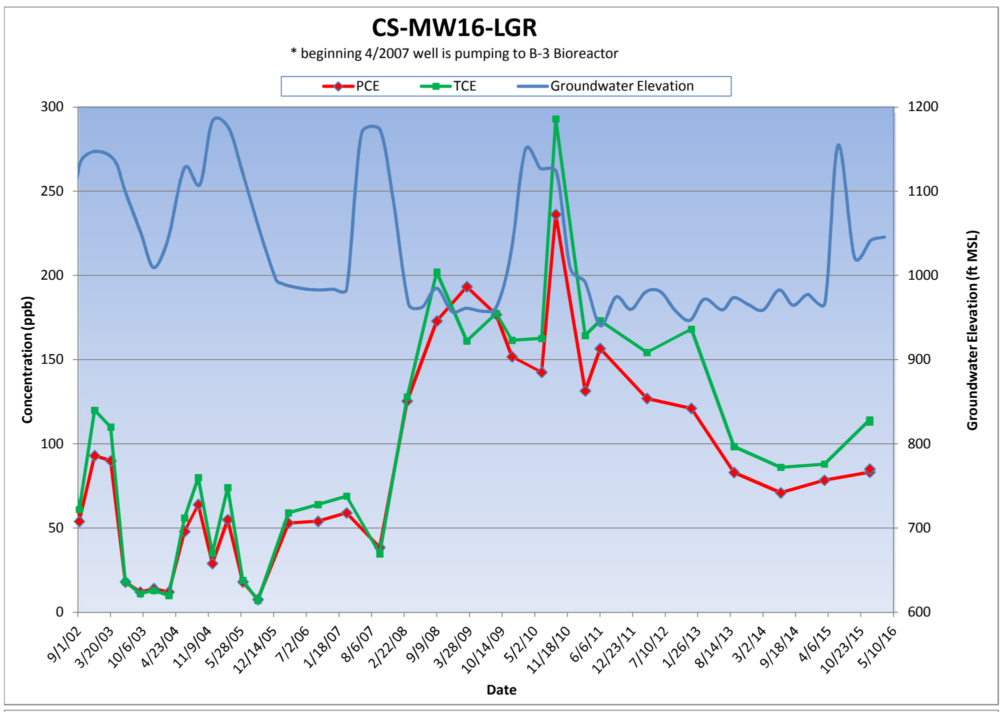
**Abbreviations/Notes:**

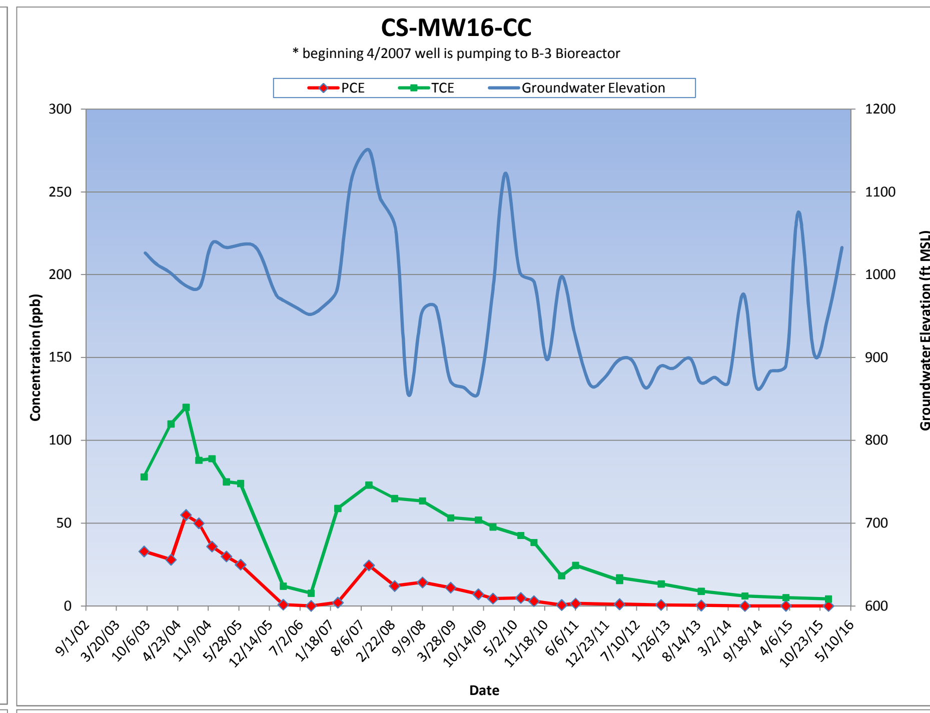
| | |
|---|---|
| FD | Field Duplicate |
| TCE | Trichloroethene |
| PCE | Tetrachloroethene |
| DCE | Dichloroethene |
| AL | Action Level |
| SS | Secondary Standard |
| NA | Not Analyzed for this parameter |

