SUPPLEMENTAL REMEDIAL INVESTIGATION
WORK PLAN
EMERSON POWER TRANSMISSION FACILITY
620 AURORA STREET
ITHACA, NEW YORK
SITE NO. 7-55-010

PREPARED

BY

WSP ENVIRONMENTAL STRATEGIES LLC

JUNE 29, 2007
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<td>3D</td>
<td>3 dimensional</td>
</tr>
<tr>
<td>AOC</td>
<td>area of concern</td>
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<tr>
<td>bgs</td>
<td>below ground surface</td>
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<tr>
<td>DQO</td>
<td>data quality objectives</td>
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<tr>
<td>DOT</td>
<td>Department of Transportation</td>
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<tr>
<td>EPA</td>
<td>Environmental Protection Agency</td>
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<td>EPT</td>
<td>Emerson Power Transmission</td>
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<tr>
<td>ER</td>
<td>electrical resistivity</td>
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<tr>
<td>ft/ft</td>
<td>feet per foot</td>
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<tr>
<td>GPR</td>
<td>ground penetrating radar</td>
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<tr>
<td>ID</td>
<td>inside-diameter</td>
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<td>NAPL</td>
<td>non-aqueous phase liquid</td>
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<td>NYSDEC</td>
<td>New York State Department of Environmental...</td>
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<td>NYSDOH</td>
<td>New York State Department of Health</td>
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<td>OPTV</td>
<td>optical televiewer</td>
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<tr>
<td>PAHs</td>
<td>polycyclic aromatic hydrocarbons</td>
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<tr>
<td>PCBs</td>
<td>polychlorinated biphenyls</td>
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<tr>
<td>PID</td>
<td>photoionization detector</td>
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<tr>
<td>QA/QC</td>
<td>quality assurance/quality control</td>
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<tr>
<td>R&amp;D</td>
<td>research and development</td>
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<tr>
<td>RMS</td>
<td>root mean square</td>
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<tr>
<td>SOP</td>
<td>standard operating procedure</td>
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<tr>
<td>STARS</td>
<td>Spill Technology and Remediation Series</td>
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<td>STL</td>
<td>Severn Trent Laboratories, Inc.</td>
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<tr>
<td>SVOCs</td>
<td>semi-volatile organic compounds</td>
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<td>TAL</td>
<td>target analyte metals</td>
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<tr>
<td>TCE</td>
<td>trichloroethene</td>
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<td>VOC</td>
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1.0 Introduction

On behalf of Emerson Electric Co. and its subsidiary, Emerson Power Transmission Corp. (EPT), WSP Environmental Strategies LLC has prepared this Supplemental Remedial Investigation work plan for the EPT site in Ithaca, New York. This work plan addresses comments in the May 31, 2007 correspondence from the New State Department of Environmental Conservation (NYSDEC) and includes proposed scopes of work for (1) investigating the 25 Areas of Concern (AOCs) identified at the site; (2) investigating the fire water reservoir; (3) evaluating identified structural features within the bedrock both onsite and offsite; (4) evaluating the potential presence of site-related compounds in soil vapor in the Phase VI Expansion area identified by the NYSDEC in the May 31, 2007 correspondence; and (5) evaluating potential groundwater discharge areas north of the site. All activities addressed in this Work Plan will be conducted in accordance with the NYSDEC Draft DER-10 Technical Guidance for Site Investigation and Remediation, dated December 25, 2002. This work plan is prepared under and consistent with requirements outlined in the July 13, 1987 Consent Order (Index # A7-0125-87-09) entered into by the NYSDEC and EPT.

Section 2 of the work plan presents background information on the site and describes the geology and hydrogeology. Section 3 provides the proposed scope of work for investigating the 25 AOCs identified at the site. The proposed scope of work involves drilling 75 soil borings and collecting samples for laboratory analysis at the 25 AOCs. The intermittent stream channel and other identified geophysical structures are addressed in Section 5.0 of this work plan. Section 4 presents the scope of work for investigating the fire water reservoir. The investigation is designed to further evaluate the distribution of the affected groundwater within horizontal bedding plane fractures and within the uppermost portion of the fractured bedrock (B-zone). Six open boreholes will be drilled in areas hydraulically upgradient, cross-gradient, and downgradient of the fire water reservoir and three shallow B-zone wells will be constructed immediately surrounding the reservoir. Two directional borings will be drilled to evaluate conditions below the reservoir area and determine if a source of trichloroethene (TCE) is present. Section 5 details the findings of the 2006 Geophysical Survey and presents a scope of work for evaluating the identified structural features (vertical fractures, in-filled void, and buried stream channel) that may be migration pathways for affected groundwater. Thirteen target areas have
been identified for exploratory drilling. Up to three exploratory borings will be drilled within each target area and, after determining the presence of each suspected structural feature, monitoring wells will be installed to assess groundwater quality. Section 6 discusses the proposed scope of work for evaluating the potential for vapor intrusion in the Phase VI Expansion area identified by the NYSDEC in the May 31, 2007 correspondence. Section 7 provides a scope of work for evaluating potential groundwater discharge areas identified by the NYSDEC in the May 31, 2007 letter. Project mobilization and demobilization plans are discussed in Section 8, and the project schedule and report preparation are discussed in Section 9.
2.0 Site Background

2.1 Facility Description

The EPT facility is located at 620 South Aurora Street in Ithaca, New York (Figure 1). The site consists of three main buildings along the northeast and southwest portion of South Hill, one of many relatively steep hills that overlook the city of Ithaca (Figure 1). The facility buildings are located at an elevation of approximately 600 feet above mean sea level. The majority of the floor space is in the main plant building, which extends approximately 1,600 feet near the eastern portion of the 110-acre site. The main building is flanked by a number of smaller buildings to the west and a series of access roads and parking lots that terrace the hillside above the plant to the east. Further uphill and to the east are South Aurora Street and the campus of Ithaca College. Undeveloped woodland borders the site to the southwest along the steep embankments of the hill. West Spencer Street, which runs parallel to the EPT property, marks the western edge of the wooded area and the base of South Hill. Beyond Spencer Street to the west and in areas along the steep northern approach to South Hill and the EPT property are residential areas. These neighborhoods are bordered by Six Mile Creek, which flows north along the base of South Hill and eventually empties into Cayuga Lake approximately 2 miles northwest of the site.

The original building at the EPT site was built in 1906 by Morse Industrial Corporation, which manufactured steel roller chain for the automobile industry. From approximately 1928 to 1983, Borg-Warner Corporation owned the property and manufactured automotive components and power transmission equipment using similar processes, but not necessarily the same materials, as those currently conducted by EPT. Up until the late 1970s, Borg-Warner Corporation used TCE, a widely-used solvent for cleaning and degreasing metal parts. In 1983, Morse Industrial Corporation was purchased from Borg-Warner Corporation by Emerson and, in the late 1980's, became known as Emerson Power Transmission. EPT manufactures industrial roller chain, bearings and clutching for the power transmission industry. Under Emerson's ownership, TCE has not been used at the Ithaca facility. Investigations conducted by Emerson revealed onsite groundwater contamination in 1987, originating from a fire-water reservoir located on the western portion of the property. Emerson promptly reported these findings to the New York State Department of Environmental Conservation.
2.3 Site Geology

The EPT site is located on the northern edge of the Appalachian Plateau Physiographic Province, which is characterized in central New York by deeply dissected hilly uplands and glacially gouged stream valleys. The EPT site lies on the limits of one of the dissected hills and overlooks the Cayuga Lake basin, which is formed in a former stream valley eroded and enlarged by the advance of glaciers. Underlying the site is a thin, discontinuous veneer of glacial till and man-made fill. The soil classified as the "A-zone" in the site conceptual model and hydrogeologic framework presented below, is typically a silty or clayey gravel and ranges in depth from 2.5 to 33 feet thick, though most of the EPT site and the western slope of South Hill is covered by less than 15 feet of soil. Soil depths generally increase with decreasing elevation and eventually merge with glacio-lacustrine silt and clay that lines the bottom of the valley floor below South Hill.

Beneath the overburden lies bedrock of the Ithaca Siltstone, a member of the Genesee Formation. The bedrock is typically well-cemented with generally non-fossiliferous beds ranging in thickness from 0.1 inch to 2.5 feet in thickness. Previous interpretations of the site bedrock, based on core logs recovered from borehole drilled for investigation activities, differentiated the rock into three zones based on the frequency of bedding plane fractures: an upper "stress relief zone" (B-zone), a middle "transitional zone" (C-zone), and a lower "lithologically controlled zone" (D-zone). The uppermost B-zone is weathered bedrock and very highly to highly fractured. Onsite the B-zone extends to a maximum depth of approximately 22 feet below ground surface (bgs) and has an average thickness of approximately 8 to 10 feet on the west portion of the site where the current remediation system is located.

The transitional zone (C-zone) extends from the base of the B-zone to a maximum depth of approximately 55 feet bgs at the EPT site. The lower lithologically controlled zone (D-zone) extends from the bottom of the C-zone to a minimum depth of 145 feet bgs. According to geologic logs prepared by Radian, fractures are reportedly confined to intervals that are widely spaced, and their occurrence is controlled by lithology. This terminology was developed by Radian Corporation, the previous consultants at the site, and carried forward by WSP Environmental Strategies.
2.3.1 Joint Measurements

The bedrock in the Ithaca area is cut by at least three sets of vertical fractures or joints. Limited geologic mapping performed by Radian at 16 bedrock outcrop locations on and around the EPT facility identified three consistent joint orientations: N13W to N21W (north-northwest); N70E to N89E (east-northeast); and N45E to N55E (northeast). Two of the three strike orientations measured by Radian are in close agreement with regional joint set measurements of N19W and N7E made at outcrops of the Genesee Group in Tompkins County. All of the joints measured by Radian were within 8 degrees of vertical.

In December 2005, WSP Environmental Strategies measured the orientation of bedrock joints sets at seven bedrock outcrops in the South Hill area northwest of the EPT facility. Two primary joint sets were identified, one oriented north-northwest and another oriented east-northeast. The north-northwest trending joint set was more common and better expressed in the observed bedrock outcrops. A total of 22 measurements were made of the north-northwest trending joint set and three measurements of the east-northeast trending joint set. Measurements were made using a Brunton compass adjusted for magnetic declination of Ithaca, New York at the time of the investigation (12° 12’ W). The mean joint orientation of the 22 north-northwest trending joint set measurements was 342/82 (strike/dip using right-hand rule) or N18W/82E. The mean joint orientation of the 3 north-northeast trending joint set measurements was 252/81 or S72W/81N. These orientations are consistent with published regional trends, as well as previous measurements collected by Radian.

