REMEDIAL ACTION CONTRACT 2 FOR REMEDIAL, ENFORCEMENT OVERSIGHT, AND NON-TIME-CRITICAL REMOVAL ACTIVITIES IN REGION 5

ATTACHMENT B

PHASE I QUALITY ASSURANCE PROJECT PLAN EAST TROY CONTAMINATED AQUIFER SITE TROY, MIAMI COUNTY, OHIO

Prepared for
U.S. Environmental Protection Agency
Region 5
77 West Jackson Boulevard
Chicago, IL 60604

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Prepared by:	SulTRAC
SulTRAC Project Manager:	Guy Montfort
Telephone No:	(513) 564-8350
US EPA Work Assignment Manager:	Shari Kolak
Telephone No:	(312) 886-6151

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ACRONYMS AND ABBREVIATIONS

%D	Percent difference
%R	Percent recovery
µg/L	Micrograms per liter
µm	Micrometer
AES	Atomic emission spectroscopy
ASTM	American Society for Testing and Materials (now ASTM International)
ATSDR	Agency for Toxic Substances and Disease Registry
bgs	Below ground surface
CA	Corrective action
CADRE	Computer-aided data review and evaluation
CAS	Chemical Abstract Services
cc	Cubic centimeter
CCV	Continuing calibration verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CF	Calibration factor
CLP	Contract Laboratory Program
CMS	Carbon molecular sieve
CRL	Central Regional Laboratory
CRQL	Contract-required quantitation limit
CVAA	Cold vapor atomic absorption
%D	Percent difference
DCA	Dichloroethane
DCE	Dichloroethene
DNPL	Dense-nonaqueous phase liquid
DQI	Data quality indicator
EPA	U. S. Environmental Protection Agency
ESI	Expanded site inspection
FS	Feasibility study
FSP	Field sampling plan
GC	Gas chromatography
HAZWOPER	Hazardous Waste Operations and Emergency Response Standard
HCl	Hydrochloric acid
HNO_3	Nitric acid
ICP	Inductively coupled plasma

ACRONYMS AND ABBREVIATIONS (CONTINUED)

ID	Identification
IDEM	Indiana Department of Environmental Management
KC	Kimberly Clark, Inc.
L/min	Liters per minute
LEGS	Laboratory for Environmental and Geological Studies
LIMS	Laboratory information management system
MCL	Maximum contaminant level
mg/kg	Milligrams per kilogram
mL	Milliliter
mm	Millimeter
MS	Matrix spike
MSD	Matrix spike duplicate
NA	Not applicable
NC	No criteria
ND	Not detected
NFG	National Functional Guidelines
NPL	National Priorities List
ODH	Ohio Department of Health
ODNR	Ohio Department of Natural Resources
Ohio EPA	Ohio Environmental Protection Agency
OSHA	Occupational Safety and Health Administration
PCB	Polychlorinated biphenyl
PCE	Tetrachloroethene
PID	Photoionization detector
ppb	Parts per billion
ppbv	Parts per billion by volume
ppm	Parts per million
PQO	Project quality objective
PRG	Preliminary remediation goal
PTFE	Polytetrafluoroethylene
QA	Quality assurance
QAPP	Quality assurance project plan
QC	Quality control
QL	Quantitation limit

ACRONYMS AND ABBREVIATIONS (CONTINUED)

%R	Percent recovery
RAC	Remedial Action Contract
RI	Remedial investigation
RISC	Risk Integrated System of Closure
RPD	Relative percent difference
RRF	Relative response factor
RSCC	Regional Sample Control Coordinator
RSD	Relative standard deviation
RSL	Regional Screening Level
SAP	Sampling and analysis plan
SOP	Standard operating procedure
SOW	Statement of work
SI	Site investigation
SSI	Screening site inspection
SVOC	Semivolatile organic compound
TAL	Target Analyte List
TBD	To be determined
TCA	Trichloroethane
TCE	Trichloroethene
UFP	Uniform Federal Policy for Implementing Environmental Quality Systems
UST	Underground storage tank
VAS	Vertical aquifer sampling
VOC	Volatile organic compound
WA	Work assignment
WAM	Work assignment manager

1.0 INTRODUCTION

SulTRAC has prepared this quality assurance project plan (QAPP) as part of the sampling and analysis plan (SAP) for the East Troy Contaminated Aquifer Site (East Troy site) in Troy, Ohio, under the U.S. Environmental Protection Agency (EPA) Remedial Action Contract (RAC) II for Region 5, Contract No. EP-S5-06-02, Work Assignment (WA) No. 045-RICO-B5EN. A Remedial Investigation (RI)/Feasibility Study (FS) will be conducted at the East Troy site. The RI/FS will investigate the nature and extent of contamination in soil, subsurface gas, indoor air, groundwater, sediment, and surface water; and the threat this contamination poses to human health and the environment. The RI/FS will generate sufficient data to allow selection of an approach for site remediation that eliminates, reduces, or controls risks to human health and the environment posed by the site as well as to support a Record of Decision (ROD). The RI/FS is being conducted in two phases. Data gathered during Phase I will be used to develop an approach for the Phase II RI that will address additional field investigations (if needed). Phase I could begin as early as summer 2010, while Phase II will likely begin in the fall of 2010.

The SAP consists of the field sampling plan (FSP) (Attachment A) and the QAPP (Attachment B), which are among the site-specific plans to be prepared under the WA in accordance with Task 1 of the EPA statement of work (SOW) (EPA 2009).

This QAPP describes quality assurance (QA) and quality control (QC) protocols and objectives, methods, and procedures to be performed by SulTRAC during the first field investigation (Phase I) of the RI/FS at the East Troy site. The scope of the QAPP, as outlined in the work plan, has been developed to perform various field activities or combinations of activities in order to acquire data for the RI/FS. The primary goals of the Phase I investigation are to (1) investigate the nature and extent of contamination, (2) attempt to identify, if present, ongoing sources of groundwater contamination, (3) assess the potential vapor intrusion exposure pathway at residences and businesses located within the plume area that were not evaluated during previous studies, (4) evaluate the potential for impacts to the Great Miami River, and (5) collect updated groundwater quality data, including additional information on background water quality.

This document presents quality assurance protocols applicable to all sampling and analytical procedures for Phase I activities with the exception of sub-slab vapor and indoor monitoring for volatile organic compounds (VOC). The Ohio Environmental Protection Agency (Ohio EPA) recently issued guidance, and EPA Region 5 is currently developing guidance, that will influence the sampling and analytical methodology that will apply to the East Troy RI/FS. In addition, the specific locations for monitoring will be determined, based in part on the results of groundwater and soil investigations that will comprise the initial activities during Phase I. Based on these considerations and discussions with EPA and Ohio EPA, SulTRAC will prepare and issue a SAP addendum addressing the specific guidance, methodologies and locations for the sub-slab/ indoor air VOC monitoring prior to commencing that portion of the RI. This will allow the initial components of Phase I to commence and generate necessary data for selection of sub-slab and indoor air monitoring locations as guidance is finalized.

Section 2.0 of this QAPP describes the site and its history, and Section 3.0 specifies the QAPP procedures. The QAPP worksheets appear after Section 3.0. References used to prepare this QAPP are listed after the worksheets, and tables and figures appear after the list of references. A separate QAPP for Phase II activities will be prepared.

All information regarding laboratory analysis presented in this QAPP pertains to samples to be analyzed by the EPA's Central Regional Laboratory (CRL)/Contract Laboratory Program (CLP) or a subcontracted laboratory. At the beginning of the Phase I activities, some of the groundwater samples from vertical aquifer sampling (VAS) and soil borings will be analyzed by a subcontracted laboratory for a fast turnaround. Once the subcontracted laboratory has been identified, relevant worksheets in this QAPP will be revised to include the standard operating procedures (SOP), QA procedures, and QC limits for the subcontracted laboratory.

2.0 SITE DESCRIPTION AND HISTORY

The East Troy site consists of groundwater contamination that has been detected in a mixed residential, commercial and industrial area in the eastern part of the City of Troy. Contamination has also been detected in samples from several of the City of Troy's municipal water supply wells. The Troy municipal water system serves approximately 28,000 residents and is supplied by groundwater from two wellfields, the East Wellfield and the West Wellfield, located approximately 0.75 mile apart, on the east bank of the Great Miami River (Figures 1 and 2). The municipal wells are installed in the deep portion of a surficial sand and gravel aquifer along the east bank of the Great Miami River. Low concentrations of chlorinated volatile organic compounds (VOC) have been detected in samples from production wells in both wellfields (Ohio Environmental Protection Agency [Ohio EPA 2002]; City of Troy [Troy] 2009b). The sources of contamination of each wellfield are currently believed to different.

An area of groundwater contamination has been discovered in the eastern part of the City of Troy, across the Great Miami River from the East Wellfield, and is identified as the East Troy Contaminated Aquifer Site (Figures 2 and 3). Soil and groundwater data collected at the Spinnaker Coatings (Spinnaker) site on Water Street, which was formerly operated by a division of Kimberly Clark Inc., (KC) indicate that the

Spinnaker site is a source of groundwater contamination in the plume area (Ohio EPA 2002; EPA 2008; Kimberly Clark Inc. [KC] 2009). Several other sites, including Hobart Cabinet Company on Water Street, and several additional entities that no longer exist, are suspected sources contributing to the contaminant plume(s) and the contamination in the East Wellfield. Overall, the investigations conducted to date indicate that the contamination at the Site may represent multiple plumes that originated from two or more sources, and may co-mingle in some areas, as described below.

Residential Area PCE Plume - One plume, that contains primarily PCE at concentrations as high as approximately 800 ug/L in shallow (less than 30 feet below ground surface [bgs]) groundwater, with lower concentrations of other chlorinated VOCs is located in the predominantly residential area roughly bounded by Walnut Street (northwest/ upgradient side), East Main Street, and Canal Street. The highest PCE concentrations were observed in the vicinity of the intersections of Clay and Crawford Streets with Franklin Street. Only trace levels of PCE have been detected in a deep monitoring well (Troy well MW-Q), screened at a depth of approximately 84 to 94 feet bgs, located in this area. The shallow portion of the plume extends at least as far southeast (downgradient) as Union Street; but appears to decrease significantly in concentration in the block between Crawford and Union.

Water Street PCE Plume - A second area of high PCE concentrations, with lower concentrations of other chlorinated VOCs in groundwater has been found along Water Street, approximately 2 blocks east/northeast of the aforementioned residential area, between Clay Street on the northwest (upgradient) side, and the vicinity of New Street on the southeast (downgradient) side. Data collected by Ohio EPA from 2001-2004 appear to indicate that this plume is separated from the aforementioned residential area PCE plume, based on several "nondetect "concentrations in shallow groundwater samples collected along Main Street, and on Clay Street northeast of Main. The deeper portion of the aquifer was not investigated in this intervening area. This plume appears to extend to the Great Miami River and onto the Spinnaker site property. PCE and other chlorinated VOCs have been detected in shallow soil samples and groundwater samples collected around the perimeter of the Hobart Cabinet building, suggesting the possibility that Hobart Cabinet is a contributing source of contamination to the plume in this area.

Spinnaker Site Plume - Groundwater and soil contamination, including chlorinated VOCs, has been detected in the western part of the Spinnaker property. This area of groundwater contamination appears to contain primarily TCE, cis-1,2-DCE, and vinyl chloride and extends at least to the Great Miami River. The plume also contains PCE at some locations, with the highest PCE levels typically being detected at the locations closer to the western end of the property, near the upgradient boundary, which is also the reported general vicinity of a former dry cleaner that was located in a part of the area now covered by

Spinnaker's parking lot. (KC 2009; Ohio EPA 2002, 2004; EPA 2007b, 2008; Agency for Toxic Substances and Disease Registry [ATSDR] 2008; SulTRAC 2009).

SulTRAC will perform various field activities or combinations of activities for data acquisition to support the RI/FS. The primary goals of the Phase I investigation are to (1) determine the nature and extent of contamination in soil, groundwater, indoor subsurface gas, surface water, and sediment; (2) identify sources of groundwater contamination; (3) assess the potential vapor intrusion exposure pathway at residences and businesses located within the plume area that were not evaluated during previous studies; (4) evaluate the potential for impacts to the Great Miami River; and (5) collect updated groundwater quality data, including additional information on background water quality.

2.1 SITE HISTORY

The East Troy site area encompasses a relatively old residential, industrial, and commercial portion of the City of Troy. This area includes a long history of residential use with interspersed commercial and industrial areas. Most of the residences within the 20-block area are more than 60 years old. The former Miami and Erie Canal ran from northwest to southeast along the southwestern portion of the East Troy site area, and a mill race (the Dye Mill Race) ran roughly parallel to the canal. These two features were located in the area between Canal and Race Streets and were filled in some time after the 1920s. Maps prepared in the early 1920s indicating the route of the former canal and mill race show numerous businesses and small industries in the eastern part of Troy, within the area that is now primarily residential (ODNR 2009). It should be noted that the groundwater contaminant concentrations detected to date do not suggest the likelihood that these former features are source areas of VOCs in groundwater at the East Troy site (Ohio EPA 2002; KC 2009).

As previously discussed, the sources of groundwater contamination at the East Troy site include known and unknown or unconfirmed sources. In addition to contamination in soil and groundwater at the Spinnaker site, past investigations have identified several additional possible sources, based primarily on their geographic proximities to the plumes and nature of chemicals typically used in similar operations. Figures 3 and 4 indicate the known boundaries of the area of contamination at the East Troy site outside of the Spinnaker site, and the reported locations of several other possible source areas identified to date. These include a group of businesses that no longer exist including dry cleaners, print shops, and auto repair facilities formerly located throughout the 20-block area. These businesses operated in the area from approximately the 1940s to 1980s. One active industrial facility, Hobart Cabinet on Water Street, a manufacturer of specialty metal cabinetry, has also been suspected of contributing chlorinated VOCs to the contaminant plume, based on detections of chlorinated VOCs in groundwater at locations adjacent to the Hobart property perimeter and in soil samples collected directly adjacent to the Hobart building by Ohio EPA between 2002 and 2004 (Applied Science and Engineering 1994; Ohio EPA 2002, 2004; KC 2009).

The presence of chlorinated VOCs in on-site soils at another active industrial facility in the area, Spinnaker, has been confirmed, and Spinnaker has been identified as a contributor to the contamination in the East Troy contaminant plume based on past investigations completed on site. The Spinnaker facility on Water Street, directly across the river from the East Wellfield, began operations in the 1920s. Spinnaker is a manufacturer of adhesive-coated papers and related products. (EPA 2008). Additional information regarding past investigations at Spinnaker is included in Section 2.2.

The East Troy site was discovered through detection of chlorinated VOCs at low concentrations in raw water from several wells in the City of Troy's East Wellfield, beginning in 1988. VOCs have not been detected in the finished water supply. Primarily, *cis*-1,2-DCE has been noted in the East Wellfield. The two wells with detections of chlorinated VOCs in the East Wellfield have been Troy wells 14 and 18, which are the two northernmost production wells in the East Wellfield. In recent years, well 18 has been the only well in the East Wellfield in which chlorinated VOCs have been detected. Raw water from the production wells is sampled and analyzed monthly for VOCs. Table 2 summarizes analytical data for raw water samples from these wells collected in 2009. Concentrations of *cis*-1,2-DCE detected in the raw water samples from well 18 are relatively low (recent data indicates concentrations ranging from non-detect to 1.3 micrograms per liter (ug/L) and have not exceeded the federal maximum contaminant level (MCL), which is 70 ug/L (Troy 2009b).

The chlorinated VOCs PCE, TCE, and *cis*-1,2-DCE have been detected in production well 12W in Troy's West Wellfield, located approximately 0.75 mile northwest of the East Wellfield, along the Great Miami River (see Figure 2); however, the suspected source areas of these contaminants are believed to differ from those associated with the contaminants affecting the East Wellfield. For this reason, the West Wellfield contaminant plume is not assumed to be within the East Troy site, which consists of the East Troy plume and sources based on EPA and SulTRAC's current understanding; thus, the West Wellfield contaminant plume is not within the scope of this RI/FS. Well 12W is within the one-year, time-of-travel for East Wellfield wells 14 and 18 (Malcolm Pirnie 2004), and therefore the presence of these contaminants in the West Wellfield may be relevant to the RI/FS with regard to background water quality on the east side of the river. However, it should be noted that limited data from existing City of Troy monitoring wells located east of the Great Miami River, between the two wellfields, do not indicate that the West Wellfield plume is migrating directly to the East Wellfield. Phase I of the RI will include additional sampling locations to further evaluate the possibility that sources of contamination in the East

Wellfield may be present east of the Great Miami River. These data will be used to evaluate whether expansion of the area of investigation during Phase II of the RI will be necessary.

It should also be noted that Troy may be increasing production on the east side of the river in the near future. Troy is currently evaluating the possibility of adding more production wells. The effects that increased pumping may have on contaminant migration are unknown.

2.2 PREVIOUS SITE INVESTIGATIONS

As previously discussed, chlorinated VOCs were detected in raw water from various Troy water production wells beginning in 1988. A series of investigations by Ohio EPA, private entities, and EPA have been completed since the late 1990s. These investigations confirmed the presence of chlorinated VOCs in soil and groundwater at the Spinnaker site, and in groundwater and soil at locations adjacent to the perimeter of the Hobart Cabinet facility. Additional "hot spots" of chlorinated VOC contamination in groundwater and soil were detected in the area; however, the original sources of these additional areas of contamination have not been confirmed. Industrial or commercial operations prior to the 1980s that have not existed for more than 20 years may have contributed to the contamination, and new construction has covered some areas at the sites of these former operations.

The following sections summarize the scope and relevant results of past investigations of the nature and extent of contamination in the East Troy site vicinity. Significantly, none of the suspected sources listed in Table 3 appears to be located directly over the area of highest PCE groundwater concentrations identified to date, along and just north of Franklin Street in the vicinity of the Clay/Franklin and Crawford/Franklin intersections. This issue is discussed in further detail below.

Ohio EPA Investigations

Ohio EPA Investigations

Ohio EPA initiated investigations of the chlorinated VOC plumes beginning in 1999. Figure 3 summarizes key results for PCE from Ohio EPA groundwater sampling from 1999 through 2004. The investigations by Ohio EPA between 1999 and 2004 included investigations of the contamination in both the East and West Wellfield areas. Investigations of the East Wellfield contamination included on-site investigations at Spinnaker as well as off-site areas located throughout the eastern part of Troy. Ohio EPA's investigations of the East Wellfield plume included installation and sampling of 13 groundwater monitoring wells, and collection of groundwater samples from over 60 locations using a direct-push rig.

The results of these investigations indicated 3 general areas of groundwater contamination: (1) an on site area at Spinnaker; (2) a plume concentrated along Water Street (referred to herein as the "Water Street PCE plume") and (3) a third plume generally located between Franklin and Main Streets, referred to herein as the "residential area PCE plume".

The Water Street plume and the residential area plume were defined by Ohio EPA through the detection of PCE and several PCE degradation products including TCE, *cis*-1,2-DCE, and vinyl chloride in groundwater samples at locations throughout a 20-block area south, southwest, and west of the Spinnaker property, immediately east of downtown Troy and west of the Great Miami River. The data indicated that the contamination is roughly divided into two plumes by an area of low or "nondetect" VOC concentrations along Main Street and thus may represent contamination that originated from multiple sources. (Ohio EPA 2002; EPA 2008). These plumes are described in detail below:

- The "residential area" PCE plume is concentrated in a mostly older residential area between Main and Franklin Streets, with Walnut Street at or near its upgradient end. This PCE plume extends downgradient (east/southeast) to at least Union Street; however, concentrations appear to decrease significantly in the block between Crawford and Union. Ohio EPA's data indicated that at least part of this plume originates in the vicinity of the intersection of Main and Walnut streets, where a former "One-Hour Martinizing" dry cleaner had been located. This dry cleaner reportedly burned down, and the site is currently occupied by a relatively recent addition to the neighboring Methodist Church. An automobile service garage and a second dry cleaner (another Waltz Cleaners) were also reportedly located in this area. However, the highest VOC concentrations in groundwater were detected in a "hot spot" approximately 3 blocks downgradient/lateral from this area, just to the east/northeast of the intersections of Clay and Crawford Streets with Franklin Street, in an area where no known likely existing or historical VOC sources have been identified to date. It is possible that the sanitary sewer (see Figure 4) may have transported contamination from sources operating in the vicinity of Main and Walnut Streets, and this contamination was released through a joint or break in the sewer lines resulting in a residual source of contaminants such as contaminated soil or dense-nonaqueous phase liquid (DNAPL) in the Clay/Crawford/Franklin area. Data from deep (94 feet deep) City of Troy monitoring well MW-Q, also located in this area does not indicate the presence of significant concentrations of VOCs in the deep part of the aquifer at that location (EPA 2008). No other deep wells have been installed in the residential plume area.

- A second plume, also predominantly PCE, is concentrated in the area along and near Water Street, and extends east/southeast from just northwest of Crawford Street at its upgradient end. VOCs were not detected in groundwater samples collected by Ohio EPA along Clay Street, between Water Street and the river, indicating that the source of the PCE contamination along Water Street is, or was formerly, in the area downgradient/southeast from Clay Street. Several Ohio EPA sampling locations along East Main Street were also "nondetect" indicating that this plume is separate from the aforementioned residential areas PCE plume. The highest contaminant concentrations associated with this plume were detected along Water Street near Crawford, in the general vicinity of the Hobart Cabinet Company, St. Patrick's school, and the west end of the Spinnaker parking lot; and near a former rail spur that served Spinnaker and Hobart. Suspected sources in this portion plume area include Hobart Cabinet and several former dry cleaning operations that were located along Main Street and Water Street. The Water Street PCE plume may merge and become co-mingled with a plume of primarily TCE, cis-1,2-DCE and vinyl chloride contamination on the Spinnaker site, as well as possibly extending to the Great Miami River.

As part of its investigations Ohio EPA completed soil and groundwater sampling in the vicinity of Hobart Cabinet (Figure 4). In 2002 and 2003, Ohio EPA collected groundwater samples from locations on Water Street, near the southeast end of the Hobart building, using a direct push rig. These data indicated the presence of PCE at concentrations up to 78 ug/L in groundwater in front of the Hobart building near the intersection of Crawford and Water Streets. Ohio EPA also collected samples at two locations along a former rail spur parcel that lies between Hobart and the river, but is owned by Spinnaker. Very low concentrations of PCE and TCE were detected along the rail spur. However, one sample collected north of the Hobart building contained vinyl chloride at 6.6 ug/L, and cis-1,2-DCE was reported at 62 ug/L in the second sample, which was collected at the western end of what is now the Spinnaker west parking lot, adjacent to the Hobart property.

In August 2004 Ohio EPA collected soil samples from locations adjacent to the front of the Hobart building. The samples were collected from unpaved areas along the sidewalk on Water Street including one location near a vent hood for Hobart's vapor degreaser. PCE was detected at concentrations of 95 and 138 ug/kg in two of the soil samples that were collected in close proximity to Hobart's vapor degreasing unit. (KC 2009; Ohio EPA 2002, 2004; EPA 2007b; Agency for Toxic Substances and Disease Registry [ATSDR] 2008; SulTRAC 2009).

The third area of groundwater contamination was defined by Ohio EPA on-site investigations and additional investigations conducted by KC (see below) on the Spinnaker site. This area is located between Water Street and the Great Miami River, and contains primarily TCE, cis-1,2-DCE and vinyl chloride with PCE also being detected. Ohio EPA completed investigations on the Spinnaker site including soil borings, installation of groundwater monitoring wells, groundwater sampling, and pump tests. Ohio EPA's data, and subsequent data collected by Spinnaker, confirm that on-site sources at Spinnaker released TCE to site soil and groundwater. PCE, *cis*-1,2-DCE and vinyl chloride have also been detected in soil and groundwater samples collected on-site at Spinnaker. Based on the presence of PCE in groundwater samples collected from monitoring wells and direct push borings on the west end of the Spinnaker facility and in the former rail spur parcel areas, the Water Street PCE plume may be commingling with the on-site plume at Spinnaker (Mill Creek Environmental Consultants [Mill Creek] 2002; KC 2007, 2009; EPA 2008).

The third area of groundwater contamination was defined by Ohio EPA on-site investigations on the Spinnaker site, and additional investigations conducted by KC (see below). This area is located between Water Street and the Great Miami River, and contains primarily TCE with PCE, cis-1,2-DCE, and vinyl chloride also being detected. Ohio EPA completed investigations on the Spinnaker site including soil borings, installation of groundwater monitoring wells, groundwater sampling, and pump tests. Ohio EPA's data, and subsequent data collected by Spinnaker, confirm that on-site sources at Spinnaker released TCE to site soil and groundwater. PCE, *cis*-1,2-DCE, and vinyl chloride have also been detected in soil and groundwater samples collected on-site at Spinnaker. Based on the presence of PCE in some groundwater samples collected from monitoring wells and direct push borings on the west end of the Spinnaker facility and in the former rail spur parcel areas, the Water Street PCE plume may be comingling with the on-site plume at Spinnaker (Mill Creek Environmental Consultants [Mill Creek] 2002; KC 2007, 2009).

Other findings of Ohio EPA's investigations included:

- The highest PCE concentrations detected in groundwater in the area (283 to 800 micrograms per liter [µg/L]) were just northeast of Franklin Street, on Clay and Crawford Streets. These concentrations were found in samples collected in June 2004 from permanent monitoring wells OEPA-1, 5, 6, and 7, approximately 0.25 mile downgradient or crossgradient of the former One-Hour Martinizing location. No known former dry cleaners or other obvious potential sources of chlorinated VOCs have been identified in this immediate area.
- Ohio EPA's June 2004 sampling event included City of Troy deep monitoring well, "MW-Q", located adjacent to shallow Ohio EPA monitoring well OEPA-6, on the northwest corner of Crawford and Franklin Streets. Only trace concentrations (0.71 ug/L) of PCE were detected , indicating that the chlorinated VOC plume is most concentrated in the upper portion of the aquifer in the residential area.
- Based on comparison of data from monitoring wells and/or Geoprobe borings along Water Street, behind the Hobart facility, and on Spinnaker, the composition of the groundwater contaminant

plume changes from primarily PCE at the upgradient (west) side of the Spinnaker site to TCE, *cis*-1,2-DCE, and vinyl chloride across the Spinnaker site.

- In the area west of the river, groundwater flow in the upper sand and gravel aquifer is east/southeastward, roughly parallel to and toward the Great Miami River.
- During a pumping test by Ohio EPA that used the East Troy Wellfield wells and shallow monitoring wells at the Spinnaker site, Ohio EPA observed that groundwater levels in shallow wells at Spinnaker responded quickly to variations in pumping rates on the production wells across the river. This observation is consistent with the results of groundwater modeling completed by the City of Troy indicating that (1) the river is not a hydraulic barrier to groundwater flow and (2) the shallow and deep aquifer units are in hydraulic communication. (Mill Creek 2002; Ohio EPA 2002; KC 2007, 2009; EPA 2008).

Ohio EPA compiled the data from the investigations and completed an Expanded Site Inspection (ESI) Report (Ohio EPA 2002). The ESI was used to support the decision for listing on the National Priorities List (NPL) by EPA (EPA 2008).

Spinnaker Coatings/ Kimberly Clark Facility Investigations

Within the East Troy plume, the current or historical presence of chlorinated VOCs in on-site soils and groundwater has been confirmed at the Spinnaker facility on Water Street, directly across the river from the East Wellfield. Spinnaker is a manufacturer of adhesive-coated papers and related products.

Spinnaker is a manufacturer of adhesive-coated papers and related products. The facility started operations in 1928 when Brown-Bridge Industries, Inc., began manufacturing adhesive products. KC acquired Brown-Bridge Industries in 1971 and continued operation of the facility until 1994, when the property was sold to Spinnaker.

Since the 1990s, extensive investigations have been conducted on the Spinnaker property by KC and Ohio EPA to evaluate the presence and sources of contamination in soils and groundwater. The Ohio EPA investigations were summarized in the preceding section. In addition to the work conducted by Ohio EPA, KC has completed a number of investigations at the site.

Environmental assessments were conducted as part of Kimberly-Clark's sale of the property to Spinnaker in 1994. It was determined that the Spinnaker property included a narrow parcel that was formerly used as a rail spur, extending from part of the area now occupied by Spinnaker's west parking area, northwest between Hobart and the Great Miami River, to the main rail line along Clay Street. KC's consultant collected soil samples for analysis for VOCs and chlorinated VOCs, including PCE and TCE, were detected in several soil samples from this parcel (Applied Science and Engineering 2004). The highest reported concentration of chlorinated VOCs was 12,000 ug/kg of TCE detected in shallow soil sample SB-4 (2.5 feet depth) from an area adjacent to a municipal sewer and water easement that crosses the parcel, near the western end of the Spinnaker west parking lot. This sample also reportedly contained lower concentrations of PCE; 1,2-DCE; and 1,1,1-TCA, as well as other chlorinated and non-chlorinated VOCs, and semi-volatile organic compounds (SVOC). The highest concentration of PCE (470 ug/kg) was reportedly detected in a sample collected at a depth of 2 feet from boring SB-8, which was collected adjacent to the Hobart facility structure. The maps associated with that report indicate that although boring SB-8 was on the rail spur parcel, the Hobart building encroached onto the rail spur parcel as it was configured at that time. This area is now owned by Hobart.

Also as part of the investigations supporting the sale of the Spinnaker property , soil and groundwater impacted by fuel oil and VOC (primarily toluene) releases were discovered in two small areas on the west side of the facility and two areas on the east side of the facility. An area of soil contaminated with chlorinated solvents, primarily TCE, was later detected near a loading dock in the western portion of the facility (Mill Creek 2002, 2009).

According to a closure report prepared by KC, remediation of the impacted areas on the Spinnaker property began in April 1995 with removal of impacted soil from the two fuel oil/ toluene spill areas on the west end of the facility and installation of groundwater remediation systems in all four areas impacted by the fuel oil/ toluene releases. Ohio EPA was involved in the development of the cleanup plan, reviewed KC's cleanup goals, and encouraged KC to begin voluntary remediation in accordance with the plan. Soil contamination was removed by excavation on the west end of the facility. Analysis of contaminant concentrations in soil samples collected from the walls and floors of the two excavations on the west end of the property indicated that the excavated areas met regulatory soil guidelines for the toluene/ fuel oil related contamination. Groundwater cleanup goals were reportedly achieved on the east end of the facility by January 1998, and the east remediation system was shut down with no further action required. Cleanup goals or background concentrations for groundwater were reportedly achieved on the west end of the facility by December 2000, with regard to the fuel oil/ toluene spills (Mill Creek 2002, 2009).

Concentrations of chlorinated VOCs continued to be detected in groundwater at the Spinnaker site. TCE and vinyl chloride, both possible breakdown products of PCE but also known to have been released to soil and groundwater on the Spinnaker site, continue to be present in groundwater on the downgradient boundary of the Spinnaker property. Investigations completed by Ohio EPA and KC indicated that the on-site contamination plume at Spinnaker changes in composition from primarily PCE and lower concentrations of suspected degradation products TCE, *cis*-1,2-DCE and vinyl chloride on the upgradient side of the property, to primarily TCE and *cis*-1,2-DCE with lower concentrations amounts of PCE and vinyl chloride at downgradient locations on the Spinnaker site. These observations suggest that at least part of the Water Street plume may have originated from an upgradient, off-site source or sources may be commingling with the Spinnaker plume. (Mill Creek 2002, KC 2007, 2009).