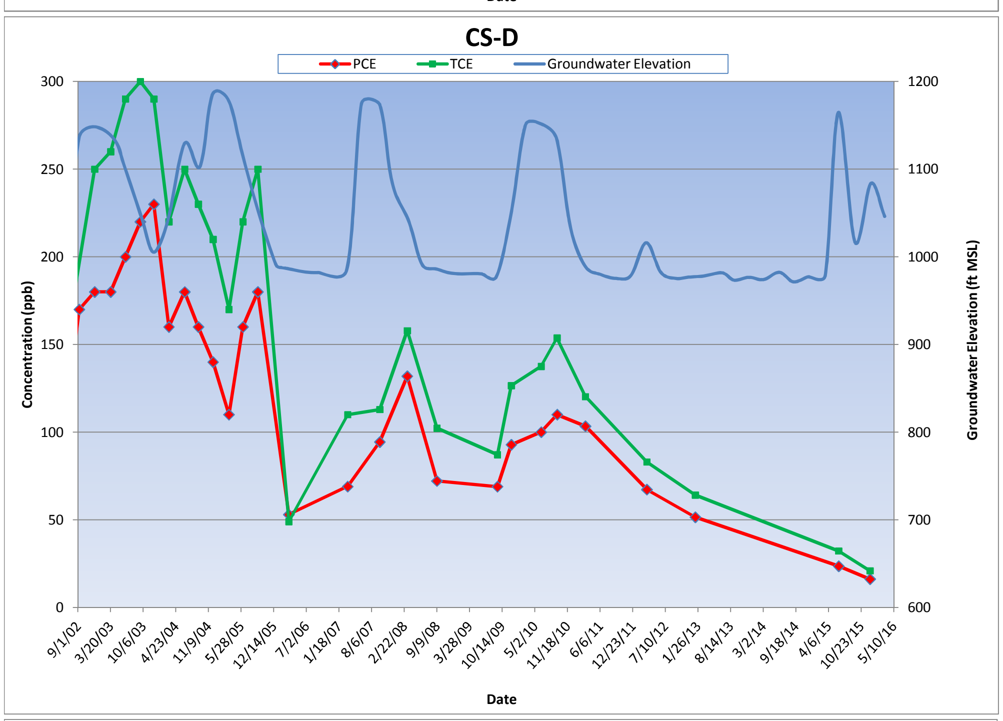
**Data Qualifiers**

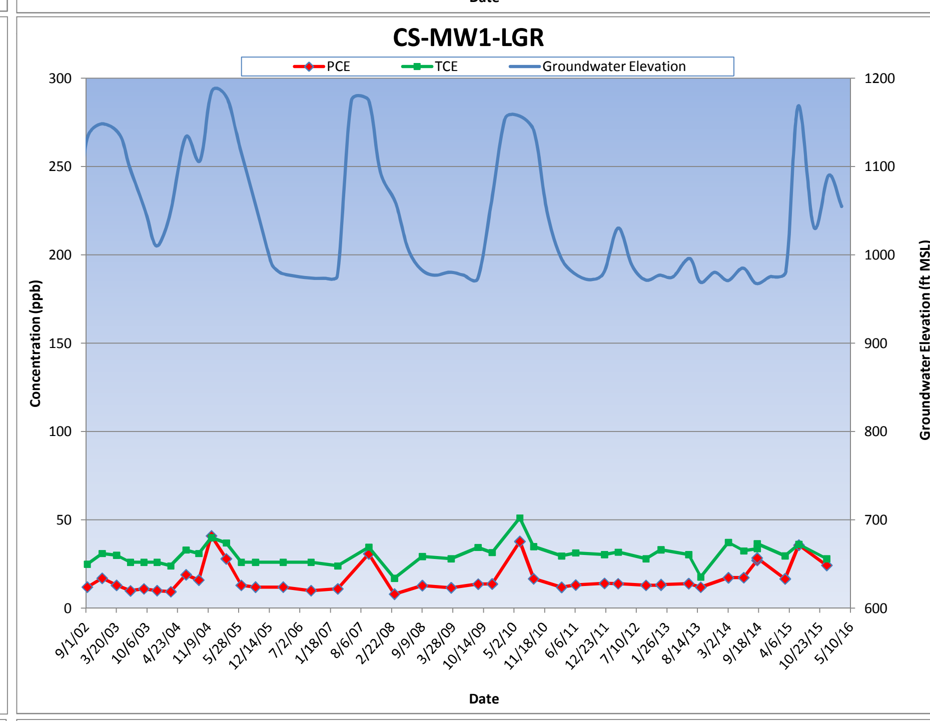
--The analyte was analyzed for, but not detected. The associated numerical value is at or below the MDL.
F-The analyte was positively identified but the associated numerical value is below the RL.

