SUPPLEMENTAL INTERIM REMEDIAL MEASURE WORK PLAN

300, 304-308, 320 ANDREWS STREET AND 25 EVANS STREET
ROCHESTER, NEW YORK 14604

NYSDEC SITE #E828144

Prepared For: City of Rochester
Division of Environmental Quality
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I, Nathan E. Simon, certify that I am currently a NYS registered professional engineer as defined in 6 NYCRR Part 375 and that this Supplemental Interim Remedial Measure Work Plan was prepared in accordance with applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

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1.0 INTRODUCTION

The City of Rochester, Department of Environmental Services, Division of Environmental Quality (City) entered into a New York State Department of Environmental Conservation (NYSDEC) 1996 Clean Water/Clean Air Bond Act Environmental Restoration Program (ERP) State Assistance Contract (SAC) in February 2008, to investigate and remediate an approximate 1.5-acre property located in in the City of Rochester, New York.

This Supplemental Interim Remedial Measure Work Plan (Supplemental IRM Work Plan) was prepared to address remaining contamination at the Site after an initial phase of Interim Remedial Measure (IRM) source removals was completed. The Supplemental IRM Work Plan includes a combination of proactive remedial measures, engineering controls and institutional controls that are intended to meet project standards, criteria and guidance (SCG) values and goals, and satisfy NYSDEC requirements for obtaining a Certificate of Completion for the Site. Provisions set forth in NYSDEC guidance documents including, but not limited to, "DER-10, Technical Guidance for Site Investigation and Remediation" dated May 2010 and the NYSDEC "Municipal Assistance Environmental Restoration Projects 'Brownfield Program' Procedures Handbook" dated July 2004 were also used in the preparation of this Supplemental IRM Work Plan.

1.1 Background

The Site is located at 300, 304-308, and 320 Andrews Street and 25 Evans Street in the Center City District (CCD) of the City of Rochester, County of Monroe, New York and is identified as four parcels: Section 106.72 Block 01 Lots 84, 85, 86, and 87 on the City of Rochester Tax Map. The Site is situated on an approximately 1.5-acre area bounded by the Inner Loop to the north, Andrews Street to the south, Franklin Square with a City-owned park beyond to the east, and Bristol Street with commercial property beyond to the west (see Figure 1). The former Evans Street right-of-way separates the 320 Andrews Street parcel from the other three parcels that are contiguous with each other. The Evans Street right-of-way was officially abandoned by the City in March 2013, and has been incorporated into the adjoining Site parcels.

Demolition of on-site structures was completed between the fall of 2010 and the spring of 2011. The demolition work was managed by the City Department of Neighborhood Business Development and the City Division of Environmental Quality. Prior to demolition, the Site was improved with four buildings with associated paved parking lots and city streets. The former buildings had a total floor area of approximately 38,349 square feet and consisted of single and two-story brick or concrete block buildings with partial basements and/or slab-on-grade construction, constructed between 1925 and 1965. Pre-demolition and post-demolition Site conditions are shown on Figure 2 and Figure 3, respectively.

1.2 Previous Environmental Work

Previous environmental work has included: Phase I Environmental Site Assessments (Phase I ESAs); a Phase II Environmental Site Assessment (Phase II ESA); environmental investigation during building demolition work; the majority of work associated with a

Remedial Investigation (RI); an initial set of IRMs; and supplemental RI work. The findings of the Phase I ESAs, Phase II ESA, demolition-phase study, and majority of RI work were summarized in the NYSDEC-approved At-Grade and Sub-Grade Demolition Phase Environmental Report dated August 2011, the NYSDEC-approved Remedial Investigation/Remedial Alternatives Analysis (RI/RAA) Work Plan dated August 2011, and/or the NYSDEC-approved Interim remedial Measures Work Plan dated October 4, 2012. The work associated with the initial set of IRMs is documented in a Construction Completion Report dated October 2013 that has been approved by the NYSDEC. The Supplemental RI work is further summarized in the subsection below.

1.2.1 Supplemental Remedial Investigation

In 2012, in accordance with Section 4.10 of the October 4, 2012 IRM Work Plan (IRMWP), four additional overburden groundwater monitoring wells (designated as MW-03A, MW-15, MW-16, and MW-17) were installed at the Site. Refer to Figure 4 for the locations of these four wells. These additional wells were included in the IRMWP to assist in evaluating subsurface soil and groundwater conditions subsequent to completing IRM-01 and IRM-02. Select soil samples collected during advancement of these wells were tested for volatile organic compounds (VOCs) and/or permanganate natural oxidant demand (PNOD). The data was provided in NYSDEC analytical services protocol (ASP) Category B reports, which has been validated in a Data Usability Summary Report (DUSR). Table 1 includes the VOC test results for soil/fill samples and a comparison to applicable NYSDEC Part 375 SCOs. One round of groundwater monitoring (Round 3) was performed at these four new overburden wells in February 2013.

In 2012 and 2013, additional supplemental RI field work and analytical laboratory testing was performed to further evaluate the extent of chlorinated VOCs [primarily consisting of Tetrachloroethylene (PCE)] in various media (i.e., soil vapor, soil and groundwater). This work was completed in accordance with the NYSDEC-approved Supplemental RI Work Plan dated May 2013, a NYSDEC-approved scope of work for evaluation of existing clean cover material thickness dated September 10, 2013, a NYSDEC-approved Addendum to the Supplemental RI Work Plan dated November 18, 2013, and a NYSDEC-approved Second Addendum to the Supplemental RI Work Plan dated December 3, 2013. This work included the following elements:

- Performance of an on-site soil vapor survey using five soil vapor points (designated as SV-1 through SV-5) to collect soil vapor samples along the perimeter of the Site and the collection of one outdoor upwind air sample (designated as BG071813), which were tested for TO-15 VOCs. The locations of these points are shown on Figure 5.
- Performance of an off-site soil vapor survey using three soil vapor points (designated as SV-6 through SV-8) to collect soil vapor samples near potential receptors (two off-site buildings and City parklands) and the collection of one outdoor upwind air sample (designated as BG012414), which were tested for TO-15 VOCs. The locations of these points are shown on Figure 5.
- A supplemental overburden investigation involving the advancement of 18 Membrane Interface Probe/Hydraulic Profiling Tool (MiHPT) test points, and collection of corresponding soil samples that were tested for VOCs and/or PNOD. Figure 6 shows the locations of the 18 MIHPT points (designated as MIP-27 through MIP-44).

- Installation of four additional overburden monitoring wells designated as MW-18, MW-19, MW-20 and MW-21. Select soil samples collected during advancement of these wells were tested for VOCs and/or PNOD. One round of groundwater monitoring (Round 4) was performed in September 2013 that included the entire well field comprised of 21 overburden monitoring wells (including MW-18 through MW-21), nine bedrock monitoring wells, and four overburden backfill wells. Figure 7 shows the locations of the overburden monitoring wells and backfill wells, and Figure 8 shows the locations of the bedrock monitoring wells.
- Excavating 39 shallow test pits (designated as CS-01 through CS-39) and documenting existing cover material thickness observed at each test pit. During this work, select soil samples were collected from test pits CS-10, CS-38 and CS-39 and tested by an analytical laboratory for target compound list (TCL) VOCs and tentatively identified compounds (TICs) to assist in evaluating the cause of elevated photoionization detector (PID) readings at CS-10 and CS-38. This area is south of IRM-01.
- Advanced 12 direct-push test borings (designated as TB-04 through TB-15) in proximity to cover material test pit location CS-10 to further evaluate the extent of VOCs, primarily consisting of PCE, in soil. As part of this work, select samples from some borings around CS-10 were tested by an analytical laboratory for TCL VOCs and tentatively identified compounds (TICs).

The following sections summarize the scope and findings of the supplemental RI work described above.

Soil Vapor Survey

Summa canisters with two-hour regulators connected to the five soil vapor survey points (designated as SV-1 through SV-5) were used to collect the soil vapor samples (designated as 535-SV-1 through 539-SV-5). In addition, a summa canister equipped with a two-hour regulator was used to collect one outdoor air background sample (designated as 540-BG071813). Figure 5 shows the locations of the soil vapor points and background air sample. The six samples were analyzed for TO-15 VOCs. A summary of detected VOCs is included on Table 2. As shown, the detected concentrations of many VOCs in the soil vapor samples are similar to those detected in the outdoor air background sample. However, the results of the helium tracer testing conducted at each soil vapor point prior to collection of a soil vapor sample met the criteria outlined in Section 2.7.5 of the New York State Department of Health (NYSDOH) document titled “Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York” dated October 2006 (i.e., <10% of the helium-enriched air above each soil vapor point was detected within each sample point). It is noted that higher concentrations of PCE were detected in some of the soil vapor samples. Soil vapor sample locations where PCE was detected in proximity to potential receptors (i.e., buildings) consist of SV-2 and SV-5.

Summa canisters with two-hour regulators connected to the three soil vapor survey points (designated as SV-6 through SV-8) were used to collect the soil vapor samples (designated as 655-SV-8, 656-SV-7 and 657-SV-6). In addition, a summa canister equipped with a two-hour regulator was used to collect one outdoor air background sample (designated as 658-BG012414). Figure 5 shows the locations of the soil vapor points and background air sample. The four samples were analyzed for TO-15 VOCs. A summary of detected VOCs is included on Table 3. As shown, the detected concentrations of a few VOCs in the soil vapor samples are similar to those detected in the outdoor air background sample. However, the results of the helium tracer testing conducted at each soil vapor point prior to collection of a soil vapor sample met the criteria outlined in Section 2.7.5 of the NYSDOH document titled "Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York" dated October 2006 (i.e., <10% of the helium-enriched air above each soil vapor point was detected within each sample point). PCE concentrations of 2.71 ug/m^3 and 1.7 ug/m^3 were detected in soil vapor samples from locations SV-6 and SV-8, respectively. PCE was not detected in the soil vapor sample from location SV-7 or in the background outdoor air sample. The PCE concentrations detected at location SV-6 and SV-8 are two orders of magnitude lower than PCE concentrations detected in the closest on-site soil vapor samples at locations SV-2 and SV-5, respectively (refer to Table 2 and Figure 5). The SV-6 and SV-8 locations are respectively within the asphalt-capped public right-of-ways of Bristol Street and Andrews Street, and generally assimilate VOC vapor conditions that may be present beneath nearby buildings. Although there is no published NYSDOH action level criteria for soil vapor samples, the concentrations of PCE detected in soil vapor samples from locations SV-6 (2.71 ug/m^3) and SV-8 (1.7 ug/m^3) are more than an order of magnitude below the NYSDOH PCE air guidance value of 30 ug/m^3.

Supplemental Overburden Investigation

The eighteen MiHPT test points (designated as MIP-27 through MIP-44) were advanced to equipment refusal, which was encountered at depths ranging between approximately 14.5 feet and 25.5 feet below the ground surface. Figure 6 shows the locations of the 18 MiHPT points, which were advanced within, and in proximity to, the IRM-01 and IRM-02 areas. The intention of the MiHPT study was to obtain VOC and hydrogeologic data within the saturated overburden zone in the previously documented PCE source area and associated groundwater plume. The MiHPT study involved measuring continuous electrical conductivity or EC (mS/m), hydraulic profiling tool (HPT) pressure (pounds per square inch or psi), HPT Flow (ml/min), hydrostatic pressure from HPT dissipation tests (psi), estimated hydraulic conductivity or K (foot per day or ft/day), membrane interface probe (MIP) PID response (microvolts or uV), and MIP halogen specific detector (XSD) Response (uV).

Appendix A includes logs designated as MiHPT-27 through MiHPT-44 that correspond to test locations MIP-27 through MIP-44, respectively. From left to right, each log graphically shows the results of EC (mS/m), PID max response (uV), HPT pressure max. (psi) and HPT Flow max. (ml/min), and XSD max. response (uV). [Note: Some of the parameter scales on the logs vary between points since they are dependent on the measured responses that were recorded. The MiHPT results of these illustrated data are summarized below:

- The EC can loosely be used to discern between fill material and significant changes in lithology. For this data set, the peaks in measurements near the ground surface appear to represent urban fill material (e.g., MiHPT-27), which then transitions to indigenous soils that are less conductive. Also, in general, silts and clays exhibit higher electrical conductivity readings than sands and gravels.

- HPT pressure and the HPT flow rate are generally inversely related. Tight dense fine grained lithologic units such as glacial till with clays and silts have high HPT pressure and low HPT flow rates, whereas looser or more transmissive lithologic units have low HPT pressures and high HPT flow rates. As presented on the MiHPT logs, the Site data generally shows that the near surface urban fill material has low HPT pressures and high HPT flow rates, that transitions to dense glacial till with high HPT pressure and low HPT flow rates, which is underlain by more transmissive fine sands and gravels with low HPT pressures and high HPT flow rates.
- PID measurements and XSD measurements generally show the same response pattern, which suggests the VOCs present in the study area are chlorinated VOCs, which is consistent with the previously documented presence of PCE in this area.
- A review of the data logs generally indicate that the highest chlorinated VOC concentrations within the plume, but away from the known PCE source area, are present primarily in deeper more permeable/transmissive fine sand layers and occasional gravel beneath the dense glacial till. At test locations in the PCE source area, the data show high concentrations of VOCs in both the dense glacial till and underlying fine sand and occasional gravel layers, which is expected since the source was above or within the glacial till, and PCE is denser than water and can migrate vertically in the saturated zone. In many cases, elevated PID and XSD responses are only a half foot or so wide, which suggests thin zones of contaminated lithologic units surrounded by less contaminated lithologic units.

Geographic information system (GIS) was used to visualize and model XSD concentrations in a two-dimensional (2D) depiction. Figure 9 shows 2D GIS-modeled peak XSD concentrations detected at test points MIP-27 through MIP-44. For this figure, data input included the North American Datum (NAD) 83 New York State (NYS) Western Zone coordinates and peak XSD concentrations for test locations MIP-27 through MIP-44. ArcGIS Spatial Analyst Nearest Neighbor modeling was then used to create a colored contour map of interpolated peak XSD values for the study area. As shown, the area of highest XSD values is at test location MIP-37 (i.e., peak XSD greater than 2.4×10^7 uV), which is located beneath and within the footprint of the IRM-01 PCE source area. From MIP-37, a high concentration core plume appears to trend northeast in a line along MIP-34, MIP-31 and MIP-29. This plume direction is consistent with the direction of groundwater flow (i.e., towards the northeast) for this portion of the Site.

Two soil samples designated as 520-MW-17 (15-16) and 522-MW-17 (21-22) collected from monitoring well MW-17 were submitted to the laboratory for TCL VOCs and TICs using United State Environmental Protection Agency (USEPA) Method 8260. A summary of detected VOCs in these samples is included on Table 1. As shown, PCE was detected in samples 520-MW-17 (15-16) and 522-MW-17 (21-22) at concentrations of 11 milligram per kilogram (mg/kg) or parts per million (ppm) and 6.9 mg/kg or ppm, respectively, which exceeded the NYSDEC Part 375 Protection of Groundwater SCO for PCE of 1.3 mg/kg or ppm. Toluene, trichloroethene (TCE) and xylenes were also detected in sample 520-MW-17 (15-16), but at significantly lower concentrations that were below their respective SCOs. In addition, Samples 519-MW-17 (17-20), 521-MW-17 (13-14) and 524-MW-16 (15-23) were tested for PNOD using American Society for Testing Materials (ASTM) Method D7262-07. These samples are from depths beneath the extent of the previously excavated and backfilled IRM-01 area in order to assist in evaluating the PNOD in these deeper soils. Figure 4 and Figure 7 show the location of MW-17. PNOD results for Samples 519-MW-17 (17-20), 521-MW-17 (13-14) and 524-MW-16 (15-23) were 4.83, 2.58 and 1.0 $gKMnO_4/kg$, respectively.

Two soil samples designated as 532-TB-MIP-27 (19-22) and 533-TB-MIP-27 (22-24) collected from test boring TB-MIP-27 were submitted to the laboratory for testing of TCL VOCs and TICs using USEPA Method 8260. This test location is northwest of the IRM-01 area, the samples were collected at depths greater than the depth of the bottom of the IRM-01 excavation, and the results were used to assist in evaluating soil conditions at these deeper depths. Figure 6 shows the location of TB-MIP-27 (shown as MIP-27). A summary of detected VOCs is included on Table 1. As shown, PCE was detected in sample 532-TB-MIP-27 (19-22) at a concentration of 0.0178 mg/kg or ppm (below NYSDEC Part 375 Protection of Groundwater SCO), and PCE was not detected in sample 533-TB-MIP-27 (22-24). Sample 532-TB-MIP-27 (19-22) was also tested for PNOD using ASTM Method D7262-07, and had a result of 1.2 $gKMnO_4/kg$.

Eleven soil samples designated as 542-MW-18 (19) through 552-MW-20 (26) collected from monitoring wells MW-18, MW-19 and MW-20 were submitted to the laboratory for testing of TCL VOCs and TICs using USEPA Method 8260. Monitoring wells MW-18, MW-19 and MW-20 are located northwest, northeast and east of the IRM-01 area, and samples were collected at depths that exceed the bottom of the IRM-01 excavation to assist in evaluating deeper soil conditions. Figure 4 and Figure 7 show the locations of MW-18, MW-19 and MW-20. A summary of detected VOCs in these samples is included on Table 1. As shown, the highest PCE concentration of 7.5 mg/kg or ppm was detected in sample 546-MW-19 (20-22), which is above its Protection of Groundwater SCO. PCE was detected in the other ten samples at concentrations ranging between 0.0038 and 0.62 mg/kg or ppm, which were below the NYSDEC Part 375 Protection of Groundwater SCO for PCE of 1.3 ppm. Methylene chloride, 4-methyl-2-pentanone, trichloroethene and 2-hexanone were also detected in one or more of these samples, but at significantly lower concentrations that were below their respective SCOs. In addition, Samples 546-MW-19 (20-22), 553-MW-18 (22) and 554-MW-20 (28) were tested for PNOD using ASTM Method D7262-07. PNOD results for Samples 546-MW-19 (20-22), 553-MW-18 (22) and 554-MW-20 (28) were 1.6, 0.9 and 2.0 $gKMnO_4/kg$, respectively.

During the excavation of 39 shallow test pits (designated as CS-01 through CS-39) that were used to evaluate existing cover material thickness, an elevated PID reading of 64.9 ppm was measured on a sample from CS-10 at a depth of 1.8 feet below the ground surface (bgs). As a result, three soil samples designated as 614-CS-10 (1.8), 615-CS-38 (2) and 616-CS-39 (2) were submitted to the laboratory for testing of TCL VOCs and TICs using USEPA Method 8260. These three test pit locations are immediately south of the previous IRM-01 excavation. The highest PID readings measured on different portions of the corresponding soil samples from CS-38 and CS-39 were 11.0 ppm and 0.0 ppm, respectively. Figure 10 shows the locations of CS-10, CS-38 and CS-39. A summary of detected VOCs in these samples is included on Table 1. As shown, the detected concentrations of PCE in samples 614-CS-10 (1.8), 615-CS-38 (2) and 616-CS-39 (2) were 2.2, 1.1, and 0.12 mg/kg or ppm, respectively. The detected concentration PCE in sample 614-CS-10(1.8) is above its Protection of Groundwater SCO of 1.3 ppm.

In order to further evaluate the vertical and lateral extent of PCE in the area of CS-10, twelve test borings designated as TB-04 through TB-15 were advanced to depths of 8 feet bgs (refer to Figure 11). Samples were collected within each two foot interval (i.e., four samples for each test boring), which were screened in the field with a PID. Based on the PID screening, a soil sample within each depth interval at each test boring was collected for possible laboratory analysis, and submitted under chain-of-custody to Chemtech Consulting Group, Inc. (Chemtech). The following samples were analyzed by Chemtech for TCL VOCs and TICs using USEPA Method 8260:

- TB-04: 618-TB-04 (0-2); 619-TB-04 (2-4); 620-TB-04 (4-6); and 621-TB-04 (6.5-7.5).
- TB-05: 622-TB-05 (1-2); 623-TB-05 (2-3); 624-TB-05 (5-6); and 625-TB-05 (7-8).
- TB-06: 626-TB-06 (0-1); 627-TB-06 (2-4); 628-TB-06 (4-6); and 629-TB-06 (6-8).
- TB-07: 630-TB-07 (1-2); 631-TB-07 (2-4); 632-TB-07 (4-6); 633-TB-07 (6-7); and 634-TB-07 (7-8).
- TB-08: 636-TB-08 (0-2); 637-TB-08 (2-4); 638-TB-08 (5-6); and 639-TB-08 (7-8).
- TB-09: 640-TB-09 (0-2); 641-TB-09 (3-4); 642-TB-09 (4-6); and 643-TB-09 (6-8).
- TB-10: 644-TB-10 (0-2); 645-TB-10 (2-4); 646-TB-10 (4-6); and 647-TB-10 (7-8).
- TB-11: 649-TB-11 (0-2) and 650-TB-11 (3-4).
- TB-12: 651-TB-12 (0-2) and 652-TB-12 (2-4).
- TB-14: 653-TB-14 (0-2) and 654-TB-14 (2-4).

GIS was used to visualize and PCE soil concentrations in 2D and three-dimensional (3D) depictions. Figure 12 shows the peak PCE concentrations detected in soil samples that represent existing conditions after the completion of IRM-01 through IRM-06. For this figure, data input included the NAD 83 NYS Western Zone coordinates and peak PCE concentrations in soil sample test locations that had available data. GIS was then used to color code the test location symbols based on the following three ranges of PCE soil concentrations: Green for 0.0 to 1.3 ppm PCE; Orange for > 1.3 ppm to 10 ppm PCE; and Red for > 10 ppm to 20 ppm PCE. A summary of the evaluation of this data is provided below:

- Most sample locations across the Site are color-coded green since the peak PCE concentrations were below the NYSDEC Part 375 Protection of Groundwater SCO of 1.3 ppm for PCE.
- For samples collected from within the footprint of the IRM-01 excavation, only samples from four test locations (TB-03, MW-17, 260 and 263) are color-coded red or orange, meaning they exceeded the NYSDEC Part 375 Protection of Groundwater SCO of 1.3 ppm for PCE. These four locations are indicative of the PCE that is present in glacial till and also underlying more permeable fine sand layers located beneath the bottom of the IRM-01 PCE source area excavation.
- For samples collected northeast, north and northwest of the IRM-01 area, samples from four test locations (TB-01, TB-02, MW-01R and MW-19) from depths ranging between 18 and 22 ft. bgs (i.e., greater than the bottom of the IRM-01 excavation) exceeded the NYSDEC Part 375 Protection of Groundwater SCO of 1.3 ppm for

  PCE. These four locations are indicative of the PCE in the plume that is present in deeper more permeable fine sand layers that exist beneath the overlying dense glacial till away from the source area.

  - For samples collected south of the IRM-01 area, samples from three test locations (CS-10, TB-05 and TB-06) from depths ranging between 0 and 2 feet bgs exceeded the NYSDEC Part 375 Protection of Groundwater SCO of 1.3 ppm for PCE This shallow PCE impact appears localized to an approximate 300 square foot area that does not extent past a depth of 2 feet bgs.

- Based on comparison of soil concentrations to XSD concentrations in the PCE source and plume area, it was determined that subsurface media that had XSD values greater than 1 x 10^6 uV represented media that warranted further remediation. [Note: The previous unsaturated zone model used an XSD value of 2.73 x 10^6 uV as a value representing media that warranted remediation.] GIS was used to visualize XSD measurements greater than 1 x 10^6 uV in a 3D depiction. The average XSD value for each half-foot interval at MiHPT test locations MIP-27 through MIP-44 were averaged and then modeled based on true surveyed elevations. Given the observed fine sand layers that can act as preferential migration pathways of VOCs, which intermingle with less permeable silts and clay layers, modelling the data using half-foot intervals of averaged XSD data was selected to provide definition to the model. ArcGIS Spatial Analyst Nearest Neighbor modelling was used to create an interpolated raster of average XSD values for each half-foot interval. Using ArcGIS 3D Analyst, each interpolated raster was then extruded downward a half foot to create 67 polygons for XSD values greater than 1 x 10^6 uV. The polygons were then merged using ArcGIS 3D Analyst to create a 3D model of PCE contamination with XSD values greater than 1 x 10^6 uV, and snap shots of this 3D model looking north, south, east and west are provided on Figure 13A, Figure 13B, Figure 13C and Figure 13D, respectively. As shown, XSD measurements greater than 1 x 10^6 uV are present beneath the previous IRM-01 soil removal area, and appear to show a plume trending toward the northeast that migrates downward with distance away from the source areas. As previously discussed, the lateral migration is likely most prominent in thin fine sand layers that are present beneath the denser glacial till. As presented on Figure 13A, Figure 13B, Figure 13C and Figure 13D, a shallower “lobe” of media with XSD values greater than 1 x 10^6 uV follows this same northeast trend away from the source area, and is presumed to be the result of preferential migration along the bedding material for former buried utilities (i.e., combined sewer) in this area and elevation.

Supplemental Groundwater Investigation

Round 3 Groundwater Sampling and Analysis

Overburden groundwater monitoring wells MW-03A, MW-15, MW-16 and MW-17 were installed in December 2012. Wells MW-03A, MW-15 and MW-16 are screened between approximately 10 feet and 30 feet bgs, and well MW-17 is screened between approximately 10 feet and 25 feet bgs. Wells MW-03A and MW-17 are located within the footprint of the IRM-01 area. Wells MW-15 and MW-16 are located along the northern property boundary at potentially hydraulic downgradient positions northwest and northeast of the IRM-01 area, respectively. The Round 3 groundwater sampling was completed using passive diffusion bag (PDB) samplers at wells MW-03A, MW-15, MW-

16 and MW-17. On January 15, 2013, static water levels were measured from the entire overburden well field that existed at that time. Figure 4 depicts the overburden groundwater contours and direction of groundwater flow for January 15, 2013. As shown, groundwater in the overburden appeared to generally flow radially away from the area of the previous IRM-01 backfilled excavation in the center of the Site. On January 15, 2013, PDBs were deployed within the saturated zone at wells MW-03A, MW-15, MW-16 and MW-17. On February 2, 2013, the PDBs were retrieved, and the following groundwater samples were collected:

- 525-MW-03A (22-23)
- 526-MW-15 (22-23)
- 527-MW-16 (22-23)
- 528-MW-17 (18-19)
- 529-MW-D [a duplicate of 526-MW-15 (22-23)]

The five Round 3 groundwater samples were analyzed for TCL VOCs and TICs via USEPA Method 8260. A summary of detected VOCs is included on Table 4, and PCE results are included on Figure 4. As shown, PCE was detected in samples 525-MW-03A (22-23) and 528-MW-17 (18-19) at concentrations of 9,600 microgram per liter (ug/l) or parts per billion (ppb) and 82.6 ug/l or ppb, respectively, which are above the NYSDEC Division of Water Technical and Operational Guidance Series (TOGS 1.1.1) PCE groundwater standard of 5 ug/l or ppb. PCE was not detected in samples 526-MW-15 (22-23), 527-MW-16 (22-23) and 529-MW-D, which established that the width of the VOC plume migrating off-site to the north was relatively narrow.

Supplemental Groundwater Monitoring Well Installations

Overburden groundwater monitoring wells MW-18, MW-19, MW-20 and MW-21 were installed in August 2013 to further define the VOC plume in groundwater. As shown on Figure 7, wells MW-18, MW-19, and MW-20 are located on-site in the area of the PCE contamination, and well MW-21 is located at a hydraulically downgradient location in the public right-of-way of Cumberland Street located north of the Site. Wells MW-18, MW-19 and MW-20 are screened between approximately 6 feet and 31 feet bgs, and well MW-21 is screened between approximately 10 feet and 30 feet bgs.

Round 4 Groundwater Sampling and Analysis

The Round 4 groundwater sampling was completed using the Site's entire well field consisting of the 21 overburden wells (including wells MW-18, MW-19, MW-20 and MW-21), the nine bedrock wells, and the four overburden backfill wells. The Round 4 sampling event is intended to represent baseline VOC conditions prior to completing Supplemental IRM work. On August 21, 2013, static water levels were measured at the entire overburden and bedrock well field. Figure 7 and Figure 8 depict the groundwater contours and direction of groundwater flow on August 21, 2013 for overburden wells and bedrock wells, respectively. As shown, groundwater in the overburden appeared to generally flow northward, and groundwater in the bedrock appeared to generally flow northward with some outward radial flow from the center of the Site. On August 21

2013, PDBs were deployed within the saturated zone at the 21 overburden wells, nine bedrock wells and four backfill wells. Twelve of the overburden wells received three PDBs set at various depths within particular wells to assist in evaluating vertical trends of VOC contamination in the overburden. On September 5, 2013, the 58 PDBs were retrieved, and were analyzed for TCL VOCs and TICs via USEPA Method 8260. A summary of detected VOCs is included on Table 4 and Table 5, and PCE results for overburden groundwater samples and bedrock groundwater samples are included on Figure 7 and Figure 8, respectively. ArcGIS Spatial Analyst Nearest Neighbor modeling was used to create a colored contour map of interpolated peak PCE in Round 4 overburden groundwater samples, which is shown as Figure 14. The Round 4 PCE results are summarized below:

- PCE was detected in 32 of 45 groundwater samples that were collected from the 21 overburden monitoring wells. PCE was detected at concentrations exceeding the NYSDEC TOGS 1.1.1 groundwater standard of 5 ug/l or ppb at overburden wells MW-01, MW-02, MW-03A, MW-05, MW-06, MW-11, MW-17, MW-18, MW-19 and MW-20. The wells with the three highest detected concentrations included MW-01 (15,500 ug/l or ppb from a depth of 23 feet bgs), MW-02 (8,900 ug/l or ppb from a depth of 22 feet bgs), and MW-03A (4,800 ug/l of ppb from a depth of 17 feet bgs). PCE was also detected at overburden wells MW-07 and MW-15, but at concentrations below the NYSDEC TOGS 1.1.1 groundwater standard of 5 ug/l or ppb. PCE was not detected at overburden wells MW-04, MW-08, MW-09, MW-10, MW-12, MW-13, MW-14, MW-16, and MW-21. These data generally define the extent of VOCs in overburden groundwater at the Site, and show PCE is not present in groundwater on the northeast, east, southeast, south, southwest, west or northwest portions of the Site. In addition, the data for well MW-21 show that potentially site-related VOCs are not present in overburden groundwater in proximity to the nearest hydraulically downgradient off-site building that is located along Cumberland Street.
- PCE was not detected at seven of the nine bedrock wells (MW-01R, MW-02R, MW-05R, MW-07R, MW-09R, MW-10R, and MW-14R). PCE was only detected in groundwater samples that were collected from bedrock monitoring wells MW-04R and MW-06R. Well MW-04R contained 130 ug/l of ppb of PCE, which exceeds the NYSDEC TOGS 1.1.1 groundwater standard of 5 ug/l or ppb. Well MW-06R contained 0.57 ug/l of ppb of PCE, which is below this NYSDEC TOGS 1.1.1 groundwater standard. These data confirm that, consistent with previous groundwater sampling results, VOCs are generally confined to the overburden groundwater, likely as a result of migration being inhibited by the dense glacial till and other fine-grained soil types.
- PCE was detected in the four overburden backfill well samples at concentrations ranging between 28.1 and 72.9 ug/l or ppb, which exceed the NYSDEC TOGS 1.1.1 groundwater standard of 5 ug/l or ppb.
- With the exception of MW-19, PCE concentrations in overburden wells where three PDB samples were collected show a trend of decreasing PCE concentrations between the middle and deepest samples. A consistent trend of decreasing or increasing PCE concentrations between upper and middle samples was not apparent (refer to Figure 7).

- In general, significantly lower concentrations (e.g., one or more orders of magnitude) of one or more additional chlorinated VOCs (such as TCE, cis-1,2-Dichloroethene, and Vinyl Chloride), suggesting minimal degradation of PCE, were also detected in many of the overburden groundwater samples where PCE was detected, and also in the bedrock groundwater sample from MW-04R where PCE was detected.
- Acetone was detected in each PDB sampled from overburden monitoring wells, bedrock monitoring wells and backfill wells at concentrations ranging between 110 ug/l and 1,600 ug/l. These detections were later determined to be attributable to the acetone-contaminated reagent grade water that was purchased from EON Products and was used to fill the PDB samples prior to their deployment.

Summary of Supplemental RI Findings.

In summary, the Supplemental RI was successful in defining the PCE source area and associated plume, which was found to cover an approximate 0.6-acre area generally situated on the north central portion of the Site. Residual source area PCE contamination exists beneath the bottom of the previous IRM-01 excavation, and a distinct approximate 40-foot wide plume core of higher VOC concentrations trends northeast. In general, this PCE is confined to the overburden, and PCE concentrations in deepest soils above bedrock are generally significantly lower than overlying soils within the saturated zone. Groundwater results indicate that the PCE concentrations decrease by more than two orders of magnitude between on-site well MW-01 located at the northern property boundary and off-site well MW-11 located approximately 40 feet to the north of MW-01 within the right-of-way (ROW) of the New York State Department of Transportation (NYSDOT) Inner Loop. It was determined that the on-site PCE plume does not extend completely across the NYS Inner Loop in the direction of the nearest hydraulically downgradient building located north of Cumberland Street. Also, an approximately 300 square foot area of PCE-contaminated soil, from the ground surface to a depth of 2 feet bgs, exceeding regulatory criteria is present south of the IRM-01 area (in the area of test location CS-10).

The output of the 3D model for XSD values greater than 1 x 10^6 uV was compared to soil and groundwater data within the modeled area and depth interval to confirm the model accuracy. With the exception of detected groundwater samples collected from wells set within the footprint of the backfilled IRM-01 excavation area, the 3D XSD model is consistent with the array of VOC concentrations measured in soil and groundwater samples at the Site. As such it appears the 3D model accurately depicts chlorinated VOC concentrations in soil and groundwater requiring further remediation to meet associated cleanup criteria (i.e., Part 375 Protection of Groundwater SCO for PCE of 1.3 mg/Kg, and also TOGS 1.1.1 groundwater standard for PCE of 5 ug/l). Lower than expected chlorinated VOC groundwater values were detected at overburden monitoring well MW-17 and backfill wells BW-1 through BW-4. It is presumed that precipitation water has infiltrated into the more permeable backfill material, and may have diluted the groundwater at these locations which resulted in low chlorinated VOC concentrations. However, soil sample results beneath the IRM-01 excavation limits indicate chlorinated VOCs are present at concentrations exceeding soil regulatory criteria, which generally agrees with the supplemental XSD data collected from this area and depth.

On-site soil vapor study results showed that PCE and other VOCs are present at test locations along the property boundaries of the Site. The results of off-site soil vapor test locations positioned near closest off-site receptors indicate PCE was detected near off-site buildings addressed as 176-180 North Clinton Avenue and 331-33 Andrews Street, but at concentrations of only 2.71 ug/m3 and 1.7 ug/m3, respectively. The PCE concentrations at SV-6 and SV-8 are more than two orders of magnitude lower than the PCE concentrations detected in the closest on-site soil vapor samples from locations SV-2 and SV-5. The SV-6 and SV-8 locations are respectively within the asphalt-capped public right-of-ways of Bristol Street and Andrews Street, and generally assimilate VOC vapor conditions that may be present beneath nearby buildings. Although the NYSDOH does not have action level criteria for soil vapor data, the detected concentrations of PCE at SV-6 and SV-8 are more than an order of magnitude below the NYSDOH PCE air guidance value of 30 ug/m^3. PCE was not detected in the soil vapor sample from location SV-7 (i.e., in City Parklands east of the Site) or in the outdoor air background sample.

Based the remedial investigation, it appears that the extent of PCE in the source area and associated groundwater plume has been adequately delineated. Based on the cumulative soil vapor results in conjunction with the nearby groundwater plume sample results, it appears that additional soil vapor intrusion sampling is not warranted at this time. However, continued groundwater monitoring will be conducted at select site perimeter wells (e.g., MW-08 and MW-13) following the proposed in-situ chemical oxidant injections to ensure that displacement of the contamination does not occur and present a concern for potential exposure via soil vapor intrusion.

1.2.2 Remaining Contamination

A comparison to soil and fill sample data generated as part of the Demolition-Phase Environmental study, the RI, the initial IRMs, and the Supplemental RI, indicate the following types of constituents are present in soil and/or fill samples at concentrations exceeding NYSDEC Part 375 Restricted Residential Use SCOs and/or Protection of Groundwater SCOs at the following areas:

- VOCs primarily consisting of PCE at nine test locations in the documented PCE source and plume area on the north central portion of the Site;
- Polycyclic aromatic hydrocarbon (PAH) semi-volatile organic compounds (SVOCs) at five test locations on the western portion of the Site and also in Site soil used as backfill at the IRM-01 excavation as allowed by the NYSDEC; and
- Various target analyte list (TAL) metals at three test locations on the western portion of the Site, one test location on the eastern portion of the Site, and also in Site soil used as backfill at the IRM-01 excavation as allowed by the NYSDEC.

Based on the September 5, 2013 (Round 4) groundwater sampling event completed as part of the Supplemental RI work, PCE and its degradation products [e.g., TCE, Dichloroethene (DCE), and Vinyl Chloride (VC)] are the primary constituents of concern in groundwater at the Site that exceed NYSDEC TOGS 1.1.1 groundwater standards or guidance values. There are sporadic groundwater test locations with other VOCs (e.g., benzene at one bedrock well location, Freon 11 at one upgradient overburden well location, etc.), and TAL metals (e.g., primarily iron, manganese and sodium) that exceed NYSDEC TOGS 1.1.1 groundwater standards or guidance values. The TAL metals generally appear attributable to naturally occurring conditions. Based on the Site history, the benzene is most likely attributable to the historic release of a petroleum based product to the environment. In addition, the VOC acetone was detected in many groundwater samples, but was generally determined to be attributable to sampling equipment and/or laboratory artifacts.

At a minimum, it appears that PCE in the residual source area, the majority of the associated plume to the northeast, and PCE in the near surface soil south of IRM-01 require further remediation to prohibit continued off-site migration. Lower level on-site areas of PCE and associated VOCs can be controlled with the implementation of institutional controls and engineering controls that would apply to the entire Site. Subsequent to implemental the Supplemental IRMs, any remaining off-site soil vapor intrusion concerns can be addressed through the implementation of further monitoring and/or engineering controls.

The sporadic areas of urban fill and soil across the Site contain concentrations of SVOCs and/or TAL metals that exceed NYSDEC Part 375 Restricted Residential SCOs and/or Protection of Groundwater SCOs can be controlled with the implementation of institutional controls and engineering controls that would apply to the entire Site

1.2.3 Geology, Hydrogeology and Subsurface Conditions in PCE-Impacted Area

The Site is currently covered with a layer of NYSDEC-approved imported crushed stone. A layer of heterogeneous historic urban fill material is present beneath the surficial layer of imported crushed stone (i.e., not beneath backfilled basements or deep IRM excavations in select areas of the Site). The fill material generally consists of reworked soils, with lesser amounts of coal, cinders, glass, brick, gravel, rock, concrete and asphalt and appears to extend to approximate depths ranging from 1.5 feet to 8 feet bgs. At depths ranging between approximately 9 and 16 feet bgs, a glacial till was encountered that generally consists of dense gray-brown fine sand and silt with some gravel and clay. This till is underlain by stratified silt and sand layers that extend to the top of bedrock present at approximately 30 to 34 feet bgs. The bedrock consists of Eramosa Dolomite (a/k/a Lockport Dolomite) belonging to the Lockport Group, Upper Silurian Period, Paleozoic Era. Documented Rock Quality Designation (RQD) values were calculated to range between 58% and 96.7%, and no distinct trend in increasing or decreasing RQDs for the Site was evident over the approximate 10 to 12 foot thick intervals of bedrock that were cored at nine locations on the Site.

Based on the findings of the RI and previous intrusive studies, the top of the uppermost groundwater table in the overburden on the Site was generally encountered between approximately 8 and 15 feet bgs. At off-site overburden well MW-11 located in the Inner Loop right-of-way north of the Site, the top of the uppermost groundwater table in the overburden was generally encountered approximately five feet bgs. [Note: the ground surface at off-site well MW-11 is approximately 7 feet lower in elevation than the ground surface at nearby on-site well MW-01.]

Figure 7 and Figure 8 illustrate the most recent documented groundwater flow conditions in the overburden and the bedrock at the Site on August 21, 2013, respectively. As shown, groundwater in the overburden appeared to generally flow northward, and groundwater in the bedrock appeared to generally flow northward with some outward radial flow from the center of the Site.

Using contour data for groundwater monitoring events conducted in January 2012, June 2012 and January 2013, average hydraulic gradients across the Site in overburden and bedrock were calculated to be 0.024 foot per foot (ft/ft) and 0.068 ft/ft, respectively.

Hydraulic conductivities calculated from slug-in and slug-out tests at five overburden wells and three bedrock wells are summarized on Table 6. Based on the values listed in Table 6, the average calculated hydraulic conductivity for overburden at the Site was 1.36 x 10^{-4} centimeter per second or cm/sec (i.e., 0.39 ft/day) and the average calculated hydraulic conductivity for bedrock at the Site was 3.84 x 10^{-4} cm/sec (i.e., 1.09 ft/day). These hydraulic conductivities are consistent with those typically present in till overburden glacial till deposits and dolomite as referenced in Groundwater, R. Allan Freeze & John A. Cherry, 1979.

Using the average hydraulic gradient of 0.024 ft/ft, the average hydraulic conductivity of 0.39 ft/day (i.e., 1.36 x 10^{-4} cm/sec), and an estimated porosity of 0.15 for glacial till from the range of values referenced in Groundwater and Wells, F.G. Driscoll, 1989, the seepage velocity of groundwater flow in overburden at the Site was calculated to be 0.06 ft/day (i.e., 21.9 ft/year).

Using the average hydraulic gradient of 0.068 ft/ft, the average hydraulic conductivity of 1.09 ft/day (i.e., 3.84 x 10^{-4} cm/sec), and an estimated porosity of 0.1 for dolomite from the range of values referenced in Groundwater, R. Allan Freeze & John A. Cherry, 1979, the seepage velocity of groundwater flow in Eramosa bedrock intercepted by bedrock wells at the Site was calculated to be 0.74 ft/day (i.e., 270.1 ft/year).

The backfilled IRM-01 excavation and the backfilled utility corridor along the former Evans Street ROW are located above the area of the residual PCE source area and associated dissolved plume area. In general, the backfilled IRM-01 excavation and utility corridor contain little or no PCE in soil or groundwater. The glacial till layer is present at the bottom of the IRM-01 excavation that contains concentrations of PCE requiring remediation. The PCE appears to have migrated vertically downward through this glacial till and intercepted the underlying stratified silt and sand layers. The PCE contamination appears to have then migrated laterally in a northeast direction away from the residual source area primarily through these deeper sand layers. In addition, the shallower bedding material (i.e., 10 to 14 feet bgs) of the former combined system located below the former Evans Street ROW may have acted as a northerly preferential migration pathway for some of the source area PCE and/or from leaks in the former sewer where PCE may have historically been discharged.

2.0 SUPPLEMENTAL INTERIM REMEDIAL MEASURES

To further address the remaining contamination at the Site, Supplemental IRMs have been developed that include implementing a combination of proactive remedial measures, engineering controls and institutional controls. These remedial measures and controls are intended to meet project SCG values and goals, and satisfy NYSDEC requirements for obtaining a Certificate of Completion for the Site.

Supplemental IRM work will be performed by subcontractors that are selected through a competitive bid process in accordance with NYSDEC ERP procurement requirements. The IRM activities will be observed by Day Environmental, Inc. (DAY). Equipment, materials and/or vehicles that arrive at the Site contaminated (e.g., not decontaminated from the previous job), will not be permitted to enter the Site.

Vehicles, including trucks, will be prohibited from stopping and idling outside the project Site. If necessary, queuing of trucks will be performed on-site in order to minimize off-site disturbance; therefore, a traffic control plan is not necessary. In accordance with 6 New York Codes, Rules, and Regulations (NYCRR) Subpart 217-3, efforts will be made to keep diesel-fueled trucks from idling for more than 5 minutes. Egress points for truck and equipment transport from the Site will be kept clean of dirt and other materials during the supplemental IRM work.

Non-hazardous contaminated soil and other non-hazardous solid wastes will be disposed at Mill Seat Landfill in Bergen, New York or High Acres Landfill in Perinton, New York, which are operated by Waste Management, Inc. Off-site trucking routes will be dependent on which facility is selected, but will likely consist of Andrews Street west to Clinton Avenue north, to the Inner Loop west and I-490 west. This route does not include transport through residential areas or past sensitive sites, and is the most direct route to major highways. Although soil exceeding characteristic hazardous waste thresholds is not anticipated, it would be transported to Model City Landfill in Model City, New York or to a Biogenic facility in Quebec, Canada. A similar truck route to I-490 will be utilized for off-site transport of hazardous soil.

2.1 Applicable Project Standards, Criteria and Guidance

Based on the CCD zoning, the proposed mixed-use development scenario, the urban setting of the Site, and NYSDEC requirements, the applicable SCG values that will be used for this project are outlined below:

- Unrestricted Use, Restricted-Residential Use, Restricted Commercial Use, Protection of Groundwater Soil Cleanup Objectives (SCOs) and other guidance as set forth in 6 NYCRR Part 375-4 Environmental Restoration Program dated December 14, 2006.
- Appropriate water quality standards and guidance values as set forth in NYSDEC Division of Water Technical and Operational Guidance Series (TOGS 1.1.1) document titled "Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations", June 1998 and amended by a January 1999 Errata Sheet, an April 2000 Addendum and a June 2004 Addendum.
- Guidelines referenced in the NYSDEC document titled "DER-10 Technical Guidance for Site Investigation and Remediation", May 2010.

- Guidelines referenced in the NYSDOH document titled “Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York”, October 2006.
- Monroe County Pure Waters (MCPW) Sewer Use Permit Effluent Standards.
- USEPA Underground Injection Control (UIC) Program requirements for Class V injection wells.
- United States Homeland Security’s Chemical Security Assessment Tool (CSAT) requirements.

2.2 Site Preparation, Mobilization and Controls

Site preparation activities will be implemented as warranted and during various phases of the supplemental IRM fieldwork at the Site. These activities may include, but not be limited to, the following:

- Site controls to ensure the safety of Site workers and the public. The Site is currently secured with perimeter fencing containing two locked gates large enough for vehicles to enter and exit the Site. Access to the Site will be limited to DAY and City staff, Rochester Fire Department staff, workers, and pertinent agencies involved with the project only. The City, DAY, Rochester Fire Department and Rochester Gas and Electric (RG&E) are the only entities with keys to locks on the gates. [Note, RG&E has a key to the gates in order to access a utility vault in the public ROW of Franklin Square. RG&E does not enter the Site itself.] The public will not be permitted to enter within the fenced area. DAY’s contract with the City includes maintaining the integrity of the perimeter fence and gates to ensure proper Site security.
- NYSDEC-approved crushed stone meeting requirements set forth in Section 5.4(e) of DER-10 may be imported to the Site and used to improve access roads and work areas, and minimize tracking of Site soils.
- Parking areas will be designated as shown on Figure 15. There will also be off-site parking available at 101-113 Franklin Street located south of the Site. Supplemental IRM remedial activities are to be contained within the Site boundaries. Figure 15 also identifies the anticipated layout of the Site during the Supplemental IRM activities, including planned staging, mixing, storage, transportation and support areas. Components shown on Figure 15 are subject to change based on input from the actual IRM subcontractor(s) selected for the project, and any significant changes to Site layout will be identified to the City and the NYSDEC.
- A dumpster, drum or other receptacle will be placed on the east side of the Site for general refuse/solid waste disposal (refer to Figure 15).
- Support facilities, including an office trailer (or PODS) and a portable toilet, will be located on the eastern and southern portions of the Site (refer to Figure 15).
- The existing unused approximate 15’ x 30’ decontamination pad consisting of a layer of 60 mil high density polyethylene (HDPE) sheeting covered by 12 inches of crushed stone will be evaluated. Any rain water that has collected in the decontamination pad is uncontaminated and will be discharged on-site prior to use of the pad (refer to Figure 15).
- Vegetation and/or snow will be cleared as required during the duration of the Supplemental IRM project.

- An approximate 30’ x 30’ at-grade centralized material mixing/staging area consisting of a layer of 60 millimeter HDPE sheeting covered by 4 inches of clean NYSDEC-approved crushed stone that is bermed for secondary containment will be constructed on-site (refer to Figure 15). The berms will be sufficiently sized to contain greater than 110% of the largest volume tank within the containment system.
- An Erosion and Sedimentation Control Plan has been prepared (refer to Appendix B), which includes the installation of hay bales around open stormwater drains on the East side of the Site that discharge to an active sewer, maintenance of gravel/crushed stone at access locations and the installation of siltation fencing along the perimeter of the Site to prevent run-off.
- Steel storage containers with locked doors will be staged on the Site for storage of remediation materials. An outdoor forklift will also be mobilized to the Site for transfer and moving of remediation materials.
- A global positioning system (GPS) and/or a licensed surveyor will be used to locate Supplemental IRM features (e.g., injection points), which will be marked using marking paint, pin flags, wood stakes, or other methods prior to initiation of specific Supplemental IRM activities. If deemed warranted, areas of the Site to be used for staging, parking, decontamination and other related activities may also be marked using the methods stated above.
- A USEPA Class V UIC Inventory form has been completed and provided to the USEPA, the NYSDEC, and the City. On May 1, 2014, the USEPA provided a letter acknowledging receipt of the inventory information addressing wells authorized by rule (Reference UICID: 14NY05599031). In addition, the United States Homeland Security’s CSAT User Registration and Top Screen form will be completed to address the storage of potassium permanganate ($KMnO_4$) at the Site prior to its use as a Supplemental IRM in-situ chemical oxidation (ISCO) reagent.

  Figure 15 shows the tentative location of an approximate 30’ x 30’ contaminated soil staging area. The ground surface at the staging area is currently covered in angular crushed stone. Therefore, a layer of 10-millimeter reinforced poly sheeting of sufficient size to contain the soil will be laid on the ground surface. An approximate 2-3 inch layer of NYSDOT and NYSDEC-approved clean sand (or equivalent) meeting the applicable imported material requirements of DER-10 Section 5.4(e) will be placed on the poly sheeting, covering the entire surface of the poly. This sand (or equivalent) material will be approved by the NYSDEC prior to being imported to the Site. A second layer of 10-millimeter reinforced poly sheeting of equal size will then be placed on top of the sand such that it will contain the soil placed on it. This will prevent the likelihood of cross-contamination occurring if a single layer of poly sheeting was torn during placement/staging of the impacted soil. The staging area will be bermed. Any soil piles placed in the contaminated soil staging area will be covered with 10-millimeter poly sheeting and secured with sand bags (or other acceptable method) until disposal occurs. The above components will inhibit run-off and run-on.
- Prior to excavation, staging and disposal activities, the Subcontractor will be directed to provide the provisions necessary to implement dust and vapor suppression controls as described in the Health and Safety Plan (HASP) in Section 3.0 of this Work Plan.

- Prior to completing intrusive work, and in accordance with Dig Safely New York requirements, subcontractors involved with intrusive work will be responsible for calling in and coordinating utility stakeouts for identification and clearance of Site utilities.
- As a precautionary measure, the adjoining City parkland (i.e., Schiller Park located east of Site on the opposite side of Franklin Square) will be closed to the public immediately prior to, and for the duration of time that potassium permanganate is present aboveground on the Site.

2.3 Evaluation and Selection of Remedial Option for Saturated Zone of IRM-01 and IRM-02 Areas

Bioremediation and various chemical oxidation technologies were evaluated by the City and DAY to potentially address the residual chlorinated VOC (primarily PCE) contamination in saturated soil and groundwater at the Site.

Chlorinated Reduction via Bioremediation

Various groundwater samples were collected and analyzed for Dehalococcoides (DHC) strains and DHC functional genes. The DHC results were $<10^1$ cells/ml (i.e., low), which indicates complete reductive dechlorination of PCE and TCE to ethane is unlikely to occur under existing conditions. Based on this testing, and cumulative groundwater and soil data suggesting little or no reductive dechlorination is occurring, the use of bioremediation at this Site was eliminated from consideration.

Chemical Oxidation

Contamination at the Site that requires remediation is primarily present within soil and groundwater in the unconsolidated overburden. In-situ chemical oxidation involves the introduction of a chemical oxidant into the subsurface for the purposes of oxidizing groundwater or soil contaminants into less harmful chemical species. Permanganate, Fenton's Reagent, and Ozone are excellent oxidizers for chlorinated ethenes (e.g., PCE), and Persulfate is a good oxidizer of chlorinated ethenes. The reaction between sodium permanganate or potassium permanganate and chlorinated solvents results in complete mineralization of the chlorinated solvent to carbon dioxide, manganese dioxide, potassium/sodium, hydrogen and chloride in a relatively short period of time (e.g., days to months). In general, chlorinated hydrocarbons with higher chlorine substitution consume less oxidant (per the stoichiometric requirement) and produce less MnO_2 solids. The degradation of chlorinated organic compounds via permanganate oxidation involves direct electron transfer rather than free radical processes that characterize oxidation by persulfate, hydrogen peroxide and ozone.

Permanganate oxidation is generally independent of pH in the range of 4 to 8 standard units (S.U.) and thus will be effective of the pH range observed at the Site. Oxidation of PCE and TCE will lower the pH by the release of H^+; and oxidation of DCE and VC raises the pH by release of OH^-. The Site's primary contaminant is PCE, and as such, a decrease in pH is expected to occur during oxidation of the Site contaminants, however, the resulting change in aquifer pH is not expected to be inhibitive of permanganate oxidation. Typically the use of permanganate as a groundwater remediation reagent does not produce heat, steam and vapors or associated health and safety concerns. [Note: Permanganate will react with water, at very slow rates, resulting in non-productive depletion of permanganate and further generation of

MnO_2 solids. This slow decomposition process eventually results in depletion of excess permanganate that may remain in the subsurface after treatment.]

The Site's geology is an important consideration in relation to planning an effective in-situ remediation program. The overburden in the treatment area at the Site consists of upper highly porous backfilled areas intermixed with upper undisturbed lower permeability areas. The upper areas are underlain by a low permeability dense till that is contaminated in the source area, which is underlain by stratified layers of fine sands and silts and clays that are contaminated beneath the source area and plume area. The impacted low permeable layers at the Site require a persistent reagent since this affects the contact time for advective and diffusive transport and ultimately the delivery of oxidant to targeted zones in the subsurface. Fenton's Reagent and ozone would be expected to have poor results, especially in low permeable silts and clays where diffusion is the dominant method of the chemical oxidant coming in contact with the contaminant. Compared to the other common oxidants, permanganates persist for long periods of time, allowing for diffusion into low-permeability materials and greater transport distances through porous media. In general, permanganates persist for periods greater than three months, and likely years if injected as high percent slurry. However, persistence depends on site-specific conditions. The proposed permanganate solution will have a density greater than water allowing density driven transport of permanganate to occur resulting in the vertical transport of oxidant both in fractured and porous media, further enhancing distribution and contact between oxidant and contaminants.

Based on the above evaluation, permanganates were selected for further evaluation and consideration.

Evaluation of Using Permanganate for ISCO

DAY and the City performed research and interviews with remediation contractors and vendors to supplement the evaluation of permanganate ISCO technology and identify their associated advantages and disadvantages. The information was used to assist in the development of the scope of the ISCO work outlined in this work plan.

$KMnO_4$ and sodium permanganate ($NaMnO_4$) are two commonly used ISCO reagents. $KMnO_4$ was selected over $NaMnO_4$ due to its lower cost, and literature suggesting $KMnO_4$ has a higher potential than $NaMnO_4$ to diffuse into low permeability soils, such as glacial till; thus, minimizing back-diffusion of VOCs from low permeability layers.

Traditional injection and pneumatic/hydraulic enhanced injection were evaluated for use at this Site. Traditional injection was removed from consideration based on the low permeability soils, including the dense glacial till at the Site. Hydraulic enhanced injections use fluid pressure to create the stress needed to break and propagate a fracture in soil or bedrock. Initially, a relatively high borehole pressure is required for fracture initiation, which is followed by fracture propagation. The pressure required to propagate a fracture through the formation is typically significantly less than the breaking pressure; however, some appreciable pressure is still required. The fracture will continue to propagate until it hits an obstruction, intersects the ground surface, or until the rate of fluid loss from the fracture into the surrounding formation equals rate of injection. The inclination of the fractures is a function of the injection pressure, the lithology of the formation (e.g., strong bedding planes, wetting/drying history, etc.), the depth of fracture, and the over consolidated ratio of the soil. Pneumatic enhanced injection of oxidants typically use compressed air to create fractures in the media and subsequently inject the reagent. The pressure used is greater than the natural geostatic pressures, and the flow volumes are greater than the natural permeability of the media. Based on the Site's geology that involves the need to treat varying layers of permeable and impermeable media, including backfilled excavated areas, dense glacial till, and deeper stratified sands, silts and clays, pneumatic/ hydraulic enhanced injections were considered appropriate for this Site for proper distribution of $KMnO_4$.

For the Andrews Street Site, it is anticipated that a combination of both pneumatic and hydraulic enhanced techniques will be used to create fractures in the subsurface soil media at injection points that consist of boreholes sealed above and below the desired fracture zones by packers, or other means. The reagent slurry (e.g., water, $KMnO_4$ and possibly also sand and guar gum) will be injected into the formation at a rate and pressure that exceeds the ability of the formation to accept the reagent slurry via permeation. Material Safety Data Sheets (MSDS) for the $KMnO_4$, guar gum, and other materials associated with this project, as well and other related information, are provided in the HASP presented in Section 3.0. Fracturing occurs when a sudden and significant drop in injection pressure in conjunction with a steady, or increased, slurry flow rate is observed. After fracturing occurs, the injection flow rate of the reagent slurry will be maintained to propagate the fractures out from the injection point until the specified mass or volume of reagent is injected. [Note: Pressure log interpretation provides low resolution with respect to determinations of fracture orientation, but may provide some indication of spatial distribution when correlated with other performance monitoring results. The pressure logs can also show indications of preferential daylighting.]

In addition to the high pressures experienced in the subsurface during fracturing, surface deflections (e.g., relatively small rise in the ground surface) are usually experienced during fracturing. These surface deflections normally recede to an extent over time, but some permanent deflection (on the order of 1-2 cm) should be expected. Surface deflections at multiple locations during and after fracturing can be monitored to estimate the formation and pattern of subsurface fractures. In addition, temporary rises in static water levels at nearby groundwater monitoring wells generally occurs, and can also be monitored.

Injection of low percentage $KMnO_4$ solution versus injection of high percentage $KMnO_4$ solution or slurry was evaluated. Assuming the target mass of $KMnO_4$ to be injected is 33,528 pounds, an approximate 5% solution would require mixing the $KMnO_4$ with water to create approximately 80,356 gallons of injection fluid, and an approximate 30% slurry would require mixing the $KMnO_4$ with water to create approximately 13,393 gallons of injection fluid. The reduced amount of water required for the high percent $KMnO_4$ slurry (e.g., 30% or more) is desirable and is anticipated to assist in reducing the potential for daylighting of reagent and limit contaminant migration due to groundwater displacement. The approximately 80,356 gallons of approximate 5% $KMnO_4$ solution injection fluid could present problems in over flooding the available pore space to the point that the appropriate amount of $KMnO_4$ cannot be delivered to overcome the PNOD. In addition, the 30% or greater slurry of $KMnO_4$ may persist in the environmental and actively remediate the contamination for years whereas an approximate 5% solution of $KMnO_4$ may only last up to a few months.

Common reasons for ISCO failure is often attributed to injection of an inadequate mass of oxidant to contact the entire target zone, poor uniformity of oxidant delivery caused by low permeability zones and site heterogeneity, excessive oxidant consumption by natural subsurface materials and/or presence of large masses of dense non-aqueous phase liquid (DNAPL). During development of the Andrews Street remediation strategy, each of these common pitfalls were considered, evaluated, and addressed. Specifically, conservative values/assumptions were used during the development of the GIS contaminant model and the Carus ISCO injection spreadsheets, resulting in a proposed mass of $KMnO_4$ to effectively contact the entire treatment zone. The conservative assumptions included consideration of the two highest PNOD values measured in samples collected from the Site to represent the PNOD for the entire site. To address the poor uniformity of oxidant delivery and difficulties associated with site heterogeneity, the $KMnO_4$ will be injected using pneumatic/hydraulic enhanced injection techniques that will result in $KMnO_4$ filled factures that will increase the secondary permeability of the targeted zones as well as the mass of $KMnO_4$ that can be injected. In addition, the $KMnO_4$ will be injected as an approximate 30% or greater slurry by mass so that its increased persistence will allow the $KMnO_4$ to further diffuse into the low permeably zones over time following the injection event. Also, it has been reported that the degree of degradation of compounds such as TCE and PCE increase with increasing concentrations of oxidant above the PNOD, further supporting the proposed high oxidant loading strategy. Lastly, the source zone excavation and groundwater monitoring events conducted to date have not identified DNAPL, and it is not anticipated that large masses, if any, DNAPL exist on the Site.

There are varying grades of $KMnO_4$ available that will mineralize the PCE and other related VOCs at the Site; however, some of the commercially available $KMnO_4$ products contain elevated levels of metals impurities (i.e., chromium). This work plan assumes that the solid $KMnO_4$ product would be provided by Hepure Technologies, Inc. (Hepure) . The $KMnO_4$ (typically $\geq$98.8% $KMnO_4$) has been specifically manufactured for environmental applications and will be shipped with a certificate of analysis to document assay and trace metals. Refer to Appendix C for Hepure $KMnO_4$ technical data presenting the typical trace metal content of the product. Based on the $KMnO_4$ technical data and the proposed mass of $KMnO_4$ to be injected, it is estimated that the trace metal impurities loading will range between 0.000004 mg/kg (selenium) and 0.49971 mg/kg (sodium). This loading will not result in concentrations of metal impurities exceeding the applicable regulatory guidance values.

Based on the research and interviews performed, the geology that includes a dense glacial till, the hydrogeological information including relatively low hydraulic conductivities in overburden deposits, and other Site factors, it was determined that ISCO consisting of a combination of pneumatic and hydraulic enhanced injections of an approximate 30% or greater $KMnO_4$ slurry represents a viable remedial option for the Site. In addition, information obtained indicates that injection point radius of influence can reach up to approximately 30 feet at Sites with similar geology as this Site. However, as an initial conservative design consideration, an injection radius of influence of 12 feet has been assumed.

2.4 Implement ISCO at IRM-01 and IRM-02 Areas

In order to further remediate chlorinated VOCs (primarily consisting of PCE in saturated soil and overburden groundwater in the areas of IRM-01 and IRM-02, ISCO will be completed as part of the Supplemental IRM scope of work. Further details regarding initial design, implementation, process monitoring and performance monitoring associated with the ISCO remediation are provided in the subsections below.

Figure 16A, Figure 16B, Figure 16C and Figure 16D respectively show north, south, east and west 3D snapshots of the proposed limits where ISCO treatment injections will be made which encompass the 3D model of XSD data greater than 1 x 10^6 uV. This figure also depicts 47 injection points (designated as IP-01 through IP-47) with an assumed radius of influence (ROI) of 12 feet, and an average overlap of 25%, covering the footprint of XSD values exceeding 1 x 10^6 uV. [Note: Post-excavation IRM-03 confirmatory samples from the former UST area were below applicable NYSDEC Part 375 SCOs; however, IP-47 is intended to treat the residual weathered petroleum odors and staining on the soil in this area in order to reduce soil management restrictions during redevelopment of the Site.] Figure 17 and Figure 18 provide 2D plan views of this initial gallery of overlapping injection points in relation to peak XSD values measured at MIP locations and peak PCE concentrations in groundwater measured in the September 2013 Round 4 overburden groundwater samples, respectively. In addition, these figures also show that ISCO injection treatment will be completed in proximity to bedrock well MW-04R. [Note: MIP points were advanced to equipment refusal, which was encountered at depths ranging between 14.5 feet and 25.5 feet bgs. Bedrock at the Site is approximately 30 to 32 feet bgs in the area of MW-04R. PCE results for soil and groundwater samples collected from the deepest interval of overburden (i.e., saturated zone not evaluated using the MIP) were used to establish the bottom of the deepest zone requiring ISCO treatment injections.] Model output parameters are summarized on Table 7, which includes the top and bottom elevations of proposed injection intervals, the thickness of the injection interval at each location, the target loading rate of $KMnO_4$ to be injected, and the total pounds of $KMnO_4$ to be injected at each location pneumatic and hydraulic enhanced injections are proposed. The information on Table 7 is for planning purposes, and actual amounts of $KMnO_4$ will be rounded in the field, etc. Since the injection intervals are based on true 3D modeled elevations, the ground surface elevations at each injection point will be established with a laser level relative to the elevation of an existing monitoring well so that targeted injection point depth elevations can be established.

Based on the 3D ISCO injection model input parameters and project objectives to treat soil and groundwater with XSD data greater than 1 x 10^6 uV, it has been determined that the volume of the saturated zone to be treated with $KMnO_4$ ISCO is approximately 179,915 cubic feet. The treatment area is approximately 15,338 square feet, and the average treatment thickness is approximately 11.73 feet.

Carus Corporation’s Oxidant Calculator was used to estimate the amount of $KMnO_4$ needed to remediate the chlorinated VOCs at the Site. Based on this calculator it was determined that 33,528 pounds of $KMnO_4$ would be required for the designated treatment volume. As a contingency, $KMnO_4$ may also be injected at existing backfill wells BW-01 through BW-04 to treat the shallow saturated zone associated with the backfilled IRM-01 and IRM-02 areas. Using the Oxidant Calculator, it was estimated that at least 2,335 pounds of $KMnO_4$ would be required to overcome the PNOD and treat the shallow saturated zone associated with the backfilled IRM-01 and IRM-02 areas. As such, it is estimated that a total of up to approximately 35,863 pounds (i.e., 33,528 pounds + 2,335 pounds) of $KMnO_4$ would be needed for this project. Oxidant Calculator output tables for each are included in Appendix D.

The total amount of solid $KMnO_4$ to be injected at the Site (i.e., 33,528 pounds) was based on the following Carus Corporation Oxidant Calculator input parameters:

- Treatment Area volume as determined by the GIS model is approximately 179,914 cubic feet (entered as 123.8465' x 123.8465' x 11.73' thick)
- Porosity is 20%
- Average PCE concentration is 80 ppm (set conservatively high)
- PNOD is 3.5 gram per kilogram or g/kg (Conservative approximate value biased toward highest PNOD results, which were detected beneath the PCE source area)
- Effective PNOD is 40%
- Average stoichiometric demand for PCE is 1.3 pound per pound (lb/lb)
- Confidence factor is 1.2 (3 is least confident, 1 is most confident)

The total amount of solid $KMnO_4$ to potentially be injected in the 4 backfill wells (i.e., 2,335 pounds) set within the previously excavated IRM-01 and IRM-02 source area was based on the following Carus Corporation Oxidant Calculator input parameters:

- Treatment Area dimensions were 40' wide x 78' long x 4' thick (representative of the approximate volume of saturated backfill)
- Porosity is 30%
- Average PCE concentration is 80 ppm
- PNOD is 3.5 g/kg (Conservative approximate value biased toward highest PNOD results, which were detected beneath the PCE source area)
- Effective PNOD is 40%
- Average stoichiometric demand for PCE is 1.3 lb/lb
- Confidence factor is 1.2

2.4.1 Baseline Monitoring

The data collected during the September 2013 (Round 4) groundwater sampling event that included samples from 21 overburden monitoring wells, nine bedrock monitoring wells and four backfill wells as summarized in Section 1.2.7 of this Supplemental RI Work Plan, constitutes the baseline conditions (groundwater flow, VOC concentrations in groundwater, etc.) prior to initiating ISCO.

To supplement the existing baseline data, within one month prior to the start of ISCO injection work, separate disposable bailers will be used to collect groundwater samples from the 21 overburden monitoring wells, nine bedrock monitoring wells and four backfill wells (total of 34 samples). These samples will be field tested for: oxidation-reduction potential (ORP), dissolved oxygen (DO), conductivity, temperature, pH, and turbidity using a Horiba U-22 or equivalent water quality meter; color using comparison to $KMnO_4$ blanks or using a

Lamotte Smart3, Hach DR890, Hach DR900, or similar meter; and Chloride using Chloride QuanTab® Test Strips (30-600 milligram per liter or mg/L, and/or 300-6000 mg/L) or similar test. If $KMnO_4$ blanks are to be used, they will be prepared using deionized water that are spiked with solid $KMnO_4$ to produce 0.5 ppm, 1 ppm, 5 ppm, 10 ppm, 25 ppm, 50 ppm, and 100 ppm solutions of $KMnO_{4.}$ It is anticipated that the color comparison method (i.e., $KMnO_4$ blanks or colorimeter) will be consistently used for the duration of the project.

The baseline monitoring results will be tabulated and later used for comparison to performance monitoring results after ISCO injections and possibly long term monitoring results as the project progresses.

2.4.2 ISCO Injection

This section describes the fieldwork associated with the ISCO injection work.

Prior to starting the ISCO injection work, previous test borings, MIP borings, etc. will be located to extent practicable using GPS, tape measurements from existing Site features, and/or a licensed surveyor Once located, the ground surface at the previous test location will be observed for evidence of any depression or void. Improperly sealed test locations can act as conduits and result in surfacing ("daylighting") of the $KMnO_4$ during the actual injection work. DAY will retain a drilling subcontractor to reseal the upper few feet at such locations by adding Portland cement grout in one to two foot lifts, which will then be allowed to cure at least 24 hours before injections are performed in the area of the repaired test location. In addition, the drilling subcontractor will be available to over-drill the complete depth interval of test locations that are determined to be likely or known conduits of ISCO reagent daylighting either prior to or during the ISCO injection work. It is anticipated that either 4.25-inch or 6.25-inch ID hollow stem augers (HSAs) would be used for the over-drilling depending upon the diameter of the original test location. The over-drilled borings would then be backfilled by tremie grouting the complete depth interval using a 94-96% Portland/4-6% bentonite grout, which will then be allowed to cure at least 24 hours before injections are performed in the area of the repaired test location. Other provisions to inhibit daylighting of $KMnO_4$ to the ground surface via existing wells may include temporary packers inside existing well casings, reducing hydraulic/pneumatic injection pressures, etc.

As presented in Section 2.4, the initial ISCO design calls for the $KMnO_4$ slurry to be injected at 47 injection points that have a ROI of 12 feet. As part of the process monitoring presented in Section 2.4.4, ISCO injections will be completed using an initial set of injection points consisting of IP-11, IP-25, IP-32, IP-40, IP-45 and IP-47. IP-11 and IP-25 are situated at plume core and source area positions respectively, and IP-32, IP-40, IP-45 and IP-47 are situated at periphery locations. After completing the ISCO injections at the six initial injection points, the ISCO injection approach will be to start remaining injection work at injections points at the periphery of the plume and then move inward to complete injection points that are within the source area and plume core, to the extent practicable. This approach is intended to assist in minimizing the potential for displacement of contaminated water to uncontaminated areas.

DAY will retain ARS Technologies, Inc. (ARS) as the remediation subcontractor to complete the ISCO reagent mixing and injection work. A total of up to 36,000 pounds of $KMnO_4$ will be ordered, and shipped in 55-gallon drums each containing approximately 330 pounds of $KMnO_4$ (total of up to 109 55-gallon drums). In order to minimize the amount of $KMnO_4$ securely staged on-site at any given time, and to ensure that $KMnO_4$ is not present on-site for a period greater than 60 days, which would trigger additional homeland security requirements, it is anticipated that the $KMnO_4$ will be divided into two or more shipments. The first shipment of approximately 6,000 pounds will initially arrive on-site just before the remediation subcontractor is ready to use it. Subsequent shipment(s) will be arranged for later arrival based on recommendations of the remediation subcontractor and on the actual rate of use of the initial shipment. In addition, the last shipment may also contain a number smaller pales each containing approximately 55 pounds of $KMnO_4$ to allow for better control of any material that may require returning to the vendor for restocking if it cannot be used at the Site for some reason.

In general, it is anticipated that the ARS will mix batches of $KMnO_4$ with appropriate amounts of water obtained from the City of Rochester and/or Monroe County Water Authority supply system to create an approximate 30% or greater $KMnO_4$ slurry. ARS has identified that it currently intends to obtain potable water from the closest appropriate hydrant to the Site (located on the south side of Andrews Street from the Site) under a hydrant permit with the City. As an example to create an approximate 30% slurry, approximately 33,528 pounds of $KMnO_4$ will need to be mixed with water to create 13,393 gallons or less of injection fluid for the primary treatment. As an exception, a 10% or less $KMnO_4$ solution will be injected at shallow injection point IP-47 to reduce the potential of encountering residual $KMnO_4$ during subsequent site redevelopment. Sand and guar gum may also be added to the slurry as a proppant and delivery supplement (suspension agent), respectively.

Precautionary measures will be taken by the remediation subcontractor to reduce the potential of airborne potassium permanganate solid in a dust (particulate) form. Transfer of solid potassium permanganate from its storage container (e.g., 255-gallon drum) to a mixing vessel or tank will be completed slowly and methodically within an enclosure or "sea container". Containers of potassium permanganate will be kept sealed, except for immediately prior to being used. Granular potassium permanganate will be agitated as little as possible and will be protected from exposure to wind.

The remediation subcontractor will utilize hydraulic/pneumatic enhancement to inject the $KMnO_4$ slurry within enhanced injection zones at each injection point. Ancillary equipment, such as pressure-rated hoses, quick-connect fittings connected to injection wells, relief valves, and shut-off valves are anticipated to be used. The tightness of fittings and piping on pressurized injection equipment will be checked on a frequent basis. Since the potassium permanganate has a corrosive effect on the fittings that can result in rapidly rusting in the field, quick-connect fittings will not be left on well heads. To extend usability, fittings prone to corrosion can be neutralized when deemed warranted.

Injection zones will be selected depending upon the specific injection point's location within the treatment area, the desired corresponding treatment thickness, and the specific methods offered by ARS. Table 7 provides pertinent information for each of the 47 injection points. The target enhanced injection zone vertical spacing will be 3.5 feet or less within the depth intervals to be treated to allow for adequate diffusion into surrounding fine grained soils, including the dense glacial till at this Site. It is assumed that density driven advection, fingering, dispersion, and diffusion will cause the $KMnO_4$ solution to spread between the pneumatic/hydraulic enhanced injection zones resulting in interzonal distribution of oxidant. The elevations of the pneumatic/hydraulic enhanced injection zones will be biased towards the top of the impacted zones to account for density driven downward vertical distribution.

It is anticipated that equipment to be employed for the ISCO work at the Site may include, but not limited to, the following:

- Steel storage containers with locked doors for $KMnO_4$ storage.
- An outdoor forklift/bobcat will also be mobilized to the Site for transfer and moving of remediation materials.
- Roto-sonic drill-rig equipment for installation of injection points and collection of performance monitoring soil samples.
- Rotary drilling equipment for grouting any surficial voids in existing borings, and for over-drilling/grouting any borings or wells where unacceptable surfacing of permanganate is observed.
- A water truck or service truck equipped with water tank or totes for obtaining potable water off-site and also for use with spray equipment for dust suppression as deemed warranted.
- Poly tanks, totes and secondary containment.
- Dust suppression/containment equipment.
- Mobile injection pod containing feed/transfer pumps, a Moyno series variable frequency drive injection pump, flow meters/totalizers, bypass valves, and 500 gallon graduated polyethylene holding/injectate tanks.
- Pneumatic/Hydraulic injection equipment.
- A 25 KW tow behind generator (or similar).
- Enclosed equipment trailer with ancillary equipment including computers, tilt meters, packers and down-hole injection tooling.
- Appropriate personal protective equipment (PPE).
- Spill control equipment, supplies and adequate amounts of chemicals (e.g., sodium thiosulfate, vinegar, hydrogen peroxide) used to neutralize $KMnO_4$, and other spill containment equipment, should there be daylighting, a spill, etc.
- Support truck/equipment refueling vehicle.
- Hoist Lifting Truck.
- Liquid Atomized Injection equipment (e.g., slurry feed pump, gas injection module control manifold, down hole packer injector nozzle).
- Pressure Transducers and pressure gauges.

If warranted, the remediation subcontractor will mix approximately 2,335 pounds of $KMnO_4$ with water to create approximately 5,597 gallons of a 5% $KMnO_4$ injection solution, which will be injected into existing backfill wells BW-1 through BW-4 for treatment of overburden groundwater and previous IRM-01 and IRM-02 excavation walls/bottom and the backfill from the previous source area removal.

During or after the ISCO injection work, additional water may subsequently be introduced at injection point and backfill well locations to enhance distribution of $KMnO_4$ in the subsurface and also enhance its contact with surrounding soil.

