Supplemental Polishing Phase
Remedial Actions Work Plan

300, 304-308, 320 Andrews Street & 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 and that this 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

On behalf of the City of Rochester (City), Day Engineering, P.C. (DAY) has prepared this Work Plan for supplemental polishing phase remedial actions consisting of a deep soil removal and in-situ chemical oxidation (ISCO) treatment in a source area that contains residual chlorinated volatile organic compound (CVOC) contamination in dense glacial till.

1.1 Background

The Site is located at 300, 304-308, and 320 Andrews Street and 25 Evans Street in the City of Rochester, New York (refer to Figure 1 and Figure 2). The Site has a combined area of 1.527 acres and is located at the intersection of Andrews Street and Evans Street. The Inner Loop ramp, and associated infrastructure, borders the Site to the north. Commercial properties are located west and south of the Site. A city park is located east of the Site. The Site owned by the City.

The Site was previously investigated and remediated under the New York State Department of Environmental Conservation (NYSDEC) Environmental Restoration Program (ERP). The remediation included soil removals in the unsaturated zone and various phases of in-situ chemical oxidation using potassium permanganate ($KMnO_4$) within the saturated zone. The Site received a Certificate of Completion from the NYSDEC in December 2015; however, polishing phase ISCO and groundwater monitoring have continued to be performed to address residual CVOC contamination in the overburden saturated zone generally present between 10 and 24 feet below grade. The CVOCs generally consist of tetrachloroethene (i.e., Perchloroethene or PCE) with some lower concentrations of Trichloroethene (TCE), Dichloroethene (DCE) and Vinyl Chloride (VC).

Subsequent to the activities described above, it has become evident that an apparent small localized source zone of CVOC contamination is present in a generally impermeable dense glacial till soil located within the overburden saturated zone. Back diffusion of CVOCs from this glacial till source zone appears to result in continued elevated concentrations of CVOCs in groundwater on this portion of the Site. Cumulative photoionization detector (PID) readings were used with Geographical Information System (GIS) Spatial Analyst to model the extent of CVOC impact in the source area soil. The cumulative PID readings, other observations at test borings advanced with recent polishing phase injection wells, cumulative groundwater monitoring data, and previous subsurface soil results were used to delineate the localized CVOC source area. As shown on Figure 3, the localized PCE-contaminated area generally encompasses an oval shaped area (approximately 20’ short axis x 30’ long axis) totaling 471 square feet (SF) and is primarily present between a depth interval of 12 and 24 feet below the ground surface (bgs). Figure 4 and Figure 5 illustrate the oval shaped area in relation to previously completed IRM and ISCO treatment components. Based on the cumulative information, it has become apparent that further polishing via in-situ treatment alone will not result in timely remediation of this localized PCE contaminated portion of the Site.

1.2 Planned Supplemental Polishing Phase Remedial Actions

In order to accelerate remediation and further ready the Site for redevelopment, the primary goal of the scope of work presented in this Work Plan is to physically remove and dispose of the localized area of PCE-contaminated soil, amend the excavation with potassium permanganate, and continue to perform ISCO polishing of the groundwater in the overburden as deemed warranted. The intent of the supplemental polishing phase remedial actions is to eliminate the need for long term monitoring in the center of the Site. Based on the above information, approximately 209 cubic yards (i.e., 345 tons) of CVOC-contaminated soil is being targeted for removal and off-site disposal, followed by application of approximately 925 gallons of 5% potassium permanganate solution into the bottom of the excavation area and/or along select excavation sidewalls to enhance ISCO of residual CVOCs in this area. Further details concerning this project are provided in subsequent sections of this Work Plan.

The City does not have generator knowledge that PCE was a spent solvent or unused commercial chemical product when it was released to the environment; therefore, the wastes being generated by this work do not meet the definition of F-listed wastes as defined by 40 CFR Part 261.31. Waste streams suspected of containing PCE will be sampled to determine if the wastes exhibit the properties of a characteristic hazardous waste as defined in 40 CFR Part 201, Subpart C.

1.3 Standards, Criteria, and Guidance

Standards, criteria, and guidance (SCG) values to be utilized as part of this Work Plan, and that are consistent with those utilized in previous work plans approved by the NYSDEC for this Site, include the following:

- Analytical laboratory test results for soil samples will be compared to Restricted-Residential Use Soil Cleanup Objectives (RRUSCOs) and Protection of Groundwater Soil Cleanup Objectives (PGWSCOs) referenced in the NYSDEC document titled "*6 New York Codes, Rules and Regulations (NYCRR) Part 375, Environmental Remediation Programs*" dated December 14, 2006.
- Analytical laboratory test results for groundwater samples will be compared to groundwater standards and guidance values referenced in the NYSDEC document titled "Division of Water Technical and Operational Guidance series (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations" dated June 1998, as amended by a January 1999 Errata sheet, a April 200 addendum and a June 2004 addendum.

2.0 Scope of Work

The anticipated components of the supplemental polishing phase remedial actions are further outlined in this section of the Work Plan. The components will generally be performed in the order they are presented herein. However, as the work progresses, it is anticipated that some modifications of the methods, means and order of tasks may be warranted to address the actual field conditions that are encountered.

Remedial contractor work will be performed by TREC Environmental, Inc. (TREC), which was selected through a competitive bid process and has been retained by DAY. TREC was the remediation contractor that completed the previous IRM soil removals at this Site; thus, has experience with conditions at this Site. The remediation activities will be observed by DAY. Personnel from DAY and its subcontractors that are involved with this project will be 40-hour Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations (HAZWOPER) trained in accordance with OSHA 29 CFR 1910.120.

This work is not associated with other intrusive work and involves disturbance of less than an acre area. As such, the work does not require a United States Environmental protection Agency (USEPA) National Pollutant Discharge Elimination System (NPDES) permit.

2.1 Site Controls

Planned remedial work will require Site controls to ensure the safety of Site workers and the public. The Site is currently fully secured with perimeter fencing and two locked gates (refer to Figure 6). Access to the Site will be limited to staff, workers, and pertinent agencies involved with the project only. The public will not be permitted to enter within the fenced area. Equipment, materials and/or vehicles entering the Site will be observed prior to being permitted on-site to ensure that they are not contaminated (i.e., free of accumulations of non-hazardous, hazardous substances, and petroleum products). Equipment, materials and/or vehicles that arrive at the Site contaminated and not decontaminated from the previous job, will not be permitted to enter the Site.

Remediation activities will be contained within the Site boundaries. Figure 6 identifies the anticipated layout of the Site during remediation activities. Planned staging, transportation and support areas are located such that movement of heavily contaminated waste materials across the Site will be limited to the extent necessary to allow excavation without compromising safety and efficient access to each work area.

<u>Vapor/Odor Management</u>

Consistent with previous NYSDEC-approved work plans for this Site, DAY will conduct continuous air monitoring of worker breathing zone air and perimeter air monitoring during disturbance of potentially contaminated soil in accordance with the Health and Safety Plan (HASP), which is presented in Section 5.0. Volatile organic compounds (VOCs) in worker's breathing zone air will be monitored with a PID during activities that have the potential to disturb contaminated material to aid in determining if vapor suppression is necessary. Readings will be recorded on log sheets and/or the Site logbook.

Also, as conducted under previous NYSDEC-approved work plans for this Site, vapor suppression will be implemented if PID readings greater than 25 parts per million (ppm) above background are measured within the breathing zone, and sustained for greater than 5 minutes. Vapor suppression will also be implemented if nuisance odors are detected at the Site boundary, or at the discretion of City or DAY on-site representatives. If nuisance odors are identified at the Site boundary, or if odor complaints are received, work will be halted and the source of odors will be identified and corrected.

TREC will use BioSolve Pinkwater for vapor suppression during CVOC-contaminated soil excavation and staging work. A 3-4% solution of BioSolve Pinkwater will be sprayed on VOC-contaminated soil within and/or outside the excavation(s) as determined by DAY's on-site representatives.

Noise and Vibration Mitigation

Vibratory rolling or equivalent compaction equipment will be used to attain 95% compaction of the backfilled material. Noise and vibration related issues were not encountered during previous backfilling activities and excessive noise and/or vibration is not anticipated during this project. Noise and vibration levels will be monitored in the work areas and at the Site perimeter by DAY on-site personnel. The fieldwork associated with this project is generally located in the center of the Site, and no vibration-sensitive businesses are known to be located adjacent to the Site.

Traffic Control and Trucking Routes

Trucks will be prohibited from stopping and idling outside the project site. Queuing of trucks, if necessary, will be performed on-site in order to minimize off-site disturbance; therefore, a traffic control plan is not necessary.

Egress points for truck and equipment transport from the site will be kept clean of dirt and other materials during site remediation. Locations where vehicles enter or exit the site shall be observed daily for evidence of off-site soil tracking.

Off-site trucking routes will be dependent on the actual facility(s) where project-derived wastes are approved for disposal. To the extent possible, planned truck routes will avoid residential areas or other sensitive sites, and will be designed to be on commercially-bounded roadways that lead to major highways.

2.2 Site Preparation

Site preparation will include the following:

Utility Stakeout: TREC will coordinate a utility stakeout for identification and clearance of Site utilities prior to commencement of the work.

Mobilization: DAY and TREC will mobilize to the Site. TREC's equipment will be moved on-site as deemed necessary depending upon the type of work being performed. Support facilities, including a POD portable storage unit and a portable toilet, will be located on the southeast portion of the Site (see Figure 6). The POD will be used for storage of equipment and as a field office.

Remediation Mark Out: A Global Positioning System (GPS) and/or tape measurements from existing site features (e.g., surveyed monitoring wells) will be used to locate remediation-related features. The extent of the clean soil removal area and the contaminated soil removal area will be marked using aerosol marking paint and other methods prior to initiation of remediation activities. Likewise, areas of the Site to be used for staging, parking, decontamination and related activities will be marked using aerosol marking paint. For reference, the perimeter of the previous 2012 IRM-01 soil removal area will also be marked using aerosol marking paint. The marks will serve as excavation perimeter reference points to allow precise determinations to be made as to depth and location of the excavation while work is in progress.

Decontamination Pad: TREC will construct a bermed 20’ x 30’ decontamination pad that consists of a 3” layer of imported clean washed pea stone meeting NYSDEC DER-10 Section 5.4(e) requirements and 60-millimeter thick poly plastic liner (refer to Figure 6 for anticipated location of decontamination pad).

Well Decommissioning: TREC will decommission one 2-inch diameter stainless steel monitoring well (MW-17) and fifteen 2-inch diameter polyvinyl chloride (PVC) injection wells (IW-6, IW-13 through IW-16, IW-21 through IW-30). The monitoring well is 25 feet deep. One injection well is 12 feet deep, thirteen injection wells are 20 feet deep, and one injection well is 25 feet deep. Decommissioning will be conducted in accordance with protocols outlined in the NYSDEC document titled “CP-43: Groundwater Monitoring Well Decommissioning Policy” dated November 3, 2009, and will consist of tremie-grouting from the bottom of the wells to the ground surface using a 96% Portland Cement/4% Bentonite Powder and water grout mix. The location of these wells can be found on Figure 6 and Figure 7. [Note: TREC will be responsible for protection of monitoring wells and injection wells that are not being decommissioned throughout the duration of its on-site services.]

Soil Staging Areas: TREC will construct up to four bermed soil staging areas totaling up to 8,000 SF using a 3” layer of clean washed pea stone meeting NYSDEC DER-10 Section 5.4(e) requirements and 25-millimeter thick poly plastic liner. Bags filled with the pea stone, or other material meeting NYSDEC DER-10 Section 5.4(e) requirements, will be used to secure the poly plastic liner in each bermed soil staging area. The soil staging areas are to be integrated with the excavation ramp (refer to Figure 6 and Figure 7) to preclude tracking of contaminated soil on the clean cover system cap. When staged soil piles are generated, they will be covered with 6-mil poly sheeting and secured with sand bags.

Poly sheeting will not be required to be placed beneath clean existing or imported crusher run material that are to be staged on-site.

2.3 Excavate and Stage Re-Useable Soil

Approximately 759 cubic yards (CY) of re-usable soil will be excavated. The excavated material will be placed into one or more staging areas that were constructed during the Site preparation. Re-useable soil excavated from areas beyond the limits of the previous 2012 IRM-01 excavation shall be segregated and staged separately from re-usable soil that is excavated from within the limits of the previous IRM excavation. A DAY representative will screen approximately 25% of the excavator buckets of soil beneath the cover system cap and outside the previous IRM-01 boundary with a PID as it is being removed since some of this material may not have been field screened in the past. The re-useable soil excavation generally consists of removing re-useable soil from an approximate oval-shaped 1,865 SF area, such that the completed excavation sidewalls extend beyond the smaller approximate oval-shaped 471 SF localized PCE-contaminated soil removal area and be sloped (~45° angle) or benched back in accordance to OSHA requirements. The estimated excavation volume also includes a ramp into the excavation for ingress/egress of the TREC's heavy equipment. Calculations generally assume the ramp will have an approximate 18.5° pitch (change in elevation from 0-12 feet bgs over a 36-foot length), and that the two sidewalls will require some benching or sloping for stability. Actual dimensions may differ due to field conditions encountered and TREC's actual methods and means. The ramp will be integrated with the soil staging areas to preclude tracking of contaminated soil on the re-useable cover system cap (refer to Figure 6 and Figure 7). The upper two feet of re-useable soil to be removed from the excavation area is considered part of the clean cover cap system for the Site and consists of crusher run and soil. This cover system material will be removed and staged separately from deeper re-useable soil so that it can be re-used as cover system material during backfilling and Site restoration activities. A staked construction fence will be installed around the perimeter of the excavation at the end of each day.

2.4 Excavate and Stage Contaminated Soil

Approximately 209 CY (345 Tons) of contaminated soil will be excavated from the approximate 471 SF oval-shaped removal area (refer to Figure 6 and Figure 7). Dimensions of the oval excavation are 20' short axis x 30' long axis from a depth interval of 12' to 24' bgs. It is anticipated that this work will be substantially within the overburden groundwater table, and it is possible that the groundwater recharge rate may be significant, especially beneath the dense glacial till layer. Adequate equipment and labor to dewater the excavation will be immediately available, as deemed necessary. The excavated soils will be transported and placed into two of the previously-constructed staging areas.

Consistent with previous NYSDEC-approved work plans for this Site, BioSolve Pinkwater will be supplied, prepared and used for vapor suppression. Properly sized mixing drums, pump, hose and sprayer will be provided to ensure adequate spray volume and spray distance can be achieved to amend the excavation, contaminated soil staging area, and contaminated heavy equipment surfaces.

As identified in previous NYSDEC-approved work plans for the Site, DAY will generally screen approximately 50% of the excavator buckets of contaminated soil with a PID as it is being removed. Contaminated soil with peak PID readings $\geq$1,000 ppm will be placed in a soil staging area, and segregated from contaminated soil with peak PID readings <1,000 ppm that will be placed in a different soil staging area.

It is anticipated that soils will be removed using an excavator and transferred directly into a front-end loader for appropriate staging. It is assumed that the front-end loader will be loaded with two to four excavator bucket loads of excavated soils at a time prior to staging. Alternatively, it is anticipated that materials may be temporarily staged within a portion of the removal area and subsequently placed in the designated staging area. Efforts will be made to avoid cross-contamination between loads by excavating like materials continuously to the extent possible based on access and other considerations. To the extent feasible, TREC will keep its heavy equipment involved with excavation or handling of contaminated soil within the removal area, ramp area and staging areas in order to prevent spillage of soils or liquids during transfer efforts to the extent possible.

During truck loading or equipment soil transfer activities, polyethylene sheeting or tarps may be used to prevent unnecessary tracking of wastes through the Site during transport. Efforts will be made to unload, use and load transport equipment in a manner that prevents contact of the vehicles with impacted materials. Adherence to these procedures will help to ensure that decontamination will not be necessary, or be kept to a minimum.

Before leaving the Site each day, the staged contaminated soil will be covered with two layers of 6-millimeter thick plastic sheeting that is overlapped and secured with bags filled with the pea stone, or other material meeting NYSDEC DER-10 Section 5.4(e) requirements, which can subsequently be re-used on site, if necessary. A staked construction fence will be installed around the perimeter of the excavation at the end of each day.

2.5 Post-Excavation Sampling and Analysis

Up to eight post-excavation soil samples will be collected from the bottom and/or sidewalls of the contaminated soil removal area, which exceeds the number of required samples outlined in Section 5.4(b) of DER-10 (refer to Figure 7). A handheld GPS unit will be used during and after excavation activities to the extent possible in order to locate the sample points, the limits of excavation, and other significant features of interest. The location, depth and concentrations of residual contamination will be documented and incorporated into the existing GIS database.

DAY will retain Chemtech Consulting Group (Chemtech) to test select soil samples for target compound list (TCL) VOCs and tentatively identified compounds (TICs) using USEPA Method 8260. Chemtech is a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP) certified analytical laboratory (ELAP #11376) for the parameters being tested. [Note: Based on the groundwater table and planned soil removal depth, the excavation will be backfilled prior to receipt of the analytical laboratory results for these soil samples.]

2.6 Excavation Dewatering, Treatment, and Disposal

The excavation will be dewatered as deemed necessary using adequately sized equipment (e.g., pump, hose, etc.). A $\geq$20,000-gallon frac tank will be staged on the Site for holding water should excavation dewatering become necessary (refer to Figure 6). [Note: the frac tank will also be used for storage of decontamination water (refer to Section 2.10).] DAY will collect a sample of staged water in the frac tank, and Chemtech will test the sample for the following parameters:

- TCL VOCs using Method 624.
- TCL semi-volatile organic compounds (SVOCs) using USEPA Method 625.
- Metals using USEPA Methods 200.7 and 245.1.

Subsequent to characterization, it is anticipated that a Specialty Short Term Discharge Permit will be obtained from Monroe County, NY. Pre-treatment will be conducted if required to meet the Monroe County allowable concentration of < 2.13 mg/l or ppm for total VOCs. It is anticipated that the frac tank water will be pumped and discharged to a designated public combined sewer identified in the Specialty Short Term Discharge Permit that discharges to a publicly-owned treatment works (POTW). The frac tank will be cleaned, any solids (e.g., sediments) will be placed into a contaminated soil staging area for subsequent disposal, and any sediment-free washwaters will be discharged to the designated public combined sewer.