In 2002, KC submitted a closure report for the areas of soil contamination at the facility. Table 4 summarizes the maximum concentrations of chlorinated VOCs detected in groundwater presented in the closure report, as well as those detected in the most recent (March 2010) quarterly sampling event. Figure 5 presents a detail map of the Spinnaker west end area, with the monitoring well locations.

The closure report indicated that because PCE concentrations in groundwater were highest at the upgradient side of the Spinnaker site, PCE may migrate onto the property from an off-site source or sources However, subsequent sampling of soils at the Spinnaker site in 2005 (see below) detected the presence of various chlorinated VOCs in samples collected at depths above the water table, confirming the presence of on-site sources of chlorinated VOCs at Spinnaker.

Ohio EPA subsequently expressed concerns about the source of remaining concentrations of VOCs on the Spinnaker property, the migration and breakdown mechanisms of VOCs coming onto the Spinnaker property, and the risks that remaining groundwater VOC concentrations pose to human health and the environment, including the City of East Troy Wellfield located across the Great Miami River from the Spinnaker property. Consequently, KC continued to operate the groundwater remediation system while conducting additional assessment.

In 2005, KC conducted an investigation of site soils to evaluate the risk from residual concentrations of VOCs, including areas that were not addressed by the previous soil remediation efforts. The investigation involved collection and analysis of 134 subsurface soil samples. Chlorinated VOCs, primarily TCE and *cis*-1,2-DCE (with lower concentrations of PCE), were detected in numerous soil samples at the site, many of which were collected from depths above the water table. TCE was detected at concentrations up to 133,000 ug/kg and *cis*-1,2-DCE up to 14,900 ug/kg. These observations, combined with groundwater monitoring data for the site, indicate that on-site releases of chlorinated VOCs to soil and groundwater occurred at the Spinnaker property. (Mill Creek 2002, KC 2007, 2009; EPA 2008).

KC continued to operate the on-site groundwater pump and treat system until May 2009. At that time KC terminated operation of the Spinnaker system as it no longer appeared to be effectively removing significant amounts of contamination or effectively controlling migration of the chlorinated VOC plume.

KC is continuing quarterly groundwater monitoring at the west end of the Spinnaker site to evaluate VOC concentration trends and groundwater flow patterns. All of the monitoring wells in the west end monitor the upper portion of the aquifer.

On behalf of EPA, SulTRAC split groundwater samples from 5 of the monitoring well locations with KC's consultant in December 2009. The split samples were analyzed for VOCs through the EPA Region 5 Central Regional Laboratory (CRL). The data were found to correlate with the data obtained by KC. Additional split sampling may be incorporated into the RI field program in the future.
As indicated on Table 4, data from the most recent sampling event (March 2010) indicated that the highest concentrations of PCE were detected in wells KMW-15 (20 ug/L), located near the levee at the extreme northwest corner of the property, in addition to wells EEIB-4 and GZA-1 (14 ug/L and 16 ug/L, respectively) located near Water Street. Well KMW-15 also contained the highest detected concentration of TCE, at 6.5 ug/L. The highest concentrations of cDCE (73 ug/L and 26 ug/L, respectively) were detected in wells KMW-10 and KMW-11, located on the western side of the Spinnaker parking lot, between wells KMW-15 and EEIB-4. Concentrations of chlorinated VOCs in wells in the center and eastern (downgradient) portions of the lot were lower or nondetect; however, low concentrations of cDCE and TCE were detected in several wells including OEPA -3 and RS-04, located between the Spinnaker building and the Great Miami River.

Future actions that may be required at Spinnaker have not been determined and will likely depend on the outcome of the EPA RI. The effects on local groundwater flow direction from ceasing operation of the system are unknown. KC is continuing quarterly groundwater sampling at the Spinnaker site to evaluate VOC concentration trends and groundwater flow patterns (Mill Creek 2009).

EPA Time Critical Removal Action

Elevated concentrations of VOCs have been detected in sub-slab soil gas and indoor air of structures within an area roughly corresponding to the area of groundwater contamination in the East Troy Site. PCE and other VOCs were detected in indoor air samples collected by the City of Troy from several occupied structures including the Troy police station, a church, and a school in 2005. In 2006, Ohio EPA noted that residences and other occupied structures above and adjacent to the groundwater plumes were at risk for exposure to VOCs through vapor intrusion from soil gas to indoor air. Ohio EPA requested that EPA conduct a time-critical removal action assessment to determine the extent of vapor intrusion contamination and to mitigate levels of VOCs in indoor air that exceed screening levels established by the

Agency for Toxic Substances and Disease Registry (ATSDR) and Ohio Department of Health (ODH) (Ohio EPA 2006; EPA 2007c).

EPA conducted sub-slab and indoor air sampling at residences, churches, and schools to evaluate threat to human health. The sampling program was conducted using methods described in EPA's Standard Operating Procedure for the Construction and Installation of Permanent Sub-Slab Soil Gas Wells SOP#2082 (EPA 2004a). Approximately 200 residents were notified to participate in the sampling program. From July 2006 through April 2007, the EPA collected sub-slab and indoor air samples from a total of 85 locations, which included 78 residences, two churches, four schools, and the Troy Police Station during Phase 1 and Phase 2 air sampling activities. VOC concentrations at 17 residences exceeded the indoor air screening criteria of 1.2 and 0.4 parts per billion (ppb) for PCE and TCE, respectively, in indoor air (EPA 2007b).

The EPA removal action was initiated on May 31, 2007, to install vapor abatement mitigation systems were in 17 residences and also at St. Patrick Elementary School, located across Water Street from the Spinnaker and Hobart Cabinet facilities. The EPA removal action was completed on April 17, 2008. Table 5 summarizes the results of the indoor air sampling, before and after installation of mitigation systems.

EPA proposed the site for inclusion on the NPL, and the site was listed in September 2008. The EPA initiated negotiations with KC in 2008 for performance of the RI/FS. Negotiations did not result in a settlement; therefore, EPA initiated the investigation in 2009. In February 2009 EPA issued the fund lead RI/FS WA to SulTRAC (EPA 2009).

Summary

In summary, based on the background information reviewed, the following key data gaps were identified with regard to the RI:

- The eastern/ southeastern horizontal limits of the shallow residential area PCE and Water Street PCE contaminant plumes have not been determined.
- Additional data are needed in the area between Main Street and Water Street to confirm the horizontal extent and possible sources of the residential area PCE plume and the Water Street PCE plume.
- Investigation of the vertical distribution of contaminants in the residential area PCE plume has been limited to one location. Data from deep (94 feet deep) City of Troy monitoring well Q, located in the "hot spot" of the residential PCE plume area does not indicate the presence of significant concentrations of VOCs at that depth. However, additional data are needed to ensure that the extent of the contaminant plume does not extend farther at depth..

- Sampling completed at the Spinnaker west end confirmed the presence of chlorinated VOCs, primarily TCE and *cis*-1,2-DCE in soil and groundwater. Detections of these substances at significant concentrations in soil samples collected above the water table indicates on site sources of both of these contaminants at the Spinnaker property. Chlorinated VOCs in shallow groundwater extend downgradient to at least the area between the Spinnaker building and the Great Miami River; however, decrease significantly in concentration in the area between the west side of the parking lot and the east side of the lot. For this reason, the potential for deep plume migration should be evaluated in this area.

- Shallow groundwater contamination detected on Water Street, the Spinnaker property, and on the perimeter of the Hobart property indicate possible comingling of two or more plumes, one primarily composed of PCE, and one primarily composed of cDCE and TCE. Chlorinated VOCs, primarily PCE, may be migrating onto the Spinnaker site from the unknown source plume along Water Street or the Hobart property. For this reason, other potential source areas need to be evaluated.

- The vertical extent and potential for migration of contaminants in the deep portion of the aquifer in the vicinity of Hobart and Spinnaker needs to be evaluated.

- An apparent "hot spot" of groundwater contamination is present in the area bounded by Franklin, Clay, Crawford, and Main streets. The highest VOC concentrations in groundwater were detected just to the east/northeast of the intersections of Clay and Crawford Streets with Franklin Street, in wells screened near the top of the uppermost aquifer (approximately 18 to 28 feet below ground surface). The aforementioned area does not coincide with any known likely existing or historical VOC sources. Possibly, a preferential pathway such as a sewer resulted in a release that has caused a residual source of contaminants such as contaminated soil or dense-nonaqueous phase liquid (DNAPL) in the shallow subsurface and is an ongoing release mechanism and thus should be evaluated.

- Although maps of the Miami and Erie Canal indicate historic businesses and industries in the eastern part of Troy prior to the 1920s, the Franklin Street area is primarily residential; moreover, no historical dry cleaning operations, auto service facilities, or other likely sources of chlorinated VOCs are known to have operated in this immediate area. Based on this consideration, sanitary or storm sewer lines may have provided a mechanism for migration of VOCs from suspected source areas closer to Main and Market Streets. (Figure 4 shows the sanitary sewers in the area.)

- Past investigations of the nature and extent of contamination have been limited to public right-of-ways, parking lots, the Spinnaker property, and the perimeter of Hobart Cabinet. Suspected source areas directly upgradient of the Spinnaker facility, such as interior portions of the Hobart Cabinet property, need to be investigated through on-site sampling of soil and groundwater.

- Groundwater data collected to date are extensive, but were collected by multiple entities using a variety of sampling and analytical methods, some of which were completed with the objective of rapid screening rather than to meet the data quality objectives of an RI. In addition, the data were collected over more than 15 years. For these reasons, a comprehensive set of groundwater data collected from fixed, discrete monitoring locations and depths within a short timeframe and using consistent EPA-approved methodology, is necessary to document current conditions.

- Subsurface soil sampling in the residential area has been extremely limited; it is necessary to try to locate hot spots of residual soil contamination assuming the possibility that the contamination is related to past releases from historical primary sources which no longer exist; an emphasis should be placed on areas near former suspected sources and possible alternate migration pathways (such as sewers).

- Possible interactions between the shallow and deep aquifers, and between the shallow aquifer and the Great Miami River, have not been fully evaluated.

- To date, only limited groundwater data have been collected to the northwest of the East Wellfield to rule out the possibility of contaminant sources on that side of the river or to confirm that the contamination affecting the West Wellfield is not also migrating to the East Wellfield.
- Due to limited public response to EPA's requests, sub-slab and indoor air monitoring were completed at only approximately 20 percent of the residences in the plume area that were invited by EPA to participate in the monitoring program. For this reason, additional sub-slab vapor monitoring is needed to define the extent of contamination and assess human health risk. The locations to be monitored will be selected based in part on groundwater and soil analytical data that become available as Phase I of the RI progresses and will be presented in an Addendum to the SAP.

The chemicals of interest potentially hazardous to human health and the environment at the East Troy Site were identified based on the investigations previously discussed and information obtained by SulTRAC. To date, the plume has been confirmed to contain the chlorinated VOCs PCE, TCE, *cis*-1,2-DCE, and vinyl chloride; therefore, these VOCs are considered the primary chemicals of interest for the RI. However, because the nature and extent of contamination have not been confirmed, other contaminants may be present in the area related to suspected or currently unknown sources. Other contaminants, regardless of source, must be included in evaluating overall human health and ecological risks; for this reason, limited sampling and analysis for semivolatile organic compounds (SVOC), metals, herbicides, pesticides, and polychlorinated biphenyls (PCB) will also be completed to account for other contaminants that might be present.

3.0 QUALITY ASSURANCE PROJECT PLAN PROCEDURES

This QAPP presents procedures that will be used to ensure the quality of data generated for the East Troy Site RI/FS. The QAPP provides a framework for how environmental data will be collected to achieve specific project objectives, and describes procedures that will be implemented to obtain data of known and adequate quality. This QAPP was prepared in accordance with the EPA's "Uniform Federal Policy for Implementing Environmental Quality Systems" (UFP) (EPA 2005).

Phase I activities for the East Troy Site RI/FS are anticipated to begin in summer 2010. As previously discussed, the sub-slab monitoring and indoor air sampling locations and methodologies, which are yet to be determined, will be presented in an addendum to this SAP. For this reason, subsequent discussions in this SAP focus on the other activities (soil, groundwater, surface water, and sediment sampling and related activities) that will be completed during Phase I of the RI.

As discussed with the EPA and as outlined in the Troy East Wellfield Contamination Site work plan (SulTRAC 2009), SulTRAC will conduct the following Phase I field sampling activities:

- A baseline groundwater sampling event to include 13 existing Ohio EPA monitoring wells and six City of Troy monitoring wells (see Table 1), with collection of groundwater elevations and field parameter data. This task also includes collection of groundwater split samples for VOC analysis at up to 5 locations on the Spinnaker site (completed in December 2009) and ongoing evaluation of the Spinnaker quarterly monitoring data in conjunction with the data to be obtained during the RI.

- Investigation of the sewer lines in the vicinity of Franklin, Clay, and Crawford Streets (if sewer lines are accessible) in order to evaluate the possibility of sewer breaks as a transport/ release mechanism for VOCs.

- Collection of subsurface soil samples from up to 30 locations (including background - see Table 7) and surface soil samples at 10 of these locations, in and around the existing contaminant plumes; with collection and analysis of two soil samples per boring.

- Collection of groundwater grab samples at the water table at up to 10 of the 30 soil boring locations; analyses will be rapid-turnaround for VOCs using a local laboratory facility with the objective of supporting field decisions regarding well locations.

- VAS of the upper aquifer at seven locations west of the Great Miami River using direct-push techniques; collection of up to six groundwater samples from two of the locations, and up to three groundwater samples from the remaining five locations; analyses will be rapid-turnaround for VOCs using a local laboratory facility with the objective of supporting field decisions regarding well screen depths. The VAS data will be screening level data. These data will also be used to evaluate the need for additional monitoring or VAS locations during Phase II of the RI. The proposed VAS locations are summarized in Table 8 and depicted on Figure 7.

- Installation of at least five new deep monitoring wells using rotosonic techniques west of the Great Miami River. The proposed deep well locations are summarized in Table 8 and depicted on Figure 7. Deep wells are planned to be installed at four of the VAS locations (Hobart, Spinnaker west end, Spinnaker East end, and either at New and Main or on Oak Street). In addition, a deep well will be installed adjacent to existing well OEPA-14 on Walnut, near Main, at the known upgradient end of the residential area PCE plume. Deep wills be paired with new shallow monitoring wells, or placed in proximity to existing shallow wells. Depths for the deep wells will be determined by review of the rapid turnaround VOC data. During Phase II, additional deep wells may be installed.

- Installation of up to 7 new shallow monitoring wells in the area west of the Great Miami River to further evaluate plume boundaries and potential source areas, as indicated on Tables 6 and 8. Locations include Oak Street between Franklin and East Main; New Street and East Main; Hobart (2 wells); Crawford Street between East Main and Water Street; and in the vicinity of New Street and Water Street.

- Installation of one additional shallow monitoring well as a permanent "background" location for characterizing groundwater quality as it enters the residential PCE plume area. Past definition of the upgradient plume boundary has been based on samples from temporary wellpoints. This location, and existing Ohio EPA well MW-13, will provide background monitoring data for the residential area PCE plume and Water Street PCE plumes, respectively.

- Repair of several existing Ohio EPA monitoring well surface casings, including MW-13. In addition, wells at locations that are considered significant to the RI and are in need of repair, or are constructed with small diameter casing, may be replaced after the baseline sampling event. Such wells will be replaced if the small casing diameter interferes with efficient collection of samples of sufficient volume or quality in accordance with current EPA approved methods (i.e. low-flow purging and sampling for VOCs).

- Installation of two monitoring wells in a single cluster east of the Great Miami River using Rotosonic techniques, north/northeast of the East Wellfield; these will include one shallow monitoring well screened in the upper aquifer and one deep monitoring well screened in the lower aquifer.

- Installation of two staff gauges in the Great Miami River.

- An elevation survey to tie all new groundwater monitoring locations and staff gauges to a common elevation reference with the existing wells; the elevation data will be used to confirm the groundwater flow direction

- A comprehensive groundwater sampling event of the 19 previously existing wells included in the baseline sampling and 5 Spinnaker wells, plus the 20 new monitoring wells installed during the RI; collection of groundwater elevation data and field parameter data.

- Collection of surface water samples from up to four locations on the Great Miami River (including background).

- Collection of sediment samples from up to four locations on the Great Miami River (including background).

- Collection of indoor sub-slab vapor monitoring samples in the contaminant plume area west of the Great Miami River.

As VOC concentrations in soil vapor and indoor air are anticipated to correlate with soil and groundwater concentrations, it will be preferable to sequence Phase I to allow collection of soil and groundwater data before finalizing the locations that will be selected for sub-slab and indoor air VOC monitoring. In addition, Ohio EPA recently issued guidance, and EPA Region 5 is currently developing guidance, that will influence the sampling and analytical methodologies that will apply to the East Troy RI/FS. Based on these considerations and discussions with EPA and Ohio EPA, SulTRAC will prepare and issue a SAP addendum addressing the specific guidance, methodologies and locations for the sub-slab/ indoor air VOC monitoring prior to commencing that portion of the RI.

QAPP WORKSHEET #1
TITLE AND APPROVAL PAGE

Quality Assurance Project Plan for Remedial Investigation/Feasibility Study, East Troy Site, Troy, Miami County, Ohio
Document Title

SulTRAC
Lead Organization

Guy Montfort, SulTRAC
Preparer's Name and Organizational Affiliation

250 W. Court St., Ste. 200 W, Cincinnati OH; (513) 564-8350; guy.montfort@ttemi.com
Preparer's Address, Telephone Number, and E-mail Address

November 23, 2009
Preparation Date (Day/Month/Year)

E sig and date

Guy Montfort
SulTRAC Project Manager
Signature/Date

E sig and date

John Dirgo
SulTRAC QA Officer
Signature/Date

Approval Signatures:

Signature/Date
Shari Kolak, Work Assignment Manager
Printed Name/Title

Signature/Date
Off-Site Laboratory Director
Printed Name/Title

Approval Authority
Other Approval Signatures:

Signature/Date
QAPP Reviewer
Printed Name/Title

Signature/Date
Jon Watterworth, Project Manager (OEPA)
Printed Name/Title

QAPP WORKSHEET #2
QAPP IDENTIFYING INFORMATION

1. Identify guidance used to prepare QAPP:
"Uniform Federal Policy for Implementing Environmental Quality Systems" (UFP) (EPA 2005) and "EPA Guidance for Quality Assurance Project Plans" (EPA 2002)

2. Identify regulatory program:
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

3. Identify approval entity: EPA Region 5

4. Indicate whether the QAPP is a generic or project-specific QAPP: Project-specific

5. List dates of scoping sessions that were held: March 23, 2009

6. List dates and titles of QAPP documents written for previous work site, if applicable: NA

7. List organizational partners (stakeholders) and connection with lead organization:
EPA Region 5, SulTRAC, Ohio EPA

8. List data users: EPA Region 5, SulTRAC, Ohio EPA

9. If any required QAPP elements and required information are not applicable to the project, then circle the omitted QAPP elements and required information on the attached table. Provide an explanation for their exclusion below: No assessments are planned, so Worksheets 31 and 32 are not applicable.

Identify where each required QAPP element is located in the QAPP (provide section, worksheet, table, or figure number) or other project planning documents (provide complete document title, date, section number, page numbers, and location of the information in the document). Circle QAPP elements and required information that are not applicable to the project. Provide an explanation in the QAPP.

QAPP WORKSHEET #2 (CONTINUED)
QAPP IDENTIFYING INFORMATION

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	QAPP Worksheet # or Crosswalk to Related Documents
Project Management and Objectives		
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2.2 - Document Format and Table of Contents	Table of Contents	
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2.2.2 Document Control Numbering System		
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2.2.4 QAPP Identifying Information		
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2.5 - Project Planning/Problem Definition		
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QAPP WORKSHEET #2 (CONTINUED)
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QAPP WORKSHEET #3
DISTRIBUTION LIST

(UFP QAPP Section 2.3.1)
List individuals who received copies of the approved QAPP, subsequent QAPP revisions, addenda, and amendments.

QAPP Recipient	Title	Organization	Telephone Number	E-mail Address
Shari Kolak	Work Assignment Manager (WAM)	EPA Region 5	(312) 886-6151	Shari.kolak@epa.gov
TBD - EPA	QAPP Reviewer	EPA Region 5	TBD	@epa.gov
Jon Watterworth	Project Manager	Ohio EPA	(937) 285-6062	randy.watterworth@epa.state.oh.us
Guy Montfort	Project Manager	SulTRAC	(513) 564-8350	guy.montfort@tetratech.com
TBD	Field Team Leader	SulTRAC	TBD	TBD
TBD	Project Scientist and Sample Custodian	SulTRAC	TBD	TBD
Ron Riesing	Project QA Reviewer	SulTRAC	(312) 201-7722	ronriesing@tetratech.com
John Dirgo	QA Officer	SulTRAC	(312) 201-7765	john.dirgo@tetratech.com
William Earle	Analytical Coordinator	SulTRAC	(312) 443-0550, ext. 12	wearle@onesullivan.com
David Homer	Ecological Risk Assessor	SulTRAC	(816) 412-1762	david.homer@tetratech.com
Eric Morton	Human Health Risk Assessor	SulTRAC	(312) 201-7797	eric.morton@tetratech.com
Subcontractors	Drillers/Geoprobe/ Surveyors/Storm sewer	TBD	TBD	TBD
Off-site Laboratory	Off-site Laboratory Services	TBD	TBD	TBD

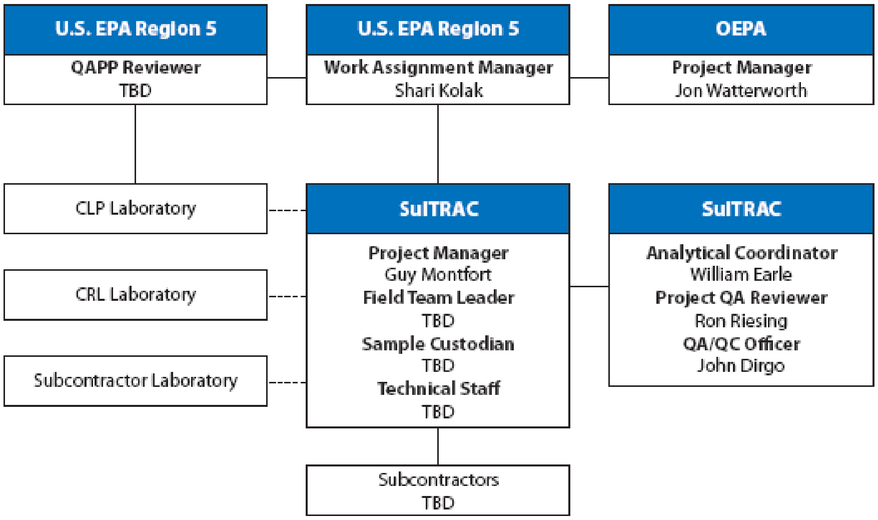
QAPP WORKSHEET #4
PROJECT PERSONNEL SIGN-OFF SHEET

(UFP QAPP Section 2.3.2)
Have copies of this form signed by key project personnel from each organization to indicate that they have read the applicable sections of the QAPP and will perform the tasks as described. Ask each organization to forward signed sheets to central project file.

Project Personnel	Organization	Title	Telephone No.	Signature	Date QAPP Read
Guy Montfort	SulTRAC	Project Manager	(513) 564-8350		
William Earle	SulTRAC	Analytical Coordinator	(312) 443-0550, ext. 12		
Ron Riesing	SulTRAC	Project QA Reviewer	(312) 201-7722		
John Dirgo	SulTRAC	QA/QC Officer	(312) 201-7765		
TBD	SulTRAC	Project Scientist and Sample Custodian	TBD	TBD	TBD
TBD	SulTRAC	Field Team Leader	TBD	TBD	TBD
Drilling Subcontractor	TBD	TBD	TBD	TBD	TBD
Geoprobe Subcontractor	TBD	TBD	TBD	TBD	TBD
Surveyor Subcontractor	TBD	TBD	TBD	TBD	TBD
Storm Sewer Subcontractor	TBD	TBD	TBD	TBD	TBD
Off-site Laboratory	TBD	TBD	TBD	TBD	TBD

QAPP WORKSHEET #5
PROJECT ORGANIZATION CHART

(UFP QAPP Section 2.4.1)
Identify reporting relationships between all organizations involved in the project, including the lead organization and all contractor and subcontractor organizations. Identify the organizations providing field sampling, on-site and off-site analysis, and data review services, including the names of project managers for each organization.



Notes
CLP: Contract Laboratory Program
CRL: Central Regional Laboratory
EPA: Environmental Protection Agency
FS: Feasibility study
OEPA: Ohio Environmental Protection Agency
QA: Quality assurance
QAPP: Quality assurance project plan
RI: Remedial investigation
TBD: To be determined

PROJECT TEAM ORGANIZATIONAL CHART
RI/FS EAST TROY
CONTAMINATED AQUIFER SITE

ST SulTRAC

QAPP WORKSHEET #6
COMMUNICATION PATHWAYS

(UFP QAPP Section 2.4.2)
Describe the communication pathways and modes of communication that will be used during the project, after the QAPP has been approved. Describe the procedures for soliciting and/or obtaining approval between project personnel, between different contractors, and between samplers and laboratory staff. Describe the procedure that will be followed when any project activity originally documented in an approved QAPP requires real-time modification to achieve project goals or a QAPP amendment is required. Describe the procedures for stopping work and identify who is responsible.

Communication Drivers	Responsible Entity	Name	Telephone No.	Procedure (Timing, Pathways, etc.)
Point of contact with EPA WAM	Project Manager	Guy Montfort	(513) 564-8350	Guy Montfort will forward all materials and information about the project to Shari Kolak.
Manage all project phases	Project Manager	Guy Montfort	(513) 564-8350	Communicate information to project team (including subcontractors) on a timely basis. Notify EPA WAM by telephone or e-mail of any significant issues. Direct field team and facilitate communication with analytical coordinator. Deliver all laboratory data packages to project QA reviewer for final review of validation.
Daily field progress report	Field Team Leader	TBD		Conduct specific field investigation tasks, direct field activities of subcontractors, and provide daily communication with project manager and sample custodian.
Manage Field Sample Organization and Delivery to CLP	Sample Custodian	TBD		Ensure field staff is collecting samples in proper containers, observing holding times, and properly packaging and preparing samples for shipment. Coordinate daily with analytical coordinator concerning sample quantities and delivery locations and dates. Communicate daily with field staff and project manager regarding any issues and developments.
Point of contact with EPA Region 5 Regional Sample Control Coordinator (RSCC)	Analytical Coordinator	William Earle	(312) 443-0550, ext. 12	Contact the RSCC or subcontractor laboratory before each sampling event to schedule laboratory services. Notify sample custodian and project manager of any laboratory issues or developments. Track all laboratory data deliveries. Notify project manager and forward data to him.
Release of Analytical Data	SulTRAC Project QA Reviewer	Ron Riesing	(312) 201-7722	No analytical data can be released until validation is completed and the QA reviewer has reviewed and approved the release.

QAPP WORKSHEET #6 (CONTINUED)
COMMUNICATION PATHWAYS

Communication Drivers	Responsible Entity	Name	Telephone No.	Procedure (Timing, Pathways, etc.)
Report of laboratory data quality issues	Laboratory QA Officer	TBD	TBD	All QA/QC issues with project field samples will be reported by the laboratory QA officer to the RSCC (for CLP or CRL) or to the SulTRAC analytical coordinator (for subcontractor laboratories).

Note:

CLP	Contract Laboratory Procedure
CRL	Central Regional Laboratory
QA	Quality assurance
QC	Quality control
RSCC	Regional Sample Control Coordinator
TBD	To be determined
WAM	Work assignment manager

QAPP WORKSHEET #7
PERSONNEL RESPONSIBILITIES AND QUALIFICATIONS TABLE

(UFP QAPP Section 2.4.3)
Identify project personnel associated with each organization, contractor, and subcontractor participating in responsible roles. Include data users, decision-makers, project managers, QA officers, project contacts for organizations involved in the project, project health and safety officers, geotechnical engineers and hydrogeologists, field operation personnel, analytical services, and data reviewers. Identify project team members with an asterisk (*).

Name	**Title**	**Organization/ Affiliation**	**Responsibilities**	**Education and Experience Qualifications**
Guy Montfort*	Project Manager	SulTRAC	Manages project; coordinates between lead agency and subcontractor; coordinates laboratory data deliverables from analytical coordinator to project QA reviewer; manages field staff	B.S. Geophysical Engineering, 22 years of experience
TBD*	Field Team Leader	SulTRAC	Supervises field sampling and coordinates all field activities; daily reporting to project manager while conducting field activities	TBD
TBD*	Project Scientist Sample Custodian	SulTRAC	Prepares QAPP; implements field plan; verifies sample processing, packaging, and shipping	TBD
Ron Riesing	Project QA Reviewer	SulTRAC	QA/QC oversight	B.S. Chemical Engineering and M.S. Environmental Engineering, 38 years of experience
John Dirgo	QA/QC Officer	SulTRAC	QA/QC oversight	B.S. Biology; M.S. and Sc.D. Environmental Health Sciences; 30 years of experience
William Earle*	Analytical Coordinator	SulTRAC	Coordinates sample scheduling; verifies sample chain of custody; reviews computer-aided data review and evaluation (CADRE) results and data from subcontracted laboratories; notifies sample custodian and project manager of any issues or developments	B.S. Civil Engineering, Professional Engineer, 17 years of experience
TBD*	Technical Staff	SulTRAC	Implements field plan	TBD
TBD	Drillers	TBD Subcontractor	Provides subsurface drilling	TBD
TBD	Surveyors	TBD Subcontractor	Provides survey of monitoring wells locations at the site	TBD
TBD	Geoprobe Company	TBD Subcontractor	Provides subsurface drilling using Geoprobe	TBD
TBD	Storm Sewer Camera Company	TBD Subcontractor	Provides robotic camera operation and video of the storm sewer investigation.	TBD
TBD	Off-site (local) Laboratory Director	Subcontracted Laboratory	Provides analytical services for the groundwater samples collected from Vertical Aquifer Sampling and Soil Boring programs	TBD

QAPP WORKSHEET #8
SPECIAL PERSONNEL TRAINING REQUIREMENTS TABLE

(UFP QAPP Section 2.4.4)
Provide the following information for those projects requiring personnel with specialized training. Attach training records and/or certificates to the QAPP or note their location.

Project Function	Specialized Training – Title or Description of Course	Training Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates
Field Staff	40-hour and 8-hour refresher - OSHA HAZWOPER training	Various	Various	SulTRAC	SulTRAC	Corporate human resources office
Subcontractors	40-hour OSHA HAZWOPER training	TBD	TBD	Drillers/Geoprobers/Surveyors/ Storm sewer investigators	TBD	As noted in subcontract agreement – corporate human resources office

Notes:

HAZWOPER	Hazardous Waste Operations and Emergency Response Standard
OSHA	Occupational Safety and Health Administration
TBD	To be determined

QAPP WORKSHEET #9
PROJECT SCOPING SESSION PARTICIPANTS SHEET

(UFP QAPP Section 2.5.1)
Complete this worksheet for each project scoping session held. Identify project team members who are responsible for planning the project.