2.4.3 Number of ISCO Injection Events

The ISCO injection described in Section 2.4.2 is intended to be completed in one event involving a single mobilization and demobilization. However, depending on actual conditions encountered, success of injecting desired amounts without releases to the ground surface, etc., it is possible that the planned ISCO injection presented in Section 2.4.2 may require being completed under more than one event.

The results of performance monitoring described in Section 2.4.5 will be used to evaluate whether additional ISCO injection events for targeted locations within the designated treatment area are needed (i.e., polishing phase). If required, additional targeted ISCO injections would be completed approximately three to six months apart following the last injection event to allow diffusion of the $KMnO_4$ and desorption of PCE in the fine-grained soils at the Site (e.g., glacial till layer, underlying stratified fine sands, etc.). The performance monitoring results will be provided to the City and the NYSDEC, and recommendations regarding whether additional ISCO injections are needed to address any observed areas of PCE rebound in groundwater, etc. will be provided to the City and the NYSDEC for consideration and approval prior to implementation.

2.4.4 Process Monitoring

Process monitoring will be completed by the remediation contractor and by DAY during the ISCO injection work. Process monitoring will include, but not be limited to, monitoring injection equipment for leaks, monitoring injections pressures, addressing any wells with packers, monitoring injection locations and wells for daylighting of $KMnO_4$ (i.e., aboveground release), monitoring overburden uplift, monitoring groundwater at monitoring points and wells for water levels, color (i.e., purple/pink water indicative of permanganate), and other water quality parameters. [Note: To the extent practicable, $KMnO_4$ that is daylighting will be cleaned up and may be re-injected.]
It is anticipated that the process monitoring will include the following scope:

- Continuously monitor injection equipment starting pressures, injection pressures and post-injection pressures to evaluate backpressure behavior, which is inversely related to the target zone’s transmissivity. This will include observation of backpressure vs. time curves. To the extent possible, data will be transmitted from the exclusion zone to the support zone electronically via a secure Wi-Fi system or other means.
- Continuously monitor equipment temperatures, flow rates, and quantities of slurry injected.
- Continuously monitor static water levels within wells using transducers or other acceptable method. This will be completed prior to start of injection work, during injection work, and after injection work to evaluate potential mounding of the groundwater table. It is anticipated that wells in the areas of the injection work, and also two to three wells away from the injection work (i.e., background wells) will be monitored.

- Monitor vapor concentrations with a PID at potential pathways to the ground surface (e.g., well heads)
- Frequently collect grab samples of water from nearby overburden monitoring wells, backfill wells and bedrock monitoring wells and evaluate for water quality parameters (e.g., conductivity, ORP, pH, temperature, etc.) and water color (comparison between grab samples and the permanganate blanks or take colorimeter measurements on the grab samples).
- At least for the first two injection points, utilize tilt meters or laser levels to measure pre-injection and post-injection ground surface elevations using an array of test locations that radiate outward in different directions and distances from the injection points.
- After completion of injection work at the first or second injection point, advance four test borings with a roto-sonic drill-rig or other acceptable drilling method. Continuous soil samples will be collected from the ground surface to desired depths. Each sample will be visually observed for evidence of enhanced injection zones, $KMnO_4$ slurry, and purple/pink color.
- Periodically observe on-site, and nearby adjacent/off-site features and utilities (monitoring wells, downslope on Inner Loop right-of-way located north of the Site, etc.) for evidence of daylighting of $KMnO_4$ slurry.
- An objective of the pneumatic/hydraulic enhanced injection program is to evenly distribute $KMnO_4$ throughout the modeled volume of soil and groundwater containing PCE concentrations exceeding applicable NYSDEC standards. Oxidant distribution will be tracked by recording the mass/volume of reagent injected into the subsurface. The tracking mechanism will consist of an ISCO Injection Log containing applicable target injection parameters (i.e., number of pneumatic/hydraulic enhanced injection zones, target elevations of pneumatic/hydraulic enhanced injection zones, target mass of $KMnO_4$ to be injected into each pneumatic/hydraulic enhanced injection zone, orientation of pneumatic/hydraulic enhanced injection zones, etc.). Subsequent to completion of a pneumatic/hydraulic enhanced injection zone, the actual mass injected, anticipated elevation of enhanced injection zone and other pertinent information will be documented on the ISCO Injection Log. Refer to Appendix E for a copy of an example injection log.
- It is recognized that each injection location may not receive the target quantity of reagent due to various reasons (e.g., pneumatic/hydraulic enhanced injection zone ROI is less than anticipated, pneumatic/hydraulic enhanced injection zone width/thickness is less than anticipated, $KMnO_4$ slurry reagent daylighting, etc.). However, an adjacent injection point may accept more $KMnO_4$ slurry reagent than the target mass/volume, and there is approximately 25% overlap of injection points. To reduce the potential of a specific area of the Site receiving a disproportionate mass/volume of $KMnO_4$ slurry reagent, the actual mass/volume of $KMnO_4$ slurry reagent injected will be tracked and evaluated on a sector basis. To this end, the treatment area has been divided into three sectors: centerline of the plume, east lobe and west lobe, refer to Figure 17. Comparing the individual sectors target injection mass/volumes versus the actual mass/volume of injected reagent in real time will dictate the need for additional injection points in a specific sector. As such, injection completion for the group of injection points comprising the sector will be dependent on the mass/volume of reagent injected over that specific sector rather than on an injection point basis.

Initially, injection point installation drilling, $KMnO_4$ slurry injection work, and process monitoring will be completed at injection point IP-25 located within the footprint, and deeper than, the IRM-01 backfilled excavation, and at injection point IP-11 located outside the footprint of the IRM-01 excavation (refer to Figure 17). The process monitoring results (e.g., radius of influence based on tilt meters, pre-injection and post-injection ground surface elevations, daylighting of slurry at the ground surface, etc.) from these initial injection points will be used to assist in making any necessary modifications to the injection point grid, quantities and/or percentage of $KMnO_4$ slurry to be injected, injection pressures, etc. The objective of the finalized injection point program will be to provide complete vertical and lateral coverage of the modeled extent of VOC impact, views of which are presented on Figure 16A, Figure 16B, Figure 16C and Figure 16D. Any modifications to the injection program will be implemented after approval from the City and the NYSDEC has been received, recorded via emails, and documented as a deviation to the Supplemental IRM Work Plan. The locations of the injection points will be recorded by GPS or tape measurements from existing Site features. The target $KMnO_4$ loading rate will be dependent on the number of injection points and pneumatic/hydraulic enhanced injection zones within each injection point; however, the entire mass of $KMnO_4$ (i.e., 33,528 lbs.) will be evenly distributed in the subsurface.

Components of this process monitoring will continue as the injection work progresses, and additional modifications to the injection work will be made as deemed warranted, with input and approval from the City and the NYSDEC.

2.4.5 Performance Monitoring after ISCO Injections

Subsequent to completing of the ISCO injection work, weekly performance monitoring will be completed for a period of two months. Each weekly monitoring event will include the following scope of work:

- Static groundwater measurements and groundwater grab samples will be collected from:
    - Overburden wells MW-01, MW-02, MW-03A, MW-04, MW-05, MW-06. MW-07, MW-08, MW-11, MW-13, MW-15, MW-16, MW-17, MW-18, MW-19, and MW-20;
    - Bedrock wells MW-01R, MW-02R, MW-04R, MW-05R, MW-06R and MW-07R; and
    - Backfill well BW-2 and BW-4.
- The groundwater grab samples will be collected by lowering dedicated disposable bailers into the corresponding wells, and obtaining a groundwater sample to be placed in dedicated clear glass sample containers. These samples will be field tested for:
    - ORP, DO, conductivity, temperature, pH, and turbidity using a Horiba U-22 or equivalent water quality meter.
    - Color using comparison to $KMnO_4$ blanks or using a Lamotte Smart3, Hach DR890, Hach DR900, or similar meter. Observations on water color (e.g., pink or purple color indicative of permanganate presence) for each sample will be documented. It is anticipated that whichever color comparison method is selected (i.e., $KMnO_4$ blanks or colorimeter) will be consistently used for the duration of the project. Color observations will be considered a qualitative measurements and are not intended to replace analytical laboratory samples.

  - Chloride using Chloride QuanTab® Test Strips (30-600 mg/L and/or 300-6000 mg/L) or similar test.

It is anticipated that four comprehensive performance monitoring events will be completed subsequent to the ISCO injection work. The first performance monitoring event will be completed two months after the ISCO injection work, the second performance monitoring event will be completed six months after the ISCO injection work and the other performance monitoring event will be completed on a quarterly basis (i.e., nine and 12 months after ISCO injection work). Each monitoring event will include the following scope of work:

- Static groundwater measurements will be collected from overburden monitoring wells, bedrock monitoring wells, and backfill wells at the Site. Potentiometric groundwater contour maps for the overburden and bedrock will be prepared.
- For the two performance monitoring events (i.e., two and six months after ISCO injection), groundwater samples will be collected at the following 24 wells using the PDB sampler method:
  - Overburden wells MW-01, MW-02, MW-03A, MW-04, MW-05, MW-06. MW-07, MW-08, MW-11, MW-13, MW-15, MW-16, MW-17, MW-18, MW-19, MW-20.
  - Bedrock wells MW-01R, MW-02R, MW-04R, MW-05R, MW-06R and MW-07R.
  - Backfill well BW-2 and BW-4
- For subsequent performance monitoring events, groundwater samples would be collected from the wells listed above or a smaller subset of wells using the PDB sampler method. The results of the initial sampling events will assist in determining which wells to sample during the subsequent performance monitoring events, and will involve input and approval from the City and the NYSDEC.
- During each sampling event, dedicated disposable bailers will first be lowered into the corresponding wells, and a groundwater sample will be obtained. These samples will be field tested for:
  - ORP, DO, conductivity, temperature, pH, and turbidity using a Horiba U-22 or equivalent water quality meter.
  - Color using comparison to $KMnO_4$ blanks or using a Lamotte Smart3, Hach DR890, Hach DR900, or similar meter.
  - Chloride using Chloride QuanTab® Test Strips (30-600 mg/L and/or 300-6000 mg/L) or similar test.
- New PDBs will then be set at a desired depth at each well. The depths of the PDBs will be determined with input and approval from the City and the NYSDEC. At least two weeks after deployment, the PDBs will be retrieved, and the groundwater samples will be submitted to Chemtech along with a trip blank and field blank for quality assurance/quality control (QA/QC) purposes. Chemtech is a NYSDOH Environmental Laboratory Approval Program (ELAP)-certified analytical laboratory, and will analyze the groundwater samples, trip blank and field blank for TCL VOCs and TICs using USEPA Method 8260. The laboratory will provide preliminary data in about 5 business days, followed by ASP category B deliverables.

- A Groundwater Monitoring Report (GMR) with cumulative results will be provided after each monitoring event. It is anticipated that the first GMR will be provided to the City, the NYSDEC and the NYSDOH for review and comment. After addressing City and regulatory agency comments, the initial GMR will be finalized and re-submitted to the City, the NYSDEC and the NYSDOH, including an electronic copy in the appropriate format required by the NYSDEC. It is anticipated that subsequent GMRs will use the same format as the initial approved GMR, and will include an electronic copy in the appropriate format required by the NYSDEC.

2.5 Implement Supplemental IRM Soil Removal

As identified in Section 1.2.1, an approximate 300 square foot area of soil from the ground surface to two feet bgs located south of the IRM-01 excavation contains PCE that exceeds the NYSDEC Part 375 Protection of Groundwater SCO of 1.3 ppm. To further address the this area, up to 40 tons of PCE-contaminated soils will be removed from the ground surface to a depth of two feet bgs from the area shown on Figure 11. The contaminated soil will be placed in the contaminated soil staging area. Existing soil data for this area will be used to characterize the material and obtain disposal approval. If required, additional samples will be collected for other requested waste characterization parameters to obtain approvals from the disposal facility. Once approved by the disposal facility, the contaminated soil will be loaded onto NYSDEC Part 364 permitted trucks, transported off-site, and disposed at a regulated landfill facility.

Prior to backfilling, five post-excavation samples (four sidewall and one bottom) will be collected and submitted to Chemtech, which will analyze the samples for TCL VOCs and TICs using USEPA Method 8260. These samples will be analyzed using an accelerated laboratory turnaround time of no greater than five business days. If one or more post-excavation sample exceeds applicable Part 375 SCOs, then additional soil will be removed and new post-excavation samples will be collected and analyzed for TCL VOCs and TICs using USEPA Method 8260. It is anticipated that removal and post-excavation sampling /analysis will continue until applicable Part 375 SCOs for VOCs are met. Once the post-excavation sample results indicate that further removal is not warranted, the analytical laboratory results will be provided to the NYSDEC for review.

Subsequent to NYSDEC review of post-excavation analytical laboratory sampling results, approximately 40 tons or more of clean NYSDEC-approved crusher run dolomite stone meeting the applicable DER-10 Section 5.4(e) provisions will be placed and compacted in the excavation to match the existing ground surface and provide at least two feet of clean material at the ground surface.

2.6 Contingency – Further In-Situ Remediation

It is possible that chlorinated VOC contamination requiring further remediation may be present in saturated soil or groundwater after completing the ISCO treatment and performance monitoring outlined in Section 2.4.2 and 2.4.5, respectively. If further remediation is warranted, DAY and the City will evaluate further in-situ remedial options, which may include one or more of the following:

- Monitored attenuation due to continued release of $KMnO_4$ in the existing injection point field.

- Design and implementation of a polishing phase, or additional round(s) of ISCO injection, that may include utilizing pneumatic and/or hydraulic enhanced techniques;
- Design and implementation of soil mixing of remediation products for any localized high concentration areas in soil and groundwater; and
- Design and implementation of a permeable reactive barrier (PRB) to control, and inhibit, off-site migration of chlorinated VOCs in groundwater.

The results of performance monitoring of the ISCO, and input from the City and the NYSDEC, would be used to assist in selecting which contingency remedial option(s) are appropriate and should be further pursued. A separate Addendum to this Supplemental IRM Work Plan would be prepared and submitted to the City, the NYSDEC and the NYSDOH for review. Subsequent to addressing City and regulatory agency comments, the addendum to the Supplemental IRM Work Plan would be finalized and submitted to the City and the regulatory agencies for approval.

2.7 Management of IRM-Derived Wastes

IRM-generated liquids and solids will be managed per the guidelines set forth in DER-10, Section 3.3.

- Liquid IRM-derived wastes, such as decontamination water, that are generated during the supplemental IRM work will be containerized (e.g., placed in NYSDOT-approved drums, frac tanks, etc.) and staged on-site. Final disposal of liquid IRM-derived wastes will be completed in accordance with applicable local, state and federal regulations and dependent upon documented composition of the waste and/or the results of analyses on waste characterization samples as described below.

  If warranted to characterize a liquid IRM-derived waste, it is anticipated that one or more samples will be collected and submitted to Chemtech for total purgeable organics using USEPA Method 624. Depending upon the results, the liquid (e.g., decontamination water) will be: (1) discharged to the sanitary sewer under a MCPW sewer use permit, (2) pre-treated and then discharged to the sanitary sewer under a MCPW sewer use permit after obtaining acceptable effluent results, or (3) disposed off-site as a hazardous or non-hazardous waste. Prior to any discharge of liquid to the sanitary sewer, the NYSDEC will be notified and provided with a copy of the MCPW sewer use permit.
- Solid IRM-derived wastes (e.g., PCE-contaminated soils; solids from dry decontamination of heavy equipment; and soil, PPE or other materials contaminated with $KMnO_4$ and/or neutralizing agents) will be placed in a soil staging area that is constructed of a layer of 10-millimeter poly sheeting of sufficient size laid on the ground surface, overlain by an approximate 2-3 inch layer of NYSDOT and NYSDEC-approved clean sand (or equivalent) meeting the applicable DER-10 Section 5.4(e) provisions, and then covered by a second layer of 10-millimeter poly sheeting of equal size. Staging areas will be bermed to mitigate the possibility of run-off and run-on. In addition, 10-mil poly sheeting will also be used to completely cover the solid IRM-derived wastes, and sand bags (or equivalent) will be placed on top of the poly sheeting cover to secure it in-place. As an alternative staging method, select portions of solid IRM-derived wastes (e.g., disposable personal protective equipment) may be containerized (e.g., placed in

NYSDOT-approved drums, covered roll-off container). Final disposal of staged solid IRM-derived wastes will be completed in accordance with applicable local, state and federal regulations and dependent upon documented composition of the waste and/or the results of analyses on waste characterization samples as described below. If deemed necessary to characterize a solid IRM-derived waste, it is anticipated that one or more samples will be collected and submitted to Chemtech for testing of one or more of the following parameters:

- TCL VOCs (USEPA Method 8260)
- Toxic Characteristic Leaching Procedure (TCLP) VOCs (USEPA Methods 1311, 8260)
- TCLP Metals (USEPA Methods 1311, 6010/7470)
- TCL SVOCs (USEPA Method 8270)

Samples may also be analyzed for other parameters to the extent required by specific disposal facilities. Transport of materials will be performed by licensed haulers in accordance with appropriate local, State, and Federal regulations, including 6 NYCRR Part 364. Haulers will be appropriately licensed and trucks properly placarded. Trucks will be logged, and drivers and their respective time on-site will be documented, by DAY to ensure compliance with applicable health and safety requirements and prevailing wage considerations.

A subcontractor to be retained by DAY will be responsible for loading, transporting, and disposing of solid IRM-derived wastes. Excavated impacted soils will be transported to an off-site disposal facility permitted to accept such wastes. Waste profiling will be coordinated with the City. Waste manifests or bills of lading will be used for off-site shipments, and such documentation will be included in the subsequent IRM Construction Completion Report. At the discretion of the field team leader and the City, if solid IRM-derived wastes (e.g., soil) contain wet material capable of producing free liquid, truck bed liners will be used. Trucks exiting the Site with contaminated material will be covered with tight-fitting tarps prior to departure and during precipitation events when in queue Tarps will also be required if a loaded truck is to remain on-site overnight. The contractor is responsible for ensuring that staging of trucks will not interfere with community traffic and that truck idling will be in accordance with applicable local, State, and Federal regulations.

2.8 Cover System

The ground surface at the Site contains a layer of crushed stone; and this stone layer will be maintained during the Supplemental IRM project. In order to meet restricted residential criteria, the Site currently requires a minimum two (2) foot thick earthen cover system. In October 2013, 39 test points (CS-01 through CS-39) were excavated with a mini-excavator as part of a cover system evaluation (refer to Figure 10), and it was determined that areas outside the footprints of former basements and backfilled previous IRM excavations had an average crushed stone thickness of approximately 0.3 foot. GIS was used to model the amount of additional crushed stone needed to supplement the existing crushed stone in order to result in a clean cover system across the Site that is two feet thick. Figure 10 also shows the locations of backfilled former basements and backfilled previous IRM excavations that do not require additional stone cover. It was documented during previous work that the two backfilled former basement areas and the six previously-excavated/backfilled IRM areas that cumulatively comprise about 22% of the Site are documented to contain at least a two foot thick top layer of crushed stone that meets SCOs for this Site; thus, these areas do not require additional cover material. Based on the GIS modeling, it was calculated that approximately 3,269 cubic yards (4,905 tons) of new imported crushed stone and/or other NYSDEC-approved earthen material, is needed outside the footprints of former basements and previous IRM excavations in order to establish a two foot clean cover system at the Site.

For purposes of drainage and matching the elevations of adjoining public right-of-ways that are improved with concrete sidewalks or asphalt pavement, existing stone will be stripped along an 8-foot wide areas adjacent to the right-of-ways, and then up to two feet of underlying soil/fill will be removed from these areas and staged on-site (refer to Figure 10). As shown, the total linear footage of the 8-foot wide areas is estimated to be 505 feet long. Based on the 0.3 foot average thickness of existing crushed stone layer at the Site, it is estimated that approximately 45 cubic yards of existing crushed stone, and up to 250 cubic yards of underlying soil/fill will be removed from the 8-foot wide perimeter areas. The displaced soil/fill will then be re-used on-site away from public right-of-ways primarily in the location (area of existing low-lying depression) designated on Figure 10. At re-use locations, underlying crushed stone may first be stripped and staged for later re-use as cover material. Adequate NYSDEC-approved new imported crushed stone, or other NYSDEC-approved earthen material, will then be placed and compacted over the 8-foot wide perimeter areas, the relocated soil/fill, and the remainder of the Site requiring additional cover material so that the entire Site (except for existing paved areas) has a minimum 2-foot thick earthen cover system that meets NYSDEC requirements.

Once a Certificate of Completion is received from the NYSDEC, it is the City’s intention that the Site be redeveloped. As such, the two-foot thick layer of earthen cover material is considered an interim cover system. Any proposed modifications to this cover system will be approved by the NYSDEC prior to final redevelopment at the Site.

2.9 Site Restoration, Demobilization, and Closeout Activities

A number of site restoration activities will be required at, or near, the completion of the supplemental IRM fieldwork at the Site. These activities include the following:

- Update the United States Homeland Security Top Screen form to show no $KMnO_4$ is present aboveground on the Site.
- Demobilize the 18-wheeler storage trailer and forklift that were used during the ISCO.
- Demobilize the office trailer and portable toilet from the Site.
- Characterize, remove and dispose of the 30’ x 30’ material mixing/staging area.
- Characterize, remove and dispose of the 30’ x 30’ contaminated soil staging area.
- Characterize, remove and dispose of the existing 15’ x 20’ decontamination pad.
- Remove and dispose of hay bales around open stormwater drains and siltation fencing.
- Remove the general refuse/solid waste dumpster (or other trash receptacles) used during the duration of the project.
- Re-open the adjoining parkland (Shiller Park) located east of the Site on the opposite side of Franklin Square once ISCO injection work is completed and potassium permanganate is not present aboveground at the Site.

- Possibly install an additional 150 linear feet of 6-foot chain link fencing, and a two piece 20-foot long 6-foot high double swing gate, constructed of Schedule 40 galvanized steel with top rails and bottom tension wires along the shared eastern boundary of the 320 Andrews Street parcel and the west side of the Franklin Square right-of-way. Prior to installing the fencing, and if deemed warranted at the time the work is scheduled, the paved and hard surfaces of the Franklin Square right-of-way will be washed, and the washwaters and any solids will be characterized and disposed in accordance with applicable regulations.
- Remove the project sign, if requested.

2.10 Construction Completion Report for Supplemental IRMs

A Construction Completion Report (CCR) will be prepared for the Supplemental IRMs, including record drawings. The CCR will be prepared using the NYSDEC Final Engineering Report (FER) template, and will also address the CCR requirements set forth in NYSDEC DER-10. The CCR will be provided to the City, the NYSDEC and the NYSDOH for review and comment. City and regulatory agency comments will be addressed prior to obtaining NYSDEC and NYSDOH approval. The final CCR shall include electronic copy in the appropriate format required by the NYSDEC. It is anticipated that this CCR will also be incorporated into the Remedial Investigation report for the project.

2.11 Subdivision Plan

If desired by the City, a subdivision plan may be developed to subdivide and/or combine the Site into new parcels. One of the new parcels may be configured so that it contains the majority of any residual PCE contamination above SCOs or groundwater standards. The City would provide the NYSDEC with a conceptual site division plan for review and comment. It is anticipated that tasks to be completed would include completion of a site survey, preparation of a metes and bounds, preparation of a legal description, obtaining new title deeds, completing and submitting an Official Map Amendment (OMA) application, and attending a City Planning Commission meeting regarding the OMA. The City would also provide the NYSDEC with a Change in Use notification per ERP requirements.

[Note: The City and/or Site owner is/are jointly responsible for ensuring that every required site management responsibility identified in the Site Management Plan (refer to Section 2.12) environmental easement (refer to Section 2.13, and oversight document (e.g., Periodic Review Report) are performed. As per DER-10 Section 6.3, one institutional control/engineering control certification is filed per site and if the site comprises multiple properties or parcels and/or multiple owners, the remedial parties/owners must arrange for one Periodic Review Report and one certification to be submitted to the NYSDEC for the entire site. This requirement will be taken into consideration when developing the Subdivision Plan for the Site.]

2.12 Site Management Plan

A Site Management Plan (SMP) will be prepared for the Site to require evaluating the potential for vapor intrusion into any future buildings to be constructed on the Site, including requirements to mitigate such potential vapor intrusions through use of environmental engineering controls [e.g., sub-slab depressurization system (SSDS) or sub-membrane depressurization system (SMDS), etc.], or through other means associated with construction of future buildings in a manner that precludes soil vapor intrusion (SVI) exposure. The SMP will identify any use restrictions for the Site (e.g., property development and groundwater use restrictions, etc.). The SMP will also include: an Excavation Work Plan to outline the necessary procedures to manage, handle, characterize, dispose and re-use potentially-impacted Site media; a HASP to assist in reducing potential exposures to Site contaminants; and also a Site Monitoring Plan and an Operation and Maintenance Plan associated with groundwater monitoring and engineering controls.

The SMP will be prepared using the NYSDEC SMP Template. The SMP will be provided to the City, the NYSDEC and the NYSDOH for review and comment. City and regulatory agency comments will be addressed prior to obtaining NYSDEC and NYSDOH approval. The final SMP shall be provided in the appropriate electronic format as required by the NYSDEC.

2.13 ALTA Survey and Environmental Easement

An Alta Survey and an Environmental Easement will be prepared for the Site. The NYSDEC's Environmental Easement template will be used, and these documents will be prepared in accordance with NYSDEC requirements. A licensed surveyor and an attorney will assist DAY in the preparation of these documents, including acquisition of required title insurance and titles reports. These documents will be provided to the City, the NYSDEC and the NYSDOH for review and comment. City and regulatory agency comments will be addressed prior to obtaining NYSDEC and NYSDOH approval. These documents shall include an electronic copy in the appropriate format required by the NYSDEC. Once approved, the attorney will record the Environmental Easement at the Monroe County Clerk's office.

2.14 Long-Term Groundwater Monitoring

The Site's SMP will present the details on the long-term groundwater monitoring to be conducted at the Site. The decision as to which groundwater monitoring wells will be sampled will depend upon the analytical results obtained during the performance monitoring events and involve input and approval from the NYSDEC and the NYSDOH. Once the Certificate of Completion has been issued, the Media Monitoring Program presented in the SMP will be followed. The SMP will detail the sampling frequency, sampling protocols, the groundwater monitoring wells to be sampled, and the protocol for monitoring well repairs, replacement and decommissioning.

3.0 HEALTH AND SAFETY PLAN

A site-specific HASP is attached as Appendix F. The HASP outlines the policies and procedures to protect workers and the public from potential environmental hazards during activities that have the potential to disturb contaminated subsurface materials and during IRM activities with the potential for exposures to hazardous remediation products. The HASP includes a Community Air Monitoring Plan (CAMP) that is required during intrusive Site activities, and an Emergency Contingency Plan (ECP) should unanticipated emergencies or Site conditions be realized.

DAY's Industrial Hygienist has reviewed this HASP, and to the extent deemed warranted, will visit the Site during certain activities to observe working conditions, and will make revisions to the HASP, personal protective equipment, monitoring, etc. for the protection of on-site personnel and the surrounding community.

In accordance with the HASP, DAY will conduct on-site worker breathing zone and perimeter CAMP air monitoring for VOCs and particulates (inclusive of airborne $KMnO_4$) during intrusive activities (e.g., drilling, excavation, backfilling, injecting $KMnO_4$, etc.), and also extrusive activities involving the handling, mixing, etc. of $KMnO_4$. Corrective actions will be initiated if VOC or particulate on-site worker or CAMP action levels specified in the HASP are exceeded. In addition, if nuisance odors are identified at the Site perimeter, or if odor complaints are received, work will be halted and the source of odors will be identified and corrected. If warranted, it is anticipated that a 3-4% solution of BioSolve would be used by the Supplemental IRM subcontractor for vapor suppression by spraying it on VOC-contaminated soil within and/or outside the excavations, etc. as determined by a DAY on-site representative.

Excessive noise and/or vibration from heavy equipment, drill-rigs, or other Supplemental IRM equipment are not anticipated during this project. However, if there are complaints, noise and/or vibration levels will be monitored in the work areas and at the Site perimeter by DAY on-site personnel using one or more technique to be approved by the NYSDEC. No vibration-sensitive businesses are known to be located adjacent to the Site.

DAY will coordinate with the NYSDEC, NYSDOH, MCDPH, Monroe County Office of Emergency Management (HAZMAT) and City Fire Department regarding the HASP and more specifically the storage, use, security, and safety precautions associated with potassium permanganate as part of this project. Any questions or comments received from these agencies will be addressed to their satisfaction.

As security measures, the Site has a perimeter fence and locked gates, potassium permanganate will be stored in a locked trailer, a security service will be retained to watch the Site on a continuous basis between the hours of 6:00 PM EST and 6:00 AM EST weekdays and around the clock (24 hours/day) on weekends, holidays, or other weekdays if the site is not occupied when potassium permanganate is actively being stored on-site, and the adjoining Schiller park will be closed to the public immediately prior to, and for the duration of, the time that potassium permanganate is present on-site.

4.0 QUALITY ASSURANCE PROJECT PLAN

A QAPP is included in Appendix G. The QAPP describes the procedures to be used to ensure the integrity of the field data and analytical data to be collected is preserved. The QAPP includes specific information pertaining to: handling of samples; analytical methods to be used; QA/QC procedures to be followed; analytical laboratory reporting limits; documentation procedures; project organizational decontamination procedures; ISCO procedures; sampling procedures; and a sampling and analysis plan.

5.0 SCHEDULE

The Supplemental IRM work will proceed immediately following NYSDEC approval of this Supplemental IRM Work Plan. A tentative schedule for each phase of the Supplemental IRM work is provided below. As shown, it is anticipated that the duration of the Supplemental IRM work will be between approximately April 2014 and December 15, 2015.

Site Preparation, Mobilization and Controls	6/15/2014 to 6/30/2014
Baseline Monitoring	6/15/2014 to 6/30/2014
ISCO Injection and Process Monitoring,	7/1/2014 to 8/15/2014
Performance Monitoring	9/15/2014 to 12/15/2015
Implement Supplemental IRM Soil Removals	10/15/2014 to 11/15/2014
Contingency- Further In-Situ Remediation	7/15/2015 to 8/15/2015
Management of IRM-Derived Wastes	6/1/2014 to 8/15/2015
Cover System	11/15/2014 to 12/15/2014
Site Restoration, Demobilization and Closeout Activities	8/15/2014 to 12/15/2014
Construction Completion Report for Supplemental IRMs	2/31/2015 to 9/15/2015
Subdivision Plan	3/1/2015 to 5/31/2015
Site Management Plan	3/1/2015 to 6/15/2015
ALTA Survey and Environmental Easement	3/1/2015 to 7/15/2015
Final Engineering Report	11/1/2014 to 12/15/2015
Remedial Investigation Report	11/1/2014 to 12/15/2015

DAY will coordinate and communicate with the City and NYSDEC project managers and their staff regarding implementation of the various aspects of this project. This includes, but is not limited to, participation in regularly-scheduled progress meetings, presentation of field findings and analytical laboratory test results, and submission of various deliverables.

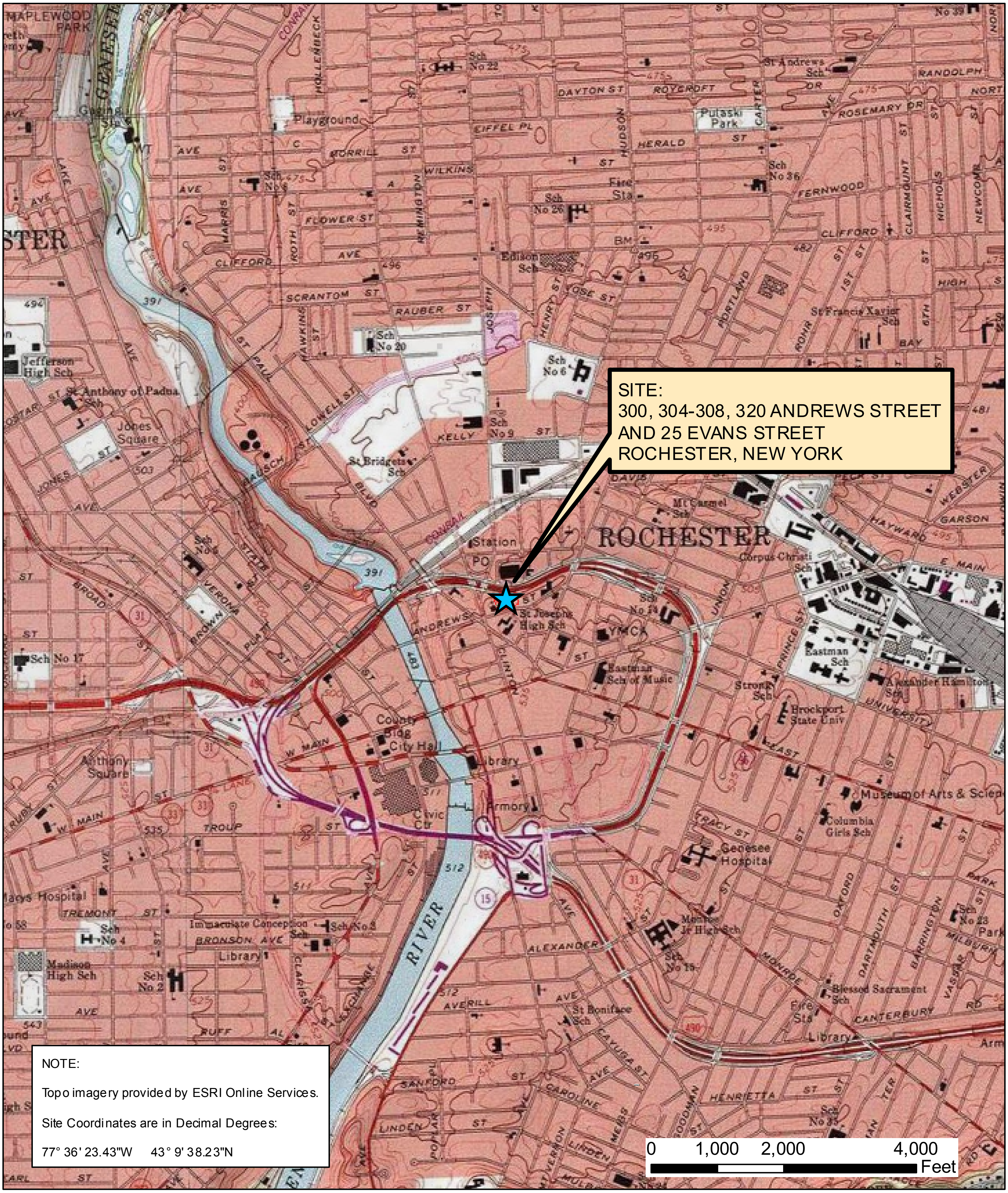
Note, the anticipated schedule provided above is dependent on a number of factors and could change. For example, the schedule is dependent on timely input on various aspects of the work by the City and regulatory agencies, weather conditions, subcontractor availability, field results that require modifications to the scope of work, etc.

6.0 ACRONYMS

ASP	Analytical Services Protocol
ASTM	American Society for Testing Materials
BGS	Below the Ground Surface
CAMP	Community Air Monitoring Plan
CCD	Center City District
CCR	Construction Completion Report
Chemtech	Chemtech Consulting Group, Inc.
City	City of Rochester
Cm/Sec	Centimeter Per Second
CSAT	Chemical Security Assessment Tool
DAY	Day Environmental, Inc.
DCE	Dichloroethene
DNAPL	Dense Non-Aqueous Phase Liquid
DO	Dissolved Oxygen
DUSR	Data Usability Summary Report
EC	Electrical Conductivity
ECP	Emergency Contingency Plan
ELAP	Environmental Laboratory Approval Program
ERP	Environmental Restoration Program
FER	Final Engineering Report
Ft/Day	Foot Per Day
Ft/Ft	Foot Per Foot
GIS	Geographic Information System
G/Kg	Gram Per Kilogram
GMR	Groundwater Monitoring Report
GPS	Global Positioning System
HASP	Health And Safety Plan
HDPE	High Density Polyethylene
HPT	Hydraulic Profiling Tool
IRM	Interim Remedial Measure
IRMWP	Interim Remedial Measure Work Plan
ISCO	In-Situ Chemical Oxidation
K	Hydraulic Conductivity
$KMnO_4$	Potassium Permanganate
Lb/Lb	Pound Per Pound
LNAPL	Light Non-Aqueous Phase Liquid
MCPW	Monroe County Pure Waters
Mg/Kg	Milligram Per Kilogram
Mg/L	Milligram Per Liter
MiHPT	Membrane Interface Probe/Hydraulic Profiling Tool
MIP	Membrane Interface Probe
NAD	North American Datum
$NaMnO_4$	Sodium Permanganate
NYCRR	New York Codes, Rules and Regulations
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSDOT	New York State Department of Transportation
OMA	Official Map Amendment
ORP	Oxidation-Reduction Potential
PAH	Polycyclic Aromatic Hydrocarbon

PCE	Tetrachloroethene (a/k/a perchloroethene)
PDB	Passive Diffusion bag
P.E.	Professional Engineer
Phase I ESA	Phase I Environmental Site Assessment
Phase II ESA	Phase II Environmental Site Assessment
PID	Photoionization Detector
PNOD	Permanganate Natural Oxidant Demand
PPB	Parts Per Billion
PPE	Personal Protective Equipment
PPM	Parts Per Million
PRB	Permeable Reactive Barrier
PSI	Pounds Per Square Inch
PVC	Polyvinyl Chloride
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RG&E	Rochester Gas and Electric
RI	Remedial Investigation
RI/RAA	Remedial Investigation/Remedial Alternatives Analysis
ROI	Radius Of Influence
ROW	Right-Of-Way
RQD	Rock Quality Designation
SAC	State Assistance Contract
SCG	Standard, Criteria and Guidance
SCO	Soil Cleanup Objective
SMP	Site Management Plan
S.U.	Standard Unit
SVI	Soil Vapor Intrusion
SVOC	Semi-Volatile Organic Compound
SMDS	Sub-Membrane Depressurization System
SSDS	Sub-Slab Depressurization System
TAL	Target Analyte List
TCE	Trichloroethene
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
3D	Three Dimensional
TIC	Tentatively Identified Compound
TOGS	Technical and Operational Guidance Series
2D	Two Dimensional
ug/l	Microgram per Liter
UIC	Underground Injection Control
USEPA	United States Environmental Protection Agency
uV	Microvolts
VC	Vinyl Chloride
VOC	Volatile Organic Compound
XSD	Halogen Specific Detector

FIGURES



SITE:
300, 304-308, 320 ANDREWS STREET
AND 25 EVANS STREET
ROCHESTER, NEW YORK

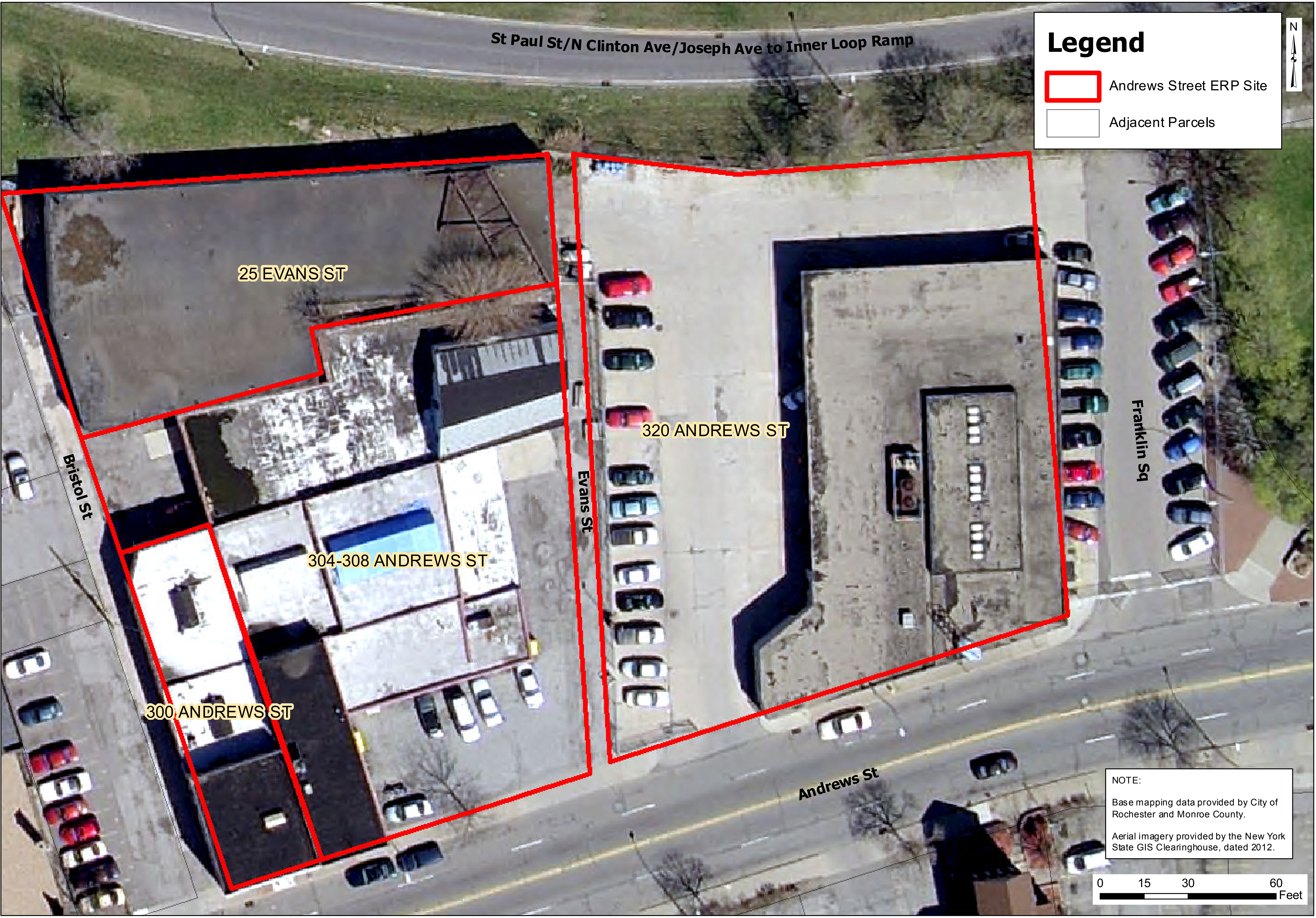
NOTE:

Topo imagery provided by ESRI Online Services.

Site Coordinates are in Decimal Degrees:

77° 36' 23.43"W 43° 9' 38.23"N

Date 10-01-2012	**DAY ENVIRONMENTAL, INC.** **Environmental Consultants** **Rochester, New York 14606** **New York, New York 10016-0701**	Project Title 300, 304-308, 320 ANDREWS STREET AND 25 EVANS STREET ROCHESTER, NEW YORK (NYSDEC SITE NO.: E828144) ENVIRONMENTAL RESTORATION PROJECT	Project No. 4355S-10 FIGURE 1
Drawn By CPS		Drawing Title Project Locus Map	
Scale AS NOTED			



Legend

🟥 Andrews Street ERP Site

☐ Adjacent Parcels

NOTE:

Base mapping data provided by City of Rochester and Monroe County.

Aerial imagery provided by the New York State GIS Clearinghouse, dated 2012.

DESIGNED BY JAD	DATE 05-2013
DRAWN BY CPS	DATE DRAWN 05-2013
SCALE AS NOTED	DATE ISSUED 05-16-2013

day
DAY ENVIRONMENTAL, INC.
Environmental Consultants
Rochester, New York 14606
New York, New York 10170

Project Title
300, 304-308, 320 ANDREWS STREET
AND 25 EVANS STREET
ROCHESTER, NEW YORK

ENVIRONMENTAL RESTORATION PROJECT NYSDEC SITE NO.: E828144

Drawing Title
Pre-Demolition Site Conditions

Project No.
4355S-10

FIGURE 2

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Legend

🟥 Andrews Street ERP Site
🟨 Former Evans Street right-of-way
⬜ Adjacent Parcels

NOTE:

Base mapping data provided by City of Rochester and Monroe County.

Aerial imagery provided by the New York State GIS Clearinghouse, dated 2012.

DESIGNED BY	DATE
JAD	05-2013
DRAWN BY	DATE DRAWN
CPS	05-2013
SCALE	DATE ISSUED
AS NOTED	05-16-2013

DAY ENVIRONMENTAL, INC.
Environmental Consultants
Rochester, New York 14606
New York, New York 10170

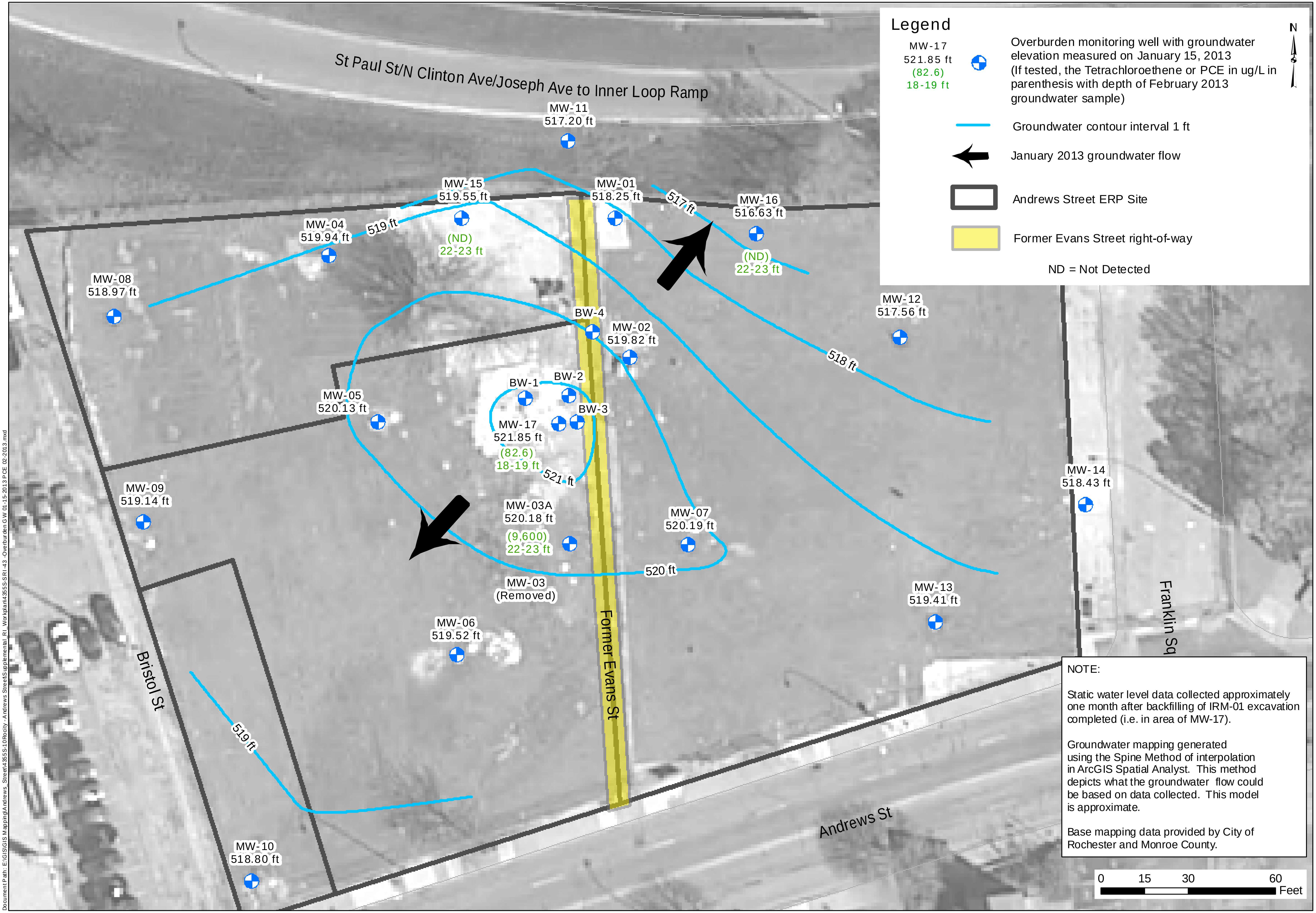
Project Title
300, 304-308, 320 ANDREWS STREET
AND 25 EVANS STREET
ROCHESTER, NEW YORK
ENVIRONMENTAL RESTORATION PROJECT NYSDEC SITE NO.: E828144

Drawing Title
Post-Demolition Site Conditions

Project No.
4355S-10

FIGURE 3

Document Path: E:\GIS\GIS Mapping\Andrews_Street\4355S-10Rocity - Andrews Street\Supplemental_RI_Workplan\4355S-SRI - Site Plan.mxd



Legend

MW-17 521.85 ft (82.6) 18-19 ft	⊕	Overburden monitoring well with groundwater elevation measured on January 15, 2013 (If tested, the Tetrachloroethene or PCE in ug/L in parenthesis with depth of February 2013 groundwater sample)
	─	Groundwater contour interval 1 ft
	←	January 2013 groundwater flow
	☐	Andrews Street ERP Site
	▭	Former Evans Street right-of-way

ND = Not Detected

NOTE:

Static water level data collected approximately one month after backfilling of IRM-01 excavation completed (i.e. in area of MW-17).

Groundwater mapping generated using the Spine Method of interpolation in ArcGIS Spatial Analyst. This method depicts what the groundwater flow could be based on data collected. This model is approximate.

Base mapping data provided by City of Rochester and Monroe County.

DESIGNED BY NES	DATE 01-2014
DRAWN BY CPS	DATE DRAWN 01-2014
SCALE AS NOTED	DATE ISSUED 01-24-2014

day
DAY ENVIRONMENTAL, INC.
Environmental Consultants
Rochester, New York 14606
New York, New York 10170

Project Title
300, 304-308, 320 ANDREWS STREET
AND 25 EVANS STREET
ROCHESTER, NEW YORK

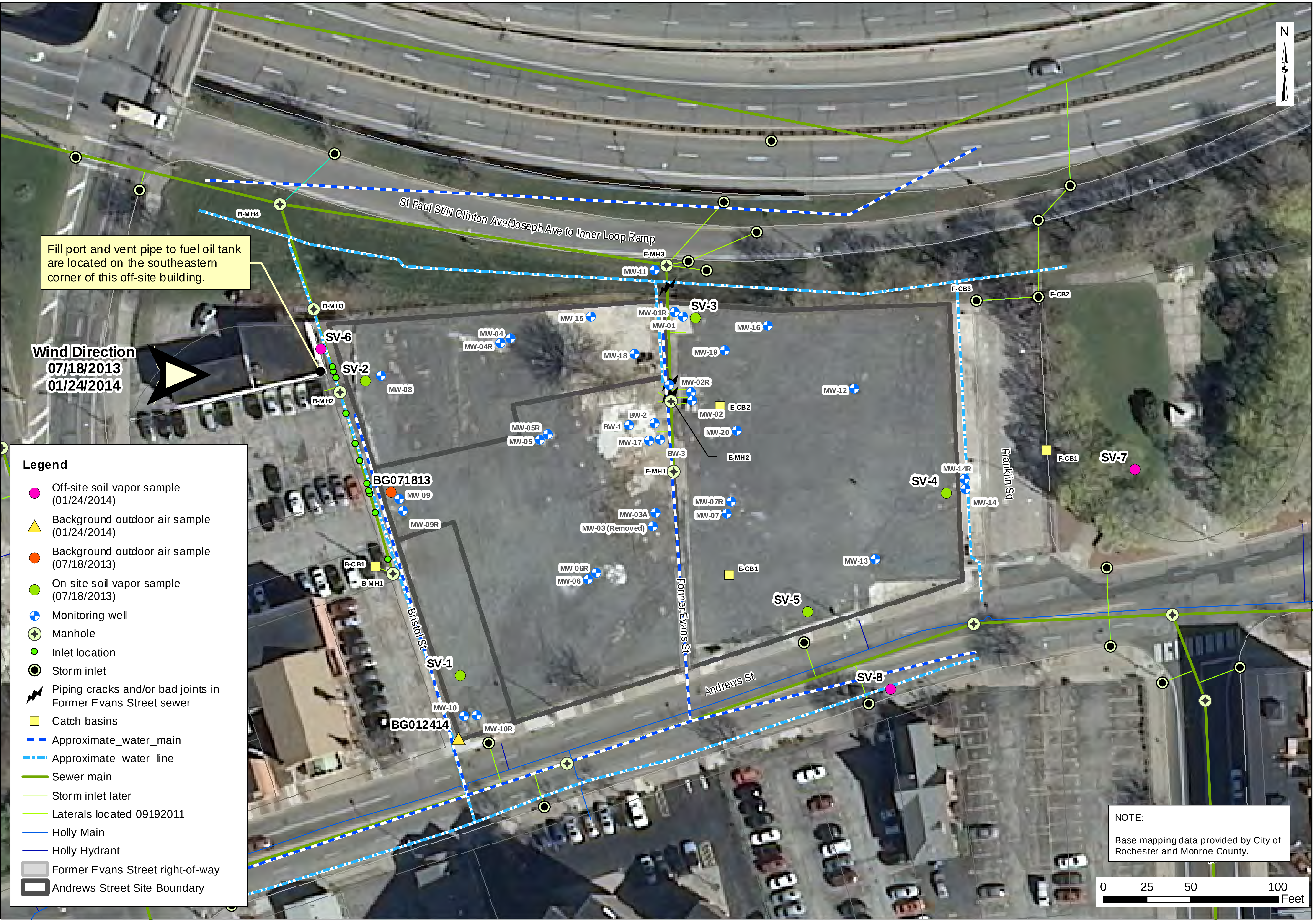
ENVIRONMENTAL RESTORATION PROJECT NYSDEC SITE NO.: E828144

Drawing Title
Site Plan with Overburden Groundwater Potentiometric Map for January 15, 2013 and PCE Concentrations Detected in February 2013 Overburden Groundwater Samples

Project No.
4355S-10

FIGURE 4

Document Path: E:\GIS\GIS Mapping\Andrews_Street\4355S-10Rocity - Andrews Street\Supplemental_RI_Workplan\4355S-SRI-43 -Overburden GW 01-15-2013 PCE 02-2013.mxd



NOTE:

Base mapping data provided by City of Rochester and Monroe County.

Document Path: E:\GIS\GIS Mapping\Andrews_Street\4355S-10Rocity - Andrews Street\Supplemental_RI_Workplan\4355S-SRI-57 - SVI Locations and Utilities.mxd

DATE	04-2014
DATE DRAWN	04-2014
DATE ISSUED	04-09-2014
DESIGNED BY	JAD
DRAWN BY	CPS
SCALE	AS NOTED

day
DAY ENVIRONMENTAL, INC.
Environmental Consultants
Rochester, New York 14606
New York, New York 10170

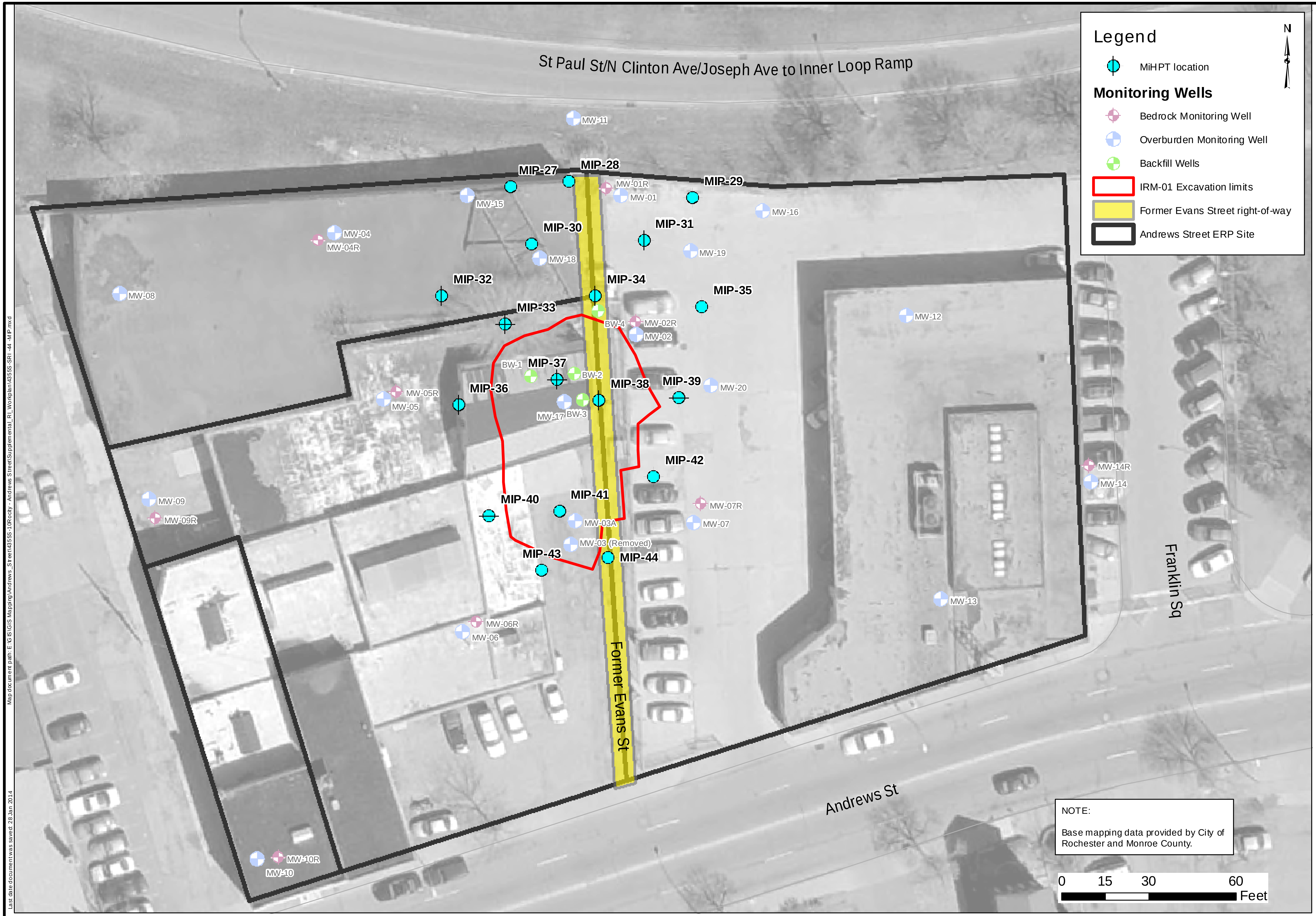
Project Title
300, 304-308, 320 ANDREWS STREET
AND 25 EVANS STREET
ROCHESTER, NEW YORK

ENVIRONMENTAL RESTORATION PROJECT NYSDEC SITE NO.: E828144

Drawing Title
Soil Vapor Sample Location Plan with Utilities Overlay

Project No.
4355S-10

FIGURE 5



Legend

- MiHPT location

Monitoring Wells

- Bedrock Monitoring Well
- Overburden Monitoring Well
- Backfill Wells
- 🟥 IRM-01 Excavation limits
- 🟨 Former Evans Street right-of-way
- ⬛ Andrews Street ERP Site

NOTE:

Base mapping data provided by City of Rochester and Monroe County.

Map document path: E:\GIS\GIS Mapping\Andrews_Street\4355S-10Rocity - Andrews Street\Supplemental_RI_Workplan\4355S-SRI -44 -MIP.mxd

Last date document was saved: 28 Jan 2014

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DRAWN BY CPS	DATE DRAWN 01-2014
SCALE AS NOTED	DATE ISSUED 01-24-2014

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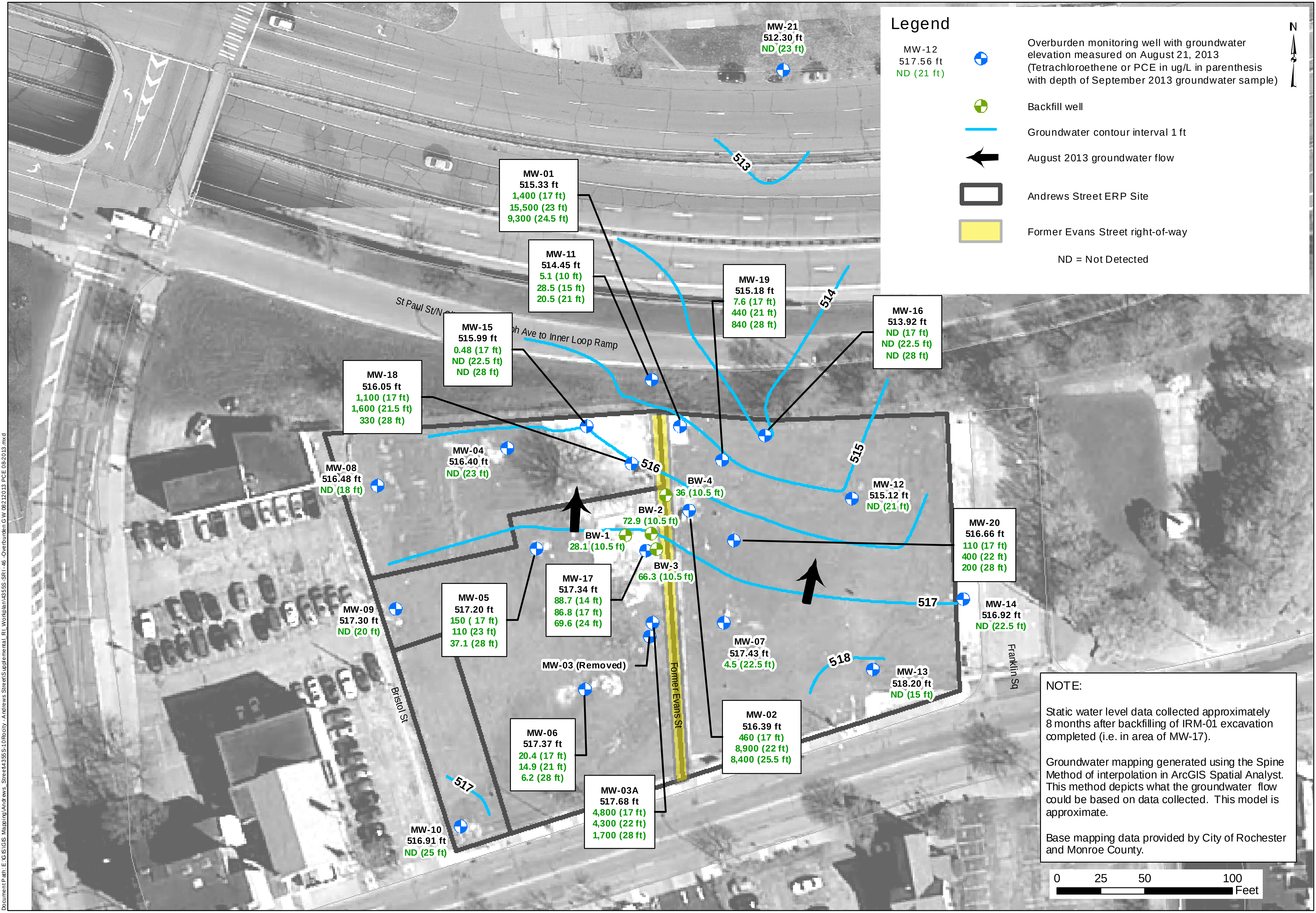
DAY ENVIRONMENTAL, INC.
Environmental Consultants
Rochester, New York 14606
New York, New York 10170

Project Title
300, 304-308, 320 ANDREWS STREET
AND 25 EVANS STREET
ROCHESTER, NEW YORK
ENVIRONMENTAL RESTORATION PROJECT NYSDEC SITE NO: E828144

Drawing Title
MiHPT Location Plan

Project No.
4355S-10

FIGURE 6



Legend

MW-12 517.56 ft ND (21 ft)	⊕	Overburden monitoring well with groundwater elevation measured on August 21, 2013 (Tetrachloroethene or PCE in ug/L in parenthesis with depth of September 2013 groundwater sample)
	⊕	Backfill well
	—	Groundwater contour interval 1 ft
	←	August 2013 groundwater flow
	▭	Andrews Street ERP Site
	🟨	Former Evans Street right-of-way

ND = Not Detected

NOTE:

Static water level data collected approximately 8 months after backfilling of IRM-01 excavation completed (i.e. in area of MW-17).

Groundwater mapping generated using the Spine Method of interpolation in ArcGIS Spatial Analyst. This method depicts what the groundwater flow could be based on data collected. This model is approximate.

Base mapping data provided by City of Rochester and Monroe County.

Document Path: E:\GIS\GIS Mapping\Andrews_Street\4355S-10Rocity - Andrews Street\Supplemental_RI_Workplan\4355S-SRI - 46 -Overburden GW 08212013 PCE 08-2013.mxd

DESIGNED BY	DATE
NES	01-2014
DRAWN BY	DATE DRAWN
CPS	01-2014
SCALE	DATE ISSUED
AS NOTED	01-24-2014

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DAY ENVIRONMENTAL, INC.
Environmental Consultants
Rochester, New York 14606
New York, New York 10170

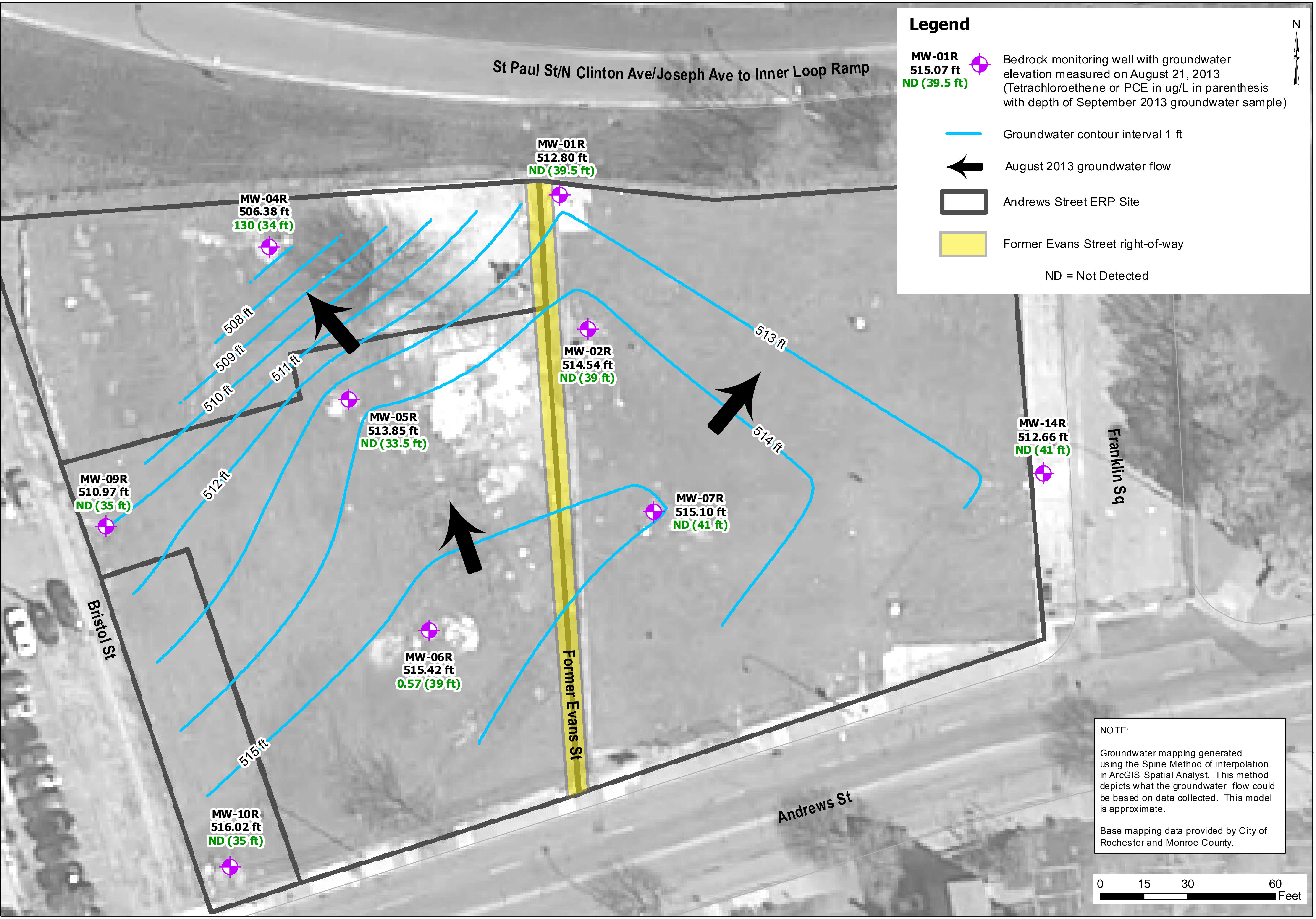
Project Title
300, 304-308, 320 ANDREWS STREET
AND 25 EVANS STREET
ROCHESTER, NEW YORK

ENVIRONMENTAL RESTORATION PROJECT NYSDEC SITE NO.: E828144

Drawing Title
Site Plan with Overburden Groundwater Potentiometric Map for August 21, 2013 and PCE Concentrations Detected in September 2013 Overburden Groundwater Samples

Project No.
4355S-10

FIGURE 7



NOTE:

Groundwater mapping generated using the Spine Method of interpolation in ArcGIS Spatial Analyst. This method depicts what the groundwater flow could be based on data collected. This model is approximate.

Base mapping data provided by City of Rochester and Monroe County.

Document Path: E:\GIS\GIS Mapping\Andrews_Street\4355S-10Rocity - Andrews Street\Supplemental_RI_Workplan\4355S-SRI -47 -Bedrock GW 08-21-2013 PCE 09-2013.mxd

DESIGNED BY	DATE
NES	09-2013
DRAWN BY	DATE DRAWN
CPS	09-2013
SCALE	DATE ISSUED
AS NOTED	09-26-2013

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Environmental Consultants
Rochester, New York 14606
New York, New York 10170

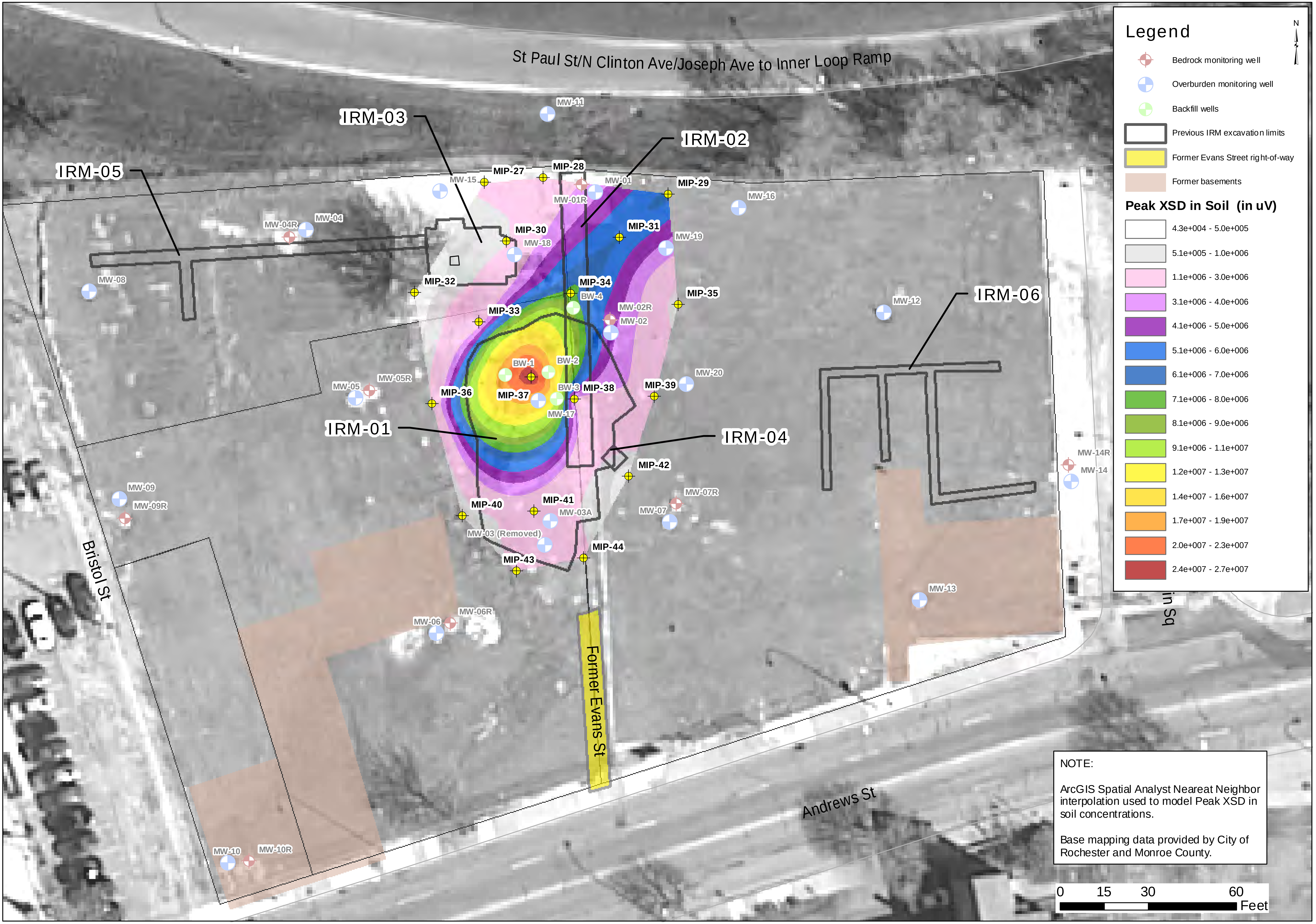
Project Title
300, 304-308, 320 ANDREWS STREET
AND 25 EVANS STREET
ROCHESTER, NEW YORK

ENVIRONMENTAL RESTORATION PROJECT NYSDEC SITE NO.: E828144

Drawing Title
Site Plan with Bedrock Groundwater Potentiometric Map for August 21, 2013 and PCE Concentrations Detected in September 2013 Bedrock Groundwater Samples

Project No.
4355S-10

FIGURE 8



NOTE:

ArcGIS Spatial Analyst Neareat Neighbor interpolation used to model Peak XSD in soil concentrations.

Base mapping data provided by City of Rochester and Monroe County.

Last date document was saved: 24 Apr 2014

Map document path: E:\GIS\GIS Mapping\Andrews_Street\4355S-10Rocity - Andrews Street\Supplemental_RI_Workplan\4355S-SRI-49-SIRM Peak XSD.mxd

DESIGNED BY JAD	DATE 04-2014
DRAWN BY CPS	DATE DRAWN 04-2014
SCALE AS NOTED	DATE ISSUED 04-09-2014

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Environmental Consultants
Rochester, New York 14606
New York, New York 10170

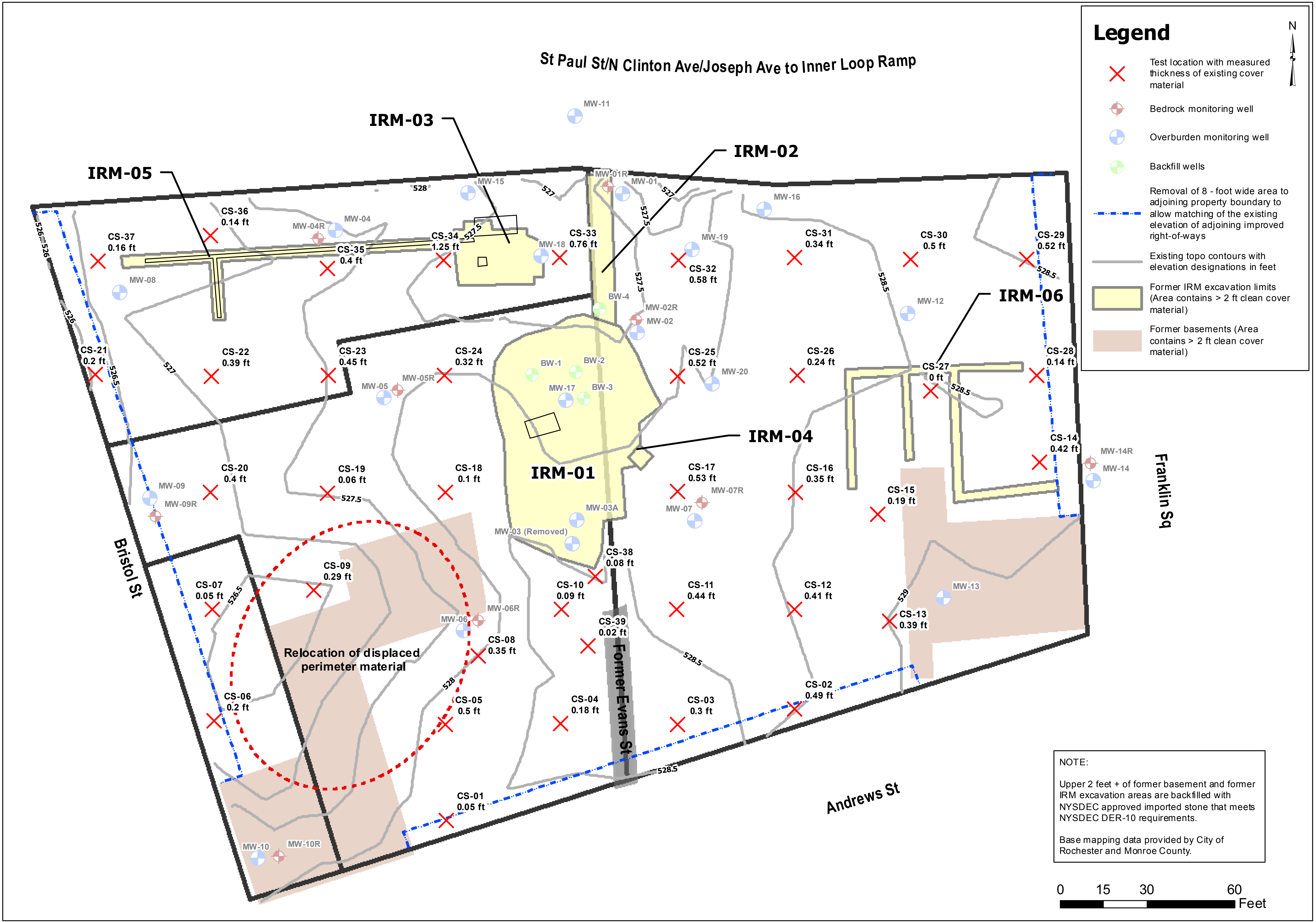
Project Title
300, 304-308, 320 ANDREWS STREET
AND 25 EVANS STREET
ROCHESTER, NEW YORK

ENVIRONMENTAL RESTORATION PROJECT NYSDEC SITE NO: E828144

Drawing Title
Peak XSD in Soil

Project No.
4355S-10

FIGURE 9



NOTE:

Upper 2 feet + of former basement and former IRM excavation areas are backfilled with NYSDEC approved imported stone that meets NYSDEC DER-10 requirements.