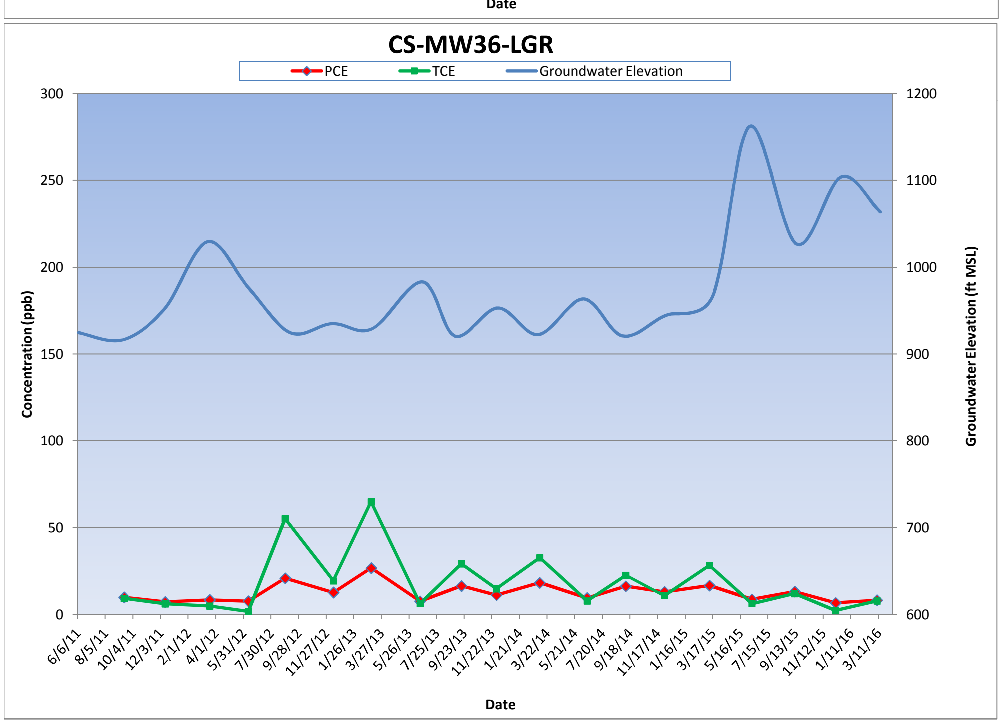
## Figure 3.2
## On-Post Cumulative Analytical vs. Groundwater Elevation

