



**FIELD SAMPLING AND ANALYSIS PLAN  
FOR  
ADDITIONAL GROUNDWATER INVESTIGATION**

**FORMER VERMONT BOSCH SITE  
FOUNTAIN INN, SOUTH CAROLINA  
SCDHEC SITE ID #52309**

**Prepared for:**

**ROBERT BOSCH TOOL CORPORATION  
1800 West Central Road  
Mount Prospect, Illinois 60056**

**Prepared by:**

**Amec Foster Wheeler Environment & Infrastructure, Inc.  
37 Villa Road, Suite 201  
Greenville, South Carolina 29615**

**Amec Foster Wheeler Project 6251121007.03.01**

**June 3, 2016**



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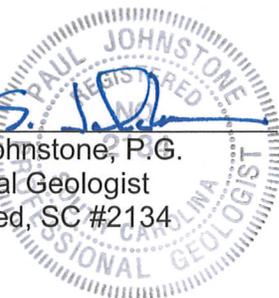
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**June 3, 2016**

  
Paul S. Johnstone, P.G.  
Principal Geologist  
Registered, SC #2134

A circular professional seal for Paul S. Johnstone, a Registered Professional Geologist in South Carolina. The seal contains the text "PAUL JOHNSTONE", "REGISTERED", "NO. 2134", and "PROFESSIONAL GEOLOGIST".

  
Christopher H. Bruce, P.G.  
Senior Geologist  
Registered, SC #2166

A circular professional seal for Christopher H. Bruce, a Registered Professional Geologist in South Carolina. The seal contains the text "CHRISTOPHER H. BRUCE", "REGISTERED", "NO. 2166", and "PROFESSIONAL GEOLOGIST".

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## LIST OF ACRONYMS

AOC	Area of concern
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DO	Dissolved Oxygen
DPT	Direct Push Technology
FB	Field Blank
FSAP	Field Sampling and Analysis Plan
ID	Inside diameter
IDW	Investigative Derived Waste
ORP	Oxidation Reduction Potential
PQL	Practical Quantitation Limit
PVC	Polyvinyl Chloride
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RB	Rinse Blank
RBTC	Robert Bosch Tool Corporation
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study Work Plan
SCDHEC	South Carolina Department of Health and Environmental Control
SESD	Science and Ecosystem Support Division
SPGS	Screen Point Groundwater Sampler
TB	Trip Blank
USEPA	United States Environmental Protection Agency
VCC	Voluntary Cleanup Contract
VOCs	volatile organic compounds

## 1.0 INTRODUCTION

This Field Sampling and Analysis Plan (FSAP) for Additional Groundwater Investigation has been prepared to describe the proposed additional remedial investigation (RI) activities at the Former Vermont Bosch Site (Site) located in Fountain Inn, South Carolina. The FSAP has been prepared by Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler), formerly AMEC Environment & Infrastructure, Inc. and MACTEC Engineering and Consulting, Inc., on behalf of Robert Bosch Tool Corporation (RBTC), in accordance with Voluntary Cleanup Contract (VCC) #05-5613-RP, executed on August 29, 2005, and the United States Environmental Protection Agency (USEPA) “Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA” (USEPA, 1988). The additional groundwater investigation is being conducted in response to a comment on the RI Report (Amec Foster Wheeler, 2016) from the South Carolina Department of Health and Environmental Control (SCDHEC) in a letter dated April 20, 2016.

This FSAP for Additional Groundwater Investigation presents the details associated with the SCDHEC-requested Site assessment activities. The following sections describe the proposed additional RI sampling program including sampling rationale, the locations, number and types of samples to be collected, and the analyses that will be performed. The general procedures for field sample collection and analysis, field documentation, RI investigation procedures, sample labeling, sample custody and data management are described in the project Quality Assurance Project Plan (QAPP) which is contained as Appendix B in the Remedial Investigation/Feasibility Study (RI/FS) Work Plan (AMEC, 2012). When procedural information is provided in the FSAP, its inclusion is intended as a Site-specific supplement to QAPP procedure. If Site-specific sample collection requirements described in the FSAP conflict with the general requirements in the QAPP, the Site-specific FSAP procedure will supersede the QAPP requirement for that activity.