Project Name	Phase I RI/FS for East Troy Contaminated Aquifer Site	Site Name	East Troy Contaminated Aquifer Site
Projected Date(s) of Sampling	July 2010 through January 2011	Site Location	City of Troy, Miami County, Ohio
Project Manager	Guy Montfort		
Date of Session	March 23, 2009		
Scoping Session Purpose:	Define scope of project		

Name	Title	Affiliation	Phone #	E-Mail Address	Project Role
Shari Kolak	WAM	EPA Region 5	(312) 886-6151	Shari.kolak@epa.gov	WAM
Guy Montfort	Project Manager	SulTRAC	(513) 564-8350	guy.montfort@ttemi.com	Project Manager
Ron Riesing	Program Manager	SulTRAC	(312) 201-7722	ronald.riesing@ttemi.com	Program Manager

Comments/Decisions: During the initial kick-off meeting it was decided that WA No. 045-RICO-B5EN will cover the Phase I field investigation of the RI/FS at the East Troy Contaminated Aquifer Site. Based on the WA duration, the Phase I activities are anticipated to be completed in the winter of 2011. The Phase I field investigation will include Tasks 1 through 6 and Task 15 of the SOW for the WA.   A review of the Phase I data will be performed and based upon the findings.

QAPP WORKSHEET #10
PROBLEM DEFINITION

(UFP QAPP Section 2.5.2)
Clearly define the problem and the environmental questions that should be answered for the current investigation and develop the project decision "If..., then..." statements in the QAPP, linking data results with possible actions. The prompts below are meant to help the project team define the problem. They are not comprehensive.

The problem to be addressed by the project: Since 1988, volatile organic compounds (VOC) have been detected in the City of Troy's East Wellfield, a municipal drinking water wellfield located approximately 0.25 mile and across the Great Miami River from an identified VOC plume area. *Cis*-1,2-dichloroethene (DCE) is the compound detected most frequently in the East Wellfield. The chlorinated VOCs tetrachloroethene (PCE), trichloroethene (TCE) and *cis*-1,2-DCE have been detected in samples from production wells in the West Wellfield. However, the sources of contamination in each wellfield are currently believed to differ. This Remedial Investigation/Feasibility Study (RI/FS) addresses only the area of contamination affecting the East Wellfield.

At least two, and possibly more, sources west of the Great Miami River are believed to be contributing to the contamination plumes within the site. One source is an area of soil contaminated with chlorinated solvents, primarily TCE but also including other VOCs (PCE and *cis*-1,2-DCE), on property owned by Spinnaker Coating, Inc., (Spinnaker), a manufacturer of adhesive-coated papers and related products. A groundwater plume containing primarily *cis*-1,2-DCE and TCE, but other chlorinated VOCs as well, is present under and near the Spinnaker property. This TCE-contaminated groundwater plume extends at least to the east of the Spinnaker property to near the western bank of the Great Miami River.

An approximately 20-block area with elevated levels of PCE and several PCE degradation products including TCE, DCE, and vinyl chloride is present to the northwest, west, southwest and south of Spinnaker. Ohio EPA conducted investigations of this area between 1999 and 2006. This area is called the PCE-contaminated groundwater plume and is located approximately 0.5 mile to the east of downtown Troy between Walnut Street and the City of Troy's East Wellfield along the Great Miami River. This area appears to possibly represent plumes from at least two sources. One source appears to be located in the vicinity of Hobart Cabinet Company, along Water Street. Other possible sources appear to have been located in the vicinity of Walnut and Main Streets. An area of high concentrations of PCE in groundwater is located in the vicinity of the intersections of Clay and Crawford Streets with Franklin Street, and may indicate a secondary source area, such as contaminated soil.

In addition to the groundwater contamination, elevated levels of PCE, TCE, and DCE were detected in soil gas and indoor air of structures within an area roughly corresponding to the area of groundwater contamination. At the request of Ohio EPA, EPA conducted a time-critical removal action to mitigate levels of VOCs in indoor air that exceeded screening levels established by the Agency for Toxic Substances and Disease Registry (ATSDR) and Ohio Department of Health (ODH). Vapor abatement mitigation systems were ultimately installed in 16 residences and also at an elementary school. The EPA removal action was completed on April 17, 2008.

QAPP WORKSHEET #10 (CONTINUED)
PROBLEM DEFINITION

EPA proposed the site for inclusion on the National Priorities List (NPL) on September 9, 2006.

The environmental questions being asked: Are existing source areas contributing to contamination at the East Troy Contaminated Aquifer Site, and what is the nature and extent of the plume in the East Wellfield?

Observations from any site reconnaissance reports: Ohio EPA conducted investigations of this area between 1999 and 2006. During the time of the investigations, groundwater contamination was discovered, and elevated levels of PCE, TCE, and DCE were detected in soil gas and indoor air structures within an area roughly corresponding to the area of groundwater contamination.

A synopsis of secondary data or information from site reports: See Worksheet #13

The possible classes of contaminants and the affected matrices: Data collected by Ohio EPA, the City of Troy, and private entities indicate that chlorinated VOCs are the contaminants of concerns; affected matrices defined to date include groundwater, subsurface soil, and (indoor) air.

SulTRAC will conduct hydrogeologic investigations to include (1) an initial baseline sampling of existing monitoring wells (2) collection of shallow groundwater samples at 10 of the 30 soil boring locations, (3) a vertical aquifer sampling (VAS) program to evaluate the vertical distribution of VOCs in the uppermost aquifer, (4) installation and development of new monitoring wells, and collection of one round of samples at all monitoring wells (previously existing and new wells), with surface elevation measurements. Groundwater samples collected from VAS (seven locations) will be analyzed for VOCs using EPA Method 8260 by a local laboratory for fast turnaround. SulTRAC will collect one “baseline” round of groundwater samples from 19 monitoring wells, which will be submitted to the EPA Contract Laboratory Program (CLP) for only VOC analysis. Groundwater samples from up to five locations will be analyzed for target analyte list (TAL) metals (including mercury and cyanide), VOCs, semi-volatile organic compounds (SVOC), polychlorinated biphenyls (PCB), and pesticides. SulTRAC will obtain preliminary data from EPA as quickly as possible following the sampling event, and will use these data to select/confirm the proposed locations for intrusive investigations.

A comprehensive round of groundwater samples will be collected at all monitoring wells (the 19 wells included in the baseline sampling plus the 14 new wells installed during Phase I of the RI). Four out of the total 33 groundwater samples will be analyzed for TAL metals (including mercury and cyanide), VOCs, SVOCs, PCBs, and pesticides. The remaining 29 groundwater samples will be analyzed only for VOCs. Groundwater samples from existing and new wells will be submitted to the designated EPA CLP laboratory for analysis by EPA Methods CLP SOW SOM01.2 for VOCs, SVOCs, PCBs, and pesticides; and CLP SOW ILM05.4 for TAL metals (including cyanide and mercury).

Soil borings will be drilled at 30 locations, with collection of two soil samples per boring. Six soil samples will be analyzed for TAL metals (including mercury and cyanide), VOCs, SVOCs, PCBs, and pesticides. The remaining 54 samples will be analyzed for VOCs only. Soil samples will be submitted to the designated EPA CLP laboratory for analysis by EPA Methods CLP SOW SOM01.2 for VOCs, SVOCs, PCBs, and pesticides; and CLP SOW ILM05.4 for TAL metals (including cyanide and mercury). Groundwater samples will be collected at up to 10 of the soil boring locations with analysis for VOCs using EPA Method 8260 by a local laboratory for fast turnaround.

Four surface water samples and four sediment samples will be collected from the Great Miami River to evaluate the potential for impacts to the river from discharge of contaminated groundwater. Two surface water and two sediment samples will be analyzed for TAL metals (including mercury and cyanide), VOCs, SVOCs, PCBs, and pesticides. The remaining surface water and sediment samples will be analyzed for VOCs only. Surface water and sediment samples will be submitted to the designated EPA CLP laboratory for analysis by EPA Methods CLP SOW SOM01.2 for VOCs, SVOCs, PCBs, and pesticides; and CLP SOW ILM05.4 for TAL metals (including cyanide and mercury).

Thirty sub-slab vapor samples will be collected from the residences at the site and analyzed for VOCs only. Soil gas samples will be analyzed for all analytes identified in EPA Method TO-15. The methodologies and procedures for the collection and analysis of these samples will be submitted in an addendum to this QAPP..

Once determined, the off-site laboratory will provide Standard Operating Procedures (SOPs) for the analyses of groundwater and soil samples (by EPA Method 8260). SOPs for sample log-in, storage, internal chain of custody, and disposal must be provided. CRL will provide SOPs for the analyses of sub-slab vapor samples (by TO-15 method). The SOPs for CRL and off-site laboratory will be submitted together when the off-site laboratory has been identified.

Project decision conditions (“If…, then…” statements): If the Phase I activities indicate that contamination at the East Troy site poses an unacceptable risk to human health and/or the environment, an interim remedial action will be implemented. If contamination is localized on the properties investigated, Phase II activities will consist of additional sampling to define the extent of contamination and eliminate any data gaps. If contamination is identified from potential off-site sources, these sources will be further investigated in Phase II activities.

QAPP WORKSHEET #11
PROJECT QUALITY OBJECTIVES/SYSTEMATIC PLANNING PROCESS STATEMENTS

(UFP QAPP Section 2.6.1)
Use this worksheet to develop PQOs in terms of type, quantity, and quality of data determined using a systematic planning process. Provide a detailed discussion of PQOs in the QAPP. List the PQOs in the form of qualitative and quantitative statements. These statements should answer questions such as those listed below. These questions are examples only; however, they are neither inclusive nor appropriate for all projects.

Who will use the data: EPA Region 5, Ohio EPA, and SulTRAC will use the data.
What will the data be used for? During the Phase I field investigation, the data will be used to characterize potential contamination sources, as well as determine the nature of the contamination at the East Troy site. As part of the Feasibility Study (FS), data from both the Phase I and Phase II field investigations will be referenced by those conducting a risk assessment for the entire East Troy site and evaluating remedial alternatives.

QAPP WORKSHEET #11 (CONTINUED)
PROJECT QUALITY OBJECTIVES/SYSTEMATIC PLANNING PROCESS STATEMENTS

What type of data are needed (target analytes, analytical groups, field screening, on-site analytical or off-site laboratory techniques, sampling techniques)? A baseline groundwater sampling will be performed at 13 existing Ohio EPA monitoring wells, and six City of Troy monitoring wells; 14 of these samples will be analyzed for volatile organic compounds (VOCs) through the EPA Contract Laboratory Program (CLP). A subset of five baseline groundwater samples will be analyzed for target analyte list (TAL) metals (including mercury and cyanide), VOCs, semi-volatile organic compounds (SVOC), polychlorinated biphenyls (PCB) and pesticides through EPA's Contract Laboratory Program (CLP).

In addition, 27 groundwater samples collected through vertical aquifer sampling (VAS) (eight locations) and groundwater collected at 10 of the soil boring locations will be analyzed for VOCs using a local lab for fast turnaround. These are considered field screening level data to support decisions regarding monitoring well placement and screen depths.

SulTRAC will collect up to 70 subsurface soil samples and 10 groundwater samples from the plume area west of the Great Miami River, including three background locations (see Figures 5 and 6). Soil boring samples will be collected from 30 locations, with collection of two soil samples per boring. An additional surface soil sample may be collected if visual evidence, odors or PID screening indicates surficial contamination (assume 10 locations). Seven out of 70 soil samples will be analyzed for target analyte list TAL metals (including mercury and cyanide), VOCs, SVOCs, PCBs and pesticides through EPA's CLP. The remaining 63 soil samples will be analyzed for VOCs through the CLP. Groundwater samples will be collected as screening level samples from the top of the aquifer at up to 10 boring locations, with analysis by the off-site laboratory for VOCs.

A comprehensive round of groundwater samples will be collected at all monitoring wells (the 19 wells included in the baseline sampling plus the 14 new wells installed during Phase I of the RI). Four of 33 samples will be analyzed for TAL metals (including mercury and cyanide), VOCs, SVOCs, PCBs, and pesticides through the CLP. The remaining 29 groundwater samples will be analyzed only for VOCs through the CLP.

Four surface water samples and four sediment samples from the Great Miami River will be collected to evaluate the potential for impacts to the river from discharge of contaminated groundwater. Two surface water and two sediment samples will be analyzed for TAL metals (including mercury and cyanide), VOCs, SVOCs, PCBs, and pesticides through the CLP. Two surface water and two sediment samples will be analyzed for VOCs only through the CLP.

Sub-slab vapor samples will be collected at the site and analyzed for VOCs. Numbers and locations of samples, and applicable methodologies have not been determined and will be presented in a SAP addendum.

Split samples that are collected at the Spinnaker site will be analyzed for VOCs through the CLP. It is anticipated that split samples will be collected from at least 5 locations, during one or more of the routine Spinnaker quarterly groundwater monitoring events.

QAPP WORKSHEET #11 (CONTINUED)
PROJECT QUALITY OBJECTIVES/SYSTEMATIC PLANNING PROCESS STATEMENTS

How “good” do the data need to be in order to support the environmental decision? Ultimately, the data from SulTRAC’s samples of soil, water, and sub-slab vapor need to allow full assessment of the nature and extent of contamination in groundwater, subsurface soil, and other environmental media. The data also need to support a risk assessment and evaluation of remedial alternatives. However, screening level data collected during the VAS and soil boring programs will not be used to support the risk assessment.

How much data are needed (number of samples for each analytical group, matrix, and concentration)?

SulTRAC will conduct hydrogeologic investigations that will include (1) an initial baseline sampling of existing monitoring wells (19 samples), (2) collection of shallow groundwater samples at 10 of the 30 soil boring locations, (3) a VAS program to evaluate the vertical distribution of VOCs in the uppermost aquifer (36 samples), (4) installation and development of new monitoring wells, and collection of one round of samples at all monitoring wells (previously existing and new wells), with surface elevation measurements.

In addition, SulTRAC will collect subsurface soil samples from up to 30 locations (including background) in and around the existing contaminant plumes; conduct a comprehensive groundwater sampling of the 19 existing and 14 new monitoring wells; collect surface water and sediment samples from four locations on the Great Miami River; and collect indoor sub-slab vapor samples from structures in the contaminant plume area. Quality control (QC) samples will be collected and analyzed, including duplicates, matrix spikes (MS), matrix spike duplicates (MSD), and trip blanks.

Where, when, and how should the data be collected/generated? See above answers in Worksheet 10 and 11.

Who will collect and generate the data? SulTRAC will collect all the samples discussed herein. The groundwater samples collected from VAS and soil borings will be analyzed for VOCs by the subcontracted off-site laboratory.

The remaining baseline groundwater samples, soil boring samples, groundwater samples from comprehensive sampling, sediment samples, surface water samples and split samples from the Spinnaker site will be analyzed by a laboratory from the EPA CLP. The analytical approach for the sub-slab vapor samples will be confirmed as Phase I progresses and will be presented in a SAP addendum.

How will the data be reported? Data will be reported by the CLP and CRL laboratories using standard data reporting techniques. Data will be reported in electronic and hard-copy formats. The preliminary VOC analysis data will be reported by the subcontracted laboratory using standard data reporting techniques.

How will the data be archived? Electronic and hard copies of CLP and CRL analytical data will be archived by the individual laboratory. Electronic and hard copies of subcontracted laboratory data will be archived by the SulTRAC analytical coordinator. Field data (notebooks, sampling sheets, etc.) will be maintained at SulTRAC’s Chicago office. SulTRAC will also provide 10-year data storage.

QAPP WORKSHEET #12
MEASUREMENT PERFORMANCE CRITERIA TABLE

Complete this worksheet for each matrix, analytical group, and concentration level. Identify the data quality indicators (DQIs), measurement performance criteria (MPC) (percent recovery (% R), and relative percent difference (% RPD), and QC sample and/or activity used to assess the measurement performance for both the sampling and analytical measurement systems. Use additional worksheets if necessary. If MPC for a specific DQI vary within an analytical parameter, i.e., MPC are analyte-specific, then provide analyte-specific MPC on an additional worksheet.

Matrix	Soil, Sediment
Analytical Group	CLP VOCs
Concentration Level	NA[3]

Sampling Procedure[1]	**Analytical Method SOP**[2]	**DQIs**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
S-1, S-2	A-1	Precision	RPD ≤ 70%	Field duplicate	S & A
S-1, S-2	A-1	Accuracy/ Bias-Contamination	VOC < QL	Trip blank	S & A
S-1, S-2	A-1	Accuracy/ Bias-Contamination	VOC < QL	Rinsate blank	S & A
S-1, S-2	A-1	Accuracy/Bias	1,1-Dichloroethene: 59-172 %R TCE: 62-137 %R Benzene: 66-142 %R Toluene: 59-139 %R Chlorobenzene: 60-133 %R	MS/MSD	S & A
S-1, S-2	A-1	Precision	1,1-Dichloroethene: 22% RPD TCE: 24% RPD Benzene: 21% RPD Toluene: 21% RPD Chlorobenzene: 21% RPD	MS/MSD	S & A

QAPP WORKSHEET #12 (CONTINUED)
MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix	Soil, Sediment
Analytical Group	CLP VOCs
Concentration Level	NA[3]

Sampling Procedure[1]	**Analytical Method SOP**[2]	**DQIs**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
S-1, S-2	A-1	Accuracy	Vinyl chloride-d_3: 68-122 %R Chloroethane-d_5: 61-130 %R 1,1-Dichloroethene-d_2: 45-132 %R 2-Butanone-d_5: 20-182 %R Chloroform-d: 72-123 %R 1,2-Dichloroethane-d_4: 79-122 %R Benzene-d_6: 80-121 %R 1,2-Dichloropropane-d_6: 74-124 %R Toluene-d_8: 78-121 %R 1,1,2,2-Tetrachloroethane-d_2: 56-161 %R Trans-1,3-Dichloropropene-d_4: 72-130 %R 2-Hexanone-d_5: 17-184 %R 1,4-Dioxane-d_8: 50-150 %R 1,2-Dichlorobnzene-d_4: 70-131 %R	Deuterated monitoring compounds	A
S-1, S-2	A-1	Accuracy/ Bias-Contamination	VOC < QL	Method blank	A
S-1, S-2	A-1	Completeness	≥ 90%	Data completeness defined as data not qualified as rejected after validation	S & A

QAPP WORKSHEET #12 (CONTINUED)
MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix	Soil, Sediment
Analytical Group	CLP SVOCs
Concentration Level	NA[3]

Sampling Procedure[1]	**Analytical Method SOP**[2]	**DQIs**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
S-1, S-2	A-1	Precision	RPD ≤ 70%	Field duplicate	S & A
S-1, S-2	A-1	Accuracy/ Bias-Contamination	SVOC < QL	Rinsate blank	S & A
S-1, S-2	A-1	Accuracy/Bias	Phenol: 26-90 %R 2-Chlorophenol: 25-102 %R N-Nitroso-di-n-propylamine: 41-126 %R 4-Chloro-3-methylphenol: 26-103 %R Acenaphthene: 31-137 %R 4-Nitrophenol: 11-114 %R 2,4-Dinitrotoluene: 28-89 %R Pentachlorophenol: 17-109 %R Pyrene: 35-142 %R	MS/MSD	S & A
S-1, S-2	A-1	Precision	Phenol: 35% RPD 2-Chlorophenol: 50% RPD N-Nitroso-di-n-propylamine: 38% RPD 4-Chloro-3-methylphenol: 33% RPD Acenaphthene: 19% RPD 4-Nitrophenol: 50% RPD 2,4-Dinitrotoluene: 47% RPD Pentachlorophenol: 47% RPD Pyrene: 36% RPD	MS/MSD	S & A

QAPP WORKSHEET #12 (CONTINUED)
MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix	Soil, Sediment
Analytical Group	CLP SVOCs
Concentration Level	NA[3]

Sampling Procedure[1]	Analytical Method SOP[2]	DQIs	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
S-1, S-2	A-1	Accuracy	Phenol-d_5: 17-103 %R Bis(2-Chloroethyl)ether-d_8: 12-98 %R 2-Chlorophenol-d_4: 13-101 %R 4-Methylphenol-d_8: 8-100 %R Nitrobenzene-d_5: 16-103 %R 2-Nitrophenol-d_4: 16-104 %R 2,4-Dichlorophenol-d_3: 23-104 %R 4-Chloroaniline-d_4: 1-145 %R Dimethylphthalate-d_6: 43-111 %R Acenaphthylene-d_8: 20-97 %R 4-Nitrophenol-d_4: 16-166 %R Fluorene-d_{10}: 40-108 %R 4,6-Dinitro-2-methylphenol-d_2: 1-121 %R Anthracene-d_{10}: 22-98 %R Pyrene-d_{10}: 51-120 %R Benzo(a)pyrene-d_{12}: 43-111 %R	Deuterated monitoring compounds	A
S-1, S-2	A-1	Accuracy/Bias-Contamination	SVOC < QL	Method blank	A
S-1, S-2	A-1	Completeness	≥ 90%	Data completeness defined as data not qualified as rejected after validation	S&A

QAPP WORKSHEET #12 (CONTINUED)
MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix	Soil, Sediment
Analytical Group	CLP PCBs
Concentration Level	NA[3]

Sampling Procedure[1]	Analytical Method SOP[2]	DQIs	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
S-1, S-2	A-1	Precision	RPD ≤ 70%	Field duplicate	S & A
S-1, S-2	A-1	Accuracy/ Bias-Contamination	PCB < QL	Rinsate blank	S & A
S-1, S-2	A-1	Accuracy/Bias	Aroclor-1016: 29-135 %R Aroclor-1260: 29-135 %R	MS/MSD	S & A
S-1, S-2	A-1	Precision	Aroclor-1016: 15% RPD Aroclor-1260: 20% RPD	MS/MSD	S & A
S-1, S-2	A-1	Accuracy	Decachlorobiphenyl: 30-150 %R, Tetrachloro-m-xylene: 30-150 %R	Surrogate spike	A
S-1, S-2	A-1	Accuracy/ Bias-Contamination	PCB < QL	Method blank	A
S-1, S-2	A-1	Accuracy	Aroclor-1016: 50-150% R Aroclor-1260: 50-150% R	Laboratory control sample	A
S-1, S-2	A-1	Completeness	≥ 90%	Data completeness defined as data not qualified as rejected after validation	S & A

QAPP WORKSHEET #12 (CONTINUED)
MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix	Soil, Sediment
Analytical Group	CLP Pesticides
Concentration Level	NA[3]

Sampling Procedure[1]	Analytical Method SOP[2]	DQIs	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
S-1, S-2	A-1	Precision	RPD ≤ 70%	Field duplicate	S & A
S-1, S-2	A-1	Accuracy/ Bias-Contamination	Pesticides < QL	Rinsate blank	S & A
S-1, S-2	A-1	Accuracy/Bias	Gamma-BHC: 46-127 %R Heptachlor: 35-130 %R Aldrin: 34-132 %R Dieldrin : 31-134 %R Endrin : 42-139 %R 4,4'-DDT : 23-134 %R	MS/MSD	S & A
S-1, S-2	A-1	Precision	Gamma-BHC: 50% RPD Heptachlor: 31% RPD Aldrin: 43% RPD Dieldrin: 38% RPD Endrin: 45% RPD 4,4'-DDT: 50% RPD	MS/MSD	S & A
S-1, S-2	A-1	Accuracy	Tetrachloro-m-xylene: 30-150 %R Decachlorobiphenyl: 30-150 %R	Surrogate spike	A
S-1, S-2	A-1	Accuracy/ Bias-Contamination	Pesticide < QL	Method blank	A
S-1. S-2	A-1	Accuracy	Gamma-BHC: 50-120 %R Heptachlor: 50-150 %R Dieldrin : 30-130 %R Endrin: 50-120 %R 4,4'-DDE: 50-150 %R Endosulfan sulfate: 50-120% R Gamma-Chlordane: 30-130% R	Laboratory control sample	A

QAPP WORKSHEET #12 (CONTINUED)
MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix	Soil, Sediment
Analytical Group	CLP Pesticides
Concentration Level	NA[3]

Sampling Procedure[1]	Analytical Method SOP[2]	DQIs	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
S-1, S-2	A-1	Completeness	≥ 90%	Data completeness defined as data not qualified as rejected after validation	S & A
S-1, S-2	A-2	Precision	RPD ≤ 70%	Field duplicate	S & A

QAPP WORKSHEET #12 (CONTINUED)
MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix	Soil, Sediment
Analytical Group	CLP Metals (including mercury and cyanide)
Concentration Level	NA[3]

Sampling Procedure[1]	Analytical Method SOP[2]	DQIs	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
S-1, S-2	A-2	Accuracy/ Bias-Contamination	Metals and cyanide < QL	Rinsate blank	S & A
S-1, S-2	A-2	Accuracy/Bias	Metals and cyanide: 75-125 %R	MS	A
S-1, S-2	A-2	Precision	Metals and cyanide: < 20% RPD	Laboratory duplicate	A
S-1, S-2	A-2	Accuracy	Metals and cyanide: 70-130% R	Laboratory control sample	A
S-1, S-2	A-2	Sensitivity/Contamination	Metals and cyanide <QL	Method blank	A
S-1, S-2	A-2	Completeness	≥ 90%	Data completeness defined as data not qualified as rejected after validation	S & A

Note:

DQI	Data quality indicator
MS/MSD	Matrix spike/matrix spike duplicate
QL	Quantitation limit
%R	Percent recovery
RPD	Relative percent difference

[1] Reference number from QAPP Worksheet #21

[2] Reference number from QAPP Worksheet #23

[3] Not applicable, only one concentration level is listed for the analytical method selected

QAPP WORKSHEET #12 (CONTINUED)
MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix	Water
Analytical Group	VOCs[3]
Concentration Level	Low concentration

Sampling Procedure[1]	Analytical Method SOP[2]	DQIs	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
S-5, S-6	A-1 and A-4	Precision	RPD ≤ 50%	Field duplicate	S & A
S-5, S-6	A-1 and A-4	Accuracy/ Bias-Contamination	VOC < QL	Trip blank	S & A
S-5, S-6	A-1 and A-4	Accuracy/ Bias-Contamination	VOC < QL	Rinsate blank	S & A
S-5, S-6	A-1 and A-4	Accuracy/Bias	1,1-Dichloroethene: 61-145 %R TCE: 71-120 %R Benzene: 76-127 %R Toluene: 76-125 %R Chlorobenzene: 75-130 %R	MS/MSD	S & A
S-5, S-6	A-1 and A-4	Precision	1,1-Dichloroethene: 14% RPD TCE: 14% RPD Benzene: 11% RPD Toluene: 13% RPD Chlorobenzene: 13% RPD	MS/MSD	S & A

QAPP WORKSHEET #12 (CONTINUED)
MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix	Water
Analytical Group	VOCs[3]
Concentration Level	Low concentration

Sampling Procedure[1]	Analytical Method SOP[2]	DQIs	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
S-5, S-6	A-1 and A-4	Accuracy	Vinyl chloride-d_3: 65-131 %R Chloroethane-d_5: 71-131 %R 1,1-Dichloroethene-d_2: 55-104 %R 2-Butanone-d_5: 49-155 %R Chloroform-d: 78-121 %R 1,2-Dichloroethane-d_4: 78-129 %R Benzene-d_6: 77-124 %R 1,2-Dichloropropane-d_6 : 79-124 %R Toluene-d_8 : 77-121 %R 1,1,2,2-Tetrachloroethane-d_2: 73-125 %R Trans-1,3-Dichloropropene-d_4: 73-121 %R 2-Hexanone-d_5: 28-135 %R 1,4-Dioxane-d_8: 50-150 %R 1,2-Dichlorobnzene-d_4: 80-131 %R	Deuterated monitoring compounds	A
S-5, S-6	A-1 and A-4	Accuracy/ Bias-Contamination	VOC < QL	Method blank	A
S-5, S-6	A-1 and A-4	Completeness	≥ 90%	Data completeness defined as data not qualified as rejected after validation	S & A

QAPP WORKSHEET #12 (CONTINUED)
MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix	Water
Analytical Group	CLP SVOCs
Concentration Level	Low concentration

Sampling Procedure[1]	Analytical Method SOP[2]	DQIs	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
S-5, S-6	A-1	Precision	RPD ≤ 50%	Field Duplicate	S & A
S-5, S-6	A-1	Accuracy/Bias-Contamination	SVOC < QL	Rinsate blank	S & A
S-5, S-6	A-1	Accuracy/Bias	Phenol: 12-110 %R 2-Chlorophenol: 27-123 %R N-Nitroso-di-n-propylamine: 41-116 %R 4-Chloro-3-methylphenol: 23-97 %R Acenaphthene: 46-118 %R 4-Nitrophenol: 10-80 %R 2,4-Dinitrotoluene: 24-96 %R Pentachlorophenol: 9-103 %R Pyrene: 26-127 %R	MS/MSD	S & A
S-5, S-6	A-1	Precision	Phenol: 42% RPD 2-Chlorophenol: 40% RPD N-Nitroso-di-n-propylamine: 38% RPD 4-Chloro-3-methylphenol: 42% RPD Acenaphthene: 31% RPD 4-Nitrophenol: 50% RPD 2,4-Dinitrotoluene: 38% RPD Pentachlorophenol: 50% RPD Pyrene: 31% RPD	MS/MSD	S & A

QAPP WORKSHEET #12 (CONTINUED)
MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix	Water
Analytical Group	CLP SVOCs
Concentration Level	Low concentration

Sampling Procedure[1]	Analytical Method SOP[2]	DQIs	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
S-5, S-6	A-1	Accuracy	Phenol-d_5: 39-106 %R Bis(2-chloroethyl)ether-d_8: 40-105 %R 2-Chlorophenol-d_4: 41-106 %R 4-Methylphenol-d_8: 25-111 %R Nitrobenzene-d_5: 43-108 %R 2-Nitrophenol-d_4: 40-108 %R 2,4-Dichlorophenol-d_3: 37-105 %R 4-Chloroaniline-d_4: 1-145 %R Dimethylphthalate-d_6: 47-114 %R Acenaphthylene-d_8: 41-107 %R 4-Nitrophenol-d_4: 33-116 %R Fluorene-d_{10}: 42-111 %R 4,6-Dinitro-2-methylphenol-d_2: 22-104 %R Anthracene-d_{10}: 44-110 %R Pyrene-d_{10}: 52-119 %R Benzo(a)pyrene-d_{12}: 32-121 %R	Deuterated monitoring compounds	A
S-5, S-6	A-1	Accuracy/ Bias-Contamination	SVOC < QL	Method blank	A
S-5, S-6	A-1	Completeness	≥ 90%	Data completeness defined as data not qualified as rejected after validation	S & A

QAPP WORKSHEET #12 (CONTINUED)
MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix	Water
Analytical Group	CLP PCBs
Concentration Level	NA[4]

Sampling Procedure[1]	Analytical Method SOP[2]	DQIs	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
S-5, S-6	A-1	Precision	RPD ≤ 50%	Field duplicate	S & A
S-5, S-6	A-1	Accuracy/Bias-Contamination	PCB < QL	Rinsate blank	S & A
S-5, S-6	A-1	Accuracy/Bias	Aroclor-1016: 29-135 %R Aroclor-1260: 29-135 %R	MS/MSD	S & A
S-5, S-6	A-1	Precision	Aroclor-1016: 15% RPD Aroclor-1260: 20% RPD	MS/MSD	S & A
S-5, S-6	A-1	Accuracy	Decachlorobiphenyl: 30-150 %R Tetrachloro-m-xylene: 30-150 %R	Surrogate spike	A
S-5, S-6	A-1	Accuracy/ Bias-Contamination	PCB < QL	Method blank	A
S-5, S-6	A-1	Accuracy	Aroclor-1016: 50-150% R Aroclor-1260: 50-150% R	Laboratory control sample	A
S-5, S-6	A-1	Completeness	≥ 90%	Data completeness defined as data not qualified as rejected after validation	S & A

