

FINAL REPORT
AUGUST 2024

Country Cleaners Site Soil Vapor Extraction Pilot Study Work Plan



Prepared for:

**New York State Department of Environmental Conservation
Investigation and Design Engineering Services**

STANDBY CONTRACT/WORK ASSIGNMENT NO.: D009805-10





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Acronyms and Abbreviations

°F	degrees Fahrenheit
µg/L	micrograms per liter
ACFM	actual cubic feet per minute
amsl	above mean sea level
AWQS	ambient water quality standards
BEI	Berninger Environmental, Inc.
bgs	below ground surface
CAMP	community air monitoring plan
CDM Smith	Camp Dresser McKee & Smith
cis-1,2-DCE	cis-1,2- dichloroethylene
COC	contaminant of concern
DCE	dichloroethylene
Earth Tech	Earth Tech Northeast, Inc.
ESD	Explanation of Significant Difference
GAC	granular activated carbon
GSS	Getty Service Station
Hg	mercury
IDW	investigation-derived waste
ISCO	in situ chemical oxidation
KO tank	knock-out tank
mg/kg	milligrams per kilogram
MIP	membrane interface probe
MiHPT	membrane interface probe hydraulic profiling tool
MTBE	methyl-tert-butyl ether
NYCRR	New York Codes, Regulations and Rules
NYSDEC	New York Department of Environmental Conservation
P&ID	piping and instrumentation diagram
PCE	tetrachloroethylene

PID	photoionization detector
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
RAO	remedial action objective
RD	remedial design
ROD	record of decision
SCDHS	Suffolk County Department of Health Services
SCO	soil cleanup objective
SVE	soil vapor extraction
TCE	trichloroethene
VOC	volatile organic compound
VFD	variable-frequency drive
VMP	vapor monitoring probe
WC	water column
ZEBRA	ZEBRA Environmental Corporation
ZOI	zone of influence



1.0 Introduction and Background Information

1.1 Introduction

Camp Dresser McKee & Smith (CDM Smith) prepared this pilot study work plan for the New York Department of Environmental Conservation (NYSDEC) under the Standby Contract/Work Assignment No. D009805-10 for the Country Cleaners State Superfund Site 152187 (the site). The objective of the pilot test is to provide a basis for a remedial design (RD) for the potential full-scale soil vapor extraction (SVE) system proposed to remove volatile organic compounds (VOCs) mass from soil within the site source area.

1.2 Site Description and History

The site is located at 410 West Main Street, Huntington, Suffolk County, New York at the southeast corner of West Main Street and Hillside Avenue (Figure 1-1). The Suffolk County Property Tax Map identifies the site as Section 69, Block 3, Lot 1. The site is 0.226 acres and consists of an active single-story dry-cleaning facility with a small anterior parking lot. It is bordered by Nathan Hale Condominiums, a large residential complex to the north; residential properties to the west and south; and a service station to the east. The property east of the site was previously occupied by Getty Service Station and is currently occupied by Lawrence Hill Services Inc.

The site tenants conducted on-site dry-cleaning operations from at least 1985 to present day. Such tenants include Country Cleaners, Pamper Cleaners, and the current tenant, Jim Dandy Cleaners. Jim Dandy Cleaners ceased on-site dry-cleaning operations using chlorinated solvents in 2007 but continued operations on-site. Jim Dandy Cleaners still performs garment care, alterations and dry-cleaning operations on-site with hydrocarbon based dry cleaning solvent.

1.3 Previous Site Investigations and Remedial Actions

The following section summarizes the site's key investigative and remedial milestones.

A limited 1996 investigation at the current Lawrence Hill Services Inc. property performed by Berninger Environmental, Inc. revealed elevated levels of methyl-tert-butyl ether (MTBE), tetrachloroethylene (PCE), and trichloroethene (TCE) in the groundwater. Monitoring wells installed on the Lawrence Hill Services Inc. property had elevated contaminant concentrations of MTBE (960 micrograms per liter [$\mu\text{g/L}$]), PCE (2,170 $\mu\text{g/L}$), and TCE (398 $\mu\text{g/L}$) in monitoring well 2 (MW-2) located immediately north of the building (Figure 1-2 in Appendix A). MTBE was presumed to be a result of on-site operations at the Lawrence Hill Services Inc. property; however, PCE and TCE were suspected to be a result of an upgradient source (AECOM 2011). Therefore, following these investigations, NYSDEC was contacted to investigate the potential upgradient source of contamination for PCE and TCE (i.e., Pamper Cleaners).

Suffolk County Department of Health Services (SCDHS), under the oversight of NYSDEC, performed follow up investigations from 1997 to 2000. On October 20, 1997, SCDHS collected four soil samples from the site: two from a storm drain, one near the laundry boiler blowdown system, and one underneath a condensate pipe (Figure 1-2 in Appendix A). The sampling locations were within the narrow rear yard located on the south side of the site; however, the depth of the samples and method

of collection is unknown (AECOM 2011). The analytical results confirmed that there was an elevated concentration of PCE in the soil underneath the condensate pipe (12,000 milligrams per kilogram [mg/kg]). This was identified to be a likely source of PCE to groundwater, as confirmed by an on-site groundwater sample from MW-1 (also located in the narrow rear yard south of the site) which had elevated levels of PCE above applicable NYSDEC ambient water quality standards (AWQS) Class GA (1,888 µg/L).

In December 2001, under SCDHS' direction and oversight, the owner remediated the storm drain located near the southeast corner of the on-site building. This effort resulted in the excavation and removal of 1,000 gallons of oily water and 26 tons of contaminated soil and sediments to a depth of 26 feet. The extents of this investigation are unknown; however, the excavation was performed within the area surrounding the former storm drain shown on Figure 1-2 in Appendix A. An unknown quantity of soil was also removed from the unpaved portions of the yard. However, subsequent investigation adjacent to the excavation area confirmed that there was residual PCE contamination near the southeastern corner of the on-site building. The investigation also revealed the location of an old floor drain beneath the boiler room floor. NYSDEC suspected that the drain was a contributing source of groundwater contamination given that it represented a possible point of past discharges. NYSDEC was ultimately unable to investigate the drain and its piping because the drain was directly underneath a newly installed boiler (AECOM 2011).

Due to the residual chlorinated solvent contamination in the soil and groundwater, NYSDEC designated the site as a Class 2 inactive hazardous waste disposal site in 2003. In October 2007, NYSDEC contracted Earth Tech Northeast, Inc. (Earth Tech) to conduct a remedial investigation at the site. Earth Tech, under AECOM, submitted a dynamic work plan in March 2008, detailing the method for determining the nature and extent of site related contaminants (Earth Tech 2008). AECOM initiated the remedial investigation in July 2008. The purpose of the remedial investigation was to delineate the horizontal and vertical extents of any residual subsurface soil and the associated groundwater plume. The investigation consisted of three phases including: a membrane interface probe (MIP) investigation (July 2008); direct push soil sampling and Hydropunch groundwater sampling (September 2008–February 2009); and groundwater monitoring well installation and sampling (December 2009–February 2010). The remedial investigation report submitted by AECOM confirmed that chlorinated solvents and their associated daughter products (e.g., PCE, TCE, and cis-1,2-dichloroethylene [cis-1,2-DCE]) are the principal contaminants of concern (COCs) (AECOM 2011). The report further discussed the extent of contamination, the fate and transport of contaminants, and the contamination's threat to human health or the environment. Ultimately, the remedial investigation identified only minimal residual soil PCE contamination, mainly residing in the southwestern corner of the Lawrence Hill Services Inc. property, just east of Jim Dandy Cleaners. However, the soil investigation was only limited to a select set of soil borings where halogenated VOC MIP peaks were previously identified. Only one boring (MIP-33/SS-33) was advanced east of the Jim Dandy Cleaners property, and this location had the highest PCE soil concentration detected at 2.5 mg/kg from 33 to 34 feet below ground surface (bgs) (Figure 3-2 in Appendix A). This was also the only location that exceeded the unrestricted use soil cleanup objectives (SCOs) during the remedial investigation. No soil samples exceeded the commercial use SCOs. The groundwater plume identified during the remedial investigation extends from behind the Jim Dandy Cleaners property across Main Street north toward the Nathan Hale Apartments approximately 420 feet

(Figure 6-1 in Appendix A). The most elevated groundwater detections for PCE were identified at both the Hydropunch (Figure 3-1 in Appendix A) and monitoring well sample locations (Figure 3-3 in Appendix A) immediately north of both the Jim Dandy Cleaners and Lawrence Hill Services Inc. buildings. The highest PCE concentration detected in groundwater from samples collected from the monitoring wells was 680 µg/L at MW-4S (Figure 3-3 in Appendix A).

Due to lack of detections and exceedances of COCs identified during the remedial investigation, AECOM primarily focused their feasibility study report on the existing groundwater plume. AECOM released a feasibility study report in January 2012 (AECOM 2012). In addition, NYSDEC issued the Record of Decision (ROD) in March 2012 which identified a selected remedy for groundwater that included both in-situ chemical oxidation (ISCO) and in-situ bioremediation. Section 1.4 describes the ROD selected remedy for the site in greater detail.

A pre-design investigation and ISCO pilot study were performed at the site in September 2015 by HDR (HDR 2015). The pilot study evaluated the use of sodium permanganate to treat PCE contaminated groundwater. The study results suggested that sodium permanganate would be successful in reducing PCE concentrations below the groundwater quality standards via multiple rounds of injections. A site RD was completed in 2017 (HDR 2017).

In September and October 2019 Environmental Assessment & Remediations (EAR) performed the first round of injections at the site (EAR 2019) as a part of the remedial action. All 21 injection wells installed at the site were injected with sodium permanganate (Figures 1-2 and 1-3). Several weeks later, in November 2019 HDR performed groundwater sampling at 13 wells (HDR 2020). HDR noted increases in PCE concentrations at several wells (IW-3, IW-6, IW-9, MW-3S, and IW-18) compared to historical concentrations and concluded that a continuing source of contamination may be present in the vicinity of these wells. These wells are mainly located in the center line of the plume on the Lawrence Hill Services Inc. property with the exception of IW-3, which is located along the rear drive behind the Jim Dandy Cleaners. The wells that had increases in PCE concentrations, were located within the area or downgradient of the area where the one soil exceedance of the unrestricted use SCOs was identified east of the Jim Dandy Cleaners during the remedial investigation.

In support of the continuing remedial action at the site, NYSDEC contracted CDM Smith to conduct a pre-injection groundwater sampling event (CDM Smith 2021), based on the recommendations from the HDR ISCO Injection Results Summary report (HDR 2020). Based on the evaluation of the pre-injection round of groundwater samples collected in December 2020, the lack of delineation along the northern and western edges of the plume was deemed a data gap. Findings also indicated that the injections performed may not have been successful due to the in-situ delivery methods, meaning the format of the injections in an array along the centerline of the plume may not have been effective and may have caused mobilization of contaminant mass further downgradient. Additionally, findings indicated the potential for VOC mass present in too high of concentrations for the injectant mass to effectively treat. NYSDEC agreed that additional characterization and delineation of contamination was warranted at the site, in order to pursue any next steps in regard to the remedy. Therefore, CDM Smith, with the approval of NYSDEC, performed a supplemental remedial investigation in 2022 for additional contamination characterization and delineation (Figure 1-3) (CDM Smith 2023). The following paragraph describes the supplemental remedial investigation activities.

The 2022 supplemental remedial investigation included advancing 13 membrane interface probe-hydraulic profiling tool (MiHPT) screening locations, collection of both soil and groundwater screening samples, and installation and sampling of three offsite monitoring wells (Figure 1-2). A total of 15 soil and 18 groundwater samples were collected during the event. Groundwater results indicated that PCE concentrations remain above the AWQS Class GA on- and off-site (Figure 1-3). Soil sample results identified PCE concentrations above unrestricted use SCOs in a limited area of unsaturated soil east of the site building (Figure 1-4). Analytical results of the 2022 investigation are provided in Tables 1-1, 1-2, and 1-3.

In addition to the supplemental remedial investigation, a limited subsurface investigation was performed in 2023 by CDM Smith. A total of two borings were installed via angled drilling methods to collect soil and groundwater samples beneath the boiler room at the southeast portion of the on-site building (CDM Smith 2024b) to determine if any residual source was present underneath the building where a former floor drain that potentially had PCE discharges is present beneath the existing boiler. The angled borings were able to reach soils beneath the boiler room. However, as no borings were able to be completed inside the building, soils immediately beneath the floor drain were not able to be sampled. Sampling depths were limited to where the angled borings were able to reach, approximately 20 to 48 feet bgs in the vicinity of the boiler room. This investigation did not identify soil with VOC concentrations above unrestricted SCOs at the depths sampled. Groundwater concentrations were similar to results from wells near the south side of the Jim Dandy Cleaners building. No obvious residual source of soil contamination beneath this area of the building was identified. Therefore, the defined area to the east of the building remained as the main focus area with identified unsaturated soil impacts.

In February 2024, based on the 2022 supplemental remedial investigation and 2023 investigation results, CDM Smith and NYSDEC proposed to implement a pilot test to evaluate SVE as a remedy for remediating unsaturated soil exceeding SCOs. For the purposes of this work plan, the soils exceeding the protection of groundwater SCOs (generally equivalent to the unrestricted use SCOs) will be the soils targeted as these are considered to be the most likely to continuously impact groundwater within the site area. CDM Smith recommended SVE on the basis that it would increase the efficiency of the ISCO/bioremediation remedy by reducing PCE mass in the vadose zone, reducing the mass flux from vadose zone soils to groundwater, and would have minimal impact on site operations. NYSDEC approved this technology and CDM Smith provided an Explanation of Significant Difference (ESD) to NYSDEC for public use in March 2024 (NYSDEC 2024).

1.3.1 Conceptual Site Model Summary

A majority of the Jim Dandy Cleaners property and the Lawrence Hill Services Inc. property are covered by asphalt pavement, concrete-covered sidewalks, and concrete building slabs. A portion of sloped unpaved land exists in between the two properties. The Jim Dandy Cleaners building sits approximately 8 feet higher than the Lawrence Hill Services Inc. parking lot. Soil underlying the site mainly consists of medium to coarse sands with some silt and areas of more notable gravel and cobble content down to a depth of approximately 100 feet bgs. Groundwater is encountered at different depths throughout the site due to the varying topography within the site area; despite this, the groundwater gradient is

relatively shallow (0.0025 feet/foot), and the groundwater is present at roughly 50 feet above mean sea level (amsl). Groundwater generally flows north-northeast (Figure 1-2).

The site sustained releases of PCE to the ground over time due to poor operating practices and poor infrastructure by one or more dry cleaning businesses operating at the 410 W Main Street property. The site operated as a dry cleaner that used chlorinated solvents from approximately 1985 to 2007. The exact nature of the release is generally unknown. However, based on sampling performed during the initial source area investigation in the late 1990s, PCE contamination was found in the subsurface underneath a condensate pipe and near a storm drain system. Therefore, it can be presumed that the source of the contamination was via one or multiple of these outlets. Additionally, a floor drain present within the back portion of the building has also been suspected to have historical releases to its structure. Although, the soils beneath the drain structure have never been immediately investigated as a large boiler has been placed on top of it.

Contaminant migration pathways include release mechanisms at the site, impacts to and leaching from shallow soils, and transport in groundwater and soil vapor. Prior soil, soil vapor, and groundwater sampling identified such pathways. It is expected that PCE product released, within the southeastern corner of the site property, to the subsurface made its way to the groundwater table via migration of PCE product through preferential pathways within the subsurface soil. A total of 26 tons of contaminated soil was excavated behind the Jim Dandy Cleaners building but remaining contamination in soil was still noted following the excavation activities. The recent subsurface investigations did provide evidence that vadose zone soil contamination is present within the parking area west of the Lawrence Hill Services Inc building. Soil contamination is expected along the slopped hillside between the two properties, and some very shallow soil contamination may also be present beneath the floor drain now covered by a boiler within the Jim Dandy Cleaners building. The current associated groundwater plume extends from behind the dry cleaners to approximately 380 feet downgradient to the north. The chlorinated solvent contamination extends vertically from the water table (55 ft bgs) to approximately 70 feet bgs.

1.4 ROD and ESD Requirements

As stated, in the March 2012 ROD, NYSDEC selected ISCO followed by in situ bioremediation as the site remedy. However, as discussed, this remedy is not sufficient in addressing residual soil contamination within the vadose zone. Therefore, in February 2024, CDM Smith proposed the use of SVE to address the continuing source of groundwater and soil vapor contamination in the vadose zone, thus improving the efficiency of the selected remedy (CDM Smith 2024a). NYSDEC approved the addition of SVE in February 2024. The decision was written in an ESD prepared for NYSDEC (NYSDEC 2024). The ROD-specified and ESD-adjusted remedy consists of the following elements as of March 2024:

- An RD program that provides the details necessary for the construction, operation, maintenance, and monitoring of the remedial program and implements, to the extent feasible, green remediation principles and techniques in accordance with the NYSDEC Division of Environmental Remediation-31.
- SVE followed by ISCO and in situ bioremediation on site and near the site with SVE and in-situ bioremediation only in the off-site downgradient locations. EAR previously implemented the

ISCO remedy in September and October 2019. They installed 21 injection wells at the site and injected each of them with sodium permanganate.

- Imposition of an institutional control in the form of an environmental easement for the controlled property that achieves the following:
 - Requires the remedial party or site owner to complete and submit to NYSDEC a periodic certification of institutional and engineering controls in accordance with Part 375-1.8(h)(3)
 - Allows the use and development of the controlled property for commercial and industrial uses as defined by Part 375-1.8(g), although land use is subject to local zoning laws
 - Restricts the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the New York State Department of Health or County Department of Health
 - Prohibits agriculture or vegetable gardens on the controlled property
 - Requires compliance with the NYSDEC-approved Site Management Plan
- A Site Management Plan which includes an Institutional and Engineering Control Plan, an Operation and Maintenance Plan, and a Monitoring and Sampling Plan.

1.5 Remedial Action Objectives

The March 2012 ROD defined the following remedial action objectives (RAOs) for this site:

Groundwater

RAOs for Public Health Protection consist of the following:

- Prevent ingestion of groundwater with contaminant levels exceeding drinking water standards
- Prevent contact with, or inhalation of volatiles, from contaminated groundwater

RAOs for Environmental Protection consist of the following:

- Restore groundwater aquifer to pre-disposal/pre-release conditions, to the extent practicable
- Prevent the discharge of contaminants to surface water
- Remove the source of groundwater or surface water contamination

Soil Vapor

RAOs for Public Health Protection include the following actions:

- Mitigate impacts to public health resulting from existing, or the potential for soil vapor intrusion into buildings at the site

The completion of the SVE pilot study and potential full-scale implementation of SVE will aid in achieving the above RAOs. The intention of the SVE is to remediate any residual subsurface soil contamination to the extent practicable within the vadose that is contributing to the groundwater contamination at and within the vicinity of the site. Therefore, soils within the vadose are planned to be cleaned up to the

protection of groundwater SCOs, to accomplish these RAOs. The SVE pilot will also determine how effective SVE can be in reducing the impacts of soil vapor intrusion into the Jim Dandy Cleaners building.

1.6 Technology Description

1.6.1 SVE

SVE is an in-situ remediation technology that removes VOCs from vadose zone and capillary fringe soils. SVE withdraws vapor from the subsurface using vacuum blowers and vapor extraction wells. The contaminated vapors are typically collected (at the surface), treated, and then discharged to the atmosphere. The induced advection of air draws clean air through the contaminated vadose zone, promoting transfer of contaminants from the subsurface soil matrix to the vapor phase. An SVE system typically consists of an air/water separator to remove entrained moisture and condensate, a particulate filter, a blower, valves, gauges, piping, and a vapor treatment system. The type of vapor treatment system selected is based on the nature and concentrations of the contaminants. Chlorinated solvents can typically be treated with granular activated carbon (GAC).

1.7 Pilot Test Objectives

The primary objective of the pilot testing is to collect data that will aid in selecting the most appropriate design parameters for a potential full-scale SVE system. Specific objectives of the pilot testing include the following:

- Determine the design parameters for the full-scale design, including flow rate versus vacuum, the zone of influence (ZOI) for SVE wells, condensate production, and the spatial distribution of SVE points needed
- Obtain estimates for baseline soil gas concentrations and mass removal rates
- Collect vapor and condensate data for equipment sizing during the full-scale design
- Determine the overall remedial effectiveness of an SVE system at the site based on mass removal rates, SVE well ZOIs, and other measured operational parameters
- Refine estimate of extent of vadose zone soil contamination based on soil sampling analytical results and vadose zone lithology

1.8 Testing Approach

The SVE pilot testing will consist of two types of tests: an SVE Step Test and an Extended Operations Test. The SVE Step Test will be performed to evaluate the relationship between the applied vacuum at the SVE well and the resulting flow rates and preliminary subsurface vacuum distribution. The Extended Operations Test is intended to provide design information for implementation of SVE technology once near-equilibrium pressure and flow conditions are established via operation for several days (i.e., specific design criteria for the RD).



2.0 Pilot Test Design and Procedures

2.1 Test Apparatus

This section describes the wells, monitoring points, and equipment that will be used to perform and monitor the pilot testing. All work will be performed in accordance with the procedures detailed in this document. In addition, work will be performed in accordance with the CDM Smith Generic Quality Assurance Project Plan prepared for use under the NYSDEC Standby Contract for Engineering Services D009805 (CDM Smith 2020).

2.1.1 Well Installation

The SVE well network will consist of two SVE well pairs (SVE-01S/D and SVE-02S/D), two vapor pins (PIN-01 and PIN-02), and five vapor monitoring probes (VMPs) (VMP-01-1/2/3 through VMP-05-1/2/3). The SVE wells will be installed in the parking lot of the Lawrence Hill Services Inc. property where the highest level of vadose zone contamination was observed at the site. The vapor pins will be installed inside southern portion of the Jim Dandy Cleaners building to monitor sub-slab vapor. The VMPs will be installed at varied distances and directions radiating outward from the SVE wells to allow for evaluation of size and directionality of the SVE ZOI. The VMPs will be installed at locations within the Lawrence Hill Services Inc. property and the Jim Dandy Cleaners property. The proposed well locations are shown in Figures 2-1 through 2-3, and the proposed well construction details are summarized in Table 2-1 and shown on Figure 2-4.

2.1.1.1 SVE System Wells

Elevated VOC levels in vadose zone soil were encountered during January 2022 soil sampling at depths from approximately 15 feet bgs (88 feet amsl) to the water table, which was measured at approximately 52 feet bgs (51 feet amsl) in the Lawrence Hill Services Inc. property parking lot (i.e., the area of highest measured VOCs) during synoptic water level measurement activities performed in December 2020. Two SVE well pairs will be installed at the location of highest measured VOCs, spaced approximately 15 feet apart. Installing these wells in the immediate vicinity of highest soil PCE concentration, measured at MIP-10, will yield the largest amount of contaminant mass available within the ZOI of the SVE wells for removal during the pilot test. The wells will be spaced 15 feet apart because 15 feet is a typical, conservative estimate of an SVE system ROI, so this spacing will provide the largest combined ZOI for the two well locations while also capturing the space between the two locations. Additionally, installing four separated SVE wells will allow for 1) a more precise estimate of the SVE ZOI based on the distances between each SVE well VMP, and 2) evaluating the impact on performance parameters of operating multiple SVE wells at the same time. The wells will be installed as deep and shallow well pairs to account for the limited vertical delineation of vadose zone contaminant mass and limited characterization of subsurface lithology. By comparing mass removal rates of the shallow and deep wells, vertical distribution of contaminant mass can be determined, and treatment intervals can be selected for the full-scale system to target contaminant mass. Also, by providing well pairs at each location, less flow will be anticipated in each individual well, which will be easier to manage and control.

The proposed SVE wells layout is shown in Figures 2-1 through 2-3.

To capture the full vertical extent of impacted vadose zone soil and assess differences in efficacy of SVE at varied depths across the vadose zone, both SVE well pairs will be screened at two depths: 78 to 93 feet amsl and 59 to 74 feet amsl. Installation depths bgs will vary due to varied surface elevations; however, approximate depths are 13 to 28 feet bgs and 32 to 47 feet bgs (SVE-01). During installation, if the groundwater table is encountered shallower than anticipated, well screens will be adjusted shallower; the screens will be installed as close to the planned intervals as possible while maintaining at least 3 vertical feet between the groundwater table and the bottom of the deeper screen and at least 3 vertical feet between the two screens.

A utility survey will be performed prior to the start of drilling operations. The locations of the wells to be installed will be modified as needed to avoid impacting underground utilities. Concrete cutting is anticipated and will be performed to allow for installation of the wells into the existing parking lot surface. Each SVE well pair will be constructed within two adjacent 8-inch diameter boreholes, installed using hollow stem auger drilling methods or alternative methods as recommended by the drilling subcontractor. The wells will be installed with 4-inch-diameter polyvinyl chloride (PVC) screens and risers, filter packs around each screen, and grout/bentonite seals to the surface and between screens within each borehole. SVE wells will be completed with a well pad with a flush mount vault and traffic-rated well box lid.

2.1.1.2 Sub-Slab Vapor Sampling Points

Two permanent sub-slab sampling points (referred to herein as vapor pins) will be installed in the sub-slab of the Jim Dandy Cleaners building using VaporPin® sub-slab sampling devices. The two vapor pins will be located in the southwest and southeast corners of the building to coincide with the locations sampled during the winter 2024 vapor sampling event performed by CDM Smith. The vapor pins will be used to monitor VOC concentrations and induced vacuum in the sub-slab. The vapor pins can be used in current and future vapor sampling at the site. The proposed layout of the two vapor pins (PIN-01 and PIN-02) is shown on Figures 2-1 through 2-3. The vapor pins will be installed in accordance with the Installation and Extraction of the VaporPin® Standard Operating Procedure (VaporPin® 2020).

2.1.1.3 Vapor Monitoring Points

Five VMPs will be installed in the vadose zone to monitor vapors at varying radial distances from SVE-01S/D (approximately 10, 20, 30, 40, and 45 feet) and SVE-02S/D (approximately 5, 15, 25, 33, and 50 feet) to determine the ZOI. The proposed layout of the five VMPs (VMP-01-1/2/3, VMP-02-1/2/3, VMP-03-1/2/3, VMP-04-1/2/3, and VMP-05-1/2/3) is shown in Figures 2-1 through 2-3. Each VMP will be screened at multiple depths to encompass the full vertical column of VOC contamination and SVE well operation. Each VMP will be screened from 54 to 64 feet amsl, 67 to 77 feet amsl, and 80 to 90 feet amsl. Installation depths bgs will vary due to varied surface elevations; however, approximate depths are 20 to 25 feet bgs, 29 to 34 feet bgs, and 38 to 43 feet bgs (VMP-01). During installation, if the groundwater table is encountered shallower than anticipated, well screens will be adjusted shallower. The screens will be installed as close to the planned intervals as possible while maintaining at least 3 vertical feet between the groundwater table and the bottom of the deepest screen and at least 3 vertical feet between each screen.

A utility survey will be performed prior to the start of drilling operations. The locations of vapor monitoring points to be installed will be modified as needed to avoid impacting underground utilities. Concrete coring will be performed to allow for installation of the VMPs into the existing parking lot surface. Each VMP will be constructed within an 8-inch diameter borehole, installed using hollow stem auger drilling methods or alternative methods as recommended by the drilling subcontractor. The wells will be installed with three 0.5-inch-diameter PVC screens and risers, filter packs around each screen, and grout/bentonite seals to the surface and between screens within each borehole. Each VMP will be equipped with an expansion plug and quick-connect sampling port to ensure an adequate seal is maintained throughout testing.

2.1.1.4 Borehole Soil Sampling and Lithologic Logging

At each SVE borehole and VMP borehole, CDM Smith field staff will complete a lithologic log to include the following information, as a minimum:

- Name of the project and site.
- Name of CDM Smith field staff member completing the lithologic log.
- Boring identification number.
- Location of boring.
- Name of drilling subcontractor and name of driller.
- Make and model designation of drill rig.
- Date of start and end of drilling.
- Reference points for all depth measurements.
- Borehole diameter.
- Total boring depth.
- Depth at which groundwater is initially encountered and when stabilized, if applicable.
- Depth of each change of lithologic stratum, including indication if depth is approximate.
- Description of the lithology of each lithologic stratum based on visual inspection of the drill cuttings in accordance with ASTM D2488; this description will include the following, as a minimum:
 - Unified Soil Classification Group Name and symbol
 - Secondary components and estimated percentages
 - Depositional environment and formation, if known
 - Munsell color
 - Plasticity
 - Consistency/density
 - Moisture content

- Grain angularity
- Other visual observations
- Any unusual odors detected
- PID readings during core screening
- Depth at which soil samples were collected.

All lithologic logging will be performed by a qualified, licensed geologist or engineer experienced in subsurface exploration and lithologic logging. A lithologic logging form is provided in the QAPP (Appendix C).

Soil samples will also be collected from each SVE and VMP borehole. Each soil core will be screened using a PID, and one soil sample will be collected from the depth at which the highest PID reading was measured. If PID readings from a soil core are similar to background readings, the soil sample will be collected from approximately midspan within the anticipated vertical column of contamination (i.e., 15 ft bgs to the bottom of the borehole). Soil sampling procedures will be followed as outlined in Section 3.23 of the QAPP (Appendix C). Soil samples will be analyzed for VOCs. Sampling and analysis requirements are summarized in Table 2-3.

2.1.1.5 Well Survey

A local surveyor will be subcontracted to survey all newly installed pilot study wells. The survey will include the two SVE well pairs (SVE-01S/D and SVE-02S/D), the two vapor pins (PIN-01 and PIN-02), and five VMPs (VMP-01-1/2/3 through VMP-05-1/2/3). Surveys of wells will include horizontal and vertical elevations of the surveyor's mark on the top of the inner riser casing in each well, along with the ground surface elevation of the surveyor's mark in the drainage apron at each well.

2.1.2 Process Equipment

2.1.2.1 Soil Vapor Extraction

NYSDEC contractor, EAR, will supply a portable SVE system and test all equipment to confirm function prior to shipping equipment to the site. The SVE unit will consist of a vacuum blower capable of extracting up to 320 standard cubic feet per minute (scfm) and a vacuum of at least 155 inches of water. This will allow approximately 80 scfm (105 actual cubic feet per minute [acfm]) at 70 inches of water column (WC) to be induced at each SVE well operating simultaneously. Appendix B provides the pore volume and SVE blower sizing calculations. If determined to be cost-effective based on results from the sustainable and resilient remediation evaluation (see Section 5.6), the blower will be equipped with a variable-frequency drive (VFD) to control the blower speed and extraction flow rate. If the blower does not have a VFD then a recirculation line with a throttling valve will be installed to allow more flexible flow adjustment. The SVE system will be powered by a diesel-fueled generator. The SVE system will have an air/water separator or condensate knock-out tank (KO tank); a particulate filter; a silencer; an air-to-air heat exchanger; and pressure/vacuum, temperature, and flow gauges. Vapors will be treated using two 55-gallon drums of vapor-phase GAC prior to discharging through a stack. The discharge stack will be a 4-inch diameter PVC pipe. The stack will extend 5 feet above the top of the Jim Dandy Cleaners building and will have a rain cap to avoid debris and water from entering the stack. A piping and

instrumentation diagram (P&ID) of the pilot SVE system is also shown on Figure 2-4. EAR must meet these performance requirements and must provide the specified process equipment, unless otherwise approved by CDM Smith and NYSDEC. CDM Smith and NYSDEC will work with EAR to select an appropriate type and size of blower. The SVE system will be confined within a noise-dampening enclosure to be provided by EAR which is anticipated to reduce noise levels to within allowable nighttime limits as discussed in Section 4.2.2.

Conveyance piping from the SVE well head to the SVE system will be a 2-inch flexible hose to traverse the hillside from Lawrence Hill Services, Inc. property to the south side of Jim Dandy Cleaners. Each SVE well will have a sampling port, temperature gauge, and a pressure gauge for monitoring SVE performance at the system.

Piping within the SVE system is assumed to be 4-inch PVC, except for the section between the blower and the heat exchanger where it will be 4-inch carbon steel. When the SVE blower is turned on, under the resulting vacuum soil vapors from the impacted vadose zone in the vicinity of the SVE well are drawn into the SVE screen. The vapors are pulled through the KO tank where entrained water is removed first. The moisture-free vapor stream gets filtered to remove particulate matter before it enters the blower inlet. The vapor stream leaving the blower is under positive pressure and goes through an air-cooled heat exchanger, which helps cool it down to a temperature no greater than 110 degrees Fahrenheit (°F) before the vapors pass through vapor-phase GAC drums and are discharged to the atmosphere. The condensate collected in the KO tank will be periodically pumped out automatically and collected in a temporary storage tank(s) for testing before EAR characterizes and disposes it at the end of the pilot study. It is estimated that up to three tanks, each with 275-gallons capacity, will be required to contain the water generated over the course of the testing. Additional tanks may be needed and will be supplied by EAR.

Throughout the SVE system, a series of check valves, relief valves, ball valves, globe valves, and butterfly valves will be required for safe and precise control of air and water flows. Flow meters, pressure gauges, and temperature gauges will be used to measure gas and water flows and process pressure and temperature. Ball valves will be used to isolate components during startup, shutdown, and any required maintenance. Sampling valves will be used to collect vapor or condensate samples.

2.2 Test Procedures

This section describes the testing modes and procedures and the types, locations, and frequencies of parameters that will be monitored during the testing. Section 3 presents a more focused and complete description of monitoring and sampling requirements.

2.2.1 Baseline Measurements

Prior to beginning the pilot testing, baseline subsurface pressure readings and photoionization detector (PID) measurements will be taken at all SVE wells (SVE-01S/D and SVE-02S/D), vapor pins (PIN-01 and PIN-02), and VMPs (VMP-01-1/2/3 through VMP-05-1/2/3). The baseline measurements will be performed prior to the start of the test.

In addition, soil gas samples for VOC analysis will be collected from each of the SVE wells, vapor pins, and VMPs using SUMMA® canisters. These data will represent the pre-test soil gas phase concentrations of the COCs and may be used for future reference.

2.2.2 System Setup

2.2.2.1 SVE System Setup

A portable SVE system comprised of the components and configuration shown on the P&ID (Figure 2-4) will be mobilized to the site either fully assembled or to be assembled on-site. All temperature, pressure (or vacuum), and flow gauges installed along the process train will be factory calibrated.

Once the SVE system is fully assembled, electrical power lines from a temporary diesel-powered generator will be connected to the main control panel of the SVE system and grounded. Power to the vacuum blower and the condensate pump will be fed through the main control panel. The electrical circuit to the condensate pump will include float actuated switches on the KO tank that will control the condensate pump operation under normal steady state conditions. The condensate discharge line to the storage tank will be equipped with a water flow totalizer meter to record the volume of condensate generated over time. The electrical connections at both the SVE system and the generator ends will be performed by a licensed electrician.

2.2.2.2 System Leak Check

SVE piping will be checked for leaks prior to operation. Once the system is fully assembled, while the dilution valve is fully opened and the valve to each SVE well is fully closed, turn on the power to the blower and apply soapy water to the joints downstream of the blower (i.e., the pressurized side). Leaks will be identified via the presence of soap air bubbles, sound, or a drop in indicated pressure. At the same time, field staff will check for sounds in the piping upstream of the blower (i.e., the suction side with vacuum) and identify leaks.

Any identified leaks will be repaired appropriately, and the system will be retested until no leaking sounds or bubbles are observed. No SVE activities will begin until the system is confirmed to be leak-free and operational. Repeat the leak check at each of the SVE wells.

2.2.3 SVE Step Test

The SVE Step Test will be performed at the SVE wells by applying various air flow rates and vacuums. This will develop a vacuum and flow rate relationship for each of the tests that will help determine a flow rate for operating the Extended Operations Test. Five separate tests will be performed: one at each SVE well and one with all four wells in operation.

The air flow rate that can be pulled from each well is dependent on the applied wellhead vacuum, and the nature and state of formation around it. During the SVE Step Tests, the SVE wellheads will be subjected to multiple levels (steps) of vacuum. Vacuum will first be applied at approximately 30 inches WC. If no flow is observed after 15 minutes at 30 inches WC, the vacuum will be increased an additional 15 inches of WC and the flow observed for another 15 minutes. The first step would be run at the lowest vacuum with flow. Subsequent steps will be run at 15 to 30 inches WC higher than the initial step, depending on the amount of water being extracted – this will be a field decision with CDM Smith project

manager input. The objective is to minimize groundwater upwelling and mounding, which will prevent vapor flow in the subsurface and lead to more extracted groundwater by SVE. At least three steps will be performed, and possibly more if the water extraction rate is low at the second and third steps. At each step, the applied vacuum will be maintained at a constant level, to the extent practical, for a duration of approximately 2 hours, and perhaps longer depending on how long it takes monitored parameters to stabilize. If parameters do not stabilize after 2 hours, direction for continued operation will be provided by the CDM Smith project manager. During this period, subsurface-induced vacuum will be measured periodically (approximately every 15 minutes) at PIN-01 through PIN-02 and VMP-01-1/2/3 through VMP-05-1/2/3 to estimate the ZOI for the given applied vacuum and extracted vapor flow rate. In addition, the temperature, pressure (or vacuum), and vapor stream flow rate at various points along the SVE process train (Figure 2-4) will be measured and logged (Table 2-2). Vapor-phase VOC concentrations will be measured using a PID. During the SVE Step Tests, the VMPs will remain capped.

After the balancing of operational parameters is complete, towards the end of the last step, one air and one condensate sample will be collected for VOC analysis.

2.2.3.1 System Operation Procedure During SVE Step Test

The step-by-step procedure for operating the pilot SVE system during the SVE Step Test is as follows (see Figure 2-4 for valve tag IDs):

- 1) Verify that the generator is fully fueled.
- 2) Visually inspect and confirm that all electrical lines are damage free and connections between major equipment (main control panel, blower, and condensate pump) are secure.
- 3) Confirm that all gauges (temperature, pressure/vacuum, and flow) along the process train read zero when the system is off.
- 4) Ensure that the Dilution Air Valve DA-0 is fully open. This will ensure that when the SVE blower is turned ON, it will be subjected to the smallest load. If the blower does not have a VFD, ensure the recirculation valve is fully open.
- 5) Ensure that the flow control valves for each SVE well (SV-1-01S, SV-1-01D, SV-1-02S, and SV-1-02D) are closed.
- 6) Turn the generator on.
- 7) Turn the master power switch on the control panel on.
- 8) Turn the Condensate Pump switch to auto. Note: Because there may not be sufficient water collected in the KO tank, the condensate pump may not activate.
- 9) Turn the SVE blower switch on. If the blower has a VFD, start at half speed. If the blower does not have a VFD, partially close the recirculation valve on the recirculation line. At this point, the flow and vacuum gauges on the SVE well wellhead should not be responding because the flow control valves are closed.
- 10) Collect the system operating parameters (corresponding to “zero”-applied vacuum to SVE wells) on the Step Test Log Sheet (Table 2-2).

- 11) Fully open the flow control valve based on the current step testing location (SV-1-01S, SV-1-01D, SV-1-02S, and SV-1-02D) at the SVE system. Because the DA-0 Valve is still fully open, there should be flow coming from both the dilution line and the SVE well(s).
- 12) Start closing the DA-0 valve gradually until completely closed. This should result in a gradual increase in the applied vacuum and the extracted air flow from the SVE well. Gradually adjust the VFD speed or the recirculation valve (if no VFD) until the desired Step 1 SVE wellhead vacuum (approximately 30 inches WC) is reached. Alternatively, the DA-0 valve can be left partially open and can be used to restore SVE well wellhead vacuum, as described in Step 14.
- 13) Note the start time for the Step 1 test. Collect the system operating parameters, including PID measurements, at the various points along the process train, in accordance with Table 2-2.
- 14) During the Step Test, monitor the SVE well vacuum gauge (e.g., PI-1 for SVE-01S). If the set vacuum level changes, restore the SVE well wellhead vacuum to the desired step level. This can be achieved through adjusting the DA-0 valve, the VFD, or the recirculation valve (if no VFD). If performing the all well Step Test, flow may also be balanced among each of the wells (e.g., SV-1 for SVE-01S).
- 15) Collect system operating parameters during the given Step Test, including PID measurements, in accordance with Table 2-2. Collect all parameters once every 15 minutes except PID measurements at the VMPs which will be collected one every 60 minutes.
- 16) Repeat Steps 12 through 15 and complete the SVE well Step Test at the remaining applied vacuum levels.
- 17) Upon completion of the SVE Step Test, turn the system OFF by turning off the power to the SVE blower, the condensate pump, and the master power switch. Fully open DA-0 and close the well valve (e.g., SV-1 for SVE-01S). Turn the generator OFF.

These step testing procedures will be followed five times: once for each individual SVE well and once for all SVE wells simultaneously.

2.2.4 Extended Operations Test

Once the five SVE Step Tests are complete, an Extended Operations Test will be conducted with all SVE wells in operation. Various measurements from the SVE system, vapor pins, and VMPs will be collected during the Extended Operations Test and recorded into Table 2-4. The Extended Operations Test will last 4 weeks. The SVE system will be in operation continuously, including nighttime hours, for the full 4-week duration. Vapor concentrations will be measured at the SVE system, vapor pins, and VMPs via a PID. Table 2-3 provides the sampling and analysis requirements to be collected once per week during the Extended Operations Test to determine mass removal and emissions rates. One water sample will be collected from the condensate line during the final week of the Extended Operations Tests for VOCs analysis.

Procedures for operating the SVE system during the Extended Operations Test are described below.

2.2.4.1 SVE Operation During Extended Operations Test

The step-by-step procedure for operating the SVE system during the Extended Operations Test is as follows:

- 1) Follow Steps 1–12 of the SVE Step Test.
- 2) Gradually adjust the VFD speed or the recirculation valve (if no VFD) until the desired SVE well wellhead vacuum (based on results of SVE Step Test) is reached. Begin optimizing operation based on operating parameters (e.g., water extraction rates, upwelling of the water table, observed flow rates, vacuums).
- 3) Note the start time of the Extended Operations Test. Collect the system operating parameters, including PID measurements, at the various points along the process train, in accordance with Table 2-4. The objective is to operate at a sustainable vacuum and flow without extracting excessive water.
- 4) Monitor the SVE wellhead vacuum gauges (PI-1-01S, PI-1-01D, PI-1-02S, PI-1-02D) over the next 8 hours. If the set vacuum levels change, adjust the flow control valves to restore the SVE wellhead vacuums to the desired level.
- 5) Every hour following the start of the Extended Operations Test, collect system operating parameters, including PID measurements in accordance with Table 2-4.
- 6) During the 8th hour of the fifth day of each week of extended SVE operation, the field crew will use SUMMA® canisters to collect process vapor samples for VOC analysis in (Table 2-3).
- 7) Each morning, collect the system operating parameters, including PID measurements along the process train (Table 2-4).
- 8) Manipulate VFD speed, recirculation valve (if no VFD), valves DA-0 and/or SVE well valves (SV-1-01S, SV-1-01D, SV-1-02S, SV-1-02D) to adjust the applied vacuums and flow at the SVE wellhead to target flow. Repeat Steps 2 through 7 as needed.
- 9) Upon completion of the Extended Operations Test, turn the system off by turning off the SVE blower, the condensate pump, and the master power switch. Close wellhead valves and fully open DA-0. Turn the generator off.

These procedures will be followed for the duration of the Extended Operations Test.

2.3 Pilot Implementation Responsibilities

A drilling subcontractor will be responsible for drilling and constructing the SVE wells and VMPs.

A surveying subcontractor will be responsible for surveying the SVE wells and VMPs.

EAR will supply the SVE pilot study systems. Additional performance-based criteria for the pilot treatment system will be supplied to EAR, as needed, e.g., vacuum, pressure, and air flow requirements for the pilot system. It is anticipated that the SVE system equipment will be housed in a trailer or on a skid and will be located in the parking lot of the Lawrence Hill Services Inc. property. During the pilot

test representatives from CDM Smith will oversee the drilling, surveying, system installation, and equipment operation.

CDM Smith will be responsible for renting or purchasing all field monitoring equipment and field monitoring supplies required for the pilot study. The field equipment will be inspected for acceptability in accordance with the vendor's recommended procedures, and instruments will be calibrated as required prior to use.

Access to the property will be coordinated through NYSDEC.



3.0 Sampling and Analysis Plan

3.1 Data Quality Requirements

The data generated during this pilot study is required to support decisions made during the testing activities. The pilot test objectives are typically achieved through the collection and use of screening level data, with a limited amount of definitive data also collected for confirmation purposes of the aforementioned screening data.

- The screening data are used to rapidly identify and quantify site conditions and test performance, although the quantification can be relatively imprecise.
- The definitive confirmation data allow for more precise interpretation of screening data, estimation of VOC mass removal, and confirmation of discharge concentrations.

This approach is supported by the end use of the data, mainly to support the RD, which is flexible in nature. For example, off-gas and water treatment systems can address a broad range of contaminants and concentrations. Therefore, it is necessary that the SVE pilot test data provide information regarding contaminant types and concentration ranges to be treated. The various types of data to be collected and their specific requirements are discussed in the follow subsections.

3.1.1 Screening with PID

Soil vapor and soil field screening with a PID is screening level data that will be used semi-quantitatively to estimate the level of VOCs in soil and in soil vapor. This data will be field collected and will be used to estimate the level of VOC removal by SVE and assess the functionality of the soil vapor treatment unit. The field screening data will be used in conjunction with the soil vapor analytical data to develop estimates of soil concentrations and associated VOC mass removal. Field screening of the soil will be performed during the installation of the SVE well and VMP locations and will be used to target discrete intervals for soil collection.

3.1.2 Soil Vapor Sample Collection

Soil vapor samples from the SVE wells, VMPs, and from the treatment unit itself will be submitted to the NYSDEC standby analytical laboratory, Pace Analytical. All samples will be submitted for TO-15 analysis, these data will be used to evaluate the effectiveness of the SVE pilot study. The laboratory data for vapor will be used to estimate the VOC mass removal by the SVE system. Also, data collected from the air treatment effluent will be used to confirm effluent concentrations. The laboratory analysis of select soil vapor samples will be conducted during the baseline sampling, step testing and SVE extended operation testing.

3.1.3 Soil Sample Collection

Discrete soil samples will be submitted to the NYSDEC standby laboratory, Pace Analytical for VOC analysis via EPA Method 8260D, and the data will be used to collect additional soil samples for delineation of vadose zone contamination. The laboratory analysis of select soil samples will occur during the installation of the SVE wells and VMPs.