2.7 Backfilling and Installation of ISCO Polishing Hardware

Once the excavation of contaminated soil is complete, the excavation will be backfilled using the approximately 759 CY of re-useable site soil that was previously placed in a staging area, and with approximately 345 tons of imported replacement fill consisting of #2 crushed stone that meets NYSDEC DER-10 requirements for clean backfill material without requiring chemical testing. This imported material must be approved by the NYSDEC prior to being imported to, or used at, the Site. Backfill will be placed and compacted in one-foot lifts or less with a goal of achieving 95% compaction to the extent possible.

A minimum one-foot layer of the imported crushed stone will be placed in the bottom of the excavation to facilitate post-excavation ISCO treatment discussed in Section 2.8. A network of horizontal 2-inch inner diameter Schedule 40 PVC 10-slot screen will be placed within the layer of crushed stone and possibly other depths of the excavation as the excavation is being backfilled. Actual locations will be dependent upon the field conditions encountered (i.e., odors, PID readings of in-situ soil, etc.) in relation to potential residual CVOC impact that is left in place in the bottom and/or sidewalls of the targeted soil removal excavation. The horizontal PVC screens will be connected to solid 2-inch Schedule 40 PVC riser piping that extends to above the ground surface at up to eight locations.

For planning purposes, it is anticipated that the following quantities of PVC piping and connections will be on-site for construction of the ISCO treatment system:

- 80 linear feet of 2-inch inner diameter Schedule 40 PVC 10-slot screen
- 120 linear feet of solid 2-inch inner diameter Schedule 40 PVC piping
- 16 end caps
- 8 90^{o} elbows
- 8 tees
- 20 straight couplings (if the screen and piping are not threaded)
- 8 j-plugs

DAY and the City will decide the order of placement of remaining Site soil and imported #2 crushed stone into the excavation, which will depend upon actual field conditions encountered and the actual depths that the horizontal perforated piping is installed. The upper two feet of backfill will generally consist of the existing crushed stone that was reserved for re-use as cover system material and new imported #2 crushed stone.

2.8 Post-Excavation ISCO Treatment

Prior to or after backfilling, 385 pounds of 97% pure potassium permanganate will be mixed with approximately 950-gallons of potable water resulting in an approximate 5% solution of potassium permanganate. The Safety Data Sheet (SDS) for potassium permanganate is included in the HASP in Appendix A. The potassium permanganate will be delivered to the Site in seven 55-pound containers. TREC's personnel involved with the mixing will wear Level C personal protective equipment (PPE) with proper respiratory protection during mixing of the potassium permanganate in accordance with provisions of the Site's HASP.

The following method is currently anticipated for mixing and delivery of the 5% potassium permanganate solution:

- A clean poly tank (minimum 500-gallon capacity) will be set at the Site.
- The poly tank will either arrive filled with potable water, or will be filled on-site with potable water, as needed.
- A trash pump and hoses will be used to recirculate/mix an appropriate amount of 97% pure potassium permanganate with the water inside the poly tank to result in an approximate 5% potassium permanganate solution.
- Depending upon timing, and at the direction of a DAY or City representative, TREC will pump the solution into the bottom of the excavation or through the ISCO polishing PVC piping hardware.
- Once the ISCO treatment is complete, the tank will be rinsed, neutralized and removed from the Site.

2.9 Characterize, Transport and Dispose Contaminated Soil

DAY will collect up to two samples of staged contaminated soil. Chemtech will test these samples for the parameters required by the disposal facility, which are anticipated to include, but may not be limited to, the following:

- Full Toxicity Characteristic Leaching Procedure (TCLP) using USEPA Methods 1311, 8260, 8270, 6010, 7470, 8081, and 8151.
- Ignitability using USEPA Method 1010.
- Corrosivity (pH) using USEPA Method 9045, or similar.
- Reactivity (Cyanide and Sulfide) using USEPA Methods 9012 and 9034, or similar.
- TCL VOCs using USEPA Method 8260.
- Polychlorinated Biphenyls (PCBs) using USEPA Method 8082.

Subsequent to waste characterization, waste profile(s) will be prepared to obtain approval(s) from an appropriate waste disposal facility(s). DAY and the City will review the Draft waste profile(s) prior to submitting them to the disposal facility(s) for consideration. Once the waste profile(s) is approved by the disposal facility(s), the contaminated soil and underlying staging area materials will be loaded, transported and disposed at the disposal facility(s) (landfill). The decontamination pad materials will also be loaded, transported and disposed at the disposal facility(s) (landfill) at the appropriate time near the end of the project. It is anticipated that the majority of the contaminated material will require transportation and disposal as a non-hazardous waste at a permitted disposal facility; however, it is possible that some of the contaminated material (e.g., soil) may require transportation and disposal as a characteristic hazardous waste (D0039) based on its chlorinated VOC content. Transport of materials will be performed by licensed and permitted haulers in accordance with appropriate local, State, and Federal regulations, including 6 NYCRR Part 364. Haulers will be appropriately licensed and trucks properly placarded and permitted. Trucks will be logged, and drivers and their respective time on-site will be documented.

If soil to be loaded contains wet material capable of producing free liquid, truck bed liners will be used. In addition, loading during significant rain events will be avoided to the extent possible. Each truck exiting the Site with contaminated material will be covered with tight-fitting tarps prior to departure and during precipitation events. Tarps will also be required if a loaded truck is to remain on-site overnight. TREC 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.

Appropriate shipping documents will be prepared for each waste shipment, for execution by the City. Copies of disposal documentation will be maintained and will be available for review upon request. Documentation from the disposal facility verifying the weight of each shipment will be obtained by TREC and provided to DAY and the City as soon as possible.

2.10 Decontamination of Heavy Equipment/Vehicles

Heavy equipment (trucks, excavator, loader, etc.) will be decontaminated on the decontamination pad (refer to Figure 6) as deemed necessary prior to the equipment leaving the Site. Dry or wet methods will be employed as deemed necessary. TREC will supply the necessary shovels, brushes, brooms, potable water, pressure washer, hoses, etc. to perform decontamination operations. TREC will pump any decontamination water to the same frac tank identified in Section 2.6. Any solids generated in the decontamination area will be placed in one of the contaminated soil staging areas (refer to Sections 2.2 and 2.4) or will be disposed as part of the decontamination pad (refer to Section 2.9).

2.11 Installation and Development of New Monitoring Well

One replacement overburden monitoring well (designated as MW-17A) will be installed to replace existing monitoring well MW-17 that has to be decommissioned. It is anticipated that replacement well MW-17A will be located in the same area as MW-17 (refer to Figure 7) with consideration to the location of the ISCO polishing PVC hardware. DAY will retain Nothnagle Drilling, Inc. (Nothnagle) to provide the rotary drilling equipment and labor to install the well. Nothnagle will show up on-site with clean drilling equipment. Nothnagle will use a 4.25-inch inner diameter hollow stem auger system to advance the well boring to a depth of 20 feet. Starting at 20 feet bgs, Nothnagle will collect 2-foot split spoons ahead of augers to a depth up to 30 feet bgs. A two-inch inner diameter Schedule 40 PVC well consisting of up to fifteen feet of 10-slot PVC screen connected to solid PVC riser equipped with a cap that extends above the ground surface will be installed in the borehole. A sand pack will be installed around and at least one foot above the screened interval. A minimum two-foot bentonite seal will be installed above the sand pack. Grout will be used to fill the remainder of the borehole to approximately one-foot bgs. A protective casing will be cemented in-place over the aboveground portion of the PVC riser. Soil cuttings will be placed in one of the contaminated soil staging areas (refer to Sections 2.2 and 2.4), and decontamination water will be placed in frac tank identified (refer to Section 2.6).

Well Development

New monitoring well MW-17A will be developed by utilizing either a new dedicated disposable bailer with dedicated cord, and/or a pump and dedicated disposable tubing depending on the field conditions. Monitoring well development can occur a minimum of 48 hours after installation. No fluids will be added to the well during development, and well development equipment will be decontaminated after its use. The well development procedure is listed in Appendix B.

2.12 Post-Excavation Performance Groundwater Monitoring Event

Approximately four to six weeks after the project is considered substantially complete, DAY will complete a post-excavation performance groundwater monitoring event. Analytical laboratory testing of field samples and one trip blank will be completed by Chemtech for TCL VOCs and TICs using USEPA Method 8260. Field groundwater samples are anticipated to be collected from the following monitoring wells: MW-01, MW-02, MW-03A, MW-11, MW-15, MW-16, MW-17A, MW-18, and MW-19. The field samples will be collected using the passive diffusion bag (PDB) sampler technique (i.e., deploy PDBs filled with deionized water, retrieve PDBs at least 14 days after deployment, and decant PDB water into laboratory provided containers). A data usability summary report (DUSR) is not planned for this event.

2.13 Construction Completion Report

Upon receipt and review of necessary data, a Construction Completion Report will be prepared including:

- A discussion of the work completed;
- Extents of soil removal;
- Manifests for off-site disposal of waste materials;
- Photographs;
- Figures depicting the soil removal area, polishing phase ISCO treatment hardware, post-excavation soil sample locations, and monitoring well locations;
- Tabulated post-excavation soil sampling results, including comparison to appropriate NYSDEC SCOs in 6 NYCRR Part 375;
- Tabulated post-excavation performance groundwater sampling results, including comparison to appropriate NYSDEC groundwater standards and guidance values in TOGS 1.1.1; and,
- Laboratory analytical reports and chain-of-custody forms.

A draft report will be prepared for review by the City and then the NYSDEC. The report will be prepared in accordance with Section 5.8(b)-(d) of DER-10 and identify and list recommended cleanup levels in accordance with SCGs. In addition, the report shall identify applicable Federal and State criteria, advisories and guidance associated with any identified hazardous substances. Hazardous substances to which SCGs have been exceeded or contravened will be identified in the report. Upon approval of the draft report by the City and the NYSDEC, the report will be finalized and submitted to the City and the NYSDEC.

3.0 GIS DATABASE AND EQUIS

DAY will update the existing GIS database to identify, track, and document the supplemental polishing phase remedial actions as they progress. The database will also prove to be an efficient vehicle for locating the removal area and data from previous environmental work.

Consistent with previous laboratory data submittal protocol for this Site, the laboratory data generated for the work conducted under this Work Plan will be submitted to the NYSDEC using the NYSDEC’s Equis format.

4.0 QA/QC PROTOCOLS

Consistent with previous NYSDEC-approved work plans for this Site, a Quality Assurance Project Plan (QAPP) is included in Appendix B. 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 HEALTH AND SAFETY

Consistent with previous NYSDEC-approved work plans for this Site, a site-specific HASP has been prepared for this project and is included as Appendix A. A Community Air Monitoring Plan (CAMP) is included in the HASP. The HASP will be reviewed by DAY employees before starting site work. Other entities can adopt the protocols set forth in the HASP, or can develop their own HASP which must be submitted to the NYSDEC and NYSDOH. Monitoring of the work area and screening of soil and groundwater will be conducted throughout the duration of soil disturbance activities using the following (or equivalent) instrumentation:

- Aerosol particulate meter (Thermo Scientific Data RAM).
- Two MiniRAE 2000 or MiniRAE 3000 PIDs equipped with a 10.2 eV or 10.6 eV lamps.

Air monitoring at the Site will be continuous during ground intrusive activities. Air monitoring will be periodic during non-intrusive activities. Daily CAMP real-time air monitoring readings for VOCs and particulates will be available upon request.

On-site DAY and TREC employees will have completed the OSHA 40-hour HAZWOPER training with current refresher courses. A copy of the HASP will be available on-site during the project activities.

Professional personnel entering the Site will have current OSHA HAZWOPER Certifications. Non-professional personnel will maintain OSHA 10-hour Certifications, at a minimum.

6.0 PROJECT ORGANIZATION

The personnel for this project are anticipated as follows:

Joseph Biondolillo	City Project Leader
Dennis Peck	City Project Manager
Jeff Danzinger	DAY Project Manager
Nate Simon, P.E.	DAY Professional Engineer
Heather McLennan, CHMM	DAY Site Safety Officer and Environmental Professional
Bart Kline, P.E.	DAY Quality Assurance Officer
Cat Demian	DAY Field Technician
Hannah Miller	DAY Field Technician
Alex Zobel Martino	City Field Technician
Chris Smelt	DAY GIS Specialist
<u>Subcontractors</u>	
TREC	Environmental Remediation Contractor
Chemtech	Analytical Laboratory

7.0 SCHEDULE

The project is tentatively scheduled to start on or about Tuesday September 3, 2019. The anticipated schedule for project tasks is provided below.

Task 2.1 through Task 2.12	Week 1 through Week 8
Task 2.13	Week 9 through Week 12
Task 2.14	Week 10 through Week 24

The NYSDEC shall be notified at least seven days in advance of any field activities so that it can elect to provide appropriate NYSDEC field oversight. [Note: if the NYSDEC determines that it requires a longer notice (e.g., 60-day change of use of the Site) based on the scope of work presented herein, the schedule can be modified accordingly and any required supplemental written notification will be provided to the NYSDEC.]

8.0 ACRONYMS

Bgs	Below the Ground Surface
CAMP	Community Air Monitoring Plan
Chemtech	Chemtech Consulting Group
City	City of Rochester
CVOC	Chlorinated Volatile Organic Compound
CY	Cubic Yards
DAY	Day Engineering, P.C.
DCE	Dichloroethene
DUSR	Data Usability Summary Report
ELAP	Environmental Laboratory Approval program
ERP	Environmental Restoration Program
GIS	Geographical Information System
GPS	Global Positioning System
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations
ISCO	In-Situ Chemical Oxidation
$KMnO_4$	Potassium Permanganate
NPDES	National Pollutant Discharge Elimination System
NYCRR	New York Codes, Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OSHA	Occupational Safety and Health Administration
PCB	Polychlorinated Biphenyl
PCE	Perchloroethene
PGWSCO	Protection of Groundwater Soil Cleanup Objective
PID	Photoionization Detector
POTW	Publicly-Owned Treatment Works
PPE	Personal Protective Equipment
Ppm	Parts Per Million
PVC	Polyvinyl Chloride
QAPP	Quality Assurance Project Plan
Qa/QC	Quality Assurance/Quality Control
RRUSCO	Restricted Residential Use Soil Cleanup Objective
SDS	Safety Data Sheet
SF	Square Feet
SVOC	Semi-Volatile Organic Compound
TCE	Trichloroethene
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TIC	Tentatively Identified Compound
TREC	TREC Environmental, Inc.
USEPA	United States Environmental Protection Agency
VC	Vinyl Chloride
VOC	Volatile Organic Compound

FIGURES

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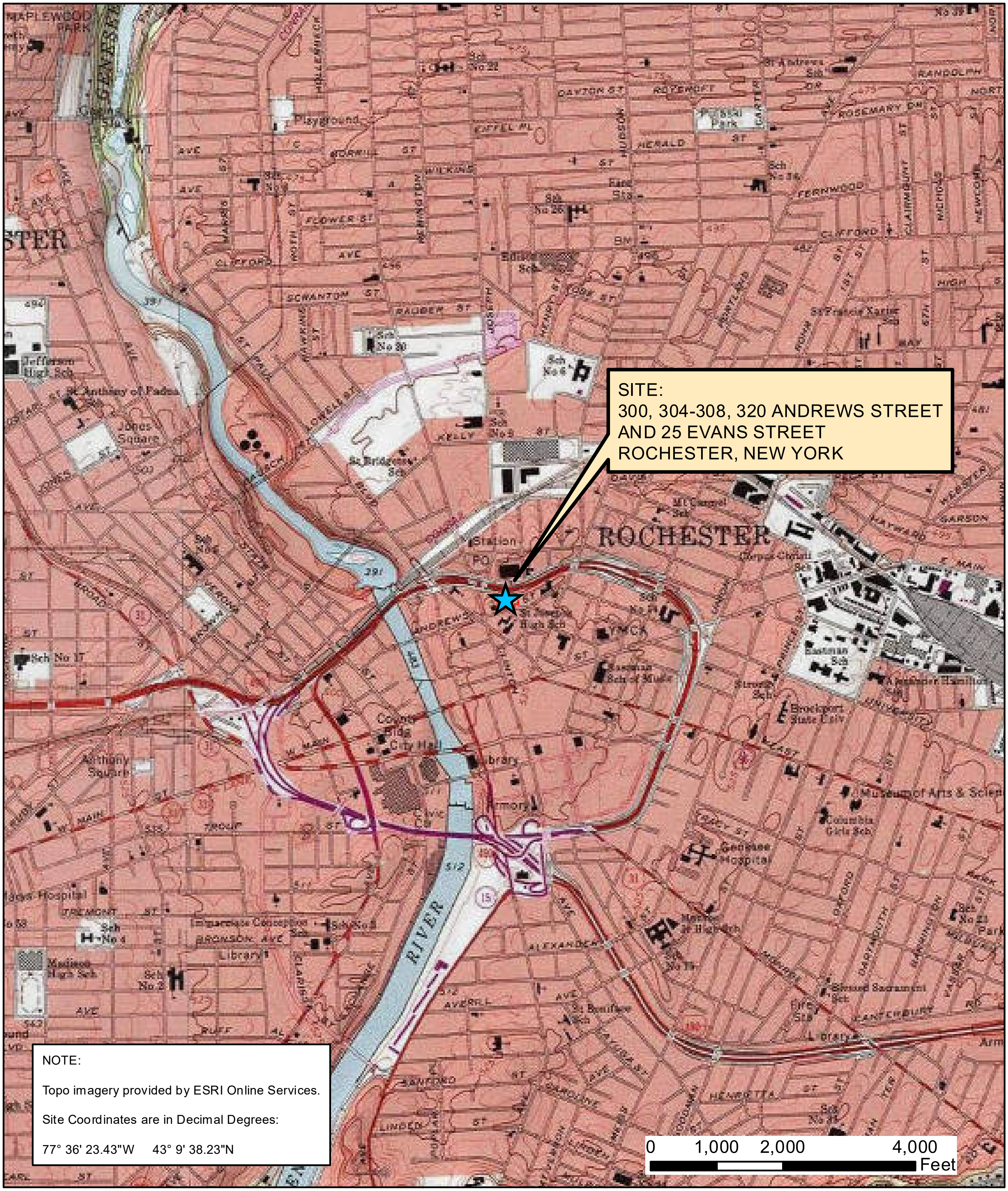

SITE:
300, 304-308, 320 ANDREWS STREET
AND 25 EVANS STREET
ROCHESTER, NEW YORK

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 12-04-2014	**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. 5334S-17 FIGURE 1
Drawn By CPS		Drawing Title Project Locus Map	
Scale AS NOTED			

Legend

🟨 Former Evans Street right-of-way

🟥 Andrews Street ERP Site

▭ Adjacent Parcels

NOTE:

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

Aerial imagery provided by the City of Rochester, dated 2012.