## **2.0 SAMPLING OBJECTIVES**

The purpose of the proposed additional assessment activities described in this FSAP for Additional Groundwater Investigation is to provide additional information on the nature and extent of contaminated groundwater present at the Site. SCDHEC has requested further evaluation of the intermediate water table aquifer downgradient of the suspected source area.

Volatile organic compounds (VOCs) were detected in the previous field-screening groundwater samples and RI monitoring well groundwater samples collected immediately downgradient from Area of Concern (AOC) # 9 (Former Hazardous Waste Accumulation Building) and from the adjacent Fort Dearborn (former Sherwin-Williams) property , which is also downgradient from the Former Hazardous Waste Accumulation Building.

This sampling will target the water table aquifer below the current depth of the shallow groundwater monitoring wells that were installed during the RI. This includes the intermediate (mid-level) water table aquifer, approximately 25 to 50 feet below ground surface (bgs), and the top of bedrock zone, approximately 50 to 80 feet bgs.

Field screening borings will be installed both side gradient and down the center line of known shallow groundwater contamination to further assess and define the extent of impacted groundwater downgradient of the identified source area.

### 3.0 SAMPLING RATIONALE AND LOCATIONS

This section describes the field investigation, which will include sampling of groundwater in AOC #9 to develop information on the nature and distribution of chlorinated VOCs at the Site. These activities will be performed in accordance with the RI/FS Work Plan (AMEC, 2012).

The field activities will include the collection and field screening of groundwater samples within AOC #9 to evaluate the intermediate (mid-level) zone of the water table aquifer and the groundwater at the top of the bedrock surface. Depending on the results of the field screening, permanent monitoring wells may be installed and sampled. The sampling approach includes the collection of discrete groundwater field-screening samples. The field-screening program includes the installation of eight multi-level groundwater borings and the collection of as many as 32 discrete groundwater field-screening samples. The proposed field-screening borings and potential groundwater monitoring wells are described in additional detail below.

#### 3.1 GROUNDWATER FIELD SCREENING

Up to eight multi-level groundwater field-screening borings will be installed at the Site. The borings will be advanced using direct-push technology (DPT) drill rig. Each of the borings will be advanced to DPT refusal/top of the bedrock surface (approximately 55 to 80 feet bgs). A summary of the proposed DPT boring locations and their anticipated sample intervals is provided on **Table 1**. The locations of the proposed field screening borings, identified as GW-09-01 through GW-09-08, are shown on **Figure 1**. A cross-sectional view of the proposed sampling depths are included as **Figure 2**.

Groundwater field-screening samples will be collected on ten-foot centers from approximately five feet below the bottom of existing shallow groundwater monitoring wells (approximately 25 feet bgs) to DPT refusal. The groundwater samples will be collected from each field-screening boring using a Geoprobe® Screen Point Groundwater Sampler (SPGS). The SPGS will be driven to the desired sampling depth and the two-foot long screen will be exposed. Once groundwater has entered the sampler, a length of tubing is inserted into the SPGS and a groundwater sample is extracted using a peristaltic pump or manually extracted using a check valve system installed on the bottom of the tubing. The SPGS is then removed from the borehole and decontaminated before being driven to the next sampling depth. Based on the August 2015 depth to water table

and the anticipated depth of the DPT refusal, three to six field-screening groundwater samples will be collected from each boring (see **Table 1**).

A portion of each groundwater sample collected will be field screened using the Color-Tec method and the remainder will be containerized and held for potential laboratory analysis. The Color-Tec method is described in Section B4 (pages B-24 to B-25) of the QAPP. Based on field screening results, selected groundwater samples will be submitted to a fixed-based laboratory for analysis of VOCs by USEPA Method 8260B. Sample selection will be based on Color-Tec field-screening results.