2.4 Site Hydrogeology

Based on groundwater elevation data collected on December 12, 2005, the direction of groundwater flow within the shallow bedrock aquifer and the hydraulically connected sand and gravel aquifer is to the northwest. This groundwater flow pattern is consistent with data collected during previous sampling events, with the overall gradient of flow generally following the gradient of surface topography. A steep groundwater gradient of approximately 0.22 feet per foot (ft/ft) was observed on South Hill, and a shallower gradient of approximately 0.027 ft/ft was observed west of West Spencer Street.
3.0 **AOC Investigation**

This section describes the scope of the investigations to evaluate soil quality (and groundwater, if encountered) at each AOC identified at the EPT site. The AOCs identified at the site are based on a review of all available records including onsite files, database reports, NYSDEC and New York State Department of Health (NYSDOH) site files, and historical maps, as detailed in the Onsite Assessment Report that was approved by the NYSDEC on September 5, 2006. The investigation activities will be conducted in accordance with the NYSDEC Draft DER-10 Technical Guidance for Site Investigation and Remediation, dated December 25, 2002, and WSP Environmental Strategies' standard operating procedures (SOPs), which are included as Appendix A. Additionally, all manufacturer specifications will be adhered to for the operation and maintenance of field sampling and monitoring equipment.

3.1 **Soil Borings**

The soil borings will be located based on engineering diagrams, employee interviews, and historical maps. Soil borings will be installed at each of the 25 identified AOCs (Figure 2a) using a hand auger, bucket auger, or Geoprobe® (direct push) type equipment. The type of equipment selected will be based on the location of the borings. For example, a hand or bucket auger will be used to collect soil samples in areas of shallow bedrock. Soil samples collected from the borings will be analyzed for constituents representative of the former operations conducted at the AOC.

At all soil boring locations, a Geoprobe® unit or hand/bucket auger will be used to collect continuous soil samples beneath the slab or outside the buildings. If the locations inside the building are not accessible for a conventional Geoprobe® unit, then a tripod with cathead, slam bar, or similar method will be employed after the floor is cored. On retrieval, the soil, if present, will be logged and classified according to the Unified Soil Classification System. Other pertinent soil observations, such as staining, odors, presence of fill, and moisture content, will be recorded. A photoionization detector (PID) will be used to screen each sample for organic vapors and visually checked for evidence of staining. The PID screening results and visual observations will be recorded in a field log book. The sample with either the highest PID reading or the heaviest staining (if staining is observed) will be selected for laboratory analysis.
If no PID readings are measured and no evidence of staining is observed, then a sample of the soil on top of the bedrock will be collected for laboratory analysis, if feasible. For borings installed inside the buildings, the concrete slab will be cored before initiating sampling with the Geoprobe® unit or hand auger. If bedrock is encountered with 3 inches of the slab bottom, no soil samples will be collected at that location and a notation will be recorded in the field log book. In addition, if actual groundwater is encountered in soil borings within the buildings, a sample will be collected for laboratory analysis of volatile organic compounds (VOCs).

Following sampling activities, the boreholes will be backfilled with bentonite pellets or coarse bentonite chips, the bentonite material will be hydrated with tap water, and the concrete floor will be repaired. All down-hole sampling equipment will be decontaminated after each use.

The following sections provide a brief description of the AOC and the proposed sampling activities.

3.1.1 AOC 1 - Former Department 507 Degreaser

Solvent degreasing and recovery operations conducted in Department 507, formerly located on the main floor of Building 4, included two conveyor type vapor degreasers and a solvent distillation and recovery unit. Solvents used in the degreasing operations included trichloroethene and Safe-Tee-Solvent, which is a mixture of tetrachloroethene and methylene chloride. According to facility drawing D-118940, the degreasers were located immediately east of column numbers 86 through 93. The degreaser units, which were located in a depressed floor area of Building 4 are no longer present (Figure 2a).

Two soil borings will be installed within the formerly depressed area of the floor and two soil borings will be installed along the western exterior wall. Each boring will be installed to the top of bedrock, which is anticipated to be between 5 and 6 feet bgs. One soil sample will be collected from each boring for laboratory analysis of VOCs and target analyte list (TAL) metals. Engineering drawings will be used to determine the location of the former degreaser area; specifically the location of former equipment will be determined based on placement relative to numbered support columns.

3.1.2 AOC 2 - Former Solvent Degreaser Building 6A

A solvent degreaser unit was formerly located on the main floor of Building 6A within the chain assembly area (116 Department; Figure 2b). Historical maps, engineering diagrams, and any remaining structures will be used to identify the location of the degreaser. According to
facility drawing D-118930, the degreaser was located to the east of column numbers 54 through 58. As indicated in Figure 2B, one boring will be drilled within the location of this former degreaser and one boring will be installed downgradient of the former degreaser location. The borings will be drilled to the top of bedrock, assumed to be approximately 5 feet below grade. One soil sample will be collected from each boring for laboratory analysis of VOCs and TAL metals.

3.1.3 AOC 3 - Former Morse Chain Reservoir/Spray Pond

A former reservoir/spray pond was identified north of Building 18 across the railroad tracks on several Sanborn Fire Insurance maps (Figure 2a). According to historic files (facility drawing 27036), the reservoir appears to have been used for storing cooling water. However, no documentation detailing the use and closure of the former spray pond is available.

Three soil borings will be installed in and around the former spray pond to characterize the soils within this area. One soil boring will be located within the former spray pond and two will be located downgradient (northwestern) of the former pond walls. The borings will be installed to the top of bedrock, approximately 15 feet bgs. Because the former use of the spray pond is unknown, two soil samples will be collected from each boring and analyzed for VOCs, semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), and TAL metals.

3.1.4 AOC 4 - Former Open Reservoir (Stone)

An open stone reservoir was identified on historical site maps west of Building 35 (within Building 6A – Figure 2b). The former use of this reservoir is unknown. According to facility drawing 27036, the former reservoir was located immediately west of the south corner of former Building 16A, which is now the east portion Building 6A (structure approximately 100 feet from the south wall and 15 feet from east wall). Two soil borings will be installed to the top of bedrock (approximately 5 feet bgs) to identify if releases occurred in this area. One boring will be located within the reservoir and one boring will be located on the downgradient side (northwestern), within 5 feet of the reservoir. Because the former use of the reservoir is unknown, one soil sample will be collected from each boring and analyzed for VOCs, SVOCs, PCBs, and TAL metals.

3.1.5 AOC 5 - Former 100,000 Gallon Fuel Oil Tank/Pump House

A former 100,000-gallon aboveground fuel oil tank and associated pump house were located to the south of Building 6A (Figure 2b). Building 33 was since constructed over the
location of the former tank and pump house. Based on the size of the former tank and its contents, there is a potential that releases to soil may have occurred during use or decommissioning. This tank was located approximately 55 feet south of Building 6A and 60 feet west of the east wall of Building 33 (facility drawing 27036).

As indicated in Figure 2B, 3 soil borings will be completed in this area. One soil boring will be installed to the top of bedrock (~5 feet bgs) outside Building 33 on the downgradient (northwest-west) side. In addition, one soil boring will be installed in the location of the former oil tank/pump house. A third boring will be installed in Building 33 on the lower level within 5 feet of the former sub-slab vapor/indoor air testing location where trichloroethene concentrations in the soil vapor exceeded the NYSDOH Soil Vapor/Indoor Air Matrix guidance value. One soil sample will be collected from each of the first two borings for laboratory analysis of NYSDEC Spill Technology and Remediation Series 8260 (STARS) VOCs and polycyclic aromatic hydrocarbons (PAHs), per Table 1. One soil sample will be collected from the third boring and analyzed for STARS VOCs, per Table 1.

3.1.6 AOC 6 - Oil Shed (Building 30)

A shed (Building 30) used for bulk oil storage (both past and present) is located to the south of Building 34 (Figure 2a). Facility records indicate that secondary containment was constructed around the building in 1974. In 1995, an investigation was conducted in a specific area southwest of the building. Based on the results of that investigation, which identified TPH impacts, the affected soil within this area was excavated and disposed of offsite.

One soil boring will be installed to the top of bedrock (~5 feet bgs) outside Building 30 on the downgradient (west-northwest) side. One soil sample will be collected for laboratory analysis of STARS VOCs and PAHs.

3.1.7 AOC 7 - Former Copper-Cyanide & Cadmium Plating Department

Copper-cyanide and cadmium plating operations were historically conducted in Building 14 (Figure 2a). Cadmium plating occurred from approximately 1960 to 1975. Copper plating, which used copper cyanide solutions, occurred from 1972 to approximately 1982. According to a 1968 engineering drawing, the plating department consisted of two pickling tanks, four plating tanks and three rinse tanks. The former plating area was decommissioned and the area remains unused. Notes on a 1968 plant drawing indicate that the drainage trench or drain line carrying effluent from the plating area was leaking and that they were to be plugged.
and replaced with a new drain line. The leak occurred in the basement of Building 4, which is
two levels below Building 14. The drain line in Building 4 is located approximately 68 feet
northeast of elevator 5 (facilities drawing 81590).

Seven soil borings will be installed within the former plating department. Borings will be
installed at the locations of the former 4 plating and 2 pickling, and rinse tanks, which will be
identified based on engineering diagrams. One additional boring will be installed outside the
plating room near the location of a former discharge line that reportedly leaked (1968
engineering drawing). The borings will be installed to approximately 3 to 5 feet bgs. One soil
sample from each boring will be collected and analyzed in the laboratory for TAL metals and
cyanide based on the type of chemicals used in the plating process.

3.1.8 AOCs 8/9 - Former Tank Shed

Two former tank sheds were identified on Sanborn fire insurance maps; one to the south
of Building 24 and the other to the southwest of Building 21 (Figure 2a). A 15,000 gallon fuel
oil tank was housed in the shed south of Building 24 (AOC No. 8) and a hydraulic oil tank of
unknown size was housed in the shed southwest of Building 21 (AOC No. 9; Figure 2a).

One soil boring will be installed to the top of bedrock (~10 feet bgs) outside each
building on the downgradient (west-northwest) side. One soil sample from each boring will be
collected for laboratory analysis of STARS VOCs and PAHs.

3.1.9 AOC 10 - Former Drum Area (Woods)

Empty drums were discovered on the hillside to the west of the facility between 1970 and
2004 (Figure 2a). Borg-Warner Corporation removed approximately 75 to 100 drums from the
hillside southwest of Building 34 between 1980 and 1982 and Emerson removed additional
drums and remnants in 1988 and 2004. A limited investigation was conducted during the most
recent removal activities in 2004.

A depression in the wooded area located southwest (Area A - Figure 2b) of Building 34
was identified on a 1976 aerial photograph and appeared to contain objects that could have been
drums. This area will be investigated by installing five shallow soil borings using a hand auger,
to a depth of approximately 3 feet bgs. One soil sample will be collected from each boring and
analyzed for VOCs, SVOCs, TAL metals, and PCBs, per Table 1. If no PID readings are
recorded and there is no evidence of staining, then a soil sample will be collected at
approximately 3 feet bgs and tested for the same analytes.
3.1.10 AOC 11 - Former Drum Storage Area (near Building 30)

A 1976 historical aerial photograph shows an apparent outdoor drum storage area to the north of Building 30, south of Building 34 (Figures 2a and 2b). Several drums appear to have been stored in this area of the site. No additional documentation was available describing the storage area or the drums stored at this location.