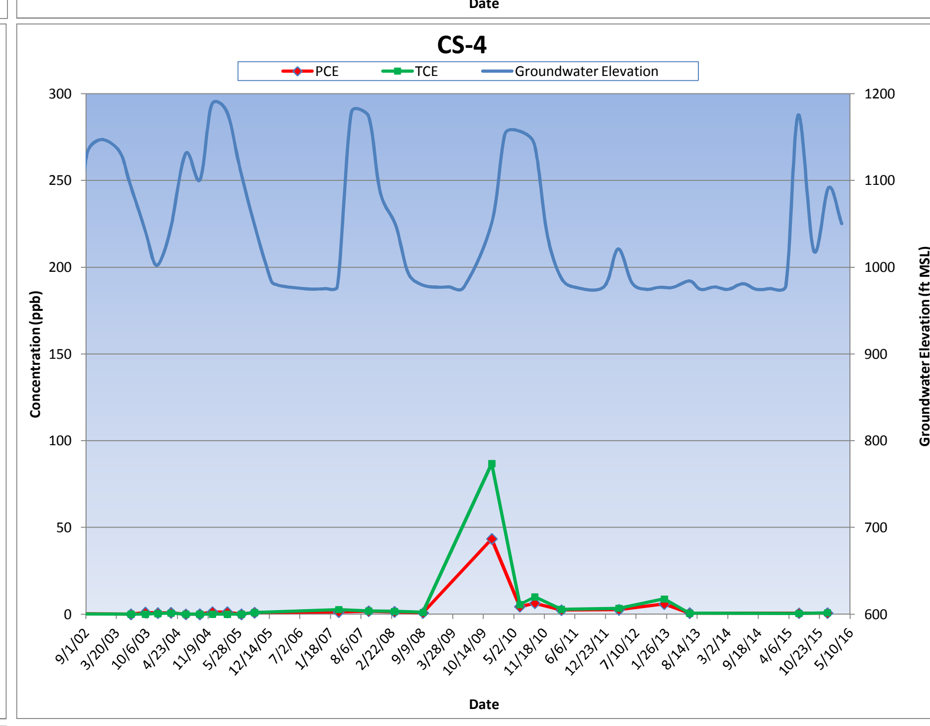


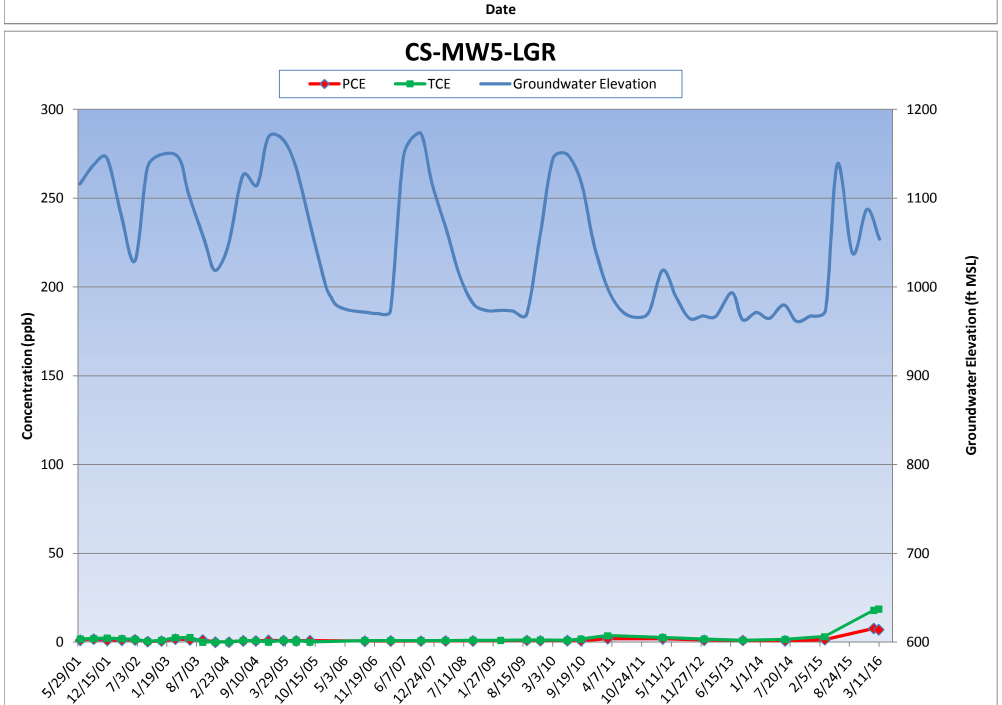




NOTE: Sampling dates are indicated by the squares on the trend line.

for sampling in March 2016. However, these wells were profiled to capture water level readings. These Westbay wells are located in the vicinity of AOC-65, and are part of the post wide quarterly groundwater monitoring program. The Upper Glen Rose (UGR)/LGR zones are sampled on a 9-month schedule, and the BS/CC zones are sampled on an 18-month schedule, as recommended in the LTMO. The sampling of these wells began in September 2003.

There are four other Westbay wells (CS-WB05, CS-WB06, CS-WB07, and CS-WB08) that are located at the SWMU B-3 remediation site. Those wells are sampled on a separate schedule in association with the SWMU B-3 bioreactor monitoring. Results for those wells are presented in the SWMU B-3 Performance Status Reports.