DESIGNED BY	DATE
JAD	02-2015

DRAWN BY	DATE DRAWN
CPS	02-2015

SCALE	DATE ISSUED
AS NOTED	02-06-2015

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

Project No.
5334S-17

FIGURE 2

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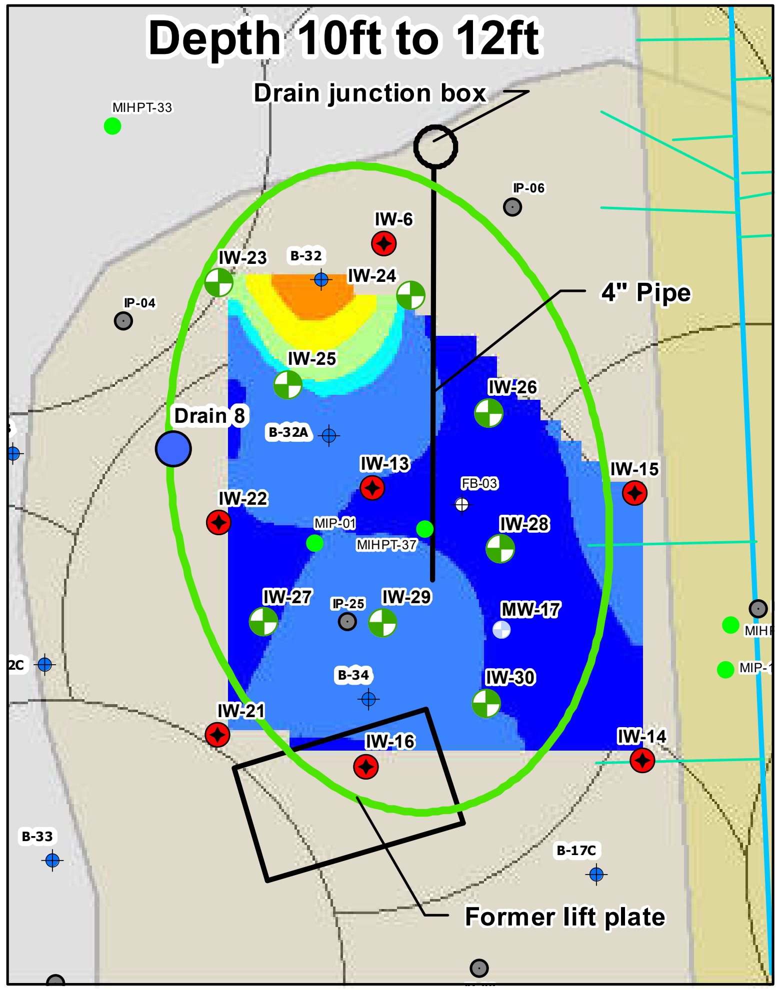
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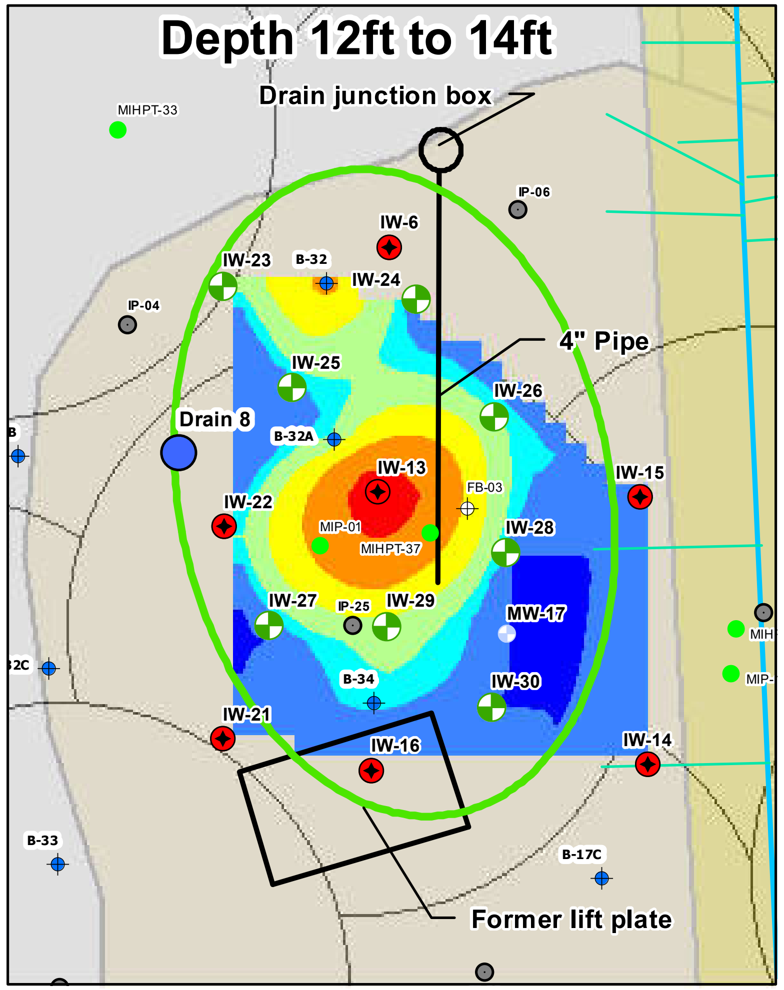
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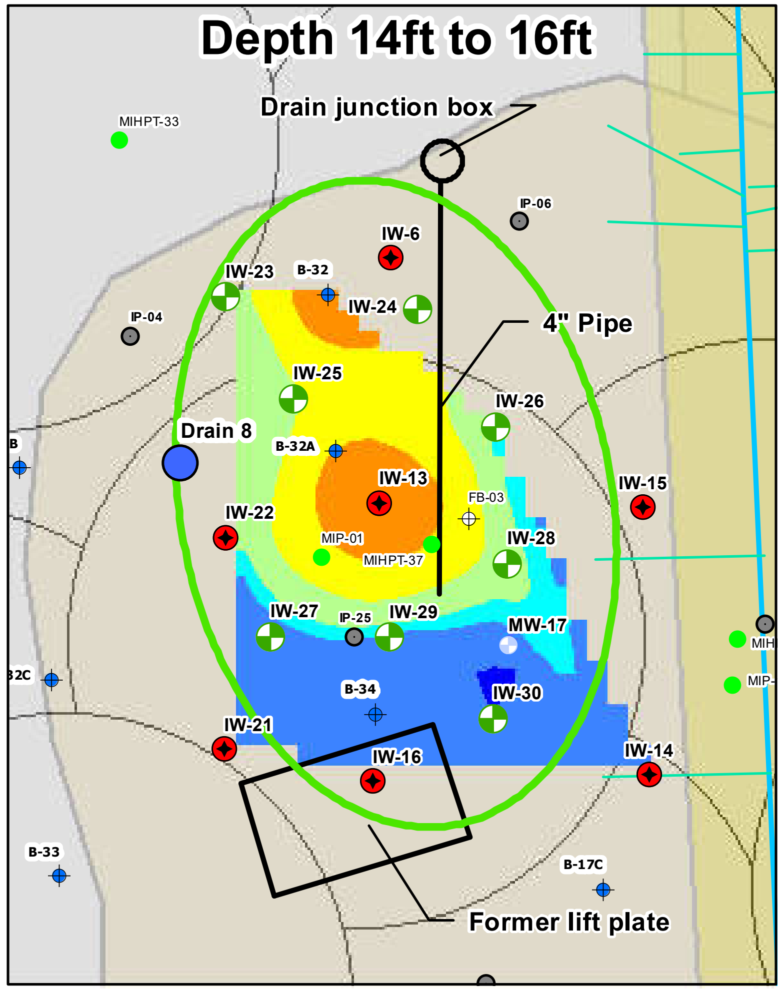
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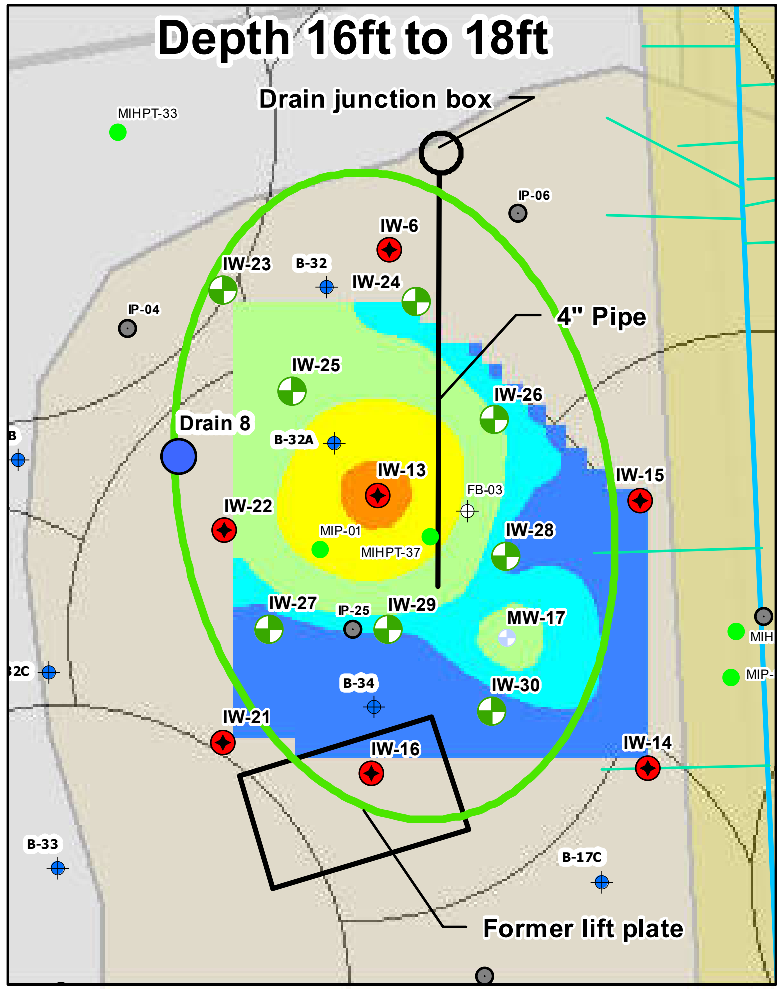
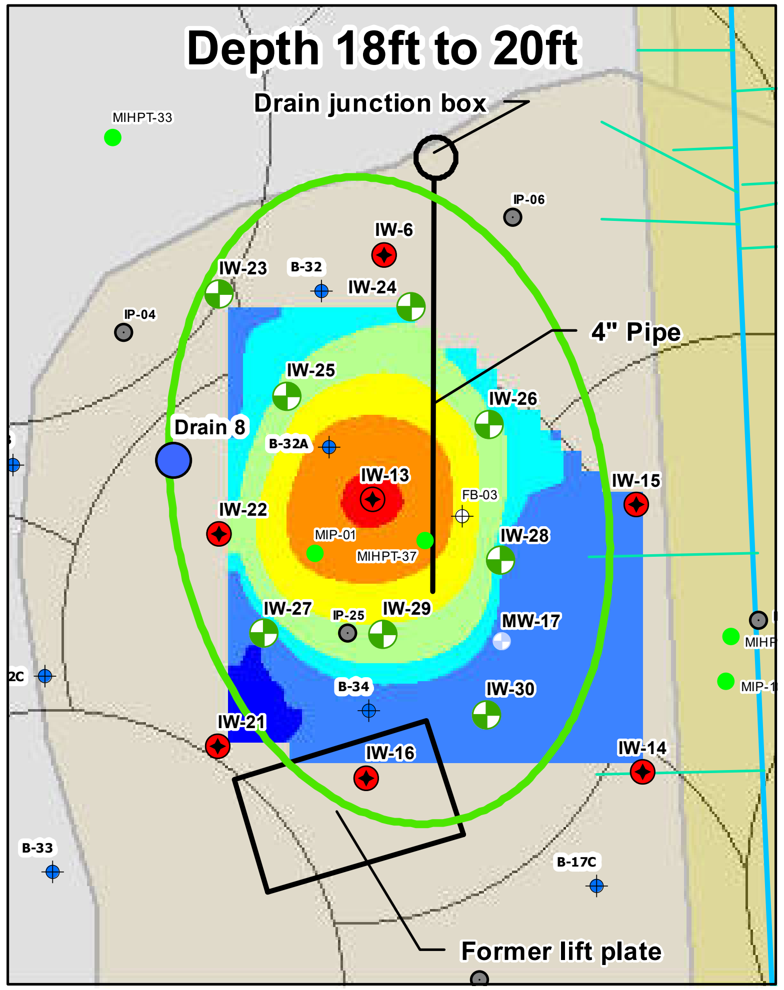

Depth 16ft to 18ft


Depth 18ft to 20ft

Legend

N

◕	Additional ISCO Injection Well
⊕	Overburden injection well
●	Overburden monitoring well
●	Backfill well (decommissioned)
●	Temporary ISCO Injection point
⌖	Frac borings
●	MIPHT locations
—	Additional treatment area
—	Storm sewer lateral
—	Storm sewer
▭	Completed 15 ft ISCO radius of influence from temporary injection points
🟨	Former Evans Street right-of-way
▭	Former IRM excavation limits

PID Readings in parts per million (ppm)

🟦	0 - 5
🟦	5 - 100
🟦	100 - 200
🟩	200 - 500
🟨	500 - 1,000
🟧	1,000 - 2,000
🟥	2,000 - 5,000

Feet
0 5 10 20

NOTE:

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

Map document path: E:\GIS Mapping\Rocity\Andrews_Street\GIS_Data\Andrews_Street\Supplemental_Deep_Soil_Removal\5334S-03-SDSR- PID Modeling 20181114.mxd

Last date document was saved: 29 Jul 2019

DESIGNED BY JAD	DATE 11-2018
DRAWN BY CPS	DATE DRAWN 11-2018
SCALE AS NOTED	DATE ISSUED 11-14-2018

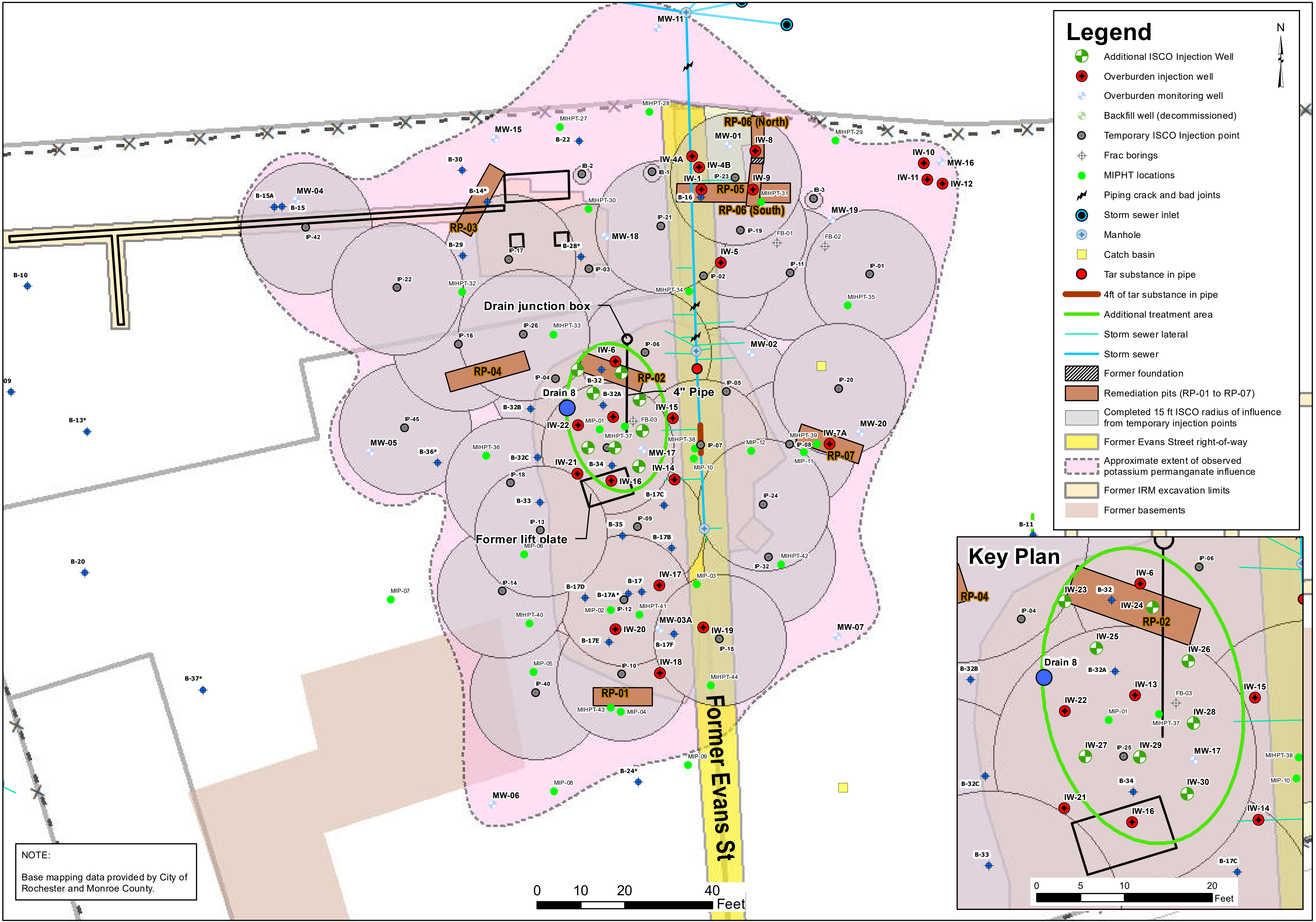
day
DAY ENVIRONMENTAL, INC.
Environmental Consultants
Rochester, New York 14606
New York, New York 10170

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

Drawing Title
PID Interpolation by Depth Interval

Project No.
5334S-17

FIGURE 3



NOTE:

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

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Last date document was saved: 29 Jul 2019

