Quality Assurance – Sampling and Analysis Plan
Quality Analytical Services
1633 Marsh Avenue
Blue Summit, Missouri

EPA ID Number MOD073027609

Aquaterra Project Number 2641.11
January 2010

Prepared For:

Quality Analytical Services
c/o RDD Family Office LLC
6240 West 135th Street, Suite 150
Overland Park, Kansas 66223

AQUATERRA

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.

January 21, 2010

Mr. Charles Wetzler
Quality Analytical Services
c/o RDD Family Office LLC
6240 West 135th Street, Suite 150
Overland Park, KS 66223

Re: Quality Assurance – Sampling and Analysis Plan
Quality Analytical Services, Blue Summit, Missouri
EPA ID Number MOD073027609
Aquaterra Project Number 2641.11

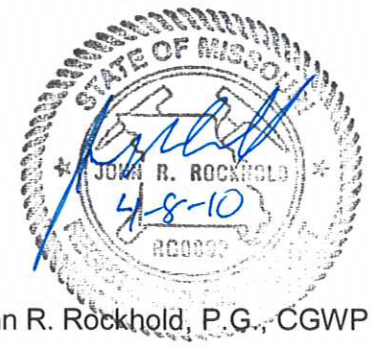
Dear Mr. Wetzler:

Aquaterra Environmental Solutions, Inc. (Aquaterra) has prepared this Quality Assurance – Sampling and Analysis Plan (QA-SAP) for the Quality Analytical Services (QAS) site in Blue Summit, Missouri. This plan is intended to combine, update, and replace the groundwater monitoring specifications currently detailed in Appendix A of the June 2002 Post-Closure Plan (Deffenbaugh Industries, Inc.) and April 2006 Final Quality Assurance Project Plan (QAPP, Shaw Environmental). This plan also incorporates Missouri Department of Natural Resources (MDNR) and Environmental Protection Agency (EPA) comments from their reviews of the October 2008 draft QA-SAP, as presented in their May 15, 2009 letter, the June 2009 draft QA-SAP, as presented in their September 2, 2009 letter, and the September 2009 draft QA-SAP, as presented in a letter from EPA received via email on December 16, 2009. If you have any questions or comments regarding the QA-SAP, please do not hesitate to contact our office at (913) 681-0030.

Sincerely,
Aquaterra Environmental Solutions, Inc.

Susan L. McCart

Susan L. McCart, P.E. P.G.
Senior Project Manager



John R. Rockhold, P.G., CGWP
Senior Project Manager/Quality Review

SIGNATURE PAGE

Aquaterra Environmental Solutions, Inc. has prepared this Quality Assurance – Sampling and Analysis Plan (QA-SAP) for the Quality Analytical Services (QAS) facility located at 1633 Marsh Avenue in Blue Summit, Missouri.

Prepared By:

Susan L. McCart

Susan L. McCart, P.E.
Aquaterra Environmental Solutions, Inc.

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RCRA Project Manager, USEPA Region VII

Diane Harris
QA/QC Officer, USEPA Region VII

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QUALITY ASSURANCE – SAMPLING AND ANALYSIS PLAN
Quality Analytical Services
1633 Marsh Avenue
Blue Summit, Missouri

EPA ID Number MOD073027609
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1.0 INTRODUCTION

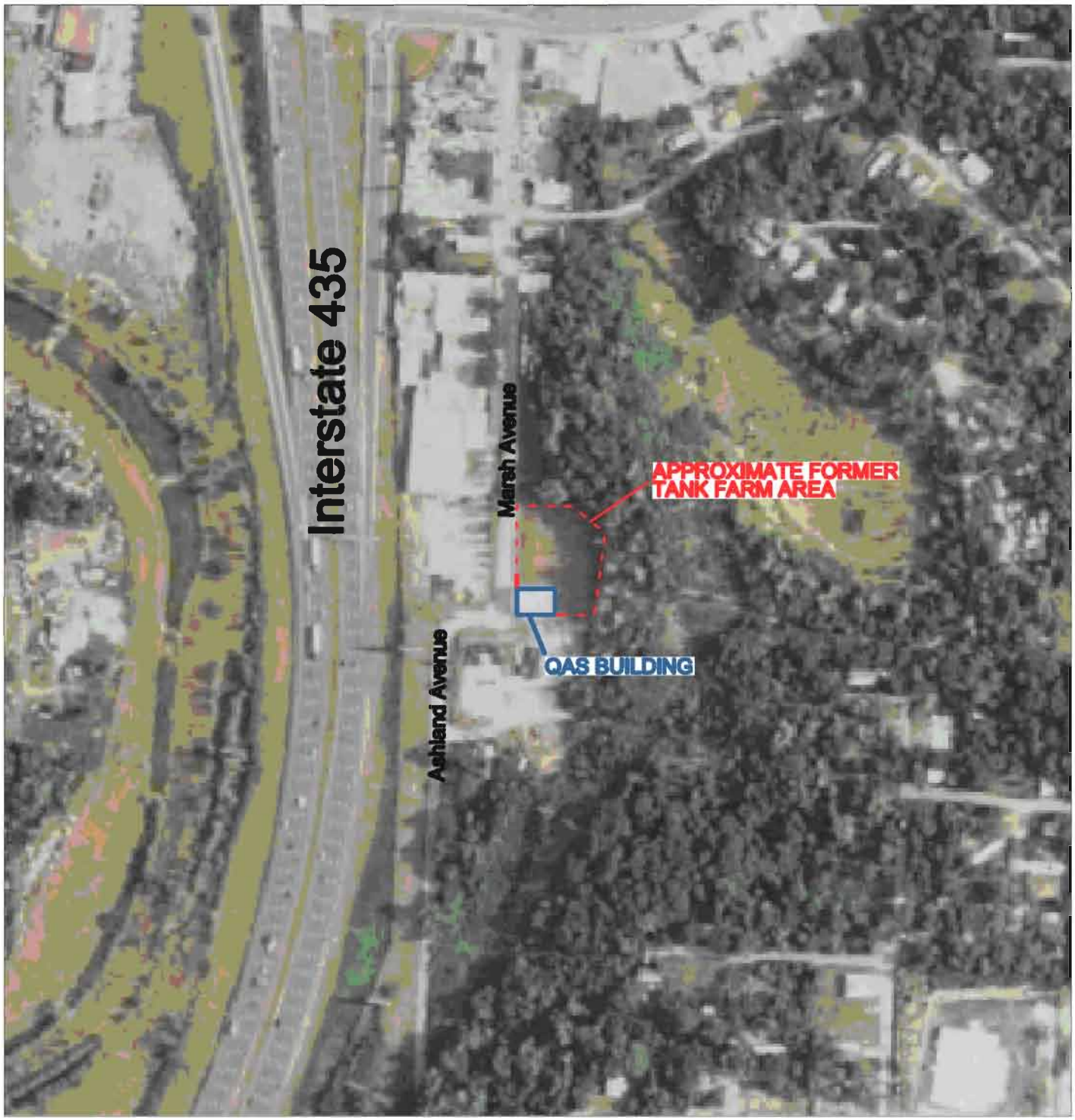
Quality Analytical Services (QAS) is a closed Resource Conservation and Recovery Act (RCRA) treatment, storage, and disposal (TSD) facility located in western Jackson County, near Kansas City, Missouri. Groundwater monitoring requirements are specified in Missouri Department of Natural Resources (MDNR) regulations 10 CSR 25-7.265, and federal regulations 40 CFR §264.117. This document presents the groundwater monitoring plan for the QAS facility and is consistent with both the MDNR Hazardous Waste Program and the United States Environmental Protection Agency Region 7 (EPA) requirements.

1.1 Site Location and Background Information

The QAS site is located at 1633 Marsh Avenue in Blue Summit, Missouri, just southeast of Highway I-435 and Truman Road in western Jackson County. The legal description of the facility is the southeast quarter of Section 6, Township 49 North, Range 32 West, Independence, Jackson County, Missouri. A general site map is presented as Figure 1.

The QAS facility collected and processed waste oils from 1958 through 1996. During 1998, site closure activities occurred, including the decontamination, dismantling, and proper disposal of above-ground waste oil storage tanks from the former tank farm area and associated waste oil processing equipment. During 2000, impacted soil and concrete were excavated and disposed of from beneath the former tank farm area. The excavated area was backfilled, and a geosynthetic cap, groundwater interceptor trench, and remediation system were installed. The site was certified closed in January 2002; however remediation activities continue at the site.

This Quality Assurance – Sampling and Analysis Plan (QA-SAP) is intended to update, combine, and replace the groundwater monitoring specifications currently detailed in Appendix A of the June 2002 Post-Closure Plan (Deffenbaugh Industries, Inc.) and April 2006 Final Quality Assurance Project Plan (QAPP, Shaw Environmental). The current monitoring system consists of 24 monitoring wells and four extraction wells. The well locations are shown on Figure 2. Additionally, groundwater samples are collected from the interceptor trench and the system effluent as part of the groundwater monitoring program.



AERIAL SOURCE: NAIP (2006)

300 0 300 600

SCALE FEET

AQUATERRA
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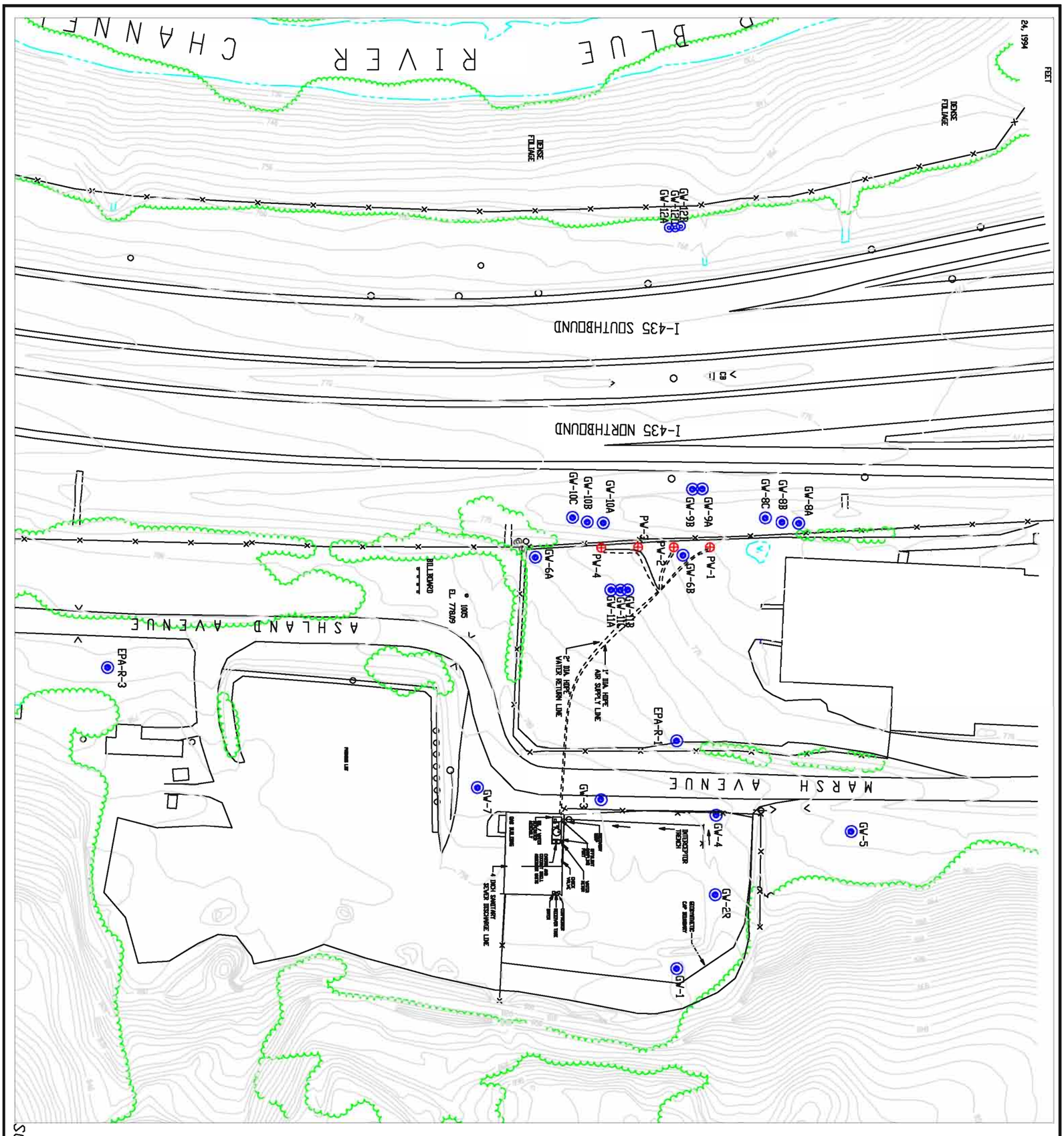
FIGURE 1 – GENERAL SITE LOCATION MAP
QUALITY ANALYTICAL SERVICES
1633 MARSH AVENUE
KANSAS CITY, MISSOURI

Project Mgr.	Drawn By	Designed By	Project No.
SLM	LAM	LAM	2641.10
Scale	**Date**	**File Name**	**Drawing No.**
AS SHOWN	8/22/08	2641.10_FIG1.dwg	1



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90 0 90 180

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LEGEND

⊕ EXTRACTION WELLS

◎ MONITORING WELLS

FIGURE 2 – SITE BASE MAP

REV:	DRAWING NUMBER:	PROJECT NUMBER:
0	2	2641.10

CLIENT: QUALITY ANALYTICAL SERVICES
1633 MARSH AVENUE
KANSAS CITY, MISSOURI

DRAWN BY: LAM | DESIGNED BY: LAM | PROJECT MGR: SLM

ELECTRONIC FILE NAME: 2641.10_FIGURE 2.DWG | DATE: 8/22/08

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Overland Park, Kansas 66213

REV.	DATE	BY	DESCRIPTION
R5	–	5BY	–
R4	–	4BY	–
R3	–	3BY	–
R2	–	2BY	–
R1	–	1BY	–
R0	–	0BY	–

1.2 Project Management/Responsible Parties

While all personnel involved in an investigation and in the generation of data are implicitly a part of the overall project and quality assurance program, certain individuals have specifically delegated responsibilities. For the groundwater monitoring program at the QAS facility, these are the Project Manager, Quality Assurance Manager, and Project Geologists/Technicians. In addition to the responsibilities listed below, these individuals will play a significant role in the development of the Semi-Annual and Annual Groundwater Monitoring Reports, under the supervision of a Missouri-licensed geologist.

1.2.1 Project Manager

The Project Manager is an experienced manager and technical professional who provides quality assurance review, coordinates the various project tasks, and maintains day-to-day regulatory contact. It is a major responsibility of the Project Manager to ensure that all personnel have a good understanding of the project quality assurance plan, an understanding of their respective roles relative to one another, and an appreciation of the importance of the roles to the overall success of the program.

1.2.2 Quality Assurance Manager

The Quality Assurance Manager's responsibilities include reviewing project plans and recommending revisions to the plans to ensure proper quality assurance is maintained. The Quality Assurance Manager is also responsible for final data quality review.

1.2.3 Project Geologists and Technicians

All tasks required by the groundwater monitoring activities will be conducted by experienced environmental geologists and technicians. Their responsibilities will include the documentation of the proper monitoring protocols, sample collection, equipment decontamination, and chain-of-custody documentation. Technical personnel are required to successfully complete site safety courses in accordance with 29 CFR 1910.120. Staff are also expected to be trained on sampling for hazardous materials as well as read and be familiar with applicable procedures and this QA-SAP prior to performing site activities.

1.2.4 Laboratory Organization and Responsibilities

The laboratory organization is designed to facilitate information exchange between the laboratory and the project manager. Information exchange specifically includes: sample identification, preservation procedures, sample container requirements, decontamination materials, and sample labeling, packing, holding times and shipping. Roles and responsibilities for laboratory personnel are located in the laboratory's specific Quality

Assurance Manual (QAM). The QAM defines the overall policies, organization objectives and functional responsibilities for achieving the laboratory's data quality goals. The laboratory's Quality Assurance Program (QAP) ensures that data produced conforms to the standards set by state and/or federal regulations. The program functions at the management level through company goals and management policies, and at the analytical level through Standard Operating Procedures (SOPs) and quality control. The laboratory's QAP is designed to minimize systematic error, encourage constructive, documented problem solving, and provide a framework for continuous improvement within the organization. The laboratory's QAM, QAP, and SOPs may be requested at any time.

1.3 QA-SAP Recordkeeping and Distribution

This QA-SAP, and any updates or amendments thereto, will be maintained by the site owner, *Quality Analytical Services, c/o RDD Family Office, LLC, Kansas City, Missouri,* as well as distributed to the following parties:

- Missouri Department of Natural Resources, Hazardous Waste Program;
- Environmental Protection Agency, Region VII;
- Selected Contractor and/or Consultant performing the groundwater monitoring activities; and
- Selected Laboratory/Laboratories performing the analytical testing.

2.0 HYDROGEOLOGIC SETTING

The site hydrogeologic setting has been evaluated and described in several previous documents associated with the QAS facility. The following sections contain excerpts from these previous reports, referenced in Section 10.0.

2.1 Geology

The QAS site is situated on the eastern edge of a terrace above the Blue River floodplain, approximately 700 feet east of the river. The majority of the eastern side of the site was bench-cut from the base of a greater than 200-foot bluff, with the excavated portion resting on Pennsylvanian-aged limestone and shale bedrock. The bluff forms the facility's eastern boundary. The surface in the extreme western portion of the site is comprised of fill and colluvium, a heterogeneous mixture of soil and rock debris. The topography is relatively level in the vicinity of the site, and slopes gently to the west. Immediately west of the site is a sharp drop in elevation, marking the edge of terrace deposits.

Most of the site is underlain by 1 to 2 feet of gravel or other anthropogenic materials. Underlying the fill material are soils belonging to the Snead-Menfro-Oska association, formed in loess or residuum from shale and limestone. Below the fill and surface soils, boring logs are highly variable. Generally, the first unit encountered (Zone A) is a silty clay containing a moderate density of plant root cavities. This unit is likely associated with loess deposits. Below this unit, as observed in deeper borings, there appears to be a coarsening downward sequence beginning with silty clay, to clayey silt, to a variable fine- to coarse-grained sand, and finally to a sand and gravel layer (Zone B), encountered overlying the bedrock. Although the sequence is laterally variable, there is evidence suggesting that the units thicken to the west as depths to bedrock increase. Zone B appears to be alluvial in origin.

In portions of the site, a slightly cemented, very fine grained sand has been encountered at depths of 40 to 50 feet below ground surface (bgs) and, where present, directly overlies Zone B. This sand is identified as Zone C and acts locally as an aquitard.

2.2 Hydrogeology

Prior to 1997, the Blue River was located approximately 625 feet west of the QAS facility. In 1997, the Corps of Engineers relocated the Blue River farther west of the facility, leaving an oxbow between the site and the Blue River. QAS is located within the drainage of the Blue River, and is approximately 3.5 miles south of the confluence of the Blue and Missouri

Rivers. Under natural conditions, the groundwater flow direction generally follows the topographic surface. As such, groundwater from the site flows from east to west, toward the low lying area of the oxbow. Average depth to groundwater is 15 feet bgs.

Three groundwater horizons have been identified: A-Horizon, B-Horizon, and C-Horizon. The depths and thickness of these horizons vary across the site. The A-Horizon is the uppermost zone and is present from the surface to depths of between 25 and 40 feet bgs. This horizon is considered to mainly be comprised of silts and clays. The B-Horizon continues from the bottom of the A-Horizon to a depth of approximately 75 feet or to the top of the underlying bedrock. This B-Horizon is mainly comprised of silts and sands, grading to sands and gravel with increasing depths. The C-Horizon is identified as a 5-foot thick lens at approximately 40 to 50 feet bgs. The C-Horizon is made up of fine-grained, semi-consolidated sand that hydraulically separates the A and B-Horizons. The C-Horizon was identified only in borings located within 500 feet of the Blue River, approximately 200 feet west of the former tank farm area.

Depth to water in the A-Horizon is generally encountered from 5 to 15 feet bgs. Depth to water in the B-Horizon is generally encountered approximately 10 to 15 feet below the water encountered in the A-Horizon. Depth to water in the C-Horizon is generally 5 to 10 feet below the water encountered in the A-Horizon, and 5 to 10 feet above the water encountered in the B-Horizon.

3.0 GROUNDWATER MONITORING PROGRAM

The purpose of the groundwater monitoring program is to monitor the groundwater plume, monitor the progress of implemented corrective action(s), and/or detect releases of hazardous constituents from the facility. This section describes the groundwater monitoring program for the QAS facility.

3.1 Monitoring Network

The monitoring network consists of 28 locations, including 24 monitoring wells and four groundwater extraction wells, as shown on Figure 2 (page 3). One monitoring well (GW-1) is located upgradient of the groundwater plume. Four monitoring wells (EPA-R-3, GW-2R, GW-5, and GW-7) are located cross-gradient of the groundwater plume. The remaining 19 monitoring wells are located within or downgradient of the groundwater plume. Four monitoring wells (EPA-R-1, GW-2R, GW-3, and GW-4) currently or have previously contained free product. The 24 monitoring network wells are considered to be completed in one of the three groundwater horizons, as indicated below. Wells currently containing free product or that have contained free product in the past are indicated in bold font.

A-Horizon (14)

This groundwater horizon consists of silts and clays, and is located from the ground surface to depths ranging from 25 to 40 feet below ground surface (bgs).

EPA-R-1	GW-6A
EPA-R-3 (cross-gradient)	GW-7 (cross-gradient)
GW-1 (upgradient)	GW-8A
GW-2R (cross-gradient)	GW-9A
GW-3	GW-10A
GW-4	GW-11A
GW-5 (cross-gradient)	GW-12A

B-Horizon (6)

This groundwater horizon consists of silts and sands, grading to sands and gravels with depth, and is located from 25 to 40 feet bgs to approximately 75 feet bgs, or bedrock.

GW-6B	GW-10B
GW-8B	GW-11B
GW-9B	GW-12B

C-Horizon (4)

This groundwater horizon consists of an approximate 5-foot thick fine-grained sand lens, located approximately 40 to 50 feet below ground surface, hydraulically separating the A and B horizons.

GW-8C	GW-11C
GW-10C	GW-12C

The four groundwater extraction wells (PW-1 through PW-4) are located within the groundwater plume source area for the collection of impacted groundwater. These groundwater extraction wells are completed through all three groundwater horizons.

Well construction information is summarized on Table 1, Appendix A. Copies of boring logs and well completion diagrams for the monitoring network wells are included in Appendix B.

3.2 Monitoring Schedule

The 24 monitoring wells and four extraction wells are monitored semi-annually, during May and November of each year. During November, all 28 monitoring and extraction wells are gauged and sampled. During May, all wells are gauged, but only 19 are sampled, as summarized below. Wells currently containing free product or that have contained free product in the past are indicated in bold font.

Well ID	Groundwater Horizon	Location	Sample in May	Sample in November
EPA-R-1	A	downgradient		x
EPA-R-3	A	cross-gradient		x
GW-1	A	upgradient	x	x
GW-2R	A	cross-gradient		x
GW-3	A	downgradient		x
GW-4	A	downgradient		x
GW-5	A	cross-gradient	x	x
GW-6A	A	downgradient		x
GW-6B	B	downgradient	x	x
GW-7	A	cross-gradient	x	x
GW-8A	A	downgradient		x
GW-8B	B	downgradient	x	x
GW-8C	C	downgradient	x	x
GW-9A	A	downgradient		x
GW-9B	B	downgradient	x	x
GW-10A	A	downgradient		x
GW-10B	B	downgradient	x	x
GW-10C	C	downgradient	x	x

Well ID	Groundwater Horizon	Location	Sample in May	Sample in November
GW-11A	A	within plume	x	x
GW-11B	B	within plume	x	x
GW-11C	C	within plume	x	x
GW-12A	A	downgradient	x	x
GW-12B	B	downgradient	x	x
GW-12C	C	downgradient	x	x
PW-1	A, B, & C	within plume	x	x
PW-2	A, B, & C	within plume	x	x
PW-3	A, B, & C	within plume	x	x
PW-4	A, B, & C	within plume	x	x

In addition, samples are collected semi-annually from the interceptor recovery trench sump and from the treatment system effluent.

3.3 Analytical Requirements

Groundwater analysis will be performed on a semi-annual or biennial basis, during May and November. Parameters specified for biennial analysis will be collected during the November semi-annual events of even-numbered years, beginning in 2008. Table 2, Appendix A, summarizes the analytical requirements.

During the semi-annual events, groundwater samples will be collected from the wells described in Section 3.2 and submitted for volatile organic compounds (VOC) analysis by Method 8260 and total metals analysis by Methods 6010 and 7470. Additional groundwater samples will be collected from nine of the 19 monitoring wells in May, and 17 of the 28 monitoring wells in November, for low-level 1,4-dioxane analysis by Method 8260. The constituents of concern and laboratory reporting limits are summarized on Table 3, Appendix A.

During biennial sampling events (even-numbered years beginning in 2008), additional groundwater samples will be collected from the following nine select monitoring wells and submitted for semi-VOCs (SVOCs) analysis by Method 8270, organochorine pesticides analysis by Method 8081, polychlorinated biphenyls analysis by Method 8082, total cyanide analysis by Method 335.4, total sulfide analysis by Method 376.2, and hexavalent chromium analysis by Method SW-856 7196A. The specific constituents and required reporting limits for these additional analyses are summarized on Table 4, Appendix A.

GW-8A	GW-9A	GW-10A	GW-11C
GW-8B	GW-9B	GW-10B	
GW-8C		GW-10C	

Additionally, groundwater from one well that has previously been reported with detections will be submitted biennially for analysis of the full Appendix IX list of 40 CFR Part 264. Appendix IX analytical parameters are listed in Table 5, Appendix A.

3.4 Sample Collection

Environmental sampling will be performed by personnel trained in proper sampling protocol. A site-specific Health and Safety Plan is included in Appendix C. As site conditions change, activities related to monitoring at the site will be reviewed and evaluated for completeness and integrity.

3.4.1 Equipment

The following is a list of field equipment anticipated to be required to complete the groundwater monitoring events.

- Keys to monitoring wells;
- Static water level indicator and oil/water interface probe;
- Sample collection containers (prepared by laboratory prior to sampling event);
- Coolers and ice;
- Sample collection device (dedicated pump controller, compressed air supply, and spare tubing for using dedicated pumps; bailers and rope for wells sampled with a bailer);
- Flow-through cell for temperature, pH, and specific conductivity for sampling with a dedicated pump;
- Sample cup and temperature, pH, and conductivity meters for purging and sampling with a bailer;
- Field instrumentation calibration materials and calibration forms (example forms provided in Appendix D);
- Decontamination equipment (de-ionized or distilled water, non-phosphate detergent, buckets, towels, and brushes);
- Disposable gloves;
- Field logbook and field information forms (example field information form provided in Appendix D);

- Chain of custody forms (example provided in Appendix D); and
- Equipment/meter manuals.

Additional field equipment may be required to complete the groundwater monitoring requirements. Field equipment shall be checked for proper operation prior to mobilization to the site. Supplies, including laboratory-supplied containers, shall be verified for integrity (not broken, disposable consumables not opened, etc) prior to mobilization and prior to use in the field.

3.4.2 Sampling Event Recordkeeping and Documentation

The following information will be noted in the field logbook and/or field information forms (example field information forms are provided in Appendix D).

- Dates and times;
- Total depth of the well from the top of casing;
- Depth to the static water level from top of casing;
- Purge volume if purged with bailer, or pumping rate and purge volume if purging with a dedicated pump;
- Field parameter measurements;
- Date and time of well purging, and well sampling sequence;
- Field observations (well recharge rates, equipment malfunction, possible sample contamination, or sampling rates);
- Weather conditions (including air temperature and wind direction);
- Well inspection information (condition of the well pad, protective casing, well casing, elevation reference mark, well identification, and locks); and
- Name of person(s) performing sampling.

3.4.3 Groundwater Level and Total Depth Measurements

An electronic interface probe will be used to collect groundwater level measurements. The probe will be capable of distinguishing the oil/water interface for wells containing free product. Groundwater levels and the depth to free product, if applicable, will be measured at all monitoring wells within a groundwater horizon prior to purging and sampling of any monitoring well within that horizon. Total well depths will be measured for all monitoring locations during the November annual sampling event, with the exception of the four monitoring wells that contain free product. Dedicated micro-purge pumps are installed in the four monitoring wells that currently contain, or have previously contained free product (EPA-R-1, GW-2R, GW-3, and GW-4). The pumps require removal and replacement in

order to obtain total depths in these wells, which would smear free product into the underlying groundwater. Therefore, total depths will not be measured in these four locations.

All groundwater levels, free product levels, and total depths will be measured to the surveyed reference mark on the top of the well casing, or the north side of the casing if no survey reference mark is present. The ground surface and top of the well casings have been surveyed to within 0.01-foot relative to mean sea level (msl). The most recent survey data is provided on Table 1, Appendix A.

The following procedure will be used to measure groundwater levels, free product levels, and total depths. The groundwater levels should be measured from the least impacted well to the most impacted well, based on previous chemical analysis.

1. Decontaminate the cable and probe as specified in Section 3.4.7 before the first measurement and then after each measurement.

2. Turn on the well probe and push the instrument test button to check the probe's batteries.

3. Lower the probe into the well by pulling the cable from the hand-held reel until the indicator light or audible signal responds.

4. Move the cable up and down while observing the indicator. Note the exact length of cable extended from the tip of the probe sensor to the top of the well casing at the reference point or well cap port when the probe sensor indicates the fluid/air interface. Record the cable length to the nearest 0.01-foot, well number, time, and date of the measurement in the field logbook or field information form.

5. If applicable, slowly lower the cable until the indicator light or audible signal responds to indicate the oil/water interface. Record the cable length to the nearest 0.01-foot in the field logbook or field information form.

6. If applicable, measure the total well depth by lowering the probe to the bottom of the well. Add the length of the distance between the end of the probe and the probe sensor to the total depth measurement. Record the total depth measured at the top of the well casing at the reference point to the nearest 0.01-foot.

7. Decontaminate the probe and cable, as described in Section 3.4.7, prior to measuring the next well.

8. Water and product levels will be compared with historic measurements as indicated on the groundwater contour map from the previous sampling event. If a large difference from the previous sampling event is noted, the level(s) should be re-measured. If the re-measurement gives the same result, the inconsistency should be noted in the field logbook or field information form.

3.4.4 Well Purging

Monitoring wells will be purged in order from least to most impacted, based on previous laboratory analyses. Wells should be purged in a manner that causes the least disturbance to the groundwater present in the monitoring location. Low-flow purging and sampling is required for wells containing free product, using dedicated low-flow pumping systems. A dedicated bailer or new disposable bailer will be used to purge and sample the remaining wells. The four groundwater extraction wells and interceptor trench sump will not be purged, assuming groundwater pumping activities are ongoing.

3.4.4.1 Purging with a Bailer

When a bailer is used for purging, monitoring wells will be purged of three well volumes and until purge parameters have stabilized prior to sample collection to prevent collection of non-representative stagnant water in a sample. During purging, the bailer will be slowly lowered into the air/water interface, allowed to fill with water, and slowly retrieved. The bailers will not be allowed to strike the water surface with “falling” velocity to minimize the aeration and agitation of the groundwater when purging. Additionally, the bailers will not be allowed to sink to the bottom of the well, if sufficient water is present to fill the bailer at the top of the air/water interface.

A minimum of three well volumes of water will be purged for wells screened in formations that have moderate to high yields. Purging will continue until temperature, pH, and specific conductivity have stabilized between three consecutive well volumes or a maximum of five well volumes have been removed. Purge parameters will be recorded on the field information form. Consecutive readings of the three purge parameters within 10 percent of each other are an indication that the water is representative of the aquifer. This method of purging will be used for those wells that produce sufficient amounts of water.