3.1.4 Condensate Sample Collection

A condensate sample will be submitted to Pace Analytical for VOC analysis via EPA Method 8260D, and the data will be used to determine disposal requirements. The laboratory analysis of the condensate sample will occur during the extended operations testing.

Additional information regarding data quality requirements for NYSDEC are included in Section 5 of the CDM Smith Generic Quality Assurance Project Plan.

3.2 Sampling and Monitoring Requirements

This section focuses on the sampling and monitoring requirements during the pilot study. Some of the sampling and monitoring related information contained in this section is already discussed in Section 2.2 but is repeated here in further detail for clarity.

It is assumed that analytical samples will be analyzed by Pace Analytical, the NYSDEC standby analytical laboratory. The laboratory will be capable of analyzing all analytical samples (i.e., VOCs in vapor, soil, and water) included in the pilot study sampling program. Category B reports are expected for all analytical data analyzed by Pace Analytical. The data will be validated by a third-party validator to be subcontracted by CDM Smith. Following completion of laboratory analyses and receipt of all validated data, CDM Smith will perform a data usability assessment to evaluate the overall usability of the data for use in evaluating the effectiveness of the pilot study.

Quality assurance (QA) and quality control (QC) are briefly discussed in Section 3.4 and in more detail in Section 5 of the CDM Smith Generic Quality Assurance Project Plan. These data will be used as the design basis for the full-scale SVE system design. Table 2-3 summarizes the sampling location, media, and analysis.

3.2.1 Borehole Drilling Soil Sampling

During installation of the SVE wells and VMPs, lithology of the drilled boreholes will be logged, and the soil cores will be screened with a PID. After PID screening, one soil sample will be collected from each location at the depth of the highest PID measurement, or midspan within the depth of the anticipated vertical column of contamination (i.e., 15 ft bgs to the bottom of the borehole) if PID readings are similar to background readings. The samples will be collected using a single-use sample transfer tool and pre-weighted 40-milliliter vials with magnetic stir bars and sample preservative. These samples will be sent for VOC analysis. These VOC data will be used to refine the extent of VOC contamination in vadose zone soil. Sampling requirements are summarized in Table 2-3.

3.2.2 Baseline Sampling

Prior to beginning the SVE testing, basic static measurements will be collected at all vapor pins, and VMP and SVE well screen intervals, including pressures, and PID measurements. Three casing volumes must be removed from the vapor pins, VMPs, and SVE wells after measuring the pressure and before PID measurements and VOC sampling (See Appendix C QAPP Section 3.9). After PID screening, soil vapor samples will be collected from the four SVE wells, the vapor pins, and the screen interval from each VMP with the highest PID reading. Samples will be collected using SUMMA® canisters and analyzed for VOCs. These VOC data will represent the pre-treatment equilibrium soil gas phase concentrations to be used

with the pilot data for assessing mass removal rates and estimating a treatment duration. Table 2-3 shows the baseline sampling information.

3.2.3 Pilot Phase

3.2.3.1 SVE Step Test

The SVE Step Tests will determine SVE operational parameters, including vacuums to establish individual ZOIs and establishing a pressure and flow relationship. Each SVE Step Test will be performed using a minimum of three steps. Additional steps may be warranted depending on the vacuum and flow rate relationship and condensate production. During each of the steps, extraction flow rates, pressure/vacuum, and PID readings will be collected from each SVE well screen interval in operation every 15 minutes as shown in Table 2-2. Pressure/vacuum and PID readings will also be collected at each VMP screen interval and vapor pin every 15 and 60 minutes, respectively. Three casing volumes must be removed from the VMPs and vapor pins after measuring pressure and before taking the PID measurement(s). Toward the end of the last step test for each SVE well, SUMMA® canisters will be used to collect a process vapor sample from the operating SVE well sample port (VSP-1-01S, VSP-1-01D, VSP-1-02S, or VSP-1-02D) for VOC analysis. PID measurements, pressure readings, temperature readings, and flow readings will also be recorded for each SVE Step Test as shown on Table 2-2. Samples to be collected during step testing are summarized in Table 2-3.

3.2.3.2 Extended Operations Test

During each week of the Extended Operations Test, extraction flow rate, vacuum/pressure, and PID readings will be monitored hourly from each SVE well screen interval and recorded on Table 2-4. Vacuum/pressure and PID readings will be monitored from the two vapor pins and all five VMPs at each screen interval. Three casing volumes must be removed from the vapor pins and VMPs after measuring pressure and before PID measurements.

Near the end of each week of the Extended Operations Test, vapor samples will be collected. Sample locations include each of the four SVE wells, the vapor pins, and the VMP screen interval with the highest PID reading. Additionally, the KO tank vapor effluent and the vapor-phase GAC effluent will also be sampled near the end of week 4 of extended operations. Samples will be collected for VOC analysis using SUMMA® canisters. Three casing volumes must be removed from the vapor pins and VMPs after measuring pressure and before VOC sampling. In addition, one condensate sample will be collected near the end of the Extended Operations Test and sent for VOC analysis.

These data will represent the post-treatment soil vapor concentrations and condensate characterization. Table 2-3 shows the sampling locations, schedule, matrices, and analysis for the Extended Operations Tests.

3.3 Field Equipment and Sampling/Monitoring Procedures

This section describes the field equipment and instrumentation that will be used during the testing. Sampling and monitoring will consist of on- and off-site groundwater, soil, and vapor analysis, and measurements of extraction flow rate, vacuum/pressure, and temperature.

On-site Vapor Quality Measurement – A field PID will be used to frequently measure the total VOC concentration in the vapor samples along the SVE process train at vapor sampling ports VSP-1-01S, VSP-1-01D, VSP-1-02S, VSP-1-02D, VSP-2, VSP-3, VSP-4, and VSP-5. The PID will be equipped with a 10.6-electron-volt lamp for detection of the primary COCs. At the time of the PID reading, the tip of the pre-calibrated handheld PID device will be temporarily connected to the Teflon-lined tubing at the end of the sample port and the VSP valve opened to allow the device to analyze the vapor stream for the total VOC concentration.

VOC Analyses – Vapor – To gather definitive VOC concentrations data in subsurface soil gas and extracted vapors, samples will be collected from the VMPs and SVE vapor sample ports along the process train using SUMMA® canisters.

Vapor Flow, Temperature, and Vacuum/Pressure Measurement – The vapor flow rate at various points along the SVE process trains will be monitored by pitot tubes and direct-read magnehelic gauges, capable of reading 0 to 100 scfm. If pitot tubes and magnehelic gauges not available (or too cost prohibitive) for the specified flow rates and pressures, an air velocity meter may be used in combination with a sample port. Magnehelic gauges are factory-calibrated under standard conditions and, therefore, will indicate they are reading scfm. However, under nonstandard conditions, the readings will be recorded as acfm along with the temperature and pressure (or vacuum) to allow for conversion.

Pressure or vacuum readings will be read off the connected pressure or vacuum gauges, respectively. Vacuum and pressures will be read on a 0 to 100 inches of WC scale. A handheld micromanometer or similar device will also be used for measuring vacuum at the VMPs. Temperature readings will be collected using temperature gauges. For SVE, the expected temperatures along the process stream upgradient of the vacuum pump will be between 55°F (or the subsurface temperature) to just below the ambient temperature. The expected temperature at the blower outlet and before the heat exchanger will be up to approximately 250°F, depending on the blower that is used. The temperatures expected between the heat exchanger and the discharge stack will be between ambient temperature and 120°F.

The field crew will verify that all vacuum and pressure gauges read zero each time the SVE system is turned off.

3.4 QA and QC Requirements

QC samples to be collected as part of field QC include field duplicates, matrix spike/matrix spike duplicates, equipment rinsate blanks, and trip blanks. These QC samples will be collected in accordance with frequencies outlined in the CDM Smith Generic Quality Assurance Project Plan, which is provided in Appendix C Section 3.4. The measurement performance criteria for the analytical samples and laboratory-specific detection/quantitation limits will be in accordance with criteria outlined in the CDM Smith Generic Quality Assurance Project Plan and in accordance with the contract requirements set in the NYSDEC standby laboratory contract with Pace Analytical. Quality control procedures for field staff are included in Section 3.4 of the plan; laboratory quality control procedures are included in Section 5.

Field equipment will either be factory-calibrated or calibrated in the field in accordance with the manufacturer's specifications.



4.0 Implementation and Installation

4.1 Health and Safety

Field staff will follow the Health and Safety Plan for the site, which will be provided under a separate cover. It is anticipated that the pilot testing can be completed using Level D personal protection. Areas of concern include eye, foot, and hand injuries; slips, trips, and falls; working around motorized equipment; working around high-vacuum/high-pressure/high-temperature equipment, piping, and fittings; working around diesel-powered portable generators; and severe weather. These are potential hazards to be monitored during the pilot study. Hearing conservation measures will be observed when the blower is in use. Eye protection will be used at all times when working around pipes under pressure. Measures to limit heat stress will also be implemented.

The site-specific Health and Safety Plan will include a Community Air Monitoring Plan (CAMP) prepared in accordance with Appendix 1A and 1B of NYSDEC Program Policy DER-10. The CAMP will detail continuous monitoring of VOCs and particulates at 15-minute running averages, action levels, and response steps if action levels are exceeded. The CAMP will establish the protocols necessary for the anticipation, recognition, evaluation, and control of emissions associated with each task based on site-specific conditions. Any exceedances of CAMP action levels must be reported to NYSDEC and New York State Department of Health within 24 hours. Daily field reports will be prepared that include all field activities, CAMP activities, CAMP data, action level exceedances and durations, and mitigation measures performed each day.

4.2 Permitting

4.2.1 SVE Off-Gas Emissions

Per 6 CRR-NY 201, procurement of a Title V facility permit, state facility permit and air facility registration is required for any major stationary source, major source, or major facility. The most stringent criteria for categorization as a major facility applicable to the site is the potential to emit 10 tons per year of a hazardous air pollutant or combination of hazardous air pollutants, as defined under 6 CRR-NY 200. PCE was the only hazardous air pollutant detected onsite during the January 2022 soil sampling. Based on the concentration of PCE in the SVE pilot study area and the anticipated volume of soil receiving treatment, it is conservatively estimated that total emissions throughout the pilot study will be about 0.2 tons of PCE. This value does not exceed the emission threshold; therefore, permit procurement and facility registration are not required. Backup calculations are included as Appendix D.

Nevertheless, as a best management practice, the soil vapors extracted from the subsurface will be treated through two 55-gallon (200-pound) vapor-phase GAC units in series. Consequently, the VOC concentrations and the mass release rate in the discharge air stream during the pilot tests are anticipated to be very low. Because of the low anticipated VOC concentrations in the systems emissions and the limited duration of pilot testing, GAC replacement is not anticipated to be required during the duration of pilot testing activities. Any GAC units that do require replacement will be sent offsite for regeneration. Need for GAC unit replacement will be evaluated based on vapor effluent PID readings collected at VSP-4 and VSP-5 (Figure 2-4) during step testing and extended operations testing at

frequencies indicated in Table 2-2 and Table 2-4, respectively. If PID measurements significantly exceeding baseline conditions are encountered, the SVE system will be shutdown. Elevated PID measurements at VSP-4 and VSP-5 will trigger replacement of GAC units GAC 1 and GAC 2 (Figure 2-4), respectively.

4.2.2 Noise

All work will be performed in accordance with the Huntington Town Code, Chapter 141 Noise. Under this chapter, noise disturbances, defined as “Any noise, which endangers or injures the safety or health of humans or animals, or annoys or disturbs a reasonable person of normal sensitivities, or endangers or injures personal or real property,” are prohibited. Likewise, as per Subchapter 141-5, “the use of any sound device, machinery, equipment, or engine so as to cause the sound produced thereby to be audible outside the building or beyond the property lines of where it originates between the hours of 11:00 p.m. and 7:00 a.m. the following day shall be prima facie evidence of a violation of this chapter.”

No formal, numerical threshold for noise is identified in the Huntington Town Code or New York State regulations; however, an increase of 6 A-weighted decibels above ambient sound levels at the site boundary is identified in NYSDEC’s guidance as a typical threshold at which adverse noise impacts will occur and will be used as a target for noise reduction methods (NYSDEC 2001).

Noise-generating equipment that will be operated during the pilot study include the drill rig, blower, and generator. Noise monitoring will be performed at the site boundary during all equipment operation and sound-dampening methods will be required to minimize noise impact on the surrounding properties. Specific sound-dampening methods will be evaluated by EAR and CDM Smith based on available equipment; however, it is anticipated that a sound-dampening enclosure and silencer will be utilized and will reduce noise levels of SVE and drilling operation to within allowable limits during nighttime hours (i.e., between 11:00 p.m. and 7:00 a.m.). As a result, overnight operation of the SVE system during extended operations testing is planned, and drilling during nighttime hours may be performed as needed.

4.3 Residuals Management

The anticipated residuals from the pilot testing include soil cuttings from the SVE well and VMP installations, spent vapor-phase GAC from vapor treatment, and condensate from extracted vapor. Soil cuttings will be collected for testing before characterization and disposal. EAR will remove spent GAC units from the site. All potentially contaminated personnel protective equipment will be drummed. It is anticipated that prior to offsite disposal drummed waste may be temporarily stored in the Church of Saint Patrick parking lot located at 400 Main St, adjacent to the Lawrence Hill Services Inc. property. The condensate collected in the KO tank will be periodically pumped out and collected in a temporary storage tank(s) for testing before it is characterized and disposed by EAR at the end of the pilot study.

4.4 Pilot Study Schedule

The overall project schedule, which include the pilot study activities, is provided in Figure 5-1. Well installation is anticipated to take place in July 2024. The pilot study is anticipated to be performed in August 2024, with the final comprehensive sampling event to be subsequently performed in August 2024.

4.5 Green Remediation

To the extent practicable, CDM Smith will explore and implement green remediation strategies and applications during the pilot study to maximize sustainability, reduce energy and water usage, promote carbon neutrality, promote industrial materials reuse and recycling, and protect and preserve land resources. Specific green remediation practices that will be implemented during the pilot study and associated analytical sampling are:

- Obtain materials locally when available
- Work with local staff to reduce fuel consumption (minimize idling of vehicles and gas/diesel powered equipment)
- Use biodiesel, if feasible, to run the portable generator to support the SVE systems
- Use of regenerated GAC for the off-gas treatment system, if available
- Regeneration of spent GAC is not anticipated to be needed during pilot study activities due to duration of the pilot and anticipated vapor concentrations; however, all GAC used onsite will be taken offsite for regeneration either at the end of activities or when replacement is necessary

Sustainable and resilient remediation (SRR) is an optimized approach to cleaning up remediation sites that limits negative environmental impacts, maximizes social and economic benefits, and creates resilience against increasing threats (ITRC 2021). SRR is an updated approach to green and sustainable remediation (GSR) that includes not only a comprehensive evaluation of environmental and social impacts from the remedy but also considers resiliency of the remedy to address the increasing threats of climate change. The process involves:

1. Developing a scoring methodology for the SRR matrix
2. Evaluating the existing design based on the SiteWise run
3. Recommending modifications or enhancements to improve SRR performance, aiming to reduce areas of concern
4. Integrating GSR metrics into the specifications based on the SiteWise run
5. Conducting a SiteWise evaluation of the new design and scoring it within the SRR matrix.

CDM Smith has initiated the SiteWise assessment. The inputs are provided in Appendix E. Assessment of GSR metrics will be detailed in the Final SVE Pilot Study Work Plan.



5.0 Analysis and Interpretation of Test Results

This section describes the data analysis, interpretation, and reporting methods that will be used in evaluating the SVE test results. The data collected during the pilot testing will provide the following information relevant to SVE performance and RD:

SVE:

- Changes in vacuum in VMPs located at various distances and depths from the SVE wells
- VOC mass removal rate
- Extraction flow rates that can be achieved at various applied vacuums
- Groundwater/condensate production rates achieved at various applied vacuums
- Type and concentration of VOCs in extracted vapors and in condensate to support treatment system design
- Changes in VOC concentrations in soil vapor due to SVE

5.1 Data Analysis and Interpretation

Data collected from the testing will be evaluated to support the objectives of the test, including:

- Verification nominal (or average) mass discharge rates for individual VOCs, and total contaminant concentrations in pounds per hour, pounds per day, and pounds per year do not exceed atmospheric discharge limitations.
- Subsurface vacuum data will be used to estimate the SVE ZOI at various levels of applied vacuum. Typically, the SVE ZOI is the extent of the subsurface within which a vacuum of 0.1 inch of WC (or a differential pressure of 0.1 inch of WC relative to ambient pressure) results from the applied vacuum (and vapor extraction) at the SVE wells.
- Vapor extraction rates and wellhead vacuum levels will be used to size the SVE blower for the full-scale system.
- Lithology data and experience from well drilling will be used to optimize the locations and screened intervals for SVE wells and VMPs.
- Soil sampling analytical results for VOCs will be used to refine the estimated extent of vadose zone soil VOC contamination and determine the area requiring SVE treatment during full-scale operation.
- Comparison of operational parameters with either both or only one SVE well in operation will be used to evaluate the applicability of pilot scale data to a full-scale system with several wells in operation.
- Vapor VOC data will be used to design the vapor treatment system.

- Condensate analytical results and volumetric accumulation rates will be used to design the condensate treatment system.

5.2 Reporting

CDM Smith will prepare and submit a Pilot Study Report to summarize the results and conclusions of the pilot study. The report will describe the performance of the technology compared with the established site performance standards and evaluate the treatment technology's effectiveness and implementability. The report will provide the technical basis for design of a full-scale SVE system.

The Pilot Study Report will present the following:

- Objectives of the pilot study
- Summary of the work performed
- Summary and discussion of any deviations from the pilot study work plan
- Discussion and evaluation of the results based on engineering calculations and trend analyses
- Summary of QA/QC activities and results
- Conclusions and recommendations on the performance of the pilot system, and the technical basis for design and implementation of a full-scale SVE system



6.0 References

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- . 2017. Design Summary Memorandum.
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- ITRC. 2021. Sustainable Resilient Remediation SRR-1. Washington, DC: Interstate Technology & Regulatory Council, SRR Team. <https://srr-1.itrcweb.org/>.
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- . 2012. Record of Decision. New York: NYSDEC.
- . 2011. Division of Environmental Remediation-31: Green Remediation. New York: NYSDEC.
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- VaporPin®. 2020. Installation of the VaporPin® Insert Standard Operating Procedure.



7.0 Figures

Figure 1.1 Site Map

Figure 1.2 Site Plan – Site View

Figure 1.3 Historical Groundwater Contamination

Figure 1.4 Soil Boring PCE Results

Figure 2.1 SVE Pilot Study Well Layout – Source Area

Figure 2.2 SVE Pilot Study Well Layout – Work Area

Figure 2.3 SVE Pilot Study Well Layout – Cross Section

Figure 2.4 P&ID for SVE Pilot System

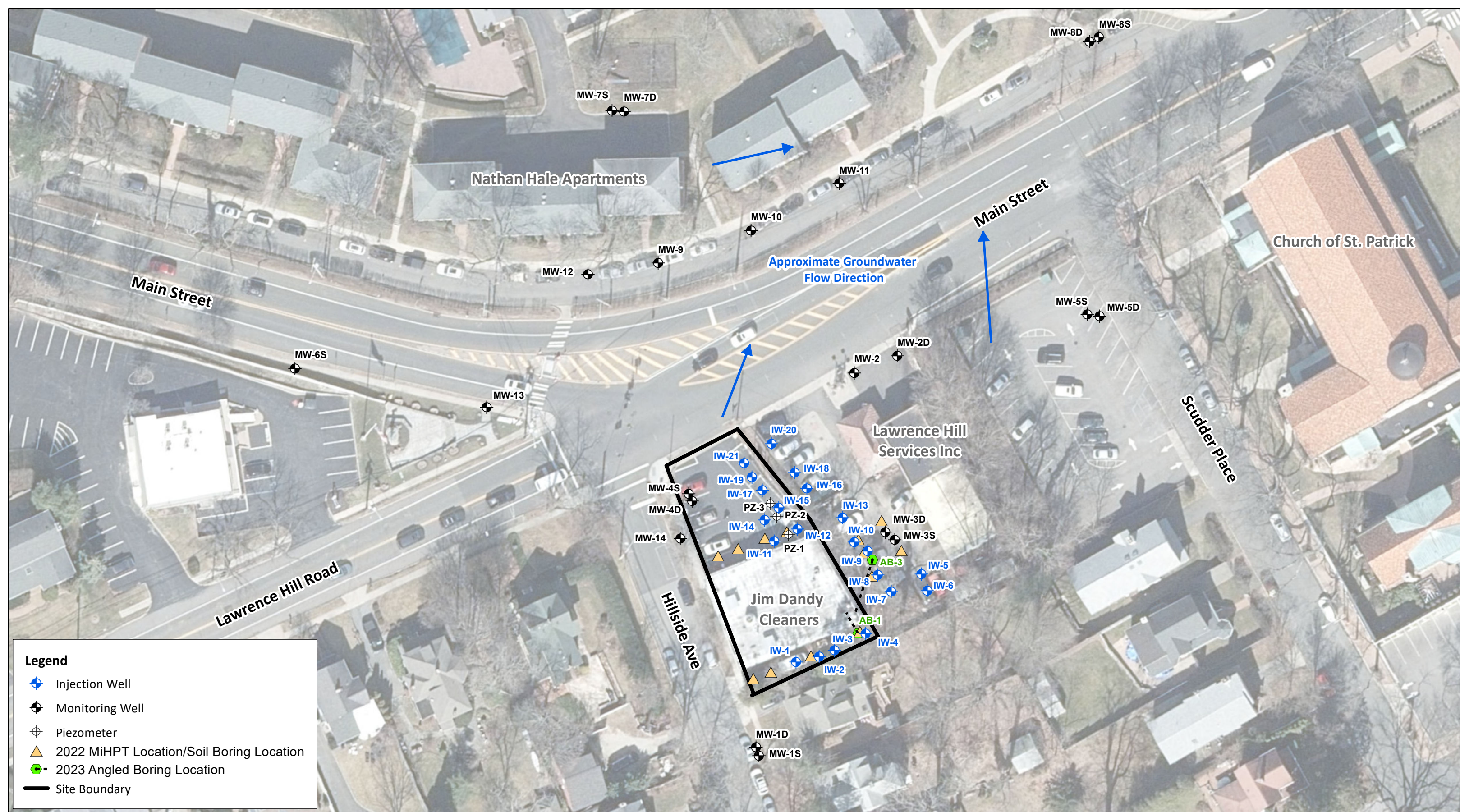
Figure 5.1 Country Cleaners Project Schedule



Figure 1-1

Site Location Map
NYSDEC Country Cleaners Site
Huntington, New York





1 inch = 50 feet

0 25 50 100 Feet

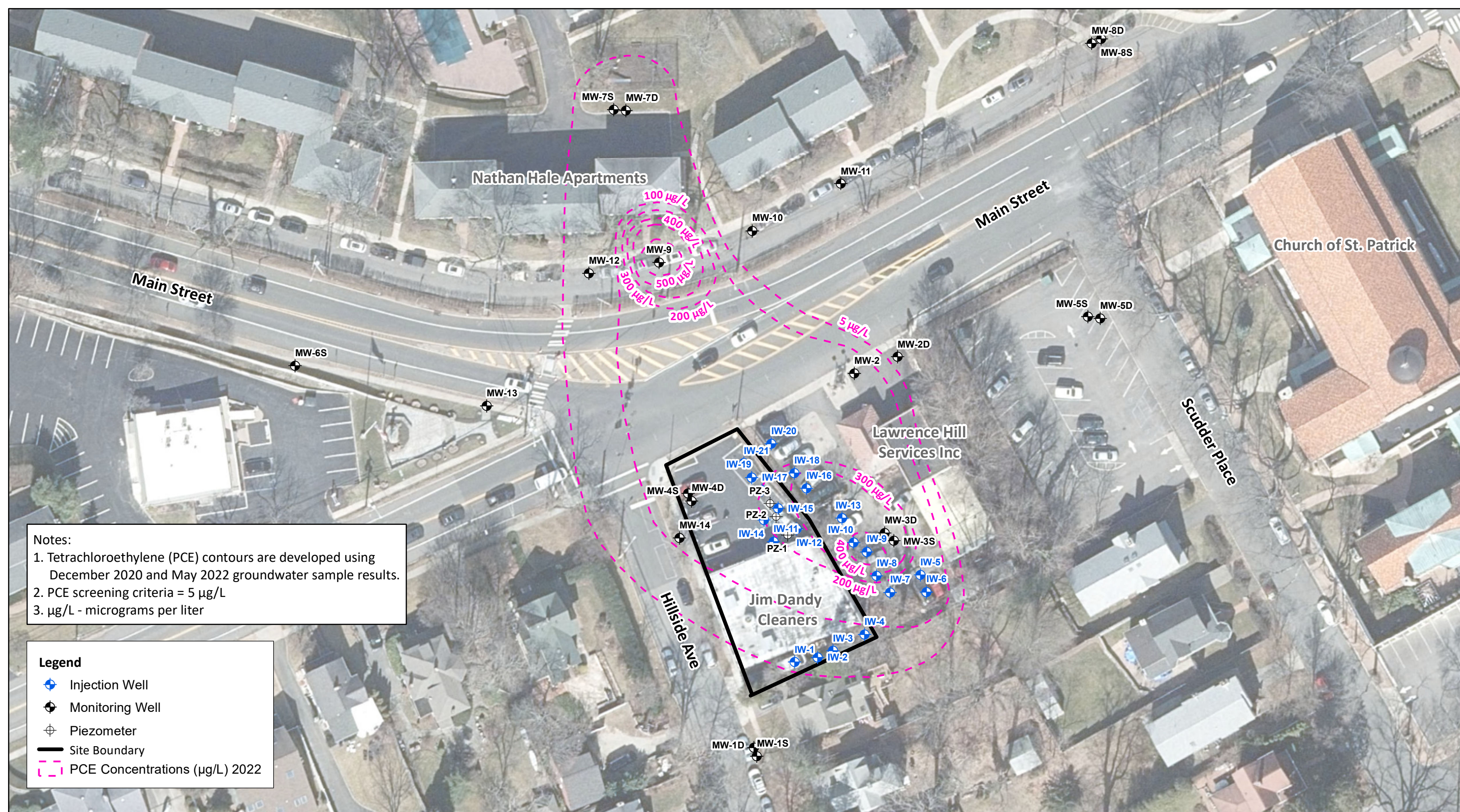
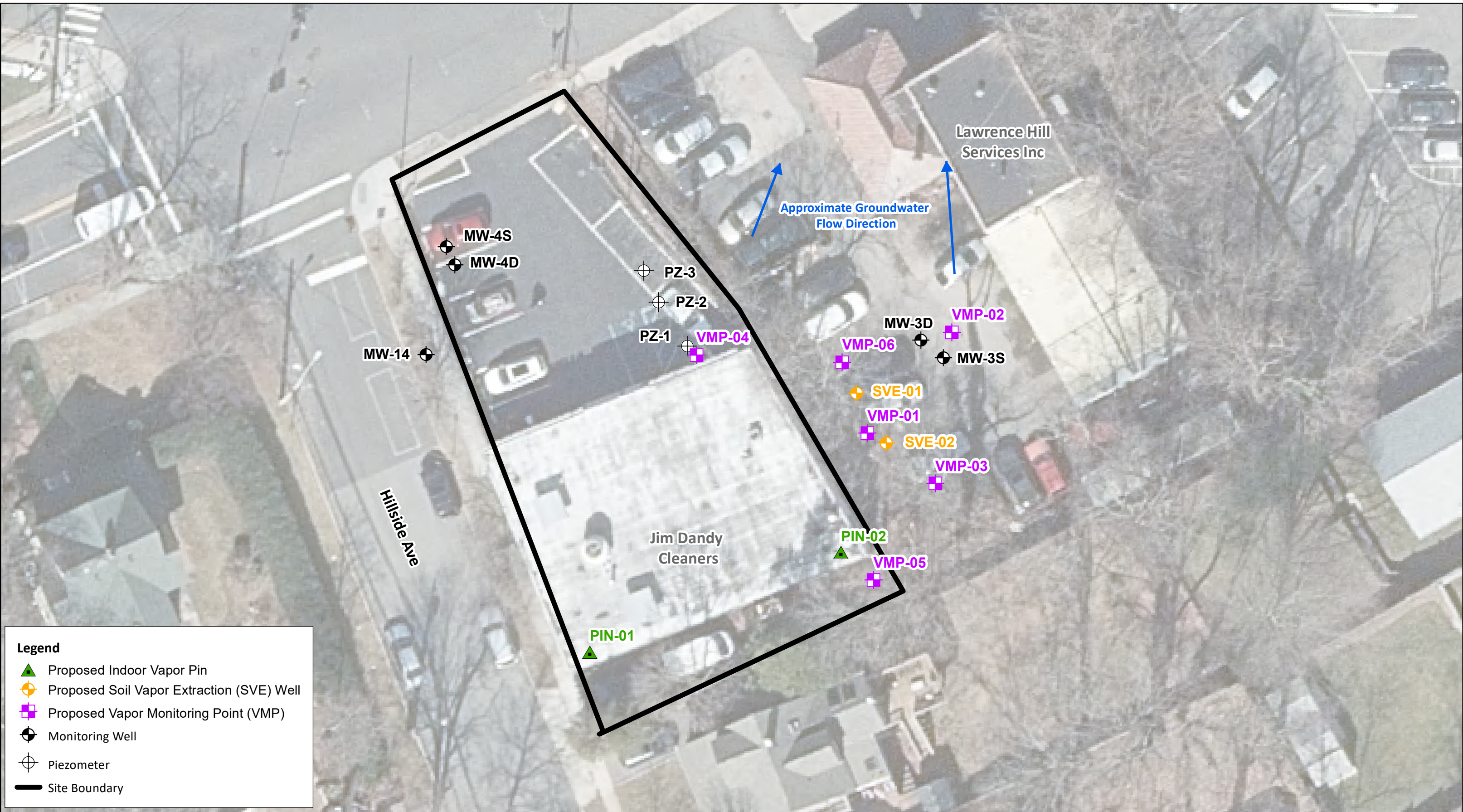


Figure 1-3
Historical Groundwater Contamination
NYSDEC Country Cleaners Site
Huntington, New York



Figure 1-4
Soil Boring PCE Results
NYSDEC Country Cleaners Site
Huntington, New York



Legend

- ▲ Proposed Indoor Vapor Pin
- ⊕ Proposed Soil Vapor Extraction (SVE) Well
- ⊞ Proposed Vapor Monitoring Point (VMP)
- ⊗ Monitoring Well
- ⊕ Piezometer
- Site Boundary



1 inch = 21 feet

0 7.5 15 30 Feet

Figure 2-1
SVE Pilot Study Well Layout - Source Area
NYSDEC Country Cleaners Site
Huntington, New York



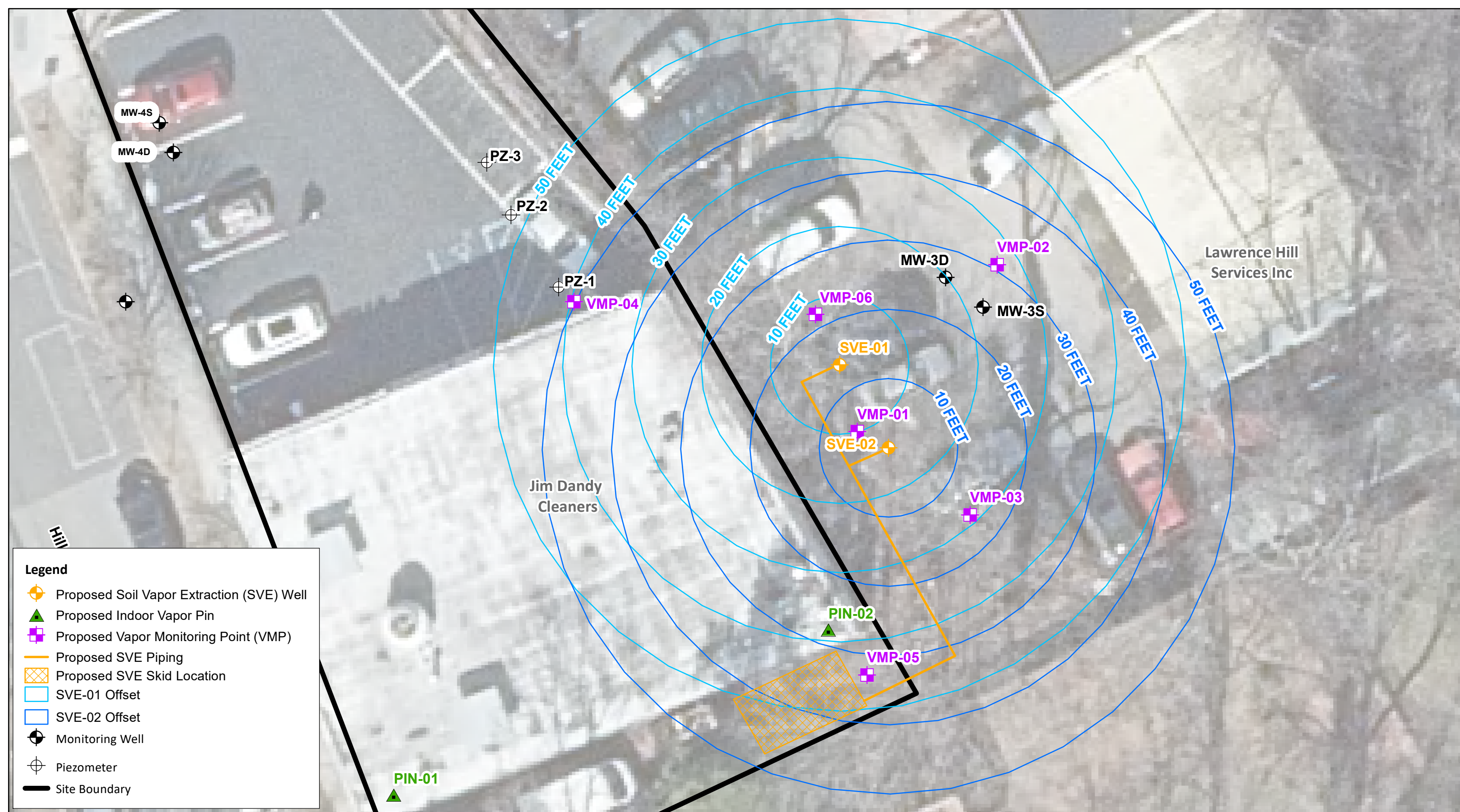
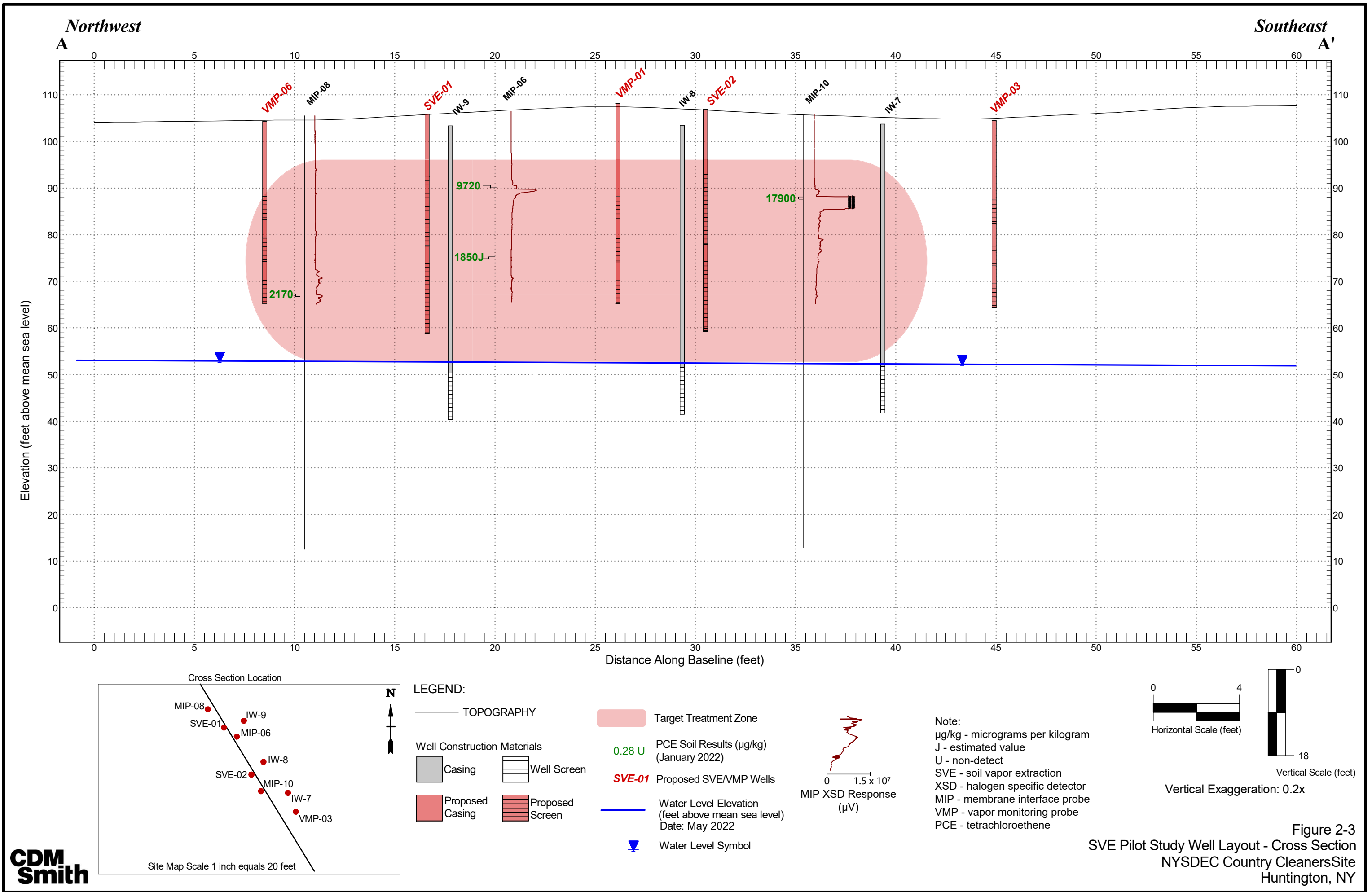
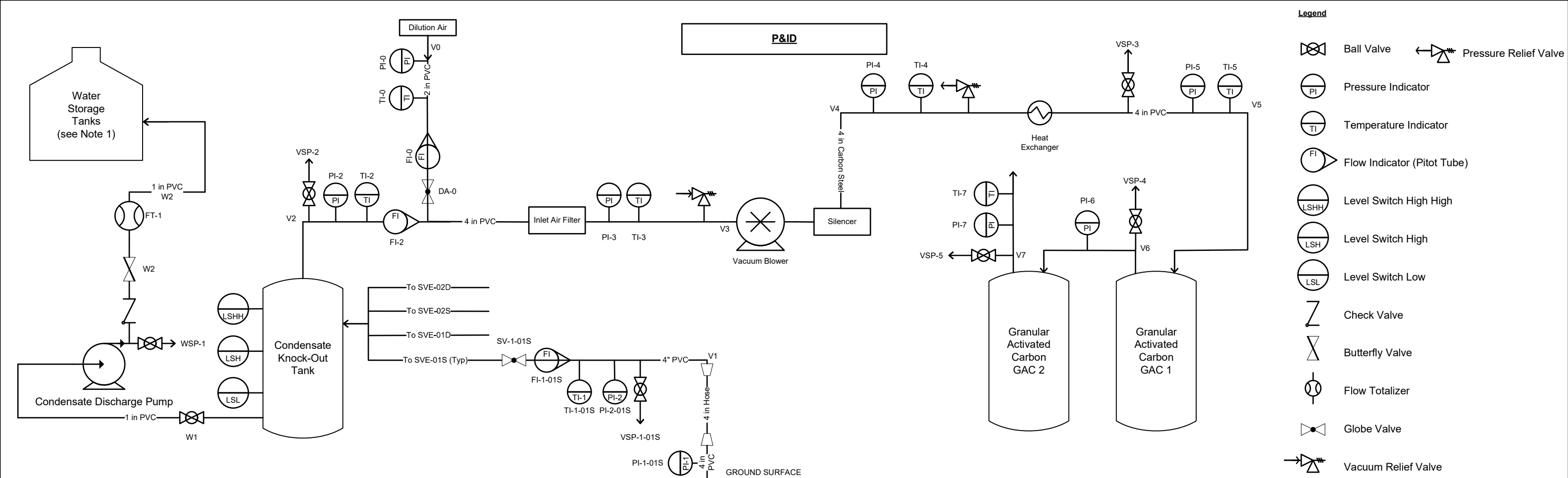


Figure 2-2
SVE Pilot Study Well Layout - Work Area
NYSDEC Country Cleaners Site
Huntington, New York





Notes:

- Storage tanks will be provided by EAR. Additional tanks may be necessary.
- VMPs must maintain 1 in clearance between/among casings.
- Follow all manufacturer suggestions such as appropriate inlet and outlet piping before and after any instrumentation or equipment.
- If cost effective, a variable frequency drive (VFD) will be installed to control the speed of the vacuum blower. However, if a VFD is not installed, a recirculation line connecting the blower effluent to the blower influent will be installed along with a valve on the recirculation line to assist in throttling the blower for better control.
- This P&ID is for diagrammatic purpose only; actual orientation will be determined in the field.
- A temporary riser pipe will be fastened to each SVE well using a rubber coupler. Each riser pipe will be equipped with a tee. One end of the tee will monitor wellhead pressure. The other end of the tee will include a reducer and camlock fittings to reduce pipe from 4 inch to 2 inch. Two inch flexible EPDM air hose, or similar, with camlock fittings will convey extracted air from the well head riser pipe to the manifold.
- All fittings, piping, instrumentation, and materials must have pressure ratings exceeding 20 percent of the pilot study design pressures.