DESIGNED BY	DATE	DRAWN BY	DATE DRAWN	SCALE	DATE ISSUED
JAD	10-2018	CPS	10-2018	AS NOTED	10-29-2018

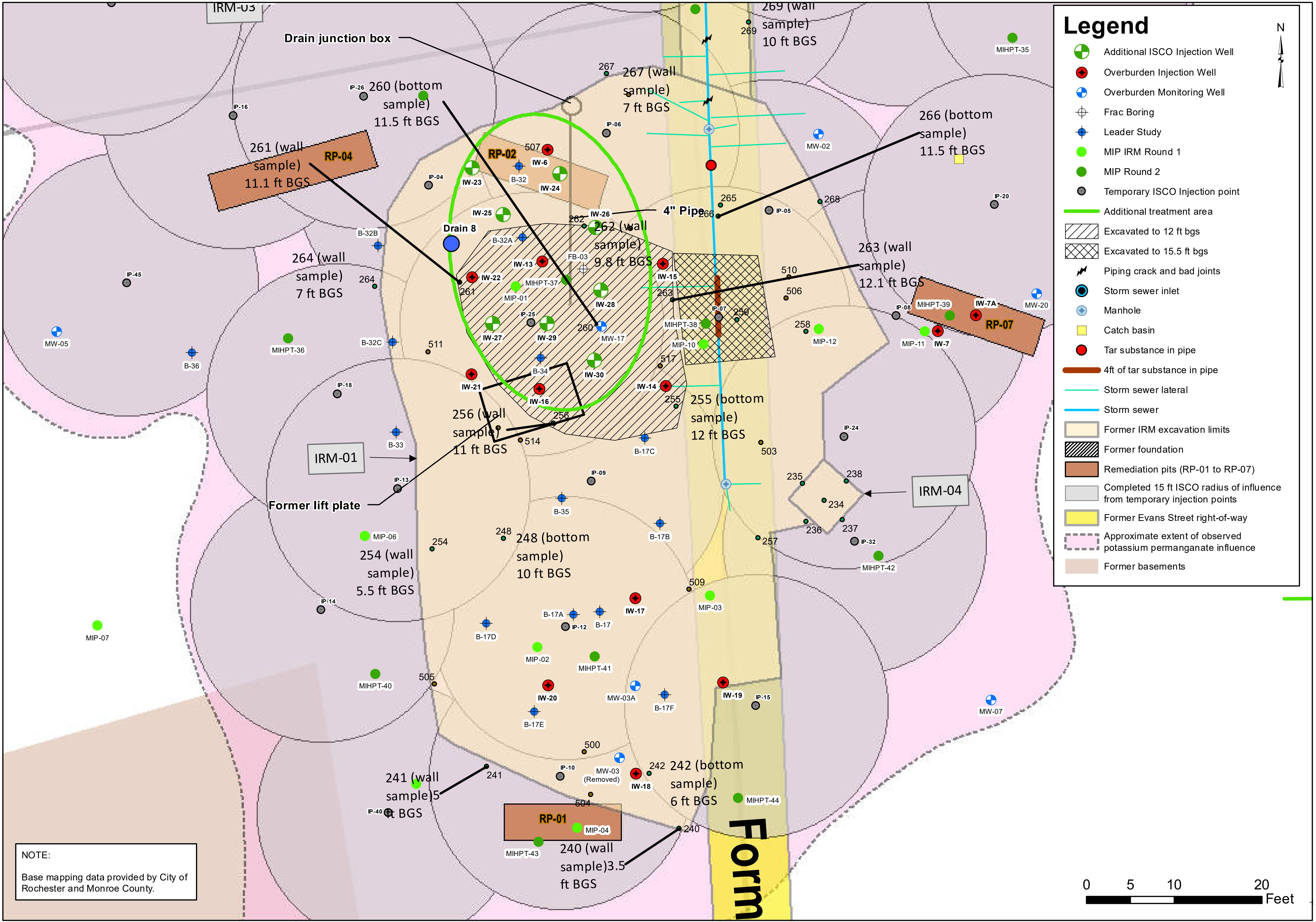
DAY ENVIRONMENTAL, INC.
Environmental Consultants
Rochester, New York 14606
New York, New York 10170

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 In-Situ Chemical Oxidation Treatment Measures

Project No.
5334S-17

FIGURE 4



NOTE:

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

Map document path: E:\GIS Mapping\Rocity\Andrews_Street\GIS_Data\Andrews_Street\Supplemental_Deep_Soil_Removal\5334S-05-SDSR- IRM-01 Overlay.mxd

Last date document was saved: 29 Jul 2019

DATE	DATE DRAWN	DATE ISSUED
11-2018	11-2018	11-20-2018

DESIGNED BY	DRAWN BY	SCALE
JAD	CPS	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

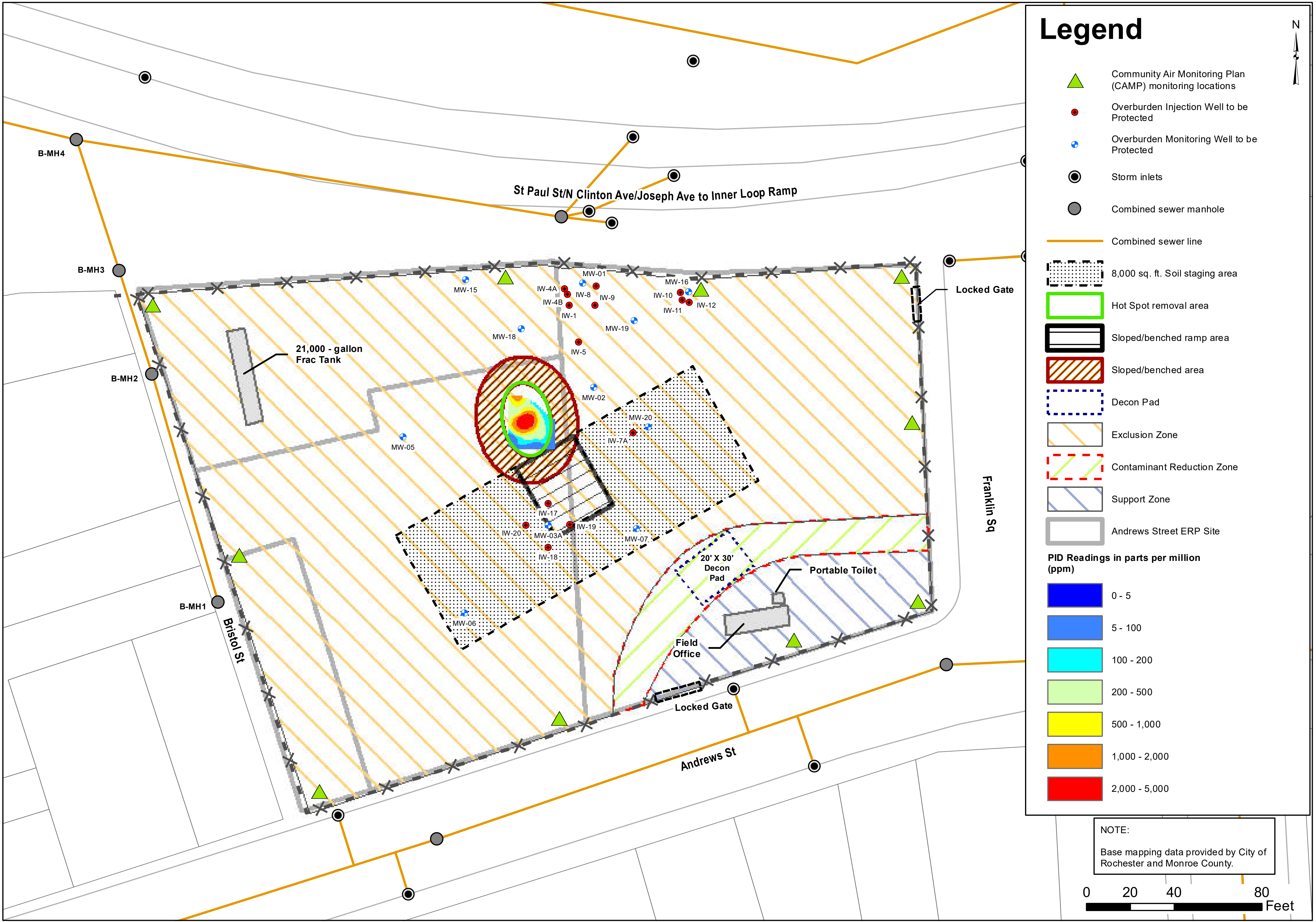
Drawing Title
Site Plan with Previous IRM and ISCO Treatment Areas

Project No.
5334S-17

FIGURE 5

Map document path: E:\GIS Mapping\Rocity\Andrews_Street\GIS_Data\Andrews_Street\Supplemental_Deep_Soil_Removal\5334S-06-SDSR- H and S Concept 1.mxd

Last date document was saved: 29 Jul 2019



NOTE:

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

DATE	02-2019
DATE DRAWN	02-2019
DATE ISSUED	02-15-2019
DESIGNED BY	JAD
DRAWN BY	CPS
SCALE	AS NOTED

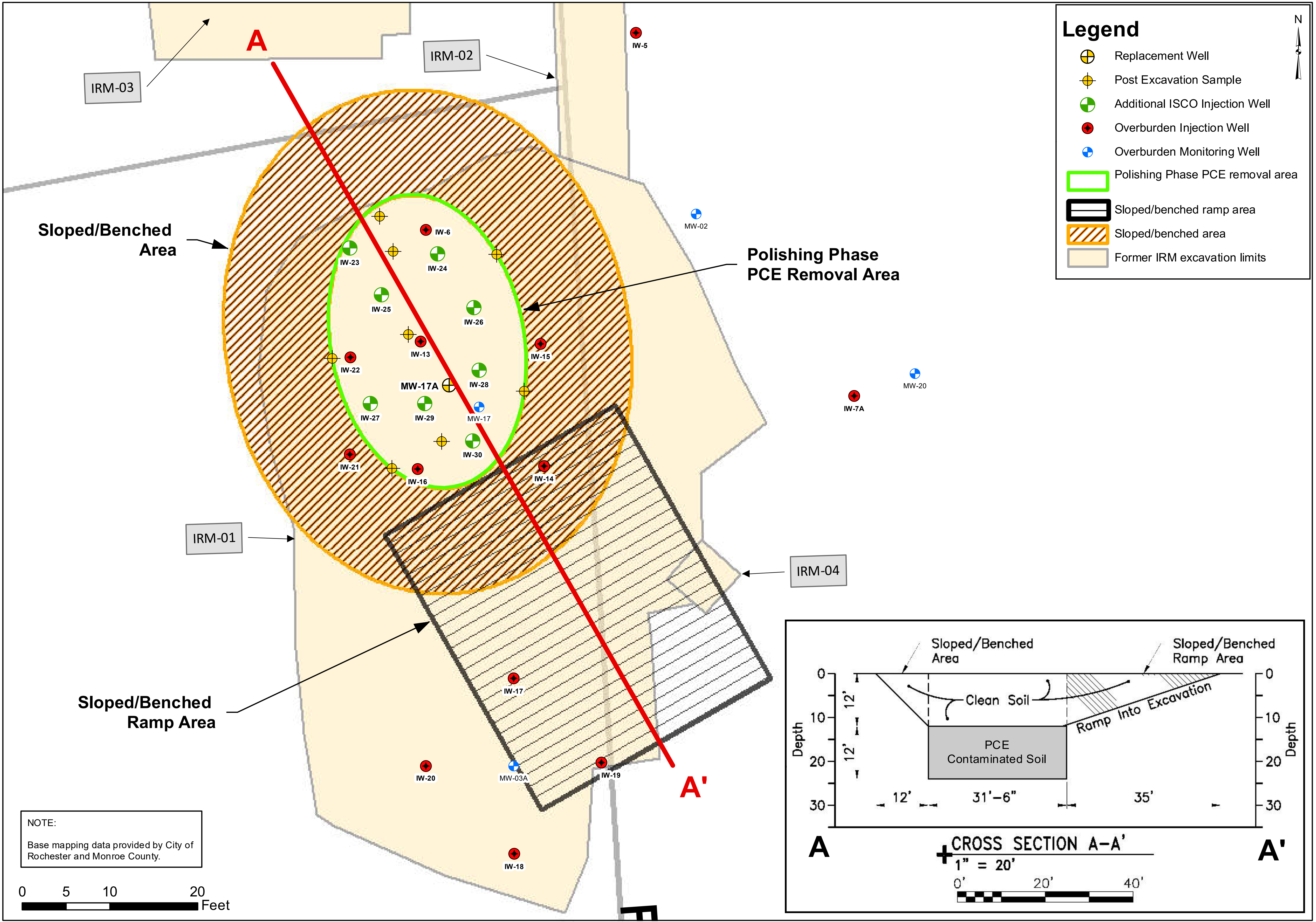
DAY ENVIRONMENTAL, INC.
Environmental Consultants
Rochester, New York 14606
New York, New York 10170

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

Drawing Title
Site Layout Plan for Supplemental Polishing Phase Remedial Action

Project No.
5334S-17

FIGURE 6



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

Map document path: E:\GIS Mapping\Rocity\Andrews_Street\GIS_Data\Andrews_Street\Supplemental_Deep_Soil_Removal\5334S-07-SDSR- Polishing Phase PCE Removal.mxd

Last date document was saved: 29 Jul 2019

DATE 07-2019
DATE DRAWN 07-2019
DATE ISSUED 07-29-2019
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
Site Plan with Supplemental Polishing Phase Excavation Detail

Project No.
5334S-17

FIGURE 7

APPENDIX A

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

Project No.: 5334S-17

Date: February 2019

TABLE OF CONTENTS

ATTACHMENTS

Attachment 1	Figure 1 - Route for Emergency Services
Attachment 2	Figure 2 - Site Layout Plan with Health and Safety Control Zones and CAMP Monitoring Locations
Attachment 3	Resume of Nicholas J. Harding
Attachment 4	Safety Data Sheets
Attachment 5	Daily Air Monitoring Logs and Figure

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 remediation of a "Hot Spot" of soil contaminated with Tetrachloroethene (aka Perchloroethene or PCE) and other chlorinated volatile organic compounds that are breakdown products of PCE. 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).

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 Interim Remedial Measures (IRMs); a supplemental RI; and supplemental IRMs.

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:

<u>IRM-01:</u> 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).

<u>IRM-02:</u> 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 were further remediated and/or addressed with 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. Post-IRM monitoring has identified a "Hot Spot" of PCE-contaminated soil in the saturated zone on the central portion of the Site, which may be acting as a source of persistent PCE detections in groundwater.

1.2 PLANNED ACTIVITIES COVERED BY HASP

This HASP is intended to be used during this 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;
- Hot Spot soil removal in a subsurface area of the Site that is contaminated with PCE;
- Mixing of an approximate 5% potassium permanganate solution and placement of the solution in the excavation;
- Management of project-derived wastes;
- 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 of DAY's representatives in the field that are associated with implementing the scope of the project. 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 DAY's 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 by DAY's representatives, 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.

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	Heather McLennan, Charles Hampton, or Nathan Simon

* Mr. Harding has a Master's Degree in Industrial Hygiene from the University of Rochester, and has over 30 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, and 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 Safety Data Sheet (SDS). A copy of Hepure's SDS for potassium permanganate ($KMnO_4$) is included in Attachment 4.

As part of the project, $KMnO_4$ will be used for ISCO of PCE in the saturated overburden zone within and in proximity to the Hot Spot excavation. The SDS 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 SDS. Additional information on potassium permanganate is summarized below.

Physical and Chemical Properties

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

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

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

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)	0.1 mg/m^3 as Mn	500 mg/m^3 (as Mn)

Mn = manganese

Neutralizing Potassium Permanganate

During mixing and placement into the excavation, potassium permanganate stains and spills 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 manufacturer 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 spills or stains shall be contained or collected, and then neutralized.

Aqueous solutions of potassium permanganate can be neutralized using sodium thiosulfate (refer to SDS 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 SDS' 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.

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 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., $KMnO_4$) 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 brought to the Site the day it is to be mixed with water and subsequently used, or will be stored inside a lockable storage container that is staged on-site until it is mixed and used.

5.1 SITE CONTROL ZONES

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

- 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" will be established where personnel can begin and complete personal and equipment decontamination procedures. Each on-site entity (e.g., consultant, regulator, remediation subcontractor, 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.

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	
Clean Soil Removal and Staging	Modified D/D	Based on scope, air monitoring, and SSO discretion
Hot Spot Soil Removal and Staging	C/Modified D/D	Based on scope, air monitoring, and SSO discretion
$KMnO_4$ Mixing	C/Modified D/D	Based on air monitoring, and SSO discretion
$KMnO_4$ Solution Pumping or Placement	C/Modified D/D	Based on air monitoring, and SSO discretion
Emergency Response, Neutralizing permanganate spills, stains, etc.	C/Modified D	Based on air monitoring, and SSO discretion
Management of IRM-Derived Wastes	C/Modified D/D	Based on air monitoring, and SSO discretion
Excavation backfilling	Modified D/D	Based on scope, air monitoring, and SSO discretion
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. If conditions are encountered that require Level A or Level B 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 emergencies when spills or stains 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, 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 parts per million (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 will be implemented in order to: 1) eliminate the potential of contaminating clean areas of the Site; and 2) eliminate the potential for off-site migration of Site contaminants. Where possible, dedicated disposable equipment will be used to minimize decontamination requirements, and minimize the possibility of cross-contamination.

A decontamination pad will be constructed on the Site for decontamination of equipment and vehicles (refer to Figure 2).

Contaminated equipment and vehicles will be decontaminated by at least one of the following methods:

- Steam clean 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.

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 project 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 5. 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 real-time aerosol monitor (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 photoionization detector (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 5 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 of potassium permanganate with water. Ground intrusive activities include soil excavation and backfilling.

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 management of project-derived wastes, long-term monitoring, etc.), and during pumping or placement of potassium permanganate solution.

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 5. 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 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, release, etc.).

Supplemental emergency procedures that are specific to the use of $KMnO_4$ during this project (e.g., transferring, mixing, pumping, placement, etc.) are included on the $KMnO_4$ SDS in Attachment 4.

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.