### **3.2 MONITORING WELL INSTALLATION**

Based on the groundwater field screening results and/or laboratory results, additional monitoring wells may be installed. For the purposes of this work plan the installation of four additional wells (two well pairs) is assumed (MW-09-26, MW-09-27D, MW-09-28 and MW-09-29D). Tentatively proposed monitoring wells MW-09-26 and MW-09-27D will be installed downgradient of existing monitoring well pair MW-09-07/MW-09-08D (on the Fort Dearborn property). MW-09-28 and MW-09-29D will be installed downgradient of existing monitoring well pair MW-09-11/MW-09-12D. The actual number, location and well depth (if wells are determined to be necessary) will be based on field screening results. A summary of the monitoring well construction specifications is shown on **Table 2**. The potential locations and screened intervals for both well pairs are shown on **Figure 3**.

Each well pair location will consist of an intermediate (mid-level) water table well and a top of rock well. At the proposed intermediate monitoring well locations, the augers will be advanced to an estimated depth of 30 to 45 feet bgs. At each of the proposed deep monitoring well locations (top of rock), the augers will be advanced to the top of bedrock (approximately 50 feet bgs). For the intermediate wells, two-inch inside diameter (ID) Schedule 40 polyvinyl chloride (PVC) flush-threaded well casing with a 10-foot manufactured well screen with 0.010-inch machined slots will be set at the desired depth. In the top of rock monitoring wells, the well screen will be five feet in length. For both intermediate and top of rock wells, surface completions will consist of a six-inch diameter steel or cast iron flush-mount manhole. Borehole completion procedures and monitoring well installation procedures are described in Section B2 (pages B-10 to B-12) of the QAPP.

Monitoring well development will be performed, as soon as practical, after well installation but not sooner than 48 hours following placement of the grout seal. Monitoring well development will be conducted in accordance with methods described in Section B2 (pages B-12 to B-13) of the QAPP.

### **3.3 MONITORING WELL GROUNDWATER SAMPLING**

If monitoring wells are installed, groundwater samples will be collected from the monitoring well and analyzed for VOCs. Groundwater sampling procedures are described in Section B2 (pages B-13 to B-16) of the QAPP. For informational purposes, field measurements of pH, conductivity, temperature, dissolved oxygen (DO), and oxidation reduction potential (ORP) will be collected from each monitoring well.

## **4.0 SAMPLE EQUIPMENT AND HANDLING PROCEDURES**

The sampling will be performed in accordance with procedures described in the QAPP and in general conformance with the USEPA Region IV, Science and Ecosystem Support Division (SESD), Field Branches Quality System and Technical Procedures.

The QAPP contains specific procedures and requirements for data management which includes a format for unique sample identification numbers, initiating the sample custody process, and preparing field documentation on each sample collected. The field documentation includes use of field logbooks to describe and document the sequence of daily activities on-Site and field data records to record observations and field measurements for each sample collected. These procedures, as well as data quality objectives, and details concerning the analytical program, including quality assurance/quality control (QA/QC) sample requirements are described in Section A7 (pages A-20 to A-26) of the QAPP.

Sampling related procedures contained in this FSAP for Additional Groundwater Investigation are in addition to those contained in the QAPP.

### **4.1 GROUNDWATER SAMPLING PROCEDURES**

Groundwater samples will be collected in accordance with procedures described in Section B2 (pages B-13 to B-16) of the QAPP. The analytical methods, the sample bottle, sample preservation and sample hold time requirements are specified in Table B-2 of the QAPP.

### **4.2 FIELD DOCUMENTATION AND SAMPLE NUMBERING**

During sampling activities, field data will be documented in a field logbook and a field data record form. The use and content of the field logbook is described in Section A9 (pages A-27 to A-28) and Section B3 (pages B-21 to B-22) of the QAPP. The field data records are described in Section A9 (pages A-27 to A-28) of the QAPP.

Field monitoring equipment will be calibrated in accordance with manufacturer's procedures and the calibration results will be documented in a field data record.

A unique sample number will be used for each sample collected. The sample number system is described in Section B3 (pages B-20 to B-21) of the QAPP. This system includes identification of field samples and QA/QC samples.