Acronyms:

SVE = soil vapor extraction, in = inches, Sch = schedule, ft AMSL = feet above mean sea level, TD = total depth, Typ = typical, PVC = polyvinyl chloride, VSP = vapor sample port, PI = pressure indicator, TI = temperature indicator, SV = soil vapor, FI = flow indicator, LSHH = level switch high high, LSH = level switch high, LSL = level switch low, WSP = water sample port, W1 = water stream 1, V = vapor stream 1

Backfill

Bentonite/Cement Grout
(from top of bentonite seal to surface)

Bentonite Seal
(minimum 2 ft thickness above filter pack)

Filter Pack = No. 3 Sand
(Minimum 1 ft above screen interval to TD)

SVE Well Details (Typ)

Nested SVE Well Construction:

Shallow SVE Well

- 4 in Sch 40 Blank Casing: 93 ft AMSL to Surface
- 4 in 40 Slot Sch 40 Screen (continuous wrap): 78 to 93 ft AMSL
- 4 in Sch 40 End Cap: 77 to 78 ft AMSL

Deep SVE Well

- 4 in Sch 40 Blank Casing: 75 ft AMSL to Surface
- 4 in 40 Slot Sch 40 Screen (continuous wrap): 60 to 75 ft AMSL
- 4 in Sch 40 End Cap: 59 to 60 ft AMSL

Backfill

Bentonite/Cement Grout
(from top of bentonite seal to surface)

Filter Pack = No. 1 Sand
(Minimum 1 ft above screen interval to TD)

Bentonite Seal
(minimum 2 ft thickness above filter pack)

Filter Pack = No. 1 Sand
(Minimum 1 ft above and below shallow screen interval)

Bentonite Seal
(minimum 2 ft thickness between filter packs)

Filter Pack = No. 1 Sand
(Minimum 1 ft above screen interval to TD)

Nested VMP Details (Typ)

Nested VMP Construction:

Shallow VMP

- 0.5 in Sch 40 Blank Casing: 88 ft AMSL to Surface
- 0.5 in 10 Slot Sch 40 in Screen: 83 to 88 ft AMSL
- 0.5 in Sch 40 End Cap: 82 to 83 ft AMSL

Intermediate VMP

- 0.5 in Sch 40 Blank Casing: 79 ft AMSL to Surface
- 0.5 in 10 Slot Sch 40 in Screen: 74 to 79 ft AMSL
- 0.5 in Sch 40 End Cap: 73 to 74 ft AMSL

Deep VMP

- 0.5 in Sch 40 Blank Casing: 79 ft AMSL to Surface
- 0.5 in 10 Slot Sch 40 in Screen: 74 to 79 ft AMSL
- 0.5 in Sch 40 End Cap: 73 to 74 ft AMSL



Country Cleaners Project Schedule
NYSDEC Site No. 152187
Huntington, NY

ID	Task Name	Duration	Start	Finish	Actual Start	Actual Finish	% Complete	Qtr 4, 2023			Qtr 1, 2024			Qtr 2, 2024			Qtr 3, 2024			Qtr 4, 2024		
								Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
53	Kickoff Meeting	1 day	Tue 7/9/24	Tue 7/9/24	NA	NA	0%															
54	Pilot Study Implementation (EAR)/Construction Mgmt & Inspection (CDM Smith) (Task 3)	36 days	Wed 7/31/24	Wed 9/18/24	NA	NA	0%															
55	Well and VMP Installation/System Construction	10 days	Wed 7/31/24	Tue 8/13/24	NA	NA	0%															
56	Baseline Testing	1 day	Wed 8/14/24	Wed 8/14/24	NA	NA	0%															
57	Step Test	5 days	Thu 8/15/24	Wed 8/21/24	NA	NA	0%															
58	Extended Rate Test	20 days	Thu 8/22/24	Wed 9/18/24	NA	NA	0%															
59	Construction Completion Report (CCR) - SVE Pilot Study	60 days	Thu 9/19/24	Wed 12/11/24	NA	NA	0%															
60	Prepare CCR	35 days	Thu 9/19/24	Wed 11/6/24	NA	NA	0%															
61	Draft CCR to NYSDEC	0 days	Wed 11/6/24	Wed 11/6/24	NA	NA	0%															
62	NYSDEC Review/Provide Comments	15 days	Thu 11/7/24	Wed 11/27/24	NA	NA	0%															
63	Final CCR	10 days	Thu 11/28/24	Wed 12/11/24	NA	NA	0%															
64	Site Management Plan (Task 4)	165 days	Mon 11/27/23	Fri 7/12/24	Mon 11/27/23	NA	53%															
65	Prepare Site Management Plan	55 days	Mon 11/27/23	Fri 5/31/24	Mon 11/27/23	NA	82%															
66	Draft Site Management Plan to NYSDEC	0 days	Fri 5/31/24	Fri 5/31/24	NA	NA	0%															
67	NYSDEC Review of SMP	20 days	Mon 6/3/24	Fri 6/28/24	NA	NA	0%															
68	Final SMP	10 days	Mon 7/1/24	Fri 7/12/24	NA	NA	0%															
69	Green and Sustainable Remediation Metrics Assessment (Task 10)	125 days	Tue 2/6/24	Mon 7/29/24	NA	NA	0%															
70	Submit Draft GSR Metrics Assessment	100 days	Tue 2/6/24	Mon 6/24/24	NA	NA	0%															
71	NYSDEC Comments	15 days	Tue 6/25/24	Mon 7/15/24	NA	NA	0%															
72	Submit Final GSR Metrics Assessment	10 days	Tue 7/16/24	Mon 7/29/24	NA	NA	0%															
73	Groundwater Remedy Design (in-situ treatment)				NA	NA	0%															
74	Amendment Injection Groundwater RD Work Plan		TBD	TBD	NA	NA	0%															
75	Remedial Design Work Plan - Injections		TBD	TBD	NA	NA	0%															
76	Submit Preliminary RD Workplan to NYSDEC		TBD	TBD	NA	NA	0%															
77	NYSDEC Comments on Preliminary RD Workplan		TBD	TBD	NA	NA	0%															
78	Submit Final RD Workplan		TBD	TBD	NA	NA	0%															
79	Constrcution Mgmt and Inspection Services (Task 3)		TBD	TBD	NA	NA	0%															
80	Post -Injection Field Screening		TBD	TBD	NA	NA	0%															
81	Post-Injection Groundwater Sampling		TBD	TBD	NA	NA	0%															
82	Post-Injection Evaluation Memo				NA	NA	0%															
83	Draft Memo to NYSDEC		TBD	TBD	NA	NA	0%															
84	NYSDEC Review of Memo		TBD	TBD	NA	NA	0%															
85	Final Post Injection Evaluation Memo		TBD	TBD	NA	NA	0%															
86	Final Engineering Report (Task 5)		TBD	TBD	NA	NA	0%															
87	Prepare Final Engineering Report		TBD	TBD	NA	NA	0%															
88	Draft FER to NYSDEC		TBD	TBD	NA	NA	0%															
89	NYSDEC Review of FER		TBD	TBD	NA	NA	0%															
90	Final FER		TBD	TBD	NA	NA	0%															

Country Cleaners (152187) Date: Mon 5/20/24	Task		Project Summary		Manual Task		Start-only		Deadline	
	Split		Inactive Task		Duration-only		Finish-only		Progress	
	Milestone		Inactive Milestone		Manual Summary Rollup		External Tasks		Manual Progress	
	Summary		Inactive Summary		Manual Summary		External Milestone			



8.0 Tables

Table 1.1 MIP Groundwater Analytical Results

Table 1.2 MIP Soil Analytical Results

Table 1.3 Monitoring Well Groundwater Analytical Results

Table 2.1 Proposed Well Construction

Table 2.2 SVE Step Test Log Sheet

Table 2.3 Sampling and Analysis Requirements

Table 2.4 SVE Extended Operations Test Log Sheet

Table 1-1
MIP Groundwater Analytical Results
NYSDEC Site No. 152187 - Country Cleaners Site
Huntington, Suffolk County, New York

Location				MIP-02-GW-100		MIP-02-GW-70		MIP-03-GW-98		MIP-04-GW-100		MIP-04-GW-68		MIP-04-GW-85		MIP-05-GW-68		MIP-08-GW-55		MIP-08-GW-75		MIP-08-GW-90	
Sample ID				MIP-02-GW-100-012522		MIP-02-GW-70-012522		MIP-03-GW-98-012422		MIP-04-GW-100-020222		MIP-04-GW-68-020222		MIP-04-GW-85-020222		MIP-05-GW-68-020322		MIP-08-GW-55-012622		MIP-08-GW-75-012622		MIP-08-GW-90-012622	
Sample Start Depth				100		70		98		100		68		85		68		55		75		90	
Sample End Depth				103		73		101		103		71		88		71		58		78		93	
Depth Unit				ft		ft		ft		ft		ft		ft		ft		ft		ft		ft	
Sample Type				N		N		N		N		N		N		N		N		N		N	
Sample Date				1/25/2022		1/25/2022		1/24/2022		2/2/2022		2/2/2022		2/2/2022		2/3/2022		1/26/2022		1/26/2022		1/26/2022	
Analyte	CAS No.	NYSDEC TOGS -		Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
		GA	Units																				
1,1,1-Trichloroethane	71-55-6	5	µg/L	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
1,1,2,2-Tetrachloroethane	79-34-5	0.2	µg/L	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	5	µg/L	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
1,1,2-Trichloroethane	79-00-5	1	µg/L	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
1,1-Dichloroethane	75-34-3	5	µg/L	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
1,1-Dichloroethene	75-35-4	5	µg/L	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
1,2,4-Trichlorobenzene	120-82-1	5	µg/L	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
1,2-Dibromo-3-Chloropropane	96-12-8	0.04	µg/L	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	0.0006	µg/L	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
1,2-Dichlorobenzene	95-50-1	3	µg/L	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
1,2-Dichloroethane	107-06-2	0.6	µg/L	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
1,2-Dichloropropane	78-87-5	1	µg/L	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
1,3-Dichlorobenzene	541-73-1	3	µg/L	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
1,4-Dichlorobenzene	106-46-7	3	µg/L	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
2-Hexanone	591-78-6	50	µg/L	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Acetone	67-64-1	50	µg/L	5	U	5	U	5	U	2.1 J		3.2 J		4 J		2.8 J		2.2 J		5	U	5	U
Benzene	71-43-2	1	µg/L	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Bromodichloromethane	75-27-4	50	µg/L	1	U	1	U	1	U	1	UJ	1	UJ	1	UJ	1	UJ	1	U	1	U	1	U
Bromoform	75-25-2	50	µg/L	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Bromomethane	74-83-9	5	µg/L	1	UJ	1	UJ	1	UJ	1	UJ	1	UJ	1	UJ	1	UJ	1	UJ	1	UJ	1	UJ
Carbon Disulfide	75-15-0	8	µg/L	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Carbon Tetrachloride	56-23-5	5	µg/L	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Chlorobenzene	108-90-7	5	µg/L	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Chloroethane	75-00-3	5	µg/L	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Chloroform	67-66-3	7	µg/L	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Chloromethane	74-87-3	5	µg/L	1	U	1	U	1	U	1	UJ	1	UJ	1	UJ	1	UJ	1	U	1	U	1	U
Cis-1,2-Dichloroethylene	156-59-2	5	µg/L	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Cis-1,3-Dichloropropene	10061-01-5	0.4	µg/L	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Cyclohexane	110-82-7	0.1	µg/L	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Dibromochloromethane	124-48-1	50	µg/L	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Dichlorodifluoromethane	75-71-8	5	µg/L	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Ethylbenzene	100-41-4	5	µg/L	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Isopropylbenzene (Cumene)	98-82-8	5	µg/L	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Methyl Acetate	79-20-9	nc	µg/L	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Methyl Ethyl Ketone (2-Butanone)	78-93-3	50	µg/L	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	108-10-1	nc	µg/L	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Methylcyclohexane	108-87-2	nc	µg/L	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Methylene Chloride	75-09-2	5	µg/L	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Styrene	100-42-5	5	µg/L	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Tert-Butyl Methyl Ether	1634-04-4	10	µg/L	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Tetrachloroethylene (PCE)	127-18-4	5	µg/L	1	U	1	U	1	U	1.1		4.1		1.5		1	U	51.2 J		1	U	1	U
Toluene	108-88-3	5	µg/L	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Trans-1,2-Dichloroethene	156-60-5	5	µg/L	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Trans-1,3-Dichloropropene	10061-02-6	0.4	µg/L	1	UJ	1	UJ	1	UJ	1	U	1	U	1	U	1	U	1	UJ	1	UJ	1	UJ
Trichloroethylene (TCE)	79-01-6	5	µg/L	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Trichlorofluoromethane	75-69-4	5	µg/L	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Vinyl Chloride	75-01-4	2	µg/L	1	U	1	U	1	U	1	UJ	1	UJ	1	UJ	1	UJ	1	U	1	U	1	U
Xylenes	1330-20-7	5	µg/L	3	U	3	U	3	U	3	U	3	U	3	U	3	U	3	U	3	U	3	U

Notes:

Exceeded Criteria

BOLD Detected

Acronyms:

µg/L - micrograms per liter

CAS - chemical abstract service

ft - feet

GA - Class GA Groundwater

ID - identification

J - The analyte is an estimated quantity

GW - groundwater

N - normal sample

nc - no criteria

No. - number

NYSDEC TOGS - New York State Department of Environmental Conservation Technical and Operational Guidance

MIP - membrane interface probe hydraulic profiling tool

U - The analyte was analyzed but not detected above the reported sample quantitation limit

Table 1-1
MIP Groundwater Analytical Results
NYSDEC Site No. 152187 - Country Cleaners Site
Huntington, Suffolk County, New York

Location				MIP-10-GW-75		MIP-10-GW-90		MIP-12-GW-100		MIP-12-GW-68		MIP-12-GW-85	
Sample ID				MIP-10-GW-75-013122		MIP-10-GW-90-013122		MIP-12-GW-100-020122		MIP-12-GW-68-020122		MIP-12-GW-85-020122	
Sample Start Depth				75		90		100		68		85	
Sample End Depth				78		93		103		71		88	
Depth Unit				ft		ft		ft		ft		ft	
Sample Type				N		N		N		N		N	
Sample Date				1/31/2022		1/31/2022		2/1/2022		2/1/2022		2/1/2022	
Analyte	CAS No.	NYSDEC TOGs -		Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
1,1,1-Trichloroethane	71-55-6	5	µg/L	1	U	1	U	1	U	1	U	1	U
1,1,2,2-Tetrachloroethane	79-34-5	0.2	µg/L	1	U	1	U	1	U	1	U	1	U
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	5	µg/L	1	U	1	U	1	U	1	U	1	U
1,1,2-Trichloroethane	79-00-5	1	µg/L	1	U	1	U	1	U	1	U	1	U
1,1-Dichloroethane	75-34-3	5	µg/L	1	U	1	U	1	U	1	U	1	U
1,1-Dichloroethene	75-35-4	5	µg/L	1	U	1	U	1	U	1	U	1	U
1,2,4-Trichlorobenzene	120-82-1	5	µg/L	1	U	1	U	1	U	1	U	1	U
1,2-Dibromo-3-Chloropropane	96-12-8	0.04	µg/L	1	U	1	U	1	U	1	U	1	U
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	0.0006	µg/L	1	U	1	U	1	U	1	U	1	U
1,2-Dichlorobenzene	95-50-1	3	µg/L	1	U	1	U	1	U	1	U	1	U
1,2-Dichloroethane	107-06-2	0.6	µg/L	1	U	1	U	1	U	1	U	1	U
1,2-Dichloropropane	78-87-5	1	µg/L	1	U	1	U	1	U	1	U	1	U
1,3-Dichlorobenzene	541-73-1	3	µg/L	1	U	1	U	1	U	1	U	1	U
1,4-Dichlorobenzene	106-46-7	3	µg/L	1	U	1	U	1	U	1	U	1	U
2-Hexanone	591-78-6	50	µg/L	5	U	5	U	5	U	5	U	5	U
Acetone	67-64-1	50	µg/L	5	U	5	U	2.2	J	3.4	J	2.3	J
Benzene	71-43-2	1	µg/L	1	U	1	U	1	U	1	U	1	U
Bromodichloromethane	75-27-4	50	µg/L	1	UJ	1	UJ	1	UJ	1	UJ	1	UJ
Bromoform	75-25-2	50	µg/L	1	U	1	U	1	U	1	U	1	U
Bromomethane	74-83-9	5	µg/L	1	UJ	1	UJ	1	UJ	1	UJ	1	UJ
Carbon Disulfide	75-15-0	8	µg/L	1	U	1	U	1	U	1	U	1	U
Carbon Tetrachloride	56-23-5	5	µg/L	1	U	1	U	1	U	1	U	1	U
Chlorobenzene	108-90-7	5	µg/L	1	U	1	U	1	U	1	U	1	U
Chloroethane	75-00-3	5	µg/L	1	U	1	U	1	U	1	U	1	U
Chloroform	67-66-3	7	µg/L	1	U	1	U	1	U	1	U	1	U
Chloromethane	74-87-3	5	µg/L	1	UJ	1	UJ	1	UJ	1	UJ	1	UJ
Cis-1,2-Dichloroethylene	156-59-2	5	µg/L	1	U	1	U	1	U	1	U	1	U
Cis-1,3-Dichloropropene	10061-01-5	0.4	µg/L	1	U	1	U	1	U	1	U	1	U
Cyclohexane	110-82-7	0.1	µg/L	1	U	1	U	1	U	1	U	1	U
Dibromochloromethane	124-48-1	50	µg/L	1	U	1	U	1	U	1	U	1	U
Dichlorodifluoromethane	75-71-8	5	µg/L	1	U	1	U	1	U	1	U	1	U
Ethylbenzene	100-41-4	5	µg/L	1	U	1	U	1	U	1	U	1	U
Isopropylbenzene (Cumene)	98-82-8	5	µg/L	1	U	1	U	1	U	1	U	1	U
Methyl Acetate	79-20-9	nc	µg/L	1	U	1	U	1	U	1	U	1	U
Methyl Ethyl Ketone (2-Butanone)	78-93-3	50	µg/L	5	U	5	U	5	U	5	U	5	U
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	108-10-1	nc	µg/L	5	U	5	U	5	U	5	U	5	U
Methylcyclohexane	108-87-2	nc	µg/L	1	U	1	U	1	U	1	U	1	U
Methylene Chloride	75-09-2	5	µg/L	1	U	1	U	1	U	1	U	1	U
Styrene	100-42-5	5	µg/L	1	U	1	U	1	U	1	U	1	U
Tert-Butyl Methyl Ether	1634-04-4	10	µg/L	1	U	1	U	1	U	1	U	1	U
Tetrachloroethylene (PCE)	127-18-4	5	µg/L	1	U	1	U	1	U	1.2		1	U
Toluene	108-88-3	5	µg/L	1	U	1	U	1	U	1	U	1	U
Trans-1,2-Dichloroethene	156-60-5	5	µg/L	1	U	1	U	1	U	1	U	1	U
Trans-1,3-Dichloropropene	10061-02-6	0.4	µg/L	1	U	1	U	1	U	1	U	1	U
Trichloroethylene (TCE)	79-01-6	5	µg/L	1	U	1	U	1	U	1	U	1	U
Trichlorofluoromethane	75-69-4	5	µg/L	1	U	1	U	1	U	1	U	1	U
Vinyl Chloride	75-01-4	2	µg/L	1	UJ	1	UJ	1	UJ	1	UJ	1	UJ
Xylenes	1330-20-7	5	µg/L	3	U	3	U	3	U	3	U	3	U

Notes:

Exceeded Criteria

BOLD Detected

Acronyms:

µg/L - micrograms per liter

CAS - chemical abstract service

ft - feet

GA - Class GA Groundwater

ID - identification

J - The analyte is an estimated quantity

GW - groundwater

N - normal sample

nc - no criteria

No. - number

NYSDEC TOGS - New York State Department of Environmental Conservation Technical and Operational Guidance

MIP - membrane interface probe hydraulic profiling tool

U - The analyte was analyzed for but not detected above the level of the reported sample quantitation limit.

Table 1-2
MIP Soil Analytical Results
NYSDEC Site No. 152187 - Country Cleaners Site
Huntington, Suffolk County, New York

Location		MIP-01-SB-17	MIP-02-SB-17	MIP-05-SB-37	MIP-05-SB-52	MIP-06-SB-17.5	MIP-06-SB-17.5	MIP-06-SB-31	MIP-08-SB-32.5	MIP-08-SB-38	MIP-09-SB-36	MIP-10-SB-17.5	MIP-11-SB-18	MIP-11-SB-53	MIP-12-SB-18	MIP-13-SB-17	MIP-13-SB-46		
Sample ID	Sample Start Depth	MIP-01-SB-17-012022	MIP-02-SB-17-012522	MIP-05-SB-37-012722	MIP-05-SB-52-012722	DUP-012122	MIP-06-SB-17.5-012122	MIP-06-SB-31-012122	MIP-08-SB-32.5-012622	MIP-08-SB-38-012622	MIP-09-SB-36-012722	MIP-10-SB-17.5-013122	MIP-11-SB-18-012022	MIP-11-SB-53-012022	MIP-12-SB-18-012722	MIP-13-SB-17-012022	MIP-13-SB-46-012022		
Sample End Depth	Depth Unit	17	17	37	52	17.5	17.5	31	32.5	38	36	17.5	18	53	18	17	46		
Sample Type	Parent Sample ID	N	N	N	N	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft		
Sample Date	Sample Date	1/20/2022	1/25/2022	1/27/2022	1/27/2022	MIP-06-SB-17.5-012122	1/21/2022	1/21/2022	1/26/2022	1/26/2022	1/27/2022	1/31/2022	1/20/2022	1/20/2022	1/27/2022	1/20/2022	1/20/2022		
Analyte	CAS No.	NYSDEC Soil SCO-		Units	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	
		Unrestricted	Units																
1,1,1,2-Tetrachloroethane	630-20-6	nc	mg/kg		0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U	
1,1,1-Trichloroethane	71-55-6	0.68	mg/kg	0.002	U	0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U
1,1,2,2-Tetrachloroethane	79-34-5	nc	mg/kg	0.002	U	0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	nc	mg/kg	0.002	U	0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U
1,1,2-Trichloroethane	79-00-5	nc	mg/kg	0.002	U	0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U
1,1-Dichloroethane	75-34-3	0.27	mg/kg	0.002	U	0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U
1,1-Dichloroethene	75-35-4	0.33	mg/kg	0.002	U	0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U
1,1-Dichloropropene	563-58-6	nc	mg/kg		0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U	
1,2,3-Trichlorobenzene	87-61-6	nc	mg/kg		0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U	
1,2,3-Trichloropropane	96-18-4	nc	mg/kg		0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U	
1,2,4,5-Tetramethylbenzene	95-93-2	nc	mg/kg		4.53	J	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U	
1,2,4-Trichlorobenzene	120-82-1	nc	mg/kg	0.002	U	0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U
1,2,4-Trimethylbenzene	95-63-6	3.6	mg/kg		0.227	J	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U	
1,2-Dibromo-3-Chloropropane	96-12-8	nc	mg/kg	0.002	U	0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	nc	mg/kg	0.002	U	0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U
1,2-Dichlorobenzene	95-50-1	1.1	mg/kg	0.002	U	0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U
1,2-Dichloroethane	107-06-2	0.02	mg/kg	0.002	U	0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U
1,2-Dichloropropane	78-87-5	nc	mg/kg	0.002	U	0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U
1,3,5-Trimethylbenzene (Mesitylene)	108-67-8	8.4	mg/kg		0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U	
1,3-Dichlorobenzene	541-73-1	2.4	mg/kg	0.002	U	0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U
1,3-Dichloropropane	142-28-9	nc	mg/kg		0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U	
1,4-Dichlorobenzene	106-46-7	1.8	mg/kg	0.002	U	0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U
1,4-Diethyl Benzene	105-05-5	nc	mg/kg		2.37	J	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U	
2,2-Dichloropropane	594-20-7	nc	mg/kg		0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U	
2-Chlorotoluene	95-49-8	nc	mg/kg		0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U	
2-Hexanone	591-78-6	nc	mg/kg	0.002	UJ											0.0019	UJ		
4-Chlorotoluene	106-43-4	nc	mg/kg		0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U	
4-Ethyltoluene	622-96-8	nc	mg/kg		0.136	UJ											0.0018	U	
Acetone	67-64-1	0.05	mg/kg	0.0142	J	0.136	UJ	0.0022	UJ	0.0022	UJ	0.0935	U	0.0713	J	0.0674	J	0.0046	J
Benzene	71-43-2	0.06	mg/kg	0.002	U	0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U
Bromobenzene	108-86-1	nc	mg/kg		0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U	
Bromochloromethane	74-97-5	nc	mg/kg		0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U	
Bromodichloromethane	75-27-4	nc	mg/kg	0.002	U	0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U
Bromoform	75-25-2	nc	mg/kg	0.002	UJ	0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U
Bromomethane	74-83-9	nc	mg/kg	0.002	U	0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U
Carbon Disulfide	75-15-0	nc	mg/kg	0.002	U											0.0019	UJ		
Carbon Tetrachloride	56-23-5	0.76	mg/kg	0.002	U	0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U
Chlorobenzene	108-90-7	1.1	mg/kg	0.002	U	0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U
Chlorodifluoromethane	75-45-6	nc	mg/kg		0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U	
Chloroethane	75-00-3	nc	mg/kg	0.002	U	0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U
Chloroform	67-66-3	0.37	mg/kg	0.002	U	0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U
Chloromethane	74-87-3	nc	mg/kg	0.002	U	0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U
Cis-1,2-Dichloroethylene	156-59-2	0.25	mg/kg	0.002	U	0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U
Cis-1,3-Dichloropropene	10061-01-5	nc	mg/kg	0.002	UJ	0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U
Cyclohexane	110-82-7	nc	mg/kg	0.002	U											0.0019	UJ		
Cymene	99-87-6	nc	mg/kg		0.122	J	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U	
Dibromochloromethane	124-48-1	nc	mg/kg	0.002	U	0.136	UJ	0.0022	UJ	0.0022	UJ	0.0935	U	0.0951	U	0.0024	UJ	0.118	U
Dibromomethane	74-95-3	nc	mg/kg		0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U	
Dichlorodifluoromethane	75-71-8	nc	mg/kg	0.002	U	0.136	UJ	0.0022	UJ	0.0022	UJ	0.0935	U	0.0951	U	0.0024	U	0.118	U
Ethylbenzene	100-41-4	1	mg/kg	0.002	U	0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U
Hexachlorobutadiene	87-68-3	nc	mg/kg		0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U	
Isopropylbenzene (Cumene)	98-82-8	nc	mg/kg	0.0045		0.335	J	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U
m,p-Xylene	179601-23-1	0.26	mg/kg		0.272	UJ	0.0043	U	0.0043	U	0.187	U	0.183	U	0.237	U	0.254	U	
Methyl Acetate	79-20-9	nc	mg/kg	0.002	U											0.0019	U		
Methyl Ethyl Ketone (2-Butanone)	78-93-3	0.12	mg/kg	0.0022	J	0.136	UJ	0.0017	J	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	108-10-1	nc	mg/kg	0.002	U	0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0024	U	0.118	U
Methylcyclohexane	108-87-2	nc	mg/kg	0.0033												0.0019	U		

Table 1-2
MIP Soil Analytical Results
NYSDEC Site No. 152187 - Country Cleaners Site
Huntington, Suffolk County, New York

Location Sample ID Sample Start Depth Sample End Depth Depth Unit Sample Type Parent Sample ID Sample Date				MIP-01-SB-17 MIP-01-SB-17-012022	MIP-02-SB-17 MIP-02-SB-17-012522	MIP-05-SB-37 MIP-05-SB-37-012722	MIP-05-SB-52 MIP-05-SB-52-012722	MIP-06-SB-17.5 DUP-012122	MIP-06-SB-17.5-012122	MIP-06-SB-31 MIP-06-SB-31-012122	MIP-08-SB-32.5 MIP-08-SB-32.5-012622	MIP-08-SB-38 MIP-08-SB-38-012622	MIP-09-SB-36 MIP-09-SB-36-012722	MIP-10-SB-17.5 MIP-10-SB-17.5-013122	MIP-11-SB-18 MIP-11-SB-18-012022	MIP-11-SB-53 MIP-11-SB-53-012022	MIP-12-SB-18 MIP-12-SB-18-012722	MIP-13-SB-17 MIP-13-SB-17-012022	MIP-13-SB-46 MIP-13-SB-46-012022		
				17	17	37	52	17.5	17.5	31	32.5	38	36	17.5	18	53	18	17	46		
				17.5	17.5	37.5	52.5	18	18	33	38.5	38.5	36.5	31.5	38.5	53.5	18.5	17.5	46.5		
				ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft		
				N	N	N	N	FD	N	N	N	N	N	N	N	N	N	N	N		
				1/20/2022	1/25/2022	1/27/2022	1/27/2022	1/21/2022	1/21/2022	1/21/2022	1/26/2022	1/26/2022	1/27/2022	1/31/2022	1/20/2022	1/20/2022	1/27/2022	1/20/2022	1/20/2022		
Analyte	CAS No.	NYSDEC Soil SCO- Unrestricted	Units	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
Methylene Chloride	75-09-2	0.05	mg/kg	0.0024		0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0917	U	0.0024	U	0.118	U
Naphthalene	91-20-3	12	mg/kg			0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0917	U	0.0024	U	0.118	U
N-Butylbenzene	104-51-8	12	mg/kg			2.65	J	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0917	U	0.0024	U	0.118	U
N-Propylbenzene	103-65-1	3.9	mg/kg			0.858	J	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0917	U	0.0024	U	0.118	U
O-Xylene (1,2-Dimethylbenzene)	95-47-6	nc	mg/kg			0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0917	U	0.0024	U	0.118	U
Sec-Butylbenzene	135-98-8	11	mg/kg			3.79	J	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0917	U	0.0024	U	0.118	U
Styrene	100-42-5	nc	mg/kg	0.002	U	0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0917	U	0.0024	U	0.118	U
T-Butylbenzene	98-06-6	5.9	mg/kg			0.115	J	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0917	U	0.0024	U	0.118	U
Tert-Butyl Methyl Ether	1634-04-4	0.93	mg/kg	0.002	U	0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0917	U	0.0024	U	0.118	U
Tetrachloroethylene (PCE)	127-18-4	1.3	mg/kg	0.002	UJ	0.136	UJ	0.0024	J	0.0172	J	8.4	J	9.72		1.85	J	0.115	J	2.17	
Toluene	108-88-3	0.7	mg/kg	0.002	U	0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0917	U	0.0024	U	0.118	U
Trans-1,2-Dichloroethene	156-60-5	0.19	mg/kg	0.002	U	0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0917	U	0.0024	U	0.118	U
Trans-1,3-Dichloropropene	10061-02-6	nc	mg/kg	0.002	U	0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0917	U	0.0024	U	0.118	U
Trichloroethylene (TCE)	79-01-6	0.47	mg/kg	0.002	U	0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0917	U	0.0024	U	0.118	U
Trichlorofluoromethane	75-69-4	nc	mg/kg	0.002	U	0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0917	U	0.0024	U	0.118	U
Vinyl Chloride	75-01-4	0.02	mg/kg	0.0011	J	0.136	UJ	0.0022	U	0.0022	U	0.0935	U	0.0951	U	0.0917	U	0.0024	U	0.118	U
Xylenes	1330-20-7	nc	mg/kg	0.0041	U	0.272	UJ	0.0043	U	0.0043	U	0.187	U	0.19	U	0.183	U	0.0047	U	0.237	U
Moisture, Percent	MOIST	nc	mg/kg	22.9		24		3		4.7		9		9.6		5.4		11.1		17.3	

Notes:

Exceeded Criteria

BOLD Detected

Acronyms:

CAS - chemical abstract service

DUP - duplicate

FD - field duplicate

ft - feet

ID - identification

J - The analyte is an estimated quantity.

mg/kg - milligrams per kilogram

MIP - membrane interface probe hydraulic profiling tool

N - normal sample

nc - no criteria

No. - number

NYSDEC - New York State Department of Environmental Conservation

SB - soil boring

SCO - Soil Cleanup Objectives

Table 1-3
Monitoring Well Groundwater Analytical Results
NYSDEC Site No. 152187 - Country Cleaners Site
Huntington, Suffolk County, New York

Location				MW-12		MW-13		MW-14	
Sample ID				MW-12-050422		MW-13-050422		MW-14-050422	
Sample Start Depth				57		72		60	
Sample End Depth				67		82		70	
Depth Unit				ft		ft		ft	
Sample Type				N		N		N	
Sample Date				5/4/2022		5/4/2022		5/4/2022	
Analyte	CAS No.	NYSDEC TOGs - GA	Units	Result	Qualifier	Result	Qualifier	Result	Qualifier
1,1,1-Trichloroethane	71-55-6	5	µg/L	1	U	1	U	1	U
1,1,2,2-Tetrachloroethane	79-34-5	0.2	µg/L	1	U	1	U	1	U
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	5	µg/L	1	U	1	U	1	U
1,1,2-Trichloroethane	79-00-5	1	µg/L	1	U	1	U	1	U
1,1-Dichloroethane	75-34-3	5	µg/L	1	U	1	U	1	U
1,1-Dichloroethene	75-35-4	5	µg/L	1	U	1	U	1	U
1,2,4-Trichlorobenzene	120-82-1	5	µg/L	1	U	1	U	1	U
1,2-Dibromo-3-Chloropropane	96-12-8	0.04	µg/L	1	U	1	U	1	U
1,2-Dibromoethane (Ethylene Dibromide)	106-93-4	0.0006	µg/L	1	U	1	U	1	U
1,2-Dichlorobenzene	95-50-1	3	µg/L	1	U	1	U	1	U
1,2-Dichloroethane	107-06-2	0.6	µg/L	1	U	1	U	1	U
1,2-Dichloropropane	78-87-5	1	µg/L	1	U	1	U	1	U
1,3-Dichlorobenzene	541-73-1	3	µg/L	1	U	1	U	1	U
1,4-Dichlorobenzene	106-46-7	3	µg/L	1	U	1	U	1	U
2-Hexanone	591-78-6	50	µg/L	5	U	5	U	5	U
Acetone	67-64-1	50	µg/L	5	U	5	U	5	U
Benzene	71-43-2	1	µg/L	1	U	1	U	1	U
Bromodichloromethane	75-27-4	50	µg/L	1	U	1	U	1	U
Bromoform	75-25-2	50	µg/L	1	U	1	U	1	U
Bromomethane	74-83-9	5	µg/L	1	UJ	1	UJ	1	UJ
Carbon Disulfide	75-15-0	8	µg/L	1	U	1	U	1	U
Carbon Tetrachloride	56-23-5	5	µg/L	1	U	1	U	1	U
Chlorobenzene	108-90-7	5	µg/L	1	U	1	U	1	U
Chloroethane	75-00-3	5	µg/L	1	U	1	U	1	U
Chloroform	67-66-3	7	µg/L	1	U	1	U	1	U
Chloromethane	74-87-3	5	µg/L	1	U	1	U	1	U
Cis-1,2-Dichloroethylene	156-59-2	5	µg/L	1	U	1	U	1	U
Cis-1,3-Dichloropropene	10061-01-5	0.4	µg/L	1	U	1	U	1	U
Cyclohexane	110-82-7	0.1	µg/L	1	U	1	U	1	U
Dibromochloromethane	124-48-1	50	µg/L	1	U	1	U	1	U
Dichlorodifluoromethane	75-71-8	5	µg/L	1	U	1	U	1	U
Ethylbenzene	100-41-4	5	µg/L	1	U	1	U	1	U
Isopropylbenzene (Cumene)	98-82-8	5	µg/L	1	U	1	U	1	U
Methyl Acetate	79-20-9	nc	µg/L	1	U	1	U	1	U
Methyl Ethyl Ketone (2-Butanone)	78-93-3	50	µg/L	5	U	5	U	5	U
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	108-10-1	nc	µg/L	5	U	5	U	5	U
Methylcyclohexane	108-87-2	nc	µg/L	1	U	1	U	1	U
Methylene Chloride	75-09-2	5	µg/L	1	U	1	U	1	U
Styrene	100-42-5	5	µg/L	1	U	1	U	1	U
Tert-Butyl Methyl Ether	1634-04-4	10	µg/L	1	U	1	U	1	U
Tetrachloroethylene (PCE)	127-18-4	5	µg/L	24.1	J	1	UJ	105	J
Toluene	108-88-3	5	µg/L	1	U	1	U	1	U
Trans-1,2-Dichloroethene	156-60-5	5	µg/L	1	U	1	U	1	U
Trans-1,3-Dichloropropene	10061-02-6	0.4	µg/L	1	U	1	U	1	U
Trichloroethylene (TCE)	79-01-6	5	µg/L	1	U	1	U	1	U
Trichlorofluoromethane	75-69-4	5	µg/L	1	U	1	U	1	U
Vinyl Chloride	75-01-4	2	µg/L	1	U	1	U	1	U
Xylenes	1330-20-7	5	µg/L	3	U	3	U	3	U

Notes:

	Exceeded Criteria
BOLD	Detected

Acronyms:

µg/L - micrograms per liter	N - normal sample
CAS - chemical abstract service	nc - no criteria
ft - feet	No. - number
GA - Class GA Groundwater	NYSDEC TOGS - New York State Department of Environmental Conservation Technical and Operational Guidance
J - The analyte is an estimated quantity	MIP - membrane interface probe hydraulic profiling tool
ID - identification	U - The analyte was analyzed for but not detected above the level of the reported sample quantitation limit
MW - monitoring well	

Table 2-1
Proposed Well and Vapor Probe Construction
NYSDEC Site No. 152187 - Country Cleaners Site
Huntington, Suffolk County, New York

Well ID	Interval ID	Location	State Plane Easting	State Plane Northing	Ground Surface Elevation (ft amsl)	Borehole Diameter (in)	Casing Diameter (in)	Number of Inner Casings/ Screens	Casing Material	Screen Type	Screen Start (ft amsl)	Screen End (ft amsl)	Approximate Elevation of Boring Depth (ft amsl)	Screen Start (ft bgs)	Screen End (ft bgs)	Total Boring Depth (ft bgs)
Soil Vapor Extraction (SVE) Wells ¹																
SVE-01	SVE-01S	East of Jim Dandy Cleaners Building	1140921	256474	106	8	4	1	Schedule 40 PVC	0.040 in (continuous wrap)	93	78	78	13	28	28
	SVE-01D				106	8	4	1			74	59	59	32	47	47
SVE-02	SVE-02S	East of Jim Dandy Cleaners Building	1140928	256462	107	8	4	1			93	78	78	14	29	29
	SVE-02D				107	8	4	1			74	59	59	33	48	48
Vapor Monitoring Probes (VMP)																
VMP-01	VMP-01-1	10 feet from SVE-01; 5 feet from SVE-02	1140923	256464	108	8	0.5	3	Schedule 40 PVC	0.010 in	70	65	64	38	43	44
	VMP-01-2				108						79	74		29	34	
	VMP-01-3				108						88	83		20	25	
VMP-02	VMP-02-1	25 feet from SVE-01; 30 feet from SVE-02	1140944	256488	102	8	0.5	3	Schedule 40 PVC	0.010 in	70	65	64	32	37	38
	VMP-02-2				102						79	74		23	28	
	VMP-02-3				102						88	83		14	19	
VMP-03	VMP-03-1	28 feet from SVE-01; 15 feet from SVE-02	1140940	256452	105	8	0.5	3	Schedule 40 PVC	0.010 in	70	65	64	35	40	41
	VMP-03-2				105						79	74		26	31	
	VMP-03-3				105						88	83		17	22	
VMP-04	VMP-04-1	38 feet from SVE-01; 48 feet from SVE-02	1140883	256483	111	8	0.5	3	Schedule 40 PVC	0.010 in	70	65	64	41	46	47
	VMP-04-2				111						79	74		32	37	
	VMP-04-3				111						88	83		23	28	
VMP-05	VMP-05-1	44 feet from SVE-01; 32 feet from SVE-02	1140925	256429	111	8	0.5	3	Schedule 40 PVC	0.010 in	70	65	64	41	46	47
	VMP-05-2				111						79	74		32	37	
	VMP-05-3				111						88	83		23	28	
VMP-06	VMP-06-1	8 feet from SVE-01; 21 feet from SVE-02	1140918	256481	104	8	0.5	3	Schedule 40 PVC	0.010 in	70	65	64	34	39	40
	VMP-06-2				104						79	74		25	30	
	VMP-06-3				104						88	83		16	21	
Sub-Slab Vapor Sampling Probes (VaporPin®) ²																
PIN-01	-	Southwest corner of Jim Dandy Cleaners Building	1140857	256412	-	-	-	-	-	-	-	-	-	-	-	-
PIN-02	-	Southeast corner of Jim Dandy Cleaners Building	1140917	256436	-	-	-	-	-	-	-	-	-	-	-	-

Notes

- Each SVE well pair (SVE-01 and SVE-02) will consist of two adjacent 8-inch diameter boreholes, for a total of 4 SVE well boreholes (SVE-01S, SVE-01D, SVE-02S, SVE-02D).
- The vapor pins will be installed in accordance with the Installation and Extraction of the VaporPin® Standard Operating Procedure (VaporPin® 2020).

Acronyms:

ft amsl - feet above mean sea level in = inches
ft bgs - feet below ground surface ID - identification
PVC - polyvinyl chloride

Table 2-2
SVE Step Test Log Sheet
NYSDEC Site No. 152187 - Country Cleaners Site
Huntington, Suffolk County, New York

Step #	Date	Suggested Timing of Readings and Sampling	Actual Time of Readings and Sampling	Select Test: () SVE-01S Only () SVE-01D Only () SVE-02S Only () SVE-02D Only () Combined Operation														
				Dilution Air (V0)				Extracted Vapor - Combined (V2)				Blower Inlet (V3)		Blower Outlet (V4)		Pre-VGAC (V5)		
				Flowrate FI-0 ACFM	Temp TI-0 °F	Vacuum PI-0 in of WC	DA-0 % Open	Flowrate FI-2 ACFM	Temp TI-2 °F	Vacuum PI-2 in of WC	PID at VSP-2 ppm	Vacuum PI-3 in of WC	Temp TI-3 °F	Pressure PI-4 in of WC	Temp TI-4 °F	PID at VSP-3 ppm	Pressure PI-5 in of WC	Temp TI-5 °F
0																		
1		Start Time																
		+15 min																
		+30 min																
		+45 min																
		+60 min																
		+75 min																
		+90 min																
		+105 min																
		+120 min																
2		Start Time																
		+15 min																
		+30 min																
		+45 min																
		+60 min																
		+75 min																
		+90 min																
		+105 min																
		+120 min																
3		Start Time																
		+15 min																
		+30 min																
		+45 min																
		+60 min																
		+75 min																
		+90 min																
		+105 min																
		+120 min																
Notes: Acronyms: SVE= soil vapor extraction, VMP = vapor monitoring point, ACFM = actual cubic feet per minute, °F = degrees Fahrenheit, % = percent, # = number, DA = dilution air, PID = photoionization detector, VSP = vapor sampling point, ppm = parts per million, PI = pressure indicator, FI = flow indicator, TI = temperature indicator, in of WC = inches of water column, VGAC = vapor phase granular activated carbon, Temp = temperature, hr = hour, min = minute																		

Table 2-2
SVE Step Test Log Sheet
NYSDEC Site No. 152187 - Country Cleaners Site
Huntington, Suffolk County, New York

Step #	Date	Suggested Timing of Readings and Sampling	Actual Time of Readings and Sampling	Select Test: () SVE-01S Only () SVE-01D Only () SVE-02S Only () SVE-02D Only () Combined Operation																
				VGAC 1 Outlet (V6)		VGAC 2 & Discharge Air (V7)		Condensate	Extracted Vapor - SVE-01S (V1)					Extracted Vapor - SVE-01D (V1)						
				PID at VSP-4 ppm	Pressure PI-6 in of WC	PID at VSP-5 ppm	Pressure PI-7 in of WC	Temp TI-7 °F	Flow Totalizer FT-1 gallons	Flowrate FI-1-01S ACFM	Temp TI-1-01S °F	Vacuum PI-1-01S in of WC	Vacuum PI-2-01S in of WC	PID at VSP-1-01S ppm	Flowrate FI-1-01D ACFM	Temp TI-1-01D °F	Vacuum PI-1-01D in of WC	Vacuum PI-2-01D in of WC	PID at VSP-1-01D ppm	
0													0					0		
1		Start Time												30 in WC					30 in WC	
		+15 min																		
		+30 min																		
		+45 min																		
		+60 min																		
		+75 min																		
		+90 min																		
		+105 min																		
		+120 min																		
2		Start Time												in WC					in WC	
		+15 min																		
		+30 min																		
		+45 min																		
		+60 min																		
		+75 min																		
		+90 min																		
		+105 min																		
		+120 min																		
3		Start Time												in WC					in WC	
		+15 min																		
		+30 min																		
		+45 min																		
		+60 min																		
		+75 min																		
		+90 min																		
		+105 min																		
		+120 min																		
Notes: Acronyms: SVE= soil vapor extraction, VMP = vapor monitoring point, ACFM = actual cubic feet per minute, of = degrees Fahrenheit, % = percent, # = number, DA = dilution air, PID = photoionization detector, VSP = vapor sampling point, ppm = parts per million, PI = pressure indicator, FI = flow indicator, , Flow Totalizer, TI = temperature indicator, in of WC = inches of water column, VGAC = vapor phase granular activated carbon, Temp = temperature, hr = hour, min = minute																				

Table 2-2
SVE Step Test Log Sheet
NYSDEC Site No. 152187 - Country Cleaners Site
Huntington, Suffolk County, New York

Step #	Date	Suggested Timing of Readings and Sampling	Actual Time of Readings and Sampling	Select Test: () SVE-01S Only () SVE-01D Only () SVE-02S Only () SVE-02D Only () Combined Operation													
				Extracted Vapor - SVE-02S (V1)					Extracted Vapor - SVE-02D (V1)					PIN-01		PIN-02	
				Flowrate FI-1-02S ACFM	Temp TI-1-02S °F	Vacuum PI-1-02S in of WC	Vacuum PI-2-02S in of WC	PID at VSP-1-02S ppm	Flowrate FI-1-02D ACFM	Temp TI-1-02D °F	Vacuum PI-1-02D in of WC	Vacuum PI-2-02D in of WC	PID at VSP-1-02D ppm	Vacuum in of WC	PID ppm	Vacuum in of WC	PID ppm
0							0					0					
1		Start Time					30 in WC					30 in WC					
		+15 min															
		+30 min															
		+45 min															
		+60 min															
		+75 min															
		+90 min															
		+105 min															
		+120 min															
2		Start Time					in WC					in WC					
		+15 min															
		+30 min															
		+45 min															
		+60 min															
		+75 min															
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3		Start Time					in WC					in WC					
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Notes: Acronyms: SVE= soil vapor extraction, VMP = vapor monitoring point, ACFM = actual cubic feet per minute, oF = degrees Fahrenheit, % = percent, # = number, DA = dilution air, PID = photoionization detector, VSP = vapor sampling point, ppm = parts per million, PI = pressure indicator, FI = flow indicator, , Flow Totalizer, TI = temperature indicator, in of WC = inches of water column, VGAC = vapor phase granular activated carbon, Temp = temperature, hr = hour, min = minute																	

Table 2-2
SVE Step Test Log Sheet
NYSDEC Site No. 152187 - Country Cleaners Site
Huntington, Suffolk County, New York

Step #	Date	Suggested Timing of Readings and Sampling	Actual Time of Readings and Sampling	Select Test: () SVE-01S Only () SVE-01D Only () SVE-02S Only () SVE-02D Only () Combined Operation																	
				VMP-01-1		VMP-01-2		VMP-01-3		VMP-02-1		VMP-02-2		VMP-02-3		VMP-03-1		VMP-03-2		VMP-03-3	
				Vacuum in of WC	PID ppm	Vacuum in of WC	PID ppm	Vacuum in of WC	PID ppm	Vacuum in of WC	PID ppm	Vacuum in of WC	PID ppm	Vacuum in of WC	PID ppm	Vacuum in of WC	PID ppm	Vacuum in of WC	PID ppm	Vacuum in of WC	PID ppm
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Table 2-2
SVE Step Test Log Sheet
NYSDEC Site No. 152187 - Country Cleaners Site
Huntington, Suffolk County, New York

Step #	Date	Suggested Timing of Readings and Sampling	Actual Time of Readings and Sampling	Select Test: ☐ SVE-01S Only ☐ SVE-01D Only ☐ SVE-02S Only ☐ SVE-02D Only ☐ Combined Operation																	
				VMP-04-1		VMP-04-2		VMP-04-3		VMP-05-1		VMP-05-2		VMP-05-3		VMP-06-1		VMP-06-2		VMP-06-3	
				Vacuum in of WC	PID ppm	Vacuum in of WC	PID ppm	Vacuum in of WC	PID ppm	Vacuum in of WC	PID ppm	Vacuum in of WC	PID ppm	Vacuum in of WC	PID ppm	Vacuum in of WC	PID ppm	Vacuum in of WC	PID ppm	Vacuum in of WC	PID ppm
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Notes:																					
Acronyms: SVE= soil vapor extraction, VMP = vapor monitoring point, ACFM = actual cubic feet per minute, oF = degrees Fahrenheit, % = percent, # = number, DA = dilution air, PID = photoionization detector, VSP = vapor sampling point, ppm = parts per million, PI = pressure indicator, FI = flow indicator, , Flow Totalizer, TI = temperature indicator, in of WC = inches of water column, VGAC = vapor phase granular activated carbon, Temp = temperature, hr = hour, min = minute																					

Table 2-3
Sampling and Analysis Requirements
NYSDEC Site No. 152187 - Country Cleaners Site
Huntington, Suffolk County, New York

Sampling Event	Timing	Sampling Location	Media	VOCs (8260D)	VOCs (TO-15)
Borehole Soil Sampling	During SVE well/VMP installation	SVE-01S	Soil	1	-
		SVE-01D	Soil	1	-
		SVE-02S	Soil	1	-
		SVE-02D	Soil	1	-
		VMP-01	Soil	1	-
		VMP-02	Soil	1	-
		VMP-03	Soil	1	-
		VMP-04	Soil	1	-
		VMP-05	Soil	1	-
		VMP-06	Soil	1	-
Baseline	Before pilot study	SVE-01S	Vapor	-	1
		SVE-01D	Vapor	-	1
		SVE-02S	Vapor	-	1
		SVE-02D	Vapor	-	1
		VMP-01	Vapor	-	1
		VMP-02	Vapor	-	1
		VMP-03	Vapor	-	1
		VMP-04	Vapor	-	1
		VMP-05	Vapor	-	1
		VMP-06	Vapor	-	1
		PIN-01	Vapor	-	1
		PIN-02	Vapor	-	1
SVE-01S SVE Step Test	Towards the end of the SVE Step Test (3rd Step)	SVE-01S	Vapor	-	1
SVE-01D SVE Step Test	Towards the end of the SVE Step Test (3rd Step)	SVE-01D	Vapor	-	1
SVE-02S SVE Step Test	Towards the end of the SVE Step Test (3rd Step)	SVE-02S	Vapor	-	1
SVE-02D SVE Step Test	Towards the end of the SVE Step Test (3rd Step)	SVE-02D	Vapor	-	1
All Well SVE Step Test	Towards the end of the SVE Step Test (3rd Step)	KO Tank Vapor Effluent (VSP-2)	Vapor	-	1
		VGAC Effluent (VSP-5)	Vapor	-	1
		Condensate Line (WSP-1)	Water	1	-
All Well Extended Operations Test	Towards the end of each week	SVE-01S	Vapor	-	4
		SVE-01D	Vapor	-	4
		SVE-02S	Vapor	-	4
		SVE-02D	Vapor	-	4
		VMP-01	Vapor	-	4
		VMP-02	Vapor	-	4
		VMP-03	Vapor	-	4
		VMP-04	Vapor	-	4
		VMP-05	Vapor	-	4
		VMP-06	Vapor	-	4
		PIN-01	Vapor	-	4
		PIN-02	Vapor	-	4

Table 2-3
Sampling and Analysis Requirements
NYSDEC Site No. 152187 - Country Cleaners Site
Huntington, Suffolk County, New York

Sampling Event	Timing	Sampling Location	Media	VOCs (8260D)	VOCs (TO-15)
All Well Extended Operations Test - Week 4	Towards the end of Week 4	KO Tank Vapor Effluent (VSP-2)	Vapor	-	1
		VGAC Effluent (VSP-5)	Vapor	-	1
		Condensate Line (WSP-1)	Water	1	-
Total				2	68
Acronyms: SVE= soil vapor extraction, VOCs = volatile organic compounds, VMP = vapor monitoring point, VGAC = vapor phase granular activated carbon, VSP = vapor sampling point, PID = photoionization detector, KO tank = Knock-out tank, WSP = water sampling point					
Notes: 1. IDW sample requirements are not included in Table 3-1 and will be managed by EAR. 2. Only the VMP interval with the highest PID reading will be sampled.					