9.1 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
NYSDEC	
Charlotte Theobald	(585) 226-5354
Spills Hotline	1-800-457-7362
NYSDOH	
Melissa Doroski	(518) 402-7860
MCDPH	
Wade Silkworth, P.E.	(585) 753-5060
MCOEM	
Frederick J. Rion, Jr.	(585) 753-3810
CITY OF ROCHESTER	
Joseph Biondolillo	(585) 428-6649; (585) 314-1617 (cell)
Dennis Peck	(585) 428-6884; (585) 469-6372 (cell)
DAY ENVIRONMENTAL, INC.	
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).

9.2 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.

9.3 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.

9.4 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.

9.5 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.

9.6 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.

$KMnO_4$ Spill Control Guidance

Clean up spills of dry $KMnO_4$ immediately by sweeping of 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 use. The recovered dried material must be diluted with water to less than a 6% solution and neutralized as outlined below. Small system leaks from the mixing, transferring or pumping equipment will be captured with a drum vacuum pump and/or contained with absorbent pads or soil berm.

For minor stains and spills of potassium permanganate solution, a mixture of 1 part vinegar, 1 part water and 1 part 3% hydrogen peroxide will be prepared in a pressure washer or container. Apply the mixture on the stain or spill to neutralize, and rinse with water.

For larger spills of potassium permanganate, dilute Sodium Thiosulfate ($Na_2S_2O_3$) to a 6% solution using water. A pre-mix 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 PERMANAGANATE. A VIOLENT REACTION MAY OCCUR THAT CAN RESULT IN INJURY.

1. Clear personnel from the spill area to prevent exposures and to avoid expanding the affected area.
2. Suspend other Site work in the immediate area to focus on response activities. Notify Project Manager, and coordinate with Site personnel.
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 of less than 6% potassium permanganate. **For safety reasons, do not neutralize concentrated potassium permanganate solutions.**

5. Slowly add the dilute 6% solution of Sodium Thiosulfate to the diluted potassium permanganate 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 potassium permanganate has dissipated and is brown/brownish black in color. In order to expedite the response to a potassium permanganate 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 the handling, mixing, pumping or placement of potassium permanganate. Safe neutralization of the spilled and diluted potassium permanganate can then occur using buckets, shovels and brooms.
6. Containerize the spilled, diluted, and neutralized solution for disposal. If authorized, neutralized fluids may be discharged to the sanitary sewer or combined sewer system under a Monroe County sewer use permit.
7. Rinse the area with large amounts of water, except if run-off will enter a storm drain of water body.

If personnel are exposed to potassium permanganate, consult the KMnO4 SDS for first aid procedures. Rinse the exposed area with large amounts of water.

9.7 LOCATING CONTAINERIZED WASTE AND/OR UNDERGROUND STORAGE TANKS

In the event that unanticipated containerized waste (e.g., drums) and/or 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.

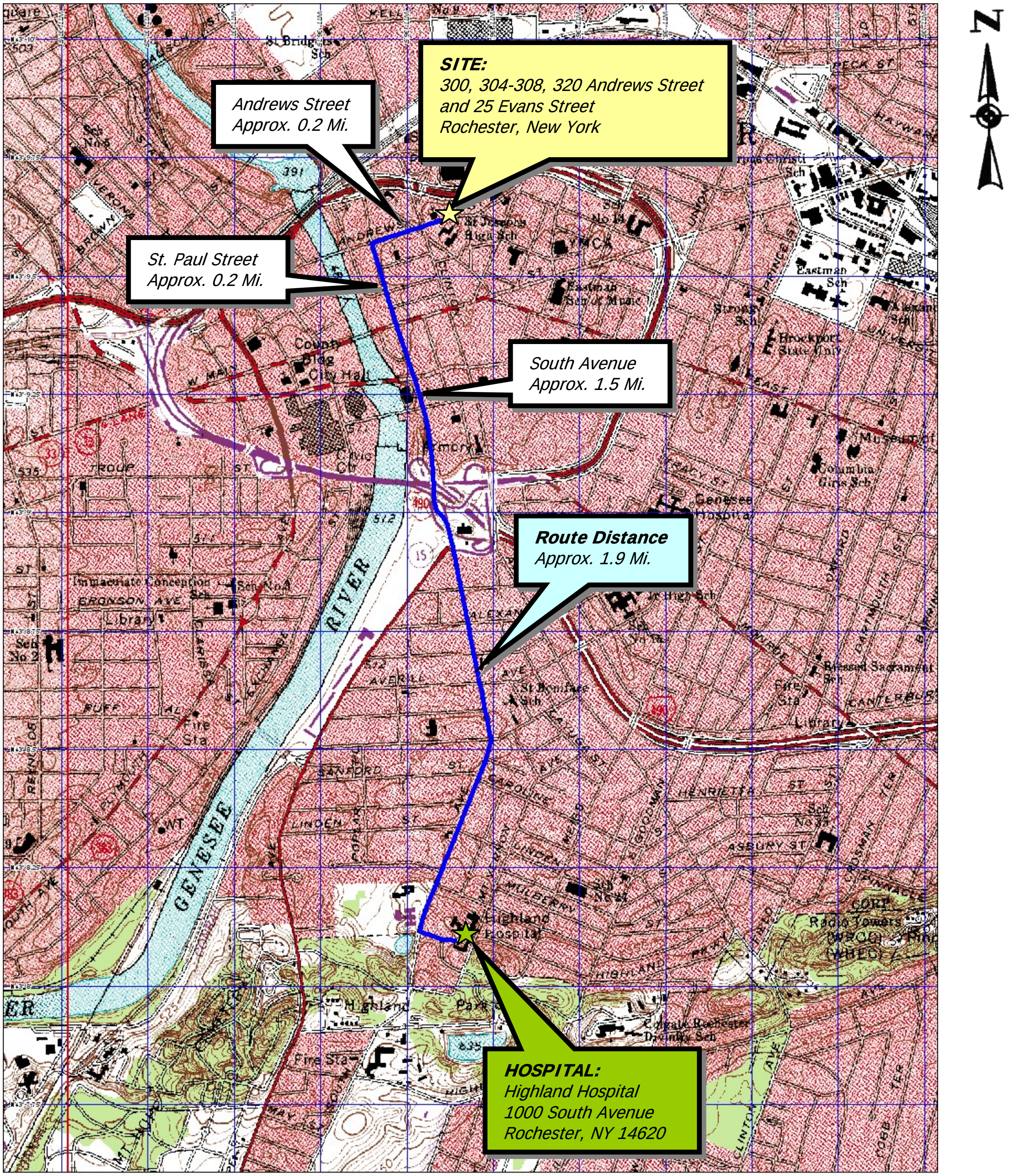
Prior to any handling, unanticipated containers will be visually assessed by the SSO to gain as much information as possible about their contents. As a precautionary measure, personnel shall assume that unlabeled containers and/or tanks contain hazardous materials until their contents are characterized. 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.

10.0 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
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
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
REL	Recommended Exposure Limit
RI	Remedial Investigation
RTAM	Real-Time Aerosol Monitor
SCG	Standards, Criteria and Guidance
SDS	Safety Data Sheet
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 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

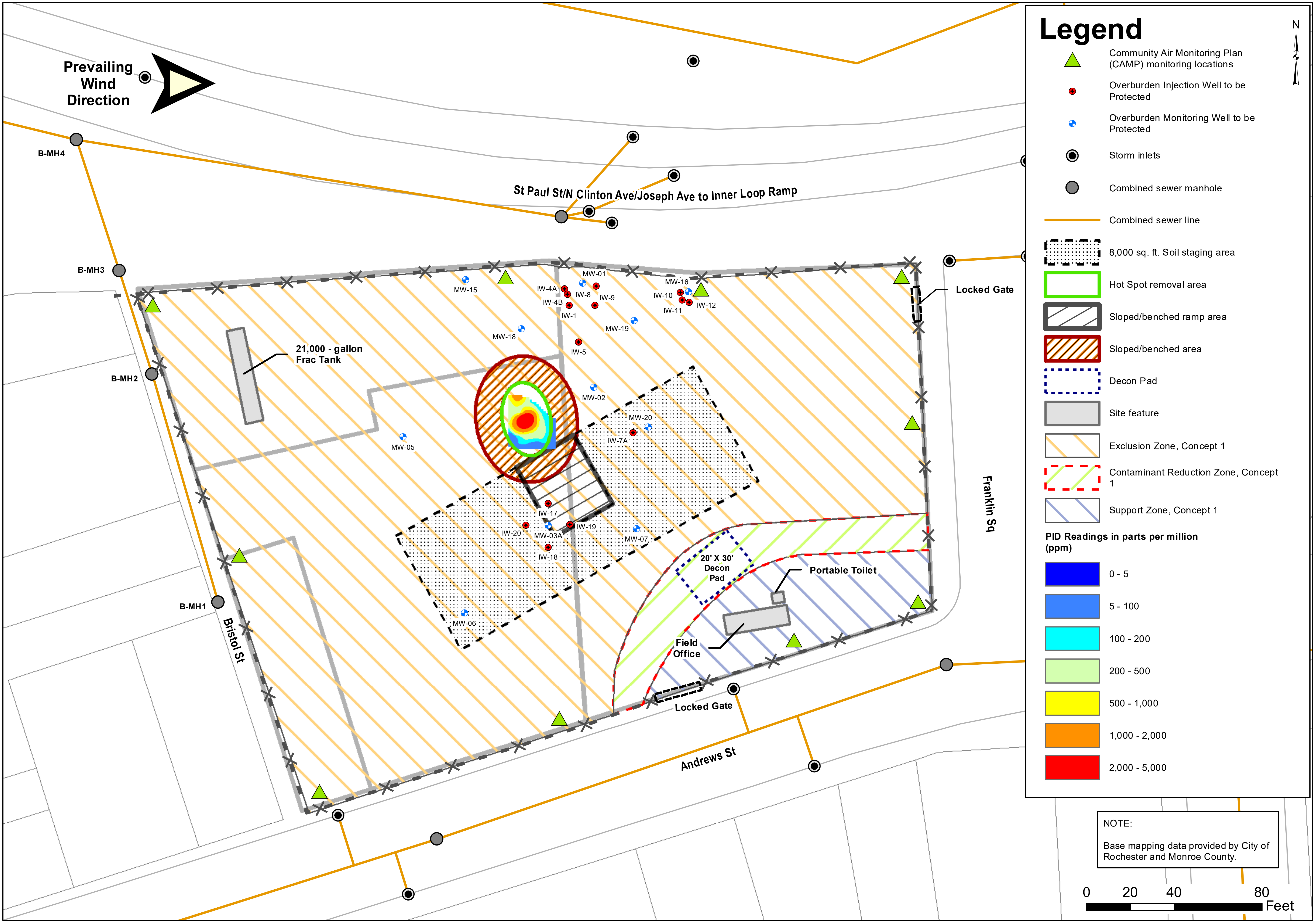
DRAWING TITLE
ROUTE FOR EMERGENCY SERVICES

PROJECT NO.
4355S-10

FIGURE 1

ATTACHMENT 2

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



Map document path: E:\GIS Mapping\Rocity\Andrews_Street\GIS_Data\Andrews_Street\OPC\5334S-05-OPC - H and S Concept 1.mxd

Last date document was saved: 15 Feb 2019

DESIGNED BY	DATE
JAD	02-2019
DRAWN BY	DATE DRAWN
CPS	02-2019
SCALE	DATE ISSUED
AS NOTED	02-15-2019

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 Layout Plan with Health and Safety Control Zones and CAMP Monitoring Locations

Project No.
5334S-17

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

Safety Data Sheets

hepure

POTASSIUM PERMANGANATE

SAFETY DATA SHEET

Reviewed on 8/12/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifier	**Potassium Permanganate**
1.2 Recommended use	Potassium Permanganate is an oxidant recommended for applications that require a strong oxidant.

1.3 Details of the supplier of the safety data sheet

Company:
Hepure Technologies, Inc.
63 Main Street, Suite 203B
Flemington, NJ 08822
Phone: 877-727-4776

1.4 Emergency telephone number

Emergency Phone #: CHEMTREC 1-800-424-9300

2. HAZARDS IDENTIFICATION

Physical hazards	Oxidizing solids	Category 2
Health hazards	Acute toxicity, oral	Category 4
	Skin corrosion/irritation	Category 1B
	Serious eye damage/eye irritation	Category 1
	Specific target organ toxicity, single exposure	Category 1 (Respiratory System)
	Specific target organ toxicity, repeated exposure	Category 1 (Respiratory System, Central Nervous System)
Environmental hazards	Hazardous to the aquatic environment, acute hazard	Category 1
	Hazardous to the aquatic environment, long-term hazard	Category 1
OSHA defined hazards	Not classified.	

Label elements

Signal word	Danger
Hazard statement	May intensify fire; oxidizer. Harmful if swallowed. Causes severe skin burns and eye damage. Causes damage to organs (Respiratory System). Causes damage to organs (Respiratory System, Central Nervous System) through prolonged or repeated exposure. Very toxic to aquatic life with long lasting effects.

Precautionary statement

Prevention

Keep away from heat. Keep/Store away from clothing and other combustible materials. Take any precaution to avoid mixing with combustibles. Do not breathe dust. Wash thoroughly after handling. Wear protective gloves/protective clothing/eye protection/face protection. Do not eat, drink or smoke when using this product. Avoid release to the environment.

Response

In case of fire: Use water for extinction. If swallowed: Rinse mouth. Do NOT induce vomiting. If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. Wash contaminated clothing before reuse. If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If inhaled: Remove person to fresh air and keep comfortable for breathing. Immediately call a poison center/doctor. If exposed: Call a poison center/doctor. Collect spillage.

Storage

Store locked up

Disposal

Dispose of contents/container in accordance with local/regional/national/international regulations.

Hazard(s) not otherwise classified (HNOC)

None known

3. COMPOSITION/INFORMATION ON INGREDIENTS

Substances

Chemical name	Common name and synonyms	CAS number	%
Potassium permanganate		7722-64-7	> 97.5

Composition comments

All concentrations are in percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

4. FIRST AID MEASURES

Inhalation

Remove victim to fresh air and keep at rest in a position comfortable for breathing. For breathing difficulties, oxygen may be necessary. Get medical attention immediately.

Skin contact

Take off immediately all contaminated clothing. Immediately flush skin with plenty of water. Get medical attention immediately. Wash contaminated clothing before reuse.

Contact with skin may leave a brown stain of insoluble manganese dioxide. This can be easily removed by washing with a mixture of equal volume of household vinegar and 3% hydrogen peroxide, followed by washing with soap and water.

Eye contact

Immediately flush with plenty of water for up to 15 minutes. Remove any contact lenses and open eyelids wide apart. Continue rinsing. Get medical attention immediately.

Ingestion

Immediately rinse mouth and drink plenty of water. Never give anything by mouth to a victim who is unconscious or is having convulsions. Do not induce vomiting. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs. Get medical attention immediately.

Most important symptoms/effects, acute and delayed

Contact with this material will cause burns to the skin, eyes and mucous membranes. Permanent eye damage including blindness could result.

Indication of immediate medical attention and special treatment needed

Provide general supportive measures and treat symptomatically. In case of shortness of breath, give oxygen. Decomposition products are alkaline. Brown stain is insoluble manganese dioxide.

General information

In the case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. Show this safety data sheet to the doctor in attendance. For personal protection, see Section 8 of the SDS. Wash contaminated clothing before reuse.

5. FIREFIGHTING MEASURES

Suitable extinguishing media	Flood with water from a distance, water spray or fog.
Unsuitable extinguishing media	The following extinguishing media are ineffective: Dry chemical. Foam. Carbon dioxide (CO_2). Halogenated materials.
Specific hazards arising from the chemical	May intensify fire; oxidizer. May ignite combustibles (wood, paper, oil, clothing, etc.). Contact with incompatible materials or heat (135 ºC / 275 ºF) could result in violent exothermic chemical reaction. Oxidizing agent, may cause spontaneous ignition of combustible materials. By heating and fire, corrosive vapors/gases may be formed.
Special protective equipment and precautions for firefighters	Self-contained breathing apparatus and full protective clothing must be worn in case of fire. Selection of respiratory protection for firefighting: follow the general fire precautions indicated in the workplace.
Fire-fighting equipment/instructions	Move container from fire area if it can be done without risk. Cool containers exposed to flames with water until well after the fire is out. Prevent runoff from fire control or dilution from entering streams, sewers, or drinking water supply. Dike fire control water for later disposal. Water runoff can cause environmental damage.
General fire hazards	The product is not flammable. May intensify fire; oxidizer. May ignite combustibles (wood, paper, oil, clothing, etc.). Contact with incompatible materials or heat (135 °C / 275 °F) could result in violent exothermic chemical reaction.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures	Keep unnecessary personnel away. Keep upwind. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Avoid inhalation of vapors and contact with skin and eyes. Wear protective clothing as described in Section 8 of this safety data sheet. Local authorities should be advised if significant spillages cannot be contained.
Methods and materials for containment and cleaning up	Keep combustibles (wood, paper, oil, etc.) away from spilled material. Should not be released into the environment. This product is miscible in water. Stop leak if possible without any risk. Dike the spilled material, where this is possible. Clean up spills immediately by sweeping or shoveling up the material. Do not return spilled material to the original container; transfer to a clean metal or plastic drum. To clean up potassium permanganate solutions, follow either of the following two options: Option # 1: Dilute to approximately 6% with water, and then reduce with sodium thiosulfate, a bisulfite or ferrous salt solution. The bisulfite or ferrous salt may require some dilute sulfuric acid (10% w/w) to promote reduction. Neutralize with sodium carbonate to neutral pH, if acid was used. Decant or filter and deposit sludge in approved landfill. Where permitted, the sludge may be drained into sewer with large quantities of water. Option # 2: Absorb with inert media like diatomaceous earth or inert floor dry, collect into a drum and dispose of properly. Do not use saw dust or other incompatible media. Disposal of all materials shall be in full and strict compliance with all federal, state, and local regulations pertaining to permanganates. To clean contaminated floors, flush with abundant quantities of water into sewer, if permitted by federal, state, and local regulations. If not, collect water and treat as described above. Never return spills in original containers for re-use. For waste disposal, see Section 13 of the SDS.
Environmental precautions	Do not allow to enter drains, sewers or watercourses. Contact local authorities in case of spillage to drain/aquatic environment.

