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10 May 2016

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Subject: Submittal of the Final *Long-term Monitoring Report, October 2015 Event, CCFTBR0044, Fort Bragg, North Carolina* (Contract W912QR-12-D-0002, Delivery Order CV02)

Ms. Thompson,

Please find enclosed one electronic copy of the Final *Long-term Monitoring Report, October 2015 Event, CCFTBR0044, Fort Bragg, North Carolina.* This document was prepared by Parsons Government Services, Inc. (Parsons) for the Savannah District of the United States Army Corps of Engineers and the Fort Bragg Directorate of Public Works (DPW). A copy of this document was also submitted to the North Carolina Department of Environmental Quality (NCDEQ).

If you have any questions or require additional information, please contact me at (801) 572-5999 or at ross.miller@parsons.com.

Sincerely,

PARSONS

Ross Miller PhD, P.E.
Project Manager

cc:
Mr. Paul Humphrey – Fort Bragg DPW (1 hard copy and 1 electronic copy)
Ms. Marti Morgan – NCDEQ (1 electronic copy)

FINAL
LONG-TERM MONITORING REPORT
OCTOBER 2015 EVENT
SITE CCFTBR0044

REMEDIATION SERVICES
AT
FORT BRAGG, NORTH CAROLINA

Prepared For:

U.S. Army Corps of Engineers, Savannah District

and

Fort Bragg

Prepared By:

PARSONS

May 2016

LONG-TERM MONITORING REPORT

Site CCFTBR0044

Project Title: Performance Based Remediation of 66 Sites, Fort Bragg-Pope AAF, North Carolina

Project Number: 748776

Client Name: U.S. Army Corps of Engineers, Savannah District

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Ross Miller, PhD, P.E. Date

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TABLE OF CONTENTS

Page

1.0 INTRODUCTION 1
1.1 Site Description 1
1.1.1 Topography and Surface Water Features 1
1.2 History of Fluoride Spill 2
1.3 Previous Investigations 2
1.4 Remediation Plan and Objectives 3
2.0 HISTORICAL REMEDIATION ACTIVITIES 4
2.1 Groundwater Injection System Design and Events 4
2.2 Soil Infiltration System Design and Events 5
2.3 Historic Remedial Systems Performance 5
Treatment Solution Distribution 5
Effects of Remedial Systems on Fluoride and pH 6
2.4 Stormwater Diversion System 7
3.0 GROUNDWATER AND STORM/SURFACE WATER MONITORING ACTIVITIES (CURRENT EVENT) 8
3.1 Water Level Gauging 8
3.2 Monitoring Well Purging, Sampling, and Analysis 8
3.3 Investigative Derived Waste (IDW) 9
3.4 Stormwater Sampling 9
4.0 RESULTS SUMMARY 10
4.1 Groundwater Results 10
4.1.1 Fluoride in Groundwater 10
4.1.2 Expected Natural Attenuation Mechanisms 10
4.2 Storm Water Results 11
5.0 CONCLUSIONS AND RECOMMENDATIONS 11
6.0 REFERENCES 11

TABLE OF CONTENTS (CONTINUED)

APPENDICES

A – Historical Soil Data – Fluoride and pH
B – Historical Injection and Infiltration Data
C – Groundwater Monitoring Field Forms
D - Laboratory Data Sheets (included in PDF version only)

LIST OF FIGURES

No.	Title
Figure 1	Site Location
Figure 2	Site Layout/Remediation System Elements
Figure 3	Groundwater Potentiometric Surface, October 2015 Event
Figure 4	Cross-section of Transect A-A'
Figure 5	Fluoride Concentration (October 2015) in Groundwater and Surface Water
Figure 6	Historic Fluoride Concentrations in Groundwater and Surface Water

LIST OF TABLES

No.	Title
Table 1	Well Construction Summary
Table 2	Water Gauging Summary – October 2015
Table 3	Historic Water Level Summary
Table 4	Water Quality Parameters
Table 5	Summary of Fluoride Data – October 2015
Table 6	Summary of Historic Fluoride and pH Results

ACRONYMS AND ABBREVIATIONS

AFB	Air Force Base
bgs	below ground surface
$CaCl_2$	calcium chloride
CaF_2	calcium fluoride
DO	Dissolved oxygen
GCAL	Gulf Coast Analytical Laboratories, Inc.
ft	feet
H_2SiF_6	fluorosilicic acid
IDW	Investigation derived waste
mg/kg	Milligrams per Kilograms
mg/L	Milligrams per Liter
mL/min	milliliters per minute
NCDEQ	North Carolina Department of Environmental Quality
Parsons	Parsons Government Services, Inc.
PGR	Preliminary Remediation Goal
POTW	Publicly Owned Treatment Works
RCRA	Resource Conservation and Recovery Act
Redox	Oxidation-reduction potential
RFI	RCRA Facility Investigation
RSL	Residential Screening Level
SSR	Site-specific remediation
SU	Standard Units
USACE	United States Army Corps of Engineers
VOC	volatile organic compound
WTP	water treatment plant
WWTP	Wastewater Treatment Plant OU7

LONG-TERM MONITORING REPORT
OCTOBER 2015 EVENT
CCFTBR0044
FORT BRAGG, NORTH CAROLINA

1.0 INTRODUCTION

This Long-term Monitoring Report presents the results of groundwater and surface water monitoring conducted by Parsons at CCFTBR044 (Site 44), the Fort Bragg water treatment plant (WTP), during the October 2015 monitoring event. This report was prepared by Parsons Government Services, Inc. (Parsons) to meet the format and content requirements identified in the United States Army Corps of Engineers (USACE) Performance Work Statement issued for this Task Order, and the Project Management Plan for Remediation Services at Fort Bragg, North Carolina for Task Order CV02 issued under contract number W912QR-12-D-0002.

1.1 Site Description

The Fort Bragg WTP was a conventional surface water treatment facility that provided drinking water to Fort Bragg and Pope Air Force Base (AFB). The WTP was decommissioned in March 2010 and no longer supplies water to the bases. The WTP site is located on West Manchester Road, west of the intersection with Waterworks Road. The site location is shown in **Figure 1**. Major features of the WTP project are shown in **Figure 2**, with the exception of background well 18M12, which is near the eastern entrance to the site (shown on **Figure 3**).

The Little River abuts the western border of the WTP fenced property. Surrounding land to the north, west and south is wooded property belonging to Fort Bragg. East of the site, or approximately 400 feet northeast of the former fluoride tank, is a small development of residential and commercial properties. Following the facility shutdown, no significant changes have been made to the infrastructure that would affect the shallow groundwater flow characteristics.

1.1.1 Topography and Surface Water Features

The topography at the WTP slopes fairly steeply away from the former fluoride tank containment basin to the southwest. At the base of the slope, approximately 330 feet from the containment basin, is an unnamed tributary of Little River. The banks of the tributary are very steep, and the surface water level is approximately 15 feet below the normal grade. Approximately 200 feet further downstream, the tributary flows into the Little River, just below a low-head dam. The Little River is a tributary of the Cape Fear River.

Topographic elevations are approximately 197 feet (1983 North American Datum, or NAD '83(07)) at the former fluoride tank slab and 160 feet at MW3. An unnamed tributary that runs through the southwest portion of the site, had a surface water elevation of approximately 145 feet during field work in January 2008. A cross-section depicting elevations of monitoring wells and the former fluoride tank slab is provided in **Figure 4**.

1.2 History of Fluoride Spill

The WTP was built in 1918 and was upgraded in 2000 to a plant capacity of 16 million gallons per day (Arcadis, 2011). The plant operated until March 2010. Finished water from the WTP was fluoridated with a 22.81% solution of fluorosilicic acid (H_2SiF_6). Until 2007, the fluoride solution was contained in a 10,000-gallon bulk storage tank on a concrete containment basin.

A leak was discovered near the base of the tank on March 19, 2007. The leak was caused by the failure of bolts in a flange and was stopped in less than 45 minutes after discovery by installing new bolts in the flange. WTP personnel estimated that approximately five to 30 gallons of fluorosilicic acid solution leaked out between discovery and repair. However, it was also reported by plant personnel that the leak may have started over the weekend, two days prior to the discovery on Monday. The total amount of solution unaccounted for in a review of inventory records since December 30, 2006 was approximately 7,000 gallons. Although the leak occurred inside the concrete containment basin, none of the leaked material was recovered. Due to the deteriorated state of the concrete, including a hole approximately one foot in diameter beneath the flanged outlet, the leaked material seeped into the ground. It appeared that the containment basin had deteriorated over a long period of time due to small leaks in the tank's connections and piping. After the release, the tank was emptied and removed, and the fluoride feed system was reconfigured in another area.

1.3 Previous Investigations

During the initial investigations conducted at the site in 2007 and 2008, fluoride concentrations in soil were as great as 10,000 mg/kg (9 feet below ground surface {bgs}) near the containment basin. Historical soil data is included in **Appendix A**. The highest concentration of fluoride in groundwater was 760 mg/L measured in MW-1 in 2008. Historic groundwater data is summarized in **Table 6.**

Previous environmental investigations relevant to the site are addressed in the following reports:

- *Final RCRA Facility Investigation (RFI) Report, Wastewater Treatment Plant OU7 (WWTP), Water Treatment Plant AOC A (WTP), Fort Bragg, North Carolina, RCRA Permit No. NC8210020121*, Zapata Engineering, August 2005 (predates the fluoride release but discusses an Area of Concern at the WTP related to a 1988 kerosene spill)
- *Phase II Remedial Investigation, Pope Air Force Base – Site SS018. Prepared for AFCEE under Contract # F41624-00-D-8609*, URS, April 2007 (concerns volatile organic compound (VOC) plumes at Pope AFB, for which wells were drilled on the WTP site)
- *Soil Sampling Results: Spring Lake Water Treatment Plant*, Terracon, Inc., April 20, 2007 (initial report prepared in response to fluoride release)
- *Groundwater Sampling Results: Spring Lake Water Treatment Plant*, Terracon, Inc., June 18, 2007 (supplemental to the previous Terracon report)
- *Site Investigation and Remedial Action Evaluation Report*, ARCADIS, November 2008 (provides the basis for the current remediation effort)

- ARCADIS, 2010a. First Quarterly Groundwater Sampling Report. Spring Lake, North Carolina. August.
- ARCADIS, 2010b. Second Quarterly Groundwater Sampling Report. Spring Lake, North Carolina. December.
- ARCADIS, 2011. Third Quarterly Groundwater Sampling Report. Spring Lake, North Carolina. April.
- ARCADIS, 2011. Fourth Quarterly Groundwater Sampling Report. Spring Lake, North Carolina. August.

1.4 Remediation Plan and Objectives

Remediation activities at the WTP have included the following:

- Removal of the concrete containment basin which was part of the release pathway;
- Installation and operation of an injection system for treatment of groundwater, followed by monitored natural attenuation of residual concentrations;
- Installation and operation of an infiltration system for in situ treatment of vadose zone soils; and
- Interim diversion of stormwater through a permitted discharge to the nearby wastewater treatment plant.

Objectives of the remediation systems were to meet site-specific fluoride and pH remediation goals for soil, groundwater and surface water. Site-specific remediation goals (SSR Goals) for fluoride are as follows:

- Fluoride remediation goals for soil are the former EPA Region 9 Preliminary Remediation Goal (PRG) for residential soils (3,700 mg/kg) and a leachability-based goal (40 mg/kg, which takes into account a dilution-attenuation factor of 20). It is noted that after the site specific goals were established, EPA replaced PRGs with Regional Screening Levels (RSLs); the residential RSL for fluoride in soil is 3,100 mg/kg. However, the PRG remains the SSR Goal for the project.
- The fluoride remediation goal for groundwater is the 15A NCAC 2L groundwater standard for fluoride (2 mg/L). It was anticipated that the in situ treatment system would be able to reduce fluoride concentrations to approximately 10 mg/L. Thereafter, monitored natural attenuation would be relied upon to reduce residual fluoride from approximately 10 mg/L to the 2 mg/L goal.
- The fluoride remediation goal for surface water is the 15A NCAC 2B .0211 Fresh Surface Water Quality Standard for Class C Waters (1.8 mg/L).

Because the background pH of these media in the vicinity of the site is acidic, pH SSR Goals are based on background levels derived from available data rather than regulatory levels:

- The pH remediation goal for soil is > 5.6 standard units.

- The pH remediation goal for groundwater is > 5.6 standard units.
- The pH remediation goal for surface water is > 5.0 standard units.

In setting these pH goals, it was recognized that they were conservative, and that a more nuanced statistical analysis may later be required to see if the pH post-treatment was actually inside or outside of the background range. After the January 2014 monitoring event, it was recommended that the SSR Goal for pH in groundwater and surface water be eliminated because surface water was in compliance with the SSR Goal and pH levels in groundwater are consistent with levels observed at the water treatment plant prior to the fluoride spill. The North Carolina Department of Environmental Quality (NCDEQ) concurred with the recommendation.

2.0 HISTORICAL REMEDIATION ACTIVITIES

The following sections detail the elements of the remedial groundwater and soil treatments that have been implemented at the site. Three full groundwater injection events ($CaCl_2$ and NaOH) and three soil infiltration events were completed, and an additional partial groundwater injection event (NaOH only) was conducted.

2.1 Groundwater Injection System Design and Events

Two groundwater injection wells (IW-1 and IW-2) are located approximately 50 to 60 feet hydraulically downgradient of the former fluoride tank containment basin to treat impacted groundwater emanating from the former fluoride tank containment basin area. Injection well construction details are summarized along with monitoring well construction details in **Table 1**.

Groundwater remediation events consisted of injection of two solutions during separate events to initially increase pH and to subsequently precipitate the dissolved phase fluoride in the form of calcium fluoride (CaF_2, the mineral fluorite). The first injection solution contained sodium hydroxide (NaOH) at a concentration of 0.8% weight/weight (w/w) (0.008 kilograms (kg) of NaOH per kg of water) to increase the pH of the groundwater to approximately 8 SU, the optimum pH for the subsequent precipitation reactions to occur.

The second injection solution contained calcium chloride ($CaCl_2$) at a concentration of 16% w/w (0.16 kg $CaCl_2$ per kg water). This second solution provides the calcium to bind with the existing fluoride in groundwater to form CaF_2, which has low solubility in water and is expected to precipitate as a solid and settle within the soil matrix. The precipitation of the mineral fluorite should result in removal of dissolved phase fluoride from the groundwater and eventually reduce groundwater concentrations of fluoride to levels of approximately 10 mg/L.

A summary of the groundwater injection events is as follows:

- Groundwater injection event #1 – Injection of 11,300 gallons of NaOH solution (0.8% w/w) and 11,400 gallons of $CaCl_2$ solution (16% w/w) in the two injection wells (IW-1 and IW-2) between February 3 and February 25, 2010. Dose-response testing in the surrounding aquifer was performed during this injection event to evaluate operation parameters and optimize injection performance.

- Groundwater injection event #2 – Injection of 10,000 gallons of NaOH solution (0.8% w/w) and 10,000 gallons of $CaCl_2$ solution (17% w/w) in the two injection wells (IW-1 and IW-2) between March 24 and March 31, 2010.
- Partial groundwater injection event – Injection of 10,000 gallons of NaOH solution (0.8% w/w) on August 26, 2010.
- Groundwater injection event #3 – Injection of 10,000 gallons of NaOH solution (0.8% w/w) on November 30, 2010 and injection of 8,000 gallons of $CaCl_2$ solution (12% w/w) in the two injection wells (IW-1 and IW-2) on December 6.

The injection data collected during these events are summarized in **Appendix B**. In accordance with the remediation plan, no further injections are planned. Subsequently, monitored natural attenuation is expected to reduce fluoride concentrations below the NCAC 2L groundwater standard of 2 mg/L.

2.2 Soil Infiltration System Design and Events

An infiltration system was constructed over the areas where vadose zone soils were impacted with elevated fluoride concentrations. The system consists of a series of trenches that are approximately one to two feet deep, approximately two feet wide, spaced three to four feet apart edge to edge, and approximately 40 to 50 feet long. A layout of the trench system is depicted on **Figure 2**. An approximate 6-inch layer of gravel was placed in the trenches to help increase stability of the trench sidewalls. A series of perforated PVC pipes were placed along the centerlines of the trenches to evenly distribute the infiltration solutions throughout the infiltration gallery.

The infiltration events were designed in a similar manner to the groundwater injection events with regard to delivery of two different solutions (NaOH and $CaCl_2$) applied sequentially to initially increase pH and subsequently precipitate fluoride in the vadose soil. Solution strengths for the infiltrations were designed to be higher than for the ground water injections with planned concentrations of 1.5% w/w of NaOH solution and 17 to 21% w/w of $CaCl_2$ solution. The infiltration data collected during these events are summarized in **Appendix B**. A summary of the soil infiltration events is as follows:

- Soil infiltration event #1 – Infiltration of 4,000 gallons of NaOH solution (1.5% w/w) within the infiltration gallery between April 5 and April 6, 2010.
- Soil infiltration event #2 – Infiltration of 32,000 gallons of NaOH solution (1.5% w/w) and 18,000 gallons of $CaCl_2$ solution (17% w/w) within the infiltration gallery between May 7 and May 18, 2010.
- Soil infiltration event #3 – Infiltration of 14,500 gallons of NaOH solution (1.5% w/w) on November 30, 2010 and 4,000 gallons of $CaCl_2$ solution (12% w/w) on December 6, 2010.

2.3 Historic Remedial Systems Performance

Treatment Solution Distribution

Results from the remedial system testing indicate that the infiltration solutions were adequately delivered to the impacted vadose soils, and both calcium and chloride

persisted in groundwater for at least one to three weeks after they were introduced. Remediation system monitoring data (**Appendix B**) provides information about the distribution of treatment solutions.

The background calcium concentration at the site was about 5 to 25 mg/L (at background or downgradient wells 18M12, 18M13 and MW-3 in August, 2010). Concentrations of 43 to 259 mg/L were detected in the groundwater treatment area at MW-2, MW-4 and SW-6 in December 2011. The ideal calcium concentration needed to meet the stoichiometric requirement for CaF_2 precipitation is 3 to 5 times the fluoride concentration. This condition was met at MW-4 and SW-6, suggesting that the mid-plume area was an active treatment zone.

Chloride was present at elevated concentrations in the same locations. Although chloride is not necessary for the precipitation reaction, it provides an additional indication of reagent distribution. It is noted that the chloride level at MW-2 (130 mg/L) and SW-6 (140 mg/L) did not exceed the 15A NCAC 2L groundwater standard for chloride (250 mg/L).

The pH level is another indicator of reagent effects from NaOH injection. Although pH increased dramatically during injections, it typically rebounded toward the low end of the remediation target range (5.6 to 8.5 SU). December 2010 pH results show that the treatment did not overshoot the target range. The highest pH at MW-2 (8.4 SU) suggests that the NaOH injections had a sustained effect.