Two test pits will be excavated within the estimated center of the former storage area, that is approximately 10 to 15 feet from the wall that runs along the north side of Building 30 (Figures 2a and 2b). Visual observations will be made of the excavated soil as well as sidewalls and base of the test pit to identify any evidence of a release to the environment. Two soil samples will be collected from the bottom of each test pit (or where evidence of a release is identified) for laboratory analysis of VOCs, SVOCs, PCBs, and TAL metals.

3.1.11 AOC 12 - Former Quench Oil Pits

Four below-grade quench oil pits were formerly located near the center of current Building 9 (Figure 2a). The pits were reportedly taken out of service and either filled or covered over. A fifth quench oil pit in this area is currently in use. A review of facility records indicates that holes were identified in the bottom of one of the four pits (Westinghouse furnace quench pit). The former quench oil pits were located approximately 30 feet west of the east wall of Building 9 and 55 feet north of the south wall (facility drawing 27036).

Two soil borings will be installed along the downgradient (west-northwest) sides of the former pits, within approximately 5 feet. One soil sample will be collected from each boring for laboratory analysis of VOCs, PAHs, and PCBs.

3.1.12 AOC 13 - Former 20,000 gallon Fuel Oil Aboveground Tank

A 20,000 gallon fuel oil tank was formerly located northwest of Building 18 (Figure 2a). No information related to the closure of this tank was available. One soil boring will be installed to the top of bedrock (~15 feet bgs) in the center of the area where the tank was stored. One soil sample will be collected for laboratory analysis of STARS VOCs and PAHs.

3.1.13 AOC 14 - Former 6,000 gallon Lubricating Oil Aboveground Tank

A 6,000 gallon aboveground lubricating oil tank was formerly located in Building 20 (no longer present; Figure 2a). No information related to the closure of this tank was available. One soil boring will be installed to the top of bedrock (~15 feet bgs) in the center of the area where
the tank was stored. One soil sample will be collected for laboratory analysis of STARS VOCs and PAHs.

3.1.14 AOC 15 - Former 500 Gallon Gasoline Aboveground Tank

A 500 gallon gasoline tank was formerly located northwest of Building 4 (Figure 2a). No information related to the closure of this tank was available. One soil boring will be installed to the top of bedrock (~15 feet bgs) in the center of the area where the tank was stored. One soil sample will be collected for laboratory analysis of STARS VOCs, naphthalene, and lead.

3.1.15 AOC 16 - Former 5,000 Gallon Sulfuric Acid Tanks

Two 5,000 gallon sulfuric acid tanks were located in Building 13A along the western wall (Figure 2a). No information related to the closure of these tanks was available. One soil boring will be installed to a depth of approximately 3 feet in the center of the area where each tank was stored. Two soil samples will be collected at 2 feet and 3 feet below the slab for laboratory analysis of pH. The former acid tanks were located approximately 155 feet north of Building 14 and 65 west of the east wall of Building 13A (facility drawing 27036).

3.1.16 AOC 17 - Former 10,000 Gallon Fuel Oil Aboveground Tank

A 10,000 gallon fuel oil tank was formerly located west of Building 18 (Figure 2a). No information related to the closure of this tank was available. One soil boring will be installed to the top of bedrock (~15 feet bgs) in the center of the area where the tank was stored. One soil sample will be collected for laboratory analysis of STARS VOCs and PAHs.

3.1.17 AOC 18 - Former Outdoor Area of Disturbance

A review of a 1976 aerial photograph shows an apparent area of disturbance to the north of Building 24 (Figure 2a), which was formerly occupied by both NCR and Borg-Warner Corporation. No documentation was available to identify the use of this area.

Two test pits will be excavated within 20 feet of the northeastern wall of Building 24. Visual observations will be made of the excavated soil as well as sidewalls and base of the test pit to identify any evidence of a release to the environment. Two soil samples will be collected from the bottom of each test pit (or where evidence of a suspected release is identified) for laboratory analysis of VOCs, SVOCs, PCBs, and TAL metals.

3.1.18 AOC 19 - Drainage Ditches along Railroad Tracks/Oil Traps

A drainage ditch formerly extended along the railroad tracks northwest of Buildings 6A and 34 (Figures 2a and 2b). This ditch was approximately 400 feet long and was identified on a
site engineering drawing. At various locations along the ditch, oil traps were constructed to collect oil that dripped from rail cars. No information is available on how the former ditch was closed.

Five shallow soil borings will be installed using a hand auger to approximately 4 feet bgs along this former drainage ditch spaced approximately 100 feet apart. One of the borings will be located adjacent to the oil trap on the southernmost end of the ditches. One soil sample will be collected from each boring for laboratory analysis of STARS VOCs, PAHs, and PCBs.

3.1.19 AOC 20 - Storm Sewer along South Cayuga Street

EPT is permitted to discharge storm water associated with industrial activity through two outfalls (001 and 003) under State Pollutant Discharge Elimination System permit No. NY-000-2933 (Figure 2a). Outfall 001 receives non-contact cooling water, boiler blowdown, storm water runoff, and groundwater from the facility’s groundwater treatment system. Outfall 003 receives non-contact cooling water and storm water. Both outfalls discharge to an underground storm sewer line that extends along the east side of South Cayuga Street and discharge to Six Mile Creek. Historical site records indicate that oil and possibly other materials may have been released to the storm sewer.

Four soil borings will be installed to a depth of 3 to 4 feet bgs along the first 100 feet of South Cayuga Street spaced approximately 25 feet apart along the storm sewer (Figure 2a). The borings will be within 4 feet of the line in accordance with the utility locating and marking requirements. One soil sample will be collected from each boring for laboratory analysis of VOCs, PCBs, PAHs, TAL metals, and cyanide. In addition, two soil vapor sampling points will be installed along the storm sewer line, approximately 1 foot above the invert elevation (Figure 2a). Soil vapor samples will be analyzed for VOCs. Sample collection will follow procedures outlined in the NYSDEC approved Vadose Zone Work Plan for the EPT site (July 2005).

3.1.20 AOC 21 - Sanitary Sewer Lines

EPT discharges sanitary wastewater, process wastewater, non-contact cooling water, boiler blowdown, and miscellaneous wastewater, to the municipal sanitary sewer at two connection points; Turner Place and South Cayuga Street (Figures 2a and 2b). Sanitary wastewater, process wastewater, non-contact cooling water, boiler blowdown, and miscellaneous wastewater streams are discharged to the municipal sewer at Turner Place while sanitary wastewater and non-contact cooling water is discharged to the municipal sewer at South Cayuga.
Street. The two lines along Turner Place have been investigated and the report of this work was submitted to the NYSDEC in July 2006. In addition, soil gas samples were collected further to the north along South Cayuga Street in July 2004. Elevated levels of VOCs were identified in three of the soil gas samples (VP-6, VP-8, and VP-9, Figure 3). This work plan addresses the sewer along South Cayuga Street, further north along Turner Place and down Columbia Street (Figure 3).

Four soil borings (SB21a through SB21d) will be installed to a depth based on the invert elevation of the line (approximately 5 to 7 feet bgs) along the sewer line that extends from the west side of Buildings 34 and 6a and continues down South Cayuga Street (Figures 2a and 2b). The borings will be within 4 feet of the sewer line based on concurrence by the City of Ithaca. One soil sample will be collected from each boring for laboratory analysis of VOCs, PCBs, PAHs, and cyanide. In addition, two soil borings will be installed within 3 feet of each former soil gas sample location further north along South Cayuga Street. The borings are designated as SB21e through SB21j on Figure 3. One soil sample will be collected from each boring for laboratory analysis of VOCs.

Four soil vapor points (SV-21a through SV-21d) will be installed along the sewer line on South Cayuga Street to the north of the EPT site (Figure 2a). In addition, as requested by the NYSDEC, six additional soil vapor points (SV-21e through SV-21j) will be installed along the sewer lines on Turner Place and Columbia Street (Figure 3) and three additional soil vapor points (SV-21k through SV-21m) will be installed along the upgradient section of the NCR sewer line (Figure 4). The 13 soil vapor sampling points will be installed to a depth of 1 foot above the invert elevation of the sewer lines and sampling procedures will follow those described in the NYSDEC-approved Vadose Zone Work Plan for the EPT site dated January 16, 2004 and Section 6.0 of this work plan. All soil vapor samples will be analyzed for VOCs.

As requested by the NYSDEC, five vapor samples and dry weather water samples (Figure 3) will also be collected from manholes located along South Hill Terrace, Turner Place, and Columbia Street (MH-1 through MH-5). The vapor and water samples will be analyzed for VOCs, as requested by NYSDEC (Table 1).

3.1.21 AOC 22 - Former Outdoor Drum Storage Area (SE Building 13B)

Based on a 1991 aerial photograph, a former outdoor drum storage area was located southeast of Building 13B (Figure 2a). No information is available regarding the contents of
drums stored in this area. The NYSDEC requested that these be considered an AOC (letter dated September 5, 2006). This former storage area will be marked out using measurements taken from the aerial photograph and a scaled site map. Two soil borings will be installed to the top of bedrock. One soil sample will be collected from each boring for laboratory analysis of VOCs, SVOCs, PCBs, and TAL metals.

3.1.22 AOC 23 - Buildings 1, 2, and 10

Based on a 1910 Sanborn map, Buildings 1 and 2 formerly contained machine shops, and Building 10 contained the former coke operation (Figure 2a). Two borings will be installed inside each building to the top of bedrock. The boring locations will be selected in the field using historical engineering diagrams or Sanborn maps to focus on areas where equipment or raw materials were stored. In addition, one of the borings (SB-23f) installed in Building 10 will be located within 5 feet of the former sub-slab vapor/indoor air testing location. One soil sample from each boring will be collected for laboratory analysis of VOCs, SVOCs, PCBs, and TAL metals.

3.1.23 AOC 24 - Fire Water Reservoir

The fire water reservoir, located northwest of Building 3 (Figure 2a), was identified as a source of VOCs detected in groundwater downgradient of the site and has been investigated under a Consent Order, dated July 13, 1987, entered into by the NYSDEC and Emerson. The NYSDEC requested that the fire water reservoir be considered an AOC (letter dated September 5, 2006).

A scope of work for investigating the area around the firewater reservoir is detailed in Section 4 of this work plan.

3.1.24 AOC 25 – Previous Soil Vapor Sample Locations in Main Building

The following areas of concern are included in the work plan based on the results of the sub-slab soil vapor sampling conducted in the main buildings in December 2005 and January 2006. Locations included as AOCs are those where levels of VOCs in the sub-slab and associated indoor air samples were detected above the NYSDOH Soil Vapor/Indoor Air Matrix guidance values for evaluating soil vapor and indoor air. A list of these AOCs follows:

- AOC 25a – Building 3
- AOC 25b – Building 34
In addition, results for soil vapor and associated indoor air samples collected at three other locations (in Buildings 4 [AOC 11], 10 [AOC 23], and 33 [AOC 5]) were above the NYSDOH Matrix guidance values. The proposed soil sampling activities for these areas are described in Sections 3.1.1, 3.1.5, and 3.1.22 of this work plan.