Base mapping data provided by City of Rochester and Monroe County.

Map document path: E:\GIS\GIS Mapping\Andrews_Street\4355S-10Rocity - Andrews Street\Supplemental_RI_Workplan\4355S-SRI-42 - Cover Material Plan.mxd

Last date document was saved: 30 Apr 2014

DESIGNED BY	DATE
JAD	01-2014
DRAWN BY	DATE DRAWN
CPS	01-2014
SCALE	DATE ISSUED
AS NOTED	01-24-2014

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Environmental Consultants
Rochester, New York 14606
New York, New York 10170

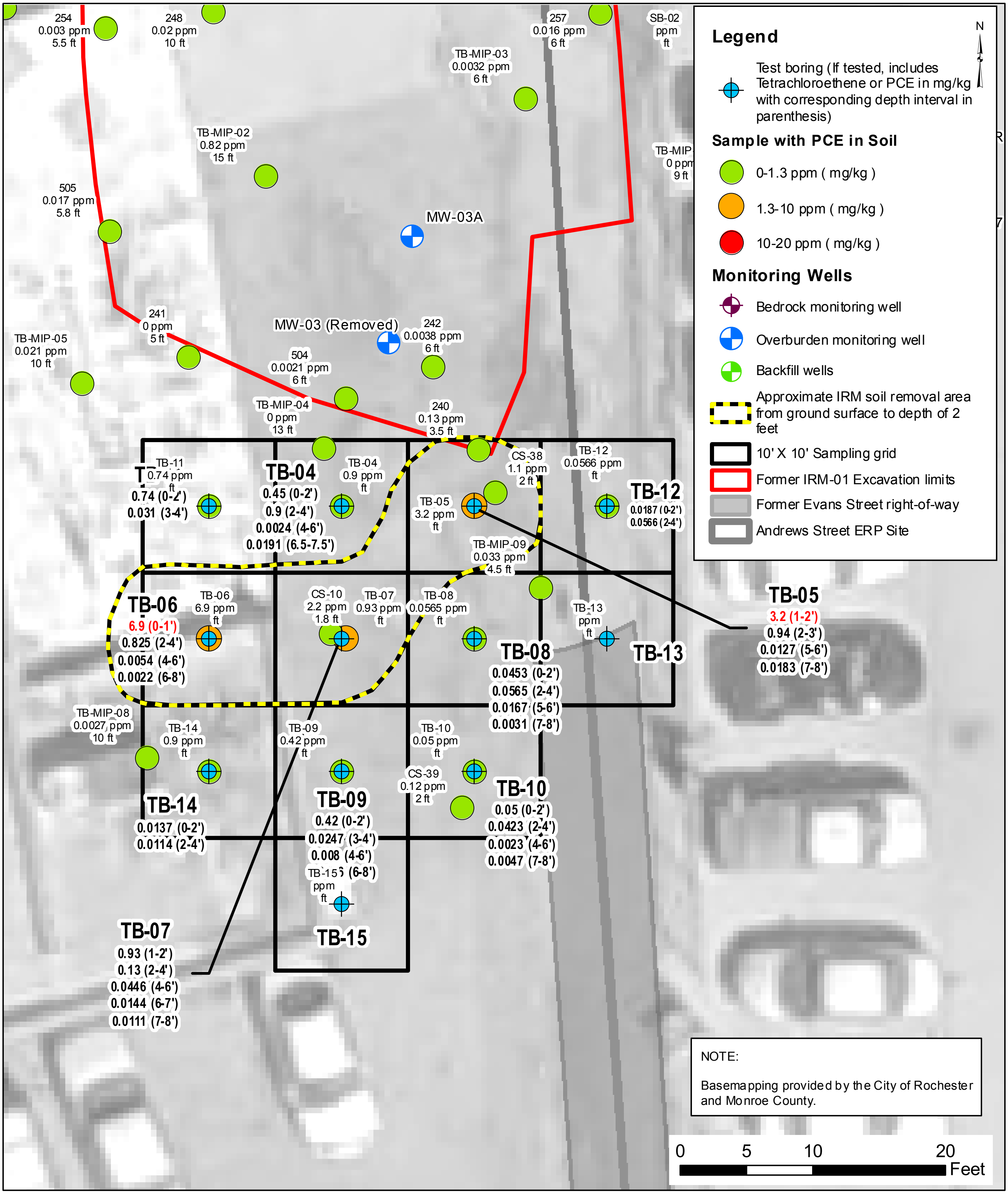
Project Title
300, 304-308, 320 ANDREWS STREET
AND 25 EVANS STREET
ROCHESTER, NEW YORK

ENVIRONMENTAL RESTORATION PROJECT NYSDEC SITE NO: E828144

Drawing Title
Cover Material Plan

Project No.
4355S-10

FIGURE 10



Date
11-13-2013

Drawn By
CPS

Scale
AS NOTED

day
DAY ENVIRONMENTAL, INC.
Environmental Consultants
Rochester, New York 14606
New York, New York 10016-0701

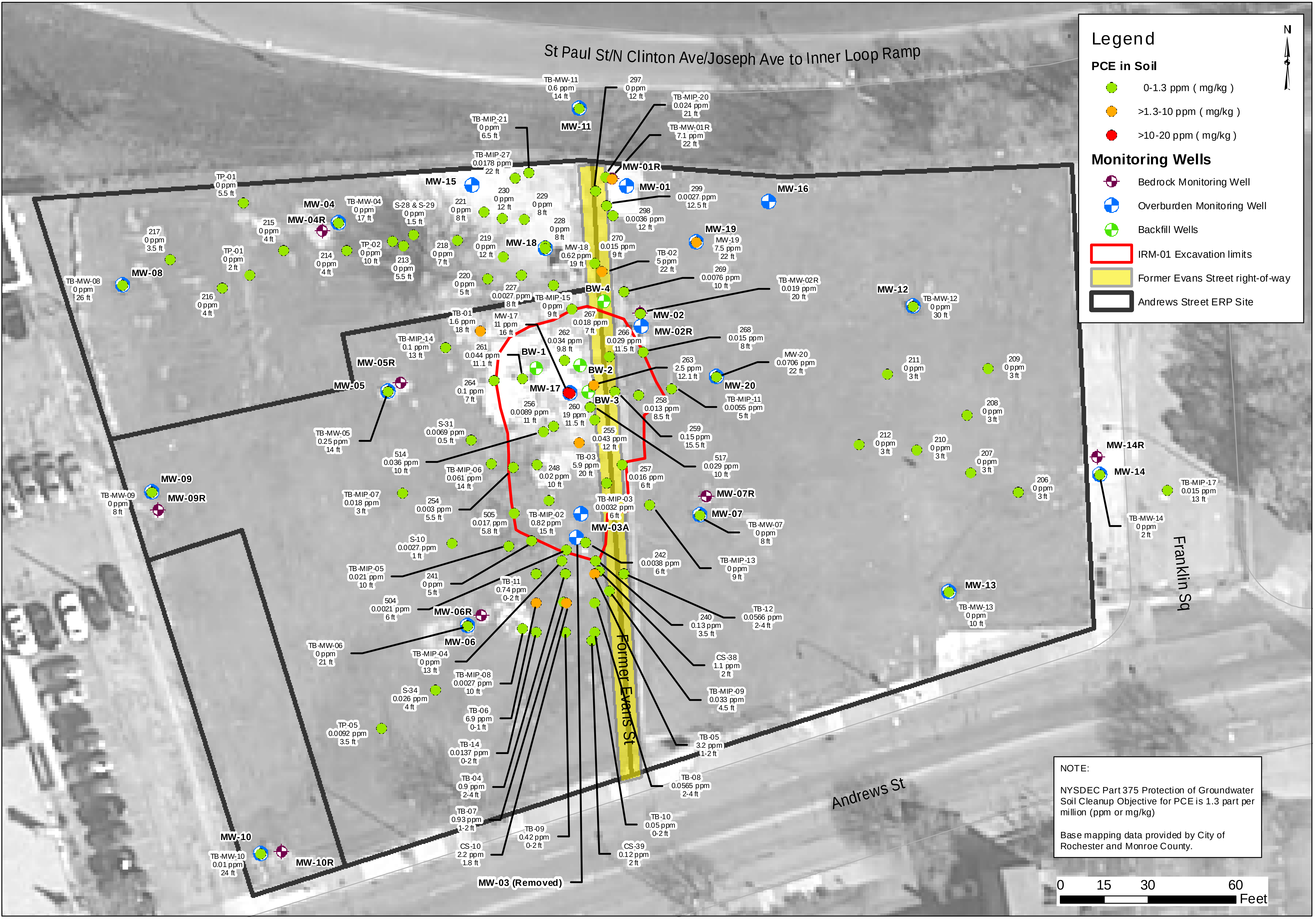
Project Title
300, 304-308, 320 ANDREWS STREET AND
25 EVANS STREET
ROCHESTER, NEW YORK
(NYSDEC SITE NO.: E828144)

ENVIRONMENTAL RESTORATION PROJECT

Drawing Title
Location of Supplemental IRM Soil Removal Area

Project No.
4355S-10

FIGURE 11



Legend

PCE in Soil

- 🟢 0-1.3 ppm (mg/kg)
- 🟠 >1.3-10 ppm (mg/kg)
- 🔴 >10-20 ppm (mg/kg)

Monitoring Wells

- ⊕ Bedrock Monitoring Well
- ⊕ Overburden Monitoring Well
- ⊕ Backfill Wells
- 🟥 IRM-01 Excavation limits
- 🟨 Former Evans Street right-of-way
- ⬛ Andrews Street ERP Site

NOTE:

NYSDEC Part 375 Protection of Groundwater Soil Cleanup Objective for PCE is 1.3 part per million (ppm or mg/kg)

Base mapping data provided by City of Rochester and Monroe County.

Map document path: E:\GIS\GIS Mapping\Andrews_Street\4355S-10Rocity - Andrews Street\Supplemental_RI_Workplan\4355S-SRI -48 - MIP.mxd

Last date document was saved: 28 Jan 2014

DESIGNED BY	DATE
JAD	01-2014
DRAWN BY	DATE DRAWN
CPS	01-2014
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AS NOTED	01-24-2014

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DAY ENVIRONMENTAL, INC.
Environmental Consultants
Rochester, New York 14606
New York, New York 10170

Project Title
300, 304-308, 320 ANDREWS STREET
AND 25 EVANS STREET
ROCHESTER, NEW YORK

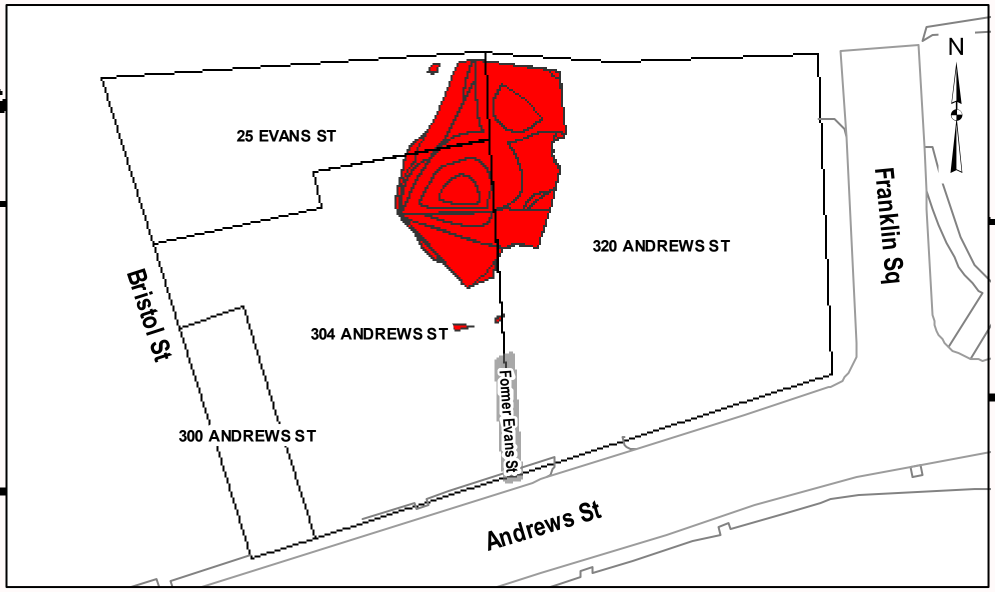
ENVIRONMENTAL RESTORATION PROJECT NYSDEC SITE NO: E828144

Drawing Title
Post - IRM Peak PCE Concentrations in Soil Samples from Demolition Phase, RI andSupplemental RI Test Locations

Project No.
4355S-10

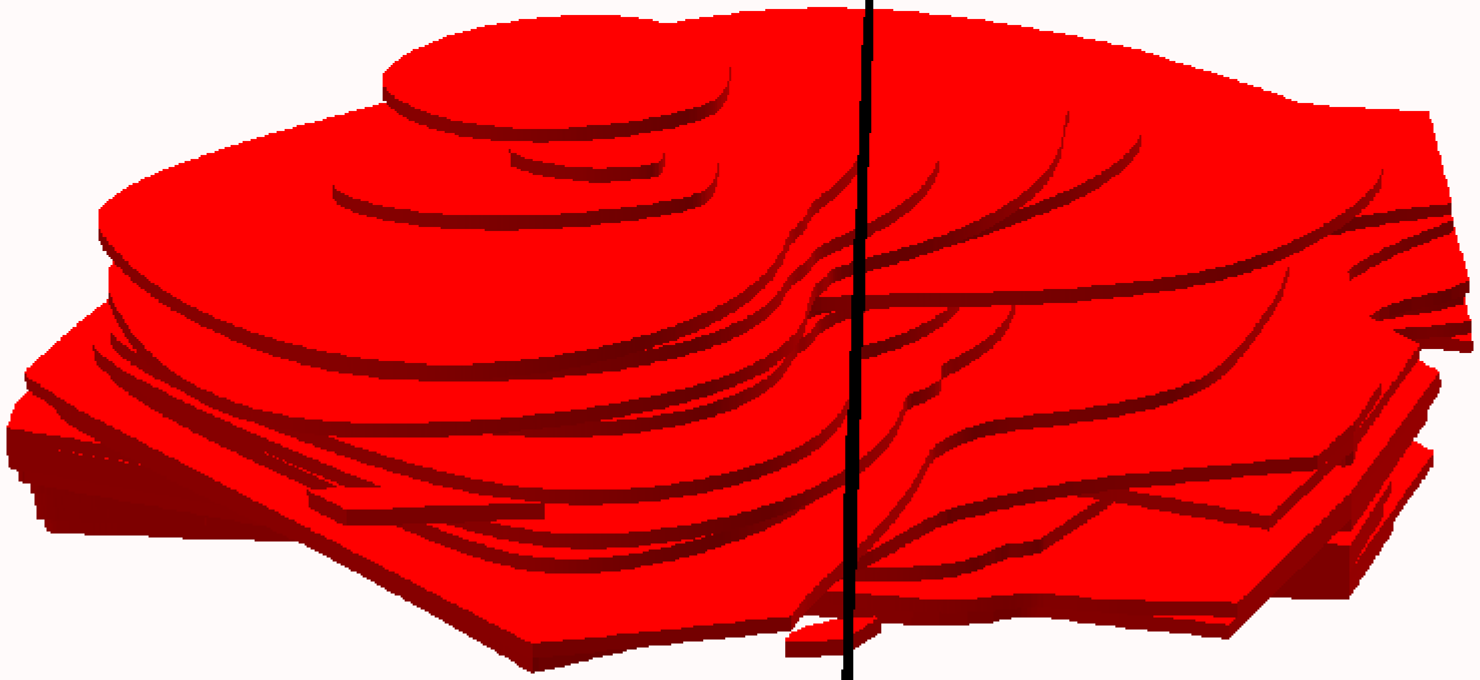
FIGURE 12

Key Plan



Legend

🟥 Polygon shapes in red represent XSD >= 1.0 x 10^6 uV



View Looking North

DESIGNED BY	DATE
JAD	04-2014
DRAWN BY	DATE DRAWN
CPS	04-2014
SCALE	DATE ISSUED
AS NOTED	04-24-2014

day
DAY ENVIRONMENTAL, INC.
Environmental Consultants
Rochester, New York 14606
New York, New York 10170

Project Title
300, 304-308, 320 ANDREWS STREET
AND 25 EVANS STREET
ROCHESTER, NEW YORK

ENVIRONMENTAL RESTORATION PROJECT NYSDEC SITE NO.: E828144

Drawing Title
3D View Looking North of PCE Plume based on
XSD Values >= 1.0 X 10^6 uV

Project No.
4355S-10

FIGURE 13A

Document Path: E:\GIS\GIS Mapping\Andrews_Street\4355S-10Rocky - Andrews Street\Supplemental_RI_Workplan\4355S-SRI-37A-2 -Plume 3D Views.mxd

Date Saved: 4/24/2014 8:55:51 AM

Key Plan

Legend

🟥	Polygon shapes in red represent XSD >= 1.0 x 10^6 uV

View Looking South

Date Saved: 4/24/2014 9:05:55 AM

Document Path: E:\GIS\GIS Mapping\Andrews_Street\4355S-10Rocity - Andrews Street\Supplemental_RI_Workplan\4355S-SRI -37B-2 -Plume 3D Views.mxd

DESIGNED BY JAD	DATE 04-2014	
DRAWN BY CPS	DATE DRAWN 04-2014	
SCALE AS NOTED	DATE ISSUED 04-24-2014	

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Environmental Consultants
Rochester, New York 14606
New York, New York 10170

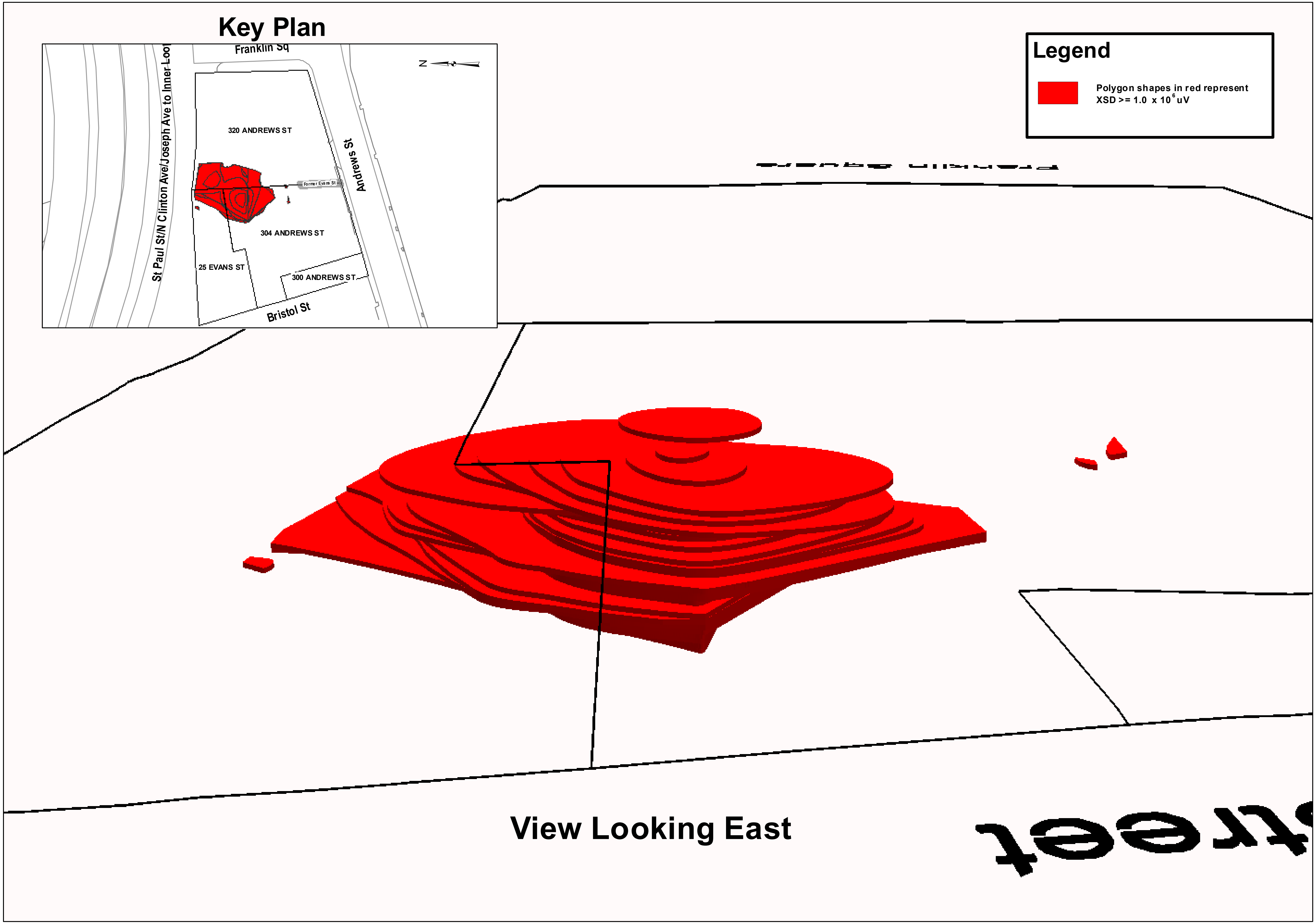
Project Title
300, 304-308, 320 ANDREWS STREET
AND 25 EVANS STREET
ROCHESTER, NEW YORK

ENVIRONMENTAL RESTORATION PROJECT NYSDEC SITE NO.: E828144

Drawing Title
3D View Looking South of PCE Plume based on
XSD Values >= 1.0 X 10^6 uV

Project No.
4355S-10

FIGURE 13B



Legend

🟥 Polygon shapes in red represent XSD >= 1.0×10^6 uV

View Looking East

DESIGNED BY JAD
DATE 04-2014
DRAWN BY CPS
DATE DRAWN 04-2014
SCALE AS NOTED
DATE ISSUED 04-24-2014

DAY ENVIRONMENTAL, INC.
Environmental Consultants
Rochester, New York 14606
New York, New York 10170

Project Title
300, 304-308, 320 ANDREWS STREET
AND 25 EVANS STREET
ROCHESTER, NEW YORK

ENVIRONMENTAL RESTORATION PROJECT NYSDEC SITE NO.: E828144

Drawing Title
3D View Looking East of PCE Plume based on
XSD Values >= 1.0×10^6 uV

Project No.
4355S-10

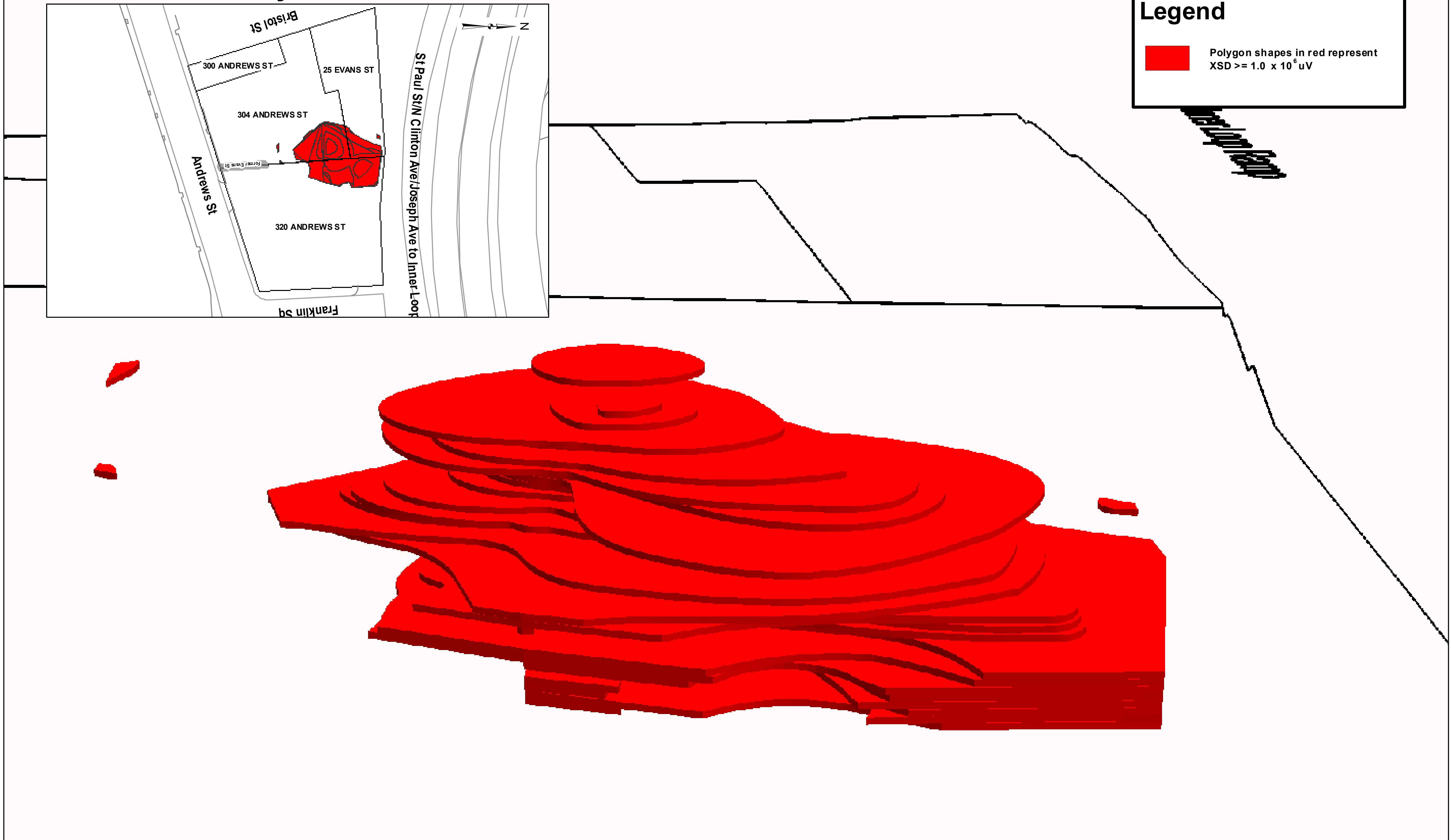
FIGURE 13C

Date Saved: 4/24/2014 9:03:10 AM
Document Path: E:\GIS\GIS Mapping\Andrews_Street\4355S-10Rocity - Andrews Street\Supplemental_RI_Workplan\4355S-SRI -37C-2 -Plume 3D Views.mxd

Document Path: E:\GIS\GIS Mapping\Andrews_Street\4355S-10Rocity - Andrews Street\Supplemental_RI_Workplan\4355S-SRI -37D-2 -Plume 3D Views.mxd

Date Saved: 4/24/2014 9:00:27 AM

Key Plan



Legend

🟥 Polygon shapes in red represent XSD >= 1.0 x 10^6 uV

View Looking West

DATE	04-2014
DESIGNED BY	JAD
DATE DRAWN	04-2014
DRAWN BY	CPS
DATE ISSUED	04-24-2014
SCALE	AS NOTED

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New York, New York 10170

Project Title
300, 304-308, 320 ANDREWS STREET
AND 25 EVANS STREET
ROCHESTER, NEW YORK

ENVIRONMENTAL RESTORATION PROJECT NYSDEC SITE NO.: E828144

Drawing Title
3D View Looking West of PCE Plume based on
XSD Values >= 1.0 X 10^6 uV

Project No.
4355S-10

FIGURE 13D

NOTE:

ArcGIS Spatial Analyst Neareat Neighbor interpolation used to model Peak PCE in groundwater concentrations.

Base mapping data provided by City of Rochester and Monroe County.

Document Path: E:\GIS\GIS Mapping\Andrews_Street\4355S-10Rocity - Andrews Street\Supplemental_RI_Workplan\4355S-SRI-32 -Peak PCE in Groundwater.mxd

DESIGNED BY NES	DRAWN BY CPS	SCALE AS NOTED
DATE 10-2013	DATE DRAWN 10-2013	DATE ISSUED 10-21-2013

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Environmental Consultants
Rochester, New York 14606
New York, New York 10170

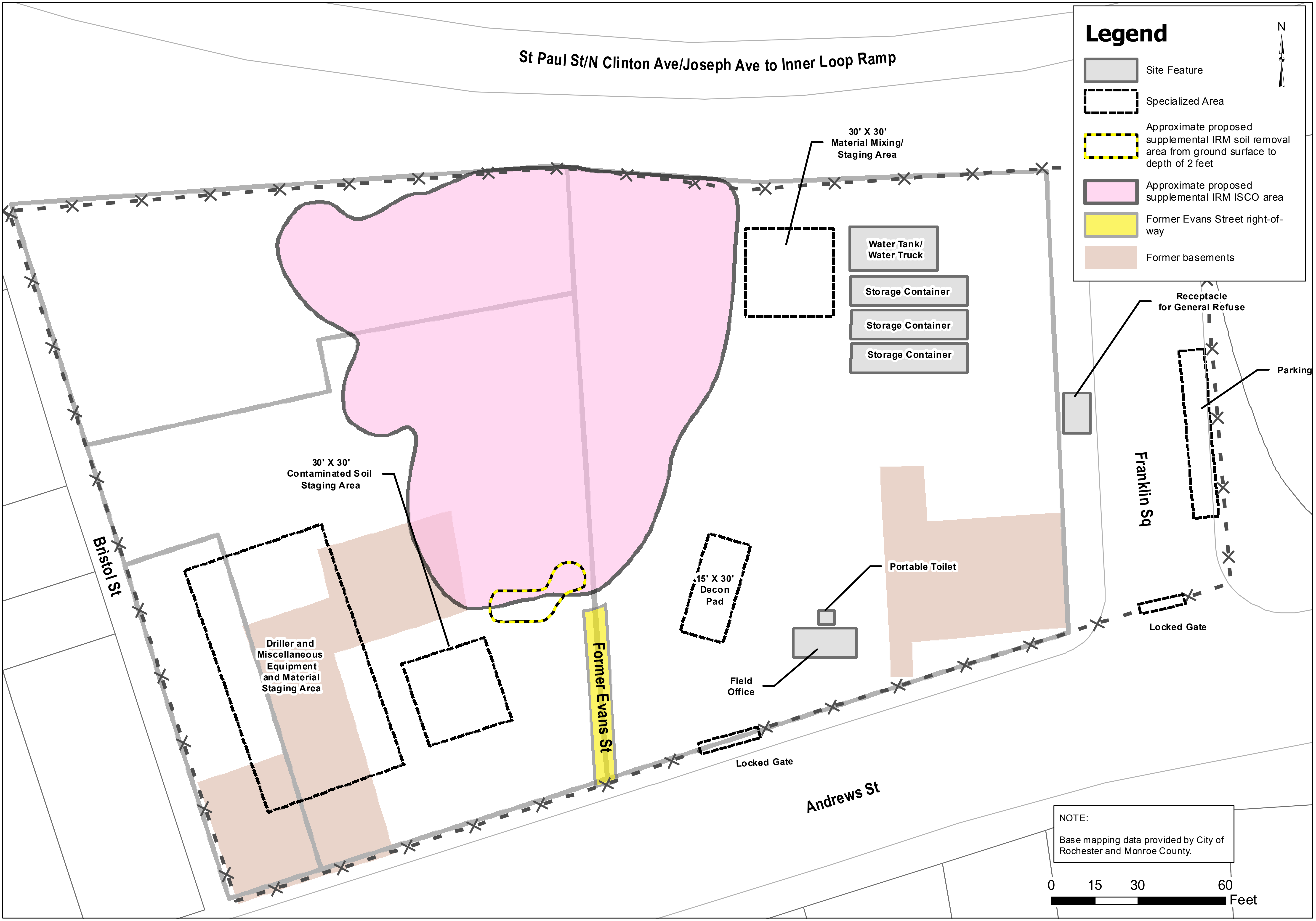
Project Title
300, 304-308, 320 ANDREWS STREET
AND 25 EVANS STREET
ROCHESTER, NEW YORK

ENVIRONMENTAL RESTORATION PROJECT NYSDEC SITE NO.: E828144

Drawing Title
Peak PCE Concentrations Detected in September 2013
Overburden Groundwater Samples

Project No.
4355S-10

FIGURE 14



NOTE:

Base mapping data provided by City of Rochester and Monroe County.

Last date document was saved: 21 May 2014

Map document path: E:\GIS\GIS Mapping\Andrews_Street\4355S-10Rocity - Andrews Street\Supplemental_RI_Workplan\4355S-SRI-40 - SIRM Layout Plan.mxd

DESIGNED BY	DATE
JAD	01-2014
DRAWN BY	DATE DRAWN
CPS	01-2014
SCALE	DATE ISSUED
AS NOTED	05-21-2014

DAY ENVIRONMENTAL, INC.
Environmental Consultants
Rochester, New York 14606
New York, New York 10170

Project Title
300, 304-308, 320 ANDREWS STREET
AND 25 EVANS STREET
ROCHESTER, NEW YORK

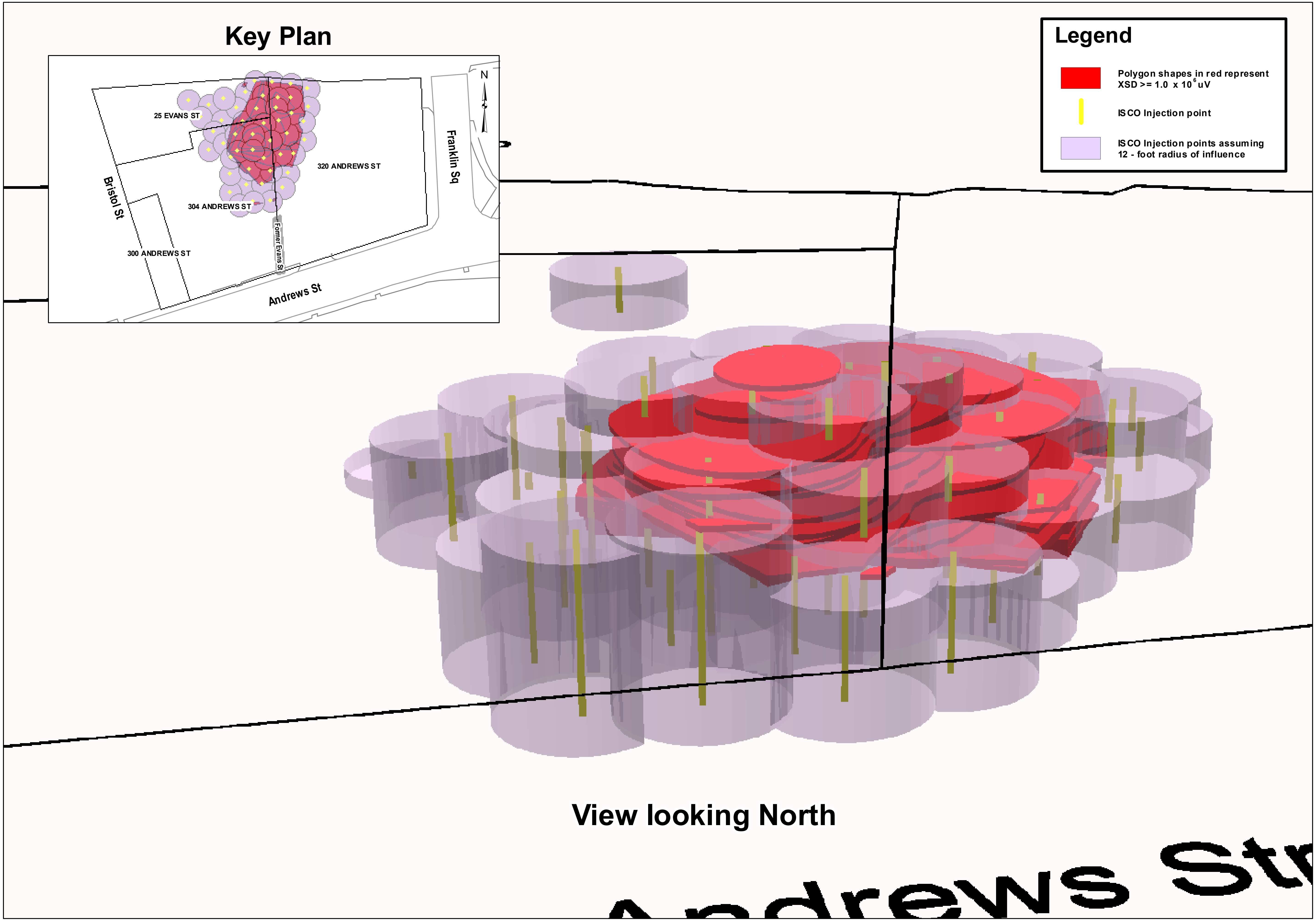
ENVIRONMENTAL RESTORATION PROJECT NYSDEC SITE NO: E828144

Drawing Title
Supplemental IRM Site Layout Plan

Project No.
4355S-10

FIGURE 15

Key Plan



Legend

🟥	Polygon shapes in red represent XSD >= 1.0 x 10^6 uV
|	ISCO Injection point
▨	ISCO Injection points assuming 12 - foot radius of influence

View looking North

Map document path: E:\GIS\GIS Mapping\Andrews_Street\4355S-10Rocity - Andrews Street\Supplemental_RI_Workplan\4355S-SRI -38A-2 -Inject 3D Views.mxd

Last date document was saved: 24 Apr 2014

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DRAWN BY CPS	DATE DRAWN 04-2014
SCALE AS NOTED	DATE ISSUED 04-24-2014

day
DAY ENVIRONMENTAL, INC.
Environmental Consultants
Rochester, New York 14606
New York, New York 10170

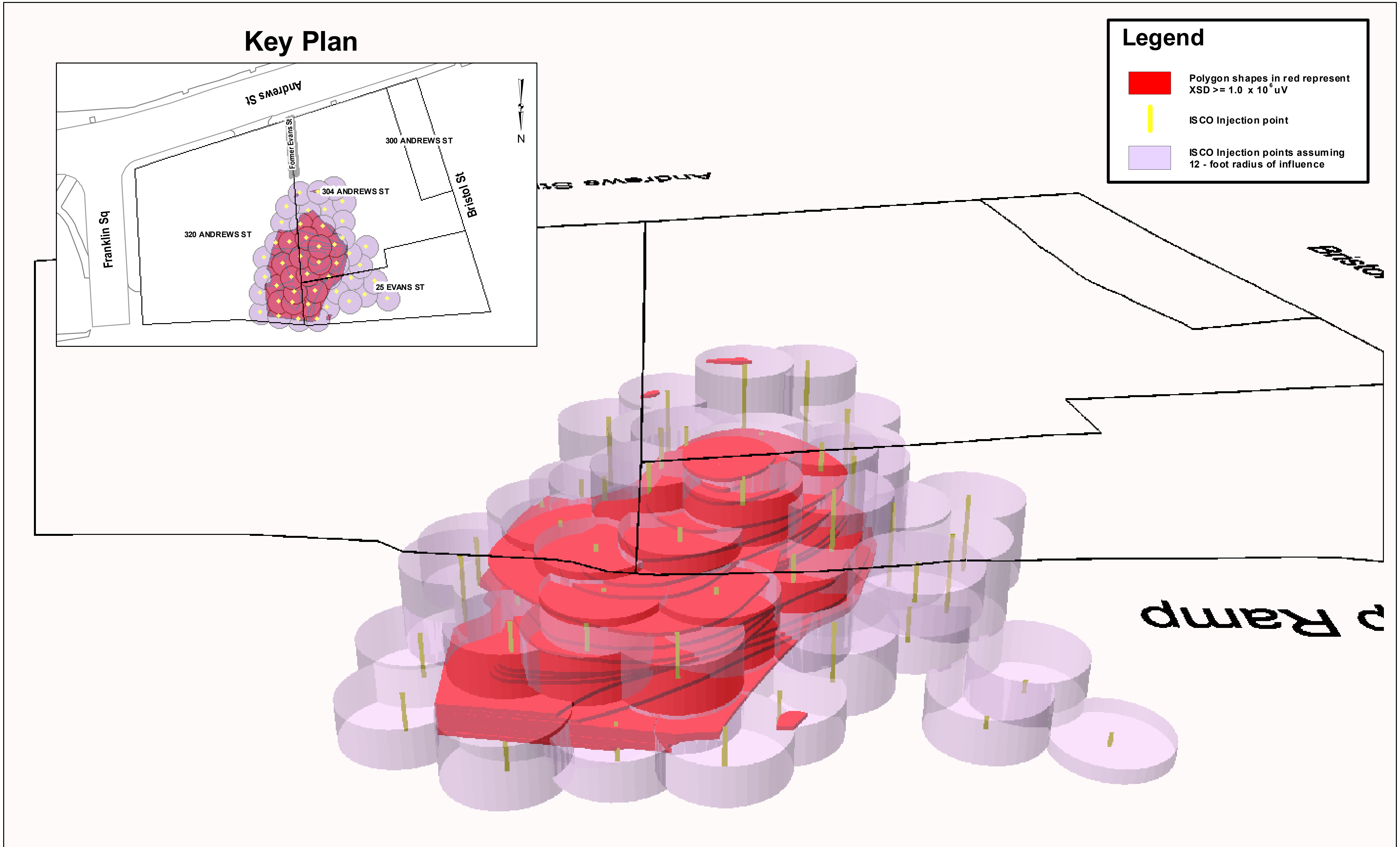
Project Title
300, 304-308, 320 ANDREWS STREET
AND 25 EVANS STREET
ROCHESTER, NEW YORK

ENVIRONMENTAL RESTORATION PROJECT NYSDEC SITE NO: E828144

Drawing Title
3D View North of PCE Plume based on XSD Values >= 1.0 x 10^6 eV
with ISCO Injection Points having 12 foot Radius of Influence

Project No.
4355S-10

FIGURE 16A



Legend

🟥	Polygon shapes in red represent XSD >= 1.0 x 10^6 uV
▮	ISCO Injection point
▭	ISCO Injection points assuming 12 - foot radius of influence

View looking South

DESIGNED BY JAD	DATE 04-2014
DRAWN BY CPS	DATE DRAWN 04-2014
SCALE AS NOTED	DATE ISSUED 04-24-2014

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Environmental Consultants
Rochester, New York 14606
New York, New York 10170

Project Title
300, 304-308, 320 ANDREWS STREET
AND 25 EVANS STREET
ROCHESTER, NEW YORK

ENVIRONMENTAL RESTORATION PROJECT NYSDEC SITE NO: E828144

Drawing Title
3D View South of PCE Plume based on XSD Values >= 1.0 x 10^6 eV
with ISCO Injection Points having 12 foot Radius of Influence

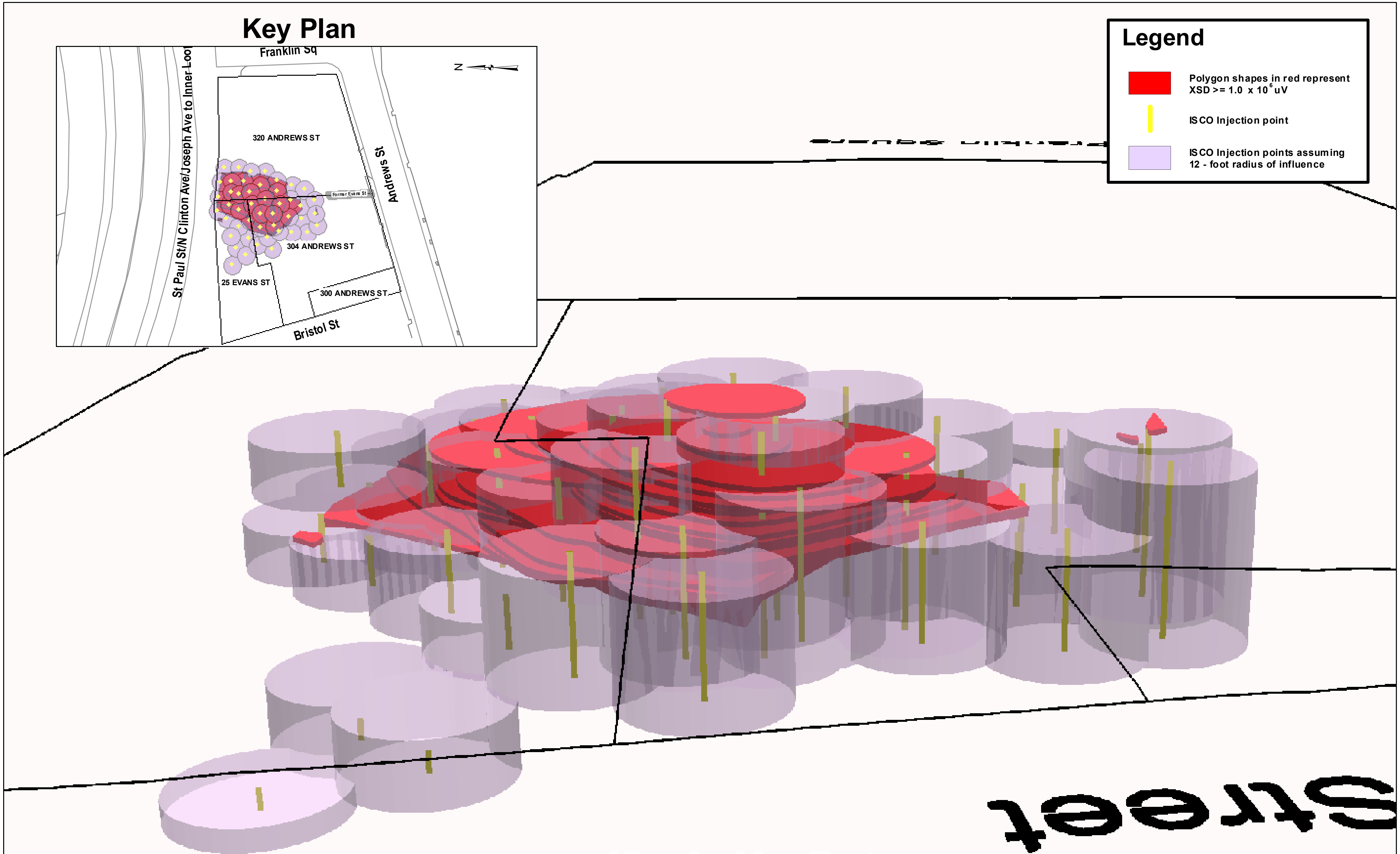
Project No.
4355S-10

FIGURE 16B

Map document path: E:\GIS\GIS Mapping\Andrews_Street\4355S-10Rocty - Andrews Street\Supplemental_RI_Workplan\4355S-SRI-38B-2-Inject 3D Views.mxd

Last date document was saved: 24 Apr 2014

Key Plan



View looking East

Legend

🟥	Polygon shapes in red represent XSD >= 1.0 x 10^6 uV
|	ISCO Injection point
🟪	ISCO Injection points assuming 12 - foot radius of influence

Map document path: E:\GIS\GIS Mapping\Andrews_Street\4355S-10Rocity - Andrews Street\Supplemental_RI_Workplan\4355S-SRI -38C-2 -Inject 3D Views.mxd

Last date document was saved: 24 Apr 2014

DESIGNED BY JAD	DATE 04-2014	
DRAWN BY CPS	DATE DRAWN 04-2014	
SCALE AS NOTED	DATE ISSUED 04-24-2014	

day
DAY ENVIRONMENTAL, INC.
Environmental Consultants
Rochester, New York 14606
New York, New York 10170

Project Title
300, 304-308, 320 ANDREWS STREET
AND 25 EVANS STREET
ROCHESTER, NEW YORK

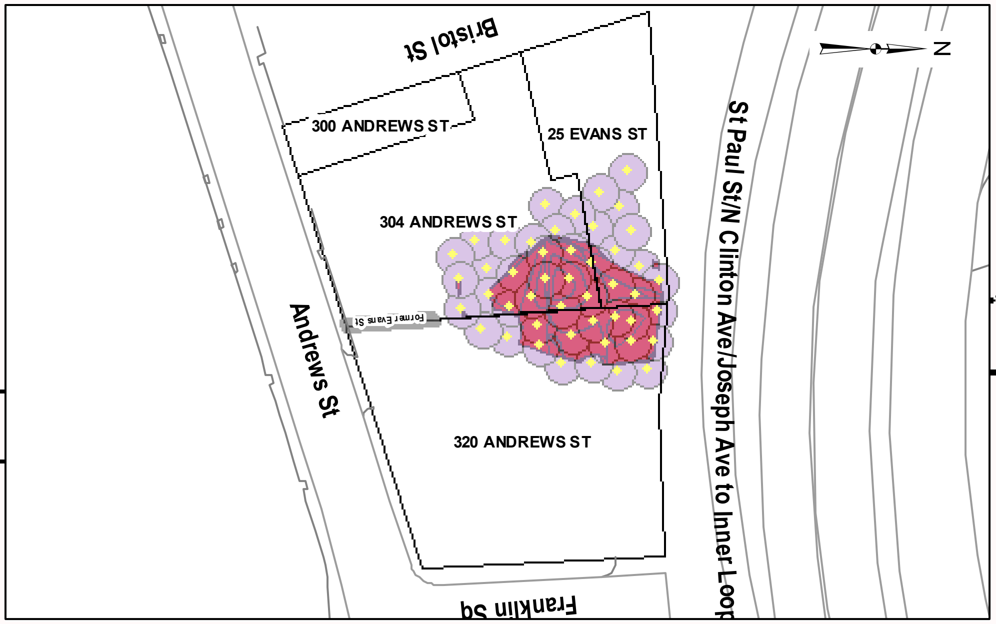
ENVIRONMENTAL RESTORATION PROJECT NYSDEC SITE NO: E828144

Drawing Title
3D View East of PCE Plume based on XSD Values >= 1.0 x 10^6 eV
with ISCO Injection Points having 12 foot Radius of Influence

Project No.
4355S-10

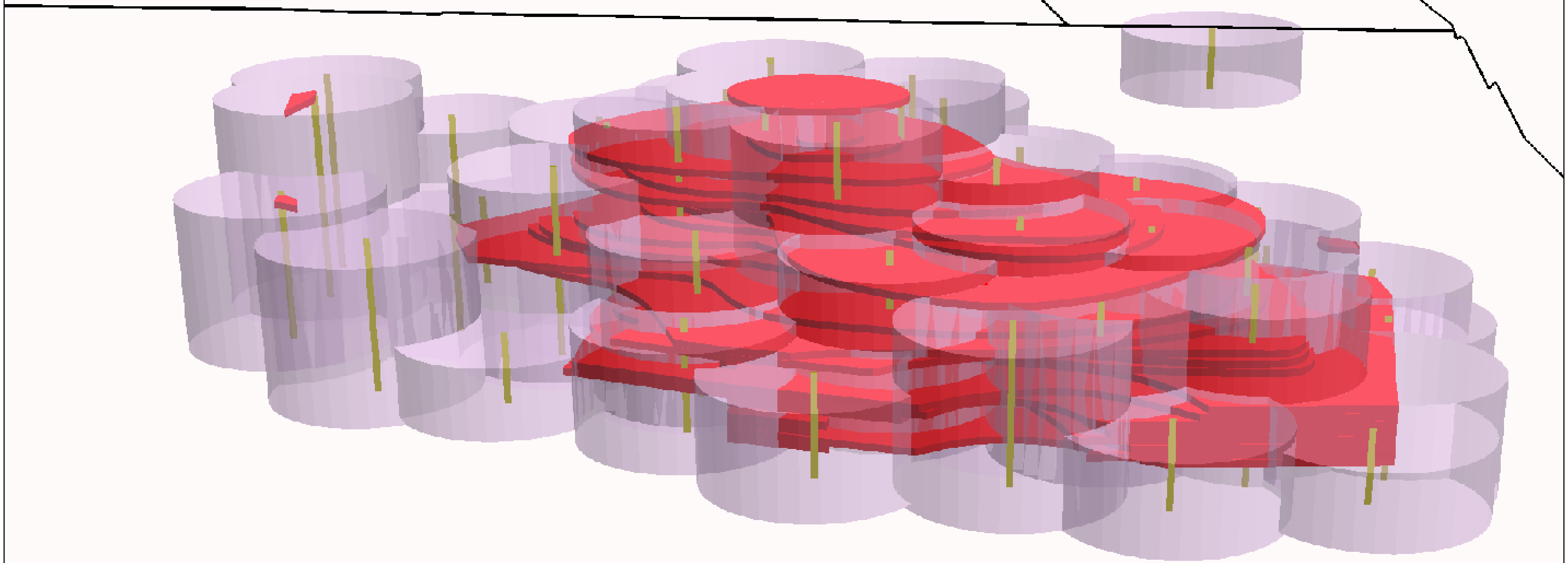
FIGURE 16C

Key Plan



Legend

🟥	Polygon shapes in red represent XSD >= 1.0 x 10^6 uV
|	ISCO Injection point
▨	ISCO Injection points assuming 12 - foot radius of influence



View looking West

Map document path: E:\GIS\GIS Mapping\Andrews_Street\4355S-10Rocity - Andrews Street\Supplemental_RI_Workplan\4355S-SRI -38D-2 -Inject 3D Views.mxd

Last date document was saved: 24 Apr 2014

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DATE 04-2014
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DATE DRAWN 04-2014
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DATE ISSUED 04-24-2014

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Environmental Consultants
Rochester, New York 14606
New York, New York 10170

Project Title
300, 304-308, 320 ANDREWS STREET
AND 25 EVANS STREET
ROCHESTER, NEW YORK

ENVIRONMENTAL RESTORATION PROJECT NYSDEC SITE NO: E828144

Drawing Title
3D View West of PCE Plume based on XSD Values >= 1.0 x 10^6 eV
with ISCO Injection Points having 12 foot Radius of Influence

Project No.
4355S-10

FIGURE 16D

NOTE:

Base mapping data provided by City of Rochester and Monroe County.

Map document path: E:\GIS\GIS Mapping\Andrews_Street\4355S-10Rocity - Andrews Street\Supplemental_RI_Workplan\4355S-SRI -34 -SIRM Peak XSD w Injection Points.mxd

Last date document was saved: 05 Jun 2014

DESIGNED BY JAD
DATE 05-2014
DRAWN BY CPS
DATE DRAWN 05-2014
SCALE AS NOTED
DATE ISSUED 05-28-2014

DAY ENVIRONMENTAL, INC.
Environmental Consultants
Rochester, New York 14606
New York, New York 10170

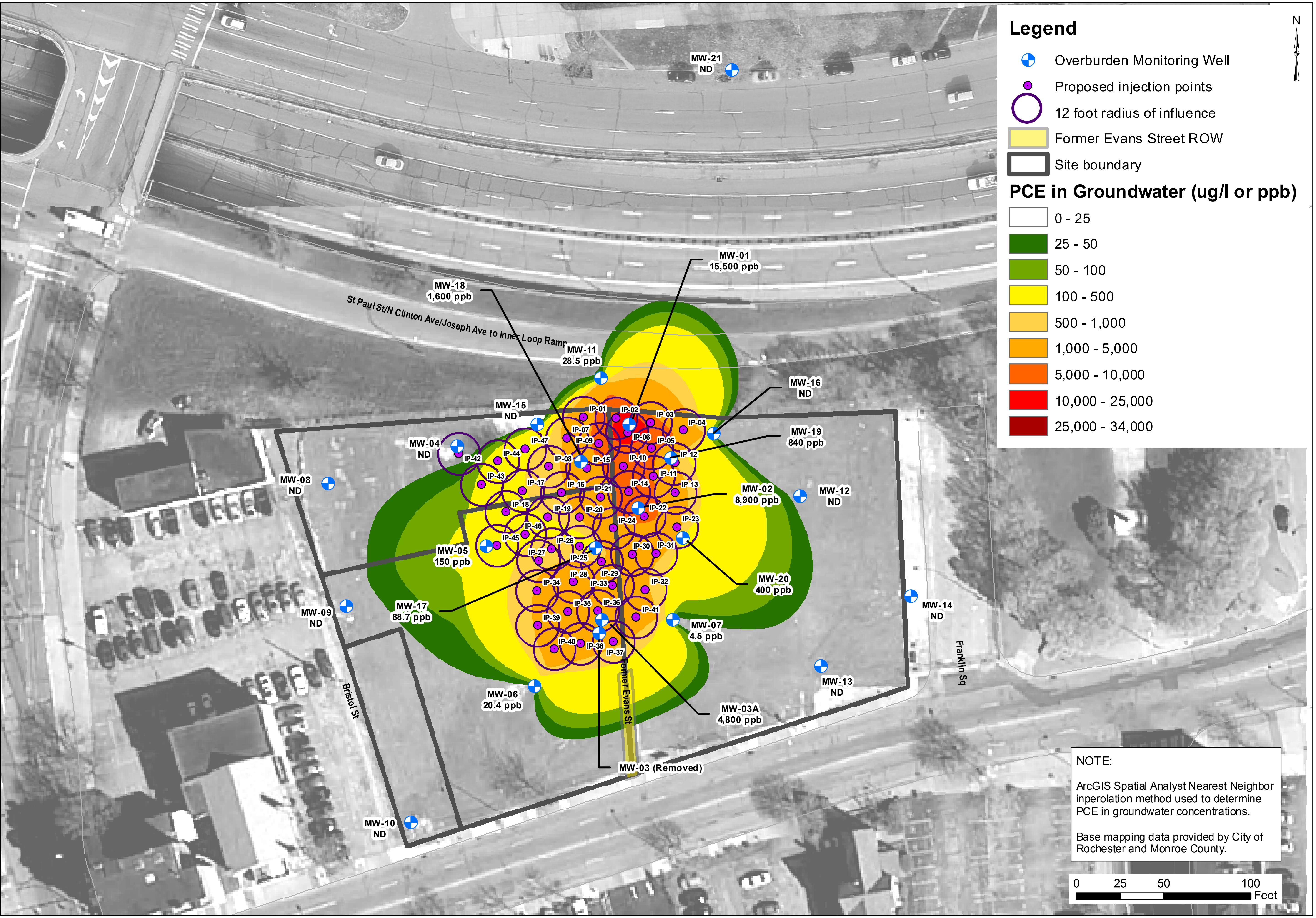
Project Title
300, 304-308, 320 ANDREWS STREET
AND 25 EVANS STREET
ROCHESTER, NEW YORK

ENVIRONMENTAL RESTORATION PROJECT NYSDEC SITE NO: E828144

Drawing Title
Peak XSD in Soil and Proposed ISCO Injection Points
assuming 12 foot Radius of Influence

Project No.
4355S-10

FIGURE 17



Legend

- Overburden Monitoring Well
- Proposed injection points
- 12 foot radius of influence
- Former Evans Street ROW
- Site boundary

PCE in Groundwater (ug/l or ppb)

- 0 - 25
- 25 - 50
- 50 - 100
- 100 - 500
- 500 - 1,000
- 1,000 - 5,000
- 5,000 - 10,000
- 10,000 - 25,000
- 25,000 - 34,000

NOTE:

ArcGIS Spatial Analyst Nearest Neighbor inperolation method used to determine PCE in groundwater concentrations.

Base mapping data provided by City of Rochester and Monroe County.

DATE	DATE DRAWN	DATE ISSUED
10-2013	10-2013	10-28-2013

DESIGNED BY	DRAWN BY	SCALE
NES	CPS	AS NOTED

day
DAY ENVIRONMENTAL, INC.
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Rochester, New York 14606
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Project Title
300, 304-308, 320 ANDREWS STREET
AND 25 EVANS STREET
ROCHESTER, NEW YORK

ENVIRONMENTAL RESTORATION PROJECT NYSDEC SITE NO.: E828144

Drawing Title
Peak PCE Concentrations Detected in September 2013 Overburden Groundwater
Samples with Proposed ISCO Injection Points assuming 12 foot Radius of Influence

Project No.
4355S-10

FIGURE 18

Document Path: E:\GIS\GIS Mapping\Andrews_Street\4355S-10Rocity - Andrews Street\Supplemental_RI_Workplan\4355S-SRI-35 -Peak PCE in Groundwater with Injection.mxd

TABLES

Table 1

300, 304-308 Andrews St and 25 Evans St
Rochester, NY
NYSDEC Site #E828144

Summary of Detected VOCs in mg/kg or ppm

Supplemental RI Soil and Fill Samples

Contaminant	**A** Unrestricted Use	**B** Restricted Residential Use	**C** Restricted Commercial Use	**D** Protection of Groundwater Use	520 MW-17 (15-16) 12/19/12	522 MW-17 (21-22) 12/19/12	532 TB-MIP-27 (19-22) 06/26/13	533 TB-MIP-27 (22-24) 06/26/13	542 MW-18 (19) 08/05/13	543 MW-18 (21) 08/05/13	544 MW-18 (25) 08/05/13	545 MW-18 (30) 08/05/13	546 MW-19 (20-22) 08/07/13
Acetone	0.05	100	500	0.05	U	U	U	U J	U	U	U	U	U
Chloroform	0.37	49	350	0.37	U	U	U	U	U	U	U	U	U
Methylcyclohexane	NA	NA	NA	NA	U	U	U	U	U	U	U	U	U
cis-1,2-Dichloroethene	0.25	100	500	0.25	U	U	U	U	U	U	U	U	U
Methylene chloride	0.05	100	500	0.05	U	U	U	0.0037 J	0.0088 J	U	U	U	U
Tetrachloroethene	1.3	19	150	1.3	**11** D AD	**6.9** D AD	0.0178	U	0.62 JD	0.0216	0.0038 J	0.0331	**7.5** JD AD
4-Methyl-2-Pentanone	NA	NA	NA	NA	U	U	U	0.0071 J	0.0152 J	0.0094 J	0.007 J	0.0104 J	0.0197 J
2-Hexanone	NA	NA	NA	NA	U	U	U	0.0073 J	U	U	U	U	U
Toluene	0.7	100	500	0.7	0.0014 J	U	U	0.0021 J	U	U	U	U	U
Trichloroethene	0.47	21	200	0.47	0.0058	U	U	U	0.0028 J	U	U	U	0.0064
Xylene (mixed)	0.26	100	200	1.6	0.0042 J	U	U	U	U	U	U	U	U
Total VOCs					11.0114	6.9	0.0178	0.0202	0.6468	0.031	0.0108	0.0435	7.5261
Total TICs (1)					0.0025 J	0.0125 J	0.0192 J	0.008 J	U	U	0.0068 J	0.0056 J	U
Total VOCs and TICs (1)					11.0139	6.9125	0.037	0.0282	0.6468	0.031	0.0176	0.0491	7.5261

Notes

U = Not Detected

NA = Not Available

VOC = Volatile Organic Compound

TIC = Tentatively Identified Compound

A = Exceeds Unrestricted Use SCO

B = Exceeds Restricted Residential Use SCO

C = Exceeds Commercial Use SCO

D =Exceeds Protection of Groundwater SCO

mg/kg = milligrams per kilogram or parts per million (ppm).

Q = Indicates LCS control criteria did not meet requirements.

DUSR APPLIED THRU SAMPLE 658 2/27/2014 jad

Soil cleanup objectives (SCO) are as referenced in 6 NYCRR Part 375-6, Remedial Program Cleanup Objectives, dated December 14, 2006.

J = Data indicates the presence of a compound that meets the identification criteria. The result is less than the quantitation limit but greater than the method detection limit. The concentration given is an approximate value.

D = The reported value is from a secondary analysis with a dilution factor. The original analysis exceeded the calibration range.

UJ = Not Detected at an estimated detection limit as qualified by the data validator.

* Duplicate of 503-RI-WALL(4)

** Duplicate of 507-RI-WALL(6)

B = Indicates the analyte was found in the blank as well as the sample.

E = Indicates the analyte's concentration exceeds the calibrated range of the instrumnet for that specific analysis.

(1) Refer to the analytical laboratory report for individual TICs detected and associated flags.

520	Sample ID
MW-17 (15-16)	Sample Location
12/19/12	Sample Date

Table 1

300, 304-308 Andrews St and 25 Evans St
Rochester, NY
NYSDEC Site #E828144

Summary of Detected VOCs in mg/kg or ppm

Supplemental RI Soil and Fill Samples

Contaminant	A Unrestricted Use	B Restricted Residential Use	C Restricted Commercial Use	D Protection of Groundwater Use	547 MW-19 (24-26) 08/07/13	548 MW-19 (28-28.4) 08/07/13	549 MW-20 (20) 08/08/13	550 MW-20 (22) 08/08/13	551 MW-20 (23) 08/08/13	552 MW-20 (26) 08/08/13	614 CS-10 (1.8) 10/09/13	615 CS-38 (2) 10/09/13	616 CS-39 (2) 10/09/13
Acetone	0.05	100	500	0.05	U	U	U	U	U	U	U	U	U
Chloroform	0.37	49	350	0.37	U	U	U	U	U	U	U	U	U
Methylcyclohexane	NA	NA	NA	NA	U	U	U	U	U	U	U	U	U
cis-1,2-Dichloroethene	0.25	100	500	0.25	U	U	U	U	U	U	0.0012 J	U	U
Methylene chloride	0.05	100	500	0.05	U	U	U	U	U	U	0.003 J	0.004 J	0.0036 J
Tetrachloroethene	1.3	19	150	1.3	0.0158	0.0542	0.0129	0.0706	0.0066	0.0095	2.2 D AD	1.1 D	0.12
4-Methyl-2-Pentanone	NA	NA	NA	NA	0.0083 J	0.0111 J	0.0056 J	0.0061 J	0.0077 J	0.0053 J	U	U	U
2-Hexanone	NA	NA	NA	NA	0.0081 J	U	U	U	U	U	U	U	U
Toluene	0.7	100	500	0.7	U	U	U	U	U	U	U	U	U
Trichloroethene	0.47	21	200	0.47	U	U	U	U	U	U	0.0064	0.0157	0.0016 J
Xylene (mixed)	0.26	100	200	1.6	U	U	U	U	U	U	U	U	U
Total VOCs					0.0322	0.0653	0.0185	0.0767	0.0143	0.0148	2.2106	1.1197	0.1252
Total TICs (1)					U	U	U	U	U	U	U	U	U
Total VOCs and TICs (1)					0.0322	0.0653	0.0185	0.0767	0.0143	0.0148	2.2106	1.1197	0.1252

Notes

U = Not Detected

NA = Not Available

VOC = Volatile Organic Compound

TIC = Tentatively Identified Compound

A = Exceeds Unrestricted Use SCO

B = Exceeds Restricted Residential Use SCO

C = Exceeds Commercial Use SCO

D =Exceeds Protection of Groundwater SCO

mg/kg = milligrams per kilogram or parts per million (ppm).

Q = Indicates LCS control criteria did not meet requirements.

DUSR APPLIED THRU SAMPLE 658 2/27/2014 jad

Soil cleanup objectives (SCO) are as referenced in 6 NYCRR Part 375-6, Remedial Program Cleanup Objectives, dated December 14, 2006.

J = Data indicates the presence of a compound that meets the identification criteria. The result is less than the quantitation limit but greater than the method detection limit. The concentration given is an

D = The reported value is from a secondary analysis with a dilution factor. The original analysis exceeded the calibration range.

UJ = Not Detected at an estimated detection limit as qualified by the data validator.

B = Indicates the analyte was found in the blank as well as the sample.

E = Indicates the analyte's concentration exceeds the calibrated range of the instrumnet for that specific analysis.

(1) Refer to the analytical laboratory report for individual TICs detected and associated flags.

547	Sample ID
MW-19 (24-26)	Sample Location
08/07/13	Sample Date

Table 1

300, 304-308 Andrews St and 25 Evans St
Rochester, NY
NYSDEC Site #E828144

Summary of Detected VOCs in mg/kg or ppm

Supplemental RI Soil and Fill Samples

Contaminant	A Unrestricted Use	B Restricted Residential Use	C Restricted Commercial Use	D Protection of Groundwater Use	618 TB-04 (0-2) 12/03/13	619 TB-04 (2-4) 12/03/13	620 TB-04 (4-6) 12/03/13	621 TB-04 (6.5-7.5) 12/03/13	622 TB-05 (1-2) 12/03/13	623 TB-05 (2-3) 12/03/13	624 TB-05 (5-6) 12/03/13	625 TB-05 (7-8) 12/03/13	626 TB-06 (0-1) 12/03/13
Acetone	0.05	100	500	0.05	U J	U J	U	U	U	0.0086 J	0.0062 J	U	U
Chloroform	0.37	49	350	0.37	U J	U J	U	U	U	U	U	U	U
Methylcyclohexane	NA	NA	NA	NA	U J	U J	U	U	U	U	U	U	U
cis-1,2-Dichloroethene	0.25	100	500	0.25	U J	U J	U	U	U	U	U	U	U
Methylene chloride	0.05	100	500	0.05	0.0163 J	0.0146 J	U J	U J	U J	0.0086 J	0.0033 J	0.003 J	0.0054 J
Tetrachloroethene	1.3	19	150	1.3	0.45 E	0.9 D	0.0024 J	0.0191	3.2 D AD	0.94 D	0.0127	0.0183	6.9 D AD
4-Methyl-2-Pentanone	NA	NA	NA	NA	U J	U J	U	U	U	U	U	U	U
2-Hexanone	NA	NA	NA	NA	U J	U J	U	U	U	U	U	U	U
Toluene	0.7	100	500	0.7	U J	U J	U	U	U	U	U	U	U
Trichloroethene	0.47	21	200	0.47	0.0253 J	0.0109 J	U	U	0.0232	0.0097	U	U	U
Xylene (mixed)	0.26	100	200	1.6	U J	U J	U	U	U	U	U	U	U
Total VOCs					0.4916	0.9255	0.0024	0.0191	3.2232	0.9669	0.0222	0.0213	6.9054
Total TICs (1)					0.006 J	U	0.0095 J	U	U	U	U	U	0.0022 J
Total VOCs and TICs (1)					0.4976	0.9255	0.0119	0.0191	3.2232	0.9669	0.0222	0.0213	6.9076

Notes

U = Not Detected NA = Not Available VOC = Volatile Organic Compound TIC = Tentatively Identified Compound

A = Exceeds Unrestricted Use SCO B = Exceeds Restricted Residential Use SCO C = Exceeds Commercial Use SCO D =Exceeds Protection of Groundwater SCO

mg/kg = milligrams per kilogram or parts per million (ppm). Q = Indicates LCS control criteria did not meet requirements. DUSR APPLIED THRU SAMPLE 658 2/27/2014 jad

Soil cleanup objectives (SCO) are as referenced in 6 NYCRR Part 375-6, Remedial Program Cleanup Objectives, dated December 14, 2006.

J = Data indicates the presence of a compound that meets the identification criteria. The result is less than the quantitation limit but greater than the method detection limit. The concentration given is an

D = The reported value is from a secondary analysis with a dilution factor. The original analysis exceeded the calibration range.

UJ = Not Detected at an estimated detection limit as qualified by the data validator.

B = Indicates the analyte was found in the blank as well as the sample. E = Indicates the analyte's concentration exceeds the calibrated range of the instrumnet for that specific analysis.

(1) Refer to the analytical laboratory report for individual TICs detected and associated flags.

618	Sample ID
TB-04 (0-2)	Sample Location
12/03/13	Sample Date

Table 1

300, 304-308 Andrews St and 25 Evans St
Rochester, NY
NYSDEC Site #E828144

Summary of Detected VOCs in mg/kg or ppm

Supplemental RI Soil and Fill Samples

Contaminant	A Unrestricted Use	B Restricted Residential Use	C Restricted Commercial Use	D Protection of Groundwater Use	627 TB-06 (2-4) 12/03/13	628 TB-06 (4-6) 12/03/13	629 TB-06 (6-8) 12/03/13	630 TB-07 (1-2) 12/03/13	631 TB-07 (2-4) 12/03/13	632 TB-07 (4-6) 12/03/13	633 TB-07 (6-7) 12/03/13	634 TB-07 (7-8) 12/03/13	636 TB-08 (0-2) 12/03/13
Acetone	0.05	100	500	0.05	0.0055 J	0.0034 J	0.0038 J	0.0039 J	0.0071 J	U	U	U	0.0104 J
Chloroform	0.37	49	350	0.37	U	U	U	U	U	U	U	U	U
Methylcyclohexane	NA	NA	NA	NA	U	U	U	U	U	U	U	U	U
cis-1,2-Dichloroethene	0.25	100	500	0.25	U	U	U	0.0131	0.0015 J	U	U	U	U
Methylene chloride	0.05	100	500	0.05	U J	0.0043 J	0.0036 J	0.0026 J	U J	U J	U J	U J	U J
Tetrachloroethene	1.3	19	150	1.3	0.025	0.0054 J	0.0022 J	0.93 D	0.13	0.0446	0.0144	0.0111	0.0453
4-Methyl-2-Pentanone	NA	NA	NA	NA	U	U	U	U	U	U	U	U	U
2-Hexanone	NA	NA	NA	NA	U	U	U	U	U	U	U	U	U
Toluene	0.7	100	500	0.7	U	U	U	U	U	U	U	U	U
Trichloroethene	0.47	21	200	0.47	U	U	U	0.0254	0.0029 J	0.0019 J	U	U	U
Xylene (mixed)	0.26	100	200	1.6	U	U	U	U	U	U	U	U	U
Total VOCs					0.0305	0.0131	0.0096	0.975	0.1415	0.0465	0.0144	0.0111	0.0557
Total TICs (1)					0.0077 J	U	U	U	U	0.0028 J	U	U	U
Total VOCs and TICs (1)					0.0382	0.0131	0.0096	0.975	0.1415	0.0493	0.0144	0.0111	0.0557

Notes

U = Not Detected
NA = Not Available
VOC = Volatile Organic Compound
TIC = Tentatively Identified Compound

A = Exceeds Unrestricted Use SCO
B = Exceeds Restricted Residential Use SCO
C = Exceeds Commercial Use SCO
D =Exceeds Protection of Groundwater SCO

mg/kg = milligrams per kilogram or parts per million (ppm).
Q = Indicates LCS control criteria did not meet requirements.
DUSR APPLIED THRU SAMPLE 658 2/27/2014 jad

Soil cleanup objectives (SCO) are as referenced in 6 NYCRR Part 375-6, Remedial Program Cleanup Objectives, dated December 14, 2006.

J = Data indicates the presence of a compound that meets the identification criteria. The result is less than the quantitation limit but greater than the method detection limit. The concentration given is an approximate

D = The reported value is from a secondary analysis with a dilution factor. The original analysis exceeded the calibration range.

UJ = Not Detected at an estimated detection limit as qualified by the data validator.

B = Indicates the analyte was found in the blank as well as the sample.
E = Indicates the analyte's concentration exceeds the calibrated range of the instrumnet for that specific analysis.

(1) Refer to the analytical laboratory report for individual TICs detected and associated flags.

627	Sample ID
TB-06 (2-4)	Sample Location
12/03/13	Sample Date

Table 1

300, 304-308 Andrews St and 25 Evans St
Rochester, NY
NYSDEC Site #E828144

Summary of Detected VOCs in mg/kg or ppm

Supplemental RI Soil and Fill Samples

Contaminant	A Unrestricted Use	B Restricted Residential Use	C Restricted Commercial Use	D Protection of Groundwater Use	637 TB-08 (2-4) 12/03/13	638 TB-08 (5-6) 12/03/13	639 TB-08 (7-8) 12/03/13	640 TB-09 (0-2) 12/03/13	641 TB-09 (3-4) 12/03/13	642 TB-09 (4-6) 12/03/13	643 TB-09 (6-8) 12/03/13	644 TB-10 (0-2) 12/03/13	645 TB-10 (2-4) 12/03/13
Acetone	0.05	100	500	0.05	0.0078 J	U	U	0.008 J	0.0055 J	U	U	U	U
Chloroform	0.37	49	350	0.37	U	U	U	U J	U	U	U	U	U
Methylcyclohexane	NA	NA	NA	NA	U	U	U	U J	U	U	U	U	U
cis-1,2-Dichloroethene	0.25	100	500	0.25	U	U	U	U J	U	U	U	U	U
Methylene chloride	0.05	100	500	0.05	U J	U J	0.0015 J	0.0031 J	U J	U J	U J	U	U
Tetrachloroethene	1.3	19	150	1.3	0.0565	0.0167	0.0031 J	0.42 D	0.0247	0.008	0.0176	0.05	0.0423
4-Methyl-2-Pentanone	NA	NA	NA	NA	U	U	U	U J	U	U	U	U	U
2-Hexanone	NA	NA	NA	NA	U	U	U	U J	U	U	U	U	U
Toluene	0.7	100	500	0.7	U	U	U	U J	U	U	U	U	U
Trichloroethene	0.47	21	200	0.47	0.002 J	U	U	0.006 J	U	U	U	U	U
Xylene (mixed)	0.26	100	200	1.6	U	U	U	U J	U	U	U	U	U
Total VOCs					0.0663	0.0167	0.0046	0.4371	0.0302	0.008	0.0176	0.05	0.0423
Total TICs (1)					U	U	U	0.0047 J	U	U	U	U	U
Total VOCs and TICs (1)					0.0663	0.0167	0.0046	0.4418	0.0302	0.008	0.0176	0.05	0.0423

Notes

U = Not Detected

NA = Not Available

VOC = Volatile Organic Compound

TIC = Tentatively Identified Compound

A = Exceeds Unrestricted Use SCO

B = Exceeds Restricted Residential Use SCO

C = Exceeds Commercial Use SCO

D =Exceeds Protection of Groundwater SCO

mg/kg = milligrams per kilogram or parts per million (ppm).

Q = Indicates LCS control criteria did not meet requirements.

DUSR APPLIED THRU SAMPLE 658 2/27/2014 jad

Soil cleanup objectives (SCO) are as referenced in 6 NYCRR Part 375-6, Remedial Program Cleanup Objectives, dated December 14, 2006.

J = Data indicates the presence of a compound that meets the identification criteria. The result is less than the quantitation limit but greater than the method detection limit. The concentration given is an approximate value.

D = The reported value is from a secondary analysis with a dilution factor. The original analysis exceeded the calibration range.

UJ = Not Detected at an estimated detection limit as qualified by the data validator.

B = Indicates the analyte was found in the blank as well as the sample.

E = Indicates the analyte's concentration exceeds the calibrated range of the instrumnet for that specific analysis.

(1) Refer to the analytical laboratory report for individual TICs detected and associated flags.

637	Sample ID
TB-08 (2-4)	Sample Location
12/03/13	Sample Date

Table 1

300, 304-308 Andrews St and 25 Evans St
Rochester, NY
NYSDEC Site #E828144

Summary of Detected VOCs in mg/kg or ppm

Supplemental RI Soil and Fill Samples

Contaminant	A Unrestricted Use	B Restricted Residential Use	C Restricted Commercial Use	D Protection of Groundwater Use	646 TB-10 (4-6) 12/03/13	647 TB-10 (7-8) 12/03/13	649 TB-11 (0-2) 12/03/13	650 TB-11 (3-4) 12/03/13	651 TB-12 (0-2) 12/03/13	652 TB-12 (2-4) 12/03/13	653 TB-14 (0-2) 12/03/13	654 TB-14 (2-4) 12/03/13
Acetone	0.05	100	500	0.05	U	U	0.0357	0.0337	0.0311	0.0338	0.031	0.0327
Chloroform	0.37	49	350	0.37	U	U	U	U	U	U	U	U
Methylcyclohexane	NA	NA	NA	NA	U	U	U	U	U	U	U	U
cis-1,2-Dichloroethene	0.25	100	500	0.25	U	U	U	U	U	U	U	U
Methylene chloride	0.05	100	500	0.05	U	U	0.0037 J	U	0.0026 J	U	0.0015 J	U
Tetrachloroethene	1.3	19	150	1.3	0.0023 J	0.0047 J	0.74 D	0.0131	0.0187	0.0566	0.0137	0.0114
4-Methyl-2-Pentanone	NA	NA	NA	NA	U	U	2.9 J	0.022 J	U J	0.0215 J	0.0205 J	0.0213 J
2-Hexanone	NA	NA	NA	NA	U	U	U	0.0278 J	U J	0.0268 J	0.0255 J	0.0265 J
Toluene	0.7	100	500	0.7	U	U	0.0018 J	U	0.0066	0.0049 J	U	U
Trichloroethene	0.47	21	200	0.47	U	U	U	U	0.0016 J	0.002 J	U	U
Xylene (mixed)	0.26	100	200	1.6	U	U	U	U	0.0011 J	U	U	U
Total VOCs					0.0023	0.0047	3.6812	0.0966	0.0617	0.1456	0.0922	0.0919
Total TICs (1)					U	U	U	U	0.0049 J	U	U	U
Total VOCs and TICs (1)					0.0023	0.0047	3.6812	0.0966	0.0666	0.1456	0.0922	0.0919

Notes

U = Not Detected

NA = Not Available

VOC = Volatile Organic Compound

TIC = Tentatively Identified Compound

A = Exceeds Unrestricted Use SCO

B = Exceeds Restricted Residential Use SCO

C = Exceeds Commercial Use SCO

D =Exceeds Protection of Groundwater SCO

mg/kg = milligrams per kilogram or parts per million (ppm).

Q = Indicates LCS control criteria did not meet requirements.

DUSR APPLIED THRU SAMPLE 658 2/27/2014 jad

Soil cleanup objectives (SCO) are as referenced in 6 NYCRR Part 375-6, Remedial Program Cleanup Objectives, dated December 14, 2006.

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D = The reported value is from a secondary analysis with a dilution factor. The original analysis exceeded the calibration range.

UJ = Not Detected at an estimated detection limit as qualified by the data validator.

B = Indicates the analyte was found in the blank as well as the sample.

E = Indicates the analyte's concentration exceeds the calibrated range of the instrumnet for that specific analysis.

(1) Refer to the analytical laboratory report for individual TICs detected and associated flags.

646	Sample ID
TB-10 (4-6)	Sample Location
12/03/13	Sample Date

Table 2

300, 304-308 and 320 Andrews Street and 25 Evans Street
Rochester, New York
NYSDEC Site #E828144

Summary of Detected VOCs in ug/m^3

On-Site Soil Vapor Survey Samples

Detected Constituent	NYSDOH Air Guidance Value (ug/m3)$^{(1)}$	NYSDOH Outdoor (ug/m3)$^{(2)}$	535-SV-1	536-SV-2	537-SV-3	538-SV-4	539-SV-5	540-BG071813 Outdoor Air
			7/18/2013	7/18/2013	7/18/2013	7/18/2013	7/18/2013	7/18/2013
1,1,1-Trichloroethane	NA	0.6	0.33 J	1.53 J	0.82 J	0.87 J	16.9	U
1,1,2-Trichlorotrifluoroethane	NA	2.5	1.23 J	1 J	1.15 J	0.92 J	2.68 J	0.84 J
1,2,4-Trimethylbenzene	NA	1.9	U	26.6	31.5	15.2	32	**25.6**
1,3,5-Trimethylbenzene	NA	0.7	U	10.3	12.3	8.85	12.8	**8.85**
1,4-Dichlorobenzene	NA	0.5	U	0.96 J	1.32 J	U	0.96 J	**1.02 J**
2-Butanone (MEK)	NA	5.3	4.13	58.4 D	101 D	97 D	72.8 D	**36.6**
4-Ethyltoluene	NA	NA	U	10.8	12.8	7.37	13.3	9.83
4-Methyl-2-Pentanone (MIBK)	NA	0.5	U	4.92	U	U	U	**2.38**
Acetone	NA	30	57.2 D*	2232 D	2850 D	1187 D	1496 D	**1449 D**
Benzene	NA	4.8	7.67	8.95	32.6	57.2 D	38.7	2.2
Carbon Disulfide	NA	NA	0.37 J	46.4	163 D	71 D	44.2 D	3.74
Carbon Tetrachloride	NA	1.2	0.44 J	0.31 J	0.38 J	0.44 J	0.38 J	0.57 J
Chloroethane	NA	0.4	U	0.45 J	0.5 J	0.66 J	0.42 J	U
Chloroform	NA	0.5	U	160 D	31.2	129 D	6.35	**0.63 J**
Chloromethane	NA	4.3	2.68	0.81 J	1.55	1.96	1.14	1.78
cis-1,2-Dichloroethene	NA	0.4	0.4 J	U	U	0.48 J	U	U
Cyclohexane	NA	0.9	1.65 J	24.8	155 D	102 D	97.1 D	**16.9**
Dichlorodifluoromethane	NA	10	6.43 J	2.42 J	3.96	1.73 J	9.4	4.35
Ethylbenzene	NA	1.0	U	5.21	10.4	14.8	8.25	**6.95**
n-Heptane	NA	4.5	U	42.6	261 D	359 D	144 D	**14.8**
Hexane	NA	2.2	3.28	40.5	332 D	352 D	226 D	**10.9**
m/p-Xylene	NA	1.0	U	15.2	37.4	46.9	30	**16.9**
Methylene Chloride	60	1.6	11.8	49.3	95.9 D	110 D	82 D	**69.8 D**
o-Xylene	NA	1.2	U	6.52	13	14.8	10.9	**7.38**
Styrene	NA	0.5	U	9.79	13.2	7.24	10.2	**10.6**
tert-Butyl alcohol	NA	NA	U	25.8	51.2 D	38.2	76.4 D	25.8
Tetrachloroethene	30	0.7	U	188 D	244 D	881 D	362 D	**92.2**
Tetrahydrofuran	NA	0.4	1.89	7.37	13.3	43.9	15.9	**10**
Toluene	NA	5.1	0.94 J	167 D	199 D	223 D	158 D	**297 D**
Trichloroethene	5	0.4	U	0.86 J	1.83 J	2.85	1.02 J	**1.56 J**
Trichlorofluoromethane	NA	5.1	1.91 J	9.55	4.72	5.39	58.4	2.25 J
Vinyl Chloride	NA	0.4	U	0.38 J	0.38 J	0.31 J	0.41 J	U

U = Not detected at concentration above analytical laboratory reporting limit. NA = Not Available. VOCs = Volatile Organic Compounds

(1) Air guidance value referenced in the NYSDOH document titled "Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York" dated October 2006.

(2) Outdoor Air Upper Fence value referenced in Table C1 of the NYSDOH document titled "Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York" dated October 2006. Outdoor air values that exceed are **bolded**.

No NYSDOH criteria is available for soil vapor samples

The results of a DUSR have been incorporated

* = Value outside QC limits

J = Estimated value

D = Compound identified in an analysis at a secondary dilution factor

535-SV-1	Sample ID / Sample Location
7/18/2013	Sample Date

Table 3

300, 304-308 and 320 Andrews Street and 25 Evans Street
Rochester, New York
NYSDEC Site #E828144

Summary of Detected VOCs in ug/m^3

Off-Site Soil Vapor Survey Samples

Acetone	NYSDOH Air Guidance Value (ug/m3)(1)	NYSDOH Outdoor (ug/m3)(2)	657-SV-6	656-SV-7	655-SV-8	658-BG012414 Outdoor Air
			1/24/2014	1/24/2014	1/24/2014	1/24/2014
1,1,1-Trichloroethane	NA	0.6	0.49 J	UJ	U	U
1,1,2-Trichlorotrifluoroethane	NA	2.5	0.84 J	UJ	U	1 J
1,2,4-Trimethylbenzene	NA	1.9	38.4	UJ	11.8	U
1,3,5-Trimethylbenzene	NA	0.7	16.7	UJ	6.39	U
2-Butanone (MEK)	NA	5.3	4.72	UJ	2.42	U
2,2,4-Trimethylpentane	NA	NA	U	UJ	U	0.28 J
4-Ethyltoluene	NA	NA	15.2	UJ	5.41	U
4-Methyl-2-Pentanone (MIBK)	NA	0.5	3.93	UJ	U	U
Acetone	NA	30	U	29.5 D	220 D	10.9
Benzene	NA	4.8	47.9	UJ	23	0.48 J
Carbon Disulfide	NA	NA	27.1	UJ	7.47	U
Carbon Tetrachloride	NA	1.2	0.44 J	UJ	U	0.63 J
Chloroform	NA	0.5	4.79	UJ	1.12 J	U
Chloromethane	NA	4.3	0.23 J	0.7 J	0.29 J	1.16
Cyclohexane	NA	0.9	11.7	UJ	51.3 D	U
Dichlorodifluoromethane	NA	10	3.02	2.92 J	3.26	3.26
Ethylbenzene	NA	1.0	18.2	UJ	9.12	U
n-Heptane	NA	4.5	34.4	UJ	97.5 D	U
Hexane	NA	2.2	37.7 D	UJ	133 D	U
m/p-Xylene	NA	1.0	69.5	UJ	46.0	U
o-Xylene	NA	1.2	30.4	UJ	17.8	U
Styrene	NA	0.5	0.6 J	UJ	U	U
Tetrachloroethene	30	0.7	2.71 J	UJ	1.7 J	U
Toluene	NA	5.1	35.8 D	UJ	56.2	0.79 J
Trichloroethene	5	0.4	0.32 J	UJ	U	U
Trichlorofluoromethane	NA	5.1	1.63 J	1.01 J	1.4 J	1.91 J

U = Not detected at concentration above analytical laboratory reporting limit. NA = Not Available. VOCs = Volatile Organic Compounds

(1) Air guidance value referenced in the NYSDOH document titled "Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York"

(2) Outdoor Air Upper Fence value referenced in Table C1 of the NYSDOH document titled "Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York" dated October 2006.

No NYSDOH criteria is available for soil vapor samples

The results of a DUSR have been incorporated

J = Estimated value

D = Compound identified in an analysis at a secondary dilution factor

B = Analyte found in assiciated method blank

657-SV-6	Sample ID / Sample Location
1/24/2014	Sample Date

Table 4

300, 304-308 Andrews St and 25 Evans St
Rochester, NY
NYSDEC Site #E828144

Summary of Detected VOCs in ug/L or ppb

Supplemental RI Overburden Groundwater Samples

Contaminant	CAS Number	X Groundwater Standard or Guidance Value	597 MW-01 9/5/13 PDB 17.0 ft	598 MW-01 9/5/13 PDB 23.0 ft	599 MW-01 9/5/13 PDB 24.5 ft	601 MW-02 9/5/13 PDB 17.0 ft	602 MW-02 9/5/13 PDB 22.0 ft	603 MW-02 9/5/13 PDB 25.5 ft	525 MW-03A 2/1/13 PDB 22-23 ft	575 MW-03A 9/5/13 PDB 17.0 ft	576 MW-03A 9/5/13 PDB 22.0 ft	577 MW-03A 9/5/13 PDB 28.0 ft	565 MW-04 9/5/13 PDB 23.0 ft
1,1-Dichloroethane	75-34-3	5	U	U	U	U	U	U	U	U	U	U	U
1,1-Dichloroethene	75-35-4	5	U	U	U	U	U	U	U	U	U	U	U
2-Butanone	78-93-3	50	U	U	U	U	U	U	U	U	U	U	U
Acetone	67-64-1	50	R	R	R	R	R	R	10.3	R	R	R	R
Benzene	71-43-2	1	U	U	U	U	U	U	U	0.37 J	U	U	U
Chloroform	67-66-3	7	U	U	U	U	U	U	1.5	0.62 J	0.66 J	0.66 J	U
Chloromethane	74-87-3	5	U	U	U	U	U	U	U	U	U	U	U
Cis-1,2-Dichloroethene	156-59-2	5	**19.3 X**	**220 E X**	**69 JD X**	**8.1 X**	**51.7 X**	**49.5 X**	**9.9 X**	**71.6 X**	**75.3 X**	**78.7 X**	U
Methyl tert-butyl Ether	1634-04-4	10	U	U	U	U	U	U	U	U	U	U	U
Methylene chloride	75-09-2	5	U	U	U	U	U	U	U	U	U	U	U
trans-1,2-Dichloroethene	156-60-5	5	U	1.7	1.7	U	0.68 J	2.9	1.1	1.1	1.2	1.2	U
Tetrachloroethene	127-18-4	5	**1400 D X**	**15500 D X**	**9300 D X**	**460 D X**	**8900 D X**	**8400 D X**	**9600 D X**	**4800 D X**	**4300 D X**	**1700 D X**	U
Toluene	108-88-3	5	U	U	U	U	U	U	U	U	U	U	U
Trichloroethene	79-01-6	5	**21.8 X**	**190 JD X**	**200 D X**	**16.3 X**	**140 X**	**190 X**	**260 D X**	**190 D X**	**170 D X**	**190 X**	U
Trichlorofluoromethane	75-69-4	5	U	U	U	U	U	U	U	U	U	U	U
Vinyl Chloride	75-01-4	2	U	0.79 J	0.82 J	U	0.51 J	0.56 J	U	U	U	U	U
Carbon Disulfide	75-15-0	NA	U	U	U	U	U	U	U	0.27 J	U	U	U
Cyclohexane	110-82-7	NA	U	U	U	U	U	U	U	U	U	U	U
Bromodichloromethane	75-27-4	NA	U	U	U	U	U	U	U	U	U	U	U
Total VOCs			1441.1	15912.49	9571.52	484.4	9092.89	8642.96	9882.8	5063.96	4547.16	1970.56	U
Total TICs (1)			U	U	U	U	U	U	U	U	U	U	U
Total VOCs and TICs (1)			1441.1	15912.49	9571.52	484.4	9092.89	8642.96	9882.8	5063.96	4547.16	1970.56	U

Notes

U = Not Detected ug/L = micrograms per Liter or parts per billion (ppb). (1) Refer to the analytical laboratory report for individual TICs detected and associated flags.

UJ = Not Detected at an estimated detection limit as qualified by the data validator. VOC = Volatile Organic Compound

X = Exceeds Groundwater Standard or Guidance Value. NA = Not Available

Groundwater Standards or Guidance Values as referenced in New York State Department of Environmental Conservation (NYSDEC) Technical and Guidance Series (TOGS) 1.1.1 dated June 1998 as amended by the NYSDEC's supplemental table dated April 2000.

J = Data indicates the presence of a compound that meets the identification criteria. The result is less than the quantitation limit but greater than the method detection limit. The concentration given is an approximate value.

D = The reported value is from a secondary analysis with a dilution factor. The original analysis exceeded the calibration range. R = Rejected due to severe quality control issues

(1) Refer to the analytical laboratory report for individual TICs detected and associated flags.

134	Sample ID
MW-01	Sample Location
1/9/2012	Sample Date
LF 20.5 ft	Sample Method with Sample Collection Depth in Feet Below the Ground Surface

🟥 = Round 3 Groundwater Sample

🟩 = Round 4 Groundwater Sample

PDB - Passive Diffusion Bag TIC = Tentatively Identified Compound E = Value Exceeds Calibration Range. DUSR APPLIED THRU SAMPLE 658 2/27/2014 JAD

Based on blank sampling, acetone detected in Round 4 Groundwater Samples appears attributable to the water used in PDB samplers that was purchased from EON Products.

Table 4

300, 304-308 Andrews St and 25 Evans St
Rochester, NY
NYSDEC Site #E828144

Summary of Detected VOCs in ug/L or ppb

Supplemental RI Overburden Groundwater Samples

Contaminant	CAS Number	X Groundwater Standard or Guidance Value	567 MW-05 9/5/13 PDB 23.0 ft	568 MW-05 9/5/13 PDB 17.0 ft	569 MW-05 9/5/13 PDB 28.0 ft	571 MW-06 9/5/13 PDB 17.0 ft	572 MW-06 9/5/13 PDB 21.0 ft	573 MW-06 9/5/13 PDB 28.0 ft	608 MW-07 9/5/13 PDB 22.5 ft	561 MW-08 9/5/13 PDB 18.0 ft	559 MW-09 9/5/13 PDB 20.0 ft	557 MW-10 9/5/13 PDB 25.0 ft
1,1-Dichloroethane	75-34-3	5	U	U	U	U	U	U	U	U	U	U
1,1-Dichloroethene	75-35-4	5	U	U	U	U	U	U	U	U	U	U
2-Butanone	78-93-3	50	U	U	U	U	U	U	U	U	U	U
Acetone	67-64-1	50	R	R	R	R	R	R	R	R	R	R
Benzene	71-43-2	1	U	U	U	U	U	U	U	U	U	U
Chloroform	67-66-3	7	0.7 J	0.77 J	0.5 J	U	U	U	U	U	U	U
Chloromethane	74-87-3	5	U	U	U	U	U	U	U	U	U	U
Cis-1,2-Dichloroethene	156-59-2	5	U	U	U	U	U	U	U	U	U	U
Methyl tert-butyl Ether	1634-04-4	10	U	U	U	U	U	U	U	U	U	U
Methylene chloride	75-09-2	5	U	U	U	U	U	U	U	U	U	U
trans-1,2-Dichloroethene	156-60-5	5	U	U	U	U	U	U	U	U	U	U
Tetrachloroethene	127-18-4	5	110 X	150 X	37.1 X	20.4 X	14.9 X	6.2 X	4.5	U	U	U
Toluene	108-88-3	5	U	U	U	U	U	U	U	U	U	U
Trichloroethene	79-01-6	5	2.1	2	1.5	U	U	U	U	U	U	U
Trichlorofluoromethane	75-69-4	5	U	U	U	U	U	U	U	U	U	11 X
Vinyl Chloride	75-01-4	2	U	U	U	U	U	U	U	U	U	U
Carbon Disulfide	75-15-0	NA	U	U	U	U	U	U	U	U	U	U
Cyclohexane	110-82-7	NA	U	U	U	U	U	U	U	U	U	U
Bromodichloromethane	75-27-4	NA	U	U	U	U	U	U	U	U	U	U
Total VOCs			112.8	152.77	39.1	20.4	14.9	6.2	4.5	U	U	11
Total TICs (1)			U	U	U	U	U	U	U	U	U	U
Total VOCs and TICs (1)			112.8	152.77	39.1	20.4	14.9	6.2	4.5	U	U	11

Notes

U = Not Detected ug/L = micrograms per Liter or parts per billion (ppb). (1) Refer to the analytical laboratory report for individual TICs detected and associated flags.

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D = The reported value is from a secondary analysis with a dilution factor. The original analysis exceeded the calibration range. R = Rejected due to severe quality control issues

(1) Refer to the analytical laboratory report for individual TICs detected and associated flags.

134	Sample ID	🟥	= Round 3 Groundwater Sample
MW-01	Sample Location		
1/9/2012	Sample Date	🟩	= Round 4 Groundwater Sample
LF 20.5 ft	Sample Method with Sample Collection Depth in Feet Below the Ground Surface		

PDB - Passive Diffusion Bag TIC = Tentatively Identified Compound E = Value Exceeds Calibration Range. DUSR APPLIED THRU SAMPLE 658 2/27/2014 JAD

Based on blank sampling, acetone detected in Round 4 Groundwater Samples appears attributable to the water used in PDB samplers that was purchased from EON Products.

Table 4

300, 304-308 Andrews St and 25 Evans St
Rochester, NY
NYSDEC Site #E828144

Summary of Detected VOCs in ug/L or ppb

Supplemental RI Overburden Groundwater Samples

Contaminant	CAS Number	X Groundwater Standard or Guidance Value	562 MW-11 9/5/13 PDB 15.0 ft	563 MW-11 9/5/13 PDB 10.0 ft	564 MW-11 9/5/13 PDB 21.0 ft	610 MW-12 9/5/13 PDB 21.0 ft	611 MW-13 9/5/13 PDB 15.0 ft	612 MW-14 9/5/13 PDB 22.5 ft	526 MW-15 2/1/13 PDB 22-23 ft	529 MW-D* 2/1/13 PDB 22-23 ft	585 MW-15 9/5/13 PDB 17.0 ft	586 MW-15 9/5/13 PDB 22.5 ft	587 MW-15 9/5/13 PDB 28.0 ft
1,1-Dichloroethane	75-34-3	5	U	U	U	U	U	U	U	U	U J	U J	U J
1,1-Dichloroethene	75-35-4	5	U	U	U	U	U	U	U	U	U J	U J	U J
2-Butanone	78-93-3	50	U	U	U	U	U	U	U	U	U J	U J	U J
Acetone	67-64-1	50	R	R	R	R	R	R	16.5	17.7	R	R	R
Benzene	71-43-2	1	U	U	U	U	U	U	U	U	U J	U J	U J
Chloroform	67-66-3	7	U	U	U	U	U	U	U	U	U J	U J	U J
Chloromethane	74-87-3	5	U	U	U	U	U	U	U	U	U J	U J	U J
Cis-1,2-Dichloroethene	156-59-2	5	U	U	U	U	U	U	U	U	U J	U J	U J
Methyl tert-butyl Ether	1634-04-4	10	U	U	U	U	U	U	U	U	U J	U J	U J
Methylene chloride	75-09-2	5	U	U	U	U	U	U	U	U	U J	U J	U J
trans-1,2-Dichloroethene	156-60-5	5	U	U	U	U	U	U	U	U	U J	U J	U J
Tetrachloroethene	127-18-4	5	**28.5** X	**5.1** X	**20.5** X	U	U	U	U	U	0.48 J	U J	U J
Toluene	108-88-3	5	U	U	U	U	U	U	U	U	U J	U J	U J
Trichloroethene	79-01-6	5	0.51 J	U	0.42 J	U	U	U	U	U	U J	U J	U J
Trichlorofluoromethane	75-69-4	5	U	U	U	U	U	U	U	U	U J	U J	U J
Vinyl Chloride	75-01-4	2	U	U	U	U	U	U	U	U	U J	U J	U J
Carbon Disulfide	75-15-0	NA	U	U	U	U	U	U	U	U	U J	U J	U J
Cyclohexane	110-82-7	NA	U	U	U	U	U	U	U	U	U J	U J	U J
Bromodichloromethane	75-27-4	NA	U	U	U	U	U	U	U	U	U J	U J	U J
Total VOCs			29.01	5.1	20.92	U	U	U	16.5	17.7	0.48	U	U
Total TICs (1)			U	U	U	U	U	U	U	U	U	U	U
Total VOCs and TICs (1)			29.01	5.1	20.92	U	U	U	16.5	17.7	0.48	U	U

Notes

U = Not Detected ug/L = micrograms per Liter or parts per billion (ppb). (1) Refer to the analytical laboratory report for individual TICs detected and associated flags.

UJ = Not Detected at an estimated detection limit as qualified by the data validator. VOC = Volatile Organic Compound

X = Exceeds Groundwater Standard or Guidance Value. NA = Not Available

Groundwater Standards or Guidance Values as referenced in New York State Department of Environmental Conservation (NYSDEC) Technical and Guidance Series (TOGS) 1.1.1 dated June 1998 as amended by the NYSDEC's supplemental table dated April 2000.

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D = The reported value is from a secondary analysis with a dilution factor. The original analysis exceeded the calibration range. R = Rejected due to severe quality control issues

(1) Refer to the analytical laboratory report for individual TICs detected and associated flags.

134	Sample ID	🟥	= Round 3 Groundwater Sample
MW-01	Sample Location		
1/9/2012	Sample Date	🟩	= Round 4 Groundwater Sample
LF 20.5 ft	Sample Method with Sample Collection Depth in Feet Below the Ground Surface		

PDB - Passive Diffusion Bag TIC = Tentatively Identified Compound E = Value Exceeds Calibration Range. DUSR APPLIED THRU SAMPLE 658 2/27/2014 JAD

Based on blank sampling, acetone detected in Round 4 Groundwater Samples appears attributable to the water used in PDB samplers that was purchased from EON Products.

Table 4

300, 304-308 Andrews St and 25 Evans St
Rochester, NY
NYSDEC Site #E828144

Summary of Detected VOCs in ug/L or ppb

Supplemental RI Overburden Groundwater Samples

Contaminant	CAS Number	X Groundwater Standard or Guidance Value	527 MW-16 2/1/13 PDB 22-23 ft	594 MW-16 9/5/13 PDB 17.0 ft	595 MW-16 9/5/13 PDB 22.5 ft	596 MW-16 9/5/13 PDB 28.0 ft	528 MW-17 2/1/13 PDB 18-19 ft	578 MW-17 9/5/13 PDB 14.0 ft	579 MW-17 9/5/13 PDB 17.0 ft	580 MW-17 9/5/13 PDB 24.0 ft	588 MW-18 9/5/13 PDB 17.0 ft	589 MW-18 9/5/13 PDB 21.5 ft	590 MW-18 9/5/13 PDB 28.0 ft
1,1-Dichloroethane	75-34-3	5	U	U J	U	U	U	U	U	U	U J	U J	U J
1,1-Dichloroethene	75-35-4	5	U	U J	U	U	U	U	U	U	U J	U J	U J
2-Butanone	78-93-3	50	U	U J	U	U	U	U	U	U	U J	U J	U J
Acetone	67-64-1	50	10.8	R	R	R	21.4 JD	R	R	R	R	R	R
Benzene	71-43-2	1	U	U J	U	U	U	U	U	U	U J	U J	U J
Chloroform	67-66-3	7	U	U J	U	U	U	U	U	U	U J	U J	U J
Chloromethane	74-87-3	5	U	U J	U	U	U	U	U	U	U J	U J	U J
Cis-1,2-Dichloroethene	156-59-2	5	U	U J	U	U	1.1	20.3 X	22.2 X	22.1 X	2.5 J	3.8 J	3.5 J
Methyl tert-butyl Ether	1634-04-4	10	U	U J	U	U	U	U	U	U	U J	U J	U J
Methylene chloride	75-09-2	5	U	U J	U	U	U	U	U	U	U J	U J	U J
trans-1,2-Dichloroethene	156-60-5	5	U	U J	U	U	U	U	U	U	U J	U J	U J
Tetrachloroethene	127-18-4	5	U	U J	U	U	82.6 D X	88.7 X	86.8 X	69.6 X	1100 D X	1600 D X	330 D X
Toluene	108-88-3	5	U	U J	U	U	U	U	U	U	U J	U J	U J
Trichloroethene	79-01-6	5	U	U J	U	U	3.3 JD	11.9 X	11.6 X	11.6 X	8.1 J X	8.9 J X	29.5 J X
Trichlorofluoromethane	75-69-4	5	U	U J	U	U	U	U	U	U	U J	U J	U J
Vinyl Chloride	75-01-4	2	U	U J	U	U	U	U	U	U	U J	U J	U J
Carbon Disulfide	75-15-0	NA	U	U J	U	U	U	U	U	U	U J	U J	U J
Cyclohexane	110-82-7	NA	U	U J	U	U	U	U	U	U	U J	U J	U J
Bromodichloromethane	75-27-4	NA	U	U J	U	U	U	U	U	U	U J	U J	U J
Total VOCs			10.8	U	U	U	108.4	120.9	120.6	103.3	1110.6	1612.7	363
Total TICs (1)			U	U	U	U	U	U	U	U	U	U	U
Total VOCs and TICs (1)			10.8	U	U	U	108.4	120.9	120.6	103.3	1110.6	1612.7	363

Notes

U = Not Detected ug/L = micrograms per Liter or parts per billion (ppb). (1) Refer to the analytical laboratory report for individual TICs detected and associated flags.

UJ = Not Detected at an estimated detection limit as qualified by the data validator. VOC = Volatile Organic Compound

X = Exceeds Groundwater Standard or Guidance Value. NA = Not Available

Groundwater Standards or Guidance Values as referenced in New York State Department of Environmental Conservation (NYSDEC) Technical and Guidance Series (TOGS) 1.1.1 dated June 1998 as amended by the NYSDEC's supplemental table dated April 2000.

J = Data indicates the presence of a compound that meets the identification criteria. The result is less than the quantitation limit but greater than the method detection limit. The concentration given is an approximate value.

D = The reported value is from a secondary analysis with a dilution factor. The original analysis exceeded the calibration range. R = Rejected due to severe quality control issues

(1) Refer to the analytical laboratory report for individual TICs detected and associated flags.

134	Sample ID	🟥	= Round 3 Groundwater Sample
MW-01	Sample Location		
1/9/2012	Sample Date	🟩	= Round 4 Groundwater Sample
LF 20.5 ft	Sample Method with Sample Collection Depth in Feet Below the Ground Surface		

PDB - Passive Diffusion Bag TIC = Tentatively Identified Compound E = Value Exceeds Calibration Range. DUSR APPLIED THRU SAMPLE 658 2/27/2014 JAD

Based on blank sampling, acetone detected in Round 4 Groundwater Samples appears attributable to the water used in PDB samplers that was purchased from EON Products.

Table 4

300, 304-308 Andrews St and 25 Evans St
Rochester, NY
NYSDEC Site #E828144

Summary of Detected VOCs in ug/L or ppb

Supplemental RI Overburden Groundwater Samples

Contaminant	CAS Number	X Groundwater Standard or Guidance Value	591 MW-19 9/5/13 PDB 17.0 ft	592 MW-19 9/5/13 PDB 21.0 ft	593 MW-19 9/5/13 PDB 28.0 ft	605 MW-20 9/5/13 PDB 17.0 ft	606 MW-20 9/5/13 PDB 22.0 ft	607 MW-20 9/5/13 PDB 28.0 ft	555 MW-21 9/5/13 PDB 23 ft	581 BW-03 9/5/13 PDB 10.5 ft	582 BW-01 9/5/13 PDB 10.5 ft	583 BW-02 9/5/13 PDB 10.5 ft	584 BW-04 9/5/13 PDB 10.5 ft
1,1-Dichloroethane	75-34-3	5	U J	U J	U J	U	U	U	U	U J	U J	U J	U J
1,1-Dichloroethene	75-35-4	5	U J	U J	U J	U	U	U	U	U J	U J	U J	U J
2-Butanone	78-93-3	50	U J	U J	U J	U	U	U	U	U J	U J	U J	U J
Acetone	67-64-1	50	R	R	R	R	R	R	R	R	R	R	R
Benzene	71-43-2	1	U J	U J	U J	U	U	U	U	U J	U J	U J	U J
Chloroform	67-66-3	7	U J	U J	U J	U	U	U	U	U J	U J	U J	U J
Chloromethane	74-87-3	5	U J	U J	U J	U	U	U	U	1.2 J	U J	U J	U J
Cis-1,2-Dichloroethene	156-59-2	5	1.2 J	**6 J X**	**17 J X**	0.91 J	1.1	1.1	U	**22.7 J X**	4.5 J	**29.8 J X**	**23 J X**
Methyl tert-butyl Ether	1634-04-4	10	U J	U J	U J	U	U	U	U	U J	U J	U J	U J
Methylene chloride	75-09-2	5	U J	U J	U J	U	U	U	U	U J	U J	U J	U J
trans-1,2-Dichloroethene	156-60-5	5	U J	U J	U J	U	U	U	U	0.3 J	0.83 J	U J	0.49 J
Tetrachloroethene	127-18-4	5	**7.6 J X**	**440 D X**	**840 D X**	**110 X**	**400 D X**	**200 X**	U	**66.3 J X**	**28.1 J X**	**72.9 J X**	**36 J X**
Toluene	108-88-3	5	U J	U J	U J	U	U	U	U	U J	U J	U J	U J
Trichloroethene	79-01-6	5	1.6 J	**10.8 J X**	**120 J X**	**65.6 X**	**62 X**	**53.5 X**	U	**10.9 J X**	**13 J X**	**10.8 J X**	**12.9 J X**
Trichlorofluoromethane	75-69-4	5	U J	U J	U J	U	U	U	U	U J	U J	U J	U J
Vinyl Chloride	75-01-4	2	U J	U J	U J	U	U	U	U	U J	U J	U J	U J
Carbon Disulfide	75-15-0	NA	U J	U J	U J	U	U	U	U	U J	U J	U J	U J
Cyclohexane	110-82-7	NA	U J	U J	U J	U	U	U	U	0.56 J	U J	U J	U J
Bromodichloromethane	75-27-4	NA	U J	U J	U J	U	U	U	U	0.25 J	U J	U J	U J
Total VOCs			10.4	456.8	977	176.51	463.1	254.6	U	102.21	46.43	113.5	72.39
Total TICs (1)			U	U	U	U	U	U	U	U	U	U	U
Total VOCs and TICs (1)			10.4	456.8	977	176.51	463.1	254.6	U	102.21	46.43	113.5	72.39

Notes

U = Not Detected

ug/L = micrograms per Liter or parts per billion (ppb).

(1) Refer to the analytical laboratory report for individual TICs detected and associated flags.

UJ = Not Detected at an estimated detection limit as qualified by the data validator.

VOC = Volatile Organic Compound

X = Exceeds Groundwater Standard or Guidance Value.

NA = Not Available

Groundwater Standards or Guidance Values as referenced in New York State Department of Environmental Conservation (NYSDEC) Technical and Guidance Series (TOGS) 1.1.1 dated June 1998 as amended by the NYSDEC's supplemental table dated April 2000.

J = Data indicates the presence of a compound that meets the identification criteria. The result is less than the quantitation limit but greater than the method detection limit. The concentration given is an approximate value.

D = The reported value is from a secondary analysis with a dilution factor. The original analysis exceeded the calibration range.

R = Rejected due to severe quality control issues

(1) Refer to the analytical laboratory report for individual TICs detected and associated flags.

134	Sample ID
MW-01	Sample Location
1/9/2012	Sample Date
LF 20.5 ft	Sample Method with Sample Collection Depth in Feet Below the Ground Surface

🟥 = Round 3 Groundwater Sample

🟩 = Round 4 Groundwater Sample

PDB - Passive Diffusion Bag

TIC = Tentatively Identified Compound

E = Value Exceeds Calibration Range.

DUSR APPLIED THRU SAMPLE 658 2/27/2014 JAD

Based on blank sampling, acetone detected in Round 4 Groundwater Samples appears attributable to the water used in PDB samplers that was purchased from EON Products.

Table 5

300, 304-308 Andrews St and 25 Evans St
Rochester, NY
NYSDEC Site #E828144

Summary of Detected VOCs in ug/L or ppb

Supplemental RI Bedrock Groundwater Samples

Contaminant	CAS Number	X Groundwater Standard or Guidance Value	600 MW-01R 9/5/13 PDB 39.5 ft	604 MW-02R 9/5/13 PDB 39.0 ft	566 MW-04R 9/5/13 PDB 34.0 ft	570 MW-05R 9/5/13 PDB 33.5 ft	574 MW-06R 9/5/13 PDB 39.0 ft	609 MW-07R 9/5/13 PDB 41.0 ft	560 MW-09R 9/5/13 PDB 35.0 ft	558 MW-10R 9/5/13 PDB 35.0 ft	613 MW-14R 9/5/13 PDB 41.0 ft
1,1-Dichloroethane	75-34-3	5	U	U	U	U	U	U	U	U	U
1,1-Dichloroethene	75-35-4	5	U	U	U	U	U	U	U	U	U
2-Butanone	95-50-1	50	U	U	U	U	U	U	U	U	U
Acetone	67-64-1	50	R	R	R	R	R	R	R	R	R
Benzene	71-43-2	1	U	U	U	U	U	U	U	U	U
Chloroform	67-66-3	7	U	U	U	U	U	U	U	U	U
Cis-1,2-Dichloroethene	156-59-2	5	0.78 J	2.4	0.31 J	**5.8** X	U	U	U	U	U
Methyl tert-butyl Ether	1634-04-4	10	U	U	U	U	U	U	U	U	U
Methylene chloride	75-09-2	5	U	U	U	U	U	U	0.22 J	U	U
trans-1,2-Dichloroethene	156-60-5	5	U	U	U	U	U	U	U	U	U
Tetrachloroethene	127-18-4	5	U	U	**130** X	U	0.57 J	U	U	U	U
Toluene	108-88-3	5	U	U	U	U	U	U	U	U	U
Trichloroethene	79-01-6	5	U	U	**14.1** X	U	U	U	U	U	U
Trichlorofluoromethane	75-69-4	5	U	U	U	U	U	U	U	U	U
Vinyl Chloride	75-01-4	2	1.4	1.6	0.48 J	U	U	U	U	U	U
Methycyclohexane	75-01-4	NA	U	U	U	U	U	U	U	0.38 J	U
Ethylbenzene	75-01-4	5	U	U	U	U	U	U	U	0.23 J	U
Total VOCs			2.18	4	144.89	5.8	0.57	U	0.22	0.61	U
Total TICs (1)			U	U	U	U	U	U	6.7 J	U	U
Total VOCs and TICs (1)			2.18	4	144.89	5.8	0.57	U	6.92	0.61	U

Notes

U = Not Detected

ug/L = micrograms per Liter or parts per billion (ppb).

(1) Refer to the analytical laboratory report for individual TICs detected and associated flags.

UJ = Not Detected at an estimated detection limit as qualified by the data validator.

VOC = Volatile Organic Compound

X = Exceeds Groundwater Standard or Guidance Value.

NA = Not Available

Groundwater Standards or Guidance Values as referenced in New York State Department of Environmental Conservation (NYSDEC) Technical and Guidance Series (TOGS) 1.1.1 dated June 1998 as amended by the NYSDEC's supplemental table dated April 2000.

J = Data indicates the presence of a compound that meets the identification criteria. The result is less than the quantitation limit but greater than the method detection limit. The concentration given is an approximate value.

D = The reported value is from a secondary analysis with a dilution factor. The original analysis exceeded the calibration range.

R = Rejected due to severe quality control issues

148	Sample ID
MW-01R	Sample Location
1/9/12	Sample Date
LF 39.5 ft	Sample Method with Sample Collection Depth in Feet Below the Ground Surface

▨ = Round 4 Groundwater Sample

(1) Refer to the analytical laboratory report for individual TICs detected and associated flags.

PDB = Passive Diffusion Bag

TIC = Tentatively Identified Compound

DUSR APPLIED THRU SAMPLE 658 2/27/2014 JAD

Based on blank sampling, acetone detected in Round 4 Groundwater Samples appears attributable to the water used in PDB samplers that was purchased from EON Products.

Table 6

300,304-308 Andrews Street and 25 Evans Street
Rochester, New York
NYSDEC Site #E828144

Summary of Hydraulic Conductivity Results

Monitoring Well Location	**MW-01**	**MW-03**	**MW-04**	**MW-05**	**MW-11**	**MW-01R**	**MW-04R**	**MW-05R**
Type of Well	Overburden	Overburden	Overburden	Overburden	Overburden	Bedrock	Bedrock	Bedrock
Hydraulic Conductivity (Slug-In) cm/sec	2.50×10^{-4}	2.10×10^{-4}	3.43×10^{-5}	1.22×10^{-4}	2.47×10^{-5}	1.15×10^{-4}	3.12×10^{-4}	5.30×10^{-4}
Hydraulic Conductivity (Slug-Out) cm/sec	2.39×10^{-4}	2.27×10^{-4}	2.04×10^{-5}	1.79×10^{-4}	5.16×10^{-5}	1.61×10^{-4}	6.93×10^{-4}	4.90×10^{-4}
Hydraulic Conductivity (Average) cm/sec	**2.45×10^{-4}**	**2.19×10^{-4}**	**2.74×10^{-5}**	**1.51×10^{-4}**	**3.82×10^{-5}**	**1.38×10^{-4}**	**5.03×10^{-4}**	**5.10×10^{-4}**

Table 7

300, 304-308 and 320 Andrews Street and 25 Evans Street
Rochester, New York
NYSDEC Site #E828144

ISCO Potassium Permanganate ($KMnO_4$) Injection Point Data

Injection Point ID	Top Elevation of Injection Interval (ft)	Bottom Elevation of Injection Interval (ft)	Thickness of Injection Interval (ft)	Total Amount of $KMnO_4$ to be Injected (lbs)
IP-01	507.50	502.05	5.45	340.79
IP-02	507.50	502.33	5.17	323.28
IP-03	508.00	499.70	8.30	519.00
IP-04	508.00	502.74	5.26	328.91
IP-05	513.50	499.53	13.97	873.54
IP-06	513.50	499.35	14.15	884.80
IP-07	507.50	502.11	5.39	337.04
IP-08	510.50	502.39	8.11	507.12
IP-09	513.50	502.30	11.20	700.34
IP-10	514.50	499.42	15.08	942.95
IP-11	513.50	502.63	10.87	679.70
IP-12	508.50	502.90	5.60	350.17
IP-13	513.50	502.61	10.90	681.58
IP-14	515.50	499.61	15.90	994.23
IP-15	514.50	502.42	12.08	755.36
IP-16	514.50	502.51	11.99	749.73
IP-17	508.00	502.50	5.50	343.92
IP-18	514.00	502.95	11.05	690.96
IP-19	519.00	502.87	16.14	1009.23
IP-20	520.50	499.60	20.90	1306.88
IP-21	517.00	499.56	17.44	1090.52
IP-22	514.50	502.55	11.95	747.23
IP-23	510.00	503.00	7.00	437.71
IP-24	520.50	499.69	20.82	1301.87
IP-25	520.50	499.76	20.74	1296.87
IP-26	520.50	499.97	20.53	1283.74
IP-27	517.00	503.29	13.72	857.91
IP-28	517.00	500.11	16.90	1056.76
IP-29	520.50	499.76	20.74	1296.87
IP-30	514.50	502.82	11.68	730.35
IP-31	511.00	502.97	8.03	502.12
IP-32	508.50	503.04	5.46	341.41
IP-33	517.00	502.95	14.05	878.55
IP-34	514.50	503.31	11.19	699.71
IP-35	510.50	503.17	7.33	458.34
IP-36	512.00	503.29	8.71	544.64
IP-37	515.00	503.55	11.45	715.97
IP-38	519.50	503.48	16.02	1001.73
IP-39	514.50	503.38	11.12	695.33
IP-40	519.00	503.06	15.94	996.73
IP-41	514.00	503.31	10.69	668.45
IP-42	499.33	497.33	2.00	125.06
IP-43	503.56	497.56	6.00	375.18
IP-44	503.53	497.53	6.00	375.18
IP-45	513.97	502.97	11.00	687.83
IP-46	514.50	502.87	11.64	727.85
IP-47	521.52	516.52	5.00	312.65
TOTALS			**536.16**	**33526.09**

Total Pounds of $KMnO_4$ Needed 33528.00

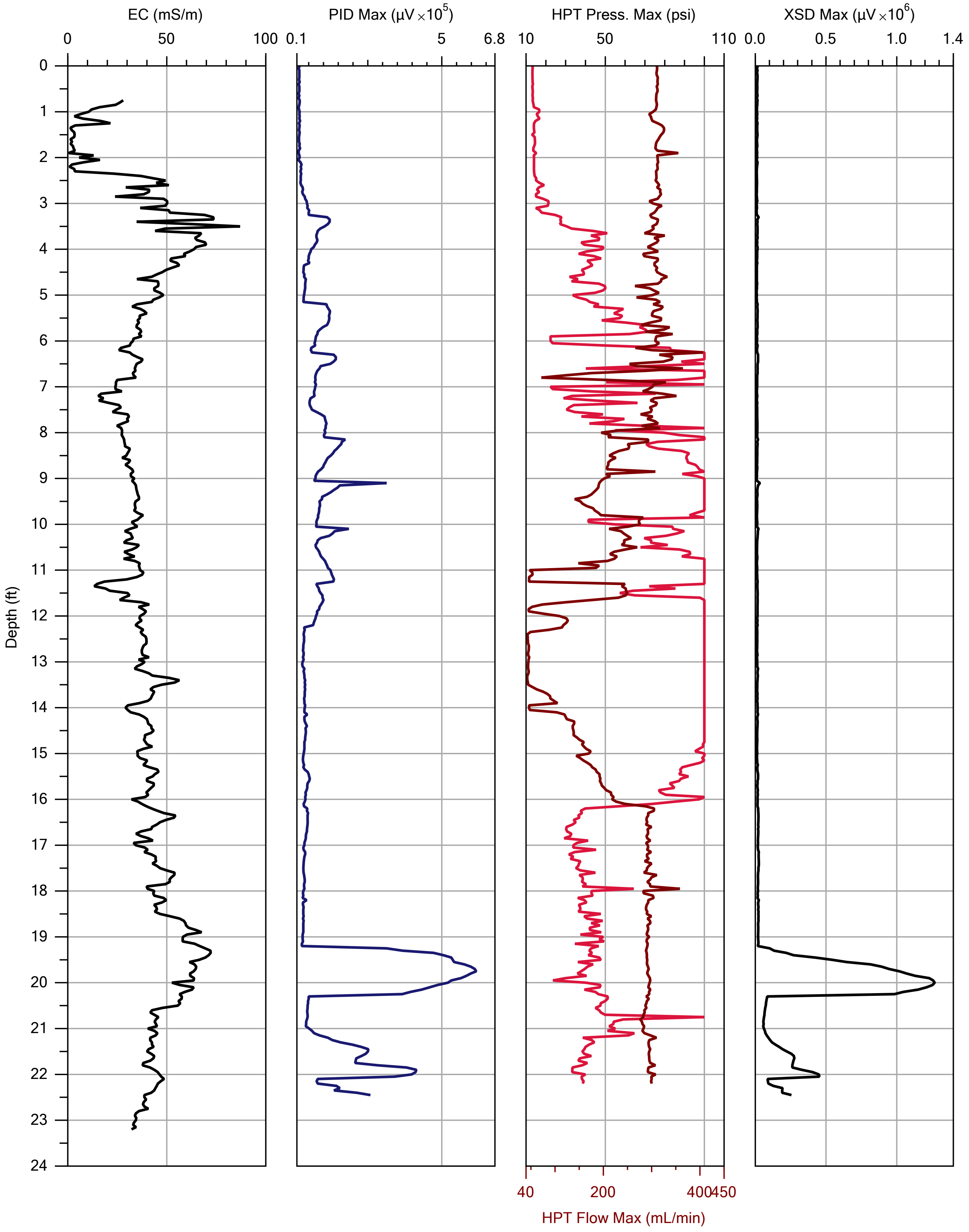
Average Pounds $KMnO_4$/foot for 12' ROI Injection Points 62.53

Total Amt. of $KMnO_4$ to be Injected = Average Pounds $KMnO_4$/foot x Thickness of Injection Interval

Enhanced injection zones must be installed at depth intervals no more than 3.5 feet apart to allow for adequate downward diffusion of $KMnO_4$ into surrounding fine grained soils, including dense glacial till.

APPENDIX A

MiHPT Logs



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By Geoprobe Systems®

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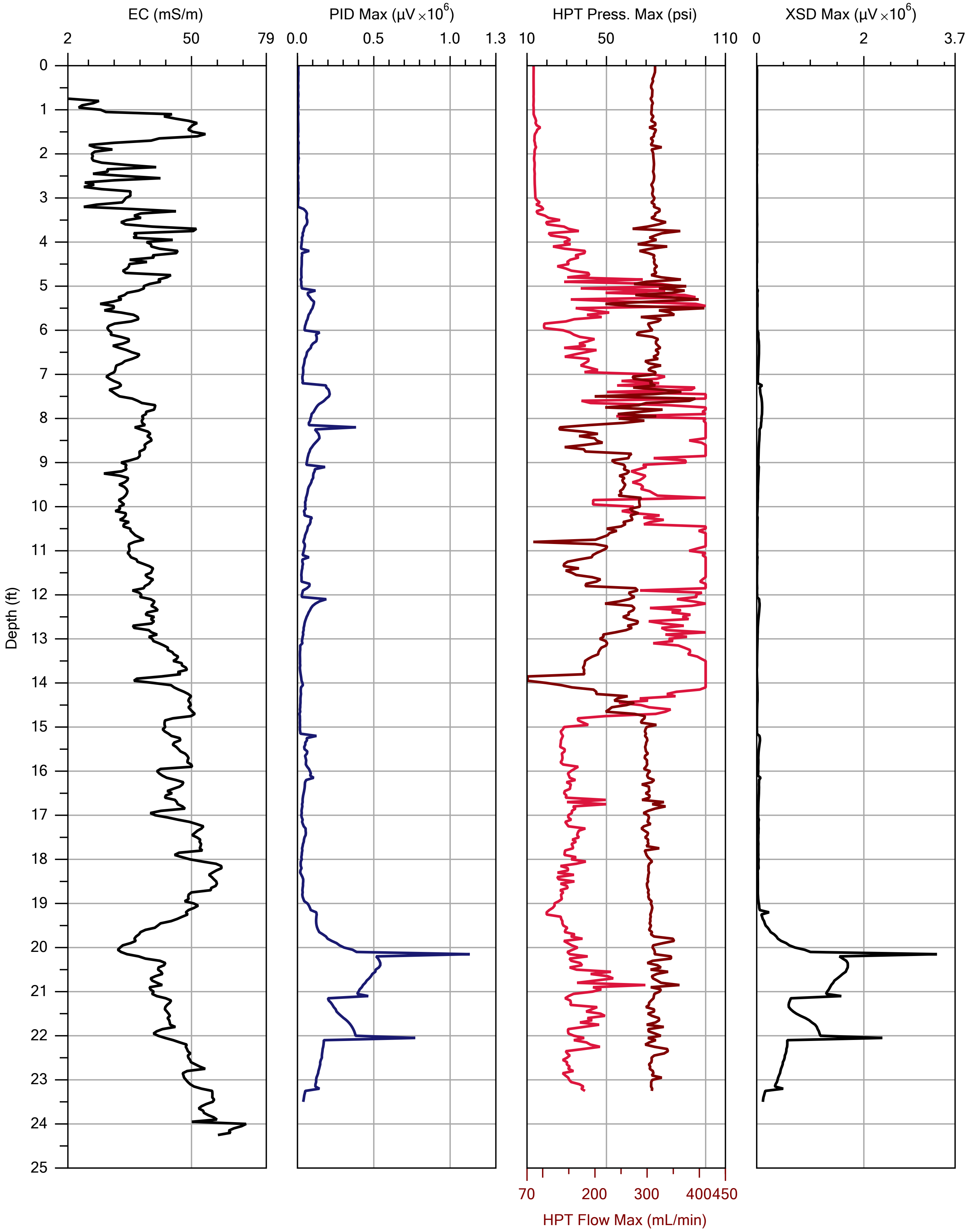

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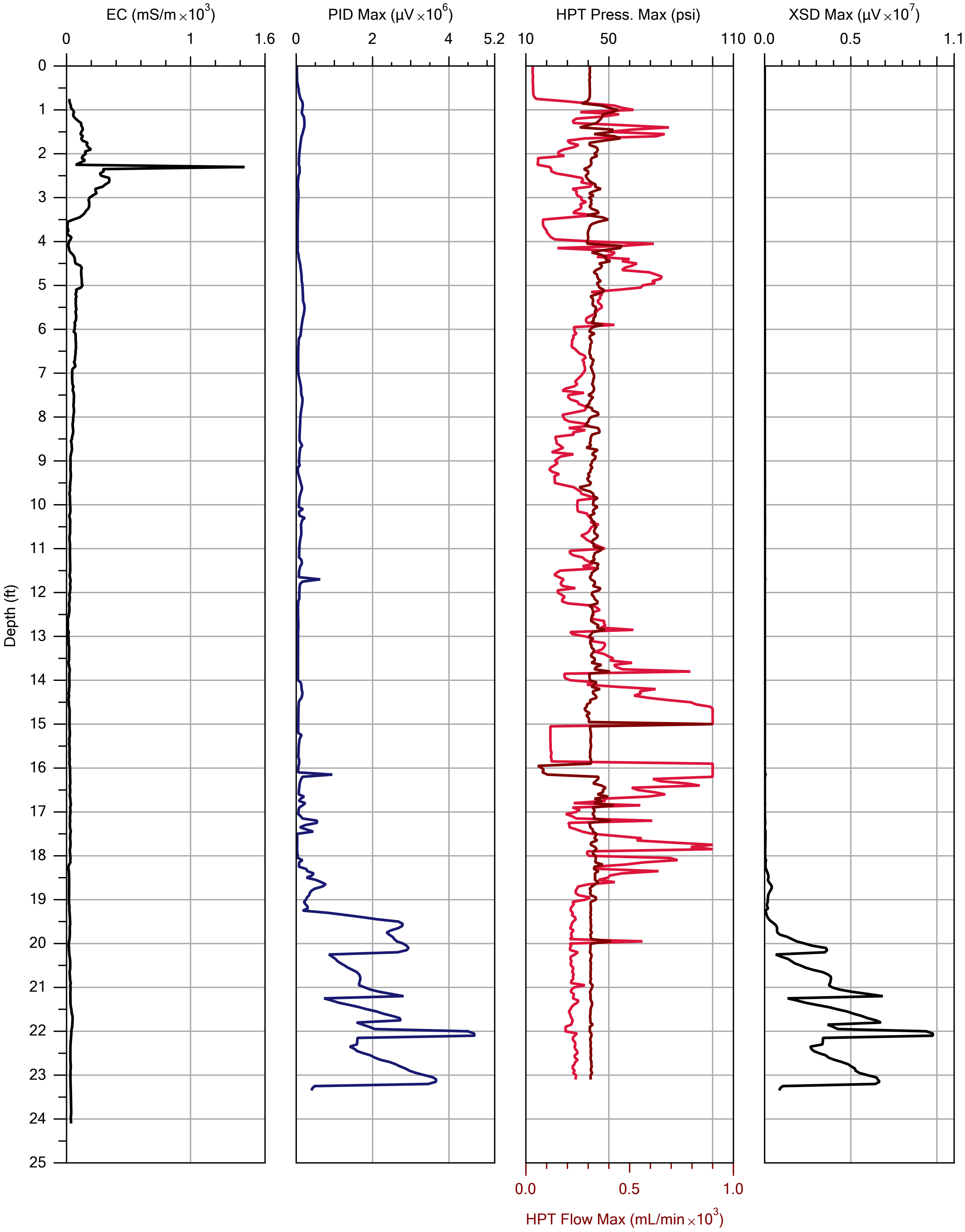

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By Geoprobe Systems®

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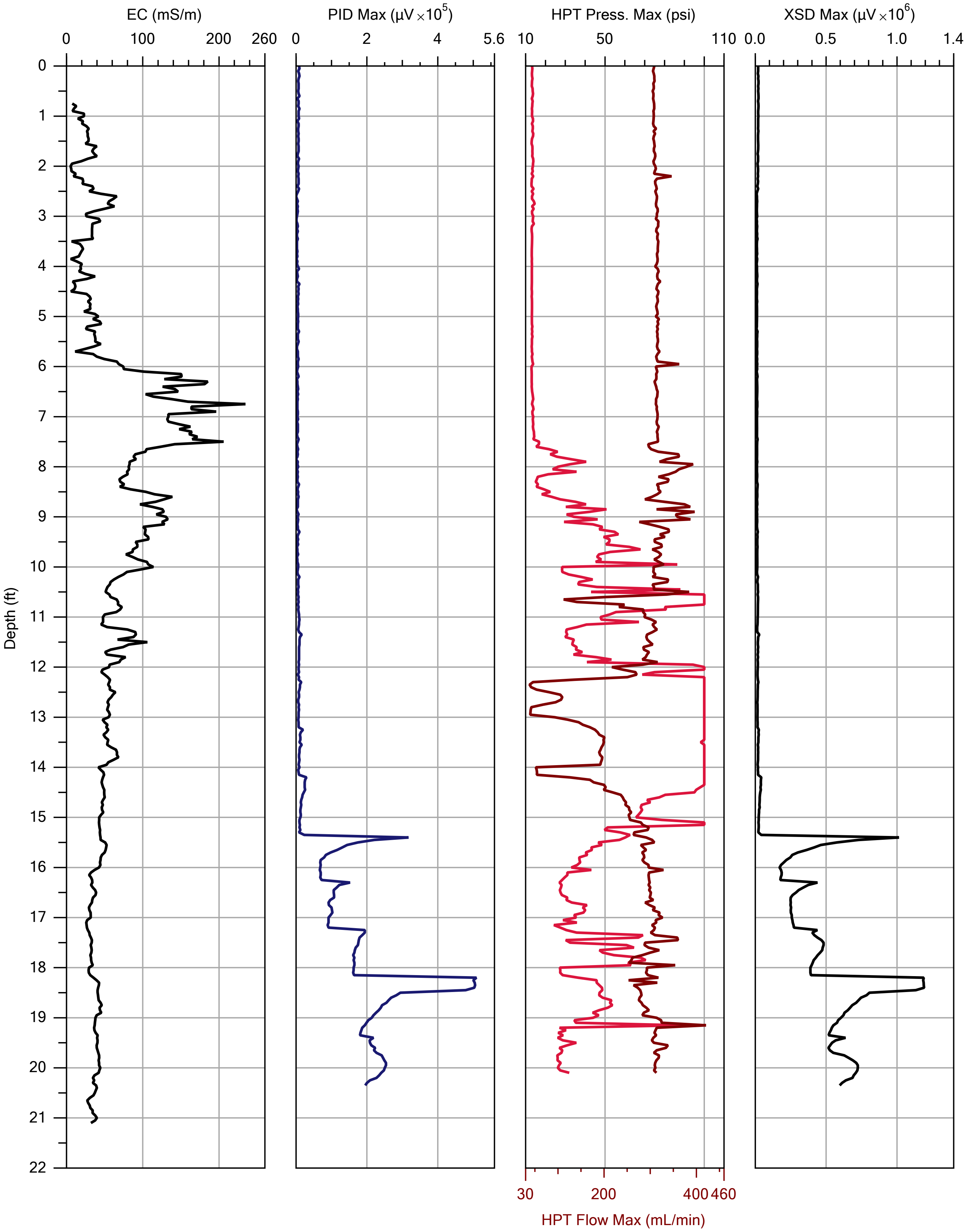

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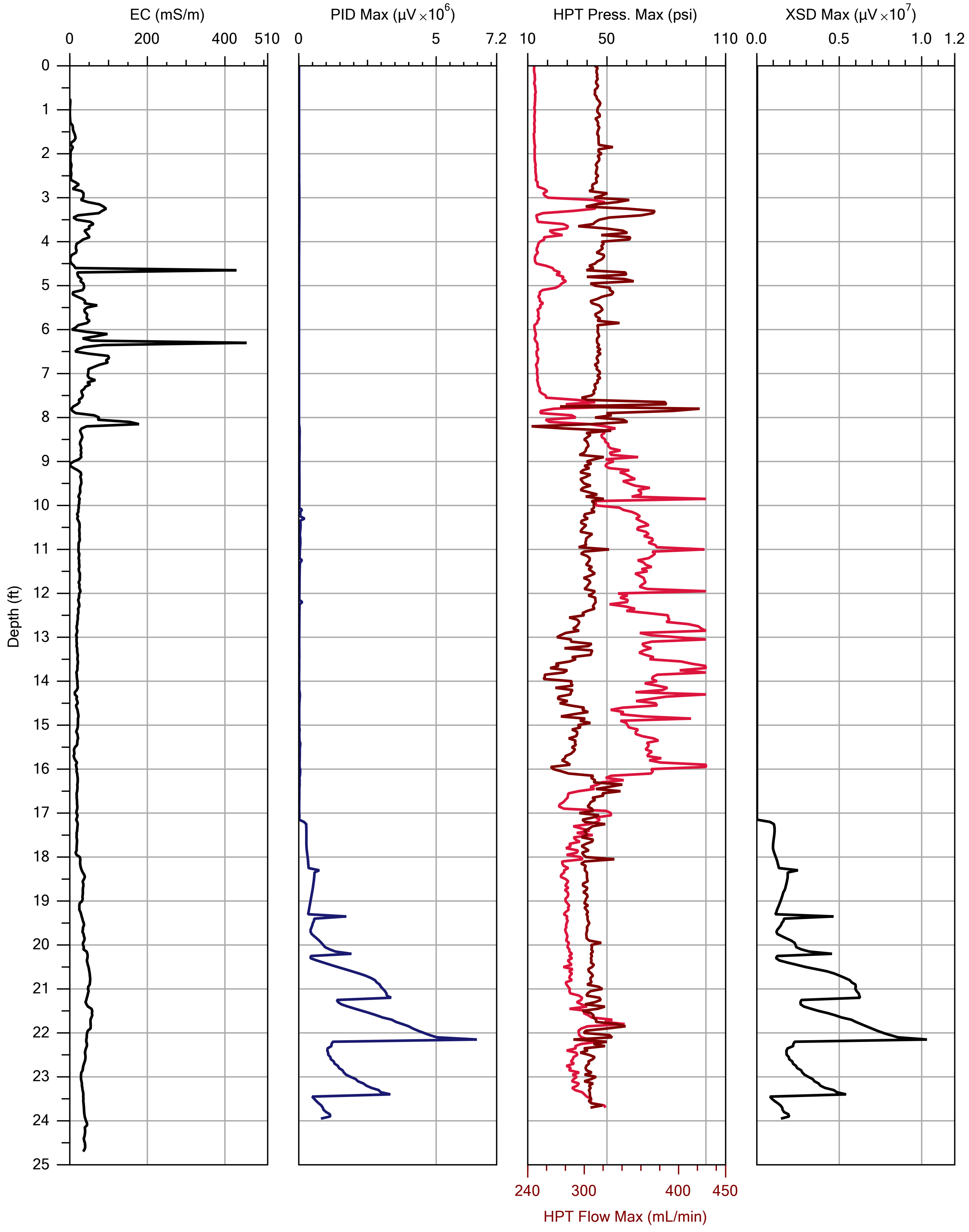

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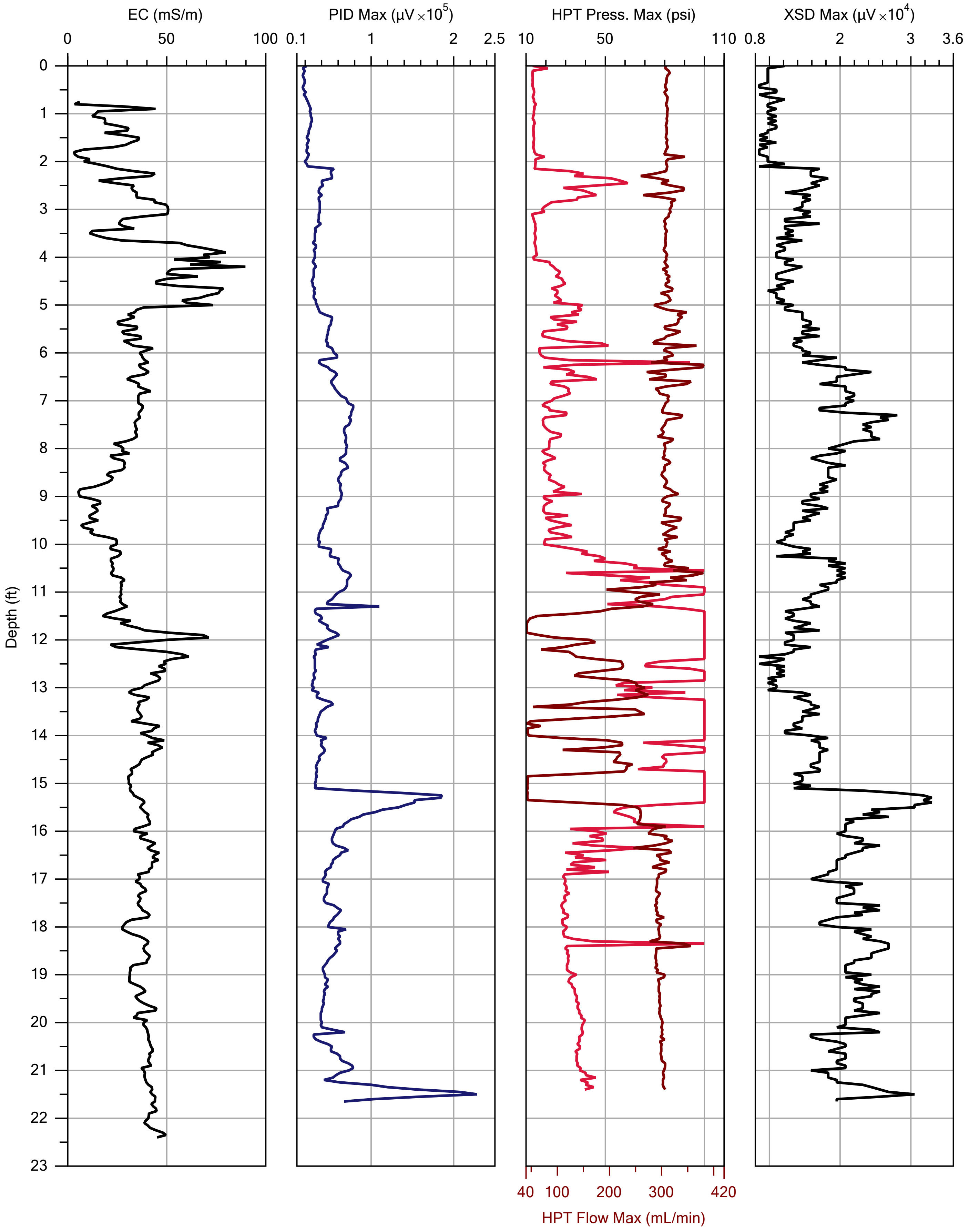

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By Geoprobe Systems®

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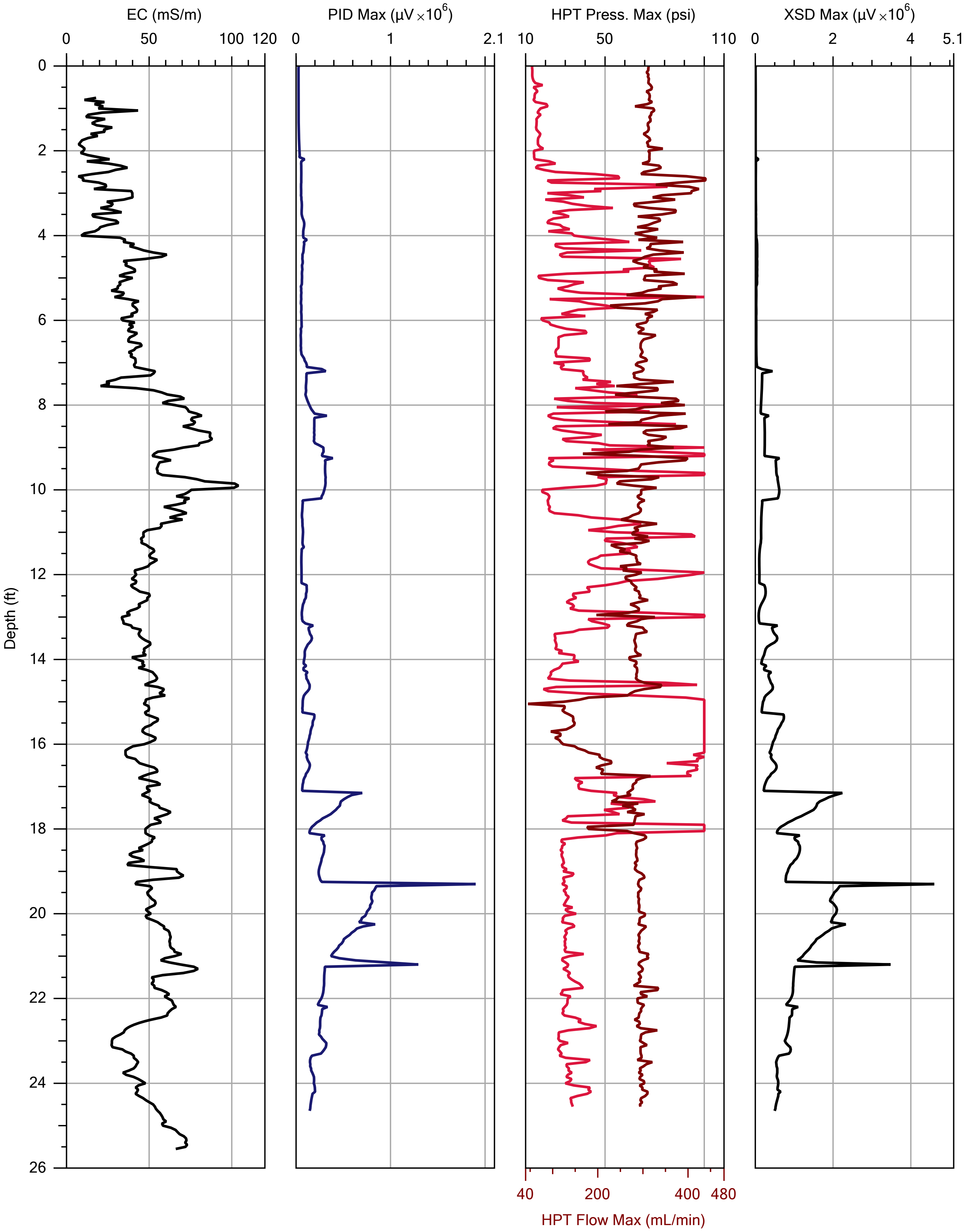

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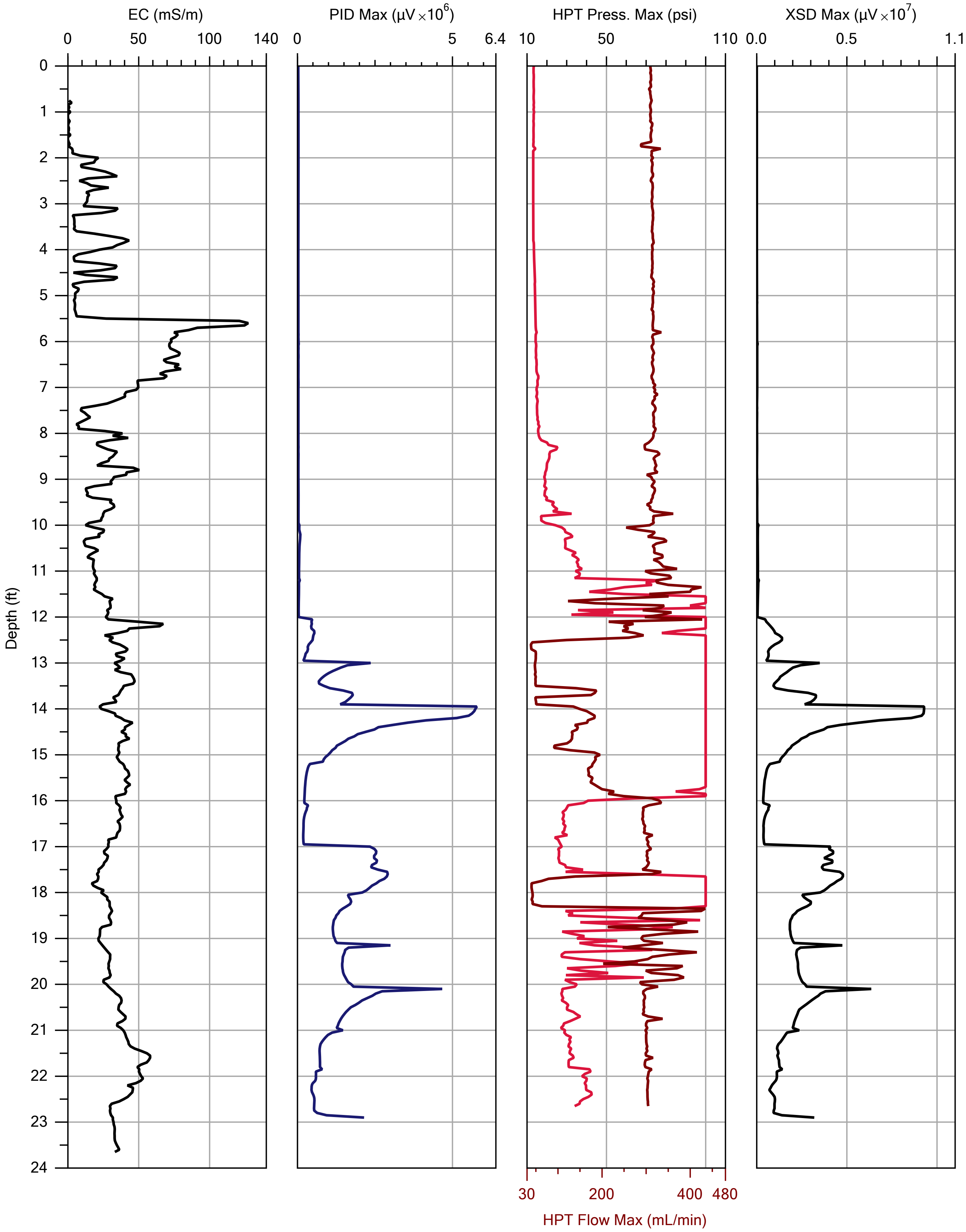