If a monitoring well is a very low yield well and does not allow the removal of three well volumes, the well will be purged dry and allowed to recharge up to 24 hours prior to

sampling. If there is not sufficient water for sampling any parameter, the well will be considered dry for the purpose of sampling. If water is available to partially complete sampling requirements, as many samples as possible will be collected. The wells that have low yields will be purged in this manner and should be identified as such on the field information form.

Well volumes per foot of groundwater in each well to be sampled are provided on Table 1, Appendix A. The following equation may be used to calculate one well volume.

$$V = (h_1 - h_2) * w$$

Where:

V = one well volume (gallons)
h_1 = total depth of well (feet)
h_2 = depth to water (feet)
w = well volume per foot of groundwater (gallons, Table 1, Appendix A)

3.4.4.2 Low-Flow Purging

Four monitoring wells, GW-2R, GW-3, GW-4, and EPA-R-1, have historically contained free product. Dedicated QED micro-purge pumps are installed in these four wells for sampling during the annual (November) events. Purging by use of low-flow techniques generally consists of clearing the stagnant water from the pump and tubing, limiting drawdown of the water column, and field parameter stabilization. This method is intended to allow sampling of the groundwater beneath the free product. The following procedures will be used when completing purging activities using the low-flow bladder pumps.

1. Measure depth to water and depth to free product, and calculate the thickness of the water column (WC). This can be determined by subtracting the measured depth to water from the installed total depth of the well (Table 1, Appendix A).

2. Calculate one saturated tube length volume. This volume can be calculated by multiplying 5 milliliters (mL) per foot WC times the thickness of WC (feet):

   One Tube Volume (mL) = 5 mL/foot WC x thickness of WC (feet)

3. Purge a minimum of 500 mL plus one tube volume by using a pumping rate of approximately 100 to 500 milliliters per minute (mL/min) or less. The monitoring well should be purged at a rate that does not exceed the yield of the well and does not dewater the screened interval or open borehole intake zone of the well. There

should be minimal drop in the water level (less than 25 percent of WC). There may be a little bit of drawdown at the beginning, but the drawdown should stop and the water level should stabilize as purging continues. If the water level continues to draw down and does not stabilize, cease purging and allow the well to recharge. Resume purging at a slower rate.

4. Following removal of 500 mL plus one tube volume, monitor purge water for stabilization of field parameters. Check purge water for pH, temperature, and specific conductivity following each additional tube volume removed. Stabilization has occurred when pH varies by no more than 0.2 standard units (S.U.) and specific conductivity varies by no more than 3 percent. Additionally, the depth to water should not drop more than 25 percent of the WC.

5. Based on these procedures, a minimum of 500 mL plus three tube volumes will be removed as follows:
    i. Remove 500 mL plus one tube volume, take first stabilization reading
    ii. Remove one tube volume, take second stabilization reading
    iii. Remove one tube volume, take third stabilization reading
    iv. If parameters are stable, collect sample; if not stabilized, continue purging and taking readings until stabilization is reached, or a maximum of 500 mL plus five tube volumes.

3.4.4.3 Purge Water Disposal

All purge water will be contained and transferred into the equalization tank of the existing treatment system on site.

3.4.4.4 Field Measurements

Field measurements of temperature, pH, and specific conductivity will be collected during purging and before the collection of samples for chemical analysis. The pH probe will be calibrated at the beginning of each day using two standard buffer solutions (pH 4 and 7) and the calibration checked at least twice a day. The conductivity meter will be checked using a fluid of known specific conductivity at the beginning and re-checked at the end of each day to determine whether any drift occurred. All calibration and calibration checks will be recorded in the field logbook or field calibration forms (example field calibration forms are provided in Appendix D). Extreme cold or hot weather is known to affect pH and conductivity meters. In these cases, the meters should be calibrated and checked for calibration more frequently.

The field sampling team will use the following procedure for field measurements:

1. If using a flow-through cell, measure the purge parameters within the cell. If not using a flow-through cell, withdraw water from the well and pour into sample cup.

2. Measure the field parameters of the collected water immediately after the water is collected. Record the readings in the field logbook or field information form.

3. If using a flow-through cell, measure field parameters following removal of each tubing volume removed.

4. If using a flow-through cell, stabilization has occurred when pH varies by no more than 0.2 standard units (S.U.), and specific conductivity varies by no more than 3 percent over three consecutive readings, or 500 mL plus five tube volumes has been removed.

5. If using a bailer, measure field parameters following removal of each borehole volume.

6. If using a bailer, stabilization has occurred when three consecutive readings between well volumes are within 10 percent of each other, or a maximum of five well volumes have been removed.

7. Record all field parameters in the field logbook or field information form as they are obtained.

3.4.5 Groundwater Sampling Procedure

If water is available to partially complete sampling requirements, samples should be obtained for VOC analysis first, followed by SVOCs, pesticides, polychlorinated biphenyls, metals, and any other parameters. (Refer to Section 3.3 for analytical requirements during each event.) Field measurements will be taken prior to sample collection. Samples will be collected using dedicated sampling systems (bailer or pump) or new sampling bailers and rope. Bailers will be made of suitable inert materials and be bottom emptying. Bailers will be delivered and retrieved into the air/water interface slowly. Bailers will not be allowed to strike the water surface with “falling” velocity to minimize the aeration and agitation of the groundwater when sampling. Wells should be sampled in order from least impacted to most impacted, as determined by the previous laboratory analyses.

Groundwater samples will be collected from the four extraction wells (PW-1 through PW-4) directly from the spigots at each wellhead, without purging. Groundwater samples will be collected from the recovery trench sump via a sample port located at the pump controller. Groundwater samples will be collected from the system effluent sample port located on the discharge line.

Sample containers and labels will be prepared by the laboratory prior to the sampling event. The sample collector will be responsible to initial the label and complete the date and time of the sample collection. The labels will include the following information.

- sample identification number
- name or initials of sample collector
- date and time of collection
- project name
- sample preservatives
- parameter(s) requested for analysis

A summary of the parameters, methods, preservatives, containers, and holding times for the sampling events is presented in Table 6, Appendix A.

When filling the sample bottles, the following procedures and precautions should be adhered to:

1. Bottle caps should be removed carefully so that the inside of the cap is not touched. Caps must never be put on the ground. Caps for VOA vials must contain a Teflon-lined septum. The Teflon side of the septum must be facing the sample to prevent contamination of the sample through the septum.

2. The sampling team must wear appropriate non-powdered surgical latex or nitrile gloves (PVC/vinyl gloves have a potential for trace levels of phthalate or vinyl chloride). Gloves will be changed between wells or on a more frequent basis.

3. Tubing or hoses from the sampling systems must not touch or be placed in the sample bottles.

4. VOA vials must be filled so that they are headspace-free. These sample bottles, therefore, need to be slightly overfilled (water tension will maintain a convex water surface in the bottle). The caps for these bottles should be replaced gently, to

eliminate any air bubbles in the sample. These bottles must then be checked by inverting them and tapping them sharply with a finger. If any air bubbles appear, open the bottle, add more water, and repeat this process until all air bubbles are gone. Do not empty the bottle and refill it. VOA vials already contain preservatives. Do not add additional preservatives to these bottles.

5. Sample bottles, caps, or septa that fall on the ground before filling must be discarded.

6. The sampling team must collect a sufficient volume of liquid (if possible) to allow for analysis of all required parameters.

7. Under no circumstances should bottles or caps not supplied by the laboratory be used for any sampling.

8. Sample coolers must be present at all sample locations and must be equipped with pre-chilled, double-bagged ice packs for immediate placement of sample bottles.

9. Sample bottles must not be opened after collection and preservation of the sample.

10. Complete chain of custody.

Samples will be packed in coolers and transported to the laboratory in a manner that minimizes risk of containers breaking during transport. The following guidelines are recommended for transporting samples. Other methods may be sufficient, as long as similar methods are employed to protect the integrity of the samples.

- Use a clean, dry cooler. Select a cooler sized appropriately for the containers and provides adequate room for ice.

- Place bubble wrap in the bottom of cooler. FedEx requires that all coolers containing wet ice need to be sealed using an inner and outer cooler liner. If shipping the cooler to a laboratory, rather than delivering samples to a local laboratory, place two, 3-mil cooler liner bags (one inside the other) in the cooler.

- All glass sample containers need to be protected with bubble sleeve bags or bubble wrap. Containers shall be placed upright into the coolers, with the caps sealed tight, completely surrounded by bubble wrap, and inside the two cooler liner bags (if used).

Containers should be sealed in zip-lock storage bags to protect the identification label and to contain spills and leaks. Vials may be placed in a cubitainer, inside a zip-lock bag. (FedEx currently requires that any container with liquid be sealed in zip-locks.)

- Do not over-pack the cooler. Pack containers in the cooler leaving room between containers for wet ice. Pack glass containers as described above so they do not touch glass on glass. Place enough ice around the containers so that samples are covered on all sides and cannot shift during transport. Samples must arrive at the laboratory at a temperature of 4 degrees Celsius, or below. However, samples also must not be frozen.

- If shipping samples to a laboratory, seal the containers and wet ice in the inner cooler liner bag using a zip tie. Seal the outer bag around the inner bag using a second zip tie, ensuring that no ice has spilled into the cooler outside of the outer liner.

- Make sure the cooler is packed tightly. Use bubble wrap and/or absorbent padding to fill any extra room in the cooler so that containers will not shift during transport.

- Seal the chain of custody documents in a waterproof zip lock storage bag and tape the bag to the inside of the cooler lid.

- If shipping samples to a laboratory, seal the cooler at each end using strong packing tape so that the lid cannot open and seal the opening around the entire cooler.

- If laboratory provides custody seals, place seal over cooler opening, or around the zip tie of the outer liner bag (if used).

- Deliver the cooler to the laboratory or shipping carrier.

3.4.6 Free Product Sampling Procedures

Four monitoring wells associated with the QAS site have historically, or currently, contained free product: EPA-R-1, GW-2R, GW-3, and GW-4. Annual or semi-annual collection of free product samples is not required. However, should the collection of a free product sample be requested or desired, the procedures described in this section shall be followed.

Field measurements (depth to product and depth to water) will be taken prior to sample collection. Samples will be collected using new sampling bailers and rope. Bailers will be made of suitable inert materials and be bottom emptying. Bailers will be delivered and retrieved into the air/product interface slowly. Bailers will not be allowed to strike the product surface with "falling" velocity to minimize the aeration and agitation of the product and the mixing of the product with the underlying groundwater when sampling. Bailers will be slowly lowered through the product thickness and approximately three inches into the underlying groundwater, unless the product thickness is greater than the length of the bailer. Once bailers are retrieved, groundwater in the bottom of the bailer will be drained, leaving only free product in the bailer. Sample containers will be prepared and filled in the same manner described for groundwater samples (Section 3.4.5).

3.4.7 Chain of Custody Procedures

Standard chain of custody procedures will be followed throughout the sampling and shipping activities. An example chain of custody form is provided in Appendix D. The chain of custody form includes the following information.

- date and time of sample collection
- sampler's name
- sample identification
- preservatives used
- analysis requested
- date and time of custody transfer
- signatures of custodians

3.4.8 Decontamination Procedures

All non-dedicated, sample-contacting and down-hole equipment must be thoroughly decontaminated prior to its use at the site. This includes groundwater level measurement devices and field parameter measurement devices. Additionally, if non-dedicated equipment is used to redevelop a monitoring well, these procedures would apply to that equipment as well. Unless otherwise required, no other non-dedicated down-hole equipment will be used during sampling.

Decontamination procedures for down-hole equipment or equipment that comes in contact with samples will include, at a minimum, washing equipment with a non-phosphate detergent solution, followed by a series of rinses with control water (i.e. water of a known chemistry) and one rinse with de-ionized or distilled water. Other non-dedicated equipment

(e.g., field meters) should be rinsed with de-ionized or distilled water before and after each use.

Decontamination generated fluids will be handed with the purge water as described in Section 3.4.4.3.

3.4.9 Redevelopment of Monitoring and Extraction Wells

Redevelopment is to be performed on any monitoring or extraction well in which more than 25 percent of the saturated screen length is occluded. The saturated screen length is defined as the length of screen submerged below the static water level. The occluded length is the difference between the installed depth of the well and the measured depth of the well. The following procedure will be used to remove fine-grained material from the well and the filter pack near the screen. Well redevelopment will proceed in the following manner:

1. Decontaminate all down-hole equipment prior to beginning redevelopment.

2. Obtain an initial groundwater level measurement.

3. Collect an initial sample of water and analyze it for field parameters including pH, specific conductivity, and temperature. Note the color, odor, and turbidity of the sample.

4. A bailer development procedure is usually adequate for low yield wells. Lower the bailer to the bottom of the well and return it to the top in a manner to cause gentle surging in and out of the well. The bailer should be brought to the surface and the water and sediment emptied. This process should be repeated until at least three times the volume of water in the well-bore is removed, field parameters have stabilized within 10 percent between borehole volumes, and until the well screen is cleared of sediment.

5. A combination of pumping and surging should be utilized in high-yield wells. Surging will be accomplished by lowering a weighted bailer or surge block into the saturated interval and repeatedly raising and lowering. This surging process should be repeated as needed to stabilize the sand pack, as well as dislodge fines into the well. This process should be repeated until at least three times the volume of water in the well-bore is removed, field parameters have stabilized within 10 percent between borehole volumes, and the well screen is cleared of sediment.

6. Should the well be purged dry during redevelopment procedures, water should be allowed to recover within a reasonable amount of time (i.e., within 8 hours) and the procedure repeated until two times the volume of water in the well-bore is removed, pH, temperature, and conductivity readings of the water have stabilized within 10 percent between borehole volumes, and until the well screen is cleared of sediment.

3.5 Field Quality Assurance/Quality Control

Field quality assurance/quality control (QA/QC) samples during each monitoring event will include one duplicate sample, one equipment rinsate blank (for non-dedicated equipment), and one sample with triple collected volume for matrix spike/matrix spike duplicate (MS/MSD) analysis at the laboratory. Trip blanks will accompany each cooler containing samples for volatile organic analysis.

3.5.1 Duplicate Samples

A minimum of one duplicate will be collected and analyzed during each sampling event. The duplicate sample will be obtained from a well that has previously been reported with detections of VOCs. The duplicate sample will be obtained at the same time and analyzed for the same set of parameters as the sample it is intended to duplicate. Each duplicate should be sampled by alternating between the regular sample bottles and the duplicate sample bottles, proceeding in the designated sampling order (i.e., VOAs first). The well at which the duplicate is collected must be identified on the field information form, along with any information/observations that may explain any anomalous results (e.g., prevailing winds, upwind potential sources of contamination, etc.). All duplicates will be blind (i.e., the well designation is not listed on the chain of custody). Once a duplicate is collected, it is handled and shipped in the same manner as the rest of the samples. Duplicate results will be reported in the laboratory results as separate samples, using the designations DUP-(#) as their sample designation point.

Split samples are collected when co-sampling of a well is conducted with a third party (i.e., Regulatory Agency or External Consultant). Split samples will be collected using the same method as a duplicate, alternating between sample bottles, and proceeding in the designated sampling order. The well at which the split sample(s) is collected must be identified on the field information form.

3.5.2 Equipment Rinsate Blanks

Equipment rinsate blanks are a required part of the field sampling QA/QC program. The purpose of the equipment blank is to detect cross-contamination that might be introduced from the non-dedicated sampling equipment. One equipment rinsate blank will be collected and analyzed during each sampling event. The blanks will be analyzed using the same procedures and methods that are used for the collected field samples.

Equipment blanks must be prepared at the sampling site using laboratory-supplied bottles and de-ionized, distilled, or laboratory reagent-quality water. Following decontamination of the non-dedicated equipment (e.g., water level indicator), an equipment blank will be collected by pouring de-ionized, distilled, or laboratory reagent-quality water over the non-dedicated equipment and into the sample bottle. The well at which the field blank is prepared must be identified on the field information form, along with any observations that may help explain anomalous results (e.g., prevailing wind direction, up-wind potential sources of contamination, etc.). Once a field blank is collected, it is handled and shipped in the same manner as the rest of the samples.

Equipment blank results will be reported in the laboratory results as separate samples, using the designations EB-(well #) as their sample point designation.

3.5.3 Matrix Spike/Matrix Spike Duplicate

Additional sample volumes will be collected from one monitoring location in the field for MS/MSD analysis by the laboratory during each sampling event. The additional groundwater samples will be collected as part of the original samples. The additional samples will not be spiked in the field. The chain of custody record will be completed to notify the laboratory that the MS/MSD is to be completed in addition to the analytical parameters specified. MS/MSD will be competed for the same parameters as the original sample.

The MS/MSD sample results will be reported in the laboratory results as separate samples, using the designation MS/MSD as their sample point designation.

3.5.4 Trip Blanks

Trip blanks are a required part of the field sampling QA/QC program. They are used to detect contamination that may be introduced in the field (either atmospheric or from sampling equipment), in transit (to or from the sampling site), or in the bottle preparation, sample log-in, or sample storage stages at the laboratory.

Trip blanks are samples of organic-free water (e.g., de-ionized) prepared at the laboratory. They remain with the sample bottles while in transit to the site, during sampling, and during the return trip to the laboratory. Trip blank sample bottles must not be opened at any time during this process. Upon return to the laboratory, trip blanks will be analyzed for VOCs using the same procedures and methods that are used for the collected field samples.

One trip blank will be included with each cooler sent to the laboratory that contains samples for VOC analysis. Trip blank results will be reported in the laboratory results as separate samples, using the designations TB-(#) or TRIP BLANK-(#) as their sample point designation.

3.6 Field Performance Assessment

The process of choosing when field audits are conducted is not based on a particular project or site-sampling event, but rather on assuring that each person involved in sample collection is audited at least once per year. The Quality Assurance Manager will review sampling personnel audit records prior to each sampling event, and will have the responsibility for initiating and implementing response actions associated with findings identified during field audits. The field personnel shall properly address any response actions needed.

3.7 Waste Handling

Disposable sampling equipment (bailers, gloves, rope, glassware, plasticware, sample containers containing broken sample bottles, etc.) will be discarded as municipal solid waste.

4.0 SITE VISUAL OBSERVATION PROGRAM

During each semi-annual monitoring event, the overall site conditions and each monitoring well will be visually observed and documented.

4.1 Overall Site Conditions

The site will be visually observed for changes in topography, such as new depressions, ponded water areas, erosion channels, etc, during each semi-annual monitoring event. Photographs may be taken to document problem areas. Observations and needed maintenance will be recorded, such as weeding, mowing, or building repairs, etc. The observations will be documented in the field logbook.

4.2 Well Conditions

A visual observation of each monitoring well will be conducted during each semi-annual monitoring event to evaluate the physical integrity of the wells with regard to surface seals, inner and outer casings, locks, surrounding area, and general condition of the well. The observations will be recorded on the field information form for each monitoring well (sample form included in Appendix D).

4.3 Procedures for Repairs

Repairs which may be performed while on site for semi-annual groundwater monitoring, such as replacing well locks, will be performed during the site activities. Other repairs and/or maintenance may require the purchase of materials and/or supplies, and therefore additional planning. For these cases, the item shall be maintained or repaired within 30 days following the discovery, or at the earliest time possible. A summary of maintenance and repairs will be included in each semi-annual monitoring report.

5.0 LABORATORY ANALYSIS

This section describes the procedures for completing successful laboratory analyses of the samples that are collected.

5.1 Laboratory Qualifications

The laboratory(s) selected to perform the analyses specified in this QA-SAP must be a Missouri-certified laboratory. The quality control manual for the site-selected laboratory(s) will be provided to MDNR upon request. The quality manual describes mechanisms the laboratory employs to ensure that all data reported meets or exceeds all applicable EPA and MDNR requirements. It describes the laboratory's experience, its organizational structure, and procedures in place to ensure quality of the analytical data. The quality manual also outlines the sampling, analysis, and reporting procedures used by the laboratory. If requested, the laboratory will provide specific information to MDNR demonstrating their ability to achieve the specified reporting limits for this project.

5.2 Quality Assurance/Quality Control Procedures

Duplicates, equipment rinsate blanks, MS/MSD samples, and trip blanks provide quality assurance/quality control (QA/QC) measures for the monitoring program. The collection of these QA/QC samples is described in Section 3.5. The evaluation of the analytical results for the QA/QC samples is described in Section 6.0.

5.3 Laboratory Quality Control Procedures

As stated in Section 5.1, all samples submitted for laboratory analysis will be analyzed by a Missouri-certified laboratory. The quality control manual for the site-selected laboratory will be provided to MDNR upon request. The quality manual describes mechanisms the laboratory employs to ensure that all data reported meets or exceeds all applicable EPA and MDNR requirements. It describes the laboratory's experience, its organizational structure, and procedures in place to ensure quality of the analytical data. The quality manual also outlines the sampling, analysis, and reporting procedures used by the laboratory. The laboratory is responsible for the implementation of and adherence to the quality assurance and quality control requirements outlined in the quality manual.

Audits are an important component of the quality assurance program at the laboratory. Audits are conducted by the laboratory. Internal system and performance audits are conducted periodically to ensure adherence by all laboratory departments to the quality standards. External audits are conducted by accrediting agencies or states. These reports

are transmitted to department managers for review and response. Corrective measures must be taken for any finding or deficiency found in an internal or external audit.

Data Quality Reviews (DQR), or equivalent, are requests submitted to the laboratory to formally review results that differ from historical results, or that exceed certain permit requirements or quality control criteria. The laboratory prepares a formal written response to each DQR explaining the discrepancy. The DQR is the first line of investigation following any anomalous result.

5.4 Analytical Methodologies

Method 8260 will be used for the analysis of the routine VOC parameters required in the monitoring program. Method 7470 will be used for the analysis of mercury and Method 6010 will be used for the analysis of the other metals. Methods 8260, 7470, and 6010 are EPA approved and fully described in the laboratory method and standard operating procedure (SOP) documents. Additional parameters will be analyzed biennially as specified in Tables 4 and 5.

6.0 DATA EVALUATION

6.1 Groundwater Protection Standards

Table 3, Appendix A is a listing of the constituents of concern that have been detected in groundwater at the facility during past investigations or that have been reported as constituents processed in past operations. This table identifies concentration levels of concern for the purpose of setting analytical detection levels.

Table 3 also presents a comparison of EPA Region 3 and EPA Region 9 regional screening levels (RSLs), federal maximum contaminant levels (MCLs)/national primary drinking water standards (NPDWS), and Missouri lowest default target levels (DTLs). The table also includes laboratory reporting limits required for the project.

6.2 Groundwater Data Evaluation

Routine groundwater sampling results from wells that are monitored in accordance with the semi-annual monitoring program will initially undergo data validation procedures as described in Section 7.1. Following data validation, the sampling results will be compared to the groundwater protection standards (EPA RSLs, federal MCLs, and Missouri DTLs) provided in Table 3, Appendix A. Time-series plots may be prepared for select monitoring locations.

6.3 Evaluation of QA/QC Procedures

A thorough review of the laboratory and field procedures will be performed to confirm the validity of the specific analytic data. This will include a review of instrument calibration information, calculations, recoveries for spiked samples, and recoveries on blanks tested that day. In addition, a review of the chain of custody records for the sampling, shipping, and preparation of the samples will be carried out to determine if there is an obvious reason for invalidation of the results.

The relative percent difference (RPD) of the analytical results between the original and duplicate samples will be calculated for each analytical parameter. If the RPD is less than 20 percent, the original sample data is considered acceptable. If the RPD is 20 percent or greater, the higher result of the duplicate or original sample will be considered representative of the sample location, and the data will be qualified as such for use in preparing isoconcentration maps or other evaluation.

The RPD will be calculated as follows:

$$RPD = \frac{ABS\ (O_c - D_c)}{0.5 * (O_c + D_c)} * 100$$

Where,

RDP = relative percent difference, percent

ABS = absolute value

O_c = original concentration, micrograms per liter

D_c = duplicate concentration, micrograms per liter

If both the original and duplicate concentrations are reported as "not detected", the RPD is zero. If either the original or duplicate concentration is reported as "not detected", the reporting limit shall be used as the concentration for the RPD calculation. If either the original or duplicate concentration is reported as "not detected", and the sample has been diluted, then one-half of the reporting limit shall be used as the concentration for the RPD calculation.

The equipment rinsate blank should not contain any target analyte above the level of the lowest calibration standard. If the target analyte found in the blank are not found in environmental samples, the sample data is considered unaffected. If, however, the target analyte found in the blank is found in the environmental samples at less than or equal to five times the blank concentrations, the result for the environmental sample will be considered as potential contamination and will be qualified with a data flag (e.g. "B") during data validation.

The matrix spike/matrix spike duplicate (MS/MSD) results will be qualified based on quality control criteria provided by the laboratory. Section 7.1.1 further discusses MS/MSD sample results.

The trip blank(s) should not contain any target analyte above the level of the lowest calibration standard. If target analytes are detected above this level, then environmental sample results must be closely inspected. If the target analyte found in the blank are not found in the environmental samples, the sample data is considered unaffected. If, however, the target analyte found in the blank is found in the environmental samples at less than or equal to five times the blank concentration, the result for the environmental sample will be considered as potential contamination and will be qualified with a data flag (e.g. "B") during data validation.

6.4 Review of Historical Data

A review of the site historical data may be performed to determine if there is an indication that the result is anomalous. The review will include inspection of the historical data for the specific sampling point, sample blank data, and data from nearby sampling points.

7.0 DATA QUALITY REVIEW AND RECORDKEEPING

Prior to the submittal of a monitoring report to the MDNR, several data evaluation, reporting, and recordkeeping tasks will be implemented. The following sections describe the evaluation, reporting and recordkeeping procedures that are followed upon receipt of the analytical report.

7.1 Data Quality Objectives

Data Quality Objectives (DQOs) are quantitative and qualitative statements that are specified to ensure that data of known and appropriate quality are obtained to support their intended use, i.e., the monitoring program and selection of an appropriate recommendation for the project. The DQOs with respect to the environmental monitoring program are to maximize confidence in the data with respect to precision, accuracy, representativeness, completeness, and comparability. The DQOs identified for this monitoring program include:

1. Are constituents of interest (COIs) present or absent in the groundwater?
2. If COIs are present, what quantities remain in the groundwater?
3. If COIs are present, how do the concentrations compare to EPA Regions 3 and 9 Risk Based Screening Levels or federal Maximum Contaminant Levels (or Missouri Table B-1 Tier 1 Default Target Levels if there are no EPA RSLs/MCLs)?
4. What impact, if any, has occurred to the groundwater?
5. What are the characteristics of the groundwater migration pathways?
6. What are the risks, if any, to human health and the environment associated with the site?
7. What degree of COI reduction, if any, will mitigate potential groundwater impacts?

Groundwater samples will be collected and submitted to the laboratory for chemical and physical analysis as specified in this QA-SAP. As stated previously, the parameters that will be used to specify data quality requirements and to evaluate the analytical system performance are precision, accuracy, representativeness, completeness, and comparability (PARCC).

Data Quality Objectives

DQO	Definition	Determination Method
Precision	A measure of the reproducibility of measurements under a given set of conditions.	Duplicate samples – Field (collect minimum of one duplicate sample per sampling event) Duplicate samples – Laboratory (minimum of one sample per batch or one per 20 samples)
Accuracy	A measure of the bias that exists in a measurement system.	Matrix Spike Samples – Field (collect additional sample volumes from minimum of one location per sampling event) Matrix Spike Samples - Laboratory (performed by laboratory; one for every 20 samples) Trip Blanks (one per cooler accompanying samples for VOC analysis)
Representativeness	The degree to which sample data accurately and precisely represent selected characteristics.	Trip Blanks (as above) Equipment Rinsate Blanks (one per each sampling event)
Completeness	A measure of the amount of valid data obtained from the measurement system compared to the amount that is required.	Compare the number of samples analyzed with the performance criteria
Comparability	A measure of confidence with which one data set can be compared with another.	Compare sampling procedures and QA protocols
Sensitivity	The capability of an instrument to discriminate between measurement responses representing the variable of interest	Determine the minimum concentration that can be measured by a laboratory (quantitation limit)

7.2 Data Validation

Each analytical report received from the Missouri-certified laboratory will undergo two levels of quality assessment. These quality assessment procedures are described below and are based on guidelines presented in the following documents: USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, October 2004 and USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, January 2005.

7.2.1 Initial QA/QC Checks

Before the data are subjected to comparison and analysis, the data will be evaluated by examining the quality control information accompanying the data report from the laboratory. Relevant quality control data include measures of accuracy (percent recovery), precision (relative percent difference (RPD)), and sample contamination (blank determinations). Data that fail any of these checks will be flagged for closer evaluation and a DQR. Results of the DQR will be submitted with the analytical data in the routine monitoring report (see Section 5.2, Laboratory Quality Control Procedures, for a description of DQR). A brief summary of these relevant quality control data follows.

Accuracy defines the relationship between the laboratory's measurement of a sample's concentration and the "true", but unknown concentration of the sample. Because the "true" concentration is unknown, accuracy must be measured indirectly by determining the percent recovery of a sample called the matrix spike (MS). The MS is analyzed under the same conditions as the groundwater sample and its concentration is determined. Because the MS has a known concentration, its percent recovery can be calculated. It is assumed that the groundwater sample behaves exactly like the MS and thus the "true" concentration of the submitted groundwater sample can be back-calculated. Control criteria for percent recovery are taken from regulatory method requirements.

Precision is the assessment of the variability that can be expected in data that result from the analytical procedures employed. It provides a measure of the reproducibility which is estimated through duplicate measurements of a matrix spike. Two matrix spike samples are prepared as described above; an MS and a matrix spike duplicate (MSD). Both spikes are analyzed along with the unknown sample and the RPD between the two spikes is determined. Control criteria for RPD are taken from regulatory method requirements.

The potential for sample contamination is assessed by measurements of "blank" samples. Blanks are samples of ultra-pure laboratory water that are not spiked with any analytes and

are carried through the field sampling and laboratory environments. These samples are known as "field," "lab," and "equipment" blanks. It is assumed that any analytes that occur in the field or laboratory which might add to the concentration of the analyte in the sample will be picked up by the blank samples and measured. If any of the analytes of interest are found in the blank samples, it is an indication of potential contamination of the unknown sample.

7.2.2 Qualitative Data Evaluation

Following the initial QA/QC checks, all data should undergo a second level of review by graphing historical time trends and comparing new results with these historical trends to flag visual outliers or other anomalous data. If a clearly anomalous result is found, a DQR will be initiated with the laboratory to ascertain if laboratory error is involved. In addition, field information will be checked for anomalous occurrences or observations that might help to explain an outlier result.

7.2.3 Quantitative Data Evaluation

Following the completion of the initial QA/QC checks and qualitative data evaluation, a quantitative data evaluation will be performed. The quantitative data validation will conform to data evaluation guidelines presented in the USEPA Functional Guidelines documents. The laboratory supplied QA/QC report included with the data results will be thoroughly reviewed to ensure that all laboratory QA/QC criteria were achieved. Laboratory QA/QC criteria to be assessed will include items stated above such as sample holding time requirements, sample preservation requirements, laboratory method blanks, and matrix spike and matrix spike duplicate samples. Additional laboratory QA/QC criteria to be evaluated will include instrument performance checks, initial and continuing calibration verification results, laboratory control sample and laboratory control sample duplicate results, internal standard results, target compound identification, sample quantitation limits, serial dilution results, and an overall assessment of data quality. Results of the quantitative data evaluation will be documented within a separate section of the report accompanying the discussion of the sampling event(s) analytical results. Additionally, if applicable laboratory QA/QC criteria are not met, affected data results will be appropriately qualified.