QAPP WORKSHEET #12 (CONTINUED)
MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix	Water
Analytical Group	CLP Pesticides
Concentration Level	NA[4]

Sampling Procedure[1]	**Analytical Method SOP[2]**	**DQIs**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
S-5, S-6	A-1	Precision	RPD ≤ 50%	Field duplicate	S & A
S-5, S-6	A-1	Accuracy/Bias-Contamination	Pesticide < QL	Rinsate blank	S & A
S-5, S-6	A-1	Accuracy/Bias	Gamma-BHC: 56-123 %R Heptachlor: 40-131 %R Aldrin: 40-120 %R Dieldrin : 52-126 %R Endrin : 56-121 %R 4,4’-DDT : 38-127 %R	MS/MSD	S & A
S-5, S-6	A-1	Precision	Gamma-BHC: 15% RPD Heptachlor: 20% RPD Aldrin: 22% RPD Dieldrin: 18% RPD Endrin: 21% RPD 4,4’-DDT: 27% RPD	MS/MSD	S & A
S-5, S-6	A-1	Accuracy	Tetrachloro-m-xylene: 30-150 %R Decachlorobiphenyl: 30-150 %R	Surrogate spike	A
S-5, S-6	A-1	Accuracy/ Bias-Contamination	Pesticide < QL	Method blank	A

QAPP WORKSHEET #12 (CONTINUED)
MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix	Water
Analytical Group	CLP Pesticides
Concentration Level	NA[4]

Sampling Procedure[1]	Analytical Method SOP[2]	DQIs	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
S-5, S-6	A-1	Accuracy	Gamma-BHC: 50-120 %R Heptachlor: 50-150 %R Dieldrin: 30-130 %R Endrin: 50-120 %R 4,4'-DDE: 50-150 %R Endosulfan sulfate: 50-120%R Gamma-Chlordane: 30-130%R	Laboratory control sample	A
S-5, S-6	A-1	Completeness	≥ 90%	Data completeness defined as data not qualified as rejected after validation	S & A

QAPP WORKSHEET #12 (CONTINUED)
MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix	Water
Analytical Group	CLP Metals (including mercury and cyanide)
Concentration Level	NA[4]

Sampling Procedure[1]	**Analytical Method SOP**[2]	**DQIs**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)**
S-5, S-6	A-2	Precision	RPD ≤ 50%	Field duplicate	S & A
S-5, S-6	A-2	Accuracy/Bias-Contamination	Metals and cyanide < QL	Rinsate blank	S & A
S-5, S-6	A-2	Accuracy	Metals and cyanide: 75-125 % R	MS	A
S-5, S-6	A-2	Precision	Metals and cyanide: < 20% RPD	Laboratory duplicate	A
S-5, S-6	A-2	Accuracy	Metals and cyanide: 70-130% R	Laboratory control sample	A
S-5, S-6	A-2	Sensitivity/Contamination	Metals and cyanide: < QL	Method blank	A
S-5, S-6	A-2	Completeness	≥ 90%	Data completeness defined as data not qualified as rejected after validation	S & A

Notes:

DQI	Data quality indicator
MS/MSD	Matrix spike/matrix spike duplicate
QL	Quantitation limit
%R	Percent recovery
RPD	Relative percent difference

[1] Reference number from QAPP Worksheet #21

[2] Reference number from QAPP Worksheet #23

[3] VOCs in groundwater will be analyzed both by CLP and subcontracted laboratory. If the QC limits are different for the subcontracted laboratory, an updated VOCs/Water table will be added. The updated table will be submitted once the subcontracted lab has been identified

[4] Not applicable, only one concentration level is listed for the analytical method selected

QAPP WORKSHEET #12 (CONTINUED)
MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix	Soil Gas[5]
Analytical Group	CRL VOCs
Concentration Level	NA[3]

Sampling Procedure[1]	Analytical Method SOP[2]	DQIs	Measurement Performance Criteria[4]	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
S-9, S-10	A-3	Precision	RPD ≤ 50%	Field duplicate	S & A
S-9, S-10	A-3	Accuracy	Bromochloromethane, 60-140 %R Chlorobenzene-d5, 60-140 %R 1,4-Difluorobenzene, 60-140 %R	Internal standards	A
S-9, S-10	A-3	Accuracy	60-140 % R	Laboratory control sample	A
S-9, S-10	A-3	Accuracy/ Bias-Contamination	VOC < QL	Method blank	A
S-9, S-10	A-3	Precision	RPD <30%	Laboratory Duplicate	A
S-9, S-10	A-3	Completeness	≥ 90%	Data completeness defined as data not qualified as rejected after validation	S & A

Notes:

DQI	Data quality indicator
QL	Quantitation limit
%R	Percent recovery
RPD	Relative percent difference

[1] Reference number from QAPP Worksheet #21

[2] Reference number from QAPP Worksheet #23

[3] Not applicable, only one concentration level is listed for the analytical method selected

[4] Once selected, the subcontracted laboratory may use a different selection of deuterated monitoring compounds (surrogates); if so, their measurement performance criteria will be substituted from the laboratory's statistical quality control measures or another appropriate source.

[5] These criteria may be modified in the subsequent SAP Addendum

QAPP WORKSHEET #13
SECONDARY DATA CRITERIA AND LIMITATIONS TABLE

(UFP QAPP Section 2.7)
Identify all secondary data and information that will be used for the project and their originating sources. Specify how the secondary data will be used and the limitations on their use.

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Source (Originating Org, Data Types, data Generation/Collection Dates)	How data will be used	Limitation on Data Use
Groundwater	Kimberly-Clark Inc. (KC) "Summary of Background Information Regarding the Spinnaker Site and the East Troy Contaminated Aquifer." May 2009.	KC	This data will be used as a starting point to characterize the nature of contamination and identify potential sources of volatile organic compounds (VOC) at the East Troy site.	None
Soil and groundwater	Mill Creek Environmental Services. "Closure Report Spinnaker Facility-West End." Prepared for KC. April 2002.	Mill Creek Environmental Services	This soil and groundwater information was used to determine the maximum concentration of VOCs found at the Spinnaker Facility.	None
Groundwater	Ohio Environmental Protection Agency (EPA). "Expanded Site Inspection Report – East Troy Contaminated Aquifer Troy, Miami County, Ohio." September 2002.	OEPA	This groundwater sampling information was used to determine the drilling location at the East Troy site.	None
Groundwater and soil vapor	Ohio EPA. "Removal Referral – East Troy Contaminated Aquifer, Miami County, 555-1353." June 2006.	OEPA	This information was used to determine the location of sub-slab vapor sampling at the East Troy site.	None

QAPP WORKSHEET #13 (CONTINUED)
SECONDARY DATA CRITERIA AND LIMITATIONS TABLE

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Source (Originating Org, Data Types, data Generation/Collection Dates)	How data will be used	Limitation on Data Use
Groundwater	EPA. "Site Assessment Report for Troy VOC Plume Site Troy, Miami County, Ohio." May 2007.	EPA	This groundwater sampling information was used to determine the drilling location at the East Troy site.	None
Groundwater	Quarterly VOC groundwater monitoring data for the Spinnaker Site	KC	The data will be evaluated in conjunction with data obtained by EPA as Phase I of the RI progresses; split samples analyzed by EPA CLP will be used to ensure confidence in the data.	None
Groundwater and soil vapor	EPA. "Action Memorandum, Request for a Time Critical Removal Action at the East Troy Contaminated Aquifer Site (aka Troy VOC Plume), Tory, Miami County, Ohio (Site ID B5EN)." May 2007.	EPA	This information was used to determine the location of sub-slab vapor sampling at the East Troy site.	

Note:

EPA	Environmental Protection Agency
ID	Identification
KC	Kimberly Clark, Inc.
VOC	Volatile organic compound

QAPP WORKSHEET #14
SUMMARY OF PROJECT TASKS

(UFP QAPP Section 2.8.1)
Provide a brief overview of the listed project activities.

Sampling Tasks:

1. Collecting baseline groundwater samples at 13 existing Ohio EPA wells and six existing city wells; collection of split samples from up to 5 locations during at least one of the Spinnaker quarterly monitoring events
2. Performing a preliminary well condition and elevation survey of the existing wells
3. Performing a sewer investigation in the vicinity of Clay, Franklin, and Crawford Streets
4. Collecting vertical aquifer samples of the upper aquifer at eight locations
5. Collecting subsurface soil samples from 30 soil boring locations (two samples per boring)
6. Collecting groundwater grab samples at the water table at 10 soil boring locations
7. Collecting sub-slab vapor samples from a currently undefined number of structures located within the contaminant plume area.
8. Installing up to 16 new monitoring wells at the eight vertical aquifer sampling (VAS) locations (location determined by review of rapid turnaround volatile organic compounds [VOC] data)
9. Installing two monitoring wells (one shallow and one deep monitoring wells in a single cluster east of the Great Miami River)
10. Installing two staff gauges in the Great Miami River
11. Performing an elevation survey of all groundwater monitoring locations
12. Conducting comprehensive groundwater sampling of the 19 previously existing wells included in the baseline sampling, plus 20 new monitoring wells installed during the remedial investigation (RI)
13. Collecting surface water samples from four locations on the Great Miami River (including background)
14. Collecting sediment samples from four locations of the Great Miami River (including background)

Analysis Tasks: A total of 14 groundwater samples collected during baseline sampling of existing monitoring wells will be analyzed for VOCs only; and a subset of five samples will be analyzed for target analyte list (TAL) metals (including mercury and cyanide), VOCs, semi-volatile organic compounds (SVOC), polychlorinated biphenyls (PCB), and pesticides . Groundwater samples collected from selected soil borings (10) and VAS locations will also be analyzed for VOCs. During the comprehensive groundwater sampling, four samples will be analyzed for TAL metals (including mercury and cyanide), VOCs, SVOCs, PCBs, and pesticides. The remaining 29 groundwater samples will be analyzed only for VOCs. Groundwater samples from existing and new wells will be submitted to the designated United States Environmental Protection Agency (EPA) Contract Laboratory Program (CLP) laboratory for analysis.

Soil borings will be drilled at 30 locations, with collection of at least two and up to three soil samples per boring. Seven soil samples will be analyzed for TAL metals (including mercury and cyanide), VOCs, SVOCs, PCBs, and pesticides. Remaining 63 samples will be analyzed for VOCs only. Soil samples will be submitted to the designated EPA CLP laboratory for analysis.

Four surface water samples and four sediment samples will be collected from the Great Miami River to evaluate the potential for impacts to the river from discharge of contaminated groundwater. Two surface water and two sediment samples will be analyzed for TAL metals (including mercury and cyanide), VOCs, SVOCs, PCBs, and pesticides. Remaining surface water and sediment samples will be analyzed for VOCs only.

Split groundwater samples from the Spinnaker site will be analyzed for VOCs by through the EPA CLP Sub-slab vapor samples will be analyzed in accordance with methodologies to be presented in a SAP addendum.
QC Tasks: The following QC samples will be collected and analyzed during the sampling event: field duplicates, matrix spike (MS)/matrix spike duplicate (MSD) samples, rinsate blanks, and trip blanks.
Secondary Data: See Worksheet #13
Data Management Tasks: Analytical data will be archived in an electronic database after validation.
Documentation and Records: All samples collected will be documented in a logbook using a ballpoint pen. The time of collection, identification number, sampling location, field observations, sampler's name, and analyses will be recorded in the logbook for each sample. Each page of the logbook will be dated, numbered, and signed by SulTRAC personnel. Field data records will be maintained at SulTRAC's Chicago office. SulTRAC will follow custody procedures outlined in SulTRAC's program-level Quality Assurance Project Plan (QAPP) for the RAC 2 contract. Further specifications are described in the Field Sampling Plan (FSP) (SulTRAC 2010).
Assessment/Audit Tasks: No field or laboratory audits are currently planned.
Data Review Tasks: EPA will perform limited computer-aided data review and evaluation (CADRE) for all CLP and Central Regional Laboratory (CRL) data, and will prepare a case narrative detailing any issues or inconsistencies discovered. The SulTRAC project manager will review the case narrative and will detail any analytical issues that may affect data quality in the RI/Feasibility Study (FS) report. The SulTRAC analytical coordinator or a SulTRAC chemist will complete a limited validation of data generated by subcontracted laboratories.

QAPP WORKSHEET #15
REFERENCE LIMITS AND EVALUATION TABLE

(UFP QAPP Section 2.8.1)
Complete this worksheet for each matrix.
Identify the target analytes/contaminants of concern and project-required action limits. Next, determine the QLs that must be met to achieve the PQOs. Finally, list the published and achievable detection and QLs for each analyte.

Reference Limits Table – Soil

Analytical Group	Analyte	CAS Number	Project Action Limit - Soil (mg/kg)[1]	CRQL - Soil (mg/kg)
VOC/CLP	Dichlorodifluoromethane	75-71-8	1.9E+02	5.0E-03
VOC/CLP	Chloromethane	74-87-3	1.2E+02	5.0E-03
VOC/CLP	Vinyl chloride	75-01-4	6.0E-02	5.0E-03
VOC/CLP	Trichlorofluoromethane	75-69-4	8.0E+02	5.0E-03
VOC/CLP	Bromomethane	74-83-9	7.9E+00	5.0E-03
VOC/CLP	Chloroethane	75-00-3	1.5E+04	5.0E-03
VOC/CLP	1,1-Dichloroethene	75-35-4	2.5E+02	5.0E-03
VOC/CLP	1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	4.3E+04	5.0E-03
VOC/CLP	Acetone	67-64-1	6.1E+04	1.0E-02
VOC/CLP	Carbon disulfide	75-15-0	6.7E+02	5.0E-03
VOC/CLP	Methyl acetate	79-20-9	7.8E+04	5.0E-03
VOC/CLP	Methylene chloride	75-09-2	1.1E+01	5.0E-03
VOC/CLP	trans-1,2-Dichloroethene	156-50-5	1.1E+02	5.0E-03
VOC/CLP	Methyl tert-butyl ether	1634-04-4	3.9E+01	5.0E-03
VOC/CLP	1,1-Dichloroethane	75-34-3	3.4E+00	5.0E-03
VOC/CLP	cis-1,2-Dichloroethene	156-59-2	7.8E+02	5.0E-03
VOC/CLP	2-Butanone	78-93-3	2.8E+04	1.0E-02
VOC/CLP	Bromochloromethane	74-97-5	NC	5.0E-03
VOC/CLP	Chloroform	67-66-3	3.0E-01	5.0E-03
VOC/CLP	1,1,1-Trichloroethane	71-55-6	9.0E+03	5.0E-03
VOC/CLP	Cyclohexane	110-82-7	7.2E+03	5.0E-03
VOC/CLP	Carbon tetrachloride	56-23-5	2.5E-01	5.0E-03
VOC/CLP	Benzene	71-43-2	1.1E-00	5.0E-03
VOC/CLP	1,2-Dichloroethane	107-06-2	4.5E-01	5.0E-03
VOC/CLP	1,4-Dioxane	123-91-1	4.4E+01	1.0E-01

QAPP WORKSHEET #15 (CONTINUED)
REFERENCE LIMITS AND EVALUATION TABLE

Analytical Group	Analyte	CAS Number	Project Action Limit - Soil (mg/kg)[1]	CRQL - Soil (mg/kg)
VOC/CLP	Trichloroethene	79-01-6	2.8E+00	5.0E-03
VOC/CLP	Methylcyclohexane	108-87-2	NC	5.0E-03
VOC/CLP	1,2-Dichloropropane	78-87-5	9.3E-01	5.0E-03
VOC/CLP	Bromodichloromethane	75-27-4	2.8E-01	5.0E-03
VOC/CLP	cis-1,3-Dichloropropene	542-75-6	1.7E+00	5.0E-03
VOC/CLP	4-Methyl-2-pentanone	108-10-1	5.3E+03	1.0E-02
VOC/CLP	Toluene	108-88-3	5.0E+03	5.0E-03
VOC/CLP	trans-1,3-Dichloropropene	10061-02-6	1.7E+00	5.0E-03
VOC/CLP	1,1,2-Trichloroethane	79-00-5	1.1E+00	5.0E-03
VOC/CLP	Tetrachloroethene	127-18-4	5.7E-01	5.0E-03
VOC/CLP	2-Hexanone	591-78-6	NC	1.0E-02
VOC/CLP	Dibromochloromethane	124-48-1	7.0E-01	5.0E-03
VOC/CLP	1,2-Dibromoethane	106-93-4	3.2E-02	5.0E-03
VOC/CLP	Chlorobenzene	108-90-7	3.1E+02	5.0E-03
VOC/CLP	Ethylbenzene	100-41-4	5.7E+00	5.0E-03
VOC/CLP	o-Xylene	95-47-6	5.3E+03	5.0E-03
VOC/CLP	m,p-Xylene	179601-23-1	4.5E+03	5.0E-03
VOC/CLP	Styrene	100-42-5	6.5E+03	5.0E-03
VOC/CLP	Bromoform	75-25-2	6.1E+01	5.0E-03
VOC/CLP	Isopropylbenzene (Cumene)	98-82-8	2.2E+03	5.0E-03
VOC/CLP	1,1,2,2-Tetrachloroethane	79-34-5	5.9E-01	5.0E-03
VOC/CLP	1,3-Dichlorobenzene	541-73-1	2.0E+03	5.0E-03
VOC/CLP	1,4-Dichlorobenzene	106-46-7	2.6E+00	5.0E-03
VOC/CLP	1,2-Dichlorobenzene	95-50-1	2.0E+03	5.0E-03
VOC/CLP	1,2-Dibromo-3-chloropropane	96-12-8	5.6E-03	5.0E-03
VOC/CLP	1,2,4-Trichlorobenzene	120-82-1	8.7E+01	5.0E-03
VOC/CLP	1,2,3-Trichlorobenzene	87-61-6	NC	5.0E-03
SVOC/CLP	Benzaldehyde	100-52-7	7.8E+03	1.7E-01
SVOC/CLP	Phenol	108-95-2	1.8E+04	1.7E-01
SVOC/CLP	bis (2-Chloroethyl) ether	111-44-4	1.9E-01	1.7E-01
SVOC/CLP	2-Chlorophenol	95-57-8	3.9E+02	1.7E-01
SVOC/CLP	2-Methylphenol	95-48-7	3.1E+03	1.7E-01
SVOC/CLP	2,2'-Oxybis(1-chloropropane)	108-60-1	3.5E+00	1.7E-01
SVOC/CLP	Acetophenone	98-86-2	7.8E+03	1.7E-01

QAPP WORKSHEET #15 (CONTINUED)
REFERENCE LIMITS AND EVALUATION TABLE

Analytical Group	Analyte	CAS Number	Project Action Limit - Soil (mg/kg)[1]	CRQL - Soil (mg/kg)
SVOC/CLP	4-Methylphenol	106-44-5	3.1E+02	1.7E-01
SVOC/CLP	N-Nitroso-di-n-propylamine	621-64-7	6.9E-02	1.7E-01
SVOC/CLP	Hexachloroethane	67-72-1	3.5E+01	1.7E-01
SVOC/CLP	Nitrobenzene	98-95-3	4.4E+00	1.7E-01
SVOC/CLP	Isophorone	78-59-1	5.1E+02	1.7E-01
SVOC/CLP	2-Nitrophenol	88-75-5	NC	1.7E-01
SVOC/CLP	2,4-Dimethylphenol	105-67-9	1.2E+03	1.7E-01
SVOC/CLP	bis(2-Chloroethoxy) methane	111-91-1	1.8E+02	1.7E-01
SVOC/CLP	2,4-Dichlorophenol	120-83-2	1.8E+02	1.7E-01
SVOC/CLP	Naphthalene	91-20-3	3.9E+00	1.7E-01
SVOC/CLP	4-Chloroaniline	106-47-8	2.4E+00	1.7E-01
SVOC/CLP	Hexachlorobutadiene	87-68-3	6.2E+00	1.7E-01
SVOC/CLP	Caprolactam	105-60-2	3.1E+04	1.7E-01
SVOC/CLP	4-Chloro-3-methylphenol	59-50-7	NC	1.7E-01
SVOC/CLP	2-Methylnaphthalene	91-57-6	3.1E+02	1.7E-01
SVOC/CLP	Hexachlorocyclopentadiene	77-47-4	3.7E+02	1.7E-01
SVOC/CLP	2,4,6-Trichlorophenol	88-06-2	4.4E+01	1.7E-01
SVOC/CLP	2,4,5-Trichlorophenol	95-95-4	6.1E+03	1.7E-01
SVOC/CLP	1,1-Biphenyl	92-52-4	3.9E+03	1.7E-01
SVOC/CLP	2-Chloronaphthalene	91-58-7	6.3E+03	1.7E-01
SVOC/CLP	2-Nitroaniline	88-74-4	1.8E+02	3.3E-01
SVOC/CLP	Dimethylphthalate	131-11-3	NC	1.7E-01
SVOC/CLP	2,6-Dinitrotoluene	606-20-2	6.1E+01	1.7E-01
SVOC/CLP	Acenaphthylene	208-96-8	NC	1.7E-01
SVOC/CLP	3-Nitroaniline	99-09-2	NC	3.3E-01
SVOC/CLP	Acenaphthene	83-32-9	3.4E+03	1.7E-01
SVOC/CLP	2,4-Dinitrophenol	51-28-5	1.2E+02	3.3E-01
SVOC/CLP	Dibenzofuran	132-64-9	NC	1.7E-01
SVOC/CLP	2,4-Dinitrotoluene	121-14-2	1.2E+02	1.7E-01
SVOC/CLP	Diethylphthalate	84-66-2	4.9E+04	1.7E-01
SVOC/CLP	Fluorene	86-73-7	2.3E+03	1.7E-01
SVOC/CLP	4-Chlorophenyl-phenyl ether	7005-72-3	NC	1.7E-01
SVOC/CLP	4-Nitroaniline	100-01-6	2.4E+01	3.3E-01
SVOC/CLP	2-Methyl-4,6-dinitrophenol	534-52-1	6.1E+00	3.3E-01

QAPP WORKSHEET #15 (CONTINUED)
REFERENCE LIMITS AND EVALUATION TABLE

Analytical Group	Analyte	CAS Number	Project Action Limit - Soil (mg/kg)[1]	CRQL - Soil (mg/kg)
SVOC/CLP	N-Nitrosodiphenylamine	86-30-6	9.9E+01	1.7E-01
SVOC/CLP	1,2,4,5-Tetrachlorobenzene	95-94-3	1.8E+01	1.7E-01
SVOC/CLP	4-Bromophenyl-phenylether	101-55-3	NC	1.7E-01
SVOC/CLP	Hexachlorobenzene	118-74-1	3.0E-01	1.7E-01
SVOC/CLP	Atrazine	1912-24-9	2.1E+00	1.7E-01
SVOC/CLP	Pentachlorophenol	87-86-5	3.0E+00	3.3E-01
SVOC/CLP	Phenanthrene	85-014-8	NC	1.7E-01
SVOC/CLP	Anthracene	20-12-7	1.7E+04	1.7E-01
SVOC/CLP	Carbazole	86-74-8	NC	1.7E-01
SVOC/CLP	Di-n-butylphthalate	84-74-2	6.1E+03	1.7E-01
SVOC/CLP	Fluoranthene	206-44-0	2.3E+03	1.7E-01
SVOC/CLP	Pyrene	129-00-0	1.7E+03	1.7E-01
SVOC/CLP	Butylbenzylphthalate	85-68-7	2.6E+02	1.7E-01
SVOC/CLP	3,3’-Dichlorobenzidine	91-94-1	1.1E+00	1.7E-01
SVOC/CLP	Benzo(a)anthracene	56-55-3	1.5E-01	1.7E-01
SVOC/CLP	Benzo(b)fluoranthene	205-99-2	1.5E-01	1.7E-01
SVOC/CLP	Benzo(k)fluoranthene	207-08-9	1.5E+00	1.7E-01
SVOC/CLP	Chrysene	218-01-9	1.3E+01	1.7E-01
SVOC/CLP	bis(2-Ethylhexyl)phthalate	117-81-7	3.5E+01	1.7E-01
SVOC/CLP	Di-n-octylphthalate	117-84-0	NC	1.7E-01
SVOC/CLP	Benzo(a) pyrene	50-32-8	1.5E-02	1.7E-01
SVOC/CLP	Indeno(1,2,3,-cd)pyrene	193-39-5	1.5E-01	1.7E-01
SVOC/CLP	Dibenzo(a,h)anthracene	53-70-3	1.5E-02	1.7E-01
SVOC/CLP	Benzo(g,h,i) perylene	191-24-2	NC	1.7E-01
SVOC/CLP	2,3,4,6-Tetrachlorophenol	58-90-2	1.8E+03	1.7E-01
PCB/CLP	Aroclor-1016	12674-11-2	3.9E+00	3.3E-02
PCB/CLP	Aroclor-1221	11104-28-2	1.7E-01	3.3E-02
PCB/CLP	Aroclor-1232	11141-16-5	1.7E-01	3.3E-02
PCB/CLP	Aroclor-1242	53469-21-9	2.2E-01	3.3E-02
PCB/CLP	Aroclor-1248	12672-29-6	2.2E-01	3.3E-02
PCB/CLP	Aroclor-1254	11097-69-1	2.2E-01	3.3E-02
PCB/CLP	Aroclor-1260	11096-82-5	2.2E-01	3.3E-02
PCB/CLP	Aroclor-1268	11100-14-4	2.2E-01	3.3E-02
Pesticides/CLP	alpha-BHC	319-84-6	7.7E-02	1.7E-03

QAPP WORKSHEET #15 (CONTINUED)
REFERENCE LIMITS AND EVALUATION TABLE

Analytical Group	Analyte	CAS Number	Project Action Limit - Soil (mg/kg)[1]	CRQL - Soil (mg/kg)
Pesticides/CLP	Beta-BHC	319-85-7	2.7E-01	1.7E-03
Pesticides/CLP	delta-BHC	319-86-8	2.7E-01	1.7E-03
Pesticides/CLP	gamma-BHC (Lindane)	58-89-9	5.2E-01	1.7E-03
Pesticides/CLP	Heptachlor	76-44-8	1.1E-01	1.7E-03
Pesticides/CLP	Aldrin	309-00-2	2.9E-02	1.7E-03
Pesticides/CLP	Heptachlor epoxide	1024-57-3	5.3E-02	1.7E-03
Pesticides/CLP	Endosulfan I	115-29-7	3.7E+02	1.7E-03
Pesticides/CLP	Dieldrin	60-57-1	3.0E-02	3.3E-03
Pesticides/CLP	4,4’-DDE	72-55-9	1.4E+00	3.3E-03
Pesticides/CLP	Endrin	72-20-8	1.8E+01	3.3E-03
Pesticides/CLP	Endosulfan II	115-29-7	3.7E+02	3.3E-03
Pesticides/CLP	4,4’-DDD	72-54-8	2.0E+00	3.3E-03
Pesticides/CLP	4,4’-DDT	50-29-3	1.4E+00	3.3E-03
Pesticides/CLP	Endosulfan sulfate	1031-07-8	3.7E+02	3.3E-03
Pesticides/CLP	Methoxychlor	72-43-5	3.1E+02	1.7E-02
Pesticides/CLP	Endrin ketone	72-20-8	1.8E+01	3.3E-03
Pesticides/CLP	Endrin aldehyde	72-20-8	1.8E+01	3.3E-03
Pesticides/CLP	alpha-Chlordane	57-74-9	1.6E+00	1.7E-03
Pesticides/CLP	gamma-Chlordane	57-74-9	1.6E+00	1.7E-03
Pesticides/CLP	Toxaphene	8001-35-2	4.4E-01	1.7E-01
Metals/CLP	Aluminum	7429-90-5	7.7E+04	2.0E+01
Metals/CLP	Antimony	7440-36-0	3.1E+01	6.0E+00
Metals/CLP	Arsenic	7440-38-2	3.9E-01	1.0E+00
Metals/CLP	Barium	7440-39-3	1.5E+04	2.0E+01
Metals/CLP	Beryllium	7440-41-7	1.6E+02	5.0E-01
Metals/CLP	Cadmium	7440-43-9	7.0E+01	5.0E-01
Metals/CLP	Calcium	17852-99-2	NC	5.0E+02
Metals/CLP	Chromium	7440-47-3	1.2E+05	1.0E+00
Metals/CLP	Cobalt	7440-48-4	2.3E+01	5.0E+00
Metals/CLP	Copper	7440-50-8	3.1E+03	2.5E+00
Metals/CLP	Iron	7439-89-6	5.5E+04	1.0E+01
Metals/CLP	Lead	7439-92-1	4.0E+02	1.0E+00
Metals/CLP	Magnesium	7439-95-4	NC	5.0E+02
Metals/CLP	Manganese	7439-96-5	1.8E+06	1.5E+00

QAPP WORKSHEET #15 (CONTINUED)
REFERENCE LIMITS AND EVALUATION TABLE

Analytical Group	Analyte	CAS Number	Project Action Limit - Soil (mg/kg)[1]	CRQL - Soil (mg/kg)
Metals/CLP	Mercury	7439-97-6	2.3E+01	1.0E-01
Metals/CLP	Nickel	7440-02-0	1.5E+03	4.0E+00
Metals/CLP	Potassium	7440-22-4	NC	5.0E+02
Metals/CLP	Selenium	7782-49-2	3.9E+02	3.5E+00
Metals/CLP	Silver	7440-22-4	3.9E+02	1.0E+00
Metals/CLP	Sodium	7440-23-5	NC	5.0E+02
Metals/CLP	Thallium	7440-28-0	5.1E+00	2.5E+00
Metals/CLP	Vanadium	7440-62-2	3.9E+02	5.0E+00
Metals/CLP	Zinc	7440-66-6	2.3E+04	6.0E+00
Cyanide/CLP	Cyanide	74-90-8	1.6E+03	2.5E+00

Notes:

CAS	Chemical Abstract Services
CRQL	Contract-required quantitation limit
mg/kg	Milligram per kilogram`
NC	No criteria

1 U.S. EPA Regional Screening Levels for Chemical Contaminants at Superfund Sites, April 2009 (EPA 2009a). The residential soil limits are listed.