Table 2-4
SVE Extended Operations Test Log Sheet
NYSDEC Site No. 152187 - Country Cleaners Site
Huntington, Suffolk County, New York

Week # 1, 2, 3, 4 (circle one)		Suggested Timing of Readings and Sampling	Actual Time of Readings and Sampling	Dilution Air (V0)				Extracted Vapor - Combined (V2)				Blower Inlet (V3)		Blower Outlet (V4)		Pre-VGAC (V5)		
Day #	Date			Flowrate FI-0 ACFM	Temp TI-0 °F	Vacuum PI-0 in of WC	DA-0 % Open	Flowrate FI-2 ACFM	Temp TI-2 °F	Vacuum PI-2 in of WC	PID at VSP-2 ppm	Vacuum PI-3 in of WC	Temp TI-3 °F	Pressure PI-4 in of WC	Temp TI-4 °F	PID at VSP-3 ppm	Pressure PI-5 in of WC	Temp TI-5 °F
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Table 2-4
SVE Extended Operations Test Log Sheet
NYSDEC Site No. 152187 - Country Cleaners Site
Huntington, Suffolk County, New York

Week # 1, 2, 3, 4 (circle one)		Suggested Timing of Readings and Sampling	Actual Time of Readings and Sampling	VGAC 1 Outlet (V6)		VGAC 2 & Discharge Air (V7)			Condensate	Extracted Vapor - SVE-01S (V1)					Extracted Vapor - SVE-01D (V1)				
Day #	Date			PID at VSP-4 ppm	Pressure PI-6 in of WC	PID at VSP-5 ppm	Pressure PI-7 in of WC	Temp TI-7 °F	Flow Totalizer FT-1 gallons	Flowrate FI-1-01S ACFM	Temp TI-1-01S °F	Vacuum PI-1-01S in of WC	Vacuum PI-2-01S in of WC	PID at VSP-1-01S ppm	Flowrate FI-1-01D ACFM	Temp TI-1-01D °F	Vacuum PI-1-01D in of WC	Vacuum PI-2-01D in of WC	PID at VSP-1-01D ppm
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Notes:																			
Acronyms: SVE= soil vapor extraction, VMP = vapor monitoring point, ACFM = actual cubic feet per minute, oF = degrees Fahrenheit, % = percent, # = number, DA = dilution air, PID = photoionization detector, VSP = vapor sampling point, ppm = parts per million, PI = pressure indicator, FI = flow indicator, TI = temperature indicator, FT = flow totalizer, Temp = temperature, in of WC = inches of water column, VGAC = vapor phase granular activated carbon, hr = hour																			

Table 2-4
SVE Extended Operations Test Log Sheet
NYSDEC Site No. 152187 - Country Cleaners Site
Huntington, Suffolk County, New York

Week # 1, 2, 3, 4 (circle one)		Suggested Timing of Readings and Sampling	Actual Time of Readings and Sampling	Extracted Vapor - SVE-02S (V1)					Extracted Vapor - SVE-02D (V1)					PIN-01		PIN-02	
Day #	Date			Flowrate FI-1-02S ACFM	Temp TI-1-02S °F	Vacuum PI-1-02S in of WC	Vacuum PI-2-02S in of WC	PID at VSP-1-02S ppm	Flowrate FI-1-02D ACFM	Temp TI-1-02D °F	Vacuum PI-1-02D in of WC	Vacuum PI-2-02D in of WC	PID at VSP-1-02D ppm	Vacuum in of WC	PID ppm	Vacuum in of WC	PID ppm
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Table 2-4
SVE Extended Operations Test Log Sheet
NYSDEC Site No. 152187 - Country Cleaners Site
Huntington, Suffolk County, New York

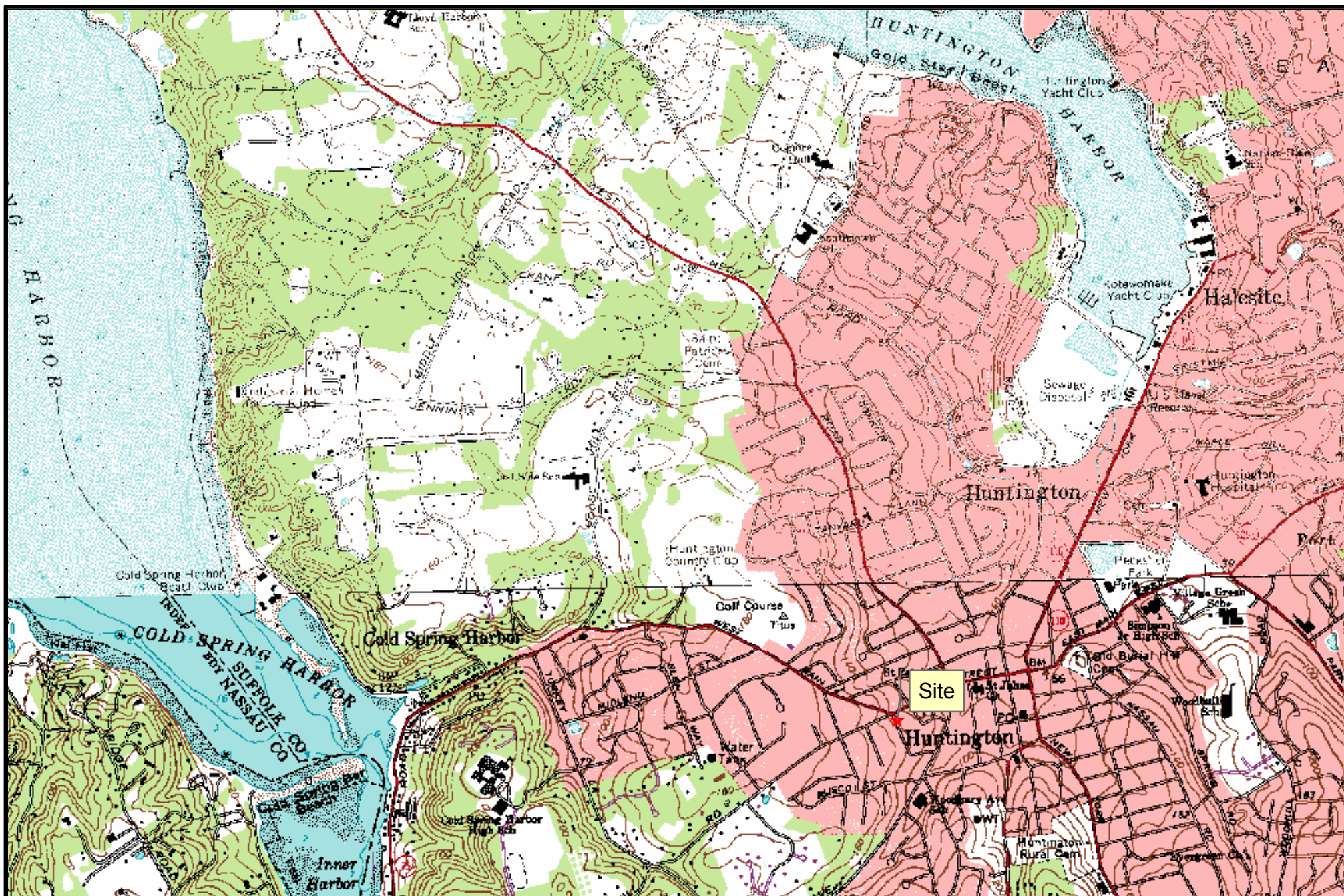
Week # 1, 2, 3, 4 (circle one)		Suggested Timing of Readings and Sampling	Actual Time of Readings and Sampling	VMP-01-1		VMP-01-2		VMP-01-3		VMP-02-1		VMP-02-2		VMP-02-3		VMP-03-1		VMP-03-2	
Day #	Date			Vacuum in of WC	PID ppm	Vacuum in of WC	PID ppm	Vacuum in of WC	PID ppm	Vacuum in of WC	PID ppm	Vacuum in of WC	PID ppm	Vacuum in of WC	PID ppm	Vacuum in of WC	PID ppm	Vacuum in of WC	PID ppm
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Table 2-4
SVE Extended Operations Test Log Sheet
NYSDEC Site No. 152187 - Country Cleaners Site
Huntington, Suffolk County, New York

Week # 1, 2, 3, 4 (circle one)		Suggested Timing of Readings and Sampling	Actual Time of Readings and Sampling	VMP-03-3		VMP-04-1		VMP-04-2		VMP-04-3		VMP-05-1		VMP-05-2		VMP-05-3		VMP-06-1		VMP-06-2		VMP-06-3	
Day #	Date			Vacuum in of WC	PID ppm	Vacuum in of WC	PID ppm	Vacuum in of WC	PID ppm	Vacuum in of WC	PID ppm	Vacuum in of WC	PID ppm	Vacuum in of WC	PID ppm	Vacuum in of WC	PID ppm	Vacuum in of WC	PID ppm	Vacuum in of WC	PID ppm	Vacuum in of WC	PID ppm
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		+ 8 Hr																					
Notes:																							
Acronyms: SVE= soil vapor extraction, VMP = vapor monitoring point, ACFM = actual cubic feet per minute, oF = degrees Fahrenheit, % = percent, # = number, DA = dilution air, PID = photoionization detector, VSP = vapor sampling point, ppm = parts per million, PI = pressure indicator, FI = flow indicator, TI = temperature indicator, FT = flow totalizer, Temp = temperature, in of WC = inches of water column, VGAC = vapor phase granular activated carbon, hr = hour																							



Appendix A – 2011 Remedial Investigation Report Figures



NYSDEC Site No. 152187
 Country Cleaners
 Huntington, New York
 0 5001,000 2,000
 Feet

★ Site

Prepared for:



Prepared by:

AECOM

Site Location Map

Project No: 60133623

Figure No: 1-1

August 19, 2010



NYSDEC Site No. 152187
Country Cleaners
Huntington, New York

0 5 10 20
Feet



Permanent Monitoring Well



Site



Suffolk County Dept. of Health Services Soil Samples 1997

Storm Drain

Prepared for:



Prepared by:

AECOM

Historical Data 1996-1997

Project No: 60133623

Figure No: 1-2

July 29, 2010



NYSDEC Site No. 152187

Country Cleaners
Huntington, New York

0 5 10 20
Feet



- Soil Samples 1998
- ⊕ Permanent Monitoring Well
- + Head Space Samples 1998
- Storm Drain
- ★ Site

Samples collected by Suffolk County Dept. of Health Services.

Prepared for:



Prepared by:

AECOM

Historical Data Post 1997

Project No: 60133623

Figure No: 1-3

July 29, 2010



NYSDEC Site No. 152187

Country Cleaners
Huntington, New York

017.55 70
Feet



● MIP Locations

★ Site

Prepared for:



Prepared by:

AECOM

MIP Locations

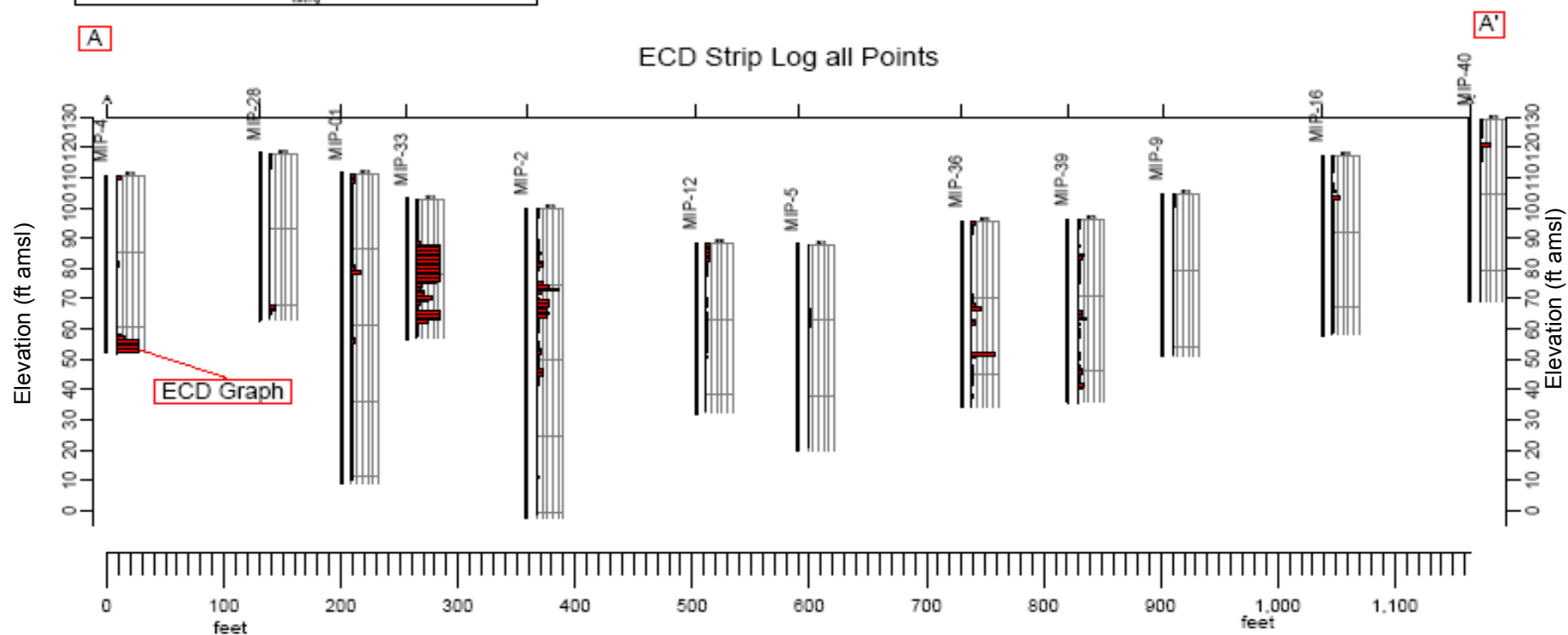
Project No: 60133623

Figure No: 2-1

July 29, 2010



ECD Strip Log



Prepared by ZEBRA ENVIRONMENTAL Subsurface Sampling, Injection and Data Collection For Environmental Professionals

NYSDEC Site No. 152187
Country Cleaners
Huntington, New York

Prepared for:



Prepared by:

AECOM

MIP Strip Log

Project No: 60133623

Figure No: 2-2

July 29, 2010



NYSDEC Site No. 152187
 Country Cleaners
 Huntington, New York

0 17.5 35 70
 Feet

- Groundwater Sample Locations (Hydropunch)
- ★ Site

Prepared for:



Prepared by:

AECOM

Groundwater Sampling Locations
 - 2008 and 2009

Project No: 60133623

Figure No: 2-3

July 29, 2010



NYSDEC Site No. 152187

Country Cleaners
Huntington, New York

0 17.5 35 70
Feet



● Soil Sample Locations (Direct Push)

★ Site

Prepared for:



Prepared by:

AECOM

Soil Sampling Locations
- 2008 and 2009

Project No: 60133623

Figure No: 2-4

July 29, 2010



NYSDEC Site No. 152187

Country Cleaners
Huntington, New York

0 17.5 35 70
Feet



Permanent Monitoring Well



Site

Prepared for:



Prepared by:

AECOM

Monitoring Well Locations

Project No: 60133623

Figure No: 2-5

July 29, 2010

Station	HP-39C	HP-39D	HP-39E
Depth (ft)	54-56	73-75	90-92
PCE	ND	1.7	1.2 (1.6)
TCE	ND	ND	ND (ND)
DCE	ND	ND	ND (ND)
VC	ND	ND	ND (ND)

HP-39

Station	HP-16B	HP-16C
Depth (ft)	70-72	80-82
PCE	ND	0.58J
TCE	ND	ND
DCE	ND	ND
VC	ND	ND

HP-16

Station	HP-05B	HP-05C	HP05D
Depth (ft)	47-50	67-70	80-83
PCE	16	4.8	ND
TCE	36	2.8	0.71J
DCE	ND	ND	ND
VC	ND	ND	ND

HP-05

Station	HP-40B	HP-40C
Depth (ft)	80-83	100-103
PCE	ND	ND
TCE	ND	ND
DCE	ND	ND
VC	ND	ND

HP-40

Station	HP-02E (Dup)	HP-02F	HP-02G
Depth (ft)	54-57	72-75	97-100
PCE	1300D (1700D)	11	ND
TCE	29 (32)	2.3	ND
DCE	31 (33)	ND	ND
VC	ND (ND)	ND	ND

HP-02

Station	HP-12A (Dup)	HP-12B	HP-12C
Depth (ft)	47-50	67-70	75-77
PCE	ND (ND)	ND	ND
TCE	ND (ND)	2.2	1.1
DCE	ND (ND)	ND	ND
VC	ND (ND)	ND	ND

HP-41

HP-12

Station	HP-41C	HP-41D	HP-41E
Depth (ft)	47-50	65-68	80-83
PCE	3.5J	1.8J	22
TCE	ND	ND	ND
DCE	ND	ND	ND
VC	ND	ND	ND

Station	HP-04B	HP-04C	HP-04D
Depth (ft)	62-65	82-85	100-103
PCE	1200D	2.6	2.3
TCE	29	ND	ND
DCE	41	ND	ND
VC	ND	ND	ND

HP-04

HP-33

Station	HP-33F	HP-33G	HP-33H	HP-33I
Depth (ft)	52-55	72-75	87-90	100-103
PCE	270D	34	92D	14
TCE	9.8	1.6	2.1	ND
DCE	13	0.53J	1.3	ND
VC	ND	ND	ND	ND

NYSDEC Site No. 152187

Country Cleaners
Huntington, New York

0 17.5 35 70
Feet



● Groundwater Sample Locations (Hydropunch)

★ Site

Bold values exceed the NYS Class GA groundwater criteria.

PCE - Tetrachloroethene

TCE - Trichloroethene

DCE - cis-1,2-dichloroethene

VC - Vinyl Chloride

Prepared for:



Prepared by:

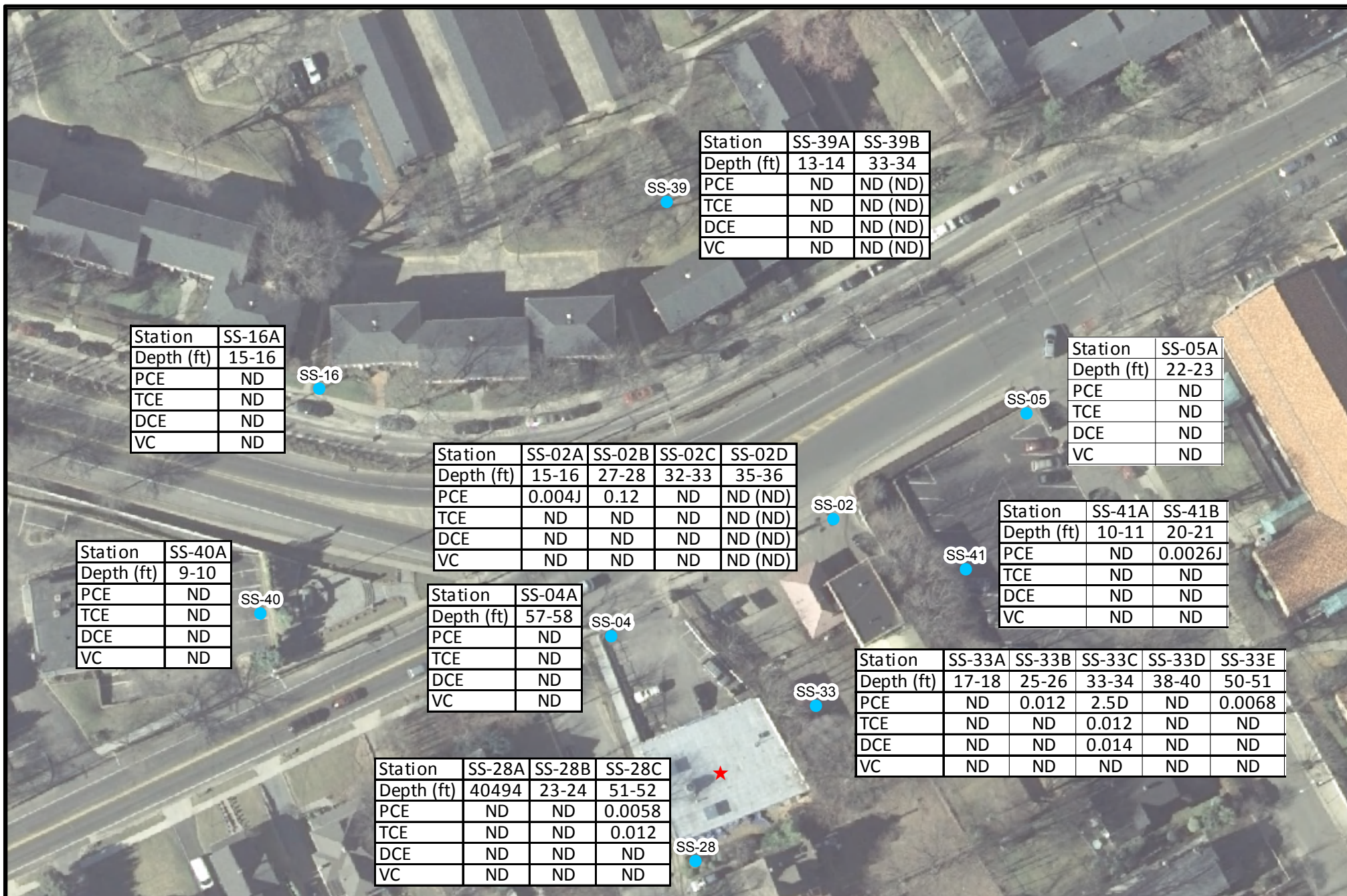
AECOM

Groundwater Sample Results
- 2008 and 2009

Project No: 60133623

Figure No: 3-1

July 29, 2010



NYSDEC Site No. 152187

Country Cleaners
Huntington, New York

0 17.5 35 70
Feet



● Soil Sample Locations (Direct Push)

★ Site

PCE - Tetrachloroethene
TCE - Trichloroethene

Concentrations are in ug/L.

DCE - cis-1,2-dichloroethene
VC - Vinyl Chloride

Prepared for:



Prepared by:

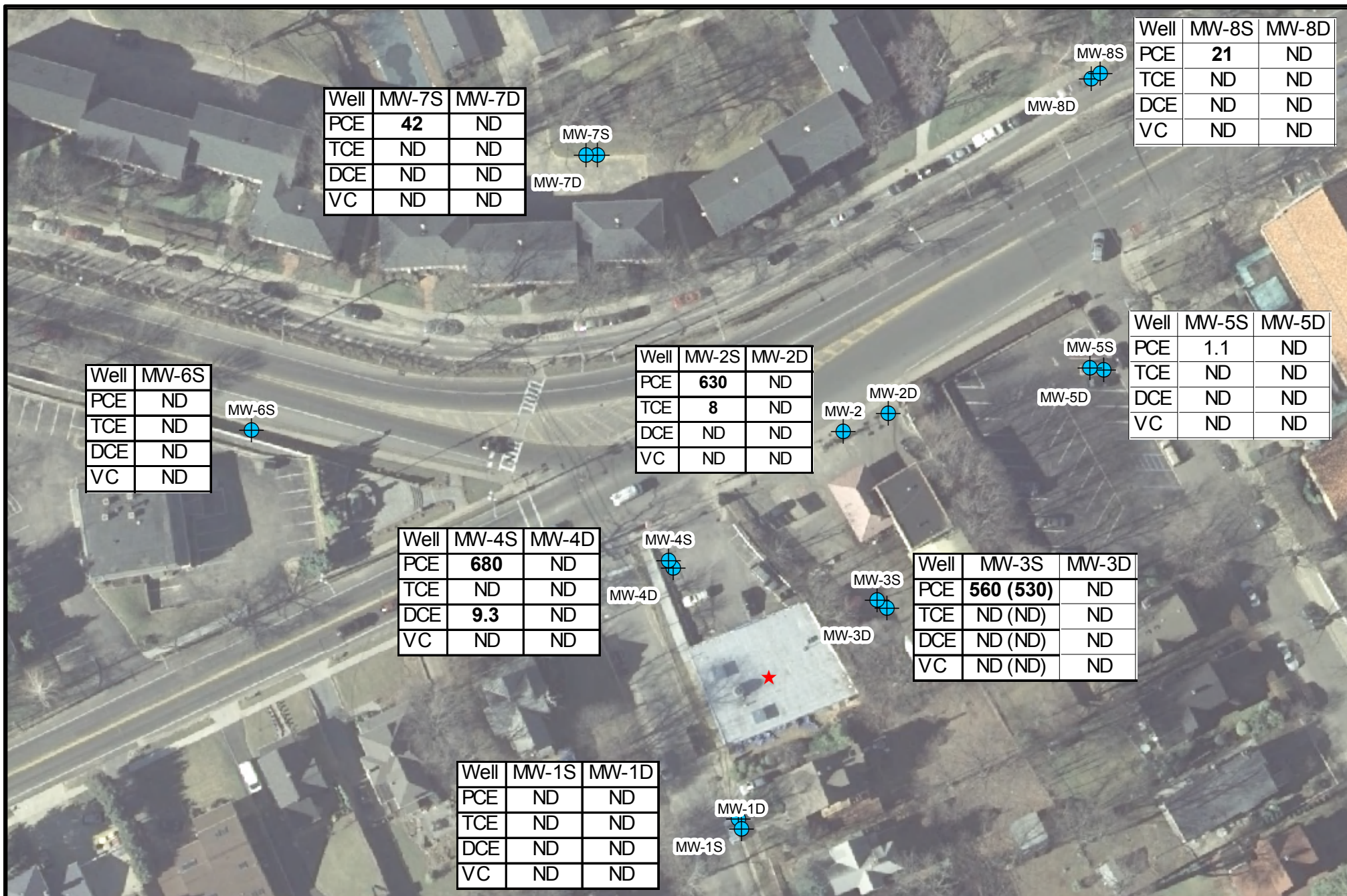
AECOM

Soil Sample Results
- 2008 and 2009

Project No: 60133623

Figure No: 3-2

July 29, 2010



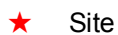
NYSDEC Site No. 152187

Country Cleaners
Huntington, New York

0 17.5 35 70
Feet



Permanent Monitoring Well



Site

Concentrations are in ug/L.

Bold values exceed the NYS Class GA groundwater criteria.

PCE - Tetrachloroethene
TCE - Trichloroethene
DCE - cis-1,2-dichloroethene
VC - Vinyl Chloride

Prepared for:



Prepared by:

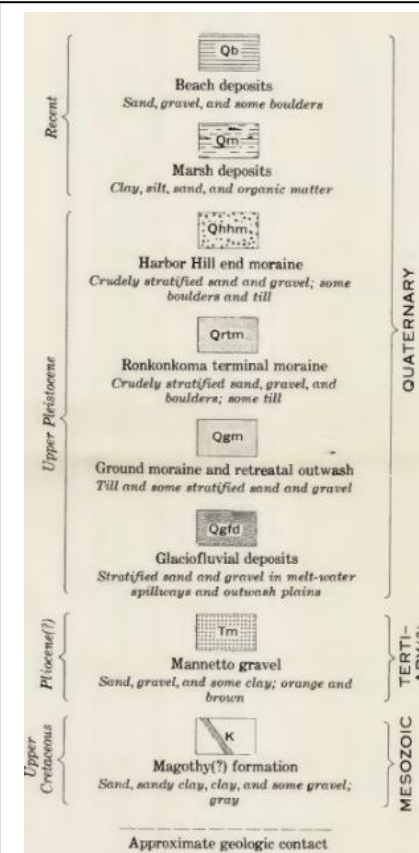
AECOM

Groundwater Sample Results - 2010

Project No: 60133623

Figure No: 3-3

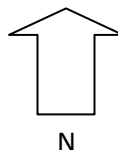
July 29, 2010



Site: ★

From USGS (1964)

NYSDEC Site No. 152187
Country Cleaners
Huntington, New York



Prepared for:

AECOM

Prepared by:

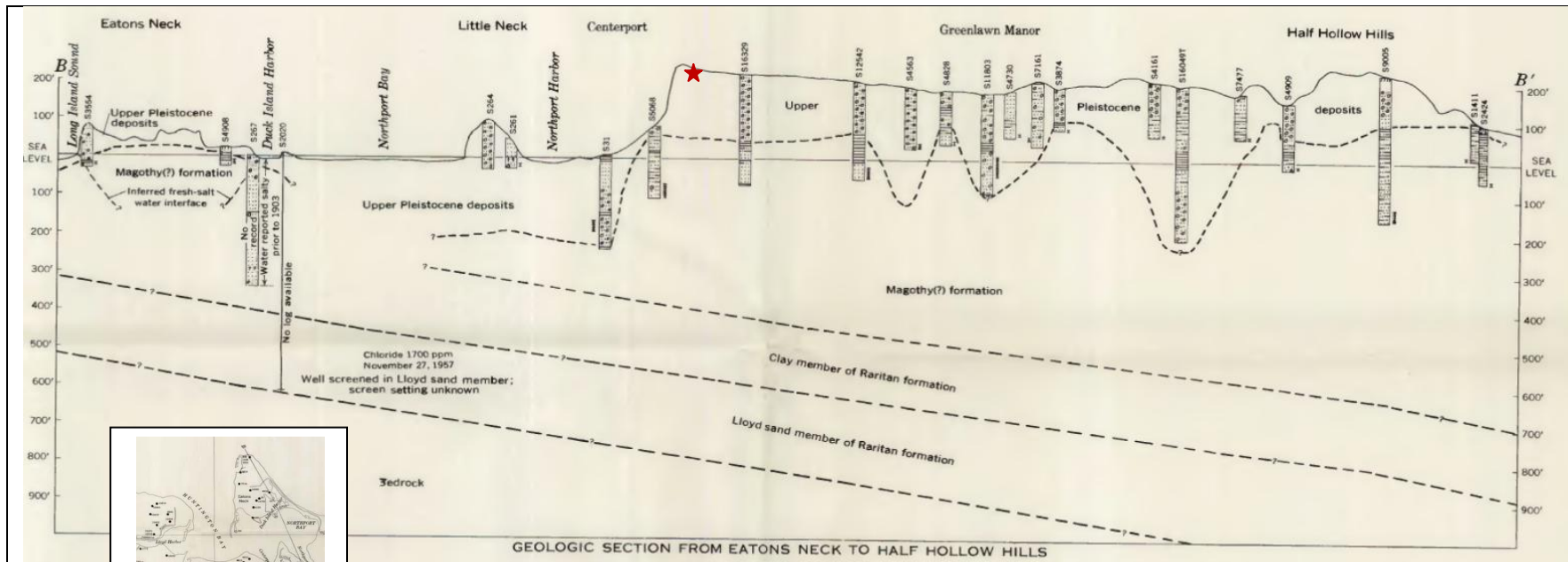


Soil Types

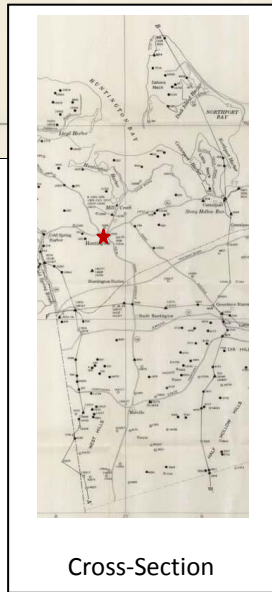
Project No.: 60133623

Figure No: 5-1

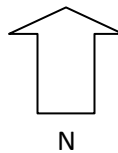
August 19, 2010



From USGS (1964).



NYSDEC Site No. 152187
Country Cleaners
Huntington, New York



Prepared for:

AECOM

Prepared by:

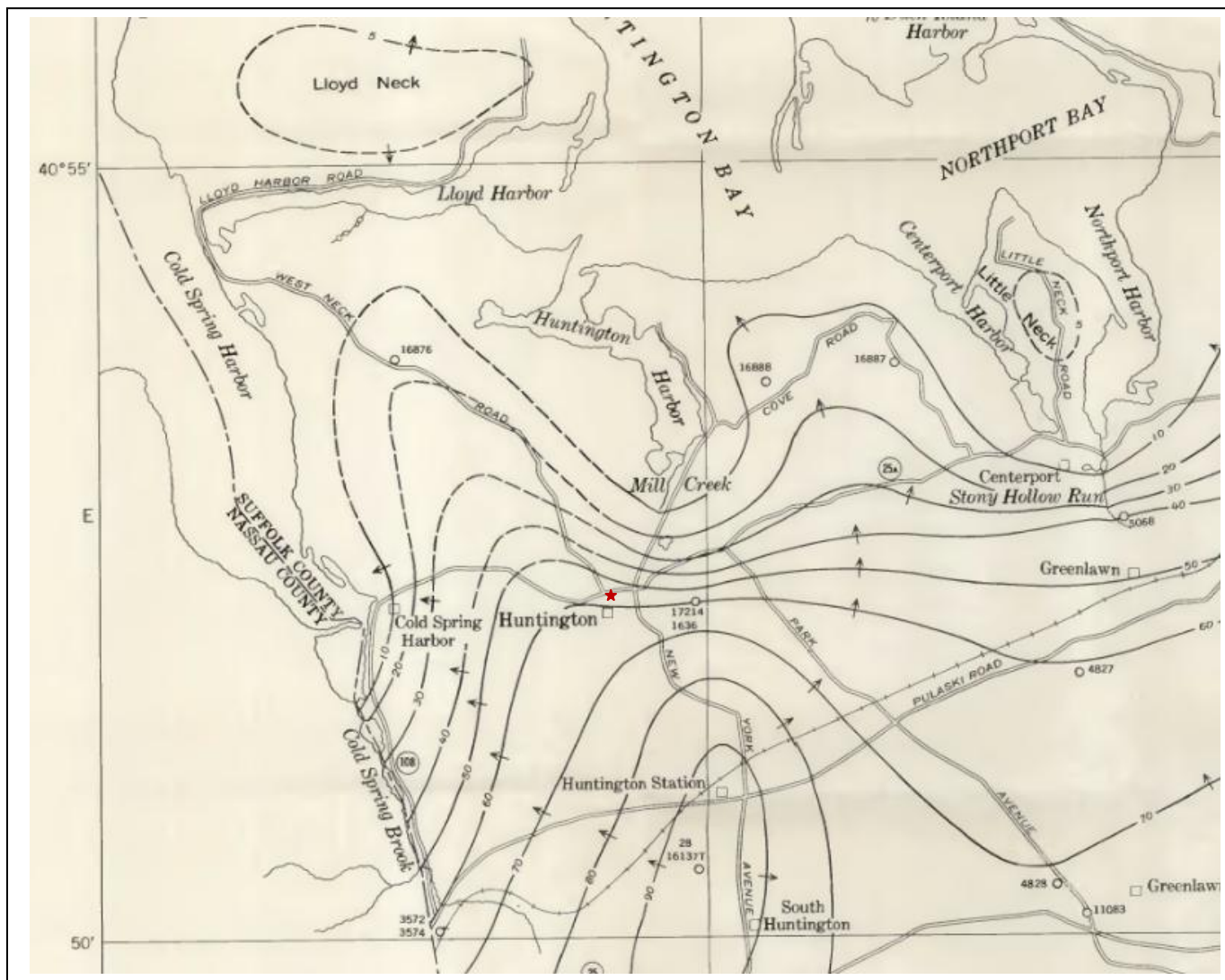


Geologic Section

Project No.: 60133623

Figure No: 5-2

August 19, 2010



EXPLANATION

↑ ——— 40 ——— ↑
 Water-table contour
Dashed where data less accurate. Arrow indicates direction of ground-water movement. Contour interval 10 and 5 feet; datum is mean sea level

X ——— X'
 Line of hydraulic profile

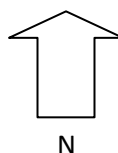
○ 16882
 Observation well and number
Prefix "S" omitted from well number for convenience

□
 Approximate center of populated area

Site: ★

From USGS (1964).

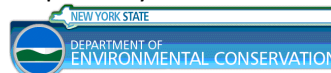
NYSDEC Site No. 152187
Country Cleaners
Huntington, New York



Prepared for:

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Prepared by:

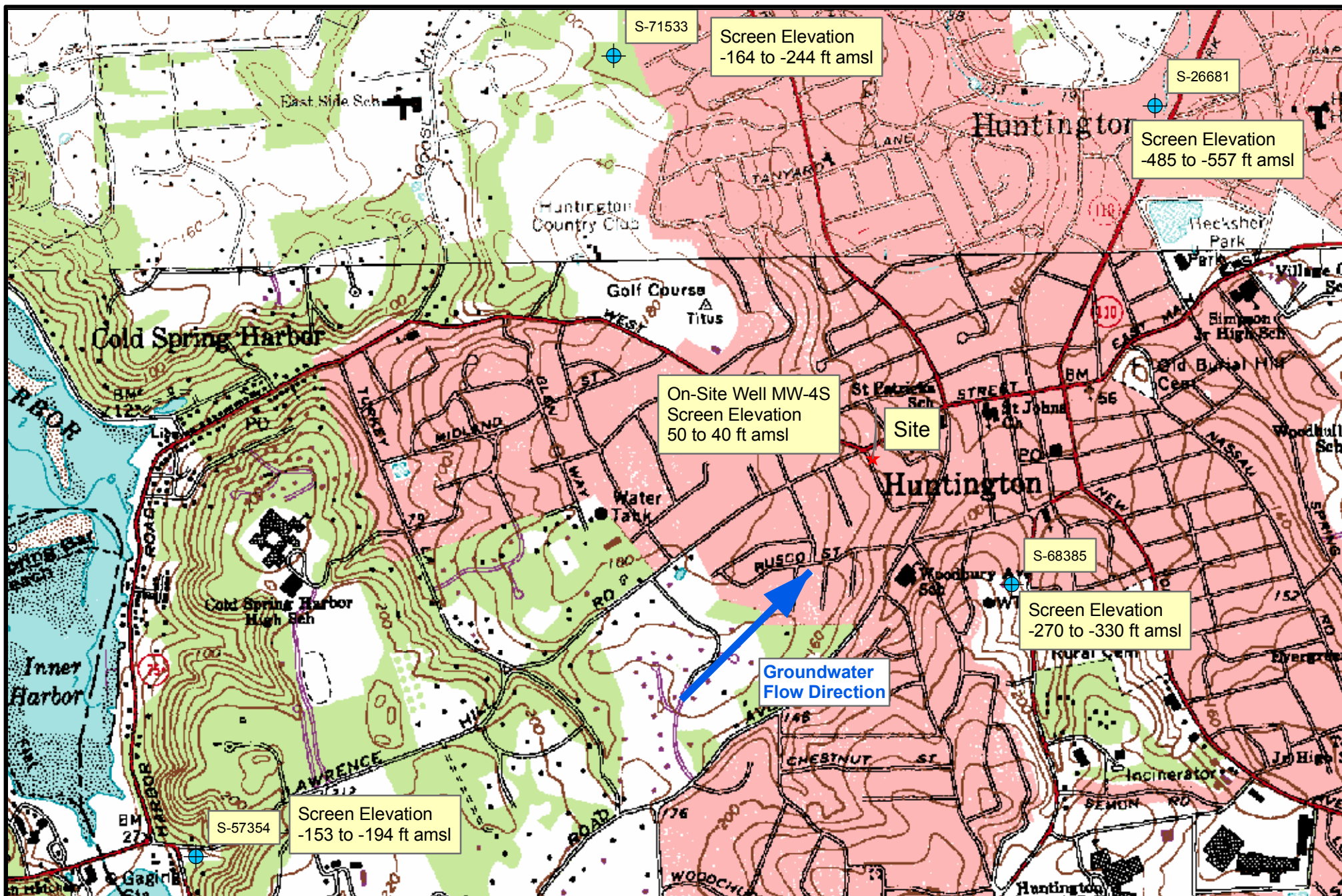


Regional Groundwater Contours

Project No.: 60133623

Figure No: 5-3

August 19, 2010



NYSDEC Site No. 152187
Country Cleaners
Huntington, New York

0 500 1,000 2,000 Feet

- ★ Site
- Suffolk County Water Authority Potable Wells

Prepared for:



Prepared by:

AECOM

Suffolk County Water Authority
Potable Well Locations

Project No: 60133623

Figure No: 5-4

July 29, 2010



NYSDEC Site No. 152187

Country Cleaners
Huntington, New York

0 17.5 35 70
Feet



Site



Monitoring Well

Groundwater elevations were
collected on May 27, 2010.

Prepared for:



Prepared by:

AECOM

Groundwater Elevations -
Shallow Wells

Project No: 60133623

Figure No: 5-5

Dec. 19, 2010



NYSDEC Site No. 152187

Country Cleaners
Huntington, New York

0 17.5 35 70
Feet



Groundwater elevations were
collected on May 27, 2010.

Prepared for:



Prepared by:

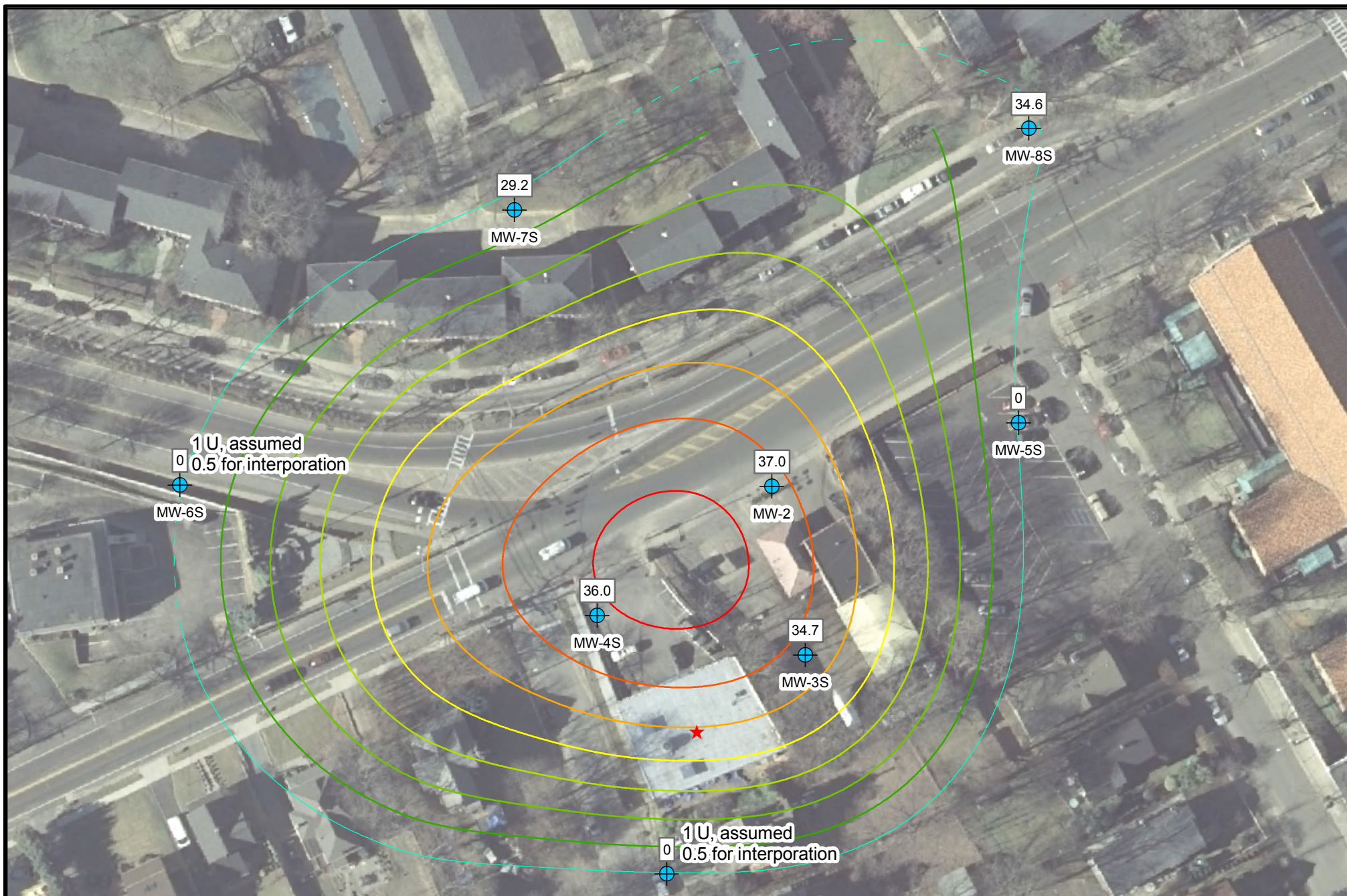
AECOM

Groundwater Elevations -
Deep Wells

Project No: 60133623

Figure No: 5-6

Dec. 19, 2010

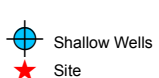


NYSDEC Site No. 152187
Country Cleaners
Huntington, New York

0 17.5 35 70
Feet



PCE Concentration Contour (ug/L)
100 200 300 400 500 600 700



Labels show the assumed lowest elevation of the PCE plume (ft amsl).

