FTS

Field & Technical Services

200 Third Avenue • Carnegie, PA 15106 • Phone: 412-429-2694 • Fax: 412-279-4512

October 13, 2008

Mr. Scott Miller, Remedial Project Manager
U.S. Environmental Protection Agency, Region IV
4WD-SRTMB
61 Forsyth Street S.W.
Atlanta, Georgia 30303-3104

RE: Submittal of the Comprehensive Groundwater Monitoring Sampling and Analysis Plan
Cabot Carbon/Koppers Superfund Site
Gainesville, Florida

Dear Mr. Miller:

Beazer East, Inc. (Beazer) hereby submits one copy and one electronic copy of the *Comprehensive Groundwater Monitoring Sampling and Analysis Plan* (CGMSAP) for your review and comment.

Please do not hesitate to contact Mr. Mitchell Brourman of Beazer at mitch.brourman@hanson.biz or (412) 208-8805 with questions or comments related to the enclosed CGMSAP.

Sincerely,

Karen C Fromme

Karen Fromme
Senior Scientist

cc: M. Brourman – Beazer East, Inc.
G. Council – GeoTrans, Inc.

COMPREHENSIVE GROUNDWATER MONITORING AND SAMPLE ANALYSIS PLAN

CABOT CARBON / KOPPERS SUPERFUND SITE
GAINESVILLE, FLORIDA

Prepared for:

Beazer East, Inc.

Prepared by:

Field & Technical Services, LLC

200 Third Avenue
Carnegie, Pennsylvania

and

GeoTrans, Inc.

363 Centennial Parkway
Louisville, Colorado

October 8, 2008

(Rev. No.: 00)

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ABBREVIATIONS/ACRONYMS

ACEPD	Alachua County Environmental Protection Division
Beazer	Beazer East, Inc.
BTEX	Benzene, Toluene, Ethylbenzene, and Xylene
CARP	Chemical Analytical Request Procedure
COC	Chain of Custody
DNAPL	Dense Non-Aqueous Phase Liquid
DO	Dissolved Oxygen
DTB	Depth to Bottom
DTW	Depth to Water
EPA	Environmental Protection Agency
FDEP	Florida Department of Environmental Protection
FTS	Field & Technical Services, LLC
GeoTrans	GeoTrans, Inc.
HASP	Health and Safety Plan
HG	Hawthorn Group
IDW	Investigation-Derived Wastes
Koppers	Koppers Inc.
LCS	Laboratory Control Sample
LNAPL	Light Non-Aqueous Phase Liquid
CGMSAP	Comprehensive Groundwater Monitoring and Sample Analysis Plan
LTZ	Lower Transmissive Zone
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NAPL	Non-Aqueous Phase Liquid
ORP	Oxidation-Reduction Potential
PPE	Personal Protective Equipment
POTW	Publicly-Owned Treatment Works
QA	Quality Assurance
QC	Quality Control
RL	Reporting Limit
SAP	Sample Analysis Plan
SOP	Standard Operating Procedure
SU	Standard Units
SVOCs	Semi-volatile Organic Constituents
USEPA	United States Environmental Protection Agency
UTZ	Upper Transmissive Zone
VOCs	Volatile Organic Constituents
WWTP	Wastewater Treatment Plant

1.0 INTRODUCTION

On behalf of Beazer East, Inc. (Beazer), Field & Technical Services, LLC (FTS) and GeoTrans, Inc. (GeoTrans) submit this Comprehensive Groundwater Monitoring and Sample Analysis Plan (CGMSAP). The purpose of the CGMSAP is to combine the current groundwater monitoring efforts into a unified Site-wide program thereby enhancing the efficiency of data collection and the quality of the data obtained for understanding Site-wide groundwater conditions. This approach also provides for reporting procedures that will present the Site-Wide monitoring data in a single unified report. This CGMSAP replaces the monitoring programs discussed in the following plans:

- The *Proposed Stage 2 Groundwater Monitoring Program, Initial Groundwater Remedial Action* (TRC, 1997) (Surficial Aquifer Monitoring Program);

- The *Floridan Aquifer Monitoring Plan, Cabot Carbon/Koppers Superfund Site, Gainesville, FL* (TRC, June 2004) and the *Addendum to the Floridan Aquifer Monitoring Plan* (GeoTrans, 2006) (Floridan Aquifer Monitoring Program); and,

- The *Supplemental Hawthorn Group Investigation and Monitoring Well Installation Workplan* (GeoTrans, 2007) (HG Aquifer Monitoring Program).

Brief descriptions of the current monitoring programs for the Surficial Aquifer, Hawthorn Group (HG) deposits, and Floridan Aquifer are presented in Section 1.1. The monitoring objectives and approach of this CGMSAP are presented in Section 2.1. The proposed monitoring locations, parameters, and frequency for the CGMSAP are presented in Section 2.2.

1.1 BACKGROUND

This section describes the current monitoring programs currently in progress at the Site for the Surficial Aquifer, HG deposits, and Floridan Aquifer. This CGMSAP presents a Site-wide monitoring approach that incorporates these efforts into a single, cohesive monitoring program and report.

1.1.1 Current Surficial Aquifer Monitoring Program

The groundwater extraction and treatment system was installed in late 1994 as part of the groundwater remedy selected in the 1990 *Record of Decision* (ROD) prepared by the United States Environmental Protection Agency (U.S. EPA), and in accordance with the *Initial Ground Water Remedial Action* prescribed by the Unilateral Administrative Order (UAO) issued to Beazer on March 29, 1991. The effectiveness of this system has been evaluated from January 1995 to the present date. The Phase I/Stage 1 monitoring program was initiated in January 1995 and consisted of the following elements:

- Monthly performance monitoring of flow rates, water levels, and dense, non-aqueous phase liquid (DNAPL) levels;
- Quarterly modeling and analytical calculations of well capture zones;
- Semiannual sampling and analysis of the extraction wells to provide baseline data for evaluating future changes in water quality. Samples were analyzed for semivolatile organic compounds (SVOCs), including pentachlorophenol; volatile organic compounds (VOCs) including benzene, toluene, ethylbenzene, and xylenes (BTEX); and arsenic and chromium.
- Quarterly sampling and analysis of eight wells located within the alignment of the extraction system. These wells were selected to monitor the near-term effectiveness of the system. Samples were analyzed for SVOCs, BTEX, arsenic, and chromium.
- Quarterly monitoring of two offsite, downgradient wells and two onsite, upgradient wells. Samples were analyzed for SVOCs, VOCs, and arsenic and chromium.

In 1997, Beazer submitted the *Proposed Stage 2 Monitoring Program* (TRC, 1997). The Stage 2 monitoring program evaluated the data collected during the first two years of the Stage 1 and proposed modifications, reductions, and additions to the program based on the evaluation. The Stage 2 Program continues to be followed at this time and consists of the following elements:

- ***Groundwater Containment System Performance Monitoring*** **–** this consists of monthly recording of total and instantaneous flow rates for the 14 onsite extraction wells and quarterly fluid-level monitoring of 14 extraction wells and 71 onsite and offsite monitoring wells/piezometers; and,
- ***Groundwater Quality Monitoring*** **–** this consists of annual groundwater sample collection and analysis of the 14 extraction wells, two downgradient wells, and three offsite wells.

Current reporting requirements include semiannual reports that contain quarterly capture zone analyses, groundwater contour maps and tabulated water levels, extraction well flow totalizer readings, and DNAPL monitoring data. The results of the annual groundwater sampling and analysis are included in the second semiannual report provided each year.

This CGMSAP incorporates monitoring of the Surficial Aquifer in conjunction with remaining Site data with the goal of understanding Site-wide groundwater conditions. This document can be amended in the future to accommodate changes or modifications to the proposed program, or to accommodate the addition of other activities and/or objectives.

1.1.2 Current Hawthorn Group Deposit Monitoring Program

There is no specific current groundwater monitoring program established for HG deposits. Most recently, a comprehensive HG monitoring well sampling event was conducted in December 2007 in conjunction with the installation of 10 new off-Site HG monitoring wells. A total of 16 HG monitoring wells were sampled as part of the December 2007 sampling event. The results of this sampling event demonstrated that no groundwater impacts are present in the HG deposits to the west of the Site; however, there are some groundwater impacts in the HG deposits to the east of the Site. The majority of the groundwater impacts to the east of the Site are opposite the Former Process and Drip Track areas. The greatest impacts are in the Upper Hawthorn with lesser impacts in the Lower Hawthorn. This CGMSAP will provide a mechanism for evaluation of groundwater in the HG deposits as part of a routine comprehensive groundwater monitoring and reporting program.

1.1.3 Current Floridan Aquifer Monitoring Program

The Floridan Aquifer Monitoring Program is conducted as per the requirements of the *Floridan Aquifer Monitoring Plan* (TRC, June 2004). Additional Floridan Aquifer monitoring wells have been installed at the Site, since the June 2004 plan was approved. A summary of the monitoring wells included in the Floridan monitoring program is presented in the following table. At this time, a total of 82 monitoring locations are included in the program. Of that total, seven wells are sampled semiannually, and 75 wells are sampled quarterly.

Floridan Aquifer Wells Monitored Under the Current Plan (TRC, June 2004)				
Well ID	**Well Type**	**Added to Program**	**Total Locations Sampled**	**Monitoring Frequency**
FW-2	Standard	2003	1	Semiannual
FW-3	Standard	2003	1	Quarterly
FW-4	Standard	2003	1	Semiannual
FW-5	Standard	2003	1	Semiannual
FW-6	Standard	2004	1	Quarterly
FW-7	Standard	2004	1	Semiannual
FW-8	Standard	2004	1	Semiannual
FW-9	Standard	2004	1	Semiannual
MWTP-MW-1	Standard	2004	1	Semiannual
FW-10B (Zones 1,2,3,4)	Westbay	1st Qtr 2006	4	Quarterly
FW-11B (Zones 1,2,3,4)	Westbay	1st Qtr 2006	4	Quarterly
FW-12B (Zones 1,2,3,4)	Westbay	1st Qtr 2006	4	Quarterly
FW-13B (Zones 1,2,3,4)	Westbay	1st Qtr 2006	4	Quarterly
FW-14B (Zones 1,2,3,4)	Westbay	1st Qtr 2006	4	Quarterly
FW-15B (Zones 1,2,3,4)	Westbay	1st Qtr 2006	4	Quarterly
FW-16B (Zones 1,2,3,4)	Westbay	1st Qtr 2006	4	Quarterly
FW-17B (Zones 1,2,3,4)	Westbay	1st Qtr 2006	4	Quarterly
FW-18B (Zones 1,2,3,4)	Westbay	1st Qtr 2006	4	Quarterly
FW-19B (Zones 1,2,3,4)	Westbay	1st Qtr 2006	4	Quarterly
FW-20B (Zones 1,2,3,4)	Westbay	1st Qtr 2006	4	Quarterly
FW-21B (Zones 1,2,3,4)	Westbay	1st Qtr 2006	4	Quarterly
FW-22B (Zones 1,2,3,4)	Westbay	1st Qtr 2006	4	Quarterly
FW-23B (Zones 1,2,3,4)	Westbay	1st Qtr 2006	4	Quarterly
FW-4C (Zones 1,2,3)	Westbay	3rd Qtr 2007	3	Quarterly
FW-22C (Zones 1,2,3)	Westbay	3rd Qtr 2007	3	Quarterly
FW-23C (Zones 1,2,3)	Westbay	3rd Qtr 2007	3	Quarterly
FW-24B (Zones 1,2,3,4)	Westbay	3rd Qtr 2007	4	Quarterly
FW-24C (Zones 1,2,3,4)	Westbay	3rd Qtr 2007	4	Quarterly

Reporting requirements include quarterly reports that summarize the field activities and the results of testing. They also include evaluations of data trends and variations, and temporal variations in groundwater flow direction in the Floridan Aquifer.

2.0 PROPOSED COMPREHENSIVE GROUNDWATER MONITORING PROGRAM

2.1 MONITORING PROGRAM OBJECTIVES

Surficial Aquifer

The primary near-term (assuming modification of the Surficial Aquifer extraction system by implementing the currently proposed interim measure and prior to remedial actions with the Surficial Aquifer, as determined by the feasibility study) objective of the Surficial Aquifer monitoring program is to ensure that the hydraulic-containment system is capturing impacted groundwater prior to flowing off Site. The principal direction for groundwater flow in the Surficial Aquifer is to the northeast. Therefore, monitoring for this aquifer will be concentrated along the eastern and northern Site property boundaries and in areas immediately downgradient of these boundaries.

Hawthorn Group Deposits

The primary near-term (prior to remedial actions within the Hawthorn, as determined by the feasibility study, but including the installation of the additional monitoring wells in the east) objective of the HG deposits monitoring program is to ensure the stability of groundwater impacts attributable to the Site within these deposits. The groundwater flow system for the HG deposits is separated into the Upper Hawthorn and Lower Hawthorn. The principal groundwater flow direction for the Upper Hawthorn is to the northeast. Therefore, groundwater monitoring for the Upper Hawthorn will be concentrated downgradient of the Site to the east and northeast.

The Lower Hawthorn contains two principal groundwater flow directions as a result of a groundwater divide that runs approximately north-south across the Site. This groundwater divide results in a principal groundwater flow direction to the northeast for the eastern half of the Site and a principal groundwater flow direction to the northwest for the western half of the Site. Therefore, groundwater monitoring for the Lower Hawthorn will be focused to the east, northeast, west, and northwest of the Site.

Floridan Aquifer

The primary near-term (prior to remedial actions within the Floridan, as determined by the feasibility study currently being completed) objective of the Floridan Aquifer monitoring is to provide sufficient warning of potential Site constituent impacts to the Floridan Aquifer, such that appropriate remedial actions can be taken, if needed. Therefore, Floridan Aquifer monitoring will concentrate on the Upper Transmissive Zone (UTZ) beneath the Site. In addition, monitoring will be performed in the Lower Transmissive Zone (LTZ) along the northern areas of the Site and immediately to the north of the Site to ensure that impacts are not present in deeper downgradient zones.

2.2 MONITORING PROGRAM

2.2.1 Surficial Aquifer

The Surficial Aquifer existing hydraulic-containment system has been in operation since 1994. The original extraction wells for this system are located along the eastern and northern Site property boundaries hydraulically downgradient of potential source areas at the Site. The hydraulic containment system is in the process of being modified to ensure a more efficient capture of impacted groundwater in closer proximity to the potential source areas. Horizontal wells will be installed adjacent to the former source areas to provide both horizontal and vertical capture of impacted groundwater. The short-term performance monitoring for the modified system is discussed in the IRM workplan (GeoTrans 2008). The long-term comprehensive monitoring for the Surficial Aquifer system is discussed in this document and will focus on the overall effectiveness of the remedial measures at preventing migration of impacted groundwater to off-Site locations.

The CGMSAP for the Surficial Aquifer will consist of sampling wells in the immediate vicinity of the eastern and northern Site property boundaries (Figure 2-1). A total of 10 Surficial Aquifer wells will be used to monitor groundwater quality in the vicinity of these two property boundaries. The majority of the Surficial Aquifer monitoring wells are nested wells completed in the upper (“A” series monitoring wells) and lower (“B” series monitoring wells) portions of the Surficial Aquifer. In general, monitoring wells completed in the lower portion of the Surficial Aquifer contain higher constituent concentrations. Therefore, Surficial Aquifer monitoring will primarily be performed in monitoring wells completed in the lower portion of the aquifer (“B” series monitoring wells). The list of wells included in the Surficial Aquifer monitoring is included in Table 2-1.

The list of constituents will be tailored to known constituent distributions established from the Stage 1 and Stage 2 monitoring programs, as well as the comprehensive Surficial Aquifer sampling performed in August 2007. All Surficial Aquifer monitoring wells will be sampled for a select list of semi-volatile organic constituents (SVOCs) and a select list of volatile organic constituents (VOCs). In addition, select wells will be sampled for arsenic and pentachlorophenol. Arsenic impacts have historically been observed in extraction and monitoring wells in the southern half of the Site and in one monitoring well in the northeastern corner of the Site. Therefore, CGMSAP monitoring wells located in these areas will be analyzed for arsenic. Pentachlorophenol is only present in monitoring wells located in the southern half of the Site. Therefore, monitoring wells within and downgradient of the pentachlorophenol-impacted areas will be analyzed for pentachlorophenol. The list of analytes and initial monitoring frequency for each of the Surficial Aquifer monitoring wells is provided in Table 2-1.

2.2.2 Hawthorn Group Deposits

The HG monitoring will primarily focus on ensuring that groundwater impacts remain on Site and that off-Site impacts to groundwater are stable and/or attenuating. As such, the HG monitoring will concentrate on wells located along the eastern and western property boundaries and downgradient of these boundaries. Initially, a total of 22 HG monitoring wells will be included in the program

A total of 16 HG monitoring wells will be sampled along the eastern property boundary and six wells will be sampled along the western property boundary (Figure 2-2). Monitoring along the eastern property boundary will be performed in both Upper and Lower Hawthorn wells and monitoring along the western property boundary will be performed in Lower Hawthorn monitoring wells. One exception along the western property boundary is monitoring well HG-24S, which was completed in the Upper Hawthorn and will continue to be monitored under this program

The list of analytes for the HG monitoring wells is tailored to the known constituent distributions established from the comprehensive sampling performed in December 2007. All HG monitoring wells will be sampled for select SVOCs and VOCs. The list of analytes for HG monitoring wells is provided in Table 2-2.

2.2.3 Floridan Aquifer

Existing Floridan Aquifer monitoring wells in the vicinity of the Site are completed in the UTZ and LTZ. The UTZ wells consist of both standard-construction monitoring wells and multiple-screen, multi-port sampling wells. The single-screen UTZ wells (FW-1 through FW-9) were the first monitoring wells installed to characterize the Floridan Aquifer at the Site. Since the installation of the single-screen wells, additional multiple-screened and multi-port wells have been installed to provide vertically discrete sampling intervals within the Floridan Aquifer. In general the multi-port wells provide data that overlaps with that from the single-screened wells. Therefore, single-screen monitoring wells, FW-1 through FW-9, will not be included in the CGMSAP.

Floridan Aquifer monitoring will provide early detection of Site-constituent impacts downgradient of potential source areas, in the event that remedial measures are needed to address impacts to the Floridan Aquifer. Present constituent impacts are currently restricted to localized on-Site areas and do not appear to be wide-spread beneath the Site. In addition, the source of these impacts is still being evaluated to establish if they are a result of short-circuiting via existing Site wells.

The Floridan Aquifer monitoring will concentrate on wells located in the northern half of the Site and in suspected source area locations. Initially, a total of 24 Floridan monitoring wells will be included in the CGMSAP, including the four sentinel wells proposed off-Site to the north (Figure 2-3). A total of eight Floridan Aquifer monitoring wells will be sampled from what has been designated the transect wells. These wells form an open ended rectangular box on the northern half of the Site that encompass the western, eastern, and approximately northern Site property boundaries. Four Floridan Aquifer monitoring wells located in the former source areas will be sampled. Nested UTZ and LTZ monitoring wells (a total of eight wells) along the northern Site property boundary will be sampled under this program. In addition, four sentinel wells to be installed approximately 1000 feet to the north of the Site in 2008 will be sampled under this program (Figure 2-3).

The majority of the wells proposed for the Floridan Aquifer monitoring contain multiple ports. The on-Site UTZ monitoring wells contain four separate ports and the LTZ wells contain three ports. Initially, groundwater samples will be collected from all ports. The list of analytes for the Floridan Aquifer monitoring wells is tailored to the known constituent distributions established from the quarterly sampling in these wells, which has been on-going since 2006. All Floridan Aquifer monitoring wells will be sampled for select SVOCs and BTEX. The list of analytes for Floridan Aquifer monitoring wells is provided in Table 2-3.

2.3 MONITORING FREQUENCIES UNDER THE COMPREHENSIVE PROGRAM

The proposed CGMSAP will maintain flexibility in the locations and numbers of monitoring wells, in addition to the sampling frequency of individual wells and monitoring ports. As conditions warrant, wells can be added and/or removed to adjust to changes to the conceptual model and plume dynamics.

The Surficial Aquifer monitoring wells have sufficient historical constituent concentration data to justify semiannual and annual sampling events. Temporal concentration trends for these wells are well established and indicate that concentrations are relatively stable. As such, the initial sampling frequency for eight of the ten Surficial Aquifer wells is proposed to be semiannual for the first four sampling events (Table 2-1). The remaining two Surficial Aquifer wells have been monitored annually since 1997 will continue to be monitored on an annual basis.