At AOC 25a (Figure 2a), three soil borings will be installed within 5 feet of the subslab vapor sampling locations. At AOC 25b (Figure 2b), six borings will be installed in two areas of the building where previous subslab soil gas samples were collected. In AOC 25c (Figure 2a), two soil borings will be installed along the former plating line and one boring will be installed west of the plating line in the vicinity of the subslab vapor sample location. Finally, at AOC 25d (Figure 2a), two soil borings will be installed within 5 feet of the subslab vapor sample location in the southern portion of the building.

At each boring location, a soil sample will be collected at a depth of approximately 2 to 3 feet and analyzed for VOCs. The samples from AOC 25c also will be analyzed for TAL metals and cyanide.

3.2 Boring Location Survey

Upon completion of each soil boring installation, each location will be marked with white paint or an orange marking flag. Locations outside the buildings will be surveyed by a surveyor licensed in the state of New York. Horizontal measurements will be measured to the nearest 0.1 foot and vertical measurements to the nearest 0.01 foot. All locations will be included on a scaled site map in the final report. For the boring locations inside the buildings, each will be marked with white paint and each location surveyed for incorporation on a scaled site drawing and included in the final report.

3.3 Sample Collection and Analysis

Soil samples for laboratory analysis will be collected using a dedicated stainless steel scoop or trowel. Disposable nitrile gloves will be worn by the sampling personnel and the gloves will be changed before each sample is collected. Soil samples will be collected in 4 ounce containers provided by the laboratory. Once the containers are filled and labeled, they
will be placed in a cooler with ice. A chain-of-custody form will be completed and placed in the cooler containing the samples. Custody seals will be placed on the outside of the coolers. The coolers will be shipped to Severn Trent Laboratories, Inc. (STL), for analysis of VOCs using EPD Method 8260.

The soil samples will be shipped to STL, which is certified by the NYSDOH Environmental Laboratory Approval Program, and analyzed for the following parameters:

- VOCs by U.S. Environmental Protection Agency (EPA) Method 8260
- NYSDEC STARS 8260 VOCs
- SVOCs by EPA Method 8270
- PAHs by EPA Method 8270
- TAL Metals by EPA Method 6020/7000 series
- cyanide by EPA Method 9010B
- PCBs by EPA Method 8082.

Table 1 summarizes the number of soil samples to be collected from each AOC and the sample parameters designated for analysis.

Groundwater grab samples will be collected using dedicated disposable Teflon or polyethylene bailers or tubing. Bailers or tubing will be lowered slowly into the boring to avoid agitating the water, if encountered. Disposable nitrile gloves will be worn by the sampling personnel and the gloves will be changed before each sample is collected. Samples for VOC analysis will be collected in three precleaned 40-ml vials, labeled with the time and date of sampling, the sample location, the sampler’s initials, and the analyses to be performed. The samples will be preserved with hydrochloric acid to a pH of 2 or less. The vials will be completely filled. Once the samples have been filled and sealed, they will be placed in a cooler with ice. Custody seals will be placed on the outside of the coolers. The coolers will be shipped to STL for analysis of VOCs using EPD Method 8260.

Photographs of soil and groundwater samples collected from each AOC will be taken and included in the Remedial Investigation Report.
3.4 Quality Assurance/Quality Control

Quality assurance/quality control (QA/QC) samples, including equipment blanks, trip blanks, and duplicates, will be collected in accordance with WSP Environmental Strategies' SOPs (Appendix A). Additional sample volumes will be collected to allow the laboratory to perform matrix spike and matrix spike duplicates of selected samples. Additional volumes will be provided for at least 1 per 20 samples per analyte group. All samples will be sealed, labeled, placed in a cooler with ice, and shipped to STL. Appropriate chain-of-custody procedures will be followed.
4.0 **Fire Water Reservoir Investigation**

The fire water reservoir investigation is designed to further evaluate the nature and extent of affected groundwater around the fire water reservoir. The data generated from this investigation will be used in developing a design for upgrading the existing groundwater remediation system. The scope of this work is consistent with requirements outlined in the Consent Order, dated July 13, 1987, entered into by the NYSDEC and Emerson.

As stated in Section 1.0, the proposed investigation is designed to further evaluate the distribution of affected groundwater within horizontal bedding plane fractures identified beneath the current remediation area, as well as within the uppermost portion of the fractured bedrock (B-zone). Based on the results of the packer testing and downhole geophysical testing conducted within the remediation area, open fractures were identified within the lower C-zone at a depth of 52 feet bgs. The additional subsurface information gained from this investigation is necessary to complete the design upgrades to the remediation system at the site. The proposed scope of work involves installing and sampling six vertical open boreholes in areas hydraulically upgradient, cross-gradient, and downgradient of the fire water reservoir and three shallow B-zone wells immediately surrounding the reservoir. The scope of work also includes installing, logging, and sampling two direction borings to evaluate conditions beneath the reservoir. In addition, one water sample from each compartment of the fire water reservoir will be collected and analyzed for VOCs, as requested by the NYSDEC.

4.1 **Fire Water Reservoir**

Based on available records, the fire water reservoir has a capacity of 200,000 gallons and was constructed in 1906. The reservoir is constructed of concrete and extends approximately 19 feet bgs. Shallow bedrock in the area is encountered at approximately 12 feet bgs.

Currently, there are three groundwater monitoring wells (MW-5-25, MW-5-40, and MW-5-100) and one extraction well (EW-4) located in areas surrounding the reservoir. These wells are screened at various depths within the subsurface and have been sampled routinely since 1994. **The open or screened interval of each of these wells is listed below:**

- **MW-5-25** – Overburden well screened between 3.6 and 11.6 feet bgs (elevation between 583.83 - 575.83 feet above mean sea level [MSL])
• MW-5-40 – Bedrock well with an open borehole interval between 17.3 and 40.3 feet bgs (elevation between 570.12 - 547.12 feet above MSL)
• MW-5-100 – Bedrock well screened between 79.0 and 99.0 feet bgs (elevation between 508.42 - 488.42 feet above MSL)
• EW-4 – Bedrock extraction well with an open borehole interval between 15 and 40 feet bgs (elevation between 565 - 540 feet above MSL)

The results of groundwater samples collected from these wells historically show that samples from MW-5-40 consistently contain the highest level of VOCs. Only trace levels of VOCs are found in the overburden well and the deeper bedrock wells in this area.

4.2 2006 Remediation Area Investigation Results

4.2.1 Borehole Geophysical and Packer Testing Results

The results of recent borehole geophysical and packer testing were provided to the NYSDEC in October 2006. The results are summarized below and are the basis for the fire water reservoir area investigation.

4.2.1.1 Borehole Geophysical Logging

In January 2006, Mid-Atlantic Geosciences of Lancaster, Pennsylvania, conducted downhole geophysical logging of selected wells located within the current remediation area. Extraction wells EW-1 and EW-3 and monitoring wells EW-2, MW-1, MW-2, and MW-3-31 were logged for temperature, conductivity, natural gamma, and borehole diameter. The open borehole sections of EW-1, EW-2, and EW-3 were also logged using a downhole Optical Viewer to identify the location of fractures within the remediation area.

The geophysical logging results showed that open horizontal bedding plane fractures were present in extraction wells EW-1 and EW-3 at approximately 52 feet below the top of each casing. Fluid conductivity logs also showed deflections or changes at this same interval, indicating a potential water-producing feature. In EW-1 an increase in borehole diameter was noted at the 52 foot depth interval, indicating a possible fracture. Partial open fractures were also observed in EW-2, which is located between extraction wells EW-1 and EW-3.

Based on the January 2006 downhole geophysical results, packer testing was proposed to isolate and evaluate the hydraulic characteristics of the identified fracture within extraction wells EW-1 and EW-3.
4.2.1.2 Packer Testing Results

In August 2006, inflatable straddle-packer assemblies were installed in extraction wells EW-1 and EW-3. The packer assemblies were installed to isolate the horizontal bedding plane fractures at approximately 52 feet below the top of casing of each well, which corresponds to an elevation of 515 feet above MSL.

During packer testing, a total of 3,137.7 gallons of groundwater was extracted from the isolated fracture interval. A total of approximately 1,400 gallons of groundwater was extracted from EW-3 with an average extraction rate of 0.47 gpm. Approximately 1,700 gallons of groundwater was extracted from EW-1 at an average extraction rate of 0.37 gallons per minute. The packer testing results indicated that the bedding plane fracture identified at 52 feet is a transport pathway for groundwater below the current remediation area. The results suggest that the horizontal bedding plane fracture has been intersected by a vertical conduit (joint set), which allows affected groundwater to migrate downward to the bedding plane fracture.

The results also indicate that operating extraction wells EW-1 and EW-3 intersect the bedding plane fracture (lower C-Zone) and are hydraulically connected. However, when the fracture identified at 52 feet was isolated and pumped out (in both EW-1 and EW-3), the upper C-zone wells screened above this depth showed no drawdown response.

Because the limits of affected groundwater within the identified open fractures have not been fully evaluated, Emerson is proposing to conduct an additional investigation to further characterize the significance of the bedding plane fractures and how they may affect design upgrades for the current remediation system.

4.3 Proposed Groundwater Investigation Scope of Work

This section describes the proposed scope of the groundwater investigation. The investigation activities will be conducted in accordance with the NYSDEC Draft DER-10 Technical Guidance for Site Investigation and Remediation, dated December 25, 2002, and Environmental Strategies' SOPs, which were provided to NYSDEC on July 28, 2004 (2004 Supplemental Groundwater Investigation Work Plan). Additionally, all manufacturer specifications will be adhered to for operation and maintenance of field sampling and monitoring equipment.
The objectives of this investigation are to gather additional geophysical and groundwater flow and groundwater quality information in areas around the fire water reservoir to: (a) further evaluate the nature and extent of affected groundwater in this area; (b) evaluate the interconnectivity of groundwater within specific bedrock bedding plane fractures and (c) evaluate the potential need to expand or modify the current groundwater remediation system.

4.3.1 Exploratory Borings

Eight exploratory borings will be installed to further characterize the bedding plane fractures in bedrock around the fire water reservoir area (Figure 5). Six vertical borings and two angled (directional) borings will be installed. The vertical borings will be completed to a depth just below an elevation of 515 feet above MSL. In the reservoir area, exploratory borings EX-1 through EX-3 will be drilled to a depth of approximately 80 feet bgs; exploratory borings EX-4 and EX-5 will be drilled to approximately 60 feet in the remediation area; and exploratory boring EX-6 will be drilled to approximately 25 feet bgs along the right-of-way of South Cayuga Street. Borings EX-1 through EX-6 will be designed to intersect the bedding plane elevation at 515 feet above MSL. Two angled borings (EX-7 and EX-8) will be drilled to assess conditions beneath the fire water reservoir. Borings EX-7 and EX-8 will be angled to intersect northwest trending vertical fractures below the fire water reservoir that may be hydraulically connected to the bedding plane fracture at 515 feet above MSL. The final locations of borings around the fire water reservoir will be based on discussions with NYSDEC. Each boring will be drilled using 4.25-inch inside-diameter (ID) hollow-stem augers through the overburden. Continuous soil samples will be collected from the ground surface to refusal at bedrock using 2-foot-long, split-spoon samplers. The soils recovered from the split spoons will be screened for organic vapors in the field using a photoionization detector.