— PCE NYS Class GA Groundwater Criterion 5 ug/L
— Extrapolation of 5 ug/L

Prepared for:



Prepared by:

AECOM

PCE Concentration Contours - Shallow Wells

Project No: 60133623

Figure No: 6-1

July 29, 2010



Appendix B – SVE Equipment Sizing Calculations

Appendix B

SVE Pore Volume Calculations

Country Cleaners

Performed by: Ben Carreon
Checked by: Jeff Bamer

Date: 5/29/2024
Date: 5/29/2024

Purpose: Estimate flow rate for SVE Pilot Study

Approach: The approach to the calculation is explained in this EPA guidance. The formulas below are used.

https://cfpub.epa.gov/si/si_public_file_download.cfm?p_download_id=538425&Lab=NRML

$$\frac{Q}{H} = \frac{\pi k k_r P_w [1 - (P_{atm}/P_w)^2]}{\mu \ln(R_w/R_i)} \quad k_r = (1 - S)^3$$

Assumptions: Included a low and high end range of input parameters, many of which are assumed for the site.

For example, a range of porosities is assumed for sand per the following reference:

https://www.researchgate.net/figure/1-Range-of-Porosity-Values_tbl4_241958123

Notes: Blue values are inputs; black values are outputs. Red values are critical outputs.

		Low	High	
Porosity		0.25	0.5	
Vadose Zone Top	ft amsl	96	96	
Vadose Zone Bottom	ft amsl	52	52	
Vadose Zone Target Thickness	ft	44	44	H
Estimated ROI	ft	20	40	Ri
Soil Volume	ft3	55292	221168	
Pore Volume	ft3	13823	110584	
Fraction of Pore Space with Water		0.1	0.2	S
Soil Vapor Pore Volume	ft3	12441	88467	
Absolute dry soil gas permeability	Darcy	5	1	
	m2	4.93462E-12	9.86923E-13	k
Unitless Relative Permeability		0.729	0.512	kr
Atmospheric Pressure	atm	1	1	
	Pa	101325	101325	Patm
	IWC atm	406.78	407.189	
Wellhead Vacuum	IWC gauge	-68	-68	
	IWC	338.78	339.189	
	Pa	84386	84458	Pw
Extraction Well Casing Radius	in	4	4	
	ft	0.33	0.33	Rw
Ambient Viscosity of Air	g/cm/sec	0.00018	0.00018	
	kg/m/sec	0.000018	0.000018	μ
Flow per unit length of screen	m3/m/sec	0.0057	0.0007	Q/H
	scfm/ft/min	3.6918	0.4414	
Flow over vadose zone	scfm/min	162	19.42	
	scfm/day	233912	27968	
Pore Volume Exchange Rate	1/day	18.80	0.32	
Pilot Test Duration	days	20	20	
PV Exchanges		376	6	

Results: Selection of 160 scfm target for a single screen or 80 scfm for dual screen is reasonable. A flowrate of 19 to 162 scfm would be needed to exchange 6 to 374 pore volumes over a 20 day, 24 hour/day test.

Appendix B
SVE Blower Sizing Calculations
Country Cleaners

Performed by: Ben Carreon Date: 5/28/2024
Checked by: Jeff Barner Date: 5/29/2024

Notes: Blue - inputs

Purpose: Size pipe and equipment for SVE Pilot Study

Assumptions: Isothermal, change in pressure is less than 10%
No density effects from heating of vapor by fans
No effects from moisture in air (heavier air, more friction etc)
Estimating vacuum losses based on the SVE well furthest from the blower

Parameter	Value	Comment/Units	Parameter	Value	Comment/Units
Absolute viscosity	3.82E-07	lbf s / ft2 at 68 deg F	Vacuum @ Wellhead	-2.45	psig
	1.82903E-05	Pa s	Temperature @ Wellhead	68	°F
Absolute viscosity	5.02E-07	lbf s / ft2 at 318 deg C			
	2.40359E-05	Pa s	Temperature @ manifold	95	
Specific Roughness	0.0003	f per ASHRAE for galvanized steel (conservative)	Pipe ID: well to manifold	2	in
	0.00009144	m	Pipe ID: manifold to GAC	4	in
Gas Constant (R)	8.31	m3 Pa / K mol	Pipe ID: GAC manifold	4	in
MW of air (MW)	28.9	g / mol	Blower Inlet Vacuum	3.29	psig
Heat capacity ratio	1.4			6.7	in Hg
Standard pressure	14.7	psia	Blower Added Static Pressure	4.8	(psig)
Standard temperature	273.15	K		132	(in WG)
Estimated Relative Humidity	0.63			9.7	(in Hg)
Sat vapor p	0.3388	psia	Blower Discharge temp	250	F
Elevation	135	f AMSL	Pressure Leaving Stack	3.0	in WG
Ambient Pressure	-0.074	psig			
			Losses on Suction Side (in wc)	22.3	
Psat@O<Pact"	TRUE		(in Hg)	1.6	
0.119	12.24999948		Losses on Discharge Side (psi)	1.4	
			(in wc)	37.9	

Description	Column	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)	(Q)	(R)	(S)	(T)	(U)	(V)	(W)	(X)	(Y)	(Z)	(AA)	(AB)	(AC)	(AD)	(AE)	(AF)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
		Item	Pipe ID	Area	Length	Fitting Loss Coeff	Flow	dT (Fan)	Inlet Temperature	Upstream Pressure	Air Density	Velocity	Mass Flow	Mass Flow / Area	Re	f	Fitting Loss	Static Pressure Change	Length Losses	Downstream Pressure	Drop	Pressure Change																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
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Appendix C – Quality Assurance Project Plan



11 British American Boulevard, Suite 200
Latham, New York 12110
tel: 518 782-4500
fax: 518 786-3810

May 1, 2020

Ms. Lisa Lewis
Contract Manager
New York State Department of Environmental Conservation
Division of Environmental Remediation
Bureau of Program Management
Contracts and Payments Section
625 Broadway, 12th Floor
Albany, New York 12233-7012

Subject: NYSDEC Standby Contract No. D009805
Quality Assurance Project Plan

Dear Ms. Lewis:

Camp Dresser McKee & Smith (CDM Smith) is pleased to submit our Quality Assurance Project Plan (QAPP) for the New York State Department of Environmental Conservation (NYSDEC) Standby Engineering Services Contract D009805.

This document outlines CDM Smith's protocols for field activities, sample collection, analysis, and evaluation of data that will be legally and scientifically defensible for all work performed under Standby Engineering Services Contract D009805. Site-specific procedures will be included in the Field Activities Plan (FAP) as an attachment to the site-specific Work Plan for each work assignment, as needed. The FAP is being submitted as a separate document.

If you have any questions, or need additional information, please call me at 518-782-4526.

Very truly yours,

A handwritten signature in blue ink, appearing to read "Amy Picunas".

Amy E. Picunas, P.E.
Environmental Engineer
Camp Dresser McKee & Smith

Attachments: QAPP, April 2020

cc: D. Gardner, NYSDEC
D. Durfee, CDM Smith



QUALITY ASSURANCE PROJECT PLAN

New York State Department of Environmental Conservation

Standby Engineering Services
Contract D009805

Prepared for:
**New York State Department of
Environmental Conservation**
Division of Environmental Remediation
625 Broadway
Albany, NY 12233-7017

Prepared by:
Camp Dresser McKee & Smith
11 British American Boulevard
Suite 200
Latham, NY 12110

April 2020



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Appendices

Appendix A Field Log Sheets

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Section 1

Introduction

This generic Quality Assurance Project Plan (QAPP) has been prepared by Camp Dresser McKee & Smith (CDM Smith) for the New York State Department of Environmental Conservation (NYSDEC) to document quality assurance/quality control (QA/QC) under the NYSDEC Standby Contract for Engineering Services D009805. Site-specific procedures will be included in the Field Activities Plan (FAP) as an attachment to the site-specific Work Plan for each work assignment, as needed. The FAP is not included as part of this QA/QC plan.

1.1 Purpose

The principal purpose of this document is to specify QA/QC procedures for the collection, analysis, and evaluation of data that will be legally and scientifically defensible.

1.2 Objectives

The QAPP provides general information and procedures applicable to the field activities and analytical program detailed in each site-specific Work Plan provided by NYSDEC for each work assignment. This information includes definitions and generic goals for data quality and required types and quantities of QA/QC samples. The procedures address field documentation; sample handling, chain of custody, and shipping; instrument calibration and maintenance; auditing; data deliverable and reduction, validation, and reporting; corrective action requirements; and QA reporting specific to the analyses performed by the laboratories subcontracted by CDM Smith.

Section 2

Project Organization and Responsibility

2.1 Overview

The project management organization for each work assignment is to provide a clear delineation of functional responsibility and authority. The project manager for CDM Smith is the primary point of contact with the NYSDEC project manager. He/she is responsible for development and completion of the site-specific investigation, project team organization and supervision of all project tasks. In this role, he/she will communicate directly with the NYSDEC.

For the fieldwork, field teams consisting of CDM Smith personnel and subcontractors will be assembled and will be responsible for implementing all aspects of the fieldwork. Several key activities will be performed as part of the field and analytical work. These activities include:

- Ensuring that sample collection, sample analysis, data validation, and electronic data deliverable procedures are performed according to Division of Environmental Remediation (DER)-10 requirements.
- Ensuring that health and safety procedures, as outlined in CDM Smith Corporate Health and Safety Manual and the site-specific health and safety plan (HASP) for each work assignment, are adhered to.
- Ensuring that field QA/QC procedures are implemented
- Ensuring that laboratory analysis, data validation, data processing, data QC and electronic data deliverables (EDD) activities are performed in accordance with applicable NYSDEC guidelines including DER-10.
- Ensuring that minority business enterprise/women business enterprise (MBE/WBE) goals are achieved.

2.2 Responsibility

The primary responsibilities for program management activities rest with the Program Manager (PGM). The PGM will have ultimate contract responsibility for the project, including responsibility for the technical content of all engineering work. The PGM will direct, review and approve all project deliverables, schedule staff and resources, resolve scheduling conflicts and identify and solve potential program problems. He/she will be directly accountable to NYSDEC's Division of Hazardous Waste Remediation for program execution. He/she has authority to assign staff, negotiate and execute contracts and amendments, as well as execute subcontracts. The PGM will communicate directly with CDM Smith's Project Manager.

The Project Manager will have overall responsibility for the technical and financial aspects of this project.

He/she will assign technical staff, maintain control of the project budget and schedule, prepare monthly progress reports, review and approve project invoices, evaluate the technical quality of the project deliverables as well as the adherence to QA/QC procedures and manage subcontractors. He/she will serve as CDM Smith's point of contact for this project.

The Program Quality Assurance Officer will monitor QC activities of program management and technical staff, as well as identify and report the needs for corrective action to the PGM. He/she will also conduct an internal review of all project deliverables prepared by CDM Smith staff and sign off on the final investigation reports.

The Program Health and Safety Officer will review and make recommendations to the Subcontractors on health and safety plans for compliance with Occupational Safety and Health Administration (OSHA) requirements. He/she will develop a HASP for CDM Smith and NYSDEC employees, handle over-sight activities, evaluate the performance of health and safety officers and maintain required health and safety records. He/she will report to the PGM.

The Health and Safety Site Supervisor/Coordinator will be responsible for ensuring that the HASP is implemented during field activities and that a copy of the site-specific HASP is maintained at the site at all times. He/she will also be responsible for upgrading or downgrading personnel protection based on actual conditions at the time of the investigation. The Coordinator must also present an overview of the HASP to field personnel prior to initiating any field activities and is responsible for assuring that field personnel sign off on this plan. He/she will contact the Program Health and Safety Officer if any questions or issues arise during the field activities that he/she cannot answer.

2.3 Subcontractors

The following subcontractor services may be required as part of the site characterization or site investigation activities and performed by subcontractors under CDM Smith's supervision:

- Geophysical Survey
- Geoprobe Installation (including Membrane Interface Probes (MIPs))
- Drilling (including soil boring and monitoring well installation)
- Vapor, Soil and Groundwater Sampling
- Analytical Services
- Construction Oversight and O&M
- Site Survey
- Investigation Derived Waste Removal
- Data Validation

Section 3

Field Procedures

CDM Smith's point of contact for any field investigation activities is the field team leader and the onsite NYSDEC representative or PM. Any minor changes in sampling activities that are within the proposed scope of the project will be documented each day in the field logbook and signed by both representatives. Any modifications that are inconsistent with the approved work plan are to be approved by the NYSDEC PM prior to implementation.

3.1 Documentation (Field Logbook)

Information recorded in field logbooks include at a minimum, field observations, data, calculations, time, weather, description of the data collection activity, methods, field instruments and calibrations, field screening results and sample identification. Additionally, the logbook may contain descriptions of wastes, biota, geologic material, and site features including sketches, maps or drawings, as appropriate.

3.1.1 Preparation

In addition to this QAPP, site personnel responsible for maintaining logbooks must be familiar with the site-specific FAP. These should be consulted as necessary to obtain specific information about equipment and supplies, health and safety, sample collection, packaging, decontamination, and documentation.

Prior to use in the field, each logbook should be marked with the specific NYSDEC site number, name and location. The field notebook will then be assigned to an individual responsible for its care and maintenance.

Field logbooks will be bound with lined, consecutively numbered pages. All pages must be numbered prior to initial use of the logbook. The following information will be recorded inside the front cover of the logbook:

- Site name, number and location
- Person and organization to whom the book is assigned, office address and phone number(s)
- Start date

3.1.2 Operation

The following is a list of requirements that must be followed when using a logbook:

- Record work, observations, quantity of materials, calculations, drawings, and related information directly in the logbook. If data collection forms are specified by the FAP, this information need not be duplicated in the logbook. However, any forms used to record site information must be referenced in the logbook.

- Do not start a new page until the previous one is full or has been marked with a single diagonal line so that additional entries cannot be made. Use both sides of each page.
- Do not erase or blot out any entry at any time. Before an entry has been signed and dated, any changes may be made but care must be taken not to obliterate what was written originally. Indicate any deletion by a single line through the material to be deleted.
- Do not remove any pages from the book.
- Record as much information as possible.
- Specific requirements for field logbook entries include:
 - Initial and date each page.
 - Initial and date all changes.
 - Multiple authors must sign out the logbook by inserting the following:
- Above notes authored by:
 - (Sign name)
 - (Print name)
 - (Date)
- A new author must sign and print his/her name before additional entries are made.
- Draw a diagonal line through the remainder of the final page at the end of the day.
- Record the following information on a daily basis:
 - Date and time.
 - Description of activity being conducted, including station (i.e., well, boring, sampling location number) if appropriate.
 - Weather conditions (i.e., temperature, cloud cover, precipitation, wind direction, and speed) and other pertinent data.
 - Level of personnel protection to be used.
 - Subcontractors on site.

Entries into the field logbook will be preceded with the time (written in military units) of the observation. The time should be recorded at the point of events or measurements that are critical to the activity being logged. All measurements made and samples collected must be recorded unless they are documented by automatic methods (e.g., data logger) or on a separate form. In these cases, the logbook must reference the automatic data record or form.

Other events and observations that should be recorded include:

- Changes in weather that impact field activities.
- Deviations from procedures outlined in any governing documents. Also, record the reason for any noted deviation.
- Problems, downtime, or delays.
- Upgrade or downgrade of personnel protection equipment.
- Visitors to the site.

3.1.3 Post-Operation

To guard against loss of data due to damage or disappearance of logbooks, completed pages will be scanned periodically (weekly, at a minimum) and submitted to the project manager.

Documents that are separate from the logbook will be scanned and submitted regularly to the project manager. This includes all automatic data recording media (printouts, logs, disks or tapes) and activity-specific data collection forms required by other FAP.

At the conclusion of each activity or phase of site work, the individual responsible for the logbook will confirm all entries have been appropriately signed and dated, and that corrections were made properly (single lines drawn through incorrect information, then initialed and dated). The completed logbook will be submitted to the records file.

3.2 Sample Collection, Documentation and Identification

The following procedures describe proper sample collection and documentation to be included in field logbooks. Documentation includes describing data collection activities, logging sample locations, sample IDs, container labeling and chain of custody (COC) forms. Procedures for sample classification to assure proper labeling of samples are also included.

3.2.1 Responsibilities

The field task manager or field engineer is responsible for overseeing field operations such as, soil vapor intrusion, soil borings, Geoprobe, well drilling, collection of vapor, soil or groundwater samples, field logbooks, sample documentation, COC forms and labeling of any Investigative Derived Waste (IDW) drums, if required. Additionally, the field manager and/or field engineer is responsible for ensuring that all field activities adhere to the site-specific HASP and that samples are sent to the laboratory as soon as practicable. Generally, samples should be received by the laboratory within 48 hours of sampling.

3.2.2 Sample Collection

3.2.2.1 Water Samples

- Volatile Organic Compounds (VOCs), if analyzed, are to be sampled first. Pour water slowly into the 40-ml vial, tipping the vial and allowing water to run down the side to prevent aeration. Fill until a meniscus forms and tightly seal the vial. Invert the vial and check for

bubbles. If bubbles are present, add water and repeat. It may be necessary to discard the vial and use another if bubbles continue to appear.

- Remaining bottles should then be filled, again preventing aeration.
- If filtering is required (filtering is sometimes requested when samples are to be analyzed for metals and turbidity is high), use a dedicated 0.45 micron filter for each sample and filter prior to preservation.
- Label bottles with sample designation, project, date, time, preservative and required analysis. Clear tape may be used to cover the completed label.
- Place sample in a cooler with ice to maintain temperature at 4°C +/- 2°C. Samples will be maintained at this temperature throughout the sampling and transportation period. COC and shipping procedures are discussed in Section 3.3 and field logbook procedures in Section 3.1.

3.2.2.2 Soil/Sediment/Sludge Samples

- VOCs, if analyzed, are to be sampled first. Fill the jar completely such that there is no air space. VOCs must not be homogenized. En Core® samplers or similar may be used to collect undisturbed soil samples. In such case, the appropriate sample collection volume and preservation methods should be followed.
- For the remaining parameters, homogenize the samples with a decontaminated stainless bowl (Section 3.1.2) and trowel prior to filling the remaining bottles. Use of dedicated disposable trowels is permitted.
- Label bottles with sample designation, project, date, time, preservative and required analysis. Clear tape may be used to cover the completed label.
- Place sample in a cooler with ice to maintain temperature at 4°C +/- 2°C. Samples will be maintained at this temperature throughout the sampling and transportation period. COC and shipping procedures are discussed in Section 3.3 and field logbook procedures in Section 3.1.

3.2.2.3 Soil Vapor/Ambient Air Samples

- Soil vapor samples will be collected with either a 1.4-liter or 6-liter Summa canister, a 2-hour or 24-hour flow controller (regulators) and particulate filters (if required). Flow rate shall not exceed 200 ml/min. The size of Summa canister and duration of sample are dependent on the type of soil vapor sample.
- Sub slab soil vapor samples will be collected with 6-liter Summa canisters, with 24-hour (unless otherwise specified in project-specific work plan) flow controllers (regulators) and particulate filters (if required). Sample flow rate shall not exceed 200 ml/minute.
- Indoor and outdoor ambient air samples will be collected with 6-liter Summa canisters, with 24-hour (unless otherwise specified in project-specific work plan) flow controllers

(regulators) and particulate filters (if required). Sample flow rate shall not exceed 200 ml/minute.

- Instantaneous grab samples may also be collected, as permitted by NYSDEC.
- Record vacuum prior to and at conclusion of sampling. Prior to sampling, vacuum should read 25-30 inches of mercury (Hg).
- At conclusion of sampling, vacuum should be 5 inches Hg +/- 1 inch Hg.
- Label Summa canister and prepare for shipping. Summa canisters are not chilled or otherwise preserved.

3.2.3 Field Logbooks

Complete and thorough notes of all field events are essential to a timely and accurate completion of each project. The field task manager and/or field engineer is responsible for accounting for actions of the subcontractor and the times for said actions while in the field. Include identification (numbers and description) of field samples, duplicates samples, and field or trip blank samples in the field logbook. For a given workday, the field logbook should contain the following:

- Names of field personnel, names of subcontractors (if any), number of persons in crew, equipment used and any calibrations completed, weather, date, time, and location at start of day (boring number).
- Sample identification number, depth, amount of sample recovery, PID readings, odors, and soil descriptions.
- Description of any unusual surface or subsurface soil conditions
- Record of Health and Safety monitoring; time, equipment and results
- Record of site accidents or incidents
- Record of any visitors
- Any field work delays and the cause of the delay, i.e. subcontractor equipment breakdown
- Materials and equipment used during borehole installation
- Final daily summary of work completed, including a list of samples obtained
- Completion of daily QA/QC log sheet
- Contractor downtime, decontamination time, equipment breakdowns, movement tracking throughout the day, etc.
- Any other data that may be construed as relevant information in the future.

The field logbooks should confirm the subcontractor's data. Field notes should be scanned weekly and submitted to the project manager.

If a borehole is completed (regardless of whether a monitoring well is installed), field personnel shall record the lithography, PID measurements, and any samples collected in the field logbook. Additionally, a soil boring log shall be completed, an example is provided in **Appendix A**. The field task manager should review field forms at the end of each day.

Monitoring well logs are required if the borehole is completed as a monitoring well. These are to be completed in the field after a monitoring well is installed. They should include data such as screen length, riser length, materials used, etc. An example monitoring well construction log is provided in **Appendix A**. The completed monitoring well logs should be reviewed by the field task manager.

3.2.4 Drum Labeling

Labeling of drums is essential for tracking hazardous materials. The subcontractor is responsible for collecting, handling, and transporting the drums for disposal, but field personnel are responsible for labeling drums appropriately. There is a significant cost implication if drums are not properly labeled. Unknown material must be disposed of as hazardous waste if any hazardous waste is found on-site.

The following drum labeling procedures are to be adhered to:

- Field staff shall secure packing list envelopes to the side of the drum(s) at the completion of a boring.
- Field staff shall print with an indelible marker on information cards all information pertaining to the contents of the drum(s). If more than one drum is collected from the same borehole, each information card shall be numbered sequentially in parenthesis starting with the number one after the boring number. The information shall include:
 - Program Area
 - Boring No.(s)
 - Date collected
 - Description of contents (i.e., soil cuttings, well water, etc.)
 - Amount of contents (specify in inches)
 - Fullness of drum (not including free liquid, specify in fractional form)
- Field staff shall insert information card into packing list envelope. The packing list envelope shall be sealed at this time.
- Field staff shall record in field logbook all information pertaining to the contents of the drum that was printed on the information card.

- Project manager, upon receipt of the analytical data for the drums, shall prepare a summary table of the analytical results on a weekly basis, and provide to the designated coordinator.
- Based on the tabulated information, the designated coordinator will determine and prepare the appropriate storage labels required:
 - Hazardous waste label
 - Non-hazardous label
- The designated coordinator will fill out these labels.
- Field staff shall attach these labels to the appropriate drums. If the information cards inside the packing list envelopes are damaged, they shall be reprinted at this time.

It is noted that waste material is expected to be transported off-site once testing is completed and disposal requirements are obtained.

3.2.5 Sample Identification

Each sample collected will be designated by an alphanumeric code that will identify the type of sampling location, matrix sampled, and the specific sample designation (identifier). The sample identification for all samples will begin with the Site ID for the site.

The following terminology shall be used for the **soil** sample identification:

SITE ID - BORING/SAMPLE LOCATION ID - DEPTH- DATE

The sample ID for the soil vapor and groundwater samples will then include the sample type designation, followed by the sample number. The following terminology shall be used for the **soil vapor** sample identification:

SITE ID – SV – # - DATE

Where there are shallow and deep samples at a location, the shallow samples will be designated “S” and the deep samples designated “D”.

The following terminology shall be used for the **groundwater** sample identification:

SITE ID-GW-MW # - DEPTH- DATE (if necessary) for monitoring well samples

SITE ID-GW-TP# - DEPTH- DATE (for temporary well point or hydro-punch samples)

For sub-slab and indoor/outdoor air samples, the site ID will be followed by the sample type designation, the sample number and then the date. The following terminology shall be used for the **structure** sample identification:

SITE ID-SS-xx-DATE (for sub-slab locations)

SITE ID-IA-xx-DATE (for indoor ambient air)

SITE ID-A-xx-DATE (for outdoor ambient air)

Field blank and **trip blank** samples will be designated as follows:

SITE ID-FB-DATE (for field blanks)

SITE ID-TB-DATE (for trip blanks)

Field **duplicates** will be designated by using the next consecutive sample number for the site.

3.3 Chain of Custody Procedures

This section describes the procedures used to ensure that sample integrity and COCs are maintained throughout the sampling and analysis program.

COC procedures provide documentation of sample handling from the time of collection until its disposal by a licensed waste hauler. This documentation is essential in assuring that each sample collected is of known and ascertainable quality.

The COC begins at the time of sample collection. Sample collection is documented in the field logbooks in accordance with the specified Standard Operating Procedure (SOP). At the same time, the sampler fills out the label on the sample container with the following information:

Sample ID code

- Required analyses
- Sampler initials
- Date and time of sample collection

3.3.1 Chain of Custody Forms

The COC forms are a paper trail system that follows the samples collected and indicates which laboratory analyses are to be performed on which samples. Each sample should be clearly labeled and listed on the COC. The laboratory will only perform analyses on samples indicated and all other samples should be indicated with a "HOLD" designation. By labeling a sample "HOLD", the laboratory will store the sample until further instruction is given. Do not check the request for analysis blocks on the COC for samples designated with "HOLD" Status. Never indicate duplicate or blank samples on a COC.

It is the responsibility of the field manager to coordinate COC forms and supply copies of all COC to the project manager for data management use.

A COC form is filled out for each sample type at each sampling location. Each time the samples are transferred to another custodian or to the laboratory, the signatures of the people relinquishing the sample and receiving the sample, as well as the time and date, are documented. Labels will be filled out with an indelible, waterproof, marking pen.

3.3.2 Chain of Custody Records

The COC record is a three-part form. The laboratory retains the original form and the person relinquishing the samples keeps a copy of the form at the time of sample submittal. This form is then returned to the project manager or person in charge of data coordination.

The COC record will be placed in a Ziplock bag and placed inside of all shipping and transport containers. All samples will be hand delivered or shipped by Federal Express to the laboratory identified for the project. Samples should be packed so that no breakage or leakage will occur (e.g. placed upright in the cooler surrounded by packing materials). Custody seals will be placed on all coolers/packages containing laboratory samples during shipment.

3.4 Field Quality Control Samples

In order to maintain QA/QC in both the field and the laboratory, additional samples such as trip blanks, duplicates, field blanks, performance evaluation samples and background samples will be collected. Each type of QA/QC sample is described below. Details of the QA/QC samples collected will be provided to the project data validator for use in their evaluation.

3.4.1 Quality Control for Soil Sampling

At a minimum, five percent of all soil samples analyzed should be QA/QC samples. These samples act as a verification of appropriate field and laboratory procedures. These samples should be recorded in the field book but should not be identified on the COC form other than with an MD (Miscellaneous Discrete). All QA/QC samples should be numbered sequentially with other field samples on the soil log form. The following is a breakdown of types of QA/QC samples that are to be taken:

3.4.1.1 Duplicate Samples

At minimum, field duplicate samples should be collected at a frequency of one per twenty soil samples analyzed. Soil duplicates shall be field-homogenized samples, excluding VOCs. To ensure laboratory "blind" analyses, duplicate samples will be identified with the next sequential sample number on sample containers and the COC forms. The actual identification of the duplicate samples shall be recorded in the field logbook. Duplicate samples are collected from the same split spoon sampler, homogenized in the field and analyzed for the same compounds.

3.4.1.2 Field Blanks

Approximately five percent of all soil samples analyzed should be field blanks. Rinsate blanks are collected after a sample is taken and the equipment used (i.e., split spoon sampler) has been decontaminated. Distilled water is then poured over the decontaminated sampling equipment and collected in sample jars for analysis. It should be documented in the field logbook which soil sample preceded the field blank and which soil sample followed the field blank for the equipment used.

3.4.2 Quality Control for Soil Vapor and Air Sampling

Approximately five percent of all soil vapor (including sub-slab soil vapor) samples analyzed should be duplicate samples. Soil vapor duplicates will be collected in a manner so that the sample and duplicate are being collected simultaneously from the same sample location. One duplicate indoor air sample will be collected per site where indoor air sampling is being conducted. Duplicate outdoor air samples will be collected only at the sites where indoor air sampling is also being conducted. Duplicate samples are analyzed for the same compounds. All Summa canisters must be certified to be free of contaminants in accordance with QA/QC protocol.

3.4.3 Quality Control for Groundwater Sampling

Approximately five percent of all groundwater samples analyzed should be QA/QC samples. These samples act as a verification of appropriate field and laboratory procedures. These samples should be recorded in the field book but should not be identified on the COC form as a QA/QC sample. All QA/QC samples should be numbered sequentially with other field samples. The following is a breakdown of types of QA/QC samples that are to be taken:

3.4.3.1 Duplicate Samples

Approximately five percent of all groundwater samples analyzed should be duplicate samples.

To ensure laboratory "blind" analysis, duplicate samples will be recorded with the well I.D. number and the next sequential sample number on sample containers and the COC forms. Duplicate samples should be collected using the same method as the parent sample and analyzed for the same compounds.

3.4.3.2 Trip Blanks

Each cooler packed and shipped for aqueous VOC analysis should also contain a trip blank. Trip blanks are VOC vials filled with distilled water. These pre-filled vials are to be carried with the sample bottles and samples and should remain sealed the entire time. It should be documented in the field book which aqueous samples were collected and transported with the trip blank.

3.4.3.3 Field Blanks

One field blank sample will be collected per day of sampling. Field blanks are collected after a sample is taken and the equipment used (i.e., bailer) has been decontaminated. Distilled water is then poured over the decontaminated sampling equipment and collected in sample jars for analysis. It should be documented in the field logbook which groundwater sample preceded the field blank and which sample followed the field blank for the equipment used.

3.5 Pre-Mobilization

Prior to initiating fieldwork, the following preparatory activities will be completed:

- Utility clearance and permitting. The drilling subcontractor is responsible for contacting the appropriate local utility or "one-call" service to locate subsurface and aboveground utilities in the vicinity of the soil gas survey area.
- Site-specific issues resolved.
- Site-specific HASP completed and approved.
- Geophysical survey completed, as necessary.
- Sample analysis will be scheduled with the laboratory.
- Appropriate sample containers and preservatives for the various sample parameters will be obtained. Extra containers will be obtained to account for possible breakage.

- Field blank water will be obtained from the laboratory performing the analysis. This water shall be specified as VOC free water.
- Necessary field sampling and monitoring equipment will be obtained. Prior to use, the equipment will be checked to confirm that it is in good working condition, properly calibrated, and decontaminated. The suggested field equipment for the procedures detailed in Sections 3.6 through 3.34 is listed in Table 3-1.
- Materials necessary for personal protection and decontamination will be obtained.
- Coordinate with subcontractors and all Task Orders completed and signed.

3.6 Direct Push Groundwater Sampling

3.6.1 Macro Core Sampling

Direct push methods will be used to collect 48 or 60 inch macro-core samples continuously at each of the groundwater sample locations. The samples will be used by the CDM Smith engineer, geologist, or field scientist to determine the depth to groundwater at each location. Once saturated soil is verified, a screen point groundwater sampler will be set approximately 5 feet into the water table. The depth to water will be used to determine the depth of the soil vapor probes.

3.6.2 Purge and Sampling

Standard purge techniques will be utilized to purge and sample groundwater. Standard purge and sampling techniques consist of using a check valve and tubing to purge the well at a low flow rate. The check valve intake is set approximately in the middle of the screen. The well is purged at the low rate until the water flows clear or the turbidity is reduced to 50 nephelometric turbidity units (NTUs) or less, or to a level deemed acceptable by NYSDEC. The sample is then collected directly from the tubing or bailer.

3.6.3 Direct Push Groundwater Sampling Procedure

Personal protective equipment will be donned in accordance with the requirements of the site-specific HASP.

- Assemble the screen point groundwater sampler.
- Attach the mill-slotted screen point groundwater sampler, onto the leading probe rod.
- Thread the drive cap onto the top of the probe rod and advance the sampler using either the hydraulic hammer or hydraulic probe mechanism. Replace the 30 centimeter (cm) rod with the 90 cm rod as soon as the top of the sampler is driven to within 15 cm of the ground surface.
- Advance the sampler to the interval to be sampled using the hydraulic hammer. Add additional probe rods as necessary to reach the specified sampling depth.

- Move the probe unit back from the top of the probe rods and remove the drive cap.
- Attach the pull cap to the top probe rod, retract the probe rods, push the screen into the formation, remove extension rods from the probe rods, and measure and record the water level, allowing time for the water level to reach equilibrium.
- Purge the groundwater until the water flows clear or the turbidity has been reduced to 50 NTUs or less. If the well is purged dry, the sample may be collected after the well recharges.
- Collect the samples using a check valve and flexible tubing system.
- Label and store samples. Samples will be preserved, labeled, and placed immediately into a cooler and maintained at 4°C throughout the sampling and transportation period.

Samples should be labeled, recorded on the COC and shipped according to the proper procedures. Custody seals will be placed on all coolers/packages containing laboratory samples during shipment.

3.7 Soil Vapor Sampling

Soil vapor sampling will be conducted in accordance with the New York State Department of Health (NYSDOH) *“Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York, dated October 2006,”* including the May 2017 Updates to Soil Vapor/Indoor Air Decision Matrices, and the NYSDEC *“DER-10 Technical Guidance for Site Investigation and Remediation, dated May 2010”*.

3.7.1 Soil Vapor Probe Installation

A soil vapor probe installation at all locations will be performed according to the following procedures:

- At each location, a Geoprobe will be used to drive stainless steel rods equipped with detachable stainless steel drive points to the desired depth (approximately 8 feet bgs).
- Once the probe is in place, retract the drive rod slightly to expose a 6 inch sampling screen and sampling port. Insert Teflon®-lined tubing through the rods and attach it to the soil gas probe just above the tip.
- Seal the probe at the surface using electrical conduit putty or non-shrink bentonite grout.
- The borehole will then be backfilled with sand to a minimum depth of 6 inches above the screen interval.
- Bentonite slurry will then be placed from approximately 6 inches above the screen to the ground surface and immediately hydrated. The bentonite will be allowed to set-up for a minimum of 24 hrs.
- Repeat steps 1 through 4 at a second co-located borehole to the second depth (~2 feet above the water table).

3.7.2 Tracer Testing

Tracer tests will be conducted at fifty percent of soil vapor locations to verify the integrity of the soil vapor probe seal. Tracer tests will be conducted according to the following procedures:

- Set up the tracer test apparatus by first sealing the open area around the Teflon®-lined tubing with wax or bentonite.
- A bucket is then placed upside down over the borehole with the tubing coming out through a hole at the top.
- Helium will then be injected through a hole near the bottom of the bucket to enrich the atmosphere to at least 80 percent helium. The concentration of helium inside the bucket will be monitored by a helium detector located at a second hole near the bottom of the bucket.

Once the atmosphere is enriched to the appropriate concentration, the helium detector will then be used to monitor the concentration coming out of the tubing from the borehole located at the top of the bucket. If the reading is below 10 percent tracer gas, the probe seal is sufficient; proceed with sampling, as described in the following sections. If the reading is above 10 percent tracer gas, the probe seal is insufficient; reseal the probe surface with bentonite and repeat the tracer test until the reading is below 10 percent tracer gas.

3.7.3 Soil Vapor Sampling Procedures for Laboratory Analysis

Once the soil gas probe is installed and a tracer test is conducted, soil gas samples for laboratory analysis will be collected according to the following procedures:

- The soil vapor samples will be collected using a laboratory-certified clean Summa canister with a regulator ensuring that the sample flow rate less than 200 milliliters per minute (ml/min) to minimize outdoor air infiltration during sampling. The Summa canisters will have a vacuum of 28 inches mercury (in Hg) $\pm$ 2 inches prior to the collection of the soil vapor sample.
- Calculate the volume of the tubing including the screen interval as part of the volume. The tubing has an inside diameter of ¼ inch and a volume of 9.65 ml/foot.
- Attach the vacuum pump and purge at least 3 tube volumes from the Teflon®-lined tubing.
- A Tedlar™ bag will be filled toward the end of the purge volume to be screened using the PID meter. The PID readings will be observed and recorded on the appropriate field form.
- After purging is complete, the tubing will be connected to the Summa canister.
- Record the initial pressure in the stainless steel Summa canister to be used for the sample prior to connecting the tubing. The samples will be collected using laboratory-certified clean Summa canisters with flow regulators and a vacuum of 28 inches Hg, $\pm$ 2 inches. Vacuum readings in the canister should be approximately 25-30 inches of Hg. If no vacuum reading is obtained, use a different canister as this indicates the canister was not properly evacuated.

- Connect the end of the tubing directly to the Summa canister intake valve.
- Collect the sample into the Summa canister, which will be provided by CDM Smith's subcontract laboratory. An additional canister and regulator will be ordered as backup. Sample flow rate will not exceed 200 ml/min.
- When the vacuum gauge reads 5 inches Hg, close the valve. Sampling is complete. A vacuum of 5 inches Hg $\pm$ 1 inch must be present when sample collection is terminated to prevent contamination during transit. Record the final pressure reading in the Summa canister.
- Field personnel will label, pack and ship the samples to an NYSDOH Environmental Laboratory Approval Program (ELAP) approved laboratory.

The serial numbers for the Summa canisters and the regulators as well as the initial and ending pressures of each canister will be recorded on the COC and in the logbook. Custody seals will be placed on all coolers/packages containing laboratory samples during shipment.

- The field sampling team will maintain a sample log sheet summarizing the following:
 - Sample identification;
 - Date and time of sample collection;
 - Sampling depth;
 - Serial numbers for Summa canisters and regulators;
 - Sampling methods and devices;
 - Purge volumes;
 - Volume of soil vapor extracted;
 - Vacuum of Summa canisters before and after sample collection;
 - Apparent moisture content (dry, moist, saturated, etc.) of the sampling zone; and
 - COC protocols and records used to track samples from sampling point to analysis

It is critical to ensure that moisture does not enter the Summa canister which can compromise the analytical results.

3.8 Temporary Sub-Slab Soil Vapor Sampling Procedures

Sub-slab soil gas samples for laboratory analysis will be collected according to the following procedures:

- Prior to installation of the sub-slab vapor point, the building floor should be inspected and any penetrations (cracks, floor drains, utility, sumps, etc.) should be recorded. Sub-slab points should be installed at locations where the potential for ambient air infiltration via floor penetrations is minimal.
- After the slab has been inspected and the location of any subsurface utilities determined, the ambient air surrounding the proposed sampling location will be screened with a PID.
- A hammer drill, equipped with a 1.25-inch diameter drill bit, will be used to advance a hole to a depth of approximately three to 6 inches beneath the slab. When drilling is complete, clean around drilled area.
- Insert tubing constructed with 3/8-inch outer diameter poly, 1/4-inch inner diameter Teflon® tubing. The tubing should not extend further than 2 inches into the sub-slab material.
- The annular space between the borehole and the sample tubing will be filled and sealed with electrical conduit putty (or equivalent) at the surface.
- Conduct tracer testing in accordance with the procedures detailed in Section 3.7.2 above.
- The tubing will be connected to a low-flow sample pump. A three-way valve will be used to allow purging of all the lines. Flow rates for both purging and collection must not exceed 200 ml/min to minimize the ambient air infiltration during sampling.
- Approximately 1 liter of gas will be purged from the subsurface point and captured in a Tedlar™ bag using the low-flow pump. PID readings will be observed from this sample and the highest reading shall be recorded on the appropriate field form.
- Record the initial pressure in the stainless steel Summa canister to be used for the sample prior to connecting the tubing. The samples will be collected using laboratory-certified clean Summa canisters with flow regulators and an initial vacuum of 28 inches Hg $\pm$ 2 inches. If no vacuum reading is obtained, close the valve and try a new regulator. If no vacuum reading is observed a second time, use a different canister as this indicates the canister was not properly evacuated.
- The end of the tubing will be connected directly to the Summa canister's regulator intake valve via the three-way valve. Flexible silicone tubing will be used at a minimum and as a tubing adapter only. The sample shall be collected with a 6 liter laboratory-certified Summa canister with dedicated regulator lab calibrated for a 24-hour sample collection.
- When the vacuum gauge reads 5 inches of Hg, close the valve. Sampling is complete. A vacuum of 5 inches Hg $\pm$ 1 inch must be present when sample collection is terminated to prevent contamination during transit. Record the final pressure reading in the Summa canister.
- CDM Smith personnel will label, pack and ship the samples to an NYSDOH ELAP approved laboratory. The serial numbers for the Summa canisters and the regulators as well as the

initial and ending pressure of each canister will be recorded on the COC and in the field logbook. Custody seals will be placed on all packages containing laboratory samples during shipment.

- Remove the sample port and patch the floor with concrete.

When sub-slab vapor samples are collected, the following actions should be taken to document conditions during sampling and ultimately to aid in the interpretation of the sampling results:

- Historic and current storage and uses of volatile chemicals should be identified, especially if sampling within a commercial or industrial building (e.g., use of volatile chemicals in commercial or industrial processes and/or during building maintenance).
- The use of heating or air conditioning systems during sampling should be noted.
- Floor plan sketches should be drawn that include the floor layout with sampling locations, chemical storage areas, garages, doorways, stairways, location of basement sumps or subsurface drains and utility perforations through building foundations, Heating, Ventilation, and Air Conditioning (HVAC) system air supply and return registers, compass orientation (north), footings that create separate foundation sections, and any other pertinent information should be completed.
- Outdoor plot sketches should be drawn that include the building site, area streets, outdoor air sampling locations (if applicable), compass orientation (north), and paved areas.
- Weather conditions (e.g., precipitation and indoor and outdoor temperature) and ventilation conditions (e.g., heating system active and windows closed) should be reported.
- Any pertinent observations, such as spills, floor stains, smoke tube results, odors and readings from field instrumentation (e.g., vapors via PID, Jerome Mercury Vapor Analyzer, etc.), should be recorded.
- Photograph documentation should be taken of all sample locations and materials stored at each sample location.

Additional documentation that could be gathered to assist in the interpretation of the results includes information about air flow patterns and pressure relationships obtained by using smoke tubes or other devices (especially between floor levels and between suspected contaminant sources and other areas), the barometric pressure and photographs to accompany floor plan sketches.

The field sampling team should maintain a sample log sheet summarizing the following:

- Sample identification;
- Date and time of sample collection;
- Sampling depth;

- Identity of samplers;
- Sampling methods and devices;
- Soil vapor purge volumes;
- Volume of soil vapor extracted;
- If canisters used, vacuum of canisters before and after samples collected;
- Apparent moisture content (dry, moist, saturated, etc.) of the sampling zone; and
- COC protocols and records used to track samples from sampling point to analysis.

3.9 Permanent Port Sub-Slab Soil Vapor Sampling Procedures for Vapor Intrusion

Sub-slab soil vapor samples for laboratory analysis will be collected from permanent sub-slab ports according to the following procedures:

- Prior to installation of the sub-slab vapor probe, the building floor should be inspected and any penetrations (cracks, floor drains, utility perforations, sumps, etc.) should be noted and recorded. Probes should be installed at locations where the potential for ambient air infiltration via floor penetrations is minimal.
- After the slab has been inspected and the location of any subsurface utilities determined, the ambient air surrounding the proposed sampling location will be screened with a PID.
- A hammer drill with a 3/8 inch diameter drill bit will be used to drill an inner pilot hole into the concrete slab to a depth of approximately 2 inches.
- Using the pilot hole as the center, drill 1 inch diameter outer hole to an approximate depth of 1 3/8 inch.
- Clean any cuttings out of the hole.
- Using the 3/8-inch drill bit, continue to drill the pilot hole through the slab and several inches into the sub-slab material.
- Assemble the stainless steel permanent point:
 - Determine the length of stainless steel tubing required to reach from the bottom of the outer hole, through the slab, and into the open cavity below the slab. To avoid obstruction of the probe tube, insure that it does not contact the sub-slab material.
 - Attach the measured length of 1/4 inch OD stainless tubing to the female connector with the swagelock™ nut and tighten the nut.
 - Insert the 1/4 inch hex socket plug into the female connector. Tighten the plug. Do not over tighten.

- Place the completed probe into the outer hole. The probe tubing should not contact the sub-slab material and the top of the female connector should be flush with the surface of the slab and centered in the outer hole.
- Fill the space between the probe and the inside of the outer hole with anchoring cement and allow to cure.
- Wrap one layer of Teflon thread tape onto the NPT end of the male connector.
- Remove the ¼ inch hex socket plug from the female connector.
- Screw and tighten the male connector into the female connector.
- A length of Teflon®-lined tubing is attached to the probe assembly and connected to the sample system for purging and sample collection.
- A three-way valve will be used to allow purging of all the lines. Flow rates for both purging and collection must not exceed 100 ml/min to minimize the ambient air infiltration during sampling.
- Purge at least 3 volumes from the subsurface probe and captured in a Tedlar™ bag using a 60 cc syringe. PID readings will be observed from this sample and the highest reading shall be recorded on the appropriate field form.
- Record the initial pressure in the stainless steel Summa canister to be used for the sample prior to connecting the tubing. The samples will be collected using laboratory certified clean Summa canisters with flow regulators and a vacuum of 28 inches Hg $\pm$ 2 inches. Vacuum readings in the canister should be approximately 25-30 in Hg. If no vacuum reading is obtained, use a different canister as this indicates the canister was not properly evacuated.
- The end of the tubing will be connected directly to the Summa canister's regulator intake valve via the three-way valve. Flexible silicone tubing will be used at a minimum and as a tubing adapter only. The sample shall be collected with a 6 liter laboratory certified Summa canister with dedicated regulator lab calibrated for a 24 hour (unless otherwise specified in the project-specific work plan) sample collection.
- Collect the sample into the Summa canister, which will be provided by the subcontracted laboratory.
- When the vacuum gauge reads 5 inches Hg, close the valve. Sampling is complete. A vacuum of 5 inches Hg $\pm$ 1 inch must be present when sample collection is terminated to prevent contamination during transit. Record the final pressure reading in the Summa canister.
- CDM Smith personnel will label, pack and ship the samples to an NYSDOH ELAP-approved laboratory. The serial numbers for the Summa canisters and the regulators as well as the

initial and end pressure of each canister will be recorded on the COC. Custody seals will be placed on all coolers/packages containing laboratory samples during shipment.