Effects of Remedial Systems on Fluoride and pH

Results from soil analyses performed in vadose soil below and surrounding the former containment basin indicate that ionic fluoride concentrations decreased significantly after implementation of the soil remedy. Fluoride concentrations in soil directly below the former fluoride tank containment basin decreased from 10,000 mg/kg in 2007 (depth of 9 ft bgs) to 20 mg/kg in the soil sample collected in 2011 from a similar location and depth. The average fluoride concentration in the 2011 samples was 28.4 mg/kg which represents a significant decrease from the average fluoride concentration of 1294 mg/kg in 2007 and 2008. Fluoride concentrations in all soil samples collected in 2011 were well below the (former) residential PRG. Although not all 2011 concentrations were below the leachability based SSR Goal of 40 mg/kg, average concentrations were below the goal, and all but one of the residual exceedances occurred near the water table. The remaining fluoride impacts to soils are expected to decrease with time to levels below SSR Goals. Historical fluoride concentrations in soil are shown in Figures 4-4 and 4-5 in **Appendix A**.

Historic pH levels detected during soil investigations in 2007 and 2008 and post-treatment are presented in Figure 4-6 and 4-7 of **Appendix A**. Comparison of the data before and after active treatment indicates that pH in soil samples increased to levels above (in compliance with) the SSR Goal in nine of the 14 samples collected in 2011. pH levels in the five samples below the SSR Goal ranged from 4.3 to 5.3 SU. Four of the five were collected at 14-15 ft bgs, near the water table. Although pH levels have not achieved the SSR Goal in all samples, overall levels have increased significantly since the soil treatment actions.

Fluoride concentrations in groundwater were at their lowest level one month after the third groundwater injection event during the December 2010 event. During this event, fluoride was detected in four wells at concentrations ranging from 8.1 to 28 mg/L. Slight rebound was observed in MW-1 and MW-2 during the March 2011 event. Although concentrations exceeded the SSR Goals in four monitoring wells and in the storm water discharge in 2010 and 2011, concentrations were significantly lower than pre-treatment concentrations measured in 2008 (760 mg/L in MW-1). Residual fluoride concentrations in groundwater are expected to achieve the final goal of 2 mg/L with continued natural attenuation.

The post-injection pH in shallow groundwater at the site was within the range observed in this area of North Carolina in precipitation and surface water, suggesting that the remaining soils are not significantly acidifying groundwater. One year after the final groundwater injection event (March 2011) the pH in groundwater had achieved the SSR Goal in all monitoring wells within the apparent plume except for MW-1 (pH 5.0). However, pH levels were below the SSR Goal for groundwater in samples collected from two wells located outside the apparent plume, indicating that natural background pH may also be below the SSR Goal. Note that NCDEQ concurred with the January 2014 LTM report recommendation to remove the SSR Goal for pH in groundwater and surface water; since surface water and groundwater were consistent with levels observed at the WTP prior to the fluoride spill.

2.4 Stormwater Diversion System

A stormwater collection vault (also referred to as a junction box or sump) is present at the site near the southern fenceline (**Figure 2**). The stormwater collection vault contains three inflow pipes, as shown in **Figure 2**; Pipe 1 (a 12-inch metal pipe leading to the north), Pipe 2 (a 12-inch metal pipe leading to the northeast), and Pipe 3 (an 18-inch reinforced concrete pipe leading to the east). Previous sampling of discharge water from each of the pipes indicated that the majority of the fluoride in the storm drains came from Pipe 1 and Pipe 2.

The origins of Pipe 1 and Pipe 2 are unknown. American Water examined historical maps of the area and interviewed former employees of the WTP, who were unable to identify their origins or purpose. An additional effort by American Water to find the pipes' origins by plugging them at the junction box did not produce any additional information. Both pipes appear to be heavily corroded, and are likely susceptible to influx from groundwater.

The stormwater previously discharged approximately 150 feet away to the unnamed tributary of the Little River through a subsurface discharge pipe; however, ARCADIS constructed a dam in front of this discharge pipe in December 2009 to reduce the potential discharge of fluoride-impacted water to the tributary. A sump pump was installed in the collection vault to pump stormwater to the surge tank via the sump pump discharge line shown on **Figure 2**. On December 15, 2009, ARCADIS completed construction of the stormwater diversion system and started the system. The stormwater diversion system is designed to stop nearly all flow from Pipe-1, Pipe- 2, and Pipe-3 to the outlet into the unnamed tributary to the Little River.

During facility decommissioning, use of the surge tank was discontinued, and the stormwater sump pump discharge line was re-routed to a nearby sewer lift station in May

2010. The location of the re-routed discharge line is depicted on **Figure 2** (see sample location SW-6). The sump pump was observed to be operating normally during quarterly monitoring events conducted between December 2010 and March 2011 and continued to divert all storm water accumulating in the vault away from the stream into the sewer lift station. During the May 2013 monitoring event, it was observed that the sump pump was not operational and it was subsequently determined that power to the overall facility has been disconnected due to decommissioning of the facility.

3.0 GROUNDWATER AND STORM/SURFACE WATER MONITORING ACTIVITIES (CURRENT EVENT)

A long-term monitoring event for groundwater and surface water was conducted in October 2015. Monitoring activities were conducted by Parsons in accordance with the Final Quality Assurance Project Plan/Sampling and Analysis Plan for Performance Based Remediation of 66 Sites at Fort Bragg-Pope AAF (Parsons, 2013).

3.1 Water Level Gauging

Depth to groundwater was measured on October 25, 2015 in seven monitoring wells (MW-1, MW-1D, MW-2, MW-3, MW-4, MW-5, and 18M13) prior to the sampling activities. Upgradient monitoring well 18M12 was eliminated from the monitoring program after the January 2014 event due to lack of fluoride exceedances. Static groundwater level measurements were collected using an electronic water level indicator. The indicator probe was lowered into each monitoring well until the alarm sounded and/or the indicator light illuminated. The probe was then withdrawn several feet and slowly lowered again until the groundwater surface was contacted, as noted by the alarm and/or indicator light. Water level measurements were estimated to the nearest 0.01 ft from the top of the well casing. Depth to water and groundwater elevation measurements from each monitoring well are summarized in **Table 2**. Historical water level measurements are summarized in **Table 3**. Well construction data, including screened intervals of each well, are provided in **Table 1**. A potentiometric surface map depicting groundwater flow is provided in **Figure 3**. Groundwater flow at the site is generally toward the west.

3.2 Monitoring Well Purging, Sampling, and Analysis

Purging and sampling of monitoring wells were performed using a decontaminated, non-dedicated bladder pump, or a low-flow peristaltic pump depending on the depth to water. Dedicated Teflon®-lined polyethylene tubing was used with the bladder pump and disposable polyethylene tubing was used with the peristaltic pump. Decontamination of non-dedicated equipment used for the purging of monitoring wells and collection of groundwater samples was conducted between samples. All decontamination liquids were contained and recovered for disposal as investigative derived waste (IDW).

Purging was performed using low-flow techniques with a pumping rate of less than 500 milliliters per minute (mL/min). The pH, specific conductance, dissolved oxygen (DO), oxidation-reduction potential (Redox), turbidity and temperature of the groundwater were recorded during well purging and sampling using a YSI 556® multi-meter equipped with a flow-through cell and a Lamotte 2020® stand-alone turbidity meter. The parameter readings were considered stable when three consecutive readings,

taken at three to five minute intervals, satisfied the following NCDEQ criteria: temperature (± 0.2°C), pH (± 0.2 Standard Units), specific conductance (± 5.0% of reading), ORP (± 10% millivolts [not required by NCDEQ criteria, but included in Parsons standard operating procedure]), DO (± 0.2 mg/L or 10% whichever is greater), and turbidity (<20 NTUs, if turbidity cannot be reduced to below 20 NTUs: ± 5NTUs, or 10% whichever is greater). A summary of the water quality parameters measured prior to sample collection is presented in **Table 4** and in the groundwater sampling forms in **Appendix C**.

Sampling of the monitoring wells was conducted immediately after completion of purging. All groundwater samples were transferred directly into pre-labeled laboratory sample containers from the discharge tubing. Immediately after collection of samples, each container was placed into an ice-filled cooler to ensure preservation. Groundwater samples were shipped to Gulf Coast Analytical Laboratories, Inc. (GCAL) in Baton Rouge, Louisiana under standard chain of custody procedures. Gulf Coast Analytical Laboratories, Inc. is currently accredited by the North Carolina Division of Water Quality and holds certificate number 618. GCAL provided analyses for fluoride by USEPA Method 300.0. Results of the groundwater analysis are presented in Section 4.1.

3.3 Investigative Derived Waste (IDW)

All purge water and decontamination fluids were containerized within 55-gallon drums and properly sealed and labeled. Drums were staged at the post drum storage yard adjacent to Building 3-1137. The IDW was classified as non-hazardous based on previous analytical profiles and transported to an appropriate disposal facility.

3.4 Stormwater Sampling

The specific locations of stormwater samples have changed throughout the project; however, all of the samples discussed in this section are expected to be representative of the same stormwater discharge. Initially, samples of the stormwater from the collection vault pipe that discharged to the unnamed tributary described in Section 2.4 were identified as SW-4. This discharge location was rerouted in December 2009 to a surge tank (see **Figure 2**), and as a result, subsequent samples of the discharge water to the surge tank were identified as SW-5. The discharge line was subsequently re-routed to the sewer lift station (SW-6) in March 2010.

During the May 2013 monitoring event, locations SW-4 and SW-6 were scoped for sampling. Water was present at location SW-6 and sampled as planned, but there was no water in the vault pipe associated with SW-4. The sample designated as SW-4 was collected from the unnamed tributary approximately 20 feet downgradient from the vault pipe.

Because there is currently no power at the facility to operate the sump pump, stormwater is no longer routed to the lift station (SW-6). It was determined that the stormwater collection vault (Sump-1) and location SW-1 were the most representative stormwater sampling locations. Location Sump-1 was sampled in November 2013 and again in January 2014, and SW-1 was sampled in February 2014. Both Sump-1 and SW-1 were sampled during the October 2015 event. Note that the location of SW-1 has been

adjusted slightly from its original location in the culvert adjacent to a headwall due to lack of water. SW-1 is presently located in the unnamed tributary, slightly downgradient from the vault pipe outfall.

The surface water sampling methods are based on the guidance provided by the USEPA Region 4 (USEPA, 2001). At each location the sampling process started with the field team donning a new pair of latex or nitrile gloves. The sampler then faced upstream and submerged each pre-labeled bottle associated with the subject sampling location. Bottles were submerged in an upright position. Each bottle was allowed to fill slowly until the bottle was filled but not overfilled to avoid losing any chemical preservative. Each bottle was capped immediately after filling and placed in an ice filled cooler. The sampler took care to avoid disturbing any sediment while filling bottles so that the samples were collected as turbidity free as possible. Results of the stormwater analysis are presented in Section 4.2.

4.0 RESULTS SUMMARY

4.1 Groundwater Results

Results of the October 2015 sampling event are summarized in the following sections and the laboratory data package is included in **Appendix D**.

4.1.1 Fluoride in Groundwater

Fluoride results for groundwater samples are summarized in **Table 5** and on **Figure 5**. Historic fluoride concentrations are summarized in **Table 6**. Exceedances of the SSR Goal for fluoride (2 mg/L) occurred in four wells (MW-1, MW-2, MW-4, and MW-5) during the October 2015 sampling event. These four wells have historically exceeded the SSR, but concentrations have steadily decreased with the exception of this sampling event; MW-5 had a detection of 38.9 mg/L. Slight rebound was observed at MW-1 after the final injection event, but concentrations have declined since rebound was observed in 2011. Historical fluoride concentrations are shown on **Figure 6**. Fluoride levels were non-detect at the downgradient well 18M13 near the Little River.

The well pair MW-1/MW-1D shows that the depth of fluoride impacts to groundwater is limited. Although MW-1D is only approximately 12 feet deeper than MW-1, fluoride concentrations decrease significantly with depth. During the October 2015 event, fluoride was detected in MW-1 at a concentration of 11.6 mg/L but was non-detect in MW-1D. These data are consistent with historic results in which fluoride concentrations in MW-1D were generally at least two orders of magnitude lower than the concurrent concentrations detected in MW-1 (**Table 6**).

4.1.2 Expected Natural Attenuation Mechanisms

Applicable natural attenuation mechanisms at this site are expected to include sorption to aluminum and iron minerals as well as dispersion and dilution (Arcadis, 2011). Fluoride sorption to soils tends to be strongest in lower pH soils. For example, Peek and Volk (1985) studied a series of 10 soils with pH ranging from 4.6 to 8.1. The strongest sorption soils were those with pH between 4.6 and 5.6. Thus, while precipitation as fluorite with added calcium and base was the primary mechanism of active treatment, sorption will likely be the primary control on fluoride mobility during natural attenuation

at typical pH levels for the region. The viability of natural attenuation should be ensured by monitoring to confirm that attenuation capacity continues to be sufficient to control contaminant mobility. A more detailed discussion of natural attenuation mechanisms can be found in the 4th Quarterly Groundwater Sampling & Remedial Systems Performance Report (Arcadis, 2011).

4.2 Stormwater Results

The fluoride results for stormwater are summarized in **Table 5** and on **Figure 5**. Historical data are summarized in **Table 6**. During the October 2015 event, fluoride concentrations at Sump-1 were 4.38 mg/L and 0.113 J mg/L at SW-1.

5.0 CONCLUSIONS AND RECOMMENDATIONS

In accordance with the remediation plan for the site, and as directed by Fort Bragg in November 2010, no further injection or infiltration events are to be conducted. Remediation has now transitioned to the long-term monitoring with monitored natural attenuation phase. It is recommended that long-term monitoring of fluoride in groundwater and storm water continue on an annual basis. Monitoring of seven wells (MW-1, MW-1D, MW-2, MW-3, MW-4, MW-5, and 18M13) and two stormwater locations (SW-1 and Sump-1) should continue.

6.0 REFERENCES

ARCADIS, 2011. Fourth Quarterly Groundwater Sampling Report. Spring Lake, North Carolina. April 2011.

Parsons, 2013. Long-term Monitoring Report, May 2013 Event, CCFTBR0044, Fort Bragg, North Carolina. September 2013.

Parsons, 2014. Long-term Monitoring Report, January 2014 Event, CCFTBR0044, Fort Bragg, North Carolina. April 2014.

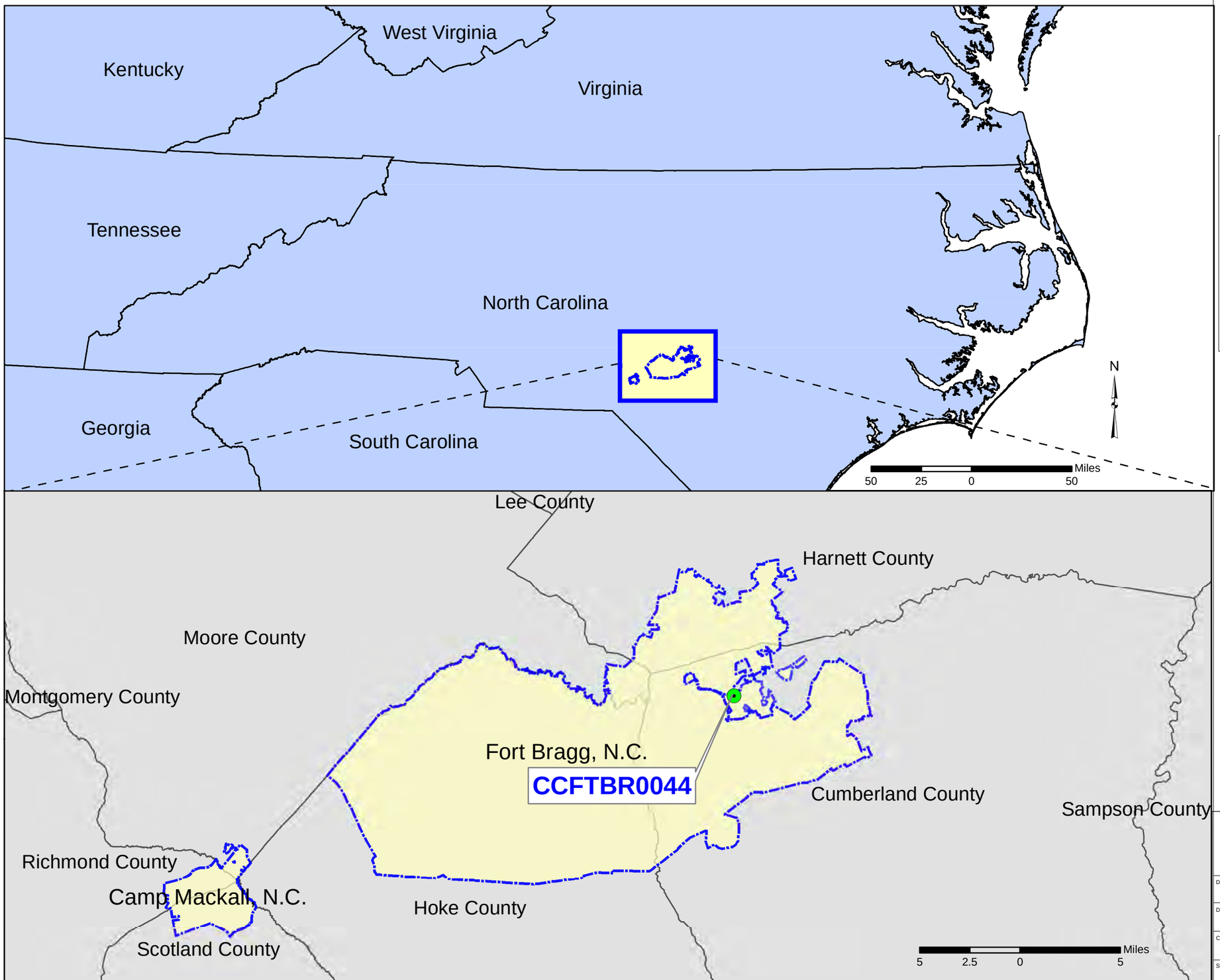
Parsons, 2015. Final Long-term Monitoring Report, November 2014 Event, CCFTBR0044, Fort Bragg, North Carolina. July 2015.