7.3 Corrective Action

Documentation as to what, if any, corrective actions were initiated concerning the site activities will be described and reported to the Project Manager. Field quality assurance activities will also be reported to the Project Manager. The Project Manager will be responsible for initiating the corrective actions and for ensuring that the actions are taken in

a timely manner and that the desired results are produced. The Project Manager will report to the Quality Assurance Manager and project team on all necessary corrective actions taken, the outcome of these actions, and their effect on data produced. All corrective action taken will be reported to the MDNR.

7.4 Quality Assurance Reporting

The Project Manager, in conjunction with the Quality Assurance Manager, will include in the final report submittal, a summary of all applicable quality assurance activities. These summaries shall contain at least the following types of information:

- The status and coverage of field quality assurance project activities.
- Significant quality assurance problems discovered, corrective actions taken, progress and improvements, plans, and recommendations for further implementation or updating of the QA-SAP.
- Any significant field observations noted in the field notebook during the groundwater monitoring procedures.

7.5 Quality Assurance Project Plan

This QA-SAP is intended to combine the requirements of a SAP and a QAPP into one document. Therefore, a separate QAPP has not been prepared and will not be utilized during the semi-annual groundwater monitoring activities. This QA-SAP is intended to minimize many specific details, such as equipment model numbers, specific software requirements, etc, to allow flexibility for future sampling events, while maintaining necessary requirements. Supplies, consumables, software, data resources, literature files, and the like are continually evolving. New products, technologies, and resources may be available in the future. Software continually changes and there are a variety of acceptable methods for preparing the time-series plots and contour maps, including manually.

A QAPP Checklist provided by the US EPA is provided in Appendix E, referencing the sections of this report that contain the information provided in standard QAPPs. Some elements on the checklist are indicated to be not applicable (N/A). "N/A" items are generally items that may vary due to changes in personnel, changes in selected laboratories, evolving technology, etc.

7.6 Data Recordkeeping Requirements

All analytical data are maintained by the laboratory indefinitely. The laboratory ensures that, at each stage of a process where a permanent data record is required, security measures are in place to guarantee the integrity of the data. Standard Operating Procedures are in place for computer security, computer data storage, and back-up. All reports and work plans generated within the previous five years must be retained by the site owner.

8.0 REPORTING

8.1 Groundwater Monitoring Reports

Upon completion of the May groundwater monitoring event, a Semi-Annual Groundwater Monitoring Report will be submitted by September 1. Upon completion of each November groundwater monitoring event, an Annual Groundwater Monitoring Report will be submitted by April 1 of the following year. The purpose of the reports is to describe the site and applicable groundwater monitoring requirements, present a summary of the data collection, comment on the groundwater quality, and discuss conclusions on the adequacy of the groundwater monitoring system. Appropriate software, databases, and presentation method shall be used to compile, evaluate, and present the data. This report will include at least the following:

- the purpose of the sampling event (i.e., semi-annual, annual, biennial);
- a description of the activities performed and any deviations from this QA-SAP;
- site layout map identifying well locations;
- documentation and/or summary of well re-development or new construction activities;
- evaluation of groundwater gradients and flow directions;
- evaluation of groundwater flow with estimated flow rates;
- discussion of analytical results (contaminant concentration levels);
- summary of data validation as described in this QA-SAP;
- brief narrative describing the groundwater monitoring system, including operation and maintenance of the groundwater treatment system conducted or required during the monitoring period;
- potentiometric surface maps for each groundwater horizon;
- isoconcentration maps of VOCs detected above DTLs for the sampling event (minimum of three detections required);
- a groundwater elevation table;
- well total depth table and comparison to original well depths;
- summary of the analytical results in table form;
- a copy of field notes and/or field information forms;
- a copy of original laboratory analytical results with QA/QC data;
- chain of custody records;
- time series charts of select analytical data; and
- certification of report by a Missouri-licensed geologist.

8.2 Report Submittals

Three bound copies of the Semi-Annual and Annual Groundwater Monitoring Reports will be submitted to:

Missouri Department of Natural Resources
Hazardous Waste Program
P.O. Box 176
Jefferson City, Missouri 65102-0176

Additionally, two bound copies will be submitted to:

Environmental Protection Agency, Region VII
901 North Fifth Street
Kansas City, Kansas 66101-2907

9.0 GENERAL COMMENTS

This sampling and analysis plan was prepared for the exclusive use of the client for specific application to this project and has been prepared in accordance with generally accepted practices. The analysis, conclusions, and recommendations presented in this plan are based upon data evaluated as discussed within this plan. Aquaterra does not warrant the work of regulatory agencies or other parties, which may have supplied information used in the assimilation of this document.

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10.0 REFERENCES

Administrative Order on Consent for Corrective Action, United States Environmental Protection Agency, Region VII, signed September 1994.

Final Quality Assurance Project Plan, Quality Analytical Service, Blue Summit, Missouri, Shaw Environmental & Infrastructure, Inc., April 18, 2006

Groundwater Sampling and Analysis Plan (SAP) Worksheet, Missouri Department of Natural Resources - Hazardous Waste Program.

Human Health and Screening Level Ecological Risk Assessment for the Quality Analytical Services Site, Section 3.3 – Site Geology, and Section 3.4 – Site Hydrogeology, Shaw Environmental, Inc., August 15, 2007.

Operation and Maintenance Inspection Report, Quality Analytical Services, Missouri Department of Natural Resources – Hazardous Waste Program, Groundwater Unit, March 2008.

Post-Closure Plan for Industrial Service Corporation, Deffenbaugh Industries, Revised June 2002.

Appendix A

Tables

The following tables are included in this Appendix:

Table 1 - Monitoring Network Construction Information
Quality Analytical Services
1633 Marsh Avenue
Blue Summit, Missouri

EPA ID Number MOD0730274609
Aquaterra Project Number: 2641.10

Well ID	Groundwater Horizon	Approximate Boring Diameter (inches)	Nominal Casing Diameter (inches)	Well Screen (feet bgs)	Total Depth, Initial (feet bTOC)	Ground Surface Elevation (feet)	Top of Casing Elevation (feet)	Top of Screen Elevation (feet)	Bottom as Installed Elevation (feet)	Approximate Depth to Water (feet)	Well Volume per Foot of Water (gallons)	Comments
EPA-R-1	**A**	6	2	18 - 28	25.07	775.02	777.57	762.50	752.50	18	0.16	Free Product
EPA-R-3	**A**	6	2	35 - 47	49.50	786.00	787.12	737.62	737.62	18	0.16	
GW-1	**A**	8	4	8 - 13	18.31	793.02	795.66	782.35	777.35	10	0.65	
GW-2R	**A**	8	4	10 - 20	32.15	789.38	793.21	771.06	761.06	16	0.65	Free Product
GW-3	**A**	8	4	25 - 35	35.19	784.39	784.39	754.20	749.20	20	0.65	Free Product
GW-4	**A**	8	4	18 - 33	42.48	782.06	786.68	759.20	744.20	15	0.65	Free Product
GW-5	**A**	8	2	5 - 15	17.50	777.91	780.28	772.78	762.78	10	0.16	
GW-6A	**A**	8	2	14 - 24	23.50	773.32	772.82	759.32	749.32	13	0.16	
GW-6B	**B**	8	2	72 - 77	76.50	767.57	767.07	695.57	690.57	20	0.16	
GW-7	**A**	8	2	16 - 26	25.50	783.74	783.24	768.24	757.74	18	0.16	
GW-8A	**A**	8	2	4 - 14	14.50	764.13	763.45	758.95	748.95	5	0.16	
GW-8B	**B**	8	2	68 - 73	73.00	764.47	764.00	696.00	691.00	18	0.16	
GW-8C	**C**	8	2	40 - 50	48.31	764.53	764.16	725.50	715.50	15	0.16	
GW-9A	**A**	8	2	14 - 24	23.91	767.54	766.95	753.54	743.04	10	0.16	
GW-9B	**B**	8	2	72 - 77	76.58	767.89	767.47	696.39	690.89	22	0.16	
GW-10A	**A**	8	2	10 - 20	19.30	766.89	766.49	757.69	747.19	7	0.16	
GW-10B	**B**	8	2	71 - 76	75.51	767.03	766.54	696.53	691.03	20	0.16	
GW-10C	**C**	8	2	40 - 50	49.17	767.60	767.28	707.11	717.11	15	0.16	
GW-11A	**A**	8	2	15 - 30	33.32	772.14	774.96	757.14	741.64	15	0.16	
GW-11B	**B**	8	2	73 - 78	80.31	771.81	774.12	699.31	693.81	28	0.16	
GW-11C	**C**	8	2	40 - 50	56.64	771.88	775.02	728.88	718.38	20	0.16	
GW-12A	**A**	8	2	15 - 30	29.66	759.03	758.69	745.53	729.03	18	0.16	

Table 1 - Monitoring Network Construction Information
Quality Analytical Services
1633 Marsh Avenue
Blue Summit, Missouri

EPA ID Number MOD0730274609
Aquaterra Project Number: 2641.10

Well ID	Groundwater Horizon	Approximate Boring Diameter (inches)	Nominal Casing Diameter (inches)	Well Screen (feet bgs)	Total Depth, Initial (feet bTOC)	Ground Surface Elevation (feet)	Top of Casing Elevation (feet)	Top of Screen Elevation (feet)	Bottom as Installed Elevation (feet)	Approximate Depth to Water (feet)	Well Volume per Foot of Water (gallons)	Comments
GW-12B	**B**	8	2	63 - 68	67.66	758.97	758.59	696.43	690.93	16	0.16	
GW-12C	**C**	8	2	40 - 50	49.57	758.93	758.54	719.47	708.97	15	0.16	
PW-1	**A, B, & C**	10	4	13 - 73	~73	766.45	765.04	753.45	Unknown	5	0.65	
PW-2	**A, B, & C**	10	4	15 - 75	~75	768.47	767.23	753.47	Unknown	10	0.65	
PW-3	**A, B, & C**	10	4	19 - 79	~79	770.00	769.00	751.00	Unknown	10	0.65	
PW-4	**A, B, & C**	10	4	18 - 80	~80	771.30	770.30	753.30	Unknown	12	0.65	

bgs - below ground surface
bTOC - below top of well casing
The initial total depth was determined by subtracting the bottom installed elevation from the top of casing elevation, except for GW-8C and GW-9C.
The initial total depth of GW-8C and GW-9C were provided on the boring logs.

Table 2 - Sampling and Analytical Schedule
Quality Analytical Services
1633 Marsh Avenue
Blue Summit, Missouri

EPA ID Number MOD0730274609
Aquaterra Project Number: 2641.10

Sample Location/ Well ID	May Events			November Events			Biennial November Events (Even-Numbered Years)						
	VOCs (Method 8260)	Low-Level 1,4-Dioxane (Method 8260)	Total Metals (Method 6010/7470)	VOCs (Method 8260)	Low-Level 1,4-Dioxane (Method 8260)	Total Metals (Method 6010/7470)	SVOCs (Method 8270)	Organochlorine Pesticides (Method 8081)	Polychlorinated Biphenyls (Method 8082)	Total Cyanide (Method 335.4)	Total Sulfide (Method 376.2)	Hexavalent Chromium (Method SW-856 7196A)	Full Appendix IX
EPA-R-1				X		X							*one location will be selected for Full Appendix IX analysis*
EPA-R-3				X		X							
GW-1	X		X	X	X	X							
GW-2R				X		X							
GW-3				X		X							
GW-4				X		X							
GW-5	X		X	X	X	X							
GW-6A				X	X	X							
GW-6B	X		X	X		X							
GW-7	X		X	X	X	X							
GW-8A				X	X	X	X	X	X	X	X	X	
GW-8B	X	X	X	X	X	X	X	X	X	X	X	X	
GW-8C	X	X	X	X	X	X	X	X	X	X	X	X	
GW-9A				X	X	X	X	X	X	X	X	X	
GW-9B	X	X	X	X	X	X	X	X	X	X	X	X	
GW-10A				X	X	X	X	X	X	X	X	X	
GW-10B	X	X	X	X	X	X	X	X	X	X	X	X	
GW-10C	X	X	X	X	X	X	X	X	X	X	X	X	
GW-11A	X		X	X	X	X							
GW-11B	X	X	X	X	X	X							
GW-11C	X		X	X		X	X	X	X	X	X	X	
GW-12A	X	X	X	X	X	X							
GW-12B	X	X	X	X	X	X							
GW-12C	X	X	X	X	X	X							
PW-1	X		X	X		X							
PW-2	X		X	X		X							
PW-3	X		X	X		X							
PW-4	X		X	X		X							
Trench	X		X	X		X							
Effluent	X		X	X		X							
Totals	*21*	*9*	*21*	*30*	*17*	*30*	*9*	*9*	*9*	*9*	*9*	*9*	*1*

Table 3 - Constituents of Concern
Quality Analytical Services
1633 Marsh Avenue
Blue Summit, Missouri

EPA ID Number MOD0730274609
Aquaterra Project Number: 2641.10

Parameter	Units	EPA Regions 3 and 9 RSLs (tapwater)	Federal MCLs (NPDWS)	Missouri DTLs	Required Reporting Limit
Volatile Organic Compounds (Analyze by Method 8260)					
Acetone	µg/l	22,000	NL	2970	50
Acrolein	µg/l	0.042	NL	NL	50
Acrylonitrile	µg/l	0.0045	NL	0.468	50
Allyl chloride	µg/l	0.65	NL	4.4	50
Benzene	µg/l	0.41	5	5	1
Bromobenzene	µg/l	20	NL	NL	1
Bromochloromethane	µg/l	NL	NL	54.4	1
Bromodichloromethane	µg/l	0.12	NL	80	1
Bromoform	µg/l	8.5	NL	80	1
Bromomethane	µg/l	8.7	NL	4.67	5
2-Butanone (MEK)	µg/l	7,100	NL	3,640	50
n-Butylbenzene	µg/l	NL	NL	98.9	1
sec-Butylbenzene	µg/l	NL	NL	106	1
tert-Butylbenzene	µg/l	NL	NL	103	1
Carbon disulfide	µg/l	1,000	NL	527	1
Carbon tetrachloride	µg/l	0.2	5	5	1
Chlorobenzene	µg/l	91	100	55.8	1
Chlorodibromomethane	µg/l	NL	NL	NL	1
Chloroethane	µg/l	NL	NL	48.5	5
2-Chloroethyl vinyl ether	µg/l	NL	NL	NL	10
Chloroform	µg/l	0.19	NL	80	5
Chloromethane	µg/l	190	NL	18.3	2.5
2-Chlorotoluene	µg/l	730	NL	61.9	1
4-Chlorotoluene	µg/l	2,600	NL	0.31	1
1,2-Dibromo-3-Chloropropane	µg/l	NL	0.2	0.2	5
1,2-Dibromoethane	µg/l	0.0065	0.05	0.05	1
Dibromomethane	µg/l	NL	NL	NL	1
1,2-Dichlorobenzene	µg/l	370	600	600	1
1,3-Dichlorobenzene	µg/l	NL	NL	89.3	1
1,4-Dichlorobenzene	µg/l	0.43	75	75	1
trans-1,4-Dichloro-2-butene	µg/l	0.0012	NL	NL	1
Dichlorodifluoromethane	µg/l	390	NL	220	5
1,1-Dichloroethane	µg/l	2.4	NL	24.9	1
1,2-Dichloroethane	µg/l	0.15	5	NL	1
1,1-Dichloroethene	µg/l	340	7	7	1

Table 3 - Constituents of Concern
Quality Analytical Services
1633 Marsh Avenue
Blue Summit, Missouri

EPA ID Number MOD0730274609
Aquaterra Project Number: 2641.10

Parameter	Units	EPA Regions 3 and 9 RSLs (tapwater)	Federal MCLs (NPDWS)	Missouri DTLs	Required Reporting Limit
cis-1,2-Dichloroethene	µg/l	370	70	70	1
trans-1,2-Dichloroethene	µg/l	110	100	100	1
1,2-Dichloropropane	µg/l	0.39	5	5	1
1,3-Dichloropropane	µg/l	730	NL	NL	1
2,2-Dichloropropane	µg/l	NL	NL	NL	1
1,1-Dichloropropene	µg/l	NL	NL	NL	1
cis-1,3-Dichloropropene	µg/l	NL	NL	NL	1
trans-1,3-Dichloropropene	µg/l	NL	NL	NL	1
Di-isopropyl ether	µg/l	830	NL	351	1
1,4-Dioxane	µg/l	6.1	NL	61	100
1,4-Dioxane (low-level)	*µg/l*	*6.1*	*NL*	*61*	*4*
Ethylbenzene	µg/l	1.5	700	700	1
Ethyl methacrylate	µg/l	3,300	NL	NL	5
Hexachlorobutadiene	µg/l	0.86	NL	2	1
2-Hexanone	µg/l	NL	NL	NL	50
Iodomethane	µg/l	NL	NL	NL	50
Isopropylbenzene	µg/l	NL	NL	330	1
p-Isopropyltoluene	µg/l	NL	NL	786	1
Methacrylonitrile	µg/l	1.0	NL	NL	50
Methylene Chloride	µg/l	4.8	NL	5	5
Methyl methacrylate	µg/l	1,400	NL	NL	50
4-Methyl-2-pentanone (MIBK)	µg/l	2,000	NL	915	50
Methyl tert-butyl ether	µg/l	12	NL	128	1
Naphthalene	µg/l	0.14	NL	1.09	5
Pentachloroethane	µg/l	0.75	NL	NL	50
Propionitrile	µg/l	NL	NL	NL	50
n-Propylbenzene	µg/l	NL	NL	115	1
Styrene	µg/l	1,600	100	100	1
1,1,2,2-Tetrachloroethane	µg/l	0.067	NL	0.689	1
1,1,1,2-Tetrachloroethane	µg/l	0.52	NL	5.27	1
Tetrachloroethene	µg/l	0.11	5	5	1
Tetrahydrofuran	µg/l	NL	NL	20.3	5
Toluene	µg/l	2,300	1,000	1,000	5
1,2,3-Trichlorobenzene	µg/l	NL	NL	NL	1
1,2,4-Trichlorobenzene	µg/l	8.2	70	70	1
1,1,1-Trichloroethane	µg/l	9,100	200	200	1
1,1,2-Trichloroethane	µg/l	0.24	5	5	1

Table 3 - Constituents of Concern
Quality Analytical Services
1633 Marsh Avenue
Blue Summit, Missouri

EPA ID Number MOD0730274609
Aquaterra Project Number: 2641.10

Parameter	Units	EPA Regions 3 and 9 RSLs (tapwater)	Federal MCLs (NPDWS)	Missouri DTLs	Required Reporting Limit
Trichloroethene	µg/l	1.7	5	5	1
Trichlorofluoromethane	µg/l	1,300	NL	698	5
1,2,3-Trichloropropane	µg/l	0.0096	NL	0.0693	1
1,2,4-Trimethylbenzene	µg/l	15	NL	7.06	1
1,3,5-Trimethylbenzene	µg/l	12	NL	7.05	1
Vinyl chloride	µg/l	0.016	2	2	1
Xylenes, Total	µg/l	200	10,000	10,000	3
Metals (Analyze by Method 6010; Mercury by Method 7470)					
Arsenic	µg/l	0.045	10	10	1
Mercury	µg/l	NL	2	50.7	0.2
Barium	µg/l	7,300	2,000	2,000	200
Cadmium	µg/l	18	5	5	5
Chromium	µg/l	55,000	100	100	1
Lead	µg/l	NL	15	15	5
Manganese	µg/l	880	NL	2,190	10
Nickel	µg/l	730	NL	313	20
Selenium	µg/l	180	50	50	10
Silver	µg/l	180	NL	78.1	20

Sources for Action Levels:
EPA Region 3 and EPA Region 9 Regional Screening Levels (RSLs), for tapwater, April 2009
Federal MCLs (maximum contaminant levels), NPDWS (national primary drinking water standards), June 2003
Missouri DTLs (lowest default target levels), June 2006
NL = Not Listed

Required Reporting Limits are the Practical Quantification Limits (PQLs)

Table 4 - Biennial Additional Target Analytes
Quality Analytical Services
1633 Marsh Avenue
Blue Summit, Missouri

EPA ID Number MOD0730274609
Aquaterra Project Number: 2641.10

Compound	CAS Number	Required Reporting Limit (µg/L)
Semi-Volatile Organic Compounds by Method 8270		
Acenaphthene	83-32-9	10
Acenaphthylene	208-96-8	10
Anthracene	120-12-7	10
Benzidine	92-87-5	50
Benzo[a]anthracene	56-55-3	10
Benzo[b]fluoranthene	205-99-2	10
Benzo[k]fluoranthene	207-08-9	10
Benzo[g,h,i]perylene	191-24-2	10
Benzo[a]pyrene	50-32-8	10
Benzoic acid	65-85-0	10
Benzyl alcohol	100-51-6	10
bis(2-Chloroethoxy)methane	111-91-1	10
bis(2-Chloroethyl)ether	111-44-4	10
bis(2-Chloroisopropyl)ether	108-60-1	10
bis(2-Ethylhexyl)phthalate	117-81-7	10
4-Bromophenyl-phenylether	101-55-3	10
Butylbenzylphthalate	85-68-7	10
4-Chloroaniline	106-47-8	10
4-Chloro-3-methylphenol	59-50-7	10
2-Chloronaphthalene	91-58-7	10
2-Chlorophenol	95-57-8	10
4-Chlorophenyl-phenylether	7005-72-3	10
Chrysene	218-01-9	10
Dibenz[a,h]anthracene	53-70-3	10
Dibenzofuran	132-64-9	10
Di-n-butylphthalate	84-74-2	10
3,3'-Dichlorobenzidine	91-94-1	10
2,4-Dichlorophenol	120-83-2	10
Diethylphthalate	84-66-2	10
2,4-Dimethylphenol	105-67-9	10
Dimethylphthalate	131-11-3	10
4,6-Dinitro-2-methylphenol	534-52-1	10
2,4-Dinitrophenol	51-28-5	10
2,4-Dinitrotoluene	121-14-2	10
2,6-Dinitrotoluene	606-20-2	10
Di-n-octylphthalate	117-84-0	10

Table 4 - Biennial Additional Target Analytes
Quality Analytical Services
1633 Marsh Avenue
Blue Summit, Missouri

EPA ID Number MOD0730274609
Aquaterra Project Number: 2641.10

Compound	CAS Number	Required Reporting Limit (µg/L)
Fluoranthene	206-44-0	10
Fluorene	86-73-7	10
Hexachlorobenzene	118-74-1	10
Hexachlorobutadiene	87-68-3	10
Hexachlorocyclopentadiene	77-47-4	10
Hexachloroethane	67-72-1	10
Indeno[1,2,3-cd]pyrene	139-39-5	10
Isophorone	78-59-1	10
2-Methylnaphthalene	91-57-6	10
2-Methylphenol	95-48-7	10
4-Methylphenol	106-44-5	10
Naphthalene	91-20-3	10
2-Nitroaniline	88-74-4	10
3-Nitroaniline	99-09-2	10
4-Nitroaniline	100-01-6	10
Nitrobenzene	98-95-3	10
2-Nitrophenol	88-75-5	10
4-Nitrophenol	100-02-7	10
N-Nitrosodimethylamine	62-75-9	10
N-Nitrosodiphenylamine	86-30-6	10
N-Nitroso-di-n-propylamine	621-64-7	10
Pentachlorophenol	87-86-5	10
Phenanthrene	85-01-8	10
Phenol	108-95-2	10
Pyrene	129-00-0	10
Pyridine	110-86-1	10
2,4,5-Trichlorophenol	95-95-4	10
2,4,6-Trichlorophenol	88-06-2	10
Organochlorine Pesticides by Method 8081		
Aldrin	309-00-2	0.5
alpha-BHC	319-84-6	0.5
Beta-BHC	319-85-7	0.5
Delta-BHC	319-86-8	0.5
gamma-BHC (Lindane)	58-89-9	0.5
4,4'-DDD	72-54-8	0.5
4,4'-DDE	72-55-9	0.5
4,4'-DDT	50-29-3	0.5

Table 4 - Biennial Additional Target Analytes
Quality Analytical Services
1633 Marsh Avenue
Blue Summit, Missouri

EPA ID Number MOD0730274609
Aquaterra Project Number: 2641.10

Compound	CAS Number	Required Reporting Limit (µg/L)
Dieldrin	60-57-1	0.5
Endosulfan I	959-98-8	0.5
Endosulfan II	33213-65-9	0.5
Endosulfan sulfate	1031-07-8	0.5
Endrin	72-20-8	0.5
Endrin aldehyde	7421-93-4	0.5
Endrin ketone	53494-70-5	0.5
Heptachlor	76-44-8	0.5
Heptachlor epoxide	1024-57-3	0.5
Methoxychlor	72-43-5	0.5
Polychlorinated Biphenyls by Method 8082		
Aroclor 1016	12674-11-2	5
Aroclor 1221	11104-28-2	5
Aroclor 1232	11141-16-5	10
Aroclor 1242	53469-21-9	5
Aroclor 1248	12672-29-6	5
Aroclor 1254	11097-69-1	5
Aroclor 1260	11096-82-5	5
Wastewater Parameters		
Total Cyanide	Method 335.4	5
Total Sulfide	Method 376.2	100
Hexavalent Chromium	SW-856 7196A	10

CAS Number = Chemical Abstracts Service registry number

Table 5 - Appendix IX Analyses
Quality Analytical Services
1633 Marsh Avenue
Blue Summit, Missouri

EPA ID Number MOD0730274609
Aquaterra Project Number: 2641.10

Parameter	Analytical Method
Volatile Organic Compounds	Method 8260
Semi-Volatile Organic Compounds	Method 8270
Organochlorine Pesticides	Method 8081
Polychlorinated Biphenyls	Method 8082
Herbicides	Method 8151
Metals (excludes Mercury)	Method 6010
Mercury	Method 7470
Cyanide	Method 335.4
Sulfide	Method 376.2
Dioxins/Furans	Method 8280

Table 6 - Containers, Preservation, and Holding Times
Quality Analytical Services
1633 Marsh Avenue
Blue Summit, Missouri

EPA ID Number MOD0730274609
Aquaterra Project Number: 2641.10

Parameter	Analytical Method	Container	Preservative	Holding Time
Volatile Organic Compounds	Method 8260	three 40-mL vials with septum lids	HCl	14 days
Low Level 1,4-Dioxane	Method 8260	two 40-mL vials with septum lids	HCl	14 days
Semi-Volatile Organic Compounds	Method 8270	two 1-liter amber glass	None	7 days to extraction; analyze within 40 days of extraction
Organochlorine Pesticides	Method 8081	two 1-liter amber glass	None	7 days to extraction; analyze within 40 days of extraction
Polychlorinated Biphenyls	Method 8082	two 1-liter amber glass	None	7 days to extraction; analyze within 40 days of extraction
Herbicides	Method 8151	two 1-liter amber glass	None	7 days to extraction; analyze within 40 days of extraction
Metals (excludes Mercury)	Method 6010	500 mL plastic	HNO3	6 months
Mercury	Method 7470	500 mL plastic	HNO3	28 days
Cyanide	Method 335.4	250 mL plastic	NaOH	14 days
Sulfide	Method 376.2	250 mL plastic	Zinc Acetate & NaOH	7 days
Hexavalent Chromium	SW-856 7196A	500 mL plastic container	None	24 hours
Dioxins/Furans	Method 8280	two 1-liter amber glass	None	28 days

Appendix B

Boring Logs and Well Construction Diagrams

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.