At a minimum of three locations, the bedrock will be cored, and each section of rock core recovered from each boring will be logged for lithology, structure, and the presence of water conducting fractures or solutional openings. As requested by the NYSDEC, all cuttings removed from the borehole will be screened with a PID and samples collected from intervals that exhibit the highest PID reading will be sent to the laboratory for analysis of VOCs. A steel casing will be grouted in place within the borehole at the base of the highly fractured ("B") zone to seal it from the C-zone bedrock. Coring will then continue until the bedrock becomes more competent (potentially at the base of the transitional "C" zone). The Rock Quality Designation of each
bedrock core will be measured and recorded on the boring log. Once the terminal depth of the boring is reached, the borehole will be expanded (reamed) using a 4.25-inch rotary air hammer. The boring will be installed by a driller licensed in the state of New York in accordance with § 15-1525 of the New York Environmental Conservation Law.

The elevation of the ground surface at the exploratory boring locations will be surveyed to the nearest 0.01 foot. The horizontal location of the boring location will also be determined to the nearest 0.1 foot and referenced to the state plane coordinate system. A surveyor licensed in New York State will survey the locations and elevations. The locations and elevations of the borings will be tied into the existing base map for the site.

4.3.1.1 Geophysical Logging

In order to identify and locate horizontal and vertical fracture features within the open sections of each exploratory boring, downhole geophysical logging will be performed. The geophysical scope of work will include video logging and collecting measurements for fluid temperature, fluid conductivity, and borehole diameter (caliper measurements).

4.3.1.1.1 Optical Televiewer

The borehole optical televiewer (OPTV) is a downhole logging device that has the capability of digitally scanning the interior of the open rock borehole. The OPTV will be used to identify, locate, and geologically characterize the horizontal and vertical fracture features within each borehole.

4.3.1.1.2 Fluid Temperature

Fluid temperature will be collected continuously from the top of bedrock to the termination depth of the borehole. Deflections in fluid temperature will be used to locate water producing features within the borehole.

4.3.1.1.3 Caliper Measurements

A caliper tool will be used to measure the borehole diameter and to identify changes in borehole diameter that indicate a potential fracture interval.

4.3.1.2 Vertical Profiling and Borehole Abandonment

4.3.1.2.1 Vertical Groundwater Profiling

Based on the results of the geophysical logging, selected intervals within each open borehole will be designated for discrete sampling to vertically evaluate groundwater quality. Groundwater monitoring will begin immediately following the downhole geophysics or as soon
as possible thereafter. Before any groundwater samples are collected, the depth to water will be measured in all exploratory borings. After the water levels have been measured, groundwater samples will be collected in accordance with the low-flow sampling SOP in Appendix A of this work plan. The low flow sampling technique will be designed to discretely sample designated intervals within each exploratory boring to vertically profile the bedrock aquifer. Measurements of temperature, pH, conductivity, dissolved oxygen, turbidity, and redox potential will be continuously monitored during the purging process at each fracture interval. *In-situ* parameters will be allowed to stabilize before sample collection begins.

Samples will be collected, handled, preserved, and transported in accordance with WSP Environmental Strategies SOPs. The samples will be placed in pre-cleaned and, if appropriate, pre-preserved sample containers. The samples will be placed in a cooler with ice and delivered to the laboratory with the appropriate chain-of-custody documentation. The groundwater samples will be submitted to the laboratory for analysis of VOCs using EPA Method 8260. QA/QC samples, including equipment blanks, trip blanks, and duplicates, will be collected in accordance with the SOPs.

4.3.1.2.2 Packer Testing

As requested by the NYSDEC, packer (pump-out) testing will be conducted of the bedding plane fracture encountered near the 515-foot interval in boreholes EX-1, EX-2, and EX-3 in order to evaluate the hydraulic connection with the downgradient recovery wells. The packer test will be completed in accordance with the “packer testing” procedures detailed in the approved Aquifer Testing and Design Modification Work Plan, dated July 7, 2005. Accordingly, the boreholes will remain open to facilitate the temporary placement of straddle packer assemblies. Following packer testing, the boreholes will be abandoned in accordance with NYSDEC guidance, and the results of the packer testing will be used to determine the number and location of additional monitoring wells, if necessary.

4.3.1.2.3 Borehole Abandonment

Immediately following packer testing, each exploratory boring will be abandoned in accordance with the NYSDEC Monitoring Well Decommissioning Procedures. In accordance with the procedures, the casing will be abandoned in-place by using a tremie pipe to fill the borehole from the bottom up with a bentonite-cement grout to a level approximately 2 feet bgs.
The top of the casing will be excavated, cut, and removed, and the upper 2 feet will be restored to match the surrounding grade.

4.4 B-zone Monitoring Well Installation

Three groundwater-monitoring wells will be installed in the vicinity immediately surrounding the fire water reservoir. The wells will be screened in the upper B-zone portion of the bedrock (MW-7B, MW-8B, and MW-9B). The proposed well locations are shown in Figure 5. Final locations may be adjusted in the field due to access issues or limitations of the drilling equipment.

The monitoring wells will be designated with a "B" qualifier and will be completed to a depth of approximately 8 feet below the contact between the overburden and the bedrock, which is anticipated to be 12 feet bgs. The wells will be screened within the highly fractured portion of the upper bedrock zone. The maximum depth of the wells is expected to be approximately 18 feet bgs.

Boreholes for the monitoring wells will be drilled using 6.25-inch ID hollow-stem augers through the overburden. Continuous soil samples will be collected from the ground surface to refusal at bedrock using 2-foot-long split-spoon samplers. The soils recovered from the split spoons will be screened for organic vapors in the field using a PID. Sample descriptions and PID readings will be recorded in a field notebook. The soil sample with the highest PID reading from each boring will be submitted to the laboratory for analysis of VOCs. If no elevated readings are recorded, then a sample will be obtained from the depth corresponding to the bottom of the reservoir.

The bedrock will then be cored and the quantity of fractures and the physical characteristics of the fractures will be logged. The screened interval and final depth of the monitoring wells will depend on the quantity of fractures present. The borehole will be terminated at a maximum depth of 18 feet bgs. Once the terminal depth of the well is reached, the borehole will be expanded (reamed) using a 4.25-inch rotary air hammer.

Boring logs will be prepared for each well after completion of the field activities. All wells will be completed and installed by a driller licensed in the state of New York in accordance with the Environmental Conservation Law 15-1525.
Monitoring wells will be constructed as shown in Appendix B. The upper B-zone monitoring wells will be constructed using 2-inch-ID threaded, flush jointed, Schedule 40 PVC. The screens in all wells will be 5 feet in length with 0.010-inch horizontal slots. A clean sand filter pack will be placed in the annular space surrounding the screen from the bottom of the borehole to approximately 2 feet above the top of the screen. A 3-foot-thick bentonite seal will then be placed on top of the sand filter pack. The remaining annular space will be backfilled with a cement-bentonite grout mixture (tremie piped from the bottom to the top). Well construction information will be recorded in a field notebook, and as-built diagrams will be prepared for each monitoring well installed during the investigation.

The wells will be completed as flush-mounts. The flush mount assembly will be 8 inches in diameter and have a lockable watertight cap. This assembly will be set in a hole that is at least 4 to 8 inches larger than the flush mount assembly, and set in concrete.

Drill cuttings and water generated during well installation will be contained in Department of Transportation (DOT)-approved, 55-gallon steel drums. The drums will be labeled and moved to an onsite staging area. The soil cuttings will be characterized for disposal after completion of the field activities. The water generated during the investigation will be treated in the onsite remediation system.

All drilling and sampling activities will be conducted with clean equipment. Split-spoon samplers will be decontaminated in accordance with WSP Environmental Strategies’ SOPs. The drilling equipment (augers and rods) will be decontaminated using a portable steam cleaner. All decontamination fluids generated during the drilling activities will be contained in 55-gallon DOT approved steel drums and managed in the same manner as water generated during the well installation.

The elevations of the ground surface at each new monitoring well and the top of the PVC well casing will be surveyed to the nearest 0.01 foot. The horizontal locations of the new wells will also be determined to the nearest 0.1 foot and referenced to the state plane coordinate system. A surveyor licensed in New York State will survey the well locations and elevations. The locations and elevations of the wells will be tied into the existing base map for the site.

4.4.1 Monitoring Well Development

The new monitoring wells will be developed to remove sediments and ensure effective communication between the well screens and surrounding saturated zones. The wells will be
developed by surging the screened interval to loosen any fine-grained sediment in the sand filter pack and adjacent aquifer material. Groundwater from the well will then be removed by bailing or pumping. Turbidity, pH, temperature, and specific conductance will be periodically monitored during the development process to ensure that groundwater representative of the screened portion of the aquifer is entering the well. Development will continue until the discharge is relatively free of suspended sediments. If water is added to the well borehole during the drilling and installation activities for the new monitoring wells, an equal volume of water will be removed during well development. Water generated during the well development will be treated at the onsite treatment building.

All development/redevelopment activities will be conducted with clean equipment to prevent potential cross-contamination between well locations. Equipment will be cleaned between each well, with the decontamination procedure dependent on the development/redevelopment method(s) and equipment used.

4.4.2 Groundwater Sampling

One round of groundwater samples will be collected from the three new B-zone wells. The sampling and analytical procedures are described below:

Before initiating sampling, the wells will be checked for the presence of a free-phase product using an interface probe. Although not expected, if the interface probe detects a product layer, the thickness and visual characteristics will be documented in the field notebook, and an attempt will be made to collect a sample for laboratory analysis. Specific analyses to be performed on the sample will be based on the type of product (e.g., light non-aqueous phase liquid [NAPL] versus dense NAPL) and its relative age.

Wells not containing NAPL will be purged of a minimum of three well volumes before sampling. Measurement of pH, conductivity, temperature, and redox potential will be obtained at least three times (beginning, middle, and end) during the well purging process. These parameters will be allowed to stabilize before sample collection begins. WSP Environmental Strategies’ procedures concerning well purging are described in the SOPs provided in Appendix A. Purging and sampling methods will be consistent for each sampling round.

Groundwater samples will be collected from each monitoring well using dedicated disposable Teflon or polyethylene bailers. Bailers will be lowered slowly into the wells to avoid agitating the water. VOC samples will be collected in three pre-cleaned 40-ml vials. The three
vials will be completely filled to avoid air bubbles in the sample. VOC samples will be preserved with hydrochloric acid to a pH of 2 or less. All non-dedicated groundwater sampling equipment will be decontaminated in the field using procedures outlined in WSP Environmental Strategies' SOPs, which are consistent with procedures outlined in the Resource Conservation and Recovery Act's Groundwater Monitoring Technical Enforcement Guidance Document. QA/QC samples, including equipment blanks, trip blanks, and duplicates, will be collected in accordance with SOPs. All samples will be sealed, labeled, and placed in a cooler with ice for shipment to an offsite analytical laboratory. Appropriate chain-of-custody procedures will be followed.

Groundwater samples will be measured for pH, conductivity, temperature, and redox potential in the field. The groundwater samples will be submitted to the laboratory for analysis of VOCs using EPA Method 8260.

4.5 Data Quality Objectives

Data quality objectives (DQOs) are qualitative and quantitative statements, the application of which ensures that data generated during the fire water reservoir investigation are adequate to support the objectives of the work plan. DQOs are based on the intended use of the data and are specified for each data collection activity. Chemical analyses of groundwater will be performed in accordance with Analytical Level III requirements. Field measurements will be conducted in accordance with Analytical Level I requirements.
5.0 **Bedrock Evaluation**

In August 2006, WSP Environmental Strategies completed a supplemental geophysical survey at the EPT site and areas to the north-northwest. The objective of the survey was to develop a more comprehensive understanding of potential water-bearing fractures (migration pathways) within bedrock underlying the area and to build on the data collected in the initial geophysical survey completed in September 2005. The supplemental survey, which used electrical resistivity (ER) to remotely image the subsurface, was completed along 27 ER line transects. The survey results identified 33 key anomalies on multiple profiles within the survey area. Further evaluation of the individual anomalies in combination with published literature on the regional fracture trends reveal that three types of structural features are present within the study area including potential water-bearing vertical fractures, in-filled voids, and a possible buried stream channel. Because these structural features may be migration pathways or discharge areas for affected groundwater, a scope of work has been developed to further evaluate each type of structural feature.

The objectives of the work proposed in this plan are to confirm the nature of the structural features identified from the 2006 Supplemental Geophysical Survey, ascertain whether these structural features are migration pathways for groundwater, and characterize groundwater quality within the features. Exploratory borings will be drilled within targeted areas to confirm the presence of the identified structural feature (vertical fracture, in-filled void, or buried stream channel). Thirteen target areas have been selected for confirmation (exploratory) drilling. The proposed scope of work involves drilling up to three exploratory (confirmation) borings within each target area and, after confirming the presence of the structural feature, installing and sampling monitoring wells to assess groundwater quality. All investigation activities will be conducted in accordance with the NYSDEC Draft DER-10 Technical Guidance for Site Investigation and Remediation, dated December 25, 2002. The work plan is consistent with requirements outlined in the Consent Order, dated July 13, 1987, entered into by NYSDEC and Emerson.

The first section of the work plan presents background information on the site and details the geologic and hydrogeologic setting of the site. This is followed by a summary of the geophysical surveys, which are the basis of this work plan. The next section details the
objectives and scope of work for the proposed field activities. The final sections present the project mobilization and demobilization activities and report preparation.

5.1 Geophysical Survey Results

5.1.1 Initial Geophysical Survey Results

An initial geophysical survey was conducted at the site in areas to the north-northwest in September 2005. The results of that survey highlighted the coarse structure of bedrock and identified approximately 30 potential conductive zones on the EPT site and in offsite areas to the northwest. Of the 30 conductive zones identified, 8 contained resistivity profiles resembling vertical water-bearing fractures and 2 resembled in-filled voids. Based on these results, a high resolution ER survey was proposed to further evaluate these zones. A supplemental ER work plan was provided to the NYSDEC on March 10, 2006, and approved in July 2006.

5.1.2 Supplemental Geophysical Survey Results

In July and August 2006, a high-resolution ER survey was conducted along 27 transect lines, designated ER-15 through ER-41A. The objective of this survey was to develop a more comprehensive understanding of potential water-bearing fractures (migration pathways) within bedrock underlying the area and to build on the data collected in the initial geophysical survey completed in September 2005. The results of this geophysical survey revealed a complex geologic and hydrogeologic network on the EPT site and in the areas to the north-northwest (WSP Environmental Strategies 2006). The survey results identified three types of structural features within the study area: potential water-bearing vertical fractures, in-filled voids, and a possible buried stream channel. These structural features are potential flow paths for affected groundwater or may be discharge areas for affected groundwater.

Discussed below are the three types of structural features that have been targeted for further evaluation. Figure 5 shows the three types of structural features and the areas within the features that have been targeted (target areas) for further evaluation.

5.1.2.1 Fracture Features

The results of the supplemental geophysical survey in combination with published literature on the regional fracture trends and observations made of exposed outcrop joint sets (fractures) in the area, reveal five fracture-like structures. These fracture structures appear to trend to the northwest; with orientations consistent with the regional and local fracture set trends.
Vertical Fracture Structure 1 extends between Turner Place and East Spencer Street encompassing fracture-like anomalies 41-A2 and 36-6. These anomalies line up along the same northwest trend line and appear to follow the same fracture trace as an exposed fracture outcrop located on the west section of Columbia Street. Based on its nature and trend, this potential vertical water-bearing fracture structure has been targeted for further evaluation.

Vertical Fracture Structure 2 appears to run parallel with fracture structure 1, and intersects Turner Place, South Hill Terrace, and East Spencer Street. This fracture structure encompasses anomalies 31-6 and 36-4, which lie within the same fracture trace. Anomaly 31-6 is located along the southern end of Turner Place and anomaly 36-4 is located along East Spencer Street. Because of the extensive nature of this structure and the fact that it is observed along several transect lines, it is targeted for further evaluation.

Vertical Fracture Structure 3 extends northwest from the EPT site toward Turner Place and encompasses fracture-like anomalies 24-6 and 31-1, which when aligned in parallel trend to the northwest. This fracture structure appears to be discontinuous, however, and was not observed in downgradient ER transect lines. Although the structure appears discontinuous, it was observed along two separate transect lines and therefore is targeted for further evaluation.

Vertical Fracture Structure 4 extends from the southeast portion of the EPT site to the northwest and encompasses anomalies 37D-1 on the EPT site and 34-10 which is at the intersection of South Hill Terrace and Hillview Place. Fracture-like anomaly 34-10, lines up with two exposed fractures outcrops located along the southern bank of Six Mile Creek and along the southern section of a residence property on South Hill Terrace. Anomaly 37D-1 appears to trend to the northwest and may be hydraulically connected to downgradient anomaly 34-10. These two anomalies appear to trend with the two exposed outcrop fractures observed along South Hill Terrace and along Six Mile Creek and therefore are targeted for further evaluation.

Vertical Fracture Structure 5 extends northwest across the EPT property from anomaly 37B-5 to anomaly 21-6, which is located near the southern limit of the EPT access road. Two exposed fracture outcrops were observed along the north portion of this feature. Because of the extensive nature of this feature, it may be a migration pathway for affected ground and therefore is targeted for further evaluation.
5.1.2.2 In-Filled Voids

In the area of the New York State Electric and Gas substation, large conductive structures were identified at anomalies 19-3 and 20-5. Each anomaly is surrounded by resistive bedrock and when placed in parallel they line up to indicate a large in-filled void in the subsurface. The conductive nature of the anomaly indicates that the void is in-filled by fine material that is potentially high in water content. Because this structure may discharge to surrounding groundwater, it is targeted for further evaluation.

5.1.2.3 Buried Stream Channel

Survey lines located at the southwest portion of the EPT site (ER-15 through ER-17) showed high variation in the subsurface with very resistive areas interpreted to be competent bedrock. Anomalies identified on ER profiles for these lines (15-1, 15-3, 16-4, and 17-1) show moderately conductive, vertical fracture-like features that run through the depth of the images (approximately 80 feet deep). A view of the profiles in parallel shows that the anomalies line up to illustrate two fracture-like features, running in a western trend. Because anomalies identified in the profiles for lines 15, 16, and 17 (shown as 15-3/17-1 and 16-4) correspond to a buried intermittent stream identified in historic topographic maps, this feature may be a migration pathway for affected groundwater. Therefore this structure is targeted for further evaluation.

5.2 Proposed Scope of Work

This section describes the proposed scope of the bedrock evaluation. The evaluation activities will be conducted in accordance with the NYSDEC Draft DER-10 Technical Guidance for Site Investigation and Remediation, dated December 25, 2002, and WSP Environmental Strategies SOPs, which were provided to the NYSDEC on July 28, 2004 (2004 Supplemental Groundwater Investigation Work Plan). All manufacturer specifications will be adhered to for operation and maintenance of field sampling and monitoring equipment.

The objectives of this evaluation are to confirm the results of the 2006 geophysical survey and evaluate groundwater quality within potential migration pathways for affected groundwater. Exploratory borings will be drilled within targeted areas to confirm the presence of the identified structural feature (vertical fracture, in-filled void, or buried stream channel). Thirteen target areas have been selected for confirmation (exploratory) drilling. The proposed scope of work involves drilling up to three exploratory (confirmation) borings within each
targeted area to confirm the existence of the structural feature. Once the structural feature has
been confirmed, a monitoring well will be installed to assess groundwater quality within the
structural feature. The exploratory boring will be used to identify and locate the structural
feature and will be designated EXB-1 A, B, C depending on the number of borings required to
confirm the structural feature. One temporary groundwater monitoring well will be installed
within each confirmed structural feature. If a structural feature is not confirmed during the
logging of the exploratory borings, no monitoring well will be installed at that location. The
depth and screened section of the monitoring wells will be based on the interval at which the
feature is first encountered during the logging of the exploratory boring.

5.2.1 Supplemental Geophysics and Exploratory Borings

As discussed in Section 5.3 of this work plan, the results of the 2006 geophysical survey
identified three types of structural features that may be migration pathways or discharge areas for
affected groundwater at the EPT site. The three types of structural features identified include
five possible vertical water-bearing fractures, an in-filled void, and a possible buried stream
channel. These structural features have been targeted for further evaluation to determine if they
are migration pathways for affected groundwater. Exploratory borings and monitoring wells will
be used to confirm and assess these structural features. A description of the areas targeted for
further evaluation is presented below and plotted on Figure 6:

- Vertical Fracture Structure 1 - Anomalies 41A-2 and 36-2 are located along
  Turner Place and East Spencer and appear to follow the same fracture trace as an
  exposed outcrop observed on Columbia Street. This fracture structure has been
targeted for further evaluation. WSP Environmental Strategies proposes to install
a series of exploratory borings (EXB-1(A/B/C) and EXB-2(A/B/C)) and possibly
monitoring wells (MW-33F and MW-34F) along this fracture structure.

- Vertical Fracture Structure 2 - Anomalies 31-6 and 36-4 appear to trend to the
  northwest and are similar in vertical extent and structure. Both are moderately
  conductive and fracture like. The fracture trace also intersects anomaly 35-2,
  which is a conductive fracture-like feature identified along ER-35. This structure
  has been targeted for further evaluation. WSP Environmental Strategies proposes
to install a series exploratory borings (EXB-3(A/B/C), EXB-4(A/B/C), and EXB-
5(A/B/C) and possibly monitoring wells (MW-35F, MW-36F, and MW-37F) along this fracture structure.