FIGURES

Figure 1

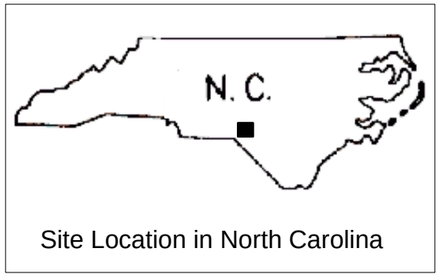
Site CCFTBR0044
Site Location

Fort Bragg, North Carolina



Legend

- CCFTBR0044 (Site 44)
- Installation Boundary
- County Boundary
- State Boundary



Coordinate System: North Carolina State Plane, NAD83, Feet

N

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DESIGNED BY: BT	Site Location FTBR-305
DRAWN BY: LH	
CHECKED BY: AW	SCALE: As Shown — PROJECT NUMBER: 747356.09000
SUBMITTED BY: AW	DATE: February 2015 — FIGURE NUMBER: 1
	FILE: SAP_FTBR-305_SiteLoc.mxd

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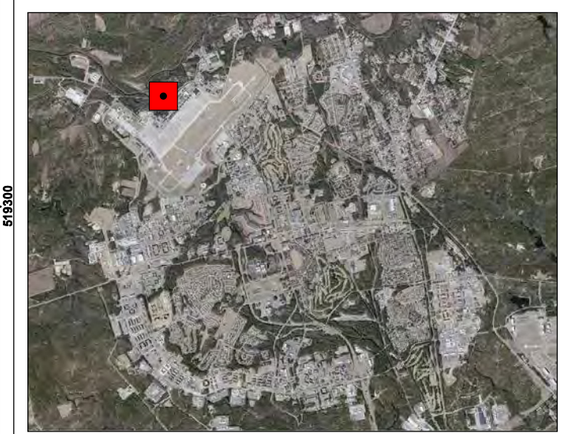
Figure 2

Site CCFTBR0044
Site Layout/Remediation System Elements

Fort Bragg, North Carolina

Legend

- Street/Road
- Stream
- Building
- Existing Infrastructure
- Monitoring Well Location
- Injection Well
- Surface Water or Storm Water Sample
- Location of CCFTBR0044
- Underground Storm Pipe
- Sump Pump Discharge Line
- Estimated Extent of Vadose Zone Soil Requiring Treatment
- Infiltration Trench
- Water Line
- Storm Sewer Line
- Cross Section Transect



Coordinate System: North Carolina State Plane, NAD83, Feet

100 50 0 100 Feet

N

PARSONS	748776.09000
DESIGNED BY: BT	Site CCFTBR0044 Site Layout/Remediation System Elements
DRAWN BY: LH	
CHECKED BY: AW	SCALE: As Shown — PROJECT NUMBER:
SUBMITTED BY: AW	DATE: February 2015 — FIGURE NUMBER: 2
	FILE: SAP_CCFTBR_0044.mxd

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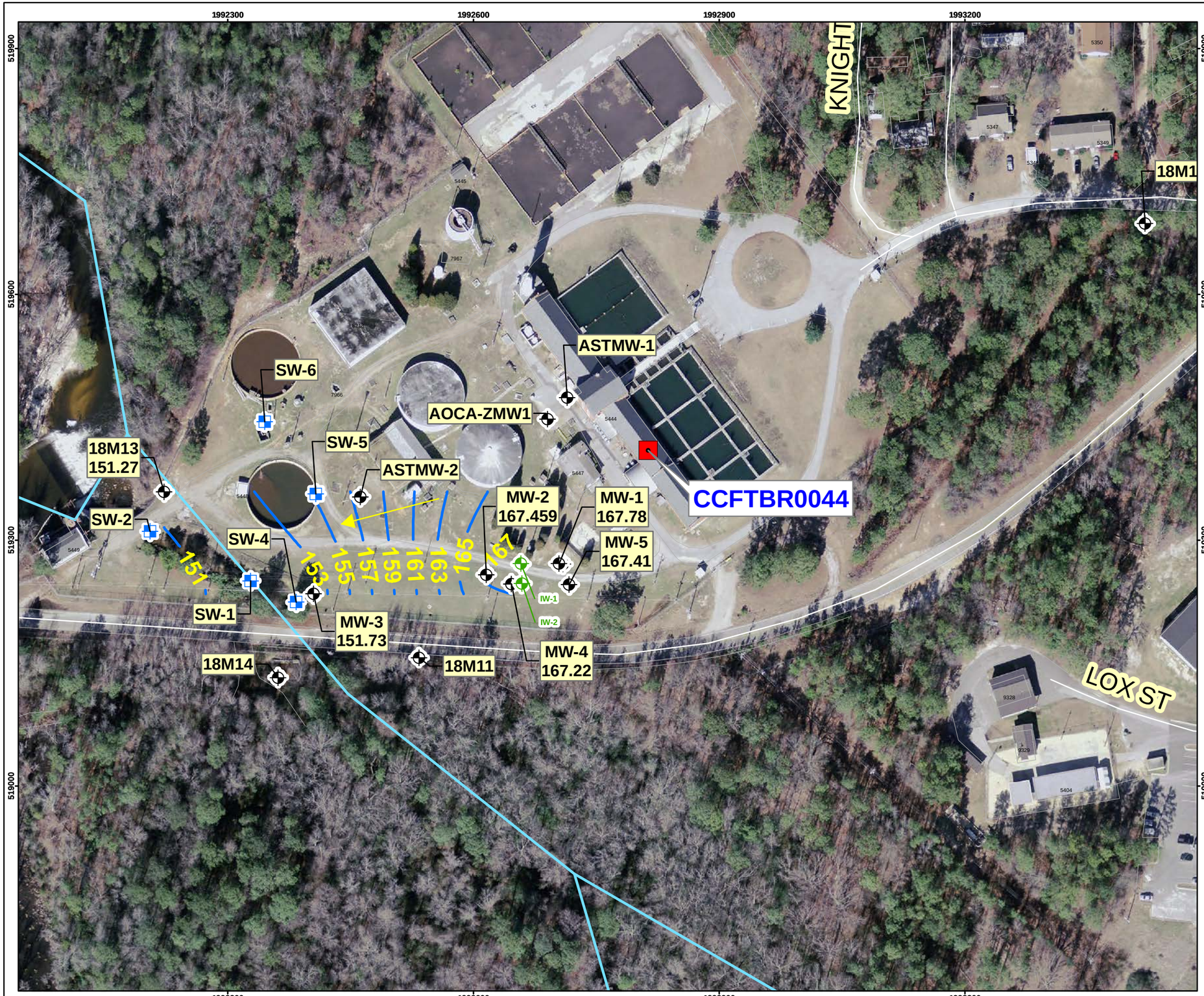
Figure 3

Site CCFTBR0044
Groundwater Potentiometric Surface
October 2015 Event
Fort Bragg, North Carolina



Legend

- Street/Road
- Stream
- Building
- Existing Infrastructure
- Location of CCFTBR0044
- Monitoring Well Location
- Injection Well
- Surface Water or Storm Water Sample
- Groundwater contour
- Direction of groundwater flow

Coordinate System: North Carolina State Plane, NAD83, Feet

120 60 0 120 Feet

N

PARSONS

748776.09000

DESIGNED BY: BT	Site CCFTBR0044 Groundwater Potentiometric Surface October 2015 Event
DRAWN BY: LH	
CHECKED BY: AW	SCALE: As Shown — PROJECT NUMBER:
SUBMITTED BY: AW	DATE: January 2016 — FIGURE NUMBER: 3
	FILE: SAP_CCFTBR_0044.mxd

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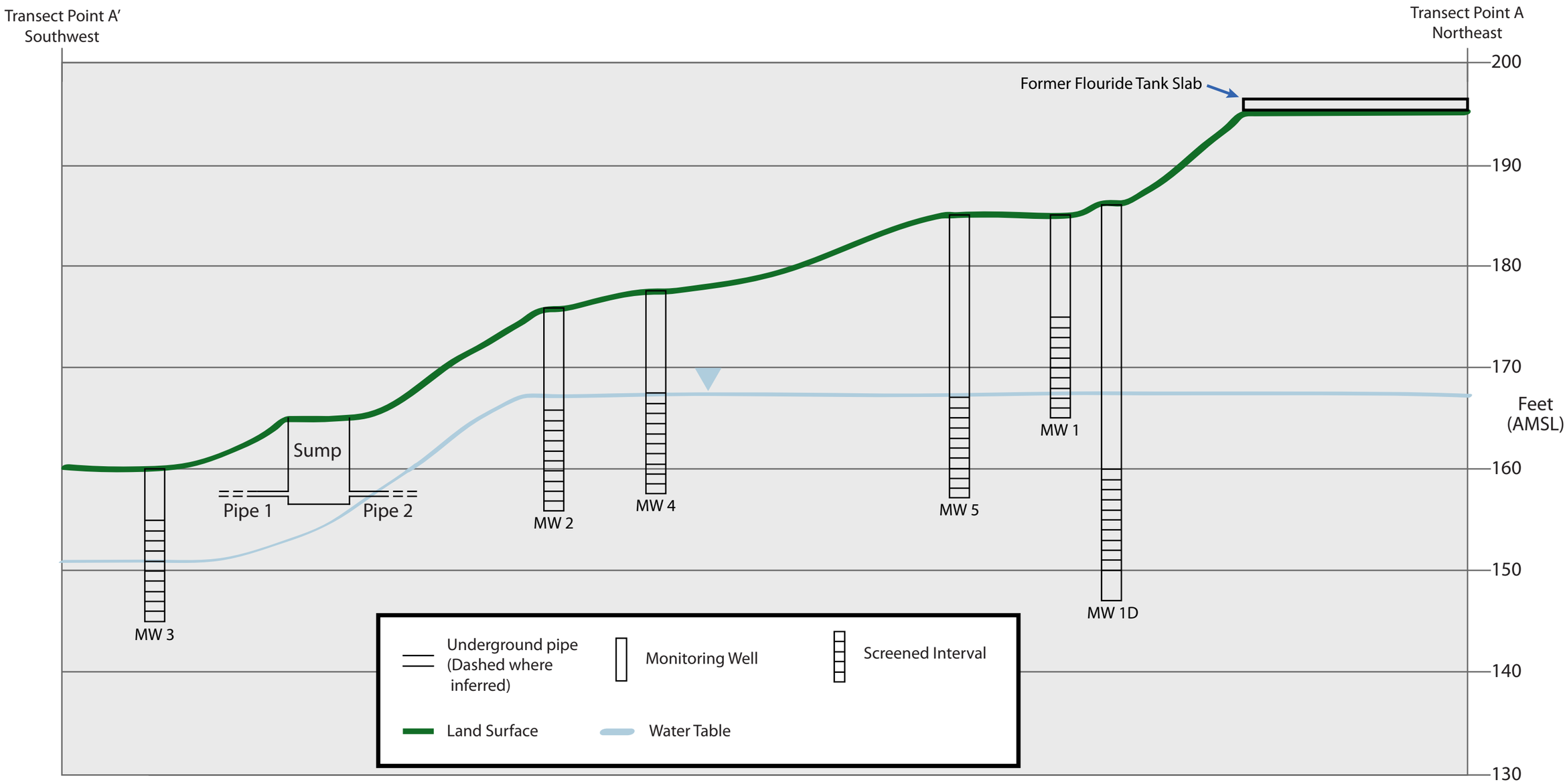
Figure 4
CROSS SECTION TRANSECT A - A'



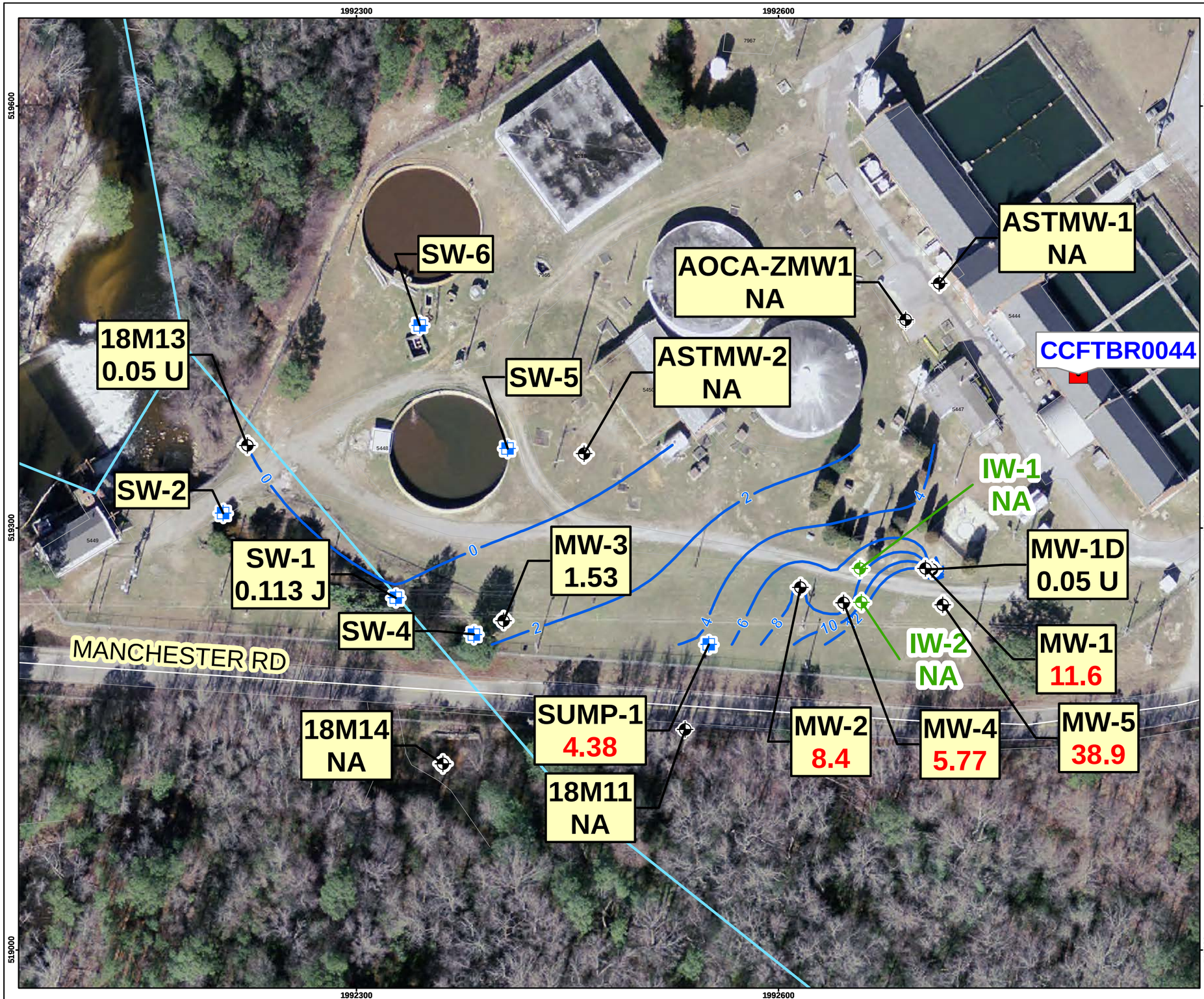


Figure 5

Site CCFTBR0044
Fluoride Concentration (October 2015)
in Groundwater and Surface Water
Fort Bragg, North Carolina

Legend

- Street/Road
- Stream
- Building
- Existing Infrastructure
- Location of CCFTBR0044
- Monitoring Well Location
- Injection Well
- Surface Water or Storm Water Sample
- Fluoride Concentration Contour

GWQS = Groundwater Quality Standards
SWQS = Surface Water Quality Standards
NA = Not Analyzed
U = Not detected above the method detection limit.
J = Qualified as estimated.

Fluoride concentration in milligrams per liter (mg/L)
Fluoride values in red exceed the North Carolina GWQS of 2 mg/L (groundwater) or the North Carolina SWQS (surface water) of 1.8 mg/L

Coordinate System: North Carolina State Plane, NAD83, Feet

70 35 0 70 Feet

N

PARSONS	748776.09000
DESIGNED BY: BT	Site CCFTBR0044 Fluoride Concentration (October 2015) in Groundwater and Surface Water
DRAWN BY: LH	
CHECKED BY: AW	SCALE: As Shown — PROJECT NUMBER:
SUBMITTED BY: AW	DATE: January 2016 — FIGURE NUMBER: 5
	FILE: SAP_CCFTBR_0044.mxd

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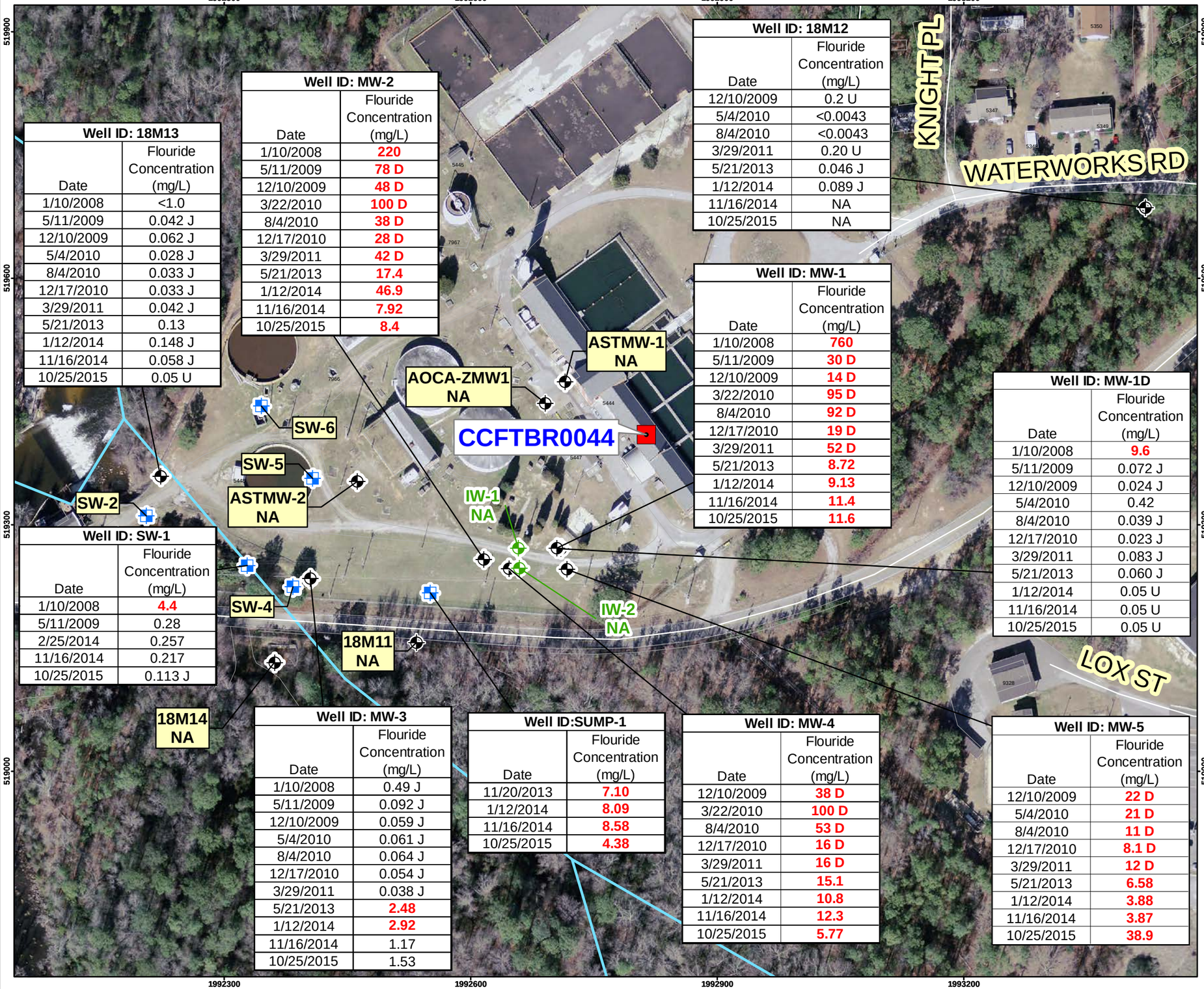
Figure 6