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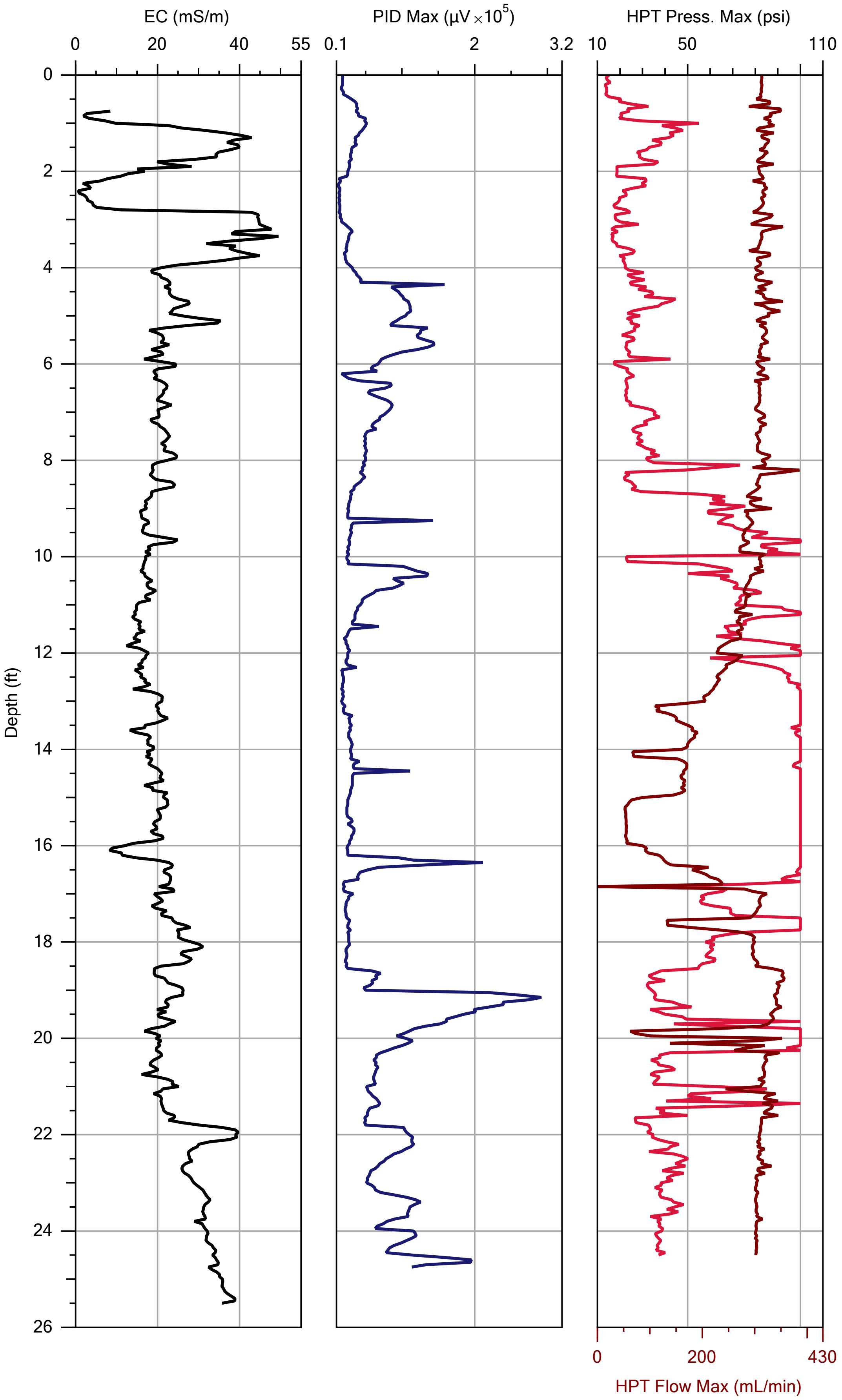

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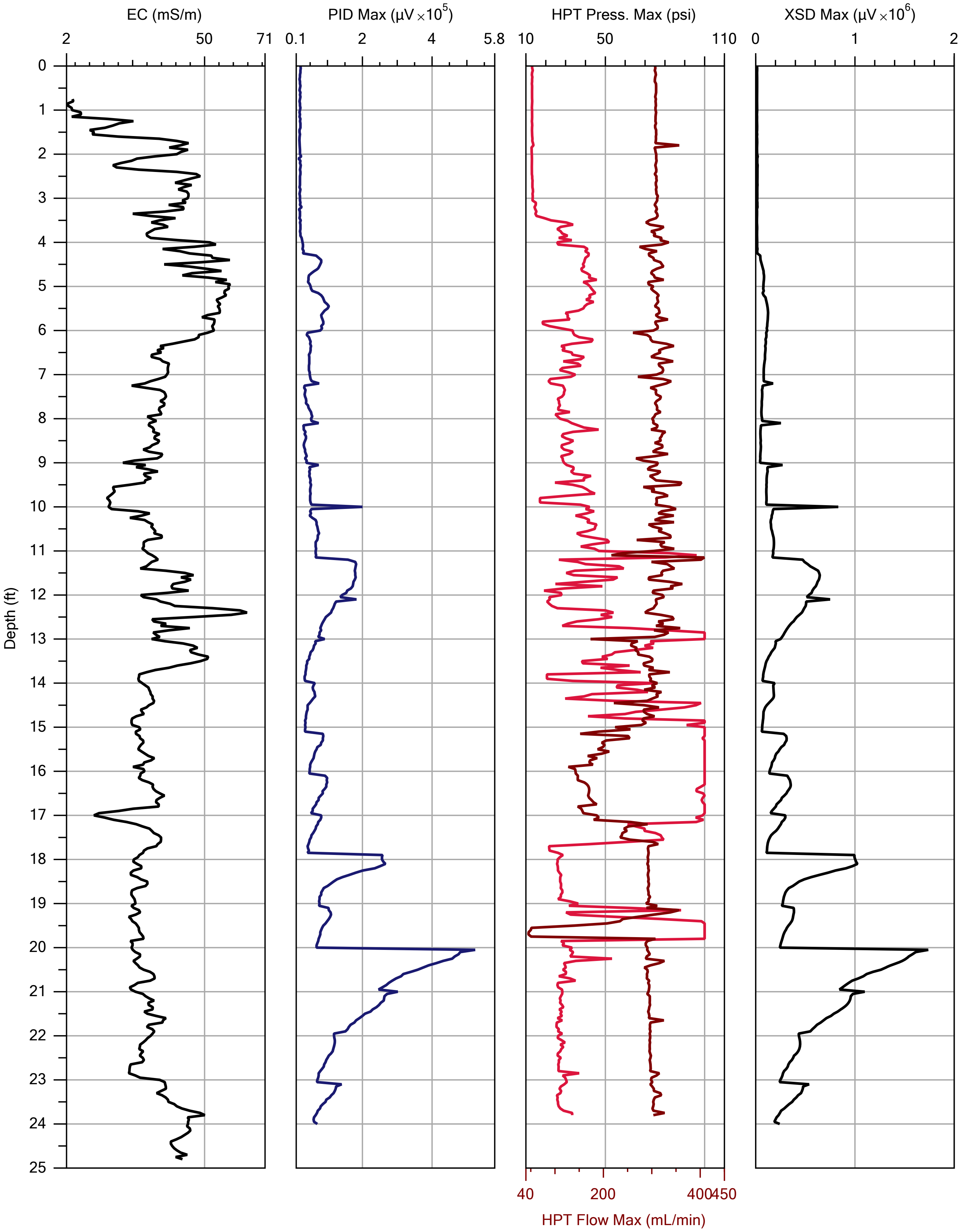

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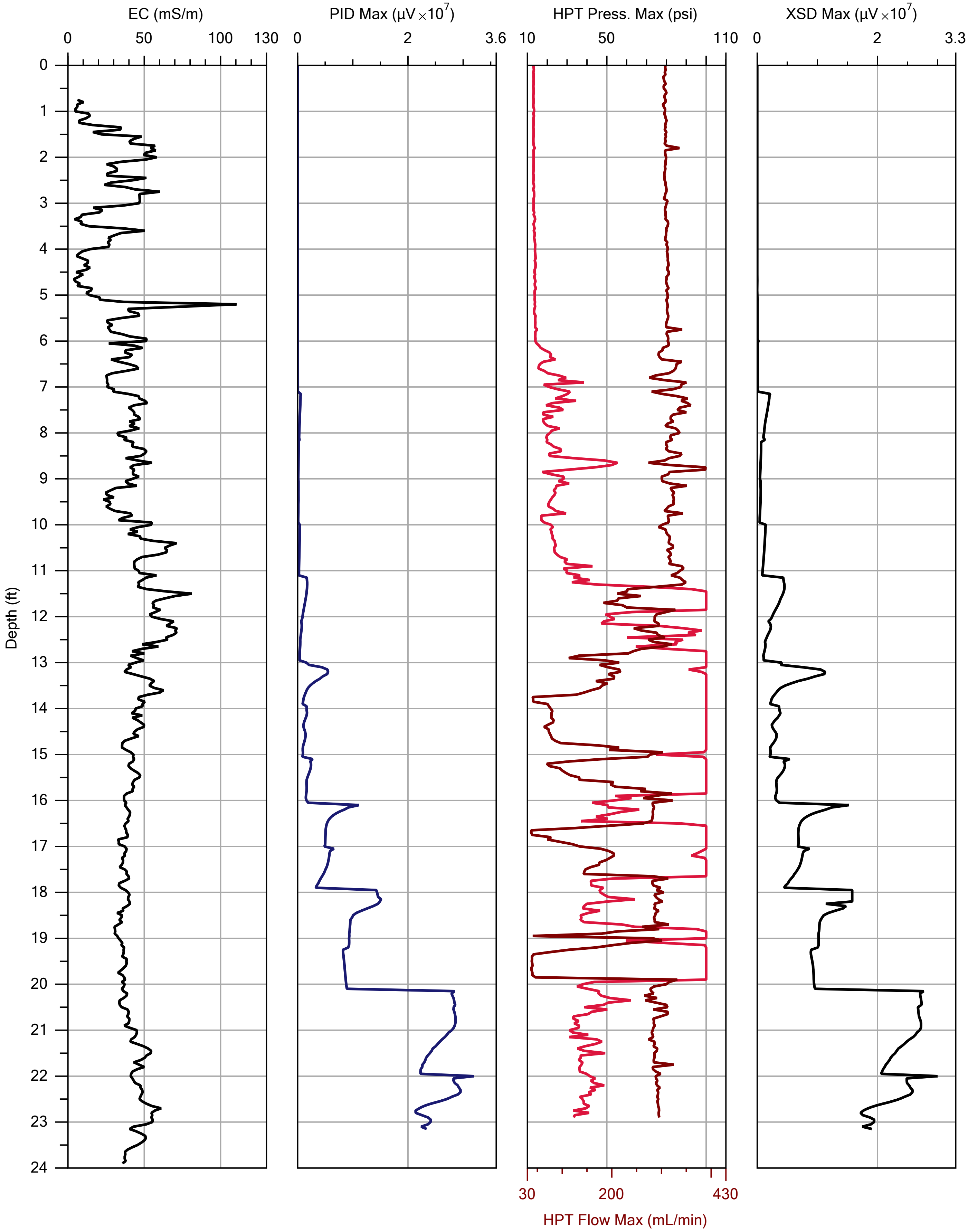

Direct Image® By Geoprobe Systems®

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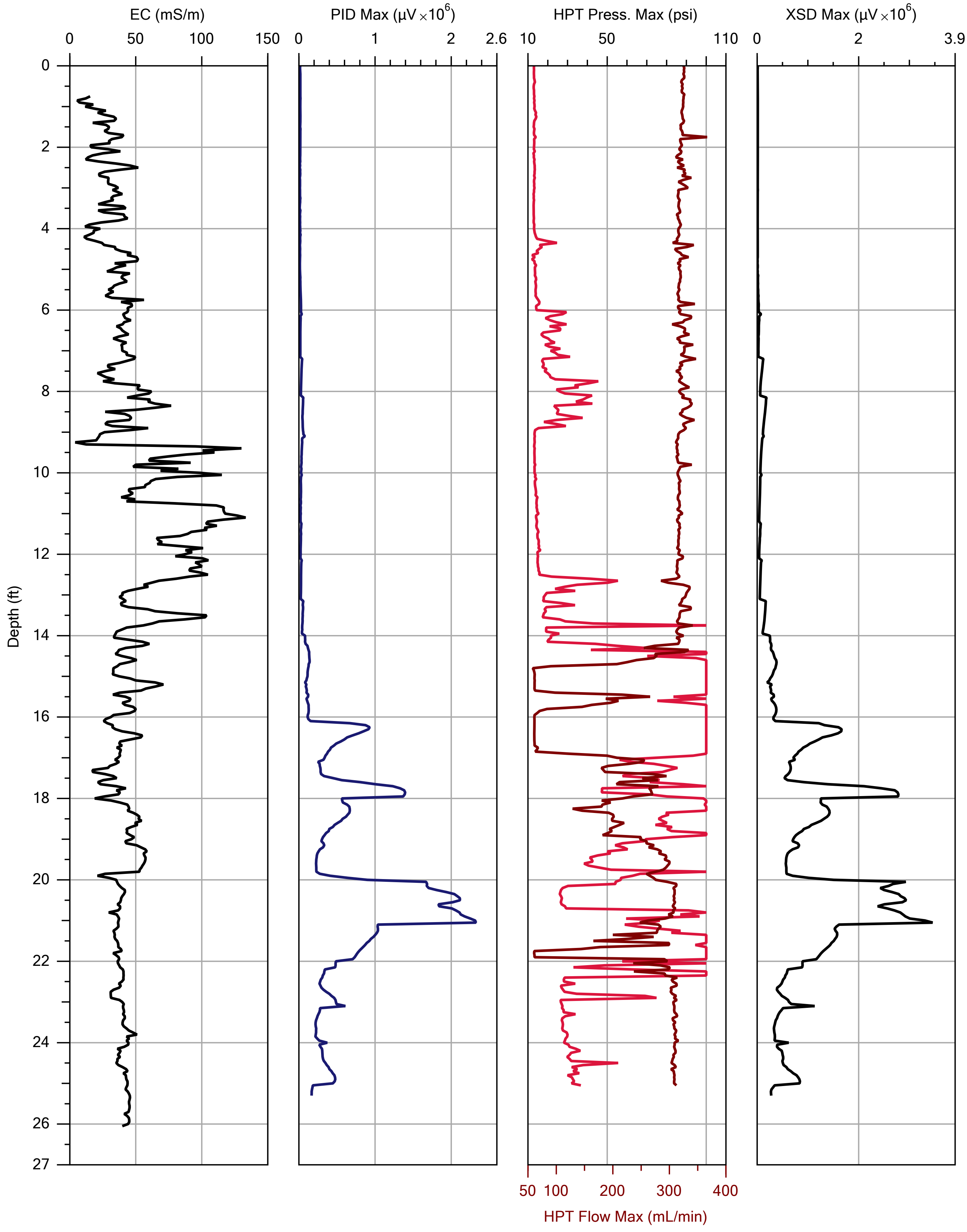

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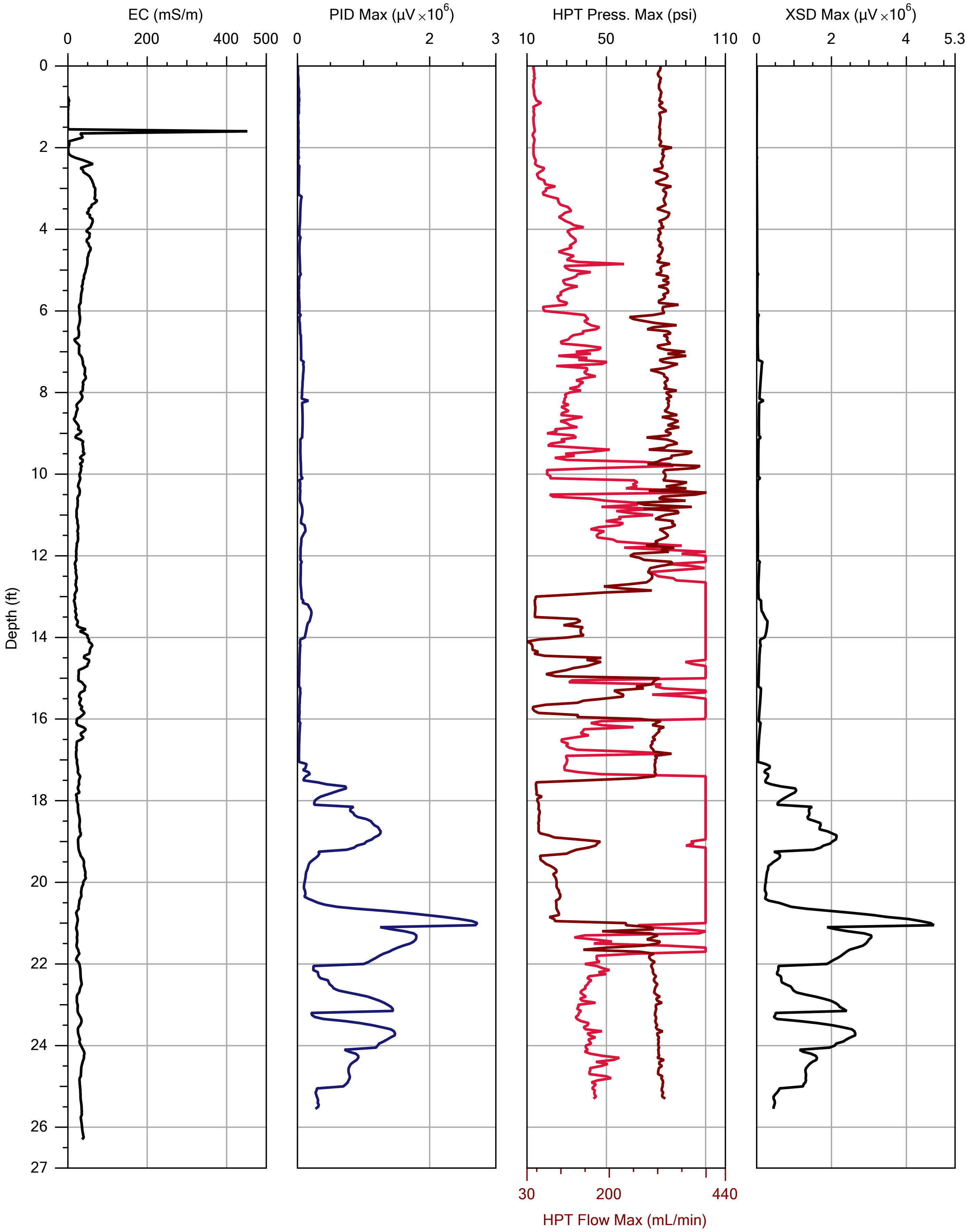

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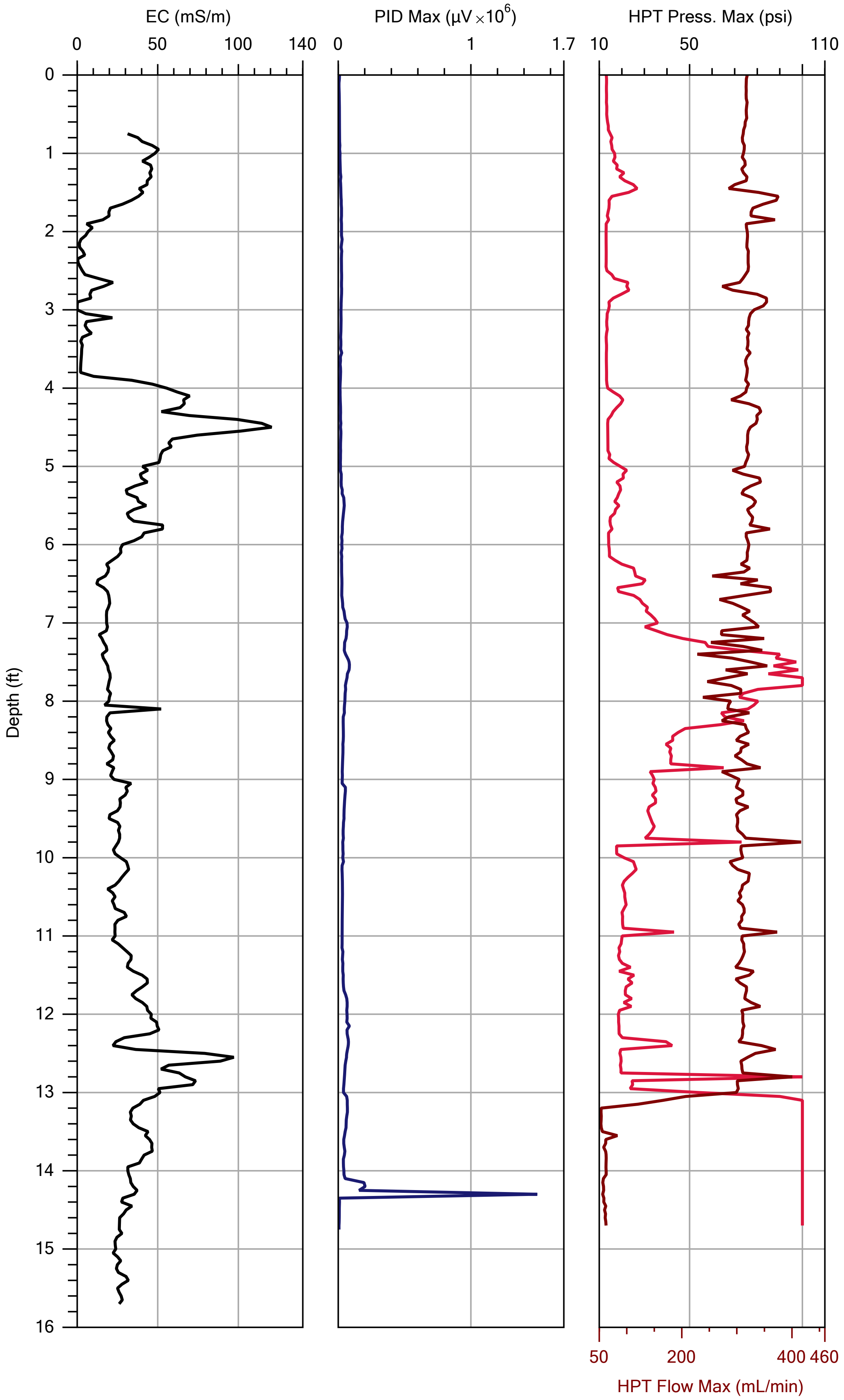

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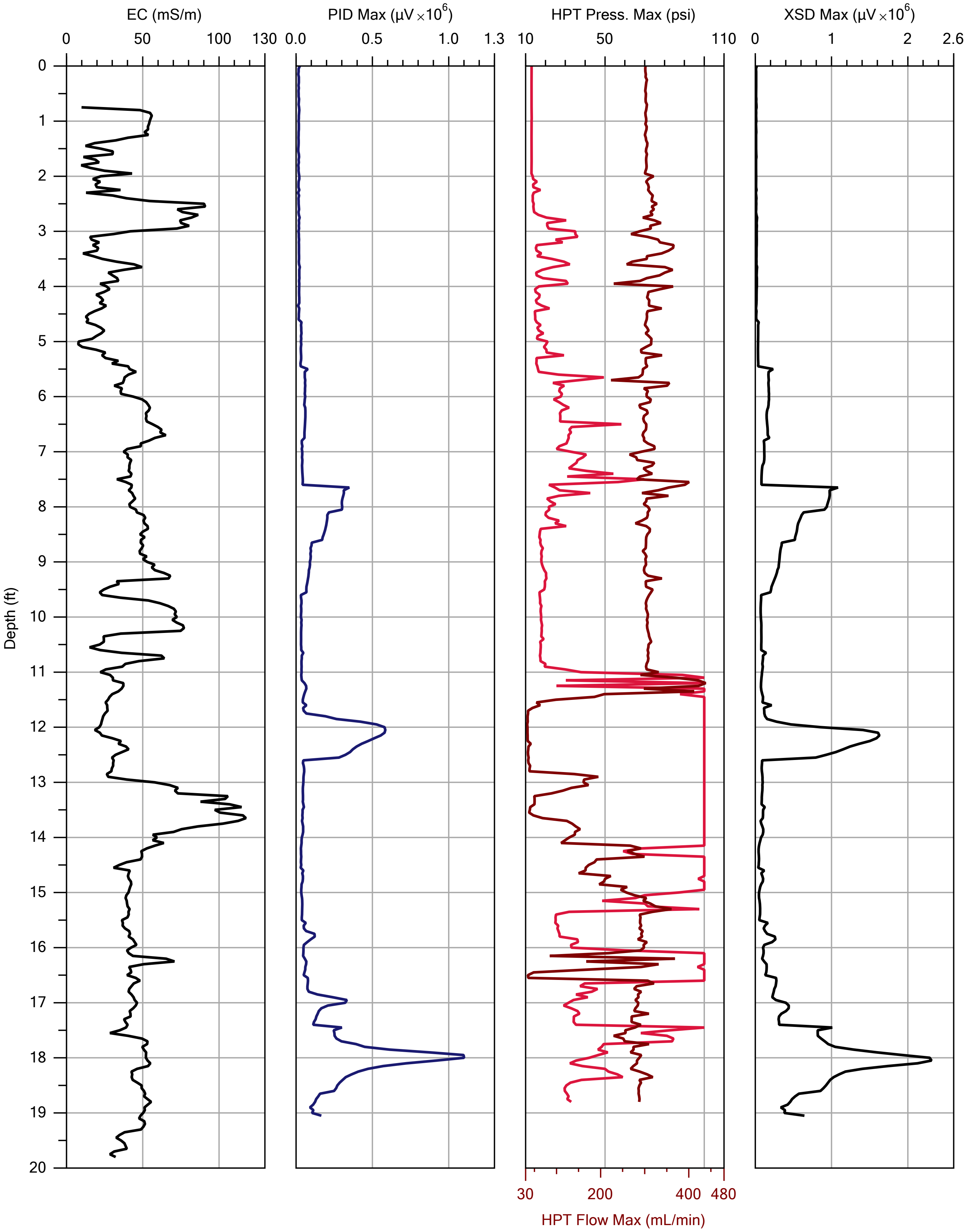

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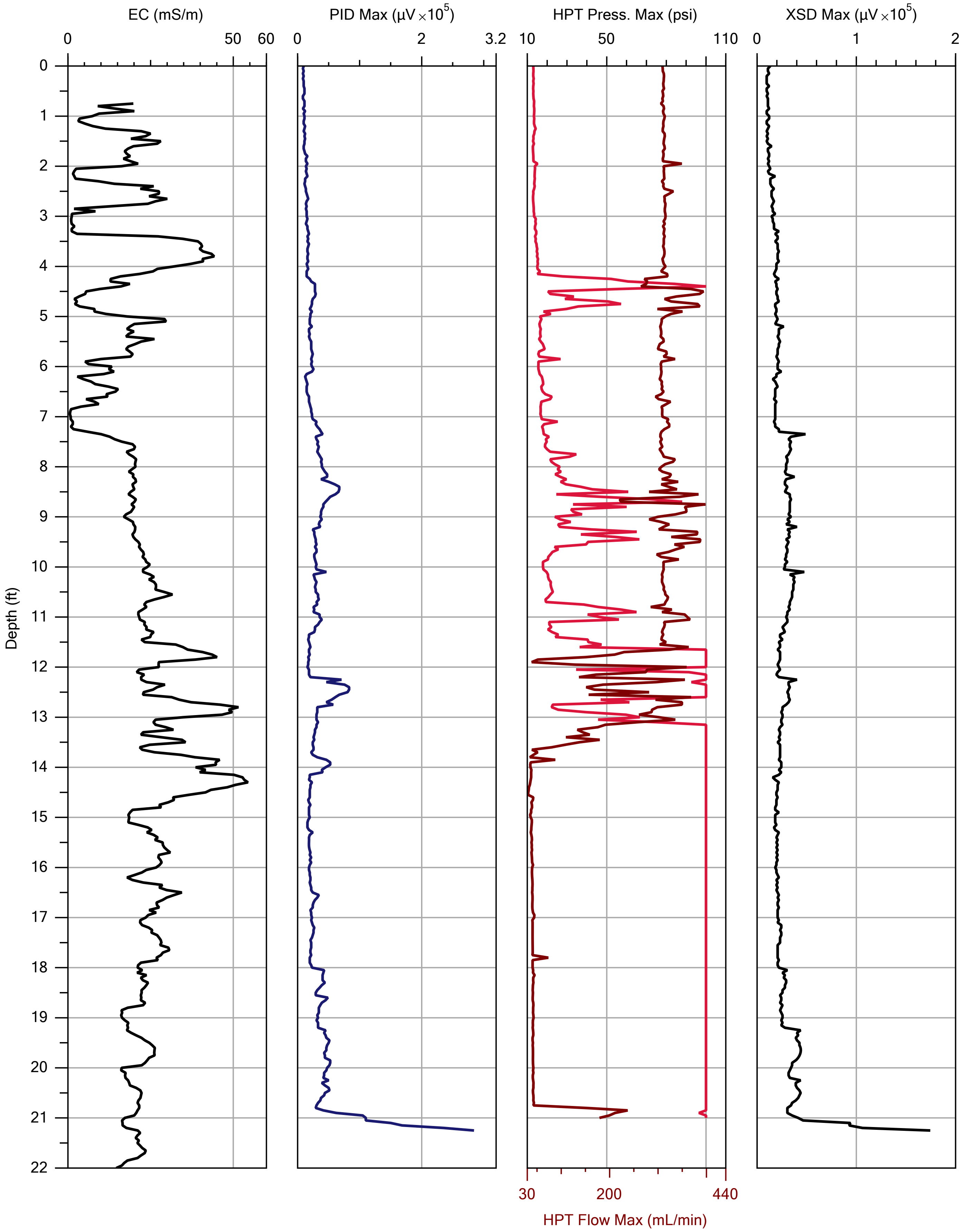
Project ID: 4355S-10	Client: Day Environmental Inc.	Location:



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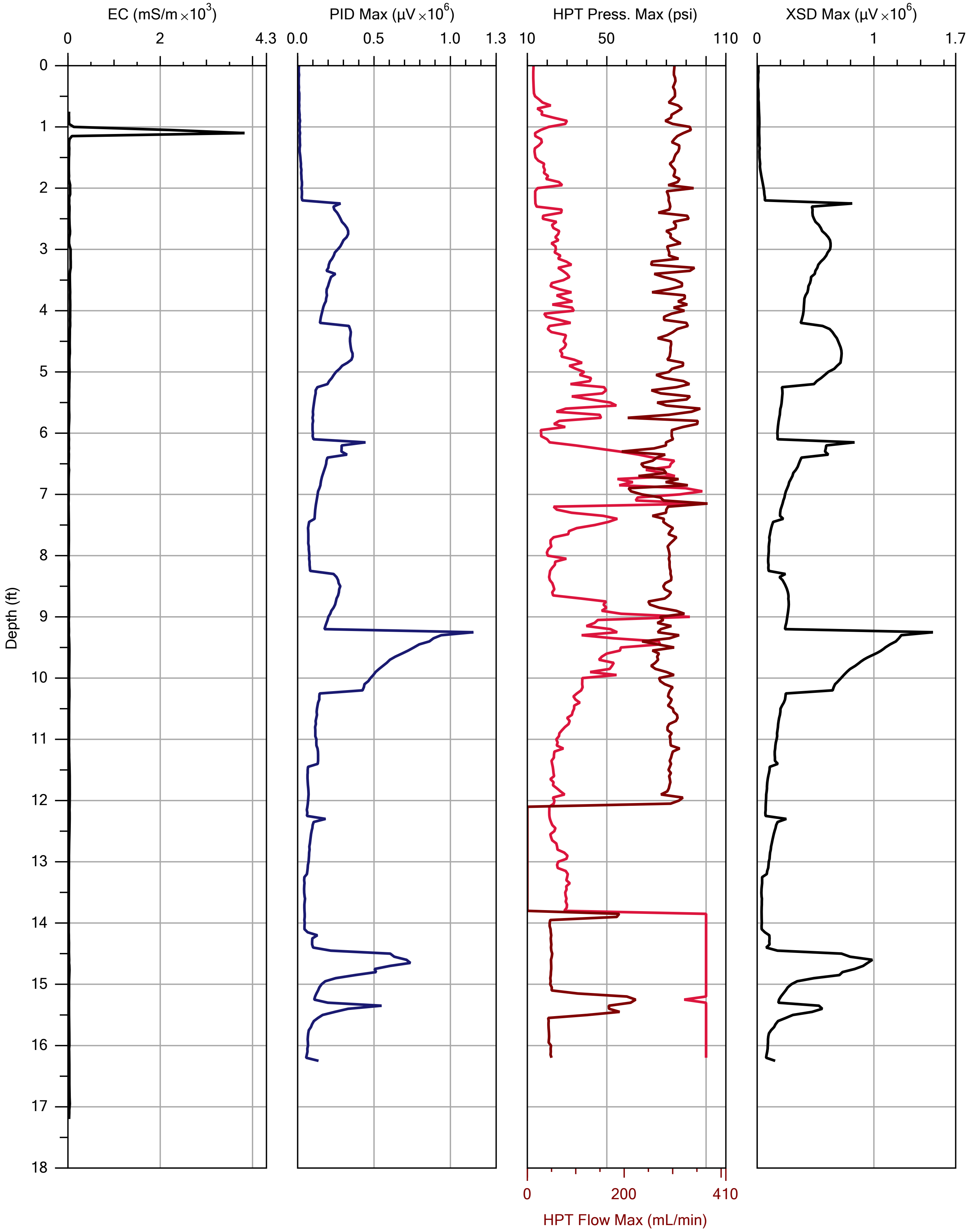

Direct Image® By Geoprobe Systems®

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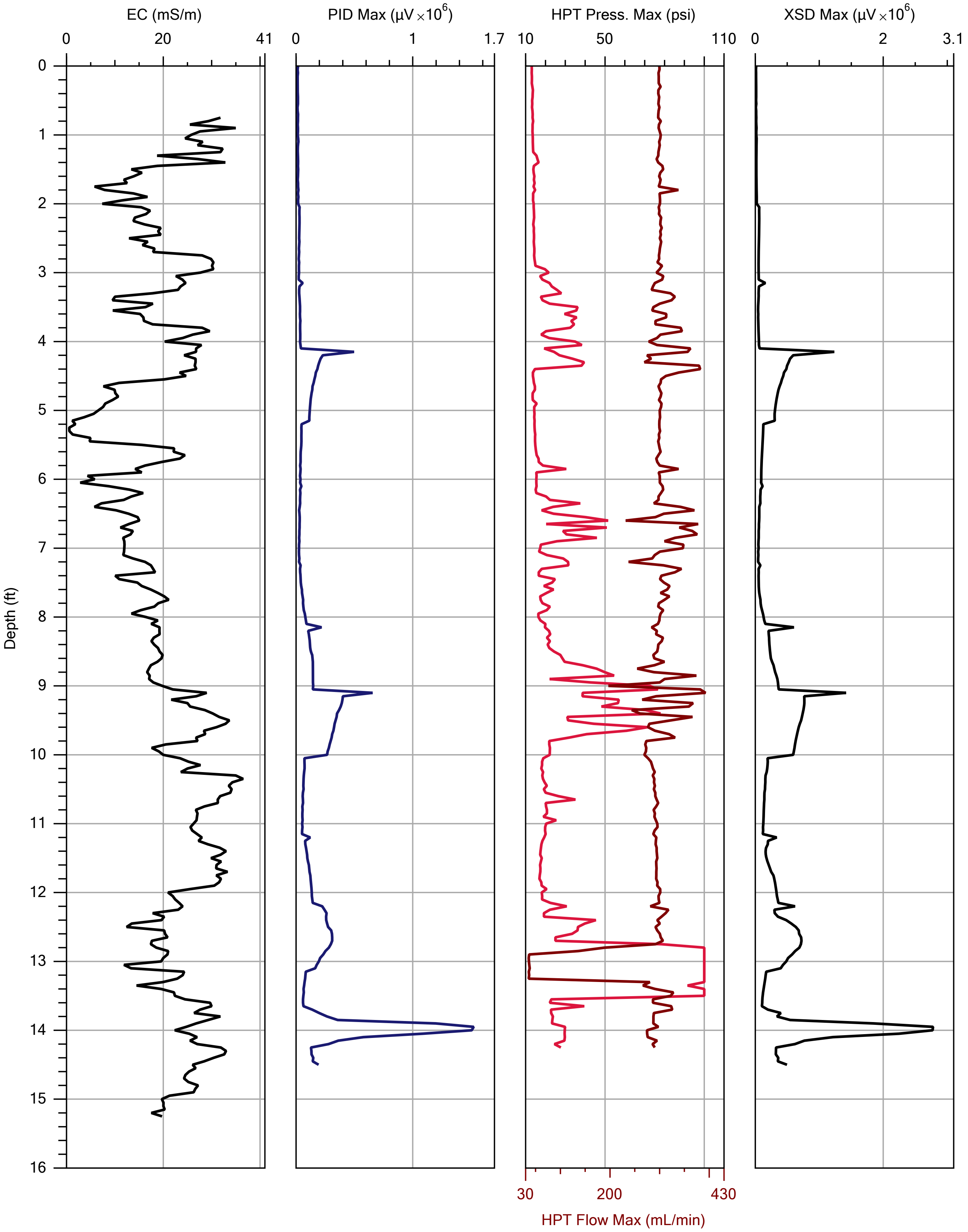
Company: S2C2	Operator: MR	Date: 6/27/2013
Project ID: 4355S-10	Client: Day Environmental Inc.	Location:



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Company: S2C2	Operator: MR	Date: 6/27/2013
Project ID: 4355S-10	Client: Day Environmental Inc.	Location:

APPENDIX B

Erosion and Sedimentation Control Plan

Erosion and Sedimentation Control Plan

Introduction

Project Description

The purpose of this Erosion and Sedimentation Control Plan is to prevent the off-site migration of sediments during completion of supplemental interim remedial measures (IRMs) at the Andrews Street Site (Site) in the City of Rochester, New York (site formerly addressed as 300, 304-308 and 320 Andrews Street, and 25 Evans Street). Activities to be performed at the approximately 1.5-acre Site include the introduction of potassium permanganate via pressured injection, test boring advancement, limited excavation and removal of soils, regrading to match adjacent property/street elevations, and backfilling of crushed stone to provide a minimum of two feet of cover over top of the underlying soils. These activities are considered a pre-cursor to eventual site redevelopment.

It is estimated that the above-mentioned remedial activities will result in exposure and disturbance of soils at less than 1 acre of the Site. As such, the proposed Site remedial activities are considered exempt from formal NYSDEC stormwater construction permit requirements. The Erosion and Sedimentation Control practices described herein have been developed as a best management practice, and are based in part on typical NYSDEC stormwater construction permit requirements.

Site Description

The Site has a slight slope that generally runs east to west, though it is not uniform, and there are small localized areas that slope offsite in the direction of the north and south Site boundaries. Additionally, some of the proposed excavation and regrading is directly against the eastern Site boundary. As such, there is potential for surface stormwater runoff to exit the Site in any direction.

The Site currently consists of vacant property with a permeable surface, predominantly covered with crushed stone, and the Site condition will remain in this state following completion of the proposed remedial activities. Adjacent off-site areas to the east, south and west of the Site are impermeable paved roadway surfaces. To the north lies a small buffer grass strip between the Site and another impermeable road surface. It is anticipated that the majority of any off-site drainage would enter storm drains in these adjacent roadways.

Construction Schedule

1. Install a silt fence around the perimeter of the Site (to surround four sides of the Site, with exception of the two Site access locations shown in Figure A).

2. Install straw bale dikes around immediately adjacent storm drains to the east of the Site, in the vicinity of the main construction entrance/exit location (see Figure A).

3. Maintain stabilized gravel/crushed stone at access locations (main entrance and emergency exit gate areas).

4. Commence and complete remedial activities in accordance with the NYSDEC-approved Interim Remedial Measures Work Plan.

5. Ensure crushed stone cover is fully in place, and no exposed areas of soil remain following completion of the remedial activities.

6. Remove silt fencing.

Planned Erosion and Sedimentation Control Practices

1. Construction equipment, vehicles and personnel shall enter and exit the Site from the main Franklin Square access location, as shown in Figure A. As the Site already has a crushed stone cover, no additional Site entrance construction is deemed necessary prior to commencement of remedial activities; however, the Site entrances (including the Andrews Street emergency exit gate) will be monitored and maintained to minimize the potential for tracking of soils and sediments beyond the Site. Additional stone will be placed and compacted at the construction entrance locations as needed during completion of the remedial activities, and the adjacent streets will be monitored and cleaned as necessary to minimize any offsite impacts and inadvertent transport of soils.

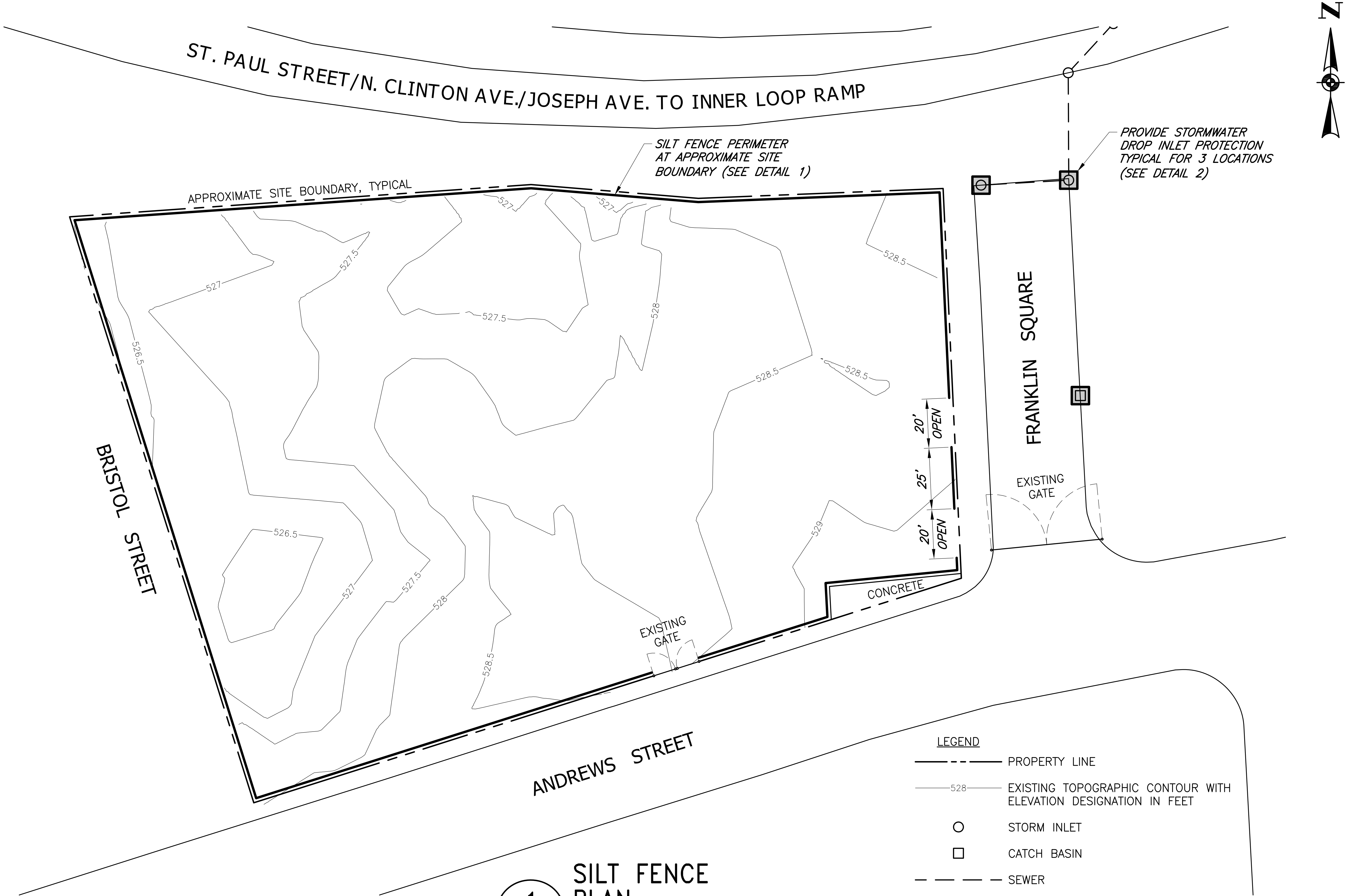
2. Silt Fence – Silt fence (see Figure B, Detail 1) will be installed around the perimeter of the Site until such time as permanent site stabilization has occurred (i.e., until the crushed stone ground cover has been fully re-established, and no areas of exposed soils remain). The silt fence will be properly maintained throughout the remedial activity period. Maintenance will be completed as needed to ensure that: (i) the bottom of the silt fence remains buried; (ii) any torn or bulging silt fence is repaired/replaced; (iii) fabric shall remain securely attached to posts; and (iv) posts shall remain securely installed in the ground.

Note: Excavation performed at the perimeter of the Site, directly up against the Silt Fence, must be sequenced and scheduled such that the bottom of the silt fence is reburied as quickly as possible. Perimeter excavation and regrading in this manner shall not be conducted during a rainfall event, and silt fence bottoms shall not be left unburied when rainfall is forecasted.

3. Straw Bale Dike - Bales (see Figure B, Detail 2) shall be placed with the cut ends vertical around off-site stormwater drainage structures in the vicinity of the Franklin Square entrances (see Figure A) to minimize sediment that may be tracked off-site from entering the drains. In areas where drainage structures are surrounded by soil, each bale shall be embedded into the soil a minimum of 4 inches, and be securely anchored. Hardwood stakes or rebar shall be installed a minimum of 12 inches into the ground below the bale. The first stake in each bale shall be driven at an angle toward the previously laid bale to force the bales together.

4. Site Stabilization – Site stabilization will consist of grading and provision of minimum two-foot permeable crushed stone ground cover, in accordance with the remedial objectives. It is anticipated that this depth of stone cover will protect the underlying soils from disturbance, and allow sufficient infiltration to minimize/prevent Site runoff, until such time as the Site is formally redeveloped.

5. Removal of Control Measures – Following Site stabilization, the silt fence and straw bale dikes will be removed and disposed of in accordance with applicable regulations.



1 Fig. A SILT FENCE PLAN

Scale: 1" = 40'

DATE 5-2014

DATE DRAWN 5-12-2014

DATE ISSUED 6-2-2014

DESIGNED BY BFK

DRAWN BY RJM/Tw

SCALE As Noted

DAY ENVIRONMENTAL, INC.
ENVIRONMENTAL CONSULTANTS
ROCHESTER, NEW YORK 14606
NEW YORK, NEW YORK 10170

PROJECT TITLE
300, 304-308, 320 ANDREWS STREET
AND 25 EVANS STREET
ROCHESTER, NEW YORK
ENVIRONMENTAL RESTORATION PROJECT NYSDEC SITE #E828144

DRAWING TITLE
Erosion and Sedimentation Control Plan

PROJECT NO.
4355S-10

FIGURE A

Time Plotted: Monday, June 02, 2014 11:45:23 AM
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Pen Setting File: 800psFullcolor.ctb

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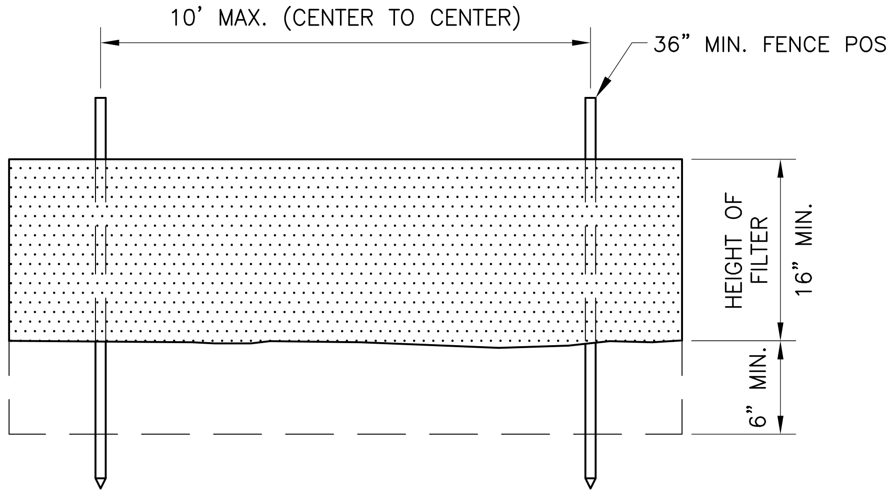
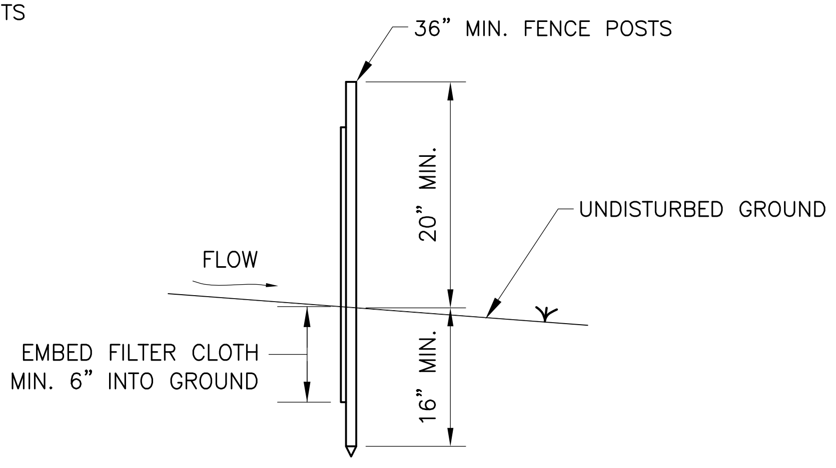
Ref2:
Ref3:



FRONT VIEW



SECTIONAL VIEW

1 Fig. B SILT FENCE DETAIL

Not To Scale

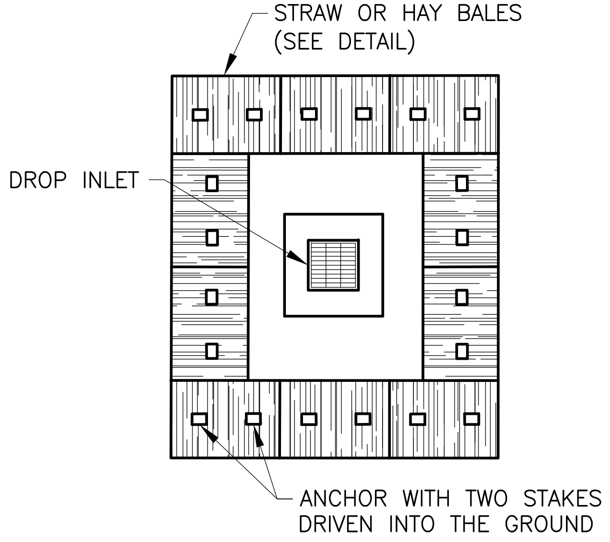
CONSTRUCTION NOTES

1. When Two Sections Of Filter Cloth Adjoin Each Other, They Shall Be Overlapped By 6" And Folded.
2. Maintenance Shall Be Performed As Needed, And Material Removed When "Bulges" Develop In The Silt Fence.

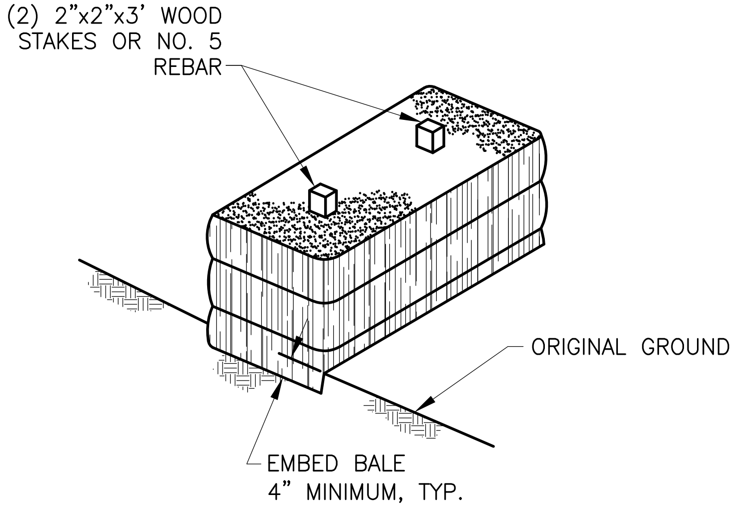
Posts: Steel, Either T Or U Type, Or 2" Hardwood.

Filter Cloth: Filter X, Mirafi 100X, Stabilinka T140N, Or Approved Equal.

Prefabricated Unit: GeoFab, Envirofence, OR Approved Equal.



PLAN



DETAIL

2 Fig. B TEMPORARY CHECK AT DROP INLET

Not To Scale

CONSTRUCTION NOTE

Place bales tight with cut edge vertical (adhearing to ground), at least 4 inches below the elevation of the drop inlet (where drainage structure is surrounded by soil). Two anchor stakes per bale shall be driven flush to bale surface (when bale is on soil). Replace bales every 4 months, or more frequently as needed, until the area is stabilized.

DATE 5-2014
DATE DRAWN 5-12-2014
DATE ISSUED 6-2-2014
DESIGNED BY BFK
DRAWN BY RJM/Tw
SCALE As Noted

day
DAY ENVIRONMENTAL, INC.
ENVIRONMENTAL CONSULTANTS
ROCHESTER, NEW YORK 14606
NEW YORK, NEW YORK 10170

PROJECT TITLE
300, 304-308, 320 ANDREWS STREET
AND 25 EVANS STREET
ROCHESTER, NEW YORK
ENVIRONMENTAL RESTORATION PROJECT NYSDEC SITE # E828144

DRAWING TITLE
Silt Fence & Temporary Check At Drop Inlet Details

PROJECT NO.
4355S-10

FIGURE B

Ref1:
Ref2:
Ref3:

Xerox432AnsiB-2; 11 x 17
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APPENDIX C

$KMnO_4$ Technical Data

Commercial Inspection and Testing Services (CITS)

Project No.	[redacted]
Client File No.	[redacted]
Testing Office	UL India
Date	12.10.2012

Test Report

Client Name:	[redacted]	Testing Location:	UL India Pvt.Ltd.
Address:	[redacted]	Address:	Kalyani Platina,Block No. 24 EPIP Zone, PhaseII Whitefield.
City, State, Zip	[redacted]	City,State, Zip	Bangalore-560068, Karnataka
Contact:	[redacted]	Contact:	[redacted]
Phone:	[redacted]	Phone:	[redacted]
Fax:	-	Fax:	[redacted]

Product Description: Potassium Permanganate FFG Grade

Number of Samples submitted: One, 500g

Test Standard of Requirement: AWWA standard B603-10.

Test Result: See Table-3 to Table-5

Test Protocol and Observation:

- All the samples were analysed for the parameters as per Table-1 and the observation captured.

[redacted]

Table – 1

Test No.	Test Name	Observation
1	Insoluble Matter	Lesser than limit
2	Moisture content	Lesser than limit
3	Nitrogen as N-NO3	
4	Cadmium	Not detected
5	Chromium	Not detected
6	Mercury	Not detected
7	Arsenic	Below the permissible limit
8	Nickel	Not detected
9	Lead	Not detected
10	Antimony	Not detected
11	Selenium	Not detected
12	Water Tolerance test	Free flowing @ 0.7ml water.
13	Particle size	Within permissible limits
14	Bulk density	Within limit
15	Assay	Within limit

Scope of the work : Analysis of $KMnO_4$ as per AWWA standard B603-10

Sampling information :

Table – 2

Sampling Date	NA
Sampling Location	[redacted]
Sampling Procedure	Sampling was done by client & submitted to UL India Pvt.Ltd.
Client Sample Lot No	11
UL Sample ID	[redacted]
Date Samples Received	10/10/2012
Analysis Start Date	10/10/2012
Notes	The analysis were performed on the sample submitted by the client and results are pertaining to the sample submitted. **The client's covering letter & Label on the sample carried the below information.** Qty : 18MT, Packing: 720 Nos X 25Kg Pails Prod Date: 1/10/2012 To 04/10/2012. PO No: [redacted] Buyer:

[redacted]

SAMPLE RESULTS

Table – 3

Metals by Graphite Furnace Atomic Absorption Spectroscopy, Mercury by Cold vapour Atomic Absorption Spectroscopy

Test Name	Result (mg/Kg) ppm	Max Limit of (AWWA B603-10) product (mg/Kg) ppm	Detection limit in µg/L
	Lot No.11		
Cadmium	<0.04	50	0.4
Chromium	<0.5	50	5.0
Mercury	<0.1	10	1.0
Arsenic	1.1	20	5.0
Nickel	<0.5	50	5.0
Lead	<0.5	50	1.0
Antimony	<0.5	50	5.0
Selenium	<0.5	50	5.0

Table – 4

Nitrogen as N-NO_3 by HACH spectrophotometer

Test Name	Result (mg/L)	Detection limit
	Lot No.11	
Nitrogen as N-NO_3	<0.3	0.3 mg/L

Table – 5

Physical parameters

Test Name	Result	Limits as per AWWA B603-10 & EN12672-2008
	Lot No.11	
Water Tolerance Test	Free flowing @ 0.7ml water	Free flowing
Moisture Content	0.22%	<0.5%
Particle size	1) 0% retained in US Standard Sieve No.40 2) 3.58% passed through US standard Sieve No.200	<20% retained in US standard Sieve No.40 <7% passes through US standard Sieve No.200.
Bulk Density	1.56 g/cm^3	1.45 – 1.60 g/cm^3
Assay	97.87%	>97.0% for free flowing grade >98.0% for technical grade
Insoluble matter	1.08%	<1% for technical grade <2% for free flowing grade

Analysed by: [redacted]

Reviewed by: [redacted]

End of Report

[redacted]

UL INDIA PVT. LTD. BANGALORE-560 068

NSF

The Public Health and Safety Organization

NSF Product and Service Listings

These NSF Official Listings are current as of **Friday, February 07, 2014** at 12:15 a.m. Eastern Time. Please contact NSF International to confirm the status of any Listing, report errors, or make suggestions.

Alert: NSF is concerned about fraudulent downloading and manipulation of website text. Always confirm this information by clicking on the below link for the most accurate information: http://info.nsf.org/Certified/PwsChemicals/Listings.asp?CompanyName=f2&TradeName=k%2Dox&

NSF/ANSI 60
Drinking Water Treatment Chemicals - Health Effects

F2 Industries, LLC
5543 Edmondson Pike #156
Nashville, TN 37211-5805
United States
877-828-1652
615-828-1652

Facility : # 3 India

Potassium Permanganate[PO]

Trade Designation	***Product Function***	***Max Use***
K-Ox	Disinfection & Oxidation Oxidant	50mg/L

[PO] The finished drinking water shall be monitored to ensure that levels of manganese do not exceed 0.05 mg/L.

Number of matching Manufacturers is 1

Number of matching Products is 1

Processing time was 0 seconds

Laboratory Report

Report prepared for:
Bill Guite
Vice President of Sales
Hepure Technologies, Inc.
98 N. Ward St.
New Brunswick, NJ 08901
Phone: 860-790-0962
Email: william@hepure.com

Report prepared by:
Tony Pickett

Purchase Order:

For further assistance, contact:
Tony Pickett
Technical Manager
PO Box 51610
Knoxville, TN 37950 -1610
(865) 546-1335
tonypickett@galbraith.com

Sample: Potassium Permanganate
Lab ID: 2014-W-4535 **Received:** 2014-04-17

Analysis	Method	Result	Basis	Sample Amount Used	Date (Time)
Ag1: Ag					
	GLI Procedure ME-30	< 0.39 mg/kg	As Received	516.98 mg	2014-04-25
As1: As					
	GLI Procedure ME-30	0.37 mg/kg	As Received	1042.20 mg	2014-04-26
Be1: Be					
	GLI Procedure ME-30	< 0.60 mg/kg	As Received	1042.20 mg	2014-04-26
Cd1: Cd					
	GLI Procedure ME-30	< 0.12 mg/kg	As Received	1042.20 mg	2014-04-26
Cr1: Cr					
	GLI Procedure ME-30	0.75 mg/kg	As Received	1042.20 mg	2014-04-26
Cu1: Cu					
	GLI Procedure ME-30	7.6 mg/kg	As Received	1042.20 mg	2014-04-26
Ni1: Ni					
	GLI Procedure ME-30	2.8 mg/kg	As Received	1042.20 mg	2014-04-26
Pb1: Pb					
	GLI Procedure ME-30	0.25 mg/kg	As Received	1042.20 mg	2014-04-26
Sb1: Sb					
	GLI Procedure ME-30	< 0.97 mg/kg	As Received	516.98 mg	2014-04-25
Se1: Se					
	GLI Procedure ME-30	< 1.2 mg/kg	As Received	1042.20 mg	2014-04-26
Ti1: Ti					
	GLI Procedure ME-30	7.8 mg/kg	As Received	516.98 mg	2014-04-25
Zn1: Zn					
	GLI Procedure ME-30	6.4 mg/kg	As Received	1042.20 mg	2014-04-26

Signatures:

Published By:	tony.pickett	2014-04-28T19:55:28.717-04:00
Created By:	tony.pickett	2014-04-28T19:55:00.353-04:00

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APPENDIX D

Carus Corporation Oxidant Calculator Output Tables

Andrews Street Site
(Treatment of 3D-Modeled >1x106 uV XSD Volume)
1/30/2014
12:04 PM

CARUS REMEDIATION TECHNOLOGIES

In Situ Chemical Oxidation (ISCO) *In Situ* Bioremediation (BIO) *In Situ* Biogeochemical Stabilization (ISBS)

RemOx® S and L ISCO Reagents Estimation Spreadsheet

Input data into box with blue font

Site Name:
Date:

	Estimates	Units
Treatment Area Volume		
Length	123.8465	ft
Width	123.8465	ft
Area	15337.96	sq ft
Thickness	11.73	ft
Total Volume	6663	cu yd
Soil Characteristics/Analysis		
Porosity	20	%
Total Plume Pore Volume	269170	gal
Avg Contaminant Conc	80	ppm
Mass of Contaminant	179.71	lb
PNOD	3.5	g/kg
Effective PNOD	40	%
Effective PNOD Calculated	1.4	
PNOD Oxidant Demand	27706.79	lb
Avg Stoichiometric Demand	1.3	lb/lb
Contaminant Oxidant Demand	233.62	lb
Theoretical Oxidant Demand	27940.41	lb
Confidence Factor	1.2	
Calculated Oxidant Demand	33528.49	
Injection Volumes for RemOx S		
RemOx S Injection Concentration	30.0%	%
Total Volume of Injection Fluid	13,393	gal
Pore Volume Replaced	0.05	%

Amount of RemOx S ISCO Reagent Estimated **33,528 pounds**

Injection Volumes for RemOx L		
RemOx L Injection Concentration	30.0%	%
Calculated Specific Gravity	1.274869	g/ml
Total Volume of Injection Fluid	9,434	gal
Pore Volume Replaced	0.04	%

Amount of RemOx L ISCO Reagent Estimated **75,271 pounds**
6,585 gallons

Andrews Street Site
(Treat Saturated IRM-01/IRM-02 Backfill Area)
1/30/2014
12:04 PM

CARUS REMEDIATION TECHNOLOGIES

In Situ Chemical Oxidation (ISCO) *In Situ* Bioremediation (BIO) *In Situ* Biogeochemical Stabilization (ISBS)

RemOx® S and L ISCO Reagents Estimation Spreadsheet

Input data into box with blue font

Site Name:
Date:

	Estimates	Units
Treatment Area Volume		
Length	**40**	ft
Width	**78**	ft
Area	3120	sq ft
Thickness	**4**	ft
Total Volume	462	cu yd
Soil Characteristics/Analysis		
Porosity	**30**	%
Total Plume Pore Volume	28007	gal
Avg Contaminant Conc	**80**	ppm
Mass of Contaminant	18.70	lb
PNOD	**3.5**	g/kg
Effective PNOD	**40**	%
Effective PNOD Calculated	1.4	
PNOD Oxidant Demand	1921.92	lb
Avg Stoichiometric Demand	**1.3**	lb/lb
Contaminant Oxidant Demand	24.31	lb
Theoretical Oxidant Demand	1946.23	lb
Confidence Factor	**1.2**	
Calculated Oxidant Demand	2335.473	
Injection Volumes for RemOx S		
RemOx S Injection Concentration	**5.0%**	%
Total Volume of Injection Fluid	5,597	gal
Pore Volume Replaced	0.20	%

Amount of RemOx S ISCO Reagent Estimated **2,335 pounds**

Injection Volumes for RemOx L		
RemOx L Injection Concentration	**10.0%**	%
Calculated Specific Gravity	1.091623	g/ml
Total Volume of Injection Fluid	2,302	gal
Pore Volume Replaced	0.08	%

Amount of RemOx L ISCO Reagent Estimated **5,243 pounds**
459 gallons

APPENDIX E

ISCO Injection Log and ISCO Injection Tracking Table

day

DAY ENVIRONMENTAL, INC.

ENVIRONMENTAL CONSULTANTS

AN AFFILIATE OF DAY ENGINEERING, P.C.

Fracture

Page 1 of 2

Project #: ____________

Project Address: ____________

DAY Representative: ____________

Drilling Contractor: ____________

Ground Elevation: ____________ Datum: ____________

Date Started: ____________ Date Ended: ____________

Well Depth: ____________ Borehole Diameter: ____________

Process Monitoirng

Time (sec)	Pressure (psi)	Flow Rate (GPM)	Notes (backpressure, fracture propagation, final pressure, etc.)

Site Sketch of Fracure Orientation and Magnitude

(center injection location on sketch)

N

Note on above sketch where daylightling occurred, if any.

Elevation Monitoring

Ground/Tiltmeter Elevation	Before Fractrure	After Fractrure
Location 1:		
Location 2:		
Location 3:		
Location 4:		
Location 5:		
Location 6:		
Location 7:		
Location 8:		
Location 9:		
Location 10:		

Notes

Reagent Notes

Parameters	Target Values	Actual Values
Mass (lbs)		
Volume (gal)		
$KMnO_4$ %		
PVC Notch Elevation (ft msl)		
Radius of Influence (ft)		

Fracture Influence Monitoirng

Well/ Location ID	SWL		PID (ppm)
	Before	After	

Water Quality Measurements

Well ID	ORP (mv)	Conductivity (Sm)	pH (S.U.)	Temp (°C)	Color

Notes:

1) PID readings are referenced to a benzene standard measured in the headspace above the sample using a MiniRae 2000 equipped with a 10.6 eV lamp.

2) NA = Not Available or Not Applicable

Fracture

1563 LYELL AVENUE
ROCHESTER, NEW YORK 14606
(585) 454-0210
FAX (585) 454-0825

www.dayenvironmental.com

420 LEXINGTON AVENUE, SUITE 300
NEW YORK, NEW YORK 10170
(212) 986-8645
FAX (212) 986-8657

300, 304-308 and 320 Andrews Street and 25 Evans Street
Rochester, New York
NYSDEC Site #E828144

ISCO Potassium Permanganate ($KMnO_4$) Sector 1 Tracking Log

Enhanced Injection Zone ID	Injection Zone Elevation (ft msl)	Target $KMnO_4$		Actual $KMnO_4$		Percent for Point		Percent for Sector	
		Mass (lbs)	Volume (gallons)	Mass (lbs)	Volume (gallons)	Mass (lbs)	Volume (gallons)	Mass (lbs)	Volume (gallons)
IP-01-1	507.5	394	385	350	385	88.9	100.0	11.5	12.9
IP-02-1	507.5	374	365	375	360	100.4	98.5	12.3	12.1
IP-03-1	508.0	300	293	290	285	96.8	97.3	9.5	9.6
IP-03-2	504.0	300	293	305	300	101.8	102.4	10.0	10.1
IP-04 -1	508.0	380	371	275	260	72.4	70.0	9.0	8.7
IP-05-1	513.5	336	329	350	340	104.1	103.4	11.5	11.4
IP-05-2	509.0	336	329	75	60	22.3	18.3	2.5	2.0
IP-05-3	503.5	336	329	245	250	72.9	76.1	8.0	8.4
IP-15-1	514.5	291	280	300	295	103.2	105.4	9.9	9.9
Sector 1 Totals		3045	2974	2565	2535			84.2	85.2

🟩	= greater than 75% of target volume injected (effective)
🟨	= Between 25% and 75% of target mass injected (Satisfactory)
🟥	= Less than 25% of target mass injected

APPENDIX F

Health and Safety Plan

HEALTH AND SAFETY PLAN
FOR SUPPLEMENTAL IRMS

300, 304-308, 320 ANDREWS STREET AND 25 EVANS STREET
ROCHESTER, NEW YORK

NYSDEC SITE #E828144

Prepared for: City of Rochester
Division of Environmental Quality
30 Church Street, Room 300B
Rochester, New York, 14614-1278

Prepared by: Day Environmental, Inc.
1563 Lyell Avenue
Rochester, New York 14606

Reviewed by: Nicholas J. Harding
Industrial Hygienist
Day Environmental, Inc.

Project No.: 4355S-10

Date: June 2014

TABLE OF CONTENTS

ATTACHMENTS

Attachment 1	Figure 1 - Route for Emergency Services
Attachment 2	Figure 2 - Supplemental IRM Site Layout Plan with Health and Safety Control Zones and CAMP Monitoring Locations
Attachment 3	Resume of Nicholas J. Harding
Attachment 4	Material Safety Data Sheets
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1.0 INTRODUCTION

Day Environmental, Inc. (DAY) prepared this Health and Safety Plan (HASP) to outline the policies and procedures to protect workers and the public from potential environmental hazards during the Supplemental Interim Remedial Measure (IRM) work. This project is being conducted under the New York State Department of Environmental Protection (NYSDEC) Environmental Restoration Program (ERP) for the City of Rochester (City). The subject Site is comprised of four parcels with a combined area of approximately 1.5 acres addressed as 300, 304-308, 320 Andrews Street and 25 Evans Street, City of Rochester, County of Monroe, New York (Site). Figure 1 included in Attachment 1 depicts the general location of the Site. Figure 2 included in Attachment 2 provides a site layout plan for the project.

Although the HASP focuses on the specific work activities planned for this Site, it must remain flexible due to the nature of this work. Conditions may change and unforeseen situations can arise that require deviations from the original HASP.

1.1 SITE HISTORY/OVERVIEW

The Site is located at 300, 304-308, and 320 Andrews Street and 25 Evans Street in the Center City District (CCD) of the City of Rochester, County of Monroe, New York. The Site is situated on an approximately 1.5-acre area bounded by the Inner Loop to the north, Andrews Street to the south, Franklin Square with a City-owned park beyond to the east, and Bristol Street with commercial property beyond to the west (see Figure 1). The Site also contains the former Evans Street right-of-way that was officially abandoned by the City in March 2013, and this former right-of-way was incorporated into the adjoining Site parcels.

Demolition of on-site structures was completed between the fall of 2010 and the spring of 2011. Prior to demolition, the Site was improved with four buildings with associated paved parking lots and city streets. The former buildings had a total floor area of approximately 38,349 square feet and consisted of single and two-story brick or concrete block buildings with partial basements and/or slab-on-grade construction, constructed between 1925 and 1965.

Previous environmental work included: Phase I Environmental Site Assessments; a Phase II Environmental Site Assessment; environmental investigation during building demolition work; the majority of work associated with a Remedial Investigation (RI); an initial phase of six IRMs; and supplemental RI work.

The initial phase of IRMs was completed to remove the majority of impacted soil from various source areas, including a large source area of PCE. The six IRM areas are shown on Figure 2, and are summarized as follows:

IRM-01: Removal of approximately 1,812 tons of soil from a large source area contaminated with chlorinated volatile organic compound (VOC) Tetrachloroethene (i.e., Perchloroethene or PCE).

IRM-02: Removal of approximately 101 tons soil contaminated with PCE that appears to have migrated away from IRM-01 along a former buried combined sewer system located in the former Evans Street right-of-way.

IRM-03: Removal of two abandoned underground storage tanks (USTs) and approximately 49 tons of petroleum-contaminated soil.

IRM-04: Removal of approximately 20 tons of polychlorinated Biphenyl (PCB)-contaminated soil

IRM-05: Removal of approximately 223 tons of soil contaminated with VOCs, semi-volatile organic compounds (SVOCs), and metals from a former trench drain area

IRM-06: Removal of approximately 210 linear feet of piping that contained sediments with some PCE contamination below NYSDEC soil criteria.

Subsequent to the IRMs, residual contaminants, including PCE and to a lesser degree other VOCs, some semi-volatile organic compounds and metals, remain in soil, fill, soil vapor and/or groundwater at the Site. Under a Supplemental IRM Work Plan, these remaining contaminants are to be further remediated and/or addressed with institutional controls and engineering controls. The Supplemental IRM Work Plan scope includes removal and disposal of a limited area of PCE-contaminated unsaturated soil, and in-situ chemical oxidation (ISCO) remediation of PCE-contaminated saturated soil and groundwater in the overburden. Further information on locations and concentrations of contaminants are provided in the Supplemental IRM Work Plan.

1.2 PLANNED ACTIVITIES COVERED BY HASP

This HASP is intended to be used during this Supplemental IRM project for on-site environmental activities. Currently, identified activities include:

- Site preparation and mobilization activities;
- Implementation of ISCO to treat the saturated soil and groundwater containing residual chlorinated VOCs, that primarily consists of PCE;
- Supplemental IRM soil removal in a near surface area of the Site that is contaminated with PCE;
- Contingency for additional in-situ remediation, if warranted;
- Management of IRM-derived wastes;
- Installation of a cover system as an engineering control;
- Site surveying activities;
- Vegetation control activities;
- Site restoration and demobilization activities; and,
- Long-term groundwater monitoring.

2.0 KEY PERSONNEL AND MANAGEMENT

The Industrial Hygienist (IH), Project Manager (PM) and Site Safety Officer (SSO) are responsible for addressing health and safety requirements, and implementing the HASP.

2.1 INDUSTRIAL HYGIENIST

The IH has the overall responsibility for ensuring the HASP addresses health and safety concerns in the field that are associated with implementing the scope of the Supplemental IRM Work Plan. The IH has reviewed this HASP. To the extent deemed warranted, the IH will visit the Site during certain activities to observe working conditions, and will make revisions to the HASP, personal protective equipment, monitoring, etc. for the protection of on-site personnel and the surrounding community.

2.2 PROJECT MANAGER

The PM has the overall responsibility for the project and will coordinate with the IH and SSO to ensure that the goals of the project are attained in a manner consistent with the HASP requirements.

2.3 SITE SAFETY OFFICER

The SSO has responsibility for administering the HASP relative to Site activities, and will be in the field while activities are in progress. The SSO's operational responsibilities will be monitoring, including personal and environmental monitoring, ensuring personal protective equipment (PPE) maintenance and use, and identification of protection levels. The air monitoring data obtained by the SSO will be available in the field for review by the City, regulatory agencies, and other on-site personnel, and will also be included in a Construction Completion Report.

2.4 EMPLOYEE SAFETY RESPONSIBILITY

Each employee is responsible for personal safety as well as the safety of others in the area. Each employee will use the equipment provided in a safe and responsible manner as directed by the SSO.

2.5 KEY SAFETY PERSONNEL

The following individuals are anticipated to share responsibility for health and safety of DAY representatives at the Site.

DAY Industrial Hygienist	Nicholas J. Harding*
DAY Project Manager	Jeffrey Danzinger
DAY Site Safety Officer	William Batiste, Charles Hampton, or Nathan Simon

* Mr. Harding has a Master's Degree in Industrial Hygiene from the University of Rochester, and has over 25 years of experience in occupational safety and industrial hygiene. A copy of Mr. Harding's resume is included in Attachment 3.

3.0 SAFETY RESPONSIBILITY

DAY is required to implement its on-site work in accordance with the provisions set forth in this HASP for the protection of its personnel. Contractors, consultants, state or local agencies including the City, or other parties, and their employees that enter the Site will be responsible for their own safety while on-site and must adopt this HASP to cover their own work, or prepare their own HASP that is as protective as this HASP and is approved by DAY, the City, the NYSDEC and the New York State Department of Health (NYSDOH).

4.0 JOB HAZARD ANALYSIS

There are many hazards associated with environmental work on a Site, and this HASP discusses some of the anticipated hazards for this Site. The chemical, physical and environmental hazards listed below deal specifically with those hazards associated with the management of potentially contaminated media (e.g., soil, fill, groundwater).

4.1 CHEMICAL HAZARDS

Chemical substances can enter the body by inhalation, skin absorption, ingestion, or injection (i.e., a puncture wound, etc.). A contaminant can cause damage at the point of contact or can act systemically, causing a toxic effect at a part of the body distant from the point of initial contact.

A list of selected constituents that have been detected at the Site and exceed soil or groundwater standards, criteria and guidance (SCG) values are presented below. This list also presents the Occupational Safety and Health Administration (OSHA) permissible exposure limits (PELs), National Institute for Occupational Safety and Health (NIOSH) recommended exposure limits (RELs), and NIOSH immediately dangerous to life or health (IDLH) levels.

CONSTITUENT	OSHA PEL	NIOSH REL	IDLH
Tetrachloroethene (PCE)	100 ppm	Minimize workplace exposure concentrations	150 ppm
Trichloroethene (TCE)	100 ppm	25 ppm	1000 ppm
1,2-Dichloroethene	200 ppm	200 ppm	1000 ppm
Naphthalene	10 ppm	10 ppm	250 ppm
1,2,4-Trimethylbenezene	NA	25 ppm	NA
1,3,5-Trimethylbenezene	NA	25 ppm	NA
Benzene	1 ppm	0.1 ppm	500 ppm
Xylene	100 ppm	100 ppm	900 ppm
Benzo(a)anthracene[1]	0.2 mg/m^3	0.1 mg/m^3	80 mg/m^3
Benzo(a)pyrene[1]	0.2 mg/m^3	0.1 mg/m^3	80 mg/m^3
Benzo(b)fluoranthene[1]	0.2 mg/m^3	0.1 mg/m^3	80 mg/m^3
Chrysene[1]	0.2 mg/m^3	0.1 mg/m^3	80 mg/m^3
PCBs	0.5 mg/m^3	0.001 mg/m^3	5 mg/m^3
Arsenic	0.01 mg/m^3	0.002 mg/m^3	5 mg/m^3
Barium	0.5 mg/m^3	0.5 mg/m^3	50 mg/m^3
Cadmium	0.005 mg/m^3	NA	9 mg/m^3
Copper	1 mg/m^3	1 mg/m^3	100 mg/m^3
Lead	0.05 mg/m^3	0.05 mg/m^3	100 mg/m^3
Mercury	0.1 mg/m^3	0.05 mg/m^3	10 mg/m^3

CONSTITUENT	OSHA PEL	NIOSH REL	IDLH
Selenium	0.2 mg/m^3	0.2 mg/m^3	1 mg/m^3
Silver	0.01 mg/m^3	0.01 mg/m^3	10 mg/m^3
Zinc	5 mg/m^3	5 mg/m^3	500 mg/m^3

NA = Not Available [1] As coal Tar Pitch ppm = parts per million mg/m^3 = milligram per meter cubed

The potential routes of exposure for these constituents include inhalation, ingestion, skin absorption and/or skin/eye contact, which are dependent on the activity being conducted. The most likely routes of exposure for the activities that are to be performed during environmental activities at the Site include inhalation and skin/eye contact.

4.1.1 Potassium Permanganate

Anyone using this material should read and understand each element and section of the vendor's current Material Safety Data Sheet (MSDS). A copy of Hepure's MSDS for potassium permanganate ($KMnO_4$) is included in Attachment 4. The remediation subcontractor's health and safety protocols for mixing and injecting the slurry are outlined in Attachment 5

As part of the Supplemental IRM work, $KMnO_4$ will be used for ISCO of the saturated overburden zone at the Site that is contaminated with chlorinated VOCs primarily consisting of PCE. The MSDS includes specific sections for first aid measures, fire-fighting measures, accidental release measures, handling and storage measures, exposure controls and personal protection. Physical and chemical properties, stability and reactivity, toxicological information, ecological information, disposal considerations, transportation information and regulatory information for $KMnO_4$ are also included on the MSDS. Additional information on potassium permanganate is summarized below.

Physical and Chemical Properties (See MSDS)

Potassium permanganate is a strong oxidizer that is an odorless, dark purple solid with a metallic luster. It is non-flammable, has a specific gravity of 2.7 at 68^{o}F, and has a bulk density ranging between 1.45 to 1.6 kg/l. At 68^{o}F and 154^{o}F, its solubility in water is 6% and 20%, respectively.

Stability and Reactivity (See MSDS)

Potassium permanganate is stable under normal temperatures and pressures, and will decompose with evolution of oxygen (O_2) at temperatures above 302^{o}F. Once decomposition starts, it can result in a violent and self-sustaining exothermic reaction. As such, potassium permanganate should be stored/used at temperatures below 302^{o}F.

Potassium permanganate is incompatible with acids, formaldehyde, antifreeze, hydraulic fluids, combustible organic materials, and oxidizable inorganic materials including metal powders. Extra care with high concentration permanganate solutions will be taken since contact with combustibles (cotton, paper, products, and other organic materials) may cause a spontaneous fire. Potassium permanganate must be stored away from gasoline, diesel fuel, ethylene glycol, hydraulic fluids, motor oil, or greases, since contact with these incompatible materials could initiate combustion and/or exothermic reaction. If potassium permanganate comes in contact with hydrochloric acid, chorine gas is released.

If solid potassium permanganate is heated to temperatures above approximately 300^{o}F, it can spontaneously decompose and release oxygen that can support an existing fire or potentially initiate combustion. To minimize any potential adverse reactions of potassium permanganate, the following procedures and practices will be implemented:

- Maintain a current MSDS at all times.
- Require personnel who may come in contact with potassium permanganate to review the current MSDS;
- Transport the potassium permanganate in closed and sealed containers according to the current MSDS;
- Store potassium permanganate in a dry and secure conditions.
- Do not store potassium permanganate near fuels or other potentially reactive materials;
- Do not store potassium permanganate near a heat source.

The above precautionary measures apply to the solid form and liquid solutions of potassium permanganate.

Routes of Exposure and Toxicity (See MSDS)

Routes of exposure to potassium permanganate include inhalation, skin and eye contact, and ingestion. Inhalation can cause respiratory disorders, coughing, and central nervous system damage from manganese poisoning. Contact of high concentrations of potassium permanganate with skin or eyes can result in severe irritation and burns, brown staining of the skin, and temporary or permanent vision loss. Ingestion may result in: nausea, vomiting, sore throat and stomach pain when involving up to 1% concentrations; swelling of the throat and possible suffocation when involving 2% to 3% concentrations; and damage to kidneys when involving 4% or higher concentrations. Damage to the intestines and liver can also occur. Potassium permanganate is not classified as a carcinogen.

Exposure Limits (See MSDS)

The OSHA PEL, the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value-Time Weighted Average (TLV-TWA) concentration limit for a normal 8-hour workday and a 40-hour workweek to which workers may be repeatedly exposed, day after day, without adverse effect, and the OSHA IDLH for potassium permanganate are provided below.

CONSTITUENT	OSHA PEL	ACGIH TLV-TWA	IDLH
Potassium Permanganate	5 mg/m^3 (as Mn)	0.2 mg/m^3 as Mn	500 mg/m^3 (as Mn)

Mn = manganese

Neutralizing Potassium Permanganate (See MSDS)

During injection work, permanganate stains, spills and daylighting are anticipated. To the extent practicable, the permanganate will be cleaned up and re-used. Any permanganate that cannot be re-used will be neutralized and diluted in order to ensure a safe working environment. In addition, excess permanganate that cannot be returned to the manufactured and is located in equipment, rinse water from containers, drums or supersacks used to store the permanganate, or other activities where excess permanganate is generated will also require neutralization.

Neutralizing solution shall only be applied to diluted potassium permanganate in order to prevent any adverse reaction. Undiluted dry potassium permanganate will be transferred to a drum or other compatible container, diluted with water until the dry potassium permanganate crystals are dissolved, and then neutralized. Liquid potassium permanganate spill, stain and/or daylighting shall be contained or collected, and then neutralized.

Aqueous solutions of potassium permanganate can be neutralized using sodium thiosulfate (refer to MSDS in Attachment 4) that result in the following reaction.

$$8\ KMnO_4 + 3\ Na_2S_2O_3 = H2O = 3\ K_2SO_4 = 3\ Na_2SO_4 + 8\ MnO_2 + 2\ KOH$$

As shown, the stoichiometric weight ratio is 0.375 parts $Na_2S_2O_3$: 1 part $KMnO_4$

Minor splashes and spills of potassium permanganate can be neutralized by spray applying a mixture of one part vinegar, one part water, and one part 3% hydrogen peroxide. The MSDS’ for vinegar and hydrogen peroxide are included in Attachment 4.

Other neutralizers include bisulfite and ferrous salt solutions, which may require some dilute sulfuric acid to promote reduction. If sulfuric acid is used, it must later be neutralized with sodium bicarbonate.

Other Injectate Materials

In addition to the potassium permanganate, it is anticipated that nitrogen gas, Rantec G150 Guar gum, and LEB-H enzyme may be used as part of the ISCO injection process. MSDS’ for each of these materials are included in Attachment 4.

4.2 PHYSICAL HAZARDS

There are physical hazards associated with this type of project. Hazard identification, training, adherence to the standard operating procedures associated with implementing the planned scope of work, and proper housekeeping can prevent incidents caused by physical hazards. Potential physical hazards associated with this project and suggested preventative measures include:

- Slip/Trip/Fall Hazards - Some areas may have wet or frozen surfaces that will greatly increase the possibility of inadvertent slips. Caution must be exercised when using steps and stairs due to slippery surfaces. Good housekeeping practices are essential in minimizing the trip hazards.

- Small Quantity Flammable Liquids - Small quantities of flammable liquids will be stored in "safety" cans and properly labeled. Fuels and oils must be stored away from potassium permanganate storage and mixing areas.

- Electrical Hazards - Electrical devices and equipment shall be de-energized prior to working near them. All extension cords will be kept out of water, protected from crushing, and observed regularly to ensure structural integrity. Temporary electrical circuits will be protected with ground fault circuit interrupters. Only qualified electricians are authorized to work on electrical circuits. Heavy equipment (e.g., excavator, backhoe, drill rig) shall not be operated within 10 feet of high voltage lines, unless proper protection from the high voltage lines is provided by the appropriate utility company.
- Noise - Large equipment often creates excessive noise. The effects of noise can include:
  - Workers being startled, annoyed, or distracted.
  - Physical damage to the ear resulting in pain, or temporary and/or permanent hearing loss.
  - Communication interference that may increase potential hazards due to the inability to warn of danger and proper safety precautions to be taken.

  Engineering controls will be used to the extent possible. Proper hearing protection will be made available to on-site workers. For most work, exposure to noise exceeding an 8-hour time weighted average (TWA) sound level of 85 decibels on the A-weighted scale (dBA) is not anticipated. However, whenever noise exposures equal or exceed an 8-hour TWA sound level of 85 dBA, the employers of the specific workers shall administer a continuing, effective hearing conservation program as described in the OSHA Regulation 29 Code of Federal Rules (CFR) Part 1910.95.
- Heavy Equipment - Each morning before start-up, heavy equipment will be checked to ensure safety equipment and devices are operational and ready for immediate use.
- Subsurface and Overhead Hazards - Before any intrusive activity, efforts will be made to determine whether underground utilities and potential overhead hazards will be encountered. Underground utility clearance must be obtained prior to subsurface work.

4.3 ENVIRONMENTAL HAZARDS

Environmental factors such as weather, wild animals, insects, snakes and irritant plants can pose a hazard when performing outdoor tasks. The SSO shall make reasonable efforts to alleviate these hazards should they arise.

4.3.1 Heat Stress

The combination of warm ambient temperature and protective clothing increases the potential for heat stress. In particular:

- Heat rash
- Heat cramps
- Heat exhaustion
- Heat stroke

Site workers will be encouraged to increase consumption of water or electrolyte-containing beverages such as Gatorade® when the potential for heat stress exists. In addition, workers are encouraged to take rests whenever they feel any adverse effects that may be heat-related. The frequency of breaks may need to be increased upon worker recommendation to the SSO.

4.3.2 Exposure to Cold

With outdoor work in the winter months, the potential exists for hypothermia and frostbite. Protective clothing greatly reduces the possibility of hypothermia in workers. However, personnel will be instructed to wear warm clothing and to stop work to obtain more clothing if they become too cold. Employees will also be advised to change into dry clothes if their clothing becomes wet from perspiration or from exposure to precipitation.

5.0 SITE CONTROLS

In order to prevent migration of contamination or remediation products (i.e., $KMnO_4$ slurry derived from RemOx®S) through tracking by personnel or equipment, work areas and personal protective equipment staging/decontamination areas will be specified prior to beginning operations. A chain link perimeter fence system with locked gates is present at the Site (refer to Figure 2). DAY and the City will have keys to the locked gates in order to control access to the Site. Potassium permanganate will be stored inside a lockable containers (e.g., a locked semi-truck trailer that is staged on-site as shown on Figure 2).

5.1 SITE CONTROL ZONES

Figure 2 depicts the proposed tentative locations of Site control zones.

- Restricted Access ISCO Areas will be used around areas of active storage, mixing or injection of potassium permanganate. During active injection, mixing, or handling of ISCO reagent, access in these areas will be restricted to the remediation subcontractor, DAY, City, and emergency personnel. Personnel entering these areas are required to wear the recommended level of protection for Restricted Access ISCO Areas (refer to Section 6.1).
- In areas where contaminated materials present a potential for worker exposure (“exclusion zone”), personnel entering the area are required to wear the recommended level of protection for the area (refer to Section 6.1).
- A "contaminant reduction zone" has been established where personnel can begin and complete personal and equipment decontamination procedures. Each on-site entity (e.g., consultant, regulator, remediation subcontractor, drilling subcontractor, surveyor, etc.) must establish one or more corridor within the contaminant reduction zone through which its personnel and equipment shall be decontaminated. This can reduce potential off-site migration of contaminated media. Contaminated materials or clothing will remain in the contaminant reduction zone until properly containerized for disposal.
- Operational support facilities will be located outside the contaminant reduction zone (i.e., in a "support zone"), and normal work clothing and support equipment are appropriate in this area.

5.2 GENERAL

The following items will be requirements to protect the health and safety of workers during implementation of activities that disturb contaminated material.

- Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand to mouth transfer and ingestion of contamination shall not occur in the exclusion zone and/or contaminant reduction zone during disturbance of contaminated material or activities involving $KMnO_4$ or other hazardous remediation chemicals.
- Personnel admitted in the exclusion zone and contaminant reduction zone shall be properly trained in health and safety techniques and equipment usage in accordance with applicable OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) regulations referenced in 29 CFR 1910.120 and 29 CFR 1926.65.

- No personnel shall be admitted in the exclusion zone without the appropriate PPE (refer to Section 6.0 – Protective Equipment).
- Proper decontamination procedures shall be followed before entering the support zone and leaving the Site.

5.3 OFF-HOURS SITE SECURITY DURING STORAGE OF POTASSIUM PERMANGANATE

When greater than 400 pounds of potassium permanganate is actively being stored on-site, a security service will be retained to monitor the Site on a continuous basis when the Site is not occupied by DAY, the City or one or more of DAY's subcontracted entities. Anticipated site security coverage includes, but is not limited to, the hours of 6:00 PM EST and 6:00 AM EST on weekdays and around the clock (24 hours/day) on weekends, holidays, or other weekdays if the site is not occupied. The security service will be staged immediately off-site in one or more of the public right-of-ways of Franklin Square, Bristol Street or Andrews Street. The security service can immediately alert police and others if intruders are observed on-site.

5.4 TEMPORARY CLOSURE OF ADJOINING PARKLAND

As a precautionary measure, the adjoining City parkland (Schiller Park) located east of the Site on the opposite side of Franklin Square will be closed to the public immediately prior to, and for the duration of, the time when potassium permanganate is actively being used on-site. Shiller Park will be re-opened for public use when the injection work has been completed and no potassium permanganate is present aboveground at the Site.

6.0 PERSONAL PROTECTIVE EQUIPMENT

This section addresses the various levels of PPE, which are or may be required at this job site. Personnel entering the exclusion zone and contaminant reduction zone shall be trained in the use of the anticipated PPE to be utilized.

6.1 ANTICIPATED PROTECTION LEVELS

The following table summarizes the protection levels (refer to Section 6.2) anticipated for tasks to be implemented during this project.

TASK	PROTECTION LEVEL	COMMENTS/MODIFICATIONS
Site Preparation and Mobilization	D	
ISCO Baseline Monitoring	D	
ISCO Drilling	C/Modified D/D	Based on air monitoring, and SSO discretion
ISCO Mixing and Injection	C	Based on air monitoring, and SSO discretion
ISCO Process Monitoring	C/Modified D	Based on air monitoring, and SSO discretion
ISCO Emergency Response, Neutralizing permanganate spills, daylighting, stains, etc.	B/C/Modified D	Based on air monitoring, and SSO discretion
ISCO Performance Monitoring	Modified D/D	Based on air monitoring, whether active ISCO injection work is being performed, and SSO discretion
Supplemental IRM Soil Removals	C/Modified D/D	Based on scope, air monitoring, and SSO discretion
Contingency – Further In-Situ Remediation	C/Modified D/D	Based on air monitoring, and SSO discretion
Management of IRM-Derived Wastes	C/Modified D/D	Based on air monitoring, and SSO discretion
Installation of Cover System	D	
Site Restoration, Demobilization and Closeout Activities	D	
Long-Term Groundwater Monitoring	D	

It is anticipated that most work conducted as part of this project will be performed in Level D, modified Level D, or Level C PPE. In some instances involving a potassium permanganate ISCO emergency (e.g., spill, adverse reaction, etc.), the contractor may be required to respond in level B PPE. If conditions are encountered that require Level A PPE, the appropriate government agencies, such as the City, the NYSDEC, the NYSDOH, Monroe County Department of Public Health (MCDPH) and Monroe County Office of Environmental Management (MCOEM) will be notified and the proper health and safety measures will be implemented (e.g., develop and implement engineering controls, upgrade in PPE, etc.).

6.2 PROTECTION LEVEL DESCRIPTIONS

This section lists the minimum requirements for each protection level. Modifications to these requirements can be made upon approval of the SSO. If Level A or Level B PPE is required, Site personnel that enter the exclusion zone and/or contaminant reduction zone must be properly trained and certified in the use of those levels of PPE in accordance with applicable OSHA HAZWOPER regulations referenced in 29 CFR 1910.120 and 29 CFR 1926.65.

6.2.1 Level D

Level D consists of the following:

- Safety glasses
- Hard hat when working near heavy equipment
- Steel-toed or composite-toed work boots
- Protective gloves during sampling or handling of potentially contaminated media
- Work clothing as prescribed by weather

6.2.2 Modified Level D

Modified Level D consists of the following:

- Safety glasses with side shields
- Hard hat when working with heavy equipment
- Steel-toed or composite-toed work boots
- Nitrile, latex, neoprene, or polyvinyl chloride (PVC) overboots
- Protective gloves during sampling or handling of potentially contaminated media
- Face shield (when projectiles or splashes pose a hazard)
- Chemical resistant clothing, such as poly-coated Tyvek or Saranex coverall with attached hoods, booties and elastic wrist bands.

6.2.3 Level C

Level C consists of the following:

- Half face air-purifying respirator and face shield, or full-face air-purifying respirator, with combination organic vapor/high-efficiency particulate air (HEPA) filter cartridges

- Chemical resistant clothing, such as poly-coated Tyvek or Saranex coverall with attached hoods, booties and elastic wrist bands
- Hard hat when working with heavy equipment
- Steel-toed or composite-toed work boots
- Nitrile, neoprene, or PVC overboots
- Inner Nitrile or latex gloves,
- Outer Nitrile, neoprene, or PVC gloves

6.2.4 Level B

Level B protection consists of the items required for Level C protection with an air-supplied respirator used in lieu of an air-purifying respirator. Level B PPE may be required during ISCO emergencies when spills, stains or daylighting areas involving potassium permanganate are being addressed (contained and neutralized) or in the case of violent oxidizing reactions with incompatible materials, should such situations occur. If Level B protection is needed to address the above situations, other activities (i.e., not related to responding to a potassium permanganate spill, stains, daylighting, etc.) in the affected area will be stopped until conditions are properly addressed.

6.2.5 Level A

Level A protection consists of the items required for Level B protection with the addition of a fully-encapsulating, vapor-proof suit capable of maintaining positive pressure. Level A PPE is not anticipated to be required during this project. If Level A protection becomes warranted, activities in the affected area will be stopped until conditions are further evaluated, and any necessary modifications to the HASP have been approved by the PM and SSO. Subsequently, the appropriate safety measures (including Level A PPE) must be implemented prior to commencing activities in the affected area.

6.3 RESPIRATORY PROTECTION

Any use of respiratory protection will be in accordance with the requirements of the OSHA 29 CFR 1910.134. Air purifying respirators shall not be worn if contaminant levels exceed designated use concentrations. The workers will wear respirators with approval for: organic vapors <1,000 ppm; and dusts, fumes and mists with a TWA < 0.05 mg/m^3.

No personnel who have facial hair, which interferes with respirator sealing surface, will be permitted to wear a respirator and will not be permitted to work in areas requiring respirator use.

Only workers who have been certified by a physician as being physically capable of respirator usage shall be issued a respirator. Personnel unable to pass a respiratory fit test or without medical clearance for respirator use will not be permitted to enter or work in areas that require respiratory protection.

7.0 DECONTAMINATION PROCEDURES

This section describes the procedures necessary to ensure that both personnel and equipment are free from contamination when they leave the work site.

7.1 PERSONNEL DECONTAMINATION

Personnel involved with activities associated with disturbing contaminated media and/or performing remediation activities associated with handling of remediation chemicals will follow the decontamination procedures described herein to ensure that material which workers may have contacted in the exclusion zone and/or contaminant reduction zone does not result in personal exposure and is not spread to clean areas of the Site. This sequence describes the general decontamination procedure. The specific stages can vary depending on the Site, the task, and the protection level, etc.

1. Leave exclusion zone and go to contaminant reduction zone
2. Neutralize any potassium permanganate contaminated PPE (refer to Section 4.1.1)
3. Remove soil/debris from boots and gloves
4. Remove boots
5. Remove gloves
6. Remove Tyvek suit and discard, if applicable
7. Remove and wash respirator, if applicable
8. Go to support zone

7.2 EQUIPMENT DECONTAMINATION

Decontamination procedures for equipment are presented as Section 4.0 of the Quality Assurance Project Plan (QAPP).

7.3 DISPOSAL

Disposable protective clothing will be disposed in accordance with applicable regulations. Liquids (e.g., decontamination water, etc.) or solids (e.g., soil) generated by Supplemental IRM activities will be disposed in accordance with applicable regulations.

8.0 AIR MONITORING

Air monitoring will be conducted in order to determine airborne particulate and contamination levels during activities that have the potential to disturb contaminated soil or fill material. Air monitoring will be conducted in order to determine airborne contamination levels, but not particulates, during activities that have the potential to disturb contaminated groundwater. During activities that have the potential to disturb potassium permanganate, air monitoring will be conducted in order to determine airborne particulate levels. This ensures that respiratory protection is adequate to protect personnel against the chemicals that are encountered and that chemical contaminants are not migrating off-site. Additional air monitoring may be conducted at the discretion of the SSO. VOC and particulate readings will be recorded on daily air monitoring logs that are accompanied by a daily figure, copies of which are included in Attachment 6. This documentation will be available for NYSDEC and NYSDOH personnel to review.

The following chart describes the direct reading instrumentation that will be utilized and appropriate action levels.

Monitoring Device	Action level	Response/Level of PPE
PID Volatile Organic Compound Meter	< 25 ppm in breathing zone	Level D
	25-100 ppm in breathing zone	Cease work, implement vapor suppression techniques such as application of BioSolve. If levels are not reduced below 25 ppm in the breathing zone, then upgrade PPE to Level C.
	>100 ppm in breathing zone	Level A, Stop work, evaluate the use of engineering controls, etc. If levels are not reduced below 100 ppm in the breathing zone, then upgrade PPE to Level A or Level B.
RTAM Particulate Meter	< 100 ug/m^3 (i.e., < 0.1 mg/m^3) over an integrated period not to exceed 15 minutes.	Continue working
	> 100 ug/m^3 over an integrated period not to exceed 15 minutes.	Cease work, implement dust suppression, change in way work performed, etc. If levels are not reduced below 150 ug/m^3, then upgrade PPE to Level C.

PID = Photoionization detector RTAM = Real Time Aerosol Monitor ug/m^3 = microgram per meter cubed

8.1 PARTICULATE MONITORING

During activities where contaminated materials (e.g., soil, fill, etc.) or potassium permanganate remediation reagent may be disturbed, air monitoring will include real-time monitoring for particulates using a RTAM particulate meter at the perimeter of the exclusion zone in accordance with the Final DER-10 Technical Guidance for Site Investigation and Remediation dated May 2010. DER-10 uses an action level of 100 ug/m^3 (0.10 mg/m^3) over background conditions for an integrated period not to exceed 15 minutes. [Note: The ACGIH TLV-TWA for potassium permanganate (as Mn) is 0.2 mg/m^3. As such, the particulate action level of 100 ug/m^3 (or 0.1 mg/m^3) is protective of this ACGIH TLV-TWA.] Levels of particulates will periodically be measured in the air at active work areas within the exclusion zone, and at the contaminant reduction zone when levels are detected above background in the exclusion zone. If the action level is exceeded, or if visible dust is observed leaving the work site, then work shall be discontinued until corrective actions are implemented. Corrective actions may include dust suppression, change in the way work is performed, and/or upgrade of personal protective equipment.

8.2 VOLATILE ORGANIC COMPOUND MONITORING

During activities where contaminated materials may be disturbed, a PID will be used to monitor total VOCs in the ambient air. The PID will prove useful as a direct reading instrument to aid in determining if current respiratory protection is adequate or needs to be upgraded. The SSO will take background measurements before operations begin in an area to determine the amount of VOCs naturally occurring in the air. Levels of VOCs will periodically be measured in the air at active work areas within the exclusion zone, and at the contaminant reduction zone when levels are detected above background at the perimeter of the exclusion zone.

8.3 COMMUNITY AIR MONITORING PLAN

During intrusive activities, activities that have the potential to disturb contaminated soil or fill material, and activities that have the potential for airborne releases of remediation chemicals (e.g., $KMnO_4$ in the form of dust or particulates), this Community Air Monitoring Plan (CAMP) will be implemented. The CAMP includes real-time monitoring for VOCs and particulates (i.e., dust) at the downwind perimeter of each designated work area when activities with the potential to release VOCs or dust are being conducted at the Site. This CAMP is based on the NYSDOH Generic CAMP included as Appendix 1A of the NYSDEC document titled *"DER-10, Technical Guidance for Site Investigation and Remediation"* dated May 2010. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of project activities. Figure 2 depicts tentative CAMP station locations along the perimeter of the Site. For each day that CAMP monitoring is performed, a copy of Figure 2 in Attachment 6 will be used to document wind directions and the actual CAMP monitoring locations based on actual areas where work that requires monitoring is being performed. An upwind background station will be established at the beginning of the day and monitored throughout the day to verify the location is upwind. In the event wind direction changes, a subsequent background location will be established and monitored, and the change in wind direction will be noted on the copy of Figure 2 for that day. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air. Reliance on the CAMP should not preclude simple, common sense measures to keep VOCs, dust, and odors at a minimum around, and downwind of, the work areas.

Continuous monitoring will be conducted during ground intrusive activities involving potentially contaminated soil, fill material or groundwater and also mixing or injection of remediation chemicals (e.g., $KMnO_4$). Ground intrusive activities include advancement / installation of test borings or injection points, and ISCO injections.

Periodic monitoring for VOCs will be conducted during non-intrusive activities involving potentially contaminated soil, fill material or groundwater where deemed appropriate (e.g., during baseline monitoring, performance monitoring, cover system installation, management of IRM-derived wastes, long-term monitoring, etc.).

VOC and particulate 15-minute readings, and instantaneous readings (if collected), will be recorded on daily air monitoring logs that are accompanied by a daily figure, copies of which are included in Attachment 6. This documentation will be available for NYSDEC and NYSDOH personnel to review.

8.3.1 VOC Monitoring, Response Levels, and Actions

VOCs must be monitored at the downwind perimeter of the immediate work area (i.e., areas within the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

- If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 ppm above background for the 15-minute average, work activities must be temporarily halted and monitoring must be continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.
- If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source or vapors identified, corrective actions taken to abate emissions (e.g., application of BioSolve), and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less (but in no case less than 20 feet), is below 5 ppm over background for the 15-minute average.
- If the organic vapor level is above 25 ppm at the perimeter of the Site, activities must be shutdown.

8.3.2 Particulate Monitoring, Response Levels, and Actions

Particulate concentrations must be monitored continuously at the upwind and downwind perimeters of the Site at temporary particulate monitoring stations. The particulate monitoring must be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during work activities.

- If the downwind PM-10 particulate level is 100 micrograms per cubic meter (ug/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 ug/m^3 above the upwind level and provided that no visible dust is migrating from the work area.
- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 ug/m^3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 ug/m^3 of the upwind level and in preventing visible dust migration.

The following chart summarizes the direct reading instrumentation and appropriate action levels that will be utilized during CAMP monitoring.

Monitoring Device	CAMP Action level	Response/Level of PPE
PID Volatile Organic Compound Meter	< 5 ppm at Site perimeter, over an integrated period not to exceed 15 minutes.	Continue work.
	5-25 ppm at Site perimeter over an integrated period not to exceed 15 minutes.	Stop work, identify vapor source, take corrective actions, and continue monitoring. Resume work if <5ppm for 15-minute average at 200 feet downwind or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less (but in no case <20 feet).
	>25 ppm at Site perimeter.	Stop work, further evaluate the use of engineering controls, etc.
RTAM Particulate Meter	< 100 ug/m^3 over an integrated period not to exceed 15 minutes, and no observable dust leaving the work area.	Continue working.
	> 100 ug/m^3 over an integrated period not to exceed 15 minutes, or if observable dust leaving the work area.	Cease work, implement dust suppression, change in way work performed, etc. Resume work if levels brought below 150 ug/m^3 above background and no visible dust leaving the work area.

9.0 AGENCY COORDINATION

DAY will coordinate with the NYSDEC, NYSDOH, MCDPH, MCOEM and City Fire Department regarding the HASP and more specifically the storage, use, security, and safety precautions associated with potassium permanganate as part of this project. As a result, these agencies will be aware of the hazards associated with the contaminants, remediation products, neutralizing agents, and heavy equipment associated with this project, which will assist them should they need to respond to the Site for an emergency situation. A copy of this HASP will be provided to each agency, and DAY and City Division of Environmental Quality (DEQ) personnel will meet with these agencies if requested. Any questions or comments received from these agencies will be addressed to the agencies' satisfaction. Agency contact information is provided below.

City of Rochester	
Fire Safety:	(585) 428-7037
Captain Christine Schryver	(585) 428-3686
Lieutenant Andrew Lonthair	(585) 753-3743
NYSDEC	
Charlotte Theobald	(585) 226-5354
NYSDOH	
Melissa Doroski	(518) 402-7860
MCDPH	
John J. Frazer, P.E.	(585) 753-5476
MCOEM	
Frederick J. Rion, Jr.	(585) 753-3810
NYSDOT	
James Willer	(585) 586-4514

10.0 EMERGENCY CONTINGENCY PLAN

This section presents the Emergency Contingency Plan (ECP) describing the procedures to be performed in the event of an emergency (e.g., fire, spill, tank/drum release, etc.).

Supplemental emergency procedures that are specific to the use of i.e., $KMnO_4$ and ISC0-related chemicals during this project (e.g., transferring, mixing, injection, etc.) are included on the $KMnO_4$ MSDS in Attachment 4 and in the remediation subcontractor's health and safety protocols in Attachment 5.

To provide first-line assistance to field personnel in the case of illness or injury, the following items will be made immediately available on the Site:

- First-aid kit;
- Portable emergency eye wash;
- Emergency shower; and
- Supply of clean water.

10.1 EMERGENCY TELEPHONE NUMBERS

The following telephone numbers are listed in case there is an emergency at the Site:

Fire/Police Department:	911
City Fire Safety:	(585) 428-7037
Poison Control Center:	(800) 222-1222
<u>NYSDEC</u>	
Charlotte Theobald	(585) 226-5354
Spills Hotline	1-800-457-7362
<u>NYSDOH</u>	
Melissa Doroski	(518) 402-7860
<u>MCDPH</u>	
John J. Frazer, P.E.	(585) 753-5476
<u>MCOEM</u>	
Frederick J. Rion, Jr.	(585) 753-3810
<u>CITY OF ROCHESTER</u>	
Joseph Biondolillo	(585) 428-6649; (585) 314-1617 (cell)
Dennis Peck	(585) 428-6884; (585) 469-6372 (cell)
<u>DAY ENVIRONMENTAL, INC.</u>	
Jeffrey Danzinger	(585) 454-0210 x114; (585) 967-2803 (cell)
Nicholas Harding	(585) 454-0210 x114

Nearest Hospital	Highland Hospital 1000 South Avenue, Rochester, NY 14620 (585) 473-2200 (Main), (585) 341-6880 (EMS)
Directions to the Hospital:	Turn west on Andrews Street toward Bristol Street. Proceed approximately 0.2 miles on Andrews Street, then turn left onto St Paul Street. Proceed approximately 0.2 miles on St. Paul Street, which then becomes South Avenue. Proceed approximately 1.5 miles on South Avenue, then turn left into Highland Hospital. Follow signs to Emergency Medical Services (Refer to Figure 1).

10.2 EVACUATION

During activities involving potential disturbance or remediation of contaminated soil, fill material, or groundwater, a log of each individual entering and leaving the Site will be kept for emergency accounting practices. Although unlikely, it is possible that a site emergency could require evacuating personnel from the Site. If required, the SSO will give the appropriate signal for site evacuation (i.e., hand signals, alarms, etc.).

All personnel shall exit the Site and shall congregate in an area designated by the SSO. The SSO shall ensure that all personnel are accounted for. If someone is missing, the SSO will alert emergency personnel. The appropriate government agencies will be notified as soon as possible regarding the evacuation, and any necessary measures that may be required to mitigate the reason for the evacuation.

10.3 MEDICAL EMERGENCY

In the event of a medical emergency involving illness or injury to one of the on-site personnel, EMS and the appropriate government agencies should be notified immediately. The area in which the injury or illness occurred shall not be entered until the cause of the illness or injury is known. The nature of injury or illness shall be assessed. If the victim appears to be critically injured, administer first aid and/or cardio-pulmonary resuscitation (CPR) as needed. If appropriate, instantaneous real-time air monitoring shall be done in accordance with air monitoring outlined in Section 8.0 of this HASP.

10.4 CONTAMINATION EMERGENCY

It is unlikely that a contamination emergency will occur; however, if such an emergency does occur, the specific work area shall be shut down and immediately secured. If an emergency rescue is needed, notify Police, Fire Department, MCOEM, and EMS units immediately. Advise them of the situation and request an expedient response. The appropriate government agencies shall be notified immediately. The area in which the contamination occurred shall not be entered until the arrival of trained personnel who are properly equipped with the appropriate PPE and monitoring instrumentation as outlined in Section 8.0 of this HASP.

10.5 FIRE EMERGENCY

In the event of a fire on-site, all non-essential site personnel shall be evacuated to a safe, secure area. The Fire Department will be notified immediately, and advised of the situation and the identification of any hazardous materials involved. The appropriate government agencies shall be notified as soon as possible.

The four classes of fire along with their constituents are as follows:

Class A:	Wood, cloth, paper, rubber, many plastics, and ordinary combustible materials.
Class B:	Flammable liquids, gases and greases.
Class C:	Energized electrical equipment.
Class D:	Combustible metals such as magnesium, titanium, sodium, potassium.

NOTE: Fires involving $KMnO_4$ should only be extinguished using water. DO NOT use dry chemicals, CO_2, Halon®, or foams.

Small fires on-site may be actively extinguished; however, extreme care shall be taken when performing this operation. Approaches to the fire shall be done from the upwind side if possible. Distance from on-site personnel to the fire shall be close enough to ensure proper application of the extinguishing material, but far enough away to ensure that the personnel are safe. The proper extinguisher shall be utilized for the Class(s) of fire present on the site. If possible, the fuel source shall be cut off or separated from the fire. Care must be taken when performing operations involving the shut-off of valves and manifolds, if present.

Examples of proper extinguishing agent as follows:

Class A:	Water Water with 1% AFFF Foam (Wet Water) Water with 6% AFFF or Fluorprotein Foam ABC Dry Chemical
Class B:	ABC Dry Chemical Purple K Carbon Dioxide Water with 6% AFFF Foam
Class C:	ABC Dry Chemical Carbon Dioxide
Class D:	Metal-X Dry Powder

No attempt shall be made against large fires. These shall be handled by the Fire Department or Hazardous Materials response team.

10.6 SPILL OR AIR RELEASE

In the event of a spill or air release of hazardous materials on-site, the specific area of the spill or release shall be shut down and immediately secured. The area in which the spill or release occurred shall not be entered until the cause can be determined and site safety can be evaluated. Non-essential site personnel shall be evacuated to a safe and secure area. The appropriate government agencies shall be notified as soon as possible. The spilled or released material shall be immediately identified and appropriate containment measures shall be implemented, if possible. Real-time air monitoring shall be implemented as outlined in Section 8.0 of this HASP. If the materials are unknown, Level B protection is mandatory. If warranted, samples of the materials shall be acquired to facilitate identification.

10.7 LOCATING CONTAINERIZED WASTE AND/OR UNDERGROUND STORAGE TANKS

In the event that unanticipated containerized waste (e.g., drums) and/or underground storage tanks (USTs) are located during remedial activities, the work will be stopped in the specific area until site safety can be evaluated and addressed. Non-essential Site personnel shall not work in the immediate area until conditions including possible exposure hazards are addressed. The appropriate government agencies shall be notified as soon as possible. The SSO shall monitor the area as outlined in Section 8.0 of this HASP.

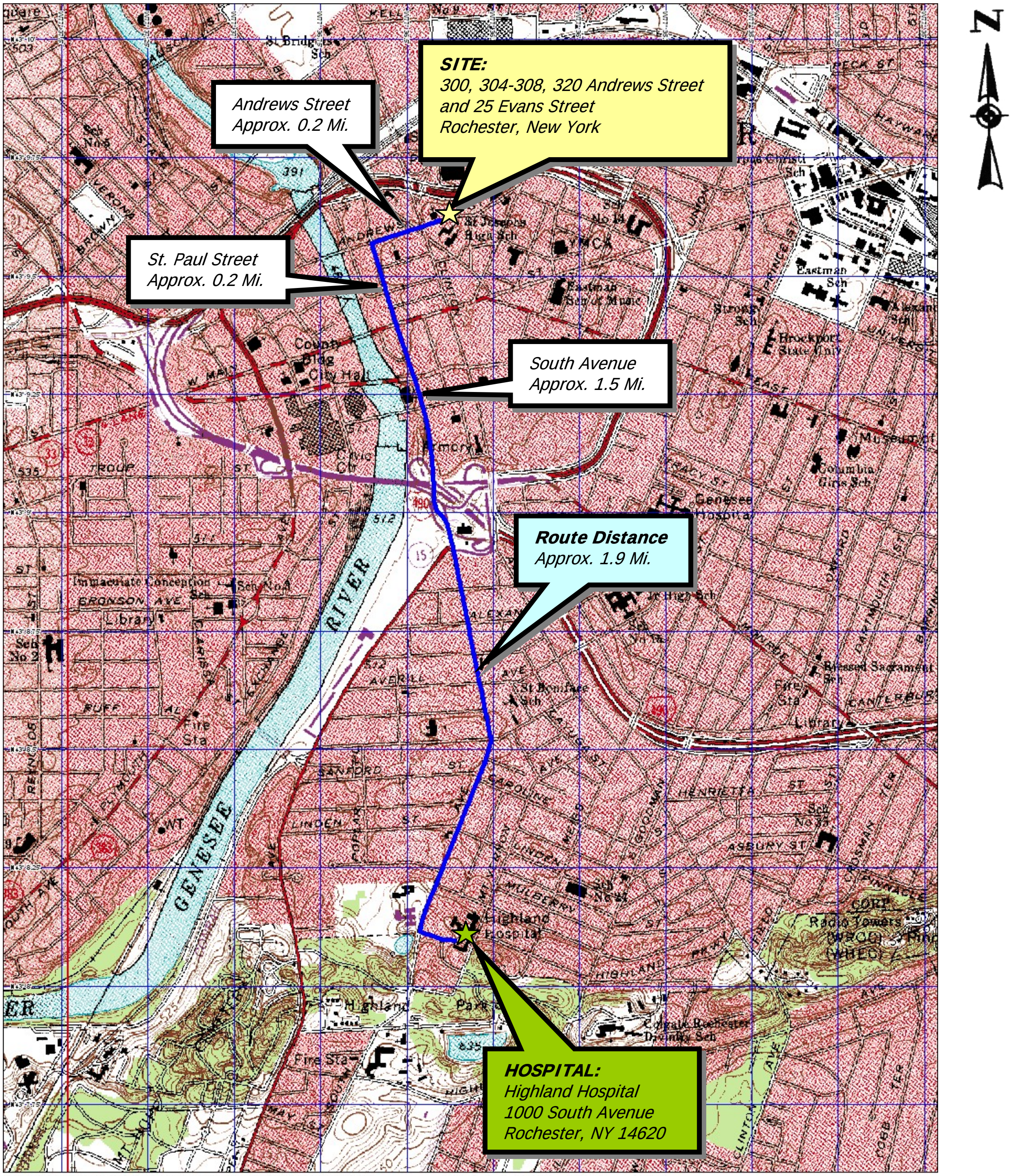
Prior to any handling, unanticipated containers will be visually assessed by the SSO to gain as much information as possible about their contents. As a precautionary measure, personnel shall assume that unlabeled containers and/or tanks contain hazardous materials until their contents are characterized. To the extent possible based upon the nature of the containers encountered, actions may be taken to stabilize the area and prevent migration (e.g., placement of berms, etc.). Subsequent to initial visual assessment and any required stabilization, properly trained personnel will sample, test, remove, and dispose of any containers and/or tanks, and their contents. After visual assessment and air monitoring, if the material remains unknown, Level B protection is mandatory.

11.0 ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists
CAMP	Community Air Monitoring Program
CCD	Center City District
CFR	Code of Federal Regulations
City	City of Rochester
CPR	Cardio-Pulmonary Resuscitation
DAY	Day Environmental, Inc.
dBA	Decibels on the A-Weighted Scale
DEQ	Division of Environmental Quality
ECP	Emergency Contingency Plan
EMS	Emergency Medical Service
ERP	Environmental Restoration Program
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HEPA	High-Efficiency Particulate Air
IDLH	Immediately Dangerous to Life or Heath
IH	Industrial Hygienist
IRM	Interim Remedial Measure
ISCO	In-Situ Chemical Oxidation
$KMnO_4$	Potassium Permanganate
MCDPH	Monroe County Department of Public Health
MCOEM	Monroe County Office of Environmental Management
mg/m^3	Milligram Per Meter Cubed
MSDS	Material Safety Data Sheet
NIOSH	National Institute for Occupational Safety and Health
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
O_2	Oxygen
OSHA	Occupational Safety and Health Administration
PCB	Polychlorinated Biphenyl
PCE	Perchloroethene, or Tetrachloroethene
PEL	Permissible Exposure Limit
PID	Photoionization Detector
PM	Project Manager
PM-10	Particulate Matter Less Than 10 Micrometers In Diameter
PPE	Personal Protection Equipment
ppm	Parts Per Million
PVC	Polyvinyl Chloride
QAPP	Quality Assurance Project Plan
REL	Recommended Exposure Limit
RI	Remedial Investigation
RTAM	Real-Time Aerosol Monitor
SCG	Standards, Criteria and Guidance
SSO	Site Safety Officer
SVOC	Semi-Volatile Organic Compound
TCE	Trichloroethene
TLV	Threshold Limit Value
TWA	Time-Weighted Average
ug/m^3	Microgram Per Meter Cubed
UST	Underground Storage Tank
VOC	Volatile Organic Compound

ATTACHMENT 1

Figure 1- Route for Emergency Services



3-D TopoQuads Copyright © 1999 DeLorme Yarmouth, ME 04096 Source Data: USGS

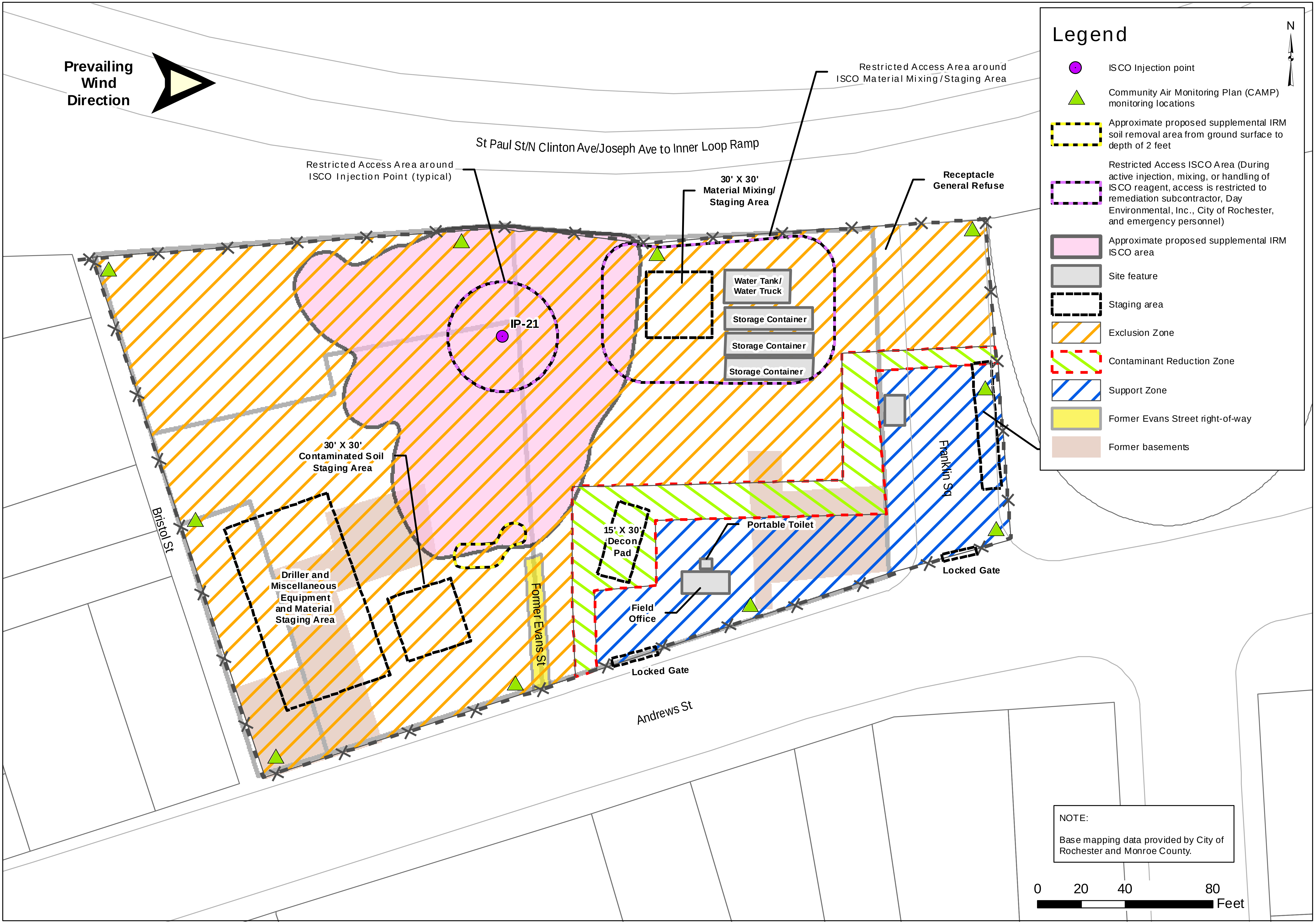
550 ft Scale: 1 : 19,200 Detail: 14-0 Datum: WGS84

Drawing Produced From: 3-D TopoQuads, DeLorme Map Co., referencing USGS quad map Rochester East (NY) 1995.

DATE **3-21-2011** DRAWN BY **RJM** SCALE **As Noted**	**day** **DAY ENVIRONMENTAL, INC.** ENVIRONMENTAL CONSULTANTS ROCHESTER, NEW YORK 14614-1008	PROJECT TITLE **300, 304-308, 320 ANDREWS STREET** **AND 25 EVANS STREET** **ROCHESTER, NEW YORK** **NYSDEC SITE #: E828144** HEALTH AND SAFETY PLAN DRAWING TITLE **ROUTE FOR EMERGENCY SERVICES**	PROJECT NO. **4355S-10** **FIGURE 1**

ATTACHMENT 2

Figure 2- Supplemental IRM Site Layout with Health and Safety Control Zones and CAMP Monitoring Locations



Legend

●	ISCO Injection point
▲	Community Air Monitoring Plan (CAMP) monitoring locations
▭	Approximate proposed supplemental IRM soil removal area from ground surface to depth of 2 feet
▭	Restricted Access ISCO Area (During active injection, mixing, or handling of ISCO reagent, access is restricted to remediation subcontractor, Day Environmental, Inc., City of Rochester, and emergency personnel)
▭	Approximate proposed supplemental IRM ISCO area
▭	Site feature
▭	Staging area
▨	Exclusion Zone
▨	Contaminant Reduction Zone
▨	Support Zone
▭	Former Evans Street right-of-way
▭	Former basements

NOTE:

Base mapping data provided by City of Rochester and Monroe County.

Map document path: E:\GIS\GIS Mapping\Andrews_Street\4355S-10Rocity - Andrews Street\Supplemental_RI_Workplan\4355S-SRI-54 - H and S Control Zones .mxd

Last date document was saved: 21 May 2014

DATE	01-2014
DESIGNED BY	JAD
DATE DRAWN	01-2014
DRAWN BY	CPS
DATE ISSUED	05-21-2014
SCALE	AS NOTED

day
DAY ENVIRONMENTAL, INC.
Environmental Consultants
Rochester, New York 14606
New York, New York 10170

Project Title
300, 304-308, 320 ANDREWS STREET
AND 25 EVANS STREET
ROCHESTER, NEW YORK

ENVIRONMENTAL RESTORATION PROJECT NYSDEC SITE NO: E828144

Drawing Title
Supplemental IRM Site Layout Plan with Health and Safety Control Zones and CAMP Monitoring Locations

Project No.
4355S-10

FIGURE 2

ATTACHMENT 3

Resume of Nicholas J. Harding

NICHOLAS J. HARDING

EXPERIENCE

Day Environmental, Inc.: 2006 to present
Years with Other Companies: 25 years

AREAS OF SPECIALIZATION

- Health and Safety Management Systems
- Environmental Management Systems
- Environmental, Health and Safety Training

EDUCATION

University of Rochester, M.S. Industrial Hygiene, 1999
Rochester Institute of Technology, B.S. Environmental Engineering, 1979

REGISTRATION/AFFILIATIONS

40-Hour OSHA Hazardous Waste Site Worker Training
OSHA 30-Hour General Industry Outreach Trainer
8-Hour OSHA Hazardous Waste Site Worker Refresher Training
New York Water Environment Association, Industrial Issues Committee, Past Chair

RESPONSIBILITIES AND PROJECT EXPERIENCE

Mr. Harding has over 25 years of technical and managerial experience working on various environmental, health and safety issues for industry and consulting firms, and he is currently a member of DAY's Industrial Compliance Group. Mr. Harding has been involved with a number of industrial clients providing services relating to conducting facility health and safety assessments and developing Corrective Action Plans; preparing comprehensive safety programs, including Hazard Communication, Hearing Conservation, Respiratory Protection, Emergency Response and Confined Space Entry; personal and area industrial hygiene monitoring, environmental compliance auditing; environmental and safety training, hazardous waste compliance assessments, etc. Some of his representative projects are described below.

As Project Manager with Day Environmental, Rochester, NY

- **Corning NetOptix facility, Keene, NH** – this long-term project includes developing comprehensive environmental, health and safety policies and procedures to comply with Corporate and regulatory agency guidelines at this Diamond Turning facility of 120 employees. Programs developed include Contingency and Emergency Action Response, Bloodborne Pathogens, Hazardous Waste Management, Exotic Materials Exposure Control, EHS Inspections, and New Equipment/Process Safety Review.
- **Bombardier Transportation, Bath, New York** – this long-term project includes conducting extensive indoor air quality and industrial hygiene monitoring at this 250-employee railcar refurbishing operation, including hexavalent chromium, lead, volatile organic compounds, sound energy levels, and particulates. Training programs developed and presented include New Employee Orientation, Respiratory Protecting, Bloodborne Pathogens, Job Safety Analysis, Fall Protection and others.
- **Metro-North Railroad, New York, New York –** this client is a major transportation provider in the metro-New York area. Programs include 40-hour Hazardous Waste Operations and Emergency Response training, Chemical, Biological and Radiological Response training programs, Responding to Weapons of Mass Destruction training programs, and developing programs related to determining sound levels in locomotives and a wide variety of railroad right-of-way and maintenance shop activities.

Ten years as Manager, Health, Safety and Environment, Celltech Pharmaceuticals, Rochester, NY

- Developed and implemented programs that achieved consistent compliance with applicable **occupational safety and health regulations** relating to hazard communication, control of hazardous energy, personal protective equipment, respiratory protection, industrial vehicle safety, and contractor safety.
- Developed and implemented comprehensive programs that achieved consistent compliance with applicable **environmental regulations** relating to air emissions, wastewater discharges, solid and hazardous waste management, preventing and responding to spills and releases and stormwater management.
- Developed and delivered over 20 effective **training programs** for hundreds of manufacturing and laboratory personnel including Hazard Communication/Right-to-Know, Hazardous Energy Control (LOTO), Powered Industrial Vehicles, Chemical Hygiene, Hazardous Waste Management, and Confined Space Entry.
- Developed and implemented comprehensive **Safety Clearance Inspection and Corrective Action Programs** for manufacturing and laboratory environments that empowered workers to maintain a safe workplace.
- Developed and implemented a detailed **Risk Assessment Program**, to anticipate, recognize, evaluate and control occupational health and safety risk in over 15 job categories, including job hazard analyses, corrective action and rigorous follow-up, resulting in consistent reductions in personnel injury and illness.
- Coordinated a highly effective plant **Medical Emergency Response Team** that consistently responded to employee health emergencies in order to evaluate conditions and implement appropriate response measures.
- Oversaw the activities associated with an on-site **NYS Department of Environmental Conservation Voluntary Cleanup Program**, involving the design, installation and operation of a dual-phase extraction system to address the removal of chlorinated solvents in the groundwater.
- Maintained close liaison with **Worker's Compensation Insurance** carrier to foster clear understandings of incidents and appropriate follow-up, minimizing premium costs by 15% of 4 years.
- Performed **industrial hygiene monitoring** throughout the facility to determine exposure levels of over 25 contaminants in order to minimize risk to the workers and to protect the surrounding environment.

- Over 13 years as Environmental Project Leader for environmental consulting companies.

  - Worked with a variety of industrial and municipal clients on behalf of an international environmental engineering firm. Provided clients **with comprehensive regulatory compliance programs**, remedial investigations and development of health and safety-related programs.
  - Prepared and negotiated **hazardous waste management** contracts; developed work plans and labor and materials budgets and managed projects through successful completion.
  - Developed detailed **engineering reports and permit applications**, which were submitted to local, State and Federal regulatory agencies for issuance of applicable environmental permits.
  - Developed **Phase I and Phase II Environmental Site Assessment** and **Corporate Environmental Regulatory Auditing** procedures that were adopted firm wide.
  - Developed and coordinated **health and safety training** programs for use throughout the organization.

ATTACHMENT 4

Material Safety Data Sheets

hepure technologies inc

innovative solutions for groundwater treatment

MSDS: Potassium Permanganate

SECTION A - PRODUCT INFORMATION

TRADE NAME : POTASSIUM PERMANGANATE, TECHNICAL GRADE **REVISION DATE :** JUNE 7, 2006
CAS NUMBER : 7722-64-7
SYNONYMS : PERMANGANATE OF POTASH; CHAMELEON MINERAL; PERMANGANIC ACID, POTASSIUM SALT
CHEMICAL FAMILY : OXIDIZERS
FORMULA : $KMnO_4$

SECTION B - HAZARDOUS COMPONENTS

COMPONENT	CAS NO.	%	PEL/TLV
POTASSIUM PERMANGANATE (AS INORGANIC MANGANESE COMPOUND CONTAINING 34-35% Mn)	7722-64-7	98% MIN.	5 mg/m^3 as Mn - OSHA CEILING LIMIT 0.2 mg/m^3 as Mn - ACGIH TWA O.2 mg/m^3 as Mn Fume - ACGIH TWA

SECTION C - PHYSICAL PROPERTIES

BOILING POINT (°C) :	N/A	**SPECIFIC GRAVITY :**	2.7
MELTING POINT (°C) :	DECOMPOSES AT < 240	**FREEZING POINT (°) :**	N/A
VAPOR PRESSURE (mm Hg) :	NOT KNOWN	**PERCENT VOLATILE (BY WT.) :**	N/A
VAPOR DENSITY (AIR=1) :	N/A	**EVAPORATION RATE :**	N/A
SOLUBILITY IN WATER :	SOLUBLE, 6.38 g/100cc @ 200°C	**pH (% IN WATER) :**	NOT KNOWN
ODOR THRESHOLD :	N/A		
APPEARANCE & ODOR :	DARK PURPLE CRYSTALS WITH METALLIC LUSTER; ODORLESS		

SECTION D - FIRE & EXPLOSION DATA

FLASH POINT (°) : N/A
FLAMMABLE LIMITS : **LEL** : (N/A) **UEL : (N/A)** **AUTO IGNITION TEMP (° F): (N/A)**
EXTINGUISHING MEDIA : **WATER** : **(X)** **FOAM** : **()** **CO_2: ()** **DRY CHEMICAL: ()**

SPECIAL FIRE FIGHTING PROCEDURES : PRODUCT IS NOT COMBUSTIBLE BUT IS A STRONG OXIDIZER. CONTACT WITH OXIDIZABLE SUBSTANCES, EITHER IN THE SOLID OR DRY STATE, CAN CAUSE EXPLOSIVE AND OR FLAMMABLE REACTIONS. EXTINGUISH FIRE WITH LARGE QUANTITIES OF WATER. DIKE TO CONTAIN RUNOFF. WATCH FOR RAPID BURNING AND BE PREPARED TO RETREAT TO A SAFE DISTANCE. POISONOUS GAS IS PRODUCED IN FIRE - WEAR A NIOSH APPROVED SELF-CONTAINED BREATHING APPARATUS OPERATED IN PRESSURE DEMAND OR POSITIVE PRESSURE MODE AND FULL PROTECTIVE GEAR. CONTAINERS MAY EXPLODE IN FIRE. COOL FIRE EXPOSED CONTAINERS WITH FLOODING QUANTITIES OF WATER SPRAY.

UNUSUAL FIRE & EXPLOSION HAZARDS : STRONG OXIDIZERS MAY EXPLODE AND DECOMPOSE SPONTANEOUSLY IF EXPOSED TO INTENSE HEAT, CONCENTRATED ACIDS, HYDROGEN PEROXIDE, REDUCING AGENTS OR ORGANIC SUBSTANCES. VIOLENT REACTION MAY OCCUR WITH FINELY DIVIDED AND READILY OXIDIZABLE SUBSTANCE. INCREASES FLAMMABILITY OF COMBUSTIBLE MATERIALS.

SECTION E - REACTIVITY DATA

STABILITY : STABLE UNDER NORMAL CONDITIONS

INCOMPATIBILITY : POTASSIUM PERMANGANATE IS A STRONG OXIDIZER, SPONTANEOUSLY EXPLOSIVE OR FLAMMABLE ON CONTACT WITH MANY INCOMPATIBLES. AVOID CONTACT WITH ALCOHOLS, ARSENITES, IODIDES, ACIDS, CHARCOAL, COMBUSTIBLE ORGANIC MATERIALS, FERROUS AND MERCUROUS SALTS, HYPOPHOSPHITES, HYPOSULFITES, SULFITES, PEROXIDES, OXALATES, INORGANIC OXIDIZABLE MATERIALS, METAL POWDERS, WOOD, GLYCERINE, POLYPROPYLENE, AND HEAT. CONTACT WITH HYDROCHLORIC ACID WILL LIBERATE CHLORINE GAS. DO NOT MIX WITH FORMALDEHYDE.

HAZARDOUS DECOMPOSITION PRODUCTS : TOXIC, CORROSIVE FUMES OF K_2O AND/OR SMOKE MAY EVOLVE WHEN IN A FIRE

HAZARDOUS POLYMERIZATION : WILL NOT OCCUR

CONDITIONS TO AVOID : CONTACT WITH INCOMPATIBLE MATERIALS; EXCESSIVE HEAT (>150°C); PHYSICAL IMPACT OR FRICTION

N/A = NOT APPLICABLE

EMERGENCY: Chemtrec - 1-800-424-9300

SECTION F - PERSONAL PROTECTIVE EQUIPMENT INFO

RESPIRATORY EQUIPMENT :	USE A NIOSH/MSHA DUST AND MIST RESPIRATOR OR AN AIR SUPPLIED RESPIRATOR WHERE THE POTENTIAL FOR OVEREXPOSURE EXISTS.
PROTECTIVE GLOVES :	RUBBER OR PLASTIC GLOVES
EYE PROTECTION :	CHEMICAL GOGGLES OR FACE SHIELD
VENTILATION :	USE MECHANICAL OR LOCAL EXHAUST TO MAINTAIN EXPOSURE BELOW THE PERMISSIBLE EXPOSURE LIMIT OR THRESHOLD LIMIT VALUE (SEE SECTION B).
OTHER PROTECTIVE EQUIPMENT :	PROTECTIVE WORK CLOTHING INCLUDING AN APRON; ACCESS TO EYE WASH FOUNTAIN AND SAFETY DRENCH SHOWER.

SECTION G - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE :	0.2 mg/m^3 as Mn (INORGANIC MANGANESE COMPOUND) and Mn FUME
PRIMARY ROUTES OF EXPOSURE :	EYES & SKIN CONTACT, INHALATION, INGESTION
ORAL LD$_{50}$:	1090 mg/kg (RAT); 780 mg/kg MALE RAT; 525 mg/kg FEMALE RAT; ORAL-HUMAN LDLo: 143 mg/kg
DERMAL IRRITATION-RABBIT :	NOT TESTED
EYE IRRITATION-RABBIT :	NOT TESTED
OSHA PEL :	5 mg/m^3 AS Mn CEILING LIMIT
ACGIH TLV :	0.2 mg/m^3 as Mn (INORGANIC MANGANESE COMPOUND) and Mn FUME
EFFECTS OF OVEREXPOSURE :	***SKIN CONTACT:*** CONTACT WITH DRY CRYSTALS OR CONCENTRATED SOLUTIONS WILL IRRITATE AND ACT AS A CORROSIVE, CAUSING BURNS TO SKIN AND BODY TISSUE ON CONTACT. CONTACT AREA WILL BE STAINED BROWN AND THE OUTER LAYER OF SKIN WILL POSSIBLY HARDEN. ***EYE CONTACT:*** CONTACT WITH EYES CAN CAUSE SEVERE BURNS RESULTING IN EYE DAMAGE. ***INHALATION:*** INHALATION OF DUST, MIST, OR SOLUTION SPRAY WILL IRRITATE NOSE, THROAT, AND RESPIRATORY TRACT CAUSING COUGHING, CHEST TIGHTNESS, AND POSSIBLE DAMAGE TO THE RESPIRATORY SYSTEM. HIGH INHALATION EXPOSURES CAN CAUSE A BUILDUP OF FLUID IN THE LUNGS (PULMONARY EDEMA) WHICH MAY RESULT IN DEATH. ***INGESTION:*** INGESTION CAN CAUSE SEVERE IRRITATION OR BURNS TO MOUTH, THROAT, ESOPHAGUS, AND STOMACH WITH DIFFICULTY IN BREATHING, NAUSEA, GASTROINTESTINAL EFFECTS, AND POSSIBLE KIDNEY DAMAGE. EXPERIMENTAL REPRODUCTIVE AND MUTATION DATA HAVE BEEN REPORTED IN LITERATURE. ***CHRONIC:*** REPEATED OR PROLONGED SKIN CONTACT MAY CAUSE DEFATTING AND DERMATITIS. LONG TERM INHALATION OF MANGANESE DUSTS (USUALLY IN FORM OF MANGANESE OXIDES) MAY LEAD TO A HIGH INCIDENCE OF UPPER RESPIRATORY INFECTIONS, LUNG IRRITATION, AND POSSIBLE CENTRAL NERVOUS SYSTEM DISORDERS WITH SYMPTOMS SIMULATING PARKINSON'S DISEASE.
KNOWN EFFECTS ON OTHER ILLNESSES :	CAN AGGRAVATE PRE-EXISTING SKIN, RESPIRATORY, AND NERVOUS SYSTEM CONDITIONS.
LISTED CARCINOGEN :	NONE **(X)** OSHA **()** NTP **()** IARC **()** OTHER **()**

SECTION H - EMERGENCY & FIRST AID DATA

SKIN :	CAN CAUSE IRRITATION OR BURNS. WASH AREA IMMEDIATELY WITH LARGE AMOUNTS OF WATER WHILE QUICKLY REMOVING CONTAMINATED CLOTHING. SEEK MEDICAL ATTENTION.
EYES :	CAN CAUSE SEVERE BURNS RESULTING IN PERMANENT DAMAGE. FLUSH EYES WITH LARGE AMOUNTS OF WATER FOR AT LEAST 15 MINUTES, LIFTING UPPER AND LOWER LIDS. DO NOT USE A CHEMICAL ANTIDOTE. SEEK MEDICAL ATTENTION IMMEDIATELY.
INHALATION :	REMOVE THE PERSON FROM EXPOSURE. BEGIN RESCUE BREATHING IF BREATHING HAS STOPPED AND CPR IF HEART ACTION HAS STOPPED. SEEK MEDICAL ATTENTION IMMEDIATELY. MEDICAL OBSERVATION IS RECOMMENDED FOR 24 TO 48 HOURS AFTER BREATHING OVEREXPOSURE, AS PULMONARY EDEMA MAY BE DELAYED.
INGESTION :	CAN CAUSE BURNING OF THROAT, NAUSEA, VOMITING AND STOMACH PAIN. A TRACHEOTOMY MAY BE REQUIRED IF SWELLING IN THROAT BLOCKS AIR. IF CONSCIOUS AND NOT CONVULSING, GIVE LARGE QUANTITIES OF WATER. SEEK MEDICAL ATTENTION IMMEDIATELY.

SECTION I - SPILL & DISPOSAL INFORMATION

STEPS TO BE TAKEN IN CASE OF SPILL OR LEAK:

WEAR FULL PROTECTIVE EQUIPMENT (SEE SECTION B). RESTRICT ACCESS TO AREA OF SPILL / LEAK UNTIL CLEAN UP IS COMPLETE. REMOVE ALL COMBUSTIBLE MATERIALS FROM AREA. ABSORB SOLUTION SPILLS (LIQUIDS) IN VERMICULITE, DRY SAND, EARTH, OR A SIMILAR MATERIAL AND DEPOSIT IN SEALED CONTAINERS. SWEEP OR SHOVEL UP POWDERED/CRYSTALLINE MATERIAL. AVOID GENERATING DUST. TRANSFER TO CLEAN METAL DRUM FOR DISPOSAL AS RCRA HAZARDOUS WASTE. FLUSH SPILL AREA WITH ABUNDANT QUANTITIES OF WATER. KEEP RUNOFF FROM ENTERING SEWERS OR WATERWAYS TO PREVENT A POSSIBLE EXPLOSION HAZARD. CONTACT THE DEP AND EPA FOR SPECIFIC RECOMMENDATIONS ON DISPOSAL.

WASTE DISPOSAL INFORMATION:

DISPOSE OF AS HAZARDOUS WASTE IN ACCORDANCE WITH LOCAL, STATE (DEP) AND FEDERAL REGULATIONS (EPA).

RCRA HAZARDOUS WASTE : NO **()** YES **(X)** **RCRA # :** (D001, D003) CHARACTERISTIC OF IGNITABILITY, REACTIVITY

N/A = NOT APPLICABLE

CERCLA : NO **()** YES **(**X**)** **RQ (**100 LBS.)

FOLLOW ALL LOCAL, STATE AND FEDERAL INFORMATION AND REGULATIONS

SECTION J - OTHER REGULATORY INFORMATION

TSCA: WE CERTIFY THAT ALL COMPONENTS OF THIS PRODUCT ARE REGISTERED UNDER THE REGULATIONS OF THE TOXIC SUBSTANCES CONTROL ACT.

SARA TITLE III, SECT. 313: **LISTED (X)** **NOT LISTED ()**

HMIS: HEALTH (3) FLAMMABILITY (0) REACTIVITY (3)

DOT REGULATED: **YES:** (X) **NO:** **( )** **RQ:** **(**100 LBS.)

IF REGULATED, PROPER SHIPPING NAME: POTASSIUM PERMANGANATE **HAZARD CLASS: (**5.1**)**

IDENTIFICATION NO: **(**UN1490**)** **PACKING GROUP: (**II**)** **LABEL REQUIRED: (**OXIDIZER**)**

INLAND B/L: RQ, POTASSIUM PERMANGANATE; 5.1, UN1490, PACKING GROUP II, OXIDIZER

EMERGENCY RESPONSE GUIDE NO.: (140)

SECTION K - SPECIAL PRECAUTIONS

FOR INDUSTRIAL USE ONLY

HANDLING & STORAGE INFORMATION:

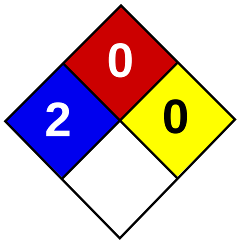
PROTECT CONTAINERS FROM PHYSICAL SHOCK AND DAMAGE. MUST BE STORED TO AVOID CONTACT WITH STRONG ACIDS (SUCH AS HYDROCHLORIC, SULFURIC AND NITRIC); ANY ORGANIC MATERIAL; OR ANY OTHER COMBUSTIBLE OR OXIDIZABLE SOLID, LIQUID OR GAS SINCE VIOLENT REACTIONS OCCUR. AVOID STORAGE ON WOODEN FLOORS. ISOLATE FROM ALL HEAT AND IGNITION SOURCES. STORE IN TIGHTLY CLOSED CONTAINERS IN A COOL WELL-VENTILATED AREA.

OTHER PRECAUTIONS :

DO NOT EAT, SMOKE OR DRINK WHERE POTASSIUM PERMANGANATE IS HANDLED, PROCESSED, OR STORED. WASH THOROUGHLY BEFORE EATING OR SMOKING. DO NOT DRY SWEEP FOR CLEAN UP. USE A VACUUM OR A WET METHOD TO REDUCE DUST DURING CLEANUP. TREAT EMPTY CONTAINERS OF THIS PRODUCT AS HAZARDOUS SINCE THEY MAY STILL CONTAIN PRODUCT RESIDUES.

IN ACCORDANCE WITH GOOD PRACTICES OF PERSONAL HYGIENE, HANDLE WITH DUE CARE AND AVOID ANY UNNECESSARY CONTACT WITH THIS PRODUCT. THIS INFORMATION IS BEING SUPPLIED TO YOU UNDER OSHA "RIGHT TO KNOW" REGULATION 29 CFR 1910.1200 AND IS OFFERED IN GOOD FAITH AS TYPICAL VALUES AND NOT AS PRODUCT SPECIFICATION. THE INFORMATION IS BELIEVED TO BE TRUE AND ACCURATE. NO WARRANTY, EXPRESSED OR IMPLIED, REGARDING THE ACCURACY OF THIS DATA, THE HAZARD CONNECTED WITH USE OF THE MATERIAL, OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF, IS MADE. UNITED MINERAL & CHEMICAL CORPORATION AND ITS SUPPLIERS ASSUME NO RESPONSIBILITY FOR DAMAGE OR INJURY FROM THE USE OF THE PRODUCT DESCRIBED HEREIN.

UNITED MINERAL & CHEMICAL CORPORATION



Health	2
Fire	0
Reactivity	0
Personal Protection	E

Material Safety Data Sheet

Sodium thiosulfate pentahydrate MSDS

Section 1: Chemical Product and Company Identification

Product Name: Sodium thiosulfate pentahydrate

Catalog Codes: SLS2341, SLS2962

CAS#: 10102-17-7

RTECS: WE6660000

TSCA: TSCA 8(b) inventory: No products were found.

CI#: Not available.

Synonym: Ametox, Antichlor; Sodium Hyposulfite, pentahydrate

Chemical Name: Thiosulfuric Acid, disodium salt, pentahydrate

Chemical Formula: Na2S2O3.5H20

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Sodium thiosulfate pentahydrate	10102-17-7	100

Toxicological Data on Ingredients: Sodium thiosulfate pentahydrate LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant), of eye contact (irritant).

Potential Chronic Health Effects:
Slightly hazardous in case of skin contact (irritant, sensitizer). CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention if irritation occurs.

Skin Contact:
Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops. Cold water may be used.

Serious Skin Contact: Not available.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards: When heated to decomposition it emits toxic fumes of sulfur oxides, hydrogen sulfide, and sodium oxide

Special Remarks on Explosion Hazards: An explosion may occur if triturated with nitrates, chlorates, or permanganates.

Section 6: Accidental Release Measures

Small Spill:
Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

Section 7: Handling and Storage

Precautions:
Do not breathe dust. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If you feel unwell, seek medical attention and show the label when possible. Keep away from incompatibles such as oxidizing agents, acids, alkalis.

Storage: Hygroscopic. Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid.

Odor: Odorless.

Taste: Saline.

Molecular Weight: 248.19 g/mole

Color: Colorless. White.

pH (1% soln/water): pH of a 5% solution: 6.0-8.4

Boiling Point: >100°C (212°F)

Melting Point: 48°C (118.4°F)

Critical Temperature: Not available.

Specific Gravity: 1.7 - 1.75(Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water.

Solubility:
Soluble in cold water, hot water. Solubility in water: 79 g/100 ml @ 4 deg. C (39 deg. F) 680 g/liter @ 20 deg. C

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials, moisture

Incompatibility with various substances: Reactive with oxidizing agents, acids, alkalis.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
It is a strong reducing and can react with oxidizers. Reacts with acids to release sulfur dioxide. Sodium Thiosulfate pentahydrate dissolves in its own water of hydation; it effloresces in warm dry air. Sodium Thiosulfate pentahydrate loses water at 100 deg. C. It is incompatible with iodine, acids, lead, mercury, and silver salts (e.g. silver nitrate), halogens. Hygroscopic; keep container tightly closed. Protect from moisture

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals:
LD50: Not available. LC50: Not available.

Chronic Effects on Humans: Not available.

Other Toxic Effects on Humans:
Hazardous in case of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans:
Acute Potenial Health Effects: Skin: It may cause mild skin irritation. Eyes: Can cause mechanical eye irritation. Inhalation: May cause upper respiratory tract and mucous membrane irritation. Ingestion: Sodium Thiosulfate is an agent with a low order of toxicity. Ingestion of large doses may cause gastrointestinal irritation disturbances with nausea, vomiting, addominal cramping, diarrhea, metabolic acidosis, and hypernatremia. May also affect respiration (cyanosis, respiratory stimulation), cardiovascular(hypotension), behavior (ataxia, convulsions) Chronic Potential Health Effects: Skin: Prolonged or repeated skin contact may allergic dermatitis, and irritation. The toxicological preperties of this substance have not been fully investigated.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations: No products were found.

Other Regulations: Not available.

Other Classifications:

WHMIS (Canada): Not controlled under WHMIS (Canada).

DSCL (EEC):
This product is not classified according to the EU regulations. S24/25- Avoid contact with skin and eyes. S28- After contact with skin, wash immediately with plenty of water. S37- Wear suitable gloves. S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 0

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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Last Updated: 06/09/2012 12:00 PM

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THE LINDE GROUP

NITROGEN, GAS
Material Safety Data Sheet

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name	NITROGEN, GAS
Product Code(s)	G-7, 1018
UN-No	UN1066
Recommended Use	Compressed gas.
Synonyms	LASER Nitrogen; LASER Nitrogen Ultra; Nitrogen, compressed
Supplier Address*	Linde Gas North America LLC - Linde Merchant Production Inc. - Linde LLC 575 Mountain Ave. Murray Hill, NJ 07974 Phone: 908-464-8100 www.lindeus.com Linde Gas Puerto Rico, Inc. Las Palmas Village Road No. 869, Street No. 7 Catano, Puerto Rico 00962 Phone: 787-641-7445 www.pr.lindegas.com Linde Canada Limited 5860 Chedworth Way Mississauga, Ontario L5R 0A2 Phone: 905-501-1700 www.lindecanada.com * May include subsidiaries or affiliate companies/divisions. For additional product information contact your local customer service.
Chemical Emergency Phone Number	Chemtrec: 1-800-424-9300 for US/ 703-527-3887 outside US

2. HAZARDS IDENTIFICATION

WARNING!