Sample labels will be prepared for each sample, which will include the sample number, the sample bottle and preservation requirements, analytical method(s), sample date, time, and sampler initials. Sample chain of custody procedures are described in Section B3 (page B-21 through B-23) of the QAPP.

## **5.0 SAMPLE PRESERVATION AND ANALYSIS**

Based on previous data and the nature of the Site activities, the sampling plan will focus on VOCs downgradient of the source area.

### **5.1 SAMPLE ANALYSIS**

Sample containers will be prepared and provided by the laboratory. Table A-4 of the QAPP presents a summary of practical quantitation limit (PQL) and regulatory standards associated with each respective compound for Method 8260B (VOCs). The sample container and preservation requirements are provided in Table B-3 of the QAPP.

### **5.2 GROUNDWATER SAMPLE ANALYTICAL PROCEDURE**

Groundwater samples will be prepared and analyzed following USEPA Method 8260B for VOCs.

### **5.3 FIELD QUALITY ASSURANCE AND QUALITY CONTROL SAMPLES**

Specific details of the project QA/QC are presented in the QAPP. The QC checks include the introduction of control samples into the sample analysis process in an effort to evaluate the accuracy and precision of the sampling and analysis program. QA/QC samples will be collected in accordance with procedures described in Section A7 (pages A-20 through A-26) and Section B5 (pages B-28 through B-29) of the QAPP

Field Blanks. One field blank (FB) sample will be collected per sampling day.

Rinsate Blanks. One rinsate blank (RB) sample will be collected per each type of media-specific sampling equipment used during a sampling event when such sampling equipment is cleaned in the field.

Trip Blanks. Trip blanks (TB) will be shipped with each cooler containing field samples collected for VOC analysis.

Field Duplicate Samples. Field duplicate samples will be collected at a frequency of ten percent for each media sampled.

## **6.0 DECONTAMINATION PROCEDURES**

### **6.1 SAMPLING EQUIPMENT**

Groundwater sampling equipment will be decontaminated prior to the start of sampling and between each discrete groundwater sample boring hole. Equipment will be decontaminated in accordance with the procedures described in Section B2 (pages B-17 to B-19) of the QAPP.

### **6.2 DECONTAMINATION PAD**

A decontamination pad will be constructed for field cleaning of sampling equipment, including downhole drilling equipment. The decontamination pad will be constructed such that it will meet the following requirements:

- The pad will be constructed in an area known or believed to be free of surface contamination.
- If feasible, the pad will be constructed on a level surface that will facilitate the collection of wastewater. This will be accomplished by either constructing the pad with one corner lower than the rest, or by creating a sump or pit in one corner or along one side. Any sump or pit will also be lined.
- The temporary pad will be lined with a water impermeable material with no seams within the pad. The material will be either easily replaced (disposable) or repairable. The pad will not leak excessively.
- Sawhorses or racks will be constructed to hold equipment while being cleaned and will be high enough off the ground to prevent equipment from being splashed.
- At the completion of the Site activities, the decontamination pad will be dismantled. Wastewater remaining in the pad will be removed and containerized for disposal.
- When isopropanol is utilized for decontamination, the decontamination fluids will be collected and containerized for proper disposal.

The location of the decontamination pad will be determined prior to mobilization to the Site for the sampling activities.

## **7.0 POST-SAMPLING ACTIVITIES**

### **7.1 SURVEYING**

Following completion of the sampling activities, DPT borings and monitoring well locations, if monitoring wells are installed, will be surveyed for horizontal and vertical control by a South Carolina registered land surveyor.

### **7.2 INVESTIGATIVE DERIVED WASTE**

During the field activities, investigative derived wastes (IDW) are expected to be generated that will consist of soil cuttings generated during the drilling of soil borings and installation of groundwater monitoring wells and development/purge water generated during installation and sampling of the monitoring wells. The IDW will be containerized in 55-gallon drums and stored within the security fence of the Site. At the conclusion of the field screening, monitoring well installation, and groundwater sampling activities, composite soil or water samples will be collected from each drum (or set of drums generated from each location), as applicable, and sent to the laboratory for waste characterization purposes to determine proper disposal of the IDW. The drums will be sealed with the drum cover and cover ring. The nut on the cover ring will be tightened to the extent possible using a ratchet and socket or other similar hand tool. The drums will be labeled with an identification number, date, contents, and associated sampling locations pending the results of the laboratory analyses, at which time the drums will be scheduled for removal and proper disposal. Transportation manifests and certificates of disposal will be obtained. The IDW drum inventory will be maintained by the Field Operations Leader.

## 8.0 REFERENCES

Amec Foster Wheeler Environment & Infrastructure, Inc., 2016. Remedial Investigation, Former Vermont Bosch Site, Fountain Inn, South Carolina, Amec Foster Wheeler Project 6251121007.03.01, Greenville, South Carolina.

AMEC Environment & Infrastructure, Inc., 2012. Remedial Investigation / Feasibility Study Work Plan, Revision 4.0, Former Vermont Bosch Site, Fountain Inn, South Carolina, AMEC Project 6251121007.01.01, Greenville, South Carolina.

United States Environmental Protection Agency, 1988, "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final," Office of Solid Waste and Emergency Response, OSWER Directive 9355.3-01 EPA/540/G-89/004.

United States Environmental Protection Agency, Region IV Science and Ecosystem Support Division, various dates, "Field Branches Quality System and Technical Procedures."

## TABLES

**TABLE 1**

**Proposed Groundwater Field-Screening Sample Intervals  
Former Vermont Bosch Site  
Fountain Inn, South Carolina  
Amec Foster Wheeler Project 6251121007.03.01**

<b>Proposed Sample ID</b>	<b>Sample Depth (bgs)</b>	<b>COLOR-TEC</b>	<b>USEPA 8260B</b>
GW-09-01	30 feet	X	TBD
	40 feet	X	TBD
	50 feet	X	TBD
	60 feet	X	TBD
	70 feet	X	TBD
	80 feet	X	TBD
GW-09-02	30 feet	X	TBD
	40 feet	X	TBD
	50 feet	X	TBD
	60 feet	X	TBD
	70 feet	X	TBD
	80 feet	X	TBD
GW-09-03	30 feet	X	TBD
	40 feet	X	TBD
	50 feet	X	TBD
	60 feet	X	TBD
	70 feet	X	TBD
	80 feet	X	TBD
GW-09-04	30 feet	X	TBD
	40 feet	X	TBD
	50 feet	X	TBD
	60 feet	X	TBD
GW-09-05	30 feet	X	TBD
	40 feet	X	TBD
	50 feet	X	TBD
	60 feet	X	TBD
GW-09-06	30 feet	X	TBD
	40 feet	X	TBD
	50 feet	X	TBD
	60 feet	X	TBD
GW-09-07	30 feet	X	TBD
	40 feet	X	TBD
	50 feet	X	TBD
	60 feet	X	TBD
GW-09-08	30 feet	X	TBD
	40 feet	X	TBD
	50 feet	X	TBD