Site CCFTBR0044
Historic Fluoride Concentrations
in Groundwater and Surface Water
Fort Bragg, North Carolina



Well ID: 18M13

Date	Flouride Concentration (mg/L)
1/10/2008	<1.0
5/11/2009	0.042 J
12/10/2009	0.062 J
5/4/2010	0.028 J
8/4/2010	0.033 J
12/17/2010	0.033 J
3/29/2011	0.042 J
5/21/2013	0.13
1/12/2014	0.148 J
11/16/2014	0.058 J
10/25/2015	0.05 U

Well ID: MW-2

Date	Flouride Concentration (mg/L)
1/10/2008	220
5/11/2009	78 D
12/10/2009	48 D
3/22/2010	100 D
8/4/2010	38 D
12/17/2010	28 D
3/29/2011	42 D
5/21/2013	17.4
1/12/2014	46.9
11/16/2014	7.92
10/25/2015	8.4

Well ID: 18M12

Date	Flouride Concentration (mg/L)
12/10/2009	0.2 U
5/4/2010	<0.0043
8/4/2010	<0.0043
3/29/2011	0.20 U
5/21/2013	0.046 J
1/12/2014	0.089 J
11/16/2014	NA
10/25/2015	NA

Well ID: MW-1

Date	Flouride Concentration (mg/L)
1/10/2008	760
5/11/2009	30 D
12/10/2009	14 D
3/22/2010	95 D
8/4/2010	92 D
12/17/2010	19 D
3/29/2011	52 D
5/21/2013	8.72
1/12/2014	9.13
11/16/2014	11.4
10/25/2015	11.6

Well ID: MW-1D

Date	Flouride Concentration (mg/L)
1/10/2008	9.6
5/11/2009	0.072 J
12/10/2009	0.024 J
5/4/2010	0.42
8/4/2010	0.039 J
12/17/2010	0.023 J
3/29/2011	0.083 J
5/21/2013	0.060 J
1/12/2014	0.05 U
11/16/2014	0.05 U
10/25/2015	0.05 U

Well ID: SW-1

Date	Flouride Concentration (mg/L)
1/10/2008	4.4
5/11/2009	0.28
2/25/2014	0.257
11/16/2014	0.217
10/25/2015	0.113 J

Well ID: MW-3

Date	Flouride Concentration (mg/L)
1/10/2008	0.49 J
5/11/2009	0.092 J
12/10/2009	0.059 J
5/4/2010	0.061 J
8/4/2010	0.064 J
12/17/2010	0.054 J
3/29/2011	0.038 J
5/21/2013	2.48
1/12/2014	2.92
11/16/2014	1.17
10/25/2015	1.53

Well ID:SUMP-1

Date	Flouride Concentration (mg/L)
11/20/2013	7.10
1/12/2014	8.09
11/16/2014	8.58
10/25/2015	4.38

Well ID: MW-4

Date	Flouride Concentration (mg/L)
12/10/2009	38 D
3/22/2010	100 D
8/4/2010	53 D
12/17/2010	16 D
3/29/2011	16 D
5/21/2013	15.1
1/12/2014	10.8
11/16/2014	12.3
10/25/2015	5.77

Well ID: MW-5

Date	Flouride Concentration (mg/L)
12/10/2009	22 D
5/4/2010	21 D
8/4/2010	11 D
12/17/2010	8.1 D
3/29/2011	12 D
5/21/2013	6.58
1/12/2014	3.88
11/16/2014	3.87
10/25/2015	38.9

Legend

- Street/Road
- Stream
- Building
- Existing Infrastructure
- Location of CCFTBR0044
- Monitoring Well Location
- Injection Well
- Surface Water or Storm Water Sample

GWQS = Groundwater Quality Standards
SWQS = Surface Water Quality Standards
NA = Not Analyzed
D = Sample was analyzed at a dilution
U = Not detected above the method detection limit.
J = Qualified as estimated.
Fluoride concentration in milligrams per liter (mg/L)

Fluoride values in red exceed the North Carolina GWQS of 2 mg/L (groundwater) or the North Carolina SWQS (surface water) of 1.8 mg/L

Coordinate System: North Carolina State Plane, NAD83, Feet

120 60 0 120 Feet

N

PARSONS

748776.09000

DESIGNED BY: BT	Site CCFTBR0044 Historic Fluoride Concentrations in Groundwater and Surface Water
DRAWN BY: LH	
CHECKED BY: AW	SCALE: As Shown — PROJECT NUMBER:
SUBMITTED BY: AW	DATE: January 2016 — FIGURE NUMBER: 6
	FILE: SAP_CCFTBR_0044.mxd

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TABLES

Table 1
Well Construction Summary
CCFTBR0044 (Site 44)
Fort Bragg, North Carolina

Well	TOC Elevation (ft amsl)	Total Depth (ft bgs)	Screened Interval (ft bgs)	Well Diameter	Installation Date
MW-1	185.39	22	12-22	2"	01/09/08
MW-1D	185.80	38	25-35	2"	01/09/08
MW-2	175.91	20	10-20	2"	01/09/08
MW-3	160.05	15	5-15	2"	01/09/08
MW-4	176.92	21	10-20.5	2"	10/21/09
MW-5	184.49	27.5	17-27.5	2"	10/21/09
IW-1	180.56	32	15-30.5	2"	10/20/09
IW-2	178.32	28.5	12.5-28	2"	10/21/09
18M11	164.94	21.7	11.51-21.51	2"	11/14/01
18M12	198.16	34	19-34	2"	03/06
18M13	157.17	18	3-18	2"	03/02/06
18M14	155.45	9	4-9	2"	02/06
AOCA-ZMW1	195.66	47	28-38	2"	02/20/05
ASTMW-1	196.16	36	26-36	2"	03/20/09
ASTMW-2	172.31	18	8-18	2"	03/21/09

Notes:
ft bgs - feet below ground surface
ft amsl - feet above mean sea level
TOC - top of casing
ASTMW-1 also named V3308AMW-1
ASTMW-2 also named V3610AMW-1
Data obtained from Arcadis, 2011

Table 2
Well Gauging Summary (October 2015)
CCFTBR0044 (Site 44)
Fort Bragg, North Carolina

Well	TOC Elevation (ft amsl)	Date Measured	Depth to Water (ft btoc)	Water Elevation (ft msl)
MW-1	185.39	10/25/15	17.61	167.78
MW-1D	185.80	10/25/15	18.04	167.76
MW-2	175.91	10/25/15	8.45	167.46
MW-3	160.05	10/25/15	8.32	151.73
MW-4	176.92	10/25/15	9.70	167.22
MW-5	184.49	10/25/15	17.08	167.41
IW-1	180.56	NM	NM	NM
IW-2	178.32	NM	NM	NM
18M11	164.94	NM	NM	NM
18M12	198.16	NM	NM	NM
18M13	157.17	10/25/15	5.90	151.27
18M14	155.45	NM	NM	NM
AOCA-ZMW1	195.66	NM	NM	NM
ASTMW-1	196.16	NM	NM	NM
ASTMW-2	172.31	NM	NM	NM

Notes:
TOC - top of casing
ft amsl - feet above mean sea level
ft btoc - feet below top of casing
NM - Not measured
ASTMW-1 also named V3308AMW-1
ASTMW-2 also named V3610AMW-1

Table 3
Historical Water Level Summary
CCFTBR0044 (Site 44)
Fort Bragg, North Carolina

Well	TOC Elevation (ft amsl)	Date	Depth to Water (ft btoc)	Water Level Elevation (ft amsl)
MW-1	185.39	01/10/08	20.08	165.31
		05/11/09	18.4	166.99
		12/10/09	18.92	166.47
		03/22/10	17.19	168.20
		08/04/10	18.60	166.79
		12/17/10	18.69	166.70
		03/29/11	18.87	166.52
		05/21/13	18.42	166.97
		01/12/14	17.83	167.56
		11/16/14	17.99	167.40
		10/25/15	17.61	167.78
MW-1D	185.80	01/10/08	20.50	165.30
		05/11/09	18.83	166.97
		12/10/09	19.37	166.43
		03/22/10	17.65	168.15
		05/04/10	18.07	167.73
		08/04/10	19.00	166.80
		12/17/10	19.14	166.66
		03/29/11	19.33	166.47
		05/21/13	18.89	166.91
		01/12/14	18.28	167.52
		11/16/14	18.42	167.38
		10/25/15	18.04	167.76
MW-2	175.91	01/10/08	11.18	164.73
		05/11/09	9.44	166.47
		12/10/09	10.05	165.86
		03/22/10	8.15	167.76
		08/04/10	9.47	166.44
		12/17/10	9.56	166.35
		03/29/11	10.73	165.18
		05/21/13	9.31	166.60
		1/12/2014 [1]	5.62	170.29
		11/16/14	8.25	167.66
		10/25/15	8.45	167.46
MW-3	160.05	01/10/08	9.70	150.35
		05/11/09	9.22	150.83
		12/10/09	8.81	151.24
		03/22/10	8.05	152.00
		05/04/10	7.78	152.27
		08/04/10	8.86	151.19
		12/17/10	9.00	151.05
		03/29/11	8.91	151.14
		05/20/13	8.98	151.07
		01/12/14	8.21	151.84
		11/16/14	8.45	151.60
		10/25/15	8.32	151.73
MW-4	176.92	12/10/09	11.12	165.80
		03/22/10	9.34	167.58
		08/04/10	10.67	166.25
		12/17/10	10.76	166.16
		03/29/11	10.93	165.99
		05/20/13	10.53	166.39
		01/12/14	9.87	167.05
		11/16/14	10.05	166.87
		10/25/15	9.70	167.22

Table 3
Historical Water Level Summary
CCFTBR0044 (Site 44)
Fort Bragg, North Carolina

Well	TOC Elevation (ft amsl)	Date	Depth to Water (ft btoc)	Water Level Elevation (ft amsl)
MW-5	184.49	12/10/09	18.37	166.12
		03/22/10	16.68	167.81
		05/04/10	17.08	167.41
		08/04/10	18.08	166.41
		12/17/10	18.16	166.33
		03/29/11	18.35	166.14
		05/21/13	17.92	166.57
		01/12/14	17.31	167.18
		11/16/14	17.58	166.91
		10/25/15	17.08	167.41
IW-1	180.56	12/10/09	14.50	166.06
IW-2	178.32	12/10/09	12.46	165.86
18M11	164.94	01/09/08	11.34	153.60
18M12	198.16	05/04/10	17.76	180.40
		08/04/10	28.89	169.27
		03/29/11	29.16	169.00
		05/21/13	28.81	169.35
		01/12/14	28.43	169.73
18M13	157.17	01/08/08	6.69	150.48
		05/11/09	7.16	150.01
		12/10/09	6.13	151.04
		03/22/10	6.59	150.58
		05/04/10	6.73	150.44
		08/04/10	6.43	150.74
		12/17/10	6.84	150.33
		03/29/11	6.54	150.63
		05/20/13	5.47	151.70
		01/12/14	5.23	151.94
		11/16/14	5.88	151.29
		10/25/15	5.90	151.27
AOCA-ZMW1	195.66	01/07/08	30.26	165.40
		05/11/09	28.59	167.07
		12/10/09	29.09	166.57
		03/22/10	27.45	168.21
		08/04/10	28.94	166.72
		12/17/10	29.03	166.63
ASTMW-1	196.16	05/11/09	28.99	167.17
		12/10/09	29.5	166.66
		03/22/10	27.88	168.28
		08/04/10	29.36	166.80
		12/17/10	29.42	166.74
ASTMW-2	172.31	05/11/09	10.18	162.13
		12/10/09	10.28	162.03
		03/22/10	9.45	162.86
		12/17/10	10.39	161.92

Notes:

[1] The 1/12/14 depth to water measurement in MW-2 is suspect.

TOC - top of casing

ft btoc - feet below top of casing

ft msl - feet above mean sea level

Data obtained from Arcadis, 2011 (2008 -2011)

Table 4
Water Quality Parameters
CCFTBR0044 (Site 44)
Fort Bragg, North Carolina

Monitoring Well ID	Sampling Date	Purging Data							
		Temperature (°C)	pH	Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	ORP (mV)	Turbidity (NTU)	Volume Purged (liters)	Pumping Rate (mL/min)
MW-1	25-Oct-15	19.59	6.59	183	3.15	96.7	5.75	6.25	150
MW-1D	25-Oct-15	20.30	6.86	158	3.07	74.9	161	10	180
MW-2	25-Oct-15	21.51	5.02	245	3.65	115.1	2.60	6.5	150
MW-3	25-Oct-15	21.07	5.32	167	0.53	39	2.54	4.75	150
MW-4	25-Oct-15	20.07	5.06	140	1.95	87.6	1.56	6.5	150
MW-5	25-Oct-15	20.90	6.08	226	3.04	84.4	53.2	6.9	180
18M13	25-Oct-15	20.27	5.55	121	0.63	-63.2	2.21	6.75	150

Values represent last reading taken after equilibrium was reached.
°C = degrees centigrade
µS/cm = microsiemens per centimeter
mg/L = milligrams per liter
mV = millivolts
mL/min = milliliters per minute

Table 5
CCFTBR0044 (Site 44)
Summary of Fluoride - October 2015
Fort Bragg, North Carolina

Sample ID	Date Collected	
Monitoring Wells		
	SSR Goal (GW):	**2**
MW-1	10/25/2015	**11.6**
MW-1D	10/25/2015	0.05 U
MW-1D DUP	10/25/2015	0.05 U
MW-2	10/25/2015	**8.4**
MW-3	10/25/2015	**1.53**
MW-4	10/25/2015	**5.77**
MW-5	10/25/2015	**38.9**
18M13	10/25/2015	0.05 U
Surface Water		
	SSR Goal (SW):	**1.8**
SW-1	10/25/2015	**0.113 J**
Stormwater Collection Vault		
	SSR Goal (SW):	**1.8**
Sump-1	10/25/2015	**4.38**

Notes:

Fluoride values in **red** are greater than the SSR Goals of 2 mg/L (groundwater) or 1.8 mg/L (surface water).

All concentrations in milligrams per liter (mg/L)

J = detected concentration is between the method detection limit and reporting limit

SU = Standard Units

GW = Groundwater

SW = Surface Water

SSR = Site-Specific Remediation

NA = Not Analyzed

Table 6
CCFTBR0044 (Site 44)
Summary of Historic Fluoride and pH Results
Fort Bragg, North Carolina

				Monitoring Well												
Constituents:	**Units:**	SSR Goal (GW)	**Date:**	MW-1	MW-1D	MW-2	MW-3	MW-4	MW-5	IW-1	IW-2	18M12	18M13	AOCA-ZMW1	ASTMW-1	ASTMW-2
Fluoride	mg/L	2	1/10/2008	760	9.6	220	0.49 J	NA	NA	NA	NA	NA	<1.0	0.39 J	NA	NA
			5/11/2009	30 D	0.072 J	78 D	0.092 J	NA	NA	NA	NA	NA	0.042 J	0.26	0.17 J	0.25
			12/10/2009	14 D	0.024 J	48 D	0.059 J	38 D	22 D	6.7 D	14 D	0.2 U	0.062 J	NA	NA	NA
			3/3/2010	First groundwater injection, February 3 - 25, 2010												
			3/22/2010	95 D	NA	100 D	NA	100 D	NA	NA	NA	NA	NA	NA	NA	NA
			3/24/2010	Second groundwater injection, March 24 - 31, 2010												
			4/4/2010	First soil infiltration, April 4 - 5, 2010												
			5/4/2010	NA	0.42	NA	0.061 J	NA	21 D	NA	NA	<0.0043	0.028 J	NA	NA	NA
			5/7/2010	Second soil infiltration, May 7 - 18, 2010												
			8/4/2010	92 D	0.039 J	38 D	0.064 J	53 D	11 D	NA	NA	<0.0043	0.033 J	NA	NA	NA
			8/26/2010	Third groundwater injection, August 26, 2010 - NaOH only												
			11/30/2010	Fourth groundwater injection and third infiltration, Nov. 30 - Dec. 6, 2010												
			12/17/2010	19 D	0.023 J	28 D	0.054 J	16 D	8.1 D	NA	NA	NA	0.033 J	NA	NA	NA
			3/29/2011	52 D	0.083 J	42 D	0.038 J	16 D	12 D	NA	NA	0.20 U	0.042 J	NA	NA	NA
			5/21/2013	8.72	0.060 J	17.4	2.48 [1]	15.1	6.58	NA	NA	0.046 J	0.13	NA	NA	NA
			1/12/2014	9.13	0.05 U	46.9	2.92	10.8	3.88	NA	NA	0.089 J	0.148 J	NA	NA	NA
			11/16/2014	11.4	0.05 U	7.92	1.17	12.3	3.87	NA	NA	NA	0.058 J	NA	NA	NA
			10/25/2015	11.6	0.05 U	8.4	1.53	5.77	38.9	NA	NA	NA	NA	NA	NA	NA
pH*	Standard units	≥ 5.6	1/10/2008	3.01	5.47	4.51	6.39	NA	NA	NA	NA	NA	5.94	5.88	NA	NA
			5/11/2009	4.47	4.87	4.51	5.24	NA	NA	NA	NA	NA	5.59	5.45	5.68	5.77
			12/10/2009	5.46	5.64	5.34	5.96	5.52	5.60	5.56	5.32	4.90	6.11	NA	NA	NA
			3/3/2010	First groundwater injection, February 3 - 25, 2010												
			3/22/2010	5.63	NA	6.52	NA	6.90	NA	NA	NA	NA	NA	NA	NA	NA
			3/24/2010	Second groundwater injection, March 24 - 31, 2010												
			4/4/2010	First soil infiltration, April 4 - 5, 2010												
			5/4/2010	NA	5.76	NA	5.90	NA	6.03	NA	NA	5.61	5.95	NA	NA	NA
			5/7/2010	Second soil infiltration, May 7 - 18, 2010												
			8/4/2010	5.2	5.9	6.2	5.9	5.6	5.6	NA	NA	6.1	5.7	NA	NA	NA
			8/26/2010	Third groundwater injection, August 26, 2010 - NaOH only												
			11/30/2010	Fourth groundwater injection and third infiltration, Nov. 30 - Dec. 6, 2010												
			12/17/2010	5.9	6.1	8.4	7.4	7.9	6.4	NA	NA	NA	6.7	NA	NA	NA
			3/29/2011	5.0	5.9	5.6	5.5	5.9	5.6	NA	NA	5.4	6.0	NA	NA	NA
			5/21/2013	4.68	5.52	5.42	5.61	5.32	5.32	NA	NA	4.86	5.92	NA	NA	NA
			1/12/2014	5.12	5.31	5.38	5.76	5.58	5.15	NA	NA	4.55	6.02	NA	NA	NA

Notes:

mg/L	Milligrams per liter.	D	The sample was analyzed at a dilution.
SSR Goal (GW)	Site-Specific Remediation Goal for Groundwater.	J	Constituent was qualified as estimated.
	Constituent above the SSR Goal for fluoride or less than the SSR Goal for pH.	U	Constituent was not detected above the reporting limit listed.
ASTMW-1	Also named V3308AMW-1.	NA	Not analyzed.
ASTMW-2	Also named V3610AMW-1.	ND	Not detected

[1] = Duplicate result

* NCDENR concurred with the January 2014 LTM report recommendation to remove the SSR Goal for groundwater.