- **Vertical Fracture Structure 3** - The anomaly identified as 24-6 on profile ER-24 is located at a depth of 50 feet bgs near the east profile limit. Based on the anomalies identified in other profiles, this is a fracture-like structure that appears to trend to the northwest and appears to intersect the south end of ER line 31 at anomaly 31-1. WSP Environmental Strategies proposed to install exploratory borings (EXB-6(A/B/C)) and possibly a monitoring well (MW-38F) to evaluate this structure.

- **Vertical Fracture Structure 4** - Anomalies 37D-1 and 34-10 appear to trend to the northwest and may be connected along a northwest fracture trace, as can be seen in two exposed fractures located northwest of the site. This possible fracture has been targeted for further evaluation. WSP Environmental Strategies proposes to install a series of exploratory borings (EXB-7(A/B/C), EXB-8(A/B/C), and EXB-9(A/B/C)) and possibly monitoring wells (MW-39F, MW-40F, and MW-41F) to evaluate this fracture structure.

- **Vertical Fracture Structure 5** - Anomalies 37B-5 and 21-6 also trend to the northwest and may be connected to an exposed fracture observed on the south side of the EPT access road. Both anomalies are similar in vertical extent and structure and are fracture-like conductive features. This fracture-like structure has been targeted for further evaluation. WSP Environmental Strategies proposes to install a series of exploratory borings (EXB-10(A/B/C) and EXB-11(A/B/C) and possibly monitoring wells (MW-42F and MW-43F) along this structure.

- **In-filled Void Structure** - Anomaly 20-5 appears to be associated with a large conductive structure that is surrounded by resistive bedrock. Because this structure may be part of a discharge area for affected groundwater, the structure has been targeted for further evaluation. Exploratory borings at the EXB-12(A/B/C) location are proposed. If the structure is confirmed, a monitoring well (MW-44F) will be installed at this location.

- **Buried Channel Structure** - Anomaly 16-4 appears to correspond with a buried intermittent stream identified in historic topographic maps. As such, it has been
targeted for further evaluation. Exploratory borings at location EXB-13(A/B/C) are proposed. If the structure is confirmed, monitoring well MW-45F will be installed.

5.2.1.1 Identifying Drilling Locations and Supplemental Geophysics

The location of each exploratory boring will be based on the geophysical survey image results. Target areas will be surveyed, located, and marked in the field prior to drilling. For locations between previously identified anomalies, supplemental geophysics will be completed within target areas to locate the structural feature and determine the appropriate drilling location. Ground penetrating radar (GPR) and ER will be conducted within focused areas to locate and identify structural features between previously identified anomalies. In the selected areas, GPR measurements will be collected continuously along focused transects spaced approximately 5 feet apart near the proposed drilling location. The transect grids will run north to south and east to west across the suspected feature (fracture). Following the GPR survey, data will be reviewed and deflection anomalies noted and marked. Based on the data review, the ER survey will be completed within the same focused areas and at similar spacing in order to verify GPR anomalies. The work will be performed by a geophysicist and reviewed by WSP Environmental Strategies personnel. The expected timeframe for the field investigation is approximately 1 day for both surveys.

The GPR profiles will be collected using a 200 MHz shielded antenna rolled across the surface. The system will transmit short duration electromagnetic pulses into the ground from the antenna and measure reflection from subsurface interfaces back to the receiver. The receiver will be connected to a control unit for processing. The control unit contains a real-time display to provide preliminary interpretations of reflected material and guide placement of additional profiles.

The ER profiles will be conducted using a Geometrics Ohm-Mapper™. This is a portable ER survey device where surface electrodes are pulled behind the collector continuously along transects. Resistivity data is collected with continuous data logging along each transect. The data logger presents real time data in order to adjust collection speed and spacing. Each transect is processed into a two-dimensional profile after data collection.
Once the features are identified, the locations will be marked and mapped with a portable handheld GPS unit. Following field work, the anomaly locations, if identified, will be added to the existing base map.

5.2.1.2 Exploratory Borings

In order to locate each structural feature, up to three exploratory borings will be installed within 13 targeted areas (Figure 6). The borings will be designated EXB-1 A, B, and C, depending on the number of borings required to confirm the structural feature. The borings will be drilled using 4.25-inch ID hollow-stem augers through the overburden. Continuous soil samples will be collected from the ground surface to refusal at bedrock using 2-foot-long, split-spoon samplers. The soils recovered from the split spoons will be screened for organic vapors in the field using a PID. Sample descriptions and PID readings will be recorded in a field notebook. The initial depth of each exploratory boring will be based on the interval at which the feature was identified during the geophysical profiling. Based on a review of the supplemental geophysical survey results, it is anticipated that the exploratory borings will be drilled into bedrock to maximum depths ranging between 25 feet and 65 feet bgs.

A steel casing may be grouted in place within the borehole at the base of the highly fractured zone to seal it from the lower bedrock zone. Once the terminal depth of the boring is reached, the borehole will be expanded (reamed) using a 4.25-inch rotary air hammer. The boring will be installed by a driller licensed in the state of New York in accordance with § 15-1525 of the New York Environmental Conservation Law.

The elevation of the ground surface at the exploratory boring locations will be surveyed to the nearest 0.01 foot. The horizontal location of the boring location will also be determined to the nearest 0.1 foot and referenced to the state plane coordinate system. A surveyor licensed in New York State will survey the locations and elevations. The locations and elevations of the borings will be tied into the existing base map for the site.

5.2.1.3 Geophysical Logging

In order to identify and locate the structural features within the open sections of each exploratory boring, downhole geophysical logging will be performed. The geophysical scope of work will include video logging and collecting measurements for fluid temperature, fluid conductivity, and borehole diameter (caliper measurements). The methods to be employed are discussed below.
5.2.1.3.1 Optical Televiewer

A borehole OPTV will be used to digitally scan the interior of the open rock borehole to identify, locate, and geologically characterize the horizontal and vertical fracture features within each borehole.

5.2.1.3.2 Fluid Temperature

Fluid temperature will be collected continuously from the top of bedrock to the termination depth of the borehole. Deflections in fluid temperature will be used to locate water producing features within the borehole.

5.2.1.3.3 Caliper Measurements

A caliper tool will be used to measure the borehole diameter and will be used to locate changes in borehole diameter that could indicate a fracture interval.

5.2.1.4 Borehole Abandonment

Immediately following logging, boreholes where the survey feature was not confirmed will be abandoned in accordance with the NYSDEC Monitoring Well Decommissioning Procedures. In accordance with the same procedures, the casing will be abandoned in-place using a tremie pipe to fill the borehole from the bottom up with a bentonite-cement grout to a level of approximately 2 feet bgs. The top of the casing will be excavated, cut, and removed, and the upper 2 feet will be restored to match the surrounding grade.

5.2.2 Monitoring Well Installation

Up to 13 temporary groundwater monitoring wells (MW-33F through MW-44F) are proposed. Proposed well locations are shown in Figure 6. The final number of monitoring wells will be based on the results of the exploratory borings. Wells will only be installed at locations where the structural feature has been confirmed. If the structural feature is not confirmed during the logging of the exploratory boring, no monitoring well will be installed at that location. The depth and screened interval of the monitoring well will be based on the interval at which the structural feature is encountered. The monitoring wells will be designed to evaluate groundwater within the confirmed structural feature.

The monitoring wells will be designated with an “F” qualifier and will be completed to a depth determined during the downhole logging of the exploratory borings. The wells will be screened within the confirmed bedrock feature. The wells will be designed to intersect the confirmed geophysical feature and will be completed within the exploratory boring. The
screened section of each well will be completed within the upper saturated section of the confirmed feature.

Boring logs will be prepared for each well after completion of the field activities. All wells will be completed and installed by a driller licensed in the state of New York in accordance with the Environmental Conservation Law 15-1525.

Monitoring wells will be constructed as shown in Appendix B. The monitoring wells will be constructed of a 2-inch-ID threaded, flush jointed, Schedule 40 PVC. The screens in all wells will be 5 feet in length with 0.010-inch horizontal slots. A clean sand filter pack will be placed in the annular space between the screen and the borehole, from the bottom of the borehole to approximately 2 feet above the top of the screen. A 3-foot-thick bentonite seal will then be placed on top of the sand filter pack. The remaining annular space will be backfilled with a cement-bentonite grout mixture (tremie piped from the bottom to the top). Well construction information will be recorded in a field notebook, and as-built diagrams will be prepared for each monitoring well installed during the investigation.

The wells will be completed as flush-mounts. The flush mount assembly will be 8 inches in diameter and have a lockable watertight cap. This assembly will be set in a hole that is at least 4 to 8 inches larger than the flush mount assembly, and set in concrete.

Drill cuttings and water generated during well installation will be contained in DOT-approved, 55-gallon steel drums. The drums will be labeled and moved to an onsite staging area. The soil cuttings will be characterized for disposal after completion of the field activities. The water generated during the investigation will be treated in the onsite remediation system.

All drilling and sampling activities will be conducted with clean equipment. Split-spoon samplers will be decontaminated in accordance with WSP Environmental Strategies' SOPs. The drilling equipment (augers and rods) will be decontaminated using a portable steam cleaner. All decontamination fluids generated during the drilling activities will be contained in 55-gallon DOT-approved steel drums and managed in the same manner as water generated during the well installation.

The elevations of the ground surface at each new monitoring well and the top of the PVC well casing will be surveyed to the nearest 0.01 foot. The horizontal locations of the new wells will also be determined to the nearest 0.1 foot and referenced to the state plane coordinate system. A surveyor licensed in New York State will survey the well locations and elevations.
The locations and elevations of the wells will be integrated into the existing base map for the site.

5.2.2.1 Monitoring Well Development

The new monitoring wells will be developed by surging the screened interval to remove sediments and ensure effective communication between the well screens and surrounding saturated zones. Groundwater from the well will then be removed by bailing or pumping. Turbidity, pH, temperature, and specific conductance will be periodically monitored during the development process to ensure that groundwater representative of the screened portion of the aquifer is entering the well. Development will continue until the discharge is relatively free of suspended sediments. If water is added to the well borehole during the drilling and installation activities for the new monitoring wells, an equal volume of water will be removed during well development. Water generated during the well development will be treated at the onsite treatment building.

All development/redevelopment activities will be conducted with clean equipment to prevent potential cross-contamination between well locations. Equipment will be cleaned between each well, with the decontamination procedure dependent on the development/redevelopment method(s) and equipment used.

5.2.2.2 Groundwater Sampling

One round of groundwater samples will be collected from the new temporary wells. Before initiating sampling, the wells will be purged of a minimum of three well volumes before sampling. Measurement of pH, conductivity, temperature, and redox potential will be obtained at least three times (beginning, middle, and end) during the well purging process. These parameters will be allowed to stabilize before sample collection begins. WSP Environmental Strategies' procedures concerning well purging are described in the SOPs provided in Appendix A. Purging and sampling methods will be consistent for each sampling round.