The 10 new HG monitoring wells will initially be sampled quarterly for a minimum of four sampling events. Six of the existing on-Site HG monitoring wells contain sufficient historical sampling data to justify an annual sampling frequency (Table 2-2). Therefore, these six on-Site wells will initially be sampled annually for four events.

The eight transect and the four source area wells in the Floridan Aquifer already have more than eight quarters of data. Therefore, the sampling frequency for the majority of the sample ports for these wells will be annual. The exception to annual sampling for this group of wells will be semiannual sampling of select ports in wells with historically elevated constituent concentrations (Table 2-3). Semiannual sampling will continue for these select ports until temporal trend analysis supports a longer sampling period. The initial sampling frequency for the nested well pairs along the northern property boundary will be semiannual. The initial sampling frequency of the four sentinel wells will be quarterly. In general, the sampling frequency and number of ports sampled will be evaluated on an annual basis and adjusted, if needed.

2.4 FUTURE MODIFICATIONS TO MONITORING PROGRAM

Modifications to the CGMSAP will be accomplished by proposing the modifications in a letter to the regulatory agencies with appropriate technical justifications for the proposed change. Modifications to the wells and sampling frequency will be reflected in Tables 2-1 through 2-3 and Figures 2-1 through 2-3. The revised tables will be appended to the original sampling plan to reflect modifications to the program. A revision number and date will be incorporated into the footer of the revised tables and figures to reflect the most recent modification. In addition, a new report cover page with the appropriate revision number and date will replace the previous report cover page.

3.0 MOBILIZATION ACTIVITIES

This section summarizes the preparatory tasks that must be performed prior to initiation of a groundwater monitoring event.

3.1 NOTIFICATIONS

Alachua County – At a minimum of two weeks prior to mobilization to the Site to perform a monitoring event, notice must be sent to Alachua County, advising them of the sampling dates.

Site Personnel - Appropriate Site personnel must be notified via telephone or electronic mail of planned sampling events to ensure that field investigation activities do not conflict with ongoing plant operations and to arrange for Site-specific Koppers Inc. Health & Safety Training. This Site-specific training is required by Koppers Inc. for all personnel prior to accessing the working areas of the Site. Notification must be completed not later than two weeks prior to the planned sampling date. This notification activity will allow for rescheduling of the monitoring event if potential logistical conflicts exist.

Laboratory **-** Appropriate laboratory personnel must be contacted via telephone or electronic mail and a Chemical Analytical Request Procedure Form must be completed and submitted to the analytical laboratory (or laboratories) at least two weeks prior to the planned sampling event. This will allow for timely completion of the sample bottle order and shipping/delivery.

3.2 PRE-JOB PLANNING ACTIVITIES

Pre-Sampling Briefing – The Field Team Leader, field team members, and subcontractors, as applicable, are to participate in a pre-sampling briefing meeting with the FTS project manager or groundwater sampling supervisor prior to deploying to the Site. The purpose of the meeting is to review the scope of work, identifying any out-of-scope activities that may be required during the current event, verifying the travel schedule, confirming that the proper equipment has been assembled or ordered for shipment to the Site, and confirming delivery of the proper and complete bottle order from the lab. Also during this meeting, the gauging and sampling order is reviewed and confirmed to reflect that the "clean-to-dirty" order has been properly determined, that all required Site-specific notifications and training are complete, relevant Site-control documents such as the CGMSAP, Site-specific Health and Safety Plan (HASP), and Site Data Sheet have been reviewed by all sampling personnel. The Field Activity Report from the previous sampling event is also reviewed. Proper management of investigative-derived waste and Site-specific waste labeling requirements are reviewed. Proper labels are supplied to the Field Team Leader. All those attending the meeting sign and date the Pre-Sampling Briefing Form.

CGMSAP Review - All field personnel must review this CGMSAP prior to mobilization to ensure that they are thoroughly familiar with the scope of the activities and the procedures to be employed. The Field Team Leader is responsible for ensuring that field personnel review the CGMSAP.

HASP Review - All field personnel must review the HASP prior to mobilization to ensure that they are thoroughly familiar with potential hazards, levels of personal protection, emergency numbers, relevant routes, etc. The Field Team Leader is responsible for ensuring that all field personnel review the HASP.

Field Activity Report **–** All field personnel must review the Field Activity Report generated as a result of the previous monitoring event. This will familiarize the field personnel with potential problems, potential corrective actions, required verification of any previous action items, etc. The Field Team Leader is responsible for ensuring that all field personnel review the previous Field Activity Report.

3.3 CONTAINERS, EQUIPMENT, AND DOCUMENTATION

Sample Containers - The analytical laboratory will identify appropriate sample containers (including appropriate preservatives) and prepare a sample container list. The laboratory will also ship or deliver the sample containers, shipping containers, sample labels, custody seals, and chain-of-custody forms to the sampling contractor at least one week prior to the sampling event. The Chemical Analytical Request Procedure (CARP) will be used by the laboratory to develop the sample container list and prepare the bottle order.

Sampling Equipment **–** Table 3-1 is a checklist of supplies and sampling equipment required for the monitoring events. The sampling contractor will assemble the required supplies which consist of planning documents, monitoring equipment, sampling equipment, documentation supplies, health and safety equipment, sample packaging and shipping supplies, and miscellaneous equipment. The Field Team Leader is be responsible for ensuring that all equipment listed in Table 3-1 is available on Site prior to initiation of the monitoring event.

***Monitoring Documentation* -** The Field Team Leader will be responsible for ensuring that Field Logbooks and all forms are made available during the groundwater monitoring event. Required forms are provided in Appendix A, and consist of the following:

- Groundwater Sampling Collection Record
- Westbay Groundwater Sampling Field Data Sheet
- Groundwater Gauging Sheet
- Equipment Calibration Form
- Monitoring Well Inspection Form
- Investigation-Derived Waste Summary Form
- Chain-of-Custody Form

4.0 QUALITY CONTROL SAMPLES

Various types of Quality Assurance/Quality Control (QA/QC) samples will be collected and/or analyzed in support of the groundwater monitoring program. These samples will be contingent upon the specific analytical methods to be employed and will likely consist of trip blank samples, field duplicate samples, field blank samples, matrix spike/matrix spike duplicate samples, filter blank samples, and laboratory duplicate samples. Note that dedicated sampling equipment will be employed. Hence, rinsate blank samples likely will not be generated or analyzed for the monitoring program. Table 4 summarizes the type and frequency of field QA/QC samples required for this project.

4.1 TRIP-BLANK SAMPLES

Trip-blank samples will be analyzed when samples are collected for VOCs analysis. The primary purpose of the trip-blank samples is to detect any potential additional non-Site-related contamination that is introduced in the samples during shipping and analysis. Trip blanks serve as a mechanism of control for sample bottle preparation, blank water quality, and laboratory sample handling conditions. The following constitute potential sources of trip-blank contamination.

- Sample container contamination;
- Cross-contamination during shipment;
- Laboratory reagent water;
- Ambient conditions in the laboratory (background air); and,
- Laboratory reagents used in analytical procedures.

Each time a group of bottles is prepared for use in the field, the laboratory will prepare the appropriate numbers of trip-blank samples. Bottles will be selected from the batch and filled with analyte-free water. This water must originate from a single source and physical location within the laboratory. Trip-blank samples will be handled, transported, and analyzed in the same manner as the field samples. Trip blanks will be submitted at a rate of one per shipping container containing samples for BTEX analysis. The trip-blank sample bottles themselves will not be opened in the field.

4.2 FIELD DUPLICATE SAMPLES

Duplicates of environmental samples will be collected and analyzed at a frequency of one per every ten samples or one per sample shipment, whichever is greater. Duplicate samples of groundwater are generated simply by filling a second set of sample bottles at a well location at the same time that the original sample is collected. Duplicate samples should be designated using a sample number that ensures that the duplicate is a double-blind sample (i.e., the laboratory cannot determine that the sample is a duplicate). The duplicate samples will be analyzed for the same parameters as the primary sample.

4.3 FIELD BLANK SAMPLES

Field blanks are collected to determine if there are any potential sources of sample contamination present in the ambient air at the time of sampling. Field blanks are prepared in the same manner as the environmental samples, but consist of analyte-free deionized water. Field blanks will be collected at a rate of one field blank per day per sampling event. The field blanks will be analyzed for the same list of analytes as the investigative samples and will be shipped to the lab with the same set of sample bottles they accompanied into the field.

4.4 EQUIPMENT RINSATE BLANK SAMPLES

Equipment rinsates are the final, analyte-free water rinsate from equipment cleaning. If equipment rinsates are generated (i.e., if disposable bailers are not used), they will be collected daily during a sampling event. The rinsates will be analyzed for the same parameters as the monitoring samples. Equipment rinsate samples will be collected at a rate of one per each day that sampling equipment such as reusable Teflon® and stainless steel bailers and Westbay sampling bottles are decontaminated and reused.

4.5 MATRIX SPIKE/MATRIX SPIKE DUPLICATE SAMPLES

As required by the organic analytical methods, matrix spike/matrix spike duplicate (MS/MSD) samples will be analyzed at a frequency of one per every 20 samples or one per shipment, at a minimum. The MS/MSD samples will consist of a field sample spiked in the laboratory with target analytes as specified by the method. Triple volume samples will be obtained to accommodate MS/MSD sample analysis.

4.6 LABORATORY DUPLICATE SAMPLES

Laboratory duplicate samples will be analyzed when inorganic parameter analysis is completed. A laboratory duplicate sample is a second aliquot of a sample that is generated and analyzed in the laboratory and is handled in the same manner as the original sample. Laboratory duplicate samples provide information regarding the precision of the inorganic analytical method. Analyses of these samples may or may not necessitate the collection of additional sample volume in the field. Laboratory batch QA analyses are acceptable for laboratory duplicate samples.

4.7 FILTER BLANK SAMPLES

Groundwater monitoring well samples scheduled for analysis of dissolved metals will be filtered through a 0.45-micrometer filter within 24 hours after collection. All filtered samples will be processed (filtered) in the field. If disposable filters are not used, the cleaning procedures for the filtration apparatus, the potential for cross-contamination, and the potential contribution to the sample from the filter itself will be assessed and one filtration blank will be collected for approximately every 15 samples filtered. The filtration blank will be prepared by passing reagent water through a freshly cleaned filtration apparatus, then preserving the sample (if required) for the analyses planned. This sample may also be prepared by filtration of the sample blank aliquot scheduled for inorganic analysis.

5.0 MONITORING AND SAMPLING/ANALYSIS ACTIVITIES

This section describes the required materials and the procedures that will be followed to implement the groundwater monitoring program. The monitoring program consists of measuring and recording groundwater elevation and Non-Aqueous Phase Liquid (NAPL) measurements and groundwater sampling for the monitoring wells. Note that monitoring wells at the Site consist of both standard-construction wells, without multi-port sampling systems, and multiple-screen or open-hole well completions equipped with the Westbay multi-port systems.

Section 5.1 presents the procedures for gauging standard-construction monitoring wells, and Section 5.2 presents the procedures for sampling these wells. Section 5.3 presents the procedures for measurement of water levels in the multi-port monitoring wells, and Section 5.4 presents sampling procedures for these wells. Standard Operating Procedures (SOP) for various aspects of the field activities are provided in Appendix B.

5.1 STANDARD WELL WATER-LEVEL AND NAPL MEASUREMENTS

This section presents the procedures for gauging and sampling the standard-construction monitoring wells at the Site.

5.1.1 Water-Level Measurement Procedure

Water levels in standard-construction monitoring wells will be measured to determine groundwater flow directions and gradients. The list of Surficial Aquifer and HG wells to be subjected to water-level and NAPL measurements is provided in Tables 5-1 and 5-2, respectively. In addition, Floridan Aquifer monitoring well FW-4 is a standard well that will be monitored as per these procedures.

Water levels will be measured before groundwater sampling commences. The depth to the bottom of the wells will also be measured to monitor the potential accumulation of silt or sand at the bottom of the wells. All monitoring wells will be allowed to equilibrate to atmospheric pressure prior to gauging and measurements for a given monitoring event will be obtained within 24 hours. The thickness of accumulated NAPL (if any) will also be measured prior to purging and sampling. The primary supplies necessary for the water-level and NAPL thickness measurements are a water-level meter and interface probe as summarized in Table 3-1.

The water-level measurements will be completed within a 24-hour period and will proceed from non-impacted wells to impacted wells to prevent cross-contamination. Non-impacted upgradient and off-Site downgradient wells will be measured prior to the impacted on-Site wells.

Wells are frequently capped with tight-fitting covers that potentially interfere with proper equilibration with the atmosphere. If the well has not been vented to the atmosphere (e.g., via holes or slots in a cap or loosely-fitting cap) before measurement, the sealing cap will be loosened or removed to allow pressure equilibration between the inside well and the ambient atmosphere. At least one hour will be allowed for equilibration before conducting a water-level measurement.

The condition of the well riser, lock, cap, casing, and concrete pad will be inspected and recorded on a monitoring well inspection form (Appendix A). Damage (if any) should be reported to the Project Manager and repairs will be implemented as soon as possible. The area around the well should be cleared of weeds and other materials before beginning measurement of the static water level.

Water-level measurements will be taken from the pre-existing surveyed measuring point on the top of the casing. The measuring point location for the well should be clearly marked on the outermost casing (marker, paint, and/or notch filed into the casing rim). If unmarked, the measurement will be taken from the north side of the casing rim.

Water levels at each well will be measured using an electronic device that can be read to an accuracy of ±0.l foot. The measuring device will be lowered into the center of the well casing to avoid contact with the casing sides and top edges that can lead to erroneous measurements and/or damage the measurement instrument.

As specified in FTS SOP #157, total well depth should not be measured prior to sampling as this activity may disturb material that has settled to the bottom of the well and increase turbidity in samples. A total well-depth measurement will be obtained after the water sample has been collected.

The depth to water (DTW) and depth to bottom (DTB) for each well will be recorded on the groundwater gauging sheet and on the groundwater sampling form (for those wells that are both gauged and sampled).

The water-level probe will be decontaminated after each use to prevent cross-contamination between wells. The probe will be decontaminated by: 1) wiping the line with an isopropanol-saturated cloth; 2) wiping the line with a distilled water-saturated cloth; and, 3) allowing the line to air dry.

5.1.2 NAPL-Thickness Measurement Procedure

An oil/water interface probe will be used in wells where Dense Non-Aqueous Phase Liquid (DNAPL) is suspected to be present. Once the probe enters the water column, the meter will emit an intermittent tone. Continue to slowly lower the oil/water interface probe until a continuous tone is emitted, indicating that the surface of DNAPL has been reached. The depth to the top of the DNAPL should be read directly from the tape at the measuring point and recorded on the groundwater gauging sheet. Record the depth to the bottom of the well to determine the apparent thickness of the DNAPL layer.

Quality control measures will include repetitive measurements of the depth to water or NAPL to ensure that accurate and precise results are obtained. Once the measuring device indicates that the water level or NAPL layer has been encountered, the probe will be raised slightly and lowered several times to check and confirm the depth measurement. A single final reading will be recorded on Site-specific gauging sheets that contain the previous round of groundwater, NAPL, and total well-depth measurements. Field crew members will compare readings to assure structural integrity of the monitoring point as well as confirm the well identification. If readings are grossly (> 5%) different from the previous round of measurements, a second reading will be taken and recorded on the appropriate field data sheets.

If DNAPL is detected in a well location where it has not been detected previously, great care will be taken to determine the accuracy of the detection and to avoid reporting a false positive. The presence of a new DNAPL detection will be confirmed by collecting the DNAPL in a clear bailer and documenting it with a photograph.

Note that Light Non-Aqueous Phase Liquid (LNAPL) has not been reported in wells at the Gainesville Cabot Carbon/Koppers Site, therefore, any detections of LNAPL will be visually confirmed with a clear bailer and documented with a photograph.

Measurements will be recorded to the nearest 0.1 foot. The interface probe will be decontaminated after each use to prevent cross-contamination between wells. The probe will be decontaminated by: 1) wiping the line with an isopropanol-saturated cloth; 2) wiping the line with a distilled water-saturated cloth; and, 3) allowing the line to air dry.

5.1.3 Total Well Depth Measurements

The total depth of each well will also be measured for comparison to the documented well-installation depth. This measurement indicates possible sediment build-up within the well, which may reduce the screened interval and cause turbidity problems, or other potential obstructions in the well. As specified in FTS SOP #157 for low-flow sampling, well depth will not be measured prior to sampling as this activity may disturb material that has settled to the bottom of the well and increase turbidity in samples. A total well-depth measurement will be obtained after the sample has been collected. The DTW and DTB for each well will be recorded on the groundwater gauging form and on a groundwater sampling form (for those wells that are both gauged and sampled).

5.1.4 Documentation

The information discussed in the preceding sections will be recorded on the Site-specific field forms. Additional comments, observations, or details will be entered in the field logbook. These documents will provide a summary of the water-level measurement procedures and conditions.

5.2 STANDARD WELL GROUNDWATER SAMPLING PROCEDURES

This section presents the groundwater sampling procedures for the standard-construction monitoring wells.

5.3.1 Materials and Supplies

The list of materials, supplies, and equipment required for groundwater sampling is provided in Table 3-1.

5.3.2 Meter Calibration

All meters will be calibrated before use and at a minimum, once a day. Each probe will be calibrated according to the manufacturer's instructions. Information regarding meter calibration will be recorded on the equipment calibration form provided in Appendix A.

5.3.3 Well Purging

Low-flow techniques will be used to purge and sample wells. Wells containing NAPL will not be sampled. Pumps capable of maintaining purge rates required for implementation of low-flow purge and sampling techniques as specified in FTS SOP #157 will be utilized in monitoring of all standard-construction monitoring wells. Well purging will be conducted using dedicated tubing stored between sampling events in individual sealed plastic bags. A clean sheet of plastic will be placed at the wellhead to prevent contact of sampling equipment with the ground.

The pump intake will be set to a depth near the middle of the screened interval of the well. Water will then be pumped from the well at a low-flow rate to preclude cascading across the well screen such that any fine-grained soil in the well casing, sandpack, or surrounding formation is not disturbed and entrained in the groundwater samples. For low-yielding wells, the flow rate of the pump may be adjusted to <0.1 L/min.

Rather than purging three well casing volumes before sampling standard-construction wells, the United States Environmental Protection Agency (USEPA) recommends that an in-line water quality meter (e.g., flow through cell) be used to establish stabilization of the groundwater (USEPA, 1996). General water quality information to be obtained consists of indicator parameters (i.e., pH, specific conductance, temperature, dissolved oxygen, oxidation-reduction potential, and turbidity). The purge water will be considered to be representative of the surrounding aquifer formation once three consecutive readings of specific conductivity and temperature are within 10 percent of the previous readings, and three consecutive pH readings are within $\pm$0.2 standard units (SU). Field parameter values and the corresponding purge volume will be recorded on the groundwater sampling form.

After passage through the flow-through chamber, the water will be discharged into a graduated bucket where the pumping rate can be determined with a watch and maintained at a rate of 0.5 L/min or less. All purge water will be transferred to the on-Site wastewater treatment plant.

In the event that the well screen is evacuated during pumping, the well will be allowed to recover, a set of water quality parameters will be recorded, and groundwater samples will be collected immediately after recharge. If the time for complete recovery exceeds two hours, the sample(s) will be obtained as soon as sufficient water volume is available to obtain samples for the requisite analyses.

5.3.4 Groundwater Sample Collection Method

Groundwater samples will be collected from each standard-construction well using pumps equipped with dedicated or disposable Teflon®-lined tubing. After the field measurements of water quality parameters have stabilized, the samples will be collected from the pump discharge line. The Teflon® tubing will be removed from the flow-through cell influent port and the groundwater samples collected directly into the appropriate containers supplied by the laboratory. This procedure will eliminate potential cross contamination from the flow-through cell. The groundwater samples will be collected according to volatility (volatile samples first, semi-volatile samples second and inorganic samples last). Caution should be employed to ensure that the tubing does not contact the sample bottles during sample collection.