QAPP WORKSHEET #15 (CONTINUED)
REFERENCE LIMITS AND EVALUATION TABLE

Reference Limits Table –Water

Analytical Group	Analyte	CAS Number	Project Action Limit – Water (µg/L)[1]	CRQL - Water (µg/L)
VOC	Dichlorodifluoromethane	75-71-8	3.9E+02	5.0E+00
VOC	Chloromethane	74-87-3	1.9E+02	5.0E+00
VOC	Vinyl chloride	75-01-4	2.0E+00[2]	5.0E+00
VOC	Bromomethane	74-83-9	8.7E+00	5.0E+00
VOC	Chloroethane	75-00-3	2.1E+04	5.0E+00
VOC	Trichlorofluoromethane	75-69-4	1.3E+03	5.0E+00
VOC	1,1-Dichloroethene	75-35-4	3.4E+02	5.0E+00
VOC	Acetone	67-64-1	2.2E+04	1.0E+01
VOC	Carbon disulfide	75-15-0	1.0E+03	5.0E+00
VOC	Methyl acetate	79-20-9	3.7E+04	5.0E+00
VOC	Methylene chloride	75-09-2	4.8E+00	5.0E+00
VOC	trans-1,2-Dichloroethene	156-50-5	1.1E+02	5.0E+00
VOC	Methyl tert-butyl ether	1634-04-4	1.2E+01	5.0E+00
VOC	1,1-Dichloroethane	75-34-3	2.4E+00	5.0E+00
VOC	cis-1,2-Dichloroethene	156-59-2	3.7E+02	5.0E+00
VOC	2-Butanone	78-93-3	7.1E+03	1.0E+01
VOC	Bromochloromethane	74-97-5	NC	5.0E+00
VOC	Chloroform	67-66-3	1.9E-01	5.0E+00
VOC	1,1,1-Trichloroethane	71-55-6	9.1E+03	5.0E+00
VOC	Cyclohexane	110-82-7	1.3E+04	5.0E+00
VOC	Carbon tetrachloride	56-23-5	5.0E+00[2]	5.0E+00
VOC	Benzene	71-43-2	5.0E+00[2]	5.0E+00
VOC	1,2-Dichloroethane	107-06-2	5.0E+00[2]	5.0E+00
VOC	1,4-Dioxane	123-91-1	6.1E+00	1.0E+02
VOC	Trichloroethene	79-01-6	5.0E+00[2]	5.0E+00
VOC	Methylcyclohexane	108-87-2	NC	5.0E+00
VOC	1,2-Dichloropropane	78-87-5	5.0E+00[2]	5.0E+00
VOC	Bromodichloromethane	75-27-4	1.2E-01	5.0E+00
VOC	cis-1,3-Dichloropropene	542-75-6	4.3E-01	5.0E+00
VOC	4-Methyl-2-pentanone	108-10-1	2.0E+03	1.0E+01

QAPP WORKSHEET #15 (CONTINUED)
REFERENCE LIMITS AND EVALUATION TABLE

Analytical Group	Analyte	CAS Number	Project Action Limit – Water (µg/L)[1]	CRQL - Water (µg/L)
VOC	Toluene	108-88-3	2.3E+03	5.0E+00
VOC	trans-1,3-Dichloropropene	10061-02-6	4.3E-01	5.0E+00
VOC	1,1,2-Trichloroethane	79-00-5	5.0E+00[2]	5.0E+00
VOC	Tetrachloroethene	127-18-4	5.0E+00[2]	5.0E+00
VOC	2-Hexanone	591-78-6	NC	1.0E+01
VOC	Dibromochloromethane	124-48-1	1.5E-01	5.0E+00
VOC	1,2-Dibromoethane	106-93-4	5.0E-02[2]	5.0E+00
VOC	Chlorobenzene	108-90-7	9.1E+01	5.0E+00
VOC	Ethylbenzene	100-41-4	7.0E+02[2]	5.0E+00
VOC	o-Xylene	95-47-6	1.4E+03	5.0E+00
VOC	m,p-Xylene	179601-23-1	1.4E+03	5.0E+00
VOC	Styrene	100-42-5	1.6E+03	5.0E+00
VOC	Bromoform	75-25-2	8.5E+00	5.0E+00
VOC	1,1,2,2-Tetrachloroethane	79-34-5	6.7E-02	5.0E+00
VOC	1,3-Dichlorobenzene	541-73-1	3.7E+02	5.0E+00
VOC	1,4-Dichlorobenzene	106-45-7	7.5E+01[2]	5.0E+00
VOC	1,2-Dichlorobenzene	95-50-1	3.7E+02	5.0E+00
VOC	1,2-Dibromo-3-chloropropane	96-12-8	2.0E-01[2]	5.0E+00
VOC	1,2,4-Trichlorobenzene	120-82-1	8.2E+00	5.0E+00
VOC	1,2,3-Trichlorobenzene	87-61-6	NC	5.0E+00

QAPP WORKSHEET #15 (CONTINUED)
REFERENCE LIMITS AND EVALUATION TABLE

Analytical Group	Analyte	CAS Number	Project Action Limit – Water (µg/L)[1]	CRQL - Water (µg/L)
SVOC/CLP	Benzaldehyde	100-52-7	3.7E+03	5.0E+00
SVOC/CLP	Phenol	108-95-2	1.1E+04	5.0E+00
SVOC/CLP	bis (2-chloroethyl) ether	111-44-4	1.2E-02	5.0E+00
SVOC/CLP	2-Chlorophenol	95-57-8	1.8E+02	5.0E+00
SVOC/CLP	2-Methylphenol	95-48-7	1.8E+03	5.0E+00
SVOC/CLP	2,2'-Oxybis(1-chloropropane)	108-60-1	3.2E-01	5.0E+00
SVOC/CLP	4-Methylphenol	106-44-5	1.8E+02	5.0E+00
SVOC/CLP	Acetophenone	98-86-2	3.7E+03	5.0E+00
SVOC/CLP	N-Nitroso-di-n-propylamine	621-64-7	9.6E-03	5.0E+00
SVOC/CLP	Hexachloroethane	67-72-1	4.8E+00	5.0E+00
SVOC/CLP	Nitrobenzene	98-95-3	1.2E-01	5.0E+00
SVOC/CLP	Isophorone	78-59-1	7.1E+01	5.0E+00
SVOC/CLP	2-Nitrophenol	88-75-5	NC	5.0E+00
SVOC/CLP	2,4-Dimethylphenol	105-67-9	7.3E+02	5.0E+00
SVOC/CLP	2,4-Dichlorophenol	120-83-2	1.1E+02	5.0E+00
SVOC/CLP	Naphthalene	91-20-3	1.4E-01	5.0E+00
SVOC/CLP	4-Chloroaniline	106-47-8	3.4E-01	5.0E+00
SVOC/CLP	Hexachlorobutadiene	87-68-3	8.6E-01	5.0E+00
SVOC/CLP	Caprolactam	105-60-2	1.8E+04	5.0E+00
SVOC/CLP	4-Chloro-3-methylphenol	59-50-7	NC	5.0E+00
SVOC/CLP	2-Methylnaphthalene	91-57-6	1.5E+02	5.0E+00
SVOC/CLP	Hexachlorocyclopentadiene	77-47-4	2.2E+02	5.0E+00
SVOC/CLP	2,4,6-Trichlorophenol	88-06-2	6.1E+00	5.0E+00
SVOC/CLP	2,4,5-Trichlorophenol	95-95-4	3.7E+03	5.0E+00
SVOC/CLP	1,1-Biphenyl	92-52-4	NC	5.0E+00
SVOC/CLP	2-Chloronaphthalene	91-58-7	2.9E+03	5.0E+00
SVOC/CLP	2-Nitroaniline	88-74-4	1.1E+02	1.0E+01
SVOC/CLP	4,6-Dinitro-2-methylphenol	534-52-1	3.7E+00	1.0E+01
SVOC/CLP	N-Nitrosodiphenylamine	86-30-6	1.4E+01	5.0E+00

QAPP WORKSHEET #15 (CONTINUED)
REFERENCE LIMITS AND EVALUATION TABLE

Analytical Group	Analyte	CAS Number	Project Action Limit – Water (µg/L)[1]	CRQL - Water (µg/L)
SVOC/CLP	1,2,4,5-Tetrachlorobenzene	95-94-3	1.1E+01	5.0E+00
SVOC/CLP	Hexachlorobenzene	118-74-1	4.2E-02	5.0E+00
SVOC/CLP	Dimethylphthalate	131-11-3	NC	5.0E+00
SVOC/CLP	2,6-Dinitrotoluene	606-20-2	3.7E+01	5.0E+00
SVOC/CLP	Acenaphthylene	208-96-8	NC	5.0E+00
SVOC/CLP	3-Nitroaniline	99-09-2	NC	1.0E+01
SVOC/CLP	Acenaphthene	83-32-9	2.2E+03	5.0E+00
SVOC/CLP	2,4-Dinitrophenol	51-28-5	7.3E+01	1.0E+01
SVOC/CLP	4-Nitrophenol	100-02-7	NC	1.0E+01
SVOC/CLP	Dibenzofuran	132-64-9	NC	5.0E+00
SVOC/CLP	2,4-Dinitrotoluene	121-14-2	2.2E-01	5.0E+00
SVOC/CLP	Diethylphthalate	84-66-2	2.9E+04	5.0E+00
SVOC/CLP	Fluorene	86-73-7	1.5E+03	5.0E+00
SVOC/CLP	4-Chlorophenyl-phenyl ether	7005-72-3	NC	5.0E+00
SVOC/CLP	4-Nitroaniline	100-01-6	3.4E+00	1.0E+01
SVOC/CLP	Atrazine	1912-24-9	2.9E-01	5.0E+00
SVOC/CLP	Pentachlorophenol	87-86-5	5.6E-01	1.0E+01
SVOC/CLP	Phenanthrene	85-014-8	NC	5.0E+00
SVOC/CLP	Anthracene	20-12-7	1.1E+04	5.0E+00
SVOC/CLP	Carbazole	86-74-8	NC	5.0E+00
SVOC/CLP	Di-n-butylphthalate	84-74-2	3.7E+03	5.0E+00
SVOC/CLP	Fluoranthene	206-44-0	1.5E+03	5.0E+00
SVOC/CLP	Pyrene	129-00-0	1.1E+03	5.0E+00
SVOC/CLP	Butylbenzylphthalate	85-68-7	3.5E+01	5.0E+00
SVOC/CLP	3,3’-Dichlorobenzidine	91-94-1	1.5E-01	5.0E+00
SVOC/CLP	Benzo(a)anthracene	56-55-3	2.9E-02	5.0E+00
SVOC/CLP	Chrysene	218-01-9	2.9E+00	5.0E+00
SVOC/CLP	Bis (2-ethylhexyl) phthalate	117-81-7	4.8E+00	5.0E+00
SVOC/CLP	Di-n-octylphthalate	117-84-0	NC	5.0E+00

QAPP WORKSHEET #15 (CONTINUED)
REFERENCE LIMITS AND EVALUATION TABLE

Analytical Group	Analyte	CAS Number	Project Action Limit – Water (µg/L)[1]	CRQL - Water (µg/L)
SVOC/CLP	Benzo(b)fluoranthene	205-99-2	2.9E-02	5.0E+00
SVOC/CLP	Benzo(k)fluoranthene	207-08-9	2.9E-01	5.0E+00
SVOC/CLP	Benzo(a)pyrene	50-32-8	2.9E-03	5.0E+00
SVOC/CLP	Indeno(1,2,3,-cd) pyrene	193-39-5	2.9E-02	5.0E+00
SVOC/CLP	Dibenzo(a,h) anthracene	53-70-3	2.9E-03	5.0E+00
SVOC/CLP	Benzo(g,h,i)perylene	191-24-2	NC	5.0E+00
SVOC/CLP	2,3,4,6-Tetrachlorophenol	58-90-03	1.1E+03	5.0E+00
PCB/CLP	Aroclor-1016	12674-11-2	9.6E-01	1.0E+00
PCB/CLP	Aroclor-1221	11104-28-2	6.8E-03	1.0E+00
PCB/CLP	Aroclor-1232	11141-16-5	6.8E-03	1.0E+00
PCB/CLP	Aroclor-1242	53469-21-9	3.4E-02	1.0E+00
PCB/CLP	Aroclor-1248	12672-29-6	3.4E-02	1.0E+00
PCB/CLP	Aroclor-1254	11097-69-1	3.4E-02	1.0E+00
PCB/CLP	Aroclor-1260	11096-82-5	3.4E-02	1.0E+00
PCB/CLP	Aroclor-1268	11100-14-4	3.4E-02	1.0E+00
Pesticides/CLP	alpha-BHC	319-84-6	1.1E-02	5.0E-02
Pesticides/CLP	beta-BHC	319-85-7	3.7E-02	5.0E-02
Pesticides/CLP	delta-BHC	319-86-8	3.7E-02	5.0E-02
Pesticides/CLP	gamma-BHC (Lindane)	58-89-9	6.1E-02	5.0E-02
Pesticides/CLP	Heptachlor	76-44-8	1.5E-02	5.0E-02
Pesticides/CLP	Aldrin	309-00-2	4.0E-03	5.0E-02

QAPP WORKSHEET #15 (CONTINUED)
REFERENCE LIMITS AND EVALUATION TABLE

Analytical Group	Analyte	CAS Number	Project Action Limit – Water (µg/L)[1]	CRQL - Water (µg/L)
Pesticides/CLP	Heptachlor epoxide	1024-57-3	7.4E-03	5.0E-02
Pesticides/CLP	Endosulfan	115-29-7	2.2E+02	5.0E-02
Pesticides/CLP	Dieldrin	60-57-1	4.2E-03	1.0E-01
Pesticides/CLP	4,4'-DDE	72-55-9	2.0E-01	1.0E-01
Pesticides/CLP	Endrin	72-20-8	1.1E+01	1.0E-01
Pesticides/CLP	Endosulfan II	115-29-7	2.2E+02	1.0E-01
Pesticides/CLP	4,4'-DDD	72-54-8	2.8E-01	1.0E-01
Pesticides/CLP	Endosulfan sulfate	115-29-7	2.2E+02	1.0E-01
Pesticides/CLP	4,4'-DDT	50-29-3	2.0E-01	1.0E-01
Pesticides/CLP	Methoxychlor	72-43-5	1.8E+02	5.0E-01
Pesticides/CLP	Endrin ketone	72-20-8	1.1E+01	1.0E-01
Pesticides/CLP	Endrin aldehyde	72-20-8	1.1E+01	1.0E-01
Pesticides/CLP	alpha-Chlordane	57-74-9	1.9E-01	5.0E-02
Pesticides/CLP	gamma-Chlordane	57-74-9	1.9E-01	5.0E-02
Pesticides/CLP	Toxaphene	8001-35-2	6.1E-02	5.0E+00
Metals/CLP	Aluminum	7429-90-5	3.7E+04	2.0E+02
Metals/CLP	Antimony	7440-36-0	1.5E+01	6.0E+01
Metals/CLP	Arsenic	7440-38-2	1.0E+01[2]	1.0E+01
Metals/CLP	Barium	7440-39-3	7.3E+03	2.0E+02
Metals/CLP	Beryllium	7440-41-7	7.3E+01	5.0E+00
Metals/CLP	Cadmium	7440-43-9	1.8E+01	5.0E+00
Metals/CLP	Calcium	17852-99-2	NC	5.0E+03
Metals/CLP	Chromium	7440-47-3	5.5E+04	1.0E+01
Metals/CLP	Cobalt	7440-48-4	1.1E_01	5.0E+01
Metals/CLP	Copper	7440-50-8	1.5E+03	2.5E+01
Metals/CLP	Iron	7439-89-6	2.6E+04	1.0E+02
Metals/CLP	Lead	7439-92-1	1.5E+01[2]	1.0E+01
Metals/CLP	Magnesium	7439-95-4	NC	5.0E+03

QAPP WORKSHEET #15 (CONTINUED)
REFERENCE LIMITS AND EVALUATION TABLE

Metals/CLP	Manganese	7439-96-5	8.8E+02	1.5E+01
Metals/CLP	Mercury	7439-97-6	1.1E+01	2.0E-01
Metals/CLP	Nickel	7440-02-0	7.3E+02	4.0E+01
Metals/CLP	Potassium	7440-22-4	NC	5.0E+03
Metals/CLP	Selenium	7782-49-2	1.8E+02	3.5E+01
Metals/CLP	Silver	7440-22-4	1.8E+02	1.0E+01
Metals/CLP	Sodium	7440-23-5	NC	5.0E+03
Metals/CLP	Thallium	7440-28-0	2.4E+00	2.5E+01
Metals/CLP	Vanadium	7440-62-2	1.8E+02	5.0E+01
Metals/CLP	Zinc	7440-66-6	1.8E+04	6.0E+01
Cyanide/CLP	Cyanide	74-90-8	7.3E+02	1.0E+01

Notes:

µg/L	Microgram per liter
CAS	Chemical Abstract Services
CRQL	Contract-required quantitation limit
NC	No criteria

1 U.S. EPA Regional Screening Levels for Chemical Contaminants at Superfund Sites, April 2009 (EPA 2009a). The tap water limits are listed.
2 Maximum contaminant level (MCL), EPA. 2006. Edition of the Drinking Water Standards and Health Advisories

QAPP WORKSHEET #15 (CONTINUED)
REFERENCE LIMITS AND EVALUATION TABLE

Reference Limits Table—Sub-Slab Vapor

Analytical Group	Analyte	CAS Number	Project Action Limit – Air ($\mu g/m^3$)[1]	PRQL - Air (ppbv)
VOC	Dichlorodifluoromethane	75-71-8	TBD	1.0E+00
VOC	Chloromethane	74-87-3	TBD	1.0E+00
VOC	Vinyl chloride	75-01-4	TBD	1.0E+00
VOC	Bromomethane	77-83-9	TBD	1.0E+00
VOC	Chloroethane	75-00-3	TBD	1.0E+00
VOC	Trichlorofluoromethane	75-69-4	TBD	1.0E+00
VOC	1,1-Dichloroethene	75-35-4	TBD	1.0E+00
VOC	Acetone	67-64-1	TBD	1.0E+01
VOC	Carbon disulfide	75-15-0	TBD	1.0E+00
VOC	Methyl acetate	79-20-9	TBD	1.0E+00
VOC	Methylene chloride	75-09-2	TBD	1.0E+00
VOC	trans-1,2-Dichloroethene	156-50-5	TBD	1.0E+00
VOC	Methyl tert-butyl ether	1634-04-4	TBD	1.0E+00
VOC	1,1-Dichloroethane	75-34-3	TBD	1.0E+00
VOC	cis-1,2-Dichloroethene	156-59-2	TBD	1.0E+00
VOC	2-Butanone	78-93-3	TBD	1.0E+01
VOC	Bromochloromethane	74-97-5	TBD	1.0E+00
VOC	Chloroform	67-66-3	TBD	1.0E+00
VOC	1,1,1-Trichloroethane	71-55-6	TBD	1.0E+00
VOC	Cyclohexane	110-82-7	TBD	1.0E+00
VOC	Carbon tetrachloride	56-23-5	TBD	1.0E+00
VOC	Benzene	71-43-2	TBD	1.0E+00
VOC	1,2-Dichloroethane	107-06-2	TBD	1.0E+00
VOC	1,4-Dioxane	123-91-1	TBD	1.0E+02
VOC	Trichloroethene	79-01-6	TBD	1.0E+00
VOC	Methylcyclohexane	108-87-2	TBD	1.0E+00
VOC	1,2-Dichloropropane	78-87-5	TBD	1.0E+00
VOC	Bromodichloromethane	75-27-4	TBD	1.0E+00
VOC	cis-1,3-Dichloropropene	542-75-6	TBD	1.0E+00
VOC	4-Methyl-2-pentanone	108-10-1	TBD	1.0E+01
VOC	Toluene	108-88-3	TBD	1.0E+00

QAPP WORKSHEET #15 (CONTINUED)
REFERENCE LIMITS AND EVALUATION TABLE

Analytical Group	Analyte	CAS Number	Project Action Limit – Air ($\mu g/m^3$)[1]	PRQL - Air (ppbv)
VOC	trans-1,3-Dichloropropene	10061-02-6	TBD	1.0E+00
VOC	1,1,2-Trichloroethane	79-00-5	TBD	1.0E+00
VOC	Tetrachloroethene	127-18-4	TBD	1.0E+00
VOC	2-Hexanone	591-78-6	TBD	1.0E+01
VOC	Dibromochloromethane	124-48-1	TBD	1.0E+00
VOC	1,2-Dibromoethane	106-93-4	TBD	1.0E+00
VOC	Chlorobenzene	108-90-7	TBD	1.0E+00
VOC	Ethylbenzene	100-41-4	TBD	1.0E+00
VOC	o-Xylene	95-47-6	TBD	1.0E+00
VOC	m,p-Xylene	179601-23-1	TBD	1.0E+00
VOC	Styrene	100-42-5	TBD	1.0E+00
VOC	Bromoform	75-25-2	TBD	1.0E+00
VOC	1,1,2,2-Tetrachloroethane	79-34-5	TBD	1.0E+00
VOC	1,3-Dichlorobenzene	541-73-1	TBD	1.0E+00
VOC	1,4-Dichlorobenzene	106-46-7	TBD	1.0E+00
VOC	1,2-Dichlorobenzene	95-50-1	TBD	1.0E+00
VOC	1,2-Dibromo-3-chloropropane	96-12-8	TBD	1.0E+00
VOC	Hexachlorobutadiene	87-68-3	TBD	1.0E+00
VOC	1,2,4-Trichlorobenzene	120-82-1	TBD	1.0E+00
VOC	1,2,3-Trichlorobenzene	87-61-6	TBD	1.0E+00

Notes:

$\mu g/m^3$	Microgram per cubic meter
ppbv	Parts per billion by volume
CAS	Chemical Abstract Services
PRQL	Project-required quantitation limit
NC	No criteria

[1] TBD - To be determined - action levels will be presented in SAP addendum.
[2] Data obtained from Agency for Toxic Substances and Disease Registry (ATSDR 2008) for residential air, modified by the same attenuation factor of 0.1.

QAPP WORKSHEET #16
PROJECT SCHEDULE/TIMELINE TABLE

(UFP QAPP Section 2.8.2)
List all project activities as well as the QA assessments that will be performed during the course of the project. Include the anticipated start and completion dates.

Activity	Organization	Date		Deliverable	Deliverable Due Date
		Anticipated Date of Initiation	Anticipated Date of Completion		
Field sampling[1]	SulTRAC	July 2010	January 2011[2]	Phase I FSP Phase I QAPP	30 days after Phase I work plan approval
Data evaluation[1]	SulTRAC	August 2010	May 2011[2]	Phase I Data Evaluation Summary Report	45 days after receipt of Phase I validated data

Note:

[1] Field sampling and data evaluation will occur after each sampling event.
[2] Completion date based upon availability of subcontractors and SAP approval for July 2010

QAPP WORKSHEET #17
SAMPLING DESIGN AND RATIONALE

(UFP QAPP Section 3.1.1)
Describe the project sampling approach. Provide the rationale for selecting sample locations and matrices for each analytical group and concentration level.

Describe the sampling design and rationale in terms of what matrices will be sampled, what analytical groups will be analyzed and at what concentration levels, the sampling locations (including QC, critical, and background samples), the number of samples to be collected, and the sampling frequency (including seasonal considerations). (May refer to map or Worksheet #18 for details).
SulTRAC will complete a baseline inspection, survey and sampling of 19 existing monitoring wells: 13 existing Ohio EPA monitoring wells and six City of Troy monitoring wells. A total of 14 groundwater samples collected from the baseline survey will be analyzed for volatile organic compounds (VOC) only and five samples will be analyzed for (TAL metals) (including mercury and cyanide), VOC, semi-volatile organic compounds (SVOC), polychlorinated biphenyls (PCB), and pesticides. The baseline samples will be analyzed by the United States Environmental Protection Agency's (EPA) Central Laboratory Program (CLP). SulTRAC will also split groundwater samples from 5 locations during at least one quarterly monitoring event at the Spinnaker site. The samples will be analyzed for VOCs through the EPA CLP. These data will be used to focus subsequent Phase I investigation activities. SulTRAC will collect groundwater samples at the top of the uppermost aquifer at 10 of the soil boring locations; SulTRAC will conduct vertical aquifer sampling (VAS) of the upper aquifer at seven locations and collect groundwater samples for VOC analysis at various depths; SulTRAC will install up to 12 additional monitoring wells west of the Great Miami River at depths to be determined by the results of the VAS program; SulTRAC will install a cluster of one shallow and one deep monitoring well east of the Great Miami River to evaluate whether sources exist east of the river that are contributing to the contamination. SulTRAC will use direct-push techniques for VAS wells, collecting up to six groundwater samples from two of the locations, and up to three groundwater samples from the remaining five locations; analyses will be rapid-turnaround for VOCs using a local laboratory with the objective of supporting field decisions regarding well screen depths. SulTRAC will conduct geological investigations by drilling 30 soil borings and collecting surface and subsurface soil samples in the area west of the Great Miami River. These borings include background locations and possibly borings along the sanitary sewer alignment. Up to 70 soil samples will be collected from 30 soil boring locations (two samples per boring). Seven of the 70 soil samples will be analyzed for TAL metals (including mercury and cyanide), VOCs, SVOCs, PCBs, and pesticides. The remaining soil samples will be analyzed for VOCs only. These samples will be analyzed through EPA's CLP. A comprehensive round of groundwater samples will be collected at all monitoring wells (the 19 wells included in the baseline sampling plus the 14 new wells installed during Phase I of the Remedial Investigation [RI]). Groundwater elevations and stream surface water elevations will be measured at all wells and staff gauges. Four samples will be analyzed for TAL metals (including mercury and cyanide), VOCs, SVOCs, PCBs, and pesticides. The remaining samples will be analyzed only for VOCs. SulTRAC will collect four surface water and four sediment samples from the Great Miami River. The hydraulic interaction between the river and the aquifer will also be evaluated. Two surface water samples and two sediment samples will be analyzed for TAL metals (including mercury and cyanide), VOCs, SVOCs, PCBs, and pesticides. The remaining samples will be analyzed for VOCs only. All sediment and surface water samples will be analyzed through EPA's CLP.

QAPP WORKSHEET #17 (CONTINUED)
SAMPLING DESIGN AND RATIONALE

SulTRAC will conduct sub-slab vapor monitoring for VOCs at an estimated 30 locations; locations to be sampled will be selected based on the results of the Phase I soil and groundwater investigations, with emphasis on locations within the defined plume area not previously sampled or areas where additional followup to EPA's TCRA is necessary (locations that were not accessible or require followup to document performance of ventilation systems.). The sub-slab vapor sample analysis will include the full list of analytes listed in EPA Method TO-15. Procedures, sampling locations and analytical methodologies will be confirmed as data, and pending guidance, become available during Phase I of the RI and will be presented in a SAP addendum.

SulTRAC will assess data from the soil, surface water, sediment, and groundwater samples for the analytical groups listed above to delineate the contamination present at the East Troy Site.

Notes:

CRL	Central Regional Laboratory
CLP	Contract Laboratory Program
EPA	Environmental Protection Agency
PCB	Polychlorinated biphenyl
SVOC	Semi-volatile organic compound
VAS	Vertical aquifer sampling
VOC	Volatile organic compound

QAPP WORKSHEET #18
SAMPLING LOCATIONS/IDS, SAMPLE DEPTHS, SAMPLE ANALYSES AND SAMPLING PROCEDURES TABLE

(UFP QAPP Section 3.1.1)
List all locations that will be sampled indicating the sample identity (ID) number or sample location. Specify sample matrix and depth at which samples will be taken. List all analyses the samples will be analyzed for.
Specify the appropriate SOP or specific section in the SAP that describes the sample collection procedure.

Sampling Location/ ID Number	Matrix	Depth (feet bgs)	Analytical Group	Sampling SOP Reference
27 locations (up to 3 depths each)	Soil[1,2,3]	Will be based on inspection[1]	CLP SOW SOM01.2 (VOCs)	S-1
3 locations (2 depths each) Soil borings		0-2. 8-10[1]	CLP SOW SOM01.2 (VOCs, SVOCs, Pesticides, and PCBs) CLP SOW ILM05.4 (TAL metals, mercury, and cyanide)	
2 locations	Sediment[5]	Surface	CLP SOW SOM01.2 (VOCs)	S-2
2 locations Great Miami River			CLP SOW SOM01.2 (VOCs, SVOCs, Pesticides, and PCBs) CLP SOW ILM05.4 (TAL metals, mercury, and cyanide)	
2 locations	Surface Water[5]	0-1	CLP SOW SOM01.2 (VOCs)	S-6
2 locations Great Miami River			CLP SOW SOM01.2 (VOCs, SVOCs, Pesticides and PCBs) CLP SOW ILM05.4 (TAL metals, mercury, and cyanide)	
14 locations	Groundwater[2,4]	Various	CLP SOW SOM01.2 (VOCs)	S-5
5 locations Baseline sampling of existing monitoring wells			CLP SOW SOM01.2 (VOCs, SVOCs, Pesticides, and PCBs) CLP SOW ILM05.4 (TAL metals, mercury, and cyanide)	

QAPP WORKSHEET #18 (CONTINUED)
SAMPLING LOCATIONS/IDS, SAMPLE DEPTHS, SAMPLE ANALYSES AND SAMPLING PROCEDURES TABLE

Sampling Location/ ID Number	Matrix	Depth (feet bgs)	Analytical Group	Sampling SOP Reference
5 locations Split groundwater samples at Spinnaker site	Groundwater [4]	Various	CLP SOW SOM01.2 (VOCs)	S-5
7 locations Soil borings for VAS	Groundwater (VAS)[2,3]	Various; maximum of 90 feet or top of aquitard[1]	EPA Method 8260 (VOCs)	S-5
10 Locations	Groundwater (Soil Borings) [2,3]	Top of aquifer [1]	EPA Method 8260 (VOCs)	S-5
29 locations (Existing and new wells) 4 locations (New monitoring wells only) Comprehensive groundwater sampling	Groundwater[2,4]	Various	CLP SOW SOM01.2 (VOCs) CLP SOW SOM01.2 (VOCs, SVOCs, Pesticides and PCBs) CLP SOW ILM05.4 (TAL metals, mercury, and cyanide)	S-5
30 locations Sub-slab vapor	Sub-Slab Vapor	1[6]	Method TO-15 (VOCs)	S-9 and S-10

Notes:

CLP	Contract Laboratory Program
ID	Identification
SOW	Statement of Work
VAS	Vertical Aquifer Sampling

[1] Sampling depths and locations will be determined based on geologic characteristics, and evidence of contamination (visual, PID readings, odors, or analytical data, as applicable)

[2] See Figure 5 for sampling locations.

[3] Samples will be collected from direct-push advanced borings.

[4] Samples will be collected from monitoring wells.

[5] Samples will be collected from the Great Miami River (see Figure 6)

[6] Sample locations will be within the boundaries of the chlorinated VOC groundwater plume, and determined based on the results of the Phase I soil and groundwater investigations.

QAPP WORKSHEET #19
ANALYTICAL METHODS, CONTAINERS, PRESERVATIVES, AND HOLDING TIMES TABLE

(UFP QAPP Section 3.1.1)
For each matrix and analytical group list the analytical and preparation method and associated container specifications, preservation requirements, and maximum holding time.