When sub-slab vapor samples are collected, the following actions should be taken to document conditions during sampling and ultimately to aid in the interpretation of the sampling results:

- Historic and current storage and uses of volatile chemicals should be identified, especially if sampling within a commercial or industrial building (e.g., use of volatile chemicals in commercial or industrial processes and/or during building maintenance).
- The use of heating or air conditioning systems during sampling should be noted.
- Floor plan sketches should be drawn that include the floor layout with sampling locations, chemical storage areas, garages, doorways, stairways, location of basement sumps or subsurface drains and utility perforations through building foundations, HVAC system air supply and return registers, compass orientation (north), footings that create separate foundation sections, and any other pertinent information should be completed.
- Outdoor plot sketches should be drawn that include the building site, area streets, outdoor air sampling locations (if applicable), compass orientation (north), and paved areas.
- Weather conditions (e.g., precipitation and indoor and outdoor temperature) and ventilation conditions (e.g., heating system active and windows closed) should be reported.
- Any pertinent observations, such as spills, floor stains, smoke tube results, odors and readings from field instrumentation (e.g., vapors via PID, Jerome Mercury Vapor Analyzer, etc.), should be recorded.

Additional documentation that could be gathered to assist in the interpretation of the results includes information about air flow patterns and pressure relationships obtained by using smoke tubes or other devices (especially between floor levels and between suspected contaminant sources and other areas), the barometric pressure and photographs to accompany floor plan sketches.

The field sampling team should maintain a sample log sheet summarizing the following:

- Sample identification;
- Date and time of sample collection;
- Sampling depth;
- Identity of samplers;
- Sampling methods and devices;
- Soil vapor purge volumes;
- Volume of soil vapor extracted;

- If canisters are used, vacuum of canisters before and after samples collected;
- Apparent moisture content (dry, moist, saturated, etc.) of the sampling zone; and
- COC protocols and records used to track samples from sampling point to analysis.

3.10 Indoor (Ambient) Air Sampling Procedures Vapor Intrusion

All indoor air samples will be collected with a 6 liter laboratory certified Summa canister regulated for a 24 hour sample collection. Sample collection will be similar to outdoor ambient air sample collection. The Summa canister will be placed in an appropriate location as to collect a representative sample from the breathing zone at 4 or 6 feet above the floor. Personnel should avoid lingering in the immediate area of the sampling device while samples are being collected.

The NYSDOH *Indoor Air Quality Questionnaire and Building Inventory* shall be completed for each structure where indoor air testing is being conducted. The following actions should be taken to document conditions during indoor air sampling and ultimately to aid in the interpretation of the sampling results:

- Historic and current uses and storage of volatile chemicals should be identified, especially if sampling within a commercial or industrial building (e.g., use of volatile chemicals in commercial or industrial processes and/or during building maintenance).
- A product inventory survey documenting sources of volatile chemicals present in the building during the indoor air sampling that could potentially influence the sample results should be completed.
- The use of heating or air conditioning systems during sampling should be noted.
- Floor plan sketches should be drawn that include the floor layout with sampling locations, chemical storage areas, garages, doorways, stairways, location of basement sumps or subsurface drains and utility perforations through building foundations, HVAC system supply and return registers, compass orientation (north), footings that create separate foundation sections, and any other pertinent information should be completed.
- Outdoor plot sketches should be drawn that include the building site, area streets, outdoor air sampling locations (if applicable), compass orientation (north), and paved areas.
- Weather conditions (e.g., precipitation and indoor and outdoor temperature) and ventilation conditions (e.g., heating system active and windows closed) should be reported.
- Any pertinent observations, such as spills, floor stains, smoke tube results, odors and readings from field instrumentation (e.g., vapors via PID, etc.), should be recorded.

Additional documentation that could be gathered to assist in the interpretation of the results includes information about air flow patterns and pressure relationships obtained by using smoke tubes or other devices (especially between floor levels and between suspected contaminant

sources and other areas), the barometric pressure and photographs to accompany floor plan sketches.

The field sampling team should maintain a sample log sheet summarizing the following:

- Sample identification;
- Date and time of sample collection;
- Sampling height;
- Identity of samplers;
- Sampling methods and devices;
- Volume of air sampled;
- Vacuum of canisters before and after samples collected; and
- COC protocols and records used to track samples from sampling point to analysis.

3.11 Outdoor (Ambient) Air Sampling Procedures for Vapor Intrusion

All outdoor air samples will be collected with a laboratory certified Summa canister regulated for a 24 hour sample collection using a 6 liter Summa canister. The Summa canister will be placed in an appropriate location as to collect a representative sample from the breathing zone at 4 or 6 feet above the ground.

Personnel will avoid lingering in the immediate area of the sampling device while samples are being collected. Ambient air samples will be collected in a location that will not be impacted by any boring or dust generating activities.

The following actions will be taken to document conditions during ambient air sampling:

- Outdoor plot sketches will be drawn that include the building site, area streets, ambient air sample locations, the location of potential interferences, compass orientation, and paved areas.
- Weather conditions (e.g. precipitation, temperature, wind direction and barometric pressure)
- Any pertinent observations, such as odors, reading from field instruments, and significant activities in the vicinity (e.g. operation of heavy equipment) will be recorded.

The field sampling team will maintain a sample log sheet summarizing the following:

- Sample identification;
- Date and time of sample collection;

- Sampling height;
- Identity of samplers;
- Sampling methods and devices;
- Volume of air sampled;
- Vacuum of canisters before and after samples collected; and
- COC protocols and records used to track samples from sampling point to analysis.

3.12 Decontamination

All non-dedicated, non-disposable sampling equipment and tools used to collect samples for chemical analysis will be decontaminated prior to and between each sample interval using an Alconox rinse and potable water rinse prior to reuse. Unless disposable sampling equipment is used, the equipment will be decontaminated by the following procedure:

- Wash with a non-phosphate detergent
- Tap water rinse
- Deionized water rinse
- Air dry and wrap in aluminum foil, shiny side out

Additional cleaning of the drilling equipment with steam may be needed under some circumstances if elevated levels of contamination appear to be present using field monitoring equipment or if there are visible stained soils. Decontamination fluids will be discharged to the ground surface unless visible sheen or odor is detected either on the equipment or the fluids, at which point the decontamination water will be contained in a 55 gallon drum, staged, labeled and properly disposed of.

3.13 Investigative Derived Waste

All IDW such as drill cuttings and other soil generated during investigation activities, shall be handled in accordance with DER-10 Section 3.3 (e). Transport, storage and disposal of IDW are generally subject to one or more solid or hazardous waste regulations (e.g. 6 New York Codes, Rules, and Regulations (NYCRR) Parts 360,364 and 370 series). All material from onsite activities, with the exception of test pits, is considered hazardous and must be containerized and properly stored onsite for offsite disposal.

Test pit material may be placed back into the hole if the material is from the same general strata from which it was removed and there is no non-aqueous phase liquid (NAPL) or free product present.

Investigation derived water/fluid resulting from well development or well purging before sampling must be collected, handled and discharged/disposed of pursuant to applicable guidance

and regulations. It shall be properly labeled and stored onsite. If the water/fluid meets any of the following criteria, it must be properly disposed of offsite:

- Visual evidence of contamination, consisting of discoloration, sheens, free product or NAPL.
- Olfactory evidence of contamination.
- Concentrations of contaminants of above groundwater standards at levels of concern that are known to be present in the monitoring wells based on previous sampling of groundwater.

If none of the conditions above apply, the containerized water/fluid may be discharged to an unpaved ground into the same groundwater unit, within or adjacent to a source area in a manner which does not result in surface water runoff, with DER approval.

3.13.1 Waste Sampling

Waste classification sampling will occur before the completion of site investigation activities. Representative soil samples will be collected from waste containers with a decontaminated stainless steel or disposable trowel.

The samples will be homogenized (except for VOC samples) in a stainless steel bowl and transferred to the sample container(s) for subsequent analysis. Grab samples will be collected from each container containing aqueous wastes.

The requirements for waste characterization will be determined by the disposal facility. The containers of waste will be stored in an area designated by NYSDEC until the analytical results are received and the waste can be characterized for disposal.

3.13.2 Waste Sampling Procedure

3.13.2.1 Soil Waste

- Scan the sample with the PID and record readings.
- Collect a sample of the soil from the container using a decontaminated stainless steel or disposable trowel and place the sample in a stainless steel bowl (for VOC samples, place sample directly in the sample container). Homogenize the soil using the trowel. Samples will be collected and homogenized in the steel bowl to represent each drum.
- Remove the cap from the container.
- Fill the sample container as completely as possible by transferring the sample to the container immediately after collected the sample with a stainless steel trowel, and screening the sample with the PID.
- Close the sample container tightly.
- Label the container and place it in a cooler with bagged ice sufficient to cool the samples to 4°C.

- Maintain COC forms for samples.
- Log the description of IDW sampled in the field book, i.e. number of drums and locations from which IDW originated.

3.13.2.2 Aqueous Waste

- Remove the cap from the drum containing the aqueous waste.
- Fill a sample container(s) as completely as possible by transferring liquid sample from the waste container to the sample container and screening the sample with a PID.
- Close the sample container(s) tightly.
- Place sample container(s) in cooler with bagged ice sufficient to cool the samples to 4°C.
- Maintain COC forms.

3.14 Soil Boring Logs/Geoprobe

Geological logging includes keeping a detailed record of drilling (or excavating) and a geological description of materials on a prepared form.

Geological logs are used for all types of drilling and exploratory excavations and include descriptions of both soil and rock. Accurate and consistent descriptions are imperative.

3.14.1 Log Form

When drilling in soils or unconsolidated deposits, the log should be kept on a standard Soil Boring Log Form (Appendix A). The following basic information should be entered on the heading of each log sheet:

- Project name and number
- Boring or well number
- Locations (approximate in relation to an identifiable landmark; will be surveyed)
- Elevations (approximate at the time; will be surveyed)
- Name of drilling contractor
- Drilling method and equipment
- Water level
- Start and finish (times and date)

The following technical information is recorded on the logs:

- Depth of sample below surface
- Sample interval

- Sample type and number
- Length of sample recovered
- Standard penetration test (American Society of Testing Materials (ASTM-D1586)) results, if applicable
- Soil description and classification
- Graphic soil symbols
- PID readings

In addition to the items listed above, all pertinent observations about drilling rate, equipment operation, or unusual conditions should be noted. Such information might include the following:

- Size of casing used and method of installation
- Rig reactions such as chatter, rod drops, and bouncing
- Drilling rate changes
- Material changes
- Zones of caving or heaving

3.14.2 Soil Classification

The soil description should be concise and should stress major constituents and characteristics. Soil descriptions should be given in a consistent order and format. The following order is as given in ASTM D2488:

- Soil name. The basic name of the predominant constituent and a single-word modifier indicating the major subordinate constituent.
- Gradation or plasticity. Granular soil (sand or gravel) should be described as well graded, poorly graded, uniform, or gap-graded, depending on the gradation of the minus 3 inch fraction. Cohesive soil (silts or clays) should be described as non-plastic, slightly plastic, moderately plastic, or highly plastic, depending on the results of the manual evaluation for plasticity as described in ASTM D2488.
- Particle size distribution. An estimate of the percentage and grain-size range of each of the soil's subordinate constituents with emphasis on clay-particle constituents. This description may also include a description of angularity. This parameter is critical for assessing hydrogeology of the site and should be carefully and fully documented.
- Color. The color of the soil using Munsell notation.
- Moisture content. The amount of soil moisture, described as dry, moist, or wet.

- Relative density or consistency. An estimate of density of a granular soil or consistency of a cohesive soil, usually based on standard penetration test results (see **Table 3-2** and **Table 3-3**).
- Local geologic name. Any specific local name or a generic name (i.e., alluvium, loess). Also use of Unified Soil Classification System of symbols.

The soil logs should also include a complete description of any tests run in the borehole; placement and construction details of piezometers, wells, and other monitoring equipment; abandonment records; geophysical logging techniques used; and notes on readings obtained by air monitoring instruments.

- Additional data in sedimentary rocks includes:
 - Sorting
 - Cementation
 - Density or compaction
 - Rounding

The core should be logged as quickly as possible after removal from the hole. Some materials may degrade rapidly upon exposure.

Check each core end carefully and try to determine if the fracture is natural or mechanical in origin. Mechanical fractures often can be identified by their orientation, the absence of secondary coatings or filling and slicken sides, and its fit with the adjacent core piece. If doubt exists, consider it a natural fracture. If it is determined that the fracture is mechanical, consider the two pieces of core as a single piece.

Table 3-2
Relative Density of Non-Cohesive Soil

Blows/Ft	Relative Density	Field Test
0-4	Very Loose	Easily penetrated w/ ½-inch steel rod pushed by hand
5-10	Loose	Easily penetrated w/ ½-inch steel rod pushed by hand
11-30	Medium	Easily penetrated w/ ½-inch steel driven with a 5-lb hammer
31-50	Dense	Penetrated one foot with a ½-inch steel rod driven with 5-lb hammer
>50	Very Dense	Penetrated only a few inches with a ½-inch steel rod driven with a 5-lb hammer

Blows/Ft= Blows per foot

lb = pound

Table 3-3
Relative Consistency of Cohesive Soil

Blows/Ft	Consistency	Pocket Penetrometer (TSF)	Torvance (TSF)	Field Test
<2	Very Soft	<0.25	<0.12	Easily penetrated several inches by fist
2-4	Soft	0.25-0.8	0.12-0.25	Easily penetrated several inches by thumb
5-8	Firm	0.50-1.0	0.25-0.5	Can be penetrated several inches by thumb with moderate effort
9-15	Stiff	1.0-2.0	0.5-1.0	Readily indented by thumb but penetrated only with great effort
16-30	Very Stiff	2.0-4.0	1.0-2.0	Readily indented by thumbnail
>30	Hard	>4.0	>2.0	Indented with difficulty by thumbnail

TSF= Tons per square foot

3.15 Monitoring Well Installation

This section provides procedures for well design and well construction to aid in the development of drilling subcontracts. Drilling operation and well development guidelines are presented to aid the reader in the oversight of the installation of monitoring wells.

The principal reason that monitoring wells are constructed is to collect groundwater samples that, upon analysis, can be used to delineate a contaminant plume and track movement of specific chemical or biological constituents.

A secondary consideration is the determination of the physical characteristics of the groundwater flow system to establish flow direction, transmissivity, quantity, etc. The spatial and vertical locations of monitoring wells is important. Of equal importance are the design and construction of monitoring wells that will provide easily obtainable samples and yield reliable, defensible, and meaningful information. In general, monitoring well design and construction follows production well design and construction techniques. However, emphasis is placed on the effect these practices may have on the chemistry of the water samples being collected rather than on maximizing well efficiency.

From this emphasis, it follows that an understanding of the chemistry of the suspected pollutants and of the geologic setting in which the monitoring wells are constructed plays a major role in determining the drilling technique and materials used.

3.15.1 Well Siting

The following procedures should be followed:

- Review pertinent proposal sections, specifications, and subcontractor's contracts. Review any regulations governing how, where or when the well is drilled. Review data (supplied by the Client, or any other data available) used for program planning.
- Identify well site on a topographic map or other suitable project base map. Contact landowner at the beginning of well siting. Inquire whether the proposed drill locations will

interfere with the landowner's established land use. Unless the property is owned by the client, the landowner is always contacted before entering the property, even if he/she is leasing back the property from the client.

- Check route to confirm a drill rig can access the proposed well site. Plan routes that require the least disturbance of natural vegetation or natural conditions and which would not require grading or other types of work using mechanical equipment.
- The well site should be reasonably level and absent of large boulders or other hazardous obstructions.
- Check to insure absence of buried high-pressure gas, oil or water lines. If any lines are present relocate the well site a safe distance away from them. Be sure to check with the subcontractor to insure his/her agreement.
- Check to insure absence of overhead power transmission lines. If any overhead power lines are present, relocate the well site a safe distance away from them. Be sure to check with the subcontractor to insure his/her agreement.
- Consult landowner about water source and access, and then notify the driller of these decisions.
- Explain to the driller the need for care and accurate retrieval of drill cuttings and, if necessary, placement and accounting of materials during well completion.
- If necessary, request access agreement to the well site.

3.15.2 Well Design

The following procedures should be followed:

- Examine the geophysical log and determine the exact interval(s) and depth(s) of the completion zone(s). Calculate the quantity of slotted casing or screen, blank casing, sealing materials, gravel pack and cement necessary to complete the well.
- Calculate the quantities of gravel pack, sealing materials and cement figuring the volume of the bore hole [borehole radius squared time the length of the borehole ($rB^2 \times L$)] minus the volume of the casing [radius of the casing squared times the length of the casing ($rC^2 \times L$)] which will yield the volume per linear foot.
 - A cubic foot of silica sand weighs 100 pounds. Frequently silica sand is packaged in 100 pound sacks but should be purchased and delivered in bulk quantities. A 5-gallon bucket is equal to 0.67 cubic feet. Dividing the determined or calculated volume between the well bore and the outside of the casing(s) into 0.67 cubic feet per bucket will yield approximately the number of feet per bucket of silica sand. Dividing the total interval of the intended gravel pack by the number of feet per bucket of gravel pack will yield approximately how many buckets of gravel will be required. This same method can be used if the silica sand arrives in 1 cubic foot sacks (100 pounds) except the final value is approximately the number of feet per sack of silica sand.

- Cement typically comes in 94 pound sacks and can be mixed in the field to obtain volumes between 0.88 cubic feet per sack to 1.50 cubic foot per sack. See **Table 3-4** for the most common cement slurry mixtures.
- Clay seals are routinely placed in a well completion above the gravel or filter pack and below the cement or grout cap or plug. The clay seals are generally a bentonite clay and, before swelling (in the borehole), has the form of ¼ inch to ½ inch pellets. The pellets generally come in plastic containers of 20 and 50 pounds, but can also arrive in boxes or cloth sacks.

Table 3-4
Monitoring Well Grout

Water-Cement Ratio (gallons water per sack)	Weight per Gallon of Slurry (pounds)	Volume of Mixture per Sack (cubic feet)
7 1/2	14.1	1.50
7	14.4	1.43
6 ½	14.7	1.35
6	15.0	1.28
5 ½	15.4	1.21
5	15.8	1.14
4 ½	16.25	1.08
4	16.50	1.00
3 ½	17.35	0.95
3	18.1	0.88

The volume of the bentonite pellets needed for a specific seal thickness is calculated in the same manner as was done for the gravel pack and cement requirements.

Measure all materials twice during the well construction. First, when estimating the quantity of supplies needed for the completion, second, during well construction. Keep the first estimate in the daily log book. Record the following; the actual (second measurement) intervals top and bottom), as well as the quantity and type of materials placed in the well. recorded

3.15.3 Well Construction

The following procedures should be followed:

3.15.3.1 Final Design of Casing - Screen/Slotted Casing String(s)

- If there is any doubt about the final design of the casing string, based on data from the pilot hole or the individual drill holes scheduled for completion, verify the design with the hydrogeologist in charge.
- It is the hydrogeologist's responsibility to insure adequate supplies are maintained at each well site even though it may be the contractor's responsibility for supplying the materials.

3.15.3.2 Installing Casing (Slotted/Screen Casing String(s))

- Plastic or Polyvinylchloride (PVC) Casing - Join all 5 or 10 foot lengths of casing (solid and slotted screen) by flush-joint threading. All pipe is cut with a cutting tool which leaves a smooth, square end.
- Both the hydrogeologist and the contractor keep a complete casing-slotted/screen string tally. Seal the bottom of the casing or slotted/screen casing string with a cap screwed permanently in place.

3.15.3.3 Installing Filter Material (Gravel Pack)

- Place the filter material downhole by gravity feed.
- The filter material shall be installed to levels pre-determined by the hydrogeologist. The exact depth for each well is determined from the final well design. However, generally the top of the filter material will be 5 feet above the top of the highest slotted screen interval.
- Following placement of the filter material "sound" or "tag" this depth with the tremie pipe to insure it is at the prescribed level.

3.15.3.4 Installing Bentonite Pellet Seals (Blanket)

Following the installation of the filter material, place a Bentonite pellet blanket seal on top of the filter material to prevent contamination of the filter pack by the grout.

The actual amount of the annulus that is filled with Bentonite pellets may vary from completion to completion but a minimum of 12 inches of the annulus should be filled with Bentonite by gravity feed from the surface. The tremie pipe remains in the bore hold during gravity feed of the Bentonite pellets. Calculate the exact volume of pellets needing placement.

3.15.3.5 Grouting

- Grout the annular space above the Bentonite pellets as directed by the hydrogeologist.
- The grouted volume of annular space will vary from well to well, and sometimes within the same completion. Generally, if the annular space exceeds approximately 20 feet then the grouting is done in more than one stage. Take care that the grout does not displace the Bentonite seal or exceed (in weight) the collapse strength of the casing.
- The methods for mixing grout in the field vary. The first concern is that the slurry mixture is fluid enough for placement by tremie pipe and heavy enough to give the desired strength and sealing properties required. Reference the table from Halliburton Cementing Tables, 1979 or other suitable source for the amount of water per sack, and then measure accurately into a large tub (water trough) or steel pit. Mix the correct number of bags of cement with the water at a rate which prevents, clotting or settling out of dry, unmixed cement. Usually this procedure is accomplished with a portable pump that sucks the water or cements mixtures in and then expels it under pressure through a hose that is used in a jetting fashion at the opposite end of the tank, pit or trough.

- Grout also can be mixed using a shovel or hoe. Generally, the grout is placed on the side of the tub, the bag is ruptured, and the cement is slowly added to the water. If the cement has hard spots place on a screen of approximately $\frac{1}{4}$ inch mesh attached to some type of frame that is placed across the mixing tub. The cement is then "filtered" for the larger; hard pieces or blocks.
- Pumping or Pouring Grout
 - Place the mixed grout above the Bentonite pellets. The time between placement of the Bentonite pellets and the grout should not be less than 15 to 20 minutes. This allows the pellets to settle to the top of the gravel pack and to begin to swell, while not allowing the grout to harden.
 - The grout can either be pumped down the tremie pipe by the same pump used for jetting or it can be poured by buckets through a funnel into the tremie pipe. Displacement of the bore hole fluid is almost certain because the grout slurry weighs more than the residual borehole fluid (10 or 11 pounds per gallon for the mud versus 14 to 18 pounds per gallon for the grout).
 - Except under rare circumstances, grout is never poured from the surface nor is it ever poured into standing water.
 - Grout the remainder of the hole by gravity feed from the surface, as directed by the hydrogeologist. The quantity of grout placed from the surface should not exceed the collapse strength of the casing and should not be initiated prior to the curing of the grout seal above the Bentonite pellets.

3.16 Monitoring Well Development

All completed wells, whether the production or monitoring type, must be developed in order to facilitate unobstructed and continuous groundwater flow into the well. Well development is the process of cleaning the fines from the face of the borehole and the formation near the well screen. During any drilling process the side of the borehole becomes smeared with drilling mud, clays or other fines. This plugging action substantially reduces the permeability and retards the movement of water into the well screen. If these fines are not removed, especially in formations having low permeability, it then becomes difficult and time consuming to remove sufficient water from the well before obtaining a fresh groundwater sample because the water cannot flow easily into the well.

The development process is best accomplished for monitoring wells by causing the natural formation water inside the well screen to move vigorously in and out through the screen in order to agitate the clay and silt, and move these fines into the screen. The use of water other than the natural formation water is not permitted.

3.16.1 Development Methods

The following well development methods may be used including:

- **Surge Block** - A surge block is a round plunger with pliable edges such as belting that will not catch on the well screen. Moving the surge block forcefully up and down inside the well screen causes the water to surge in and out through the screen accomplishing the desired cleaning action. Surge blocks are commonly used with cable-tool drilling rigs, but are not easily used by other types of drilling rigs.
- **Bailer** - A bailer sufficiently weighted that will sink rapidly through the water and can be raised and lowered through the well screen. The resulting agitating action of the water is similar to that caused by a surge block. The bailer, however, has the added advantage of removing the fines each time it is brought to the surface and dumped. Bailers can be custom-made for small diameter wells, and can be hand-operated in shallow wells.
- **Surging and pumping** - Starting and stopping a pump so that the water is alternately pulled into the well through the screen and backflushed through the screen is an effective development method. Periodically pumping to the surface will remove the fines from the well and permit checking the progress to assure that development is complete.

Well development should continue until the water becomes free of sediment or contains sediment in a lesser amount than was initially present. Conductivity, pH, temperature and turbidity (as measured by a YSI meter or equivalent) of the development water must all have stabilized prior to ceasing development. Disposal of development water shall be in accordance with Section 3.13.

3.17 Low Flow Groundwater Sampling

Low-flow purge and sampling is appropriate at locations where disturbance of the media around the well screen needs to be minimized. A common concern is turbidity in the monitoring wells and the consequent undesirable effects on metals sampling results.

The low-flow purge and sample method creates less disturbance and agitation in the well, and therefore excess turbidity is not generated during the purging and sampling process. The result is a more rapid stabilization of turbidity and other parameters (pH, temperature, specific conductivity, oxidation reduction potential (ORP), and dissolved oxygen), and a sample more representative of conditions in the formation is collected.

The low flow purge and sample method consists of using a submersible, peristaltic or bladder pump to purge the well at a very low flow rate (0.5 to 1.5 liter/minute). The pump intake is set approximately in the middle of the well screen, with a stagnant water column over the top of the pump. The well is purged at the low rate until the field parameters (temperature, pH, specific conductivity, turbidity, dissolved oxygen, and ORP) have stabilized. The sample is then collected directly from the pump discharge at a low flow rate. Procedures for collecting groundwater sampling using low flow methods are as follows:

- Check and record the condition of the well for any damage or evidence of tampering.
- Remove the well cap.

- Measure well headspace with a PID and record the reading in the field logbook. For wells installed on a landfill, also measure the headspace with a combustible gas indicator.
- Measure and record the depth to water with an electronic water level device and record the measurement in the field logbook. Do not measure the depth to the bottom of the well at this time (to avoid disturbing any sediment that may have accumulated). Obtain depth to bottom information from installation information in the field logbook or drilling logs. Calculate volume of the water column by depth of water column times the cross-sectional area of the well.
- Lower pump to desired sampling depth. During purging, monitor the water level and field parameters (temperature, pH, turbidity, specific conductance, ORP and dissolved oxygen) approximately every 3 to 5 minutes or using a flow through cell such as a YSI. Continue monitoring until the water level stabilizes and field parameters have stabilized to within 10 percent (plus or minus 5 percent) over a minimum of three readings. Turbidity and dissolved oxygen are typically the last parameters to stabilize. Note: once turbidity readings get below 10 NTUs, then the stabilization range can be amended to 20 percent (plus or minus 10 percent) over a minimum of three readings.
 - If a flow through cell is not used, readings should be taken in a clean container and the monitoring instrument allowed to stabilize before collection of the next sample. The Horiba instrument takes the readings consecutively and therefore the process to record all the measurements may take longer than five minutes. If so, measurements should be taken as often as practicable.
- Once the water level and field parameters have stabilized, collect the samples from the pump. Collect samples per Section 3.2.2.1.
- Decontaminate equipment in accordance with Section 3.12.

3.18 Monitoring Well Purging

Well purging can be performed on a volume basis or on a field parameter stabilization basis. In both cases, field parameters are recorded; however, for the former case purging is concluded after a target number of well volumes (typically 3 to 5) regardless of whether parameters have stabilized. In the latter case, purging continues until field parameters stabilize within 10 percent.

3.18.1 Volumetric Method of Well Purging

The following steps should be followed when purging a well by the volumetric method:

- Don personal protective clothing and equipment as specified in the site-specific HASP.
- Open the well cover and check the condition of the wellhead, including the condition of the surveyed reference mark, if any.
- Monitor the air space at the wellhead, using a PID or equivalent, as soon as well cover is removed according to health and safety requirements.

- Calibrate the required field parameter meters according to manufacturer's specifications.
- Determine the depth to static water level and depth to bottom of well casing. Calculate the volume of water within the well bore based on the following well volumes.

Table 3-5
Well Volumes

Well Diameter (inches)	Gallons (per foot)
2	0.16
4	0.65
6	1.5
8	2.6
10	4.1
12	5.9

Note: Record all data and calculations in the field logbook.

- Set up field parameter probes at the discharge orifice or dedicated probe port of the pump assembly or within the flow-through chamber.
- Prepare the pump and tubing, or bailer, and lower it into the casing.
- Remove the number of well volumes specified in the site-specific plans. Generally, three to five well volumes will be required. Field parameters should be measured and recorded, if required by site-specific plans. In low recharge aquifers, the well commonly will be pumped or bailed to dryness before three well volumes of water are removed. If this is the case, there is no need to continue with purging operations. Record pertinent data in the field logbook.
- Remove the pump assembly or bailer from the well, decontaminate it (if required), and clean up the site. Lock the well cover before leaving. Containerize and/or dispose of development water as required by the site-specific plan.

3.18.2 Indicator Parameter Method of Well Purging

- Don personal protective clothing and equipment as specified in the site-specific HASP.
- Open the well cover and check the condition of the wellhead, including the condition of the surveyed reference mark, if any.
- Monitor the air space at the wellhead, using a PID or equivalent, as soon as well cover is removed according to health and safety requirements.
- Calibrate the required field parameter meters according to manufacturer's specifications.
- Determine the depth to static water level and depth to bottom.
- Set up field parameter probes at the discharge orifice or dedicated probe port of the pump assembly or within the flow-through chamber.

- Assemble the pump and tubing, or bailer, and lower into the casing.
- Begin pumping or bailing the well. Record indicator parameter readings for every purge volume. Maintain a record of the approximate volumes of water produced.
- Continue pumping or bailing until indicator parameter readings remain stable within ± 10 percent for three consecutive recording intervals, or in accordance with site-specific plans. Purging should continue until the discharge stream is clear or turbidity becomes asymptotic-low or meets project requirements. In a low recharge aquifer, the well may pump or bail to dryness before indicator parameters stabilize. In this case, there is no need to continue purging. Record pertinent data in the field logbook.
- Remove the pump assembly or bailer from the well, decontaminate (if required), and clean up the site. Lock the well cover before leaving. Containerize and/or dispose of development water as required by the site-specific plans.

3.19 Groundwater Sampling by Bailer

Groundwater is typically sampled by bailer after purging 3 to 5 well volumes per Section 3.18.

- Don personal protective clothing as specified in the site-specific HASP.
- Prepare the area for sample acquisition. If required, cover ground surface around well head with plastic sheeting.
- Open well head and immediately check for organic vapors with PID or flame ionization detector as appropriate.
- Determine static water level and calculate water volume in well.
- Purge well in accordance with Section 3.18.
- Allow water level to recover to a depth at least sufficient for complete submergence of the bailer without contacting well bottom. Ideally, the water level should recharge to 75 percent of static level. Samples shall be collected within 3 hours of purging if recharge is sufficient. Wells with a low recharge rate must be collected within 24 hours of purging.
- Securely attach the bailer to the line and test the knot. The opposite end of the line should be secured to prevent loss of bailer into well.
- Lower bailer slowly into the water to prevent aeration, particularly when VOC samples are collected.
- Retrieve filled bailer and fill sample bottles in accordance with Section 3.2.2.1.
- Collect required field parameters and depth to water.
- Decontaminate non-disposable sampling equipment in accordance with Section 3.12.
- Secure well, clean up area.

3.20 Well Abandonment

Once it is deemed that the temporary or permanent monitoring well is no longer needed, the well will be abandoned by a New York State certified well driller as follows:

- The well will be sounded (its depth measured with a weighted line or appropriate method) immediately before it is destroyed to make sure that it contains no obstructions that could interfere with filling and sealing. If an obstruction is present over drilling the well to its original depth to remove obstruction(s) may be required.
- Where possible, remove all material within the original borehole – including the well casing, filter pack and annular seal. If the casing, filter pack and annular seal materials cannot be removed, they may be left in place.
- The casing left in place may require perforation or puncturing to allow proper placement of sealing materials. Where the casing is left in the hole, the casing may be cut at the surface.
- Fill well screen with sand per NYSDEC specifications.
- The monitoring well should be filled to the surface with cement grout, or within 20 feet of the surface with Bentonite grout. After the placement of the Bentonite grout (if used), the remaining portion of the well then should be sealed with a Portland Type I, II or Type I/II cement with 2 percent to 5 percent Bentonite.

3.21 Surface Water Sampling

Four surface water sampling scenarios are provided below. These include 1) shallow surface water samples for VOC analysis (preserved and unpreserved), 2) shallow surface water samples for non-VOC or inorganic compound analysis (preserved and unpreserved), 3) deep surface water samples using a weighted bottle sampler and 4) deep surface water samples using a peristaltic pump.

The following steps should be taken when preparing for sampling surface water:

- Don the appropriate personal protective clothing as dictated by the site-specific HASP.
- Identify stream/river sampling locations as directed in work plan.
- Prepare sampling site by laying out clean plastic sheeting on the ground or any flat, level surfaces near the sampling area and place equipment to be used on the plastic.
- Make field measurements as required by the project plans in physical, chemical, and biological characteristics of the water (e.g., temperature, turbidity, dissolved oxygen, conductivity, ORP, pH).
- The samples shall be collected from areas of least to greatest contamination (when known) and, when collecting several samples in 1 day, always collect from downstream to upstream.
- The sampler should be facing upstream when sampling.

- Document the sampling events, recording all information in the designated field logbook and take photographs if required or if possible. Document all deviations from this SOP and include rationale for changes.

3.21.1 Collecting Shallow Surface Water Samples

The following steps must be taken when collecting shallow surface water samples:

- Approach the sample location from downstream; do not enter the sample area. Slowly submerge VOC vials completely into an area of gently flowing water and fill. Do not disturb bottom sediments. The sampler and open end of the vials should be pointed upstream. If wading is necessary, approach the sample location from downstream; do not enter the actual sample area. When using gasoline-powered vessels, make sure the engine is turned off.
- Collect samples per Section 3.2.2.1; if preserved bottles are used, collect sample in a dedicated non-preserved bottle and transfer to the preserved bottle.

Note: When collecting samples for VOC analysis, avoid collecting from a surface water point where water is cascading and aerating. Cap the VOC vial while it is under water. After the vial is capped, check the vial to see if there are any air bubbles trapped in it. If air bubbles are present discard the sample and re-collect.

3.21.2 Collecting Deep Surface Water Samples at Specified Depth Using a Weighted Bottle Sampler

The following steps must be followed when collecting surface water samples at specific depths using a weighted bottle sampler:

- Lower the weighted bottle sampler to the depth specified in the site-specific plan.
- Remove the stopper by pulling on the sampler line; allow the sampler to fill with water.
- Release the sampler line to reseal the stopper and retrieve the sampler to the surface.
- Wipe the weighted bottle sampler dry with a Kimwipe or clean paper towel.
- Remove the stopper slowly. Collect samples per Section 3.2.2.1.
- Decontaminate equipment according to the Section 3.12.

3.21.3 Collecting Deep Surface Water Sample Collection Using a Peristaltic Pump

The following steps must be followed when collecting deep surface water samples using a peristaltic pump:

- Install clean silicon or Teflon®-lined tubing on the pump head. Leave sufficient tubing on the discharge side for convenient dispensing of liquid directly into sample containers.

- Select the appropriate length of Teflon®-lined intake tubing necessary to reach the specified sampling depth. Attach the intake sampling tube to the intake pump tube.
- Lower the intake tube into the surface water at the specified sampling location to the specified depth; make sure the end of the intake tube does not touch underlying sediments.
- Start the pump and allow at least three tubing volumes of liquid to flow through and rinse the system before collecting any samples. Do not immediately dispense the purged liquid back to the surface water body. Instead, collect the purged liquid and return it to the source after sample collection is complete.
- Fill the specified number of sample containers directly from the discharge line, in accordance with Section 3.2.2.1.
- Drain the pump system, rinse it with deionized water, and wipe it dry. Replace all tubing with new tubing before sampling at another sampling location. Place all used tubing in plastic bags to be discarded or decontaminated according to the Section 3.12.

3.22 Sediment/Sludge Sampling

The following steps should be taken when preparing for sampling sediment/sludge:

- Don the appropriate personal protective clothing as dictated by the site-specific HASP.
- Identify stream/river sampling locations in accordance with the site-specific work plan.
- Prepare sampling site by laying out clean plastic sheeting on the ground or any flat, level surfaces near the sampling area and place equipment to be used on the plastic.
- The samples shall be collected from areas of least to greatest contamination (when known) and, when collecting several samples in 1 day, always collect from downstream to upstream.
- When sampling sediment and surface water from the same surface water body, collect surface water samples prior to sediment samples.

3.22.1 Sediment/Sludge Sample Collection from Shallow Waters

- Use a decontaminated stainless steel or Teflon, long-handled scoop, corer, push tube, or dredge to collect the entire sample in one grab. If wading is necessary, approach the sample location from downstream. Do not enter the actual sample area.
- Retrieve the sampling device and slowly decant off any liquid phase.
- Collect samples in accordance with Section 3.2.2.2.

3.22.2 Subsurface Sediment/Sludge Sample Collection Using a Corer or Auger from Shallow Waters

- At the specified sampling location, force or drive the corer to the specified depth.

- Twist and withdraw the corer in a smooth motion.
- Retrieve the sampling device, remove the corer nosepiece (if possible), and extrude the sample into the specified sampling container(s). Use a clean stainless steel or Teflon spoon or spatula to completely fill the container(s), ensuring no headspace.
- Collect samples in accordance with Section 3.2.2.2.

3.22.3 Sediment/Sludge Sample Collection Using a Dredge from Deep Waters

- Attach a clean piece of 12 to 19 mm ($\frac{1}{2}$ to $\frac{3}{4}$ inch) braided nylon line or Teflon-coated wire rope to the top of the sampler. The line must be of sufficient length to reach sediment or sludge and have enough slack to release the mechanism. Mark the distance to the bottom on the line.
- Attach the free end of the sampling line to a fixed support to prevent loss of the sampler.
- At the specified sampling location, open the sampler jaws and slowly lower the sampler until contact with the bottom (sediments/sludge) is felt.
- Release tension on the line; allow sufficient slack for the mechanism (latch) to release. Slowly raise the sampler.
- Once the sampler is above the water surface, place the sampler in a stainless steel or Teflon lined tray or pan. Open the sampler.
- Collect samples in accordance with Section 3.2.2.2.

3.22.4 Restrictions/Limitations

Core sampling devices may not be usable if cobbles exist in the sediment/sludge. Bumping of core sampling devices and Ponar dredge samplers may result in the loss of some of the sample.

For VOC analysis or for analysis of any other compound(s) that may be degraded by aeration, grab sampling is necessary to minimize sample disturbance and, hence, analyte loss. The representativeness of this sample, however, is difficult to determine because the collected sample represents a single point, is not homogenized, and has been disturbed.

3.23 Subsurface Soil Sampling

Subsurface soil samples may be collected using a hand auger at depths of up to 10 feet (typical). In such cases, CDM Smith typically performs the boring and collects the samples for analysis. For deeper depths, a drilling subcontractor is typically used to perform a boring and collect subsurface soil samples by split spoon or Shelby tube via rotary drilling methods, or by direct push methods. In such cases, the driller provides the soil samples to CDM Smith, and CDM Smith then collects the laboratory samples.

The following steps should be taken when preparing for subsurface soil sampling:

- Don the appropriate personal protective clothing as dictated by the site-specific HASP.

- Locate sampling location(s) in accordance with project documents (e.g., work plan) and document pertinent information in the appropriate field logbook. When possible, reference locations back to existing site features such as buildings, roads, intersections, etc.
- Processes for verifying depth of sampling must be specified in the site-specific plans.
- Clear away vegetation and debris from the ground surface at the boring location.
- Prepare an area next to the sample collection location for laying out cuttings by placing plastic sheeting on the ground to cover the immediate area surrounding the borehole.

The following general steps must be followed when collecting all subsurface soil samples:

- VOC samples or samples that may be degraded by aeration shall be collected first and with the least disturbance possible.
- Sampling information shall be recorded in the field logbook and on any associated forms.
- Describe lithology, including color, grains size, moisture, odor and other observations.

3.23.1 Manual (Hand) Auger Sampling

The following steps must be followed when collecting hand-auger samples:

- Auger to the depth required for sampling. Place cuttings on plastic sheeting or as specified in the site-specific plans. If possible, lay out the cuttings in stratigraphic order.
- Throughout the sampling, make detailed notes concerning the geologic features of the soil or sediments in the field logbook.
- Cease augering when the top of the specified sampling depth has been reached. If required, remove the auger from the hole and decontaminate the auger or use a separate decontaminated auger, then obtain the sample.
- Scan sample with PID, as appropriate.
- Collect samples in accordance with Section 3.2.2.2. Collect VOCs quickly to minimize loss of volatiles.
- When all sampling is complete, dispose of cuttings, plastic sheeting, etc., as specified in the site-specific plans.
- Decontaminate all equipment in accordance with Section 3.12

3.23.2 Split-Spoon/ Split Barrel Sampling

Note: the first 15 bullets describe activities to be performed by a licensed drilling contractor, not CDM Smith personnel.

The following steps must be followed when collecting split-spoon samples:

- Remove any pavement and subbase material from an area of twice the bit diameter, if necessary.
- The drilling rig will be decontaminated at a separate location prior to drilling.
- Attach the hollow-stem auger with the cutting head, plug, and center rod(s) to the drill rig.
- Begin drilling and proceed to the first designated sample depth, adding auger(s) as necessary.
- Upon reaching the designated sample depth, slightly raise the auger(s) to disengage the cutting head and rotate the auger without advancement to clean cuttings from the bottom of the hole.
- Remove the plug and center rods.
- If required by the site-specific sampling plan, install decontaminated liners in the split-spoon/split barrel sampler.
- Install a decontaminated split-spoon on the center rod(s) and insert it into the hollow-stem auger. Connect the hammer assembly and lightly tap the rods to seat the drive shoe at the top of undisturbed soil or sediment.
- Mark the center rod in 15 cm (6 inch) increments from the top of the auger(s).
- Drive the split-spoon using the hammer. Use a full 76 cm (30 inch) drop as specified by the ASTM Method D-1586. Record the number of blows required to drive the spoon or tube through each 15 cm (6 inch) increment.
- Cease driving when the full length of the spoon has been driven or upon refusal. Refusal occurs when little or no progress is made for 50 blows of the hammer. ASTM D1586-99 § 7.2.1 and 7.2.2 defines “refusal” as greater than 50 blows per 6 inch advance or a total of 100 blows.
- Pull the split-spoon free by using upswings of the hammer to loosen the sampler. Pull out the center rod and split-spoon.
- Unscrew the split-spoon assembly from the center rod and place it on the plastic sheeting.
- Remove the drive shoe and head assembly. If necessary, tap the split-spoon assembly with a hammer to loosen threaded couplings.
- With the drive shoe and head assembly off, open (split) the split-spoon, being careful not to disturb the sample.
- Scan sample with PID, as appropriate.
- Collect samples in accordance with Section 3.2.2.2. Collect VOCs quickly to minimize loss of volatiles.

- When all sampling is complete, dispose of cuttings, plastic sheeting, etc., as specified in the site-specific plans.
- Decontaminate all equipment in accordance with Section 3.12.

3.23.3 Direct Push Drilling

Note: The first six bullets describe activities to be performed by a licensed drilling contractor, not CDM Smith personnel.

- Decontaminate equipment, if required.
- Install acetate sleeve in direct push sampler (no acetate sleeve required for split-spoon).
- Drive samples from the surface to the desired depth, using either 4 foot or 5 foot long direct push samplers, or 2 foot split-spoons.
- Use discrete interval sampling (sampler end is plugged while driving to top of desired sample interval to exclude soil from non-desired depths) when appropriate (for example, deeper than 8 feet or below the water table).
- At top of sampling interval, release plug (if used) and drive sampler across desired sample interval.
- Retrieve sample and provide to CDM Smith.
- Cut open acetate sleeve with two parallel slices, scan with PID as appropriate.
- Collect samples in accordance with Section 3.2.2.2.
- At the conclusion of the boring, grout the borehole and decontaminate equipment in accordance with Section 3.12.

3.23.4 Restrictions/Limitations

- Basket or spring retainers may be needed for split-spoon sampling in loose, sandy soils.

3.24 Surface Soil Sampling

The following steps must be followed when preparing for sample collection:

- Don the appropriate personal protective clothing as dictated by the site-specific HASP.
- Locate sampling location(s) in accordance with project documents (e.g., work plan) and document pertinent information in the appropriate field logbook. When possible, reference locations back to existing site features such as buildings, roads, intersections, etc.
- Processes for verifying depth of sampling must be specified in the site-specific plans.
- Carefully remove vegetation, stones etc. from the ground surface to expose soil.

- Place clean plastic sheeting on a flat, level surface near the sampling area, if possible, and place equipment to be used on the plastic; place the insulated cooler(s) on separate plastic sheeting.
- A clean, decontaminated trowel, scoop, or spoon will be used for each sample collected. Other equipment may be used (e.g., shovels) if constructed of stainless steel.
- Surface soil samples are normally collected from the least contaminated to the most contaminated areas, if known.
- Document the sampling events, recording the information in the designated field logbook. Document any and all deviations from SOPs in the field logbook and include rationale for changes.
- Collect samples in accordance with Section 3.2.2.2.
- Decontaminate sampling equipment in accordance with Section 3.12.

3.25 Water Level/NAPL Measurement

Water levels can be measured by several instruments. The three most common are covered here – electric water level meter (measures depth to water only), interface probe (measures depth to water and depth to non-aqueous phase liquid NAPL and pressure transducer (typically used to measure depth to water for long term monitoring or aquifer testing).

3.25.1 Procedures for Use of Water Level Meter

- Standing upwind of the well, open the well head and monitor with PID as dictated by the site-specific HASP.
- Check that water level meter is functioning correctly (test button, or immerse probe in tap water to test).
- Lower probe slowly into well until contact with water surface is indicated (tone and/or light).
- Slowly raise and re-lower probe until a precise, repeatable depth to water can be measured.
- Record the depth to water from the measuring point of known elevation, usually marked at the top of the casing. If no mark is present, measure from the highest point of the casing or as otherwise instructed in the site-specific work plan.
- Remove and decontaminate probe, secure well.

3.25.2 Procedures for Use of Interface Probe

The interface meter is used to measure the depth to water and the depth to non-aqueous phase liquid (light and/or dense).

- Standing upwind of the well, open the well head and monitor with PID as dictated by the site-specific HASP.