Program-specific analytical suites for the Surficial Wells and the HG wells are listed in Tables 2-1 and 2-2. Appropriate laboratory analytical methods for these analyses are provided in the United States Environmental Protection Agency's SW846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, most recent edition. Tables 5-1 and 5-2 present the laboratory reporting limit (RL) and the applicable evaluation criteria for the Surficial and HG wells, respectively. Fol1owing collection, the pre-preserved samples will be packaged and placed into a cooler containing ice pending shipment to the laboratory.

5.4 MULTI-PORT SYSTEM WELL GROUNDWATER ELEVATION MEASUREMENTS

Groundwater potentiometric surface elevation data are measured using the Westbay sampling tool equipped with an integral pressure transducer. Using the sampling tool, an ambient atmospheric pressure reading must be taken at each sample location on each day of sampling.

The atmospheric pressure readings must be recorded on the Westbay groundwater sampling field data sheets. Once atmospheric pressure has been measured, the sampling tool is lowered down-hole to engage the desired discrete interval sampling port. A pore pressure is measured and recorded on the Westbay groundwater sampling field data sheets. It is critical to record associated ambient and pore-pressure measurements observed at each sampling port to enable data reduction necessary for the generation of groundwater potentiometric surface diagrams. Task specific steps for preparing and deploying the Westbay sampling tool as well as engaging and measuring atmospheric and pore pressures are provided in Appendix B (Westbay Multi-Port System Sampling and Decontamination Procedures).

5.5 MULTI-PORT SYSTEM WELL GROUNDWATER SAMPLING PROCEDURES

Similar to measuring pore pressures, collection of groundwater sample volumes employs the use of the Westbay sampling tool. A detailed procedure for the collection of groundwater samples and subsequent decontamination of the sample collection tooling using the Westbay discrete interval sampling system is provided in Appendix B. The Westbay groundwater sampling field data sheet provided in Appendix A must be completed during sampling activities. It is important to follow sequential sampling steps provided on the sample collection sheet to assure proper location, engagement, and access of each discrete interval sampling port. The multi-port sampling equipment is not designed for flow-through cell application. Therefore, groundwater field parameters, such as pH, DO, temp, ORP, and conductivity, will not be collected at these wells

5.6 SAMPLE HANDLING, CHAIN OF CUSTODY, AND SHIPPING

Sample collection and handling will be conducted in accordance with protocols set forth in FTS SOP # 114, provided in Appendix B.

5.7 DOCUMENTATION

A number of documents must be completed before and during each sampling event. The documentation includes the calibration forms, groundwater sampling forms, chain-of-custody (COC) sheets, and any project notes pertaining to the sampling work. Following the sampling event, copies of these forms and notes will be made and will be placed in the project files.

CARP Form - This form will be filled out by the Project Manager or designated personnel and submitted to the analytical laboratory prior to each sampling event.

Calibration Forms **-** The Field Team Leader is responsible for documenting any calibration of instruments used during the sampling event (Appendix A). All calibration information should be recorded on this form daily.

Groundwater Sampling Forms **-** The groundwater sampling forms serve as logs for information pertaining to each specific sampling location.

Appendix A includes examples of the "Groundwater Sampling Collection Record" to be completed for each standard construction well sampled, as well as an example of the Westbay Groundwater Sampling Field Data Sheet that will be completed for each zone sampled from a well equipped with the Westbay multi-port system.

Following the groundwater monitoring event, a copy of these forms will be stored in the project file and another will be sent to an appropriate Site representative.

Chain-of-Custody Forms **-** When the field team sends samples to the appropriate analytical laboratories, each ice chest containing samples must be accompanied by a COC Form. These forms contain information pertaining to the samples such as: the project name, the names of the persons collecting the samples, the site of collection, the date and time of collection, the required parameters for each sample, remarks or observations of samples if appropriate, the signature of the person relinquishing control of the samples, and the name of the carrier shipping the samples to the laboratory. The original COC is sent with the samples, one copy is kept with the client, and the other copy is stored in the consultant's files.

Field Logbook

For all groundwater sampling tasks conducted at the Gainesville facility, field data and pertinent information regarding the sampling event will be recorded into the field logbook in accordance with FTS SOP #106 (Appendix B). Task-specific data sheets including groundwater gauging forms, groundwater sample collection records, equipment calibration sheets, IDW inventory sheets, and Westbay groundwater sampling field data sheets will serve as supplemental data recording locations and will be referenced in the field logbook.

5.8 LABORATORY ANALYSIS

Samples will be analyzed for the parameters identified in Tables 5-3, 5-4, and 5-6 to the reporting limits identified in the tables. Reporting limits reflect the Florida Groundwater Cleanup Target Level (GCTL) guidelines as set forth in 62-777 Florida Administrative Code (F.A.C.) and the National Primary Drinking Water Standard Federal Maximum Contaminant Levels (MCLs). Analyses will be performed via the United States Environmental Protection Agency's *SW846 Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, most recent edition*. The specific methods are identified in Tables 5-3, 5-4, and 5-6.

6.0 MANAGEMENT OF IDW

Purged groundwater will be containerized in 5-gallon buckets and transported to Beazer's on-Site wastewater treatment plant sump, located on the northern side of the Koppers Plant. There the purge water will be treated through the activated-carbon treatment system. Personal protective equipment (PPE) waste will be containerized in a 55-gallon drum with proper labeling and will be disposed by Beazer's Site System Operator. A summary of waste streams associated with the groundwater sampling program, including estimated annual volumes of each matrix generated and management practices is as follows.

Sampling Method	Type of Waste	Estimated Annual Volume Generated	Typical Management for Disposal
Standard-Construction Well (Low Flow)	Purge Water	125 gal	Transferred to Beazer On-Site Waste Water Treatment Plant
	Decon Fluids	50 gal	Transferred to Beazer On-Site Waste Water Treatment Plant
	PPE and Consumables	1 - 55 gal drum	Containerized in DOT Approved 55-gal Open Top Steel Drums for Off-Site Disposal
Westbay Discrete Interval Sampling (No Purge)	Purge Water	0	Transferred to Beazer On-Site Waste Water Treatment Plant
	Decon Fluids	500 gal	Transferred to Beazer On-Site Waste Water Treatment Plant
	PPE and Consumables	4 – 55 gal drums	Containerized in DOT Approved 55gal Open Top Steel Drums for Off-Site Disposal

All liquid waste, unless otherwise specified, will be transferred to Beazer's on-Site WWTP for treatment prior to discharging to the POTW.

PPE and consumables generated by groundwater sampling only will be handled as non-hazardous waste.

7.0 ANALYTICAL DATA MANAGEMENT

Data evaluation, transfer, and support are essential functions in summarizing monitoring results. It is important that these processes are performed accurately and, in the case of data reduction, accepted statistical techniques are used.

The first level of review and consequent data reduction, validation, and reporting is done at the laboratory. Data reduction, validation, and reporting at the laboratory will be implemented in accordance with standard USEPA methods for analytical and QA protocols. In general, the laboratory reviews will be performed by the laboratory analyst, the QA officer, and laboratory management.

The second level of data review and validation is conducted outside the laboratory. The data will be reviewed with respect to its usage for regulatory, health/risk, and remedial statements in view of QC parameters. All of the analyses will be evaluated pursuant to EPA guidelines and reported with documentation complete enough for independent review. The following sections outline the specific requirements for each of these levels of data review.

7.1 LABORATORY QUALIFICATIONS AND REPORTING

The Laboratory Department Manager will perform unannounced audits of report forms and other data sheets, as well as regular reviews of instrument logs, performance-test results, and analysts' performance. Any review of analytical results or internal QA/QC checks that indicate problems will prompt immediate corrective actions to be taken, including review of all data collected since the previous approved QC audits for validity.

Where the data does not meet QC requirements specified in this document for the items indicated above, the data will be flagged with qualifiers. Commonly used qualifiers include:

- U – Not Detected, data are usable.
- J or I – Estimated, usable for limited purposes. The data qualitatively acceptable but not quantitatively acceptable.
- R – Rejected, unusable. The data are qualitatively and quantitatively unacceptable.
- No qualifier – Data are acceptable.

For the majority of the wells sampled, the laboratory will submit a Level II analytical data package with the above mentioned qualifiers as necessary for each sample delivery group. This Level II data package includes the following:

- Case narrative (including noncompliance issues)
- Chain of Custody
- Analytical results for each sample
- Laboratory Method Blanks
- Surrogate recoveries
- MS/MSD recovery results
- LCS recovery results

The laboratory will submit a Level III analytical data package, with the above mentioned qualifiers as necessary, for Floridan Aquifer sentinel and boundary wells (Table 2-3):

The Level III data package will include the Level II data package, in addition to the following packages:

- Internal standards
- Raw data, including initial and continuing calibration data and chromatograms

7.2 DATA EVALUATIONS

The analytical data are evaluated using the USEPA National Functional Validation Guidelines for Inorganic and Organic review to the extent possible. Data submitted in Level II data packages will be evaluated for the following:

- Data completeness
- Holding times
- Laboratory Blank Contamination
- Field Blank Contamination
- Field Duplicate Evaluation
- Matrix Spike/Matrix Spike Duplicate
- Laboratory Control Sample Results

Data submitted in Level III data packages will be evaluated for the Level II criteria listed above, in addition to the following:

- Compliance with USEPA SW846-required calibration protocols
- Internal standards
- Comparison of reported results to raw chromatograms

Data qualifiers are assigned as necessary by the QA/QC Manager.

7.3 DATA MANAGEMENT

Management of the data generated by the investigations will be handled as follows:

- Laboratory and/or field data reviewed for completeness and accuracy by QA/QC Manager.
- Errors or corrections are made by the laboratory (or field personnel for field data).
- Original and/or corrected data reports are filed by data manager.
- Copies of original and/or corrected data are distributed to the appropriate organization.

The electronic data are archived in a Microsoft Access database after all data qualifications have been made to ensure that the final results are maintained. This electronic database is maintained by Beazer's consultant.

8.0 REPORTING

The reports will provide a summary of groundwater conditions, including data trends and groundwater flow direction and analytical data will be tabulated and evaluated. Each report will include tables, figures, and appendices necessary to document and support the results of the sampling event. These reports will be prepared within 60 days following receipt of laboratory data. Recommendations, if any, will be included within the report.

The data reports will be submitted by Beazer to:

- United States Environmental Protection Agency, Region IV (EPA);
- The Florida Department of Environmental Protection (FDEP); and,
- The Alachua County Environmental Protection Division (ACEPD).

9.0 REFERENCES

EPA Superfund *Record of Decision*, 1990, Cabot/Koppers, EPA ID: FLD980709356, OU 00, Gainesville, FL, EPA/ROD/R04-90/077, September 27, 1990.

Field & Technical Services, LLC, 2008, *2007 Fourth Quarter Floridan Aquifer Groundwater Monitoring Report; and December 2007 Water Quality Results: Upper Floridan Wells FW-04C through FW-24C, Cabot Carbon/Koppers Superfund Site*, Gainesville, Florida, February 15, 2008.

Field & Technical Services, LLC, 2008, *2007 Annual Stage 2 Groundwater Monitoring Report, Cabot Carbon/Koppers Superfund Site*, Gainesville, Florida, prepared for Beazer East, Inc., March 31, 2008.

Florida Administrative Code, Rule Chapter 62-777, *Contaminant Cleanup Target Levels*, effective date, April 17, 2005.

GeoTrans, Inc., 2006, *Addendum to the Floridan Aquifer Monitoring Plan, Cabot Carbon/Koppers Superfund Site, Koppers Inc. Site*, Gainesville, Florida. August 18, 2006.

GeoTrans, Inc., 2007, *Supplemental Hawthorn Group Investigation and Monitoring Well Installation Workplan*, submitted to USEPA Region IV, Superfund North Florida Section, July 20, 2007.

GeoTrans, Inc., 2008, *Surficial Aquifer Interim Remedial Measures (IRM) Work Plan, Cabot Carbon/ Koppers Superfund Site,* September 2008.

TRC Environmental Solutions Inc., 1997, *Proposed Stage 2 Ground Water Monitoring Program Initial Ground Water Remedial Action, Cabot Carbon/Koppers Superfund Site*, Gainesville, Florida, prepared for Beazer East, Inc., August 1997.

TRC, 2004, *Floridan Aquifer Monitoring Plan, Cabot Carbon/Koppers Superfund Site,* Gainesville, Florida, prepared for Beazer East, Inc., June 2004.

TABLES

Table 2-1
Surficial Aquifer Wells and Monitoring Program Parameters

Well ID	Parameters				Sampling Frequency
ITW-12	SVOCs[1]	VOCs[2]			Annual
ITW-22	SVOCs	VOCs			Semiannual
M-9AR	SVOCs	VOCs	As[3]		Semiannual
M-9BR	SVOCs	VOCs			Semiannual
M-16B	SVOCs	VOCs	As		Semiannual
M-17	SVOCs	VOCs	As	Penta[4]	Semiannual
M-20B	SVOCs	VOCs	As	Penta	Semiannual
M-23BR	SVOCs	VOCs	As	Penta	Semiannual
M-25B	SVOCs	VOCs	As	Penta	Semiannual
M-33B	SVOCs	VOCs			Annual

Notes:

(1) "SVOCs" indicates semivolatile organic compounds. The specific list of SVOCs included in the program is provided in Table 5-3.

(2) "VOCs" indicates volatile organic compounds. The specific list of VOCs included in the program is provided in Table 5-3.

(3) "As" indicates dissolved arsenic.

(4) "Penta" indicates pentachlorophenol.

Table 2-2
Hawthorn Group Wells and Monitoring Program Parameters

Well ID	Parameters		Sampling Frequency
HG-2D	SVOCs[(1)]	VOCs[(2)]	annual
HG-4S	SVOCs	VOCs	annual
HG-4D	SVOCs	VOCs	annual
HG-5D	SVOCs	VOCs	annual
HG-6S	SVOCs	VOCs	annual
HG-6D	SVOCs	VOCs	annual
HG-20S	SVOCs	VOCs	quarterly
HG-20D	SVOCs	VOCs	quarterly
HG-21S	SVOCs	VOCs	quarterly
HG-21D	SVOCs	VOCs	quarterly
HG-22D	SVOCs	VOCs	quarterly
HG-23D	SVOCs	VOCs	quarterly
HG-24S	SVOCs	VOCs	quarterly
HG-25D	SVOCs	VOCs	quarterly
HG-26S	SVOCs	VOCs	quarterly
HG-26D	SVOCs	VOCs	quarterly
HG-27S*	SVOCs	VOCs	quarterly
HG-27D*	SVOCs	VOCs	quarterly
HG-28S*	SVOCs	VOCs	quarterly
HG-28D*	SVOCs	VOCs	quarterly
HG-29S*	SVOCs	VOCs	quarterly
HG-29D*	SVOCs	VOCs	quarterly

Notes:

(1) "SVOCs" indicates semivolatile organic compounds. The specific list of SVOCs included in the program is provided in Table 5-4.

(2) "VOCs" indicates volatile organic compounds. The specific list of VOCs included in the program is provided in Table 5-4.

* Proposed

Table 2-3
Floridan Aquifer Wells and Monitoring Program Parameters

Well ID	Parameters		Site Location	Westbay Zones	Sampling Frequency
FW-4	SVOCs[1]	VOCs[2]	Boundary	n/a	semiannual
FW-4C	SVOCs	VOCs	Boundary	all	semiannual
FW-10B	SVOCs	VOCs	Transect area	all	annual
FW-11B	SVOCs	VOCs	Transect area	all	annual
FW-12B	SVOCs	VOCs	Transect area	all	semiannual
FW-13B	SVOCs	VOCs	Transect area	all	annual
FW-14B	SVOCs	VOCs	Transect area	all	annual
FW-15B	SVOCs	VOCs	Transect area	all	annual
FW-16B	SVOCs	VOCs	Transect area	1	semiannual
		VOCs	Transect area	2, 3, 4	annual
FW-17B	SVOCs	VOCs	Transect area	all	annual
FW-18B	SVOCs	VOCs	Source area	all	annual
FW-19B	SVOCs	VOCs	Source area	all	annual
FW-20B	SVOCs	VOCs	Source area	1, 2	semiannual
		VOCs	Source area	3, 4	annual
FW-21B	SVOCs	VOCs	Source area	1	semiannual
		VOCs	Source area	2, 3, 4	annual
FW-22B	SVOCs	VOCs	Boundary	all	annual
FW-22C	SVOCs	VOCs	Boundary	all	semiannual
FW-23B	SVOCs	VOCs	Boundary	all	annual
FW-23C	SVOCs	VOCs	Boundary	all	semiannual
FW-24B	SVOCs	VOCs	Boundary	all	annual
FW-24C	SVOCs	VOCs	Boundary	all	semiannual
FW-25B	SVOCs	VOCs	Sentinel	n/a	quarterly
FW-25C	SVOCs	VOCs	Sentinel	n/a	quarterly
FW-26B	SVOCs	VOCs	Sentinel	n/a	quarterly
FW-26C	SVOCs	VOCs	Sentinel	n/a	quarterly

Notes:

(1) "SVOCs" indicates semivolatile organic compounds. The specific list of SVOCs included in the program is provided in Table 5-6.

(2) "VOCs" indicates volatile organic compounds. The specific list of VOCs included in the program is provided in Table 5-6.

TABLE 3-1
GROUNDWATER MONITORING SUPPLY CHECKLIST

Project Plans

- [ ] CGMSAP
- [ ] Health and Safety Plan

Sample Documentation Supplies

- [ ] Field Logbook
- [ ] Monitoring Well Inspection Form
- [ ] Sampling Order
- [ ] Gauging Order
- [ ] Groundwater Purging & Sampling Forms
- [ ] Investigation-Derived Waste Summary Log
- [ ] Equipment Calibration Forms
- [ ] Chain-of-Custody Forms
- [ ] Westbay Well Sample Collection Forms

Monitoring Equipment

- [ ] Plastic Sheeting
- [ ] Water Level Meter
- [ ] Oil-Water Interface Probe
- [ ] Water Quality Meter(s)*
- [ ] Calibration Fluids
- [ ] Clear bailers for NAPL confirmation

Decontamination Equipment

- [ ] Spray Bottles
- [ ] Alconox
- [ ] Isopropanol
- [ ] Distilled Water
- [ ] Scrub Brushes
- [ ] 5-Gallon Buckets
- [ ] 4" PVC Decon Trough
- [ ] Paper Towels

Sample Packaging Supplies

- [ ] Sample Containers
- [ ] Bubble Wrap
- [ ] Ziploc Bags (1-gal)
- [ ] Garbage Bags

Additional Planning Documents

- [ ] Site Data Sheet
- [ ] Field Activity Report (Previous Event)

Health and Safety Equipment

- [ ] Hard Hat
- [ ] Safety Glasses
- [ ] Steel-Toe Boots
- [ ] Photoionization Detector
- [ ] Tyvek (if needed)
- [ ] Nitrile Gloves
- [ ] First Aid Kit

Sampling Equipment

- [ ] Peristaltic Pump (Field Filtered Analytes)
- [ ] Bladder Pumps/Compressors/Controllers
- [ ] Tubing (1/4"x1/4" PE/Teflon Bonded)
- [ ] Teflon Bladders (Disposable)
- [ ] 45-Micron Filters
- [ ] 3/16" Silicon Tubing
- [ ] Westbay Sampling Equipment
- [ ] Vacuum Pump (Westbay)
- [ ] Power Inverter (Westbay)

Miscellaneous Equipment

- [ ] Well Keys
- [ ] Cellular Phone
- [ ] Stop Watch
- [ ] Electronic Calculator
- [ ] Waterproof Markers/Pens
- [ ] Clipboard
- [ ] Camera

Sample Shipping Supplies

- [ ] Ice
- [ ] Sample Coolers
- [ ] Custody Seals
- [ ] Packaging Tape & Duct Tape

Notes:

* Meters for measurement of temperature, specific conductance, turbidity, pH, DO, and ORP.