Matrix	Analytical Group	Analytical and Preparation Method	Containers (number, size, type)	Preservation Requirements (chemical, temperature, etc.)	Maximum Holding Time (preparation/analysis)[1]
Soil, Sediment	VOCs	CLP SOW SOM01.2	Three 40-mL glass containers with PTFE-lined septa and open-top screw caps, pre-weighted and containing magnetic stir bars, and one 2 ounce container of sample filled with no headspace for determination of moisture content.	Cool to 4 °C ± 2 °C immediately after collection	48 hours to preservation at laboratory/14 days for analysis following preservation
Soil, Sediment	SVOCs	CLP SOW SOM01.2	Two 4- or one 8-ounce wide-mouth glass jars	Cool to 4 °C ± 2 °C immediately after collection	14 days/40 days
Soil, Sediment	PCBs	CLP SOW SOM01.2	Two 4- or one 8-ounce wide-mouth glass jars	Cool to 4 °C ± 2 °C immediately after collection	14 days/30 days
Soil, Sediment	Pesticides	CLP SOW SOM01.2	Two 4- or one 8-ounce wide-mouth glass jars	Cool to 4 °C ± 2 °C immediately after collection; keep away from light	14 days/30 days
Soil, Sediment	TAL metals (including mercury and cyanide)	CLP SOW ILM05.4	Two 4- or one 8-ounce wide-mouth glass jars	Cool to 4 °C ± 2 °C immediately after collection	NA/6 months (Metals & Hg) 14 days/14 days (CN)

QAPP WORKSHEET #19 (CONTINUED)
ANALYTICAL METHODS, CONTAINERS, PRESERVATIVES, AND HOLDING TIMES TABLE

Matrix	Analytical Group	Analytical and Preparation Method	Containers (number, size, type)	Preservation Requirements (chemical, temperature, etc.)	Maximum Holding Time (preparation/analysis) [1]
Water	VOCs	CLP SOW SOM01.2, SW-846 Method 8260	Three 40-mL glass vials with PTFE-lined septa and open-top screw caps	No headspace; cool to 4 ºC ± 2 ºC; adjust pH to less than 2 with HCl	7 days/14 days
Water	SVOCs	CLP SOW SOM01.2	Two 1-liter amber glass bottles fitted with PTFE-lined screw caps	Cool to 4 °C ± 2 °C immediately after collection	7 days/40 days
Water	PCBs	CLP SOW SOM01.2	Two 1-liter amber glass bottles fitted with PTFE-lined screw caps	Cool to 4 °C ± 2 °C immediately after collection; keep away from light	7 days/40 days
Water	Pesticides	CLP SOW SOM01.2	Two 1-liter amber glass bottles fitted with PTFE-lined screw caps	Cool to 4 °C ± 2 °C immediately after collection; keep away from light	7 days/40 days
Water	TAL metals, including mercury	CLP SOW ILM05.4	One 1-liter high-density polyethylene bottle with polyethylene-lined caps Particulate metal sample: use a 0.45-µm size filter	Acidify to pH < 2 with HNO_3 and cool to 4 ˚C (±2 ˚C) immediately after collection	6 months/28 days
Water	Cyanide	CLP SOW ILM05.4	One 1-liter high-density polyethylene bottle with polyethylene-lined caps	NaOH to pH>12 and cool to 4 ˚C (±2 ˚C) immediately after collection	14 days/14 days
Sub-Slab Vapor	VOCs	TBD	TBD	TBD	TBD

Notes:

HCl	Hydrochloric acid
HNO_3	Nitric acid
mL	Milliliter
NA	Not applicable
PTFE	Polytetrafluoroethylene
kPa	Kilopascal
TBD	To be determined; methodology will be presented in SAP addendum
1	Holding time is applicable from validated time of sample receipt and is measured to time of sample extraction and analysis.

QAPP WORKSHEET #20
FIELD QUALITY CONTROL SAMPLE SUMMARY TABLE

(UFP QAPP Section 3.1.1)
Summarize by matrix and analytical group.

Matrix	Analytical Group	Analytical and Preparation SOP Reference[1]	No. of Sampling Locations	No. of Samples	No. of Field Duplicates[2]	No. of MS/MSDs[3]	No. of Trip Blanks[4]	No. of Equipment Rinsates	Total No. of Samples to Laboratory
Soil	CLP VOCs	A-1	27	63	7	3	2	2	74
Soil	CLP SVOCs	A-1	3	7	1	1	0	1	9
Soil	CLP PCBs	A-1	3	7	1	1	0	1	9
Soil	CLP Pesticides	A-1	3	7	1	1	0	1	9
Soil	CLP Metals (with cyanide and mercury)	A-2	3	7	1	1	0	1	9
Groundwater (Existing and new wells) [5]	VOCs	A-1	38	57	6	3	3	2	70
Groundwater (VAS)[6]	VOCs	A-4	7	27	3	2	3	1	34
Groundwater Soil borings[6]	VOCs	A-4	10	10	1	1	1	1	13
Groundwater[7]	CLP SVOCs	A-1	9	9	1	1	0	1	11
Groundwater[7]	CLP PCBs	A-1	9	9	1	1	0	1	11
Groundwater[7]	CLP Pesticides	A-1	9	9	1	1	0	1	11
Groundwater[7]	CLP Metals (with cyanide and mercury)	A-2	9	9	1	1	0	1	11
Sediment	CLP VOCs	A-1	4	4	1	1	0	1	6
Sediment	CLP SVOCs	A-1	2	2	1	1	0	1	4

QAPP WORKSHEET #20 (CONTINUED)
FIELD QUALITY CONTROL SAMPLE SUMMARY TABLE

Matrix	Analytical Group	Analytical and Preparation SOP Reference[1]	No. of Sampling Locations	No. of Samples	No. of Field Duplicates[2]	No. of MS/MSDs[3]	No. of Trip Blanks[4]	No. of Equipment Rinsates	Total No. of Samples to Laboratory
Sediment	CLP PCBs	A-1	2	2	1	1	0	1	4
Sediment	CLP Pesticides	A-1	2	2	1	1	0	1	4
Sediment	CLP Metals (with cyanide and mercury)	A-2	2	2	1	1	0	1	4
Surface Water	CLP VOCs	A-1	4	4	1	1	0	1	6
Surface Water	CLP SVOCs	A-1	2	2	1	1	0	1	4
Surface Water	CLP PCBs	A-1	2	2	1	1	0	1	4
Surface Water	CLP Pesticides	A-1	2	2	1	1	0	1	4
Surface Water	CLP Metals (with cyanide and mercury)	A-2	2	2	1	1	0	1	4
Sub-slab vapor	VOCs	A-3	TBD	TBD	TBD	NA[8]	0	0	TBD

Notes:

Sample numbers in this table reflect field QC samples collected during each sampling event.

[1] Analytical and preparation SOPs are listed in Worksheet #23.
[2] Field duplicates are collected at a rate of 1 per 10 investigative samples of the same matrix.
[3] MS/MSD samples are collected at a rate of 1 per 20 investigative samples of the same matrix. MS/MSDS consist of extra sample volume and are not included in the total number of samples.
[4] A trip blank will be provided with each shipping container with samples to be analyzed for VOCs.
[5] Groundwater samples include baseline sampling of existing wells and comprehensive sampling of existing and new wells
[6] Groundwater samples collected from VAS and selected soil borings
[7] Groundwater samples from selected new monitoring wells
[8] MS/MSD samples are not applicable to sub-surface vapor samples collected by Summa canisters
TBD To be determined; methodology will be presented in SAP addendum

QAPP WORKSHEET #21
PROJECT SAMPLING SOP REFERENCES TABLE

(UFP Section 3.1.2)
List all SOPs associated with project sampling including, but not limited to, sample collection, sample preservation, equipment cleaning and decontamination, equipment testing, inspection and maintenance, supply inspection and acceptance, and sample handling and custody. Include copies of the SOPs as attachments or reference all in the QAPP. Sequentially number sampling SOP references in the Reference Number column. The reference number can be used throughout the QAPP to refer to a specific SOP.

Reference Number	Title, Revision, Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comments
S-1	Soil Sampling, SOP 005	Tetra Tech EM Inc.	Spoon or spatulas, trowel, split-spoon sampler, coring tools	N	None
S-2	Sediment Sampling, Refer to Section 5.3 in Field Sampling Plan	Tetra Tech EM Inc.	Shelby tube drive head, probe drive Geoprobe Systems	N	None
S-3	Monitoring Well Installation, SOP 020	Tetra Tech EM Inc.	Casing materials, well screen materials, filter pack materials, annular sealant, grouting materials, tremie pipe, surface completion and protective casing materials, concrete surface pad and bumper post, uncontaminated water	N	None
S-4	Monitoring Well Development, SOP 021	Tetra Tech EM Inc.	Pumps, air compressors, bailers, surge blocks	N	None

QAPP WORKSHEET #21 (CONTINUED)
PROJECT SAMPLING SOP REFERENCES TABLE

Reference Number	Title, Revision, Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comments
S-5	Groundwater Sample Using Micropurge Technology, SOP 015	Tetra Tech EM Inc.	PID, water level indicator, adjustable flow rate pump, discharge flow controller, flow-through cell, pH probe, dissolved oxygen probe, turbidity meter, oxidation and reduction probe, sampling containers.	N	None
S-6	Surface Water Sampling, SOP 009	Tetra Tech EM Inc.	Sample bottles, dipper, or other device made of inert material (stainless steel or Teflon)	N	None
S-7	Packaging and Shipping Samples, SOP 019-5	Tetra Tech EM Inc.	Cooler, chain of custody form, shipping materials	N	None
S-8	General Equipment Decontamination, SOP 002	Tetra Tech EM Inc.	Scrub brushes, large wash tubs or buckets, alconox, distilled water	N	None

Notes:

EPA	Environmental Protection Agency
REAC	Response Engineering and Analytical Contract
SOP	Standard Operation Procedure

SOPs applicable to sub-slab vapor monitoring will be presented in SAP addendum

QAPP WORKSHEET #22
FIELD EQUIPMENT CALIBRATION, MAINTENANCE, TESTING, AND INSPECTION TABLE

(UFP QAPP Section 3.1.2.4)

Identify all field equipment/instruments that require calibration, maintenance, testing, or inspection activities. Specify the frequency of each activity, acceptance criteria, and corrective action requirements. Provide the SOP reference number for each type of equipment, if available.

Field Equipment	**Calibration Activity**[1]	**Frequency**	**Acceptance Criteria**	**Corrective Action**	**Responsible Person**	**SOP Reference**	**Comments**
Multiparameter Water Quality Meter[1,2]	Oxidation-reduction potential: 2 standard solutions pH: 2 standard solutions Conductivity: 1 standard solution Temperature: no standard solution Turbidity: 2 standard solutions Dissolved oxygen: 2 standard solutions	Daily before first field measurement and after final field measurement	± 10 millivolts ± 0.01 pH unit ± 3% ± 0.1 °C ± 10% ± 10%	Repeat calibration; correct measurements for drift if necessary	Field team leader or field team members	Groundwater Sampling, SOP 010, Revision 4 Groundwater Sample Collection Using Micropurge Technology, SOP 015, Revision No. 0 Field Measurement of Groundwater Indicator Parameters, SOP 061, Revision No. 2	See note below
PID[2]	Gas calibration standard or equivalent	Daily before first field measurement	10% of reading < 2,000 ppm 20% of reading > 2,000 ppm	Repeat calibration; correct measurements for drift if necessary	Field team leader or field team members	Organic Vapor Air Monitoring, SOP 003, Revision No. 2	None

Notes:

SulTRAC will measure water temperature, pH, turbidity, dissolved oxygen, and specific conductance in purged groundwater until these parameters have stabilized within the identified tolerance.

Ppm Part per million
SOP Standard operating procedure

[1] The field equipment will be calibrated per manufacturer's instructions.
[2] Standard solutions will be provided by the vendor to calibrate this instrument.

QAPP WORKSHEET #23
ANALYTICAL SOP REFERENCES TABLE

(UFP QAPP Section 3.2.1)
List all SOPs that will be used to perform on-site or off-site analysis. Indicate whether the procedure produces screening or definitive data. Sequentially number analytical SOP references in the reference number column. The reference number can be used throughout the QAPP to refer to a specific SOP. Include copies of the SOPs as attachments or reference in the QAPP.

Reference Number	Title, Revision, Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?
A-1	CLP SOW SOM01.2 for Organics Analysis, Multi-Media, Multi-Concentration	Definitive	VOCs, SVOCs	GC/mass spectroscopy	CLP Laboratory	No
A-1	CLP SOW SOM01.2 for Organics Analysis, Multi-Media, Multi-Concentration	Definitive	PCBs, Pesticides	GC/electron capture detector	CLP Laboratory	No
A-2	CLP SOW ILM05.4 for Inorganic Analysis, Multi-Media, Multi-Concentration	Definitive	Metals and cyanide	ICP/AES ICP/mass spectroscopy Cold vapor atomic absorption	CLP Laboratory	No
A-3	Method TO15 for Volatile Organics Analysis in Air*	Definitive	VOCs	GC/mass spectroscopy	CRL Laboratory	No
A-4	SW-846 Method 8260	Definitive	VOCs	GC/mass spectroscopy	Subcontractor laboratory	No

Notes:

CLP	Contract Laboratory Program
CRL	Contract Regional Laboratory
AES	Atomic emission spectroscopy
ICP	Inductively coupled plasma
SOW	Statement of work
VOC	Volatile organic compound
SVOC	Semi-volatile organic compound
PCB	Polychlorinated biphenyl
*	To be determined; methodology will be presented in SAP addendum

QAPP WORKSHEET #24
ANALYTICAL INSTRUMENT CALIBRATION TABLE

(UFP Section 3.2.2)

Identify all analytical instrumentation that requires calibration and provide the SOP reference number for each. In addition, document the frequency, acceptance criteria, and corrective action requirements on the worksheet.

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
GC/Mass Spectroscopy (Soil & Water analysis)	VOCs: Run five calibration standard solutions and a blank SVOCs: Run five calibration standard solutions and a blank	12-hour continuing calibration acceptance criteria	Always, RRF ≥ 0.010 or per SOP Initial, RSD ≤ 20% or 40%, depending on compound. Continuing, %D ≤ 25 or 40 depending on compound.	Inspect the system for problems, clean the ion source, change the column, service the purge and trap device, and take corrective actions to achieve the technical acceptance criteria.	CLP, Subcontracted Laboratory Analysts	A-1, A-4
GC/Mass Spectroscopy (Gas analysis)	VOCs: Run five calibration standard solutions and a blank	24-hour continuing calibration acceptance criteria. If the daily calibration acceptance criteria have not been met, calibrate after corrective action has been taken.	The calculated %RSD for the RRF must be less than 30% with at most two exceptions up to a limit of 40% depending on compound. The %D for each target compound in a daily calibration sequence must be within ±30 percent depending on compound.	Inspect the system for problems, clean the ion source, change the column, service the purge and trap device, and take corrective actions to achieve the technical acceptance criteria.	CRL Laboratory Analyst	A-3

QAPP WORKSHEET #24 (CONTINUED)
ANALYTICAL INSTRUMENT CALIBRATION TABLE

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
GC/Electron Capture Detector	Pesticides: Run five calibration standard solutions and a blank PCBs: Run five calibration standard solutions and a blank	12-hour continuing calibration acceptance criteria	Always, resolution per SOP Initial, CF RSD ≤ 20% Continuing, CF %D ≤ 15 for opening and ≤ 50 for closing	Inspect the system for problems, change the column, bake out the detector, clean the injection port, and take other corrective actions to achieve the acceptance criteria.	CLP Laboratory Analyst	A-1
ICP/AES ICP/MS CVAA	Run five calibration mixed standard solutions and a blank	Each CCV analyzed shall reflect the conditions of analysis of all associated analytical samples (the preceding 10 analytical samples or the preceding analytical samples up to the previous CCV)	Deviation from the initial calibration verification: metals 90-110%	Inspect the system for problems, clean the system, verify operating conditions, and take CAs to achieve the technical acceptance criteria.	CLP Laboratory Analyst	A-2
Spectrophotometer (Cyanide)	Run at least three calibration standard solutions and a blank	A CCV will be analyzed after every 10 samples or after 2 hours, whichever is more frequent.	Deviation from the initial calibration verification: 70 to 130 percent.	Inspect the system for problems, clean the system, verify operating conditions, and take CAs to achieve the technical acceptance criteria.	CLP Laboratory Analyst	A-2

Notes:

%D	Percent difference
CVAA	Cold-vapor atomic absorption
CCV	Continuing calibration verification
CF	Calibration factor
NA	Not available
RRF	Relative response factor
RSD	Relative standard deviation

[1] See Worksheet #23 for identification of analytical methods.

QAPP WORKSHEET #25
ANALYTICAL INSTRUMENT AND EQUIPMENT MAINTENANCE TESTING, AND INSPECTION TABLE

(UFP QAPP Section 3.2.2)
Identify all analytical instrumentation that requires maintenance, testing, or inspection and provide the SOP reference number for each. In addition, document the frequency, acceptance criteria, and corrective action requirements on the worksheet.

Instrument/ Equipment	Maintenance Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action (CA)	Responsible Person	SOP Reference[1]
GC/Mass Spectroscopy	Daily Check, Instrument tune (4-bromofluorobenzene or decafluorotriphenylphosphine)	Injector syringe, injector septum, injector liner/seal, injector port, guard column, column splitter, analytical column, ion source, detector, traps, and gas supply	See A-1, A-3 and A-4	See A-1, A-3 and A-4	Inspect the system for problems, clean the ion source, change the column, and service the purge and trap device.	CLP Laboratory Analyst	A-1 and A-3
GC/Electron Capture Detector	Daily Check, Initial Calibration Verification	Injector syringe, injector septum, injector liner/seal, injector port, guard column, column splitter, analytical column, ion source, detector, traps, and gas supply	See A-1	See A-1	Inspect the system for problems, change the column, bake out the detector, and clean the injection port.	CLP Laboratory Analyst	A-1
ICP/AES ICP/MS CVAA	Daily Check, Initial Calibration Verification	Nebulizer, injection tube, flame optimization, gas supply, and detector	See A-2	See A-2	Inspect the system for problems, clean the system, verify operating conditions, and take corrective actions to achieve the technical acceptance criteria.	CLP Laboratory Analyst	A-2
Spectrophotometer (Cyanide)	Daily Check, Initial calibration verification	Connections, valves/flow rates, temperature settings, and other items specified by instrument manufacturer.	See A-2	See A-2	Inspect the system for problems, clean the system, verify operating conditions, and take corrective actions to achieve the technical acceptance criteria.	CLP Laboratory Analyst	A-2

Note:

1 See Worksheet #23 for identification of analytical methods.

QAPP WORKSHEET #26
SAMPLE HANDLING SYSTEM

(UFP QAPP Appendix A)
Record personnel, and their organizational affiliations, who are primarily responsible for ensuring proper handling, custody, and storage of field samples from the time of collection, to laboratory delivery, to final sample disposal. Indicate the number of days field samples and their extracts/digestates will be archived prior to disposal.

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT

Sample Collection (Personnel/Organization): Field sampling personnel/SulTRAC

Sample Packaging (Personnel/Organization): Field sampling personnel/SulTRAC

Coordination of Shipment (Personnel/Organization): Field sampling personnel, analytical coordinator/SulTRAC

Type of Shipment/Carrier: Cooler packed with ice and packing material such as bubble wrap/FedEx or other overnight courier; Summa canister samples should be shipped in original packaging as received from the laboratory and do not need to be cooled with ice

SAMPLE RECEIPT AND ANALYSIS

Sample Receipt (Personnel/Organization): Laboratory personnel/CLP laboratory, CRL laboratory, and subcontracted laboratory

Sample Custody and Storage (Personnel/Organization): Laboratory personnel/CLP laboratory, CRL laboratory, and subcontracted laboratory

Sample Preparation (Personnel/Organization): Laboratory personnel/CLP laboratory, CRL laboratory, and subcontracted laboratory

Sample Determinative Analysis (Personnel/Organization): Laboratory personnel/CLP laboratory, CRL laboratory, and subcontracted laboratory

SAMPLE ARCHIVING

Field Sample Storage (No. of days from sample collection): See Worksheet # 27

SAMPLE DISPOSAL

Personnel/Organization: Laboratory personnel/CLP laboratory, CRL laboratory, and subcontracted laboratory

Number of Days from Analysis: To be determined (or in accordance with individual laboratory SOP)

QAPP WORKSHEET #27
SAMPLE CUSTODY REQUIREMENTS

(UFP Appendix A)

Describe the procedures that will be used to maintain sample custody and integrity. Include examples of chain of custody forms, traffic reports, sample identification, custody seals, laboratory sample receipt forms, and laboratory sample transfer forms. Attach or reference applicable SOPs.

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to the laboratory): SulTRAC will use EPA's Field Operations and Records Management System (FORMS II Lite) software to manage sample collection, documentation, chain-of-custody (COC), and reporting for the CLP/CRL samples. Field personnel will input data into FORMS II Lite and then use the software to generate sample labels, bottle tags, and chain-of-custody forms to track samples from the field to the laboratory.

For groundwater samples that will not be analyzed through EPA CRL or the CLP, the CLP Forms-II Lite requirements will not apply. For these samples, SulTRAC will use laboratory-provided COC forms that require the same level of information as the EPA Forms-II Lite-generated COC forms, with the exception of the CLP-specific information (CLP case number, CLP sample numbers, and sample tag numbers).

COC forms will be signed in ink by the samplers and the individual relinquishing custody. SulTRAC will then follow the sample packaging and shipment procedures summarized below to ensure that samples arrive at the laboratory with the chain of custody intact.

1- Immediately after sample collection, sample containers will be labeled with the appropriate identifiers. Clear tape will be placed over the sample container's labels to prevent smearing.

2- The samples will be placed in Ziploc plastic bags and then in a cooler containing double-sealed bags of ice and maintained at 4 degrees Celsius (^{o}C). The cooler will remain in a secured area or in view of the sampler until it is properly sealed for shipment to the laboratory. (Note: Ice is not required for Summa canister samples).

3- Prior to shipping, the chain-of-custody forms, airbills, and all other relevant documents will be completed. Chain-of-custody forms will be sealed in plastic bags and taped to the inside of the cooler lid. Cushioning material, such as bubble-wrap, will be placed in the cooler.

4- A temperature blank consisting of a jar or vial containing water will be included in every cooler to be used by the laboratory to determine the cooler temperature at the time of sample receipt. (Note: A temperature blank is not required for Summa canister samples).

5- The shipping cooler will then be sealed with tape and custody seals in a manner that will indicate whether the cooler was opened. The preferred procedure includes placement of custody seals at diagonally opposite corners of the cooler. The custody seals will be covered with clear plastic tape or strapping tape.

The field sampler is personally responsible for the care and custody of the samples until they are transferred to other personnel or properly dispatched to an overnight carrier or directly to a laboratory. When transferring possession of the samples, the individuals relinquishing and receiving the samples sign, date, and note the time of transfer on the chain-of-custody form. Commercial carriers are not required to sign off on the chain-of-custody form as long as the form is sealed inside the sample cooler and the custody seals remain intact.

QAPP WORKSHEET #27 (CONTINUED)
SAMPLE CUSTODY REQUIREMENTS

Laboratory Sample Custody Procedures (receipt of samples, archiving, disposal): The laboratory sample custodian will receive all incoming samples and indicate receipt by signing the accompanying custody forms and retaining copies of the signed forms as permanent records. The laboratory sample custodian will record all pertinent information concerning the sample, including the persons delivering and receiving the sample, the date and time received, the method by which the sample was transmitted to the laboratory, sample condition at the time of receipt (sealed, unsealed, or broken container; temperature; or other relevant remarks), the sample identification number, and any unique laboratory identification number associated with the sample. This information should be entered into a computerized laboratory information management system (LIMS).

The laboratory will provide a secure storage area, restricted to authorized personnel, for all samples. Only the custodian can distribute samples to laboratory personnel authorized to conduct the required analyses. Laboratory analytical personnel are responsible for the care and custody of the sample upon receipt.

At the completion of sample analysis, any unused portion of the sample, together with all identifying labels, will be returned to the custodian. The returned tagged sample will be retained in secure storage until the custodian receives permission to dispose of the sample. Sample disposal will occur only on the order of the laboratory project manager in consultation with EPA or SulTRAC, or when it is certain that the information is no longer required or the samples have deteriorated. Likewise, laboratory records will be maintained until the information is no longer required and final disposition is ordered by the laboratory project manager in consultation with EPA or SulTRAC.

Sample Identification Procedures: Sample identification will be as described in Section 8.2 of the FSP. Each CRL or CLP sample will also be assigned an identifying number by CLP FORMS II Lite software. Before or during the sampling event, the user will enter information regarding the site, project, sampling team, analysis, location, matrix (SB – soil boring, SW – surface water, MW – monitoring well), collection time and date, and sample and tag numbers.

When the laboratory receives a sample shipment, its LIMS will generate the in-house identification numbers in accordance with its sample receipt and chain-of-custody standard operating procedures (SOP).

QAPP WORKSHEET #28
QC SAMPLES TABLE

(UFP QAPP Section 3.4)
Complete a separate worksheet for each sampling technique, analytical method/SOP, matrix, analytical group, and concentration level. If method/SOP QC acceptance limits exceed the measurement performance criteria, the data obtained may be unusable for making project decisions.

Matrix	Soil, Sediment
Analytical Group	CLP VOCs
Concentration Level	NA[1]
Sampling SOP	S-1, S-2
Analytical Method/ SOP Reference	A-1
Sampler's Name/ Organization	Guy Montfort/SulTRAC
Analytical Organization	CLP Laboratory
No. of Sampling Locations	See Worksheet #18

QC Sample	**Frequency/ Number**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**DQI**	**Measurement Performance Criteria**
Method Blank	1 per extraction batch of 20 samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. If sufficient volume is not available, reanalyze affected extracts.	Laboratory Analyst	Accuracy/Bias Contamination	No target compounds > QL
MS/MSD	1 per extraction batch of 20 samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. Otherwise, analyze laboratory control sample to see if problem is analysis or sample.	Laboratory Analyst	Accuracy and Precision	%R and RPD as presented in Worksheet #12
Deuterated Monitoring Compounds	All samples	Reanalyze sample. If upon reanalysis, the monitoring compound meets criteria, report reanalysis results. If upon reanalysis, the monitoring compound does not meet criteria, the results are reported in the narrative.	Laboratory Analyst	Accuracy	%R as presented in Worksheet #12

QAPP WORKSHEET #28 (CONTINUED)
QC SAMPLES TABLE

Matrix	Soil, Sediment
Analytical Group	CLP SVOCs
Concentration Level	NA[1]
Sampling SOP	S-1, S-2
Analytical Method/ SOP Reference	A-1
Sampler's Name/ Organization	Guy Montfort/SulTRAC
Analytical Organization	CLP Laboratory
No. of Sampling Locations	See Worksheet #18

QC Sample	**Frequency/ Number**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**DQI**	**Measurement Performance Criteria**
Method Blank	1 per extraction batch of 20 samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. If sufficient volume is not available, reanalyze affected extracts.	Laboratory Analyst	Accuracy/Bias-Contamination	No target compounds > QL
MS/MSD	1 per extraction batch of 20 samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. Otherwise, analyze laboratory control sample to see if problem is analysis or sample.	Laboratory Analyst	Accuracy and Precision	%R and RPD as presented in Worksheet #12
Deuterated monitoring compounds	All samples	Reanalyze sample. If upon reanalysis, the monitoring compound meets criteria, report reanalysis results. If upon reanalysis, the monitoring compound does not meet criteria, results are reported in narrative.	Laboratory Analyst	Accuracy	%R as presented in Worksheet #12

QAPP WORKSHEET #28 (CONTINUED)
QC SAMPLES TABLE

Matrix	Soil, Sediment
Analytical Group	CLP PCBs
Concentration Level	NA[1]
Sampling SOP	S-1, S-2
Analytical Method/ SOP Reference	A-1
Sampler's Name/ Organization	Guy Montfort/SulTRAC
Analytical Organization	CLP Laboratory
No. of Sampling Locations	See Worksheet #18

QC Sample	Frequency/ Number	Corrective Action (CA)	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	1 per extraction batch of 20 samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. If sufficient volume is not available, reanalyze affected extracts.	Laboratory Analyst	Accuracy/Bias-Contamination	No target compounds > QL
MS/MSD	1 per extraction batch of 20 samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. Otherwise, analyze laboratory control sample to see if problem is analysis or sample.	Laboratory Analyst	Accuracy and Precision	%R and RPD as presented in Worksheet #12
Surrogate Spike	All samples	Reanalyze sample. If upon reanalysis, the surrogate meets criteria, report reanalysis results. If upon reanalysis, the surrogate does not meet criteria, the results are reported in the narrative.	Laboratory Analyst	Accuracy	30-150 %R

QAPP WORKSHEET #28 (CONTINUED)
QC SAMPLES TABLE

Matrix	Soil, Sediment
Analytical Group	CLP Pesticides
Concentration Level	NA[1]
Sampling SOP	S-1, S-2
Analytical Method/ SOP Reference	A-1
Sampler's Name/ Organization	Guy Montfort/SulTRAC
Analytical Organization	CLP Laboratory
No. of Sampling Locations	See Worksheet #18

QC Sample	Frequency/ Number	Corrective Action (CA)	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	1 per extraction batch of 20 samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. If sufficient volume is not available, reanalyze affected extracts.	Laboratory Analyst	Accuracy/Bias-Contamination	No target compounds > QL
MS/MSD	1 per extraction batch of 20 samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. Otherwise, analyze laboratory control sample to see if problem is analysis or sample.	Laboratory Analyst	Accuracy and Precision	%R and RPD as presented in Worksheet #12
Surrogates	All samples	Reanalyze sample. If upon reanalysis, the surrogate meets criteria, report reanalysis results. If upon reanalysis, the surrogate does not meet criteria, the results are reported in the narrative.	Laboratory Analyst	Accuracy	30-150 %R

QAPP WORKSHEET #28 (CONTINUED)
QC SAMPLES TABLE

Matrix	Soil, Sediment
Analytical Group	Metals and cyanide
Concentration Level	NA[1]
Sampling SOP	S-1, S-2
Analytical Method/ SOP Reference	A-2
Sampler's Name/ Organization	Guy Montfort/SulTRAC
Analytical Organization	CLP Laboratory
No. of Sampling Locations	See Worksheet #18

QC Sample	**Frequency/ Number**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**DQI**	**Measurement Performance Criteria**
Method Blank	1 per extraction batch of 20 samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. If sufficient volume is not available, reanalyze affected extracts.	Laboratory Analyst	Sensitivity/ Contamination	No target compounds > QL
MS	1 per extraction batch of 20 samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. Otherwise, analyze laboratory control sample to see if problem is analysis or sample.	Laboratory Analyst	Accuracy/Bias	75-125 %R
Laboratory Duplicate	1 per extraction batch of 20 samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. Otherwise, analyze laboratory control sample to see if problem is analysis or sample.	Laboratory Analyst	Precision	<20% RPD

QAPP WORKSHEET #28 (CONTINUED)
QC SAMPLES TABLE

Matrix	Water
Analytical Group	VOCs[1]
Concentration Level	Low concentration
Sampling SOP	S-5, S-6
Analytical Method/ SOP Reference	A-1, A-4
Sampler's Name/ Organization	Guy Montfort/SulTRAC
Analytical Organization	CLP and Subcontracted Laboratories
No. of Sampling Locations	See Worksheet #18

QC Sample	**Frequency/ Number**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**DQI**	**Measurement Performance Criteria**
Method Blank	1 per extraction batch samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. If sufficient volume is not available, reanalyze affected extracts.	Laboratory Analyst	Accuracy/Bias Contamination	No target compounds > QL
MS/MSD	1 per extraction batch samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. Otherwise, analyze laboratory control sample to see if problem is analysis or sample.	Laboratory Analyst	Accuracy and Precision	%R and RPD as presented in Worksheet #12
Deuterated Monitoring Compounds	All samples	Reanalyze sample. If upon reanalysis, the monitoring compound meets criteria, report reanalysis results. If upon reanalysis, the monitoring compound does not meet criteria, the results are reported in the narrative.	Laboratory Analyst	Accuracy	%R as presented in Worksheet 12

QAPP WORKSHEET #28 (CONTINUED)
QC SAMPLES TABLE

Matrix	Water
Analytical Group	CLP SVOCs
Concentration Level	Low concentration
Sampling SOP	S-5, S-6
Analytical Method/ SOP Reference	A-1
Sampler's Name/ Organization	Guy Montfort/SulTRAC
Analytical Organization	CLP Laboratory
No. of Sampling Locations	See Worksheet #18

QC Sample	**Frequency/ Number**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**DQI**	**Measurement Performance Criteria**
Method Blank	1 per extraction batch samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. If sufficient volume is not available, reanalyze affected extracts.	Laboratory Analyst	Accuracy/Bias-Contamination	No target compounds > QL
MS/MSD	1 per extraction batch of 20 samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. Otherwise, analyze laboratory control sample to see if problem is analysis or sample.	Laboratory Analyst	Accuracy and Precision	%R and RPD as presented in Worksheet #12
Deuterated monitoring compounds	All samples	Reanalyze sample. If upon reanalysis, the monitoring compounds meets criteria, report reanalysis results. If upon reanalysis, the monitoring compound does not meet criteria, the results are reported in the narrative.	Laboratory Analyst	Accuracy	%R as presented in Worksheet #12

QAPP WORKSHEET #28 (CONTINUED)
QC SAMPLES TABLE

Matrix	Water
Analytical Group	CLP PCBs
Concentration Level	NA[2]
Sampling SOP	S-5, S-6
Analytical Method/ SOP Reference	A-1
Sampler's Name/ Organization	Guy Montfort/SulTRAC
Analytical Organization	CLP Laboratory
No. of Sampling Locations	See Worksheet #18

QC Sample	**Frequency/ Number**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**DQI**	**Measurement Performance Criteria**
Method Blank	1 per extraction batch of 20 samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. If sufficient volume is not available, reanalyze affected extracts.	Laboratory Analyst	Accuracy/Bias-Contamination	No target compounds > QL
MS/MSD	1 per extraction batch of 20 samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. Otherwise, analyze laboratory control sample to see if problem is analysis or sample.	Laboratory Analyst	Accuracy and Precision	%R and RPD as presented in Worksheet #12
Surrogate Spike	All samples	Reanalyze sample. If upon reanalysis, the surrogate meets criteria, report reanalysis results. If upon reanalysis, the surrogate does not meet criteria, the results are reported in the narrative.	Laboratory Analyst	Accuracy	30-150 %R

QAPP WORKSHEET #28 (CONTINUED)
QC SAMPLES TABLE

Matrix	Water
Analytical Group	CLP Pesticides
Concentration Level	NA[2]
Sampling SOP	S-5, S-6
Analytical Method/ SOP Reference	A-1
Sampler's Name/ Organization	Guy Montfort/SulTRAC
Analytical Organization	CLP Laboratory
No. of Sampling Locations	See Worksheet #18

QC Sample	**Frequency/ Number**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**DQI**	**Measurement Performance Criteria**
Method Blank	1 per extraction batch samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. If sufficient volume is not available, reanalyze affected extracts.	Laboratory Analyst	Accuracy/Bias-Contamination	No target compounds > QL
MS/MSD	1 per extraction batch of 20 samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. Otherwise, analyze laboratory control sample to see if problem is analysis or sample.	Laboratory Analyst	Accuracy and Precision	%R and RPD as presented in Worksheet #12
Surrogate spike	All samples	Reanalyze sample. If upon reanalysis, the surrogate meets criteria, report reanalysis results. If upon reanalysis, the surrogate does not meet criteria, the results are reported in the narrative.	Laboratory Analyst	Accuracy	30-150 %R

QAPP WORKSHEET #28 (CONTINUED)
QC SAMPLES TABLE

Matrix	Water
Analytical Group	CLP Metals and cyanide
Concentration Level	NA[2]
Sampling SOP	S-5, S-6
Analytical Method/ SOP Reference	A-2
Sampler's Name/ Organization	Guy Montfort/SulTRAC
Analytical Organization	CLP Laboratory
No. of Sampling Locations	See Worksheet #18

QC Sample	**Frequency/ Number**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**DQI**	**Measurement Performance Criteria**
Method Blank	1 per extraction batch samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. If sufficient volume is not available, reanalyze affected extracts.	Laboratory Analyst	Accuracy/Bias-Contamination	No target compounds > QL
MS	1 per extraction batch of 20 samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. Otherwise, analyze laboratory control sample to see if problem is analysis or sample.	Laboratory Analyst	Accuracy/Bias	75-125 %R
Laboratory duplicate	1 per extraction batch of 20 samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. Otherwise, analyze laboratory control sample to see if problem is analysis or sample.	Laboratory Analyst	Precision	<20% RPD

QAPP WORKSHEET #28 (CONTINUED)
QC SAMPLES TABLE

Matrix	Sub-Slab Vapor
Analytical Group	VOCs
Concentration Level	NA[2]
Sampling SOP	TBD
Analytical Method/ SOP Reference	A-3
Sampler's Name/ Organization	Guy Montfort/SulTRAC
Analytical Organization	CRL
No. of Sampling Locations	See Worksheet #18

QC Sample	**Frequency/ Number**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**DQI**	**Measurement Performance Criteria**
Method Blank	1 per extraction batch samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. If sufficient volume is not available, reanalyze affected extracts.	Laboratory Analyst	Accuracy/Bias-Contamination	No target compounds > QL
Laboratory Control Sample	1 per extraction batch of 20 samples maximum	Perform maintenance as needed. If problems continue, re-calibrate instrument.	Laboratory Analyst	Accuracy	75-125 % Recovery
Laboratory duplicate	1 per extraction batch of 20 samples maximum	If sufficient volume is available, extract and reanalyze samples in affected batch. Otherwise, analyze laboratory control sample to see if problem is analysis or sample.	Laboratory Analyst	Precision	<30% RPD

Notes:

CA	Corrective Action
DQI	Data quality indicator
QL	Quantitation limit
TBD	To be determined; methodology will be presented in SAP addendum

[1] VOCs in groundwater will be analyzed both by CLP and subcontracted laboratory. An updated VOCs/Water table will be added and submitted once the subcontracted lab has been identified

[2] Not applicable, only one concentration level is listed for the analytical method selected

[3] Assumes Method TO-15; actual methodlgy will be presented in SAP Addendum

QAPP WORKSHEET #29
PROJECT DOCUMENTS AND RECORDS TABLE

(UFP QAPP Section 3.5.1)
Identify the documents and records that will be generated for all aspects of the project including, but not limited to, sample collection and field measurement, on-site and off-site analysis, and data assessment. Identify where each document will be maintained.

Document	**Where Maintained**
Field notes/logbook	Project file (field data), SulTRAC offices
Chain of custody forms	Project file (laboratory data), SulTRAC offices
Laboratory raw data package	EPA for CLP laboratory and CRL laboratory data; project file for subcontractor laboratory data
Laboratory equipment calibration logs	EPA for CLP and CRL laboratory data; project file for subcontractor laboratory data
Validated data	Project file (laboratory data), SulTRAC offices

QAPP WORKSHEET #30
ANALYTICAL SERVICES TABLE

(UFP QAPP Section 3.5.2.3)

Identify all laboratories or organizations that will provide analytical services for the project, including on-site screening, on-site definitive, and off-site laboratory analytical work. Group by matrix, analytical group, concentration, and sample location or ID number. If applicable, identify the subcontractor laboratories and backup laboratory or organization that will be used if the primary laboratory or organization cannot be used.

Matrix	Analytical Group	Concentration Level	Sampling Location/ID Number	Analytical SOP	Data Package Turnaround Time	Laboratory/Organization (Name and Address, Contact Person, and Telephone Number)	Backup Laboratory/Organization (Name and Address, Contact Person and Telephone Number)
Soil, Sediment	VOCs SVOCs PCBs Pesticides Metals	Low concentration Low concentration NA[1] NA[1] NA[1]	See Figures 5 and 6	A-1 A-1 A-1 A-1 A-2	21 days 21 days 21 days 21 days 21 days	CLP laboratory identified by EPA Region 5	CLP laboratory identified by EPA Region 5
Water	VOCs	Low concentration	See Figures 5 and 6	A-1	21 days	CLP laboratory identified by EPA Region 5	CLP laboratory identified by EPA Region 5
Water	VOCs	Low concentration	See Figures 5 and 6	A-4	21 days	Subcontracted laboratory	Subcontracted laboratory
Water	VOCs SVOCs PCBs Pesticides Metals	Low concentration Low concentration NA[1] NA[1] NA[1]	See Figure 5 and 6	A-1 A-1 A-1 A-1 A-2	21 days 21 days 21 days 21 days 21 days	CLP Laboratory identified by EPA Region 5	CLP Laboratory identified by EPA Region 5
Sub-Slab vapor	VOCs	NA[1]	See Figure 5	A-3	21 days	TBD	TBD

[1] Not applicable, only one concentration level is listed for the analytical method selected

TBD - Methodology will be presented in SAP addendum

QAPP WORKSHEET #31
PLANNED PROJECT ASSESSMENTS TABLE

(UFP QAPP Section 4.1.1)
Identify the type, frequency, and responsible parties of planned assessment activities that will be performed for the project.

Assessment Type	**Frequency**	**Internal or External**	**Organization Performing Assessment**	**Person(s) Responsible for Performing Assessment (Title and Organization)**	**Person(s) Responsible for Responding to Assessment Findings (Title and Organization)**	**Person(s) Responsible for Identifying and Implementing CAs (Title and Organization)**	**Person(s) Responsible for Monitoring Effectiveness of CAs (Title and Organization)**
No assessments planned	NA	NA	NA	NA	NA	NA	NA

QAPP WORKSHEET #32
ASSESSMENT FINDINGS AND CORRECTIVE ACTION RESPONSES

(UFP QAPP Section 4.1.2)
For each type of assessment, describe procedures for handling QAPP and project deviations encountered during the planned project assessments.

Assessment Type	**Nature of Deficiencies Documentation**	**Individual(s) Notified of Findings (Name, Title, Organization)**	**Timeframe of Notification**	**Nature of CA Response Documentation**	**Individual(s) Receiving CA Response (Name, Title, Organization)**	**Timeframe for Response**
No assessments planned	NA	NA	NA	NA	NA	NA

QAPP WORKSHEET #33
QA MANAGEMENT REPORTS TABLE

(UFP QAPP Section 4.2)
Identify the frequency and type of planned QA Management Reports, the project delivery dates, the personnel responsible for report preparation, and the report recipients.

Type of Report	Frequency (daily, weekly, monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (Name, Title, Organization)	Report Recipient(s) (Title and Organization)
Phase I Data Validation Report	Once for field sampling Phase I	21 days after receipt of all Phase I analytical results from laboratory	Guy Montfort, SulTRAC, Project Manager	Shari Kolak, WAM, EPA Region 5

QAPP WORKSHEET #34
VERIFICATION (STEP I) PROCESS TABLE

(UFP QAPP Section 5.2.1)
Describe the processes that will be followed to verify project data. Describe how each item will be verified, when the activity will occur, and what documentation is necessary, and identify the person responsible. *Internal* or *external* is in relation to the data generator.

Verification Input	**Description**	**Internal/ External**	**Responsible for Verification (Name, Organization)**
Chain-of-custody forms	Chain-of-custody forms will be reviewed internally upon their completion and verified against the packed sample coolers they represent. The shipper's signature on the chain-of-custody form should be initialed by the reviewer, a copy of the chain-of-custody form should be retained in the project file, and the original and remaining copies should be taped inside the cooler for shipment.	Internal	TBD, SulTRAC
Field notes/ logbook	Field notes will be reviewed internally and placed in the project file. A copy of the field notes will be attached to the final report.	Internal	Guy Montfort, SulTRAC
Laboratory data	All laboratory data packages will be verified internally by the laboratory performing the work for completeness and technical accuracy prior to submittal.	Internal	CLP Laboratory EPA Region 5 CRL Subcontracted laboratory
	All received data packages will be verified externally in accordance with the data validation procedures specified in Worksheet #35.	External	William Earle, SulTRAC

QAPP WORKSHEET #35
VALIDATION (STEPS IIA AND IIB) PROCESS TABLE

(UFP QAPP Section 5.2.2)
Describe the processes that will be followed to validate project data. Validation inputs include items such as those listed in Table 9 of the UFP-QAPP Manual (Section 5.1). Describe how each item will be validated, when the activity will occur, and what documentation is necessary and identify the person responsible. Differentiate between steps IIa and IIb of validation.

Step IIa/IIb	Validation Input	Description	Responsible for Validation (Name, Organization)[1]
IIa	Chain of custody	Examine traceability of samples from sample collection to sample analysis	EPA (DAT), Analytical Coordinator, SulTRAC
IIa	Holding time	Confirm that holding time requirements are met	EPA (DAT), Chemist, SulTRAC
IIa	Instrument calibration	Confirm that instrument calibration requirements are met	EPA (DAT), Chemist, SulTRAC
IIa	Analytical method	Confirm that analytical methods are specified in QAPP	EPA (DAT), Chemist, SulTRAC
IIb	Performance criteria	Confirm that QC samples meet specified performance criteria; document any deviations in data evaluation summary report	EPA (DAT), Chemist, SulTRAC

Note:

1 EPA is responsible for conducting data assessment tool (DAT, which incorporates CADRE) of analytical data generated by CLP laboratories. SulTRAC is responsible for validation of data generated by EPA Region 5 CRL and subcontracted laboratories. EPA and SulTRAC reviews will be conducted in accordance with CLP National Functional Guidelines (NFG) for data validation. EPA will provide SulTRAC with a summary data review report for data generated by CLP laboratories.

QAPP WORKSHEET #36
VALIDATION (STEPS IIA AND IIB) SUMMARY TABLE

(UFP QAPP Section 5.2.2)
Identify the matrices, analytical groups, and concentration levels that each entity performing validation will be responsible for, as well as criteria that will be used to validate those data.

Step IIa/IIb	Matrix	Analytical Group	Concentration Level	Validation Criteria	Data Validator (Title and Organization)[1]
IIa	Soil/Sediment	VOCs	Low	DAT criteria and NFG	DAT validation (EPA) and review of case narrative by SulTRAC
IIa	Soil/Sediment	SVOCs	Low	DAT criteria and NFG	DAT validation (EPA) and review of case narrative by SulTRAC
IIa	Soil/Sediment	PCBs	NA	DAT criteria and NFG	DAT validation (EPA) and review of case narrative by SulTRAC
IIa	Soil/Sediment	Pesticides	NA	DAT criteria and NFG	DAT validation (EPA) and review of case narrative by SulTRAC
IIa	Soil/Sediment	Metals (mercury and cyanide)	NA	DAT criteria and NFG	DAT validation (EPA) and review of case narrative by SulTRAC
IIa	Groundwater/Surface Water	VOCs	Low	DAT criteria and NFG	DAT validation (EPA) and review of case narrative by SulTRAC; validation by SulTRAC for data generated by subcontracted laboratories
IIa	Groundwater/Surface Water	SVOCs	Low	DAT criteria and NFG	DAT validation (EPA) and review of case narrative by SulTRAC

QAPP WORKSHEET #36 (CONTINUED)
VALIDATION (STEPS IIA AND IIB) SUMMARY TABLE

Step IIa/IIb	Matrix	Analytical Group	Concentration Level	Validation Criteria	Data Validator (Title and Organization)[1]
IIa	Groundwater/Surface Water	PCBs	NA	DAT criteria and NFG	DAT validation (EPA[1]) and review of case narrative by SulTRAC
IIa	Groundwater/Surface Water	Pesticides	NA	DAT criteria and NFG	DAT validation (EPA[1]) and review of case narrative by SulTRAC
IIa	Groundwater/Surface Water	Metals (mercury and cyanide)	NA	DAT criteria and NFG	DAT validation (EPA[1]) and review of case narrative by SulTRAC
IIa	Sub-Slab Vapor[2]	VOCs	Low	QAPP and NFG	Data validation by SulTRAC

Note:

[1] EPA is responsible for conducting data assessment tool (DAT, which incorporates CADRE) of analytical data generated by CLP laboratories. SulTRAC is responsible for validation of data generated by EPA Region 5 CRL and subcontracted laboratories. EPA and SulTRAC reviews will be conducted in accordance with CLP NFG for data validation, as modified by the requirements in this QAPP and the method used by the laboratory. EPA will provide SulTRAC with a summary data review report for data generated by CLP laboratories. The SulTRAC analytical coordinator will review this report to verify that project-specific QC criteria have been met.

[2] Assumes analysis by EPA CRL by Method TO-15; actual methodologies and analytical responsibility will be presented in SAP addendum.

QAPP WORKSHEET #37
USABILITY ASSESSMENT

(UFP QAPP Section 5.2.3)
Describe the procedures/methods/activities that will be used to determine whether data are of the right type, quality, and quantity to support environmental decision-making for the project. Describe how data quality issues will be addressed and how limitations on the use of the data will be handled.

Summarize the usability assessment process and all procedures, including interim steps and any statistics, equations, and computer algorithms that will be used: A team of SulTRAC personnel will perform the data usability assessment. SulTRAC's project manager will be responsible for information in the usability assessment. The project manager will also be responsible for assigning work to the individuals who will be supporting the data usability assessment. Note that the data usability assessment will be conducted on validated data. The results of the data usability assessment will be presented in the final project report.

Precision – Results of laboratory duplicates will be presented separately in tabular format. For each duplicate pair, the RPD will be calculated for each analyte whose original and duplicate values are both greater than or equal to the QL. The RPDs will be checked against the measurement performance criteria presented in Worksheet #12. The RPDs exceeding criteria will be identified in the tables. Additionally, the RPD of each analyte will be averaged across all duplicate pairs whose original and duplicate values are both greater than or equal to the QL, and the combined overall average RPD for each analysis will be calculated for the laboratory duplicates. A discussion will follow summarizing the laboratory precision results. Any conclusions about the precision of the analyses will be drawn, and any limitations on the use of the data will be described.

Accuracy/Bias – Results for laboratory method blanks and instrument blanks will be presented separately in tabular format for each analysis. Similarly, the recovery results for spiked anlytes in each analysis will be evaluated. The results for each analyte will be checked against the measurement performance criteria presented in Worksheet #12. Results for analytes that exceed criteria will be identified in the tables. A discussion will follow summarizing the laboratory accuracy/bias results. Any conclusions about the accuracy/bias of the analyses based on contamination will be drawn, and any limitations on the use of the data will be described.

Overall Accuracy/Bias – The results will be presented in tabular format to allow comparison of these results to the sample batch they apply to. These results will be compared to the requirements listed in Worksheet #12. A discussion will follow summarizing overall accuracy/bias results. Any conclusions about the overall accuracy/bias of the analyses will be drawn, and any limitations on the use of the data will be described.

Sensitivity – Results for all laboratory-fortified blanks will be presented separately in tabular format for each analysis. The results for each analyte will be checked against the measurement performance criteria presented in Worksheet #12 and cross-checked against the QLs presented in Worksheet #15. Results for analytes that exceed criteria will be identified on the tables. A discussion will follow summarizing the laboratory sensitivity results. Any conclusions about the sensitivity of the analyses will be drawn, and any limitations on the use of the data will be described.

Representativeness – The large numbers of samples collected in Phases I are considered representative of site conditions, as long as completeness criteria in Worksheet 12 are met.

QAPP WORKSHEET #37
USABILITY ASSESSMENT

Comparability – The results of this study will be used as a benchmark for determining comparability for data collected during any potential future sampling events using the same or similar sampling and analytical SOPs. In addition, the results from pre-existing monitoring wells will be compared with previously collected data.

Completeness – A completeness check will be performed on all data generated by the laboratory. Completeness criteria are presented in Worksheet #12. Completeness will be calculated for each analyte as follows. For each analyte, completeness will be calculated as the number of data points for each analyte and individual matrix that meet the measurement performance criteria for precision, accuracy/bias, and sensitivity, divided by the total number of data points for each analyte. A discussion will follow summarizing the calculation of data completeness. This discussion will also note the differences, if any, between the planned sample collection (number and location) and the actual sample collection. Any conclusions about the completeness of the data for each analyte will be drawn, and any limitations on the use of the data will be described.

Describe the evaluative procedures used to assess overall measurement error associated with the project: project: NA

Identify the personnel responsible for performing the usability assessment: SulTRAC's analytical coordinator will review analytical data and the CADRE data review report and data validation results for subcontracted laboratories to assess usability of the data. SulTRAC's project manager will review QC results for samples and assess the overall usability of the data set in close consultation with the EPA WAM.

Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies: The usability assessment will be documented in the final data validation letter report, which will be generated 21 days after the last Phase I analytical results are received from the CLP laboratory.

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TABLES FROM FIELD SAMPLING PLAN (FSP)

(Eight Sheets)

TABLE 1
SUMMARY OF EXISTING OHIO EPA AND CITY OF TROY MONITORING WELLS (TO BE INCLUDED IN RI GROUNDWATER MONITORING PROGRAM)

Well	Location	ID (in.)	TD (feet)	TOIC EL (feet, amsl)	DTW (8/26/09) (feet)	GW EL (8/26/09) (feet, amsl)
OEPA-1	SW Corner Crawford and Franklin	2	24.71	832.46	18.05	814.41
OEPA-2	Crawford and East Main on traffic divider	1	19.7	830.89	16.45	814.44
OEPA-3	Spinnaker west lot, near NW building corner and levee	2	21.36	825.13	12.25	812.88
OEPA-4	NE Corner Mulberry and Franklin	2	27.35	833.22	18.35	814.87
OEPA-5	S side of Franklin, 100 feet SE of Crawford	2	27.22	830.29	15.97	814.32
OEPA-6	NW side of Crawford, about 60 feet NE of Franklin	2	27.2	831.62	17.20	814.42
OEPA-7	SE side of Clay, near Franklin	2	26.91	833.52	18.88	814.64
OEPA-8	Water Street, in front of Spinnaker west end of west lot	1.5	27.22	828.58	14.47	814.11
OEPA-9	In front of St. Patrick's School, S side of Water St.	1.5	14.47	830.43	16.00	814.43
OEPA-10	N Side of Water St. in front of private residence between Hobart and Spinnaker	1.5	24.82	829.70	15.40	814.30
OEPA-11	Walnut, near East Main	1	27.33	833.33	18.21	815.12
OEPA-12	N Side of Water Street, slightly NW of Crawford	1	27.47	831.54	16.99	814.55
OEPA-13	NE Corner, Water and Clay	1	27.4	833.68	18.98	814.70
MW-L	East Side GMR, in ballfields east of Market St.	2	25.05	825.39	10.08	815.31
MW-M	Cluster with MW-L	2	81	824.61	9.93	814.68
MW-N	East Side GMR, 300 feet SE of L/M clusterr	2	31.73	831.08	16.50	814.58
MW-O	Franklin and Scott	2	100.11	829.31	18.14	811.17
MW-P	E. Main and Williams	2	94.6	827.65	16.94	810.71
MW-Q	Franklin and Crawford, next to OEPA-1	2	93.96	832.70	18.30	814.40

Notes: "OEPA" - indicates monitoring well installed by Ohio EPA
"MW" - indicates monitoring well installed by City of Troy
in. - inches
AMSL - above mean sea level
GW - groundwater
EL - elevation
TOIC - top of inner casing
DTW - depth to water measured by SulTRAC August 2009
TD - total depth

TABLE 2

SUMMARY OF PCE, TCE AND *cis*-1,2-DCE DETECTIONS IN TROY PRODUCTION WELLS 2009

Well	Location	Date	PCE (µg/L)	TCE (µg/L)	*cis*-1,2-DCE (µg/L)
14	East Wellfield	7/7/09	None Detected	None Detected	None Detected
		6/3/09	None Detected	None Detected	None Detected
		5/4/2009	None Detected	None Detected	None Detected
		4/1/2009	None Detected	None Detected	None Detected
		3/17/2009	None Detected	None Detected	None Detected
		2/2/2009	None Detected	None Detected	None Detected
		1/5/2009	None Detected	None Detected	None Detected
18	East Wellfield	7/7/09	None Detected	None Detected	1.2
		6/3/09	None Detected	None Detected	None Detected
		5/4/2009	None Detected	None Detected	0.8
		4/1/2009	None Detected	None Detected	1.3
		3/17/2009	None Detected	None Detected	0.6
		2/2/2009	None Detected	None Detected	None Detected
		1/5/2009	None Detected	None Detected	None Detected
12W	West Wellfield	7/7/2009	4.5	0.6	1.3
		6/3/2009	4.0	0.6	1.1
		5/4/2009	5.1	0.6	0.7
		4/1/2009	7	0.9	0.9
		3/17/2009	6.3	0.8	1.0
		2/2/2009	5.0	0.7	0.8
		1/5/2009	No data	No data	No data

Notes:

Data provided by City of Troy, 2009.

Data are for raw water samples collected at the wellhead of each individual well; VOCs have not been detected in the Troy finished water supply

µg/L	Micrograms per liter
DCE	Dichloroethene
PCE	Tetrachloroethene
TCE	Trichloroethene

TABLE 3
HISTORICAL BUSINESSES IDENTIFIED AS KNOWN OR POTENTIAL SOURCES OF CHLORINATED VOCs AT THE EAST TROY SITE

Identified Area	Location	Description
Troy One-Hour Martinizing	Near Main and Walnut	Dry cleaner, 1960s-70s; current location of addition to the Methodist Church
Waltz Cleaners (1)	Near Main and Walnut	Dry cleaner, 1960s-70s
Waltz Cleaners (2)	Near Water and New, southwest corner of current Spinnaker property	Dry cleaner(?), 1950s
Waltz Cleaners (3) [1]	432 East Main	Dry cleaner(?), recent
Neat Cleaners	North Ferry, near Main	Dry Cleaner, 1950s-1970s
Hottle Cleaners	Near Main and Market	Dry Cleaner, dates unknown
Cable Cleaners	Near Franklin and Market	Dry Cleaner, dates unknown
Pearson's Laundry	Near E. Canal and Market	Dry Cleaner, dates unknown; a UST may remain in lot behind buildings
Peters Printing/Genesis Graphics	Near Main and Market	Print shop, dates unknown
Aztech Printing and Design	Near Main and Crawford	Print shop, dates unknown
Hobart Cabinet	Water Street, east of Clay, west of Spinnaker property	Metal cabinet manufacturing, active
Former Junkyard	Near New and Water	No other information available
Spinnaker Coatings Facility	Water Street, between Crawford and Counts	Active manufacturing facility with historic solvent and toluene spills
Former Auto Service Facility	Near Walnut and Main	Auto repair, no other information available, location is now municipal parking lot.

Source: KC 2009, Ohio EPA 2010.

Note: [1] Location requires additional research to confirm. This cleaner has been described in various site background documents as either being located near "Main and Union" or 432 East Main.

TABLE 4

MAXIMUM DETECTED CONCENTRATIONS OF CHLORINATED VOCS IN GROUNDWATER AT THE SPINNAKER SITE WEST END (2001 AND 2010)

VOC DETECTED	2001		2010	
	CONCENTRATION (µg/L)	MONITORING WELL	CONCENTRATION (µg/L)	MONITORING WELL
1,1-DCA	1.4	KMW-8	ND	NA
cis-1,2-DCE	50.7	PW-3	73	KMW-10
PCE	60.2	KMW-7	20	KMW-15
TCA	8.8	PW-3	ND	NA
TCE	10.4	PW-3	6.5	KMW-15
Vinyl Chloride	0.6	KMW-9	ND	NA

Notes:

µg/L	Micrograms per liter
DCE	Dichloroethene
DCA	Dichloroethane
PCE	Tetrachloroethene
TCA	Trichloroethane
TCE	Trichloroethene
NA	Not Applicable
ND	Not Detected

Source: Mill Creek 2002; 2010

TABLE 5

INDOOR AIR SAMPLE RESULTS FOR HOUSES REQUIRING VAPOR ABATEMENT

Number	EPA ID #	Location	Analyte	Initial Concentration (ppb)	1-Month After Installation, (ppb)	ODH/ATSDR Screening Level (ppb)
1	EPA-03	Franklin Street	PCE	7.6	1.5	1.2
2	EPA-06	Franklin Street	PCE	22	1.7	1.2
3	EPA-13	Water Street	PCE	2.1	ND	1.2
		(School)	TCE	1.3	ND	0.4
4	EPA-18	Water Street	TCE	1.0	1.4	0.4
5	EPA-22	E. Franklin St.	PCE	1.7	ND	1.2
6	EPA-28	E. Franklin St.	PCE	1.3	4.6	1.2
7	EPA-32	E. Franklin St.	PCE	4.5	ND	1.2
8	EPA-39	E. Franklin St.	PCE	4.8	ND	1.2
9	EPA-43	E. Franklin St.	PCE	7.2	ND	1.2
10	EPA-26	E. Main St.	TCE	0.51	0.60	0.4
11	EPA-38	E. Canal St.	TCE	0.61	ND	0.4
12	EPA-16	Franklin Street	PCE	6.6	1.2	1.2
13	EPA-45	Union Street	PCE	2.2	0.57	1.2
14	EPA-49	E. Franklin St.	PCE	11	ND	1.2
15	EPA-50	E. Franklin St.	PCE	3.5	0.33	1.2
16	EPA-72	E. Main Street	PCE	1.4	ND	1.2
17	EPA-59	E. Main Street	PCE	1.4	ND	1.2

Notes:

EPA ID #s 28 and 43 had dirt floors; EPA-50 had a partial dirt floor.

ATSDR	Agency for Toxic Substances and Disease Registry
ODH	Ohio Department of Health
ppb	Parts per billion
ND	None Detected
PCE	Tetrachloroethene
TCE	Trichloroethene

Source: ATSDR 2008.

TABLE 6

SUMMARY SAMPLE INFORMATION FOR EAST TROY CONTAMINATED AQUIFER SITE

Number of Sampling Locations	Matrix	Depth (feet)
27 locations	Soil[1,2,3]	Will be based on inspection[1]
3 locations (Background soil)	Soil [2,3.4]	0-2, 8-10[1]
10 Locations	Groundwater[2.3]	Top of uppermost water table
30 Locations (approximate)	Sub-Slab Vapor	1[6]
24 locations (Existing wells)	Groundwater[2,4, 7]	Various
7 Locations	Groundwater (VAS) [2,3]	Various, maximum of 90 feet or top of aquitard[1]
7 locations (New wells – west of river – includes background)	Groundwater[2,4]	20[1]
5 locations (New wells – west of river)	Groundwater[2,4]	60-90 (estimated - will be determined by VAS)[1]
1 location (New well – east of river)	Groundwater[2,4]	20[1]
1 location (New well – east of river)	Groundwater[2,4]	120[1]
4 locations (including background)	Surface Water[5]	Surface
4 locations (including background)	Sediment[5]	Surface

Notes:

[1] Sampling depths and locations will be determined based on geologic characteristics, and evidence of contamination (visual, photoionization detector (PID) readings, odors, or analytical data, as applicable)

[2] See Figures 5-8 for sampling locations.

[3] Samples will be collected from direct-push advanced borings.

[4] Samples will be collected from monitoring wells.

[5] Samples will be collected from the Great Miami River (see Figure 8)

[6] Sample locations will be within the boundaries of the chlorinated VOC groundwater plume, and determined based on the results of the Phase I soil and groundwater investigations , past sub-slab VOC monitoring data collected during the EPA TCRA, and consultation with EPA and Ohio EPA. Sampling and analytical methods, numbers and locations of samples will be presented in a SAP addendum to be prepared after initial soil and groundwater analytical data become available At Phase I locations where sub-slab vapor concentrations exceed screening levels, additional sub-slab monitoring and indoor air monitoring may be conducted during Phase II.

[7] Includes 13 Ohio EPA wells, 6 City of Troy wells where split samples will be collected during the baseline event, and which will also be sampled during the comprehensive sampling event; and, 5 wells at the Spinnaker site.

TABLE 7

SOIL BORING LOCATIONS FOR IDENTIFIED AREAS

Location	Use and Environmental Concern	Number of Soil Borings	Number of Samples*
Open lots in the vicinity of Walnut and Main Streets	Areas located close to locations where past data have indicated a possible point of origin for the residential area plume; close to former One-Hour Martinizing, Waltz Cleaners, and auto repair locations.	5	10
Hobart Cabinet	Active facility located on Water Street upgradient from the Spinnaker plume; soil and groundwater data and information gathered by Ohio EPA indicated the presence of chlorinated VOCs on the site perimeter and possible dumping of solvents on site	4	8
Various locations of possible sources within the plume area (Mulberry, Clay, Crawford and Water Streets, possible UST area between Market, Race, Canal and Walnut)	Potential additional contributing source areas	7	14
Vicinity of Clay/Franklin and Crawford/ Franklin Intersections	Hot spot of groundwater contamination located in vicinity of these intersections, near rail crossing	7	14
Additional locations along sanitary sewer	Possibility of sewer as historic transport mechanism from original sources (now gone) such as dry cleaners to plume area	4	8
Background/off site (west of State Route 55/ Market Street and southwest of Canal Street)	Confirmation of background soil conditions in the area	3	6

Notes:

* Number of samples indicated does not include QA/QC samples for each subset; in addition, surface soil samples may be collected at up to 10 locations, resulting in a total of 70 samples)

Groundwater samples will be collected from up to 10 of the 30 soil borings.

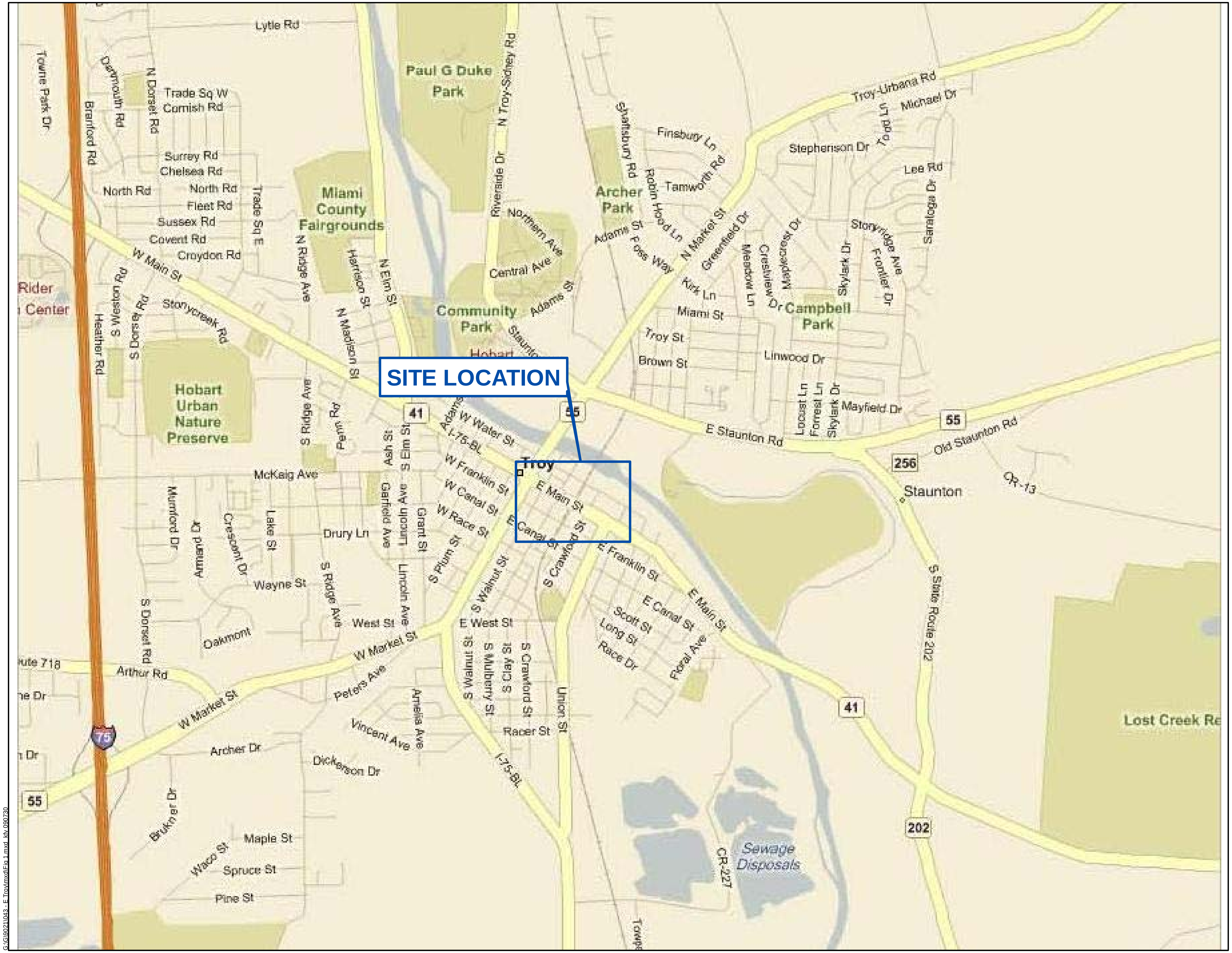
TABLE 8
SUMMARY OF PROPOSED VAS AND NEW MONITORING WELL LOCATIONS

Location	VAS	Deep Well	Shallow Well	Rationale
1 Clay and Franklin, adjacent to monitoring well OEPA-7	Yes	No	No	"Hot Spot"; possible residual or secondary source area; deep aquifer already monitored by well MW-Q in this general area; shallow aquifer monitored by well Ohio EPA-7
2 Oak Street, between Main and Franklin	Yes	Contingent (if deep well is not installed at Location 4)	Yes	Track possible migration from Residential PCE Plume toward wellfield; confirm boundaries of deep plume if present; confirm downgradient extent of shallow plume; deep well is contingent on VAS results at locations 2 and 4.
3 Parking lot, west side of Crawford, between Main and Water	Yes	Contingent (phase II)	Yes	Confirm that Residential and Water Street PCE Plumes are separate in the shallow and deep zones; track possible movement of deep plume (if present) from Walnut/Main area toward wellfield; well contingent on results of VAS and would be installed in Phase II if needed.
4 New and Main	Yes	Yes (alternate site would be Location 2)	Yes	Confirm shallow plume boundaries; confirm Residential and Water Street Plumes are separate in the deep zone; track possible movement of deep plume (if present) from Walnut/Main area toward wellfield. Location dependent on access and spatial constraints. Deep well may be installed at Location 2 (Oak Street) depending on VAS data.
5a and 5b Hobart Property, near former rail spur	Yes	Yes (1 well - location 5b)	Yes (2 wells)	Suspected source area; evaluate possibility of shallow and deep contamination; vertical gradients; 2 shallow wells will be installed (location 5a and 5b)
6 Spinnaker West End Parking Area	Yes	Yes	No	Suspected source area; area where plume changes from PCE to TCE and 1,2-DCE and concentrations drop; evaluate possibility of deep contamination and vertical gradients; shallow zone already monitored
7 Adjacent to levee, near Spinnaker east end	Yes	Yes	No	On possible flow path from Residential Area PCE plume, toward Troy wells 14 and 18; due to proximity to wellfield VAS will be terminated if confining layer (till) is encountered
8 Walnut, near Main; near shallow monitoring well Ohio EPA-11	No	Yes	No	Farthest upgradient end of plume area; evaluate possibility of vertical migration of VOCs at Walnut and Main area or serve as possible deep background well; evaluate vertical gradients; shallow well exists at this location
9 Water Street between New and Counts	No	No	Yes	Confirm boundaries of shallow Water Street PCE plume

Location	VAS	Deep Well	Shallow Well	Rationale
10 North of Troy Wells 14 and 18, east of River	No	Yes	Yes	Evaluate possible presence of source areas east of Great Miami River and vertical gradients. VAS will not be conducted due to proximity to wellfield
11 Background, West of Market Street/SR 55	No	Contingent (Phase II)	Yes	Background location for permanent shallow well; additional deep background well will be installed in Phase II only if deep well at location 8 is found to contain chlorinated VOCs
Various	No	No	Contingent (Phase I)	Replace any crucial existing monitoring wells that are found to be in poor condition or not capable of yielding representative samples during the Baseline Sampling.
Background Deep - adjacent to OEPA-13 on Clay Street	No	Contingent (Phase II)	No	Background location for permanent deep well to be installed in Phase II contingent on results of Phase I locations 5 (Hobart) and 6 (Spinnaker)
Spinnaker, between building and levee, near well RS-06	Contingent (Phase 2)	Contingent (Phase 2)	No	On possible flow path from Water Street PCE plume, Hobart and Spinnaker toward Troy wells 14 and 18; evaluate vertical gradients; VAS will be contingent on results of Locations 5 (Hobart), 6 (Spinnaker west) and 7; shallow zone is already monitored. Deep well would be installed as far southeast as possible along east side of Spinnaker building; location dependent on access and spatial constraints.
Water Street by Ohio EPA-12	No	Contingent (Phase II)	No	Confirm boundaries and source area of deep Water Street PCE plume if detected at (contingent on) VAS locations 3, 5b and 6
TOTAL	7 (plus contingent)	6 (plus contingent)	8 (plus contingent)	Number of shallow wells to be replaced, if any, will be determined after Baseline Sampling

FIGURES

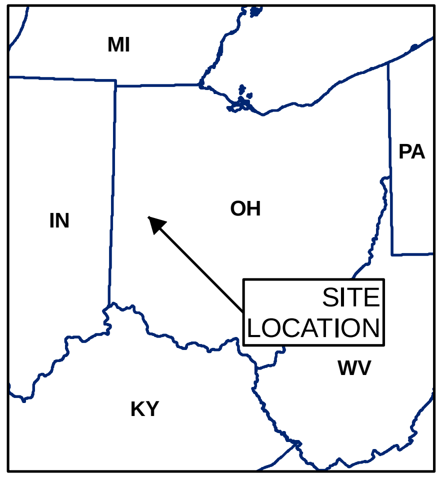
(Eight Pages)



LEGEND

▭ SITE LOCATION

0 2,625 5,250 10,500 Feet



SOURCE: © 2009 Navteq © 2009 Microsoft

EAST TROY CONTAMINATED AQUIFER SITE
RI/FS PHASE I
TROY, OHIO

FIGURE 1
SITE LOCATION MAP

SulTRAC

East Troy Contaminated Aquifer Site
RI/FS Phase I
Troy, Ohio

FIGURE 2
Site Layout

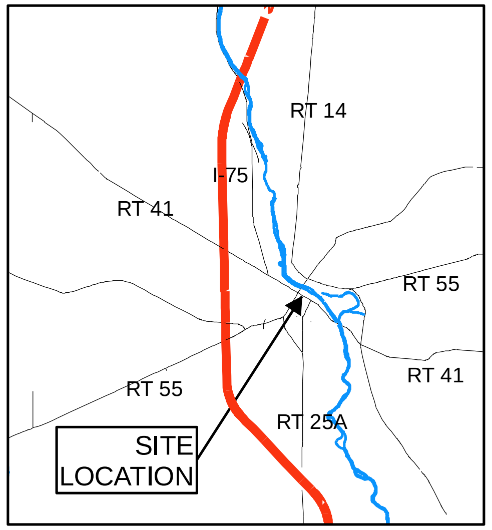
SulTRAC

LEGEND

- ● Direct Push Geoprobe (2002)
- ● Geoprobe (2003)
- ● Geoprobe (2004)
- ⬟ Monitoring Well

Note:
All Values in Micrograms Per Liter or Parts Per Billion
ND-Not Detectable

SOURCE: Modified From Ohio EPA 2009

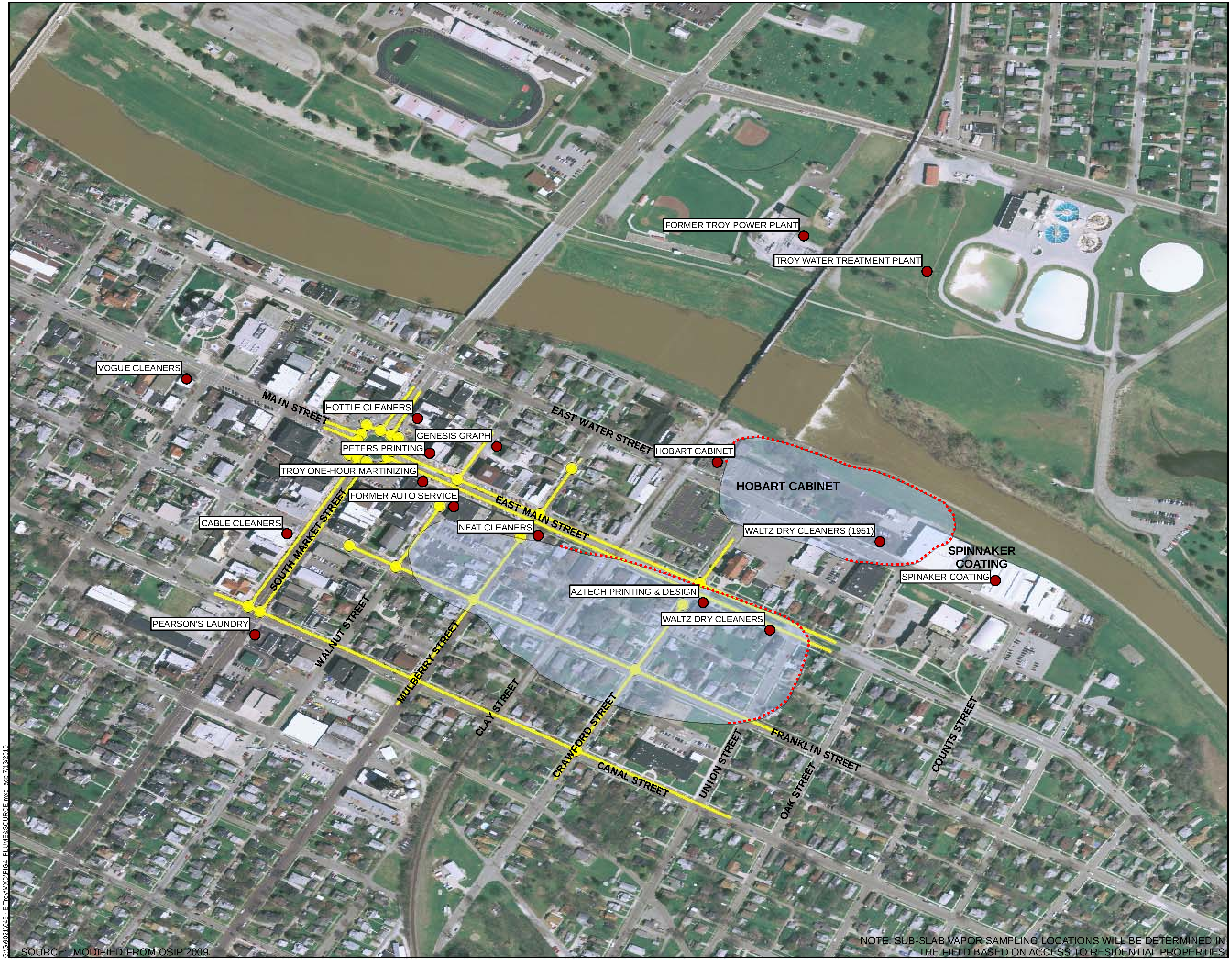


East Troy Contaminated Aquifer Site
RI/FS Phase I
Troy, Ohio

FIGURE 3
Summary of Ohio EPA Groundwater Sampling Results for PCE

ST SulTRAC

2010-01-14 g:\o9021045 - e troy\mxd\fig 3.mxd TIFMI-CH kurt voigts



SOURCE: MODIFIED FROM OSIP 2009.

NOTE: SUB-SLAB VAPOR SAMPLING LOCATIONS WILL BE DETERMINED IN THE FIELD BASED ON ACCESS TO RESIDENTIAL PROPERTIES.

G:\G\9021\045 - E Troy\MXD\FIG4_PLUME&SOURCE.mxd acp 7/13/2010

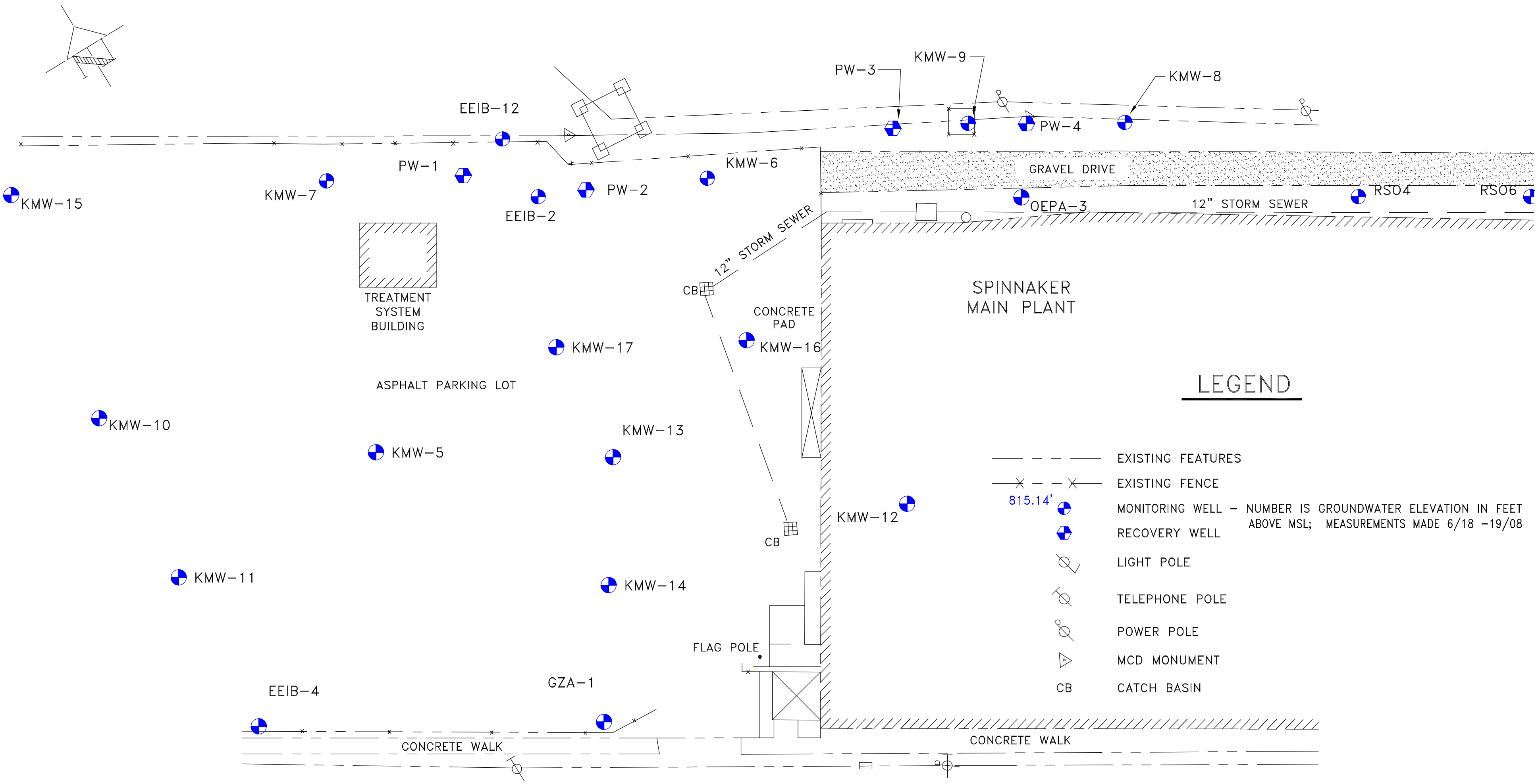
LEGEND

●	POTENTIAL HISTORIC VOC SOURCES
●	MANHOLE
⋯⋯	PLUME BOUNDARY UNKNOWN
―	SANITARY SEWER
▭	VOC PLUME BASED ON OHIO EPA PCE DATA 1999-2004

EAST TROY CONTAMINATED AQUIFER SITE
RI/FS PHASE I
TROY, OHIO

FIGURE 4
APPROXIMATE CHLORINATED VOC PLUME AREA AND HISTORIC POTENTIAL VOC SOURCE AREA

SulTRAC



EAST TROY CONTAMINATED AQUIFER SITE
RI/FS PHASE 1
TROY, OHIO

FIGURE 5
SPINNAKER COATINGS - WEST END
MONITORING WELLS

ST SulTRAC

Source: Mill Creek Environmental Services June 2008

NOTE: SUB-SLAB VAPOR SAMPLING LOCATIONS WILL BE DETERMINED IN THE FIELD BASED ON ACCESS TO RESIDENTIAL PROPERTIES.

SOURCE: MODIFIED FROM OSIP 2009.

G:\G\9021\045 - E Troy\MXD\FIG6_PROPOSEDSAMPLING.mxd 7/8/2010 acp

LEGEND

⊗	PROPOSED SOIL BORING
⊡	EXISTING CITY OF TROY MONITORING WELL
▲	OEPA MONITORING WELL
●	MANHOLE
—	SANITARY SEWER
······	PLUME BOUNDARY UNKNOWN
▭	VOC PLUME BASED ON OHIO EPA PCE DATA 1999-2004

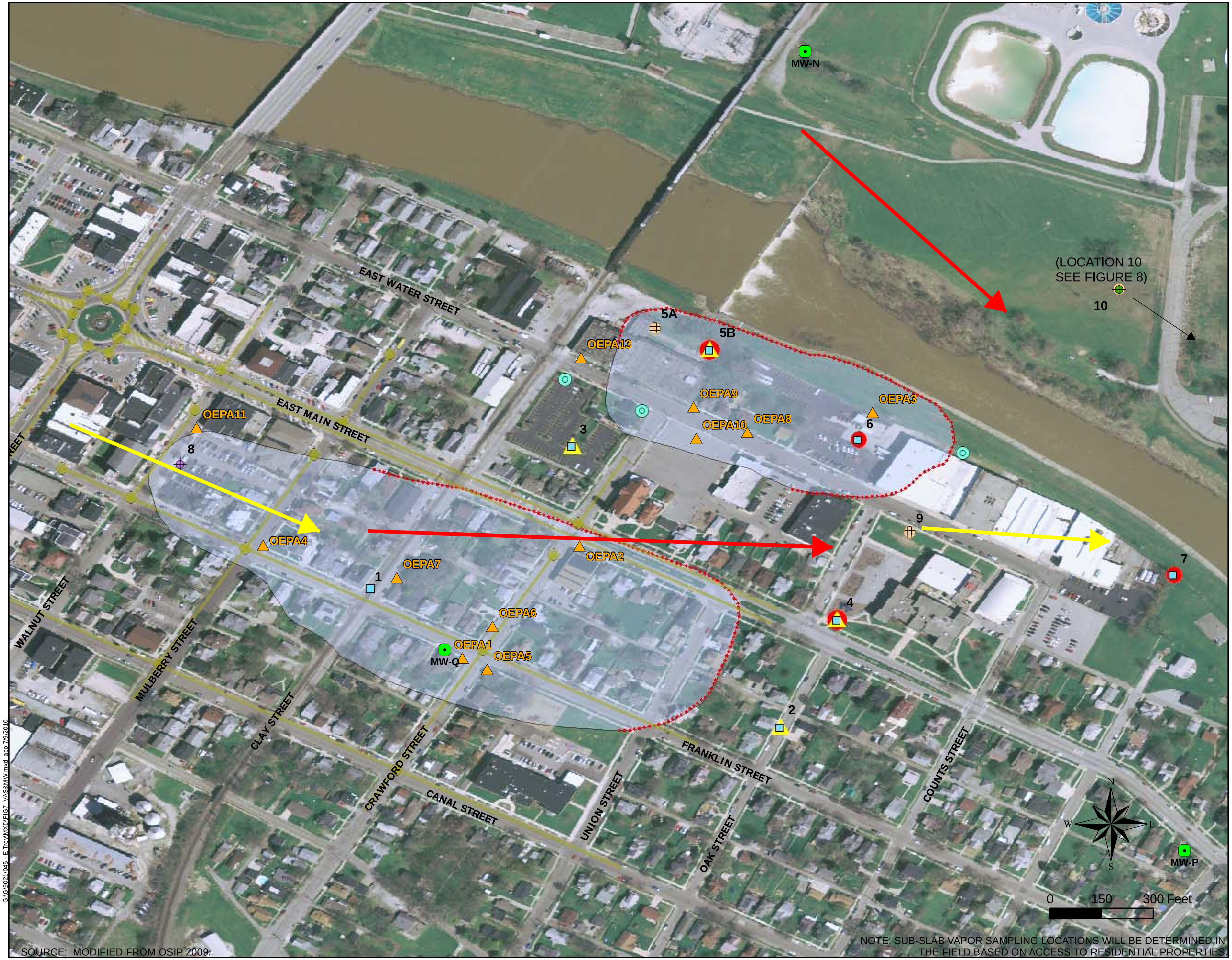
N
W E
S

0 150 300 Feet

EAST TROY CONTAMINATED AQUIFER SITE
RI/FS PHASE I
TROY, OHIO

FIGURE 6
BASELINE GROUNDWATER SAMPLING AND SOIL BORING LOCATIONS-WEST OF RIVER

ST SulTRAC



SOURCE: MODIFIED FROM OSIP 2009.

NOTE: SUB-SLAB VAPOR SAMPLING LOCATIONS WILL BE DETERMINED IN THE FIELD BASED ON ACCESS TO RESIDENTIAL PROPERTIES.

G:\G\9021\045 - E Troy\MXD\FIG7_VAS&MW.mxd_acp 7/9/2010

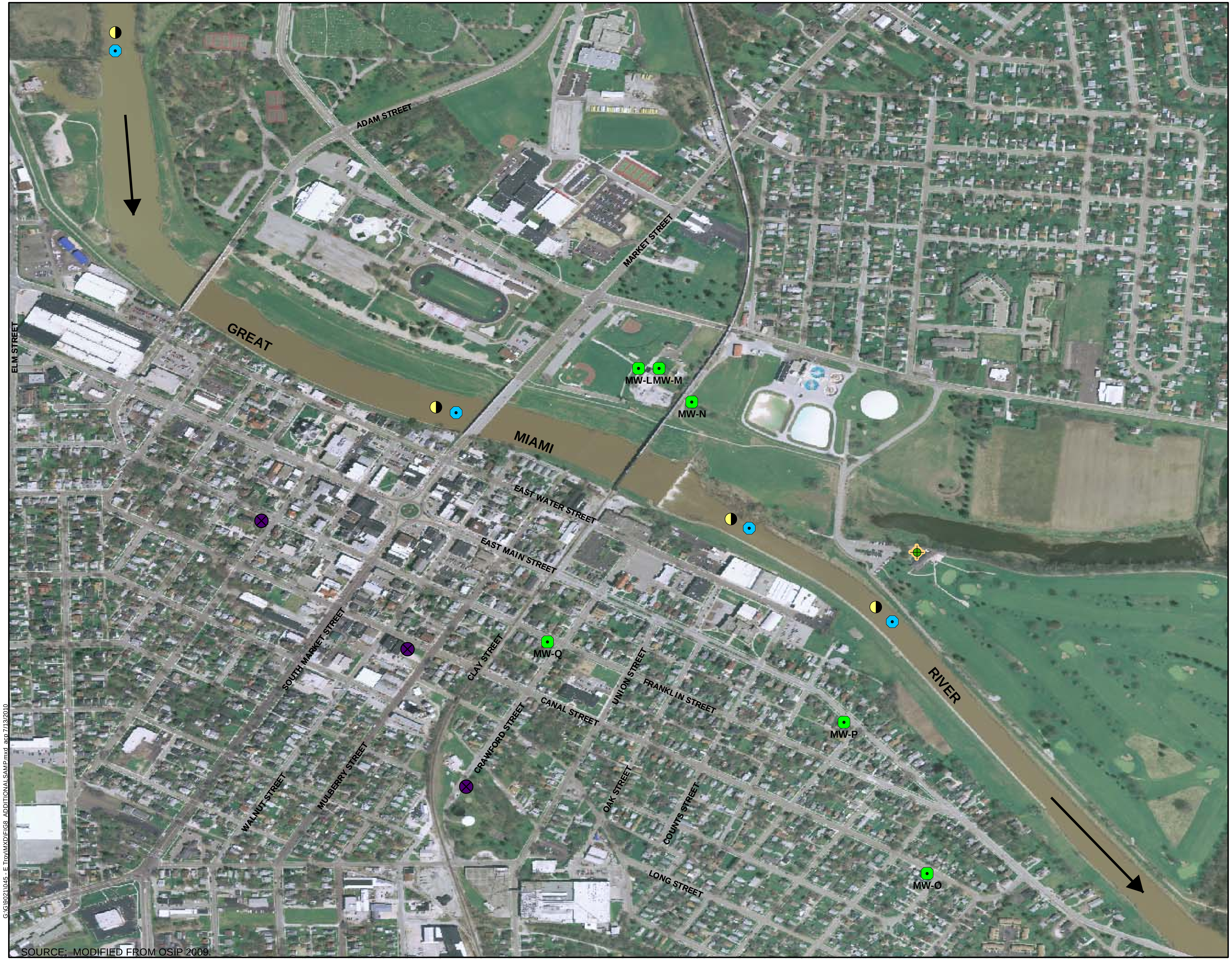
LEGEND

🟩	EXISTING CITY OF TROY MONITORING WELL
▲	OEPA MONITORING WELL
⊕	SHALLOW AND DEEP WELL PAIR
■	PROPOSED VAS ONLY
◎	CONTINGENT (PHASE II) DEEP WELL
⊕	PROPOSED SHALLOW WELL
⊕	PROPOSED DEEP WELL
▲	PROPOSED VAS AND SHALLOW WELL
●	PROPOSED VAS AND DEEP WELL
●	PROPOSED VAS AND SHALLOW AND DEEP WELL
●	MANHOLE
—	SANITARY SEWER
⋯	PLUME BOUNDARY UNKNOWN
▭	VOC PLUME BASED ON OHIO EPA PCE DATA 1999-2004
→	APPARENT FLOW DIRECTION, SHALLOW AQUIFER
→	APPARENT FLOW DIRECTION, DEEP AQUIFER

EAST TROY CONTAMINATED AQUIFER SITE
RI/FS PHASE I
TROY, OHIO

FIGURE 7
VAS AND MONITORING WELL LOCATIONS

SulTRAC



SOURCE: MODIFIED FROM OSIP 2009

LEGEND

- ⊗ BACKGROUND SOIL SAMPLING LOCATION
- ◐ SEDIMENT SAMPLING LOCATION
- ⊙ SURFACE WATER SAMPLING LOCATION
- 🟩 EXISTING CITY OF TROY MONITORING WELL
- ⊕ EAST SIDE UPPER/LOWER AQUIFER MONITORING WELL CLUSTER

NOTE: ALL LOCATIONS ARE SUBJECT TO FIELD CONDITIONS OF ACCESS AND AVAILABILITY. LOCATIONS MAY BE ADJUSTED AS NEEDED. STAFF GAUGES TO BE PLACED NEAR FARTHES TWO DOWNSTREAM SURFACE WATER AND SEDIMENT LOCATIONS.

N
W E
S

0 500 1,000 Feet

EAST TROY CONTAMINATED AQUIFER SITE
RI/FS PHASE I
TROY, OHIO

FIGURE 8
ADDITIONAL SAMPLING LOCATIONS

ST SulTRAC