- Check that the interface level meter is functioning correctly (test button, or immerse probe in tap water and NAPL to test).
- Lower probe slowly into well until contact with water or NAPL surface is indicated. Water is typically indicated by a beeping tone; NAPL is typically indicated by a steady tone – check manufacturer’s specifications.
- Slowly raise and re-lower probe until a precise, repeatable depth to water/NAPL can be measured.
- Record the depth to water/NAPL from the measuring point of known elevation, usually marked at the top of the casing. If no mark is present, measure from the highest point of the casing or as otherwise instructed in the site-specific work plan.
- Measurement of interface depth between Light Non-Aqueous Phase Liquid (LNAPL) and water: For LNAPL, the non-aqueous phase is floating on top of the water column, and the probe must be lowered through the NAPL before encountering water. In this case, shake the probe after water is encountered to help dislodge any NAPL droplets stuck to the probe. Then raise the probe slowly until it re-enters the NAPL. Perform this procedure until a repeatable result is obtained. The interface depth should be recorded in the up direction, never the down direction. When the probe is moving down, past the LNAPL, it may still be coated with product and can therefore yield misleading results. Therefore, it must be shaken in the water and raised to the interface for an accurate result. Record depth from measuring point, as noted above.
- Measurement of interface depth between Dense Non-Aqueous Phase Liquid (DNAPL) and water: For DNAPL, the non-aqueous phase is at the bottom of the well, below the water column. Lower the probe until NAPL is encountered. Then raise the probe, shake it in the water to dislodge any NAPL droplets, and lower it again. Perform this procedure until a repeatable result is obtained. The interface depth should be recorded in the down direction, never in the up direction. When the probe is moving up from the DNAPL it may still be coated with product and can therefore yield misleading results. Therefore, it must be shaken in the water and lowered to the interface for an accurate result. Record depth from measuring point, per item 5 above.
- Remove and decontaminate probe, secure well.

3.26 Tap Water Sampling

Tap water sampling may be performed in residential, commercial or industrial areas for several reasons. The most common tap water samples are used to obtain groundwater samples from private wells.

- Obtain permission to access the property and collect samples.
- Obtain the name(s) of the resident(s) or water supply owner/operator, the exact mailing address, and telephone numbers. This information is required to obtain access to the property to be sampled and to submit a letter of introduction to the owner/representative.

- Determine the location of the tap to be sampled based on its proximity to the water source. It is preferable that the tap water sampling be conducted at a tap located prior to any holding or pressure tanks, filters, water softeners, or other treatment devices that may be present.
- If possible, obtain well construction details, holding tank volumes etc. to evaluate standing volume of water in the system.
- If the sample must be collected at a point in the water line beyond a pressurization or holding tank, a sufficient volume of water should be purged to provide a complete exchange of fresh water into the tank and at the location where the sample is collected.

If the sample is collected from a tap or spigot located just before a storage tank, spigots located inside the building or structure should be turned on to prevent any backflow from the storage tank to the sample tap or spigot. It is generally advisable to open as many taps as possible during the purge, to ensure a rapid and complete exchange of water in the tanks.

- Samples collected to determine if system related variables (e.g., transmission pipes, water coolers/heaters, holding/pressurization tanks, etc.) are contributing to the quality of potable water should be collected after a specific time interval (e.g., weekend, holiday, etc.). Sample collection should consist of an initial flush, a sample after several minutes, and another sample after the system has been purged.
- Devices such as hoses, filters, or aerators attached to the tap may harbor a bacterial population and therefore should be removed prior to sampling.
- Sample containers should not be rinsed before use when sampling for bacterial content, and precautions should be taken to avoid splashing drops of water from the ground or sink into either the bottle or cap.
- Samples of the raw water supply and the treated water after chlorination should be collected when sampling at a water treatment plant.
- In the logbook, record the location and describe the general condition of the tap selected for sampling. The rationale used in selecting the tap sampling location, including any discussions with the property owner, should also be recorded. Provide a sketch of the water supply/distribution system noting the location of any filters or holding tanks and the water supply source (i.e., an onsite groundwater well or surface water intake or a water service line from a public water main). If an onsite water supply is present, observe and record the surrounding site features that may provide potential sources of contamination to the water supply.
- Don the appropriate personal protective clothing as dictated by the site-specific HASP. Gloves should be changed between sampling locations to avoid possible cross-contamination of the tap water samples.

- Prior to sample collection, the supply system should be purged by turning the cold-water tap on. The following general guidelines should be followed to determine when the system is adequately purged (refer to the site-specific sampling plans for any other requirements):
- Onsite Water Supply; A minimum of three standing volumes of water (i.e., the static volume of water in the well and holding tank, if present) should be purged. Obtain water temperature, conductivity, and pH measurements after each volume of water is purged. If the standing volume of water in the supply system is unknown, the tap should be allowed to run for a minimum of 15 minutes and temperature, conductivity, and pH measurements, or other parameters as specified by the project plan, should be collected at approximately 3- to 5-minute intervals. (In general, well construction details and holding tank volumes should be obtained prior to conducting the sampling event to estimate the standing volume of the water supply system.) The system is considered adequately purged when the temperature, conductivity, and pH stabilize within 10 percent for three consecutive readings. If these parameters do not stabilize within 15 minutes, then purging should be discontinued and tap water samples may be collected.
- Large Distribution Systems; Because it is impractical to purge the entire volume of standing water in a large distribution network, a tap should be run for a minimum of 5 minutes, which should be adequate to purge the water service line. Obtain temperature, conductivity, and pH measurements at approximately 1-minute intervals. The system is considered adequately purged when the temperature, conductivity, and pH readings, or other parameters as specified by the project plan, stabilize within 10 percent for three consecutive readings. If these parameters do not stabilize within 5 minutes, then purging should be discontinued and tap water samples may be collected. During purging, a 5 gallon bucket and stopwatch may be used to estimate the flow rate if required by the site-specific plans. Dispose of the purged water according to the site-specific plans.

Record the temperature/conductivity/pH readings, or other parameters as specified by the project plan, the volume of water purged, the flow rate if measured, and the method of disposal in the field logbook.

- After purging the supply system, collect the samples directly from the tap (i.e., if a hose was used for purging, the hose should be disconnected prior to sampling). Any fittings on the end of the faucet that might introduce air into the sample (i.e., a fine mesh screen that is commonly screwed onto the faucet) should be removed prior to sample collection also.
- Obtain a smooth-flowing water stream at moderate pressure with no splashing. Collect samples in accordance with Section 3.2.2.1 COC forms.

3.26.1 Restrictions/Limitations

To protect the sample from contamination on the exterior of a tap, a tap should not be chosen for sampling if any of the following conditions exist:

- A leaky tap allowing water to flow out from around the stem of the valve handle and down the outside of the faucet.

- A tap located too close to the bottom of the sink or the ground surface.
- A tap that allows water to run up on the outside of the lip.
- A tap that does not deliver a steady stream of water. A temporary fluctuation in line pressure may cause sheets of microbial growth, lodged in some pipe sections or faucet connections, to break loose.

Careful sampling for VOC analysis, or for any other compound(s) that may be degraded by aeration, is necessary to minimize sample disturbance and, hence, analyte loss.

3.27 Sample Handling, Packaging, and Shipping

The shipping containers (coolers or shuttles) will be provided by the laboratory providing the analysis. These containers, once filled, will be secured with fiber tape, wrapped entirely around the container and will either be shipped or delivered directly to the laboratory by the field crew or picked up by a laboratory provided courier. Consequently, the strict packaging, labeling and shipping of hazardous wastes and substances requirements set forth by the U.S. Department of Transportation (DOT) under Code of Federal Regulations (CFR) 49 will not be necessary. However, the following sample packaging procedures will be followed to guard against sample breakage and to maintain COC.

- Check to ensure that the sample is properly filled; tighten cap securely.
- Enclose and seal sample containers in a clear plastic bag.
- Place freezer packages of ice in large ziplock plastic bags and place the bags in a sample cooler so that ice is not in direct contact with sample bottles. Sufficient ice will be added to cool the samples to 4°C.
- Use appropriate packing material such as bubble wrap to protect sample bottles from breaking during shipping.
- Complete COC records and other shipping/sample documentation including air bill numbers for each shipment of samples using a ballpoint pen. Seal documentation in a waterproof plastic bag and tape the bag inside the shipping container under the container lid. Include a return address for the cooler.
- Close the container and seal it with fiber tape and custody seals in such a manner that the custody seals would be broken if the cooler were opened.

3.28 Rock Coring

Rock core will be collected as follows:

- Decontaminate all equipment in accordance with Section 3.12.
- Advance borehole to the desired depth using auger, rotary, air hammer or other drilling method, as appropriate.

- Collect core (using specified core barrel) in accordance with ASTM D2113-06, as appropriate for site conditions.
- Record penetration rate.
- Record any fluid loss and depth of loss.
- Place core in new, sturdy, wooden, core boxes.
- Clearly label boxes with borehole number and depth.
- Drilling/coring induced breaks should be marked with 3 parallel lines across the break.
- Photograph full core box, with hole's number and depths clearly visible in the photo.
- Record core data including rock type, fractures and other pertinent information.
- Determine Rock Quality Designation (RQD) for each core run:

$$\text{RQD} = \frac{\text{the total length of core pieces greater than four inches long}}{\text{total core run}}$$

- Measure core lengths along the center line of the core.
- Do not count core pieces that are not "hard and sound" as part of the RQD; however, record such lengths separately.
- Core breaks known to be induced by drilling or core handling should be fitted together and counted as one piece when determining RQD.

3.29 Packer Testing

Packer testing is performed to obtain groundwater samples from discrete intervals within a larger open borehole in bedrock. A dual straddle packer system or single packer system can be used, as appropriate. The single packer is often used when collecting a groundwater sample from near the bottom of the borehole. Inflatable packers, with a submersible pump between the packers (or below the single packer) are typically used. Geophysical logging can be used prior to packer testing to design the packer interval. If packer testing occurs concurrent with drilling, then a single packer is typically used at progressively deeper depths.

Packer testing will be conducted as follows:

- Decontaminate all down hole equipment as needed in accordance with Section 3.12.
- Assemble packer(s) lift pipe and pump. If a straddle packer system will be used, assemble packers at desired spacing.
- Lower packer assembly to desired depth.
- Measure static water level using a water level indicator.

- Inflate packers with nitrogen, with sufficient pressure to seal against borehole wall.
- Calculate volume of water in packer zone and lift pipe using Table 3-5.
- Begin purging with submersible pump; record totalizer readings and flow rates. Contain and dispose of water in accordance with Section 3.13 above and DER-10 Section 3.3 (e).
- Monitor water quality parameters, if appropriate.
- Collect water sample based upon volume of water pumped and/or water quality parameters.
- Deflate packers.
- Move system to next test zone or remove from borehole, as appropriate.
- Decontaminate all down hole equipment prior to demobilization from the site.

3.30 Aquifer Performance Test

Aquifer performance tests are typically performed to characterize the hydraulic properties of wells and aquifers. Properties evaluated include specific capacity, hydraulic conductivity, transmissivity and storativity.

3.30.1 Continuous Background Monitoring

- Baseline groundwater level measurement data will be used to evaluate the effects of outside influences (i.e., influences other than the proposed pump test withdrawal) on groundwater levels. These influences will then be considered when analyzing the pump test data.
- Groundwater level data will be recorded with electronic data loggers at selected well, at 30 minute intervals.
- The loggers will be synchronized to record water levels at the same time.
- A synoptic round of water levels will be made at the wells prior to installing the transducers. After the transducers have been installed and recording has been started, a second round of synoptic water levels will be collected on the day of transducer installation to confirm proper data recording.
- A third round of manual groundwater level measurements will be collected from continuous monitoring points and any other existing wells just prior to beginning pump testing to:
 - Confirm proper data recording by transducers.
 - Obtain a broader baseline groundwater level data set.
- Groundwater level data will also be downloaded from data loggers at this time, saved to electronic media, and reviewed to confirm that groundwater levels have stabilized.

- Precipitation and barometric pressure data will be obtained for the aquifer performance test period from the local weather station (within approximately 5 miles of the project).

3.30.2 Step Drawdown Test

The step drawdown test (or step test) is required to determine the specific capacity and short-term yield of the recovery well and select the pumping rate for the long-term pump test.

- During the test, continuous groundwater levels at the pumping well and select observation points will be recorded logarithmically. An example of a logarithmic schedule is provided on **Table 3-6**.

Table 3-6
Step Drawdown Test Logarithmic Schedule

Log Cycle	Elapsed Time	Sample Interval	Points/Cycle
1	0-20 seconds	0.2 second	101
2	20-60 seconds	1 second	40
3	1-10 minutes	10 seconds	54
4	10-100 minutes	2 minutes	45
5	100-480 minutes	10 minutes	38

- The drawdown versus time data shall be plotted semi-logarithmically.
- The drawdown (y-axis) shall be plotted on a linear scale and time (x-axis) shall be plotted on a logarithmic scale.

The drawdown curves shall be extrapolated to the specified time of the proposed long-term test. The rate that results in the maximum drawdown without dropping the water level below the design pumping level within the time period of the long-term test shall be considered the flow rate to be used for the long-term test.

- The specific capacity versus pumping rate should also be plotted to determine if excessive well losses occur at the selected rate.
- A variable rate submersible pump capable of operating across the above flow range will be used to complete testing. A vertical check valve will be placed on the discharge line immediately above the pump. A 1 inch diameter polyvinylchloride line will be placed in the well, with the open, bottom end extending to within one foot of the pump. This 1 inch line will be used as the stilling pipe for the water level transducer.

After the pumping equipment is installed, the following testing steps will be followed:

- Step 1 - Connect a flow meter, valve, and sample port to the pump discharge line. Extend the pump discharge line from the pumping well to the existing groundwater treatment system influent sump using flexible, chemical-resistant pipe/hose (e.g., garden hose, polyethylene pipe).

- Step 2 - Measure and record the static groundwater level reading in the pumping well.
- Step 3 - Start log cycle for select transducers, and initiate pumping. Set to initial flow rate (Step 1) using the valve (or variable-speed controller). Record the stabilized flow rate and start time for pumping. Confirm proper operation of the pumping well transducer. Confirm that significant leaks are not present along the above-ground hose/pipeline extending between the pumping well and the influent sump.
- Step 4 - Monitor the groundwater level in the pumping well using the transducer and collect manual groundwater level measurements at monitoring points at ± 20 minute intervals.
- Step 5 - After approximately two hours, calculate the specific capacity of the well (flow/drawdown [gpm/ft]), estimate the maximum well yield based upon the calculated capacity and pump depth, and increase the pumping rate to approximately 50 percent (%) of the calculated maximum yield.
- (Step 2). If 50% of the yield has already been exceeded, adjust the rate to approximately 75% of the yield. Record the flow rate and adjustment time. Confirm proper operation of the pumping well transducer.
- Step 6 - Monitor the groundwater level in the pumping well using the transducer, and collect manual groundwater level measurements at monitoring points at ± 20 minute intervals.
- Step 7 - Repeat Steps 5 and 6 for up to two additional steps at approximately 75% and 95% of the maximum well yield (Steps 3 and 4). Be careful not to drop the water level below the top of the pump.
- Step 8 - Shut off the pump at the end of the last step test (after 4 tests and 8 hours, maximum), and download the groundwater level data from all transducers. Also collect manual groundwater level measurements at approximately 20 minutes and 40 minutes after terminating pump operation. Leave the transducers in place.

3.30.3 Long-Term Constant Rate Test

The long-term constant rate test (72-hour pumping test) will be performed at the pumping well on the day after completion of the step test, assuming groundwater levels have recovered to 90% of baseline values. The 72-hour pump test will not commence until this condition is met or a minimum of 72 hours have elapsed since the termination of the step testing. The step test results will be reviewed in advance and used to select the pumping rate for this test, which will equate to approximately 50 to 75% of the calculated short-term, maximum well yield.

- During this test, continuous groundwater levels at the pumping well and select observation points will be recorded logarithmically. An example of a logarithmic logging schedule is provided in **Table 3-7**.

Table 3-7
Long Term Constant Rate Test Logarithmic Schedule

Log Cycle	Elapsed Time	Sample Interval	Points/Cycle
1	0-20 seconds	0.2 second	101
2	20-60 seconds	1 second	40
3	1-10 minutes	10 seconds	54
4	10-100 minutes	2 minutes	45
5	100-480 minutes	10 minutes	38

The following testing steps will be followed:

- Step 1 – Manually measure groundwater levels in recovery well and all observation points prior to initiating pumping.
- Step 2 – Start log cycle for transducers, and initiated pumping at the pre-determined rate by adjusting the valve (or variable-speed controller). Record flow rate and start time. Also check proper data recording at the pumping well transducer.
- Step 3 - Collect manual groundwater level measurements at 20 minute intervals until drawdown begins to stabilize. Also check pump flow rate and adjust valve as necessary to maintain a constant pumping rate until stabilization (difference between consecutive measurements less than 10%).
- Step 4 - Perform manual groundwater level measurements and flow rate checks/adjustments at one-hour intervals after the system has approached stabilization. Download and review pressure transducer data at 6-hour intervals to confirm proper data recording and observe data trends.
- Step 5 - Stop pumping after 72 hours have elapsed, and record time. Leave the transducers in place. Download and review pressure transducer data at 6-hour intervals to confirm proper data recording and observe data trends.

3.30.4 Recovery Water Level Measurement

- Initiate a new log cycle for the transducers immediately upon termination of the constant-rate pumping test.
- Continuous groundwater levels at the pumping well and select observation points will be recorded logarithmically.
- Leave the transducers in place to record continuous groundwater level data until:
 - The groundwater level at the pumping well has recovered to 90% of its baseline value or
 - 72 hours (minimum) have elapsed since termination of pump testing.

3.30.5 Discharge Water Management

The water pumped from the well shall be discharged and managed following the plan specific to the project and in accordance with DER-10 and all applicable local, state and federal regulations.

3.31 Pre-Packed Direct Push Well Installation

A drilling subcontractor will perform the well installation and CDM Smith will oversee the fieldwork.

- Wells will be constructed of a pre-packed 2.5 inch OD (1 inch ID) slotted PVC well screen (pre-packed with sand and stainless steel mesh) and 1 inch ID, schedule 40 PVC riser casings. The pre-packed well screens are manufactured prior to mobilization.
- Thread the drive cap onto the top of the 3.25 inch OD probe rod and advance the drive rod using either the hydraulic hammer or hydraulic probe mechanism.
- Advance the drive rod to the target depth using the hydraulic hammer. Add additional probe rods as necessary to reach the specified sampling depth.
- Lower the well assembly into the probe rod string with threaded PVC riser pipe to the bottom of the probe rod string.
- Install a sand filter around the well screen to directly above the screen. Grain size of the sand will be appropriate for the slot size of the screen (normally 0.01-inch). Retract the probe rods to a point above the screen.
- Install 2 foot grout penetration seal using “00” gravel or bankrun sand.
- Insert a tremie pipe and backfill the remainder of the hole with bentonite-cement grout until it flows at the surface.
- Square cut the well pipe below grade.
- Install protective flushmount or stick-up casing around new well.

3.32 Membrane Interface Probe (MIP)

In order to provide a screening-level characterization of VOC contamination in subsurface soil in both the vadose and saturated zones, CDM Smith may utilize a MIP to obtain qualitative, depth-continuous, relative instrument response data for VOCs and electrical conductivity data in the subsurface soil. The MIP data will be used to establish an instrument response gradient in subsurface soils to identify “hot spots” for sampling during the soil boring investigation.

- The MIP utilizes a truck-mounted PID, flame-ionization detector (FID), and an electron-capture devise (ECD).
- The 1.5 inch diameter MIP will be pushed into the subsurface at a penetration rate of approximately 1 foot per minute. The tip of the probe contains a thermister, which provides a heat source to volatilize VOCs. The gases that are produced pass into the probe

through a permeable membrane and enter a sampling loop. The gases are then transported to the surface and pass through the PID, FID, and ECD. The MIP will produce a response to all compounds that:

- Volatilize sufficiently to diffuse through the MIP probe membrane,
- Are carried to the detector in the carrier gas, and
- Produce a response on one or more of the detectors (PID, FID, and ECD).

The total response for each detector is related to the total contaminant concentration and the relative response of the detector to the compounds in the carrier gas stream. Therefore, the MIP is considered to produce qualitative data.

Several “performance checks” have been incorporated into the MIP screening program to provide a basis for evaluating MIP performance during subsurface soil screening activities. The following performance checks will be used during the MIP screening activities:

- Ex-situ response check - This performance check will be used to test the response of the probe to a known concentration of a target contaminant in a test cell. This check will be performed in accordance with Geoprobe® Systems Technical Bulletin MK3010 (Geoprobe® 2003).
- Reproducibility check - This performance check includes performance of a replicate push within 5 to 10 feet of a selected push. The MIP profiles for the replicate locations will be compared to assess the reproducibility of the data. As a guideline, MIP responses that are within one order of magnitude will be considered to be reasonable evidence of reproducibility.
- Ex situ response checks will be run at the following times:
 - At the start of each day.
 - If more than 3 hours elapses between the last response check and the next logging run.
 - If the MIP probe, membrane, trunk line, dryer, probe rod, or any major components of the MIP system are repaired or replaced.
- Replicate MIP profiles will be run on approximately 1 in 20 samples.

Performance check results will be reviewed for each sample lot to evaluate MIP performance. If MIP performance issues are identified, the MIP subcontractor will take corrective actions to remedy the issues.

3.32.1 MIP Procedure

Prior to initiating any field activities, the field team will review and discuss, in detail, the site-specific HASP and any appropriate background documentation. All monitoring and protective equipment will be thoroughly checked at this time. All underground and overhead utilities and

structures which may interfere with the progress of the work will be located prior to the commencement of subsurface drilling activities.

- The MIP soil screening will be conducted using a Geoprobe® rig or equivalent direct push rig (as discussed above) and will follow the general drilling procedures outlined in Section 3.23.3.
- At each location the direct push rig will continuously collect data on the lithology and the VOC contamination.
- The MIP technology will provide a continuous depth qualitative readout of VOC concentrations. This probe will be used until the final depth is reached.
- The MIP subcontractor will provide CDM Smith with an electronic data file of each push containing qualitative VOC readings and electrical conductivity readings.
- The screening point boreholes will be tremie-grouted with a cement-bentonite mixture after all sampling has been completed and the boring locations will be restored to pre-existing conditions.

3.33 Fish Sampling

Fish samples will be collected from an adequate number of locations in order to characterize and address project objectives, or as directed by the NYSDEC.

- Samples will be collected using site-specific common fisheries techniques (e.g., seine net, electroshocking, etc.). Electroshocking and other techniques may require that sampling personnel obtain required training.
- During each investigation, species representative of the site or individual location (i.e., dominant taxa, high percentage of total biomass, etc.) will be targeted for analysis.
- The age and/or trophic level of species and other pertinent sampling design information will be decided after consultation with the NYSDEC.
- Upon capture, sampling crews will taxonomically identify fish retained for analysis, photograph and record the weight and total length of representative individuals.
- In order to satisfy analytical requirements, it may be necessary in specific cases (e.g., minnow species) to composite samples consisting of an individual species. When required, the total number of individuals and total weight of the composite will be noted.
- After processing, individual samples will be wrapped in aluminum foil, placed in re-sealable plastic bags and placed on wet or dry ice.
- Samples will be shipped via overnight delivery (see Section 3.27) to the subcontracted analytical laboratory for the analyses specified in the site-specific work plan.

3.34 Benthic Macroinvertebrate Sampling

Benthic macroinvertebrate (benthos) samples will be collected from an adequate number of locations in order to characterize and address project objectives, or as directed by the NYSDEC.

- Samples will be collected using site-specific sampling techniques (e.g., kick net, surber sampler, etc.).
- During each investigation, species representative of the site or individual location (i.e., dominant taxa, high percentage of total biomass, etc.) will be targeted for analysis. Pertinent sampling design information (e.g., sample size, etc.) will be decided after consultation with the NYSDEC.
- As samples are collected they will be placed into a clean sample vessel (e.g., stainless steel bucket, high density polyethylene bucket, etc.) for sorting.
- Representative species retained for analysis will be taxonomically identified to order.
- Due to analytical requirements, all samples will consist of a given number of individuals composited together until the proper sample mass is achieved.
- After processing, individual samples will be placed into the appropriate sample container, placed in re-sealable plastic bags and placed on wet ice or dry ice.
- Samples will be shipped via overnight delivery (see Section 3.27) to the subcontracted analytical laboratory for the analyses specified in the site-specific work plan.

3.35 Test Pits

All excavation activities will be performed in accordance with the *Dig Safely New York Excavator's Manual: A User's Guide to Safe Excavation Practices in New York State*. Test pits will be performed as described below.

3.35.1 Equipment

- Rubber tired backhoe with extension or larger track mounted excavator (provided by subcontractor)
- Survey stakes to mark corners of the test pits
- Digital camera
- Indelible black ink pen or marker
- Field logbook
- Decontamination equipment (provided by subcontractor)
- Steel or cloth 100-foot tape
- Personal protective equipment (refer to Site-specific HASP)

- Sample containers
- Stainless steel or disposable sample bowls and trowels
- Ice and cooler
- COC forms and custody seals
- Distilled and deionized water
- Alconox
- Paper towels
- Garbage bags
- Water jugs
- Spray paint
- Hand auger

3.35.2 Procedures

A test pit will be conducted as follows:

- Prior to mobilizing to the site or beginning excavation, the subcontractor will contact Dig Safe NY for utility mark outs.
- Decontaminate all equipment as necessary in accordance with Section 3.12 of the generic QAPP.
- Advance excavation to the desired length, width and depth using appropriate equipment.
- Make visual observations of soil conditions including staining and odors and collect samples for headspace readings as needed.
- Take photograph documentation of any staining and at all sample locations.
- Samples will be collected from the bucket of the backhoe and no personnel will enter the excavation. One sample from each test pit will be submitted for laboratory analyses. Sample collection and documentation will be conducted in accordance with Section 3.2 of the Generic QAPP.
- Record the depths of any visual observations made and take digital photos.
- Excavated material shall be placed at an appropriate distance from the test pit to ensure proper slope stability.
- Upon completing the test pit, backfill and compact the excavation to grade.

- Providing that no visual staining, odors or product are observed, the test pit material can be used as backfill. If any of the above is observed the test pit material must be properly disposed of and clean material shall be used for backfilling.
- Mark the corners of the excavation so the location can be surveyed at a later date.
- Decontaminate the backhoe bucket prior to starting the next test pit.

3.35.3 Analytical Program

CDM Smith expects to collect one sample from each test pit. However, field observations may dictate that additional samples be collected. Samples may be obtained from the test pit side walls or bases and will be collected from the bucket of the excavator. All samples shall be field screened, photographed and recorded.

3.36 Per- and Polyfluoroalkyl Substances (PFAS)

Samples collected using this protocol are intended to be analyzed for per- and polyfluoroalkyl substances (PFAS) by Modified (Low Level) Test Method 537. Sampling and analytical methods for PFAS may change based on technological advancement. Any changes will be submitted as an amendment for approval by NYSDEC. The list of PFAS is shown on **Table 3-8**.

3.36.1 Monitoring Wells and Surface Water Sample Protocol

The Modified (Low Level) Test Method 537.1 provides PFAS results with reporting limits of approximately 2 nanograms per liter.

Table 3-8
Full PFAS Target Analyte List

Class	PFAS Name	Abbreviation	Cas No.
Perfluoroalkyl sulfonates	Perfluorobutanesulfonic acid	PFBS	375-73-5
	Perfluorohexanesulfonic acid	PFHxS	355-46-4
	Perfluoroheptanesulfonic acid	PFHpS	375-92-8
	Perfluorooctanesulfonic acid	PFOS	1763-23-1
	Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluoroalkyl carboxylates	Perfluorobutanoic acid	PFBA	375-22-4
	Perfluoropentanoic acid	PFPeA	2706-90-3
	Perfluorohexanoic acid	PFHxA	307-24-4
	Perfluoroheptanoic acid	PFHpA	375-85-9
	Perfluorooctanoic acid	PFOA	335-67-1
	Perfluorononanoic acid	PFNA	375-95-1
	Perfluorodecanoic acid	PFDA	335-76-2
	Perfluoroundecanoic acid	PFUA/PFUdA	2058-94-8
	Perfluorododecanoic acid	PFDoA	307-55-1
	Perfluorotridecanoic acid	PFTriA/PFTTrDA	72629-94-8
	Perfluorotetradecanoic acid	PFTA/PFTeDA	376-06-7
	6:2 Fluorotelomer sulfonate	6:2 FTS	27619-97-2

Fluorinated Telomer	8:2 Fluorotelomer sulfonate	8:2 FTS	39108-34-4
Perfluorooctane-sulfonamides	Perfluorooctanesulfonamide	FOSA	754-91-6
Perfluorooctane-sulfonamidoacetic acids	N-methyl perfluorooctanesulfonamidoacetic acid	N-MeFOSAA	2355-31-9
	N-ethyl perfluorooctanesulfonamidoacetic acid	N-EtFOSAA	2991-50-6

Bold entries depict the 6 original UCMR3 chemicals

Current acceptable materials for sampling include: stainless steel, high density polyethylene (HDPE), PVC, silicone, acetate and polypropylene. Additional materials may be acceptable if proven not to contain PFAS. Grundfos pumps and bladder pumps are known to contain PFC materials (e.g. Teflon™ washers for Grundfos pumps and low-density polyethylene (LDPE) bladders for bladder pumps). Selection of sampling devices must be carefully researched. All sampling equipment components and sample containers should not come in contact with aluminum foil, LDPE, glass or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer. Standard two step decontamination using detergent and clean water rinse should be considered for equipment that does come in contact with polyfluorinated materials. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with polyfluorinated materials must be avoided. Many food and drink packaging materials and “plumbers thread seal tape” contain PFAS.

All clothing worn by sampling personnel must have been laundered multiple times and dried without using dryer sheets of any type. The sampler must wear nitrile gloves while filling and sealing the sample bottles.

Pre-cleaned sample bottles with closures, coolers, ice, sample labels and a chain of custody form will be provided by the laboratory.

1. Fill two pre-cleaned 500 mL HDPE bottle with the sample.
2. Cap the bottles with an acceptable cap and liner closure system.
3. Label the sample bottles.
4. Fill out the chain of custody.
5. Place in a cooler maintained at $4 \pm 2^{\circ}$ Celsius.

Equipment blanks should be collected each day that sampling is conducted and at a minimum frequency of 1 per 20 samples. Collect one field duplicate for every sample batch, not to exceed 20 samples. Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, not to exceed 20 samples.

Request appropriate data deliverable (Category B) and an electronic data deliverable.

Prohibited Materials and Equipment

1. Teflon®-containing materials, when possible, should be avoided (e.g., tubing, bailers, tape, and plumbing paste). In cases where Teflon® -containing materials are unavoidable, ensure adequate purging is performed prior to sampling (e.g., in-well pumps) and/or rinse blanks are collected prior to sampling.
2. LDPE or polypropylene containing materials (e.g., bags or containers used to transport samples)
3. Paper products such as waterproof field books, plastic clipboards, binders, spiral hard cover notebooks, sticky notes or glue materials
4. Markers
5. Chemical (blue) ice packs
6. Decontamination soaps containing fluoro-surfactants such as Decon 90
7. Water that is not verified to be “PFAS-free” to be used for trip and decontamination blanks and decontamination processes
8. Water resistant, waterproof, stain-treated clothing or shoes including Gore-Tex™ and Tyvek® materials

Recommended Materials and Equipment

1. HDPE and silicon
2. Materials include: tubing, bailers, tape, plumbing paste
3. Acetate liners for direct push technologies
4. Nitrile gloves – change often
5. Loose paper with Masonite or aluminum clipboards
6. Pens
7. Bags of ice
8. Alconox® or Liquinox®
9. Laboratory supplied and verified “PFAS-free” water to be used for trip and decontamination blanks and decontamination processes
10. Cotton construction is recommended for field clothing and should be laundered a minimum of 6 times from time of purchase due to possible PFAS related treatments. Fabric softener and dryer sheets must be avoided. Rain gear should be made from polyurethane and wax-coated materials.

3.36.2 Shallow Soil Sample Protocol**Laboratory Analysis and Container**

Samples collected using this protocol are intended to be analyzed for PFAS by liquid chromatography-tandem mass spectrometry (LCMSMS) (modified method 537.1). Laboratory reporting limits should be less than or equal to 0.5 micrograms per kilogram. One 8-ounce HDPE container is required for each sample. Pre-cleaned sample containers, coolers, sample labels and a chain of custody form will be provided by the laboratory.

Sampling Location and Survey

Shallow soil sampling will generally be confined to surface or near-surface soils and/or sediments with hand equipment. For screening purposes, sampling of this type should be conducted in depositional areas. Sample locations and depths shall be located and recorded.

Equipment

At this time acceptable materials for sampling include: stainless steel, HDPE, PVC, silicone, acetate and polypropylene. Additional materials may be acceptable if proven not to contain PFAS. All sampling equipment components and sample containers **should not** come in contact with aluminum foil, LDPE, glass or PTFE, Teflon™ materials including sample bottle cap liners with a PTFE layer. A list of acceptable equipment is provided below, but other equipment may be considered appropriate at a later date.

1. stainless steel spoon
2. stainless steel bowl
3. carbon steel hand auger without any coatings

Equipment Decontamination

Standard two step decontamination using detergent and clean, PFAS-free water rinse should be considered for equipment that does come in contact with PFAS materials.

Sampling Techniques

Sampling is often conducted in areas where a vegetative turf has been established. In these cases, a clean stainless steel spoon should be used to carefully remove the turf so that it may be replaced at the conclusion of sampling. Surface soil samples (e.g. 0 to 6 inches below surface) shall then be collected using a pre-cleaned, stainless steel spoon.

Shallow subsurface soil samples (e.g. 6 to ~36 inches below surface) may be collected by digging a hole using a pre-cleaned hand auger or shovel. When the desired subsurface depth is reached, a pre-cleaned hand auger or spoon shall be used to obtain the sample.

When the soil sample is obtained, it should be deposited into a stainless-steel bowl for mixing prior to filling the sample containers. The soil should be placed directly into the bowl and mixed thoroughly by rolling the material into the middle until the material is homogenized.

Sample Identification and Logging

A label shall be attached to each sample container with an identification consistent with the format indicated below. Each sample shall be included on the COC and labelled in the formats discussed in Section 3.2.5.

Quality Assurance/Quality Control

1. Immediately place samples in cooler maintained at $4 \pm 2^{\circ}$ Celsius.
2. Collect one field duplicate for every sample batch, not to exceed 20 samples. The duplicate shall consist of an additional sample at a given location.

3. Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, not to exceed 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC.
4. Request appropriate data deliverable (Category B) and an electronic data deliverable.
5. Collect an equipment blank each day sampling is conducted to ensure the equipment does not come in contact with PFAS.

Documentation

A soil log or sample log shall document the location of the sample/borehole, depth of the sample, duplicate sample, visual description of the material and any other observations or notes determined to be appropriate.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler must wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFC materials must be avoided. All clothing worn by sampling personnel must have been laundered multiple times.

3.37 Sampling for 1, 4-Dioxane

All groundwater samples from DER remediation sites that have chlorinated solvents as a contaminant of concern must be analyzed for 1,4-dioxane. 1,4-Dioxane was added as a stabilizer in 1,1,1-trichloroethane (TCA) at percent levels. The detection limit for 1,4-dioxane should be no higher than 0.2 µg/L (ppb).

The only current analytical method that Environmental Laboratory Accreditation Program (ELAP) offers certification for is EPA method 8260C. In order to get the detection limits needed, the laboratory will need to use the mass spectrometer in “selective ion monitoring” (SIM) mode. In addition to EPA 8260C SIM, other analytical methods that can achieve the required detection limits include EPA 8270 SIM and EPA 522. The analytical method accepted by the state currently is 8270SIM, the use of 8260 may be accepted when justified by site conditions. EPA Method 8270 SIM provides a more robust extraction procedure and is the preferred method. EPA 522 is reportedly the lowest cost alternative and has the lowest detection limit (in drinking/potable water).

At sites where solvents are not a contaminant of concern, and where 1,4-dioxane is not otherwise a contaminant of concern, 1,4-dioxane should be included in the analyte list for EPA Method 8260C, but the use of SIM mode is not required.

Samples analyzed by EPA 8260C SIM should be collected in three 40 ml vials. Samples analyzed by EPA Method 8270 SIM should be collected in two 1 Liter amber glass jars. Samples analyzed by EPA Method 522 should be collected in bottles fitted with screw caps.

Clothing that contains 1,4-dioxane materials must be avoided. Avoid laundry detergents, dish soap, shampoos, and other cleaning products that contain 1,4-dioxane when sampling. An example list of detergent products reported to be free of 1,4-dioxane are listed below:

1. Honest Company
2. Seventh Generation Free & Clear laundry detergent
3. Dreft powdered detergent
4. Sun Burst
5. Planet Ultra Liquid laundry detergent
6. Clorox Green Works Natural laundry detergent
7. Ecos laundry detergent (Earth Friendly Products)
8. Life Tree Laundry Liquid
9. Method Squeaky Green Laundry detergent

The list is referenced from <https://www.honest.com/about-us/honestly-free-guarantee> and [https://www.naturalnews.com/028846 laundry detergents dioxane.html](https://www.naturalnews.com/028846_laundry_detergents_dioxane.html).

The sampler must wear nitrile gloves while filling and sealing the sample bottles.

Pre-cleaned sample bottles with closures, coolers, ice, sample labels and a chain of custody form will be provided by the laboratory.

1. Fill pre-cleaned bottle with the sample.
2. Cap the bottles with an acceptable cap and liner closure system.
3. Label the sample bottles.
4. Fill out the chain of custody.
5. Place in a cooler maintained at $4 \pm 2^{\circ}$ Celsius.

Collect one equipment blank for every sample batch, not to exceed 20 samples. Collect one field duplicate for every sample batch, not to exceed 20 samples.

Sampling and analytical methods for 1,4-dioxane may change based on technological advancement. Any changes will be submitted as an amendment for approval by NYSDEC.

Section 4

Instrument Procedures

4.1 Photoionization Detector (PID)

4.1.1 Introduction

This Standard Operating Procedure (SOP) is specific to the MiniRAE 2000 and 3000 PIDs. These portable instruments are designed to measure the concentration of trace gases in ambient atmospheres at industrial and hazardous waste sites, and are intrinsically safe. The analyzers employ PIDs.

The PID sensor consists of a sealed ultraviolet light source that emits photons which are energetic enough to ionize many trace species (particularly organics), but do not ionize the major compounds of air such as O₂, N₂, CO, CO₂, or H₂O. An ionization chamber adjacent to the ultraviolet lamp source contains a pair of electrodes. When a positive potential is applied to one electrode, the field created drives any ions, formed by absorption of UV light, to the collector electrode where the currents (proportional to concentration) are measured. One major difference between a flame ionization detector (FID) and a PID is that the latter responds to inorganic compounds as well as non-methane type organic compounds.

To assess whether the instrument will respond to a particular species, the ionization potential (IP) should be checked. If the IP is less than the lamp energy, or in some cases, up to 0.2-0.3 electron volts (ev) higher than the lamp energy, instrument response should occur. For example, hydrogen sulfide (IP = 10.5 ev) may be detected with a 10.2 ev lamp, but butane (IP 10.6 ev) will not be detected.

4.1.2 Calibration

Qualified personnel trained in calibration techniques for all field items perform calibration of all CDM Smith field equipment. When a field instrument that requires calibration is obtained from the rental facility, the unit will display a calibration tag denoting the date when the instrument was last calibrated and/or maintained. All field instruments are calibrated each time they leave the equipment facility. A maintenance file is kept for each calibrated field item.

PID and FID detector type instruments come with field calibration kits. A field calibration kit would be used if the instrument is to be kept out at the site for extended periods of time, or if the instrument endures prolonged environmental extremes. In either case, a calibration check standard could be introduced in the instrument to verify its accuracy. If an instrument will not calibrate or shows improper field operation, it should be sent back to the office, and another instrument reissued.

Field personnel should not try to maintain the instruments in the field. If long sampling program is required, be prepared to take more equipment for backup in case of instrument failure. Records and procedures of all calibration techniques are on file at the CDM Smith equipment management facility at 153 South Street, Somerville, Massachusetts.

With the instrument fully calibrated, it is now ready for use. Any results obtained should be reported in parts per million (ppm). If you need to convert these numbers based on a benzene standard, HNu offers a conversion table which is available from CDM Smith. Important instrument specifications for each PID detector are listed as follows.

MiniRAE 2000 Performance

Range - 0.1 to 9999
Detection limit 0.1 PPM

MiniRAE 3000

0 - 9999
0.1 PPM

MiniRAE 2000 Power Requirements

Continuous use, battery >10 hours
Recharge time, max >14 hours, 3 hours +
Alkaline Pack

MiniRAE3000

8 hours
8 hours
Alkaline Pack

Unit can be operated on battery charger.

Both units provide protection circuitry for the battery. This prevents deep discharging of the battery and considerably extends the battery life.

4.1.3 MiniRAE 2000

4.1.3.1 Procedure

- To turn on the unit, press and hold the Mode button and allow the unit to run 5-10 minutes in a clean air environment.
- After the warm-up, press and hold the Mode and N/- buttons simultaneously until the unit displays "Calibrate/select gas?"
- Press Y/+ "Fresh Air Cal?" is displayed
- Press N/- "Span cal?" is displayed
- Press N/- "Select Cal Memory?" is displayed
- Press N/- "Change Span Value?" is displayed
- Press Y/+, the unit will display span value. If no Change is needed. Press and hold the MODE button and "modify cal memory?" is displayed press N/-
- If you wish to change the span value, press the MODE button until SAVE? Is displayed press Y/+, "Modify cal memory?" is displayed press N/-
- "Change Correction Factor?" is displayed. If you desired correction factor is not 1.00 (default setting) press Y/+. Use the same steps as change span value to change the correction factor. If no change is required, Press N/- to continue.

- “Fresh Air Cal?” is displayed (Ensure that you are in a clean ambient air environment.) press Y/+.
- “Zero in process” will be displayed, followed by countdown. The zero reading will now be displayed. The unit will move to “Span Gas Cal?”
- Fill a 3L Tedlar bag with Span gas.
- From “Span Gas Cal?” Press the Y/+ button “Apply Gas Now” is displayed. Apply Gas to the unit. The unit will countdown and then display “Update Data” the unit is Updating the calibration =... (Span value). Followed by “Calibration Done”. Remove the Tedlar Bag from the unit.
- Press MODE twice to return to the run mode.
- Unit is now calibrated and ready to use.

Note: After the span calibration is completed and the unit is running, it is recommended to perform a function “bump test” to verify the accuracy of the calibration. To perform this test, simply reconnect the span gas to the unit and verify the displayed reading coincide with the actual concentrations of span gas used for calibration. (Manufactures specification is +/- 5% of the value)

4.1.3.2 Limitations

- Environmental factors such as humidity, rain and extreme cold can limit the instrument performance. MiniRAE2000 should be kept out of the rain as much as possible or covered. This will insure longer operating times with less false positive readings.

4.1.4 MiniRAE 3000

4.1.4.1 Procedures

- With the unit being fully calibrated before receiving it, you are ready for operation. Located on the face of the unit is a panel. On the panel is a MODE key. Press and hold the MODE key. When the display turns on, release the MODE key. The instrument is now operating and performs self tests. If any tests (including sensor and memory tests fail), refer to the Troubleshooting sector of the User’s Guide. NOTE: if Basic User/Hygiene Mode (the default setting), the instrument stops after self-testing, and asks whether to perform a zero air (fresh air) calibration. You can start this calibration, quit, or abort the calibration. When the zero calibration is done, you see screen telling you that the zero calibration is complete, along with its value. After calibration (or after you abort the calibration), the instrument then shows a numerical reading screen with icons. This indicates that the instrument is fully functional and ready to use.
- To turn off the instrument press and hold the Mode key for 3 seconds. A 5-second countdown to shut off begins. Once the countdown stops, the instrument is off. Release the Mode key. When you see “Unit off...” release your finger from the Mode key. The instrument is now off.

NOTE: You must hold your finger on the key for the entire shutoff process. If you remove your finger from the key during the countdown, the shutoff operation is canceled and the instrument continues normal operation.

- The instrument has a built-in flashlight that helps you point the probe in dark places. Press the flashlight key to turn it on. Press it again to turn it off. NOTE: Using the flashlight for extended periods shortens the battery's operating time before it needs recharging.

4.2 pH Meter

4.2.1 Introduction

pH is the negative logarithm of the effective hydrogen ion concentration (or activity) in gram equivalents per liter used. This expresses both acidity, and alkalinity on a scale whose values run from 0 to 14. Number 7 represents neutrality, and numbers greater than 7 indicate increasing alkalinity while numbers less than 7 indicate increasing acidity. pH is one of the most commonly analyzed parameters. Water supply treatments such as neutralization, softening, disinfection and corrosion control are all pH dependent. CDM Smith has a variety of pH monitoring instruments in the equipment warehouse.

4.2.2 Orion SA 250 pH Procedures

With the instrument fully calibrated, it is now ready for use. Follow the check out procedures:

- Slide power switch to on position. Attach BNC shorting plug to BNC connector on top of meter.
- If LO BAT indicator on LCD remains on, the battery must be replaced.
- Slide mode switch to mV. Display should read 0 + .3.
- Slide mode switch to TEMP. Display should read 25.0. If 25.0 is not displayed, scroll using, and X10 keys, until 25.0 is displayed and press enter.
- Slide mode switch to pH .01. Press iso. Display should read the letters ISO, then a value of 7.000. If 7.000 is not displayed, scroll until 7.00 is displayed and press enter.
- Press slope. Display should read the letters SLP, then a value of 100.0. If 100.0 is not displayed, scroll until 100.0 is displayed and press enter.
- Press sample. Observe the letters pH, then a steady reading of 7.00, +0.02 should be obtained. If not, press CAL and scroll until 200 is displayed and press enter. Press sample and observe a reading of 7.00.
- Remove the shorting plug. After completing these steps, the meter is ready to use with an electrode.
- Attach electrodes with BNC connectors to sensor input by sliding the connector onto the input, pushing down and turning clockwise to lock into position. Connect reference electrodes with pin tip connectors by pushing connector straight into reference input.

- Put the temperature probe in the sample and let it stabilize.
- Once temperature is stable, set the unit to read pH (by 0.1 or 0.01) and take a reading in the aqueous sample (remembering first to remove the cap on the end of the pH probe).

4.2.3 Model Tripar Analyzer Procedures

With the instrument fully calibrated, it is now ready for use:

- Connect the pH probe's BNC input connector to the front of the Tripar.
- Put the pH/mV switch on the pH position.
- Turn the parameter display selection switch to TEMP.
- Plug in the gray temperature plug jack in the input temperature sensor connector.
- Put end of temperature probe in the sample.
- Allow the temperature to stabilize.
- Turn the temperature compensation knob to the temperature shown.
- Turn the parameter display selection switch to pH.
- Put pH probe in the aqueous sample (remembering first to remove the cap on the end of the probe). Let it stabilize and record the reading.