Emergency Overview

Simple asphyxiant
Contents under pressure
Keep at temperatures below 52°C / 125°F

Appearance Colorless **Physical State** Compressed gas. **Odor** Odorless

OSHA Regulatory Status This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Potential Health Effects

Principle Routes of Exposure	Inhalation.
Acute Toxicity	
Inhalation	Simple asphyxiant. May cause suffocation by displacing the oxygen in the air. Exposure to oxygen-deficient atmosphere (<19.5%) may cause dizziness, drowsiness, nausea, vomiting, excess salivation, diminished mental alertness, loss of consciousness and death. Exposure to atmospheres containing 8-10% or less oxygen will bring about unconsciousness without warning and so quickly that the individuals cannot help or protect themselves. Lack of sufficient oxygen may cause serious injury or death.
Eyes	This product is a gas at room temperature. Contact with liquid may cause frostbite.
Skin	This product is a gas at room temperature. Contact with liquid may cause frostbite.
Skin Absorption Hazard	No known hazard in contact with skin.
Ingestion	Not an expected route of exposure.
Chronic Effects	None known.
Aggravated Medical Conditions	None known.
Environmental Hazard	See Section 12 for additional Ecological Information.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	CAS-No	Volume %	Chemical Formula
Nitrogen	7727-37-9	>99	N_2

4. FIRST AID MEASURES

Eye Contact	None required for gas. If frostbite is suspected, flush eyes with cool water for 15 minutes and obtain immediate medical attention.
Skin Contact	None required for gas. For dermal contact or suspected frostbite, remove contaminated clothing and flush affected areas with lukewarm water. DO NOT USE HOT WATER. A physican should see the patient promptly if contact with the product has resulted in blistering of the dermal surface or in deep tissue freezing.
Inhalation	PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF INHALATION OVEREXPOSURE. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS. Conscious inhalation victims should be assisted to an uncontaminated area and inhale fresh air. If breathing is difficult, administer oxygen. Unconscious persons should be moved to an uncontaminated area and, as necessary, given artificial resuscitation and supplemental oxygen. Treatment should be symptomatic and supportive.
Ingestion	None under normal use. Get medical attention if symptoms occur.
Notes to Physician	Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Flammable Properties	Not flammable.
Suitable Extinguishing Media	Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Explosion Data

Sensitivity to Mechanical Impact	None
Sensitivity to Static Discharge	None
Specific Hazards Arising from the Chemical	Cylinders may rupture under extreme heat. Continue to cool fire exposed cylinders until flames are extinguished. Damaged cylinders should be handled only by specialists.
Protective Equipment and Precautions for Firefighters	As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions	Ensure adequate ventilation. Evacuate personnel to safe areas. Use personal protective equipment. Monitor oxygen level.
Environmental Precautions	Prevent spreading of vapors through sewers, ventilation systems and confined areas.
Methods for Containment	Stop the flow of gas or remove cylinder to outdoor location if this can be done without risk. If leak is in container or container valve, contact the appropriate emergency telephone number in Section 1 or call your closest Linde location.
Methods for Cleaning Up	Return cylinder to Linde or an authorized distributor.

7. HANDLING AND STORAGE

Handling

Use only in ventilated areas. Never attempt to lift a cylinder by its valve protection cap. Protect cylinders from physical damage; do not drag, roll, slide or drop. When moving cylinders, even for short distance, use a cart designed to transport cylinders. Use equipment rated for cylinder pressure. Use backflow preventive device in piping. Never insert an object (e.g. wrench, screwdriver, pry bar,etc.) into valve cap openings. Doing so may damage valve, causing leak to occur.

Use an adjustable strap wrench to remove over-tight or rusted caps. Close valve after each use and when empty. If user experiences any difficulty operating cylinder valve discontinue use and contact supplier.

Never put cylinders into trunks of cars or unventilated areas of passenger vehicles. Never attempt to refill a compressed gas cylinder without the owner's written consent. Never strike an arc on a compressed gas cylinder or make a cylinder a part of an electrical circuit.

For additional recommendations consult Compressed Gas Association's (CGA) Safety Bulletin SB-2, Oxygen-Deficient Atmospheres.

For additional handling recommendations, consult Compressed Gas Association's pamphlets P-1, G-10.1, P-8.1, P-8.2, P-9, P-16, P-18, and Safety Bulletin SB-2.

Storage	Protect from physical damage. Cylinders should be stored upright with valve protection cap in place and firmly secured to prevent falling. Store in cool, dry, well-ventilated area of non-combustible construction away from heavily trafficked areas and emergency exits. Keep at temperatures below 52°C / 125°F. Full and empty cylinders should be segregrated. Use a "first in-first out" inventory system to prevent full cylinders from being stored for excessive periods of time. Always store and handle compressed gas cylinders in accordance with Compressed Gas Association, pamphlet CGA-P1, Safe Handling of Compressed Gases in Containers.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure Guidelines	This product does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.
Engineering Measures	Showers. Eyewash stations. Ventilation systems. Local exhaust ventilation to prevent accumulation of high concentrations and maintain air-oxygen levels at or above 19.5%.
Ventilation	Ensure adequate ventilation, especially in confined areas.

Personal Protective Equipment

Eye/Face Protection	If splashes are likely to occur, wear: Goggles. Face-shield.
Skin and Body Protection	Wear cold insulating gloves when handling liquid. Work gloves and safety shoes are recommended when handling cylinders.
Respiratory Protection	
General Use	No special protective equipment required.
Emergency Use	Use positive pressure airline respirator with escape cylinder or self contained breathing apparatus for oxygen-deficient atmospheres (<19.5%).
Hygiene Measures	Wear suitable gloves and eye/face protection.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Colorless.	**Odor**	Odorless.
Odor Threshold	No information available.	**Physical State**	Compressed gas
Flash Point	No information available.	**Autoignition Temperature**	No information available.
Decomposition Temperature	No information available.	**Boiling Point/Range**	-195.8°C / -320.4°F
Freezing Point	-209.9°C / -345.9°F	**Molecular Weight**	28.01
Water Solubility	Very slight	**Evaporation Rate**	No information available
Vapor Pressure	No data available.	**Vapor Density**	0.97 (air = 1)
Gas Density	0.072 lb/ft^3 (1.153 kg/m^3) (@ 21.1°C)	**VOC Content (%)**	Not applicable.
Specific Vol. @ 21.1°C & 1 atm	13.8 ft^3/lb (0.867 m^3/kg)	**Critical Pressure**	492.9 psia (3399 kPa abs)

Flammability Limits in Air

Upper	Not applicable
Lower	Not applicable

10. STABILITY AND REACTIVITY

Stability	Stable.
Incompatible Products	None known.
Conditions to Avoid	None known.
Hazardous Decomposition Products	None known.
Hazardous Polymerization	Hazardous polymerization does not occur.

11. TOXICOLOGICAL INFORMATION

Acute Toxicity

LD50 Oral:	No information available.
LD50 Dermal:	No information available.
LC50 Inhalation:	No information available.
Inhalation	Product is a simple asphyxiant.
Repeated Dose Toxicity	No information available.

Chronic Toxicity

Chronic Toxicity	None known.
Carcinogenicity	Contains no ingredient listed as a carcinogen.

Irritation	No information available.
Sensitization	No information available.
Reproductive Toxicity	No information available.
Developmental Toxicity	Oxygen deficiency during pregnancy has produced developmental abnormalities in humans and experimental animals.
Synergistic Materials	None known.
Target Organ Effects	None known.

12. ECOLOGICAL INFORMATION

Ecotoxicity

The environmental impact of this product has not been fully investigated.

Ozone depletion potential; ODP; (R-11 = 1): Does not contain ozone depleting chemical (40 CFR Part 82).

13. DISPOSAL CONSIDERATIONS

Waste Disposal Methods	Do not attempt to dispose of residual waste or unused quantities. Return in the shipping container PROPERLY LABELED WITH ANY VALVE OUTLET PLUGS OR CAPS SECURED AND VALVE PROTECTION CAP IN PLACE to Linde for proper disposal.

14. TRANSPORT INFORMATION

DOT

Proper Shipping Name	Nitrogen, compressed
Hazard Class	2.2
Subsidiary Class	None
UN-No	UN1066
Description	UN1066,Nitrogen, compressed,2.2
Emergency Response Guide Number	121

TDG

Proper Shipping Name	Nitrogen, compressed
Hazard Class	2.2
UN-No	UN1066
Description	UN1066,NITROGEN, COMPRESSED,2.2

MEX

Proper Shipping Name	Nitrogen, compressed
Hazard Class	2.2
UN-No	UN1066
Description	UN1066, Nitrogen, compressed,2.2

IATA

UN-No	UN1066
Proper Shipping Name	Nitrogen, compressed
Hazard Class	2.2
ERG Code	2L
Description	UN1066,Nitrogen, compressed,2.2
Maximum Quantity for Passenger	75 kg
Maximum Quantity for Cargo Only	150 kg
Limited Quantity	No information available.

IMDG/IMO

Proper Shipping Name	Nitrogen, compressed
Hazard Class	2.2
UN-No	UN1066
EmS No.	F-C, S-V
Description	UN1066, Nitrogen, compressed,2.2

ADR

Proper Shipping Name	Nitrogen, compressed
Hazard Class	2.2
UN-No	UN1066
Classification Code	1A
Description	UN1066, Nitrogen, compressed,2.2

15. REGULATORY INFORMATION

International Inventories

TSCA	Complies
DSL	Complies
EINECS/ELINCS	Complies

Legend

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List
EINECS/ELINCS - European Inventory of Existing Commercial Chemical Substances/EU List of Notified Chemical Substances

U.S. Federal Regulations

SARA 313

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372.

SARA 311/312 Hazard Categories

Acute Health Hazard	No
Chronic Health Hazard	No
Fire Hazard	No
Sudden Release of Pressure Hazard	Yes
Reactive Hazard	No

Clean Water Act

This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42).

Risk and Process Safety Management Programs

This material, as supplied, does not contain any regulated substances with specified thresholds under 40 CFR Part 68.
This product does not contain any substances regulated as Highly Hazardous Chemicals pursuant to the 29 CFR Part 1910.110.

Clean Air Act, Section 112 Hazardous Air Pollutants (HAPs) (see 40 CFR 61)

This product does not contain any substances regulated as hazardous air pollutants (HAPS) under Section 112 of the Clean Air Act Amendments of 1990.

CERCLA/SARA

This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material.

U.S. State Regulations

California Proposition 65

This product does not contain any Proposition 65 chemicals.

U.S. State Right-to-Know Regulations

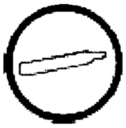
Chemical Name	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Nitrogen	X	X	X	-	X

International Regulations

Canada

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

WHMIS Hazard Class
A Compressed gases



16. OTHER INFORMATION

Prepared By	Product Stewardship 23 British American Blvd. Latham, NY 12110 1-800-572-6501
Issuing Date	05-Mar-2010
Revision Date	31-Aug-2010
Revision Number	1
Revision Note	(M)SDS sections updated. 1.

NFPA	**Health Hazard** 0	**Flammability** 0	**Stability** 0	**Physical and Chemical Hazards** Simple asphyxiant
HMIS	**Health Hazard** 0	**Flammability** 0	**Physical Hazard** 3	**Personal Protection** -

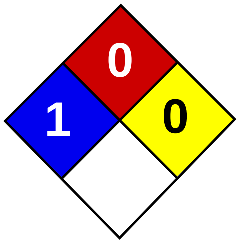
Note: Ratings were assigned in accordance with Compressed Gas Association (CGA) guidelines as published in CGA Pamphlet P-19-2009, CGA Recommended Hazard Ratings for Compressed Gases, 3rd Edition.

General Disclaimer
For terms and conditions, including limitation of liability, please refer to the purchase agreement in effect between Linde LLC, Linde Merchant Production, Inc. or Linde Gas North America LLC (or any of their affiliates and subsidiaries) and the purchaser.

DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES
Although reasonable care has been taken in the preparation of this document, we extend no warranties and make no representations as to the accuracy or completeness of the information contained herein, and assume no responsibility regarding the suitability of this information for the user's intended purposes or for the consequences of its use. Each individual should make a determination as to the suitability of the information for their particular purpose(s).

End of Safety Data Sheet

ScienceLab.com
Chemicals & Laboratory Equipment



Health	2
Fire	0
Reactivity	0
Personal Protection	H

Material Safety Data Sheet

Hydrogen Peroxide - 3% MSDS

Section 1: Chemical Product and Company Identification

Product Name: Hydrogen Peroxide - 3%

Catalog Codes: SLH2497, SLH1180

CAS#: Mixture.

RTECS: Not applicable.

TSCA: TSCA 8(b) inventory: Water; Hydrogen Peroxide

CI#: Not applicable.

Synonym: Hydrogen Peroxide 3% Solution; Hydrogen Peroxide Topical Solution

Chemical Name: Not applicable.

Chemical Formula: Not applicable.

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Water	7732-18-5	97
Hydrogen Peroxide	7722-84-1	3

Toxicological Data on Ingredients: Hydrogen Peroxide: ORAL (LD50): Acute: 2000 mg/kg [Mouse]. DERMAL (LD50): Acute: 4060 mg/kg [Rat]. 2000 mg/kg [pig]. VAPOR (LC50): Acute: 2000 mg/m 4 hours [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of eye contact (irritant). Slightly hazardous in case of skin contact (irritant, permeator), of ingestion, of inhalation (lung sensitizer). Non-corrosive for skin. Non-corrosive to the eyes. Non-corrosive for lungs. Prolonged exposure may result in skin burns and ulcerations. Over-exposure by inhalation may cause respiratory irritation.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH [Hydrogen Peroxide]. MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. [Hydrogen Peroxide]. Mutagenic for bacteria and/or yeast. [Hydrogen Peroxide]. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to blood, upper respiratory tract, skin, eyes, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention.

Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Cold water may be used.Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation: Not available.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:
Non-explosive in presence of open flames and sparks, of shocks, of heat, of reducing materials, of combustible materials, of organic materials, of metals, of acids, of alkalis.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards:
Most cellulose (wood, cotton) materials contain enough catalyst to cause spontaneous ignition with 90% Hydrogen Peroxide. Hydrogen Peroxide is a strong oxider. It is not flammable itself, but it can cause spontaneous combustion of flammable materials and continued support of the combustion because it liberates oxygen as it decomposes. Hydrogen peroxide mixed with magnesium and a trace of magnesium dioxide will ignite immediately.

Special Remarks on Explosion Hazards:
Soluble fuels (acetone, ethanol, glycerol) will detonate on a mixture with peroxide over 30% concentration, the violence increasing with concentration. Explosive with acetic acid, acetic anhydride, acetone, alcohols, carboxylic acids, nitrogen containing bases, As2S3, Cl2 + KOH, FeS, FeSO4 + 2 methylpryidine + H2SO4, nitric acid, potassium permanganate, P2O5, H2Se, Alcohols + H2SO4, Alcohols + tin chloride, Antimoy trisulfide, chlorosulfonic acid, Aromatic hydrocarbons + trifluoroacetic acid, Azeliac acid + sulfuric acid (above 45 C), Benzenesulfonic anhydride, tert-butanol + sulfuric acid, Hydrazine, Sulfuric acid, Sodium iodate, Tetrahydrothiophene, Thiodiglycol, Mercurous oxide, mercuric oxide, Lead dioxide, Lead oxide, Manganese dioxide, Lead sulfide, Gallium + HCl, Ketenes + nitric acid, Iron (II) sulfate + 2-methylpyridine + sulfuric acid, Iron (II) sulfate + nitric acid, + sodium carboxymethylcellulose (when

Section 6: Accidental Release Measures

Small Spill:
Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:
Absorb with an inert material and put the spilled material in an appropriate waste disposal. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes.

Storage:
Keep container tightly closed. Keep container in a cool, well-ventilated area. Separate from acids, alkalies, reducing agents and combustibles. See NFPA 43A, Code for the Storage of Liquid and Solid Oxidizers. Do not store above 30°C (86°F). Sensitive to light. Store in light-resistant containers.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Not available.

Taste: Bitter.

Molecular Weight: Not applicable.

Color: Colorless. Clear

pH (1% soln/water): Neutral.

Boiling Point: The lowest known value is 100°C (212°F) (Water). Weighted average: 101.56°C (214.8°F)

Melting Point: May start to solidify at -0.43°C (31.2°F) based on data for: Hydrogen Peroxide.

Critical Temperature: Not available.

Specific Gravity: Weighted average: 1.01 (Water = 1)

Vapor Pressure: The highest known value is 2.3 kPa (@ 20°C) (Water). Weighted average: 2.24 kPa (@ 20°C)

Vapor Density: The highest known value is 1.2 (Air = 1) (Hydrogen Peroxide). Weighted average: 0.64 (Air = 1)

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether.

Solubility: Soluble in cold water, diethyl ether.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Light, excess heat, combustible materials, incompatible materials (Hydrogen Peroxide)

Incompatibility with various substances: Slightly reactive to reactive with reducing agents, combustible materials, organic materials, metals, acids, alkalis.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Light Sensitive. Incompatible with reducing materials, ethers (dioxane, furfuran), oxidizing materials, Metals(eg. potassium, sodium lithium, iron, copper, brass, bronze, chromium, zinc, lead, silver), metal oxides (eg. cobalt oxide, iron oxide, lead oxide, lead hydroxide, manganese oxide), metal salts (eg. calcium permanganate), manganese, asbestos, vanadium, platinium, tungsten, molybdeum, triethylamine, palladium, sodium pyrophosphate, carboxylic acids, cyclopentadiene, formic acid, rust, ketones, cyanides, sodium carbonate alcohols, sodium borate, aniline, mercurous chloride, rust sodium pyrophosphate, hexavalent chromium compounds, tetrahydrofuran, sodium fluoride organic matter, potassium permanganate, urea, chlorosulfonic acid, manganese dioxide, hydrogen selenide, charcoal, coal, sodium borate, alkalies, cyclopentadiene, glycerine. Caused to decompose catalytically by metals (in order of decreasing effectiveness): Osmium, Palladium, Platinum, Iridium, Gold, Silver, Manganese, Cobalt, Copper, Lead (Hydrogen Peroxide) A solution of 3% Hydrogen peroxide is also incompatible with: Albumin, Alkali citrates, Balsam Peru, Phenol, Tinctures, and Lime water

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Eye contact.

Toxicity to Animals:
Acute oral toxicity (LD50): 66667 mg/kg (Mouse) (Calculated value for the mixture). Acute dermal toxicity (LD50): 66667 mg/kg (pig) (Calculated value for the mixture).

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH [Hydrogen Peroxide]. Classified 3 (Not classifiable for human.) by IARC [Hydrogen Peroxide]. MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. [Hydrogen Peroxide]. Mutagenic for bacteria and/or yeast. [Hydrogen Peroxide]. Contains material which may cause damage to the following organs: blood, upper respiratory tract, skin, eyes, central nervous system (CNS).

Other Toxic Effects on Humans:
Slightly hazardous in case of skin contact (irritant, permeator), of ingestion, of inhalation (lung sensitizer). Non-corrosive for skin. Non-corrosive to the eyes. Non-corrosive for lungs.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:
May may affect genetic material. May cause cancer (be tumorigenic) based on animal data. IARC states that there is either no adequate human data or inadequate evidence for carcinogenicity in humans. (Hydrogen Peroxide)

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: May cause skin irritation. May cause reddening of the skin and temporary discoloration/ whitening of the skin. Absorption into skin may affect behavior, brain, respiration (pulmonary edema) Eyes: Causes eye irritation. Symptoms may include burning sensation, redness, inflammaton, pain and possible corneal edema, and corneal cloudiness. Vapors may cause eye irritation. Inhalation: Not expected to be a health hazard under normal conditions. May cause respiratory tract and mucous membrane irritation with coughing, laryngitis, bronchitis, pulmonary edema. May affect respiration (dyspnea). May also cause headache, nausea, and vomiting. Ingestion: Ingestion of large doses may cause digestive tract/gastrointestinal tract irritation (irritation or possible blistering of the tongue, buccal muosa/mouth, throat, and stomach) with nausea, vomiting, hypermotility, and diarrhea. May cause difficulty in swallowing, stomach distension. May affect blood (change in leukocyte count, pigmented or nucleated red blood cells). May affect behavior/central nervous system. May affect cardiovascular system and cause vascular collapse and damage. Chronic Potential Health Effects: Prolonged or repeated skin contact may cause dermatitis. Prolonged or repeated ingestion may affect metabolism (weight loss). Prolonged or repeated inhalation may affect respiration, blood. Continue use of hydrogen peroxide solution as a mouth wash, even at half-strength, may cause hypertrophied filiform papillae of the tongue ("hairy tongue"). But these disappear after it is discontinued

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations:
New York acutely hazardous substances: Hydrogen Peroxide Rhode Island RTK hazardous substances: Hydrogen Peroxide Pennsylvania RTK: Hydrogen Peroxide Florida: Hydrogen Peroxide Minnesota: Hydrogen Peroxide Massachusetts RTK: Hydrogen Peroxide New Jersey: Hydrogen Peroxide TSCA 8(b) inventory: Hydrogen Peroxide

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada): CLASS C: Oxidizing material.

DSCL (EEC):
This product is not classified according to the EU regulations. Not applicable.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 0

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/09/2005 05:46 PM

Last Updated: 06/09/2012 12:00 PM

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H J HEINZ -- DISTILLED WHITE VINEGAR
MATERIAL SAFETY DATA SHEET
NSN: 895000N048492
Manufacturer's CAGE: 73137
Part No. Indicator: A
Part Number/Trade Name: DISTILLED WHITE VINEGAR

General Information

Company's Name: H.J. HEINZ CO.
Company's Street: 1062 PROGRESS ST.
Company's City: PITTSBURGH
Company's State: PA
Company's Country: US
Company's Zip Code: 15212-5990
Company's Emerg Ph #: 412-237-5118
Company's Info Ph #: 412-237-5119
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SMJ
Date MSDS Prepared: 13NOV92
Safety Data Review Date: 11FEB94
MSDS Serial Number: BVCGS
Hazard Characteristic Code: NK

Ingredients/Identity Information

Proprietary: NO
Ingredient: DILUTE ACETIC ACID (CH*3 COOH)
Ingredient Sequence Number: 01
NIOSH (RTECS) Number: 1010888AA
CAS Number: 8028-52-2
OSHA PEL: N/K (FP N)
ACGIH TLV: N/K (FP N)

Physical/Chemical Characteristics

Appearance And Odor: CLEAR LIQUID, ODOR OF VINEGAR
Boiling Point: 244F,118C
Vapor Pressure (MM Hg/70 F): 11 MM
Vapor Density (Air=1): 2.1
Specific Gravity: 1.01
Evaporation Rate And Ref: NOT KNOWN
Solubility In Water: COMPLETE
pH: SUPDAT

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Fire and Explosion Hazard Data

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Extinguishing Media: MEDIA SUITABLE FOR SURROUNDING FIRE (FP N).
Special Fire Fighting Proc: USE NIOSH/MSHA APPROVED SCBA & FULL PROTECTIVE EQUIPMENT (FP N).
Unusual Fire And Expl Hazrds: NONE SPECIFIED BY MANUFACTURER.

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Reactivity Data

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Stability: YES
Cond To Avoid (Stability): NONE SPECIFIED BY MANUFACTURER.
Materials To Avoid: NONE SPECIFIED BY MANUFACTURER.
Hazardous Decomp Products: NONE SPECIFIED BY MANUFACTURER.
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): NOT RELEVANT.

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Health Hazard Data

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LD50-LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: YES
Route Of Entry - Ingestion: YES
Health Haz Acute And Chronic: PROLONGED INHALATION OF VAPORS CAN CAUSE IRRITATION TO RESPIRATORY TRACT. EYES:WILL CAUSE EYE IRRITATION - SMARTING AND REDDENING OF THE EYE.
Carcinogenicity - NTP: NO
Carcinogenicity - IARC: NO
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: NOT RELEVANT.
Signs/Symptoms Of Overexp: SEE HEALTH HAZARDS.
Med Cond Aggravated By Exp: NONE SPECIFIED BY MANUFACTURER.
Emergency/First Aid Proc: INHAL:REMOVE TO FRESH AIR. SUPPORT BREATHING (GIVE O*2/ARTF RESP) (FP N). SKIN:FLUSH W/COPIOUS AMOUNTS OF WATER. CALL MD (FP N). EYE:FLUSH IMMEDIATELY AND THOROUGHLY WITH WATER FOR AT LEAST 15-20 MINUTES (TIMED BY A CLOCK). CALL A PHYSICIAN. INGEST:LARGE AMOUNTS, WATER SHOULD BE CONSUMED TO DILUTE. DO NOT INDUCE VOMITING. DO NOT GIVE EMETICS OR BAKING SODA. CALL A PHYSICIAN.

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Precautions for Safe Handling and Use

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Steps If Matl Released/Spill: IF VINEGAR IS SPILLED, WATER MAY BE USED TO DILUTE.
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.
Waste Disposal Method: DISPOSAL MUST BE I/A/W FEDERAL, STATE & LOCAL REGULATIONS (FP N).

Precautions-Handling/Storing: NONE SPECIFIED BY MANUFACTURER.
Other Precautions: NONE SPECIFIED BY MANUFACTURER.

Control Measures

Respiratory Protection: NIOSH/MSHA APPROVED RESPIRATOR APPROPRIATE FOR EXPOSURE OF CONCERN (FP N).
Ventilation: NONE SPECIFIED BY MANUFACTURER.
Protective Gloves: NONE SPECIFIED BY MANUFACTURER.
Eye Protection: NONE SPECIFIED BY MANUFACTURER.
Other Protective Equipment: NONE SPECIFIED BY MANUFACTURER.
Work Hygienic Practices: NONE SPECIFIED BY MANUFACTURER.
Suppl. Safety & Health Data: PH:2.2 @ 100 GRAIN.

Transportation Data

Disposal Data

Label Data

Label Required: YES
Technical Review Date: 11FEB94
Label Date: 11FEB94
Label Status: G
Common Name: DISTILLED WHITE VINEGAR
Chronic Hazard: NO
Signal Word: CAUTION!
Acute Health Hazard-Slight: X
Contact Hazard-Slight: X
Fire Hazard-None: X
Reactivity Hazard-None: X
Special Hazard Precautions: ACUTE:INHAL/EYES:IRRITATION. CHRONIC:NONE SPECIFIED BY MANUFACTURER.
Protect Eye: Y
Protect Skin: Y
Protect Respiratory: Y
Label Name: H.J. HEINZ CO.
Label Street: 1062 PROGRESS ST.
Label City: PITTSBURGH
Label State: PA
Label Zip Code: 15212-5990
Label Country: US
Label Emergency Number: 412-237-5118

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MATERIAL SAFETY DATA SHEET

Guar Gum
08/31/11

1. Product and Company Information

Product Name:	**Rantec® G150™ Guar Gum**
Manufacturer/Supplier:	Rantec Corporation
Address:	17 Kukuchka Lane Ranchester, WY 82839
Phone Number:	(307) 655-9565
Fax Number:	(307) 655-9528
e-mail:	rantec@ranteccorp.com

2. Composition / Information on Ingredients

Ingredient	CAS Number	% Weight	Exposure Limits
Guar Gum	9000-30-0	100	5 mg/m^3 (respirable) PEL-TWA 3 mg/m^3 (respirable) TLV-TWA 10 mg/m^3 (inhalable dust) TLV-TWA

Chemical Family:	Carbohydrate
Formula:	Approximately $(C_6H_{10}O_5)n$

3. Hazards Identification

OSHA Hazardous Material: Yes

OSHA Hazard Categories:

1. Carcinogen – NO
2. Corrosive – NO
3. Highly Toxic – NO
4. Irritant – Yes
5. Sensitizer – Yes
6. Toxic – NO
7. Target Organ Effect Lung and Cutaneous -- Yes

Emergency Overview:

Concentrations of dust suspended in the air present a fire and explosion hazard.

Inhalation of dust may cause respiratory irritation and possible lung injury with symptoms of shortness of breath and reduced lung function.

Guar gum is very slippery when wet.

Acute Health Effects:
Eye Contact: Contact may cause irritation based on studies with laboratory animals.

Skin Contact: Contact may cause dryness.

Inhalation: Inhalation of dust may cause irritation of the nose, throat and respiratory passages. Symptoms include coughing, sore throat, nasal congestion, sneezing wheezing and shortness of breath. Guar gum may cause life-threatening allergic reaction in susceptible individuals.

3. Hazards Identification (continued)

Ingestion: DO NOT INGEST. While this product is not toxic by ingestion, swallowing small amounts could cause complete blockage of the mouth, pharynx, trachea, esophagus and/or gastrointestinal system which may cause choking, suffocation and/or other life threatening medical conditions. Get medical attention immediately.

Chronic (long-term exposure) Health Effects:
- **Inhalation:** Overexposure to any nuisance dust may cause lung injury. Symptoms include cough, shortness of breath, difficulty breathing and reduced pulmonary function. Repeated exposures may cause allergic sensitization.
- **Carcinogenicity:** None of the components of this product are listed as carcinogens or suspected carcinogens by OSHA, IARC or NTP.
- **Medical Conditions Aggravated by Exposure:** Persons with pre-existing skin and respiratory disorders may be at an increased risk from exposure.

Physical Hazards:
- **Dust:** It is well documented that a dust cloud will fuel an explosion in a confined area with sufficient oxygen and an ignition source. Surface (passive) and airborne (active) dust (fuel) is a potential hazard and the appropriate protective measures should be taken when handling guar outside of the bag in confined work spaces, dust collectors, dryers, mills, sifters, blender, pneumatic conveyance systems, storage tanks, etc. Utilize good housekeeping to remove surface dust from floors, walls, beams, around equipment, etc.
- **Slick Surfaces:** It is possible that an employee will be exposed to guar powder or dust in combination with water on work platform, floor or stair, which will result in a slippery surface.

4. First Aid Measures

Eye: Flush immediately with large amounts of water. Eyelids should be held away from the eyeball to ensure thorough rinsing. If irritation persists get medical attention.

Skin: First aid is not normally needed. Wash exposed skin with soap and water after use. If irritation or rash develops get medical attention. Use skin lotion if dryness occurs.

Inhalation: If symptoms of irritation or allergy develop, remove person from source of exposure to fresh air. If symptoms persist get medical attention.

Ingestion: Swallowing even small amounts may have serious, life-threatening effects. Get immediate medical attention.

5. Firefighting Measures

Flashpoint: Not Applicable
Auto-Ignition Temperature: Not Determined
Lower Explosion Limit: 0.040 oz/cf
Upper Explosion Limit: Not determined

Extinguishing Media: Use water fog, dry chemical, carbon dioxide or foam. Do not use streams of water as dust dispersed by water streams can explode.

Special Fire Fighting Procedures: Wear positive pressure, self-contained breathing apparatus and full protective clothing.

Unusual Fire and Explosion Hazards: Powder has the potential to form explosive mixtures with air. It is well documented that a dust cloud will fuel an explosion hazard. Surface (passive) and airborne (active) dust (fuel) are a potential hazard and the appropriate protective measures should be taken when handling guar gum outside of the original packaging. Avoid creating dust. Keep away from heat, sparks and open flames. As with all dusty materials, use preventative measures including spark proof motors and ventilation to control dust. Utilize good housekeeping to remove surface dust from floors, walls, beams, around equipment, etc.

Combustion Products: Oxides of carbon and nitrogen.

6: Accidental Release Measures

Wear appropriate protective clothing and equipment. Caution: Guar gum is ***very slippery when wet***. Suspended dust may present a serious dust explosion hazard. Sweep up or vacuum, avoiding the creation of airborne dust. Keep spilled product away from flammable and combustible materials. Use vacuum equipment specifically designed for combustible dusts. Collect into a suitable container for disposal. Wash residual traces with hot water after sweep-up is complete. Test area for residual slippery conditions.

7. Handling and Storage

Handling: Avoid generating and breathing dust. Avoid eye contact. Use with adequate local exhaust ventilation and dust collection to maintain the concentration of airborne dust below the exposure limits. If clothing becomes contaminated, remove and launder before re-use. Wash thoroughly after handling. Keep product away from oxidizers and all sources of ignition including flames, electrical sparks, hot surfaces, pilot lights, etc.

Storage: Keep product dry. Store in a cool, dry area. Keep containers closed to avoid moisture absorption.

8. Exposure Controls / Personal Protection

Engineering Controls: Consult a qualified engineer for evaluation of materials handling and explosion protection system(s).

Personal Protective Equipment (PPE):

- **Eye Protection:** Safety glasses or goggles recommended.
- **Skin Protection:** Rubber, plastic or leather gloves recommended.
- **Respiratory Protection:** If the concentrations exceed the Threshold Value Limit (TLV), a NIOSH approved dust respirator, supplied air respirator or self-contained breathing apparatus is recommended. Select appropriate respiratory protection for respirable particulates based on consideration of the airborne workplace concentrations and duration of exposure. Select and use respirators in accordance with 29 CFR 1910.134 http://www.access.gpo.gov/nara/cfr/cfr-retrieve.html#page1 , ANSI Z88.2 http://www.ansi.org/, the NIOSH Respirator Decision Logic and good industrial hygiene practice http://www.cdc.gov/niosh/homepage.html. To simplify selection of the appropriate respirator, OSHA has developed the Advisor Genius. Available online, the advisor genius allows a safety professional to input the conditions under which the respirator will be used and receive a recommendation of the type of respirator to use. The advisor also contains information about types of respirators and factors that affect respirator use. The online advisor contains a set of options as to the use of the respirator (firefighting, welding, escape purposes, confined areas) and then generates a report with the relevant OSHA standard indicated. The advisor is available at http://www.osha.gov/SLTC/etools/respiratory/respirator_selection.html.

9. Physical and Chemical Properties

Boiling Point: Not Applicable
Melting Point: Decomposes
Vapor Pressure: Not Applicable
Vapor Density (Air=1): Not Applicable
% Solubility in Water: Complete

Specific Gravity: Not applicable
% Volatile: Not applicable
Evaporation Rate (Butyl Acetate=1): Not Applicable
pH: 5-8
Octanol/Water Partition Coefficient: Not Applicable

Odor/Appearance: Creamy white powder with a bean-like odor.

10. Stability and Reactivity

Stability: Material is stable.
Incompatibility: Avoid high temperatures, sparks, open flames and moisture. Avoid contact with strong oxidizing agents.
Hazardous Reactions-Decomposition Products: Combustion may produce carbon dioxide, carbon monoxide and oxides of nitrogen.
Hazardous Polymerization: Will not occur.

11. Toxicological Information

Guar Gum: Oral rat LD50: 9.4g/kg

Guar gum is a natural food additive, although direct use in powder or pill form is banned by the FDA due to the risk of respiratory or gastrointestinal blockage

12. Ecological Information

No ecotoxicity data is available at this time.

13. Disposal Considerations

Dispose in compliance with all applicable federal, state and local regulations. Do not dump down sewers or drains as this may cause blockage.

14. Transport Information

U.S. Department of Transportation (DOT)
Proper Shipping Name: Not Regulated
Hazard Class: N/A
UN/NA Code: N/A
Packing Group: N/A
Labels Required: N/A
IMDG CODE
Proper Shipping Name: NOT REGULATED
Hazard Class: N/A
UN/NA Code: N/A
Packaging Group: N/A
Labels Required: N/A

15. Regulatory Information

Regulatory Information
The United States Food and Drug Administration, the European Economic Community and the World Health Organization accept guar gum as a food additive/ingredient providing it meets specified purity standards and dosage limitations. Maximum usage levels permitted may vary from country to country. Guar gum has been affirmed as GRAS by the United States Food & Drug Administration under title 21, CFR, part 184.1339; it is listed

as item G.3 of Table IV, Division 16, of the Canadian Food and Drug Regulations and is referenced E-412 under the EEC Council Directives.

Comprehensive Environmental Response and Liability Act of 1980 (CERCLA) Reportable Quantity:
This product is not subject to CERCLA reporting requirements as it is sold.

OSHA Hazard Categories: Irritant, Sensitizer, Target Organ Effect.

Superfund Amendments and Reauthorization Act (SARA) Title III Information:
SARA Section 311/312 Hazard Categories: Fire Hazard, Acute Health
This product contains the following toxic chemical(s) subject to reporting requirements of SARA Section 313: None

15. Regulatory Information (continued)

California Proposition 65: Guar gum is not a chemical known to the State of California to cause cancer or reproductive toxicity under the "Safe Drinking Water and Toxic Enforcement Act of 1986".

Toxic Substances Control Act (TSCA): All components of this product are listed on the TSCA inventory or exempt from notification requirements.

Canadian Environmental Protection Act: All of the components of this product are listed on the Canadian Domestic Substances List or exempt from notification requirements.

European Inventory of Existing Commercial Chemical Substances (EINECS): All of the components of this product are listed on the EINECS Inventory or exempt from notification requirements.

Japan MITI: All of the components of this product are existing chemical substances as defined in the Chemical Substance Control Law.

Australian Inventory of Chemical Substances: All of the components of this product are listed on the AICS Inventory or exempt from notification requirements.

Canadian WHMIS Classification: Class B, Division 4 (Flammable Solid)

16. Other Information

NFPA Hazard Ratings:
NFPA® Flammable (combustible dust) with representative diameter less than 420 microns (40 mesh).

Health: 1	Flammability: 2	Reactivity: 0

HMIS Hazard Ratings:

Health: 1	Flammability: 1	Reactivity: 0

Abbreviations:

ACGIH	American Conference Of Governmental Industrial Hygienists
ANSI	American National Standards Institute

CAS	Chemical Abstracts Service
CDC	Centers for Disease Control and Prevention
CFR	The Code of Federal Regulations
EEC	European Economic Community
EINECS	European Inventory of Existing Commercial Chemical Substances
EPA	United States Environmental Protection Agency
FDA	United States Food and Drug Administration
HMIS	Hazardous Materials Identification System
IARC	International Agency for Research on Cancer
IMDG	International Maritime Dangerous Goods
LD50	Lethal Dose expected to cause death in 50% of the test animals
MITI	Ministry of International Trade and Industry
NFPA	National Fire Protection Association
NIOSH	CDC - National Institute for Occupational Safety
NTP	National Toxicological Program

16. Other Information -- Abbreviations (continued)

OSHA	U.S. Department of Labor, Occupational safety and health administration
PEL	OSHA - permissible exposure limit
TLV	ACGIH - threshold limit value
TWA	Time weighted average
UN/NA	United Nations / North America
US	United States
WHMIS	Workplace Hazardous Materials Information System

NOTICE:

Information contained in the company's technical literature is believed to be accurate. It is a condition to any sale that buyer conduct an examination of the products under its own operating conditions within a reasonable time after the products have been delivered to buyer and determined to its own satisfaction that the products delivered hereunder are of acceptable quality and are suitable for buyer's contemplated use. The company makes no representation or warranty of any kind, express or implied, with respect to its products or to the use of its products by the buyer in combination with other substances, whether as to merchantability, fitness for a particular purpose, or any other matter. Statements concerning the possible use of the company's products are not intended as recommendations to use the company's products in the infringement of any patent.

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LEB-H MATERIAL SAFETY DATA SHEET

Rantec Corporation, Highway 14, Ranchester, WY 82839

PRODUCT NAME: LEB-H

SECTION 1. PRODUCT IDENTIFICATION & EMERGENCY INFORMATION

TRADE NAME: LEB-H
CHEMICAL NAME: endo-1,4-R-D-mannase
CHEMICAL FAMILY: Enzyme
D.O.T. EMERGENCY PHONE: 1-307-655-9565
ISSUE DATE: 8 June 2010

SECTION 2. HAZARDOUS INGREDIENTS

CAS NO.	COMPONENT	% RANGE	ACGIH TLV	OSHA PEL
7647-14-5	Sodium Chloride	14-15	none	none

SECTION 3. PHYSICAL & CHEMICAL PROPERTIES

SPECIFIC GRAVITY: 1.090-1.1 1 0
DENSITY: approx. 9.23 LB/GAL
BOILING POINT: 220 F
FREEZING/MELTING POINT: approx. 14 OF
SOLUBILITY IN WATER: Complete
PERCENT VOLATILES: None

pH: 7.0 - 7.5
FORM: Liquid
COLOR: Light Brown
ODOR: Fermentation
VAPOR PRESSURE. (mm Hg @ F): ND

SECTION 4. FIRE & EXPLOSION HAZARD

FLASH POINT: None
FLAMMABLE LIMITS: **LEL:NA** **UEL:NA**
EXTINGUISHING MEDIA: This product is non-combustible.
FIRE FIGHTING: None
UNUSUAL FIRE HAZARD: None known.

SECTION 5. HAZARD RATING SYSTEM

	HMIS	NFPA 704	KEY
HEALTH	0	0	4 = Severe
FLAMMABILITY	0	0	3 = Serious
REACTIVITY	0	0	2 = Moderate
			1 = Slight
			0 = Minimal

SECTION 6. HEALTH INFORMATION

PRIMARY ROUTE(S) OF ENTRY: Eyes, skin and ingestion.
CARCINOGEN: Not listed in NTP, IARC monographs or OSHA regulated.
THRESHOLD LIMIT VALUE: Not established for the product.

EFFECTS OF EXPOSURE

EYE CONTACT: May cause eye irritation upon direct contact depending on individual sensitivity.
SKIN CONTACT: May produce a drying effect which can cause irritation on prolonged or repeated exposure.
INHALATION: Not expected to pose an inhalation hazard under conditions of normal use.
INGESTION: Ingestion of large quantities may cause vomiting, diarrhea, and prostration.

FIRST AID

EYES: Immediately flush with copious amounts of water for at least 15 minutes while holding eyelids open. If irritation persists, get medical attention.
SKIN: Wash with soap and water. Remove contaminated clothing and launder before reuse. If irritation persists, get medical attention.
INHALATION: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
INGESTION: **If** victim is conscious, give large quantities of water to dilute. DO NOT induce vomiting. If vomiting occurs spontaneously, keep the victim's head below hips while vomiting. Never give anything by mouth to an unconscious person. Get immediate medical attention.

TOXICITY

ACUTE: ND

CHRONIC: ND

SECTION 7. PERSONAL PROTECTION

HANDS: Wear rubber or neoprene gloves.
EYES: Chemical splash goggles.
RESPIRATORY: None generally required under conditions of normal use.
VENTILATION: None normally required.
OTHER: Emergency eye wash fountains and safety showers should be in the immediate vicinity of any potential exposure. Remove contaminated clothing and launder before reuse.

SECTION 8. REACTIVITY DATA

STABILITY: Stable
CONDITIONS TO AVOID: None known.
HAZARDOUS POLYMERIZATION: **Will** not occur.
DECOMPOSITION PRODUCTS: NA
INCOMPATIBILITY: None known.

SECTION 9. SPILL CONTROL PROCEDURE

SMALL SPILLS: Stop the flow of material. Surround spill to prevent spreading. Absorb with an inert absorbent or pump to salvage vessels. Flush spill area with water. Do not allow material to dry on floor or other surfaces as dust may be irritating.
LARGE SPILLS: Same procedures as above.
DISPOSAL: Dispose of in accordance with all applicable local, state and federal regulations.

SECTION 10. SPECIAL PRECAUTIONS

HANDLING & STORAGE: Store in a cool location from 35 - 77 OF. Do not get in eyes, on skin or clothing. Wash thoroughly after handling. Remove contaminated clothing and launder before reuse. Wear appropriate protective equipment.
PRECAUTIONARY LABEL INFORMATION: CAUTION! Do not get in eyes, on skin or clothing. May cause eye and skin irritation.

SECTION II. REGULATORY INFORMATION

DEPARTMENT OF TRANSPORTATION

D.O.T. SHIPPING NAME: ESA-15, Not Regulated
D.O.T. HAZARD CLASS: None.
UN NUMBER: NA
NA NUMBER: NA

TSCA

All components of this product are listed on the TSCA Inventory.

CERCLA

REPORTABLE QUANTITY (RQ): NA
If the reportable quantity of this product is accidentally spilled, the incident is subject to the provisions of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and must be reported to the National Response Center by calling (800) 424-8802.

SARA TITLE III

Under the provisions of the Superfund Amendments and Reauthorization Act of 1986, Section 302-Extremely Hazardous Substances (40CFR355), this product does not contain ingredients listed in Appendix A and B.

Under Sections 311/312 of SARA, this product is classified into the following hazard categories:

NO	Immediate (acute) health hazard
NO	Delayed (chronic) health hazard
NO	Fire hazard
NO	Sudden Release of Pressure Hazard
NO	Reactive Hazard

This product contains the following Section 313 Reportable Quantities: None

NE = Not Established NA = Not Applicable ND = No Data Available
PREPARED BY: Todd Sanner

ATTACHMENT 5

Remediation Subcontractor Health and Safety Protocols

REMEDIATION SUBCONTRACTOR HEALTH AND SAFETY PROTOCOLS

1.0 SUPPLEMENTAL HAZARD ASSESSMENT

Several potential hazards may exist during ISCO field activities. These hazards are inherent to the scope of work and system operation described in the HASP. The identified potential hazards presented here are not intended as a complete list. Field personnel have the duty to recognize additional potential hazards throughout each phase of the fieldwork. ARS Technologies, Inc. (ARS) has identified the following potential hazards:

1.1 Chemical Hazards During ISCO

The injection technology provided by ARS involves in situ injection, outdoors. Therefore, in most cases exposure to contaminants such as PCE in this operation should be minimal. ARS will take steps to reduce the exposure of the contaminants to personnel through the use of PPE, engineering and administrative controls. ARS personnel should be familiar with the identified contaminants on site. Gloves, eye glasses and/or face shields and impervious protective clothing will be worn as needed. Should the contaminant contact the eye of a crew member, the individual will immediately wash the eye(s) and seek medical attention. Should skin contact occur the individual will wash with soap and water to remove the contaminant. The work for this site will be conducted outdoors. The exposure to inhalation should be limited.

1.1.1 Contaminants

The available analytical data for groundwater and soil samples from the area identified several contaminants of concern. (Further information is provided in the main body of the HASP). The primary Site contaminant of concern is PCE, and exposure to this contaminant should be minimal during ISCO activities.

1.1.2 Chemical Oxidant

ARS will inject Potassium Permanganate into the soils in solutions that are anticipated to range between 5% and 30%. Nitrogen is used as a gas in ARS' ISCO injection process.

1.1.2.1 Permanganate

Permanganate is commonly used in waste water treatment to oxide organic compounds and is commercially available in two forms, potassium permanganate ($KmnO_4$) and sodium Permanganate ($NaMnO_4$). While the behavior and oxidation potential of the two compounds is similar the solubility of $NaMnO_4$ is much higher (~65% vs. ~6%). The concentrated permanganate stock solution has a sweetish, astringent taste, is odorless, purple, and highly soluble (up to 65% or 650,000 mg/L). Permanganate is a strong oxidizer and skin and eye protection should be worn when handling the material. Permanganate will keep indefinitely when stored in a cool dry place. It is incompatible with acids, peroxides, and all combustible organics or readily oxidizable materials including inorganic oxidizable materials and metal powders. When mixed with HCI acid, chlorine gas is liberated.

1.1.2.2 Nitrogen Gas

Nitrogen Gas is an asphyxiant and denser than air. In most cases, any nitrogen released should disperse and diffuse in the air, however, there is a chance of concentration in low lying areas such as trenches, valleys, retention basins or in a building. Should a release occur, safety precautions will take place, and on-site and surrounding areas will be scrutinized and monitored for nitrogen or lack of oxygen, to the extent deemed necessary by regulatory agencies.

2.0 SAFETY PRECAUTIONS SPECIFIC TO ISCO INJECTION PROCEDURES

For ISCO material transfer, mixing and injection activities, the following additional standard safety procedures shall be employed.

1. Transfer and mixing activities will be completed in a temporary enclosure consisting of PVC piping and plastic sheeting and/or “Sea Container” storage unit, that will be constructed within the footprint of the ISCO Material Mixing/Staging Area.
2. Equipment will be rated for its intended use, and will be cleaned and inspected before proceeding to the Site.
3. Equipment will be cleaned and inspected before leaving the site.
4. Equipment, including, but not limited to, packers, well heads, hoses, fittings, regulators, pumps, etc. will be inspected daily to ensure they are in proper working order.
5. Injection and fracturing hoses shall be rated for a minimum of two times the fracturing or injection pressures. Additionally, the hoses shall be compatible with any chemical for which the hose is being used.
6. Hoses shall have a hose whip at each connection. Locking cam and groove connectors, and seals or o-rings in the connectors, shall be chemically compatible with the injection material.
7. Straddle packer connections shall be connected using Schedule 80 NPT couplings that are chemically compatible as required.
8. Packer inflation lines shall be rated to withstand the pressure of the compressed air or nitrogen and the forces of the inflated packers against the formation or casing.
9. A single inflation line shall be used to inflate each packer independently in the straddle packer string. Inflation lines shall be utilized to prevent crimping or kinks. Each inflation line will have an independent deflation valve. Inflation lines will be controlled by a pressure regulator.
10. Compressed gas cylinders will be upright and secured in a cylinder cart. Compressed gas cylinders shall be transported in an upright position in a cylinder designed carrier.
11. The straddle packer system will be attached to chemically compatible metal piping to the top of the bore hole and connected to the aboveground assembly with a metal well head. The well head and down-hole assembly will be secured by chain or other method to the roto-sonic rig to prevent the down-hole assembly from launching under pressure.

12. Well heads will be equipped with pressure gauges and ball valves to monitor and relieve any back pressure at the completion of each injection event as deemed necessary.
13. The fracture module shall be inspected and tested prior to mobilization and again prior to being used on-site.
14. The minimum number of personnel necessary to achieve the objectives shall be within a 25-foot radius of the transfer, mixing and injection activities.
15. Unauthorized personnel will remain outside the transfer, mixing and injection areas.
16. ARS will establish visual and/or audible signals to let non-ARS personnel on the Site know whether active permanganate transfer, mixing and injection are being performed or whether these operations are ceased.
17. ARS will establish different visual and/or audible signals/alarms to notify on-site personnel of any large on-site releases or daylighting of $KMnO_4$, and also any off-site releases or daylighting of $KMnO_4$ regardless of size.

3.0 SPILL CONTROL GUIDANCE

3.1 Potassium Permanganate

Clean up spills of dry potassium permanganate material immediately by sweeping or shoveling up the material. Do not return spilled material to its original container. Transfer the spilled material to a clean metal drum, if the material cannot be mixed for injection. The recovered dried material must be diluted with water to less than a 6% solution and neutralized as outlined below. Small system leaks from injection, mixing and transferring equipment are captured with a drum vacuum pump and/or contained with absorbent pads.

For minor splashes and spots of potassium permanganate, a mixture of 1 part vinegar, 1 part water, and 1 part 3% hydrogen peroxide will be prepared in a Hudson pressure washer. Spray the mixture on the splashes and spots to neutralize. Rinse with water.

For larger spills of potassium permanganate, dilute Sodium Thiosulfate ($Na_2S_2O_3$) to a 6% solution using water. A premix solution of the diluted neutralization mix is important for a quick response. A pre-mix of 25 lbs of Sodium Thiosulfate in a 55 gallon drum or other similar pre-mix procedure allows a safe neutralization process of diluted $KMnO_4$.

NEVER ADD CONCENTRATED SODIUM THIOSULFATE SOLIDS OR SOLUTIONS DIRECTLY TO CONCENTRATION GREATER THAN 5% OR UNKNOWN CONCENTRATED SOLUTIONS OF POTASSIUM PERMANGANATE. A VIOLENT REACTION MAY OCCUR RESULTING IN INJURY.

1. Clear personnel from the spill area to prevent exposures and to avoid expanding the affected area.
2. Suspend additions in immediate area to focus on response activities. Notify Project Manager, coordinate activities with site staff.

3. Don protective face shield, safety glasses, and chemical-resistant clothing (coated Tyvek coveralls, rubber boots and neoprene gloves).

4. Contain spill with non-combustible materials (pigs, dikes, absorbent pads, hogs, soil, etc.). Dilute spill with water to a concentration less than 6% concentration **— For safety reasons, do not neutralize concentrated $KMnO_4$ solutions.**

5. Slowly add the dilute 6% solution of Sodium Thiosulfate to the diluted $KMnO_4$ spilled material. Monitor the temperature of the spilled material. If the temperature of the spilled material rises, add pure water. If the temperature of the spilled material does not increase, continue to add the diluted solution of Sodium Thiosulfate until purple/pink colored liquid and/or crystals associated with the $KMnO_4$ has dissipated and is brown/brownish black in color. In order to expedite response to a $KMnO_4$ spill, a pre-mixed solution of the diluted Sodium Thiosulfate will be prepared and available in one or more work area prior to commencement of KMnO4 handling, mixing and injection work. A pre-mix of 25 lbs of Sodium Thiosulfate in a 55 gallon drum or other similar pre-mix procedure allows a safe neutralization process of diluted $KMnO_4$ to occur on the ground with buckets, shovels and brooms.

6. Containerize the spilled, diluted, and neutralized solution for disposal. If authorized, neutralized fluids may be discharged to the sanitary or combined sewer system under a Monroe County sewer use permit.

7. Rinse area with large amounts of water, except if runoff will enter a storm drain or water body.

If personnel are exposed to potassium permanganate, consult the $KMnO_4$ MSDS for first aid procedures. Rinse the exposed area with large amounts of water using the eye wash station and deluge shower.

Neutralizing splashes, spots and spills of $KMnO_4$ is continued until the original purple/pink color is changed to brown/brownish black.

3.2 Nitrogen

The nitrogen used in the PF/LAI process is a gas. There is no risk of a spill. However, it is an asphyxiant and denser than air. In most cases, any nitrogen released should disperse and diffuse in the air; however, there is a chance of concentration in low lying areas such as trenches, valleys, retention basins or in a building. Should a release occur, safety precautions will take place, and on-site and surrounding areas will be scrutinized and monitored for nitrogen or lack of oxygen, to the extent deemed necessary by regulatory agencies.

3.3 Other Chemicals and Materials

Spills of other chemicals and materials used during the project will be addressed in accordance with guidance provided in the specific MSDS. These materials include guar gum, LEB-H enzyme, sodium thiosulfate, vinegar, and hydrogen peroxide.

ATTACHMENT 6

Daily Air Monitoring Log and Figure

day
DAY ENVIRONMENTAL, INC.

ENVIRONMENTAL CONSULTANTS
AN AFFILIATE OF DAY ENGINEERING, P.C.

AIR MONITORING REPORT SHEET

DATE:____________________ PAGE:_______ OF _________

JOB #: 4355S-10

SITE: Andrews Street Site - IRM

BY:____

ON-SITE:___________ OFF-SITE:______________________

WEATHER CONDITIONS:______________________ PREVAILING WIND DIRECTION:_________

PERSONNEL ON-SITE:____

NOTES:____

____

____

____

____

____

____

____

DESCRIPTION	TIME	LOCATION	PID (ppm)	PARTICULATES (mg/m3)

DESCRIPTION: BZ = Breathing Zone, BG = Upwind Background, CAMP = Outside work area/at property boundary
S:/project pdfs/4355S-10/Air Monitoring

day
DAY ENVIRONMENTAL, INC.

ENVIRONMENTAL CONSULTANTS
AN AFFILIATE OF DAY ENGINEERING, P.C.

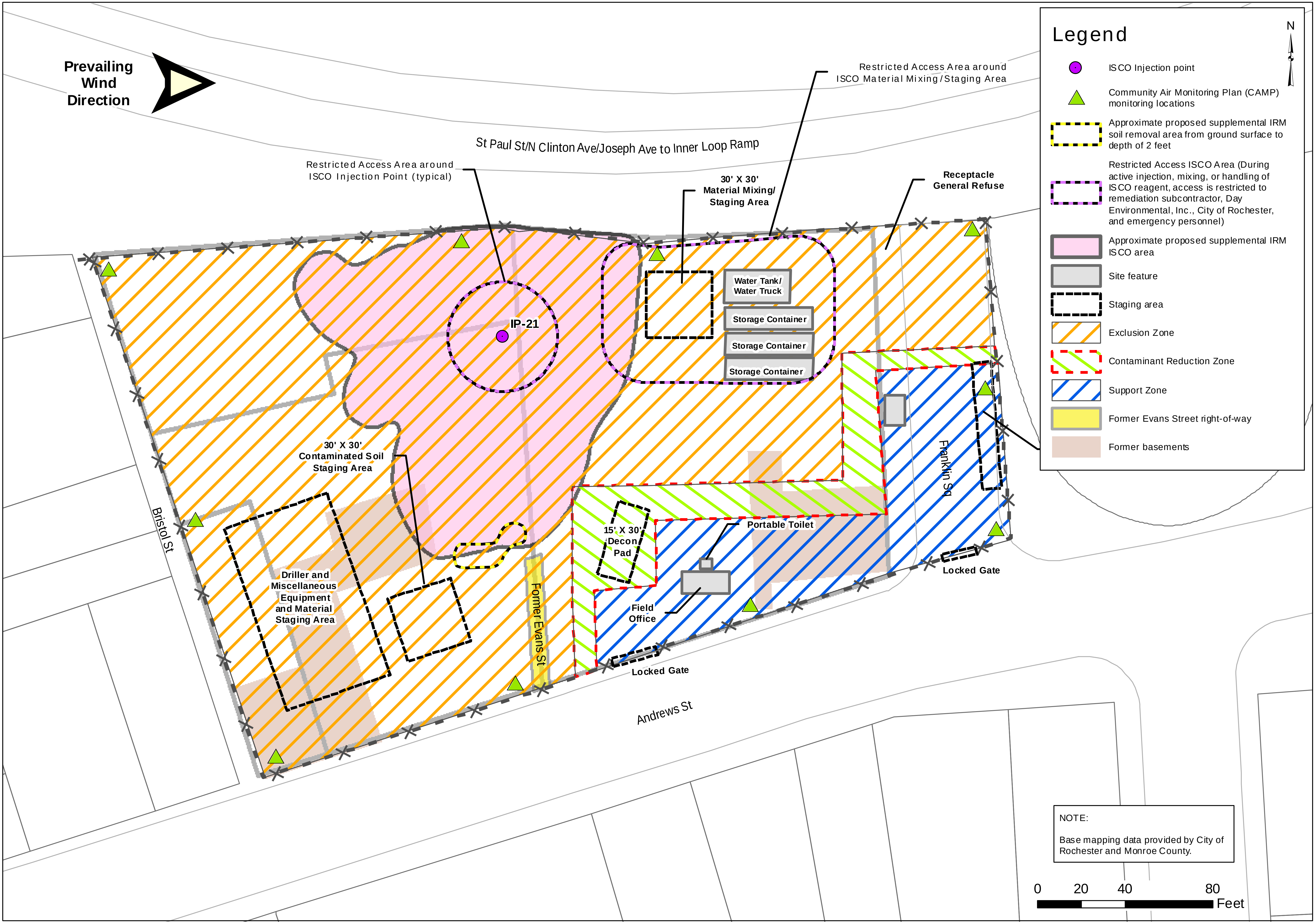
AIR MONITORING REPORT SHEET (Continued)

DATE:____________________ PAGE:_______ OF _________

JOB #: 4355S-10__________________

DESCRIPTION	TIME	LOCATION	PID (ppm)	PARTICULATES (mg/m3)

DESCRIPTION: BZ = Breathing Zone, BG = Upwind Background, CAMP = Outside work area/at property boundary
S:/project pdfs/4355S-10/Air Monitoring



NOTE:

Base mapping data provided by City of Rochester and Monroe County.

Map document path: E:\GIS\GIS Mapping\Andrews_Street\4355S-10Rocity - Andrews Street\Supplemental_RI_Workplan\4355S-SRI-54 - H and S Control Zones.mxd

Last date document was saved: 21 May 2014

DATE 01-2014
DATE DRAWN 01-2014
DATE ISSUED 05-21-2014
DESIGNED BY JAD
DRAWN BY CPS
SCALE AS NOTED

DAY ENVIRONMENTAL, INC.
Environmental Consultants
Rochester, New York 14606
New York, New York 10170

Project Title
300, 304-308, 320 ANDREWS STREET
AND 25 EVANS STREET
ROCHESTER, NEW YORK

ENVIRONMENTAL RESTORATION PROJECT NYSDEC SITE NO: E828144

Drawing Title
Supplemental IRM Site Layout Plan with Health and Safety Control Zones and CAMP Monitoring Locations

Project No.
4355S-10

FIGURE 2

APPENDIX G

Quality Assurance Project Plan

QUALITY ASSURANCE PROJECT PLAN FOR SUPPLEMENTAL IRMS

300, 304-308, 320 ANDREWS STREET AND 25 EVANS STREET
ROCHESTER, NEW YORK 14604

NYSDEC SITE #E828144

Prepared For:	City of Rochester Division of Environmental Quality 30 Church Street, Room 300B Rochester, New York, 14614-1278
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Project No.:	4355S-10
Date:	June 2014

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1.0 INTRODUCTION

This project-specific Quality Assurance Project Plan (QAPP) was prepared for the 300, 304-308, 320 Andrews Street and 25 Evans Street, Rochester, New York (Site) in accordance with Section 2.4 of the New York State Department of Environmental Conservation (NYSDEC) Technical Guidance for Site Investigation and Remediation DER-10 dated May 2010 document. This QAPP provides quality assurance/quality control (QA/QC) protocols and guidance that are to be followed when implementing the Supplemental Interim Remedial Measure (IRM) Work Plan for the Site to ensure that data of known and acceptable precision and accuracy are generated. The QAPP also provides a summary of the project, identifies personnel responsibilities, and provides procedures to be used during sampling of environmental media, other field activities, and the analytical laboratory testing of samples.

1.1 Project Scope and Project Goals

The QAPP applies to the aspects of the project associated with the performance of field activities, the collection of field data, the collection and analytical laboratory testing of field samples and QA/QC samples, and the evaluation of the quality of the data that is generated. Specifically, the IRMs will include: baseline monitoring, in-situ chemical oxidation (ISCO) injection, process monitoring, performance monitoring, supplemental IRM soil removal, management of IRM-derived wastes, and long-term groundwater monitoring. A summary of the anticipated number of analytical samples is provided in Table 1 in Attachment 1. Detailed discussions of the project scope and project goals are provided in the Supplemental IRM Work Plan. In general, the project goal is to sufficiently complete Supplemental IRM activities to further address remaining contamination at the Site, conduct sufficient monitoring to allow modifications to the IRMs, and demonstrate the effectiveness of the IRMs.

2.0 PROJECT/TASK ORGANIZATION

Project organization and tentative personnel to implement the work are outlined in this section of the QAPP. The project organization and tentative personnel identified below are the same as identified in the NYSDEC-approved August 2011 Remedial Investigation/Remedial Alternatives Analysis (RI/RAA) Work Plan.

2.1 City Project Manager

Mr. Joseph J. Biondolillo will continue to serve as the City of Rochester (City) Project Manager on this project. Mr. Biondolillo will review project documents, assist in key decisions as they relate to various components of the project, etc., as deemed necessary by the City.

2.2 DAY Organization

Information pertaining to key personnel from Day Environmental, Inc. (DAY) is provided below. Resumes of DAY's key personnel were included in the NYSDEC-approved August 2011 RI/RAA Work Plan.

DAY Principal in Charge

The Principal in Charge is responsible for review of project documents and ensuring the project is completed in accordance with relative work plans. Mr. David D. Day, P.E. will continue to serve as DAY's Principle-in-Charge on this project.

DAY Project Manager

The DAY Project Manager has the overall responsibility for implementing the project and ensuring that the project meets the objectives and quality standards as presented in this QAPP. Mr. Jeffrey A. Danzinger will continue to serve as DAY's Project Manager on this project, and will serve as DAY's primary point of contact and control for the project.

DAY Quality Assurance Officer

The Quality Assurance Officer is responsible for QA/QC on this project. The Quality Assurance Officer's responsibilities on this project are not as a project manager or task manager involved with project productivity or profitability as job performance criteria. Mr. Bart Kline, P.E. will continue to serve as DAY's Quality Assurance Officer on this project. The Quality Assurance Officer may conduct audits of the operations at the Site to ensure that work is being performed in accordance with the QAPP.

DAY Technical Staff

DAY's technical staff for this project consists of experienced professionals (e.g., professional engineers, engineers-in-training, scientists, technicians, etc.) that possess the qualifications necessary to effectively and efficiently complete the project tasks. The technical staff will be used to gather and analyze data, prepare various project documentation, etc.

2.3 Analytical Laboratories

The following two analytical laboratories will continue to be used during the Supplemental IRM work:

- Chemtech Consulting Group, Inc. (Chemtech) of Mountainside, New Jersey will be used for the majority of the analytical services work. Chemtech is a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP)-certified analytical laboratory (ELAP ID11376). A copy of the Chemtech Quality Assurance Manual (QAM) was previously provided to the NYSDEC in the NYSDEC-approved August 2011 RI/RAA Work Plan.

  Divya Mehta is the Chief Operating Officer and Technical Director for Chemtech. The laboratory director is responsible for operation, technical performance and data quality of the laboratory and works in conjunction with the Laboratory Manager and QA unit regarding QA and chain-of-custody requirements.

  Mohammed Ahmed of Chemtech will continue to act as the Laboratory Manager on this project. The Laboratory Manager will work in conjunction with the laboratory QA unit regarding QA elements of specific sample analyses tasks.

- Paradigm Environmental Services, Inc. (Paradigm) of Rochester, New York may provide quick turn analytical services during the Supplemental IRM work, primarily for characterization of IRM-derived wastes. Paradigm is a NYSDOH ELAP-certified laboratory (ELAP ID 10958). A copy of the Paradigm Statement of Qualifications (SOQ) was previously provided to the NYSDEC in the NYSDEC-approved August 2011 RI/RAA Work Plan.

  Bruce Hoogester is the President and Technical Director for Paradigm. The technical director is responsible for operation, technical performance and data quality of the laboratory and works in conjunction with the Laboratory Manager and QA unit regarding QA and chain-of-custody requirements.

3.0 QUALITY ASSURANCE/QUALITY CONTROL

As part of this Work Plan, QA/QC protocol and procedures have been developed and are described below. The objective of the QA/QC protocol and procedures is to ensure that the information, data, and decisions associated with this project are technically sound and properly documented. The QA/QC protocol and procedures also pertain to the collection, evaluation, and review of activities and data that are part of this project. These QA/QC protocol and procedures will be modified in addendums to the work plan when deemed appropriate.

3.1 Operation and Calibration of On-Site Monitoring Equipment

On-site monitoring equipment will play a significant role in addressing health and safety objectives and in selection of appropriate personal protective equipment (PPE) as noted in the health and safety plan (HASP). The on-site monitoring equipment includes volatile organic compound (VOC) monitors, particulate monitors, oil/water interface probes, an electronic static water level indicator; water quality monitors, and a global positioning system (GPS). Operation and calibration of on-site monitoring equipment that are anticipated for use during the Supplemental IRM work are discussed below.

3.1.1 VOC Monitoring Equipment

Real-time monitoring for VOCs will be conducted to evaluate the potential presence of petroleum and chlorinated solvents in soil at the Site and to determine the appropriate personal protective equipment as noted in the HASP. The primary field instrument for monitoring VOCs during the Supplemental IRM work will be a photoionization detector (PID). It is anticipated that a Minirae 2000 PID (or equivalent) equipped with a 10.6 eV lamp will be used during this work. An accredited firm/testing laboratory calibrates the equipment on an annual basis. During fieldwork, the PID will be calibrated on a daily basis in accordance with the manufacturer’s specifications. Isobutylene gas will be used to calibrate the PID prior to use and as necessary during fieldwork. Measurements will be collected before operations begin in an area to determine the amount of VOCs naturally occurring in the air (i.e., background concentrations).

3.1.2 Particulate Monitoring Equipment

Particulate monitoring will be conducted during intrusive activities as noted in the Community Air Monitoring Plan (CAMP) portion of the HASP. It is anticipated that the particulate air monitoring will be conducted using a real-time aerosol monitor (RTAM) particulate meter. An accredited firm/testing laboratory calibrates the equipment on an annual basis. During fieldwork, the particulate meter will be regularly calibrated in accordance with the manufacturer’s specifications. Measurements will be collected along the upwind perimeter of the intrusive investigation activities to determine the amount of particulates naturally occurring in the air (i.e., background concentrations) as per the requirements of the CAMP.

3.1.3 Global Positioning System Equipment

A GPS unit will be used to obtain the precise locations of test points and significant site features. It is anticipated that a Trimble GeoXH will be used during this work. The GPS location accuracy of less than one horizontal foot is the data quality objective for this project.

The GPS unit will be calibrated as needed in accordance with the manufacturer's specifications. The GPS location data will conform to Rochester's GIS coordinate system (NAD 1983 State Plane New York West) to match data gathered during previous environmental activities.

3.1.4 Miscellaneous Field Monitoring Equipment

Several other pieces of miscellaneous field monitoring equipment will be used during the Supplemental IRM work. It is anticipated that the other field monitoring equipment utilized during portions of the project may include:

- A laser level;
- An electronic static water level indicator;
- An electronic oil/water interface meter, and;
- A Horiba U-22 water quality meter that measures pH, specific conductivity, temperature, dissolved oxygen, oxygen-reduction potential, and turbidity.

These meters will be calibrated, operated, and maintained in accordance with the manufacturer's recommendations.

3.2 Installation of ISCO Injection Points

The injection point installation will be completed using a Geoprobe Model 8140LC (or similar) roto-sonic drill-rig equipped with a S/DT45 dual tube system. The dual tube system includes a 4.5-inch diameter outer casing and a 2.25-inch diameter inner probe rod. Roto-sonic drilling provides advantages over other types of drilling techniques. The sonic head is based upon the principle of high frequency vibration. The hydraulic motors on the exterior of the head oscillate off set internal weights at speeds reaching 5000 rpm. As a result of the weights being off-set, a vibration in excess of 140 HZ is created in the drill stem allowing the drill to penetrate any material with minimal side wall disturbance. In addition the vibration, sonic drilling uses both the rotational and downforce of the drill casing to advance the borehole. For sonic drilling, the inner probe rod is advanced ahead of the outer casing. Depending on the subsurface conditions, small quantities of potable water may be used to lubricate the outer casing during its advancement.

3.3 $KMnO_4$ Mixing

A track-mounted Bobcat/forklift will be utilized to transport drums, containers, and totes of materials and slurry to required locations on the Site.

$KMnO_4$ mixing operations will involve the use of a fully automated chemically compatible batch mixing plant with secondary containment. Homogeneous mixing will be accomplished with a recirculation/shear pump. Four load cells situated beneath each vertical support of the mixing tank will ensure accurate loading of the $KMnO_4$ with water. A digital readout located on the control panel will show in real time the mass of $KMnO_4$ being loaded. Water volumes will also be based on weight utilizing the load cells. Prior to mixing, the $KMnO_4$ will be transferred from an approximate 330-pound drum or 55-pound pale into a dry feed hopper fitted with a slide gate valve at the base of the hopper. The slide gate valve is designed specifically for dry powders and granules, and provides precise control on the feed rate of these dry materials. Once the transfer has been completed, the hopper will be sealed, raised, and attached to the top of the batch tank and be ready for loading. Transfer-related tasks will be performed within a temporary dust control enclose.

Once batching is complete, the recirculation bypass valve will be actuated and the slurry will be fed to a Moyno style progressive cavity pump, routed to a blending manifold, and injected down-hole at the specific injection point. [Note, the slurry may also first be transferred to a staging tank with secondary containment prior to being fed into the Moyno style progressive cavity pump.] To ensure that each injection interval receives the designated loading, corresponding slurry mass will be monitored. Dosages will be monitored on a dry-weight basis using the density of the 30% slurry as reference.

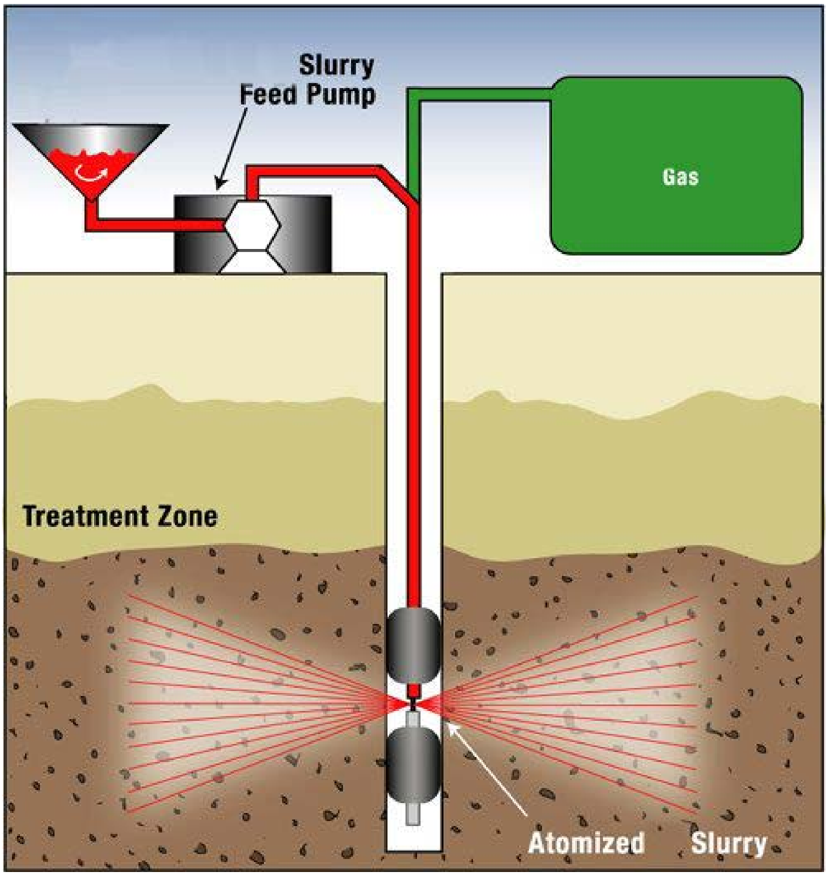
3.4 Enhanced Hydraulic/Pneumatic ISCO Injection and Process Monitoring

Once the final depth of an injection point is achieved using the roto-sonic drill-rig, ARS' proprietary pneumatic/hydraulic enhanced injection tooling and packers (above and below the injection tooling) are installed. The outer casing is pulled back exposing the injection nozzle. If heaving sands are encountered, or it tooling needs to be removed, reconfigured, and re-installed, potable water may be introduced to clean out the casing. The pneumatic packer assembly is used to isolate the discrete target intervals. This injection assembly consists of two or more pneumatic packers straddling a 360-degree injection nozzle and thereby isolating the injection interval when inflated. Prior to an injection, the straddled packers are inflated to isolate the targeted injection interval. The injection process is initiated by the introduction of nitrogen gas for approximately 10 to 15 seconds to fracture or fluidize the formation surrounding the injection point. In low permeability formations, a fracture network will be created by the pneumatic/hydraulic enhanced injection process. In higher permeability formations, the injection of nitrogen gas will initiate a local mixing or fluidization effect instead of actual fracture generation. This delivery mechanism typically results in pore space dilation and can be attributed to non-cohesive or previously fractured soils. Upon completion of the pneumatic fracturing event and establishment of gas flow within the formation, injection operations will commence. The field engineering shall signal the field crew to check for and bleed off any residual pressure on the injection point prior to the start of the product injection. The prepared injectate will be supplied to the injection pump via a chemical transfer hose. ARS also utilizes a proprietary process called Liquid Atomized Injection (LAI) that atomizes a liquid or slurry by the use of high energy nitrogen gas. For this project, nitrogen gas will be utilized to aerosolize the $KMnO_4$ slurry and solutions, thereby "atomizing" the liquids into a high velocity stream of aerosols with characteristics resembling a gas. This technique has the ability to distribute the chemicals more uniformly within the targeted zones. Additionally, the atomized injection technique can significantly minimize the potential for soil plugging since the chemical oxidant is rapidly delivered within each targeted zone before significant reaction of permanganate can occur. As part of the injection process, the pump being fed with injectate will be engaged, and the injectate will be pumped through a gas blending "y" fitting and valve where it is introduced into the nitrogen gas stream and dispersed within the formation, with LAI enhancement when deemed appropriate, through the equipment set at the specific depth interval inside the injection point. Flow rates, pressures and durations will be selected based upon depth, geology, formation response, and desired ROI. Upon completion, chase water will be delivered through the transfer hose, pump, injection hose, and down-hole injection tooling, and the chase water may then be purged from the equipment using nitrogen gas.

Once injection equipment has been purged with chase water, the field crew will bleed off any residual pressure on the system, deflate the packers, and re-set the injection tooling at the next interval designated for injection. The module/pump operator shall re-set the module and log any field measurements prior to performing tasks for the subsequent injection interval

The above injection method will allow the injected material to be uniformly distributed within the formation and documented in an organized manner. A process schematic of the equipment setup used during the application is found below. A compressed gas (in this case, nitrogen) is utilized as the fracturing agent and delivery mechanism for the reagent being injected. The nitrogen gas required for injection purposes is supplied in a bulk tube trailer. ARS' proprietary Gas Injection Module accurately regulates the high-pressure nitrogen to operational pressures and controlled flow rates necessary for the operations. The reagents will be mixed to specific concentrations and delivered into the gas stream via high pressure and high flow pumps.