7. HANDLING AND STORAGE

Precautions for safe handling	Take any precaution to avoid mixing with combustibles. Do not get this material in your eyes, on your skin, or on your clothing. Do not breathe dust or mist or vapor of the solution. Use personal protection as recommended in Section 8 of the SDS. If clothing becomes contaminated, remove and wash off immediately. When using, do not eat, drink or smoke. Good personal hygiene is necessary. Wash hands and contaminated areas with water and soap before leaving the work site. Avoid release to the environment.

Conditions for safe storage, including any incompatibilities
Store locked up. Keep container tightly closed and in a well-ventilated place. Store in a cool, dry place. Store away from incompatible materials (See Section 10). Store in accordance with NFPA 430 requirements for Class II oxidizers.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational exposure limits

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Components	Type	Value
Potassium permanganate (CAS 7722-64-7)	Ceiling	5 mg/m3

US. ACGIH Threshold Limit Values

Material	Type	Value	Form
Potassium Permanganate	TWA	0.1 mg/m3	Inhalable fraction.
		0.02 mg/m3	Respirable fraction.

Components	Type	Value	Form
Potassium permanganate (CAS 7722-64-7)	TWA	0.1 mg/m3	Inhalable fraction.
		0.02 mg/m3	Respirable fraction.

US. NIOSH: Pocket Guide to Chemical Hazards

Material	Type	Value	Form
Potassium Permanganate	TWA	1 mg/m3	Fume.

Components	Type	Value	Form
Potassium permanganate (CAS 7722-64-7)	STEL	3 mg/m3	Fume.
	TWA	1 mg/m3	Fume.

Biological limit values
No biological exposure limits noted for the ingredient(s).

Exposure guidelines
Follow standard monitoring procedures.

Appropriate engineering controls
Provide adequate general and local exhaust ventilation. An eye wash and safety shower must be available in the immediate work area.

Individual protection measures, such as personal protective equipment

Eye/face protection
Wear safety glasses with side shields (or goggles). Wear face shield if there is risk of splashes.

Skin protection

Hand protection
Wear chemical-resistant, impervious gloves. Use protective gloves made of: Rubber or plastic. Suitable gloves can be recommended by the glove supplier.

Other
Wear appropriate chemical resistant clothing. Rubber or plastic apron.

Respiratory protection
In case of inadequate ventilation or risk of inhalation of dust, use suitable respiratory equipment with particle filter. In the United States of America, if respirators are used, a program should be instituted to assure compliance with OSHA 29 CFR 1910.134.

Measurement Element: Manganese (Mn)
10 mg/m3
Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering face pieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100 or P100.
Any supplied-air respirator.

25 mg/m3
Any supplied-air respirator operated in a continuous-flow mode.
Any powered, air-purifying respirator with a high-efficiency particulate filter.

50 mg/m3
Any air-purifying, full-face piece respirator equipped with an N100, R100, or P100 filter.
Any supplied-air respirator with a tight-fitting face piece that is operated in a continuous-flow mode.

***Respiratory protection cont*.**
Any powered, air-purifying respirator with a tight-fitting face piece and a high-efficiency particulate filter.
Any self-contained breathing apparatus with a full face piece.
Any supplied-air respirator with a full face piece.

500 mg/m3
Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode.

Emergency or planned entry into unknown concentrations or IDLH conditions -
Any self-contained breathing apparatus that has a full face piece and is operated in a pressure-demand or other positive-pressure mode.

Escape
Any air-purifying, full-face piece respirator equipped with an N100, R100, or P100 filter.
Any appropriate escape-type, self-contained breathing apparatus.

Thermal hazards	Wear appropriate thermal protective clothing, when necessary.
General hygiene considerations	When using, do not eat, drink or smoke. Keep from contact with clothing and other combustible materials. Remove and wash contaminated clothing promptly. Wash hands before breaks and immediately after handling the product. Handle in accordance with good industrial hygiene and safety practice.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Dark purple solid with metallic luster.
Physical state	Solid.
Form	Solid.
Color	Dark purple.
Odor	Odorless.
Odor threshold	Not available.
pH	Not applicable.
Melting point/freezing point	Starts to decompose with evolution of oxygen (O2) at temperatures above 150 °C. Once initiated, the decomposition is exothermic and self-sustaining.
Initial boiling point and boiling range	Not applicable.
Flash point	Not applicable.
Evaporation rate	Not applicable.
Flammability (solid, gas)	Non flammable.
Upper/lower flammability or explosive limits	
Flammability limit – lower %	Not applicable
Flammability limit – upper %	Not applicable
Explosive limit – lower %	Not available
Explosive limit – upper %	Not available
Vapor pressure	< 0 kPa at 25°C .
Vapor density	Not applicable.
Relative density	2.7 (20 °C) (Water = 1)
Solubility(ies)	
Solubility (water)	6 % (20 °C)
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	Not available.
Decomposition temperature	464 °F (240 °C)
Viscosity	Not applicable.

Other information

Density	2.70 g/cm3
Explosive properties	Not explosive. Can explode in contact with sulfuric acid, peroxides and metal powders.
Molecular formula	H-Mn-O4.K
Molecular weight	158.03 g/mol 158.03
Oxidizing properties	Strong oxidizing agent.

10. STABILITY AND REACTIVITY

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Stable at normal conditions.
Possibility of hazardous reactions	Contact with combustible material may cause fire. Can explode in contact with sulfuric acid, peroxides and metal powders. Starts to decompose with evolution of oxygen (O_2) at temperatures above 150 °C. Once initiated, the decomposition is exothermic and self-sustaining.
Conditions to avoid	Contact with incompatible materials or heat (135 °C / 275 °F) could result in violent exothermic chemical reaction.
Incompatible materials	Acids. Peroxides. Reducing agents. Combustible material. Metal powders. Contact with hydrochloric acid liberates chlorine gas.
Hazardous decomposition products	By heating and fire, corrosive vapors/gases may be formed.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Ingestion	Harmful if swallowed.
Inhalation	May cause irritation to the respiratory system.
Skin contact	Causes severe skin burns.
Eye contact	Causes serious eye damage.
Symptoms related to the physical, chemical and toxicological characteristics	Contact with this material will cause burns to the skin, eyes and mucous membranes. Permanent eye damage including blindness could result.

Information on toxicological effects

Acute toxicity	Harmful if swallowed.

Components	**Species**	**Test Results**
Potassium permanganate (CAS 7722-64-7)		
Acute		
Dermal		
LD50	Rat	2000 mg/kg
Oral		
LD50	Rat	2000 mg/kg

Skin corrosion/irritation	Causes severe skin burns.
Serious eye damage/eye irritation	Causes serious eye damage
Respiratory or skin sensitization	
Respiratory sensitization	Not classified.
Skin sensitization	Not classified.
Germ cell mutagenicity	Not classified.
Carcinogenicity	Not classified.
Reproductive toxicity	Not classified.
Specific target organ toxicity - single exposure	Causes damage to organs (respiratory system).

Specific target organ toxicity – repeated exposure	Causes damage to organs (respiratory system, central nervous system) through prolonged or repeated exposure.
Aspiration hazard	Not classified
Chronic effects	May cause damage to respiratory system. Prolonged exposure, usually over many years, to manganese oxide fume/dust can lead to chronic manganese poisoning, chiefly affecting the central nervous system.

12. ECOLOGICAL INFORMATION

Ecotoxicity Very toxic to aquatic life with long lasting effects.

Components		Species	Test Results
Potassium permanganate (CAS 7722-64-7)			
Aquatic			
Fish	LC50	Bluegill (Lepomis macrochirus)	2.7 mg/l, 96 hours, static
			2.3 mg/l, 96 hours, flow through
			2.3 mg/l, 96 hours
			1.8 - 5.6 mg/l
		Carp (Cyprinus carpio)	3.16 - 3.77 mg/l, 96 hours
			2.97 - 3.11 mg/l, 96 hours
		Goldfish (Carassius auratus)	3.3 - 3.93 mg/l, 96 hours, static
		Milkfish, salmon-herring (Chanos chanos)	> 1.4 mg/l, 96 hours
		Rainbow trout (Oncorhynchus mykiss)	1.8 mg/l, 96 hours
			1.08 - 1.38 mg/l, 96 hours
			0.77 - 1.27 mg/l, 96 hours
		Rainbow trout,donaldson trout (Oncorhynchus mykiss)	0.275 - 0.339 mg/l, 96 hours

Persistence and degradability	Expected to be readily converted by oxidizable materials to insoluble manganese oxide.
Bioaccumulative potential	Potential to bioaccumulate is low.
Mobility in soil	The product is miscible with water. May spread in water systems.
Other adverse effects	None known.

13. DISPOSAL CONSIDERATIONS

Disposal instructions	Dispose of contents/container in accordance with local/regional/national/international regulations.
Hazardous waste code	D001: Ignitable waste The Waste code should be assigned in discussion between the user, the producer and the waste disposal company.
Waste from residues / unused products	Do not allow this material to drain into sewers/water supplies.
Contaminated packaging	Since emptied containers may retain product residue, follow label warnings even after container is emptied. Rinse container at least three times to an absence of pink color before disposing. Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 1490 Class: 5.1 Packing group: II

Environmental hazards	
Marine pollutant	Yes
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
Special provisions	IB8, IP2, IP4, T3, TP33
Packaging exceptions	152
Packaging non bulk	212
Packaging bulk	240
IATA	
UN number	UN1490
UN proper shipping name	Potassium permanganate
Transport hazard class(es)	
Class	5.1
Subsidiary risk	-
Label(s) Packing	5.1
group Environmental	II
hazards ERG Code	Yes
	5L
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
IMDG	
UN number	UN1490
UN proper shipping name	POTASSIUM PERMANGANATE
Transport hazard class(es)	
Class	5.1
Subsidiary risk	-
Label(s) Packing	5.1
group Environmental	II
hazards	
Marine pollutant	Yes
EmS	F-H, S-Q
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code	Not applicable.

15. REGULATORY INFORMATION

US federal regulations	This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200. All components are on the U.S. EPA TSCA Inventory List. Drug Enforcement Administration (DEA) (21 CFR 1310.02 (b) 8: List II chemical. Department of Homeland Security (DHS) Chemical Facility Anti-Terrorism Standards (6 CFR 27, Appendix A): Listed.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not listed.

CERCLA Hazardous Substance List (40 CFR 302.4)

Potassium permanganate (CAS 7722-64-7)	LISTED

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories	Immediate Hazard - Yes Delayed Hazard - Yes Fire Hazard - Yes Pressure Hazard - No Reactivity Hazard - No

SARA 302 Extremely hazardous substance

Not listed.

SARA 311/312 Hazardous chemical Yes

SARA 313 (TRI reporting)

Chemical name	CAS number	% by wt.
Potassium permanganate	7722-64-7	> 97.5

Other federal regulations

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Potassium permanganate (CAS 7722-64-7)

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

Clean Water Act (CWA) Section 112(r) (40 CFR 68.130) Hazardous substance

Safe Drinking Water Act (SDWA) Not regulated.

Drug Enforcement Administration (DEA). List 2, Essential Chemicals (21 CFR 1310.02(b) and 1310.04(f)(2) and Chemical Code Number

Potassium permanganate (CAS 7722-64-7) 6579

Drug Enforcement Administration (DEA). List 1 & 2 Exempt Chemical Mixtures (21 CFR 1310.12(c))

Potassium permanganate (CAS 7722-64-7) 15 % wt

DEA Exempt Chemical Mixtures Code Number

Potassium permanganate (CAS 7722-64-7) 6579

US state regulations This product does not contain a chemical known to the State of California to cause cancer, birth defects or other reproductive harm.

California OSH Hazardous Substance List: Listed.

US. Massachusetts RTK - Substance List

Potassium permanganate (CAS 7722-64-7)

US. New Jersey Worker and Community Right-to-Know Act

Potassium permanganate (CAS 7722-64-7)

US. Pennsylvania Worker and Community Right-to-Know Law

Potassium permanganate (CAS 7722-64-7)

US. Rhode Island RTK

Potassium permanganate (CAS 7722-64-7)

US. California Proposition 65

US - California Proposition 65 - Carcinogens & Reproductive Toxicity (CRT): Listed substance

Not listed.

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates this product complies with the inventory requirements administered by the governing country(s).
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. OTHER INFORMATION

Issue date	27-November-2013
Revision date	8/12/2016
Version #	02
Further information	HMIS® is a registered trade and service mark of the NPCA.

NFPA Ratings

List of abbreviations

GHS: Globally Harmonized System of Classification and Labeling of hazardous properties of Chemicals.
TWA: Time weighted average.
LD50: Lethal Dose, 50%.
LC50: Lethal Concentration, 50%.
IMDG: International Maritime Dangerous Goods.
IATA: International Air Transport Association.
MARPOL: International Convention for the Prevention of Pollution from Ships.

References

HSDB® - Hazardous Substances Data Bank
Registry of Toxic Effects of Chemical Substances (RTECS)
IARC Monographs. Overall Evaluation of Carcinogenicity
National Toxicology Program (NTP) Report on Carcinogens
ACGIH Documentation of the Threshold Limit Values and Biological Exposure Indices

Disclaimer

The information contained herein is accurate to the best of our knowledge. However, data, safety standards and government regulations are subject to change and, therefore, holders and users should satisfy themselves that they are aware of all current data and regulations relevant to their particular use of product. HEPURE TECHNOLOGIES, INC. DISCLAIMS ALL LIABILITY FOR RELIANCE ON THE COMPLETENESS OR ACCURACY OR THE INFORMATION INCLUDED HEREIN. HEPURE TECHNOLOGIES, INC. MAKES NO WARRANTY, EITHER EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY WARRANTIES OF MERCHANTIABILITY OR FITNESS FOR PARTICULAR USE OR PURPOSE OF THE PRODUCT DESCRIBED HEREIN. All conditions relating to storage, handling, and use of the product are beyond the control of Hepure Technologies, Inc., and shall be the sole responsibility of the holder or user of the product.

Safety Data Sheet

Infosafe No™ 1CH6W Issue Date : August 2014 RE-ISSUED by CHEMSUPP

Product Name : **SODIUM THIOSULFATE Pentahydrate**

Not classified as hazardous

1. Identification

GHS Product Identifier	SODIUM THIOSULFATE Pentahydrate
Company Name	CHEM-SUPPLY PTY LTD (ABN 19 008 264 211)
Address	38 - 50 Bedford Street GILLMAN SA 5013 Australia
Telephone/Fax Number	Tel: (08) 8440-2000 Fax: (08) 8440-2001
Recommended use of the chemical and restrictions on use	Photography (fixing agent to dissolve unchanged silver salts from exposed negatives), chrome tanning, removing chlorine in bleaching and papermaking, extraction of silver from its ores, dechlorination of water, mordant, analytical and laboratory reagent, bleaching, reducing agent in chrome dyeing, sequestrant in salt (up to 0.1%) and antidote for cyanide poisoning.

Other Names

Name	Product Code
SODIUM THIOSULFATE Pentahydrate LR	SL018
SODIUM THIOSULFATE Pentahydrate AR	SA018
Sodium hyposulfite,Sodium subsulfite	

Other Information

EMERGENCY CONTACT NUMBER: +61 08 8440 2000
Business hours: 8:30am to 5:00pm, Monday to Friday.

Chem-Supply Pty Ltd does not warrant that this product is suitable for any use or purpose. The user must ascertain the suitability of the product before use or application intended purpose. Preliminary testing of the product before use or application is recommended. Any reliance or purported reliance upon Chem-Supply Pty Ltd with respect to any skill or judgement or advice in relation to the suitability of this product of any purpose is disclaimed. Except to the extent prohibited at law, any condition implied by any statute as to the merchantable quality of this product or fitness for any purpose is hereby excluded. This product is not sold by description. Where the provisions of Part V, Division 2 of the Trade Practices Act apply, the liability of Chem-Supply Pty Ltd is limited to the replacement of supply of equivalent goods or payment of the cost of replacing the goods or acquiring equivalent goods.

2. Hazard Identification

GHS classification of the substance/mixture	Not classified as hazardous according to the Approved Criteria for Classifying Hazardous Substances [NOHSC:1008(2004] 3rd Edition, Safe Work Australia. Not classified as dangerous goods according to the Australian Dangerous Goods Code (ADG).
Signal Word (s)	None

3. Composition/information on ingredients

Chemical Characterization Solid

Ingredients

Name	CAS	Proportion	Hazard Symbol	Risk Phrase
Sodium thiosulfate pentahydrate	10102-17-7	95-100 %		

4. First-aid measures

Inhalation	Inhalation of any vapours from this product is not likely to present an acute hazard.
Ingestion	Rinse mouth thoroughly with water immediately. Give plenty of water to drink. Do not induce vomiting. Seek medical advice if effects persist.
Skin	Wash with plenty of soap and water. If irritation occurs seek medical advice.
Eye contact	Irrigate with copious quantity of water for 15 minutes. Seek medical assistance if symptoms persist.
First Aid Facilities	Maintain eyewash fountain and safety shower in work area.
Advice to Doctor	Treat symptomatically.
Other Information	For advice, contact the National Poisons Information Centre (Phone Australia 13 11 26; New Zealand 0800 764 766) or a doctor.

5. Fire-fighting measures

Hazards from Combustion Products	May librate toxic fumes in fire (sulfur oxides).

Specific Methods	No limitations to the type of extinguishing media. Use suitable measures to fight surrounding fire.
Specific hazards arising from the chemical	Material does not burn.
Decomposition Temp.	100 °C (release of crystalline water)
Precautions in connection with Fire	Use suitable protective clothing and breathing equipment for surrounding fire.

6. Accidental release measures

Personal Precautions	Avoid inhalation, contact with skin, eyes and clothing.
Personal Protection	Wear protective clothing specified for normal operations (see Section 8)
Clean-up Methods - Small Spillages	Sweep up (avoid generating dust) and remove to a suitable, clearly labelled container for disposal in accordance with local regulations.

7. Handling and storage

Precautions for Safe Handling	Avoid generation or accumulation of dusts. Wash hands and face thoroughly after working with material.
Conditions for safe storage, including any incompatabilities	Store in a cool,dry place. Store away from acids. Store away from oxidizing agents. Keep containers securely sealed and protected against physical damage.