## 4.0 MARCH 2016 SUMMARY

- Groundwater samples were collected from all 5 of the on-post wells scheduled for monitoring in March 2016. One well (CS-MW5-LGR) was added to the schedule to monitor recent rising VOC levels in the well.
- From January 1 to March 16, 2016, CSSA's AOC-65 weather station recorded 2.99 inches of rain. The rainfall was consistent with 1 inch falling in January, 1 inch in February, and 1 inch the first part of March. No events had greater than one inch of rain. The SWMU B-3 weather station measured 4.68 inches of precipitation for the same time period. These totals are just above the historical monthly averages for the Boerne area.
- The Middle Trinity aquifer levels (LGR, BS, and CC) decreased an average of 43.11 feet per non-pumping wells since last quarter. The average water level in March 2016 (excluding pumping wells) was 189.01 feet BTOC (1052.53 feet MSL).
- VOCs were detected above the MCL in wells CS-MW5-LGR and CS-MW36-LGR. The VOC levels in both wells showed a moderate increase from the previous sampling event **(see Figure 3.2)**. This is only the second sampling event CS-MW5-LGR VOC levels have been above the MCL. This well has been sampled since 2001.
- There were no metals detected above the MCL/AL/SS in wells sampled in March 2016.
- No Westbay Well zones (WB01-WB04), in the vicinity of AOC-65, were sampled in March 2016. However these wells were profiled to collect water level data in the area. The UGR/LGR zones are sampled on a 9-month schedule, and the BS/CC zones are sampled on an 18-month schedule, as recommended in the LTMO.
- The groundwater project DQOs and LTMO, last revised in 2010, have been updated and were submitted to the TCEQ and EPA for approval in January 2016.

# APPENDIX A

# EVALUATION OF DATA QUALITY OBJECTIVES ATTAINMENT

# Appendix A 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, HSP, and LTMO recommendations. | 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 on March 15, 2016. | 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 March 15, 2016 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 or 18 months and 8 selected zones are sampled during the 'snapshot' event. | Yes. | Continue sampling. |

| Activity | Objectives | Action | Objective Attained? | Recommendations |
|---|---|---|---|---|
| Characterization of Environmental Setting (Hydrogeology) (Continued) | Identify any temporal changes in hydraulic gradients due to seasonal influences (2.1.5). | Downloaded data from continuous-reading transducers in wells: CS-MW4-LGR, CS-MW9-LGR, CS-MW12-LGR, CS-MW12-CC, CS-MW10-CC and CS-MW24-LGR. Additional continuous reading transducers were added to the program through the SCADA project. The following wells can be uploaded to see real time water level data: CS-MW16-LGR, CS-MW16-CC, CS-1, CS-12, and CS-10. Data was also downloaded from the AOC-65 and B-3 weather stations. Water levels will be graphed at these wells against precipitation data through December 2016 and included in the annual groundwater report. | Yes. | Continue collection of transducer data and possibly install transducers in other cluster wells. |
| Contamination Characterization (Ground Water 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 6 of 49 CSSA wells. The 4 BS wells are no longer sampled as part of the groundwater program. | 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 (COC) 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. | Groundwater samples were collected from wells: CS-MW5-LGR and CS-MW36-LGR. Samples were analyzed for the short list of VOCs using USEPA method SW8260B, and metals (cadmium, lead, mercury, and chromium). The drinking water wells (CS-1, CS-10, CS-12 and CS-13) were sampled for the short list of VOCs and additional metals (arsenic, barium, copper, and zinc). Analyses were conducted in accordance with the CSSA QAPP and approved variances. All reporting limits (RL) were below MCLs, as listed below: | Yes. | Continue sampling. |

| Activity | Objectives | Action | Objective Attained? | Recommendations |
|---|---|---|---|---|
| Contamination Characterization (Ground Water Contamination) (Continued) | Determine the horizontal and vertical concentration profiles of all constituents of concern (COC) 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. | **ANALYTE** / **RL (µg /L)** / **MCL(µg/L)**<br>1,1-DCE 1.2 7<br>*cis*-1,2-DCE 1.2 70<br>*trans*-1,2-DCE 0.6 100<br>PCE 1.4 5<br>TCE 1.0 5<br>Vinyl chloride 1.1 2 | Yes. | Continue sampling. |
| | | **ANALYTE** / **RL (µg/L)** / **MCL/AL (µg /L)**<br>Barium 5 2,000<br>Chromium 10 100<br>Copper 10 1,300<br>Zinc 50 5,000<br>Arsenic 30 10<br>Cadmium 7 5<br>Lead 25 15<br>Mercury 1 2 | Yes. | Continue sampling. |
| | Meet CSSA QAPP quality assurance requirements. | Samples were analyzed in accordance with the CSSA QAPP and approved variances. Parsons chemists verified all data. | 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 |

| Activity | Objectives | Action | Objective Attained? | Recommendations |
|---|---|---|---|---|
| Contamination Characterization (Ground Water Contamination) (Continued) | Meet CSSA QAPP quality assurance requirements. (Continued) | Previously, a method detection limit (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. |
| 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 B

# QUARTERLY ON-POST GROUNDWATER MONITORING ANALYTICAL RESULTS MARCH 2016

# Appendix B
## Quarterly On-Post Groundwater Monitoring Analytical Results, March 2016

| Well ID | Sample Date | Arsenic | Barium | Cadmium | Chromium | Copper | Lead | Zinc | Mercury |
|---|---|---|---|---|---|---|---|---|---|
| CS-MW5-LGR | 3/8/2016 | NA | NA | 0.0005U | 0.0010U | NA | 0.0019U | NA | 0.0001U |
| CS-MW36-LGR | 3/8/2016 | NA | NA | 0.0005U | **0.0131** | NA | 0.0019U | NA | 0.0001U |
| **CSSA Drinking Water Well System** | | | | | | | | | |
| CS-1 | 3/16/2016 | **0.0067F** | **0.0344** | 0.0005U | 0.0010U | **0.005F** | 0.0019U | **0.208** | 0.0001U |
| CS-10 | 3/16/2016 | **0.0027F** | **0.0402** | 0.0005U | 0.0010U | **0.007F** | 0.0019U | **0.751** | **0.0002F** |
| CS-10 FD | 3/16/2016 | **0.0045F** | **0.0389** | 0.0005U | 0.0010U | **0.006F** | 0.0019U | **0.708** | **0.0002F** |
| CS-12 | 3/16/2016 | **0.0048F** | **0.0308** | 0.0005U | 0.0010U | **0.006F** | 0.0019U | **0.049F** | 0.0001U |
| CS-13 | 3/16/2016 | **0.0067F** | **0.0297** | 0.0005U | 0.0010U | **0.005F** | 0.0019U | **0.247** | 0.0001U |

| Well ID | Sample Date | 1,1-DCE | cis-1,2-DCE | trans-1,2-DCE | PCE | TCE | Vinyl Chloride |
|---|---|---|---|---|---|---|---|
| CS-MW5-LGR | 3/8/2016 | 0.12U | **16.94** | **0.44F** | **6.99** | **18.68** | 0.08U |
| CS-MW36-LGR | 3/8/2016 | 0.12U | **0.28F** | 0.08U | **8.26** | **7.86** | 0.08U |
| **CSSA Drinking Water Well System** | | | | | | | |
| CS-1 | 3/16/2016 | 0.12U | 0.07U | 0.08U | 0.06U | 0.05U | 0.08U |
| CS-10 | 3/16/2016 | 0.12U | 0.07U | 0.08U | 0.06U | 0.05U | 0.08U |
| CS-10 FD | 3/16/2016 | 0.12U | 0.07U | 0.08U | 0.06U | 0.05U | 0.08U |
| CS-12 | 3/16/2016 | 0.12U | 0.07U | 0.08U | 0.06U | 0.05U | 0.08U |
| CS-13 | 3/16/2016 | 0.12U | 0.07U | 0.08U | 0.06U | 0.05U | 0.08U |

| | |
|---|---|
| **BOLD** | ≥ MDL |
| **BOLD** (blue) | ≥ RL |
| **BOLD** (red) | ≥ MCL |

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

**Abbreviations/Notes:**

| | |
|---|---|
| FD | Field Duplicate |
| TCE | Trichloroethene |
| PCE | Tetrachloroethene |
| DCE | Dichloroethene |
| AL | Action Level |
| SS | Secondary Standard |
| NA | Not Analyzed for this parameter |

**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 C

# DATA VALIDATION REPORT

## SDG 78912
## SDG 79015

**DATA VERIFICATION SUMMARY REPORT**

**for on-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 two groundwater samples and the associated field quality control (QC) sample collected from on-post Camp Stanley Storage Activity (CSSA) on March 8, 2016. The samples were assigned to the following Sample Delivery Group (SDG). All samples were analyzed for volatile organic compounds (VOCs) and metals including cadmium, chromium, lead, and mercury.