Table 6
CCFTBR0044 (Site 44)
Summary of Historic Fluoride and pH Results
Fort Bragg, North Carolina

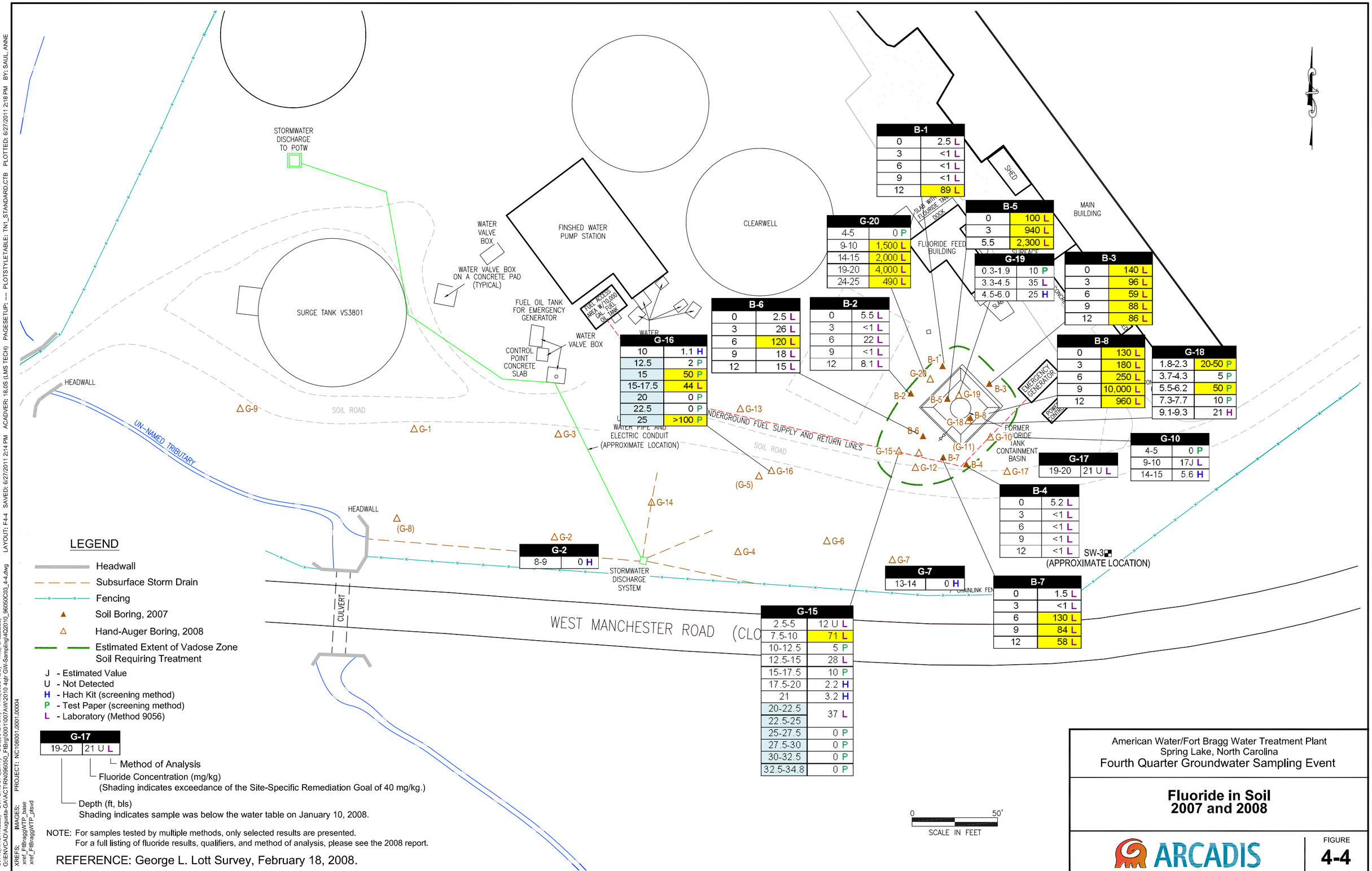
				Surface Water		Stormwater / Outfall						
Constituents:	**Units:**	SSR Goal (SW)	**Date:**	SW-1	SW-2	SW-4	SW-5	SW-6	PIPE-1	PIPE-2	PIPE-3	SUMP-1
Fluoride	mg/L	1.8	1/10/2008	4.4	NA	39	NA	NA	48	16	NA	NA
			5/11/2009	0.28	0.38	16 D	NA	NA	16 D	18 D	3.5 D	NA
			12/10/2009	NA	NA	11 D	NA	NA	9.7 D	15 D	NA	NA
			3/3/2010	First groundwater injection, February 3 - 25, 2010								NA
			3/24/2010	Second groundwater injection, March 24 - 31, 2010								NA
			4/4/2010	First soil infiltration, April 4 - 5, 2010								NA
			5/4/2010	NA	NA	NA	28 D	NA	NA	NA	NA	NA
			5/7/2010	Second soil infiltration, May 7 - 18, 2010								NA
			8/4/2010	NA	NA	2.2	NA	NA	NA	NA	NA	NA
			8/26/2010	NA	NA	NA	NA	16 D	NA	NA	NA	NA
			8/26/2010	Third groundwater injection, August 26, 2010								NA
			11/30/2010	Fourth groundwater injection and third infiltration, Nov. 30 - Dec. 6, 2010								NA
			12/17/2010	NA	NA	NA	NA	17 D	NA	NA	NA	NA
			3/29/2011	NA	NA	NA	NA	14	NA	NA	NA	NA
			5/21/2013	NA	NA	0.22	NA	4.95	NA	NA	NA	NA
			11/20/2013	NA	NA	NA	NA	NA	NA	NA	NA	7.10
			1/12/2014	NA	NA	NA	NA	NA	NA	NA	NA	8.09
			2/25/2014	0.257	NA	NA	NA	NA	NA	NA	NA	NA
			11/16/2014	0.217	NA	NA	NA	NA	NA	NA	NA	8.58
			10/25/2015	0.113 J	NA	NA	NA	NA	NA	NA	NA	4.38
pH*	Standard units	≥ 5.0	1/10/2008	6.0	6.05	5.87	NA	NA	5.6	5.6	5.8	
			5/11/2009	5.35	6.04	5.21	NA	NA	5.08	5.29	5.55	
			12/10/2009	NA	NA	5.81	NA	NA	5.40	5.51	NA	
			3/3/2010	First groundwater injection, February 3 - 25, 2010								
			3/24/2010	Second groundwater injection, March 24 - 31, 2010								
			4/4/2010	First soil infiltration, April 4 - 5, 2010								
			5/4/2010	NA	NA	NA	6.29	NA	NA	NA	NA	
			5/7/2010	Second soil infiltration, May 7 - 18, 2010								
			8/4/2010	NA	NA	5.9	NA	NA	NA	NA	NA	
			8/26/2010	NA	NA	NA	NA	6.1	NA	NA	NA	
			8/26/2010	Third groundwater injection, August 26, 2010								
			11/30/2010	Fourth groundwater injection and third infiltration, Nov. 30 - Dec. 6, 2010								
			12/17/2010	NA	NA	NA	NA	6.9	NA	NA	NA	
			3/29/2011	NA	NA	NA	NA	6.2	NA	NA	NA	
			5/21/2013	NS	NA	6.37	NA	8.09	NA	NA	NA	
			11/20/2013	NA	NA	NA	NA	NA	NA	NA	NA	NA
			1/12/2014	NA	NA	NA	NA	NA	NA	NA	NA	NA
			2/25/2014	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

mg/L	Milligrams per liter.	D	The sample was analyzed at a dilution.
SSR Goal (SW)	Site-Specific Remediation Goal for Surface water.	J	Constituent was qualified as estimated.
	Constituent above the SSR Goal for fluoride or less than the SSR Goal for pH.	NA	Not analyzed.
ASTMW-1	Also named V3308AMW-1.	ND	Not detected
ASTMW-2	Also named V3610AMW-1.		

* NCDENR concurred with the January 2014 LTM report recommendation to remove the SSR Goal for surface water.

APPENDIX A
HISTORICAL SOIL DATA – FLUORIDE AND pH



B-1	
0	2.5 L
3	<1 L
6	<1 L
9	<1 L
12	89 L

B-5	
0	100 L
3	940 L
5.5	2,300 L

G-20	
4-5	0 P
9-10	1,500 L
14-15	2,000 L
19-20	4,000 L
24-25	490 L

G-19	
0.3-1.9	10 P
3.3-4.5	35 L
4.5-6.0	25 H

B-3	
0	140 L
3	96 L
6	59 L
9	88 L
12	86 L

B-6	
0	2.5 L
3	26 L
6	120 L
9	18 L
12	15 L

B-2	
0	5.5 L
3	<1 L
6	22 L
9	<1 L
12	8.1 L

G-16	
10	1.1 H
12.5	2 P
15	50 P
15-17.5	44 L
20	0 P
22.5	0 P
25	>100 P

B-8	
0	130 L
3	180 L
6	250 L
9	10,000 L
12	960 L

G-18	
1.8-2.3	20-50 P
3.7-4.3	5 P
5.5-6.2	50 P
7.3-7.7	10 P
9.1-9.3	21 H

G-10	
4-5	0 P
9-10	17J L
14-15	5.6 H

G-17	
19-20	21 U L

B-4	
0	5.2 L
3	<1 L
6	<1 L
9	<1 L
12	<1 L

G-2	
8-9	0 H

G-7	
13-14	0 H

B-7	
0	1.5 L
3	<1 L
6	130 L
9	84 L
12	58 L

G-15	
2.5-5	12 U L
7.5-10	71 L
10-12.5	5 P
12.5-15	28 L
15-17.5	10 P
17.5-20	2.2 H
21	3.2 H
20-22.5	37 L
22.5-25	
25-27.5	0 P
27.5-30	0 P
30-32.5	0 P
32.5-34.8	0 P

LEGEND

- Headwall
- Subsurface Storm Drain
- Fencing
- ▲ Soil Boring, 2007
- △ Hand-Auger Boring, 2008
- Estimated Extent of Vadose Zone Soil Requiring Treatment

J - Estimated Value
U - Not Detected
H - Hach Kit (screening method)
P - Test Paper (screening method)
L - Laboratory (Method 9056)

G-17	
19-20	21 U L

- Method of Analysis
- Fluoride Concentration (mg/kg) (Shading indicates exceedance of the Site-Specific Remediation Goal of 40 mg/kg.)
- Depth (ft, bls) Shading indicates sample was below the water table on January 10, 2008.

NOTE: For samples tested by multiple methods, only selected results are presented. For a full listing of fluoride results, qualifiers, and method of analysis, please see the 2008 report.

REFERENCE: George L. Lott Survey, February 18, 2008.

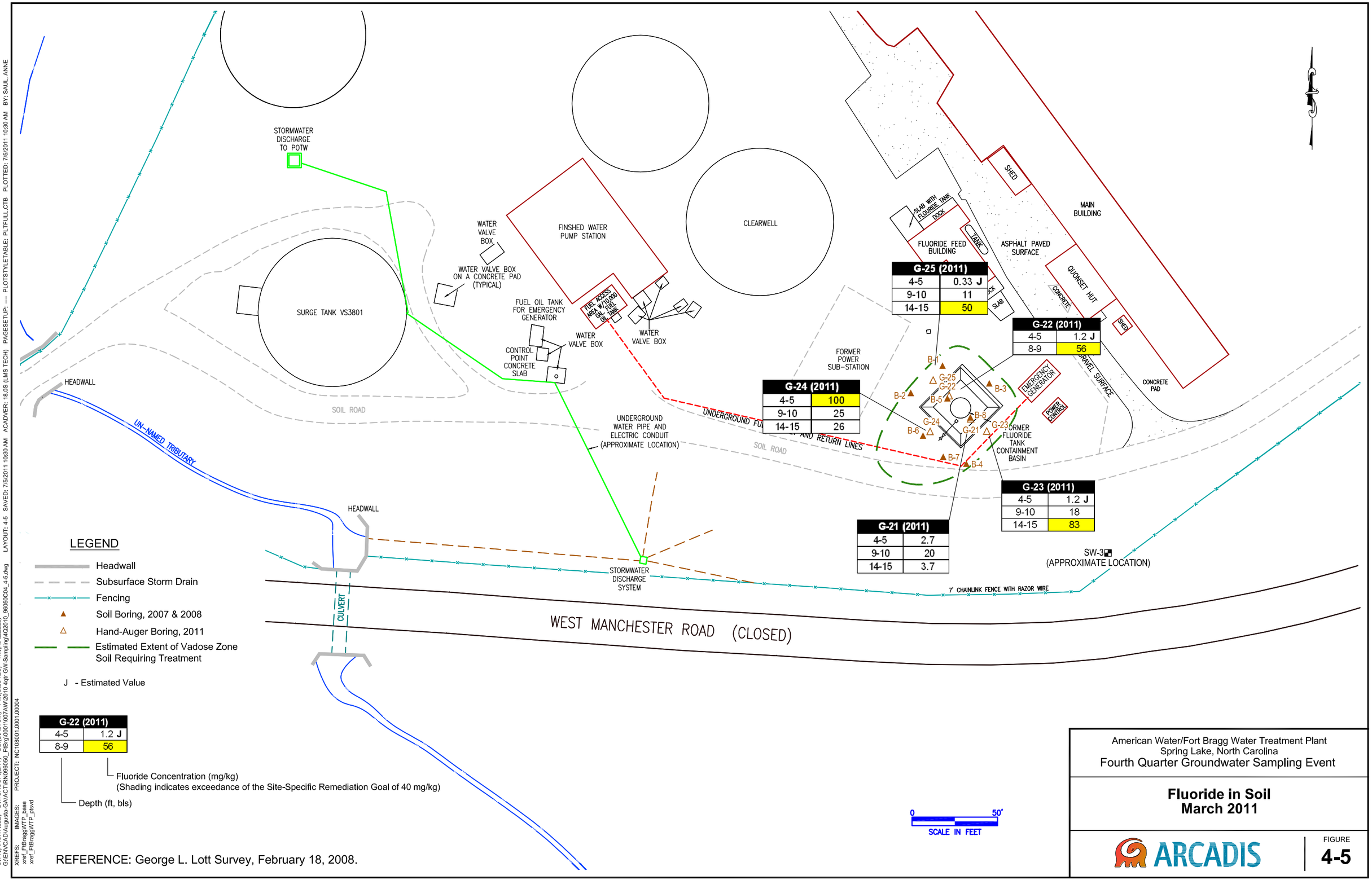
American Water/Fort Bragg Water Treatment Plant
Spring Lake, North Carolina
Fourth Quarter Groundwater Sampling Event

Fluoride in Soil 2007 and 2008

ARCADIS

FIGURE **4-4**

CITY:(KNOXVILLE) DIV/GROUP:(ENV) DB:(B.ALTOM) PM:(C.LUTES) TM:(A.FRZZELL) LAYOUT: F4-4 SAVED: 6/27/2011 2:14 PM ACADVER: 18.0S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: TN_STANDARD.CTB PLOTTED: 6/27/2011 2:18 PM BY: SAUL, ANNE
G:\ENVCAD\Augusta-GA\ACT\RN096050_FtBrg\0001\007AW\2010 4qtr GW-Sampling\4Q2010_96050C03_4-4.dwg PROJECT: NC108001.0001.00004
XREFS: xref_FtBraggWTP_base xref_FtBraggWTP_ptsxd IMAGES:



G-25 (2011)	
4-5	0.33 J
9-10	11
14-15	50

G-22 (2011)	
4-5	1.2 J
8-9	56

G-24 (2011)	
4-5	100
9-10	25
14-15	26

G-23 (2011)	
4-5	1.2 J
9-10	18
14-15	83

G-21 (2011)	
4-5	2.7
9-10	20
14-15	3.7

LEGEND

- Headwall
- Subsurface Storm Drain
- Fencing
- ▲ Soil Boring, 2007 & 2008
- △ Hand-Auger Boring, 2011
- Estimated Extent of Vadose Zone Soil Requiring Treatment

J - Estimated Value

G-22 (2011)	
4-5	1.2 J
8-9	56

Fluoride Concentration (mg/kg)
(Shading indicates exceedance of the Site-Specific Remediation Goal of 40 mg/kg)

Depth (ft, bls)

REFERENCE: George L. Lott Survey, February 18, 2008.

American Water/Fort Bragg Water Treatment Plant
Spring Lake, North Carolina
Fourth Quarter Groundwater Sampling Event

Fluoride in Soil
March 2011

ARCADIS

FIGURE
4-5

CITY:(KNOXVILLE) DIV/GROUP:(ENV) DB:(B.ALTOM) PM:(C.LUTES) TM:(A.FIZZELL) LAYOUT: 4-5 SAVED: 7/5/2011 10:30 AM ACADVER: 18.0S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 7/5/2011 10:30 AM BY: SAUL, ANNE
G:\ENVCAD\Augusta-GA\ACTIRN096050_FBrg\00010\007\AW\2010 4qtr GW-Sampling\4Q2010_96050C04_4-5.dwg
PROJECT: NC108001.0001.00004
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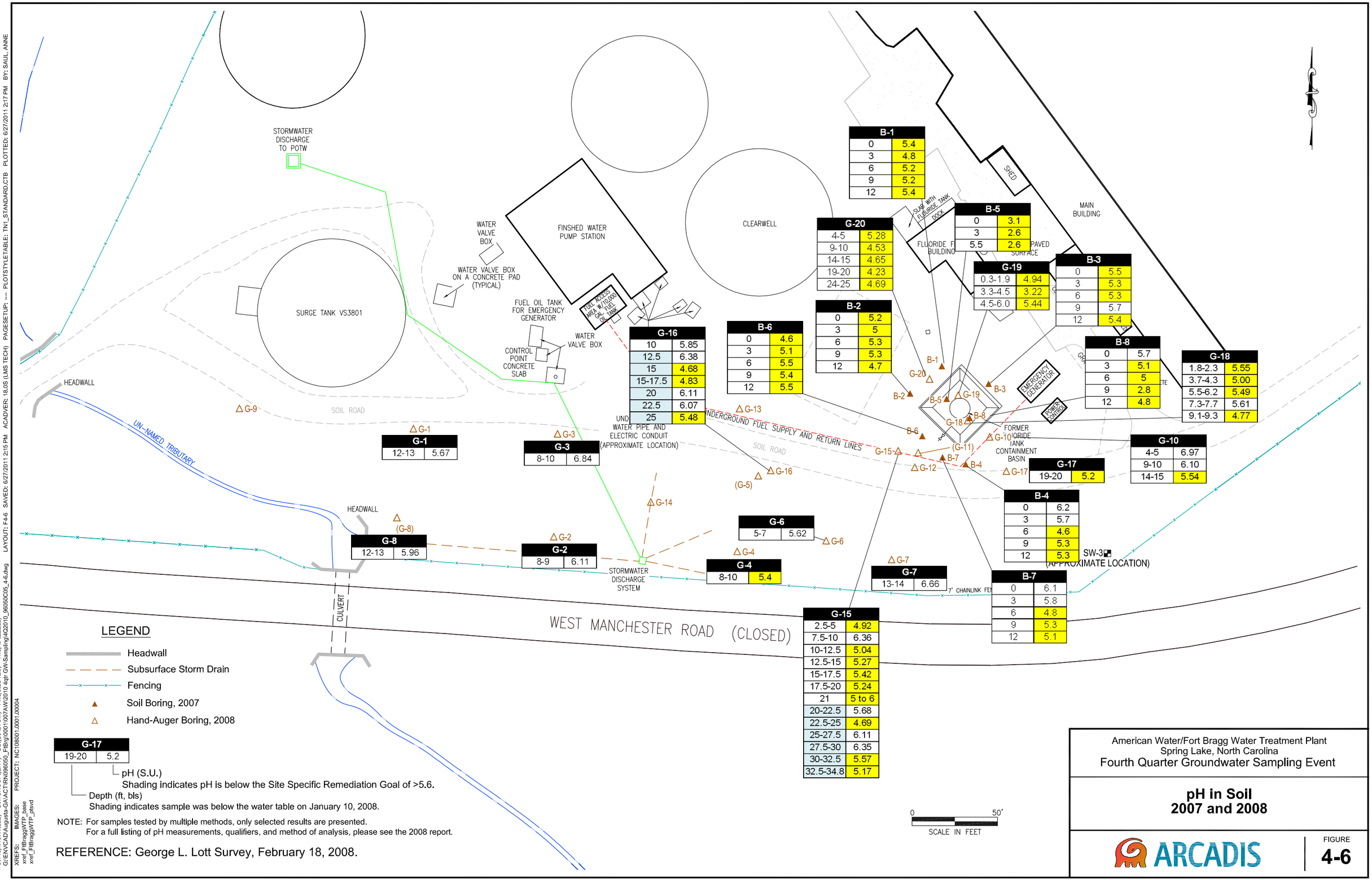


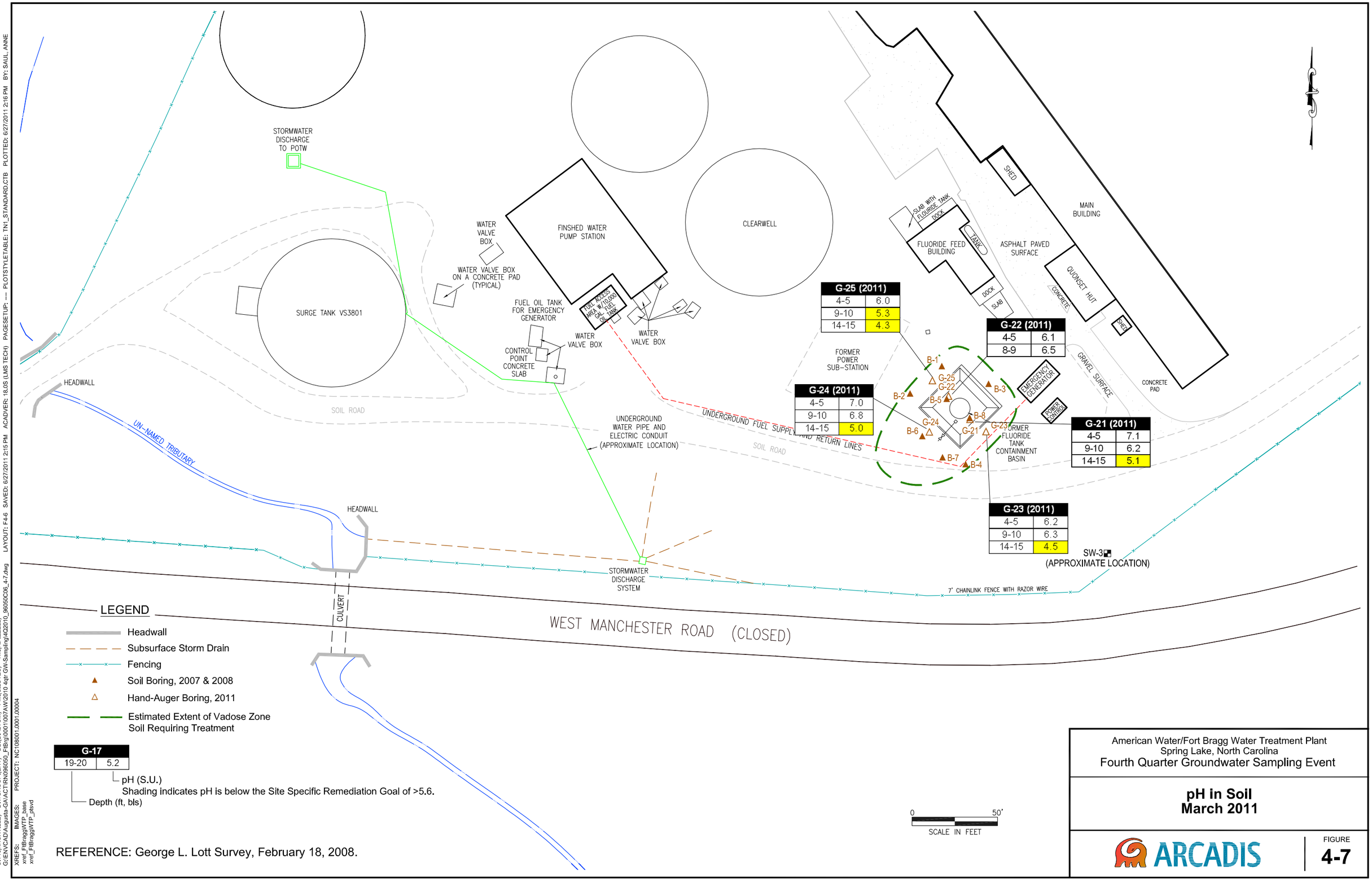
American Water/Fort Bragg Water Treatment Plant
Spring Lake, North Carolina
Fourth Quarter Groundwater Sampling Event

pH in Soil
2007 and 2008

ARCADIS

FIGURE
4-6

CITY:(KNOXVILLE) DIV/GROUP:(ENV) DB:(B.ALTOM) PM:(C.LUTES) TM:(A.FIZZELL) LAYOUT: F4-6 SAVED: 6/27/2011 2:15 PM ACADVER: 18.0S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: TN_STANDARD.CTB PLOTTED: 6/27/2011 2:17 PM BY: SAUL, ANNE
G:\ENVCAD\Augusta-GA\ACTRN\96050_FtBrg\00001007AW\2010 4qtr GW-Sampling\4Q2010_96050C05_4-6.dwg
PROJECT: NC108001.0001.00004
XREFS: xref_FtBraggWTP_base xref_FtBraggWTP_plsvd IMAGES:



G-25 (2011)	
4-5	6.0
9-10	5.3
14-15	4.3

G-22 (2011)	
4-5	6.1
8-9	6.5

G-24 (2011)	
4-5	7.0
9-10	6.8
14-15	5.0

G-21 (2011)	
4-5	7.1
9-10	6.2
14-15	5.1

G-23 (2011)	
4-5	6.2
9-10	6.3
14-15	4.5

LEGEND

- Headwall
- Subsurface Storm Drain
- Fencing
- ▲ Soil Boring, 2007 & 2008
- △ Hand-Auger Boring, 2011
- Estimated Extent of Vadose Zone Soil Requiring Treatment

G-17	
19-20	5.2

pH (S.U.)
Shading indicates pH is below the Site Specific Remediation Goal of >5.6.
Depth (ft, bls)

REFERENCE: George L. Lott Survey, February 18, 2008.

American Water/Fort Bragg Water Treatment Plant
Spring Lake, North Carolina
Fourth Quarter Groundwater Sampling Event

pH in Soil
March 2011

ARCADIS

FIGURE
4-7

CITY:(KNOXVILLE) DIV/GROUP:(ENV) DB:(B.ALTOM) PM:(C.LUTES) TM:(A.FIZZELL) LAYOUT: F4-6 SAVED: 6/27/2011 2:15 PM ACADVER: 18.0S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: TN_STANDARD.CTB PLOTTED: 6/27/2011 2:16 PM BY: SAUL, ANNE
G:\ENVCAD\Augusta-GA\ACT\RN096050_FtBrg\00011\007AW\2010 4qtr GW-Sampling\4Q2010_96050C06_4-7.dwg
PROJECT: NC108001.0001.00004
XREFS: xref_FtBragg\WTP_base xref_FtBragg\WTP_pbsvd IMAGES:

APPENDIX B
HISTORICAL INJECTION AND INFILTRATION DATA

ARCADIS

Appendix **A**

Injection and Infiltration Data

Table A-1 Ft Bragg Injection and Infiltration Data (page 1 of 2)

		Injection Log								pH									Conductivity mS/cm2								
Event	Date	Hour	Injectant Solution	Injectant Conc. (kg/L)	IW-1Total Injection Volume (gallons)	IW-2 Total Injection Volume (gallons)	Infiltration Gallery (gallons)	NaOH volume remaining in Poly Tank	NaOH Sol Strength in Poly Tank	Solution	IW-1	IW-2	MW-1	MW-1D	MW-2	MW-4	MW-5	SW-4/5/6 (Pipe Basin Discharge)	Solution	IW-1	IW-2	MW-1	MW-1D	MW-2	MW-4	MW-5	Pipe Basin
1st INJECTION	2/3/10 11:30 AM	0.00	NaOH	0.008	0	0		6900	10%	13.2	#N/A	13.2	5.94	#N/A	5.92	6.15	6.03	5.94	85,000	#N/A	85,000	132	#N/A	153	140	133	106
	2/3/10 2:30 PM	3.00	NaOH	0.008	0	2500				13.2	#N/A	13.2	5.95	#N/A	5.59	5.98	5.84	#N/A	85,000	#N/A	85,000	135	#N/A	145	132	133	#N/A
	2/3/10 6:00 PM	6.50	NaOH	0.008	0	5800	Cumulative values			13.2	#N/A	13.2	5.75	#N/A	5.66	5.84	5.89	5.82	85,000	#N/A	85,000	130	#N/A	155	138	130	105
	2/4/10 9:00 AM	21.50	NaOH	0.008	0	5800				13.5	13.5	#N/A	5.88	#N/A	5.93	6.76	5.92	5.93	85,000	85,000	#N/A	138	#N/A	155	219	141	116
	2/4/10 12:00 PM	24.50	NaOH	0.008	2500	5800				13.5	13.5	#N/A	#N/A	#N/A	6.10	12.05	#N/A	#N/A	85,000	85,000	#N/A	#N/A	#N/A	151	1884	#N/A	#N/A
	2/4/10 2:40 PM	27.00	NaOH	0.008	5500	5800		6000	10%	13.5	13.5	#N/A	5.86	#N/A	5.50	12.54	5.81	5.78	85,000	85,000	#N/A	138	#N/A	151	1840	141	102
	2/8/10 1:00 PM	122.00			0	0				#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	12.2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	4025	#N/A	#N/A
	2/8/10 3:30 PM	124.00			0	0				#N/A	#N/A	#N/A	6.07	#N/A	6.37	11.96	5.82	6.08	#N/A	#N/A	#N/A	179	#N/A	153	2119	144	112
	2/11/10 11:30 AM	192.00			0	0				#N/A	#N/A	#N/A	#N/A	#N/A	5.02	7.63	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	286	780	#N/A	#N/A
	2/16/10 3:30 PM	316.00			0	0				#N/A	#N/A	#N/A	#N/A	#N/A	6.10	10.06	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	273	1470	#N/A	#N/A
	2/18/10 11:30 AM	360.00	CaCl2		0	0				#N/A	6.31	9.15	#N/A	#N/A	#N/A	9.51	#N/A	#N/A	#N/A	565	1400	#N/A	#N/A	#N/A	1020	#N/A	#N/A
	2/19/10 2:30 PM	387.00	Water	NA	200	200				#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	2/19/10 4:45 PM	389.00	CaCl2	0.16	400	400				7.58	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	99,000	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	2/24/10 11:30 AM	504.00	CaCl2	0.16	400	400				7.98	#N/A	#N/A	#N/A	#N/A	#N/A	7.33	#N/A	#N/A	99,000	#N/A	#N/A	#N/A	#N/A	#N/A	640	#N/A	#N/A
	2/24/10 12:40 AM	505.00	CaCl2	0.16	1300	1300				#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	2/24/10 1:40 PM	506.00	CaCl2	0.16	2100	2100	Cumulative values			#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	6.64	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	314	#N/A	#N/A
	2/24/10 3:10 PM	508.00	CaCl2	0.16	2700	2700				#N/A	#N/A	#N/A	#N/A	#N/A	6.07	6.68	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	310	420	#N/A	#N/A
	2/25/10 9:00 AM	526.00	CaCl2	0.16	2700	2700				7.98	#N/A	#N/A	#N/A	#N/A	6.24	5.71	#N/A	7.96	99,000	#N/A	#N/A	#N/A	#N/A	365	253	#N/A	296
	2/25/10 10:30 AM	527.00	CaCl2	0.16	3900	3900				#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	6.12	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	311	#N/A	#N/A
	2/25/10 12:20 PM	529.00	CaCl2	0.16	5700	5700				#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	5.44	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	1000	#N/A	#N/A
	2/25/10 1:10 PM	530.00	Water		0	0				#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	6.51	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	983	#N/A	#N/A
	2/25/10 3:45 PM	533.00	Water		300	300				#N/A	#N/A	#N/A	#N/A	#N/A	5.69	6.78	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	274	572	#N/A	#N/A
	3/4/10 3:00 PM	700.00			0	0				#N/A	4.51	4.83	4.43	#N/A	5.60	6.30	5.50	6.29	#N/A	4900	3116	213	#N/A	244	940	175	232
Q1 Monitoring	3/22/10 12:00 AM									#N/A	#N/A	#N/A	5.63	#N/A	6.52	6.90	#N/A	#N/A	#N/A	#N/A	#N/A	141	#N/A	#N/A	142	#N/A	#N/A
2nd INJECTION	3/24/10 12:00 AM	0.00	NaOH	0.008	0	0				#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	3/24/10 12:00 AM		NaOH	0.008	5000	5000		5200	10%	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	3/30/10 12:00 AM		Mixed CaCl2					5500	13%	#N/A	11.9	11.7	5.0	#N/A	4.80	6.30	5.30	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	3/31/10 12:00 PM		CaCl2	0.17	0	0				#N/A	11.7	11.6	#N/A	#N/A	5.40	6.50	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	3/31/10 4:00 PM		CaCl2	0.17	5000	5000				#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
1st Infiltration	4/5/10		NaOH	0.015			2000	5300		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	4/6/10			0.015			2000	5100		#N/A	11.9	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
EM-34 Survey 1	5/4/10																										
Sup. Sampling	5/4/10									#N/A	#N/A	#N/A	#N/A	5.76	#N/A	#N/A	6.03	#N/A	#N/A	#N/A	#N/A	#N/A	111	#N/A	#N/A	108	#N/A
2nd Infiltration	5/7/10		NaOH	0.015			10,000	4,100		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	5/10/10		Hydrant was Shut Off							#N/A	#N/A	#N/A	5.6	5.3	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	5/13/10		NaOH	0.015			12,000	3500		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	5/14/10		NaOH	0.015			10,000	2500		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	5/16/10		Several Inches of Rain over weekend							#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	5/18/10		CaCl2	0.175			18,000													#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
EM-34 Survey 2	5/21/10									#N/A	#N/A	#N/A	5.6	5.5	#N/A	#N/A	#N/A	#N/A		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Q2 Monitoring	8/4/10									#N/A	#N/A	#N/A	5.2	5.2	6.2	5.6	5.6	5.9	#N/A	#N/A	#N/A	230	181	1120	217	174	843
Sup. Sampling	8/26/10									#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	6.1	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Partial Injection	8/26/10		NaOH	0.008	5000	5000		~2000	13%	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
3rd Injection and Infiltration	11/30/10		NaOH	0.008	5000	5000	14,500		13%	12.1	12.1	12.1	#N/A	#N/A	#N/A	5.3/6.1	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	12/6/10		CaCl2	0.12	4000	4000	4000	500		#N/A	9.5	9.8	#N/A	#N/A	#N/A	10.9	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
System Cleaning & Decomission	12/10/10									#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Tank Removal	12/17/10									#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Q3 Monitoring	12/17/10									#N/A	#N/A	#N/A	5.9	6.1	8.4	7.9	6.4	6.9	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Q4 Monitoring	3/29/11									#N/A	#N/A	#N/A	5.0	5.9	5.6	5.9	5.6	6.2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

Table A-1 Ft Bragg Injection and Infiltration Data (Page 2 of 2)

		Ca Hardness (mg/L)								Chloride (mg/L)					
Event	Date	IW-1	IW-2	MW-1	MW-1D	MW-2	MW-4	MW-5	Pipe Basin	MW-1	MW-1D	MW-2	MW-4	MW-5	Pipe Basin
1st INJECTION	2/3/10 11:30 AM	68	34	51	#N/A	68	68	68	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	2/3/10 2:30 PM	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	2/3/10 6:00 PM	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	2/4/10 9:00 AM	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	2/4/10 12:00 PM	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	2/4/10 2:40 PM	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	2/8/10 1:00 PM	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	2/8/10 3:30 PM	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	2/11/10 11:30 AM	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	2/16/10 3:30 PM	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	2/18/10 11:30 AM	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	2/19/10 2:30 PM	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	2/19/10 4:45 PM	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	2/24/10 11:30 AM	#N/A	#N/A	#N/A	#N/A	#N/A	17	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	2/24/10 12:40 AM	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	2/24/10 1:40 PM	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	2/24/10 3:10 PM	#N/A	#N/A	#N/A	#N/A	68	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	2/25/10 9:00 AM	#N/A	#N/A	#N/A	#N/A	#N/A	68	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	2/25/10 10:30 AM	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	2/25/10 12:20 PM	#N/A	#N/A	#N/A	#N/A	#N/A	459	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	2/25/10 1:10 PM	#N/A	#N/A	#N/A	#N/A	#N/A	325	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	2/25/10 3:45 PM	#N/A	#N/A	#N/A	#N/A	#N/A	51.3	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	3/4/10 3:00 PM	2570	1548	#N/A	#N/A	136	479	34	34	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Q1 Monitoring	3/22/10 12:00 AM	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	1.6 J	#N/A	2.7 J	23	#N/A	#N/A
2nd INJECTION	3/24/10 12:00 AM	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	3/24/10 12:00 AM	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	3/30/10 12:00 AM	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	3/31/10 12:00 PM	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	3/31/10 4:00 PM	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
1st Infiltration	4/5/10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	4/6/10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
EM-34 Survey 1	5/4/10														
Sup. Monitoring	5/4/10	#N/A	#N/A	51.3	51.30	#N/A	#N/A	34.2	85.5	#N/A	5.0	#N/A	#N/A	4.2 J	75
2nd Infiltration	5/7/10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	5/10/10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	5/13/10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	5/14/10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	5/16/10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	5/18/10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
EM-34 Survey 2	5/21/10	#N/A	#N/A	68.4	119.7	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Q1 Monitoring	8/4/10	#N/A	#N/A	16.3	24.8	137	24.7	15.7	23.2	21	7.6	290 D	13	7.8	#N/A
Sup. Monitoring	8/26/10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	62.8	#N/A	#N/A	#N/A	#N/A	#N/A	110 D
Partial Injection	8/26/10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
3rd Injection and Infiltration	11/30/10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
	12/6/10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
System Cleaning & Decomission	12/10/10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Tank Removal	12/17/10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Q3 Monitoring	12/17/10	#N/A	#N/A	15.2	22.8	42.5	259	27.4	66.9	#N/A	#N/A	130	#N/A	#N/A	140
Q4 Monitoring	3/29/11	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A

APPENDIX C
GROUNDWATER MONITORING FIELD FORMS

GROUNDWATER SAMPLING RECORD

SWMU / Site Number: 44
Well/Sample ID: 44-MW1
Project Number: 748776
Sampling Crew: Hugh

Project: Fort Bragg Remediations Services

Weather: CLOUDY HIGH 50's
Background PID: 0 (ppm) Well Headspace: 0 (ppm)

Depth to Water: 17.61
Total Depth: 20.10
Depth to LNAPL: NA
Date Purged: 10-25-15

Datum for Measurement: TOC
Casing Diameter: 2"
Casing Volume:
Purge Method: Bailer, Peristaltic Pump, Bladder Pump, other (circle)

Direct-Reading Meter Measurements:

Time	Vol. Purged (liters)	Pumping Rate (mL/min	Temp (°C)	pH (SU)	Electrical Conductivity (µs/cm)	Dissolved Oxygen (mg/L)	Redox Potential (mV)	Turbidity (NTU)	Visual Appearance	Water Level
09:55	1.0	150	18.37	6.31	203	6.64	119.8	17.1	ALMOST CLEAR	17.65
10:00	1.75	150	19.11	6.32	191	3.76	119.1	17.8	" "	17.67
10:05	2.5	150	19.35	6.38	187	3.65	115.3	6.71	CLEAR	17.68
10:10	3.25	150	19.38	6.42	187	3.26	110.1	6.33	"	17.69
10:15	4.0	150	19.47	6.51	185	3.19	105.1	5.98	"	17.70
10:20	4.75	150	19.52	6.55	184	3.15	100.2	6.61	"	17.70
10:25	5.5	150	19.53	6.56	183	3.16	98.9	5.60	"	17.71
10:30	6.25	150	19.59	6.59	183	3.15	96.7	5.75	"	17.71

Date Sampled: 10-25-15
MS/MSD Collected? NO
Duplicate Sample ID: NO

Time Sampled: 10:32
Parameters: —
Duplicate Date/Time: —

Laboratory Analytical Methods:

VOCs (SW8260B)	(3-40 ml VOA vials w/ HCL)
SVOCs (8270C)	(2-1L Amber)
EPH	(2-1L Amber w/ HCL)
VPH	(2-40ml VOA w/ HCL)
PAHs (8310)	(2-1L Amber)
RCRA Metals (6010B/7470)	(1-500 mL poly w/HNO3)
Pesticides/PCB (8081/8082)	(2-1L Amber)
Chloride & Sulfate (E300.1)	(1-250 poly)
Methane, Ethane, Ethene (AM-20)	(3-40mL VOA vials w/HCL)
Nitrate + Nitrite as N (E353.2)	(1-250mL poly)
Total Organic Carbon (SW9060)	(2-40 mL VOA amber vials w/HCL)

Total Containers: 1 FLUORIDE 9056A

Field Geochemistry:	**Results:**	**Method/Comments:**
Ferrous Iron:		
Sulfide:		
CO_2:		
Alkalinity:		
Manganese:		
Nitrite:		
Other:		

Notes (i.e. Wellhead Condition, Repairs, etc.):

GROUNDWATER SAMPLING RECORD

SWMU / Site Number: 44
Well/Sample ID: 44-MW1D
Project Number: 784776
Sampling Crew: Huey

Project: Fort Bragg Remediations Services

Weather: Cloudy Low 60's
Background PID: 0 (ppm) Well Headspace: 0 (ppm)

Depth to Water: 18.04
Total Depth: 32.93
Depth to LNAPL: NA
Date Purged: 10-25-15

Datum for Measurement: TOC
Casing Diameter: 2"
Casing Volume:
Purge Method: Bailer, Peristaltic Pump, Bladder Pump, other (circle)

Direct-Reading Meter Measurements:

Time	Vol. Purged (liters)	Pumping Rate (mL/min	Temp (°C)	pH (SU)	Electrical Conductivity (µs/cm)	Dissolved Oxygen (mg/L)	Redox Potential (mV)	Turbidity (NTU)	Visual Appearance	Water Level
10:47	1.0	180	19.57	6.71	158	4.19	84.7	>1000	Cloudy/	18.08
10:52	1.9	180	19.63	6.76	175	3.17	82.4	>1000	Turbid	18.10
10:57	2.8	180	19.77	6.81	156	3.18	80.5	861	"	18.11
11:02	3.7	180	19.79	6.81	157	3.18	80.0	583	"	18.12
11:07	4.6	180	19.88	6.85	157	3.10	78.5	532	"	18.13
11:12	5.5	180	19.94	6.87	156	3.13	77.8	331	"	18.13
11:17	6.4	180	20.05	6.89	157	3.20	77.1	194	Clearer	18.14
11:22	7.3	180	20.10	6.89	157	3.18	76.6	175	"	18.14
11:27	8.2	180	20.20	6.83	158	3.16	75.9	159	"	18.15
11:32	9.1	180	20.26	6.85	157	3.09	75.4	154	"	18.15
11:37	10.0	180	20.30	6.86	158	3.07	74.9	161	"	18.16

Date Sampled: 10-25-15
MS/MSD Collected? NO
Duplicate Sample ID: 44-MW10D

Time Sampled: 11:38
Parameters:
Duplicate Date/Time: 10-25-15 11:50

Laboratory Analytical Methods:

VOCs (SW8260B)	(3-40 ml VOA vials w/ HCL)
SVOCs (8270C)	(2-1L Amber)
EPH	(2-1L Amber w/ HCL)
VPH	(2-40ml VOA w/ HCL)
PAHs (8310)	(2-1L Amber)
RCRA Metals (6010B/7470)	(1-500 mL poly w/HNO3)
Pesticides/PCB (8081/8082)	(2-1L Amber)
Chloride & Sulfate (E300.1)	(1-250 poly)
Methane, Ethane, Ethene (AM-20)	(3-40mL VOA vials w/HCL)
Nitrate + Nitrite as N (E353.2)	(1-250mL poly)
Total Organic Carbon (SW9060)	(2-40 mL VOA amber vials w/HCL)

Total Containers: 2 FLUORIDE 9056A

Field Geochemistry:	Results:	Method/Comments:
Ferrous Iron:		
Sulfide:		
CO_2:		
Alkalinity:		
Manganese:		
Nitrite:		
Other:		

Notes (i.e. Wellhead Condition, Repairs, etc.):

GROUNDWATER SAMPLING RECORD

SWMU / Site Number: 44
Well/Sample ID: 44-MW2
Project Number: 748776
Sampling Crew:

Project: Fort Bragg Remediations Services

Weather: MOSTLY CLOUDY MID 60's
Background PID: 0 (ppm) Well Headspace: 0 (ppm)

Depth to Water: 8.45
Total Depth: 19.90
Depth to LNAPL: NA
Date Purged: 10.25.15

Datum for Measurement: TOC
Casing Diameter: 2"
Casing Volume:
Purge Method: Bailer, (Peristaltic Pump), Bladder Pump, other (circle)

Direct-Reading Meter Measurements:

Time	Vol. Purged (liters)	Pumping Rate (mL/min	Temp (°C)	pH (SU)	Electrical Conductivity (µs/cm)	Dissolved Oxygen (mg/L)	Redox Potential (mV)	Turbidity (NTU)	Visual Appearance	Water Level
1130	1.0	150	20.85	5.02	282	4.30	100.4	74.2	cloudy	8.45
1140	1.75	↓	20.42	5.01	263	4.06	104.7	26.1	clear	"
1145	2.5		20.89	4.99	248	3.81	108.7	8.43	"	"
1150	3.25		21.19	5.00	245	3.69	110.6	6.57	"	8.45
1153	4.0		21.40	5.02	247	3.81	111.5	4.08	"	"
1156	5.75		21.44	5.02	245	3.70	113.2	3.77	"	"
1159	6.5	↓	21.51	5.02	245	3.65	115.1	2.60	"	8.45

Date Sampled: 10.25.15
MS/MSD Collected? NO
Duplicate Sample ID: NO

Time Sampled: 1205
Parameters: —
Duplicate Date/Time: —

Laboratory Analytical Methods:

VOCs (SW8260B)	(3-40 ml VOA vials w/ HCL)
SVOCs (8270C)	(2-1L Amber)
EPH	(2-1L Amber w/ HCL)
VPH	(2-40ml VOA w/ HCL)
PAHs (8310)	(2-1L Amber)
RCRA Metals (6010B/7470)	(1-500 mL poly w/HNO3)
Pesticides/PCB (8081/8082)	(2-1L Amber)
Chloride & Sulfate (E300.1)	(1-250 poly)
Methane, Ethane, Ethene (AM-20)	(3-40mL VOA vials w/HCL)
Nitrate + Nitrite as N (E353.2)	(1-250mL poly)
Total Organic Carbon (SW9060)	(2-40 mL VOA amber vials w/HCL)

Total Containers: 1 FLUORIDE 9056A

Field Geochemistry:	**Results:**	**Method/Comments:**
Ferrous Iron:		
Sulfide:		
CO_2:		
Alkalinity:		
Manganese:		
Nitrite:		
Other:		

Notes (i.e. Wellhead Condition, Repairs, etc.):

GROUNDWATER SAMPLING RECORD

SWMU / Site Number: 44
Well/Sample ID: 44-MW3
Project Number: 748776
Sampling Crew: MR/KH

Project: Fort Bragg Remediations Services

Weather: 60° F humid, cloudy
Background PID: _____ (ppm) Well Headspace: _____ (ppm)

Depth to Water: 8.32
Total Depth: 15.05
Depth to LNAPL: NA
Date Purged: 10/25/15

Datum for Measurement: TOC
Casing Diameter: 2"
Casing Volume:
Purge Method: Bailer, (Peristaltic Pump), Bladder Pump, other (circle)

Direct-Reading Meter Measurements:

Time	Vol. Purged (liters)	Pumping Rate (mL/min	Temp (°C)	pH (SU)	Electrical Conductivity (µs/cm)	Dissolved Oxygen (mg/L)	Redox Potential (mV)	Turbidity (NTU)	Visual Appearance	Water Level
~~1224~~			~~25.82~~	~~5.31~~	~~2~~	~~8.57~~	~~101.5~~			~~8.32~~ MR
1233	1.0	150	21.17	5.41	167	0.96	37.7	66.1	Clear	8.32
1238	1.75	"	20.95	5.34	167	0.76	38.6	22.2	"	8.32
1243	2.5	"	21.06	5.33	167	0.70	40.0	7.68	"	8.32
1248	3.25	"	20.97	5.32	166	0.63	40.5	5.11	"	"
1253	4.0	"	21.01	5.33	166	0.57	39.9	3.47	"	"
1258	4.75	"	21.07	5.32	167	0.53	39.0	2.54	"	"

Date Sampled: 10/25/15
MS/MSD Collected? NO
Duplicate Sample ID: NO

Time Sampled: 1259
Parameters: —
Duplicate Date/Time: —

Laboratory Analytical Methods:

VOCs (SW8260B) _____	(3-40 ml VOA vials w/ HCL)
SVOCs (8270C) _____	(2-1L Amber)
EPH _____	(2-1L Amber w/ HCL)
VPH _____	(2-40ml VOA w/ HCL)
PAHs (8310) _____	(2-1L Amber)
RCRA Metals (6010B/7470) _____	(1-500 mL poly w/HNO3)
Pesticides/PCB (8081/8082) _____	(2-1L Amber)
Chloride & Sulfate (E300.1) _____	(1-250 poly)
Methane, Ethane, Ethene (AM-20) _____	(3-40mL VOA vials w/HCL)
Nitrate + Nitrite as N (E353.2) _____	(1-250mL poly)
Total Organic Carbon (SW9060) _____	(2-40 mL VOA amber vials w/HCL)

Total Containers: 1 FLUORIDE 9056A

Field Geochemistry:	**Results:**	**Method/Comments:**
Ferrous Iron:		
Sulfide:		
CO_2:		
Alkalinity:		
Manganese:		
Nitrite:		
Other:		

Notes (i.e. Wellhead Condition, Repairs, etc.):

GROUNDWATER SAMPLING RECORD

SWMU / Site Number: 44
Well/Sample ID: 44-MW4
Project Number: 748776
Sampling Crew: MANGLONA

Project: Fort Bragg Remediations Services

Weather: Cloudy Low 60's
Background PID: 0 (ppm) Well Headspace: 0 (ppm)

Depth to Water: 9.70
Total Depth: 20.02
Depth to LNAPL: NA
Date Purged: 10.25.15

Datum for Measurement: TOC
Casing Diameter: 2"
Casing Volume:
Purge Method: Bailer, (Peristaltic Pump), Bladder Pump, other (circle)

Direct-Reading Meter Measurements:

Time	Vol. Purged (liters)	Pumping Rate (mL/min	Temp (°C)	pH (SU)	Electrical Conductivity (µs/cm)	Dissolved Oxygen (mg/L)	Redox Potential (mV)	Turbidity (NTU)	Visual Appearance	Water Level
10:30	1.0	150	19.52	5.15	137	2.66	55.9	6.69	Cloudy	9.70
10:35	1.75		19.76	5.09	139	2.31	69.8	8.74	Clear	"
10:40	2.5		19.87	5.07	142	2.16	79.1	11.1	"	"
10:45	3.25		19.93	5.06	142	2.01	83.3	6.68	"	9.70
10:50	4.0		20.01	5.05	141	1.98	84.4	4.72	"	"
10:55	5.75		20.05	5.06	141	1.96	85.4	2.71	"	"
11:00	6.5		20.07	5.06	140	1.95	87.6	1.56	"	"

Date Sampled: 10.25.15
Time Sampled: 11:05
MS/MSD Collected? NO
Parameters: ~
Duplicate Sample ID: NO
Duplicate Date/Time: ~

Laboratory Analytical Methods:

VOCs (SW8260B)	(3-40 ml VOA vials w/ HCL)
SVOCs (8270C)	(2-1L Amber)
EPH	(2-1L Amber w/ HCL)
VPH	(2-40ml VOA w/ HCL)
PAHs (8310)	(2-1L Amber)
RCRA Metals (6010B/7470)	(1-500 mL poly w/HNO3)
Pesticides/PCB (8081/8082)	(2-1L Amber)
Chloride & Sulfate (E300.1)	(1-250 poly)
Methane, Ethane, Ethene (AM-20)	(3-40mL VOA vials w/HCL)
Nitrate + Nitrite as N (E353.2)	(1-250mL poly)
Total Organic Carbon (SW9060)	(2-40 mL VOA amber vials w/HCL)

Total Containers: 1 FLUORIDE 9056A

Field Geochemistry:	Results:	Method/Comments:
Ferrous Iron:		
Sulfide:		
CO_2:		
Alkalinity:		
Manganese:		
Nitrite:		
Other:		

Notes (i.e. Wellhead Condition, Repairs, etc.):

GROUNDWATER SAMPLING RECORD

SWMU / Site Number: 44
Well/Sample ID: 44-MW5
Project Number: 748776
Sampling Crew: HUEY

Project: Fort Bragg Remediations Services

Weather: CLOUDY MID 60's
Background PID: 0 (ppm) Well Headspace: 0 (ppm)

Depth to Water: 17.08
Total Depth: 26.30
Depth to LNAPL: NA
Date Purged: 10-25-15

Datum for Measurement: TOC
Casing Diameter: 2"
Casing Volume:
Purge Method: Bailer, Peristaltic Pump, Bladder Pump, other (circle)

Direct-Reading Meter Measurements:

Time	Vol. Purged (liters)	Pumping Rate (mL/min	Temp (°C)	pH (SU)	Electrical Conductivity (µs/cm)	Dissolved Oxygen (mg/L)	Redox Potential (mV)	Turbidity (NTU)	Visual Appearance	Water Level
11:52	1.5	180	20.78	~~7.00~~ 6.00 CH	227	3.22	86.2	87.9	SLIGHTLY CLOUDY	17.10
11:57	2.4	180	20.77	6.02	228	3.17	85.4	66.8	"	17.10
12:02	3.3	180	20.82	6.02	226	3.12	84.9	54.1	"	17.10
1207	4.2	180	21.03	6.06	228	3.12	84.6	51.9	"	17.10
1212	5.1	180	21.04	6.08	226	3.07	84.2	50.0	"	17.10
1217	6.0	180	21.06	6.09	226	2.99	83.5	52.3	"	17.10
1222	6.9	180	20.90	6.08	226	3.04	84.4	53.2	"	17.10

Date Sampled: 10-25-15
MS/MSD Collected? NO
Duplicate Sample ID: NO

Time Sampled: 12:23
Parameters: —
Duplicate Date/Time: —

Laboratory Analytical Methods:

VOCs (SW8260B)	(3-40 ml VOA vials w/ HCL)
SVOCs (8270C)	(2-1L Amber)
EPH	(2-1L Amber w/ HCL)
VPH	(2-40ml VOA w/ HCL)
PAHs (8310)	(2-1L Amber)
RCRA Metals (6010B/7470)	(1-500 mL poly w/HNO3)
Pesticides/PCB (8081/8082)	(2-1L Amber)
Chloride & Sulfate (E300.1)	(1-250 poly)
Methane, Ethane, Ethene (AM-20)	(3-40mL VOA vials w/HCL)
Nitrate + Nitrite as N (E353.2)	(1-250mL poly)
Total Organic Carbon (SW9060)	(2-40 mL VOA amber vials w/HCL)

Total Containers: 1 FLUORIDE 9056A

Field Geochemistry:	**Results:**	**Method/Comments:**
Ferrous Iron:		
Sulfide:		
CO_2:		
Alkalinity:		
Manganese:		
Nitrite:		
Other:		

Notes (i.e. Wellhead Condition, Repairs, etc.):

GROUNDWATER SAMPLING RECORD

Site Name: 44

Well/Sample ID: 44-18MW3 Project Name: FT. BRAGG

Project Number: 748776 Weather: CLOUDY HIGH 50°

Sampling Crew: MANGLONA Background PID (ppm): 0 Well Headspace PID (ppm): 0.1

Depth To Water: 5.90 Datum for Measurement: TOC

Total Depth: 17.69 Casing Diameter: 2"

Depth to NAPL: NA Casing Volume:

Date Purged: 10.25.15 Purging Method: Bailer, peristaltic pump, bladder pump, other

Direct-Reading Meter Measurements:

Time	Vol. Purged (liters)	Pumping Rate (mL/min)	Temp. +-0.2C° (°C)	pH +/-0.1 (SU)	Electrical Conductivity +/-3% (µS/cm)	Dissolved Oxygen +/-10% (mg/L)	ORP +/-10% (mv)	Turbidity +/-10% (NTU)	Visual Appearance	Water Level
0930	0.75	19.69 →	5.57 →		120	1.86	-28.2	9.99	clear	5.90
0935	1.5	150	19.97	5.44	118	1.13	-32.0	8.82	"	6.02
0940	2.25		20.04	5.45	121	0.91	-40.9	4.89	"	6.05
0945	3.0		20.07	5.46	121	0.85	-44.9	3.56	"	"
0950	3.75		20.14	5.47	119	0.74	-49.5	2.82	"	6.05
0955	4.5		20.20	5.50	119	0.69	-53.8	2.53	"	"
1000	5.25		20.22	5.53	119	0.66	-59.4	3.42	"	"
1003	6.0		20.24	5.53	119	0.65	-60.7	2.49	"	6.05
1006	6.75	↓	20.27	5.55	121	0.63	-63.2	2.21	"	6.05

Date Sampled: 10.25.15 Time Sampled: 10:10

MSD Collected? NO Parameters:

Duplicate Sample ID NO Duplicate Date/Time —

Laboratory Analytical Methods:

VOCs (SW8260B) _____ (3-40 mL VOA Vials w/ HCL) Diss Fe: _____ mg/L

SVOCs (8270C) _____ (2-1L Amber)

PAHs (8310) _____ (2-1L Amber)

RCRA Metals + Mn (6020A) _____ (250 mL poly w/ HNO3)

PesL/PCB (8081/8082) _____ (2-1L Amber)

Chloride and Sulfate (E300.1) _____

Methane, Ethane, Ethene (RSK-175) _____ (3-40 mL VOA Vials)

Nitrate (9056A) + Alkalinity (2310B) _____ (1 - 250mL poly)

Total Org. Carbon (SW9060) _____ (2- VOA amber)

Total Containers 1 FLUORIDE 9056A

Notes: (Wellhead Condition, Repairs, Decon, etc.)

APPENDIX D
LABORATORY DATA SHEETS
(INCLUDED IN PDF VERSION ONLY)

NELAP CERTIFICATE NUMBER: 01955
DOD ELAP CERTIFICATE NUMBER: L14-243

ANALYTICAL RESULTS

PERFORMED BY

GCAL, LLC
7979 Innovation Park Dr.
Baton Rouge, LA 70820

Report Date 11/06/2015

GCAL Report 215102706

Project Ft. Bragg - Site 44

Deliver To Ross Miller Parsons 406 W South Jordan Pkwy Suite 300 South Jordan, UT 84095 801-572-5999

Laboratory Endorsement

Sample analysis was performed in accordance with approved methodologies provided by the Environmental Protection Agency or other recognized agencies. The samples and their corresponding extracts will be maintained for a period of 30 days unless otherwise arranged. Following this retention period the samples will be disposed in accordance with GCAL's Standard Operating Procedures.

Common Abbreviations that may be Utilized in this Report

ND	Indicates the result was Not Detected at the specified reporting limit
DO	Indicates the result was Diluted Out
MI	Indicates the result was subject to Matrix Interference
TNTC	Indicates the result was Too Numerous To Count
SUBC	Indicates the analysis was Sub-Contracted
FLD	Indicates the analysis was performed in the Field
DL	Detection Limit
DL	Diluted analysis – when appended to Client Sample ID
LOD	Limit of Detection
LOQ	Limit of Quantitation
RE	Re-analysis
00:01	Reported as a time equivalent to 12:00 AM

Reporting Flags that may be Utilized in this Report

J or I	Indicates the result is between the MDL and LOQ
J	DOD flag on analyte in the parent sample for MS/MSD outside acceptance criteria
U	Indicates the compound was analyzed for but not detected
B or V	Indicates the analyte was detected in the associated Method Blank
Q	Indicates a non-compliant QC Result (See Q Flag Application Report)
*****	Indicates a non-compliant or not applicable QC recovery or RPD – see narrative
E	The result is estimated because it exceeded the instrument calibration range
E	Metals - % diference for the serial dilution is > 10%

Sample receipt at GCAL is documented through the attached chain of custody. In accordance with NELAC, this report shall be reproduced only in full and with the written permission of GCAL. The results contained within this report relate only to the samples reported. The documented results are presented within this report.

This report pertains only to the samples listed in the Report Sample Summary and should be retained as a permanent record thereof. The results contained within this report are intended for the use of the client. Any unauthorized use of the information contained in this report is prohibited.

I certify that this data package is in compliance with the NELAC Institute standard and terms and conditions of the contract and Statement of Work both technically and for completeness, for other than the conditions in the case narrative. Release of the data contained in this hardcopy data package and in the computer readable data submitted has been authorized by the Quality Assurance Manager or his/her designee, as verified by the following signature.

Estimated uncertainty of measurement is available upon request. This report is in compliance with the DOD QSM as specified in the contract if applicable.

_____
Authorized Signature
GCAL Report 215102706

Case Narrative

Client: Parsons **Report:** 215102706

Gulf Coast Analytical Laboratories received and analyzed the sample(s) listed on the Report Sample Summary page of this report. Receipt of the sample(s) is documented by the attached chain of custody. This applies only to the sample(s) listed in this report. No sample integrity or quality control exceptions were identified unless noted below.

CONVENTIONALS

In the EPA 9056A analysis, samples 21510270604 (44-MW4), 21510270605 (44-MW1), 21510270607 (44-MW2) and 21510270608 (44-MW5) had to be diluted in order to bracket the concentration within the calibration range of the instrument.

Q Flag Summary

NO Q FLAGS FOR THIS WORKORDER

Sample Summary

GCAL ID	Client ID	Matrix	Collect Date/Time	Receive Date/Time
21510270601	44-SW1	Water	10/25/2015 09:30	10/27/2015 10:06
21510270602	44-SUMP-1	Water	10/25/2015 10:00	10/27/2015 10:06
21510270603	44-18M13	Water	10/25/2015 10:10	10/27/2015 10:06
21510270604	44-MW4	Water	10/25/2015 11:05	10/27/2015 10:06
21510270605	44-MW1	Water	10/25/2015 10:32	10/27/2015 10:06
21510270606	44-MW1D	Water	10/25/2015 11:38	10/27/2015 10:06
21510270607	44-MW2	Water	10/25/2015 12:05	10/27/2015 10:06
21510270608	44-MW5	Water	10/25/2015 12:23	10/27/2015 10:06
21510270609	44-MW10D	Water	10/25/2015 11:50	10/27/2015 10:06
21510270610	44-MW3	Water	10/25/2015 12:59	10/27/2015 10:06

Sample Results

44-SW1

Collect Date	10/25/2015 09:30	**GCAL ID**	21510270601
Receive Date	10/27/2015 10:06	**Matrix**	Water

EPA 9056A

Prep Date	Prep Batch	Prep Method	Dilution	Analysis Date	By	Analytical Batch
NA	NA	NA	1	11/05/2015 23:53	RXJ	571746

CAS#	Parameter	Result	DL	LOQ	Units
16984-48-8	Fluoride	0.113J	0.050	0.200	mg/L

44-SUMP-1

Collect Date	10/25/2015 10:00	**GCAL ID**	21510270602
Receive Date	10/27/2015 10:06	**Matrix**	Water

EPA 9056A

Prep Date	Prep Batch	Prep Method	Dilution	Analysis Date	By	Analytical Batch
NA	NA	NA	1	11/06/2015 00:11	RXJ	571746

CAS#	Parameter	Result	DL	LOQ	Units
16984-48-8	Fluoride	4.38	0.050	0.200	mg/L

44-18M13

Collect Date	10/25/2015 10:10	**GCAL ID**	21510270603
Receive Date	10/27/2015 10:06	**Matrix**	Water

EPA 9056A

Prep Date	Prep Batch	Prep Method	Dilution	Analysis Date	By	Analytical Batch
NA	NA	NA	1	11/06/2015 00:28	RXJ	571746

CAS#	Parameter	Result	DL	LOQ	Units
16984-48-8	Fluoride	0.050U	0.050	0.200	mg/L

44-MW4

Collect Date	10/25/2015 11:05	**GCAL ID**	21510270604
Receive Date	10/27/2015 10:06	**Matrix**	Water

EPA 9056A

Prep Date	Prep Batch	Prep Method	Dilution	Analysis Date	By	Analytical Batch
NA	NA	NA	5	11/06/2015 11:26	DMT	571746

CAS#	Parameter	Result	DL	LOQ	Units
16984-48-8	Fluoride	5.77	0.250	1.00	mg/L

Sample Results

44-MW1

Collect Date	10/25/2015 10:32	**GCAL ID**	21510270605
Receive Date	10/27/2015 10:06	**Matrix**	Water

EPA 9056A

Prep Date	Prep Batch	Prep Method	Dilution	Analysis Date	By	Analytical Batch
NA	NA	NA	5	11/06/2015 11:43	DMT	571746

CAS#	Parameter	Result	DL	LOQ	Units
16984-48-8	Fluoride	11.6	0.250	1.00	mg/L

44-MW1D

Collect Date	10/25/2015 11:38	**GCAL ID**	21510270606
Receive Date	10/27/2015 10:06	**Matrix**	Water

EPA 9056A

Prep Date	Prep Batch	Prep Method	Dilution	Analysis Date	By	Analytical Batch
NA	NA	NA	1	11/06/2015 01:21	RXJ	571746

CAS#	Parameter	Result	DL	LOQ	Units
16984-48-8	Fluoride	0.050U	0.050	0.200	mg/L

44-MW2

Collect Date	10/25/2015 12:05	**GCAL ID**	21510270607
Receive Date	10/27/2015 10:06	**Matrix**	Water

EPA 9056A

Prep Date	Prep Batch	Prep Method	Dilution	Analysis Date	By	Analytical Batch
NA	NA	NA	5	11/06/2015 12:01	DMT	571746

CAS#	Parameter	Result	DL	LOQ	Units
16984-48-8	Fluoride	8.40	0.250	1.00	mg/L

44-MW5

Collect Date	10/25/2015 12:23	**GCAL ID**	21510270608
Receive Date	10/27/2015 10:06	**Matrix**	Water

EPA 9056A

Prep Date	Prep Batch	Prep Method	Dilution	Analysis Date	By	Analytical Batch
NA	NA	NA	20	11/06/2015 12:43	DMT	571746

CAS#	Parameter	Result	DL	LOQ	Units
16984-48-8	Fluoride	38.9	1.00	4.00	mg/L

Sample Results

44-MW10D

Collect Date	10/25/2015 11:50	**GCAL ID**	21510270609
Receive Date	10/27/2015 10:06	**Matrix**	Water

EPA 9056A

Prep Date	Prep Batch	Prep Method	Dilution	Analysis Date	By	Analytical Batch
NA	NA	NA	1	11/06/2015 03:24	RXJ	571746

CAS#	Parameter	Result	DL	LOQ	Units
16984-48-8	Fluoride	0.050U	0.050	0.200	mg/L

44-MW3

Collect Date	10/25/2015 12:59	**GCAL ID**	21510270610
Receive Date	10/27/2015 10:06	**Matrix**	Water

EPA 9056A

Prep Date	Prep Batch	Prep Method	Dilution	Analysis Date	By	Analytical Batch
NA	NA	NA	1	11/06/2015 03:08	RXJ	571808

CAS#	Parameter	Result	DL	LOQ	Units
16984-48-8	Fluoride	1.53	0.050	0.200	mg/L

General Chemistry QC Summary

Analytical Batch 571746	Client ID	MB571746		LCS571746			
	GCAL ID	1506113		1506114			
	Sample Type	MB		LCS			
	Prep Date	NA		NA			
	Analysis Date	11/05/2015 15:17		11/05/2015 14:59			
	Matrix	Water		Water			
EPA 9056A		Units Result	mg/L DL	Spike Added	Result	%R	Control Limits%R
Fluoride	16984-48-8	0.050U	0.050	2.50	2.32	93	80 - 120

Analytical Batch 571746	Client ID	44-MW1D		1503047MS				1503047MSD				
	GCAL ID	21510270606		1506120				1506121				
	Sample Type	SAMPLE		MS				MSD				
	Prep Date	NA		NA				NA				
	Analysis Date	11/06/2015 01:21		11/06/2015 02:14				11/06/2015 02:31				
	Matrix	Water		Water				Water				
EPA 9056A		Units Result	mg/L DL	Spike Added	Result	%R	Control Limits%R	Spike Added	Result	%R	RPD	RPD Limit
Fluoride	16984-48-8	0.000	0.050	2.50	2.33	93	80 - 120	2.50	2.32	93	0	15

Analytical Batch 571808	Client ID	MB571808		LCS571808			
	GCAL ID	1506442		1506443			
	Sample Type	MB		LCS			
	Prep Date	NA		NA			
	Analysis Date	11/05/2015 14:41		11/05/2015 14:23			
	Matrix	Water		Water			
EPA 9056A		Units Result	mg/L DL	Spike Added	Result	%R	Control Limits%R
Fluoride	16984-48-8	0.074J	0.050	2.50	2.40	96	80 - 120

GCAL ANALYTICAL LABORATORIES, LLC

7979 Innovation Park Dr., Baton Rouge, LA 70820-7402
Phone: 225.769.4900 • Fax: 225.767.5717 • www.gcal.com

CHAIN OF CUSTODY RECORD

Client ID: 4476 - Parsons
SDG: 215102706
PM: RCH2

Report to:
Client: PARSONS
Address: 3577 PARKWAY LANE S-100
NORCROSS, GA 30092
Contact: ANGIE WELCH
Phone: 404-803-3791
E-mail: Angie.Welch@parsons.com

Bill to:
Client: PARSONS
Address:
Contact: STEPHANIE BLISS
Phone: 801-572-5999
E-mail: Stephanie.Bliss@parsons.com

P.O. Number:
Project Name/Number: FT. BRAGG - SITE 44
Sampled By: HUGY/MANGLONA/TEPLY

GCAL use only:
Custody Seal used ☐ yes ☐ no
intact ☐ yes ☐ no
Temperature °C 3.3 E24

☐ Dissolved Analysis Requested
☐ Field filtered
☐ Lab filtered

Analytical Requests & Method

Matrix[1]	Date	Time (2400)	Comp	Grab	Sample Description	No Containers	FLUORIDE 9056A										Preservative	
W	10/25/15	09:30		X	44-SW1	1	X											1
W	10/25/15	10:00		X	44-SUMP-1	1	X											2
W	10/25/15	10:10		X	*44-18M13	1	X											3
W	10/25/15	11:05		X	~~44-18~~ CH 44-MW4	1	X											4
W	10/25/15	10:32		X	44-MW1	1	X											5
W	10/25/15	11:38	+	X	44-MW1D	1	X											6
W	10/25/15	12:05		X	*44-MW2	1	X											7
W	10/25/15	12:23		X	44-MW5	1	X											8
W	10/25/15	11:50		X	44-MW10D	1	X											9
W	10/25/15	12:59		X	*44-MW3	1	X											10

Air Bill No: 8092 2222 8821

Turn Around Time (Business Days): ☐ 24h* ☐ 48h* ☐ 3 days* ☐ 1 week* ☒ Standard (Per Contract/Quote)

Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:
[signature]	10-26-15	1500	FED EX	10 26 15	1500
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:
Fed EX	10-27-15	10:06	Dodie McCune	10-27-15	10:06
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:

Note:

By submitting these samples, you agree to GCAL's terms and conditions contained in our most recent schedule of services.

Matrix[1]: W = water, S = solid, L = liquid, T = tissue

*Requires prior approval, rush charges may apply.

We cannot accept verbal changes. Please email written changes to your PM.

WHITE: CLIENT FINAL REPORT - CANARY: CLIENT

GCAL ANALYTICAL LABORATORIES, LLC

SAMPLE RECEIVING CHECKLIST

215102706

SAMPLE DELIVERY GROUP 215102706

Client **PM** RCH2 4476 - Parsons	**Transport Method** FEDEX
Profile Number 243150	**Received By** McCune, Dodie N.
Line Item(s) 4 - Water FL by 9056/TAL Metals	***Receive Date(s)*** 10/27/15

CHECKLIST	YES	NO	NA
Were all samples received using proper thermal preservation?	☑	☐	☐
When used, were all custody seals intact?	☑	☐	☐
Were all samples received in proper containers?	☑	☐	☐
Were all samples received using proper chemical preservation?	☐	☐	☑
Was preservative added to any container at the lab?	☐	☑	☐
Were all containers received in good condition?	☑	☐	☐
Were all VOC water samples received without head space?	☐	☐	☑
Do all sample labels match the Chain of Custody?	☑	☐	☐
Did the Chain of Custody list the sampling technician?	☑	☐	☐
Was the COC maintained i.e. all signatures, dates and time of receipt included?	☑	☐	☐

COOLERS

Airbill	Thermometer ID: E24	Temp(°C)
809222228821		3.3

DISCREPANCIES

None

LAB PRESERVATIONS

None

NOTES

Revision 1.4