**Notes:**

bgs = Below ground surface

USEPA = United States Environmental Protection Agency

TBD = To be determined

**TABLE 2**

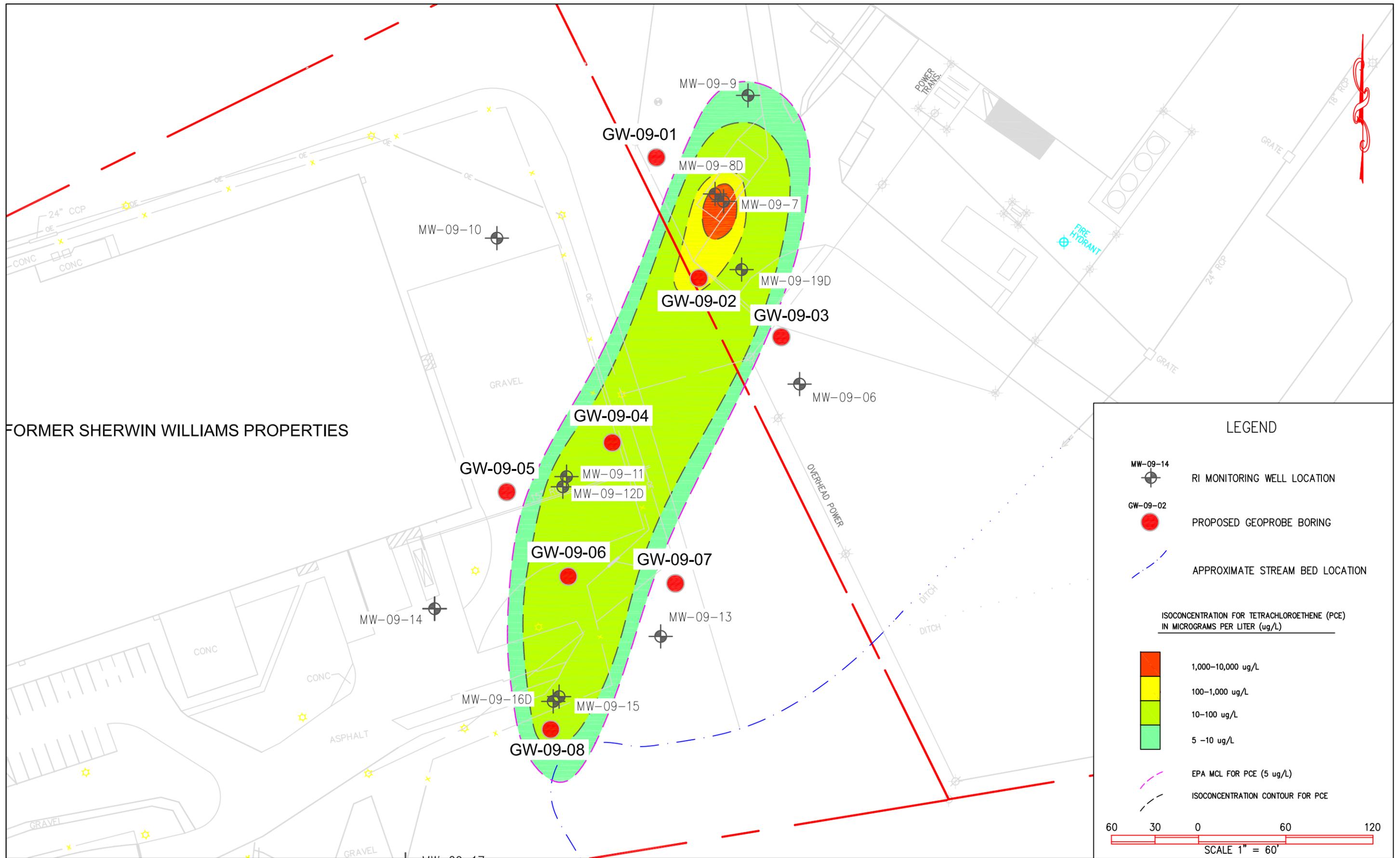
**Proposed Monitoring Well Construction Specifications  
Former Vermont Bosch Site  
Fountain Inn, South Carolina  
Amec Foster Wheeler Project 6251121007.03.01**

<b>Proposed Well ID</b>	<b>Approximate Total Well Depth (feet bgs)</b>	<b>Approximate Screen Depth (feet bgs)</b>	<b>Screen Length (feet)</b>
MW-09-26	30-45	30-40	10
MW-09-27D	50	40-50	5
MW-09-28	30-45	30-40	10
MW-09-29D	50	40-50	5