Table 4-1
Field Collection Quality Assurance Requirements

ANALYSIS	TRIP BLANK	FIELD BLANK[(1)]	EQUIPMENT RINSATE BLANKS[(2)]	FILTER BLANK	FIELD DUPLICATE[(3)]	MATRIX SPIKE AND MATRIX SPIKE DUPLICATES[(4)]
Organics[(5)]	1 per sample shipment for VOCs only	1 per day, per event	1 per day, per event	None	1 per 10 samples or 1 per sample shipment, at a minimum	1 per 20 samples or 1 per sample shipment, at a minimum
Inorganics[(6)]	None	1 per day, per event	1 per day, per event	1 per 15 samples[(7)]	1 per 10 samples or 1 per sample shipment, at a minimum	1 per 20 samples or 1 per sample shipment, at a minimum

Notes:

(1) Field blanks will be collected during groundwater sampling procedures to determine any potential sources of sample contamination present in the ambient air at the time of sampling. Field blanks require laboratory provided analyte-free DI water transfered in the field to laboratory supplied clean sample containers.

(2) Equipment rinsate blanks will be collected during groundwater sampling procedures only when non-dedicated sampling equipment is used.

(3) Field duplicates require an additional sample volume. Note that field duplicates will be labeled so the laboratory cannot determine that the sample is a field duplicate. Field duplicates will be collected as split samples from the investigative sample.

(4) MS/MSD samples require two additional sample volumes for organic analysis. Matrix spike samples require an additional sample volume for inorganic analysis.

(5) Includes VOCs, SVOCs and pesticides/PCBs.

(6) Includes dissolved and total metals.

(7) Includes dissolved metals only.

Table 5-1
Well Construction Details - Surficial Aquifer Wells

Well ID	TOC Elev (ft amsl)	TD [1]	Top of Screen [1]	Bottom of Screen [1]	Well Dia. (in)
ITW-12	177.49	22.35	6.5	26.5	2
ITW-22	180.54	30.54	3.0	13.0	2
M-9AR	173.80	15.0	5.0	15.0	2
M-9BR	173.22	26.5	21.5	26.5	2
M-16B	180.56	21.5	16.5	21.5	2
M-17	187.26	13.0	3.0	13.0	2
M-20B	183.67	22.0	17.0	22.0	2
M-23BR	185.10	23.5	18.5	23.5	2
M-25B	186.15	23.0	18.0	23.0	2
M-33B	176.39	27.3	22.3	27.3	2

Notes:

[1] Measurements are feet below top of casing.

Table 5-2
Well Construction Details - Hawthorn Group Wells

Well ID	TOC Elev (ft amsl)	TD [(1)]	Top of Screen [(1)]	Bottom of Screen [(1)]	Well (dia.)
HG-2D	188.88	115.0	100.0	110.0	2
HG-4S	180.41	50.0	40.0	50.0	2
HG-4D	180.91	105.0	95.0	105.0	2
HG-5D	187.73	110.0	100.0	110.0	2
HG-6S	184.86	50.0	40.0	50.0	2
HG-6D	185.02	105.0	95.0	105.0	2
HG-20S	174.37	40.07	29.86	39.63	2
HG-20D	174.33	84.03	73.84	83.60	2
HG-21S	167.72	41.22	30.99	40.76	2
HG-21D	167.90	95.10	84.82	94.60	2
HG-22D	186.20	82.44	71.55	81.55	2
HG-23D	186.70	89.70	79.49	89.24	2
HG-24S	184.28	71.68	61.49	71.25	2
HG-25D	181.30	86.10	75.83	85.58	2
HG-26S	183.21	44.31	34.07	43.84	2
HG-26D	182.92	94.12	83.89	93.65	2
HG-27S*	TBD	TBD	TBD	TBD	TBD
HG-27D*	TBD	TBD	TBD	TBD	TBD
HG-28S*	TBD	TBD	TBD	TBD	TBD
HG-28D*	TBD	TBD	TBD	TBD	TBD
HG-29S*	TBD	TBD	TBD	TBD	TBD
HG-29D*	TBD	TBD	TBD	TBD	TBD

Notes:

[(1)] Measurements are feet below top of casing.

* Proposed

"TBD" - to be determined

Table 5-3
Analytical Parameters, Methodology, Reporting Limits, and Evaluation Criteria - Surficial Aquifer Wells

Parameter	Methodology	Reporting Limit[(1)] (µg/L)	Federal MCL[(2)] (µg/L)	Florida GCTL[(3)] (µg/L)
Metals				
Dissolved Arsenic	SW846 6020	10	10	10-100
VOCs				
Benzene	SW846 8260	1	5	1-10
Ethylbenzene	SW846 8260	30	700	30-300
Toluene	SW846 8260	40	10000	40-400
Xylene, total	SW846 8260	20	1000	20-200
SVOCs				
2,4-Dimethylphenol	SW846 8270C	140	--	140-1400
2-Methylnaphthalene	SW846 8270C	28	--	28-280
2-Methylphenol	SW846 8270C	35	--	35-350
4-Methylphenol	SW846 8270C	3.5	--	3.5-35[(4)]
Acenaphthene	SW846 8270C	20	--	20-200
Acenaphthylene	SW846 8270C	210	--	210-2100
Anthracene	SW846 8270C	2100	--	2100-21000
Carbazole	SW846 8270 SIM	1.8	--	1.8-18
Dibenzofuran	SW846 8270C	28	--	28-280
Fluoranthene	SW846 8270C	280	--	280-2800
Fluorene	SW846 8270C	280	--	280-2800
Naphthalene	SW846 8270C	14	--	14-140
Pentachlorophenol	SW846 8270 SIM	1	1	1-10
Phenanthrene	SW846 8270C	210	--	210-2100
Phenol	SW846 8270C	10	--	10-100
Pyrene	SW846 8270C	210	--	210-2100

Notes:

(1) SW846 refers to *U.S.EPA SW846 Test Methods for the Evaluating Solid Waste, Physical/Chemical Methods*, most recent edition.
(2) Federal Maximum Contaminant Levels (MCLs) represent the National Primary Drinking Water Standards.
(3) Florida Groundwater Cleanup Target Level (GCTL) are guidelines as set forth in 62-777 Florida Administrative Code (F.A.C).
(4) 3-Methylphenol and 4-Methylphenol cannot be quantified separately using USEPA SW-846.
"--" Indicates that no criteria are available for this parameter.

Table 5-4
Analytical Parameters, Methodology, Reporting Limits, and Evaluation Criteria - Hawthorn Group Wells

Parameter	Methodology	Reporting Limit[1] (µg/L)	Federal MCL[2] (µg/L)	Florida GCTL[3] (µg/L)
VOCs				
Benzene	SW846 8260	1	5	1-10
Ethylbenzene	SW846 8260	30	700	30-300
Toluene	SW846 8260	40	1000	40-400
Xylenes, total	SW846 8260	20	-	20-200
SVOCs				
2,4-Dimethylphenol	SW846 8270C	140	-	140-1400
2-Methylnaphthalene	SW846 8270C	28	-	28-280
2-Methylphenol	SW846 8270C	35	-	35-350
4-Methylphenol	SW846 8270C	3.5	-	3.5-35[4]
Acenaphthene	SW846 8270C	20	-	20-200
Acenaphthylene	SW846 8270C	210	-	210-2100
Carbazole	SW846 8270 SIM	1.8	-	1.8-18
Dibenzofuran	SW846 8270C	28	-	28-280
Fluoranthene	SW846 8270C	280	-	280-2800
Fluorene	SW846 8270C	280	-	280-2800
Naphthalene	SW846 8270C	14	-	14-140
Phenanthrene	SW846 8270C	210	-	210-2100
Phenol	SW846 8270C	10	-	10-100
Pyrene	SW846 8270C	210	-	210-2100

Notes:

"-" Indicates that no criteria are available for this parameter.

(1) SW846 refers to U.S.EPA SW846 *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, most recent edition.

(2) Federal Maximum Contaminant Levels (MCLs) represent the National Primary Drinking Water Standards.

(3) Florida Groundwater Cleanup Target Level (GCTL) ranges are guidelines as set forth in 62-777 Florida Administrative Code (F.A.C).

(4) 3-Methylphenol and 4-Methylphenol cannot be quantified separately using SW846.

Table 5-5
Well Construction Details - Floridan Aquifer Wells

Well ID	TOC Elev (ft amsl)	TD [(1)]	Top of Screen [(1)]	Bottom of Screen [(1)]	Well (dia.)	Zone 1		Zone 2		Zone 3		Zone 4	
						Sampling Port Depth[(2)]	Sampling Port Elev[(3)]	Sampling Port Depth[(2)]	Sampling Port Elev[(3)]	Sampling Port Depth[(2)]	Sampling Port Elev[(3)]	Sampling Port Depth[(2)]	Sampling Port Elev[(3)]
FW-4	173.91	156.0	146.00	156.00	2"	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
FW-4C	174.15	380.1	n/a	n/a	4"	316.19	-142.04	345.19	-171.04	365.19	-191.04	n/a	n/a
FW-10B	187.16	237.9	n/a	n/a	4"	157.73	29.41	177.73	9.41	197.73	-10.59	217.73	-30.59
FW-11B	184.93	237.1	n/a	n/a	4"	156.77	27.89	176.77	7.89	196.77	-12.11	216.77	-32.11
FW-12B	183.26	239.7	n/a	n/a	4"	156.40	27.46	176.40	7.46	196.40	-12.54	216.40	-32.54
FW-13B	181.37	239.3	n/a	n/a	4"	158.57	22.46	178.57	2.46	198.57	-17.54	218.57	-37.54
FW-14B	178.73	240.7	n/a	n/a	4"	159.64	18.73	179.64	-1.27	199.64	-21.27	219.64	-41.27
FW-15B	178.20	238.8	n/a	n/a	4"	158.12	20.83	178.12	0.83	198.12	-19.17	218.12	-39.17
FW-16B	181.19	250.9	n/a	n/a	4"	165.13	15.77	185.13	-4.23	205.13	-24.23	225.13	-44.23
FW-17B	184.69	240.8	n/a	n/a	4"	159.65	24.85	179.65	4.85	199.65	-15.15	219.65	-35.15
FW-18B	185.97	238.2	n/a	n/a	4"	157.71	28.01	177.71	8.01	197.71	-11.99	217.71	-31.99
FW-19B	186.09	237.1	n/a	n/a	4"	157.34	29.07	177.34	9.07	197.34	-10.93	217.34	-30.93
FW-20B	183.60	238.1	n/a	n/a	4"	157.72	25.64	177.72	5.64	197.72	-14.36	217.72	-34.36
FW-21B	182.38	237.0	n/a	n/a	4"	155.77	26.39	175.77	6.39	195.77	-13.61	215.77	-33.61
FW-22B	181.37	237.6	n/a	n/a	4"	156.24	25.54	176.24	5.54	196.24	-14.46	211.24	-29.46
FW-22C	181.98	386.2	n/a	n/a	4"	321.96	-139.98	349.96	-167.98	364.96	-182.98	n/a	n/a
FW-23B	172.46	232.4	n/a	n/a	4"	153.09	19.72	173.09	-0.28	193.09	-20.28	213.09	-40.28
FW-23C	172.87	379.1	n/a	n/a	4"	312.98	-140.11	344.98	-172.11	364.98	-192.11	n/a	n/a
FW-24B	183.42	243.1	n/a	n/a	4"	165.53	17.89	185.53	-2.11	205.53	-22.11	225.53	-42.11
FW-24C	183.54	386.6	n/a	n/a	4"	307.26	-123.72	327.26	-143.72	347.26	-163.72	367.26	-183.72
FW-25B*	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
FW-25C*	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
FW-26B*	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
FW-26C*	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

Notes:

* Floridan Aquifer Sentinel Wells, currently under construction.
n/a Not applicable.
(1) Measurements are feet below top of casing.
(2) Measurements are feet below top of Westbay casing.
(3) Elevation is feet above/below mean sea level.
TBD To be determined.

Table 5-6
Analytical Parameters, Methodology, Reporting Limits, and Evaluation Criteria - Floridan Aquifer Wells

Parameter	Methodology	Reporting Limit[1] (µg/L)	Federal MCL[2] (µg/L)	Florida GCTL[3] (µg/L)
VOCs				
Benzene	SW846 8260B	1	5	1-10
Ethylbenzene	SW846 8260B	30	700	30-300
Toluene	SW846 8260B	40	1000	40-400
Xylenes, total	SW846 8260B	20	-	20-200
SVOCs				
2,4-Dimethylphenol	SW846 8270C	140	-	140-1400
2-Methylnaphthalene	SW846 8270C	28	-	28-280
2-Methylphenol	SW846 8270C	35	-	35-250
3&4-Methylphenol	SW846 8270C	3.5	-	3.5-35[4]
Acenaphthene	SW846 8270C	20	-	20-200
Acenaphthylene	SW846 8270C	210	-	210-2100
Anthracene	SW846 8270C	2100	-	2100-21000
Carbazole	SW846 8270 SIM	1.8	-	1.8-18
Dibenzofuran	SW846 8270C	28	-	28-280
Fluoranthene	SW846 8270C	280	-	280-2800
Fluorene	SW846 8270C	280	-	280-2800
Naphthalene	SW846 8270C	14	-	14-140
Phenanthrene	SW846 8270C	210	-	210-2100
Phenol	SW846 8270C	10	-	10-100
Pyrene	SW846 8270C	210	-	210-2100

Notes:

"-" Symbol indicates that no criteria are available.

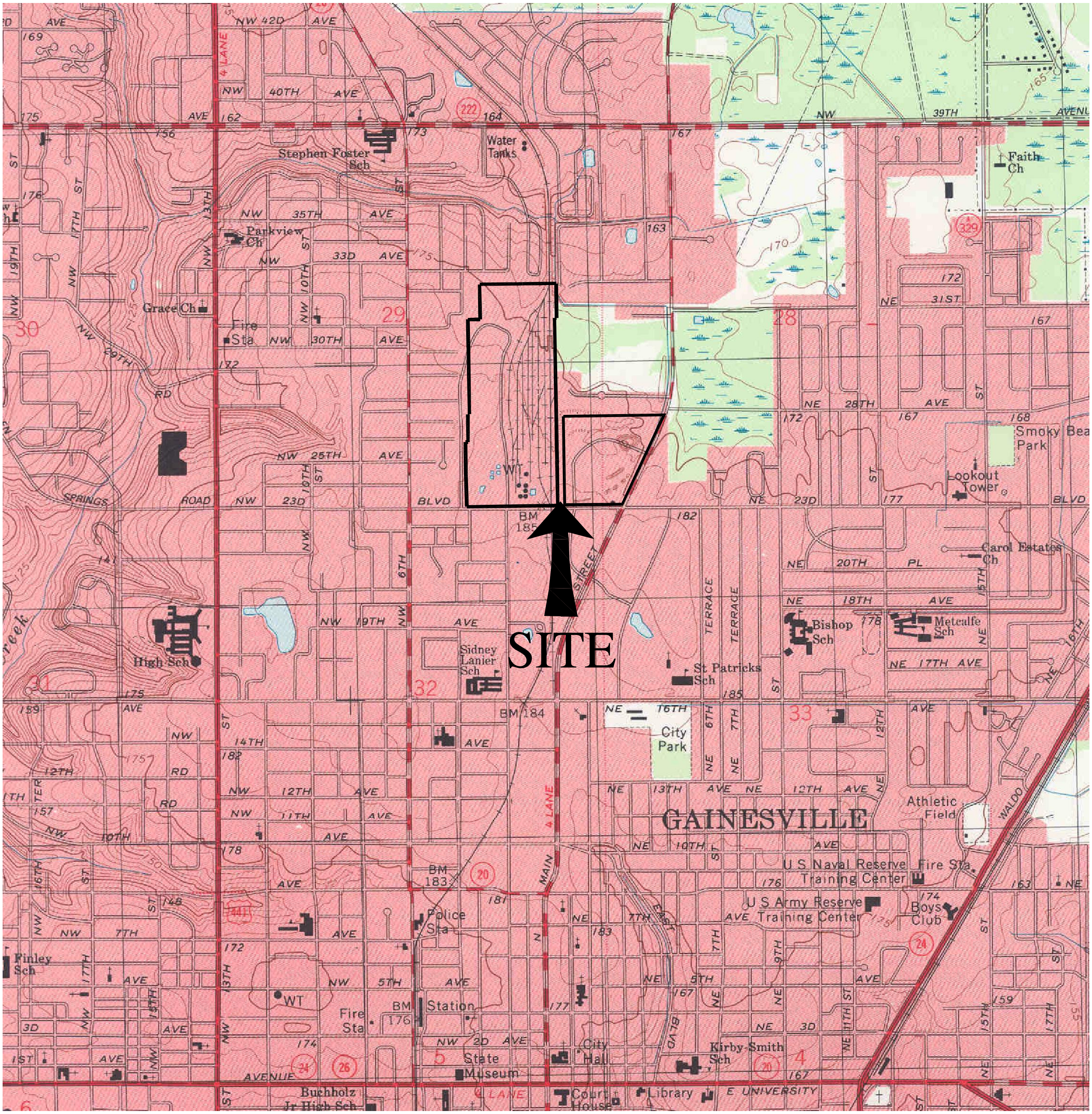
(1) SW846 refers to U.S.EPA SW846 *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, most recent edition.

(2) "MCLs" refer to Federal Maximum Contaminant Levels.

(3) Florida Groundwater Cleanup Target Level (GCTL) ranges are guidelines as set forth in 62-777 Florida Administrative Code (F.A.C).

(4) 3-Methylphenol and 4-Methylphenol cannot be quantified separately using USEPA SW846.

FIGURES



0 2000 4000
FEET

N

REFERENCE: USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLES
GAINESVILLE EAST, FLORIDA – 1994

BEAZER EAST, INC.
PITTSBURGH, PENNSYLVANIA

DRWN:	CRJ	DATE:	07/25/07
CHKD:	RMB	DATE:	07/25/07
APPD:	AMG	DATE:	07/25/07
SCALE:	1" = 2000'		
ISSUE DATE:			