4.3 Conductivity Meter

4.3.1 Introduction

Conductivity is a numerical expression of the ability of an aqueous solution to carry an electrical current. This ability depends on the presence of ions in the solution, and their total concentration. Factors such as mobility valence, relative concentration, and temperature also combine to create this occurrence. Solutions of most inorganic acids, bases and salts are relatively good conductors. Organic compounds in aqueous solutions are not good conductors. For example, freshly distilled water has conductivity reading of 0.5 to 2 mhos/cm and increases with time. This increase is caused by absorption of atmospheric carbon dioxide, and to a lesser extent ammonia. While industrial type wastes have conductivity readings of $\pm 10,000$ mhos/cm.

4.3.2 Model SCT Procedures

The model 33 SCT has 3 conductivity scales of 0-500, 0-5000, and 0-50,000 mhos/cm. Salinity is scaled 0-40 parts per thousand in a temperature range of -2 to +45°C. Temperature is scaled -2°C to +5°C.

With the instrument calibration verified, the unit is now ready for use. The model 33 S-C-T meter face is scaled and calibrated to give an accurate reading of the conductivity of a water sample by measuring the amount of current flow between two fixed electrodes in the probe.

The unit also measures salinity in a special range conductivity circuit, which includes a user-adjusted temperature compensator. A precision thermistor in the probe measures temperature by changing its resistance in relation to the temperature of the water.

The start-up procedure is as follows:

- Plug the probe plug receptacle in the side of the meter.
- With the mode select in the OFF position, check to see that the meter needle is centered at the zero mark on the conductivity scale and adjust if necessary.
- Turn the mode control switch to Red Line position.
- Adjust the Red Line control knob so the meter needle lines up with the red line on the meter face. If this cannot be accomplished, replace the batteries. If battery replacement is necessary, use only alkaline "D" cells, as regular carbon zinc batteries will cause errors.
- Place the probe into the solution to be measured.
- Set the mode control to TEMPERATURE. Read the temperature on the bottom scale of the meter in Degrees C. Allow time for the probe temperature to come to equilibrium before taking a reading.
- With the probe in the solution to be tested, adjust the conductivity scale until the meter reading is on scale. Multiply the reading by the correction on the calibration sticker on the instrument.
- When using the X10 and X100 scales, depress the CELL TEST button. If the reading on the dial moves +2%, the electrode is fouled and needs to be cleaned. Repeat the measurement on another instrument.
- Store the probe in distilled water when not in use.

4.4 Photovac Portable Gas Chromatograph

4.4.1 Introduction

The Photovac portable gas chromatograph (GC) can provide for accurate and specific identification of volatile organic compounds in a field control laboratory.

4.4.2 Equipment Preparation

- The Photovac portable GC should be set up in a sheltered area and, if possible, within a climate controlled area to minimize temperature changes. Do not place the GC near any equipment that causes vibration. A flat table, large enough to accommodate the GC, the printer, a laboratory size oven, and electrical power packs for the GC should be utilized during operation.
- Fill the GC with carrier gas being sure not to pressurize the GC with more than 1500 pounds per square inch (psi) of carrier gas. Check to ensure the pressure of the air feed to the GC column is 40 psi.

The carrier gas should contain no more than 2.0 parts per million by volume (ppmV) of total hydrocarbons and not less than 0.1 ppmv of total hydrocarbons. The lower the hydrocarbon concentration the lower the baseline of the GC. A lower baseline minimizes interference of compound identification.

- Install new Teflon septa in the injection port being utilized. The septa should be replaced at the start of each day and after every twenty injections.

4.4.3 Calibration Procedures and Frequency

The Photovac portable GC will be calibrated at the beginning of each day prior to sample analysis.

4.4.3.1 Gas Standards

Gas standards used to calibrate the GC will be obtained from certified compressed gas cylinders of known concentration. CDM Smith stocks two compressed gas standard cylinders containing the following gases and concentrations:

Cylinder 1

- Benzene - 10 ppmv
- Toluene - 10 ppmv
- Ethyl Benzene - 10 ppmv
- M-xylene - 10 ppmv
- O-xylene - 10 ppmv
- P-xylene - 10 ppmv

Cylinder 2

- Trans 1,2 Dichloroethylene - 1.05 ppmv
- 1,1,1 Trichloroethane - 19.3 ppmv
- Trichloroethylene - 1.13 ppmv

These gas cylinders were purchased from Scott Specialty Gas Corporation and are certified by Scott to be traceable to NBS standards.

The calibration procedure using these cylinders is as follows:

- A two stage pressure regulator (CGA 350) is attached to the standard gas cylinder to be used.
- A 250 ml glass sampling bulb, determined clean by injecting a volume of air obtained from the bulb onto the GC (described later), is labeled and attached to the effluent port of the second stage of the gas regulator. The Teflon stopcocks of the sampling bulb are opened.

- The sample cylinder valve is opened and the first stage of the regulator is pressurized.
- Slowly the diaphragm valve controlling the gas flow entering the second stage is opened until the pressure reads 2 psig.
- The valve allowing the gas to exit the second stage of the regulator is opened until the gas can be heard escaping from the regulator and passing through the glass sample bulb. Purge the bulb for approximately ten seconds. Close the Teflon stopcock located at the discharge end of the sampling bulb, then, the stopcock closest to the regulator. In this way the calibration gas is collected at the same pressure as the delivery pressure of the second stage of the regulator.
- Using a gas tight 1 ml syringe, extract approximately 500 microliters (μl) of the calibration gas from the glass bulb and purge the volume of gas into the atmosphere. Repeat this step.
- Place the syringe needle in the glass bulb. Pull the syringe plunger back approximately 500 μl of calibration gas enters the syringe barrel. Without removing the syringe from the glass bulb depress the plunger. Pump the syringe in this manner several times.
- Extract the syringe from the glass bulb with approximately 500 μl of calibration gas present. Carefully depress the plunger until 300 μl of calibration gas is present in the syringe barrel. Immediately inject this gas volume into the Photovac GC.
- A response factor for each analyte is obtained as the ratio of the known gas concentration injected and the area under the peak produced by that injection. This integration is performed automatically by the internal Photovac data processor and stored in the library.
- The procedure to obtain a calibration gas sample is repeated and the gas volume is injected into the GC. The GC will identify the compounds in the sample stream that have retention times within $\pm 20\%$ of the retention times of the compounds in the library. The area of these identified peaks will be compared to the response factor of the compounds stored in the library and integrate a corresponding concentration.
- If the calibration check concentration does not equal $\pm 15\%$ of the library concentration, a new calibration check is performed. If this check fails, a new library is created.

4.4.4 Sample Analyses

The following procedure will be followed when performing analysis of samples.

- The Photovac portable GC is set as described above. The GC function and application file is loaded into memory. This includes all previously established calibration data and retention time information.
- 300 μl of sample are obtained from the sample source and injected into the GC. Samples will be injected as soon as possible after it is collected.
- Immediately after injection the GC is started.

- Each chromatograph run will run for a minimum of 5 minutes. At this time the run will be stopped and the results obtained.
- Following completion of the run, the Photovac GC will produce a hard copy printout of the results. This printout will include the sample identification, time of analysis, and appropriate operating parameters.

This procedure will be followed for all sample runs.

4.4.5 Method Blanks and Duplicates

Prior to any calibration or sample injections, the integrity and level of contamination of each syringe used for injections will be verified.

- Plungers will be removed from the barrel of the syringe and placed into a laboratory oven for 5 minutes. The temperature of the oven should not be above 150 degrees Fahrenheit (F) or below 120 degrees F.
- The syringes will be removed from the oven, cooled, and reassembled.
- Pump the syringe plunger several times, purging the syringe with ambient air.
- Collect approximately 500 µl of ambient air in the syringe and carefully depress the plunger to 300 µl. Immediately inject the gas volume into the GC.
- Detection of the target compounds above the detection limit (50 ppbv for most compounds) will require another decontamination procedure before additional analyses.
- Blanks will be performed after every sample and calibration injection. Blanks will not be performed between duplicate sample injections.
- Duplicate samples will be performed at a minimum of 1 every 10 sample injections.

4.5 X-Ray Fluorescence Meter

4.5.1 Introduction

An X-Ray Fluorescence Meter or XRF meter is used to detect metals in soils or solid objects. It works on wavelength-dispersive spectroscopic principles that are similar to an electron microprobe. Several companies have developed portable XRF meters suitable for screening metals in soils for field applications.

4.5.2 Calibration

Since there are different models of XRF meters on the market, the user's manual should be consulted to determine the required calibration procedures for a specific model. The XRF meter will generally be calibrated by the rental company. Additionally, once or twice per day before performing tests or after the meter's software is restarted, it is necessary to standardize the instrument. A standard metal clip is generally included with the meter, which is placed over the analyzer window as prompted by the software.

4.5.3 Operating Procedures

The user's manual for each individual model of XRF meter should be consulted for operating instructions specific to that model. XRF meters use a "point and shoot" system where the analyzer window is held against the sample while squeezing the trigger. When analyzing soil samples, the sample must be dry, this may require oven drying. The soil sample should also be homogenized before testing by mixing the sample and removing objects such as rocks and sticks. For soil testing, use of a test stand is recommended. The test stand allows for longer analysis times, which may be required to obtain desired detection limits for the metals of interest. The accuracy of the results obtained using an XRF meter may vary and are not considered to be as accurate as laboratory analysis. End point samples should be confirmed with laboratory analysis.

4.5.4 Safety Concerns

4.5.4.1 Safe Operation Procedures

XRF meters produce ionizing radiation. The instruction manual for the specific model should be consulted for safe operating information. In general, for all models the following recommendations are provided:

- The meter should not be pointed at anyone or any body part, energized or de-energized.
- A control area should be established during use. The area at least three paces beyond the target should be unoccupied.
- The target should not be hand held and the instrument should be shot into high density materials whenever possible.
- A radiation exposure badge is recommended for the operator for personal exposure monitoring. Some rental companies include a radiation badge with the rental of an XRF meter.

4.5.4.2 Department of Health Permit Requirements

Because XRF meters contain an x-ray tube, the NYSDOH requires that XRF instruments be registered with their agency by the owner. In addition, when an XRF meter is rented, the company renting the meter must apply for a usage permit from NYSDOH at least three weeks prior to the date of intended usage. When done using the meter, NYSDOH must again be notified. These permits may require a fee and NYSDOH will want to know where the meter will be used.

4.5.4.3 Shipping Requirements

Some XRF meter models have a radioactive source, which must be shipped ground as a hazardous material by an employee trained in hazardous materials shipping. Other models of XRF meters do not have a radioactive source and may be shipped by standard shipping methods. It may be necessary to contact the manufacturer of the specific model to obtain shipping instructions.

Section 5

Laboratory Procedures

5.1 Introduction

Laboratory analysis must be conducted by a laboratory that is accredited pursuant to the NYSDOH ELAP for the category of parameters analyzed. Samples shall be analyzed using the analytical method included in the most current NYSDEC Analytical Services Protocol (ASP) available on the NYSDEC website. Unless otherwise approved by NYSDEC, laboratory data deliverables must be Category B as defined in the ASP.

The term "data quality" refers to the level of uncertainty associated with a particular data set. The data quality associated with environmental measurement data is a function of the sampling plan rationale and procedures used to collect the samples as well as the analytical methods and instrumentation used in making the measurements. Each component has its own potential sources of error and biases that can affect the overall measurement process.

Sources of error that can be traced to the sampling component of environmental data collection are:

- Poor sampling plan design,
- Inconsistent use of standard operating procedures,
- Sample handling and transportation.

The most common sources of error that can be traced to the analytical component of the total measurement system are calibration and contamination problems. It is recognized that, by far, the largest component of the total uncertainty associated with environmental data collection originates from the sampling process. All sampling programs initiated in support of this project will stress forward planning and be well conceived and reviewed prior to the collection of any samples as a way to minimize this major source of potential error.

Uncertainty cannot be eliminated from environmental measurement data. The amount of uncertainty that can be tolerated depends on the objective of the sampling program and the intended use of the data collected. The purpose of the project's quality assurance program is to assure that the quality of all data collected be of known and ascertainable value.

5.2 Data Quality Criteria

Data quality can be assessed in terms of its precision, accuracy, representativeness, completeness, and comparability. Analytical method detection limits will also be discussed in this section.

5.2.1 Precision

Precision is a measure of the reproducibility of analyses under a given set of conditions. The overall precision of a sampling event is a mixture of sampling and analytical factors. The precision of data collected in support of this project will be assessed on two different levels:

- By calculating the relative percent difference (RPD) of laboratory matrix spike duplicates and/or laboratory replicate samples (a measure of analytical precision).
- By calculating the RPD of field duplicates samples submitted to laboratory "blind" (a measure of the precision of the entire measurement system, including sampling).

Relative percent difference will be calculated according to the following equation:

$$RPD = \frac{|A - B|}{(A + B)/2} \times 100\%$$

Where: A = Sample Result
B = Replicate Sample Result

5.2.2 Accuracy

Accuracy is a measurement of the amount of bias that exists in a measurement system. This can be thought of as the degree that the reported value agrees with the supposed "true value". The accuracy of data collected in support of this project will be assessed in the following ways:

- By calculating the percent recovery (%R) of laboratory matrix spikes and/or laboratory control standards.
- By documenting the level of contamination that exists (if any) in laboratory method blanks.
- By documenting the level of contamination that exists (if any) in field and/or trip blanks submitted to the laboratory "blind" for analysis.
- Percent recovery will be calculated according to the following equation:

$$\%R = \frac{SSR - SR}{SA} \times 100$$

Where: SSR = Spiked Sample Result
SR = Sample Result
SA = Spike Concentration

5.2.3 Representativeness

Unlike the previous two criteria which can be expressed in quantitative terms, representativeness is a qualitative parameter. However, in terms of overall data quality, representativeness may be the most important parameter of all.

The representativeness criterion is concerned with the degree to which a sample reflects (represents) a characteristic of a population, parameter variations at a specific location, or an environmental condition. Sample representativeness will be addressed in support of this project through a detailed sampling plan design and rationale and through the proper use of the appropriate sampling standard operating procedures, depending on sample matrix and the parameters to be analyzed.

Composite samples will be collected in situations conducive to compositing techniques (particularly samples collected along the vertical extent of a borehole). The use of composite samples tends to maximize the representativeness of a sampling round because more information is provided about a much broader area than a single grab sample. This is especially true in situations where the objective of sampling is to determine where gross contamination exists on site and the location of any "hot spots". In these cases, broad coverage of the area to be sampled is more important than obtaining the lowest possible detection limits.

5.2.4 Completeness

Completeness is a measure of the amount of usable data obtained from a measurement system compared to the amount that was expected to be obtained under correct normal conditions. Usability will be determined by evaluation of the precision, accuracy, representativeness, and comparability parameters. The data that is validated as correct, or are qualified as estimated or non-detect, are considered usable. Rejected data is not considered usable. A completeness goal of 90% is projected. If this goal is not met, the effect of not meeting this goal will be discussed by the CDM Smith project manager and the NYSDEC site manager. Completeness is calculated using the following equation:

$$\text{Percent Completeness} = \frac{DO}{DP} \times 100$$

Where: DO = Data obtained and usable
 DP = Data planned to be obtained

There also may be incomplete data while still meeting the 90% goal if a critical sample location cannot be sampled.

5.2.5 Comparability

The comparability criterion is a quality characteristic which is an expression of the confidence with which one data set can be compared with another. Comparability issues are of importance at two different levels of a sampling program. The primary comparability issues are concerned with whether the field sampling techniques, analytical procedures, and concentration units of one data set can be compared with another.

The comparability criterion also applies to the environmental conditions/considerations present at the time of the sampling. Temporal and/or seasonal variations may make data collected from the same location at different times of the year incomparable, or comparable in a relative sense only, for example.

Comparability is judged by comparing results to other similar data sets. Consistency in the acquisition, handling, and analysis of samples is necessary for comparing results. Data developed under this investigation will be collected and analyzed using Soil Vapor Intrusion Guidance for soil vapor collection and NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation, dated May 2010 to ensure comparability of results with other analyses performed in a similar manner.

5.2.6 Method Detection Limits

Whenever environmental measurement data is to be used in comparison with predetermined "action levels" or other regulatory requirements, the reported method detection limits of the analytical data is of prime importance. Analytical methods specified in support of this project should have a reported detection limit at least 50% below the required action level to assure that measurements made in the vicinity of the action level are of high quality. In circumstances concerning extremely low action levels or regulatory requirements where analytical techniques will have to be pushed to their limits, every effort will be made to select the most appropriate analytical procedures. It is recognized that analytical detection limits are sample specific and are affected by sample volumes as well as the need for sample concentration or dilution. These circumstances will be accounted for in the review and interpretation of the analytical results.

5.3 Quality Control

Two separate levels of quality control exist for all samples collected in support of this project, internal laboratory quality control and program generated quality control.

5.3.1 Internal Laboratory Quality Control

Internal laboratory quality control is a function of the individual laboratory's QA/QC plan. A laboratory's QA/QC plan contains specific criteria governing the manner in which analyses are conducted and provides information on the laboratory's performance and control of the sources of error that exist within the lab. Included in the plan are requirements for the type and frequency of quality control check samples that are to be analyzed on a routine basis.

All laboratory analysis conducted in support of this project must include the following quality control check samples:

- Surrogate spikes (where appropriate)
- Matrix spike/matrix spike duplicate (MS/MSD) or laboratory duplicates and laboratory control samples (where appropriate)
- Method blanks

The laboratory may adhere to the analysis frequency specified in their QA/QC plan for these check samples, provided that the specified frequency is equal-to or greater-than the frequency specified in **Table 5-1** or as modified/specified by the QAPP.

5.3.2 Program Generated Quality Control

Program generated quality control consists of quality control check samples that are submitted to the laboratory for analysis "blind" along with actual environmental samples. These samples provide quality control information for the entire sampling event, from the actual sampling and handling through laboratory analysis. As such, they can provide the best overall estimate of the total uncertainty associated with the sampling round.

Table 5-1
Laboratory Sample Frequency

QC Check Sample	Frequency of Analysis
Method Blanks	One per analytical batch or one per every twenty samples
Matrix Spike/Matrix Spike Duplicate (MS/MSD)	One per analytical batch or one per every twenty samples
Surrogate Spikes	One per every trace organic analysis

The combination of laboratory duplicates and laboratory control samples may be substituted for MS/MSD analysis for parameters where they are more appropriate.

Program generated quality control samples collected in support of this project are:

- Duplicate samples
- Field and equipment blanks
- Trip blanks

Each report should have a cover page that references the CDM Smith task number.

The cover page also provides an opportunity to describe, in a narrative format, any unusual problems or interferences encountered during analysis. In addition, all results should be reported on a dry weight basis for soils and at dilution-corrected concentrations for all samples.

5.3.3 QC Deliverables Package

The following quality control data is required to be reported. For "priority pollutant" type analysis, the following quality control data is required per sample batch:

- Method Blanks associated with each analytical procedure.
- Surrogate Spike Recoveries for volatile organics, PCBs, semi-volatiles and polynuclear aromatic hydrocarbons.
- MS/MSDs for all priority pollutant parameters. One MS/MSD should be run for every 20 samples.

For non-priority pollutant parameters, the following quality control data is required per sample batch:

- Method Blanks

- **Laboratory Duplicates** - One duplicate analysis should be performed at a frequency of one per 20 samples.

No specific acceptance criteria for blanks and spike recoveries will be set forth here, however, all laboratories are expected to conform to standard EPA quality control specifications. CDM Smith expects laboratories to reanalyze samples if quality control samples fail to meet EPA specifications.

The quality control data may be presented as a quality control section within the report or it may be integrated with the results.

5.4 Data Quality Requirements

Taking into consideration a project's overall objective and intended use of the data, it should be considered that the analyses be conducted in accordance with SW-846, Test Methods for Evaluating Solid Waste, Third Edition procedures. In cases where additional procedures are required, other EPA approved laboratory methods will be used.

5.5 Data Deliverable

NYSDEC requires the use of electronic submissions to the greatest degree appropriate for the site-specific remedial program. All data generated will be submitted in an electronic data deliverable (EDD) that complies with the NYSDEC Electronic Document Standards (EDWS) or as otherwise directed by NYSDEC.

5.6 Analytical Data Validation

If a work assignment requires the validation of data, validation is performed to determine whether or not the data, as presented, meets the site/project specific criteria for data quality and data use.

Laboratory results shall be supported by sufficient back-up data and QA/QC results to enable the reviewer to conclusively determine the quality of the data. The laboratory will review data prior to its release from the laboratory. Objectives for review are in accordance with the QA/QC objectives stated in each site-specific Work Plan. The laboratory is required to evaluate their ability to meet these objectives. Outlying data will be flagged in accordance with laboratory standard operating procedures, and corrective action will be taken to rectify the problem.

A NYSDEC-approved qualified independent third party data validator will review the data package to determine completeness and compliance in accordance with Standby Contract D009805. A narrative describing how the data did or did not meet the validation criteria is part of the data validation procedure. The validation assessment will describe the overall quality of the data and the data validation report will provide a written statement upon completion of the validation indicating whether or not the data is valid and usable, and will include a percent completeness value of usable data.

5.7 Data Usability Summary Report

A Data Usability Summary Report (DUSR) provides a thorough evaluation of analytical data without the third party data validation.

The primary objective of a DUSR is to determine whether or not the data, as presented, meets the site/project specific criteria for data quality and data use. If a work assignment requires a DUSR, the DUSR will be developed by a NYSDEC approved qualified environmental scientist in accordance with Standby Contract D009805.

Table 3-1 Equipment List

[illegible]

Table 3-1 Equipment List

[illegible]

Appendix A

Field Form

PHOTOGRAPH TRACKING LOG

SITE NAME: _____

CAMERA # _____

Photograph #	Description	Date/Time	Photographer

LOW FLOW SAMPLING SHEETS

SITE NAME: _____

DATE:	WELL #:
SAMPLE TIME:	DEPTH OF PUMP:
WEATHER CONDITIONS:	SAMPLERS:

TIME	VOLUME PURGED (GALS)	DEPTH TO WATER (FT TIC)	FLOW RATE (ml/min)	DRAWDOWN (FEET)	TEMP °C (+/- 10%)	ph (+/- 0.1 SU)	REDOX POTENTIAL mV (+/- 10 mv)	SPECIFIC COND. mS/cm (+/- 3%)	DISSOLVED OXYGEN mg/L (+/- 10%)	TURBIDITY NTUs (+/- 10%)

The well is considered stabilized and ready for sampling when the indicator parameters have stabilized for three consecutive readings by the measurements indicated in parenthesis.

SAMPLE SCREENING TRACKING LOG

SITE NAME: _____

SAMPLE ID	SAMPLE DATE	SAMPLE TIME	MATRIX	DUP (Y/N)	COMMENTS

SYNOPTIC WATER LEVEL MEASUREMENTS

SITE NAME: _____

DATE: _____

[illegible]

All readings are from Top of Inner Casing (TIC)

DRUM TRACKING LOG

SITE NAME: _____

Drum #	Boring/MW#	Date Drilled/ Sampled	Related Sample #	Description of Drum Contents	Signature

SAMPLE TRACKING LOG

SITE NAME/SAMPLE EVENT: _____

LDL VOC LAB: _____ INORGANIC CLP LAB: _____

CLP CASE NO: _____ ORGANIC CLP LAB: _____ SUBCONTRACT LAB: _____

SAMPLE ID	SAMPLE DATE	SAMPLE TIME	MATRIX	DEPTH (feet)	ORGANIC CLP NO.	INORGANIC CLP NO.	SUBCONTRACT ANALYSIS	QA/QC

ANALYSIS SUMMARY: _____

DRILLING SUMMARY SHEET

SITE NAME HERE

Date:
Geologist:
Driller:
Borehole Locations:
Drums Generated (ID#s):

1.0 GENERAL CHARGES			HAS RIG	TRIPOD
1a.	Mobilization and Demobilization	Each		
1b.	Construct Decontamination Pad	Each		
1c.	Steam Cleaning (1 hour/boring maximum)	Hours		
1d.	Drums	Drums		
1e.	Drumming Residuals/Transportation	Drums		
1f.	Standby Time	Hours		
1g.	Baker Tank Rental (20,000 gallons each)	Each		

2.0 BOREHOLE DRILLING				
2a.	4 ¼ inch ID – HSA	Feet		
2b.	Split Spoon Sampling	Spoons		
2c.	Shelby Tubes	Tubes		
2d.	Geoprobe Boreholes	Feet		
2e.	Macro Core and Large Bore Sampling	Feet		
2f.	Soil Boring with Tripod	Feet		
2g.	Borehole Grouting	Feet		

3.0 OVERBURDEN MONITORING WELL INSTALLATION				
3a.	Soil Borings with 6 ¼ inch ID HAS (8 inch borehole)	Feet		
3b.	Split Spoon Sampling	Spoons		
3c.	4-inch Type 304 Stainless Steel Casing	Feet		
3d.	4-inch Type 304 Stainless Steel Screen	Feet		
3e.	Well Completion Materials (Gravel pack, bentonite, grouting installed)	Feet		
3f.	5 foot Carbon Steel Protective Casing (installed), including Well Lock and Key, Concrete Collar, etc.	Each		
3g.	Flush Mount including Well Lock and Key, Concrete Collar, etc.	Each		
3h.	Well Development (3 hours/well)	Wells		

4.0 OVERBURDEN MONITORING WELL INSTALLATION				
4a.	Surcharge for Level "C"	Per Hour		



Project Name:

Project Number:

Surface Elevation (ft amsl):
Total Depth:
Depth to Initial Water Level (ft bgs):
Field Screening Instrument:
Logged by:

[illegible]

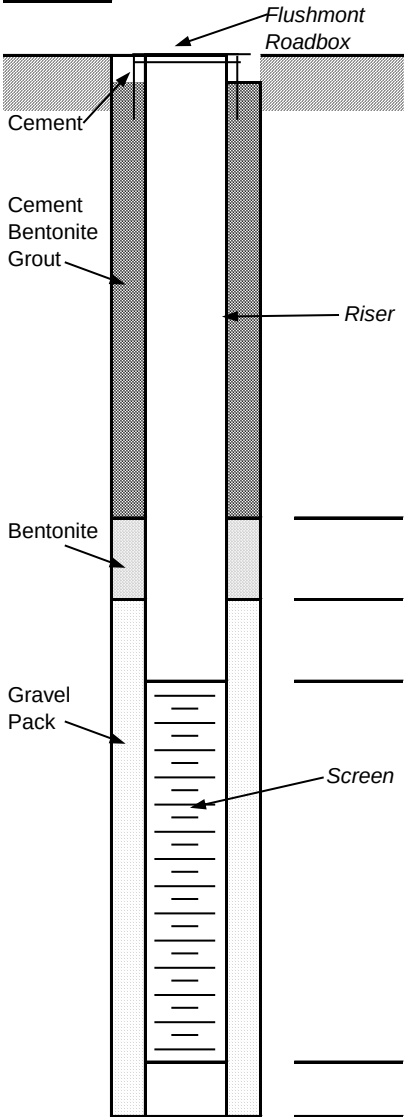
Remarks: Boring Completion Depth ft bgs _____



WELL CONSTRUCTION SUMMARY

Project: _____ Location: _____ Well No.: _____
Permit No.: _____

TOC elev.: _____ Type: _____



DRILLING SUMMARY

Drilling Company: _____ Drillers: _____
Drill Rig/Model: _____
Borehole Diameters: _____ Drilling Fluid: _____
Bits/Depths: _____
Total Depth: _____ Depth To Water: _____
Supervisor Geologist: _____

WELL DESIGN

Casing Material: _____ Diameter: _____
Screen Material: _____ Diameter: _____
Slot Size: _____ Setting: _____
Filter Material: _____ Setting: _____
Seals Material: _____ Setting: _____
Grout: _____ Setting: _____
Surface Casing Material: _____ Setting: _____

TIME LOG

	Started	Completed
Drilling:	_____	_____
Installation:	_____	_____
Development:	_____	_____

WELL DEVELOPMENT

Method: _____
Static Depth to Water: _____
Pumping Depth To Water: _____
Pumping Rate: _____ Spec. Capacity: _____
Volume Pumped: _____



Appendix D – Estimated Mass Discharge Rate

Potential Total VOC Emissions Estimate for Soil Vapor Extraction
Country Cleaners State Superfund Site

Calculated by:Peter McKay
Checked by:Ben Carreon

Date:4/26/2024
Date:5/10/2024

Objective: Estimate VOC emissions from soil vapor operation and determine vapor treatment required.

Approach/Assumptions:

- Estimate the total contaminant mass in soil based on maximum concentration detected to date.
Assume a radius of influence of 50 feet (conservative assumption) for SVE pilot implementation.
Assume that the depth to groundwater across the site is an even 52 feet below ground surface.
Conservatively assumed 24/hours per day extraction, 7 days per week, during 5 weeks of testing.
PCE is the primary source of contamination (>90%), and other contaminants will not significantly contribute to mass emission.
Emissions are compared to the following regulations:
State Compilation of Codes, Rules and Regulations of the State of New York, Title 6. Department of Environmental Conservation, Chapter III. Air Resources, Subchapter A. Prevention and Control
Excerpts from Part 201:
"Except as otherwise set forth herein, no person shall construct or operate [a major facility, as defined in Subpart 201-2 of this Part] without first obtaining a title V permit."
"Except as otherwise expressly provided in this paragraph, a stationary source, source, or facility that directly emits or has the potential to emit, 100 tons per year (tpy) or more of any air
"For hazardous air pollutants other than radionuclides, a stationary source, source, or facility that emits or has the potential to emit, in the aggregate, 10 tpy or more of any hazardous air
"For areas classified as marginal or moderate ozone nonattainment, any stationary source, source, or facility with the potential to emit 100 tpy or more of oxides of nitrogen (NOx) or 50 tpy

Calculation:

Item	Values	Units	Notes
Inputs			
Well Count	4	--	--
Radius	50	feet	conservative extent of contaminated mass
Depth	52	feet	typical depth to groundwater based on May 2022 synoptic water level measurements, SVE wells will be screened around 45 feet bgs
Maximum soil PCE concentration:	17900	ug/kg	maximum PCE soil concentration measured at the site during January 2022 soil sampling
Duration of SVE Pilot	5	weeks	including 1 week of step testing and four weeks of extended operations testing
	7	days	assumes operating 7 days per week
	8	hours/day	assumes operating 8 hours per day
Soil Density	3	g/cm^3	assumed
Conversion Factors			
--	453600000	ug/lb	--
--	1000	g/kg	--
--	28317	cm^3/ft^3	--
Calculations			
Total Soil Volume	1633628	ft^3	includes cylindrical soil area around both SVE wells, neglecting overlap
Total Mass of Contaminant	4929	lb of PCE	--
	2	ton of PCE	--
Emission rate	141	lb/day	assumes consistent mass removal rate
	18	lb/hr	--
	4929	lb/yr	assumes all mass within zone of influence is extracted
	2	tons/year	--

Summary:

The calculation results indicated that the maximum total VOC mass to be emitted from the SVE pilot study is 2 tons total, or 141 pounds per day over the course of the SVE pilot study. This maximum total VOC mass is compared to emission thresholds under 6 CRR-NY 201, the most stringent of which is a threshold of 10 tons per year of hazardous air pollutants (including PCE). If this threshold is exceeded, the facility will be considered a major facility requiring a Title V permit for air emissions. Because the anticipated emissions do not exceed this threshold, a permit is not required, and controls are not required prior to release to the atmosphere. However, VOC treatment with carbon vessels will be implemented.



Appendix E – SiteWise™ Input

Appendix D - SiteWise™ Input
Alternative 2 SVE, MNA - SVE Component
Sustainable and Resilient Remediation (SRR) Assessment
Country Cleaners Site



PROJECT: _____
JOB NO.: _____
CLIENT: _____

COMPUTED BY: _____
DATE: _____

UPDATED BY: _____
DATE: _____

CHECKED BY: _____
DATE CHECKED: _____
WRKSH T NO.: _____

Description: Assumptions and site input parameters for Alternative 2 SVE, MNA - SVE Component

Soil Vapor Extraction (SVE) Construction Assumptions

SVE Construction - General

Number of New SVE Wells	4	EA
Screen Depth	45	LF
Construction Days	10	DAYS

SVE Construction - Well Materials

SVE Wells								
	Input number of wells	4						
	Input depth of wells (ft bgs)	45						
	Input screen length (ft)	15						
	Choose specific material schedule from drop down menu	Sch 40 PVC						
	Choose well finish type from drop down menu	Flush-mount						
	Choose casing diameter (in) from drop down menu	4						
	Input borehole diameter (in)	8.25						
	Choose Filter Pack Material	Sand						
	WELL DIMENSIONS (elements arranged from bottom to top, inside to outside)					Material		Volume (cubic ft)
	a Filter Pack Base Dimensions (volume between the bottom of the borehole and bottom of the casing)	Length (ft) 0.50	Diameter (in) 8.25	Sand 0.19				
	b Screened Interval Dimensions (volume of annular space for the length of the screened interval)	Length (ft) 15.00	Outer Diameter (in) 8.25	Inner Diameter (in) 4.50	Sand 3.91			
	c Filter Pack Above Screened Interval Dimensions (volume of annular space above the screened interval below the filter pack seal)	Length (ft) 1.00	Outer Diameter (in) 8.25	Inner Diameter (in) 4.50	Sand 0.26			
	d Bentonite Filter Pack Seal Dimensions (volume of annular space filled by the filter pack seal)	Length (ft) 1.00	Outer Diameter (in) 8.25	Inner Diameter (in) 4.50	Bentonite 0.26			
	e Cement Grout Dimensions (remaining volume of annular space)	Length (ft) 27.00	Top of Layer (ft bgs) 1.00	Outer Diameter (in) 8.25	Inner Diameter (in) 4.50	Typical Cement 7.04		
	f Flush-mount Outer Casing or Stick-up Dimensions	Length (ft) 0.50	Outer Width 1 (in) 6.00	Outer Width 2 (in) 6.00	Wall Thickness (in) 0.25	Top Thickness (in) 0.75	Steel 0.02	
	g Concrete or Sand Inner Fill Dimensions (between Outer Casing and Inner Casing to Surface) (volume of annular space inside of the outer casing or stick-up)	Length (ft) 0.50	Outer Dimension 1 (in) 5.75	Outer Dimension 2 (in) 5.75	Inner Diameter (in) 4.50	Sand 0.06		
	h Concrete Outer Fill Dimensions (not included in Pad) (volume of annular space outside of the outer casing or stick-up)	Length (ft) 1.00	Outer Diameter (in) 8.25	Inner Dimension 1 (in) 6.00	Inner Dimension 2 (in) 6.00	General Concrete 0.12		
	i Pad Dimensions (does not include Bumper Guard Concrete or Casing Outer Fill) (volume of pad, minus bumper fill intended for bumper guards and fill intended for outer casing)	Depth (in) 6.00	Length (ft) 2.00	Width (ft) 2.00	Inner Diameter (in) 8.25	General Concrete 1.81		
	j Bumper Guards	Length (ft) 0.00	Diameter (in) 4.00	Thickness (in) 0.24	Number of Guards 0.00	Steel 0.00		
k Bumper Guard Concrete (not included in Pad) (volume of fill around bumpers by specified diameter from surface to depth and fill for interior of bumper)	Length (ft) 0.00	Outer Diameter (in) 8.00	Depth (ft) 2.00	General Concrete 0.00				

Appendix D - SiteWise™ Input
Alternative 2 SVE, MNA - SVE Component
Sustainable and Resilient Remediation (SRR) Assessment
Country Cleaners Site



PROJECT:

JOB NO.:

CLIENT:

COMPUTED BY:

DATE:

UPDATED BY:

DATE:

CHECKED BY:

DATE CHECKED:

WRKSHT NO.:

Description: Assumptions and site input parameters for Alternative 2 SVE, MNA - SVE Component

	RESULTS PER WELL					
		Volume (cubic ft)	Volume (cubic meters)	Density (kg/cubic meter)	Weight (kg)	
	Required Sand	4.42	0.1251	1,850.00	231.42	
	Required Gravel	0.00	0.0000	1,682.00	0.00	
	Required Bentonite	0.26	0.0074	1,800.00	13.29	
	Required Typical Cement	7.04	0.1994	1,506.00	300.26	
	Required General Concrete	1.94	0.0548	2,371.00	129.96	
	Required Steel	0.02	0.0007	7,860.00	5.46	
TOTAL WELL MATERIALS						
(kg)	Sand	9.3E+02				
(kg)	Gravel	0.0E+00				
(kg)	Bentonite	5.3E+01				
(kg)	Typical Cement	1.2E+03				
(kg)	General Concrete	5.2E+02				
(kg)	Steel	2.2E+01				

WELL MATERIALS	Well Type 1
Input number of wells	4
Input depth of wells (ft)	45
Choose specific casing material schedule from drop down menu	Sch 40 PVC
Choose well diameter (in) from drop down menu	4
Input total quantity of Sand (kg)	926
Input total quantity of Gravel (kg)	0
Input total quantity of Bentonite (kg)	53
Input total quantity of Typical Cement (kg)	1,201
Input total quantity of General Concrete (kg)	520
Input total quantity of Steel (kg)	22

SVE Construction - Drilling

Drilling Required LF

Method of Drilling

Drilling Duration DAYS

DRILLING	Event 1
Input number of drilling locations	4
Choose drilling method from drop down menu	Hollow Stem Auger
Input time spent drilling at each location (hr)	5.00
Choose fuel type from drop down menu	Diesel

Appendix D - SiteWise™ Input
Alternative 2 SVE, MNA - SVE Component
Sustainable and Resilient Remediation (SRR) Assessment
Country Cleaners Site



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Description: Assumptions and site input parameters for Alternative 2 SVE, MNA - SVE Component

SVE Construction - Piping

Trenching for Underground Piping LF

Piping LF

Trenching Days DAYS

Production Rate Trenching LF/HR

Density PVC Pipe LB/LF

TRENCHING	Trencher 1
Choose fuel type from drop down menu	
Choose horsepower range from drop down menu	
Input operating hours (hr)	

BULK MATERIAL QUANTITIES	Material 1
Choose material from drop down menu	EPDM Rubber
Choose units of material quantity from drop down menu	pounds
Input material quantity	2,509

SVE Construction - Residuals

Assume soils from trenching are used as backfilll.

Trench Width LF

Concrete/Asphalt Debris Thickness LF

Volume C&D Debris CY

C&D Debris Density LB/CY

Weight of C&D Debris TON

Diameter Borehole LF

Volume of Soil Cuttings CY

Soil Density TON/CY

Weight of Soil Cuttings TON

Number of Drums EA

Weight of Empty Drum LB

Total Weight IDW TON

Distance to Disposal Drill Cuttings MI

Distance to Disposal C&D MI

RESIDUE DISPOSAL/RECYCLING	Soil Residue/VGAC/Condensate	Other Residuals
Will DIESEL-run vehicles be retrofitted with a particulate reduction technology?	No	No
Input weight of the waste transported to landfill or recycling per trip (tons)	3.6	0.0
Choose fuel used from drop down menu	Gasoline	Gasoline
Input total number of trips	2.0	1.0
Input number of miles per trip	355.0	100.0

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Description: Assumptions and site input parameters for Alternative 2 SVE, MNA - SVE Component

LANDFILL OPERATIONS	Operation 1	Operation 1
Choose landfill type for waste disposal	Non-Hazardous	Non-Hazardous
Input amount of waste disposed in landfill (tons)	3.2	0.0
Input landfill methane emissions (metric tons CH4)		
Region		
Electricity Region	NY	NY

SVE Construction - Operator Labor

Occupation	Construction Laborers	Operating Engineers	Waste Management Services	Scientific and Technical Services	
Construction	300	0	0	0	HRS
System Startup	0	350	23.7	0	HRS
	300	350	23.7	0	

OPERATOR LABOR	Occupation 1	Occupation 2	Occupation 3	Occupation 3
Choose occupation from drop-down menu	Construction laborers	Operating engineers	Waste Management Services	Scientific and technical services
Input total time worked on-site (hours)	300.0	350.0	23.7	0.0

SVE Construction - Laboratory Analysis

Vapor Samples During Installation		EA
Unit Cost Vapor Samples	\$220	\$/sample

LABORATORY ANALYSIS	Analysis 1
Input dollars spent on laboratory analysis (\$)	\$0

SVE Construction - Treatment Media

Drums of GAC Required	2	EA
Volume of GAC	55	GAL
Density of GAC	0.5	G/ML
Weight of GAC	229.5	LB

TREATMENT MEDIA	Treatment 1
Input weight of media used (lbs)	229
Choose media type from drop down menu	Virgin GAC

SVE Construction - Steam Cleaning Equipment
Steam cleaning equipment is modeled as gasoline generator

Hours of Operation of Steam Cleaner	6	HR
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GENERATORS	Generator 1
Choose fuel type from drop down menu	Gasoline
Choose horsepower range from drop down menu	11 to 16
Input operating hours (hr)	6

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Description: Assumptions and site input parameters for Alternative 2 SVE, MNA - SVE Component

SVE Construction - Personnel Transportation

	Well Installation	Construction Laborer	Engineer	
Number of Total Days	10	5		DAYS
Number of Long Trips	2	2		DAYS
Number of Short Trips	18	8		EA
Vehicle	Light Truck	Light Truck		
Distance Long Trip	225	225		MI
Distance Short Trip	5	5		MI
Crew	3	1		EA

	Treatment System Construction	Construction Laborer	Engineer	
Number of Days	4	4		DAYS
Number of Long Trips	2	2		DAYS
Number of Short Trips	6	6		EA
Vehicle	Light Truck	Light Truck		
Distance Long Trip	225	225		MI
Distance Short Trip	5	5		MI
Crew	3	1		EA

	Treatment System Installation	Construction Laborer	Engineer	
Number of Days	4	4		DAYS
Number of Long Trips	2	2		DAYS
Number of Short Trips	6	6		EA
Vehicle	Light Truck	Light Truck		
Distance Long Trip	225	225		MI
Distance Short Trip	5	5		MI
Crew	3	1		EA

	System Startup	Electrician	Plumber	Engineer	
Number of Days	5	5	5		DAYS
Vehicle	Light Truck	Light Truck	Light Truck		DAYS
Number of Long Trips	0	0	2		EA
Number of Short Trips	10	10	8		
Distance per Trip	25	25	225		MI
Number of Trips	10	10	10		MI
Crew	1	1	1		EA

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Description: Assumptions and site input parameters for Alternative 2 SVE, MNA - SVE Component

PERSONNEL TRANSPORTATION - ROAD	Construction Laborer - Long Trip	Construction Laborer - Short Trip	Engineer - Long Trip	Engineer - Short Trip	Electrician - Short Trip	Plumber - Short Trip
Will DIESEL-run vehicles be retrofitted with a particulate reduction technology?	No	No	No	No	No	No
Choose vehicle type from drop down menu*	Light Truck	Light Truck	Light Truck	Light Truck	Light Truck	Light Truck
Choose fuel used from drop down menu	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline
Input distance traveled per trip (miles)	225	5	225	5	25	25
Input number of trips taken	6	30	8	28	10	10
Input number of travelers	3	3	1	1	1	1
Input estimated vehicular fuel economy (mi/gal) (Input only if known for the vehicle selected, otherwise a default will be used by the tool)						

SVE Construction - Equipment Transportation

Type	Weight	
Hollow Stem Auger	40,000	LB
Trench Excavator	4,000	LB

Mobilization/Demobilization Distance 225 MI

EQUIPMENT TRANSPORTATION - SHARED LOAD ROAD	Trip 1	Trip 2
Input distance traveled (miles)	450	450
Input weight of equipment transported (tons)	20	2

Soil Vapor Extraction (SVE) Operation Assumptions

SVE Operation - General

Number of Years Operational 0.068493151 Years

SVE Operation - Blower

Blower Horsepower	10.6	HP
System Power Draw	7.95	kW
Total Power Draw	15.9	kW
Total Energy Demand Per Year	139,284	kWh/YR

BLOWER, COMPRESSOR, MIXER, AND OTHER EQUIPMENT	Equipment 1
Choose type of equipment from drop down	Blower
Choose method from drop down	Method 2
Method 2 - ELECTRICAL USAGE IS KNOWN	
Input equipment electrical usage, if known (kWh)	9,540
Region	
Electricity Region	NY

SVE Operation - Laboratory Analysis

Monitoring Vapor Samples (Year 1)	58.3	EA
Monitoring Vapor Samples (Year 2-10)	24	EA
Unit Cost Vapor Samples	\$220	\$/sample

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Description: Assumptions and site input parameters for Alternative 2 SVE, MNA - SVE Component

LABORATORY ANALYSIS	Analysis 1
Input dollars spent on laboratory analysis (\$)	\$13,188

SVE Operation - Treatment Media

Number of Carbon Changeouts per Year	1	EA/YEAR
Number of Carbon Changeouts	0.068493151	EA
Drums of GAC Required Per Changeout	2	EA
Volume of GAC Required Per Changeout	55	GAL
Density of GAC	0.5	G/ML
Weight of GAC Required per Changeout	459.0	LB

Source: https://systematixusa.com/products/media/active_media/gac.htm

TREATMENT MEDIA	Treatment 1
Input weight of media used (lbs)	31
Choose media type from drop down menu	Virgin GAC

SVE Operation - Operator Labor

Occupation	Construction Laborers	Operating Engineers	Waste Management Services	Scientific and Technical Services	
First Year Operation (Year 1)	0	0	0	0	HRS
Year 2-10 Operation	0	0	0	0	HRS
	0	0	0	0	

OPERATOR LABOR	Occupation 1
Choose occupation from drop-down menu	Operating engineers
Input total time worked onsite (hours)	0.0

SVE Operation - Personnel Transportation

First Year Operation (Year 1)	Operator
Number of Days	21
Vehicle	Light Truck
Distance per Trip	25
Number of Trips	42
Crew	1
Year 2-10 Operation	Operator
Number of Days	0
Vehicle	Light Truck
Distance per Trip	25
Number of Trips	0
Crew	1

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Description: Assumptions and site input parameters for Alternative 2 SVE, MNA - SVE Component

PERSONNEL TRANSPORTATION - ROAD	Trip 1
Will DIESEL-run vehicles be retrofitted with a particulate reduction technology?	No
Choose vehicle type from drop down menu*	Light Truck
Choose fuel used from drop down menu	Gasoline
Input distance traveled per trip (miles)	25
Input number of trips taken	42
Input number of travelers	1
Input estimated vehicular fuel economy (mi/gal) (Input only if known for the vehicle selected, otherwise a default will be used by the tool)	15