8. Exposure controls/personal protection

Other Exposure Information	A time weighted average (TWA) concentration for an 8 hour day, and 5 day week has not been established by Safe Work Australia for this product. There is a blanket limit of 10 mg/m³ for dusts or mists when limits have not otherwise been established.
Appropriate engineering controls	In industrial situations maintain the concentrations values below the TWA. This may be achieved by process modification, use of local exhaust ventilation, capturing substances at the source, or other methods.
Respiratory Protection	Where ventilation is not adequate, respiratory protection may be required. Avoid breathing dust, vapours or mists. Respiratory protection should comply with AS 1716 - Respiratory Protective Devices and be selected in accordance with AS 1715 - Selection, Use and Maintenance of Respiratory Protective Devices. Filter capacity and respirator type depends on exposure levels. In event of emergency or planned entry into unknown concentrations a positive pressure, full-facepiece SCBA should be used. If respiratory protection is required, institute a complete respiratory protection program including selection, fit testing, training, maintenance and inspection.
Eye Protection	The use of a face shield, chemical goggles or safety glasses with side shield protection as appropriate. Must comply with Australian Standards AS 1337 and be selected and used in accordance with AS 1336.
Hand Protection	Hand protection should comply with AS 2161, Occupational protective gloves - Selection, use and maintenance. Recommendation: Rubber or plastic gloves.
Personal Protective Equipment	Final choice of personal protective equipment will depend on individual circumstances and/or according to risk assessments undertaken.
Footwear	Safety boots in industrial situations is advisory, foot protection should comply with AS 2210, Occupational protective footwear - Guide to selection, care and use.
Body Protection	Clean clothing or protective clothing should be worn, preferably with an apron. Clothing for protection against chemicals should comply with AS 3765 Clothing for Protection Against Hazardous Chemicals.
Hygiene Measures	Always wash hands before smoking, eating or using the toilet. Wash contaminated clothing and other protective equipment before storing or re-using.

9. Physical and chemical properties

Form	Solid
Appearance	White translucent crystals or powder.
Odour	Odourless.
Decomposition Temperature	100 °C (release of crystalline water)

Melting Point	48 °C
Solubility in Water	Soluble (680 g/L @ 20 °C)
Solubility in Organic Solvents	Soluble in oil of turpentine. Insoluble in alcohol.
Specific Gravity	1.74
pH	6.0 - 7.5 (100 g/l, H_2O, 20 °C)
Flammability	Non combustible material.
Molecular Weight	248.18
Other Information	Deliquescent in moist air. Efflorescent above 33 °C in dry air. Cooling taste and bitter aftertaste.

10. Stability and reactivity

Chemical Stability	Stable under normal use conditons.
Conditions to Avoid	Strong heating. Incompatibles.
Incompatible Materials	Sodium nitrate, nitrites, halogens, acids, fluorine, oxidising agents, peroxi compounds, iodine, silver salts, mercury salts, lead.
Hazardous Decomposition Products	Sulfur oxides, hydrogen sulfides.
Possibility of hazardous reactions	Reacts with acids to release sulfur dioxide, a highly toxic gas by inhalation. Sulfur dioxide is detectable by taste at 1 ppm and smell at approximately 4 ppm, providing some warning of unsuitable working conditions.
Hazardous Polymerization	Will not occur.

11. Toxicological Information

Acute Toxicity - Oral	LD50 (rat): > 5000 mg/kg
Ingestion	May be harmful if swallowed. May cause mild irritation to the gastrointestinal tract. Diarrhea, nausea and vomiting may occur by ingestion of large quantities.
Inhalation	May be harmful if inhaled. May cause respiratory tract irritation with symptoms including coughing and shortness of breath.
Skin	May be harmful if absorbed through the skin. May cause skin irritation.
Eye	May cause mechanical irritation to the eye.
Carcinogenicity	No evidence of carcinogenic properties.
Chronic Effects	Repeated or prolonged skin contact may cause chronic dermatitis.
Mutagenicity	No evidence of mutagenic properties.

12. Ecological information

Ecological Information	No ecological problems are to be expected when the product is handled and used with due care and attention.
Bioaccumulative Potential	No bioaccumulation is expected (log P(o/w<1) log P(o/w) -4.53 anhydrous material.
Acute Toxicity - Fish	LC50 (P. promelas): > 10000 mg/l/96 h.
Acute Toxicity - Daphnia	EC50 (Daphnia magna): 1223 mg/l/48 h.
Acute Toxicity - Other Organisms	Further ecologic data: COD: 0.322 g/g COD: 99% from TOD.

13. Disposal considerations

Disposal Considerations	Whatever cannot be saved for recovery or recycling should be disposed of according to relevant local, state and federal government regulations.

14. Transport information

Transport Information	Not classified as a Dangerous Good according to the Australian Code for the Transport of Dangerous Goods by Road and Rail.

15. Regulatory information

Regulatory Information	Listed in the Australian Inventory of Chemical Substances (AICS).
Poisons Schedule	Not Scheduled

16. Other Information

Date of preparation or last revision of SDS	August 2009.
Literature References	'Standard for the Uniform Scheduling of Medicines and Poisons No. 4', Commonwealth of Australia, June 2013. Lewis, Richard J. Sr. 'Hawley's Condensed Chemical Dictionary 13th. Ed.', Rev., John Wiley and Sons, Inc., NY, 1997. National Road Transport Commission, 'Australian Code for the Transport of Dangerous Goods by Road and Rail 7th. Ed.', 2007. 'Labelling of Hazardous Workplace Chemicals, Code of Proctice' Safe Work Australia. Standards Australia 'AS 1940-2004 The Storage and Handling of Flammable and Combustible Liquids. Standards Australia, 'SAA/SNZ HB 76:2010 Dangerous Goods - Initial Emergency Response Guide', Standards Australia/Standards New Zealand, 2010. Worksafe Australia, 'Approved Criteria for Classifying Hazardous Substances [NOHSC:1008(2004)]'. Worksafe Australia, 'Hazardous Substances Information System, 2005'. Worksafe Australia, 'National Code of Practice for the Labelling of Workplace Hazardous Substances (2011)'. Worksafe Australia, 'National Exposure Standards for Atmospheric Contaminants in the Occupational Environment [NOHSC:1003(1995)]'.
Contact Person/Point	Paul McCarthy Ph. (08) 8440 2000 DISCLAIMER STATEMENT: All information provided in this data sheet or by our technical representatives is compiled from the best knowledge available to us. However, since data, safety standards and government regulations are subject to change and the conditions of handling and use, or misuse, are beyond our control, we make no warranty either expressed or implied, with respect to the completeness or accuracy to the information contained herein. Chem-Supply accepts no responsibility whatsoever for its accuracy or for any results that may be obtained by customers from using the data and disclaims all liability for reliance on information provided in this data sheet or by our technical representatives.
Empirical Formula & Structural Formula	$Na_2 S_2 O_3 \cdot 5H_2O$

...End Of MSDS...

Safety Data Sheet

Hydrogen Peroxide, 3%

CAROLINA®
www.carolina.com

Section 1 Product Description

Product Name:	Hydrogen Peroxide, 3%
Recommended Use:	Science education applications
Synonyms:	Hydrogen Peroxide Solution
Distributor:	Carolina Biological Supply Company 2700 York Road, Burlington, NC 27215 1-800-227-1150
Chemical Information:	800-227-1150 (8am-5pm (ET) M-F)
Chemtrec:	800-424-9300 (Transportation Spill Response 24 hours)

Section 2 Hazard Identification

Classification of the chemical in accordance with paragraph (d) of §1910.1200;

DANGER

Causes skin irritation. Causes serious eye damage.

GHS Classification:
Serious Eye Damage/Eye Irritation Category 1, Skin Corrosion/Irritation Category 2

Section 3 Composition / Information on Ingredients

Chemical Name	CAS #	%
Water	7732-18-5	97
Hydrogen Peroxide	7722-84-1	3

Section 4 First Aid Measures

Emergency and First Aid Procedures

Inhalation:	In case of accident by inhalation: remove casualty to fresh air and keep at rest.
Eyes:	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
Skin Contact:	IF ON SKIN: Wash with plenty of soap and water. If skin irritation occurs: Get medical advice/attention. Take off contaminated clothing and wash before reuse.
Ingestion:	If swallowed, do not induce vomiting: seek medical advice immediately and show this container or label.

Section 5 Firefighting Procedures

Extinguishing Media:	Use media suitable to extinguish surrounding fire.
Fire Fighting Methods and Protection:	Firefighters should wear full protective equipment and NIOSH approved self-contained breathing apparatus.
Fire and/or Explosion Hazards:	N/A
Hazardous Combustion Products:	Carbon dioxide, Carbon monoxide

Section 6 Spill or Leak Procedures

Steps to Take in Case Material Is Released or Spilled: Exposure to the spilled material may be irritating or harmful. Follow personal protective equipment recommendations found in Section 8 of this SDS. Additional precautions may be necessary based on special circumstances created by the spill including; the material spilled, the quantity of the spill, the area in which the spill occurred. Also consider the expertise of employees in the area responding to the spill.
Prevent the spread of any spill to minimize harm to human health and the environment if safe to do so. Wear complete and proper personal protective equipment following the recommendation of Section 8 at a minimum. Dike with suitable absorbent material like granulated clay. Gather and store in a sealed container pending a waste disposal evaluation.

Section 7 Handling and Storage

Handling: Wash thoroughly after handling. Wear protective gloves/protective clothing/eye protection/face protection. Do not breathe dust/vapor. Do not get in eyes, on skin, or on clothing. Retained residue may make empty containers hazardous; use caution.
Storage: Suitable for any general chemical storage.
Avoid direct sunlight and heat.
Storage Code: Green - general chemical storage

Section 8 Protection Information

	ACGIH		OSHA PEL	
Chemical Name	**(TWA)**	**(STEL)**	**(TWA)**	**(STEL)**
Hydrogen Peroxide	1 ppm TWA	N/A	1 ppm TWA; 1.4 mg/m3 TWA	N/A

Control Parameters

Engineering Measures: Local exhaust ventilation or other engineering controls are normally required when handling or using this product to avoid overexposure.
Personal Protective Equipment (PPE): Lab coat, apron, eye wash, safety shower.
Respiratory Protection: No respiratory protection required under normal conditions of use.
Eye Protection: Wear chemical splash goggles when handling this product. Have an eye wash station available.
Skin Protection: Avoid skin contact by wearing chemically resistant gloves, an apron and other protective equipment depending upon conditions of use. Inspect gloves for chemical break-through and replace at regular intervals. Clean protective equipment regularly. Wash hands and other exposed areas with mild soap and water before eating, drinking, and when leaving work.
Gloves: Neoprene, Nitrile

Section 9 Physical Data

Formula: H202 (aq)
Molecular Weight: 34.01 g/mol
Appearance: Colorless Liquid
Odor: None
Odor Threshold: No data available
pH: 6.0-8.0
Melting Point: No data available
Boiling Point: 100 C
Flash Point: No data available
Flammable Limits in Air: N/A

Vapor Pressure: N/A
Evaporation Rate (BuAc=1): N/A
Vapor Density (Air=1): 1.2 (air = 1)
Specific Gravity: 1.01
Solubility in Water: Soluble
Log Pow (calculated): No data available
Autoignition Temperature: No data available
Decomposition Temperature: No data available
Viscosity: No data available
Percent Volatile by Volume: 100%

Section 10 Reactivity Data

Reactivity: No data available
Chemical Stability: Stable under normal conditions.
Conditions to Avoid: None known.
Incompatible Materials: Water-reactive materials, Metals (powdered)
Hazardous Polymerization: Will not occur

Section 11 Toxicity Data

Routes of Entry Inhalation, ingestion, eye or skin contact.

Symptoms (Acute):	Eye Irritation, Respiratory Irritation
Delayed Effects:	No data available

Acute Toxicity:

Chemical Name	CAS Number	Oral LD50	Dermal LD50	Inhalation LC50
Water	7732-18-5	Oral LD50 Rat 90000 mg/kg		
Hydrogen Peroxide	7722-84-1	Oral LD50 Rat 910 mg/kg Oral LD50 Rat 376 mg/kg	Dermal LD50 Rat 4060 mg/kg	INHALATION LC50 Rat 2 GM/M3

Carcinogenicity:

Chemical Name	CAS Number	IARC	NTP	OSHA
No data available		Not listed	Not listed	Not listed

Chronic Effects:

Mutagenicity:	No evidence of a mutagenic effect.
Teratogenicity:	No evidence of a teratogenic effect (birth defect).
Sensitization:	No evidence of a sensitization effect.
Reproductive:	No evidence of negative reproductive effects.
Target Organ Effects:	
Acute:	Skin, Eyes
Chronic:	No data available

Section 12 Ecological Data

Overview:	This material is not expected to be harmful to the ecology.
Mobility:	No data
Persistence:	No data
Bioaccumulation:	No data
Degradability:	No data
Other Adverse Effects:	No data

Chemical Name	CAS Number	Eco Toxicity
Water	7732-18-5	No data available
Hydrogen Peroxide	7722-84-1	96 HR LC50 PIMEPHALES PROMELAS 16.4 MG/L 24 HR EC50 DAPHNIA MAGNA 7.7 MG/L 72 HR EC50 CHLORELLA VULGARIS 2.5 MG/L

Section 13 Disposal Information

Disposal Methods:	Dispose in accordance with all applicable Federal, State and Local regulations. Always contact a permitted waste disposer (TSD) to assure compliance.
Waste Disposal Code(s):	This material is not considered to be a RCRA hazardous waste.

Section 14 Transport Information

Ground - DOT Proper Shipping Name:	**Air - IATA Proper Shipping Name:**
Not regulated for transport by DOT	Not regulated for air transport by IATA.

Section 15 Regulatory Information

TSCA Status: All components in this product are on the TSCA Inventory.

Chemical Name	CAS Number	§ 313 Name	§ 304 RQ	CERCLA RQ	§ 302 TPQ	CAA 112(2) TQ
Hydrogen Peroxide	7722-84-1	No	No	No	1000 lb TPQ (concentration >52%)	No

Section 16 Additional Information

Safety Data Sheet

Revised: 09/10/2015 **Replaces: 09/10/2015** **Printed: 10-29-2015**

The information provided in this (Material) Safety Data Sheet represents a compilation of data drawn directly from various sources available to us. Carolina Biological Supply makes no representation or guarantee as to the suitability of this information to a particular application of the substance covered in the (Material) Safety Data Sheet.

Glossary

ACGIH	American Conference of Governmental Industrial Hygienists	NTP	National Toxicology Program
		OSHA	Occupational Safety and Health Administration
CAS	Chemical Abstract Service Number	PEL	Permissible Exposure Limit
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	ppm	Parts per million
		RCRA	Resource Conservation and Recovery Act
DOT	U.S. Department of Transportation	SARA	Superfund Amendments and Reauthorization Act
IARC	International Agency for Research on Cancer	TLV	Threshold Limit Value
N/A	Not Available	TSCA	Toxic Substances Control Act
		IDLH	Immediately dangerous to life and health

Safety Data Sheet
Vinegar, all varieties

SDS Revision Date: 07/20/2015

1. Identification

1.1. Product identifier

Product Identity	Vinegar, all varieties
Alternate Names	Vinegar, all varieties

1.2. Relevant identified uses of the substance or mixture and uses advised against

Intended use	See Technical Data Sheet.
Application Method	See Technical Data Sheet.

1.3. Details of the supplier of the safety data sheet

Company Name	National Vinegar Company P.O. Box 255 108 Chessen Lane Alton, IL 62002
Emergency	
24 hour Emergency Telephone No.	(800) 783-3822 (618) 465-6532
Customer Service: National Vinegar Company	(800) 783-3822 (618) 465-6532

2. Hazard(s) identification

2.1. Classification of the substance or mixture

No applicable GHS categories.

2.2. Label elements

Using the Toxicity Data listed in section 11 and 12 the product is labeled as follows.

No applicable GHS categories.

[Prevention]:

No GHS prevention statements

[Response]:

No GHS response statements

[Storage]:

No GHS storage statements

[Disposal]:

No GHS disposal statements

3. Composition/information on ingredients

This product contains the following substances that present a hazard within the meaning of the relevant State and Federal Hazardous Substances regulations.

Ingredient/Chemical Designations	Weight %	GHS Classification	Notes
Acetic acid **CAS Number:** 0000064-19-7	1.0 - 10	Flam. Liq. 3;H226 Skin Corr. 1B; H314: 25% ≤ C < 90% Eye Irrit. 2; H319: 10% ≤ C < 25% Skin Corr. 1A; H314: C ≥ 90% Skin Irrit. 2; H315: 10% ≤ C < 25%	[1][2]

In accordance with paragraph (i) of §1910.1200, the specific chemical identity and/or exact percentage (concentration) of composition has been withheld as a trade secret.
[1] Substance classified with a health or environmental hazard.
[2] Substance with a workplace exposure limit.
[3] PBT-substance or vPvB-substance.
*The full texts of the phrases are shown in Section 16.

4. First aid measures

4.1. Description of first aid measures

General	In all cases of doubt, or when symptoms persist, seek medical attention. Never give anything by mouth to an unconscious person.
Inhalation	If vapors are inhaled extensively, exposed person should be removed to fresh air immediately. Seek medical attention if irritation continues.
Eyes	Irrigate copiously with clean water for at least 15 minutes, holding the eyelids apart and seek medical attention.
Skin	In case of skin contact, flush immediately and thoroughly with water. Saturated clothing should be removed and washed. Seek medical attention if irritation continues.
Ingestion	If swallowed, water should be consumed to dilute. Do not induce vomiting. Do not give emetics or baking soda. Seek medical attention.

4.2. Most important symptoms and effects, both acute and delayed

Overview	INHALATION: Avoid breathing vapors. Inhalation of vapors can cause irritation to respiratory tract. SKIN: Contact may cause mild injury and burns from vinegar of 10% acetic acid and greater. Dilute solutions may cause dermatitis in some sensitive individuals. EYES: Avoid contact with eyes. If not removed promptly, will injure eye tissue which may result in permanent damage, including blindness. INGESTION: Concentrated vinegars may cause pain, irritation, and burns in mouth, esophagus, and stomach.

5. Fire-fighting measures

5.1. Extinguishing media

As appropriate for surrounding fire.

5.2. Special hazards arising from the substance or mixture

Hazardous decomposition: Decomposition will not occur if handled and stored correctly.

5.3. Advice for fire-fighters

Vinegar will not burn.

ERG Guide No. ----

6. Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Put on appropriate personal protective equipment (see section 8).

6.2. Environmental precautions

Use good personal hygiene practices. Wash hands before eating, drinking, smoking or using toilet. Promptly remove soiled clothing and wash thoroughly before reuse.