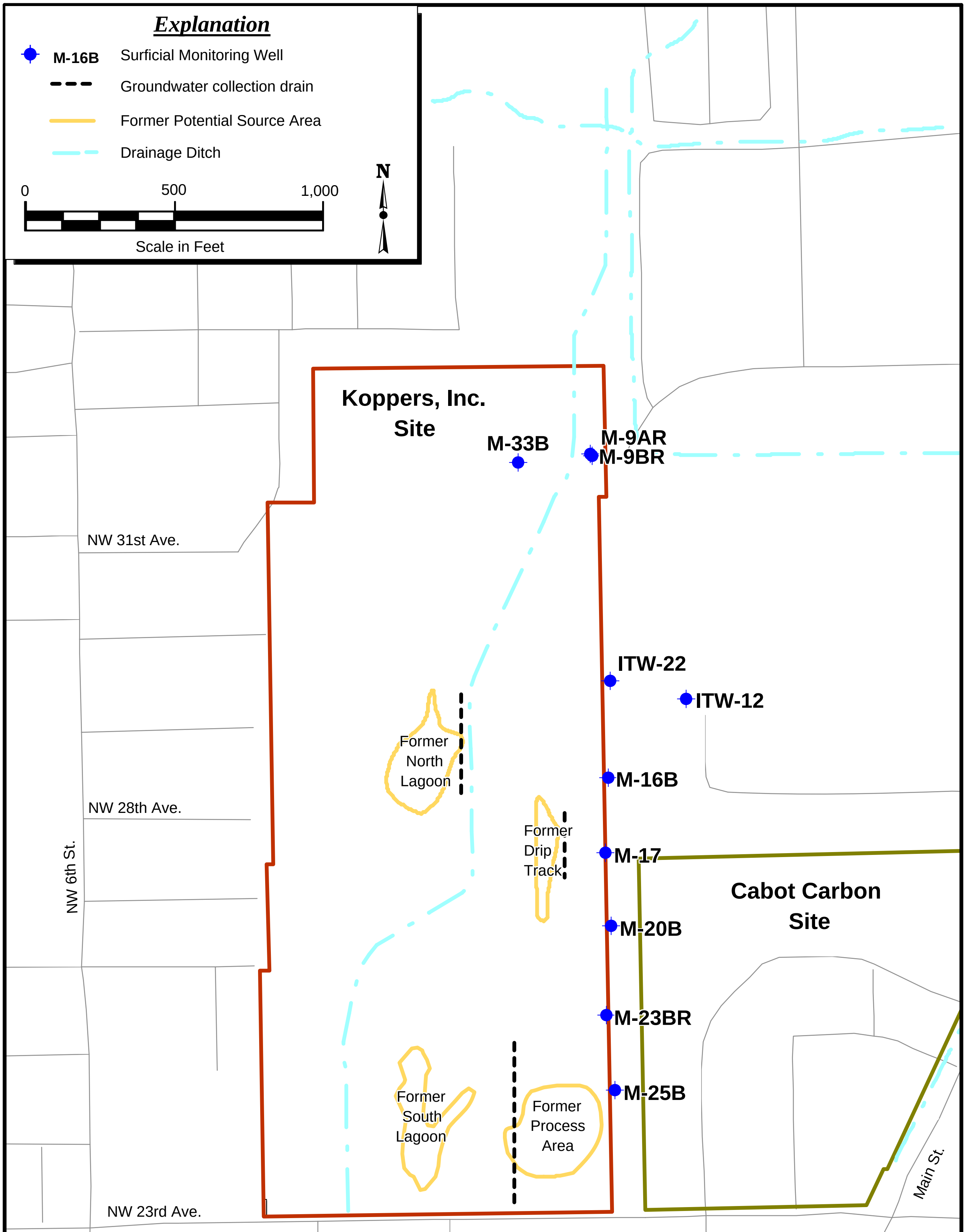
FTS

FIELD & TECHNICAL SERVICES, LLC.
200 THIRD AVENUE
CARNEGIE, PA 15106

COMPREHENSIVE GROUNDWATER MONITORING AND SAMPLE ANALYSIS PLAN
CABOT CARBON/KOPPERS SUPERFUND SITE
GAINESVILLE, FLORIDA

SITE LOCATION MAP

PROJECT NO:T004508–08
DRAWING NUMBER
FIGURE 1



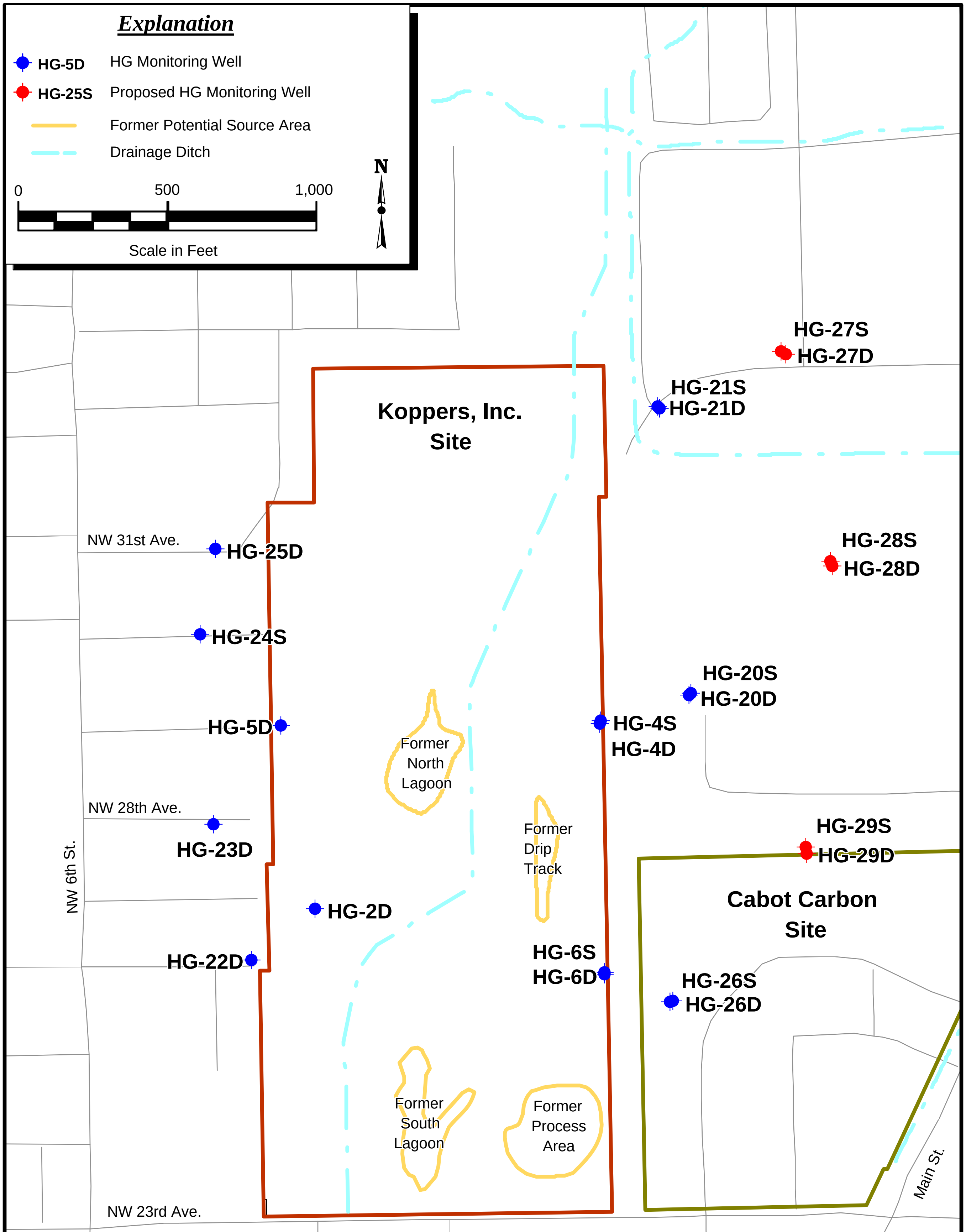
TITLE: Surficial Aquifer Monitoring Program Well Locations

LOCATION: Cabot Carbon/Koppers Superfund Site, Gainesville, Florida

GeoTrans, Inc. A TETRA TECH COMPANY

CHECKED	JRE	FIGURE:
DRAFTED	DB	2-1
FILE	SAP_well_locs.wor	
DATE	06-11-08	

t:/gainesville/mapinfo/wells/SAP_well_locs.wor (Layout 3)



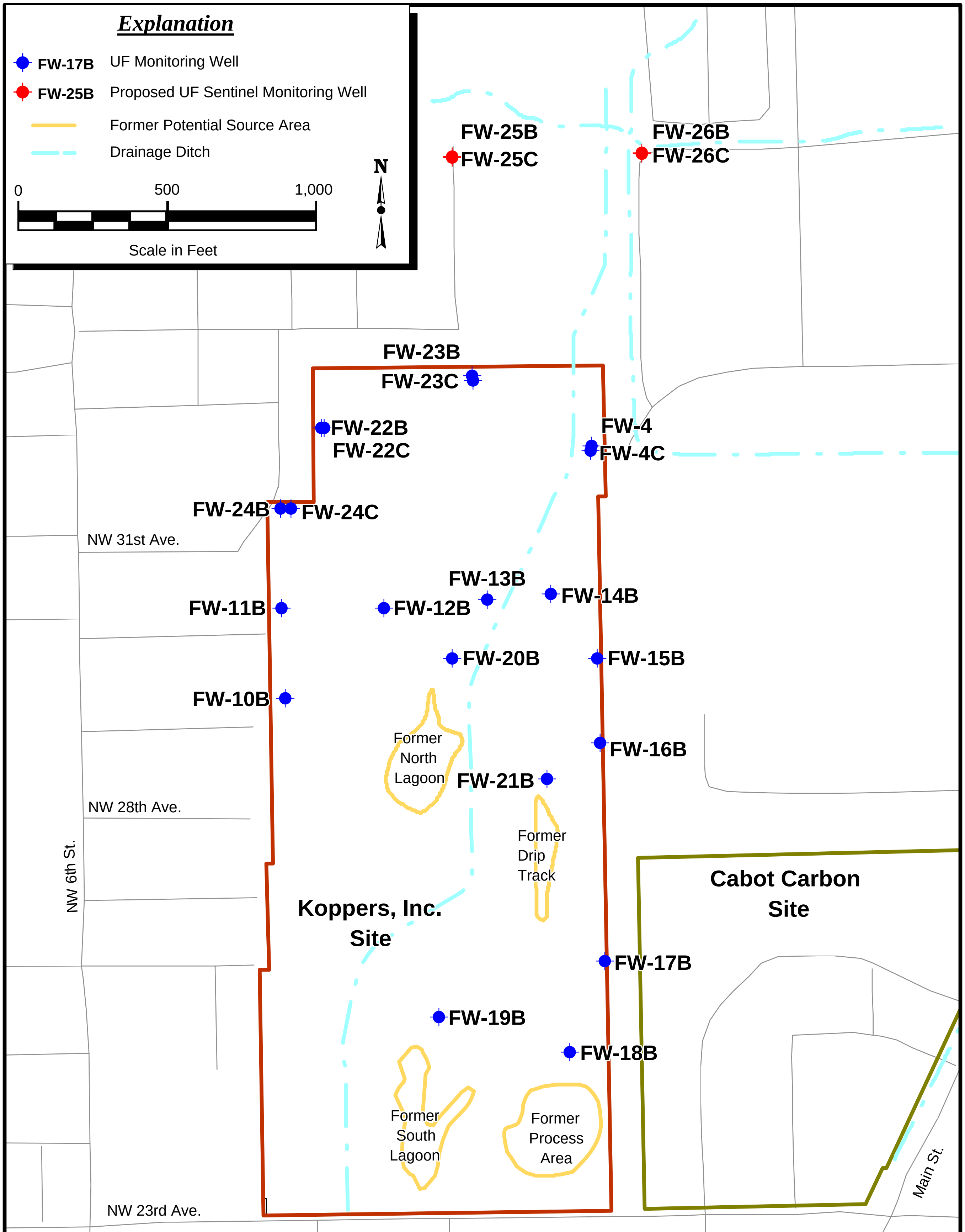
TITLE: Hawthorn Group Monitoring Program Well Locations

LOCATION: Cabot Carbon/Koppers Superfund Site, Gainesville, Florida

GeoTrans, Inc. A TETRA TECH COMPANY

CHECKED	JRE	FIGURE:
DRAFTED	DB	2-2
FILE	SAP_well_locs.wor	
DATE	06-11-08	

t:/gainesville/mapinfo/wells/SAP_well_locs.wor (Layout 2)



TITLE:	Floridan Aquifer Monitoring Program Well Locations
LOCATION:	Cabot Carbon/Koppers Superfund Site, Gainesville, Florida

GeoTrans, Inc. A TETRA TECH COMPANY

CHECKED	JRE	FIGURE: 2-3
DRAFTED	DB	
FILE	SAP_well_locs.wor	
DATE	06-11-08	

t:/gainesville/mapinfo/wells/SAP_well_locs.wor (Layout 1)

APPENDIX A

FTS

GROUNDWATER SAMPLE COLLECTION RECORD

WELL NO.:

PERMIT NO.:

Project No.: ______ **Client:** Beazer, Inc.
Project Name: ______ **Project Location:** ______
Weather Conditions: ______ **Sampling Date:** ______

1. WATER LEVEL DATA (measured from top of inner well casing)

- **a. Depth to LNAPL:** ______ **(ft)** **b. Depth to Water:** ______ **(ft)**
- **c. Depth to DNAPL:** ______ **(ft)** **d. Total Well Depth:** ______ **(ft)**
- **e. LNAPL Thickness: (a-b)** ______ **(ft)** **f. DNAPL Thickness: (c-d)** ______ **(ft)**
- **g. Length of Water Column:** ______ **(ft) (a-d)**
- **h. Well Volume:** ______ **(gal)**

Conversion Factors (a x cf = h)	
Well I.D.	Conv. Fact. (cf)
1	0.041
2	0.163
4	0.653
6	1.470

2. WELL PURGE DATA

- **a. Purge Method:** ______
- **b. Field Testing Equipment:** ______
- **c. Required Total Purge Volume (1f x 2c) (gals.):** NA
- **d. Total Volume and Number of Well Volumes Removed:** ______
- **e. Begin Purge Time:** **End Purge Time:**

Read No.	Lapse Time (min.)	Purge Rate	Temp (deg. C) (±10%)	pH (s.u.) (±0.2)	Spec. Cond. (ms/cm) (±3%)	Eh/ORP (mV) (±10mV)	Diss O2 (mg/L) (±10%)	TURB (NTU) (±10%)	Salinity %	TDS G/L	Water Level (ft)
PRE PURGE VALUES											
PURGING VALUES											

3. SAMPLE COLLECTION DATA **Sampling Personnel:** ______

Sampling Method(s) & Equip: ______
Sample I.D. (Name, Date, Time): ______
Sample Analytical Parameters/Method: ______

Sample Start Time: **End SampleTime:**
COMMENTS:

FTS

Page____of____

Groundwater Sampling

Field Data Sheet

Date:

Start Time:

End Time:

Technicians:

Project: Gainesville, FL

Monitoring Well No:

Sampling Zone No(s):

Zone No.	Run No.	Surface Function Tests (probe in flushing collar)						Position Sampler	Sampling Collection Checks (probe located at sampling zone in MP casing)								Comments (volume retrieved)
		Shoe Out	Close Valve	Check Vacuum	Open Valve	Evacuate Container	Close Valve	Locate port ( ) Arm out ( ) Land probe ( )	Pressure in MP ( )	Shoe Out	Zone Pressure ( )	Open Valve	Zone Pressure ( )	Close Valve	Shoe In	Pressure in MP ( )	

Gainesville, FL
Groundwater Gauging Sheet
Cabot Carbon/Koppers Superfund Site
Gainesville, Florida

FTS

Order	Well	Date	Time	Previous Depth to Water (ft) 1st round	Depth to Groundwater (ft) 1st round	Previous Total Depth (ft)	Total Depth (ft)	Previous Depth to LNAPL (ft)	Depth to LNAPL (ft)	LNAPL Thickness (ft)	Previous Depth to DNAPL (ft)	Depth to DNAPL (ft)	DNAPL Thickness (ft)	PID Reading (ppm)	Comments
	FW-4														
	HG-2D														
	HG-4S														
	HG-4D														
	HG-5D														
	HG-6S														
	HG-6D														
	HG-20S														
	HG-20D														
	HG-21S														
	HG-21D														
	HG-22D														
	HG-23D														
	HG-24S														
	HG-25D														
	HG-26S														
	HG-26D														
	ITW-12														
	ITW-22														
	M-9AR														
	M-9BR														
	M-16B														
	M-17														
	M-20B														
	M-23BR														
	M-25B														
	M-33B														

EQUIPMENT CALIBRATION FORM

INSTRUMENT: ______________________________

SERIAL NO.: ______________________________

DATE	TIME	PARAMETER	CALIBRATION READING	CALIBRATION RECORDED BY
		4.00		
		7.00		
		pH 10.00		
		Specific Conductivity		
		ORP		
		Dissolved Oxygen		
		Turbidity		
		Temperature		

INSTRUMENT: ______________________________

SERIAL NO.: ______________________________

DATE	TIME	PARAMETER	CALIBRATION READING	CALIBRATION RECORDED BY
		4.00		
		7.00		
		pH 10.00		
		Specific Conductivity		
		ORP		
		Dissolved Oxygen		
		Turbidity		
		Temperature		

Field & Technical Services, LLC
RCRA Facility Groundwater Monitoring Well Inspection Form

Site Name:____________________________ Site Phone:____________________________

Inspector Name:________________________ Audit Date: ____________________________

KI Contact: ___________________________ KI Phone:_______________________________ Inspector Signature: ___________________________________

Well ID	Well Condition						
	Lock	Casing	Cap	Pad/Drainage	Vegetation/Accessibility	Potential Hazards	Comments

Field & Technical Services, LLC
RCRA Facility Groundwater Monitoring Well Inspection Form

Site Name:___________________________________

Well ID	Well Condition						
	Lock	Casing	Cap	Pad/Drainage	Vegetation/Accessibility	Potential Hazards	Comments

Field & Technical Services, LLC
RCRA Facility Groundwater Monitoring Well Inspection Form

Site Name:___________________________________

Well ID	Well Condition						
	Lock	Casing	Cap	Pad/Drainage	Vegetation/Accessibility	Potential Hazards	Comments

Notes:

Summary:

Field & Technical Services

FTS

IDW INVENTORY LOG

Date:

Project Name:

Project Number:

Location:

Container Identification Number	Type of IDW (SW, GW, NAPL, PPE, Other)	Start Accumulation Date	Date Filled	Comment / Label Description	Staging Location

<u>**CHAIN OF CUSTODY**</u>

200 Third Ave
Carnegie, PA 15106
Phone (412) 429-2694
Fax (412) 279-4512

Project No.: | **Project Name:**

Samplers:
(signatures)

Sample I.D.	Date	Time	Comp	Grab	Sample Location Description	Number of Containers											Requested Analyses

Relinquish By: (signature)	Date	Time	Received By: (signature)	Date	Time	Notes:
Relinquish By: (signature)	Date	Time	Received By: (signature)	Date	Time	
Relinquish By: (signature)	Date	Time	Received By: (signature)	Date	Time	

Distribution: Original to Accompany samples; Copy Returned with Report

APPENDIX B

#104
SAMPLING EQUIPMENT DECONTAMINATION

#104 - SAMPLING EQUIPMENT DECONTAMINATION

1.0 SCOPE AND PURPOSE

This Standard Operating Procedure (SOP) presents methods for on-site decontamination of field sampling equipment. Decontamination is performed as a quality assurance measure and a safety precaution. Decontamination prevents cross-contamination between samples and also helps to maintain a clean working environment for the safety of the field personnel.

Although this SOP defines on-site decontamination procedures, it is highly recommended that (1) dedicated disposable sampling implements are used whenever possible, and (2) sufficient dedicated sampling implements are taken to the field so that the need for field decontamination is eliminated or reduced. For example, in collecting groundwater samples, dedicated, disposable bailers should be used, where practicable.

Decontamination is mainly achieved by washing and rinsing with liquids which include; soap and/or phosphate-free detergent solutions, tap water, distilled water, acetone, hexane, and nitric acid. The actual procedure will vary depending on project-specific requirements as listed in the Quality Assurance Project Plan (QAPjP), the type of equipment to be used, and the analytical parameters of interest.

2.0 REQUIRED MATERIALS[1]

- Distilled water;
- Phosphate-free detergent (e.g., Liquinox, Alconox)
- Potable water supply;
- Hexane;
- Acetone;
- Isopropanol;
- 10% Nitric acid;
- Paper towels;
- Cleaning brushes;
- Aluminum foil;
- Gloves;
- Safety glass;
- Protective clothing;
- Cleaning containers (e.g., buckets, pans); and
- Dedicated squirt bottles for each solvent above and/or distilled water.

[1] Depending on project-specific requirements, not all materials may be necessary.

3.0 METHODOLOGY

It is the primary responsibility of the field team leader to assure that the proper decontamination procedures are followed. Project-specific decontamination procedures are to be included in the field SAP. It is the responsibility of the project safety officer (or designee) to develop and implement safety measures which provide protection for all persons involved directly with decontamination.

The contaminants encountered and type of equipment used will dictate the type of field decontamination procedures required. At a minimum, the following procedures will be used:

- Remove adhered material from the sampling equipment by brushing and/or rinsing with tap water;
- Wash with non-phosphate detergent and distilled water;
- Rinse with distilled water;
- Rinse with appropriate solvent[2], if organic constituents are of interest;
- Rinse with 10% nitric acid, if metals are a constituent of interest;
- Rinse with distilled water; and
- Air dry or dry with clean paper towels.

Safety Precautions

At a minimum, eye protection, safety shoes, and gloves are to be worn. There are several types of gloves that may be worn, depending on equipment being cleaned, type and extent of equipment contamination, and cleaning solutions or solvents being used.

Nitrile gloves may be worn when the equipment to be decontaminated is not heavily coated with constituents such as tars/oils. In cases where heavy accumulations of tars/oils are present on the equipment, neoprene or similar chemically compatible gloves are recommended. If a potential for skin contact exists, protective clothing should be worn.

[2] Note the specific solvent will be dictated by project-specific requirements.

4.0 QA/QC PROCEDURES

To insure that sampling equipment is cleaned properly, and does not lead to cross-contamination of samples, field rinsate blanks will be collected (if required by the applicable SAP). A rinsate blank will consist of pouring or pumping deionized organic-free water over the specific sampling device or through the device after it has been cleaned. The rinsate sample is performed in the field and generally one rinsate blank is collected each day of sampling or at a rate of 1 per 20 for each parameter, which ever is less, for each matrix being sampled or for each type of sampling instrument decontaminated and reused per day. The rinsate samples are analyzed for the specific parameters of concern (for each matrix). Rinsate blanks are not required if dedicated sampling equipment is used. Additional quality assurance samples may be collected if deemed necessary by project specific requirements. All project specific quality assurance sampling will be defined in the sampling and analysis plan (SAP) or QAPjP prior to initiation of the field work.