Groundwater samples will be collected from each monitoring well using dedicated disposable Teflon or polyethylene bailers. Bailers will be lowered slowly into the wells to avoid agitating the water. VOC samples will be collected in three pre-cleaned 40-ml vials. The three vials will be completely filled to avoid air bubbles in the sample. VOC samples will be preserved with hydrochloric acid to a pH of 2 or less. All non-dedicated groundwater sampling equipment will be decontaminated in the field using procedures outlined in WSP Environmental

QA/QC samples, including equipment blanks, trip blanks, and duplicates, will be collected in accordance with SOPs. All samples will be sealed, labeled, and placed in a cooler with ice for shipment to an offsite analytical laboratory. Appropriate chain-of-custody procedures will be followed.

Groundwater samples will be measured for pH, conductivity, temperature, and redox potential in the field. The groundwater samples will be submitted to the laboratory for analysis of VOCs using EPA Method 8260.

5.2.3 Data Quality Objectives

DQOs are qualitative and quantitative statements, the application of which ensures that data generated during the groundwater investigation are adequate to support the objectives of the work plan. DQOs are based on the intended use of the data and are specified for each data collection activity. Chemical analyses of groundwater will be performed in accordance with Analytical Level III requirements. Field measurements will be conducted in accordance with Analytical Level I requirements.
6.0 Phase VI Expansion - Soil Vapor Sampling

The objective of the proposed sampling activities is to evaluate the potential presence of site-related constituents in soil vapor within the Phase VI expansion area identified by the NYSDEC in the May 31, 2007, correspondence. The area is bounded by South Aurora Street on the east, Turner Place on the west, Prospect Street on the north, and the entrance to EPT just south of Hillview Place. Sampling procedures will follow those described in the NYSDEC-approved Vadose Zone Work Plan for the EPT site, dated January 16, 2004 and are detailed below.

6.1 Scope of Work

WSP Environmental Strategies proposes to collect 10 soil vapor samples at the locations designated SV-22 through SV-31 on Figure 3. The proposed locations were selected to evaluate the potential presence of site-related VOCs in soil gas north and northeast of the EPT facility. The area is topographically upgradient of the Turner Place sanitary sewer lines that connect to the EPT facility and topographically downgradient from the South Aurora Street sanitary that connected to the former NCR facility to the south. The sample locations shown in Figure 3 are approximate and will be adjusted in the field based on access or the location of underground and overhead utilities.

Soil vapor samples will be collected at the ten locations shown on Figure 3. To install the temporary soil gas sampling devices, direct-push rods equipped with a 1.25-inch OD drive point will be advanced to a depth of approximately 6 feet bgs. A 6-inch-long stainless steel screen will be attached to 0.25-inch ID Teflon® or Teflon®-lined tubing and lowered to the bottom of the open borehole. Approximately 1 foot of quartz sand will be placed in the bottom of the borehole around the screen and tubing to create a 1-foot-thick sample interval. The remainder of the borehole will be sealed with a bentonite slurry. If the subsurface materials are non-cohesive, it may be necessary to lower the stainless steel screen and tubing through the hollow probe rods until it rests on top of the drive point. The base of the wire mesh screen would then be threaded into the top of the drive point by rotating the tubing and screen. The probe rods would then be removed from the hole leaving the drive point, screen, and tubing in place. Alternatively, a macro-core sampler equipped with a single-use acetate liner may be used to advance the boring.
Before sample collection, one to three well volumes of air will be purged from the sampling equipment and the surrounding sand pack using a calibrated hand pump or syringe to ensure that the sample is representative of the vadose zone. Assuming approximately 7.5 feet of 0.25-inch ID tubing, a 6-inch-long section of 0.5-inch OD screen, and a 1-foot-thick quartz sand pack with a porosity of 30 percent, one well volume of air is approximately 125 cubic centimeters. Once the well has been purged, a clamp will be placed on the end of the tubing to prevent the entry of ambient air. To collect the soil vapor sample, an Entech flow regulator will be connected directly to the sample tubing. The flow regulator will be attached to an evacuated 1-liter Entech canister to initiate sample collection. The flow regulator will be pre-set by the laboratory to collect the soil vapor sample over 1 hour. After 1 hour, the flow regulator will be disconnected from the canister to complete the sample collection. The sample name, location, time and date of sample collection, regulator and canister number, and the analytical method will be recorded on the chain-of-custody form and in the field log book. Following collection of the air samples, the tubing will be removed from the ground and the borehole will be capped with soil cuttings or asphalt patch to match the surrounding surface. The direct-push rods and drive point will be decontaminated before each soil vapor sample is collected using a non-phosphate detergent and tap water wash followed by a tap water rinse. Disposable nitrile gloves will be worn by the sampling personnel, and the gloves will be changed before the collection of each sample. Weather conditions will be documented during sampling activities.

6.1.1 Sample Analysis

All samples will be shipped, or transported by courier, under ambient conditions to a NYSDOH Environmental Laboratory Approval Program-approved laboratory under strict chain-of-custody procedures. The samples will be analyzed for the complete list of VOCs specified in EPA Method TO-15. Analytical results for all VOCs detected by EPA Method TO-15 will be reported to the NYSDEC. The minimum detection limits using EPA Method TO-15 for all sample types will be 0.25 pg/m³ for trichloroethene and 1 pg/m³ for all other VOCs.

6.1.2 Quality Assurance/Quality Control

The Entech canisters used for the sampling activities will be certified-clean by the selected laboratory. This certification involves analyzing the ambient air inside a clean canister by EPA Method TO-15. If no target compounds are detected at concentrations above the reporting limits, then the canister is evacuated again and all canisters from that lot are available.
for sampling. If target compounds are detected at concentrations above the reporting limits, then all canisters from that lot must be re-cleaned and a single canister reanalyzed for the target compounds. A duplicate soil gas sample will be collected from one location. In addition, a laboratory-prepared trip blank will accompany the sample canister for one of the indoor air samples from the laboratory to the field and from the field to the laboratory. The trip blank will be used to evaluate the potential for sample cross-contamination during shipment or during sample collection.
7.0 **Potential Groundwater Discharge Area Soil Vapor Sampling**

As requested by the NYSDEC, soil vapor samples will be collected within the South Hill Area to evaluate potential discharge areas for affected groundwater. The soil vapor points will be installed along East Spencer Street, upper South Hill Terrace, and Turner Place. Three soil vapor points (SV-32 through SV-34) will be installed along East Spencer Street, two along upper South Hill Terrace (SV-35 and SV-36) and two along Turner Place (SV-37 and SV-38). The proposed sample locations are based on the results of 2006 Supplemental Geophysical Survey and fall within the trend of identified Vertical Fracture Structure 1, Vertical Fracture Structure 2, and Vertical Fracture Structure 4. The seven sampling points (Figure 3) will be installed to a depth of approximately 6 feet bgs. Sampling procedures will follow those described in the NYSDEC-approved Vadose Zone Work Plan for the EPT site, dated January 16, 2004 and procedures detailed in Section 6.0 of this work plan.

In addition and as requested by the NYSDEC, five vapor samples and dry weather water samples (Figure 3) will also be collected from manholes located along South Hill Terrace, Turner Place, and Columbia Street (MH-1 through MH-5). The scope of this proposed work is detailed in Section 3.1.20 of this work plan. As for monitoring wells requested by NYSDEC, the proposed scope of work for installing bedrock monitoring wells is detailed in Section 5.
8.0 **Project Mobilization and Demobilization**

This section describes the activities that will be conducted to complete the Supplemental Remedial Investigation field investigations. It includes a discussion of onsite support facilities, mobilization/demobilization of equipment, orientation of all field personnel involved in the sampling activities, site restoration activities, and management of investigation derived wastes.

8.1 **Site Facilities**

Support facilities are available onsite and include a groundwater treatment system/building, sanitary facilities, electric power, water, a staging area, and a decontamination area. The staging and decontamination areas will be located at the groundwater treatment building on the northwest portion of the site.

8.2 **Mobilization of Equipment and Supplies**

This task includes all activities that are required to procure equipment and supplies and mobilize these items to the site for the sampling activities.

8.3 **Orientation of Field Personnel**

Field personnel orientation will consist of an onsite project briefing for each field team member to review health and safety requirements, QA/QC protocols, and field procedures. Subcontractors involved in field activities will also participate in onsite briefings before beginning field work. Personnel from EPT will be informed on health and safety requirements, as appropriate. Routine health and safety and field progress briefings and daily health and safety tailgate meetings will be held for the project team and subcontractor personnel, conducted by the onsite safety coordinator.

Before initiating field activities, field personnel will perform a reconnaissance of the work areas. A PID will be used during the site walkover to assess hazards and determine background concentrations of organic vapors within the breathing zone.
8.4 Demobilization and Restoration of Site

Equipment will be demobilized at the completion of each phase of field activities, as necessary. This equipment includes sampling equipment, subcontractor equipment, and decontamination equipment.

8.5 Management of Investigation Derived Waste

Decontamination fluid, disposable sampling equipment, and disposable personal protective equipment will be generated during the sampling activities. The decontamination fluid will be containerized per AOC, stored onsite, characterized, and either managed offsite or added to the onsite groundwater treatment system, as appropriate. Disposal of the other material will be as follows:

- Trash and debris will be placed in a trash dumpster and its contents disposed of by a local garbage hauler.
- All investigative-derived waste (soil) will be containerized, stored onsite, sampled, and analyzed for disposal characterization. The disposal methods will be contingent on analytical data and will be consistent with state and federal law.
- Used protective clothing and equipment will be appropriately managed as consistent with EPA Guidance Document, Management of Investigative Derived Waste During Site Inspections (May 1991), OERR 9345.3-02.
9.0 Project Schedule and Report Preparation

Figure 7 presents a detailed schedule for completing the field activities outlined in this work plan as well as the schedule for submitting the Supplemental Remedial Investigation Report to the NYSDEC.
10.0 References


### Table 1

**Sample Analysis Summary per AOC** (a)

*Emerson Power Transmission Site*

*Ithaca, New York*

<table>
<thead>
<tr>
<th>AOC</th>
<th>Description</th>
<th>VOCs</th>
<th>SVOCs</th>
<th>PAHs</th>
<th>PCBs</th>
<th>Metals</th>
<th>Cyanide</th>
<th>pH</th>
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Table 1
Sample Analysis Summary per AOC (a)
Emerson Power Transmission Site
Ithaca, New York

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<tr>
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<th>Description</th>
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<td>3) AOC 25c</td>
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<td>21</td>
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<td>VAPOR SAMPLES</td>
<td>Manholes along S. Hill Terrace and Turner Place</td>
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Table 1
Sample Analysis Summary per AOC (a)
Emerson Power Transmission Site
Ithaca, New York

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<thead>
<tr>
<th>AOC</th>
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<th>PAHs</th>
<th>PCBs</th>
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a/ AOC - area of concern  VOCs - volatile organic compounds  SVOCs - semivolatile organic compounds  
TAL - target analyte list  PAHs - polycyclic aromatic hydrocarbons

b/ NYSDEC STARS 8260 VOCs
c/ Naphthalene only
d/ AOCs were requested by the NYSDEC in letters dated May 8, 2006 and September 5, 2006.
e/ AOC will be included in a subsequent groundwater investigation conducted at the site
f/ Lead analysis