78912

The field QC samples associated with this SDG was one 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. Samples in this SDG were shipped to the laboratory in one cooler. The cooler was received by the laboratory at a temperature of 3.0 ºC, 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 two (2) on-post groundwater samples and one (1) TB. All samples were collected from March 8, 2016 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 analytical batch #205494 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 and the surrogate spikes.

All LCS and surrogate spike recoveries were within acceptance criteria.

### Precision

Precision could not be evaluated due to lack of duplicate analyses involved 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 standard. 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 at method detection limits for all target VOCs.

**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 two (2) on-post groundwater samples. Both samples were collected on March 8, 2016 and analyzed for cadmium, chromium, and lead.

The ICP-AES metals analyses were performed using USEPA SW846 Method 6010B. 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.

The samples for ICP-AES metals were digested in batch #205645. All analyses were performed undiluted.

**Accuracy**

Accuracy was evaluated using the percent recovery obtained from the LCS.

The LCS recoveries were within acceptance criteria.

**Precision**

Precision could not be measured due to lack of duplicate analyses involved 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 preservation and holding times; and
- Examining laboratory blank for cross contamination of samples during analysis.

Both 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 mercury portion of this SDG consisted of two (2) on-post groundwater samples. All samples were collected on March 8, 2016 and analyzed for mercury.

The mercury analyses were performed using USEPA SW846 Method 7470A. These two on-post groundwater 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 #205545. The analyses were performed undiluted.

**Accuracy**

Accuracy was evaluated using the percent recovery obtained from the LCS.

The LCS recovery was within acceptance criteria.

**Precision**

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

**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.

Mercury result for the two 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 on-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 four groundwater samples and the associated field quality control (QC) samples collected from on-post Camp Stanley Storage Activity (CSSA) on March 16, 2016. The samples were assigned to the following Sample Delivery Group (SDG). All samples were analyzed for volatile organic compounds (VOCs) and metals including arsenic, barium, cadmium, chromium, copper, lead, zinc, and mercury.

79015

The field QC samples associated with this SDG included one field duplicate (FD), one set of matrix spike/matrix spike duplicate (MS/MSD), and one 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. Samples in this SDG were shipped to the laboratory in one cooler. The cooler was received by the laboratory at a temperature of 3.0 ºC, 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 four (4) on-post groundwater samples, one FD, one set of MS/MSD, and one (1) TB. All samples were collected on March 16, 2016 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 analytical batch #205724 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, MS/MSD, and the surrogate spikes. Sample CS-13 was designated as the parent sample for the MS/MSD analyses.

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 results and parent/FD results. Sample CS-10 was collected in duplicate.

None of the target VOCs was detected in the parent/FD of CS-10.

All %RPDs of the 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.

- The LCS was prepared using a secondary source standard. 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 at method detection limits for all target VOCs.

**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 four (4) on-post groundwater samples, one FD and one set of MS/MSD. All samples were collected on March 16, 2016 and analyzed for arsenic, barium, cadmium, chromium, copper, lead, and zinc.

The ICP-AES metals analyses were performed using USEPA SW846 Method 6010B. 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.

The samples for ICP-AES metals were digested in batch #206165. All analyses were performed undiluted.

**Accuracy**

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

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

**Precision**

Precision was measured due based on the %RPDs of parent/FD and MS/MSD results.

All %RPDs of MS/MSD were compliant.

| Metals | Parent (mg/L) | FD (mg/L) | %RPD | Criteria (%RPD) |
|---|---|---|---|---|
| Barium | 0.0402 | 0.0389 | 3.3 | ≤ 20 |
| Zinc | 0.751 | 0.708 | 5.9 | ≤ 20 |

**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 mercury portion of this SDG consisted of four (4) on-post groundwater samples. All samples were collected on March 16, 2016 and analyzed for mercury.

The mercury analyses were performed using USEPA SW846 Method 7470A. These on-post groundwater 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 #206277. 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 measured based on the %RPD of parent/FD and MS/MSD results.

Mercury was not detected at or above reporting limit in both parent and FD samples; therefore, the %RPD calculation was not applicable.

%RPD of MS/MSD result was 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 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.

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%.