5.0 RECORDING REQUIREMENTS

The field team leader will maintain a record of the decontamination procedures.

6.0 REFERENCES

United States Environmental Protection Agency, January 1991. *Compendium of ERT Groundwater Sampling Procedures.* EPA/540/P-91/007. Washington D.C.

#106
FIELD LOG BOOK

#106 - FIELD LOG BOOK

1.0 SCOPE AND PURPOSE

This Standard Operating Procedure (SOP) presents procedures for proper documentation of site activities with respect to the daily field logbook and supplemental data collection sheets. Field logbooks are the primary source of documentation for site activities, and serve as legal record of all occurrences during those activities.

2.0 REQUIRED MATERIALS

The required materials for maintaining a field log book include a water-resistant, permanently bound *Rite in the Rain ALL-WEATHER ENVIRONMENTAL No. 550F notebook* (or equivalent) and a pen with permanent ink.

3.0 METHODOLOGIES

Pertinent information regarding the site and work procedures must be documented. Information recorded in the notebook should be noted with the date and time of entry. The following items are commonly included as logbook entries:

- Name and location of site;
- Date and time of arrival and departure;
- Name of person keeping log;
- Names and affiliations of project personnel;
- Sampling event description;
- Sampling methodology, sample numbers and volumes, description of samples, date and time of sample collection, and name of collector (Should be Referenced in the Field Log Book However, Field Data will be Recorded on Site Specific Data Sheets for inclusion in Monitoring Reports) ;
- Prevailing weather conditions;
- Out of Scope or Anomalous technical measurements and readings;
- Diagrams and sketches;
- Description of Equipment and Standard Calibration Solutions/Media used (Including Serial Numbers and Expiration Dates, Lot Numbers);
- List and descriptions of photographs; and,
- Equipment calibration information confirmation (Note that daily Calibration data for each individual piece of field equipment shall be documented on the Field Equipment Calibration Log Sheet for inclusion in Applicable Deliverables).

Information should be recorded in permanent ink for the legal record. The company name, address, and phone number should be entered at the beginning of the log book. The pages of the logbook should be numbered for ease of reference. Blank spaces should be single line striken, initialed and dated. All notes should be written at the time of observation. Changes or deletions should be single line striken, initialed and dated by the individual making the change. At the end of each field day, the holder shall place a single diagonal line through any unused lines and sign in full their name and date across the line. The Field Team Leader or designee is to sign and date the final entry page of each field crew members notebook for each day on which entries were made to verify the day's activities.

4.0 QA/QC PROCEDURES

At the end of each day of field activities, the individual or individuals maintaining the field log book should review the notes for accuracy and completeness. **Corrections or deletions are to be single line striken, initialed and dated.**

5.0 DATA RECORDING AND MANAGEMENT

All field books shall contain the holder's name and contact information located on the first page in the spaces provided.

It is essential that a running activity log be maintained, indicating the times of activities and observations; recorded data be written in the form of tables with an appropriate title; and that diagrams be included to illustrate pertinent information. Log books should be labeled with a unique and sequential number assigned to a single field team member. Each dated entry made should contain a project name, number, location and date on the appropriate lines provided at the top of each page.

6.0 REFERENCES

Environmental Research Center, University of Nevada - Las Vegas, March 1989, Soil Sampling Quality Assurance User's Guide, EPA/600/8-89/046.

Fetter, C. W., 1994, Applied Hydrogeology, Macmillan College Press Publishing Company, New York, New York, 691 p.

U.S. EPA, September 1986, RCRA Ground-Water Monitoring Technical Enforcement Guidance Document, OSWER-9950.1

#114
SAMPLE HANDLING, PRESERVATION, PACKAGING, AND SHIPPING

#114 - SAMPLE HANDLING, PRESERVATION, PACKAGING, AND SHIPPING

1.0 SCOPE AND PURPOSE

This Standard Operating Procedure (SOP) describes the procedures associated with the handling, preservation, packaging, and shipment of environmental samples for laboratory analysis or testing. Environmental samples may consist of air, groundwater, surface water, sediments, soil, non-aqueous phase liquid (NAPL), sludges and/or absorbent media (i.e. wipe samples, puff tubes) . The objective of sample preparation, handling, packaging, and shipping protocols is to develop standard procedures which will preserve the integrity of the samples and minimize the potential for sample tracking errors, sample spillage or leakage, and/or sample container breakage. The field team leader is responsible for the implementation of the sample handling, preservation, packaging, and shipping requirements outlined in the project-specific sampling and analysis plan (SAP).

2.0 REQUIRED MATERIALS

Required materials may include the following:

- Sample containers (preserved, as necessary);
- Sample bottle labels;
- Chain-of-Custody forms;
- Sample cooler;
- Bubble wrap or other suitable packing material;
- ice;
- Shipping bills (Federal Express, Airborne, etc.);
- Custody Seals;
- Packaging tape; and,
- Zip lock plastic bags.

3.0 METHODOLOGIES

3.1 Sample Handling

<u>Sample Containers</u>

Sample containers and appropriate preservatives (where necessary) will be supplied by the analytical laboratory. After the respective sample containers have been filled with appropriate sample media and preserved as necessary, samples will be properly identified using sample container labels, and the samples will be stored at an appropriate temperature (usually <4^{o}C) to preserve the integrity of the samples.

Sample Preservation

Preservatives will be supplied by the laboratory. Where possible, preserved containers should be supplied by the lab. Common preservatives include hydrochloric acid (HCl), sulfuric acid (H_2SO_4), nitric acid (HNO_3), or sodium hydroxide (NaOH). Samples will be preserved in accordance with EPA protocol specified in SW-846 or the project specific protocols outlined in the quality assurance project plan (QAPjP). Use of the preservatives will be noted on the COC for each particular sample and analytical parameter.

Sample Labels

Ssample labels will be supplied by the analytical laboratory and affixed to the sample container. Sample labels will be completed using waterproof permanent markers or ink. The labels will be filled out at the time of sample collection by the field sampling personnel. Following application of the completed bottle labels, clear packing tape will be used to seal each label to the appropriate bottle. The following identifying sample information will be included on the label:

- Client/Site;
- Sample identification alpha-numeric code;
- Sample collector's initials;
- Date and time (military) of sample collection;
- Preservative;
- Analytical method; and,
- Laboratory analysis to be performed.

Chain-of-Custody Forms

A chain-of-custody (COC) record will be established and maintained to document sample possession from the time of collection until receipt by the laboratory. Once samples are received by the laboratory, they will be handled under the laboratory internal COC procedures. Field sampling personnel will initiate a COC record by recording the following minimum data as the samples are collected:

- Client/Site;
- Name(s) of sampler(s);
- Sample identification alpha-numeric code;
- Date and time (military) of sample collection;
- Type of sample (e.g., soil, groundwater);
- Number of containers per sample location;
- Requested analyses;
- Type of containers and preservatives used;
- Name and address for the completed laboratory reports;

- Name and address for the laboratory invoices; and,
- Specific instructions/notes for the laboratory, as necessary.

Completed COC forms will be placed in waterproof plastic bags and taped to the underside of the cooler lids. Sample COC forms will generally be supplied by the subcontracting analytical laboratory.

Subsequently, at each change of possession, the COC record will be signed by the person relinquishing the samples and by the person receiving the samples. The date and time of the transfer of possession of the sample will be recorded on the COC form; this occurs when the samples are transferred from the sampling personnel to the courier and when the samples are received at the analytical laboratory. Sample COC forms shall be completed in ink. Any transcription errors shall be corrected by striking the erroneous information with a single horizontal line. The correct information will be added immediately adjacent to the strikeout. The sampler should initial and date the correction. (Refer to SOP #105 for additional information). All blank spaces are to be single line striken and a full signature of the executing crew member placed across the line and dated.

3.2 Sample Packaging and Shipping

All samples will be transported to the analytical laboratory in durable, waterproof, secured metal or plastic coolers. Sample coolers will generally be supplied by the laboratory. All samples will be packaged very carefully to prevent sample breakage. Samples will be shipped *via* overnight carrier (*e.g.*, Federal Express, Airborne, United Parcel Service) or hand delivered to the analytical laboratory, generally within 48 hours of collection. However, project specific protocols will be checked to assure that specified sample holding times are not exceeded in the event that samples are not shipped on the same day that they were collected. Additionally, the sample security and preservation must be maintained if samples are not to be transported immediately to the laboratory. The following procedure should be followed for packaging samples for shipment to the laboratory for testing and/or analysis.

1. Line the sample cooler with a cooler liner or clean heavy duty drum liner. Place plastic bubble wrap matting or suitable material over the base and bottom corners of each cooler or shipping container.

2. Obtain a chain-of-custody record (similar to the example shown in Figure 1) and enter all the appropriate information as discussed above. Chain-of-custody records will include complete information for each sample. One or more chain-of-custody records shall be completed for each cooler or shipping container as needed to manifest each sample.

3. Place bubble wrapping or other suitable material around glass bottles and enclose in a single Zip Lock bag. Place all bottles standing upright on the base of the cooler,

taking care to leave room for packing ice or equivalent. Rubber bands or tape may be used to secure wrapping completely around each sample bottle.

4. Place cold packs or ice in heavy duty "zip-lock" type plastic bags, **Ice is to be double bagged**, and distribute ice pillows down the center of the cooler as well as over the top of the samples. Add additional bubble wrap and/or Styrofoam pellets or other packing materials to fill the balance of the cooler or container.

5. If shipping the samples by express, courier, or delivery service, sign the chain-of-custody record thereby relinquishing custody of the samples. The date and time of custody transfer should be recorded on the chain-of-custody form. The custody transfer should be documented when directly transferring custody to a receiving party or when transmitting to a shipping service for subsequent receipt by the analytical laboratory. The shipping service should not be asked to sign chain-of-custody records.

6. Remove the last copy from the chain-of-custody record and retain with the field records. Place the original and remaining copies in a "zip-lock" type plastic bag and tape the bag to the underside of the lid of the cooler or shipping container.

7. Close the top or lid of the cooler or shipping container and with another person gently rotate the container to verify that the contents are packed so that they do not move. Improve the packaging if needed and reclose.

8. Packaging tape should be wrapped entirely around the sample shipping containers. A minimum of two full wraps of packaging tape will be placed in at least two places on the cooler or shipping container. Place a custody seal on the sample shipping containers. Sign and date the custody seal tape.

9. When transporting samples by automobile to the laboratory, and where periodic changes of ice are required, the cooler should only be temporarily closed so that reopening of the cooler can be easily performed. In these cases, chain-of-custody will be maintained by the person transporting the samples and chain-of-custody tape need not be used. If the cooler is to be left unattended, then chain-of-custody procedures should be implemented.

10. If shipment is required, transport the cooler to an overnight express package terminal or arrange for pickup. Obtain copies of all shipment records as provided by the shipping service.

11. Upon receipt of the samples, the analytical laboratory will open the cooler or shipping container and will sign "received by laboratory" on each chain-of-custody form. The laboratory will verify that the chain-of-custody tape has not

been broken previously and that the chain-of-custody tape number corresponds with the number on the chain-of-custody record. The analytical laboratory will then forward the back copy of the chain-of-custody record to the sample collector to indicate that sample transmittal is complete.

4.0 QUALITY CONTROL

Quality control samples such as rinsate blanks and duplicates will be specified by the project QAPjP. A sample jar containing water should be sent as a temperature blank with each sample shipment requiring temperature preservation to ensure proper temperature is maintained. Also, a trip blank, provided by the laboratory will accompany shipments with samples intended for volatile organic chemical (VOC) analysis. Note that each separate crew od samplers will be required to submit a Trip Blank specific to the wells that particular crew sampled each day. Trip Blanks should be numbered and details recorded in the field note book indicating which sample locations are associated with a particular Trip Blank.

5.0 DATA RECORDING/MANAGEMENT

The documentation for supporting the sample handling, preservation, packaging and shipping will consist of chain-of-custody records, shipping records laboratory reports. In addition, a description of sample packaging procedures will be written in the Field Log Book. All documentation will be retained in the project files.

6.0 REFERENCES

U.S. Environmental Protection Agency, 1986. *RCRA Groundwater Monitoring Technical Enforcement Guidance Document.* OSWER-9950.1. September 1986.

U.S. Environmental Protection Agency, 1986. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846 3rd Edition (with revisions).

U.S. Environmental Protection Agency, 1987. *A Compendium of Superfund Field Operations Methods, Part 1*. EPA/540/P-87/001. December 1987.

U.S. Environmental Protection Agency, 1991. *Compendium of ERT Groundwater Sampling Procedures.* EPA/540/P-91/007. January 1991.

#116
DEPTH TO GROUNDWATER AND NAPL MEASUREMENTS

116 - DEPTH TO GROUNDWATER AND NAPL MEASUREMENTS

1.0 SCOPE AND PURPOSE

This Standard Operating Procedure (SOP) describes procedures to be followed for determining groundwater level measurements as well as a description of the procedures to be followed for determining the depth to any non-aqueous phase liquid (NAPL) in monitoring wells, and the apparent thickness of the NAPL layers in monitoring wells.

Generally, water level measurements from boreholes, piezometers, or monitoring wells are used to construct potentiometric surface maps and product elevation maps. Product levels and thickness and water levels should generally be taken in a 24-hour period unless certain situations necessitate measurements be taken in shorter time intervals.

2.0 REQUIRED MATERIALS

The following list identifies the preferred types of materials to be used when measuring depth to water, depth to light NAPL (LNAPL), or depth to dense NAPL (DNAPL):

- Electronic water level meter for water level measurements only;
- Interface probe (suitable for groundwater, LNAPL and DNAPL measurements);
- Field Note Book and/or site specific gauging forms;
- Appropriate PPE (i.e. Nitrile gloves, safety glasses, hard hat, steel toed boots);
- Plastic bucket with sealable lid for containerizing decon fluids;
- Second plastic bucket outfitted with a liner for solid consumables;
- Decontamination solutions in dedicated squirt bottles; and,
- Paper towels.

3.0 METHODOLOGY

Depth to Groundwater Measurements

- Open the well and monitor the headspace with the appropriate monitoring instrument to determine the presence of volatile organic compounds if there is information to suggest that volatiles may be present at levels to warrant an upgrade in the level of PPE. This activity will be conducted at least once per year unless specified otherwise in specific site control documents. Head space screening data will be recorded on the appropriate site specific gauging data sheets.

- Locate the surveyed measuring point of the well. The surveyed measuring point location is typically the top of the inner well riser, and should be clearly marked in permanent ink on the well riser or identified in previous sample collection records. The measuring point location should be described in the Field Notes and should be the same point used for all subsequent measurements.

- To obtain a water level measurement, lower a decontaminated water level meter into the monitoring well. Care must be taken to assure that the water level measuring device hangs freely in the monitoring well and is not adhering to the wall of the casing. The water level measuring tape will be lowered into the well until the audible sound of the unit is detected or the light on an electronic sounder illuminates. At this time, the precise measurement should be determined (to the nearest 0.01') by repeatedly raising and lowering the tape to converge on the exact measurement. The water level measurement will then be entered in the Field Notes.

- The water level measuring device shall be decontaminated in accordance with SOP #104 immediately after use. Generally, only that portion of the measuring tape which penetrates the water table will require decontamination. If NAPL is encountered, use of a solvent (*e.g.*, acetone) will be required to clean the probe.

NAPL Measurements

NAPL measurements should be made using an interface probe. Interface probes are commonly used to detect the presence of any floating (LNAPL) or sinking (DNAPL) immiscible layers. These probes can also be used to measure the water levels inside wells.

- Using the grounding cable attached to the interface probe, ground the probe to a metal object (*i.e.*, protective steel locking well cover) to prevent electric shock.

- The probe should be lowered slowly inside each well. When LNAPL is detected, the probe will make a solid tone. Record the measurement from the surveyed point on the top of the well casing to the top of the LNAPL. Continue lowering the probe (observing the calibrated drop line) until the steady tone stops. When water is detected, the probe will emit an intermittent audible sound to signify the beginning of the water column. When the intermittent tone is heard, observe the calibrated drop line to determine the water level. Record this measurement. The measurement on the drop line between when the steady tone began (*i.e.*, LNAPL was encountered) and when it stopped (*i.e.*, groundwater was encountered) will determine the apparent thickness of the LNAPL layer.

- The depth to DNAPL can also be determined using the interface probe. Lower the probe through the water column to the bottom of the well. The probe will make a solid tone if a DNAPL is encountered. Record the depth to the top of the DNAPL layer, and the depth to the bottom of the well to determine the apparent thickness of the DNAPL layer.

- The NAPL measuring device should be thoroughly cleaned after each use in accordance with SOP #104. If NAPL is encountered, use of a solvent (*e.g.*, acetone) will be required to clean the probe.

4.0 QA/QC PROCEDURES

Quality control measures include repetitive measurements of the depth to water or NAPL to ensure that accurate and precise results are obtained. Once the measuring device indicates that the water level or NAPL layer has been encountered, the probe should be raised slightly and lowered several times to check and confirm the measurement. A single final reading should be recorded in the field notes or on the project specific form. Site specific gauging sheets contain the previous round of groundwater, NAPL and total depth measurements. Field crew members are to compare readings to assure structural integrity of the monitoring point as well as confirm the well identification. If readings are grossly (> 5%) different from the previous round of measurements, a second reading will be taken and recorded as such on the appropriate field data sheets and/or field log book.

Water levels in piezometers and monitoring wells should be allowed to stabilize for a minimum of 24 hours after well construction and development, prior to measurement. Note that various states have different requirements for the stabilization time required following well installation and development. Consult the Project Manager or Site Supervisor when newly installed wells are being gauged and/or sampled to confirm enough time has elapsed between installation/development and gauging activies. Also, measurements should always be taken from the least to the most contaminated wells while decontaminating the equipment between each well. Assure that you have been provided a current gauging an sample collection order during the Pre-job meeting prior to mobilization to the work site.

If water level data are to be used for groundwater flow direction determination, all measurements should be taken within the shortest time frame feasible.

5.0 DATA RECORDING OR MANAGEMENT

Proper field data collection and management is important. Data may either be entered into a bound field notebook or other form specified in a site-specific work plan. All erroneous data entries are to be single line striken, initialed and dated by the party making the correction in the field.

6.0 REFERENCES

United States Environmental Protection Agency, January 1991. *Compendium of ERT Groundwater Sampling Procedures.* EPA/540/P-91/007. Washington D.C.

United States Environmental Protection Agency, September 1986. *RCRA Groundwater Monitoring Technical Enforcement Guidance Document.* EPA/OSWER/9950.1. Washington D.C.

#122
MANAGEMENT OF
INVESTIGATION DERIVED WASTES

#122 - MANAGEMENT OF INVESTIGATION DERIVED WASTES

PURPOSE

This standard operating procedure (SOP) presents general guidelines for the management of investigation derived wastes (IDWs), such as, but not limited to the following:

- Drill cuttings generated during soil boring investigations or well installations;
- Drilling fluids generated during soil boring investigations or well installations;
- Groundwater generated during well development, monitoring well purging, aquifer testing (i.e., pumping tests), or remedial activities;
- Water and sediment generated during equipment decontamination;
- Used personal protective equipment; and,
- Miscellaneous debris (e.g., well construction materials generated through abandonment of monitoring wells).

Due to the wide range of materials which may be generated and the variety of situations which may arise, it is likely that these SOPs will need to be supplemented with project-specific procedures. Where project-specific procedures are necessary, they should be developed to be consistent with the general guidelines presented below. Determination of the need for and scope of the development of project-specific procedures, will be determined as part of the initial project planning.

CONTAINERIZATION

Project-specific requirements for containerization of waste materials will be developed during initial project planning. If applicable, this information may be presented in a project-specific waste management plan. Project-specific containerization requirements should be developed to be consistent with the general guidelines provided below.

1. All potentially impacted materials generated during any investigation or remedial activity must be containerized unless one of the exceptions described below under Item 10 apply. Unless directed otherwise by the client, containers (drums, frac tanks, roll-off boxes, etc.) are to be provided by the consultant or contractor.

2. All potentially impacted materials shall be placed in new or reconditioned 55-gallon (DOT-UN1A2) drums. All drums brought onsite must be clean and in sound condition, free of any rust, dents, holes, or other types of damage.

3. Various types of waste materials (e.g., soils, groundwater, PPE, etc.) must be containerized separately without exception. Additionally, dry and wet soils should be containerized separately, if feasible.

4. Materials generated from various plant process areas, which may require potentially different waste classifications, should be containerized separately. As an example, soils generated in the vicinity of a surface impoundment which managed sludge from the treatment of wastewater from wood treating operations that use creosote and/or pentachlorophenol (EPA Hazardous Waste K001) should be containerized separately from soils generated in a creosote drip track area (EPA Hazardous Waste F034). Likewise, materials generated at off-site locations should be managed separately from those generated on-site.

5. If possible, drums should be filled to approximately 90% capacity. As necessary, drums containing liquids should have enough freeboard to prevent rupture in the event of freezing.

6. Containers inside of containers are not permitted by waste management regulations. As a result, PPE must be placed directly into the drum. **Do not place PPE in a plastic bag and in turn place the plastic bag into a drum.** This constitutes a violation of waste management regulations. Similarly, all soil samples must be removed from jars or plastic bags and the jars crushed or plastic bags torn prior to being placed in a drum.

7. All lids and gaskets must be securely fastened prior to moving from one location to another. The consultant or subcontractor is responsible for transporting containers to an on-site temporary staging area as directed by the Facility Waste Management Director. Containers must be loaded, transported and unloaded in a safe manner.

8. The exterior of all containers must be thoroughly cleaned prior to staging. All mud, dirt or debris must be removed, with no exception. Waste management facilities will not accept containers which are visibly dirty on the outside.

9. Under no circumstances shall non-waste materials or general trash be placed in waste containers. The consultant/subcontractor should provide a dumpster for management of non-waste materials and general trash.

10. Under certain circumstances, the following exceptions to the above requirements may be made if provided by regulations and state/federal concurrence:

    a. Some regulatory agencies may allow for all or a portion of generated materials (i.e., auger cuttings, drilling fluids) to be placed back into or onto the ground from which they were generated. The consultant is responsible for identifying these requirements.

    b. If an operating water treatment facility exists on-site, groundwater and/or decontamination liquids may be managed into the treatment system if the discharge permit for the treatment facility provides for management of those liquids, and the liquids do not contain materials (e.g., solids or oils) which could potentially effect the operation of the system in an adverse manner. In this instance, consideration must be given to the classification and management of waste materials generated through the treatment of the liquid (e.g., spent activated carbon, filtered soils, etc.)

CONTAINER DESIGNATION AND LABELING

Project-specific requirements for container identification and labeling will be developed during initial project planning. If applicable, this information may be presented in a project-specific waste management plan. Project-specific container designation and labeling requirements should be developed to be consistent with the general guidelines provided below.

1. Each container will be assigned a unique designation. This designation should include a sequential number associated with each waste type, a code which identifies the type of waste (e.g., "S" for soil, "GW" for groundwater, etc.), and the date the material was placed in the container (e.g. 1-GW-12/12/98; 2-GW-12/12/98 etc...). The container designation must be clearly marked on the lid and the side of the container prior to transport to the temporary on-site staging area. The markings must be made in a manner such that the markings are legible, highly visible and permanent (i.e., weather resistant). A "Mean Streak®" grease pen or a paint stick is recommended for marking the container.

2. The appropriate waste classification label, as specified buy the site control documents, shall be affixed to the exterior side of the drum at a location at least two-thirds of the way up from the bottom of the container.

3. In the event the IDW waste stream has not yet be characterized, the Field team Leader will apply a "Contents Pending Analysis" label which will include information as specified in entry number 4 below.

4. The following information is to be recorded by field personnel in the field notebook and/pr on the IDW waste summary sheets, as appropriate.

   a. Container Designation;

   b. Contents (e.g., soil, groundwater, PPE);

   c. Date that the container was filled (i.e. start accumulation date);

   d. Location where the drums are staged;

   e. Location, and plant process area, where the material was generated (e.g., soil boring number, monitoring well designation);

f. Relative moisture content (e.g., dry, moist, damp, wet, saturated) for soils only, for the purpose of managing the materials for disposal, damp or moist soil are considered "liquid"; and ,

g. Approximate volume or percentage of the container filled.

CONTAINER STORAGE

Project-specific container storage requirements will be developed during the initial planning phase. If applicable, this information may be presented in a project-specific waste management plan. Project-specific container storage requirements should be developed to be consistent with the general guidelines provided below.

1. If the investigative or remedial work is conducted at active or inactive sites owned formerly by the consultant's client, plans for container storage must be developed in conjunction with the current property owner.

2. If containers are to be transported to an on-site staging area, all container handling and moving must be conducted in a safe manner. Contractors are responsible for providing the necessary equipment (e.g., front-end loader, fork lift with drum grappler, etc.) to provide for safe and efficient staging of containers.

3. All containers shall be stored in a neat and organized fashion with all labels clearly visible. Containers shall not be stacked.

4. Containers holding materials of different waste classifications should be staged together to facilitate loading of the materials onto transport vehicles.

5. To the extent practicable, all containers should be protected from the elements.

6. If stored outdoors in an area where precipitation could accumulate, all containers must be placed on pallets.

7. In accordance with DOT requirements, all containers must be rust-free and in sound condition for shipment.

8. Prior to demobilization, field personnel should conduct an inspection of the container storage area to ensure all containers are clearly marked, clean and staged in a neat and organized manner.

WASTE MATERIAL INVENTORY

FTS personnel are responsible for completing an inventory of waste materials stored at the project site. The inventory will be completed and submitted as part of the Field Trip Report.

Monthly the data is updated in the FTS waste management inventory located on the open share ORCA web site. The inventory will include a tabular summary of all containers stored at the project site and their respective contents as well as start accumulation dates for disposal planning and schedule.

WASTE MATERIAL SAMPLING AND ANALYSIS

Composite samples of the containerized materials for laboratory analysis may be collected for each IDW media. The results of the analysis may be used for waste profiling purposes required by the waste management facility and/or waste classification purposes. Project-specific requirements for waste sampling and analysis will be developed during initial project planning. If applicable, this information may be presented in a project-specific waste management plan. Project-specific waste material sampling and analysis requirements should be developed to be consistent with the standard procedures provided below. To the extent practicable, historical information, site-specific analytical data and knowledge of the waste composition should be utilized to minimize sampling and analysis requirements.

1. Specific details regarding the number and types of samples to be collected, required laboratory turn-around time, analytical parameters and analytical methods will be determined on a project-specific basis during the initial planning phase. If applicable, this information may be presented in a project-specific waste management plan.

2. At a minimum, samples must be collected and handled in accordance with standard industry protocols. If an approved project-specific Sampling and Analysis Plan or Quality Assurance Project Plan exists, then sample collection and handling procedures, as specified therein, must be followed.

3. All analyses must be performed using the appropriate analytical methods specified in EPA SW846 "Test Methods for the Evaluation of Solid Wastes".

4. The sampler must complete and maintain copies of all chain-of-custody documentation.

5. In accordance with Subpart CC or 40CFR Par 264/265 which became effective on December 6, 1996, hazardous wastes containing greater than 500 parts per million by weight total volatile organic compounds (VOCs), are subject to the emission control requirements of this rule. Determination of VOC content may be made through laboratory analyses or generator knowledge. Thus, analysis for VOCs will likely be required by the waste disposal facility for profiling purposes in the future. Analysis is to be performed using method 25D in 40CFR Part 60 Appendix A, or through the use of an approved alternate method. Knowledge-based waste determinations must be thoroughly documented.

6. Composite samples of similar waste classification of containerized materials will be profiled based on the characteristics presented in 40 CFR Part 261 Subpart C - Characteristics of Hazardous Wastes:

   - §261.21 - Characteristic of Ignitability.
   - §261.22 - Characteristic of Corrosivity.
   - §261.23 - Characteristic of Reactivity.
   - §26124 - Toxicity Characteristic.

TRANSPORTATION AND DISPOSAL

Transportation, disposal, and manifesting of IDW are the responsibility of the owner.

ATTACHMENT A

EXAMPLE WASTE INVENTORY SUMMARY

ATTACHMENT A

Field & Technical Services

FTS

IDW INVENTORY LOG

Date:

Project Name:

Project Number:

Location:

Container Identification Number	Type of IDW (SW, GW, NAPL, PPE, Other)	Start Accumulation Date	Date Filled	Comment / Label Description	Staging Location

#128
GROUNDWATER FIELD TESTING

SOP 128 - GROUNDWATER FIELD TESTING

1.0 SCOPE AND PURPOSE

This Standard Operating Procedure (SOP) identifies general calibration, measurement, and decontamination procedures for common field testing equipment, including pH, specific conductance meters, Dissolved Oxygen meters and thermometers. Defining the procedures that are to be consistently implemented will promote project quality assurance and control measures.

Because certain field parameters (*e.g.*, pH, temperature) are sensitive to climatic effects, field testing is performed on water collected from the first sample aliquot extracted for analysis following purging (generally, this aliquot is split between the volatile organic sample bottles and the field parameters) to ensure that representative measurements are obtained to the extent practicable. Evaluation of various parameters in the field, specifically pH, specific conductance, dissolved oxygen, temperature and turbidity, can be used as a preliminary means of identifying potentially impacted areas and to assess changes in water chemistry, which may occur during purging. Measurement of turbidity may be a means of evaluating the adequacy of well development.

The site specific sampling plan may require that measurements of pH, specific conductance, and temperature be reported during purging of the well until these parameters are consistent. This helps to ensure that water representative of conditions in the saturated zone are present in the well prior to sampling. The procedures that follow are generic and are likely modified in the site specific sampling and analysis plan based on the project-specific requirements, the equipment to be used, or the preference of the state or federal agency providing regulatory oversight. For groundwater quality meters being used to measure parameters in the field, all operations, calibration and trouble shooting should be consistent with the manufacturers recommendations.

2.0 REQUIRED MATERIALS

Equipment and materials necessary for completing groundwater field testing include, at a minimum, the following:

- Multi parameter groundwater quality meter (i.e. Oakton 10 series, YSI 556 or equivalent);
- Fresh calibration solutions and calibration log sheets;
- Clean, plastic sample container or flow through cell (of appropriate size and depth to accommodate the specific probes);
- Appropriate PPE (i.e. Nitrile gloves, safety glasses, hard hat, steel toed boot);
- Sealable buckets for containerizing decon fluids and spent PPE;
- Spare set of batteries for each piece of equipment;
- Stop watch;
- Graduated containers for measuring volumes of purge water removed;

- Permanent marker, packing tape, zip lock bags, garbage bags, chemical free paper towels;
- Water recovery device such as a bailer or pump;
- Appropriate tubing, rope, fittings to facilitate purging;
- Disposal or transfer containers for IDW (i.e. 55 gal DOT approved steel drums, plastic buckets with gasket equipped lids);
- Previous gauging and purging information for the wells to be sampled;
- Current HASP and applicable site control documents detailing sampling protocol;
- Squirt bottle and supply of deionized or distilled water and phosphate-free detergent;
- Field notebook and/or applicable site specific groundwater purging and sample collection data sheets; and

3.0 METHODOLOGIES

Unless otherwise directed by the site sampling and analysis plan, FTS personnel should follow the procedures indicated below.

3.1 Calibration

All field testing equipment will be calibrated in accordance with the equipment manufacturers recommendations. The date, time, personnel conducting the calibration, equipment model, serial number, readings, and necessary adjustments will be documented on the equipment calibration sheet.

The Compendium of Superfund Field Operations Methods (Compendium), U.S. Environmental Protection Agency, 1987, suggests recalibration at each well location; this suggestion may be employed on a site-specific basis. If there appears to be an equipment malfunction or if readings are other than expected, recalibration will be performed. If recalibration does not appear to bring the unit back to within historical ranges of monitored parameters, consult the manual for trouble shooting activities or contact the manufacturer for help diagnosing the malfunction. If the issue can not be resolved in the field, the unit will be tagged for repair and a replacement unit used for completing the event. All malfunctions will be documented in the field note book as well at the purge and sample collection sheet associated with the well at which the anomalous readings were noted.

- **Horiba** - The Horiba field meter, which simultaneously measures pH, specific conductance, turbidity, temperature, dissolved oxygen, and salinity, is calibrated using one prepared solution that is provided by the equipment rental company.

- **Oakton 10 Series –** The Oakton 10 Series multi parameter groundwater meter monitors for Temp, pH and Conductivity. The buffer solutions, one 4, 7 and 10 pH buffer solution will be used for calibration. The conductivity will be calibrated using a 1409µs buffer solution.

- **YSI 556 –** The YSI 556 is a multi parameter water quality meter that monitors temp, pH, conductivity, dissolved oxygen and oxygen reducing potential. The unit can be equiped with a probe guard for down hole and surface water applications or installed in a flow thru cell for Low Flow applications. The buffer solutions, one 4, 7 and 10 pH buffer solution will be used for calibration. The conductivity will be calibrated using a 1409µs buffer solution.

- **La Motte 2020 0r 2020e Turbidity Meter –** The LaMotte 2020 and 2020e turbidity meters monitor only turbidity of water samples. Both LaMotte units are calibrated using manufacture prepared calibration standards of 0, 1, and 10 NTU.

3.2 Measurement

If field parameter measurements are performed during well purging to evaluate the representativeness of the groundwater for sampling, the first testing is performed at the beginning of the initial volume removed from the well and subsequent testing is performed at completion of removal of the first, second, and third well volumes purged (in some cases, removal of four or five well volumes may be required by the sampling plan).

If field parameters have stabilized to within the prescribed variances as specified on the Groundwater Purging and Sample Collection log sheet after three well volumes have been removed (or the minimum required by the sampling plan), purging may be discontinued; if conditions have not stabilized, purging should be continued and the water quality evaluated at each additional well volume removed until the field parameters have stabilized or a total of five (5) well volumes has been purged. Turbidity is normally the last parameter to stabilize, it is permissible to allow a well to settle following purge if all other parameters have stabilized but turbidity readings are elevated. Sample collection should not exceed 24hrs from completion of purge.

The water to be tested should be placed in a clean, plastic container and readings obtained immediately in the following order:

- Temperature;
- pH;
- Specific conductance, and;
- Turbidity (separate glass vial for LaMotte meter).

Monitoring equipment must produce stable readings prior to recording a field measurement to insure data quality. All field parameter data is to be compared against historical data in the field during collection to assure consistency of data and/or to identify a malfunctioning piece of equipment which is producing erroneous data.

3.3 Decontamination

Between samples, the sampling probe on any multi parameter groundwater quality meter should be thoroughly rinsed with distilled, deionized water. The glass vial used for measuring turbidity with the LaMotte meter should also be rinsed between reading to prevent particulate carryover.

4.0 DATA RECORDING OR MANAGEMENT

Documentation of field measurement activities should be recorded in the project field notebook (SOP # 106). The field book should serve as the primary reference for field data and observations; recorded on site specific field forms.

All data should be recorded at the time of measurement. Information to be recorded should include, at a minimum, the following information:

- Project and site identification;
- Weather conditions;
- Date and personnel present and performing measurements;
- Listing of equipment, including name, model and serial numbers;
- Calibration procedures and results for each piece of equipment;
- Equipment malfunctions;
- Measurement results; and
- Any factors which may have an effect on the project and/or the measurements being collected.

#157
LOW-FLOW (MINIMAL DRAWDOWN) GROUNDWATER SAMPLING PROCEDURES

SOP #157 LOW-FLOW (MINIMAL DRAWDOWN) GROUNDWATER SAMPLING PROCEDURES

1.0 SCOPE AND PURPOSE

This standard operating procedure (SOP) provides guidelines for the collection of representative groundwater samples from monitoring wells. Groundwater samples are typically collected from monitoring wells for laboratory analysis to support the characterization of representative groundwater quality. Low-flow purging has the advantages of minimizing the turbidity and mixing between the overlying stagnant casing water and water within the screened interval. Low-flow refers to the velocity with which water enters the pump intake and that is imparted to the formation pore water in the immediate vicinity of the well screen. Water level drawdown provides the best indication of the stress imparted by a given flow-rate for a given hydrological situation. Typically, flow rates on the order of 0.1-0.5 liter/minute are used, however, these flow rates may be varied dependent upon site-specific hydrogeology.

2.0 REQUIRED MATERIALS

The following list identifies the types of equipment which may be used during groundwater sampling tasks. Project-specific equipment should be selected based upon project objectives, the depth of groundwater, purge volumes, analytical parameters, and well construction. The types of groundwater sampling equipment are as follows:

- Purging/Sample Collection Equipment

  - Low-flow (e.g., 0.1-0.5 liter/minute) pumps such as peristaltic pumps; bladder pumps, electrical submersible pumps, and gas-driven pumps;
  - Pumps are to be constructed of stainless steel or Teflon™;
  - (Note that bailers are inappropriate devices for low-flow sampling.)

Peristaltic pumps may be the lease desirable choice, and for some projects, may not be an option at all. Some regions have specific requirements regarding what type of pumps should be used for sampling of particular analytical parameters. For example, USEPA Region II does not allow the use of peristaltic pumps for collecting samples for analysis of organic parameters. For this reason, region-specific requirements regarding pump selection shall be specified in the project-specific work plan. Another consideration is the soft silicon tubing required for use with the peristaltic pump mechanism. There is potential that this tubing may react with more complex organic compounds.

- Related sampling and field measurement equipment will include some or all of the following:

- A multi-parameter measurement unit with in-line sampling capability such as a Horiba® U-10 or U-22;
- A photoionization detector (PID) to monitor for volatile organic constituents upon opening the monitoring well cap (the need for this instrument will be specified in the project specific work plan)
- An in-line dissolved oxygen meter;
- An in-line turbidity meter;
- An in-line filtration apparatus, 0.45 m or 0.1 m, if dissolved metals are a constituent of interest at the site;
- A water level meter; and,
- An interface probe, if light non-aqueous phase liquid (NAPL) or dense NAPL are potentially present on site (the need for this instrument will be specified in the project-specific work plan).

• General Equipment:

- Safety Glasses or equivalent eye protection;
- Distilled water and dispenser bottle;
- Decontamination solutions (such as Alconox and solvents);
- Field data sheets and log book;
- Sample preservation solutions;
- Sample containers;
- Buckets and intermediate containers;
- Coolers;
- Shipping labels;
- Permanent markers/pens;
- Packing tape;
- First aid kit;
- Key(s) for well locks; and,
- Stopwatch.

• Disposable Materials:

- Plastic sheeting/bags;
- Pump tubing;
- Gloves;
- Filters;
- Chemical-free paper towels; and,
- Protective coveralls (e.g., Tyvek), if necessary.

3.0 METHODOLOGIES

3.1 Pre-Sampling Considerations

Water samples should not be collected immediately following well development. Sufficient time should be allowed for the groundwater flow regime in the vicinity of the monitoring well to stabilize and to approach chemical equilibrium with the well construction materials. This lag time will depend on site conditions and method of installation. New Jersey protocols require a minimum lag time of two weeks. USEPA protocols recommend an evaluation of site conditions with a typical minimum time lag of one week. (Note: Project personnel shall review applicable regulatory guidelines regarding the required lag time on a project-specific basis).

Several preparatory activities need to be completed prior to actual sampling of each well. These preparatory activities can be summarized as follows:

- Log in sample bottles received from laboratory, prepare any deionized water or preservatives needed for the sampling;

- If necessary, prepare pumps with standard decontamination procedures;

- Don the necessary personnel protective equipment (PPE) stipulated in the Site health and safety plan (HASP);

- Measure static water level prior to well purging. Water levels may be measured to the nearest hundredth of a foot with an electronic probe from the established measuring point of the well casing. If water levels will be used to determine groundwater flow direction and/or hydraulic gradients, all measurements should be collected over as short a time period as possible. Water level measurements will be consistent with the procedures specified in FTS SOP #116, Depth to Groundwater Measurements.

- Unless specified otherwise in the project-specific Field Sampling Plan (FSP), well depth should be obtained from the well logs, rather than from measuring total depth, as this activity may disturb material that has settled to the bottom of the well and increase turbidity in samples. If it is necessary to measure total depth, or to measure dense non-aqueous phase liquid (DNAPL), perform these measurements after the sample has been collected.

3.2 Equipment Calibration

Prior to purging and sampling, all sampling devices and monitoring equipment should be calibrated according to manufacturer's recommendations and the site Quality Assurance Project Plan (QAPP) and FSP. Dissolved oxygen calibration must be corrected for local barometric pressure readings and elevation.

3.3 Well Purging

For low-flow, minimal drawdown sampling protocols, an in-line water quality measurement device such as a flow-through cell is used to establish the stabilization time on a well-specific basis for several indicator parameters, as follows:

- pH;
- specific conductance;
- dissolved oxygen;
- turbidity; and,
- Oxidation-Reduction Potential (ORP) (as required on a project-specific basis).

This differs from the general guideline used in conventional purging and sampling protocols that requires removal of a minimum of three casing volumes prior to sampling. Following are recommendations to be considered before, during, and after purging and sampling:

- establish a flow rate that maintains minimal drawdown in the well during both purging and sampling;
- maximize tubing wall thickness and minimize tubing length;
- place the sampling device intake at the middle or slightly above the middle of the screened interval, unless specified otherwise in the project-specific work plan
- For wells completed as open boreholes in bedrock, placement of the sampling device will be specified in the project-specific work plan;
- minimize disturbances of the stagnant water column above the screened interval during water level measurement and sampling device insertion;
- make proper adjustments to stabilize the flow rate as soon as possible;
- monitor water quality indicators during purging.

PUMP SELECTION

There are no unusual requirements for groundwater sampling devices when using low-flow, minimal drawdown techniques. The primary requirement is that the device give consistent results and minimal disturbance of the sample across a range of low flow rates (i.e., <0.5 liter/minute). Note that pumping rates that cause minimal to no drawdown in one well could easily cause significant drawdown in another well that has been installed in a less transmissive formation. Consistency in operation is critical to meet accuracy and precision goals.

There are several pumps which are used frequently for purging or sampling. These types include the peristaltic, bladder, and submersible pumps. It is desirable that the pump be easily adjustable and operates reliably at these lower flow rates. Gas-driven pumps should be of a type that does not allow the gas to be in direct contact with the sampled fluid. Bailers and other grab-type samplers are not suited for low-flow sampling and shall not be used.

Bladder Pumps

The bladder pump is a compressed air or gas-operated, positive displacement submersible well pump that uses inert compressed gas, e.g., nitrogen, to inflate an internal bladder which pumps water up the discharge line. These pumps are used when large volumes of water must be purged from monitoring wells or when water depths exceed the limits of a peristaltic pump. Usually these pumps are used on wells with diameters of 2 inches or greater and wells with depths up to 150 feet. When economically feasible the bladder pumps will be dedicated to each well. The line assembly is dedicated for use on one well only. After use, the tubing is wrapped, marked, and stored for future use in the well to which it is dedicated.

The following procedures should be followed for using the bladder pump:

1. Connect the line assembly to the pump by first attaching the cable and then connecting the sample and gas lines.

2. Lower the pump down the well by unrolling the line off the spool until the pump is located at the desired position inside the well.

3. Secure the cable to hold the pump at the desired depth.

4. Connect the gas line to the control box. The discharge line should be connected to the water quality meter or flow-through cell, with cell discharge line placed into a container (e.g., 5-gallon bucket or 55-gallon drum) to collect the purged water.

5. Connect the gas supply to the control box and adjust the pressure according to the manufacturer's manual.

6. As noted, the tubing is used on one well only; after each sampling event it is packed, sealed, and stored for future use on that well.

Submersible Pumps

When wells are encountered which require excessive lift (depth to water is greater than 20 feet) or have diameters greater than 2 inches, positive displacement submersible pumps may also be used to purge the required amount of water. When economically feasible, the submersible pumps will be dedicated to each well. However, in some cases, this is not economically feasible, and the same pump must be used in several wells. When this must be done, the pumps will be appropriately decontaminated between wells. Also, a pump will be used on wells known to contain similar constituent levels, or used first in wells with lower constituent levels before use in wells suspected to contain higher constituent concentrations.

1. The submersible pump should be lowered to the desired depth using a safety line that is secured to the well casing.

2. Connect the power cord to the power source (generator) and turn on the pump.

3. Connect the discharge line to the water quality meter or flow-through cell, with cell discharge line placed into a container (e.g., 5-gallon bucket or 55-gallon drum) to collect the purged water.

4. Continue to monitor the pumping rate and water level in the well, slowing the rate if drawdown occurs.

Peristaltic Pumps

Peristaltic pumps must be operated above ground next to the well and are limited to water level depths of 20 to 30 feet below ground surface. The following procedure describes the use of peristaltic pumps for purging and sample collection.

1. New Nalgene or low density polyethylene (LDPE) suction line is used on each well being purged. New silicone pump head tubing will also be used if the pump is also used for sampling.

2. The type of tubing used to collect the sample will be contingent on the parameters of interest.

   - If conventional parameters (i.e., biological oxygen demand [BOD], total suspended solids [TSS], fecal coliform, pH, and oil and grease) are being analyzed, then standard Nalgene tubing is sufficient to collect the sample.

   - If volatile, semi-volatile, or metals parameters are the constituents of interest, Teflon™ tubing is used to collect the sample.

3. Unless authorized otherwise, all purged groundwater is collected, containerized, and when possible, managed in an onsite treatment system. All tubing is discarded after each use or dedicated to future use within the same well.

Unless authorized otherwise, all purged groundwater is collected, containerized, and when possible, managed in an onsite treatment system.

3.4 Monitoring or Water Level and Water Quality Indicator Parameters

Performance criteria for determining stabilization should be based on water-level drawdown, pumping rate, and equipment specifications for measuring indicator parameters. Check the water level periodically during purging and sampling to monitor drawdown in the well as a guide to flow rate adjustment. The goal is minimal drawdown (<0.1 meter) during purging. This goal may not be possible to achieve under some circumstances and may require adjustment based on site-specific conditions and personal experience.

In-line water quality indicator parameters should be continuously monitored during purging, as follows:

- temperature;
- pH;
- ORP;
- conductivity,
- dissolved oxygen; and,
- turbidity.

Measurements should be taken every three to five minutes. Stabilization is achieved after all parameters have stabilized for three successive readings. The three successive reading should be within the following guidelines to indicate stabilization:

- ± 10% for temperature;
- ± 0.2 s.u. for pH;
- ± 3% for conductivity;
- ± 10 mv for ORP;
- ± 10% for turbidity; and,
- ± 10% for dissolved oxygen.

Note that these are guidelines only; for example, in those instances where the field parameters measure at very low quantities, even minor fluctuations can exceed the guidelines, even though stabilization has been achieved. In these instances, the field technician must use professional judgment to determine that parameter stabilization has been achieved.

Parameters will typically stabilize in the following order: pH, temperature, and specific conductance, followed by ORP, dissolved oxygen, and turbidity. If parameter stabilization criteria are too stringent, then minor oscillations in indicator parameters may cause purging operations to become unnecessarily protracted. It should also be noted that turbidity is a very conservative parameter in terms of stabilization and is normally the last parameter to stabilize. Excessive purge times are invariably related to the establishment of too stringent turbidity stabilization criteria. Note that natural turbidity levels in groundwater may exceed 10 nephelometric units (NTU). Pumping rate, drawdown, and the time or volume required to obtain stabilization of parameter readings can be used as a future guide to purge the well.

3.5 Groundwater Sampling

Once parameters have stabilized, begin sample collection as soon as possible. Disconnect or bypass the in-line monitoring device that was used to measure field parameters prior to sample collection. The sampling flow rate should remain at the established purge rate or may be adjusted slightly to minimize aeration, bubble formation, turbulent filling of sample bottles, or loss of volatiles due to extended residence time in tubing. Typically, flow rates <0.5 liters/minute are appropriate. The same device used for purging should be used for sampling. Samples will be collected in decreasing order of their volatility. This order is generally as follows:

- Volatile organic chemicals (VOCs);
- Total organic halogens (TOX);
- Gas sensitive parameters (e.g., Fe2+, CH4, H2S/HS-, alkalinity);
- Total organic carbon (TOC);
- Semivolatile organics chemicals (SVOCs);
- Inorganic parameters; and,
- If filtered samples are to be collected, these should be collected last.

Samples collected for volatile organics should be carefully placed into 40 milliliter glass vials with Teflon septum lids. No air bubbles should be present in the vial after sealing the septum lid; if air bubbles are present, fill the vial more completely. Other common laboratory-provided sample bottles include polyethylene or clear glass for metals and amber glass for phenols and SVOCs.

If the FSP or QAPP specifies dissolved metals analysis, field filtration of each sample will be necessary. Filtering is performed using an in-line filtration device, hand vacuum pumps with transfer vessels, or peristaltic pumps with disposable funnels/filters. If using the vacuum pump method, a laboratory cleaned transfer vessel is used. If using a peristaltic pump, new silicone tubing is used in the pump head for each sample filtered and new Teflon tubing is used from the pump head to the filter. Samples are filtered through 0.45 micron filter unless specified otherwise in the FSP. After filtering, samples requiring preservatives are preserved and all containers are securely placed in coolers and chilled to an appropriate temperature (usually < 4oC). Each cooler containing samples will contain a completed chain-of-custody form.

Sampling technicians should wear a clean pair of disposable gloves for each well.

4.0 QA/QC PROCEDURES

Quality control requirements depend upon project-specific circumstances and objectives and should be addressed in the QAPP or FSP.

5.0 DATA RECORDING AND MANAGEMENT

A written record of each monitoring event must be maintained. The record provides a summary of the sample collection procedures and conditions, shipment method, the analyses requested and the custody history. This record consists of the following:

- Field notebook;
- Groundwater Sample Collection Form;
- Chain of custody form; and,
- Shipping receipts.

Sample labels shall be completed at the time each sample is collected and will include the information listed below.

- Project name;
- Sample number;
- Time and date;
- Preservative (if applicable);
- Analyses to be performed; and,
- Sampler's name.

6.0 REFERENCES

U.S. EPA, Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures, by Robert W. Puls and Michael J. Barcelona, EPA/540/S-95/504, April 1996.

U.S. EPA, Region II, Ground Water Sampling Procedure - Low Flow Pump Purging and Sampling.

WESTBAY MULTI-PORT SYSTEM SAMPLING
AND
DECONTAMINATION PROCEDURES

WESTBAY MULTI-PORT SYSTEM SAMPLING AND DECONTAMINATION PROCEDURES

The Westbay Multi-Port System (Westbay System) is a multi-level sampling system that allow discrete groundwater samples to be collected from multiple intervals within a single monitoring well. Each interval is isolated with the use of packers to seal the well annulus between the monitoring zones. Each monitoring interval contains a measurement port and a pumping port. Sampling should be performed by a qualified individual trained in the operation of the Westbay System.

1.0 Westbay System Sampling Procedures

1.1 The sampling procedures outlined in this section are the same for each monitoring zone in every well. Within each monitoring interval, a measurement port is installed as part of the MP System. The measurement ports incorporate a valve in the wall of the coupling, with an alignment notch on the opposite, inside wall of the coupling.

1.2 The Westbay sampling probe (currently the MOSDAX Sampler Probe Model 2531), the Westbay MOSDAX Automated Groundwater Interface (MAGI), Westbay sample bottles, and laboratory supplied sample bottles are required to perform the sampling.

1.3 Review Westbay's as-built well diagrams to determine the depths of each monitoring zone and associated measurement ports for the well being sampled.

1.4 Assemble the tripod and wireline cable reel above the well, and attach the evacuation port coupling to the top of the MP System. Designate a location with a clean stable surface for handling the sample bottle string such that the bottles do not come in contact with the ground surface.

1.5 Using new disposable gloves, assemble the sample bottles (maximum of 4) using the wrenches provided in the Westbay kit to snug the connections between the sample bottles and the connector tubing. Confirm that the o-rings on the connector tubing are present and intact. Replace o-rings if necessary. Using the valve tool, close the valve on the bottom sampling tube, and open the valves between each bottle.

APPENDIX A: STANDARD OPERATING PROCEDURES

1.6 The sample bottles can now be attached to the sampling probe. The MAGI also needs to be connected to the sampling probe. Lastly, attach the MAGI to the battery source by clipping the red lead to the positive battery terminal and the black lead to the negative battery terminal. NOTE: It is important to connect the sampling probe to the MAGI prior to connecting the MAGI to the power source to avoid the potential for an electric shock to the sampling technician or an electrical surge to the MAGI.

1.7 The sampling probe and bottles are now ready to be placed in the monitoring well. Ensure the cable reel brake is on, and there is adequate slack in the wireline cable to maneuver the sampling train into the monitoring well without kinking the cable. Using the MAGI, activate the location arm on the sampling probe so it is in the extended position (the MAGI display should indicate 15 to 16 revolutions). Carefully lift the sampling train into the monitoring well, paying special attention to the connection between the wireline and sampling probe so as not to kink the wireline. Lower the sample bottles and probe until the location arm is firmly seated in the alignment notch of the evacuation collar.

1.8 Remove the slack from the wireline cable, and zero the reel counter.

1.9 With the sampling probe seated in the evacuation collar, the following Westbay surface function checks must be performed and recorded on the groundwater sampling form:

- Record the ambient pressure indicted by the MAGI. This pressure reading is required once per well, unless the well is being sampled over multiple days, in which case the ambient pressure should be recorded at the start of sampling on subsequent days.
- Activate the shoe. The shoe should extend and the MAGI display should indicate 16 to 19 revolutions (23 revolutions in open air outside of the evacuation collar).
- Close the sampler valve. The motor should run for approximately 5 seconds, and the MAGI display will indicate 1 revolution.
- Attach the vacuum pump to the fitting on the vacuum coupling. Note the pressure reading on the MAGI. Begin applying a vacuum with the vacuum pump. The MAGI display should maintain a constant pressure. If the pressure reading begins decreasing, inspect for leaks at the face seal of the probe, the connection to the pump, and the connection at the probe sampling valve. Repeat procedure as necessary to ensure seals and connections are secure.
- Open the sampler valve.

- Use the vacuum pump to apply a vacuum to the sample bottles. The vacuum should be applied until the pressure inside the sample bottles is below 4 pounds per square inch (psi) as displayed on the MAGI.
- Close the sampler valve. A vacuum has now been applied to the sample bottles.
- Retract the shoe.
- Confirm the cable reel brake is on and the reel counter has been zeroed. Retract the location arm.

1.10 The sampling probe and bottles can then be lowered into the MP System well. The sampling train should be lowered to the approximate sample depth, until the MAGI beeps indicating the sampling probe has reached the magnetic reference installed on the MP System (note that the beep system is not always reliable, so the depth readings show be monitored). Raise the sampling probe approximately 3 feet to ensure the sampling probe location arm is above the measurement port.

1.11 The location arm should then be activated, and the sampling probe and bottles can be lowered until the location arm is secured in the measurement port alignment notch. The depth on the wireline reel counter should be checked against the Westbay System as-built well diagram to verify the sample probe and bottles are at the correct measurement port.

1.12 When the sample probe and bottles are located at the correct measurement port, the following steps are required, including recording data on the groundwater sampling form:

- Tighten the brake on the cable reel.
- Record the pressure reading inside the casing as displayed on the MAGI.
- Activate the shoe, noting that a pressure change on the MAGI display should occur indicating a connection with the formation when the shoe is fully extended.
- Record the pressure reading of the formation as displayed on the MAGI.
- Open the sampler valve. NOTE: the pressure displayed on the MAGI will jump to a significantly lower reading due to the vacuum applied to the sample bottles. The pressure will then begin to climb as the sample bottles are filled with groundwater.
- Allow the sample bottles to fill with groundwater until the pressure displayed on the MAGI is the same as the formation pressure noted prior to opening the sampler valve. NOTE: The Westbay MOSDAX Sampler Probe Model 2531 pressure transducer has a reported accuracy of ± 0.25 %.

- Close the sampler valve.
- Retract the shoe.
- Record the pressure reading inside the casing as displayed on the MAGI. The pressure reading should be similar to the original casing pressure recorded prior to activating the shoe.
- Ensure there is no slack in the wireline cable, and the cable reel brake is applied. Retract the location arm, and retrieve the sample probe and bottles.

1.13 When the sampling probe reaches the top of the MP System, activate the location arm and seat the probe in the alignment notch of the evacuation coupling. Provide adequate slack in the cable so the probe will reach the designated bottle handling area without kinking the cable.

1.14 Paying special attention not to kink the wireline cable at the connection to the sampling probe, remove the sample probe and bottles from the monitoring well and lay out the unit on a split PVC casing or other clean, level surface.

1.15 Close each of the valves connecting the sample bottles. Each of the bottles can then be separated from the sampling train.

1.16 The sample bottles can then be used to fill laboratory-prepared sample containers. Hold the sample bottle vertically over the laboratory sample container, with the top of the bottle pointed away from the sampler's face. Slowly open the top valve to release the pressure from within the bottle. Close the top valve once the pressure has been released. The bottom valve can then be opened and the groundwater can be directed into the laboratory container.

1.17 Ice should be present during each sampling event, and samples are to be placed in a cooler with ice immediately after the samples are transferred from the Westbay bottles to the laboratory supplied bottles. In the event a laboratory bottle is only partially filled with the sample collected on a particular run, the laboratory bottle should be closed and placed in a cooler with ice until subsequent runs with the Westbay sampling probe and bottles are performed to complete the sample collection.

1.18 In the event multiple runs with the Westbay sampling probe and bottles are required to collect the full sample volume from a particular monitoring zone, the Westbay sampling equipment does not need to be decontaminated between runs. Each run with the sampling probe and bottles should be recorded and performed as described above in Sections 1.6 and 1.9.

1.19 Each sample will be appropriately labeled, logged on the chain-of-custody, and packaged in a cooler with ice for delivery to the laboratory.

2.0 Westbay Sampling Probe and Bottles Decontamination Procedures

2.1 The Westbay sampling probe and bottles must be decontaminated prior to moving between each monitoring zone (but not for multiple use within a single zone). Before disconnecting the sampling probe and bottles from the MAGI, activate the shoe so it is extended out from the sampling probe and open the sampling port valve. The decontamination process includes the following:

- The equipment decontamination wash solution will consist of Liquinox (or equivalent) and store-bought distilled water. The equipment rinse solution will consist of store-bought distilled water. The wash and rinse process can be performed in clean 5-gallon plastic buckets.
- Ensure that all the valves between sample bottles are open. Separate the sample bottles from their end caps (valves and connection lines between sample bottles).
- Wash the Westbay sample bottles in the wash solution by using a brush to scrub the inside and outside of the sample bottle. The bottle should then be rinsed by pouring distilled water over the outside and through the inside of the sample bottle.
- Disconnect the sample bottle end caps (valves) from the connection lines. Swirl the end caps in the wash solution and use a dedicated wash squirt bottle to direct a spray of wash solution through the valve. Rinse with distilled water, including using a dedicated rinse squirt bottle to rinse the valve.
- Use a dedicated wash squirt bottle to direct a spray of wash solution through the connector line. Use a dedicated rinse squirt bottle to rinse the connector lines with distilled water. Inspect o-rings for damage or wear, and replace if necessary.
- The sampling probe should NOT be completely submerged in the wash solution. A scrub brush saturated in the wash solution may be used to scrub the exterior of the probe. The sample tool must be disconnected from the MAGI prior to cleaning. To clean the sample tool, use the dedicated wash squirt bottle to direct a spray of wash

solution through the sampling port of the extended shoe. The wash solution will run through the inside of the tool, and exit through the bottom of the sampling probe. Use the dedicated rinse squirt bottle to rinse the sampling probe with distilled water by directing a spray of distilled water through the sampling port of the extended shoe. Finally, rinse the exterior of the sampling probe with distilled water. Visually inspect the sampling port o-ring (seal) for damage or wear and replace as necessary to ensure a seal between the sample tool and sample port.

2.2 Following decontamination, the Westbay sampling probe and bottles should be either returned to the storage container, or assembled for additional sampling on a split PVC casing or other clean, level surface.

2.3 Reference the Westbay Operations Manual for complete instructions on care, storage, and use of the sampling probe and bottles. Among the details noted in the manual, it is extremely important that the sampling probe is NOT exposed to below freezing temperatures or the pressure transducer could be damaged.

Field & Technical Services, LLC
200 Third Avenue
Carnegie, Pennsylvania 15106
Tel. (412) 429-2694
Fax (412) 279-4332

GeoTrans, Inc.
363 Centennial Parkway
Louisville, Colorado 80027
Tel. (303) 665-4390
Fax (303) 665-4391