**Notes:**

bgs = below ground surface

## FIGURES



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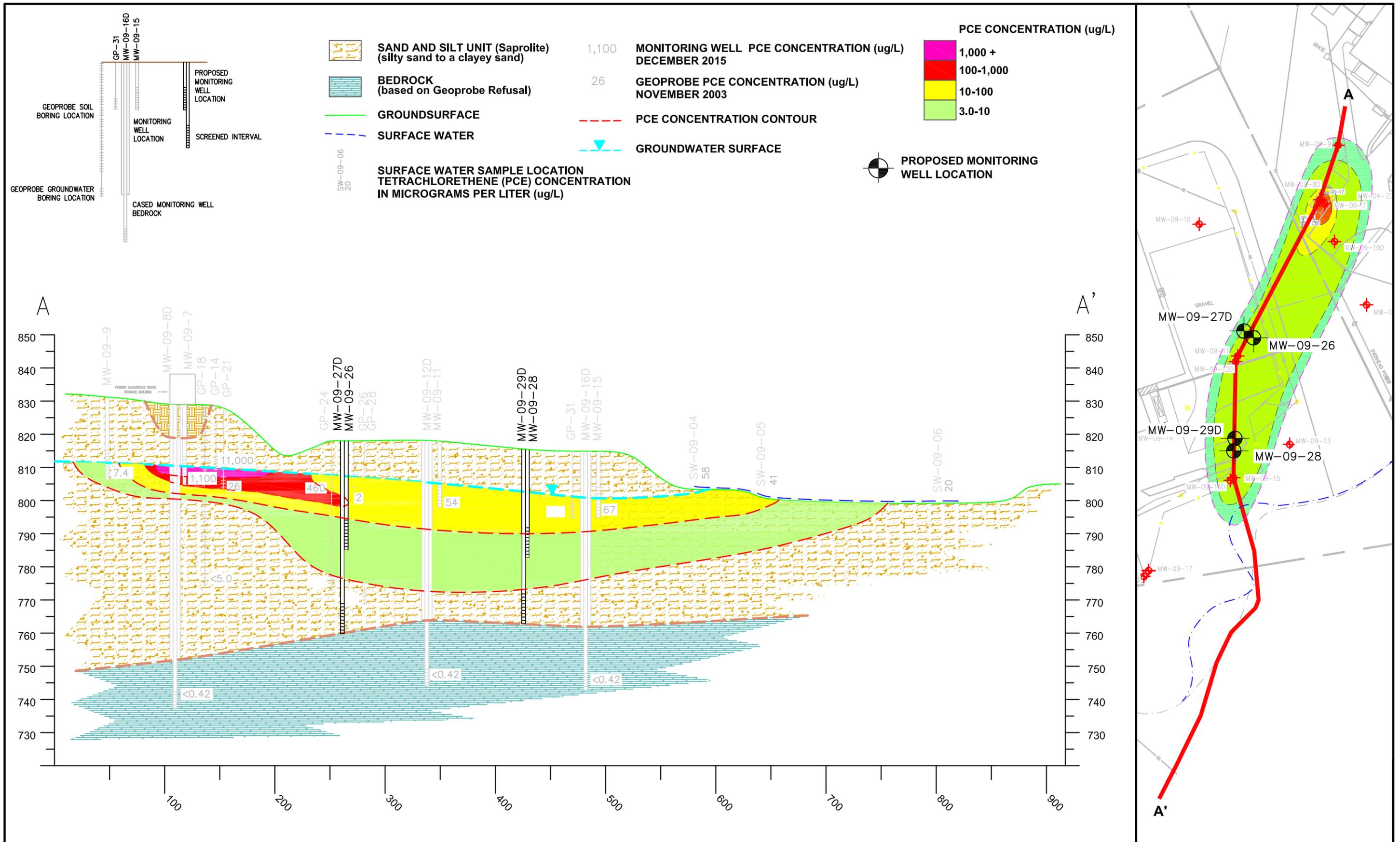
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PROPOSED FIELD-SCREENING BORING LOCATION MAP  
RBTC FOUNTAIN INN DIVISION/FORMER SHERWIN WILLIAMS PROPERTIES  
FOUNTAIN INN, SOUTH CAROLINA

FIGURE  
1





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PROPOSED MONITORING WELL LOCATION MAP WITH CROSS-SECTIONAL VIEW  
 RBTC FOUNTAIN INN DIVISION/FORMER SHERWIN WILLIAMS PROPERTIES  
 FOUNTAIN INN, SOUTH CAROLINA