TEST
TOTAL ENVIRONMENTAL SERVICES & TECHNOLOGIES

BOREHOLE LOG

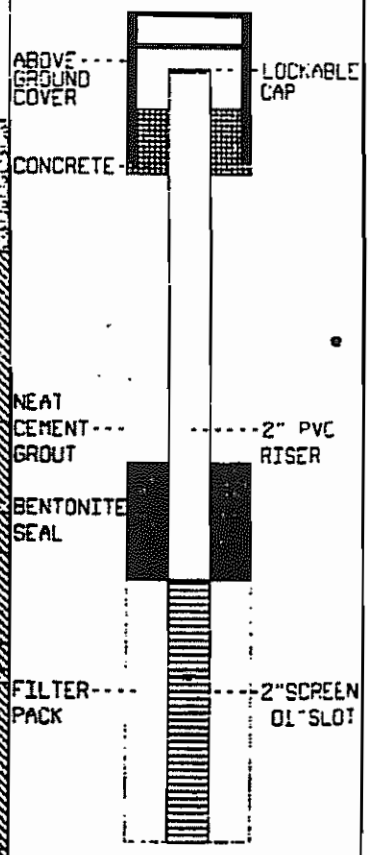
LOCATION DESCRIPTION
WEST OF ISC FACILITY ACCROSS
MARSH STREET IN LIVERS PARKING

BORING/WELL ID	EPA-R-1	CLIENT	USEPA
WELL TAG ID	UNKNOWN	ADDRESS	
RIG TYPE & NUMBER	UNKNOWN		
DRILLING METHOD	UNKNOWN	PROJECT CODE	39-7L00
SAMPLING METHOD	UNKNOWN	TEST ID	N/A
BORING DIAMETER	UNKNOWN	TOTAL DEPTH	29 5'
DATE DRILLED	8/19/86		
DRILLING CREW	KC TESTING LAB		
GEOLOGIST	E & E		

ELEVATIONS (ft)		
PAD	TOC	SWL

STATIC WATER LEVEL (BLS)		
	While Drilling	After Boring
Depth(ft)	21.5'	21 3'
Time	UNKNOWN	UNKNOWN
Date	8/19/86	8/19/86

SOIL SAMPLES	FIELD (ppm) ANALYSIS	LAB SAMPLES	DEPTH	LITHOLOGIC DESCRIPTION	LITHOLOGY	WELL INSTALLATION
			5			
			0	GRAVEL BROWN, SILTY, MOIST.		
			-5	CLAY BROWN, SILTY, MOIST SOFT		
			-10			
				CLAY BROWN WITH MOTTLED GRAY, SILTY, MOIST, SOFT		
			-15	CLAY GRAY, SILTY, MOIST, MEDIUM		
				CLAY LT BROWN WITH OLIVE GRAY, SILTY, MOIST, MEDIUM		
			-20	CLAY LT BROWN WITH OLIVE GRAY, SILTY, MOIST, SOFT		
				CLAY OLIVE GRAY, SILTY, WET, SOFT		
			-25	CLAY LT BROWN WITH GRAY, SILTY, SANDY, WET, SOFT, WATER @ 29 5'		
			-30			



TEST

BOREHOLE LOG

LOCATION DESCRIPTION:
SOUTH OF ISC PARKING AREA
NEAR ASHLAND AVENUE

BORING/WELL ID	EPA-R-3	CLIENT	USEPA
WELL TAG ID	UNKNOWN	ADDRESS	
RIG TYPE & NUMBER	UNKNOWN		
DRILLING METHOD	UNKNOWN	PROJECT CODE	39-7L00
SAMPLING METHOD	UNKNOWN	TEST ID	N/A
BORING DIAMETER	UNKNOWN	TOTAL DEPTH	47 5'
DATE DRILLED	8/20/86		
DRILLING CREW	KC TESTING LAB		
GEOLOGIST	E & E		

ELEVATIONS (FT)

PAD	TOC	SWL

STATIC WATER LEVEL (BLS)

	While Drilling	After Boring
Depth(ft)	46 5'	23.85'
Time	UNKNOWN	UNKNOWN
Date	8/20/86	8/22/86

SOIL SAMPLES	FIELD (ppm) ANALYSIS	LAB SAMPLES	DEPTH	LITHOLOGIC DESCRIPTION	LITHOLOGY	WELL INSTALLATION
			5			
			0	CLAY BROWN, SILTY, DRY, SOFT WITH ROCK FRAGMENTS		ABOVE GROUND COVER CONCRETE
				CLAY BROWN, SILTY, MOIST, SOFT		
			-5	CLAY BROWN, MOIST, MEDIUM		
				CLAY BROWN, SILTY, MOIST, MEDIUM		
			-10			
				CLAY BROWN, SILTY, MOIST, SOFT		
				CLAY LT BROWN, SILTY, MOIST, SOFT		
			-15			NEAT CEMENT GROUT
				CLAY LT BROWN WITH RUST AND GRAY MOTTLED, SILTY, MOIST, SOFT		
			-20			
				CLAY LT BROWN, SILTY, MOIST, SOFT		
			-25			
				CLAY BROWN, VERY SILTY, MOIST, SOFT		
			-30			
			-35	CLAY BROWNISH GRAY, VERY SILTY, SMALL ROCK FRAGMENTS, MOIST, SOFT		BENTONITE SEAL
			-40			FILTER PACK
			-45	CLAY GRAY, FAT, VERY STIFF, VERY MOIST		
				LIMESTONE AUGER REFUSAL ON LIMESTONE @ 46 5'		
			-50			

LOCKABLE CAP
2" PVC RISER
2" SCREEN
.01" SLOT

TEST
TOTAL ENVIRONMENTAL SERVICES &

BOREHOLE LOG

LOCATION DESCRIPTION
18' SOUTH AND 135' EAST OF
NORTHWEST CORNER OF FACILITY

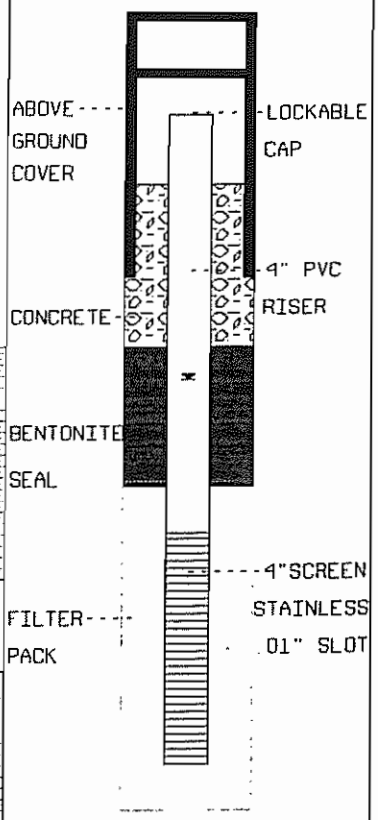
File: QAS (Formerly ISC)
HW/GWM

BORING/WELL ID	GW-1	CLIENT	INDUSTRIAL SERVICE CORP.
WELL TAG ID	N/A	ADDRESS	1633 S. MARSH
RIG TYPE & NUMBER	MOBILE B-80/715		KANSAS CITY, MO
DRILLING METHOD	AIR ROTARY	PROJECT CODE	KC, MO. ISC
SAMPLING METHOD	CONTINUOUS	TEST ID	N/A
BORING DIAMETER	7 7/8	TOTAL DEPTH	13.0'
DATE DRILLED	3/25/92		
DRILLING CREW	C.WEST / B.C. MILLET		
GEOLOGIST	K.J. BROOKS		

ELEVATIONS (Ft)		
PAD	TOC	SWL

STATIC WATER LEVEL (BLS)		
	While Drilling	After Boring
Depth(Ft)	8-11'	5.7'
Time	?	8:57 am
Date	3/25/92	4/24/92

SOIL SAMPLES	FIELD (ppm) ANALYSIS	LAB SAMPLES	DEPTH	LITHOLOGIC DESCRIPTION	LITHOLOGY	WELL INSTALLATION
			5			
			0	LIMESTONE GRAY, HARD		
			-5	SHALE MEDIUM GRAY TO BLACK, PLATY		
			-10	LIMESTONE DARK GRAY, HARD		
				SHALE MEDIUM GRAY, CALCAREOUS, DRILLING DISCONTINUED @ 13'		
			-15			



TEST
TOTAL ENVIRONMENTAL SERVICES

BOREHOLE LOG

LOCATION DESCRIPTION
15' NORTH AND 75' EAST OF
NORTHWEST CORNER OF FACILITY

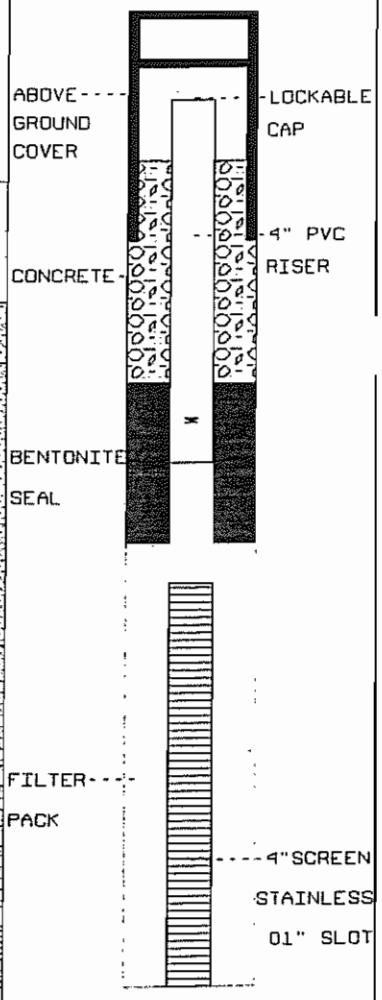
BORING/WELL ID	GW-2	CLIENT	INDUSTRIAL SERVICE CORP.
WELL TAG ID	N/A	ADDRESS	1633 S. MARSH
RIG TYPE & NUMBER	MOBILE B-80/715		KANSAS CITY, MO
DRILLING METHOD	AIR ROTARY	PROJECT CODE	KC, MO. ISC
SAMPLING METHOD	CONTINUOUS	TEST ID	N/A
BORING DIAMETER	7 7/8	TOTAL DEPTH	20.0'
DATE DRILLED	3/31/92		
DRILLING CREW	C.WEST / B.C. MILLET		
GEOLOGIST	K.J. BROOKS		

ELEVATIONS (Ft)		
PAD	TOC	SWL

STATIC WATER LEVEL (BLS)		
	While Drilling	After Boring
Depth(ft)	9.5'	8.0'
Time	UNKNOWN	UNKNOWN
Date	3/31/92	4/24/92

SOIL SAMPLES	FIELD (ppm) ANALYSIS	LAB SAMPLES	DEPTH	LITHOLOGIC DESCRIPTION	LITHOLOGY
			5		
			0	FILL GRAVEL, OIL STAINED	
				CLAY GRAY GREEN BROWN, STIFF, SILTY, OIL STAINED	
				CLAY TAN TO BROWN, SILTY, STIFF, SLIGHTLY MOIST, OIL STAINED	
			-5		
				CLAY GRAYISH GREEN TO BROWN, STIFF, SILTY, SLIGHTLY MOIST, OIL STAINED	
				CLAY BROWN TO GRAY, SILTY, SLIGHTLY MOIST, OIL STAINED	
			-10		
				LIMESTONE TAN TO GRAY, FRACTURED, CLAYEY	
				CLAY BROWN AND GRAY, SILTY, OIL STAINED	
				LIMESTONE TAN TO GRAY, FRACTURED, CLAYEY	
			-15	CLAY DK GRAY, SILTY, STIFF, OIL STAINED	
				LIMESTONE TAN TO GRAY, FRACTURED, CLAYEY	
				CLAY BROWN AND TAN, SILTY WITH GRAVEL AND WEATHERD LIMESTONE FRAGMENTS, OIL STAINED IN LOWER 1'. DRILLING DISCONTINUED ON AUGER REFUSAL @ 20'	
			-20		

WELL INSTALLATION



DEFFENBAUGH INDUSTRIES ENGINEERING

BOREHOLE LOG

LOCATION DESCRIPTION
100' SOUTH AND 3' WEST OF NORTHWEST CORNER OF FACILITY

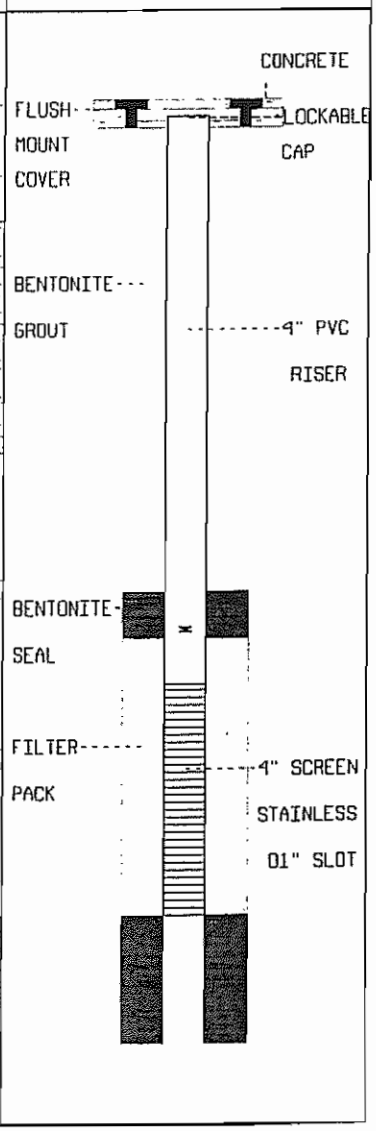
BORING/WELL ID	GW-3	CLIENT	INDUSTRIAL SERVICE CORP.
WELL TAG ID	N/A	ADDRESS	1633 S. MARSH
RIG TYPE & NUMBER	MOBILE B-80/715		KANSAS CITY, MO
DRILLING METHOD	HOLLOW STEM	PROJECT CODE	KC, MO. ISC
SAMPLING METHOD	CONTINUOUS	TOTAL DEPTH	40.0'
BORING DIAMETER	7 5/8		
DATE DRILLED	4/8/92		
DRILLING CREW	C. WEST / B.C. MILLETT		
GEOLOGIST	K.J. BROOKS		

ELEVATIONS (ft)		
PAD	TOC	SWL

STATIC WATER LEVEL (BLS)		
	While Drilling	After Boring
Depth(ft)	21.0'	22.75'
Time	UNKNOWN	UNKNOWN
Date	4/8/92	4/24/92

SOIL SAMPLES	FIELD (ppm) ANALYSIS	LAB SAMPLES	DEPTH	LITHOLOGIC DESCRIPTION	LITHOLOGY
			0	FILL GRAVEL, OIL STAINED	
			-10	CLAY GRAY, SILTY, STIFF OIL STAINED	
			-20	CLAY GRAYISH GREEN, STIFF, SLIGHTLY MOIST, OIL STAINED, WATER @ 21'	
			-30		
			-40	CLAY GRAY TO GREEN, SILTY, WITH LIMESTONE FRAGMENTS	
				LIMESTONE TAN TO GRAY, FRACTURED AUGER REFUSAL @ 40' DRILLING DISCONTINUED	

WELL INSTALLATION



DEFFENBAUGH INDUSTRIES ENGINEERING

BOREHOLE LOG

LOCATION DESCRIPTION
8' NORTH AND 2' EAST OF NORTHWEST CORNER OF FACILITY

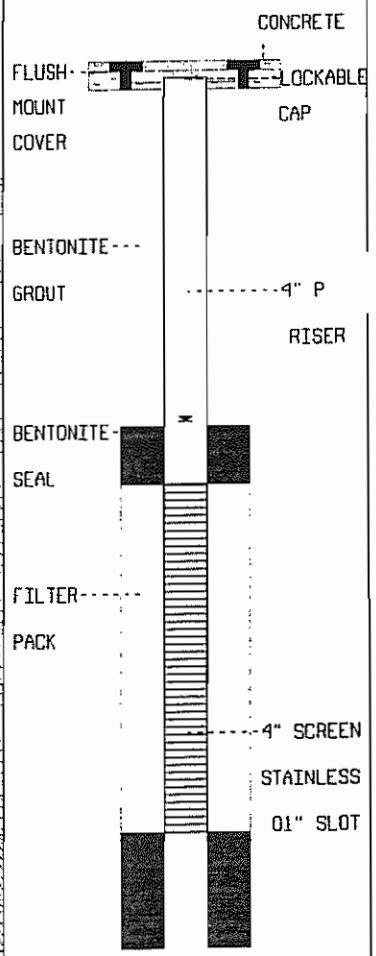
BORING/WELL ID	GW-4	CLIENT	INDUSTRIAL SERVICE CORP.
WELL TAG ID	N/A	ADDRESS	1633 S. MARSH
RIG TYPE & NUMBER	MOBILE B-80/715		KANSAS CITY, MO
DRILLING METHOD	HOLLOW STEM	PROJECT CODE	KC, MO. ISC
SAMPLING METHOD	CONTINUOUS	TOTAL DEPTH	38.0'
BORING DIAMETER	7 5/8		
DATE DRILLED	4/3/92		
DRILLING CREW	C. WEST / B.C. MILLETT		
GEOLOGIST	K.J. BROOKS		

ELEVATIONS (ft)		
PAD	TOC	SWL

STATIC WATER LEVEL (BLS)		
	While Drilling	After Boring
Depth(Ft)	21.5'	15.3'
Time	UNKNOWN	UNKNOWN
Date	4/3/92	4/24/92

SOIL SAMPLES	FIELD (ppm) ANALYSIS	LAB SAMPLES	DEPTH	LITHOLOGIC DESCRIPTION	LITHOLOGY
			0	FILL GRAVEL, OIL STAINED	
				CLAY GRAYISH GREEN WITH RED AND BROWN STREAKING IN LOWER 3', SILTY, STIFF, OIL STAINED	
			-10		
			-20		
				CLAY DARK GRAY, SILTY, STIFF, SLIGHTLY MOIST, OIL STAINED, WATER @ 21 5'	
			-30		
				SILT DARK GRAY, CLAYEY, STIFF, SLIGHTLY MOIST, SMALL LIMESTONE GRAVEL PRESENT, SIZE INCREASED IN LOWER 1'	
			-40	LIMESTONE TAN TO GRAY, FRACTURED AUGER REFUSAL @ 38' DRILLING DISCONTINUED	

WELL INSTALLATION



TEST
TOTAL ENVIRONMENTAL SERVICES &

BOREHOLE LOG

LOCATION DESCRIPTION
'NORTH OF PLANT WALL
' WEST OF MARSH RD.

BORING/WELL ID	GW5	CLIENT	INDUSTRIAL SERVICE CORP.
WELL TAG ID	N/A	ADDRESS	1633 S. MARSH
RIG TYPE & NUMBER	MOBILE B-61/716		KANSAS CITY, MO
DRILLING METHOD	HOLLOW STEM	PROJECT CODE	ISC-KC
SAMPLING METHOD	CONTINUOUS	TEST ID	N/A
BORING DIAMETER	7 5/8	TOTAL DEPTH	17.5'
DATE DRILLED	3/14/94		
DRILLING CREW	G. GUERRA / K. TAYLOR		
GEOLOGIST	B. ROBINSON		

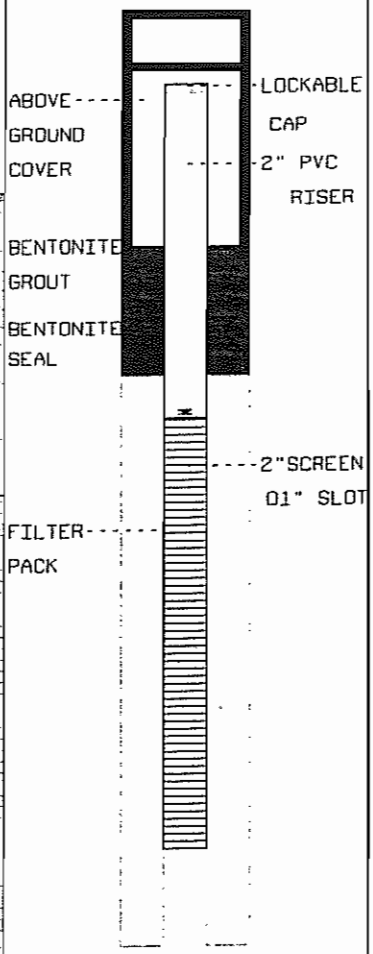
ELEVATIONS (ft)		
PAD	TOC	SWL

STATIC WATER LEVEL (BLS)		
	While Drilling	After Boring
Depth(ft)	13.0'	5.17'
Time	?	8:57 am
Date	3/14/94	3/15/94

SOIL SAMPLES	FIELD (ppm) ANALYSIS	LAB SAMPLES	DEPTH	LITHOLOGIC DESCRIPTION
			5	
GW5-0'	0		0	TOPSOIL Brown, organic
GW5-2'	0			
				CLAY Brown, stiff
GW5-4'	0			
			-5	
GW5-6'	0			
				SILT Brown, CLAYEY, moist water at 13'
GW5-8'	0			
GW5-10'	0		-10	
GW5-12'	0			
			-15	
			-20	

LITHOLOGY

WELL INSTALLATION



TEST
TOTAL ENVIRONMENTAL SERVICES & TECHNOLOGIES

BOREHOLE LOG

LOCATION DESCRIPTION
13.75' NORTH OF FENCE AT SOUTH PROPERTY BOUNDARY
9.5' EAST OF FENCE AT WEST PROPERTY BOUNDARY

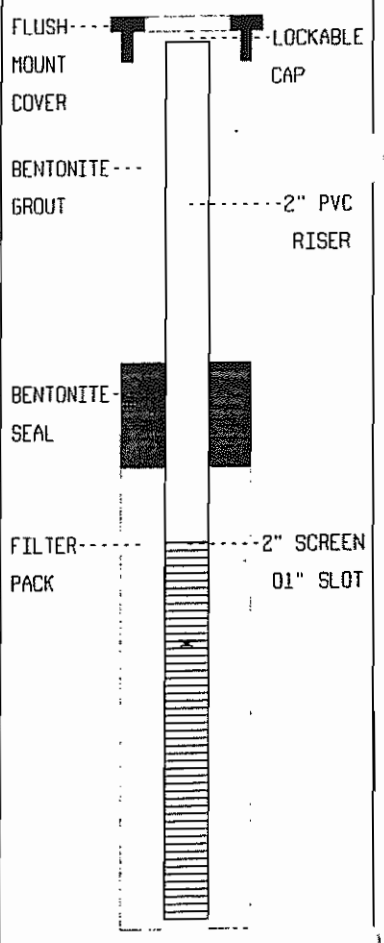
BORING/WELL ID	GW6A	CLIENT	INDUSTRIAL SERVICE CORP.
WELL TAG ID	N/A	ADDRESS	1633 S. MARSH
RIG TYPE & NUMBER	MOBILE B-61/716		KANSAS CITY, MO
DRILLING METHOD	HOLLOW STEM	PROJECT CODE	ISC-KC
SAMPLING METHOD	CONTINUOUS	TEST ID	N/A
BORING DIAMETER	7 5/8	TOTAL DEPTH	24.0'
DATE DRILLED	3/16/94		
DRILLING CREW	G. GUERRA / K. TAYLOR		
GEOLOGIST	B. ROBINSON		

ELEVATIONS (Ft)		
PAD	TOC	SWL

STATIC WATER LEVEL (BLS)		
	While Drilling	After Boring
Depth(Ft)	18.0'	16.49'
Time	?	8:35 am
Date:	3/16/94	3/21/94

SOIL SAMPLES	FIELD (ppm) ANALYSIS	LAB SAMPLES	DEPTH	LITHOLOGIC DESCRIPTION	LITHOLOGY
			0	GRAVEL Fill	
				CLAY Brown, SANDY, very fine grained, stiff, roots and root canals	
GW6B-5'	0				
GW6B-6'	0				
GW6A-7'	0				
GW6A-8'	0				
GW6A-9'	0				
GW6A-10'	0		-10		
GW6A-11'	0				
GW6A-12'	0				
GW6A-13'	0				
GW6A-14'	0			SILT Brown, CLAYEY, SANDY, very fine to fine grained, with roots and canals, wet at 18'	
GW6A-15'	0				
GW6A-16'	0				
GW6A-17'	0				
GW6A-18'	0				
GW6A-19'	0				
			-20		

WELL INSTALLATION



TEST
TOTAL ENVIRONMENTAL SERVICES & TECHNOLOGIES

BOREHOLE LOG

LOCATION DESCRIPTION
15.0' EAST OF FENCE ON WEST PROPERTY BOUNDARY
93.0' SOUTH OF SOUTHWEST CORNER OF BUILDING

BORING/WELL ID	GW6B	CLIENT	INDUSTRIAL SERVICE CORP.
WELL TAG ID	N/A	ADDRESS	1633 S. MARSH
RIG TYPE & NUMBER	MOBILE B-61/716		KANSAS CITY, MO
DRILLING METHOD	HOLLOW STEM	PROJECT CODE	ISC-KC
SAMPLING METHOD	CONTINUOUS	TEST ID	N/A
BORING DIAMETER	7 5/8	TOTAL DEPTH	77.0'
DATE DRILLED	3/15/94		
DRILLING CREW	G. GUERRA / K TAYLOR		
GEOLOGIST	B. ROBINSON		

ELEVATIONS (ft)		
PAD	TOC	SWL

STATIC WATER LEVEL (BLS)		
	While Drilling	After Boring
Depth(Ft)	12.0'	23.3'
Time	?	?
Date	3/15/94	3/16/94

SOIL SAMPLES	FIELD (ppm) ANALYSIS	LAB SAMPLES	DEPTH	LITHOLOGIC DESCRIPTION	LITHOLOGY	WELL INSTALLATION
			0	GRAVEL Fill		FLUSH MOUNT COVER; LOCKABLE CAP
				CLAY Brown, SANDY, very fine grained, stiff		
			-10	SILT Brown, SANDY, very fine grained, CLAYEY, moist		BENTONITE GROUT
				SILT Brown, SANDY, fine to medium grained, CLAYEY, wet at 13'		
			-20	SILT Brown, SANDY, fine to coarse grained, CLAYEY, moist, wet at 20'		
				SILT Brown, SANDY, very fine grained, CLAYEY, wet		BENTONITE SEAL
			-30	CLAY Dark brown, SILTY, plastic, moist to wet, loess (no sample recovery below 22.5' - log to 77' obtained from test hole 1 [TH-1] dated December 29, 1987)		2" PVC RISER
				CLAY Mottled brown to gray, SILTY, sticky moist to wet with pebbles		
			-40	SAND Light gray, with gray SILT and some coarse gravels		
			-50			FILTER PACK
			-60	GRAVEL SANDY, with boulders washed angular to subangular, much water		
			-70			2" SCREEN 01" SLOT
				SHALE Dark gray, hard bedrock		
			-80			

DEFFENBAUGH INDUSTRIES ENGINEERING

BOREHOLE LOG

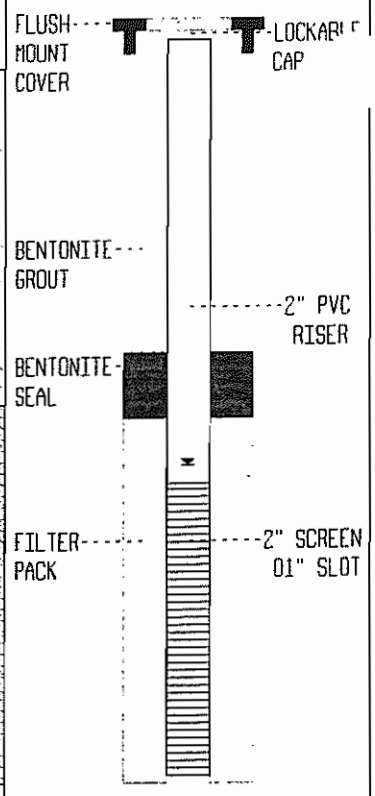
LOCATION DESCRIPTION
17.5' SOUTH OF ISC BASEMENT DOOR
23.0' WEST OF ISC BASEMENT DOORS

BORING/WELL ID	GW-7	CLIENT	INDUSTRIAL SERVICE CORP.
WELL TAG ID	N/A	ADDRESS	1633 S. MARSH
RIG TYPE & NUMBER	MOBILE B-61/716		KANSAS CITY, MO
DRILLING METHOD	HOLLOW STEM	PROJECT CODE	ISC-KC
SAMPLING METHOD	CONTINUOUS	TOTAL DEPTH	26.0'
BORING DIAMETER	7 5/8		
DATE DRILLED	3/14/94		
DRILLING CREW	G. GUERRA / K. TAYLOR		
GEOLOGIST	B. ROBINSON		

ELEVATIONS (ft)		
PAD	TOC	SWL

STATIC WATER LEVEL (BLS)		
	While Drilling	After Boring
Depth(ft)	21.0'	15.12'
Time	?	8:40 am
Date	3/14/94	3/15/94

SOIL SAMPLES	FIELD (ppm) ANALYSIS	LAB SAMPLES	DEPTH	LITHOLOGIC DESCRIPTION	LITHOLOGY	WELL INSTALLATION
GW7-0'	0		0	GRAVEL Fill		
GW7-2'	0			CLAY Red-brown, stiff		
GW7-4'	0					
GW7-6'	0					
GW7-8'	0					
GW7-10'	0		-10			
GW7-12'	0					
GW7-14 5'	0			SILT Brown, CLAYEY, with root cavities and holes, wet at 21'		
GW7-16'	0					
GW7-18'	0					
GW7-18 5'	0					
GW7-20'	0		-20			
GW7-21'	0					
GW7-22'	0					
GW7-23'	0					
GW7-23 5'	0					



TEST
TOTAL ENVIRONMENTAL SERVICES & TECHNOLOGIES

BOREHOLE LOG

LOCATION DESCRIPTION
40' WEST OF LIVERS BLDG. AND 30' SOUTH OF BOX CULVERT
UNDER UNDER I-435 N. EXIT RAMP TO TRUMAN RD. RIGHT-OF-WAY

BORING/WELL ID	GW8A	CLIENT	I. S. C.
WELL TAG ID	N/A	ADDRESS	1633 S. MARSH
RIG TYPE & NUMBER	MOBILE B-61/716		KANSAS CITY, MO
DRILLING METHOD	HOLLOW STEM	PROJECT CODE	ISC-KC
SAMPLING METHOD	CONTINUOUS	TEST ID	N/A
BORING DIAMETER	7 5/8	TOTAL DEPTH	14.5'
DATE DRILLED	7/26/95		
DRILLING CREW	G. GUERRA/ R. GEORGE/ H. GLEN		
GEOLOGIST	M. COSSAIRT		

ELEVATIONS (ft)		
PAD	TOC	SWL
764.13	763.95	755.31

STATIC WATER LEVEL (BLS)		
	While Drilling	After Boring
Depth(ft)	7.8'	8.19'
Time	?	?
Date	7/26/95	8/23/95

SOIL SAMPLES	FIELD (ppm) ANALYSIS	LAB SAMPLES	DEPTH	LITHOLOGIC DESCRIPTION	LITHOLOGY	WELL INSTALLATION
			0	SOIL DARK BROWN, FRIABLE		FLUSH MOUNT COVER; CONCRETE; BENTONITE SEAL; LOCKABLE CAP; 2" PVC RISER
				CLAY DARK BROWN		
GW8B-5'	2			CLAY DARK BROWN, ROOT CAVATIES WET @ 7 8'		
GW8A-7'	2					2" SCREEN 01" SLOT; FILTER PACK
				NO SAMPLE SAMPLE LOST FROM SAMPLER		
			-10			
GW8A-11 5	2			CLAY GRAY, SILTY, IRON STAINING PRESENT BORING STOPPED @ 14 5'		NATURAL MATERIAL
GW8A-13 5	2					

TEST
TOTAL ENVIRONMENTAL SERVICES & TECHNOLOGIES

BOREHOLE LOG

LOCATION DESCRIPTION
40' WEST OF LIVERS BRONZE BLDG. AND 30' SOUTH OF BOX CULVERT UNDER I-435 N. EXIT RAMP TO TRUMAN RD. RIGHT-OF-WAY

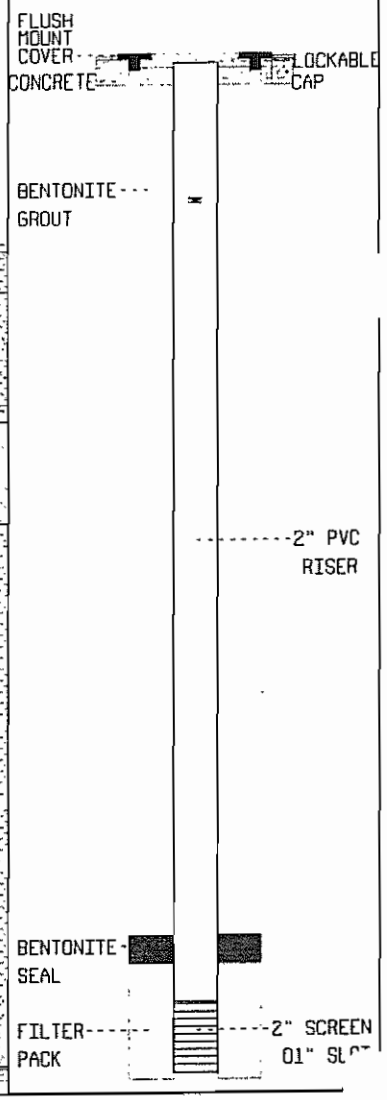
BORING/WELL ID	GW8B	CLIENT	I. S. C.
WELL TAG ID	N/A	ADDRESS	1633 S. MARSH
RIG TYPE & NUMBER	MOBILE B-61/716		KANSAS CITY, MO
DRILLING METHOD	HOLLOW STEM	PROJECT CODE	ISC-KC
SAMPLING METHOD	CONTINUOUS	TEST ID	N/A
BORING DIAMETER	7 5/8	TOTAL DEPTH	73.0'
DATE DRILLED	7/26/95 - 7/28/95		
DRILLING CREW	G. GUERRA / R.GEORGE / H. GLENN		
GEOLOGIST	M. COSSAIRT		

ELEVATIONS (ft)		
PAD	TOC	SWL
764.47	763.97	753.52

STATIC WATER LEVEL (BLS)		
	While Drilling	After Boring
Depth(Ft)	7.8'	10.45'
Time	?	?
Date	7/26/95	8/23/95

SOIL SAMPLES	FIELD (ppm) ANALYSIS	LAB SAMPLES	DEPTH	LITHOLOGIC DESCRIPTION
			0	NO SAMPLE SEE LOG FOR GW8A
			-10	CLAY BROWN
				CLAY GRAY, SILTY, SOME SAND LESS SAND AND WATER WITH INCREASING DEPTH
			-20	CLAY GRAY, SILTY, WITH BROWN IRON STAINING
8B 22-24				CLAY GRAY, SILTY, NO IRON STAINING
				CLAY GRADING FROM DARK TO MEDIUM GRAY
			-30	
				SILT GRAY - (SAMPLER STUCK FROM WET SILT PACKING BETWEEN SAMPLER AND AUGER. SAMPLING DISCONTINUED, ATTEMPTED AGAIN @45'-50' BUT UNSUCCESFUL. BALANCE OF LOG FROM CUTTINGS)
			-40	
				SILT GRAY
8B 48-50			-50	
			-60	
				GRAVEL GRAY, WITH PEBBLES TO 1 5" DIA (IDENTIFIED FROM CUTTINGS AND VIBRATION OF DRILL)
8B 68-70			-70	SHALE DARK GRAY, BORING DISCONTINUED @ 73'

LITHOLOGY



WELL INSTALLATION

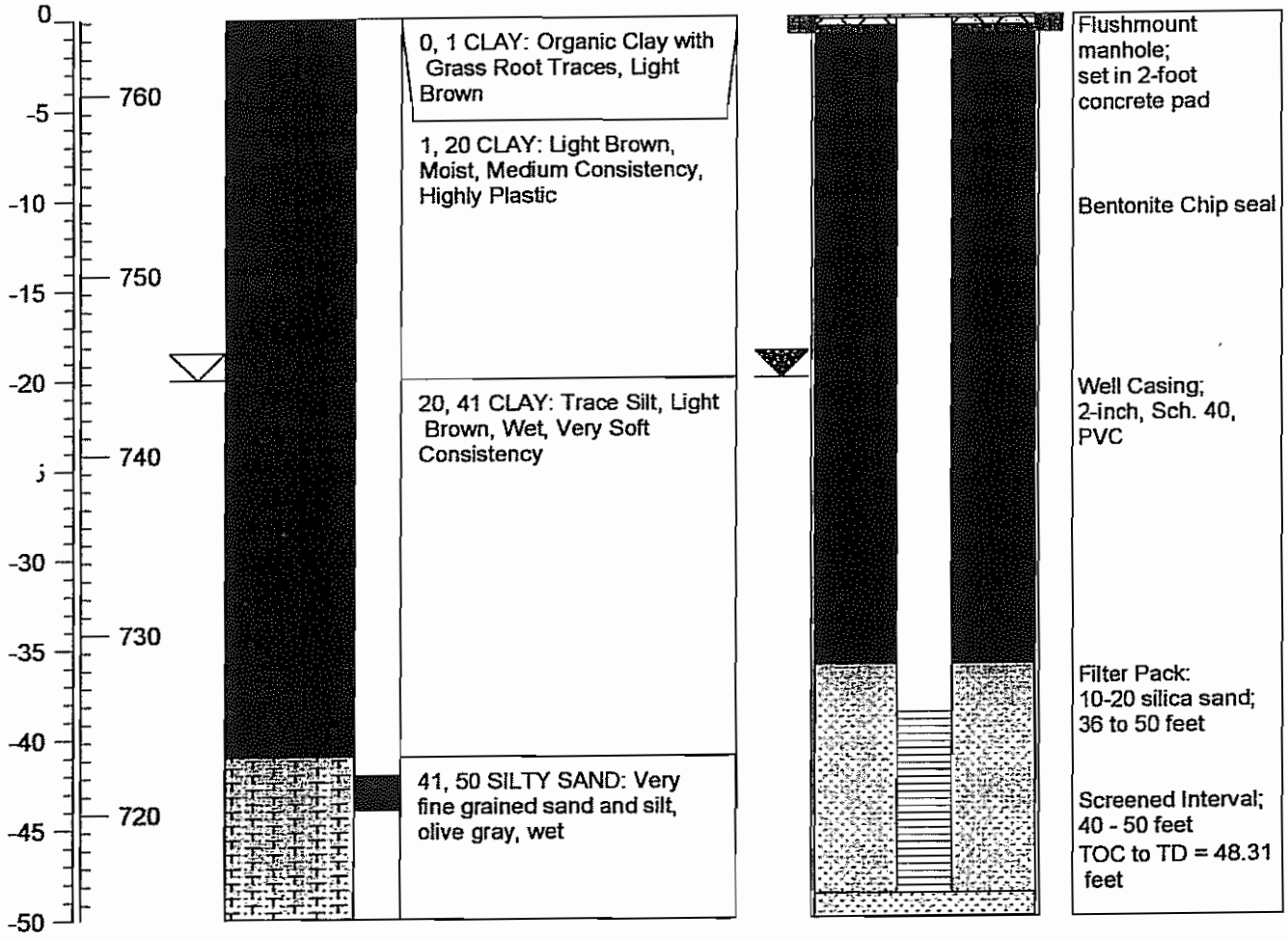
Deffenbaugh Industries, Inc.

Project Name: QAS - Kansas City
Project Location: 1633 Marsh, Kansas City, MO
Geologist: Chris Eaton
Driller: John Johnson
Date Drilled - Constructed: 04/07/05 - 04/07/05

Boring ID: GW-8C
Total Depth of Boring: 50 feet
Top of Casing Elevation: 764.16
Ground Surface Elevation: 764.53
Depth Water Encountered: 20'
Static Water Level: 20.00 Date Measured: 05/11/05

Northing	Easting
1064417.694	2792420.741

Sample Interval | Lithology Description | Well Construction



otal Depth = 50 feet

Depth Water Encountered While Drilling

Depth to Water in Well

DEFFENBAUGH INDUSTRIES ENGINEERING

BOREHOLE LOG

LOCATION DESCRIPTION
EAST RIGHT OF WAY TO INTERSTATE I-435
APPROXIMATELY 60 FEET WEST OF GW-6B

BORING/WELL ID	GW-9A	CLIENT	I.S.C.
RIG TYPE & NUMBER	MOBILE B-61/7160	PROJECT CODE	OAS-KC
DRILLING METHOD	HOLLOW STEM	START DATE	11/4/97
SAMPLING METHOD	CONTINUOUS	FINISH DATE	11/4/97
BORING DIAMETER	7 5/8	TOTAL DEPTH	24.5'
GEOLOGIST	M. Cossairt		
DRILLING CREW	G Guerra/K Taylor/H. Glen		

ELEVATIONS (ft)		
PAD	TOC	SWL
767.54	766.95	753.12

STATIC WATER LEVEL (BLS)		
	While Drilling	After Boring
Depth(ft)	20'	13.77
Time		
Date	11/4/97	12/2/97

CORING RECORD: CORE SIZE | RUN NUMBER | RUN LENGTH(ft) | RUN RECOVERY(ft) | ROD RECOVERY(ft) | % RECOVERY | ROD

STRATIGRAPHY: SYSTEM/SERIES | GROUP | SUBGROUP | FORMATION | MEMBER

GRAPHIC LOG | DEPTH

LITHOLOGIC DESCRIPTION

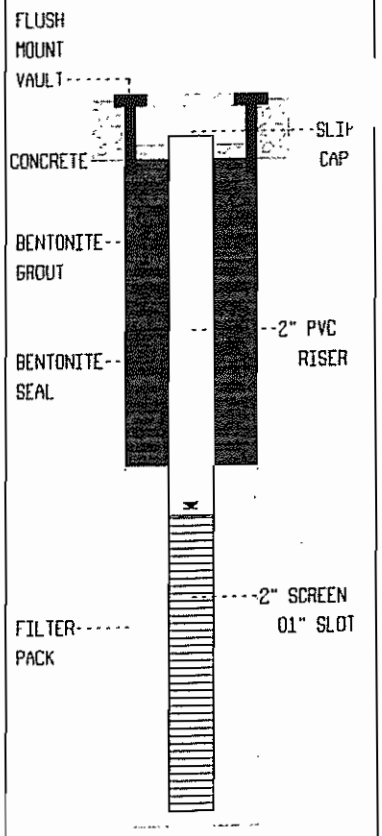
SOIL BROWN, CLAYEY, FILL

SOIL BLACK, FRIABLE

CLAY DARK BROWN, MODERATELY PLASTIC

CLAY BROWN, MODERATELY PLASTIC, MOIST @ 14'.

WELL INSTALLATION



DEFFENBAUGH INDUSTRIES ENGINEERING

BOREHOLE LOG

LOCATION DESCRIPTION:
EAST RIGHT OF WAY TO INTERSTATE I-435
APPROXIMATELY 60 FEET WEST OF GW-6B

BORING/WELL ID	GW-9B	CLIENT	I.S.C.
RIG TYPE & NUMBER	MOBILE B-61/7160	PROJECT CODE	DAS-KC
DRILLING METHOD	HOLLOW STEM	START DATE	11/10/97
SAMPLING METHOD	CONTINUOUS	FINISH DATE	11/12/97
BORING DIAMETER	7 5/8	TOTAL DEPTH	77.0'
GEOLOGIST	M. Cossoirt		
DRILLING CREW	G. Guerro/K. Taylor		

ELEVATIONS (ft)		
PAD	TOC	SWL
767.89	767.47	740.91

STATIC WATER LEVEL (BLS)		
	While Drilling	After Boring
Depth(ft)		26.56
Time		
Date		12/2/97

CORING RECORD: CORE SIZE | RUN NUMBER | RUN LENGTH(ft) | RUN RECOVERY(ft) | ROD RECOVERY(ft) | % RECOVERY | ROD

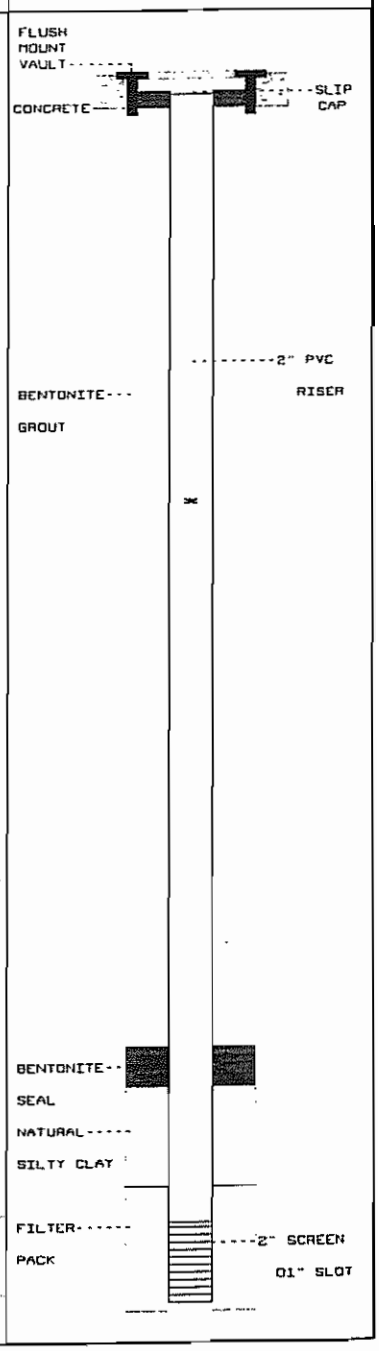
STRATIGRAPHY: SYSTEM/SERIES | GROUP | SUBGROUP | FORMATION | MEMBER

GRAPHIC LOG | DEPTH

LITHOLOGIC DESCRIPTION

DEPTH	LITHOLOGIC DESCRIPTION
0	CLAY LIGHT BROWN, FILL
3	SOIL DARK BROWN, CLAYEY
5	CLAY DARK BROWN
10	CLAY BROWN
50	SAND GREY
55	CLAY GREY, SILTY
70	CLAY GREY, W/ GRAVEL Increased drilling difficulty
75	SHALE GREY, REFUSAL ON BEDROCK @ 76'

WELL INSTALLATION



DEFFENBAUGH INDUSTRIES ENGINEERING

BOREHOLE LOG

LOCATION DESCRIPTION
EAST RIGHT OF WAY TO INTERSTATE I-435
APPROXIMATELY 170 FEET SOUTH OF GW-8B

BORING/WELL ID	GW-10A	CLIENT	I.S.C.
RIG TYPE & NUMBER	MOBILE B-61/7160	PROJECT CODE	OAS-KC
DRILLING METHOD	HOLLOW STEM	START DATE	11/3/97
SAMPLING METHOD	CONTINUOUS	FINISH DATE	11/3/97
BORING DIAMETER	7 5/8	TOTAL DEPTH	20.0'
GEOLOGIST	M. Cossairt		
DRILLING CREW	G Guerra/K. Taylor/H. Glen		

ELEVATIONS (ft)		
PAD	TOC	SWL
766.89	766.49	753.36

STATIC WATER LEVEL (BLS)		
	While Drilling	After Boring
Depth(ft)	15.5'	13.13'
Time		
Date	11/3/97	12/2/97

CORING RECORD: CORE SIZE | RUN NUMBER | RUN LENGTH(Ft) | RUN RECOVERY(Ft) | ROD RECOVERY(Ft) | % RECOVERY | ROD

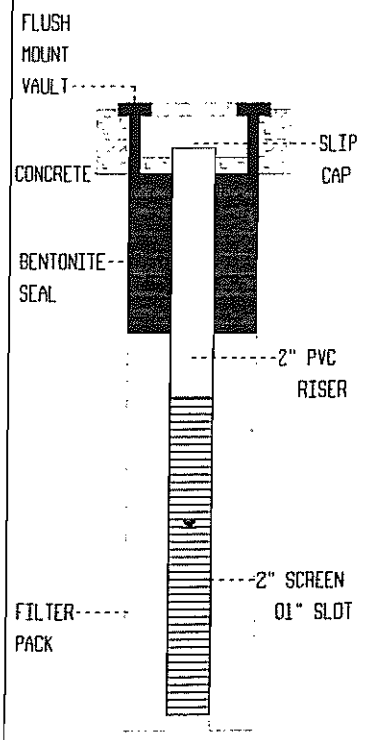
STRATIGRAPHY: SYSTEM/SERIES | GROUP | SUBGROUP | FORMATION | MEMBER

GRAPHIC LOG | DEPTH

LITHOLOGIC DESCRIPTION

WELL INSTALLATION

DEPTH	LITHOLOGIC DESCRIPTION
0	CLAY BROWN, MODERATELY PLASTIC, MOIST @ 9', WET @ 15 5' TD @ 20 0'



DEFFENBAUGH INDUSTRIES ENGINEERING

BOREHOLE LOG

LOCATION DESCRIPTION
EAST RIGHT OF WAY TO INTERSTATE I-435
APPROXIMATELY 170 FEET SOUTH OF GW-8B

BORING/WELL ID	GW-10B	CLIENT	I.S.C.
RIG TYPE & NUMBER	MOBILE B-61/T160	PROJECT CODE	OAS-KC
DRILLING METHOD	HOLLOW STEM	START DATE	11/5/97
SAMPLING METHOD	CONTINUOUS	FINISH DATE	11/7/97
BORING DIAMETER	7 5/8	TOTAL DEPTH	75.0'
GEOLOGIST	M. Cossairt		
DRILLING CREW	G. Guerra/K. Taylor/H. Glen		

ELEVATIONS (Ft)		
PAD	TOC	SWL
767.03	766.54	740.82

STATIC WATER LEVEL (BLS)		
	While Drilling	After Boring
Depth(ft)		25.72
Time		
Date		12/2/97

CORING RECORD: CORE SIZE | RUN NUMBER | RUN LENGTH(ft) | RUN RECOVERY(ft) | ROD RECOVERY(ft) | % RECOVERY | ROD

STRATIGRAPHY: SYSTEM/SERIES | GROUP | SUBGROUP | FORMATION | MEMBER

GRAPHIC LOG | DEPTH

LITHOLOGIC DESCRIPTION

SOIL BROWN, CLAYEY
CLAY BROWN

CLAY GREY

SAND GREY, FINE-GRAINED, SILTY

CLAY GREY, SILTY

LIMESTONE REFUSAL ON BEDROCK @ 75'

WELL INSTALLATION

FLUSH MOUNT VAULT
CONCRETE
SLIP CAP
2" PVC RISER
BENTONITE GROUT
BENTONITE SEAL
FILTER PACK
2" SCREEN .01" SLOT

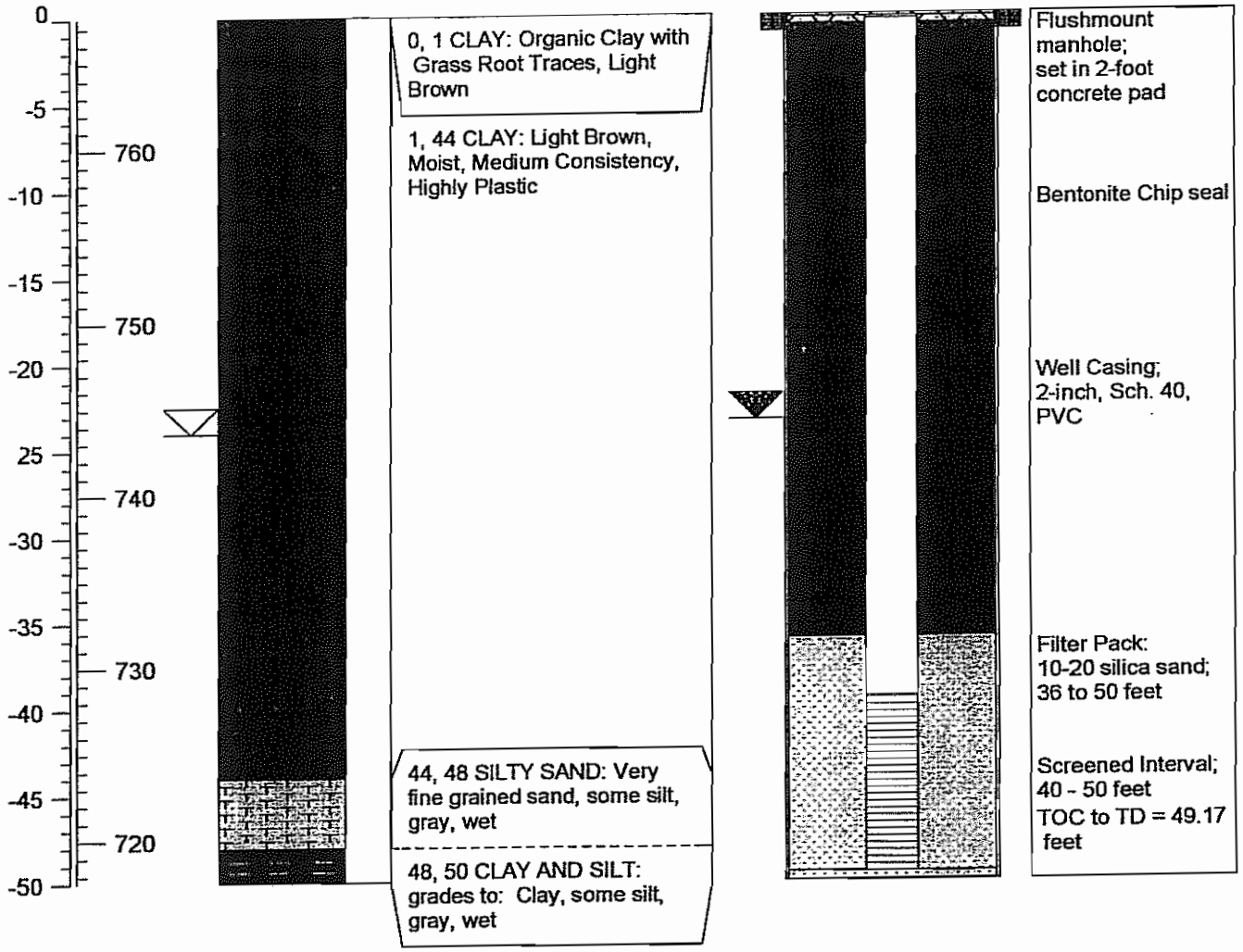
Deffenbaugh Industries, Inc.

Project Name: QAS - Kansas City
Project Location: 1633 Marsh, Kansas City, MO
Geologist: Chris Eaton
Driller: John Johnson
Date Drilled - Constructed: 04/04/05

Northing: 1064245.51
Easting: 2792422.16

Boring ID: GW-10C
Total Depth of Boring: 50 feet
Top of Casing Elevation: 767.28
Ground Surface Elevation: 767.60
Depth Water Encountered: 20'
Static Water Level: 23.34 Date Measured: 05/11/05

Sample Interval | Lithology Description | Well Construction



Total Depth = 50 feet

Depth Water Encountered While Drilling

Depth to Water in Well

DEFFENBAUGH INDUSTRIES ENGINEERING

BOREHOLE LOG

LOCATION DESCRIPTION
150' SOUTH OF LIVERS BRONZE BLDG. AND 44' EAST OF FENCE ADJACENT TO INTERSTATE I-435

BORING/WELL ID	GW-11A	CLIENT	I. S. C.
RIG TYPE & NUMBER	MOBILE B-61/7160	PROJECT CODE	ISC-KC
DRILLING METHOD	HOLLOW STEM	START DATE	8/24/01
SAMPLING METHOD	CONTINUOUS	FINISH DATE	8/24/01
BORING DIAMETER	7 5/8	TOTAL DEPTH	30.5'
GEOLOGIST	J. DAVIS		
DRILLING CREW	M.TEACHOUT / JR. REA		

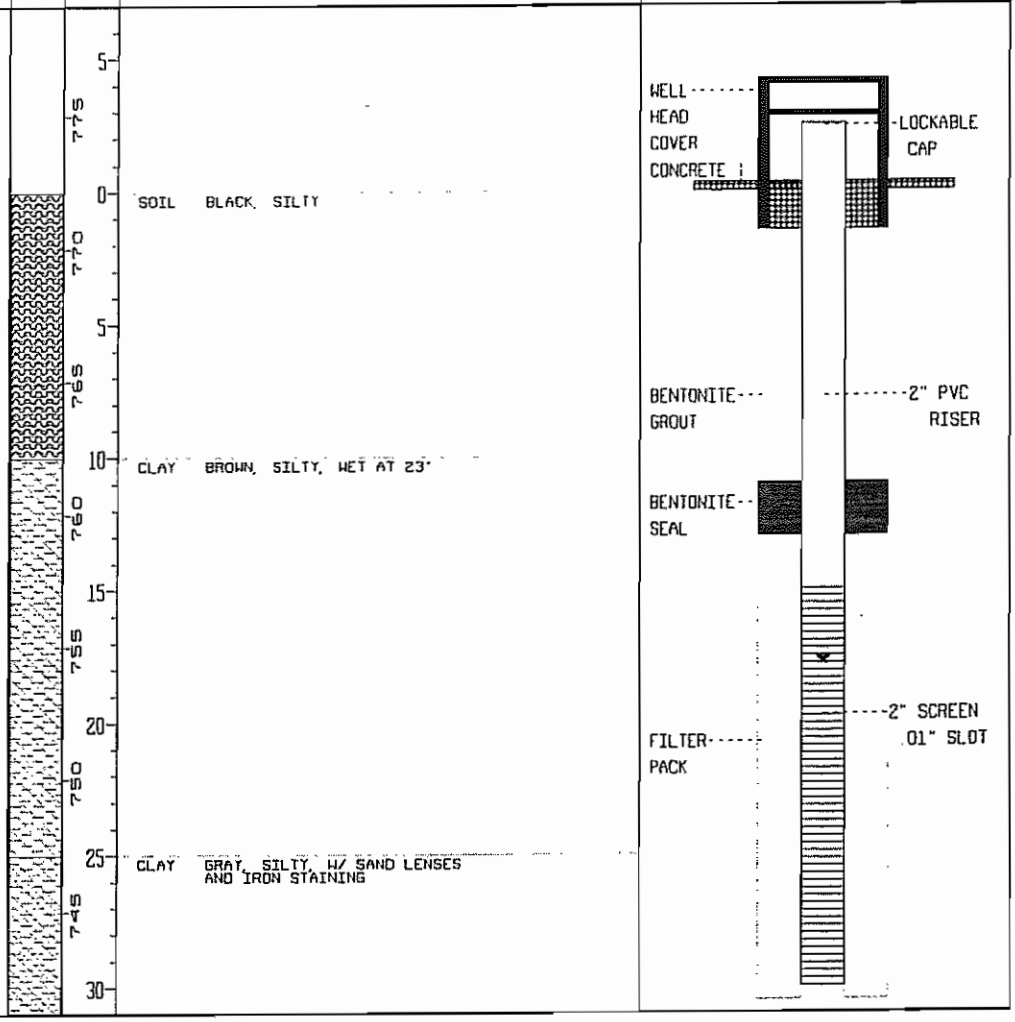
ELEVATIONS (ft)		
PAD	TOC	SWL
772.14	774.96	754.31

STATIC WATER LEVEL (BLS)		
	While Drilling	After Boring
Depth(ft)	23'	20.65
Time		
Date	8/24/01	11/11/01

CORING RECORD: CORE SIZE | RUN NUMBER | RUN LENGTH(ft) | RUN RECOVERY(ft) | ROD RECOVERY(ft) | % RECOVERY | ROD

STRATIGRAPHY: SYSTEM/SERIES | GROUP | SUBGROUP | FORMATION | MEMBER

GRAPHIC LOG | DEPTH | LITHOLOGIC DESCRIPTION | WELL INSTALLATION



DEFFENBAUGH INDUSTRIES ENGINEERING

BOREHOLE LOG

LOCATION DESCRIPTION
140' SOUTH OF LIVERS BRONZE BLDG. AND 44' EAST OF FENCE ADJACENT TO INTERSTATE I-435

BORING/WELL ID	GW-118	CLIENT	I. S. C.
RIG TYPE & NUMBER	MOBILE B-61/7160	PROJECT CODE	ISC-KC
DRILLING METHOD	HOLLOW STEM	START DATE	8/20/01
SAMPLING METHOD	CONTINUOUS	FINISH DATE	8/21/01
BORING DIAMETER	7 5/8	TOTAL DEPTH	78.0'
GEOLOGIST	J. DAVIS		
DRILLING CREW	M.TEACHOUT / JOHN OREGON		

ELEVATIONS (ft)		
PAD	TOC	SWL
771.81	774.12	743.62

STATIC WATER LEVEL (BLS)		
	While Drilling	After Boring
Depth(ft)	23'	30.5
Time		
Date	8/20/01	11/11/01

CORING RECORD: CORE SIZE | RUN NUMBER | RUN LENGTH(ft) | RUN RECOVERY(ft) | ROD RECOVERY(ft) | % RECOVERY | ROD

STRATIGRAPHY: SYSTEM/SERIES | GROUP | SUBGROUP | FORMATION | MEMBER

GRAPHIC LOG | DEPTH

LITHOLOGIC DESCRIPTION

SOIL BLACK, SILTY

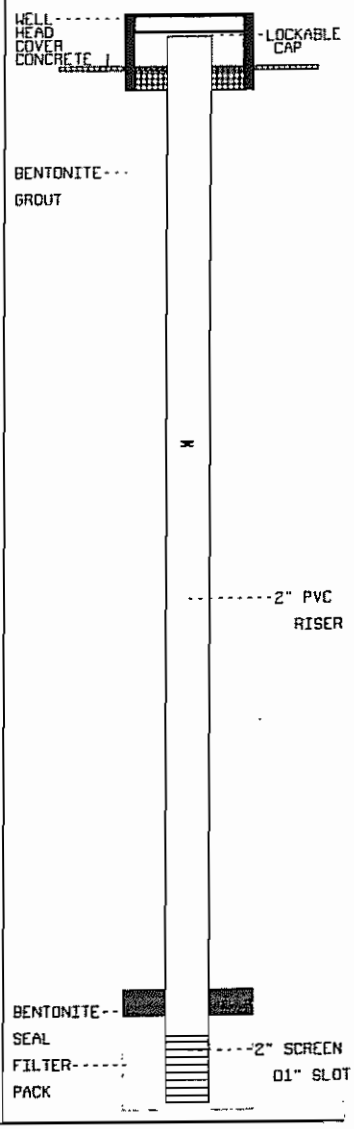
CLAY BROWN, SILTY, WET AT 23'

CLAY GRAY, SILTY, W/ SAND LENSES AND IRON STAINING
clay LENS @ 34'

SAND DARK GREY TO GREY, WET, VERY FINE GRAINED
clay LENS @ 48.5

CLAY GRAY, W/ SOME SILT, WET,
chert encountered @ 63'
65'-66' AND 75'-78'
BORING DISCONTINUED @ 78 FEET

WELL INSTALLATION



DEFFENBAUGH INDUSTRIES ENGINEERING

BOREHOLE LOG

LOCATION DESCRIPTION
145' SOUTH OF LIVERS BRONZE BLDG. AND 44' EAST OF FENCE ADJACENT TO INTERSTATE I-435

BORING/WELL ID	GW-11C	CLIENT	I. S. C.
RIG TYPE & NUMBER	MOBILE B-61/7160	PROJECT CODE	ISC-KC
DRILLING METHOD	HOLLOW STEM	START DATE	8/22/01
SAMPLING METHOD	CONTINUOUS	FINISH DATE	8/23/01
BORING DIAMETER	7 5/8	TOTAL DEPTH	53.5'
GEOLOGIST	J DAVIS		
DRILLING CREW	M.TEACHOUT / JOHN OREGON / J. CRUMB		

ELEVATIONS (ft)		
PAD	TOC	SWL
771.88	775.02	750.35

STATIC WATER LEVEL (BLS)		
	While Drilling	After Boring
Depth(Ft)	23'	24.67
Time		
Date	8/22/01	11/11/01

CORING RECORD: CORE SIZE | RUN NUMBER | RUN LENGTH(Ft) | RUN RECOVERY(Ft) | ROD RECOVERY(Ft) | % RECOVERY | ROD

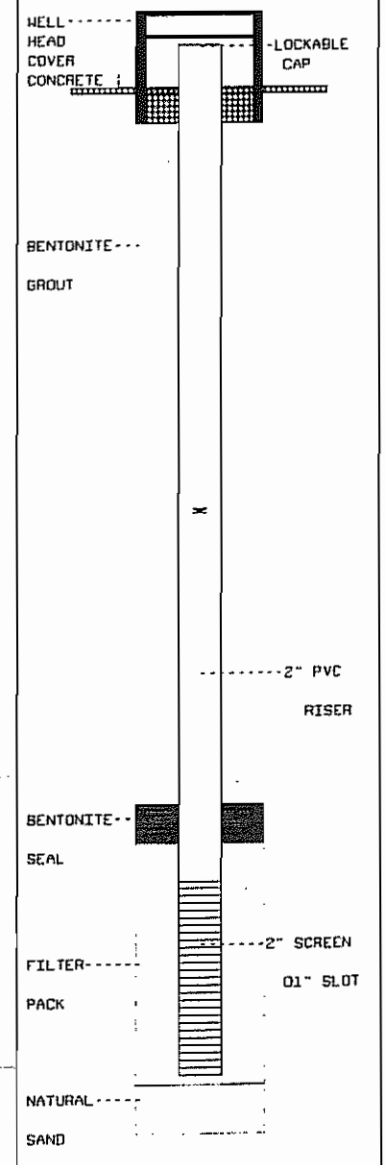
STRATIGRAPHY: SYSTEM/SERIES | GROUP | SUBGROUP | FORMATION | MEMBER

GRAPHIC LOG | DEPTH

LITHOLOGIC DESCRIPTION

SOIL	BLACK, SILTY
CLAY	BROWN, SILTY, WET AT 23'
CLAY	GRAY, SILTY, W/ SAND LENSES AND IRON STAINING clay LENS @ 34'
SAND	DARK GREY TO GREY, WET, VERY FINE GRAINED clay LENS @ 48.5
CLAY	GRAY, W/ SOME SILT, WET BORING DISCONTINUED @ 53.5 FEET

WELL INSTALLATION



DEFFENBAUGH INDUSTRIES ENGINEERING

BOREHOLE LOG

LOCATION DESCRIPTION
WEST RIGHT OF WAY TO INTERSTATE I-435 AT SOUTH END OF TRUMAN RD RAMP

BORING/WELL ID	GW-12A	CLIENT	O.A.S.
RIG TYPE & NUMBER	MOBILE B-61/7160	PROJECT CODE	OAS-KC
DRILLING METHOD	HOLLOW STEM	START DATE	12/4/03
SAMPLING METHOD	CONTINUOUS	FINISH DATE	12/4/03
BORING DIAMETER	7 5/8	TOTAL DEPTH	30.0'
GEOLOGIST	J. DAVIS		
DRILLING CREW	R.WOOD / M.TEACHOUT / J. KRUMWEIDE		

ELEVATIONS (ft)		
PAD	TOC	SWL
759.03	758.69	

STATIC WATER LEVEL (BLS)		
	While Drilling	After Boring
Depth(ft)	25'	
Time		
Date	12/4/03	

CORING RECORD: CORE SIZE | RUN NUMBER | RUN LENGTH(Ft) | RUN RECOVERY(Ft) | ROD RECOVERY(Ft) | % RECOVERY | ROD

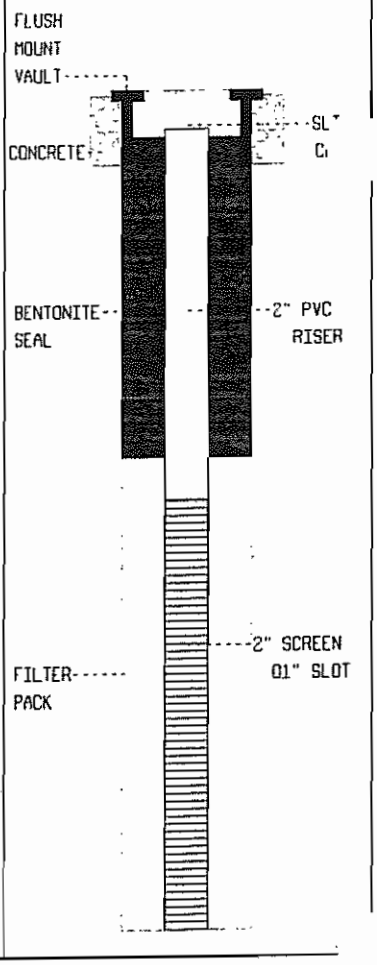
STRATIGRAPHY: SYSTEM/SERIES | GROUP | SUBGROUP | FORMATION | MEMBER

GRAPHIC LOG | DEPTH

LITHOLOGIC DESCRIPTION

DEPTH	
0	SOIL BROWN
5	SOIL BROWN/BLACK, SILTY
25	CLAY DARK BROWN, MOIST
30	

WELL INSTALLATION



DEFFENBAUGH INDUSTRIES ENGINEERING

BOREHOLE LOG

LOCATION DESCRIPTION
WEST RIGHT OF WAY TO INTERSTATE I-435 AT SOUTH END OF TRUMAN RD RAMP

BORING/WELL ID	GW-12B	CLIENT	O.A.S.
RIG TYPE & NUMBER	MOBILE B-61/7160	PROJECT CODE	OAS-KC
DRILLING METHOD	HOLLOW STEM	START DATE	12/1/03
SAMPLING METHOD	CONTINUOUS	FINISH DATE	12/2/03
BORING DIAMETER	7 5/8	TOTAL DEPTH	68.0'
GEOLOGIST	J. DAVIS		
DRILLING CREW	V. REA / M. TEACHOUT/ J.KRUMWEIDE		

ELEVATIONS (Ft)		
PAD	TOC	SWL
758.97	758.59	

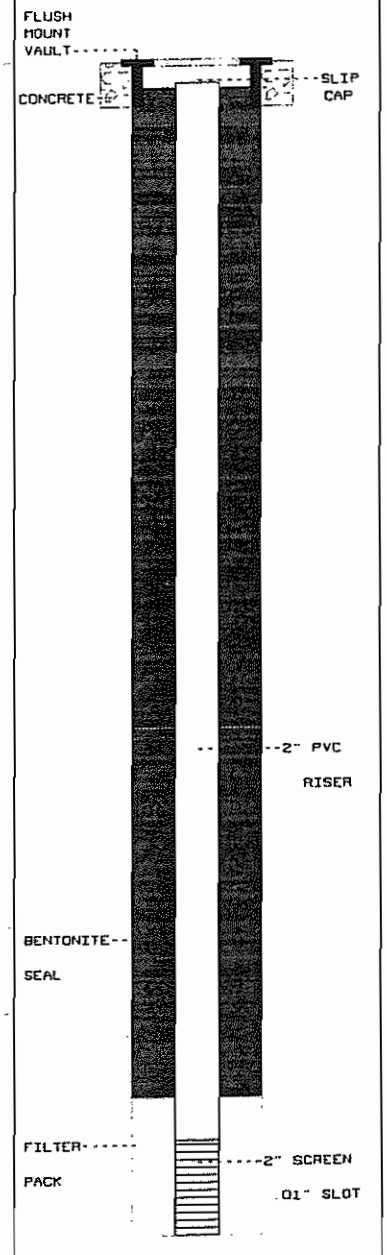
STATIC WATER LEVEL (BLS)		
	While Drilling	After Boring
Depth(Ft)	45'	
Time		
Date	12/1/03	

CORING RECORD: CORE SIZE | RUN NUMBER | RUN LENGTH(Ft) | RUN RECOVERY(Ft) | ROD RECOVERY(Ft) | % RECOVERY | ROD

STRATIGRAPHY: SYSTEM/SERIES | GROUP | SUBGROUP | FORMATION | MEMBER

GRAPHIC LOG | DEPTH | LITHOLOGIC DESCRIPTION | WELL INSTALLATION

DEPTH	LITHOLOGIC DESCRIPTION
0	SOIL BROWN, W/ SMALL ROCKS
5	SOIL DARK-BROWN/BLACK " "
20	CLAY GRAY, SILTY, MOIST MORE RESISTANT LAYER @ 40' WET @ 45'
50	NO RETURN
55	CLAY GRAY, SILTY, WET REFUSAL ON BEDROCK



DEFFENBAUGH INDUSTRIES ENGINEERING

BOREHOLE LOG

LOCATION DESCRIPTION
WEST RIGHT OF WAY TO INTERSTATE I-435 AT SOUTH END OF TRUMAN RD RAMP

BORING/WELL ID	GW-12C	CLIENT	O.A.S.
RIG TYPE & NUMBER	MOBILE B-61/7160	PROJECT CODE	OAS-KC
DRILLING METHOD	HOLLOW STEM	START DATE	12/2/03
SAMPLING METHOD	CONTINUOUS	FINISH DATE	12/4/03
BORING DIAMETER	7 5/8	TOTAL DEPTH	50.0'
GEOLOGIST	J. DAVIS		
DRILLING CREW	V. REA / M.TEACHOUT / J KRUMBWEIDE		

ELEVATIONS (Ft)		
PAD	TOC	SWL
758.93	758.59	

STATIC WATER LEVEL (BLS)		
	While Drilling	After Boring
Depth(Ft)	45'	
Time		
Date	12/4/03	

CORING RECORD: CORE SIZE | RUN NUMBER | RUN LENGTH(Ft) | RUN RECOVERY(Ft) | ROD RECOVERY(Ft) | % RECOVERY | ROD

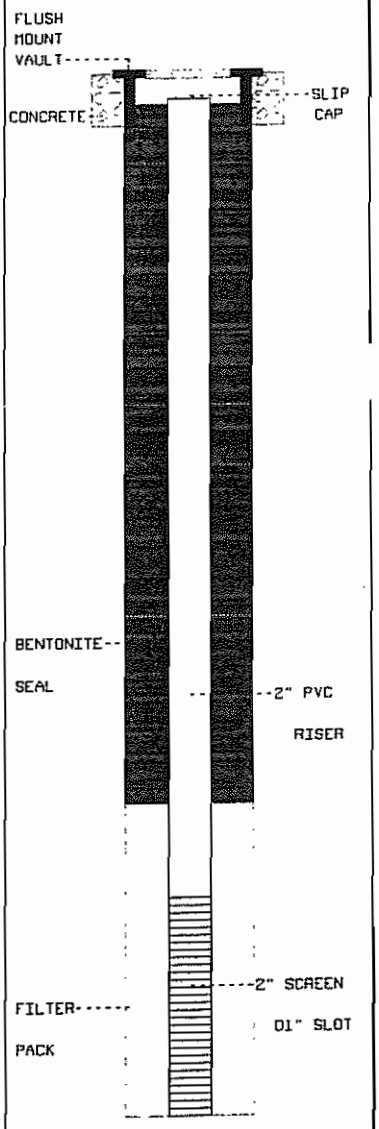
STRATIGRAPHY: SYSTEM/SERIES | GROUP | SUBGROUP | FORMATION | MEMBER

GRAPHIC LOG | DEPTH

LITHOLOGIC DESCRIPTION

DEPTH	LITHOLOGIC DESCRIPTION
0	SOIL BROWN
5	SOIL DARK BROWN
10	SOIL DARK BROWN/BLACK
20	CLAY GRAY SILTY MOIST MORE RESISTANT @ 40'

WELL INSTALLATION



DEFFENBAUGH INDUSTRIES ENGINEERING

BOREHOLE LOG

LOCATION DESCRIPTION
67.5' SOUTH OF LIVERS BRONZE BLDG. AND 8.5' EAST OF FENCE ADJACENT TO INTERSTATE I-435

BORING/WELL ID	PW-1	CLIENT	I. S. C.
RIG TYPE & NUMBER	MOBILE B-61/7160	PROJECT CODE	ISC-KC
DRILLING METHOD	HOLLOW STEM	START DATE	4/23/02
SAMPLING METHOD	CUTTINGS	FINISH DATE	4/24/02
BORING DIAMETER	10 1/4	TOTAL DEPTH	75.0'
GEOLOGIST	M. COSSAIRT		
DRILLING CREW	M.TEACHOUT / JR. REA		

ELEVATIONS (ft)		
PAD	TOC	SWL
766.45	765.04	756.40

STATIC WATER LEVEL (BLS)		
	While Drilling	After Boring
Depth(Ft)	14'	10.05
Time		
Date	4/23/02	4/25/01

CORING RECORD: CORE SIZE | RUN NUMBER | RUN LENGTH(Ft) | RUN RECOVERY(Ft) | ROD RECOVERY(Ft) | % RECOVERY | ROD

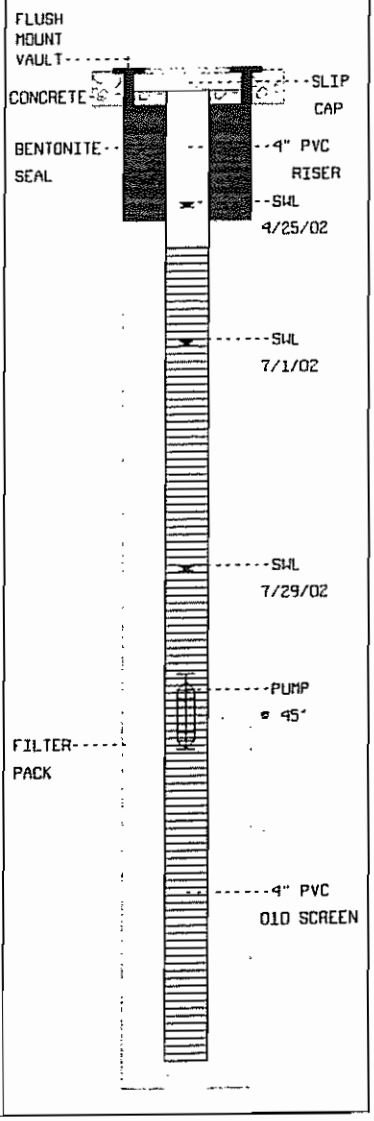
STRATIGRAPHY: SYSTEM/SERIES | GROUP | SUBGROUP | FORMATION | MEMBER

GRAPHIC LOG | DEPTH

LITHOLOGIC DESCRIPTION

SOIL	BROWN	
CLAY	RED-BROWN, WET @ 14'- 16' WET @ 24'	
CLAY	BROWN, SILTY, W/ GREY SAND LENSES	
CLAY	GREY, SILTY, WET	
SAND	GREY, VERY FINE GRAINED WITH SILT AND CLAY LENSES, WET, SLOW DRILLING.	
CLAY	GREY, WITH SILT AND VERY FINE GRAINED SAND, WET DISCONTINUED BORING @ 75'	

WELL INSTALLATION



DEFFENBAUGH INDUSTRIES ENGINEERING

BOREHOLE LOG

LOCATION DESCRIPTION
96.75' SOUTH OF LIVERS BRONZE BLDG. AND 8.5' EAST OF FENCE ADJACENT TO INTERSTATE I-435

BORING/WELL ID	PW-2	CLIENT	I. S. C.
RIG TYPE & NUMBER	MOBILE B-61/7160	PROJECT CODE	ISC-KC
DRILLING METHOD	HOLLOW STEM	START DATE	5/7/02
SAMPLING METHOD	CUTTINGS	FINISH DATE	5/29/02
BORING DIAMETER	10 1/4	TOTAL DEPTH	75.0'
GEOLOGIST	M. COSSAIRT		
DRILLING CREW	M.TEACHOUT / JR. REA		

ELEVATIONS (Ft)		
PAD	TOC	SWL
768.47	767.23	759.54

STATIC WATER LEVEL (BLS)		
	While Drilling	After Boring
Depth(Ft)	16'	8.93'
Time		
Date	5/7/02	5/30/02

CORING RECORD: CORE SIZE | RUN NUMBER | RUN LENGTH(Ft) | RUN RECOVERY(Ft) | ROD RECOVERY(Ft) | % RECOVERY | ROD

STRATIGRAPHY: SYSTEM/SERIES | GROUP | SUBGROUP | FORMATION | MEMBER

GRAPHIC LOG | DEPTH

LITHOLOGIC DESCRIPTION

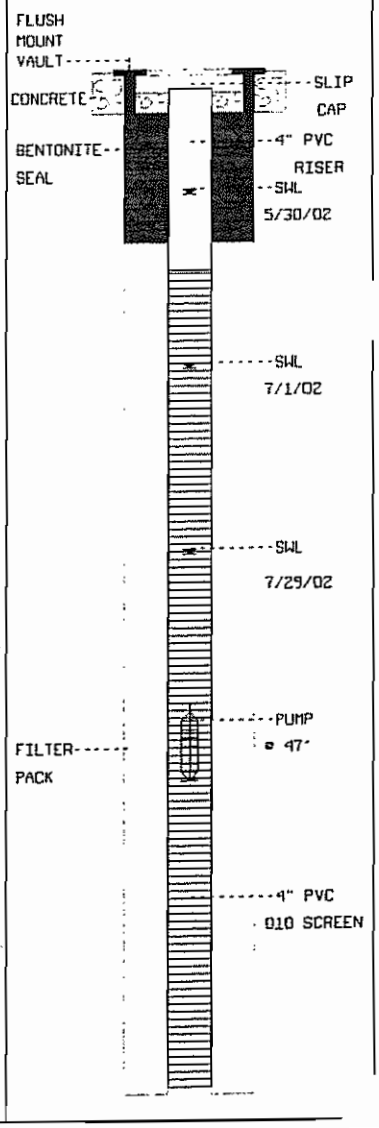
SOIL BROWN, W/GRAVEL & BRICK

CLAY BROWN, MOIST
WATER @ 16', 19', 23'
SLOW DRILLING 20' - 23'

CLAY GREY, SILTY, WET
SLOW DRILLING 53' - 54'
RIG DAMAGED @ 64' 5/7/02

CLAY GREY, SILTY, WET
DRILLING RESUMED 5/24/02
BORING DISCONTINUED @ 75'

WELL INSTALLATION



DEFFENBAUGH INDUSTRIES ENGINEERING

BOREHOLE LOG

LOCATION DESCRIPTION
131' SOUTH OF LIVERS BRONZE BLDG. AND 8.5' EAST OF FENCE ADJACENT TO INTERSTATE I-435

BORING/WELL ID	PW-3	CLIENT	I. S. C.
RIG TYPE & NUMBER	MOBILE B-61/7160	PROJECT CODE	ISC-KC
DRILLING METHOD	HOLLOW STEM	START DATE	5/21/03
SAMPLING METHOD	CUTTINGS	FINISH DATE	5/22/03
BORING DIAMETER	10 1/4	TOTAL DEPTH	79.5'
GEOLOGIST	M. Cossairt		
DRILLING CREW	G. Guero/M.Teachout, W.Bagby		

ELEVATIONS (Ft)		
PAD	TOC	SWL
770.0	769.0	750.18

STATIC WATER LEVEL (BLS)		
	While Drilling	After Boring
Depth(Ft)	22.0'	19.82'
Time		
Date	5/21/03	5/29/03

CORING RECORD: CORE SIZE | RUN NUMBER | RUN LENGTH(Ft) | RUN RECOVERY(Ft) | ROD RECOVERY(Ft) | % RECOVERY | ROD

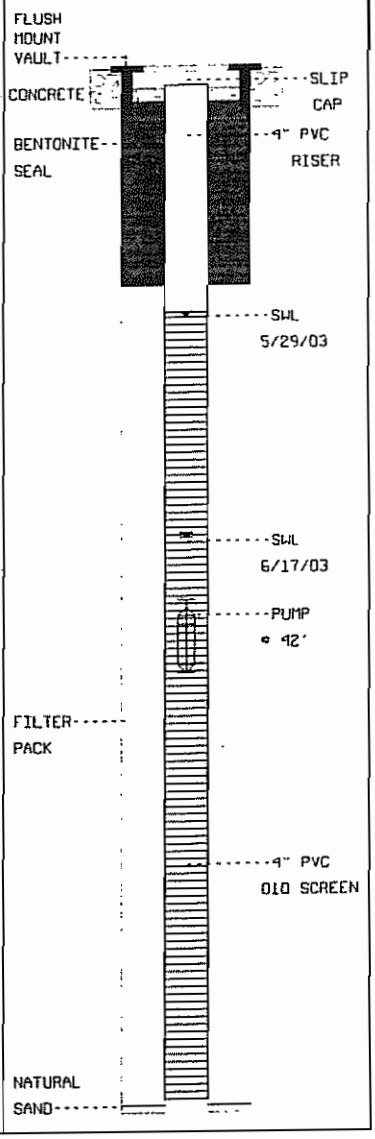
STRATIGRAPHY: SYSTEM/SERIES | GROUP | SUBGROUP | FORMATION | MEMBER

GRAPHIC LOG | DEPTH

LITHOLOGIC DESCRIPTION

SOIL	BROWN, W/GRAVEL
SOIL	BROWN, FRIABLE
CLAY	RED-BROWN, SILTY WATER @ 22'
CLAY	RED-BROWN, SILTY, MOIST
SILT	W/CLAY, GREY, MOIST, SLOW DRILLING 40 - 42, 46 - 55 WET AT 76' REFUSAL ON SHALE @ 79 5'

WELL INSTALLATION



DEFFENBAUGH INDUSTRIES ENGINEERING

BOREHOLE LOG

LOCATION DESCRIPTION
164' SOUTH OF LIVERS BRONZE BLDG. AND 8.5' EAST OF FENCE ADJACENT TO INTERSTATE I-435

BORING/WELL ID	PW-4	CLIENT	I. S. C.
RIG TYPE & NUMBER	MOBILE B-61/7160	PROJECT CODE	ISC-KC
DRILLING METHOD	HOLLOW STEM	START DATE	5/20/03
SAMPLING METHOD	CUTTINGS	FINISH DATE	5/21/03
BORING DIAMETER	10 1/4	TOTAL DEPTH	80.0'
GEOLOGIST	M. Cossoirt		
DRILLING CREW	G. Guero/M. Teachout, W. Bogby		

ELEVATIONS (ft)		
PAD	TOC	SWL
771.3	770.3	749.22

STATIC WATER LEVEL (BLS)		
	While Drilling	After Boring
Depth(ft)	28.0'	22.08'
Time		
Date	5/20/03	5/21/03

CORING RECORD: CORE SIZE | RUN NUMBER | RUN LENGTH(ft) | RUN RECOVERY(ft) | ROD RECOVERY(ft) | % RECOVERY | ROD

STRATIGRAPHY: SYSTEM/SERIES | GROUP | SUBGROUP | FORMATION | MEMBER

GRAPHIC LOG | DEPTH

LITHOLOGIC DESCRIPTION

SOIL BLACK, W/GRAVEL

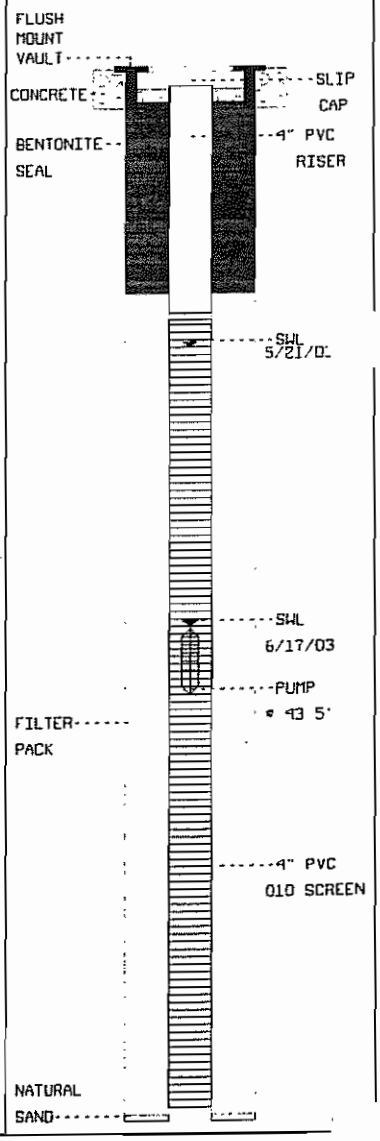
SOIL BROWN, FRIABLE

CLAY RED-BROWN, SILTY
WATER @ 28'

SILT GREY, WET

SILT W/GRAVEL, GREY, WET
BOTTOM OF HOLE 80'

WELL INSTALLATION



Appendix C

Site Specific Health and Safety Plan

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.

SITE SPECIFIC HEALTH AND SAFETY PLAN
Quality Analytical Services
1633 Marsh Avenue
Blue Summit, Missouri

Aquaterra Project Number 2641.10

Prepared For:

Quality Analytical Services
c/o RDD Family Office, LLC
6240 West 135th Street, Suite 150
Overland Park, Kansas 66223

AQUATERRA

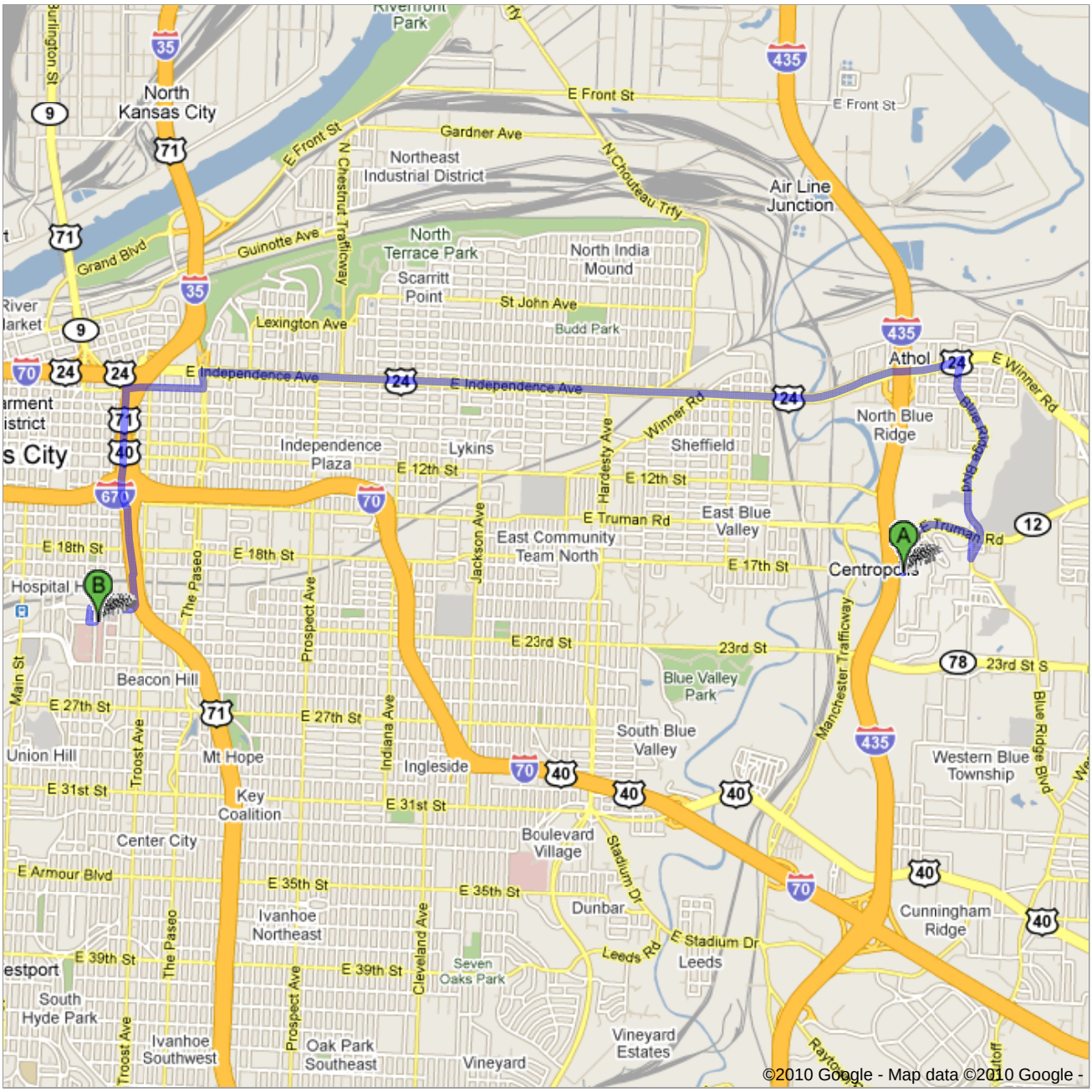
EMERGENCY CONTACT INFORMATION

911

LOCAL LAW ENFORCEMENT
Name: Kansas City Police – East Patrol Address: 5301 East 27th Street City: Kansas City State: Missouri Telephone: (816) 234-5530
LOCAL FIRE DEPARTMENT
Name: Sugar Creek Fire Department Address: 503 North Sterling Avenue City: Sugar Creek State: Missouri Telephone: (816) 252-5560
NEAREST HOSPITAL or MEDICAL FACILITY
Name: Cass Medical Center/Truman Medical Center Address: 2301 Holmes Street City: Kansas City State: Missouri Telephone: (816) 404-1000 ***(Attach MAP with DIRECTIONS)***
HAZ MAT
1-800-424-8802
POISON CONTROL
1-800-955-9119
OSHA (In case of emergency call)
1-800-321-OSHA
MDNR CONTACT(s)
Name: George Fletcher Phone #: (573) 751-3553
AQUATERRA PROJECT MANAGER
Name: Susie McCart Phone #: (913) 681-0030 ext 210

Google maps

Directions to 2301 Holmes St, Kansas City, MO 64108
8.9 mi – about **17 mins**



E 17 St S/E 17th St/Ashland/Marsh Ave

	1. Head **north** on **E 17 St S/E 17th St/Ashland/Marsh Ave** toward **Karleen St** Continue to follow Marsh Ave	go 0.2 mi total 0.2 mi
	2. Turn **right** at **MO-12 E/E Truman Rd** About 1 min	go 0.4 mi total 0.7 mi
	3. Take the 3rd **right** onto **Stark Ave**	go 0.1 mi total 0.8 mi
	4. Sharp **left** at **Blue Ridge Blvd** About 3 mins	go 1.3 mi total 2.1 mi
	5. Turn **left** at **E Winner Rd** About 1 min	go 0.9 mi total 3.0 mi
	6. Continue onto **Independence Ave** About 4 mins	go 3.6 mi total 6.7 mi
	7. Turn **left** at **The Paseo** About 1 min	go 0.1 mi total 6.8 mi
	8. Take the 1st **right** onto **Admiral Blvd** About 1 min	go 0.5 mi total 7.2 mi
	9. Turn **left** to merge onto **I-70 E** toward **I-35 S** About 1 min	go 0.4 mi total 7.6 mi
	10. Slight **right** at **US-71 S** (signs for **US-71 S**)	go 0.7 mi total 8.3 mi
	11. Take the exit toward **E 22nd St**	go 0.2 mi total 8.6 mi
	12. Turn **right** at **E 22nd St** About 1 min	go 0.2 mi total 8.8 mi
	13. Turn **left** at **Kenwood Ave**	go 456 ft total 8.9 mi
	14. Take the 1st **left** onto **E 23rd St**	go 177 ft total 8.9 mi
	15. Turn **left** at **Holmes St** Destination will be on the right	go 33 ft total 8.9 mi

2301 Holmes St, Kansas City, MO 64108

SITE SPECIFIC HEALTH AND SAFETY PLAN

Project Name: QAS – Marsh Ave, Semi-Annual Groundwater Monitoring

Project Address: 1633 Marsh Avenue

City: Blue Summit State: Missouri Zip: 64126

Aquaterra Project Manager: Susie McCart

Phone: (913) 681-0030 ext 210 Cell: (913) 634-0156 Fax: (913) 681-0012

Aquaterra Employees Onsite: 1) _____,

2) _____,

3) _____

Emergency Assembly Area: In front of main office building

PROJECT ACCIDENT PREVENTION POLICY

Aquaterra Environmental Solutions, Inc. (Aquaterra) has established this Site Specific Health and Safety Plan (SSHASP) to provide its management, employees, subcontractors, and clients with an understanding of Aquaterra's position regarding the prevention of accidents, to provide the guidelines for the SSHASP, and to assist Aquaterra in meeting its responsibility to provide safe working conditions for its employees.

KNOWN PHYSICAL HAZARDS

1. Field Conditions (possibly wet, muddy)
2. Slips, Trips, Falls

KNOWN CHEMICAL HAZARDS:

1. VOCs
2. Petroleum Hydrocarbons

PERSONAL PROTECTIVE EQUIPMENT (PPE) REQUIRED:

1. Safety Glasses
2. Hard Hart
3. Safety Shoes
4. Gloves
5. _____

SPECIAL SAFETY AND HEALTH CONSIDERATIONS:

1. _____
2. _____

General Health and Safety

Purpose

Aquaterra's policy is that all employees be provided with a safe and healthful place of employment. Identification of hazardous conditions may be accomplished at the planning and design stage, as a result of workplace inspections. All recognized safety and health hazards shall be eliminated or controlled as quickly as possible, subject to priorities based upon the degree of risk posed by the hazards. The preferred method of hazard abatement shall be through application of engineering controls or substitution of less hazardous processes or materials. Total reliance on personal protective equipment is acceptable only when all other methods are proven to be technically and/or economically infeasible.

Responsibilities

Project Managers and Site Safety & Health Officers are responsible for following all safety program requirements and safety practices. If procedures or practices are identified as needing changes, these changes shall be accomplished through normal review practice

Hazard Control

Substitution. The risk of injury or illness may be reduced by replacement of an existing process, material, or equipment with a similar item having more limited hazard potential. Care must be exercised in any substitution to ensure that the substitute materials are technically acceptable and to avoid introducing new or unforeseen hazards.

Isolation. Hazards are controlled by isolation whenever an appropriate barrier or limiter is placed between the hazard and an individual who may be affected by the hazard. This isolation can be in the form of physical barriers, time separation, or distance. Examples include machine guards, electrical insulation, glove boxes, acoustical containment, and remote controlled equipment.

Ventilation. The control of a potentially hazardous airborne substance by ventilation can be accomplished by one or two methods: diluting the concentration of the substance by mixing with uncontaminated air or capturing and removing the substance at its source or point of generation. Local exhaust ventilation is generally the preferred and more economical method of hazard control. However, dilution ventilation can be very effective for the removal of large volumes of heated air or for the removal of low concentrations of non-toxic or low toxicity contaminants from minor and decentralized sources.

Administrative Control. This method of hazard mitigation depends on effective operating practices that reduce the exposure of individuals to chemical or physical hazards. These practices may take the form of limited access to high hazard areas, preventive maintenance programs to reduce the potential for leakage of hazardous substances, or adjusted work schedules which involve a regimen of work in high hazard and low hazard areas. Adjusted work schedules are appropriate only when the hazard is recognized as having a limit below which nearly all workers may be repeatedly exposed without adverse effect.

Personal Protective Equipment. This method of hazard control is least preferred because personal protective devices may reduce a worker's productivity, while affording less effective protection against the recognized hazard than other methods of control. Nevertheless, there are instances where adequate levels of risk reduction cannot be achieved through other methods, and personal protective devices must be used, either alone or in conjunction with other protective measures.

Hazard Control Principles

Hazardous conditions in the workplace may be prevented through appropriate actions when facilities are designed, when operating procedures are developed, and when equipment is purchased. Once

hazards are identified, whether through inspection or complaint, immediate action shall be taken to avoid unreasonable danger.

Operating Procedures. Standard operating procedures or similar directives developed by the supervisor that are issued to direct the manner in which work is performed shall include appropriate health and safety requirements. Supervisors are encouraged to submit standard operating procedures. Recommendations for changes/additions to the procedures for safety and health purposes shall be submitted in writing to department managers.

Authorized employees - many operations and tasks that require specific safety training are to be conducted only by trained and authorized employees. Examples of these include:

- Forklift / Man-lift Operations
- Chemical use
- Electrical repairs
- Facility Maintenance
- Grounds Work
- Use of power tools

Hazard Control Development

The following possible actions will be considered when recommendations are developed for prevention or reduction of hazards:

1. Avoiding, eliminating, or reducing deficiencies by engineering design, material selection or substitution;
2. Isolating hazardous substances, components, and operations from other activities, areas, personnel, and incompatible materials;
3. Incorporating "fail-safe" principles where failures would disable the system or cause a catastrophe through injury to personnel, damage to the equipment, or inadvertent operation of critical equipment;
4. Relocating equipment/components so that personnel access during operation, maintenance, repair or adjustment shall not result in exposure to hazards such as chemical burns, electrical shock, electromagnetic radiation, cutting edges, sharp points, or toxic atmospheres;
5. Providing suitable warning and notes of caution concerning required personnel protection in operation, assembly, maintenance, and repair instructions;
6. Providing distinctive markings on hazardous components, equipment, or facilities;
7. Requiring use of personal protective equipment when other controls do not reduce the hazard to an acceptable level;
8. Monitoring exposure to insure that engineering controls effectively reduce the hazard; and
9. Training employees to recognize hazards and take appropriate precautionary measures.

Hazard Reporting

Identification and reporting of potentially unsafe or unhealthful working conditions is the responsibility of all employees. All employees are encouraged to report unsafe or unhealthful working conditions to their immediate supervisor who will promptly investigate the situation and take appropriate corrective actions. Supervisors will contact the CSHO for assistance as necessary. Supervisors will keep the reporting employee informed of all actions taken. Any employee may submit a written report of an unsafe or unhealthful working condition directly to the CSHO.

Signs and Tags

Signs and tags are not intended as substitutes for preferred abatement methods such as engineering controls, substitution, isolation, or safe work practices. Rather, they are additional safety guidance and increase the employee's awareness of potentially hazardous situations.

Tags are temporary means of warning all concerned of hazardous conditions, defective equipment, etc. Tags are not to be considered as a complete warning method, but should only be used until a positive means can be employed to eliminate the hazard; for example, a "Do Not Start" tag is affixed to a machine and is used only until the machine can be locked out, de-energized, or inactivated.

Danger Signs shall be used where an immediate hazard exists and specific precautions are required to protect personnel or property. The sign shall be of red, black, and white colors.

Danger Tags shall be placed on a damaged ladder or other damaged equipment, and immediate arrangements made for the ladder/equipment to be taken out of service and sent to be repaired.

Caution Signs shall be used to warn of a potential hazard or to caution against unsafe practices, and to prescribe the precaution that will be taken to protect personnel and property from mishap probability. The sign shall be of yellow and black colors.

Radiation Signs shall be used to warn of radiation hazards and of special precautions that will be taken. "Radiation" signs shall use the conventional radiation warning colors of magenta on a yellow background.

Exit Signs shall be utilized to clearly identify the means of egress from a building or facility. Where the exit is not apparent, signs shall have an arrow indicating the direction of the exit.

Biological Hazard Warning Signs shall be used to signify the actual or potential presence of a biological hazard and to identify equipment, containers, rooms, experimental animals, etc., which contain or are contaminated with viable hazardous agents. The symbol on these signs shall be the standard fluorescent orange or orange-red color.

Hazard Communication

Many company employees perform operations which commonly require the use of chemicals that have inherent chemical and physical hazards. The OSHA Hazard Communication Standard (29 CFR 1910.1200) requires employers to provide information to their employees concerning the hazardous chemicals in the workplace through a written program, training sessions, materials safety data sheets, labels and warnings, and other pertinent information. All employees and management shall fully comply with the company Hazard Communication Program requirements.

Noise

Employee exposure to noise of sufficient intensity and duration can result in hearing damage. Engineering controls such as mufflers on heavy equipment exhausts or on air release valves are required where possible. If engineering solutions cannot reduce the noise, administrative controls such as increasing the distance between the noise source and the worker or rotation of jobs between workers in the high noise area should be used if possible. Employees will be given the opportunity to select hearing protective devices from a variety of suitable ones provided by the company.

Housekeeping

All places of employment including outside areas should be kept as clean as the nature of the work allows but must be kept free and clear of debris, trash, scrap, spills or other extraneous materials which could create a health hazard or cause an accident. Proper layout, spacing and arrangement of equipment, facilities, and machinery are essential to good housekeeping, allowing orderly operation and avoiding congestion.

Maintain the floor of every work area so far as practicable, in a dry condition. Where wet processes are used, maintain drainage and provide removable false floors, platforms, mats, or other dry standing places. When necessary or appropriate, provide waterproof footgear.

To facilitate cleaning, every floor, working place, and passageway will be as smooth as feasible but allowing for the need to provide non-skid flooring where appropriate floors will not be cleaned with flammable materials or materials creating significant toxic hazards.

Tailgate Safety Meetings

Each Project Manager is required to conduct a weekly discussion of safety with their crew. This discussion can be stand-alone or as part of a pre-existing meeting and is intended to remind the crew to prioritize safety.

1. The Project Manager is responsible for circulating and retaining a sign-in sheet to document attendance. He/She is also responsible for documenting minutes of the meeting.
2. One copy of the Weekly Tailgate Safety Talk Record is forwarded to the CSHO for the permanent record and one copy is maintained in the project folder.

WEEKLY “TAILGATE SAFETY” MEETING RECORD

Project Name: _____ Project Number: _____

Safety Talk Title: _____

Key Points: _____

_____

Safety Reminders: _____

_____

Employee Safety Recommendations: _____

_____

Meeting Attended By

PRINTED NAME	***SIGNATURE***

Project Manager (Printed Name): _____

Project Manager's Signature _____

Appendix D

Sample Field Forms

The following sample field forms are included in this Appendix:

- Field Instrumentation Calibration Form
- Field Data Sheet
- Chain of Custody

FIELD METER
CALIBRATION/CALIBRATION CHECK

Project Name: *QAS - Marsh Avenue*
Project Location: *1633 Marsh Avenue, KCMO*
Project Number:

Data Recorded By: **Date:**

pH & Conductivity

Meter Make:		**Meter Model:**	
Meter Serial Number:		**Calibrated By:**	

pH

Time	Standard (pH)	Standard ID Number	Instrument Reading (pH)	Comments
	pH 7.00			Calibration Point 1
	pH 4.00			Calibration Point 2
	pH 10.00			Calibration Check

Conductivity

Time	Standard (umhos/cm)	Standard ID Number	Instrument Reading (umhos/mc)	Comments
				Calibration Point
				Calibration Check

Temperature

Calibrated By:	
Thermometer - Field Thermometer ID Number:	
Checked Date:	

Field Data Sheet

Project Name: QAS - Marsh Avenue **Monitoring Point:** _____
Project Location: 1633 Marsh Avenue, Blue Summit, MO
Project Number: _____ **Date(s):** _____

Field Team Members

Name: _____ Affiliation: _____
Name: _____ Affiliation: _____

Weather Conditions

Temp: _____ °F Wind Direction: N S E W (circle two if needed)
Precipitation: None Light Heavy Sky: Cloudy Sunny Partly

Well Observations

Well Pad _____
Casing _____
Protective Casing _____
Reference Mark/Identification _____
Area Surrounding Well Pad _____

Locks	Yes	No
Protective Casing		
Well		

Groundwater Level Measurements

Depth To Product: _____ feet below TOC
Depth To Water: _____ feet below TOC
Date/Time Measured: _____ Total Depth: _____ feet below TOC

Purging Activities

Purged By: _____ Purge Date: _____
Purge Method: Bailer Dedicated Pump Non-Dedicated Pump (circle one)
Well Diameter: 1-inch 2-inch 3-inch 4-inch Other _____ (circle one)
Purge Volume Calculation: _____ Total Purge Volume: _____ gallons
Initial Parameter Readings: _____ pH _____ Spec. Cond. _____ Temp (°C)
Physical appearance of purge water: _____

Purge Time	Cumulative Purge Vol. ( )	Purge Rate ( )	pH	Specific Conductivity (µS)	Temp (°C)	Other	Other

Sampling Activities

Sampled By: _____ Sample Date/Time: _____
Sample Method: Bailer Dedicated Pump Non-Dedicated Pump (circle one)
Sample Parameters: _____ pH _____ Spec. Cond. _____ Temp (°C)
Water Level: _____ feet below TOC

Observations/Comments: (i.e., equipment malfunctions, contamination sources, sampling difficulties; duplicate sample)

Form Completed By: _____ **Date:** _____

Alternate billing information:

Report to:

Email to:

Project Description:

City/Sate Collected

Phone:

FAX:

Client Project #:

ESC Key:

Collected by:

Site/Facility ID#:

P.O.#:

Collected by (signature):

Immediately Packed on Ice N ____ Y ___

Rush? (Lab MUST Be Notified)

____ Same Day. 200%
____ Next Day.. . . . . 100%
____ Two Day 50%
Three Day 25%

Date Results Needed:

Email? __No__Yes

FAX? __No__Yes

Sample ID	Comp/Grab	Matrix*	Depth	Date	Time	No. of Cntrs	Analysis/Container/Preservative	Remarks/Contaminant	Sample # (lab only)

Analysis/Container/Preservative

Chain of Custody
Page 1 of 1

Prepared by:

ENVIRONMENTAL SCIENCE CORP.

12065 Lebanon Road
Mt. Juliet, TN 37122

Phone (615) 758-5858
Phone (800) 767-5859
FAX (615) 758-5859

CoCode (lab use only)

Template/Prelogin

Shipped Via:

*Matrix: **SS** - Soil/Solid **GW** - Groundwater **WW** - WasteWater **DW** - Drinking Water **OT** - Other_____

pH _____ Temp _____

Remarks:

Flow _____ Other _____

Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Samples returned via: ☐ UPS ☐ FedEx ☐ Courier ☐ _____	Condition: (lab use only)	
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Temp:	Bottles Received:	CoC Seals Intact: ____ Y ____ N _____ NA
Relinquished by: (Signature)	Date:	Time:	Received for lab by: (Signature)	Date:	Time:	pH Checked: / NCF:

Appendix E

QAPP Checklist

EPA QA/R-5 QAPP REVIEW CHECKLIST

10/00

Site Name: Quality Analytical Services QATS Document No.: _____

Site Manager: _____ Date of QAPP: _____

QAPP Author: _____ QAPP Reviewer: _____

TOPIC	COMMENTS
Project Management	
A1. Title and Approval Sheet	
a. Title	Cover Page
b. Organization's Name	Cover Page
c. Dated signature of project manager	Signature Page
d. Dated signature of quality assurance officer	Signature Page
e. Other signatures, as needed	Signature Page
A2. Table of Contents and Document Control Format	
a. Includes Table of Contents	Pages i - ii
b. Includes document control format	N/A
A3. Distribution List	
a. Includes a list of people who will receive the completed QAPP	Section 1.3
A4. Project/Task Organization	
a. Identifies key individuals, with their responsibilities (data users, decision-makers, project QA manager, subcontractors, etc.)	Section 1.2
A5. Problem Definition/Background	
a. Clearly states problem or decision to be resolved	Section 1.1
b. Provides historical and scientific background information	Section 1.1
A6. Project/Task Description	
a. Lists measurements to be made	Section 3.0
b. Cites applicable technical, regulatory, or program-specific quality standards, criteria, or objectives	Section 6.1 - 6.2
c. Notes special personnel or equipment requirements	Section 3.4 - 3.4.1

TOPIC	COMMENTS
A6. Project/Task Description (continued)	
d. Identifies the assessment tools needed	Section 3.4.1
e. Provides work schedule	Section 3.3; Table 2
f. Notes required project and QA records/reports	Sections 3.4.2, 7.5, 8.0
A7. Quality Objectives and Criteria for Measurement Data	
a. States project objectives and limits, both qualitatively and quantitatively	Section 3.5
b. States and characterizes measurement quality objectives as to applicable action levels or criteria	N/A
A8. Special Training/Certification Requirements	
a. Lists special training and certification requirements	Section 1.2
A9. Documentation and Records	
a. Lists information and records to be included in data report (e.g., raw data, field logs, results of QC checks, problems encountered)	Section 8.1
b. Describes process and responsibilities for ensuring that the most current approved version of the QAPP is available	Section 1.3
c. Specifies the level of detail of the field sampling and/or lab analysis narrative needed to completely describe difficulties encountered	N/A
d. Gives retention time and location for records and reports	Section 7.5
Measurement/Data Acquisition	
B1. Sampling Process Design (Experimental Design)	
a. Lists samples required as to type and number	Section 3.3; Table 2
b. States sampling network design and rationale	Section 3.1
c. Gives sampling locations and sampling frequency	Section 3.2, Table 2
d. Identifies sample matrices	Section 3.3
e. Gives appropriate validation study information for non-standard situations	N/A
B2. Sampling Methods Requirements	
a. Identifies sample collection procedures and methods	Section 3.4

TOPIC	COMMENTS
b. Lists equipment needed	Section 3.4.1
c. Identifies support facilities	Section 1.2.4
d. Identifies individuals responsible for corrective action	Section 1.2
e. Describes process for preparation and decontamination of sampling equipment	Section 3.4
f. Describes selection and preparation of sample containers and sample volumes	Section 3.4; Table 6
g. Describes preservation methods and maximum holding times	Table 6
B3. Sample Handling and Custody Requirements	
a. Notes sample handling requirements	Section 3.4
b. Notes chain of custody procedures, if required	Section 3.4.6
B4. Analytical Methods Requirements	
a. Identifies analytical methods to be followed (with all options) and required equipment	Sections 3.3, 5.0, Tables
b. Provides available validation and/or performance information for non-standard methods	N/A
c. Identifies individuals responsible for corrective action	Section 1.2
d. Specifies needed laboratory turnaround time if important to project schedule	N/A
B5. Quality Control Requirements	
a. Identifies QC procedures and frequency for each sampling, analysis, or measurement technique, as well as associated acceptance criteria and corrective action	Sections 3.5, 5.0
b. Referenced procedures used to calculate QC statistics (precision and bias or accuracy)	Sections 6.0, 7.0
B6. Instrument/Equipment Testing, Inspection and Maintenance Requirements	
a. Identifies acceptance testing of sampling and measurement systems	Section 3.4
b. Describes equipment preventive and corrective maintenance	Section 3.4.1
c. Notes availability and location of spare parts	N/A
B7. Instrument Calibration and Frequency	

TOPIC	COMMENTS
a. Identifies equipment needing calibration and frequency for such calibration	Section 3.4
b. Notes required calibration standard and/or equipment	Section 3.4, Appendix D
c. Cites calibration records and manner traceable to equipment	Section 3.4, Appendix D
B8. Inspection/Acceptance Requirements for Supplies and Consumables	
a. States acceptance criteria for supplies and consumables	Section 3.4.1
b. Notes responsible individuals	Section 1.2
B9. Data Acquisition Requirements for Non-direct Measurements	
a. Identifies type of data needed from non-measurement sources (e.g., computer data bases and literature files) along with acceptance criteria for their use	N/A
b. Describes any limitations of such data	N/A
B10. Data Management	
a. Describes standard record keeping, data storage, and retrieval requirements	Section 7.5
b. Checklists or standard forms attached to QAPP	Appendix D
c. Describes data handling equipment and procedures used to process, compile, and analyze data (e.g., required computer hardware and software)	Section 8.1
d. Describes process for assuring that applicable information resource management requirements are satisfied	N/A

Assessment / Oversight	
C1. Assessments and Response Actions	
a. Lists required number, frequency, and type of assessments with approximate dates and names of responsible personnel (assessments include but are not limited to peer review, management systems review, technical systems audits, performance evaluations, and audits of data quality)	Section 7.0
b. Identifies individuals responsible for corrective actions	Sections 1.2, 7.0
C2. Reports to Management - Identifies frequency and distribution of reports for:	
a. Project status	N/A
b. Results of performance evaluations and audits	N/A
c. Results of periodic data quality assessments	Section 7.0
d. Any significant QA problems	Section 7.0
e. Preparers and recipients of reports	Section 8.0
Data Validation and Usability	
D1. Data Review, Validation, and Verification	
a. States criteria for accepting, rejecting, or qualifying data	Section 7.0
b. Includes project-specific calculations or algorithms	N/A
D2. Validation and Verification Methods	
a. Describes process for data validation and verification	Section 7.0
b. Identifies issue resolution procedure and responsible individuals	Section 7.0
c. Identifies method for conveying these results to data users	Section 7.0
D3. Reconciliation with User Requirements	
a. Describes process for reconciling project results with DQOs and reporting limitations on use of data	Sections 5.0, 6.0, 7.0

Appendix F

Correspondence

STATE OF MISSOURI
Jeremiah W (Jay) Nixon, Governor • Mark N. Templeton, Director
DEPARTMENT OF NATURAL RESOURCES
www.dnr.mo.gov

May 15, 2009

CERTIFIED MAIL - 7004 1160 0000 8178 4168
RETURN RECEIPT REQUESTED

Mr. Charles E. Wetzler
Quality Analytical Services
3240 West 135th Street, Suite 150
Overland Park, KS 66223

RE: Quality Assurance - Sampling and Analysis Plan (SAP) October 2008, Quality Analytical Services, Blue Summit, Missouri, EPA ID Number MOD073027609

Dear Mr. Wetzler:

The Missouri Department of Natural (Department) Resources and the U.S. Environmental Protection Agency (EPA) have completed review of the November 24, 2008, draft SAP and Quality Assurance Project Plan (QAPP). The SAP is deficient in several areas and requires some clarification. All of the comments must be addressed before approval for the SAP can be granted.

Comments

1. The SAP does not indicate how sampling of free phase liquid will be done, this must be included in an approvable SAP.

2. Section 1.2 Please include in the description who is responsible for compiling the Semi-Annual and Annual Groundwater Monitoring Reports.

3. Section 3.4.5 Groundwater Sampling Procedure, page 19 - How will samples be packaged and shipped to the laboratory (e.g., vials placed in cubitainer with a charcoal thimble, custody seals on the cooler, chain-of-custody document placed in a plastic bag, etc.)? Please explain.

4. All detections of anilities shall be reported in µg/L.

5. Many of the reporting limits are elevated and must be revised to be no higher than the Maximum Contaminant Level (MCL) or in absence of an MCL must not be any higher than the Department's and EPA's risk-based values. The Missouri values are available at http://www.dnr.mo.gov/env/hwp/mrbca/mrbca.htm. The EPA values are at http://www.epa.gov/Region6/6pd/rcra_c/pd-n/screen.htm.

6. Section 5.2 Laboratory Quality Control procedures, page 25. This section generally discusses laboratory audits. A QAPP should also discuss field audits or clearly indicate they are not applicable. Please revise.

7. Section 6.0 Data Evaluation, page 27.

   a) Although it may be a standard statistic, the calculation for Relative Percent Difference should be provided or referenced in the QAPP.

   b) The QAPP review checklist attached to the QAPP indicates data handling equipment and procedures for compiling, processing, and analyzing do not apply. However, this section does refer to time-series plots and isoconcentration maps.

8. Data Quality Review and Recordkeeping, page 29. If any statistical analysis of the data is planned, this should be summarized in the QAPP.

9. Missing QAPP Elements. The following sections were not included:

   a) Inspection/Acceptance Requirements for Supplies and Consumables; and

   b) Data Acquisition Requirements for Non-direct Measurements.

   The enclosed checklist identifies these two elements as not applicable. However, the checklist does reference a section for the responsible individuals for *Inspection/Acceptance Requirements for Supplies and Consumables* which implies this QAPP element is applicable. Please note that if an element is not applicable, the QAPP should still include them and state they are not applicable and give the reason why.

10. Signature page. If EPA approval of the document is needed, a final version needs to be submitted with appropriate signatures from the facility with space for the appropriate EPA signatures. The Department will not be signing the QAPP.

11. Section 3.3 Analytical Requirements - In May, 9 of the 19 monitoring wells will be sampled for 1,4-dioxane analysis. In November, 17 of the 28 monitoring wells will

be sampled for 1, 4-dioxane analysis. Why will only these wells be sampled for 1, 4-dioxane at these frequencies and how were these particular wells chosen?

12. Section 3.5 Field Quality Assurance/Quality Control, page 21. This section seems to address the data quality indicators of precision and accuracy, and the sampling procedures described in Section 3 appear to address ensuring the samples are representative. Completeness and comparability are also a concern, so the QAPP needs to describe how they are being addressed.

13. Section 6.1 Groundwater Protection Standards, page 27. This section references Table 3 for the constituents of concern and the concentration levels of concern. There are some contaminants where the required reporting limit appears to be higher than the levels of concern listed including the Missouri Default Target Limit.

    a) Why would a reporting limit be required to be higher than the level of concern?

    b) How will having a reporting limit higher than the level of concern impact the usability of the data?

    c) Because no laboratory-specific information or documentation was included, it could not be verified if the laboratory could achieve the reporting limits needed for the project. This information should be provided.

14. Laboratory references. Because only generic references to laboratory documentation are included and it appears as if the laboratory has not been selected (although a chain-of-custody form for Environmental Science Corporation was attached), the laboratory references could not be verified including analytical Standard Operating Procedures, Quality Control criteria, data package contents, data management, equipment testing/calibration, audits, and data review. Please submit the appropriate information in the revised SAP/QAPP.

Several of the requested changes are considered a modification to the approved post-closure plan. Therefore, public participation will have to be conducted prior to final approval, namely the addition of wells to the sampling plan. Once a revised SAP and QAPP is submitted the Department will initiate a 30-day comment period. This is required by 10 CSR 25-8.124(1)(A)10.D. and 40 CFR 265.118(f), incorporated by reference in 10 CSR 25-7.265(1).

Please submit a revised SAP/QAPP within 30 days of receipt of this letter.

If you have any questions regarding this letter, please contact me, at the Missouri Department of Natural Resources, Hazardous Waste Program, P.O. Box 176, Jefferson City, MO 65102-0176, or by phone at (573) 751-3553 or 1-800-361-4827, or by e-mail at george.fletcher@dnr.mo.gov. Thank you.

Sincerely,

HAZARDOUS WASTE PROGRAM

George Fletcher
Environmental Engineer
Permits Section

GF:mj

Enclosure

c: Mr. David Garret, Project Manager, U.S. EPA Region VII
John R. Rockhold, P.G., Professional Geologist, Aquaterra Environmental Solutions, Inc.
Kansas City Regional Office

GROUNDWATER SAMPLING AND ANALYSIS PLAN (SAP) WORKSHEET
Prepared by
MISSOURI DEPARTMENT OF NATURAL RESOURCES
HAZARDOUS WASTE PROGRAM

Facility Name and Address: Quality Analytical Services
1633 Marsh Avenue
Blue Summit, Missouri

Date of SAP evaluation: October 27, 2008
Person performing evaluation: George Fletcher
Date and Source of SAP evaluated: October 2008, Aquaterra

		Y/N/NA
1.	**Does the SAP specify that the following field data be measured and recorded (field logbook or sample sheets) during each sampling event:**	
a)	Water level (each sampling event)?	Y
b)	Total well depth (at least annually)?	N[1]
c)	Weather (temp, general atmospheric conditions)?	Y
d)	Physical condition of the well?	Y
e)	Sampling team members?	Y
f)	Well number, date and time of sampling?	Y
g)	Physical description of well area?	Y
h)	Instrument calibration information (before and after)?	Y
i)	Actual well purge volume and calculations?	Y
j)	Presence/thickness of any immiscible layers present?	Y
k)	Any deviation from planned sampling methodology?	Y
2.	**For well purging does the SAP specify:**	
a)	Purging technique?	Y
b)	Type/composition of equipment (manufacture, model)?	
c)	Dedicated equipment?	Y
d)	Non-dedicated equipment?	Y
e)	Decontamination procedures for non-dedicated equipment?	Y
f)	Volume to purge (generic)?	N[2]
g)	Method of calculation of purge volume?	Y
h)	Use of stabilized field parameters (pH, temp, Sp Cond, Eh) to determine when purging is complete?	Y
i)	Method to prevent purge equipment contact with contaminated surfaces.	Y
j)	Manner of disposal of purged fluids?	Y

[1] Well depth will be measured in the wells with a removable pump
[2] Does provide calculations to determine well volume to purge

		Y/N/NA
3.	**For well sampling does the SAP specify:**	
a)	Sampling technique (gentle bailer lowering, bottom discharge for volatiles, pump rates, etc.)?	Y
b)	Type/composition of equipment (manufacture, model)?	Y
c)	Dedicated equipment?	Y
d)	Non-dedicated equipment?	Y
e)	Decontamination procedures for non-dedicated equipment?	Y
f)	Dry well contingency plan for persistently dry wells?	NA
g)	Sampling protocol for low yield wells?	Y
h)	Sampling protocol of high yield wells?	NA
i)	Immiscible phase detection methods?	Y
j)	Immiscible phase sampling methods?	N[3]
k)	Pump and/or bailer intake level (generally)?	Y
l)	Pump rate (non-volatilization of sensitive parameters)?	Y
m)	Sampling order according to parameter volatilization potential?	Y
4.	**In relation to the monitored parameters does the SAP specify:**	
a)	Parameters required by regulation (detection)?	Y
b)	Waste-specific parameters (assessment)?	Y
5.	**In sampling for site-specific parameters does the SAP specify:**	
a)	Specific container/cap type for each parameter?	Y
b)	Volume of each type of sample container?	Y
c)	Parameter specific preservative method (chemical and/or cooling)?	Y
d)	Maximum parameter-specific holding time?	Y
e)	Sample container labeling requirements?	Y
f)	Method of packaging & shipment (coolers, blue ice, carrier, etc.)?	Y
6.	**In relation to field and laboratory QA/QC does the SAP specify:**	
a)	General QA/QC procedures?	Y
b)	The use and frequency of trip blanks (e.g., 1 trip blank per container type)?	Y
c)	Trip blank preparation protocol?	Y
d)	The use and frequency of equipment blanks where non-dedicated samplers are used (e.g., one per non-dedicated sampling equip type)?	Y
e)	Equipment blank preparation protocol?	Y
f)	The use and frequency of duplicate samples (e.g., 5-10% of total samples)?	Y
g)	Split/duplicate sampling protocol?	Y
h)	The use and frequency of spiked samples as an indicator of analytical performance or cross-contamination?	Y
i)	Spike sample preparation protocol?	NA

[3] Quality Analytical Services must provide details concerning immiscible phase sampling

		Y/N/NA
6.	**In relation to field and laboratory QA/QC (con't):**	
j)	Replicate parameter sampling protocol (e.g., pH, Sp Cond, TOX, TOC)?	N
k)	Calibration frequency for field and laboratory analytical equipment?	Y
l)	Verification & reporting of analytical data (% recoveries for spiked samples, analytical detection limits, raw analytical data and calculations, etc.)?	Y
7.	**In relation to contaminated equipment does the SAP discuss:**	
a)	Decontamination of field equipment other than that used for purging or sampling (e.g., analytical instrument probes, depth measuring devices, etc.)?	Y
b)	Decontamination of laboratory equipment (e.g., sample bottles, sample analysis equipment, contaminated sample shipment containers)?	NA
c)	Disposal of potentially contaminated sampling equipment and clothing (e.g., glassware, plasticware, sample coolers containing broken sample bottles, gloves, coveralls, etc.)?	Y
8.	**Does the SAP discuss sample Chain-of-Custody (COC) including:**	
a)	Field and laboratory COC procedures?	Y
b)	Disposition of samples?	Y
c)	COC sample forms?	Y
9.	**Does the SAP include a Health and Safety Plan (HSP) that discusses:** The plan includes some details of the HSP	
a)	Required level of personal protection?	
b)	Required or recommended personal protective/monitoring equipment?	
c)	Use of a photo-ionization detector or HNU meter to check the wellbore headspace prior to sampling in wells known or suspected of being contaminated with volatile organics?	
d)	Special sample handling requirements?	
e)	Periodic medical monitoring for site personnel?	
f)	A field emergency contingency plan?	
g)	The telephone numbers and location of emergency facilities?	
h)	Field personnel training requirements/documentation?	
i)	Physical/chemical hazards discussion?	
10.	**Does the SAP specify routine well inspection and maintenance procedures including:**	
a)	Inspection and documentation of all visible components of each monitoring well (See O&M Worksheet 3 of 3) during each groundwater elevation measurement/sampling event?	Y
b)	A copy of the well inspection worksheet used to document the above inspections?	Y

10. SAP specify routine well inspection and maintenance procedures? (con't):		Y/N/NA
c)	Contingencies for well repair/replacement within a reasonable time frame should the well integrity inspection reveal damage?	Y
d)	A contingency for inspection of wells contacted by flood waters as soon as such waters recede enough to perform such inspection?	N
e)	Measurement of total depth to ±0.1' in each well at least annually?	N[1]
f)	Comparison of total versus as-built depths for each well at least annually to assess the degree of well screen occlusion?	N[1]
g)	A well redevelopment trigger criterion (e.g., 5-10% of screen) as based on the degree of well screen occlusion/contaminants of concern including a general time frame for such redevelopment?	Y
h)	Other procedures for periodically assessing subsurface casing integrity (e.g., gauge ring, caliper logs, downwell video logging) including provisions for repair/replacement of wells if indicated?	N

11. Additional comment pertaining to the Sampling & Analysis Plan:
Does not provide detail about sampling of light non-aqueous phase liquid layer in four wells.

[1] Well depth will be measured in the wells with a removable pump

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.

June 22, 2009

Mr. Charles Wetzler
Quality Analytical Services
c/o RDD Family Office, LLC
6240 West 135th Street, Suite 150
Overland Park, KS 66223

Re: Quality Assurance – Sampling and Analysis Plan
Quality Analytical Services, Blue Summit, Missouri
EPA ID Number MOD0730027609
Aquaterra Project Number 2641

Dear Mr. Wetzler:

Aquaterra Environmental Solutions, Inc. (Aquaterra) has reviewed the May 15, 2009 letter from the Missouri Department of Natural Resources (MDNR) regarding their review, and the US Environmental Protection Agency's (EPA's) review, of the above-referenced draft Quality Assurance – Sampling and Analysis Plan (QA-SAP) document for the Quality Analytical Services (QAS) site located in Blue Summit, Missouri. Aquaterra provided an electronic version of the draft QA-SAP to MDNR and EPA for review via email on October 24, 2008. Aquaterra received the MDNR comment letter on May 21, 2009. This letter and attachments address the comments presented in the MDNR letter. For ease of reference, the comments included in the MDNR letter are re-stated in this letter and our responses follow in italics. The comments are numbered consistent with the MDNR May 15, 2009 letter.

May 15, 2009 MDNR Letter

1. The SAP does not indicate how sampling of free phase liquid will be done; this must be included in an approvable SAP.

   Four monitoring wells associated with the QAS site have historically, or currently, contained free product: EPA-R-1, GW-2R, GW-3, and GW-4. Monitoring well GW-2R has not contained measurable free product for the past several monitoring events (at least two years). As discussed with MDNR and EPA during a meeting on July 22, 2008, due to the abundance of previous free product analytical data collected, Aquaterra proposes to discontinue the annual sampling of free product. Therefore, procedures related to free product sampling were not included in the draft

QA-SAP. However, as requested, and in the event MDNR or EPA requests the sampling of free product in the future, Aquaterra has added procedures for collecting samples of free product to the revised QA-SAP (enclosed, new Section 3.4.6).

2. Section 1.2 – Please include in the description who is responsible for compiling the Semi-Annual and Annual Groundwater Monitoring Reports.

All personnel involved in the monitoring event, from field technicians to project managers, may assist with compiling the Semi-Annual and Annual Groundwater Monitoring Reports. The reports will be prepared under the supervision of a Missouri-licensed geologist, as required by regulation, and specified in Section 8.1 – Groundwater Monitoring Reports. A sentence has been added to Section 1.2 as requested.

3. Section 3.4.5 – Groundwater Sampling Procedure, page 19 – How will samples be packaged and shipped to the laboratory (e.g., vials placed in cubitainer with a charcoal thimble, custody seals on the cooler, chain-of-custody document placed in a plastic bag, etc.)? Please explain.

The requested information has been added to Section 3.4.5. As discussed during our meeting on July 22, 2008, one intent in revising the QA-SAP is to eliminate many of the specifics, to allow flexibility for future sampling events, while maintaining necessary requirements. Therefore, the added information is merely a guideline, and it is acknowledged that other methods of packaging and shipping samples may be used as long as the methods protect the integrity of the samples.

4. All detections of anilities shall be reported in µg/L.

A typographical error was found on Table 4, Appendix A, which incorrectly indicated the required reporting limit for biennial additional target analytes in milligrams per liter (mg/L). This typographical error has been corrected.

5. Many of the reporting limits are elevated and must be revised to be no higher than the Maximum Contaminant Level (MCL) or in absence of an MCL must not be any higher than the Department's and EPA's risk-based values. The Missouri values are available at http://www.dnr.mo.gov/env/hwp/mrbca/mrbca.htm. The EPA values are at http://www.epa.gov/Region6/6pd/rcra_c/pd-n/screen.htm.

To address this comment, Aquaterra first reviewed the maximum contaminant levels (MCLs) and the Department's and EPA's risk-based values compared to those listed on Table 3 of the QA-SAP. Aquaterra found a few typographical errors to the listed MCLs and Missouri default target levels (DTLs) on Table 3, and has corrected those values. Additionally, EPA Region 3 and EPA Region 9 updated their Regional Screening Levels (RSLs) as of April 2009 (after submission of the draft QA-SAP). Both regions now use the same RSL values. The regions have published RSLs for tapwater, but default to federal MCLs for other water uses. Please note, although listed on the table for comparison, because groundwater at the QAS site is not currently, and is not likely in the future, used as tapwater, Aquaterra believes it is not appropriate to compare concentrations reported in groundwater samples collected from the site to the EPA RSLs.

Aquaterra then researched appropriate reporting limits for the various analytical parameters and methods specified in the QA-SAP. In our research, we found the following helpful for understanding reporting limits:

> *The Method Detection Limit (MDL) is the basic measure of whether a parameter has been detected. It is the minimum concentration at which we can be confident that the concentration is greater than zero. All analytical methods and systems have a certain level of "noise" associated with them. This "noise" is due to random variations in the analytical and detection components of the system. When testing for contaminants at low concentrations, there is a point where the method's results can not be distinguished from the "noise" level of the analytical system. The Practical Quantification Level (PQL) is the minimum concentration at which we can be confident that the numerical result is accurate.*
>
> *(Limits Below Quantification Levels, Ohio EPA Permit Guidance Document)*

Understanding reporting limits and following common industry practice, Aquaterra requires the PQL be the reporting limit for the analyzed parameters associated with the QAS site. The PQLs are indicated on Table 3 as the "Required Reporting Limit" for this project. Aquaterra has added this clarification to the notes at the end of Table 3.

Finally, Aquaterra compared the PQLs to the MCLs and/or Missouri DTLs. As noted by MDNR, some PQLs are higher than the MCLs and/or Missouri DTLs. This is because of limitations due to the instrumentation required to perform the various analytical methods. For some parameters, the MCL or Missouri DTL values are

simply below achievable reporting limits by the methods specified. It is common industry practice to require laboratories to meet PQLs when reporting data. Additionally, it is not uncommon for some PQLs to be above the regulatory values. On a case-by-case basis, a decision must be made if additional analytical methods should be performed that may be able to achieve lower reporting limits (this is not an option for all parameters). For example, groundwater samples collected from selected monitoring wells at QAS are submitted for a separate analysis of 1,4-dioxane, to achieve a lower reporting limit, because the 1,4-dioxane concentration in the groundwater is of concern at the QAS site.

Based on our evaluation of the chemicals of concern for the QAS site, analytical parameters, specified analytical methods, PQLs, MCLs, and Missouri DTLs, Aquaterra believes the indicated reporting limits are appropriate.

6. Section 5.2 – Laboratory Quality Control procedures, page 25. This section generally discusses laboratory audits. A QAPP should also discuss field audits or clearly indicate they are not applicable. Please revise.

A new Section 3.6, Field Performance Assessment, has been added to address field audits.

7. Section 6.0 – Data Evaluation, page 27.

   a. Although it may be a standard statistic, the calculation for Relative Percent Difference should be provided or referenced in the QAPP.

      The calculation has been added to Section 6.3.

   b. The QAPP review checklist attached to the QAPP indicates data handling equipment and procedures for compiling, processing, and analyzing do not apply. However this section does refer to time-series plots and isoconcentration maps.

      Aquaterra currently uses Excel to create the time-series plots, and AutoCAD Civil 3D software for developing the isoconcentration maps. However, software continually changes and there are a variety of acceptable methods for preparing the time-series plots and isoconcentration maps, including manually. As discussed during our meeting on July 22, 2008, one intent in revising the QA-SAP is to eliminate many of the specifics, to allow flexibility for future

sampling events, while maintaining necessary requirements. Aquaterra does not believe it is appropriate to specify particular software programs for compiling, processing, and analyzing the data, as additional methods may be desired or employed during future events, software may be updated, or new software may become available. Therefore, Section B10.c of the QAPP checklist (Appendix E) is indicated to be not applicable (N/A). A statement has been added to Section 7.5, explaining QAPP items that are N/A.

8. Data Quality Review and Recordkeeping, page 29. If any statistical analysis of the data is planned, this should be summarized in the QAPP.

Statistical analysis of the data is not planned.

9. Missing QAPP Elements. The following sections were not included:

   a. Inspection/Acceptance Requirements for Supplies and Consumables; and
   b. Data Acquisition Requirements for Non-direct Measurements.

   The enclosed checklist identifies these two elements as not applicable. However, the checklist does reference a section for the responsible individuals for *Inspection/Acceptance Requirements for Supplies and Consumables* which implies this QAPP element is applicable. Please note that if an element is not applicable, the QAPP should still include them and state they are not applicable and give the reason why.

   As explained in the response to Comment 7b above, both of these elements were intentionally omitted from the QA-SAP to allow flexibility in supplies, materials, data resources, etc, that may be used in the future and cannot be anticipated at this time. Supplies, consumables, software, data resources, literature files, and the like are continually evolving. New products, technologies, and resources may be available in the future. Therefore, these sections are indicated to be not applicable. As stated in the response to Comment 7b, a statement has been added to Section 7.5, explaining QAPP items that are N/A.

10. Signature page. If EPA approval of the document is needed, a final version needs to be submitted with appropriate signatures from the facility with space for the appropriate EPA signatures. The Department will not be signing the QAPP.

Aquaterra contacted EPA and was provided the names of the individuals who would sign to indicate their approval of the QA-SAP. A signature sheet has been added to the QA-SAP, immediately preceding the Table of Contents.

11. Section 3.3 – Analytical Requirements. In May, 9 of the 19 monitoring wells will be sampled for 1,4-dioxane analysis. In November 17 of the 28 monitoring wells will be sampled for 1.4-dioxane analysis. Why will only these wells be sampled for 1,4-dioxane at these frequencies and how were these particular wells chosen?

To clarify, all samples collected during each event are analyzed for 1,4-dioxane as part of the full VOC analysis. Samples collected from nine specific wells in May, and 17 specific wells in November, are additionally analyzed under a separate run, which provides a lower reporting limit for 1,4-dioxane (4 ug/L) than the reporting limit achievable with a full VOC scan (100 ug/L).

Four of the ten wells in May, and four of the 11 wells in November not selected for the additional low-level analysis are pumping wells PW-1 through PW-4. A review of historical 1,4-dioxane analytical data for these wells indicates until the past two to four years, 1,4-dioxane in samples collected from the pumping wells was reported above 100 ug/L. Therefore, the result by the standard VOC analysis was sufficient. In the past two to four years, 1,4-dioxane has not been detected above the reporting limit of 100 ug/L. However, since these wells are operating pumping wells, Aquaterra does not believe it is necessary to run the additional analysis. In our opinion, data from surrounding monitoring wells are sufficient to evaluate the 1,4-dioxane plume.

The remaining six monitoring wells that were not selected for the additional low-level analysis in May are monitoring wells GW-1, GW-5, GW-7, GW-6B, GW-11A, and GW-11C.

- *Monitoring wells GW-1, GW-5, and GW-7 are located upgradient or outside the groundwater plume extent. Samples collected from these three wells historically have very low to non-detected concentrations of 1,4-dioxane. These three wells are submitted for the additional low-level 1,4-dioxane analysis on an annual basis, which Aquaterra believes is sufficient.*
- *Samples collected from monitoring wells GW-6B, GW-11A, and GW-11C have historically contained 1,4-dioxane above 100 ug/L; therefore the result by the standard VOC analysis is sufficient.*

The remaining seven monitoring wells that were not selected for the additional low-level analysis in November are monitoring wells EPA-R-1, EPA-R-3, GW-2R, GW-3, GW-4, GW-6B, and GW-11C.

- *Monitoring wells EPA-R-1, GW-2R, GW-3, and GW-4 were not previously selected for the additional low-level analysis because of the historically high concentrations of 1,4-dioxane in these wells (greater than 100 ug/L). In the past two to four years, 1,4-dioxane has not been detected above 100 ug/L; however, Aquaterra did not select these wells for the low-level analysis due to the presence of free product at these locations.*
- *Monitoring well EPA-R-3 is located well outside the extent of the groundwater plume. Groundwater samples collected from monitoring well EPA-R-3 typically do not contain any VOCs; therefore, this well was not selected for the low-level analysis of 1,4-dioxane.*
- *Samples collected from monitoring wells GW-6B and GW-11C have historically contained 1,4-dioxane above 100 ug/L; therefore the result by the standard VOC analysis is sufficient.*

12. Section 3.5 – Field Quality Assurance/Quality Control, page 21. This section seems to address the data quality indicators of precision and accuracy, and the sampling procedures described in Section 3 appear to address ensuring the samples are representative. Completeness and comparability are also a concern, so the QAPP needs to describe how they are being addressed.

A new Section 7.1, Data Quality Objectives, has been added to the revised QA-SAP to address the data quality indicators of precision, accuracy, representativeness, completeness, and comparability.

13. Section 6.1 – Groundwater Protection Standards, page 27. This section references Table 3 for the constituents of concern and the concentration levels of concern. There are some contaminants where the required reporting limit appears to be higher than the levels of concern listed including the Missouri Default Target Limit.

    a. Why would a reporting limit be required to be higher than the level of concern?

    Refer to Comment/Response 5.

b. How will having a reporting limit higher than the level of concern impact the usability of the data?

Common industry practice considers "not detected" analytical results to be a maximum of ½ of the reporting limit; there are no "zero" values. Therefore, even if a reporting limit is higher than the MCL or Missouri DTL, an evaluation can still be performed by assuming the maximum concentration of the data is ½ of the reporting limit. Thus, Aquaterra believes the data remains usable and valuable. Furthermore, if a laboratory reports a concentration below the PQL, that concentration is an estimate only, and may in fact not be reliable. Therefore, the data is actually more reliable as a value above the MCL or Missouri DTL, than as an estimated value below the PQL.

c. Because no laboratory-specific information or documentation was included, it could not be verified if the laboratory could achieve the reporting limits needed for the project. This information should be provided.

As discussed during our meeting on July 22, 2008, one intent in revising the QA-SAP is to eliminate many of the specifics, to allow flexibility for future sampling events, while maintaining necessary requirements. Therefore, Aquaterra intentionally did not provide any laboratory specific information. However, a new Section 5.1, Laboratory Qualifications, has been added to the revised QA-SAP, which specifies the laboratory must be able to achieve the required reporting limits, as well as meet all other laboratory requirements of the QA-SAP.

14. Laboratory referenced. Because only generic references to laboratory documentation are included and it appears as if the laboratory has not been selected (although a chain-of-custody form for Environmental Science Corporation was attached), the laboratory references could not be verified including analytical Standard Operating Procedures, Quality Control criteria, data package contents, data management, equipment testing/calibration, audits, and data review. Please submit the appropriate information in the revised SAP/QAPP.

Refer to Comment/Response 13c.

A revised QA-SAP is enclosed, with the modifications referenced in this letter. Additionally, Aquaterra has revised the submittal date for the Annual Groundwater monitoring report,

from April 1 to March 1 (Section 8.1). Aquaterra appreciates the opportunity to continue providing environmental services to Quality Analytical Services and the RDD Family Office, LLC. If you have any questions or comments regarding the responses to the comments contained herein or the revised QA-SAP, please do not hesitate to contact our office at (913) 681-0030.

Sincerely,
Aquaterra Environmental Solutions, Inc.

Susan L. McCart, P.E., P.G.
Senior Project Manager

John R. Rockhold, P.G., CGWP
Senior Project Manager/Quality Review

Enclosure: Revised QA-SAP

C: Ms. Jessica Merrigan, Lathrop and Gage
Mr. George Fletcher, MDNR
Mr. David Garrett, EPA Region VII

STATE OF MISSOURI
Jeremiah W. (Jay) Nixon, Governor • Mark N. Templeton, Director
DEPARTMENT OF NATURAL RESOURCES
www.dnr.mo.gov

September 2, 2009

CERTIFIED MAIL – 7004 1160 0000 8177 3858
RETURN RECEIPT REQUESTED

Mr. Charles E. Wetzler
Quality Analytical Services
6240 West 135th Street, Suite 150
Overland Park, KS 66223

RE: Draft Quality Assurance Sampling and Analysis Plan (SAP)
Quality Analytical Services (QAS), Blue Summit, Missouri
EPA ID# MOD073027609

Dear Mr. Wetzler:

This letter is to notify you that the Missouri Department of Natural Resources (Department) and the U.S. Environmental Protection Agency Region VII (EPA) reviewed QAS's draft SAP, dated June 2009. The purpose of the SAP is to update the previously existing SAP. The Department and EPA have several comments that must be addressed before the SAP may be approved.

Comments:

1. The June 22, 2009, Responses to Comments, page 3 of 9, Aquaterra statement, "Aquaterra believes it is not appropriate to compare concentrations reported in GW samples collected from the site to the RSLs." They are mistaken on this point. There is a difference between "comparison" and "action levels." There is nothing improper in comparing groundwater detections to any state and federal risk screening levels. In some cases, the federal level is more than the state and vice versa. In other cases, there is a state number but not a federal risk value and again vice versa. Since the facility is operating under an EPA order, they must also compare all environmental sampling results to EPA risk based screening levels.
2. Page 29, Section 6.1- 2nd paragraph: Please remove the following part of Section 6.1 "The state standards are based on groundwater concentrations and carry the force of law. Federal drinking water standards are included for guidance only and do not imply they are federally imposed standards for groundwater. The EPA Region 3 and Region 9 RSLs are presented as guidance as these are risk-based values that apply to tapwater and not groundwater concentrations."

3. Page 29, Section 6.2 - The sampling results shall be compared to EPA Maximum Containment Levels and Regional Screening Levels (RSLs). If QAS chooses they may also compare the results to Missouri Risk Based Corrective Action Default Target Levels.
4. Page 32, Section 7.1- Data Quality Objective 3 - "If Constituents of Interest (COIs) are present, how do the concentrations compare to Missouri Table B-1Tier 1 Default Target Levels or federal maximum contaminant levels"? The groundwater concentration shall be compared to EPA RSLs. The Missouri Risk Based Corrective Action Target Levels shall not be used in any decision making, unless there are no EPA RSLs.

Please address the individual comments by submitting a written response to the draft SAP comments to the Department within 30 days of receiving this letter.

Several of the requested changes are considered a modification to the approved post-closure plan. Therefore, public participation will have to be conducted prior to final approval, namely the addition of wells to the sampling plan. Once a revised SAP is submitted, the Department will initiate a 30-day comment period. This is required by 10 CSR 25-8.124(1)(A)10.D. and 40 CFR 265.118(f), incorporated by reference in 10 CSR 25-7.265(1).

If you have any questions regarding this letter, please contact me at the Missouri Department of Natural Resources, Hazardous Waste Program, P.O. Box 176, Jefferson City, MO 65102-0176, or by phone at (573) 751-3553 or 1-800-361-4827, or by e-mail at george.fletcher@dnr.mo.gov. Thank you.

Sincerely,

HAZARDOUS WASTE PROGRAM

George Fletcher
Environmental Engineer
Permits Section

GF:mj

c: Mr. David Garrett, Project Manager, U.S. EPA Region VII
Ms. Jessica Merrigan, Lathrop and Gage
Kansas City Regional

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.

September 21, 2009

Mr. George Fletcher
Missouri Department of Natural Resources
Hazardous Waste Program
P.O. Box 176
Jefferson City, MO 65102-0176

Re: Quality Assurance – Sampling and Analysis Plan (Third Draft)
Quality Analytical Services, Blue Summit, Missouri
EPA ID Number MOD0730027609
Aquaterra Project Number 2641

Dear Mr. Fletcher:

Aquaterra Environmental Solutions, Inc. (Aquaterra) has reviewed the September 2, 2009 letter from the Missouri Department of Natural Resources (MDNR) regarding their review, and the US Environmental Protection Agency's (EPA's) review, of the above-referenced second draft Quality Assurance – Sampling and Analysis Plan (QA-SAP) document for the Quality Analytical Services (QAS) site located in Blue Summit, Missouri. Aquaterra provided an electronic version of the second draft QA-SAP to MDNR and EPA for review via email on June 22, 2009. Aquaterra received the MDNR comment letter on September 8, 2009. This letter and attachments address the comments presented in the MDNR letter. For ease of reference, the comments included in the MDNR letter are re-stated in this letter and our responses follow in italics. The comments are numbered consistent with the MDNR September 2, 2009 letter.

September 2, 2009 MDNR Letter

1. The June 22, 2009, Responses to Comments, page 3 of 9, Aquaterra statement, "Aquaterra believes it is not appropriate to compare concentrations reported in GW samples collected from the sit to the RSLs." They are mistaken on this point. There is a difference between "comparison" and "action levels." There is nothing improper in comparing groundwater detections to any state and federal risk screening levels. In some cases, the federal level is more than the state and vice versa. In other cases, there is a state number but not a federal risk value and again vice versa. Since the facility is operating under an EPA order, they must also compare all environmental sampling results to EPA risk based screening levels.

As Aquaterra previously discussed in our June 2009 response letter to MDNR, some reporting limits are higher than the EPA RSLs, federal MCLs, and/or Missouri DTLs because of limitations due to the instrumentation required to perform the various analytical methods. For some parameters, the EPA RSL, MCL, and/or Missouri DTL values are simply below achievable reporting limits by the methods specified. It is common industry practice to require laboratories to meet practical quantification limits (PQLs) when reporting data, although it is not uncommon for some PQLs to be above the regulatory values. On a case-by-case basis, a decision must be made if additional analytical methods should be performed that may be able to achieve lower reporting limits, although this is not an option for all parameters. Due to the stringent screening levels for tapwater, several of the EPA RSLs are lower than the required reporting limit. Groundwater at the QAS site is not currently used for tapwater, and is not likely to be in the future; therefore, it is Aquaterra's opinion that comparison to the EPA RSLs may not be practical. However, Aquaterra understands that since the facility is operating under an EPA order, the groundwater concentrations collected at the site should first be compared to the EPA RSLs, in addition to the federal MCLs and Missouri DTLs.

2. Page 29, Section 6.1 – 2nd paragraph: Please remove the following part of Section 6.1 - "The state standards are based on groundwater concentrations and carry the force of the law. Federal drinking water standards are included for guidance only and do not imply they are federally imposed standards for groundwater. The EPA Region 3 and Region 9 RSLs are presented as guidance as these are risk-base values that apply to tapwater and not groundwater concentrations."

   The above statement has been removed from Section 6.1 as requested.

3. Page 29, Section 6.2 – The sampling results shall be compared to EPA Maximum Containment Levels and Regional Screening Levels (RSLs). If QAS chooses they may also compare the results to Missouri Risk Based Corrective Action Default Target Levels.

   Aquaterra has modified Section 6.2 to indicate that sampling results will be compared to EPA RSLs and Maximum Contaminant Levels (MCLs), as well as Missouri Risk Based Corrective Action Default Target Levels.

4. Page 32, Section 7.1 – Data Quality Objective 3 – "If Constituents of Interest (COIs) are present, how do the concentrations compare to Missouri Table B-1 Tier 1 Default Target Levels or federal maximum contaminant levels"? The groundwater concentration shall be compare to EPA RSLs. The Missouri Risk Based Corrective Action Target Levels shall not be used in any decision making, unless there are no EPA RSLs.

   Aquaterra has modified Section 7.1 – Data Quality Objective 3 to indicate that concentrations shall be compared to EPA RSLs, unless there are no EPA RSLs or MCLs, in which case MRBCA Default Target Levels shall be used.

A revised QA-SAP is enclosed, with the modifications referenced in this letter. Aquaterra appreciates the opportunity to continue providing environmental services to Quality Analytical Services and the RDD Family Office, LLC. If you have any questions or comments regarding the responses to the comments contained herein or the revised QA-SAP, please do not hesitate to contact our office at (913) 681-0030.

Sincerely,
Aquaterra Environmental Solutions, Inc.

Leah A. Meyer
Project Manager

John R. Rockhold, P.G., CGWP
Senior Project Manager/Quality Review

Enclosure: Revised QA-SAP (Third Draft)

C: Ms. Jessica Merrigan, Lathrop and Gage
Mr. Charles Wetzler, Quality Analytical Services
Mr. David Garrett, EPA Region VII

George Fletcher
Missouri Department of Natural Resources
Hazardous Waste Program
P. O. Box 176
Jefferson City, Missouri 65102-0176

Mr. Fletcher:

RE: Quality Analytical Services, 1633 Marsh Avenue, Blue Summit, Missouri
Quality Assurance Project Plan and Sampling and Analysis Plan dated September 2009
EPA ID #MOD073027609

The Environmental Protection Agency (EPA) Region 7 has reviewed the Quality Assurance Project Plan (QAPP) and Sampling & Analysis Plan (SAP) received electronically on December 09, 2009 and prepared by Aquaterra Environmental Solutions on behalf of Quality Analytical Services (QAS). The QAPP and SAP were reviewed according to AEPA Requirements for Quality Assurance Project Plans for Environmental Data Operations,@ EPA QA/R-5 March 2001.

The document is approved with the following comments. The QAPP and SAP, in conjunction with the response letter from Aquaterra dated 06/22/2009, comply with QA/R-5 and address most of the key topics although minor issues were noted. These issues are noteworthy of pointing out for the record.

General Comments

1. Aquaterra 06/22/09 Response Letter. Because several of the comments are addressed in this response letter rather than within the QAPP itself, a copy of this response letter should be attached to the QAPP to provide clarity.

2. § 5.1 Laboratory Qualifications, page 27. As noted in the initial Quality Assurance review memo dated 11/17/2008, only generic references to laboratory documentation are included, and therefore, the laboratory references could not be verified. This version of the QAPP does state laboratory information will be provided to MDNR upon request. It is recommended that MDNR verify the laboratory's documentation if the Department has not done so already.

3. § 7.1 Data Quality Objectives, page 33. The table on this page identifies "Matrix Spike Samples – Field" as a determination method for accuracy. It is unclear whether the intent is to spike samples in the field, including for volatile organic compounds. If so, the QAPP must describe how this will be done, how the results will be evaluated, and what action(s) might be taken if the results are not acceptable. Acceptable ranges should be identified in the QAPP.

RCAP	RCAP
Garrett	Crysler
12/ /09	12/ /09

4. § 7.5 Quality Assurance Project Plan, page 36. It is not clear what is meant by the statement "The QA-SAP is intended to minimize many specific details, such as equipment model numbers, specific software requirements, etc. to allow flexibility for future sampling events, while maintaining necessary requirements." Specific details regarding equipment model numbers, specific software requirements, etc. were not requested, nor are they necessarily required in a QAPP. However, enough detail must be provided. Information such as the type of equipment (e.g., pH meter, multi-meter, PID, etc.), data handling procedures (e.g., data entry into an Excel spreadsheet, displaying data using histograms, etc.), criteria for inspecting supplies (e.g., no cracked or missing lids, only glass containers), etc. must be included in the QAPP. If the QAPP simply lists "not applicable" for this type of information, users may not have enough detail to know what needs to be done to meet the project's needs.

   Please note the QAPP is intended to be a "living document." Therefore, even in those situations where specific details may be required (e.g., a certain model number, a certain version of a software package, etc.), the QAPP can easily be amended if changes to this type of detailed information are needed for future sampling events.

   QAS should provide revision pages electronically that addresses these comments.

If you have any questions, you may contact me at (913) 551-7159 or by email at Garrett.David@epa.gov.

Sincerely,

David Garrett
Environmental Scientist
RCRA Corrective Action and Permits Branch
Air and Waste Management Division

Bcc: Lynn Slugantz, EPA

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.

January 22, 2010

Mr. Charles Wetzler
Quality Analytical Services
c/o RDD Family Office, LLC
6240 West 135th Street, Suite 150
Overland Park, KS 66223

Re: Quality Assurance – Sampling and Analysis Plan
Quality Analytical Services, Blue Summit, Missouri
EPA ID Number MOD0730027609
Aquaterra Project Number 2641

Dear Mr. Wetzler:

Aquaterra Environmental Solutions, Inc. (Aquaterra) has reviewed the Environmental Protection Agency (EPA) letter provided via email on December 16, 2009, from Mr. David Garrett (EPA) to Mr. George Fletcher, Missouri Department of Natural Resources (MDNR), regarding an additional review of the above-referenced draft Quality Assurance – Sampling and Analysis Plan (QA-SAP) document for the Quality Analytical Services (QAS) site located in Blue Summit, Missouri.

Aquaterra provided electronic versions of the draft QA-SAP to MDNR and EPA for review via email on October 24, 2008 (first draft), June 22, 2009 (second draft), and September 21, 2009 (third draft). Aquaterra received an MDNR comment letter, which included EPA comments, to the first draft submittal on May 21, 2009, and to the second draft submittal on September 8, 2009. The EPA letter referenced above (received via email on December 16, 2009) conditionally approved the third draft version of the QA-SAP, pending responses to four comments. MDNR indicated they have no additional comments.

This letter and attachments address the comments presented in the EPA letter. For ease of reference, the comments included in the EPA letter are re-stated in this letter in italics and our responses follow. The comments are numbered consistent with the EPA letter.

EPA Letter (received via email on 12/16/09)

1. *Aquaterra 06/22/09 Response Letter. Because several of the comments are addressed in this response letter rather than within the QAPP itself, a copy of this response letter should be attached to the QAPP to provide clarity.*

   Aquaterra has added an appendix (Appendix F) for correspondence. A copy of each comment and response letter for the draft submittals is included in this appendix. Future correspondence can also be added to this appendix.

2. *§ 5.1 Laboratory Qualifications, page 27. As noted in the initial Quality Assurance review memo dated 11/17/2008, only generic references to laboratory documentation are included, and therefore, the laboratory references could not be verified. This version of the QAPP does state laboratory information will be provided to MDNR upon request. It is recommended that MDNR verify the laboratory's documentation if the Department has not done so already.*

   Currently, Aquaterra is subcontracting Environmental Science Corp (ESC) laboratory to complete the required analyses. Therefore, Aquaterra is providing (electronically) the most recent Quality Assurance Manual (QAM) and Statement of Qualifications (SOQ) for Environmental Science Corporation (ESC) to MDNR for review. If a different laboratory is used in the future, laboratory information will be provided to MDNR upon request, as stated in the QAPP.

3. *§ 7.1 Data Quality Objectives, page 33. The table on this page identifies "Matrix Spike Samples – Field" as a determination method for accuracy. It is unclear whether the intent is to spike samples in the field, including for volatile organic compounds. If so, the QAPP must describe how this will be done, how the results will be evaluated, and what action(s) might be taken if the results are not acceptable. Acceptable ranges should be identified in the QAPP.*

   Matrix Spike Samples are not intended to be spiked in the field. Section 3.5.3, page 24 and the table in Section 7.1, page 33 has been revised to clarify.

4. *§ 7.5 Quality Assurance Project Plan, page 36. It is not clear what is meant by the statement "The QA-SAP is intended to minimize many specific details, such as equipment model numbers, specific software requirements, etc. to allow flexibility for future sampling events, while maintaining necessary requirements." Specific details*

regarding equipment model numbers, specific software requirements, etc. were not requested, nor are they necessarily required in a QAPP. However, enough detail must be provided. Information such as the type of equipment (e.g., pH meter, multi-meter, PID, etc.), data handling procedures, (e.g., data entry into an Excel spreadsheet, displaying data using histograms, etc.), criteria for inspecting supplies (e.g., no cracked or missing lids, only glass containers), etc. must be included in the QAPP. If the QAPP simply lists "not applicable" for this type of information, users may not have enough detail to know what needs to be done to meet the project's needs.

Please note the QAPP is intended to be a "living document." Therefore, even in those situations where specific details may be required (e.g., a certain model number, a certain version of software package, etc.), the QAPP can easily be amended if changes to this type of detailed information are needed for future sampling events.

As stated in our June 22, 2009 letter, response to comments 7b and 9, the referenced statement in Section 7.5, page 36 is meant to explain why certain items on the QAPP checklist are indicated to be not applicable (N/A). As explained in the response letter, supplies, consumables, software, data resources, literature files, and the like are continually evolving. New products, technologies, and resources may be available in the future. Aquaterra currently uses Excel to create the time-series plots, and AutoCAD Civil 3D software for developing the contour maps. However, software continually changes and there are a variety of acceptable methods for preparing the time-series plots and contour maps, including manually. Aquaterra does not believe it is appropriate to specify particular software programs for compiling, processing, and analyzing the data, as additional methods may be desired or employed during future events, software may be updated, or new software may become available. Aquaterra believes the user and/or evaluator should determine the appropriate software, databases, and presentation methods for compiling, evaluating, and presenting the data.

However, as requested, Aquaterra again reviewed the N/A items on the QAPP checklist, and modified the following sections to provide additional detail for users:

- Section 3.4.1, Equipment (page 12);
- Section 7.5, Quality Assurance Project Plan (page 36);
- Section 8.1, Groundwater Monitoring Reports (page 37); and
- Appendix E, QAPP Checklist, Items A6.d, B6.b, B8.a, and B10.c.

Revised pages for the QA-SAP, along with this letter, have been provided to MDNR and EPA electronically, with the modifications referenced in this letter. Additionally the signature page has been provided electronically, which requires EPA execution. The EPA letter indicates the QA-SAP is approved with the comments included herein. Aquaterra anticipates EPA can now sign the signature page so that a final document can be compiled and provided to all applicable parties.

Aquaterra appreciates the opportunity to continue providing environmental services to Quality Analytical Services and the RDD Family Office, LLC. If you have any questions or comments regarding the responses to the comments contained herein or the revised QA-SAP, please do not hesitate to contact our office at (913) 681-0030.

Sincerely,
Aquaterra Environmental Solutions, Inc.

Susan L. McCart, P.E., P.G.
Senior Project Manager

John R. Rockhold, P.G.
Senior Project Manager/Quality Review

C: Ms. Jessica Merrigan, Lathrop and Gage
Mr. George Fletcher, MDNR
Mr. David Garrett, EPA Region VII