Enhanced Injection Process Schematic



Process Monitoring

During each injection, system operational parameters to be observed and collected include:

- Down-hole injection initiation and maintenance pressures;
- Gas injection flow rate; and
- Injection pressure influence at surrounding monitoring points.

Other visual observations will also be recorded during the injection events. Detailed discussions of the operational parameters are provided below:

Injection Initiation and Maintenance Pressures

During each injection, a pressure transducer records data every 1/8 of a second. This data may be used to create a pressure-time history curve from which the initiation pressure and the maintenance pressure can be determined. The initiation pressure represents the pressure at which the formation yields to the influx of injection fluids. The maintenance pressure represents the pressure required to maintain the injection flow into the formation. Initiation pressures typically range between 300 and 400 psi, and maintenance pressures typically range between 200 and 250 psi. The graphical representation of this data plotted over time provides information as to the in-situ stresses of the formation corresponding to depth, as well as a confirmation that fractures were created and propagated.

Gas Injection Flow Rate

During each injection interval the flow rate of nitrogen gas is measured. The flow rate is measured by a mass vortex flow meter that corrects for ambient temperature, pressure and Reynolds number. The flow rate will be measured at least once every 5 minutes during every injection event. The average flow rate will be determined by dividing the sum of the flow rates recorded by the number of measurements taken.

Pressure Influence at Adjacent Wells

During each injection, pressure gauges will be placed at each monitoring well within a 50-foot radius of the injection point. These pressure gauges are set up to monitor for the maximum pressure influence at the monitoring well. Each pressure gauge is outfitted with a drag arm indicator that records the maximum pressure detected at the monitoring point during the injection. Pressures in the discrete injection interval are also recorded by a pressure transducer located in-line within the conduit leading to the injection nozzle. During each injection initiation, injection interval pressures are recorded by a data logging system located on the injection module and accessed using a laptop computer for real-time display of the injection pressure. The pattern of the injection interval pressure history curves, supplemented by the pressure gauge data from nearby monitoring wells serve as an indicator of whether enhanced injection initiation and propagation have occurred. In addition, visual and physical observations will be used to indicate pressure influence in surrounding wells.

Visual and physical observations of gas release from the vent valve on the monitoring well packer assembly will be recorded. This will assure that the gauge on each monitoring well packer assembly is functioning correctly and that the appropriate range gauge is installed. This pressure influence data is used to assist in the evaluation of achievable ROI, will be used to revise the injection point field where deemed necessary in an effort to ensure proper coverage and delivery of $KMnO_4$ to the volume of soil targeted for treatment.

QA/QC Measures

In assuring and maintaining the quality of the various field parameters to be collected, ARS will implement measures designed to provide accurate and representative data. Many of these measures are inherent in the procedures as part of the injection and monitoring processes.

As outlined previously, during each injection, ARS will measure and record the several operational parameters that include pressure flow rate and mass or volume of injected materials. The following is a list of parameters and descriptions of the methods to be taken in ensuring accurate measurements as part of quality assurance and control:

> Injection Pressure - The injection pressure will be both manually recorded from a pressure gauge and electronically logged by an in-line pressure transducer. Pressure gauges will be checked for accuracy before mobilization to the Site.
>
> Materials Loading - During $KMnO_4$ injection, the dosage will be recorded on a mass basis by accounting for the quantity used in batching the solution for each borehole.
>
> Nitrogen Gas Flow Rate - The gas flow rate will be measured by the use of a vortex flow meter. The meters will be factory-calibrated for nitrogen gas within the range of expected operating pressures and flow. As a qualitative check, ARS may also calculate the average flow rate at each injection location based on the pressure differential at the nitrogen source before and after the injection and the duration of injection. Nitrogen flow rates typically run between 750 SCFM to more than 1500 SCFM.
>
> Pressure Influence - Maximum pressure readings at monitoring wells within 50 feet of the injection points will be recorded by using pressure gauges and mechanical or pneumatic packers that seal off the well risers.

Injection activities and the associated field measurements will be recorded daily and made available to the DAY, City and NYSDEC field personnel. The daily reporting will ensure a disciplined and organized management of pertinent field data in documenting and quantifying the work performed. The following information will be recorded daily:

- Work date and names of personnel on-site.
- Time that work began and ended.
- The total depth of each completed boring.

- The starting and ending times for performing formation fracturing and injections.

- The injection interval (reported to the nearest ½ ft bgs), starting and ending times of each injection, type of chemical injected, concentration of solution/slurry, volume of slurry injected, and pressures recorded during injection.

- Types of materials (bentonite, cement) used to seal the boring.

- Results of daily equipment and materials inspections including corrective actions involved, and maintenance and repairs resulting from these inspections.

- Any unusual occurrence, including visitors, injuries, breakdowns, weather, or any other out-of-the-ordinary event.

- Other pertinent documentation developed during the day.

Tiltmeter Monitoring To Evaluate Injection Radius Of Influence

ARS utilizes wireless, bi-axial tiltmeters that are sensitive down to 3 microradians displacement. The tiltmeters provide data in 360 degrees around the injection point for the entire duration of the injection event. This data is then used to extrapolate visual representations of heave in each direction around the injection point. The ground surface heave is used to detected injection initiation, propagation and ROI. Ground surface tiltmeter (heave) measurements will be recorded during up to 20 injection events to obtain ROI data used to revise the injection point field where deemed necessary in an effort to ensure proper coverage and delivery of $KMnO_4$ to the volume of soil targeted for treatment.

Soil Sampling to Evaluate Injection Radius Of Influence

Soil samples are collected to confirm the extent of ROI of $KMnO_4$ injection near specific injection points using the Geoprobe Model 8140LC (or similar) roto-sonic drill-rig equipped with a S/DT45 dual tube system. The dual tube system will include a 4.5-inch diameter outer casing and a 2.25-inch diameter inner sample sheath equipped with a PVC liner and core catcher. The inner sample sheath will collect samples in four to six foot intervals from the ground surface to the desired depth (e.g., 32 feet bgs). No fluid, air or mud is used during this sampling process, which allows for virtually undisturbed soil samples to be collected. Samples are retrieved and the PVC liners are cut open to expose the samples for observation, screening, etc. The data obtained will be used to revise the injection point field where deemed necessary in an effort to ensure proper coverage and delivery of $KMnO_4$ to the volume of soil targeted for treatment.

3.5 Groundwater Color Monitoring

A DAY or City representative will frequently collect grab groundwater samples as part of the process and performance monitoring activities. The samples collected will be observed for pink or purple color that is indicative of the presence of $KMnO_4$. The color evaluation will be conducted using visual comparison between standards of known concentrations and the groundwater samples, and/or colorimeter measurements on the groundwater samples. Each set of results will be recorded in a log book or field data table. To establish the estimated concentration of $KMnO_4$ in the collected groundwater samples, the following $KMnO_4$ standards in clear glass 4-oz jars will be prepared using distilled water and $KMnO_4$ product that arrives on-site:

- 0.5 ppm,
- 1 ppm,
- 5 ppm,
- 10 ppm,
- 25 ppm,
- 50 ppm, and
- 100 ppm.

The standards will be stored in a closed cooler.

Colorimeter Method

Initially, a sample from each of the standards will be placed in the colorimeter cuvette (or similar) and measured in accordance with the colorimeter manufacture's recommendations. The colorimeter result for each standard will be recorded and used to compare groundwater colorimeter results to determine a general estimate of $KMnO_4$ concentration.

Subsequent to establishing $KMnO_4$ standards colorimeter output, groundwater samples will be collected using a new disposable bailer. Samples will be allowed to settle for up to four hours if turbidity appears to be influencing the color. Samples will then be transferred to the colorimeter's cuvette (or similar) for measurement. The groundwater samples output will then be compared to the outputs measured for the standards to assist in evaluating the approximate concentration range of $KMnO_4$ for the tested location.

Visual Method

Groundwater samples will be collected using a new disposable bailer and transferred to a clear 4-oz jar (same jars as standards) and evaluated under the same lighting conditions to the extent possible. The sample evaluation will be completed within four hours of sample collection. Samples will be allowed to settle for up to four hours if turbidity appears to be influencing the color. The standard that is closest in color to the groundwater sample will represent the approximate concentration of the $KMnO_4$ in the groundwater sample.

3.6 General Boring Screening and Logging

A DAY representative will: document visual observations; screen split spoon and macro-core samples with a PID; collect selected portions of the samples for possible laboratory analysis; collect other portions of the samples (and process and screen the headspace of these selected samples with a PID); photograph the test boring work; and prepare test boring logs that provide pertinent field information. Pertinent information will be recorded on test boring logs, and will include:

- Date, boring identification, and project identification;

- Name of individual developing the log;
- Name of drilling contractor;
- Drill make and model, and auger size;
- Identification of alternative drilling methods used and justification thereof;
- Depths recorded in feet and fractions thereof (tenths of inches) referenced to ground surface;
- Standard penetration test (ASTM D-1586) blow counts (if applicable);
- The length of the sample interval and the percentage of the sample recovered;
- Description of soil type using the Unified Soil Classification System;
- The depth of the first encountered water table, along with the method of determination, referenced to ground surface;
- Drilling and borehole characteristics;
- Sequential stratigraphic boundaries and soil types consistent with logging performed on other project elements;
- Well specifications (materials; screened interval; amount of Portland cement, bentonite and water used to mix grout; etc.); and
- PID screening results of ambient headspace air above selected soil samples.

3.7 Soil Sample Headspace Screening

Recovered soil samples will be visually examined for evidence of suspect contamination (e.g., staining, unusual odors) and screened with a PID. Portions of the recovered soil samples may be placed in containers for possible analytical laboratory testing. Different portions of the soil samples will concurrently be placed in sealable Ziploc®-type plastic baggies, and will be field screened the same day they are collected. Each sample will be agitated and homogenized for at least 30 seconds and allowed to equilibrate for at least three minutes. The ambient headspace air inside the baggie above each sample will be screened for total VOC vapors with the PID equipped with a 10.6 eV lamp. The sampling port for the PID will be placed in the ambient air headspace inside the bag by opening a corner of the "locked" portion of the bag. The PID will monitor air inside the baggie for a period of at least 15 seconds and the peak readings measured will be recorded on a log sheet or log book.

3.8 NAPL Screening Shake Test

Field evidence of suspect non-aqueous phase liquid (NAPL) includes, but is not limited to, elevated PID readings [i.e., greater than 1,000 parts per million (ppm)], saturated soil with petroleum or solvent odors or significant staining, and apparent free phase or residual NAPL. When deemed appropriate, evidence of suspect NAPL will be further evaluated in the field utilizing a hydrophobic dye shake test. The NAPL screening shake test is applicable for both light non-aqueous phase liquid (LNAPL) and dense non-aqueous phase liquid (DNAPL). The NAPL shake test will be performed on an aliquot of the corresponding soil sample using hydrophobic dye. The sample aliquot will be mixed with approximately two ounces potable water, and a pinch of Sudan IV or equivalent hydrophobic dye will be placed in a sealable plastic baggie, agitated for approximately 10 seconds, and then observed for pigment staining. If organic NAPL is present, the Sudan IV Pigment should result in pigment staining. The NAPL screening shake test results will be recorded in the field log book/notes, and if possible photographed for further documentation purposes. The hydrophobic dye will be handled with care using a new pair of disposable gloves. Following the shake test, the plastic baggie containing the soil-dye moisture and associated PPE will be managed as IRM-derived waste. Soils containing hydrophobic dye and PPE will not be used for confirmatory analytical analyses or headspace measurements.

3.9 Well Development

Existing wells, new monitoring wells or injection wells may require development. Development will consist of utilizing either new dedicated disposable bailers with dedicated cord, and/or a pump and dedicated disposable tubing depending on the field conditions. Well development can occur a minimum of 48 hours after installation. No fluids will be added to the wells during development without prior approval of the NYSDEC, and well development equipment will be decontaminated prior to development of each well.

The well development procedure is listed below:

- Obtain pre-development static water level and oil/water interface reading for the presence of LNAPL or DNAPL using a Heron Model HO1.L oil/water interface probe or similar instrument;
- Calculate water/sediment volume in the well;
- Obtain initial field water quality measurements (e.g., pH, specific conductivity, oxidation-reduction potential (ORP), turbidity, temperature, and PID readings). The pH, specific conductivity, ORP, turbidity and temperature readings will be obtained using Horiba U-22 water quality meter (or similar equipment);
- Select development method and set up equipment depending on method used;
- Alternate water agitation methods (e.g., moving a bailer or pump tubing up and down inside the screened interval) and water removal methods (e.g., pumping or bailing) in order to suspend and remove solids from the well;
- Obtain field water quality measurements for every two to five gallons of water removed. Record water quantities and rates removed;
- Stop development when the following water quality criteria are met and at least 10 well volumes have been removed;
  - Water is clear and free of sediment and turbidity is less than 50 nephelometric turbidity units (NTUs);
  - pH is ±0.1 standard unit between readings;
  - Specific conductivity is ±3% between readings, and;
  - Temperature is ±10% between readings.
- Obtain post-development water level readings; and
- Document development procedures, measurements, quantities, etc.

Pertinent information for each well will be recorded on well development logs.

3.10 Low-Flow Groundwater Purging and Sampling

The low-flow procedures that will be utilized are outlined below:

- In order to minimize the potential re-suspension of solids in the bottom of the well, well depths will not be measured prior to or during low-flow purging and sampling. Well depth information will be obtained from measurements collected during well development or the well logs.
- PID readings will be obtained from the well headspace immediately following opening the well. The peak PID readings will be noted on the field logbook.
- Prior to purging and sampling, static water level measurements will be taken from each well using a Heron Model HO1.L oil/water interface probe or similar instrument. The presence or absence of LNAPL will be determined. If present, the thickness of LNAPL will be obtained.
- If necessary to confirm whether NAPL is present in groundwater that contains PID measurements greater than 500 ppm or other field indications of NAPL, hydrophobic dye (i.e., Sudan IV) may be introduced to an aliquot of the sample. If LNAPL or DNAPL is detected, the NYSDEC will be notified to determine whether analytical characterization of the NAPL is warranted.
- A portable bladder pump connected to new disposable polyethylene tubing will be lowered and positioned at or slightly above the mid-point of the well screen or cored open bedrock when this interval is set in relatively homogeneous material. When the screened interval or cored open bedrock interval is set in heterogeneous materials, the pump may be positioned adjacent to the zone of highest hydraulic conductivity (as defined by geologic samples), or at a different depth agreed to by the City, the NYSDEC and DAY. Care will be taken to install and lower the bladder pump slowly in order to minimize disturbance of the water column.
- The pump will be connected to a control box that is operated on compressed gas (nitrogen, air, etc.) and is capable of varying pumping rates. An in-line flow-through cell attached to a Horiba U-22 water quality meter (or similar equipment) will be connected to the bladder pump effluent tubing to measure water quality data.
- The pump will be started at a low pumping rate of 100 ml/min or less (for pumps that cannot achieve a flow rate this low, the pump will be started at the lowest pump rate possible). The water level in the well will be measured and the pump rate will be adjusted (i.e., increased or decreased) until the drawdown is stabilized. In order to establish the optimum flow-rate for purging and sampling, the water level in the well will be measured on a periodic basis (i.e., every one or two minutes) using an electronic water level meter or the Heron Model HO1.L oil/water interface meter (or equivalent). When the water level in the well has stabilized (i.e., use goal of < 0.33 feet of constant drawdown), the water level measurements will be collected less frequently.
- While purging the well at the stabilized water level, water quality indicator parameters will be monitored on a three to five minute basis with a Horiba U-22 water quality meter (or

similar equipment). Water quality indicator parameters will be considered stabilized after three consecutive readings for each of the following parameters are generally achieved:

  - pH (± 0.1);
  - specific conductance (± 3%);
  - dissolved oxygen (± 10 %);
  - oxidation-reduction potential (± 10 mV);
  - temperature (± 10%); and
  - turbidity (± 10%, when turbidity is greater than 10 NTUs).

- Following stabilization of the water quality parameters, the flow-through cell will be disconnected and a groundwater sample will be collected from the bladder pump effluent tubing. The pumping rate during sampling will remain at the established purging rate or it may be adjusted downward to minimize aeration, bubble formation, or turbulent filling of sample containers. A pumping rate below 250 ml/min will be used when collecting VOC samples.
- To minimize the potential for re-suspension of solids in the bottom of the well, the presence of DNAPL will be determined following purging and sampling at each well location using the Heron oil/water interface probe (or equivalent).
- Field observations, real-time parameter readings, and other pertinent information obtained during the sampling effort will be noted in the field logbook and a low-flow groundwater purge and sample form.

3.11 Passive Diffusion Bag Groundwater Sampling

The passive diffusion bag (PDB) samplers will be positioned at target depths by attachment to a weighted line secured to the wellhead. PDBs will only be used for collection of samples to be tested for VOCs. The following procedure, in general accordance with the United States Geological Survey document titled “User’s Guide for Polyethylene-Based Passive Diffusion Bag Samplers to Obtain Volatile Organic Compound Concentrations in Wells” dated 2001, will be utilized to deploy and retrieve the PBD samplers in the monitoring wells:

- Measure the well depth and compare the measured depth to the reported depth to bottom of the well screen/open hole recorded on the well construction logs.
- Attach a stainless steel weight to the end of the dedicated cord. A sufficient weight will be added to counterbalance the buoyancy of the PDB samplers.
- Calculate the distance from the wellhead to the point where the PDB sampler is to be placed. The midpoint of the PDB sampler will be placed at the target sample depth.
- Fill the laboratory grade PDB with deionized water in the field that is provided by the laboratory.
- Attach the sampler to the weighted line.
- Lower the PDB sampler and weighted line down the well to the target sampling depth.
- Secure the assembly to the wellhead in this position.

- Allow the assembly to remain undisturbed as the PDB sampler equilibrates with the aquifer (i.e., a minimum of 14 days).
- The following procedure will be used to recover the PBD sampler following equilibration:
  - Remove the PDB sampler from the well by using the attached line. Care will be taken not to expose the PDB to heat or agitation.
  - Examine the surface of the PDB sampler of evidence of algae, iron or other coatings, and for tears in the membrane. Note the observations on a sampling log. [Note: If there are tears in the membrane, the sample should be rejected.]
  - Detach and remove the PDB sampler from the weighted line. Remove the excess liquid from the exterior of the bag to minimize the potential for cross contamination.
  - Transfer the water from the PDB to the analytical laboratory supplied sample containers. [Note: Sample transfer will be accomplished by piercing the PDB near the bottom with a small-diameter dedicated disposable discharge tube and allowing the water to flow through the tube into the VOC vials.]
- Any unused water from the PDB sampler, and water used to decontaminate cutting devices will be disposed in accordance with the Supplemental IRM Work Plan.

3.12 Waste Characterization Sampling

IRM-derived waste will be managed in accordance with the guidelines outlined in Section 2.6 of the Supplemental IRM Work Plan. Supplemental sampling of the IRM-derived wastes is anticipated in order to obtain approvals for disposal and/or recycling at an authorized solid waste management facility or publicly owned wastewater treatment works (liquids). The objective of IRM-derived waste sampling is to characterize a substantial mass of waste requiring disposal. The following protocols likely apply to IRM-derived waste sampling:

- Samples should be collected in a manner that is representative of the entire waste mass and not limited to a specific zone of concern or observed contamination.
- Grab samples may be composited to form one sample for analytical analyses.

4.0 EQUIPMENT DECONTAMINATION PROCEDURES

Decontamination procedures will be implemented in order to: 1) reduce the potential for cross-contamination of samples collected during this project to ensure that the data collected (primarily the laboratory data) is acceptable; 2) eliminate the potential of contaminating clean areas of the Site; and 3) eliminate the potential for off-site migration of Site contaminants. Where possible, dedicated disposable sampling methods and equipment will be used to minimize decontamination requirements, and minimize the possibility of cross-contamination.

An existing decontamination pad is present on-site for decontamination of trucks, equipment, and personnel to prevent tracking of contaminated residuals (refer to Figure 17 of the Supplemental IRM Work Plan).

When equipment must be re-used (e.g., drill rigs, static water level indicator, split spoon or macrocore samplers, etc.), it will be decontaminated by at least one of the following methods:

- Steam clean the equipment within a dedicated decontamination area; or
- Rough wash in tap water; wash in mixture of tap water and Alconox-type soap; double rinse with deionized or distilled water; and air dry and/or dry with clean paper towel.

The effectiveness of the equipment decontamination of non-dedicated sampling equipment such as split-spoon samplers will be evaluated via analytical laboratory testing of field blanks (e.g., rinsate samples). Decontamination liquids and disposable equipment and PPE will be containerized and left on-site until a proper disposal method is determined.

5.0 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

During sampling activities, personnel will wear disposable latex or nitrile gloves. Between collection of samples, personnel performing the sampling will discard used latex gloves and put on new gloves to preclude cross-contamination between samples. As few personnel as possible will handle samples or be in charge of their custody prior to shipment to the analytical laboratory.

New laboratory-grade sample containers will be used to store samples. Sufficient volume (i.e., as specified by the analytical laboratory and on the tables included in Attachment 2) will be collected to ensure that the laboratory has adequate sample volume to perform the specified analyses. Samples with zero headspace will be collected when VOC analysis is to be performed. Samples will be kept on ice in a cooler for shipment to the analytical laboratory.

Samples will be preserved as specified by the analytical laboratory for the type of parameters and matrices being tested. The required amount of preservatives will be added to the sample containers by the analytical laboratory prior to delivery to DAY’s office. The sample preservation requirements and holding times that will be adhered to are provided on the tables in Attachment 2.

Chain-Of-Custody

Samples that are collected for subsequent testing as part of this project will be handled using chain-of-custody control. Chain-of-custody documentation will accompany samples from their inception to their analysis, and copies of chain-of-custody documentation will be included with the laboratory’s report. The chain-of-custody will include the date and time each sample was collected, each sample’s identity and sampling location, the requested analyses, and turnaround time.

Sample Labels

Sample labels with adhesive backing will be placed on sample containers for field samples and QC samples in order to identify the sample. Sample information will be clearly written on the sample labels using waterproof ink. Sufficient sample information will be provided on the label to allow for cross-reference with the field sampling records or sample logbook.

The following information will be provided on each sample label:

- Name of company.
- Initials of sampler.
- Date and time of collection.
- Sample identification.
- Intended analyses
- Preservation required.

Custody Seals

Custody seals are pre-printed adhesive-backed seals that are designed to break if disturbed. Seals will be signed and dated before being placed on the shipping cooler. Seals will be placed on one or more location on each shipping cooler as necessary to ensure security. Shipping tape will be placed over the seals on the coolers to ensure that the seals are not accidentally broken during shipment. Sample receipt personnel at the laboratory will check and document whether the seals on the shipping coolers are intact when received.

Sample Identification

The following format will be used on the labels affixed to sample containers to identify samples:

> Each sample will be numbered sequentially starting at the next number that follows the last number used during the Supplemental RI study. The number will then continue in succession (i.e., if the last number used in the Supplemental RI study is 617, then the first number to be used during the Supplemental IRM work will be 618, and then continue on with 619, 620, 621, etc.). The sample test location will also be provided after the sample number using the following test location designations:

B-xx (x-x)	Boring soil sample with depth interval in parentheses below ground surface in tenths of a foot (x – x)
MW-xx	Groundwater sample with monitoring well number
TBxx/xx/xx-	Trip Blank sample with month/day/year
FBxx/xx/xx-	Field Blank sample (rinsate) with month/day/year

> As an example, assuming the first project sample is a soil sample collected from a Test Boring TB-50 at a depth of 10 feet, the sample will be designated as 618-TB-50(10).

Transportation of Samples

Samples will be handled, packaged and shipped in accordance with applicable regulations, and in a manner that does not diminish their quality or integrity. Samples will be delivered to the laboratory no later than 48 hours from the day of collection.

6.0 ANALYTICAL QUALITY ASSURANCE/QUALITY CONTROL

Analytical laboratory test results for samples of Site media will be reported in NYSDEC Analytical Services Protocol (ASP) Category B deliverable reports. Analytical laboratory test results for Supplemental IRM-derived wastes can be reported in shorter formats acceptable to disposal facilities that are accepting the waste. Analytical laboratory test results for soil samples will be reported on a dry-weight basis. Chemtech and Paradigm will make every effort to analyze the samples using the lowest practical quantitation limits possible for Site media samples. Based on the sampling program for site media samples, tables with Chemtech's compound lists, method detection limits (MDL), limits of detection (LOD), and limits of quantitation (LOQ) for VOCs and semi-volatile organic compounds (SVOCs) in soil and/or groundwater are included in Attachment 3. Chemtech is the primary analytical laboratory for testing samples of Site media. Paradigm will generally be used on a supplemental basis for analyzing samples of Supplemental IRM-derived wastes being characterized for off-site disposal. In addition, analytical laboratory results for samples of Site media will be provided to the NYSDEC using the NYSDEC's Equis Format.

Chemtech and Paradigm will provide internal QA/QC checks that are required by NYSDEC ASP and/or USEPA contract laboratory protocol (CLP), such as analyses performed, spike blanks, internal standards, surrogate samples, calibration standards, and reference standards. Laboratory reports will be reviewed as outlined in the Chemtech QAM and Paradigm SOQ that were previously provided to the NYSDEC in the NYSDEC-approved August 2011 RI/RAA Work Plan. Laboratory results will be compared to data quality indicators in accordance with the laboratory's quality assurance procedures and NYSDEC ASP. Data quality indicators include: precision, accuracy, representation, completeness, and comparability.

DAY's Table 1 in Attachment 1 provides a summary of the samples scheduled for collection and their anticipated analytical parameters to be tested. The analytical methods to be used for each type of sample and sample matrix are identified on Table 1 and in the Supplemental IRM Work Plan. In order to provide control over the collection, analysis, review, and interpretation of analytical laboratory data for samples of Site media, the following QA/QC samples will be included:

- One matrix spike/matrix spike duplicate (MS/MSD) for each sample matrix, at a frequency of one per set of 20 field samples, or per shipment if less than 20 samples, within a seven-day period. MS/MSD samples will be tested for same parameters that the field samples are being analyzed for.
- One field blank (i.e., rinsate sample) will be collected from reusable sampling equipment at a frequency of one per set of 20 field samples, or per shipment if less than 20 samples. The field blank(s) will be tested for the suite parameters of the samples obtained using the subject re-useable sampling equipment (e.g., split spoon samplers).
- For shipments containing groundwater samples to be tested for VOCs, one trip blank will be included per set of 20 liquid samples with a minimum of one trip blank per sample shipment. Each trip blank will be analyzed for target compound list (TCL) VOCs and tentatively identified compounds (TICs).

Data Usability Summary Report

Dr. Maxine Wright-Walters of Environmental Data Validation Inc. (EDV) of Pittsburgh, Pennsylvania will complete a data usability summary report (DUSR) on the Category B deliverables analytical laboratory data that is generated as part of the scope of work in the Supplemental IRM work plan. The DUSR will be conducted in accordance with the provisions set forth in Appendix 2B of DER-10 Technical Guidance for Site Investigation and Remediation dated May 2010. The findings of the DUSR will be incorporated in the Supplemental IRM Construction Completion Report. A copy of Dr. Maxine Wright-Walters curriculum vitae was included in the NYSDEC-approved August 2011 RI/RAA Work Plan.

Reporting

Analytical and QC data will be included in the Supplemental IRM Construction Completion Report. This report will summarize the environmental work and provide evaluation of the data that is generated, including the validity of the results in the context of QA/QC procedures.

7.0 RECORD KEEPING AND DATA MANAGEMENT

DAY will document project activities in a bound field book on a daily basis. Information that will be recorded in the field book will include:

- Dates and time work is performed;
- Details on work being performed;
- Details on field equipment being used;
- Field evidence of contamination such as staining, odors, degree of saturation, etc.
- Field meter measurements collected during monitoring activities;
- Sampling locations and depths measured in tenths of feet;
- Measurements of sample locations, and test locations, excavations, etc.;
- Personnel and equipment on-site;
- Weather conditions; and
- Other pertinent information as warranted.

In addition, the field notes will be converted into logs for each test boring and monitoring well that may be completed as part of the Supplemental IRM work.

Differential GPS, swing ties from existing surveyed site structures, and/or a licensed surveyor will be used to collect spatial data. The spatial data will be plotted using integrated GIS and/or computer-aided design (CAD) mapping. Electronic and hard copy files will be maintained by DAY.

8.0 ACRONYMS

ASP	Analytical Services Protocol
CAD	Computer-Aided Design
CAMP	Community Air Monitoring Plan
Chemtech	Chemtech Consulting Group, Inc.
City	City of Rochester
CLP	Contract Laboratory Protocol
DAY	Day Environmental, Inc.
DNAPL	Dense Non-Aqueous Phase Liquid
DUSR	Data Usability Summary Report
EDV	Environmental Data Validation, Inc.
ELAP	Environmental Laboratory Approval Program
GPS	Global Positioning System
HASP	Health and Safety Plan
IRM	Interim Remedial Measure
ISCO	In-Situ Chemical Oxidation
LNAPL	Light Non-Aqueous Phase Liquid
LOD	Limit of Detection
LOQ	Limit of Quantitation
MDL	Method Detection Limit
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NAPL	Non-Aqueous Phase Liquid
NTU	Nephelometric Turbidity Units
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
Paradigm	Paradigm Environmental Services, Inc.
PDB	Passive Diffusion Bag
PID	Photoionization Detector
PPE	Personal Protective Equipment
QAM	Quality Assurance Manual
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RI/RAA	Remedial Investigation/Remedial Alternatives Analysis
RTAM	Real-Time Aerosol Monitor
SOP	Standard Operating Procedure
SOQ	Statement of Qualification
SVOC	Semi-Volatile Organic Compound
TCL	Target Compound List
TIC	Tentatively Identified Compound
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

Attachment 1

Table 1 (Summary of Analytical Laboratory Testing)

Table 1

Sampling and Analysis Plan
Supplemental IRM Work Plan

Andrews Street Site
300, 304-308 and 320 Andrews Street and
25 Evans Street, Rochester, New York

NYSDEC Site ERP #E828144

TASK	ANALYTICAL LABORATORY	PARAMETERS	METHOD	SAMPLE MATRIX	MAXIMUM ANTICIPATED # OF FIELD SAMPLES	TRIP BLANKS	MS/MSD OR MS/MD	FIELD BLANKS
2.4.5 Performance Monitoring (4 Events; 24 Field Samples/Event)	Chemtech	VOCs	8260	Groundwater	96	8	8	8
2.5 Implement Supplemental IRM Soil Removal (Post-Excavation Soil Samples)	Chemtech	TCL VOCs+TICs	8260	Soil	5	0	1	0
2.7 Management of IRM-Derived Waste	Chemtech or Paradigm	TCL VOCs	8260	Soil	TBD	0	0	0
		TCLP VOCs	1311, 8260	Soil	TBD	0	0	0
		TCLP Metals	1311, 6010/7470	Soil	TBD	0	0	0
		Purgeable Organics	624	Water	TBD	0	0	0
2.14 Long-Term Groundwater Monitoring	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

Note: Refer to QAPP in Supplemental IRM Work Plan for additional information requested by DER-10 Section 2.4(a)v

VOCs = Volatile Organic Compounds

TCL = Target Compound List

TCLP = Toxicity Characteristic Leaching Procedure

TBD = To be determined

Attachment 2

Recommended Containers, Preservation Techniques, and Holding Times for CLP/ASP Analyses

APPENDIX C

Water Sampling and Holding Time Information

Parameter	EPA Method	Standard Method and/or SW 846 Method	Preservation	Container	Holding Time	Minimum Volume
Turbidity	180.1	2130B	Cool, 4 deg C	P or G	48 Hrs	100 mL
Nitrate	300	-----	Cool, 4 deg C	P or G	48 Hrs	250 mL
Nitrate-Nitrite	300	-----	Cool to 4 deg C, Conc. H_2SO_4 to pH<2	P or G	28 Days	250 mL
Fluoride	300	4500 F-C	Cool, 4 deg C	P or G	28 Days	300 mL
Cyanide	-----	4500-CN C&E	Cool, 4 deg C 50%NaOH pH>12	P or G	14 Days	500 mL
Sulfate	300	4500-SO4 E	Cool, 4 deg C	P or G	28 Days	50 mL
Total Dissolved Solids	-----	2540C	Cool, 4 deg C	P or G	7 Days	100 mL
Calcium	200.7	-----	1:1 HNO_3 to pH<2	P or G	6 Months	100 mL
Calcium-Hardness	200.7	-----	1:1 HNO_3 to pH<2	P or G	6 Months	100 mL
Alkalinity	-----	2320B	Cool, 4 deg C	P or G	14 Days	100 mL
Bromide	300	-----	None	P or G	28 Days	250 mL
Chloride	300	4500-CL C	Cool, 4 deg C	P or G	28 Days	100 mL
Chlorite	300	-----	1mL EDA to 1L Cool, 4 deg C	P or G	14 Days 10 mins	250 mL
Color	-----	2120B	Cool, 4 deg C	P or G	24 Hrs	100 mL
Foaming Agents (MBAS)	-----	5540C	Cool, 4 deg C	P or G	48 Hrs	250 mL
Odor	-----	2150B	Cool, 4 deg C	G only	24 Hrs	200 mL
Conductivity	120.1	2510B, 9050A	Cool, 4 deg C	P or G	28 Days	100 mL
Silica	200.7	-----	Cool, 4 deg C	P only	7 Days	50 mL
Ortho Phosphate	300	4500 P-E	Cool, 4 deg C	P or G	48 Hrs	50 mL
Chlorine, Residual Disinfectant	-----	4500Cl-G	None	P or G	15 minutes	200 mL
pH, Hydrogen ion	-----	4500-H-B	None	P or G	15 minutes	25 mL
Temperature	-----	2550B	None	P or G	15 minutes	1000 mL
Volatiles (Regulated)	524.2	-----	Cool, 4 deg C 1:1 HCl to pH<2	G, screw cap Teflon faced silicone septum	14 Days	60-120 mL
Parameter	**EPA Method**	**Standard Method**	**Preservation**	**Container**	**Holding Time**	**Minimum Volume**

		and/or SW 846 Method				
Acidity as $CaCO_3$	-----	ASTM D1067-92	Cool, 4 deg C	P or G	14 Days	100 mL
Alkalinity as $CaCO_3$	-----	2320B	Cool, 4 deg C	P or G	14 Days	100 mL
Ammonia	-----	4500-NH3 H	Cool, 4 deg C, Conc. H_2SO_4 to pH<2	P or G	28 Days	400 mL
Biochemical Oxygen Demand	-----	5210B	Cool, 4 deg C	P or G	24 Hrs.	1000 mL
Carbonaceous BOD	-----	5210B	Cool, 4 deg C	P or G	24 Hrs.	1000 mL
Cyanide	-----	9012A	Cool 4 deg C, 50% NaOH to pH>12 0.6 g ascorbic acid if residual chlorine present	P or G	Sulfide absent: 14 Days (Sulfide Present 24 Hrs.)	500 mL
Cyanide, Amenable	-----	4500-CN C,G	Cool 4 deg C, 50% NaOH to pH>12 0.6 g ascorbic acid if residual chlorine present	P or G	Sulfide absent: 14 Days (Sulfide Present 24 Hrs.)	500 mL
Acid Soluble & Insoluble Sulfide	-----	9030B	2N Zn Acetate, 6N NaOH to pH > 9, Cool, 4 deg C	P or G	7 Days	8 oz.
Total Hardness	200.7	-----	HNO_3 to pH<2	P or G	6 Months	100 mL
Total Kjeldahl Nitrogen	-----	4500-N OrgBorC	Cool, 4 deg C Conc. H_2SO_4 to pH<2	P or G	28 Days	500 mL
Oil & Grease	-----	1664A	Cool 4 deg C, 1:1 HCL or conc. H_2SO_4 to pH<2	G	28 Days	1000 mL
Orthophosphate	300	4500-P E	Filter immediately, Cool 4 deg C	P or G	48 Hrs.	50 mL
Phenols	420.1	9065	Cool 4 deg C, Conc. H_2SO_4 to pH<2	G	28 Days	500 mL
Total Phosphorus	365.3	-----	Cool 4 deg C, Conc. H_2SO_4 to pH<2	G	28 Days	50 mL
Total-Residue (TS)	-----	2540 B	Cool, 4 deg C	P or G	7 Days	100 mL
Residue-filtered (TDS)	-----	2540 C	Cool, 4 deg C	P or G	7 Days	100 mL
Residue-non-filtered (TSS)	-----	2540 D	Cool, 4 deg C	P or G	7 Days	100 mL
Parameter	**EPA Method**	**Standard Method**	**Preservation**	**Container**	**Holding Time**	**Minimum Volume**

		and/or SW 846 Method				
Residue-Settleable (SS)	-----	2540 F	Cool, 4 deg C	P or G	48 Hrs.	1000 mL
Residue-Volatile	160.4	-----	Cool, 4 deg C	P or G	7 Days	100 mL
Salinity	-----	2520 C	Cool, 4 deg C	G	28 Days	100 mL
Specific Conductance	120.1	2510B, 9050A	Cool, 4 deg C	P or G	28 Days	100 mL
Sulfate	300	4500-SO4 E	Cool, 4 deg C	P or G	28 Days	50ml
Sulfide	-----	9034	Cool 4 deg C, add 2N Zinc Acetate + 6N NaOH to pH>9	P or G	7 Days	50 mL
Sulfite (SO3)	-----	4500-SO3 B	Fix cooled samples (<50°C) immediately by adding 1mL EDTA soln./100mL sample	G, Bottle and Top	15 minutes	50 mL
Temperature	-----	2550 B	None Required	G, Bottle and Top	15 minutes	1000 mL
Metals	200.7	-----	1:1 HNO_3 to pH<2	G	6 Months	100 mL
Mercury	-----	7470A	Cool, 4 deg C	P or G	28 Days	8 oz.
Organochlorine Pesticides/PCB	608	8081A/N,8082/ 8082A	Cool, 4 deg C 0.008% $Na_2S_2O_3$ if residual chlorine present , Adjust to pH 5-9 with 10N NaOH or 1:1 H2SO4	G, Amber Teflon-lined screw cap	7 days until extraction 40 days after extraction	1000 mL
Volatile Organics	624	8260B/C	Cool, 4 deg C 4 drops 10% $Na_2S_2O_3$ if residual chlorine present 1:1 HCl to pH <2	G, Vial screw cap with center hole Teflon-faced silicone septum	7 days without HCl 14 days with HCl	40 mL
Semi volatile Organics	625	8270C/D	Cool, 4 deg C 0.008% $Na_2S_2O_3$ if residual chlorine present	G, Amber Teflon-lined screw cap	7 days until extraction 40 days after extraction	1000 mL
DRO	-----	8015B	Cool, 4 deg C 0.008% $Na_2S_2O_3$ if residual chlorine present	G, Amber Teflon-lined screw cap	7 days until extraction 40 days after extraction	1000 mL
COD	-----	SM5220D	Cool, 4 deg C H2SO4 to pH<2	P	28 Days	1000 mL
TOC	-----	SW9060 Lloyd Kahn	Cool, 4 deg C HCl or H2SO4 to pH<2	P	28 days 14 days	1000 mL
Herbicide	-----	SW8151	Cool, 4 deg C	G, Amber	7 days until extraction 40 days after extraction	1 L

Parameter	EPA Method	Standard Method and/or SW 846 Method	Preservation	Container	Holding Time	Minimum Volume
GRO	-----	8015B	Cool, 4 deg C 0.008% $Na_2S_2O_3$ if residual chlorine present 1:1 HCl to pH <2	G, Vial screw cap with center hole Teflon-faced silicone septum	7 days without HCl 14 days with HCl	40 mL
Gases	-----	3810	Cool, 4 deg C 0.008% $Na_2S_2O_3$ if residual chlorine present 1:1 HCl to pH <2	G, Vial screw cap with center hole Teflon-faced silicone septum	7 days without HCl 14 days with HCl	40 mL
HPLC (Explosive)	-----	8330A/B	Cool, 4 deg C	G, Amber Teflon-lined screw cap	7 days until extraction 40 days after extraction	1000mL
Hexavalent Chromium	-----	3500 Cr D	Cool, 4 deg C	P	24 Hrs.	100mL
Ferrous Iron	-----	HACH 8146	Cool, 4 deg C	Amber G	24 Hrs.	250mL
RSK 175	-----	RSK 175	Cool, 4 deg C 1:1 H2SO4 or HCl to ph<2	G, Vial screw cap with center hole Teflon-faced silicone septum	14 days	40 mL
Formaldehyde	-----	HACH 8110	Cool, 4 deg C	P	Analyze Immediately within 48hrs	1000mL
Ferrous Iron	-----	HACH 8146 SM3500	Cool, 4 deg C	P	Analyze Immediately within 48hrs	1000mL
Chemical Warfare Agents	-----	8270-modified	Cool, 4 deg C	G, Amber Teflon-lined screw cap	7 days until extraction 40 days after extraction	1000mL
Glycols	-----	Chemtech SOP	Cool, 4 deg C	G	28 days	100mL
Perchlorate	314.0	-----	-----	P or G	28 days	500mL

Container Key:	P = Plastic
	G =Glass
	DW= Drinking Water

Soil/Hazardous Waste Sampling and Holding Time Information

Parameter	EPA Method	Standard Method and/or SW 846 Method	Preservation	Container	Holding Time	Minimum Volume
Ignitability	-----	1010	None	P or G	None	8 oz.
Ignitability of Solids	-----	1030	None	P or G	None	8 oz.
Corrosivity pH Waste>20% water	-----	9040B	Cool, 4 deg C	P	15 minutes	4 oz.
Corrosivity Toward Steel	-----	1110	Cool, 4 deg C	P	14 Days	4 oz.
Reactivity Cyanide	-----	SW-846 7.3.3.2	Cool, 4 deg C	P	14 Days	8 oz.
Reactivity Sulfide	-----	SW-846 7.3.4.2	Cool, 4 deg C	P	14 Days	8 oz.
TCLP Volatile Organics	-----	1311	Cool, 4 deg C	G	14 Days to TCLP extraction, 14 days to analysis	4 oz.
TCLP Metals	-----	1311	Cool, 4 deg C	G	180 Days to TCLP extraction, 180 days to analysis	16 oz
TCLP Mercury	-----	1311	Cool, 4 deg C	G	28 Days to TCLP extraction, 28 days to analysis	16 oz
TCLP Semi volatiles	-----	1311	Cool, 4 deg C	G	14 Days to TCLP extraction, 7 days to extraction, 40 days to analysis	16 oz
TCLP Pesticides and Herbicides	-----	1311	Cool, 4 deg C	G	14 Days to TCLP extraction, 7 days to extraction, 40 days to analysis	16 oz
PH	-----	9040B, 9041A, 9045C	Cool, 4 deg C	P	15 minutes	4 oz.

Parameter	EPA Method	Standard Method and/or SW 846 Method	Preservation	Container	Holding Time	Minimum Volume
Temperature	-----	2550 B	-----	P	15 minutes	4 oz.
Metals	-----	6010B/C	Cool, 4 deg C	P or G	6 Months	8 oz.
Mercury	-----	7471A	Cool, 4 deg C	P or G	28 Days	8 oz.
Organochlorine Pesticides	-----	8081A/B	Cool, 4 deg C	P or G	14 Days for extraction, 40 days to analysis	8 oz.
PCB's	-----	8082/8082A	Cool, 4 deg C	P or G	14 Days for extraction, 40 days to analysis	8 oz.
Chlorinated Herbicides	-----	8151A	Cool, 4 deg C	G, wide mouth, Teflon liner	14 Days	8 oz.
Volatile Organics	-----	8260B/C	Cool, 4 deg C	G, wide mouth, Teflon liner	14 Days	4 oz.
Semi volatile Organics	-----	8270C/D	Cool, 4 deg C	Amber Glass	14 Days to extraction, 40 days to analysis	8 oz.
Total Cyanide	-----	9012A	Cool, 4 deg C	P or G	14 Days	8 oz.
Amenable Cyanide	-----	9010B	Cool, 4 deg C	P or G	14 Days	8 oz.
Acid Soluble & Insoluble Sulfide	-----	9030B	Cool, 4 deg C No Headspace	P or G	7 Days	8 oz.
Extractable Sulfide	-----	9031	Cool, 4 deg C Fill solid surface with 2N Zinc Acetate until moistened, 4 drops 2N Zinc Acetate/100mL sample, 50%NaOH to pH>9	P or G	7 Days	8 oz.
Sulfate	-----	9038, 9056	Cool, 4 deg C	P or G	28 Days	8 oz.
pH, Soil and Waste	-----	9045C	Cool, 4 deg C	G	15 minutes	8 oz.
Parameter	**EPA Method**	**Standard Method and/or**	**Preservation**	**Container**	**Holding Time**	**Minimum Volume**

		SW 846 Method				
Phenol	-----	9065	Cool 4 deg C	G	28 Days	8 oz.
Oil & Grease (Sludge, Sludge-Hem)	-----	9071B	Cool 4 deg C	G	28 Days	8 oz.
Paint Filter Liquids Test	-----	9095	Cool, 4 deg C	P or G	-----	8 oz.
Nitrate	-----	9056	Cool, 4 deg C	P or G	48 Hrs	8 oz.
Bromide	-----	9056	Cool, 4 deg C	P or G	28 Days	8 oz.
Chloride	-----	9056	None	P or G	28 Days	8 oz.
Fluoride	-----	9056, 9214	None	P	28 Days	8 oz.
Cation-Exchange Capacity	-----	9080, 9081	Cool, 4 deg C	P	-----	8 oz.
DRO	-----	8015B	Cool, 4 deg C	Amber Glass	14 Days to extraction, 40 days to analysis	8 oz.
GRO	-----	8015B	Cool, 4 deg C	G, wide mouth, Teflon liner	14 Days	4 oz.
Gases	-----	3810	Cool, 4 deg C	Amber Glass	14 Days	8 oz.
Hexavalent Chromium	------	3060, 7196A	Cool, 4 deg C	P	30 Days to extraction, 7 days to analysis	4 oz.
Explosives	------	8330A/B	Cool, 4 deg C	Amber Glass	14 Days to extraction, 40 days to analysis	16 oz.
TOC	-----	SW9060 Lloyd Kahn	Cool, 4 deg C	G	28 Days 14 Days	8 oz.
Herbicide	-----	SW8151	Cool, 4 deg C	G	14 Days to extraction, 40 days to analysis	4 oz.
Formaldehyde	-----	HACH 8110	Cool, 4 deg C	G	Analyze Immediately within 48hrs	4 oz.
Ferrous Iron	-----	HACH 8146 SM3500	Cool, 4 deg C	G	Analyze Immediately within 48hrs	4 oz.
Chemical Warfare Agents	-----	8270-modified	Cool, 4 deg C	G	14 days until extraction 40 days after extraction	8 oz.
Grain Size	-----	ASTM D422	-----	P or G	-----	4 oz.

Attachment 3

Tables with VOC and SVOC Compound List, MDLs, LODs and LOQs

VOA 8260B (Water)

Method	Matrix	CAS #	Compound	MDL ug/L	LOD ug/L	LOQ ug/L
8260B/C-5030B	Water	630-20-6	1,1,1,2-Tetrachloroethane	0.43	2.5	5
8260B/C-5030B	Water	71-55-6	1,1,1-Trichloroethane	0.40	2.5	5
8260B/C-5030B	Water	79-34-5	1,1,2,2-Tetrachloroethane	0.31	2.5	5
8260B/C-5030B	Water	79-00-5	1,1,2-Trichloroethane	0.38	2.5	5
8260B/C-5030B	Water	76-13-1	1,1,2-Trichlorotrifluoroethane	0.45	2.5	5
8260B/C-5030B	Water	75-34-3	1,1-Dichloroethane	0.36	2.5	5
8260B/C-5030B	Water	75-35-4	1,1-Dichloroethene	0.47	2.5	5
8260B/C-5030B	Water	563-58-6	1,1-Dichloropropene	0.39	2.5	5
8260B/C-5030B	Water	87-61-6	1,2,3-Trichlorobenzene	0.65	2.5	5
8260B/C-5030B	Water	96-18-4	1,2,3-Trichloropropane	0.50	2.5	5
8260B/C-5030B	Water	120-82-1	1,2,4-Trichlorobenzene	0.62	2.5	5
8260B/C-5030B	Water	95-63-6	1,2,4-Trimethylbenzene	0.38	2.5	5
8260B/C-5030B	Water	96-12-8	1,2-Dibromo-3-Chloropropane	0.46	2.5	5
8260B/C-5030B	Water	106-93-4	1,2-Dibromoethane	0.41	2.5	5
8260B/C-5030B	Water	95-50-1	1,2-Dichlorobenzene	0.45	2.5	5
8260B/C-5030B	Water	107-06-2	1,2-Dichloroethane	0.48	2.5	5
8260B/C-5030B	Water	78-87-5	1,2-Dichloropropane	0.46	2.5	5
8260B/C-5030B	Water	108-67-8	1,3,5-Trimethylbenzene	0.46	2.5	5
8260B/C-5030B	Water	541-73-1	1,3-Dichlorobenzene	0.43	2.5	5
8260B/C-5030B	Water	142-28-9	1,3-Dichloropropane	0.35	2.5	5
8260B/C-5030B	Water	106-46-7	1,4-Dichlorobenzene	0.32	2.5	5
8260B/C-5030B	Water	594-20-7	2,2-Dichloropropane	0.55	2.5	5
8260B/C-5030B	Water	78-93-3	2-Butanone	1.32	12.5	25
8260B/C-5030B	Water	110-75-8	2-Chloroethyl vinyl ether	1.79	12.5	25
8260B/C-5030B	Water	95-49-8	2-Chlorotoluene	0.43	2.5	5
8260B/C-5030B	Water	591-78-6	2-Hexanone	1.94	12.5	25
8260B/C-5030B	Water	95-49-8	4-Chlorotoluene	0.42	2.5	5
8260B/C-5030B	Water	108-10-1	4-Methyl-2-Pentanone	2.10	12.5	25
8260B/C-5030B	Water	67-64-1	Acetone	2.75	12.5	25
8260B/C-5030B	Water	107-02-8	Acrolein	2.53	12.5	25
8260B/C-5030B	Water	107-13-1	Acrylonitrile	1.76	12.5	25
8260B/C-5030B	Water	71-43-2	Benzene	0.32	2.5	5
8260B/C-5030B	Water	108-86-1	Bromobenzene	0.52	2.5	5
8260B/C-5030B	Water	74-97-5	Bromochloromethane	2.25	2.5	5
8260B/C-5030B	Water	75-27-4	Bromodichloromethane	0.36	2.5	5
8260B/C-5030B	Water	75-25-2	Bromoform	0.47	2.5	5
8260B/C-5030B	Water	74-83-9	Bromomethane	0.62	2.5	5
8260B/C-5030B	Water	75-15-0	Carbon disulfide	0.54	2.5	5
8260B/C-5030B	Water	56-23-5	Carbon Tetrachloride	0.62	2.5	5
8260B/C-5030B	Water	108-90-7	Chlorobenzene	0.49	2.5	5
8260B/C-5030B	Water	75-00-3	Chloroethane	0.66	2.5	5
8260B/C-5030B	Water	67-66-3	Chloroform	0.34	2.5	5
8260B/C-5030B	Water	74-87-3	Chloromethane	0.54	2.5	5
8260B/C-5030B	Water	156-59-2	cis-1,2-Dichloroethene	0.35	2.5	5
8260B/C-5030B	Water	10061-01-5	cis-1,3-Dichloropropene	0.31	2.5	5

VOA 8260B (Water)

8260B/C-5030B	Water	110-82-7	cyclohexane	0.55	2.5	5
8260B/C-5030B	Water	124-48-1	Dibromochloromethane	0.52	2.5	5
8260B/C-5030B	Water	74-95-3	Dibromomethane	0.44	2.5	5
8260B/C-5030B	Water	75-71-8	Dichlorodifluoromethane	0.55	2.5	5
8260B/C-5030B	Water	60-29-7	Diethyl Ether	0.27	2.5	5
8260B/C-5030B	Water	100-41-4	Ethyl Benzene	0.53	2.5	5
8260B/C-5030B	Water	67-72-1	Hexachloroethane	0.65	2.5	5
8260B/C-5030B	Water	87-68-3	Hexachlorobutadiene	1.28	2.5	5
8260B/C-5030B	Water	98-82-8	Isopropylbenzene	0.45	2.5	5
8260B/C-5030B	Water	136777-61-2	m/p-Xylenes	0.95	5.0	10
8260B/C-5030B	Water	79-20-9	Methyl Acetate	0.83	2.5	5
8260B/C-5030B	Water	1634-04-4	Methyl tert-butyl Ether	0.35	2.5	5
8260B/C-5030B	Water	108-87-2	Methylcyclohexane	0.68	2.5	5
8260B/C-5030B	Water	75-09-2	Methylene Chloride	0.41	2.5	5
8260B/C-5030B	Water	91-20-3	Naphthalene	0.67	2.5	5
8260B/C-5030B	Water	104-51-8	n-Butylbenzene	0.41	2.5	5
8260B/C-5030B	Water	103-65-1	N-propylbenzene	0.45	2.5	5
8260B/C-5030B	Water	95-47-6	o-Xylene	0.43	2.5	5
8260B/C-5030B	Water	99-87-6	p-Isopropyltoluene	0.43	2.5	5
8260B/C-5030B	Water	135-98-8	Sec-butylbenzene	0.46	2.5	5
8260B/C-5030B	Water	100-42-5	Styrene	0.36	2.5	5
8260B/C-5030B	Water	10061-02-6	t-1,3-Dichloropropene	0.29	2.5	5
8260B/C-5030B	Water	27975-78-6	Tert butyl alcohol	2.61	12.5	25
8260B/C-5030B	Water	98-06-6	tert-Butylbenzene	0.44	2.5	5
8260B/C-5030B	Water	127-18-4	Tetrachloroethene	0.27	2.5	5
8260B/C-5030B	Water	108-88-3	Toluene	0.37	2.5	5
8260B/C-5030B	Water	156-60-5	trans-1,2-Dichloroethene	0.41	2.5	5
8260B/C-5030B	Water	79-01-6	Trichloroethene	0.28	2.5	5
8260B/C-5030B	Water	75-69-4	Trichlorofluoromethane	0.35	2.5	5
8260B/C-5030B	Water	108-05-4	Vinyl Acetate	1.05	12.5	25
8260B/C-5030B	Water	75-01-4	Vinyl chloride	0.34	2.5	5

VOA 8260 Low (Water)

Method	Matrix	CAS #	Compound	MDL ug/L	LOD ug/L	LOQ ug/L
8260B/C-5030B	Water	630-20-6	1,1,1,2-Tetrachloroethane	0.43	0.5	1
8260B/C-5030B	Water	71-55-6	1,1,1-Trichloroethane	0.40	0.5	1
8260B/C-5030B	Water	79-34-5	1,1,2,2-Tetrachloroethane	0.31	0.5	1
8260B/C-5030B	Water	79-00-5	1,1,2-Trichloroethane	0.38	0.5	1
8260B/C-5030B	Water	76-13-1	1,1,2-Trichlorotrifluoroethane	0.45	0.5	1
8260B/C-5030B	Water	75-34-3	1,1-Dichloroethane	0.36	0.5	1
8260B/C-5030B	Water	75-35-4	1,1-Dichloroethene	0.47	0.5	1
8260B/C-5030B	Water	563-58-6	1,1-Dichloropropene	0.39	0.5	1
8260B/C-5030B	Water	87-61-6	1,2,3-Trichlorobenzene	0.20	0.5	1
8260B/C-5030B	Water	96-18-4	1,2,3-Trichloropropane	0.50	0.5	1
8260B/C-5030B	Water	120-82-1	1,2,4-Trichlorobenzene	0.20	0.5	1
8260B/C-5030B	Water	95-63-6	1,2,4-Trimethylbenzene	0.38	0.5	1
8260B/C-5030B	Water	96-12-8	1,2-Dibromo-3-Chloropropane	0.46	0.5	1
8260B/C-5030B	Water	106-93-4	1,2-Dibromoethane	0.41	0.5	1
8260B/C-5030B	Water	95-50-1	1,2-Dichlorobenzene	0.45	0.5	1
8260B/C-5030B	Water	107-06-2	1,2-Dichloroethane	0.48	0.5	1
8260B/C-5030B	Water	78-87-5	1,2-Dichloropropane	0.46	0.5	1
8260B/C-5030B	Water	108-67-8	1,3,5-Trimethylbenzene	0.46	0.5	1
8260B/C-5030B	Water	541-73-1	1,3-Dichlorobenzene	0.43	0.5	1
8260B/C-5030B	Water	142-28-9	1,3-Dichloropropane	0.35	0.5	1
8260B/C-5030B	Water	106-46-7	1,4-Dichlorobenzene	0.32	0.5	1
8260B/C-5030B	Water	594-20-7	2,2-Dichloropropane	0.20	0.5	1
8260B/C-5030B	Water	78-93-3	2-Butanone	1.32	2.5	5
8260B/C-5030B	Water	110-75-8	2-Chloroethyl vinyl ether	1.79	2.5	5
8260B/C-5030B	Water	95-49-8	2-Chlorotoluene	0.43	0.5	1
8260B/C-5030B	Water	591-78-6	2-Hexanone	1.94	2.5	5
8260B/C-5030B	Water	95-49-8	4-Chlorotoluene	0.42	0.5	1
8260B/C-5030B	Water	108-10-1	4-Methyl-2-Pentanone	2.10	2.5	5
8260B/C-5030B	Water	67-64-1	Acetone	0.50	2.5	5
8260B/C-5030B	Water	107-02-8	Acrolein	0.50	2.5	5
8260B/C-5030B	Water	107-13-1	Acrylonitrile	1.76	2.5	5
8260B/C-5030B	Water	71-43-2	Benzene	0.32	0.5	1
8260B/C-5030B	Water	108-86-1	Bromobenzene	0.20	0.5	1
8260B/C-5030B	Water	74-97-5	Bromochloromethane	0.20	0.5	1
8260B/C-5030B	Water	75-27-4	Bromodichloromethane	0.36	0.5	1
8260B/C-5030B	Water	75-25-2	Bromoform	0.47	0.5	1
8260B/C-5030B	Water	74-83-9	Bromomethane	0.20	0.5	1
8260B/C-5030B	Water	75-15-0	Carbon disulfide	0.20	0.5	1
8260B/C-5030B	Water	56-23-5	Carbon Tetrachloride	0.20	0.5	1
8260B/C-5030B	Water	108-90-7	Chlorobenzene	0.49	0.5	1
8260B/C-5030B	Water	75-00-3	Chloroethane	0.20	0.5	1
8260B/C-5030B	Water	67-66-3	Chloroform	0.34	0.5	1
8260B/C-5030B	Water	74-87-3	Chloromethane	0.20	0.5	1
8260B/C-5030B	Water	156-59-2	cis-1,2-Dichloroethene	0.35	0.5	1
8260B/C-5030B	Water	10061-01-5	cis-1,3-Dichloropropene	0.31	0.5	1

VOA 8260 Low (Water)

8260B/C-5030B	Water	110-82-7	cyclohexane	0.20	0.5	1
8260B/C-5030B	Water	124-48-1	Dibromochloromethane	0.20	0.5	1
8260B/C-5030B	Water	74-95-3	Dibromomethane	0.44	0.5	1
8260B/C-5030B	Water	75-71-8	Dichlorodifluoromethane	0.20	0.5	1
8260B/C-5030B	Water	60-29-7	Diethyl Ether	0.27	0.5	1
8260B/C-5030B	Water	100-41-4	Ethyl Benzene	0.20	0.5	1
8260B/C-5030B	Water	67-72-1	Hexachloroethane	0.20	0.5	1
8260B/C-5030B	Water	87-68-3	Hexachlorobutadiene	0.20	0.5	1
8260B/C-5030B	Water	98-82-8	Isopropylbenzene	0.45	0.5	1
8260B/C-5030B	Water	136777-61-2	m/p-Xylenes	0.95	1	2
8260B/C-5030B	Water	79-20-9	Methyl Acetate	0.20	0.5	1
8260B/C-5030B	Water	1634-04-4	Methyl tert-butyl Ether	0.35	0.5	1
8260B/C-5030B	Water	108-87-2	Methylcyclohexane	0.20	0.5	1
8260B/C-5030B	Water	75-09-2	Methylene Chloride	0.41	0.5	1
8260B/C-5030B	Water	91-20-3	Naphthalene	0.20	0.5	1
8260B/C-5030B	Water	104-51-8	n-Butylbenzene	0.41	0.5	1
8260B/C-5030B	Water	103-65-1	N-propylbenzene	0.45	0.5	1
8260B/C-5030B	Water	95-47-6	o-Xylene	0.43	0.5	1
8260B/C-5030B	Water	99-87-6	p-Isopropyltoluene	0.43	0.5	1
8260B/C-5030B	Water	135-98-8	Sec-butylbenzene	0.46	0.5	1
8260B/C-5030B	Water	100-42-5	Styrene	0.36	0.5	1
8260B/C-5030B	Water	10061-02-6	t-1,3-Dichloropropene	0.29	0.5	1
8260B/C-5030B	Water	27975-78-6	Tert butyl alcohol	0.50	2.5	5
8260B/C-5030B	Water	98-06-6	tert-Butylbenzene	0.44	0.5	1
8260B/C-5030B	Water	127-18-4	Tetrachloroethene	0.27	0.5	1
8260B/C-5030B	Water	108-88-3	Toluene	0.37	0.5	1
8260B/C-5030B	Water	156-60-5	trans-1,2-Dichloroethene	0.41	0.5	1
8260B/C-5030B	Water	79-01-6	Trichloroethene	0.28	0.5	1
8260B/C-5030B	Water	75-69-4	Trichlorofluoromethane	0.35	0.5	1
8260B/C-5030B	Water	108-05-4	Vinyl Acetate	1.05	2.5	5
8260B/C-5030B	Water	75-01-4	Vinyl chloride	0.34	0.5	1

Method	Matrix	CAS #	Compound	MDL ug/Kg	LOD ug/Kg	LOQ ug/Kg
8260B/C-5035A	Soil	630-20-6	1,1,1,2-Tetrachloroethane	0.43	2.5	5
8260B/C-5035A	Soil	71-55-6	1,1,1-Trichloroethane	0.88	2.5	5
8260B/C-5035A	Soil	79-34-5	1,1,2,2-Tetrachloroethane	0.46	2.5	5
8260B/C-5035A	Soil	79-00-5	1,1,2-Trichloroethane	0.90	2.5	5
8260B/C-5035A	Soil	76-13-1	1,1,2-Trichlorotrifluoroethane	1.33	2.5	5
8260B/C-5035A	Soil	75-34-3	1,1-Dichloroethane	0.94	2.5	5
8260B/C-5035A	Soil	75-35-4	1,1-Dichloroethene	1.47	2.5	5
8260B/C-5035A	Soil	563-58-6	1,1-Dichloropropene	0.46	2.5	5
8260B/C-5035A	Soil	87-61-6	1,2,3-Trichlorobenzene	0.50	2.5	5
8260B/C-5035A	Soil	96-18-4	1,2,3-Trichloropropane	0.49	2.5	5
8260B/C-5035A	Soil	120-82-1	1,2,4-Trichlorobenzene	0.70	2.5	5
8260B/C-5035A	Soil	95-63-6	1,2,4-Trimethylbenzene	0.50	2.5	5
8260B/C-5035A	Soil	96-12-8	1,2-Dibromo-3-Chloropropane	0.87	2.5	5
8260B/C-5035A	Soil	106-93-4	1,2-Dibromoethane	0.64	2.5	5
8260B/C-5035A	Soil	95-50-1	1,2-Dichlorobenzene	0.62	2.5	5
8260B/C-5035A	Soil	107-06-2	1,2-Dichloroethane	0.64	2.5	5
8260B/C-5035A	Soil	78-87-5	1,2-Dichloropropane	0.26	2.5	5
8260B/C-5035A	Soil	108-67-8	1,3,5-Trimethylbenzene	0.45	2.5	5
8260B/C-5035A	Soil	541-73-1	1,3-Dichlorobenzene	0.37	2.5	5
8260B/C-5035A	Soil	142-28-9	1,3-Dichloropropane	0.74	2.5	5
8260B/C-5035A	Soil	106-46-7	1,4-Dichlorobenzene	0.41	2.5	5
8260B/C-5035A	Soil	594-20-7	2,2-Dichloropropane	1.04	2.5	5
8260B/C-5035A	Soil	78-93-3	2-Butanone	3.11	12.5	25
8260B/C-5035A	Soil	110-75-8	2-Chloroethyl vinyl ether	11.51	12.5	25
8260B/C-5035A	Soil	95-49-8	2-Chlorotoluene	0.74	2.5	5
8260B/C-5035A	Soil	591-78-6	2-Hexanone	3.92	12.5	25
8260B/C-5035A	Soil	95-49-8	4-Chlorotoluene	0.62	2.5	5
8260B/C-5035A	Soil	108-10-1	4-Methyl-2-Pentanone	2.92	12.5	25
8260B/C-5035A	Soil	67-64-1	Acetone	3.02	12.5	25
8260B/C-5035A	Soil	107-02-8	Acrolein	3.98	12.5	25
8260B/C-5035A	Soil	107-13-1	Acrylonitrile	4.91	12.5	25
8260B/C-5035A	Soil	71-43-2	Benzene	0.38	2.5	5
8260B/C-5035A	Soil	108-86-1	Bromobenzene	0.52	2.5	5
8260B/C-5035A	Soil	74-97-5	Bromochloromethane	0.79	2.5	5
8260B/C-5035A	Soil	75-27-4	Bromodichloromethane	0.62	2.5	5
8260B/C-5035A	Soil	75-25-2	Bromoform	0.74	2.5	5
8260B/C-5035A	Soil	74-83-9	Bromomethane	2.45	2.5	5
8260B/C-5035A	Soil	75-15-0	Carbon disulfide	1.06	2.5	5
8260B/C-5035A	Soil	56-23-5	Carbon Tetrachloride	0.99	2.5	5
8260B/C-5035A	Soil	108-90-7	Chlorobenzene	0.50	2.5	5
8260B/C-5035A	Soil	75-00-3	Chloroethane	1.40	2.5	5
8260B/C-5035A	Soil	67-66-3	Chloroform	0.74	2.5	5
8260B/C-5035A	Soil	74-87-3	Chloromethane	0.86	2.5	5
8260B/C-5035A	Soil	156-59-2	cis-1,2-Dichloroethene	0.89	2.5	5
8260B/C-5035A	Soil	10061-01-5	cis-1,3-Dichloropropene	0.72	2.5	5
8260B/C-5035A	Soil	110-82-7	Cyclohexane	1.01	2.5	5
8260B/C-5035A	Soil	124-48-1	Dibromochloromethane	0.54	2.5	5

Method	Matrix	CAS #	Compound	MDL ug/Kg	LOD ug/Kg	LOQ ug/Kg
8260B/C-5035A	Soil	74-95-3	Dibromomethane	0.78	2.5	5
8260B/C-5035A	Soil	75-71-8	Dichlorodifluoromethane	0.65	2.5	5
8260B/C-5035A	Soil	60-29-7	Diethyl ether	1.92	2.5	5
8260B/C-5035A	Soil	100-41-4	Ethyl Benzene	0.62	2.5	5
8260B/C-5035A	Soil	87-68-3	Hexachlorobutadiene	0.79	2.5	5
8260B/C-5035A	Soil	67-72-1	Hexachloroethane	0.76	2.5	5
8260B/C-5035A	Soil	98-82-8	Isopropylbenzene	0.48	2.5	5
8260B/C-5035A	Soil	136777-61-2	m/p-Xylenes	0.72	5.0	10
8260B/C-5035A	Soil	79-20-9	Methyl Acetate	1.51	2.5	5
8260B/C-5035A	Soil	80-62-6	Methyl methacrylate	0.70	2.5	5
8260B/C-5035A	Soil	1634-04-4	Methyl tert-butyl Ether	0.96	2.5	5
8260B/C-5035A	Soil	108-87-2	Methyl cyclohexane	1.06	2.5	5
8260B/C-5035A	Soil	75-09-2	Methylene Chloride	1.42	2.5	5
8260B/C-5035A	Soil	91-20-3	Naphthalene	0.45	2.5	5
8260B/C-5035A	Soil	104-51-8	n-Butylbenzene	0.46	2.5	5
8260B/C-5035A	Soil	103-65-1	N-propylbenzene	0.36	2.5	5
8260B/C-5035A	Soil	95-47-6	o-Xylene	0.68	2.5	5
8260B/C-5035A	Soil	99-87-6	p-Isopropyltoluene	0.29	2.5	5
8260B/C-5035A	Soil	135-98-8	Sec-butylbenzene	0.52	2.5	5
8260B/C-5035A	Soil	100-42-5	Styrene	0.45	2.5	5
8260B/C-5035A	Soil	10061-02-6	t-1,3-Dichloropropene	0.79	2.5	5
8260B/C-5035A	Soil	27975-78-6	Tert butyl alcohol	7.41	12.5	25
8260B/C-5035A	Soil	98-06-6	tert-Butylbenzene	0.59	2.5	5
8260B/C-5035A	Soil	127-18-4	Tetrachloroethene	1.01	2.5	5
8260B/C-5035A	Soil	108-88-3	Toluene	0.64	2.5	5
8260B/C-5035A	Soil	156-60-5	trans-1,2-Dichloroethene	0.69	2.5	5
8260B/C-5035A	Soil	79-01-6	Trichloroethene	0.86	2.5	5
8260B/C-5035A	Soil	75-69-4	Trichlorofluoromethane	1.32	2.5	5
8260B/C-5035A	Soil	108-05-4	Vinyl Acetate	3.47	12.5	25
8260B/C-5035A	Soil	75-01-4	Vinyl chloride	1.23	2.5	5

SVOA 8270C (Soil)

Method	Matrix	CAS #	Compound	MDL ug/Kg	LOD ug/Kg	LOQ ug/Kg
8270C/D-3541	Soil	92-52-4	1,1-Biphenyl	12.6	170	330
8270C/D-3541	Soil	95-94-3	1,2,4,5-Tetrachlorobenzene	13.1	170	330
8270C/D-3541	Soil	120-82-1	1,2,4-Trichlorobenzene	12.7	170	330
8270C/D-3541	Soil	95-50-1	1,2-Dichlorobenzene	12.7	170	330
8270C/D-3541	Soil	541-73-1	1,3-Dichlorobenzene	5.9	170	330
8270C/D-3541	Soil	106-46-7	1,4-Dichlorobenzene	11.4	170	330
8270C/D-3541	Soil	108-60-1	2,2-oxybis(1-Chloropropane)	13.8	170	330
8270C/D-3541	Soil	95-95-4	2,4,5-Trichlorophenol	23.4	170	330
8270C/D-3541	Soil	88-06-2	2,4,6-Trichlorophenol	10.2	170	330
8270C/D-3541	Soil	120-83-2	2,4-Dichlorophenol	12.7	170	330
8270C/D-3541	Soil	105-67-9	2,4-Dimethylphenol	18.9	170	330
8270C/D-3541	Soil	51-28-5	2,4-Dinitrophenol	33.9	170	330
8270C/D-3541	Soil	121-14-2	2,4-Dinitrotoluene	10.1	170	330
8270C/D-3541	Soil	606-20-2	2,6-Dinitrotoluene	13.6	170	330
8270C/D-3541	Soil	91-58-7	2-Chloronaphthalene	7.6	170	330
8270C/D-3541	Soil	95-57-8	2-Chlorophenol	17.6	170	330
8270C/D-3541	Soil	91-57-6	2-Methylnaphthalene	8.4	170	330
8270C/D-3541	Soil	95-48-7	2-Methylphenol	18.1	170	330
8270C/D-3541	Soil	88-74-4	2-Nitroaniline	14.8	170	330
8270C/D-3541	Soil	88-75-5	2-Nitrophenol	16.1	170	330
8270C/D-3541	Soil	91-94-1	3,3-Dichlorobenzidine	21.4	170	330
8270C/D-3541	Soil	65794-96-9	3+4-Methylphenols	17.3	170	330
8270C/D-3541	Soil	99-09-2	3-Nitroaniline	21.4	170	330
8270C/D-3541	Soil	534-52-1	4,6-Dinitro-2-methylphenol	19.1	170	330
8270C/D-3541	Soil	101-55-3	4-Bromophenyl-phenylether	6.5	170	330
8270C/D-3541	Soil	59-50-7	4-Chloro-3-methylphenol	14.8	170	330
8270C/D-3541	Soil	106-47-8	4-Chloroaniline	23.5	170	330
8270C/D-3541	Soil	7005-72-3	4-Chlorophenyl-phenylether	18.1	170	330
8270C/D-3541	Soil	100-01-6	4-Nitroaniline	43.4	170	330
8270C/D-3541	Soil	100-02-7	4-Nitrophenol	61.9	170	330
8270C/D-3541	Soil	83-32-9	Acenaphthene	9.4	170	330
8270C/D-3541	Soil	208-96-8	Acenaphthylene	8.4	170	330
8270C/D-3541	Soil	98-86-2	Acetophenone	10.2	170	330
8270C/D-3541	Soil	62-53-3	Aniline	28.4	170	330
8270C/D-3541	Soil	120-12-7	Anthracene	6.8	170	330
8270C/D-3541	Soil	1912-24-9	Atrazine	17.6	170	330
8270C/D-3541	Soil	103-33-3	Azobenzene	7.8	170	330
8270C/D-3541	Soil	100-52-7	Benzalaldehyde	17.4	170	330
8270C/D-3541	Soil	92-87-5	Benzidine	33.5	170	330
8270C/D-3541	Soil	56-55-3	Benzo(a)anthracene	15.9	170	330
8270C/D-3541	Soil	50-32-8	Benzo(a)pyrene	7.2	170	330
8270C/D-3541	Soil	205-99-2	Benzo(b)fluoranthene	10.9	170	330
8270C/D-3541	Soil	191-24-2	Benzo(g,h,i)perylene	13.5	170	330
8270C/D-3541	Soil	207-08-9	Benzo(k)fluoranthene	15.7	170	330
8270C/D-3541	Soil	65-85-0	Benzoic acid	66.0	170	330

SVOA 8270C (Soil)

8270C/D-3541	Soil	100-51-6	Benzyl Alcohol	12.5	170	330
8270C/D-3541	Soil	111-91-1	bis(2-Chloroethoxy)methane	19.2	170	330
8270C/D-3541	Soil	111-44-4	bis(2-Chloroethyl)ether	16.0	170	330
8270C/D-3541	Soil	117-81-7	bis(2-Ethylhexyl)phthalate	11.8	170	330
8270C/D-3541	Soil	85-68-7	Butylbenzylphthalate	16.0	170	330
8270C/D-3541	Soil	105-60-2	Caprolactam	15.5	170	330
8270C/D-3541	Soil	86-74-8	Carbazole	7.3	170	330
8270C/D-3541	Soil	218-01-9	Chrysene	15.1	170	330
8270C/D-3541	Soil	53-70-3	Dibenz(a,h)anthracene	9.6	170	330
8270C/D-3541	Soil	132-64-9	Dibenzofuran	13.0	170	330
8270C/D-3541	Soil	84-66-2	Diethylphthalate	5.2	170	330
8270C/D-3541	Soil	131-11-3	Dimethylphthalate	9.0	170	330
8270C/D-3541	Soil	84-74-2	Di-n-butylphthalate	26.2	170	330
8270C/D-3541	Soil	117-84-0	Di-n-octyl phthalate	3.8	170	330
8270C/D-3541	Soil	206-44-0	Fluoranthene	6.7	170	330
8270C/D-3541	Soil	86-73-7	Fluorene	12.6	170	330
8270C/D-3541	Soil	118-74-1	Hexachlorobenzene	13.6	170	330
8270C/D-3541	Soil	87-68-3	Hexachlorobutadiene	12.1	170	330
8270C/D-3541	Soil	77-47-4	Hexachlorocyclopentadiene	8.1	170	330
8270C/D-3541	Soil	67-72-1	Hexachloroethane	14.9	170	330
8270C/D-3541	Soil	193-39-5	Indeno(1,2,3-cd)pyrene	11.1	170	330
8270C/D-3541	Soil	78-59-1	Isophorone	11.0	170	330
8270C/D-3541	Soil	91-20-3	Naphthalene	11.5	170	330
8270C/D-3541	Soil	98-95-3	Nitrobenzene	12.6	170	330
8270C/D-3541	Soil	62-75-9	N-Nitrosodimethylamine	17.1	170	330
8270C/D-3541	Soil	621-64-7	N-Nitroso-di-n-propylamine	16.8	170	330
8270C/D-3541	Soil	86-30-6	N-Nitrosodiphenylamine	8.0	170	330
8270C/D-3541	Soil	87-86-5	Pentachlorophenol	22.8	170	330
8270C/D-3541	Soil	85-01-8	Phenanthrene	9.0	170	330
8270C/D-3541	Soil	108-95-2	Phenol	7.7	170	330
8270C/D-3541	Soil	129-00-0	Pyrene	8.0	170	330
8270C/D-3541	Soil	110-86-1	Pyridine	66.0	170	330