6.3. Methods and material for containment and cleaning up

Water may be used to dilute. Treat or dispose of waste material as a weak acid in accordance with all local, state, and national requirements.

Contain, dilute cautiously with water, and neutralize with soda ash or lime.

7. Handling and storage

7.1. Precautions for safe handling

Avoid breathing vapors. Avoid contact with eyes, skin and clothing. Wash contaminated clothing before reuse.

7.2. Conditions for safe storage, including any incompatibilities

Handle containers carefully to prevent damage and spillage.

Incompatible materials: Strong oxidizing agents, strong bases

Store in a well-ventilated place.

7.3. Specific end use(s)

No data available.

8. Exposure controls and personal protection

8.1. Control parameters

Exposure

CAS No.	Ingredient	Source	Value
0000064-19-7	Acetic acid	OSHA	TWA 10 ppm (25 mg/m^3)
		ACGIH	TWA: 10 ppm STEL: 15 ppm
		NIOSH	TWA 10 ppm (25 mg/m^3) ST 15 ppm (37 mg/m^3)
		Supplier	No Established Limit

Carcinogen Data

CAS No.	Ingredient	Source	Value
0000064-19-7	Acetic acid	OSHA	Select Carcinogen: No
		NTP	Known: No; Suspected: No
		IARC	Group 1: No; Group 2a: No; Group 2b: No; Group 3: No; Group 4: No;

8.2. Exposure controls

Respiratory	None needed under normal use conditions with adequate ventilation.
Eyes	Wear safety glasses with side shields to protect the eyes. An eye wash station is suggested as a good workplace practice.
Skin	None needed for proper use in accordance with label direction. Where prolonged or frequently repeated contact could occur, use protective clothing or gloves to minimize skin contamination. Chemical impervious gloves required.
Engineering Controls	Good general ventilation should be sufficient.
Other Work Practices	Use good personal hygiene practices. Wash hands before eating, drinking, smoking or using toilet. Promptly remove soiled clothing and wash thoroughly before reuse.

9. Physical and chemical properties

Appearance	Liquid
Odor	Appropriate
Odor threshold	Not determined
pH	2.2 @ 100 grain
Melting point / freezing point	Below 26°F @ 100 grain
Initial boiling point and boiling range	214°F
Flash Point	Not applicable
Evaporation rate (Ether = 1)	Not available
Flammability (solid, gas)	Not Applicable
Upper/lower flammability or explosive limits	**Lower Explosive Limit:** Not applicable **Upper Explosive Limit:** Not applicable
Vapor pressure (Pa)	16.9 mmHg @ 100 grain
Vapor Density	2.1 (Air = 1)
Specific Gravity	1.01 @ 100 grain
Solubility in Water	Complete
Partition coefficient n-octanol/water (Log Kow)	Not Measured
Auto-ignition temperature	Not applicable
Decomposition temperature	Not available
Viscosity (cSt)	Not available
% Volatile	100%

9.2. Other information

No other relevant information.

10. Stability and reactivity

10.1. Reactivity

Hazardous Polymerization will not occur.

10.2. Chemical stability

Stable under normal circumstances.

10.3. Possibility of hazardous reactions

No data available.

10.4. Conditions to avoid

Excessive heat and open flame.

10.5. Incompatible materials

Strong oxidizing agents, strong bases

10.6. Hazardous decomposition products

Decomposition will not occur if handled and stored correctly.

11. Toxicological information

Acute toxicity

Ingredient	Oral LD50, mg/kg	Skin LD50, mg/kg	Inhalation Vapor LC50, mg/L/4hr	Inhalation Dust/Mist LC50, mg/L/4hr	Inhalation Gas LC50, ppm
Acetic acid - (64-19-7)	3,310.00, Rat - Category: 5	1,112.00No data available 4	No data available	No data available	16,000.00, Rat - Category: NA

Note: When no route specific LD50 data is available for an acute toxin, the converted acute toxicity point estimate was used in the calculation of the product's ATE (Acute Toxicity Estimate).

Classification	Category	Hazard Description
Acute toxicity (oral)	---	Not Applicable
Acute toxicity (dermal)	---	Not Applicable
Acute toxicity (inhalation)	---	Not Applicable
Skin corrosion/irritation	3	Causes mild skin irritation. (Not adopted by US OSHA)
Serious eye damage/irritation	---	Not Applicable
Respiratory sensitization	---	Not Applicable
Skin sensitization	---	Not Applicable
Germ cell mutagenicity	---	Not Applicable
Carcinogenicity	---	Not Applicable
Reproductive toxicity	---	Not Applicable
STOT-single exposure	---	Not Applicable

STOT-repeated exposure	---	Not Applicable
Aspiration hazard	---	Not Applicable

12. Ecological information

12.1. Toxicity

No additional information provided for this product. See Section 3 for chemical specific data.

Aquatic Ecotoxicity

Ingredient	96 hr LC50 fish, mg/l	48 hr EC50 crustacea, mg/l	ErC50 algae, mg/l
Acetic acid - (64-19-7)	79.00, Pimephales promelas	65.00, Daphnia magna	73.40 (96 hr), Navicula seminulum

12.2. Persistence and degradability

There is no data available on the preparation itself.

12.3. Bioaccumulative potential

Not Measured

12.4. Mobility in soil

No data available.

12.5. Results of PBT and vPvB assessment

This product contains no PBT/vPvB chemicals.

12.6. Other adverse effects

No data available.

13. Disposal considerations

13.1. Waste treatment methods

Observe all federal, state and local regulations when disposing of this substance.

14. Transport information

Note: Product RQ (lbs) – Quantity containing the equivalent of 5,000 lbs of 100% acetic acid (e.g. 50,000 lbs of vinegar containing 10% acetic acid)

	DOT (Domestic Surface Transportation)	IMO / IMDG (Ocean Transportation)	ICAO/IATA
14.1. UN number	Not Applicable	Not Regulated	Not Regulated
14.2. UN proper shipping name	Not Regulated	Not Regulated	Not Regulated
14.3. Transport hazard	**DOT Hazard Class:** Not	**IMDG:** Not Applicable	**Air Class:** Not

class(es)	Applicable	**Sub Class:** Not Applicable	Applicable
14.4. Packing group	Not Applicable	Not Applicable	Not Applicable

14.5. Environmental hazards

IMDG Marine Pollutant: No

14.6. Special precautions for user

No further information

15. Regulatory information

Regulatory Overview	The regulatory data in Section 15 is not intended to be all-inclusive, only selected regulations are represented.
Toxic Substance Control Act (TSCA)	All components of this material are either listed or exempt from listing on the TSCA Inventory.
WHMIS Classification	Not Regulated

US EPA Tier II Hazards

Fire: No
Sudden Release of Pressure: No
Reactive: No
Immediate (Acute): Yes
Delayed (Chronic): No

EPCRA 311/312 Chemicals and RQs (lbs):

Acetic acid (5,000.00)

EPCRA 302 Extremely Hazardous:
To the best of our knowledge, there are no chemicals at levels which require reporting under this statute.

EPCRA 313 Toxic Chemicals:
To the best of our knowledge, there are no chemicals at levels which require reporting under this statute.

Proposition 65 - Carcinogens (>0.0%):
To the best of our knowledge, there are no chemicals at levels which require reporting under this statute.

Proposition 65 - Developmental Toxins (>0.0%):
To the best of our knowledge, there are no chemicals at levels which require reporting under this statute.

Proposition 65 - Female Repro Toxins (>0.0%):
To the best of our knowledge, there are no chemicals at levels which require reporting under this statute.

Proposition 65 - Male Repro Toxins (>0.0%):
To the best of our knowledge, there are no chemicals at levels which require reporting under this statute.

New Jersey RTK Substances (>1%):

Acetic acid

Pennsylvania RTK Substances (>1%):

Acetic acid

16. Other information

The information and recommendations contained herein are based upon data believed to be correct. However, no guarantee or warranty of any kind, expressed or implied, is made with respect to the information contained herein. We accept no responsibility and disclaim all liability for any harmful effects which may be caused by exposure to our products. Customers/users of this product must comply with all applicable health and safety laws, regulations, and orders.

The full text of the phrases appearing in section 3 is:

H226 Flammable liquid and vapor.

H314 Causes severe skin burns and eye damage.

H319 Causes serious eye irritation.

This is the first version in the GHS SDS format. Listings of changes from previous versions in other formats are not applicable.

The information is furnished without warranty, expressed or implied, except that it is accurate to the best of the preparer's knowledge. The data on this sheet are related only to the specific material designated herein. The preparer assumes no legal responsibility.

End of Document

ATTACHMENT 5

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 #:____________________

SITE:__Andrews Street Site (E828144)____________________

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:/fieldforms/Air Monitoring

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

day
DAY ENVIRONMENTAL, INC.

ENVIRONMENTAL CONSULTANTS
AN AFFILIATE OF DAY ENGINEERING, P.C.

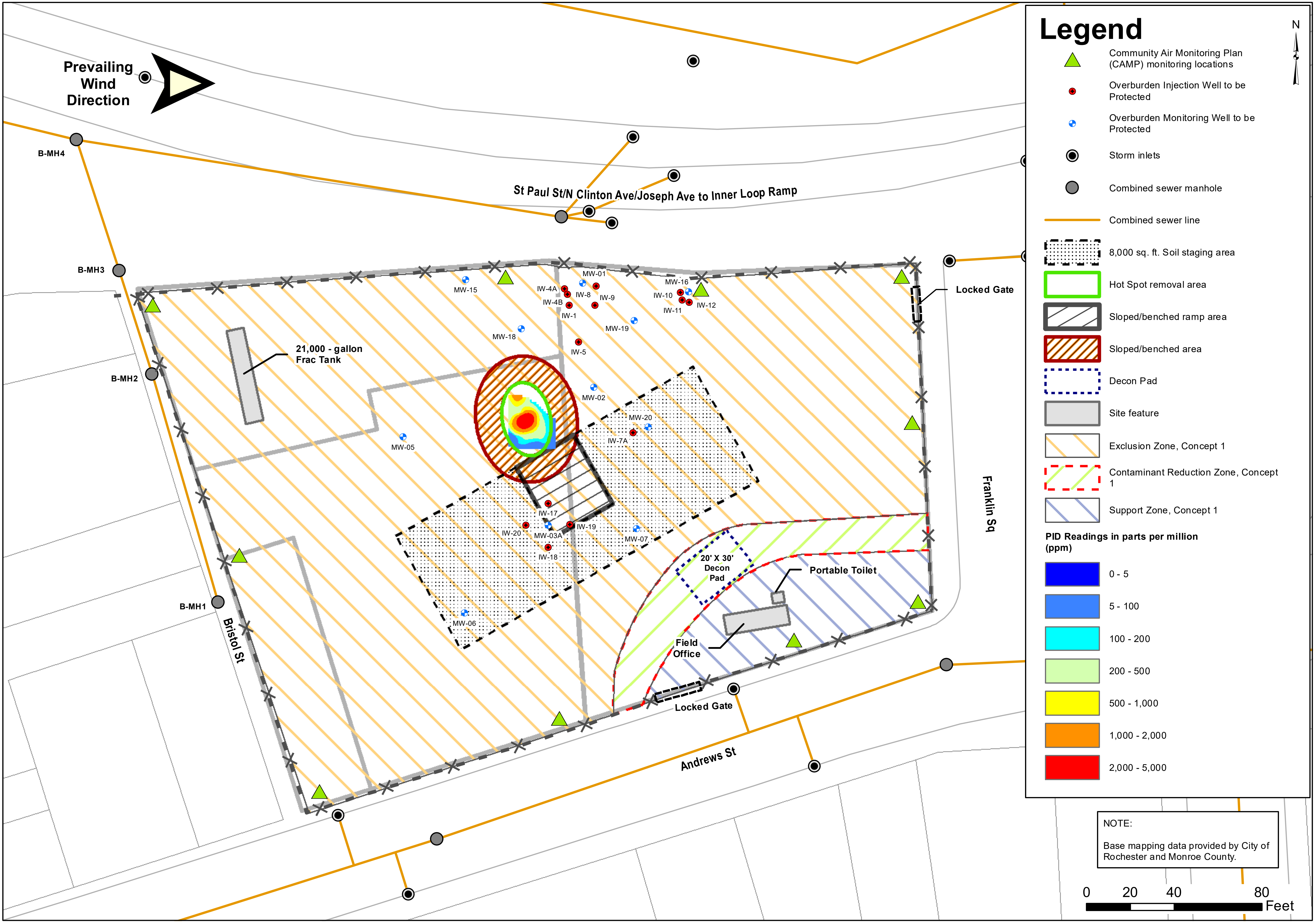
AIR MONITORING REPORT SHEET (Continued)

DATE:_____________________ PAGE:_______ OF _________

JOB #:_____________________

DESCRIPTION	TIME	LOCATION	PID (ppm)	PARTICULATES (mg/m3)

DESCRIPTION: BZ = Breathing Zone, BG = Upwind Background, CAMP = Outside work area/at property boundary
S:/fieldforms/Air Monitoring



NOTE:

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

Map document path: E:\GIS Mapping\Rocity\Andrews_Street\GIS_Data\Andrews_Street\OPC\5334S-05-OPC - H and S Concept 1.mxd

Last date document was saved: 15 Feb 2019

DATE 02-2019	DATE DRAWN 02-2019	DATE ISSUED 02-15-2019
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
Site Layout Plan with Health and Safety Control Zones and CAMP Monitoring Locations

Project No.
5334S-17

FIGURE 2

APPENDIX B

Quality Assurance Project Plan

QUALITY ASSURANCE PROJECT PLAN
FOR SUPPLEMENTAL POLISHING PHASE REMEDIAL ACTIONS

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

Prepared By: Day Engineering, P.C.
1563 Lyell Avenue
Rochester, New York 14606

Project No.: 5334s-19

Date: August 7, 2019

TABLE OF CONTENTS

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 Polishing Phase Remedial Action 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 work will include, but is not limited to removal of a localized area of dense glacial till soil that is contaminated with chlorinated volatile organic compounds (CVOCs), supplemental in-situ chemical oxidation (ISCO) treatment of the excavation area, characterization and disposal of contaminated soil and project-derived wastes, and performance groundwater monitoring. The anticipated number of analytical samples is provided in the Supplemental Polishing Phase Remedial Actions Work Plan. Detailed discussions of the project scope and project goals are also provided in that Work Plan. In general, the project goal is to sufficiently complete supplemental polishing phase remedial actions to further address remaining CVOC contamination at the Site, and demonstrate the effectiveness of the supplemental polishing phase remedial actions.

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 Supplemental Polishing Phase Remedial Action Work Plan.

2.1 City Project Manager

Mr. Dennis Peck will serve as the City of Rochester (City) Project Manager on this project. Mr. Peck 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 Engineering, P.C. (DAY) is provided below. Resumes of DAY's key personnel were included in the NYSDEC-approved August 2011 Remedial Investigation/Remedial Alternatives Analysis (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 Laboratory

The following analytical laboratory will continue to be used during the Supplemental Polishing Phase Remedial Actions:

- 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.

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.

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 Site's 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) unit. Operation and calibration of on-site monitoring equipment that are anticipated for use during the 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 PPE as noted in the HASP. The primary field instrument for monitoring VOCs during the work will be a photoionization detector (PID). It is anticipated that a MiniRAE 3000 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 and as necessary during fieldwork in accordance with the manufacturer's specifications. Isobutylene gas will be used as the calibration gas for the PID. Measurements will be collected along the upwind perimeter of the work area before operations begin 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 Geo7X 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 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 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 General Boring Screening and Logging

For replacement monitoring well MW-17A, a DAY representative will: document visual observations; screen split spoon samples with a PID; collect portions of the samples (and process and screen the headspace of these selected samples with a PID); photograph the test boring work; and prepare a test boring log that provides pertinent field information. Pertinent information will be recorded on a test boring log and monitoring well construction diagram, which 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.

3.3 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 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.

3.4 Well Development

New monitoring well MW-17A will 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 the well.

The well development procedure is listed below:

- Obtain pre-development static water level and oil/water interface reading for the presence of light non-aqueous phase liquid (LNAPL) or dense non-aqueous phase liquid (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 a water quality meter;
- 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, or 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 the well will be recorded on well development log.

3.5 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 or stainless steel length of metal chain 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 opening the cap on the top of the PDB and decanting the water in the PDB 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 Polishing Phase Remedial Actions Work Plan.

3.6 Waste Characterization Sampling

Project-derived waste will be managed in accordance with the guidelines outlined in the Supplemental Polishing Phase Remedial Action Work Plan. Supplemental sampling of the project-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 project-derived waste sampling is to characterize a substantial mass of waste requiring disposal. The following protocols likely apply to project-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.

A decontamination pad will be constructed on-site for decontamination of trucks, equipment, and personnel to prevent tracking of contaminated residuals (refer to the Supplemental Polishing Phase Remedial Action 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 nitrile gloves. Between collection of samples, personnel performing the sampling will discard used 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) 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 required by the specified test method will be adhered.

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 at the Site. The number will then continue in succession. The sample test location will also be provided after the sample number using the following test location designations:
>
> | | |
> |---|---|
> | WS-xx | Waste sample with number |
> | 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 waste sample and the first sample number to be used is 980, the sample will be designated as 980-WS-01.

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. When feasible, 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 project-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 will make every effort to analyze the samples using the lowest practical quantitation limits possible for Site media samples. In addition, analytical laboratory results for samples of Site media will be provided to the NYSDEC using the NYSDEC's Equis Format.

Chemtech will provide internal QA/QC checks that are required by NYSDEC ASP and/or United States Environmental Protection Agency (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 Statement of Qualifications (SOQ) that was 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 Supplemental Polishing Phase Remedial Actions Work Plan identifies 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 in that 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).

Reporting

Analytical and QC data will be included in a 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 are 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 the new monitoring well MW-17A that will be completed as part of the 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
CVOC	Chlorinated Volatile Organic Compound
DAY	Day Engineering, P.C.
DNAPL	Dense Non-Aqueous Phase Liquid
ELAP	Environmental Laboratory Approval Program
GPS	Global Positioning System
HASP	Health and Safety Plan
ISCO	In-Situ Chemical Oxidation
LNAPL	Light Non-Aqueous Phase Liquid
MDL	Method Detection Limit
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NTU	Nephelometric Turbidity Units
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
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
SOQ	Statement of Qualification
TCL	Target Compound List
TIC	Tentatively Identified Compound
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound