

2921 Westchester Avenue Remedial Investigation Work Plan

2921 Westchester Avenue
Bronx, NY
Bronx County
Block 4164, Portion of Lot 5
BCP Site No. C203140

Submitted to:
New York State Department of Environmental Conservation
Division of Environmental Remediation, Region 2
Hunters Point Plaza
47-40 21st Street
Long Island City, NY 11101

Prepared for:
Ralford Realty Corp.
c/o Anthony Scovotti
Eifert French & Ketchum
330 Fifth Avenue
Pelham, NY 10803

Prepared by:



121 West 27th Street, Suite 702
New York, NY 10001

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CERTIFICATION

I, Alana Carroll, certify that I am currently a Qualified Environmental Professional as defined in 6NYCRR Part 375 and that this Remedial Investigation Work Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

Alana Carroll

Alana Carroll, PG

02/03/2021

Date

1.0 INTRODUCTION

On behalf of Ralford Realty Corp. (the Participant), Tenen Environmental, LLC (Tenen) has prepared this Remedial Investigation Work Plan (RIWP) for the property located at 2921 Westchester Avenue (Block 4164, Portion of Lot 5) in the Pelham Bay neighborhood of the Bronx, New York (the Site) pursuant to the Brownfield Cleanup Agreement (October 2020) for BCP Site No. 203140. The Site location and layout are shown on Figures 1 and 2, respectively. The RIWP has been designed to further investigate and characterize the nature and extent of contamination previously identified on the Site. The scope of work includes investigation of subsurface soils, soil and sub-slab vapor and groundwater in areas where historical operations potentially impacted the Site or surrounding areas. The results of the investigation will be used to prepare a Remedial Investigation Report (RIR) and qualitative human health exposure assessment (QHHEA) and to support the development of a Remedial Action Work Plan (RAWP). This RIWP has been prepared in accordance with the New York State Department of Environmental Conservation (NYSDEC) Division of Environmental Remediation (DER) Technical Guidance for Site Investigation and Remediation (DER-10, May 3, 2010).

1.1 Work Plan Organization

This RIWP includes an introduction (Section 1), background information (Section 2), scope of work (Section 3) and project schedule (Section 4). Quality assurance/quality control, health and safety (including community air monitoring), and project team information are addressed in separate appendices. Supporting tables and figures referenced throughout are included at the end of this RIWP.

1.2 Summary of Previous Investigations

A Phase II Environmental Site Assessment (Phase II ESA) was completed at the Site by Castleton Environmental (Castleton) in August 2019 to investigate the potential for contamination associated with historical Site operations. The Phase II ESA included soil, groundwater, and soil vapor sampling and revealed the presence of chlorinated solvents, specifically the chlorinated volatile organic compounds (cVOCs) tetrachloroethene (PCE), trichloroethene (TCE), and cis-1,2-dichloroethene (cis-1,2-DCE) in soil, groundwater, and soil vapor beneath the Site. cVOCs were detected in exceedance of applicable standards in one of three soil samples collected and all three groundwater samples collected. cVOCs were also detected at elevated concentrations in two of three soil vapor samples collected.

Soil, groundwater, and indoor air sampling was completed by Tenen to further investigate the presence of chlorinated solvents in soil and groundwater at the Site and to determine if a potential soil vapor intrusion condition exists. Tenen's initial investigation was conducted between September and November 2019. On February 27, 2020, Tenen returned to the Site to delineate the extent of PCE contamination identified in soil boring SB-05 in Castleton's Phase II ESA. This investigation included the collection of twenty-two onsite and one offsite soil samples, one onsite and two offsite groundwater samples, and two onsite and three offsite indoor air samples. The investigation confirmed the presence of cVOCs in exceedance of applicable standards in nine of sixteen onsite soil samples analyzed and the one onsite groundwater sample analyzed. Chlorinated solvents were not detected in exceedance of applicable standards in any offsite soil or groundwater samples analyzed. Low concentrations of cVOCs were detected in all onsite and offsite indoor air samples analyzed, with the highest concentrations occurring in the sample collected from the basement of the Site. A PCE hotspot in soil was horizontally and vertically delineated to the extent possible within the Site basement. The hotspot comprises approximately seven cubic yards of chlorinated solvent impacted material. A map depicting previous sample locations is included as Figure 4.

1.3 Regulatory Interaction

A Brownfield Cleanup Program (BCP) application was submitted for the Site to NYSDEC DER in conjunction with this RIWP in June 2020. Following a 30-day public comment period, a Brownfield Cleanup Agreement (BCA) will be executed by the Participant and NYSDEC. The work to be performed under this RIWP, as well as, all future remedial work, will be performed in accordance with the requirements set forth in the BCA.

1.4 Work Plan Objectives

This RIWP has been developed to achieve the following BCP objectives:

- To define the nature and extent of contamination on-site and off-site;
- To identify if residual contaminant source areas are present on the Site;
- To delineate the extent of a tetrachloroethene (PCE) hotspot in soil, identified in previous investigations;
- To collect data sufficient to perform an on-site and off-site Qualitative Human Health Exposure Assessment; and
- To produce data of sufficient quantity and quality to prepare a Remedial Action Work Plan (including alternatives analysis) to support the remediation of the Site if it is determined that remedial action is needed.

2.0 BACKGROUND

This section includes a description of the Site and surrounding uses, a summary of the proposed Site development, Site characteristics, and information regarding historical operations and regulatory interactions. Summaries of previous Site investigations are also provided.

2.1 Site Description and Surrounding Uses

The Site is located at 2921 Westchester Avenue in the Pelham Bay neighborhood of the Bronx, New York. The Site is defined as an approximate 1,415 square foot (SF) vacant tenant space which is a portion of an irregularly shaped parcel, identified by the New York City Department of Finance as Block 4164, Lot 5. The Site is located on the west side of Westchester Avenue, between Pilgrim Avenue and Buhre Avenue, in Bronx Community Board 10 and was historically occupied by a drycleaner.

Lot 5 is improved with one two-story commercial building with a partial basement. The building contains multiple commercial tenant spaces currently occupied by a barber, , a cell phone store and a flooring store. The Site was historically occupied by a drycleaner and most recently, a tutoring and after-school center. Basements extend beneath the entirety of the Site and directly adjacent barber and cell phone store tenant spaces. These basement spaces share a common slab, but are separated by walls. The northwestern portion of the flooring store footprint contains a small sub-cellar consisting of a boiler room, the remainder of the flooring store footprint consists of a slab on grade. The commercial layout and cellar layout of the Site lot are depicted on Figures 2 and 3, respectively. The Site consists of one vacant tenant space within the building and the portion of the basement directly below. The Site is zoned R7-1, denoting a medium density apartment house district, with a C2-2 commercial overlay.. The area surrounding the Site is predominantly commercial and residential.

2.2 Proposed Development

There is currently no redevelopment plan for the Site. Redevelopment and/or possible remediation without redevelopment will be addressed in the Remedial Action Work Plan to be submitted to NYSDEC subsequent to the implementation of the Remedial Investigation and submission of the RIR.

2.3 Site Characteristics

Site Topography

Based on the U.S. Geological Survey (Brooklyn-NY USGS 7.5 Minute Topographic Quadrangle) topographic map, the Site is located at an elevation of approximately 45 feet above mean sea level (msl). The Site is located in a relatively flat area and gently slopes to the west.

Site Geology and Hydrogeology

The overburden at the Site is composed predominantly of native dense, fine silty sands extending to bedrock (approximately 3 to 4 feet below basement grade [ft-bbg]). Bedrock consists of schist and perched water is present above the bedrock. Perched water was detected at depths ranging from approximately 9 to 10 feet below sidewalk grade (ft-bsg) and 0.16 ft-bbg in permanent groundwater wells installed during the Due Diligence Investigation (DDI) performed by Tenen. Based upon the well survey conducted as part of the DDI investigation, groundwater generally flows south-southwest.

2.4 Historical Operations

Lot 5 was initially developed sometime prior to 1950 with the existing two-story building with a partial basement. The Site operated as a dry-cleaning facility from circa 1988 to circa 2000. Following the cessation of dry-cleaning operations, the Site was occupied for approximately five years by Tristate Interiors and then as a tutoring and after-school facility until early 2020. As noted, the Site is currently vacant.

2.5 Previous Investigations

Previous assessments and investigations include a 2019 Phase II ESA conducted by Castleton and a 2019/2020 Due Diligence Investigation conducted by Tenen.

Copies of available environmental records and reports are included in their entirety, as received, in Appendix A. A map depicting previous sample locations is included as Figure 4. The results of historical sampling are summarized on Figures 6-8 and included in their entirety in the Tables provided in Appendix A. Findings and conclusions from these reports are summarized in the following sections. Conclusions from the Castleton Phase II ESA and are not necessarily representative of Tenen's professional opinion.

2.5.1 *Phase II Environmental Site Assessment, 2925 Westchester Avenue, Bronx, NY 10461, Castleton Environmental, August 2019.*

A Phase II ESA was completed at the Site by Castleton Environmental in 2019 as part of a prospective purchaser's due diligence to investigate the potential for contamination associated with the historical use of the Site for dry cleaning. The Phase II ESA included the advancement of five soil borings, the collection of three soil samples, the installation of three temporary well points, the collection of three groundwater samples, the installation of three temporary soil vapor points, and the collection of three sub-slab soil vapor samples.

Soil Results

Results of the soil sampling indicated concentrations of several chlorinated VOCs (cVOCs), specifically tetrachloroethene (PCE), trichloroethene (TCE), and cis-1,2-dichloroethene (cis-1,2-DCE), in exceedance of their respective NYSDEC 6 NYCRR Part 375-6.8(a) Unrestricted Use (UU) Soil Cleanup Objectives (SCOs) and Part 375-6.8(b) Protection of Groundwater (PGW) SCOs in one of three samples collected.

Groundwater Results

Results of the groundwater sampling indicated concentrations of several cVOCs, specifically PCE, TCE, and cis-1,2-DCE, in exceedance of their NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1 Ambient Water Quality Standards and Guidance Values (Class GA Standards) in all three samples collected.

Soil Vapor Results

Results of the sub-slab soil vapor sampling indicated elevated concentrations of several cVOCs, specifically PCE, TCE, and cis-1,2-DCE, in two of three samples collected.

2.5.2 *Due Diligence Investigation Letter Report, 2921 Westchester Avenue, Bronx, NY 10461, Tenen Environmental, LLC, May 2020.*

A Due Diligence Investigation was conducted on and off the Site by Tenen between September 2019 and

February 2020 to further investigate the contamination identified in soil, groundwater, and soil vapor in Castleton's Phase II ESA so as to provide additional information to assist in the sale of the Site. Soil, groundwater, and indoor air sampling was completed by Tenen to further investigate the presence of chlorinated solvents in soil and groundwater at the Site and to determine if a potential soil vapor intrusion condition exists. The DDI consisted of the advancement of ten soil borings, the collection of 22 onsite soil samples and one offsite soil sample, the installation of three permanent groundwater monitoring wells (one onsite and two offsite), the collection of three groundwater samples, and the collection of two onsite indoor air samples (first floor and basement) and three offsite indoor air samples (separate tenant spaces within the building on Lot 5). A well survey was conducted at the Site as part of this investigation and groundwater was determined to flow to the south-southwest. A groundwater contour map is included as Figure 5.

Soil Results

Soil results were compared to NYSDEC PGW and RCU SCOs as listed in 6 NYCRR Part 375-6.8(b) and the October 21, 2010 NYSDEC DEC Policy CP-51. The PGW SCOs are used as a screening value for potential groundwater impacts and the RCU SCOs are consistent with the current and assumed future use of the Site.

All VOCs and metals were detected below the PGW and RCU SCOs in offsite soil sample MW-1 (16-18). All VOCs were detected below RCU SCOs in soil samples collected onsite.

PCE was detected in exceedance of its PGW SCO from 0-1 ft-bbg in soil delineation boring SB-5 (concentration 3.2 mg/kg), SB-5-N (concentration 34 mg/kg), SB-5-S (concentration 1.7 mg/kg), SB-5-W (concentration 20 mg/kg), and SB-5-W2 (concentration 8.1 mg/kg). PCE was detected at a low concentration below the PGW SCO from 0-1 ft-bbg in soil delineation boring SB-5-E. PCE was detected in exceedance of its PGW SCO from 1-2 ft-bbg in soil delineation borings SB-5-N (concentration 22 mg/kg) and SB-5-W (concentration 16 mg/kg). PCE was detected at low concentrations below the PGW SCO from 1-2 ft-bbg in soil delineation borings SB-5, SB-5-S, and SB-5-W2. PCE was detected in exceedance of its PGW SCO from 2-3 ft-bbg in soil delineation boring SB-5-W, only (concentration 7 mg/kg). PCE was detected at low concentrations below the PGW SCO from 2-3 ft-bbg in soil delineation borings SB-5, SB-5-N, and SB-5-S. PCE was also detected at a low concentration below the PGW SCO from 3-4 ft-bbg in soil delineation boring SB-5.

Concentrations of cis-1,2 DCE and TCE were detected in exceedance of their respective PGW SCO in five samples collected from three borings: SB-5(0-1ft); SB-5-N(0-1 ft, 1-2 ft and 2-3 ft); and SB-5-W(0-1ft)

Groundwater Results

Groundwater results were compared to NYSDEC TOGS Class GA Standards. Results of the groundwater sampling indicated concentrations of chlorinated solvents, specifically PCE, TCE, and cis-1,2-DCE in exceedance of Class GA Standards in the groundwater sample collected from the basement of the Site. PCE was detected at a concentration of 470 micrograms per liter (ug/l); TCE was detected at a concentration of 79 ug/l; and, cis-1,2-DCE was detected at a concentration of 210 ug/l. PCE, TCE and cis-1,2-DCE all have a Class GA Standard of 5 ug/l.

All cVOCs were detected below the Class GA Standards in the two offsite, permanent monitoring wells samples.

Indoor Air Results

Indoor air results were compared to the NYSDOH Air Guidance Values (AGVs) as presented in the NYSDOH Soil Vapor Guidance, October 2006 with May 2017 updates and the Environmental Protection Agency (EPA) Vapor Intrusion Screening Limits (VISL), Commercial Target Indoor Air Concentrations

(TIAC). Results of the indoor air sampling indicated that concentrations of VOCs were not detected in exceedance of NYSDOH AGVs in any onsite or offsite indoor air samples collected. However, low concentrations of cVOCs were detected in all five indoor air samples collected, with the highest concentrations generally occurring in the sample collected from the basement of the Site.

2.6 Summary of Previous Investigations

Based on investigations conducted to date at the Site, the primary contaminants of concern for the Site are cVOCs¹.

Soil

Concentrations of cVOCs in soil were detected in ten of 20 samples collected and analyzed as part of the Castleton and Tenen investigations in exceedance of respective UU and PGW SCOs. All soil samples met RCU SCOs. During Tenen's investigation, a PCE hotspot in soil was horizontally and vertically delineated to the extent possible within the Site basement. The hotspot comprises approximately seven cubic yards of chlorinated solvent impacted material. The vertical extent of contamination ranges from 1 ft-bbg along the eastern and southern perimeters of the hotspot, to 2 ft-bbg along the northern perimeter of the hotspot, to bedrock (approximately 3 ft-bbg) along the western perimeter of the hotspot. Access to the northern tenant's basement space is necessary to fully delineate the hotspot to the north. Additional delineation is also needed to the west. A cross section of the hot spot is provided as Figure 9; a PCE isopleth for soil is provided as Figure 10. VOCs and metals were not detected in exceedance of PGW or RCUSCOs in soils collected offsite.

Groundwater

The results of the groundwater sampling indicated that concentrations of cVOCs are present in groundwater at concentrations above Class GA Standards in all four onsite groundwater samples collected as part of the Castleton and Tenen investigations. cVOCs were not detected in exceedance of Class GA Standards in offsite wells MW-1 or MW-2, located cross- and downgradient of the Site, respectively.

Indoor Air

Based upon comparison of the detected concentrations of chlorinated solvents and petroleum-related hydrocarbons in indoor air to applicable standards and guidance, there is no meaningful soil vapor intrusion condition at the Site that would require immediate action. Comparison of the indoor air concentrations (specifically cVOCs) collected from the Site with soil vapor concentrations collected during Castleton's Phase II ESA indicate that a cVOC vapor intrusion condition does not exist onsite and that no mitigation is required. Indoor air results are consistent with the commercial use of the Site.

¹ A DUSR and EDDs will be provided in the RIR for data collected during the Due Diligence Investigation and, insofar as available, the Castleton Phase II ESA.

3.0 REMEDIAL INVESTIGATION

The Remedial Investigation (RI) proposed for the Site includes sampling of soil, sub-slab soil vapor, exterior soil vapor, indoor air, ambient air and groundwater. The objectives of this RI are to define the nature and extent of contamination onsite; to determine if onsite contamination is migrating offsite; and to provide data of sufficient quantity and quality to support development of a Remedial Investigation Report (RIR), Qualitative Human Health Exposure Assessment (QHHEA) and Remedial Action Alternatives Analysis.

This RIWP was developed to meet the following Site-specific objectives:

- Confirm prior investigation results;
- Delineate the horizontal and vertical extent of cVOCs in soil and groundwater beneath the Site;
- Evaluate bedrock conditions beneath the Site;
- Identify the extent of onsite and offsite (if present) soil vapor impacts, specifically those related to chlorinated solvents;
- Evaluate potential sources of contamination, the migration pathways, and actual or potential receptors of contaminants on or through soil, groundwater and soil vapor;
- Evaluate potential off-site impacts to soil, groundwater and soil vapor;
- Assess potential upgradient sources of chlorinated solvent impacts in groundwater;
- Investigate potential indoor air impacts inside the basement of the Site building;
- Assess potential impacts to human health as a result of the release of contaminants at the Site.

3.1 Scope of Remedial Investigation

The scoping process, for the purpose of identifying and defining the RI tasks described below, included the following:

- Review of current and historical Site reports and data;
- Review of results from the 2019 Phase II ESA and 2019/2020 Due Diligence Investigation; and
- Evaluation of DER-10 requirements and relevant State and Federal guidance documents.

The RI will begin following completion of the required 30-day public comment period and after NYSDEC approval of this RIWP. The RI will include the collection of 39 samples from 13 soil borings, installation of four permanent groundwater monitoring wells (three shallow wells and one bedrock well), collection of seven groundwater samples from three previously installed and four newly installed groundwater monitoring wells, collection of soil vapor from seven sub-slab soil vapor points and three exterior soil vapor points, within and surrounding the Site, the collection of seven indoor air samples, to be co-located with sub-slab soil vapor samples, and the collection of three ambient air samples. The type, location, and rationale for each exploration are detailed in the sections below and in summary table included in Section 3.6.

A walkthrough of all tenant basement spaces for the building located on Block 4164, Lot 5 (inclusive of the Site) was conducted on November 24, 2020 to evaluate and measure each space for sample location placement and accuracy. As a result of the walkthrough, updated figures have been prepared and the Site

was determined to be larger in size (1,415-SF) than originally reported. In response to this new information, all proposed soil delineation sample locations have been adjusted and additional onsite soil characterization borings have been proposed for Site coverage.

Installation of soil borings, groundwater monitoring wells and soil vapor will be completed in accordance with the sections below and the standard procedures included in the Quality Assurance Project Plan (QAPP) and Health and Safety Plan (HASP), included as Appendix B and C, respectively. Following the collection of this data, review and evaluation will be performed in order to determine if additional investigation is needed.

Proposed soil and groundwater RI sample locations are shown on Figure 11a. Proposed soil vapor and indoor air RI sample locations are shown on Figure 11b.

3.2 Soil Sampling

A subsurface investigation will be performed to further characterize soil conditions onsite, to complete the horizontal and vertical delineation of documented chlorinated solvent impacts onsite and to assess soil conditions offsite.

The following scope of work will be implemented:

- Advance twelve soil borings to bedrock (approximately 3 to 4 ft-bbg) within the Site basement to complete the northern and western horizontal and vertical delineation of the cVOC hot spot identified in previous investigations and complete characterization of the Site to the east, south and southwest;
 - If any delineation boring located along the northern border of the Site (SB-7 through SB-9) is not accessible due to the presence of foundation elements or other unknown impediments, then that boring will be relocated to the adjacent Boost Mobile basement and advanced along the southern boundary of that space.
- Advance one soil boring offsite in the sidewalk along Pilgrim Avenue to bedrock (approximately 20 ft-bsg) to assess offsite soil conditions;
- Collect 10 soil samples (two from each characterization boring) from five soil characterization borings advanced east, south and southwest within the Site basement (SB-2, SB-3, SB-11, SB-12, and SB-13). Soil samples will be collected from the two-foot interval directly below the basement slab and the two-foot interval directly above bedrock;
- Collect 28 soil samples from seven soil delineation borings advanced within the Site basement to the north, west, south, and southwest (SB-1 and SB-4 through SB-9). Soil delineation samples will be collected from each one-foot interval of the soil column, from directly below the basement slab to the top of bedrock (approximately 3 to 4 ft-bbg). Soil delineation samples will be analyzed if evidence of contamination (e.g., elevated PID readings, odors, and/or staining) is observed. All soil delineation samples without evidence of contamination will be placed on hold. If an analyzed sample contains concentrations of cVOCs in excess of applicable standards, then the interval below the sample will be analyzed (VOCs, only) until a clean interval is reached;
- Collect one soil sample from the offsite soil boring advanced in the sidewalk from the zone of highest suspected contamination. If no visual contamination is observed, the sample will be collected from the two-foot interval above the groundwater interface;

- Analyze soil samples collected onsite for full scan Part 375 SCOs, 1,4-dioxane, and perfluoroalkyl acids (PFAS) (minimum of two per boring); and
- Analyze all samples collected offsite for Part 375 VOCs.

3.2.1 Soil Sampling Methodology

A total of 13 soil borings will be advanced as part of this RI; proposed soil sample locations are shown in Figure 11a. Based on field measurements and observations, boring locations may be moved or added. Prior to modifications being made with regard to the above-described placement, coordination with NYSDEC will take place.

The interior soil borings will be installed using a manual sampling hammer and the exterior soil boring will be installed using a direct-push track-mounted Geoprobe® unit. All borings will be advanced to bedrock (approximately 3-4 ft-bbg, 20 ft-bsg). Soil samples will be collected from three- or five-foot macrocores fitted with dedicated acetate liners.

At each location, the liners for each interval will be opened and the soil screened for VOCs using a 10.6 electron-volt (EV) photoionization detector (PID). The soil retrieved from each sampler will be described by Tenen field staff on boring logs using the Unified Soil Classification System. All observations regarding potential contamination such as odors, staining, etc. will be documented. Soil will be screened from grade to the terminal depth of each boring. If evidence of contamination (e.g., elevated PID readings, odor) or staining is observed, the soil boring will be extended, to the extent possible based on the equipment, to delineate the vertical extent of contamination. All descriptions and observations will be documented in a field logbook.

For each soil delineation boring, SB-1 and SB-4 through SB-9, samples will be collected from each one-foot interval of the soil column, from directly below the basement slab to the top of bedrock (approximately 3 to 4 ft-bbg) and analyzed if evidence of contamination (e.g., elevated PID readings, odors, and/or staining) is observed. If soil delineation borings SB-7, SB-8, and SB-9 cannot be installed in the Site basement due to foundational elements, these borings will instead be installed in the north adjoining basement. All soil delineation samples without evidence of contamination will be placed on hold. If an analyzed sample contains concentrations of cVOCs in excess of applicable standards, then the next interval will be analyzed (VOCs, only) until a clean interval is reached. Samples will be analyzed with a rushed turn-around time (24 hour), as needed, in order to meet the 14-day holding time required for VOC analysis. A minimum of two soil samples will be analyzed from borings located onsite. Analysis of soil samples collected from offsite soil delineation samples (if any) will terminate when a clean interval is present. For each characterization boring (SB-2, SB-3, SB-11, SB-12, and SB-13), soil samples will be collected from the two-foot interval directly below the basement slab and the two-foot interval directly above bedrock. For the exterior offsite soil boring, one soil sample will be collected from the interval of highest suspected contamination based upon PID readings, visual and olfactory methods. If no contamination is observed, the sample will be collected from the two-foot interval directly above the groundwater interface.

Soil samples selected for laboratory analysis will be collected directly from the acetate liner, placed in pre-cleaned, pre-preserved laboratory-provided sample bottles or En Core samplers (En Novative Technologies), sealed and labeled, and placed in a cooler and chilled to 4°C for transport under chain-of-custody procedures. Soil samples will be submitted to a New York State Department of Health (NYSDOH) ELAP-certified laboratory via courier service and analyzed for the respective analyte lists included in 6

NYCRR Part 375 SCOs. Laboratory analytical parameters and methods are outlined below. QA/QC procedures to be followed are described in the QAPP included as Appendix B.

A minimum of two soil samples collected from each onsite boring will be analyzed for the following analytes on the Part 375 list with a Category B deliverable package:

- Target Compound List (TCL) VOCs by EPA Method 8260C;
- TCL SVOCs by EPA Method 8270D;
- Pesticides by EPA Method 8081B;
- Herbicides by EPA Method 8151A;
- Polychlorinated Biphenyls (PCBs) by EPA Method 8082A;
- Target Analyte List (TAL) Metals by EPA Method 6010C/7471B;
- Total Cyanide by EPA Method 9010C;
- Trivalent and Hexavalent Chromium by EPA Method 3060A;
- PFAS by USEPA Method 537 Modified; and
- 1,4-Dioxane by USEPA Method 8270.

All offsite samples will be analyzed for the following analytes on the Part 375 list with a Category B deliverable package:

- TCL VOCs by EPA Method 8260C.

A summary table of proposed soil samples and sampling rationale is included in Section 3.6 of this Work Plan.

3.3 Sub-slab Vapor, Soil Vapor, and Indoor Air Sampling

The following scope of work is proposed to determine the extent of impacts and potential for exposure to Site contaminants by way of the soil vapor intrusion pathway both on- and offsite.

The following scope of work will be implemented:

- Install seven sub-slab soil vapor sample points within the building on Lot 5. Two soil vapor sample probes will be installed within the Site basement, two will be installed within the northern adjoining basement (cell phone store), two will be installed within the southern adjoining basement (barber shop), and one will be installed within the basement of the home goods store, to the northwest of the Site. The soil vapor sample probes will be installed within the lowest building level no more than two inches below the building slab. These locations will be co-located with indoor air samples collected at the same time;
- Install three offsite exterior soil vapor points to approximately ten ft-bg (anticipated basement depth) to assess offsite soil vapor conditions. Two soil vapor points will be installed within the western sidewalk of Pilgrim Avenue and one soil vapor point will be installed within the eastern sidewalk of Westchester Avenue. All soil vapor points will be installed within sidewalks adjacent to residential housing;
- One outdoor ambient air sample will be collected for each sub-slab and soil vapor sampling event, for a total of three samples; and,

- Analyze sub-slab vapor, soil vapor, indoor air, and ambient air samples for EPA Method TO-15 VOCs.

3.3.1 Sub-slab Vapor and Soil Vapor Sampling Methodology

A total of seven sub-slab soil vapor samples, three exterior soil vapor samples, seven co-located indoor air samples and three outdoor ambient air samples will be collected as part of this RI. Samples will be collected in accordance with the NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York (Soil Vapor Guidance, October 2006 with updates). Two sub-slab soil vapor samples and co-located indoor air samples will be collected from the Site basement, two sub-slab soil vapor samples and co-located indoor air samples will be collected from the northern adjoining basement (cell phone store), two sub-slab soil vapor samples and co-located indoor air samples will be collected from the southern adjoining basement (barber), and one sub-slab soil vapor sample and co-located indoor air sample will be collected from the basement of the home goods store, to the northwest of the Site. Three exterior soil vapor samples will be collected from sidewalks surrounding the Site where residential housing exists. Figure 11b depicts proposed soil vapor and indoor air sample locations.

Temporary sub-slab soil vapor points will be installed using a hand-held hammer drill with a concrete drill bit. The drill bit will be extended a maximum two inches below the floor slab for sub-slab soil vapor samples.

A Geoprobe® direct push machine will be used to install the exterior soil vapor sampling probes. At each soil vapor sampling location, access to the subsurface soil will be gained by drilling through the top surface material (concrete) using a drill bit. Upon penetration through the surface material, a disposable sampling probe consisting of a 1.5-inch long hardened point and a 6-inch long perforated vapor intake will be installed to a depth of ten ft-bg.

At the terminal depth of sub-slab and soil vapor locations, the sample probe will be attached to ¼-inch diameter Teflon® tubing and extended to the surface. The borehole above the sampling probe to grade will be sealed using an inert sealant to prevent ambient air mixing with the soil vapor. Ambient air will be purged from the boring hole by attaching the surface end of the ¼-inch diameter Teflon® tube to an air valve and then to a vacuum pump. The vacuum pump will remove no more than one to three volumes of air (volume of the sample probe and tube) prior to sample collection. The flow rate for both purging and sample collection will not exceed 0.2 liters per minute.

The sub-slab soil vapor and exterior soil vapor samples will be first screened for VOCs using a PID. A tracer gas (helium) will be used in accordance with the NYSDOH protocols to verify the integrity of the soil vapor probe seal. Helium will be used as the tracer gas and a bucket will serve to keep it in contact with the probe during testing. A portable monitoring device will be used to analyze a sample of soil vapor for the tracer prior to sampling. Although there is an allowable amount of tracer gas that can be detected as per the NYSDOH SVI Guidance, if the tracer sample results show any presence of the tracer gas, the probe seals will be adjusted to prevent infiltration which would result in the generation of inaccurate (likely biased low) results.

A sample log sheet will be maintained summarizing sample identification, date and time of sample collection, sampling depth, identity of samplers, sampling methods and devices, soil vapor purge volumes, volume of the soil vapor extracted, vacuum of canisters before and after the samples are collected, apparent moisture content of the sampling zone and chain of custody

Sub-slab soil vapor samples will be collected in laboratory-supplied and batch-certified 6-liter Summa canisters using eight-hour regulators and exterior soil vapor samples will be collected in laboratory-supplied and batch-certified 6-liter Summa canisters using two-hour regulators. All samples will be sealed, labeled, and placed in a secure container for delivery to a NYSDOH ELAP-certified analytical laboratory. All soil vapor samples will be analyzed for EPA Method TO-15 VOCs.

3.3.2 Indoor and Ambient Air Sampling Methodology

All samples will be collected in accordance with the NYSDOH Soil Vapor Guidance. Sample locations may be adjusted based on field observations or conditions.

A total of seven indoor air samples and three outdoor ambient air samples will be collected as part of this RI. The indoor air samples will be co-located with sub-slab soil vapor samples. All indoor air samples will be collected from breathing height (three to five feet above the floor) from within the onsite basement, northern adjoining basements and southern adjoining basement. All outdoor ambient air samples will be collected from breathing height (three to five feet above the ground surface) from upgradient sampling locations. The sampling flow rate will not exceed 0.2 liters per minute (L/min). Sampling will occur for a duration of eight hours. A sample log sheet will be maintained summarizing sample identification, date and time of sample collection, sampling depth, identity of samplers, sampling methods and devices, soil vapor purge volumes, volume of the soil vapor extracted, vacuum of canisters before and after the samples are collected, apparent moisture content of the sampling zone, and chain of custody protocols.

Indoor air and ambient air samples will be collected in laboratory-supplied and individually-certified 6-liter Summa canisters using eight-hour regulators and will be sealed, labeled, and placed in a secure container for delivery to a NYSDOH ELAP-certified analytical laboratory. All samples will be analyzed for EPA Method TO-15 VOCs.

A summary table of proposed soil vapor samples and sampling rationale is included in Section 3.6 of this Work Plan.

3.4 Groundwater Sampling

The following scope of work is proposed to further characterize groundwater on-and offsite:

- One permanent bedrock monitoring well will be installed within the onsite basement approximately five feet into bedrock to assess groundwater conditions within bedrock fractures. The overburden will be cased off from the underlying bedrock during well installation to prevent downward migration of cVOC impacts into bedrock fractures;
- One permanent groundwater monitoring well will be installed within the onsite basement and will be seated above bedrock (approximately 3 to 4 ft-bbg) to further investigate onsite groundwater conditions and the potential for offsite migration of cVOC impacts;
- One permanent groundwater monitoring well will be installed within the northern adjoining basement and will be seated above bedrock (approximately 3 to 4 ft-bbg) to assess offsite and upgradient groundwater conditions;
- One permanent groundwater monitoring well will be installed offsite concurrent with an offsite soil boring to further evaluate offsite and downgradient groundwater conditions. The monitoring well will be installed in the eastern sidewalk of Pilgrim Avenue and will be seated above bedrock (approximately 20 ft-bbg);

- Gauge and collect groundwater samples from four newly-installed and three existing groundwater wells;
- Groundwater samples will be analyzed for Part 375 VOCs, SVOCs, pesticides, herbicides, PCBs, total and dissolved metals, cyanide, trivalent and hexavalent chromium, 1,4-dioxane, and PFAS; and,
- Survey newly-installed monitoring wells; collect one round of depth-to-groundwater measurements from newly-installed and previously-installed wells; and evaluate groundwater elevations and present updated groundwater contours.

Proposed RI well and existing well locations are shown on Figure 11a.

3.4.1 Groundwater Well Sampling

Three previously installed permanent monitoring wells (MW-1 through MW-3) and four newly-installed permanent monitoring wells (MW-4 through MW-6 and BW-1) will be sampled. All sampling equipment will be decontaminated prior to use. Prior to sampling, water levels will be measured using an electronic product-water level indicator. Sample collection will be accomplished by using low-flow procedures. Samples will not be collected until pH, temperature, and conductivity measurements stabilize and the turbidity reading is 50 Nephelometric Turbidity Units (NTU) or less, or stabilizes above 50 NTU.

All exterior monitoring wells will be installed using a Geoprobe® direct-push rig, all interior monitoring wells seated above bedrock will be installed using a manual sampling hammer, and the bedrock monitoring well will be installed using a hydraulic drill rig with coring capabilities. All non-bedrock monitoring wells will consist of a two-inch inner diameter (ID) PVC casing and riser. A ten-foot PVC screen (0.020-inch slot) will be installed and straddle the groundwater table (five ft above and five ft below) in the offsite and exterior well; a four-foot pre-packed PVC screen (0.020-inch slot) will be installed into the groundwater table in the interior non-bedrock wells; and a two-inch five-foot screen (0.020-inch slot) will be installed five feet into bedrock for the bedrock well. For the bedrock well, the overburden will be cased off from the underlying bedrock to prevent downward migration of cVOC impacts into bedrock fractures.

A filter pack of sand will be placed in the annular space around the screen of the monitoring wells (minimum 2-inches around the circumference of the screen) and will extend two feet above the screen. The annular area around the well casing above the sand pack will be sealed with bentonite pellets for an interval of two feet. The annular space above the bentonite pellets to one ft-bg will be backfilled with unimpacted drill cuttings. Upon completion of the well, a locking well cap will be installed atop the PVC riser and a steel flush-mount roadbox and concrete apron will be installed at grade.

Groundwater well construction logs will be completed for all of the newly constructed wells, including description of the lithology, top of casing, and screening interval. Boring and well construction logs will be included in the RIR.

The monitoring wells will be developed on the day of installation by pumping, using a peristaltic pump and dedicated high-density polyethylene (HDPE) tubing. The wells will be developed until at least three well volumes have been evacuated, turbidity reaches 50 NTU or less, or stabilized above 50 NTU, and pH, temperature, and conductivity measurements stabilize. Stability is defined as variation between field measurements of 10 percent or less and no overall upward or downward trend in measurements. All permanent monitoring wells will be surveyed to a common datum.

Samples will be collected using low-flow techniques in accordance with EPA Region 1 Low-Stress (Low-Flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells. (EQASOP-GW 001 Revision 3 dated July 30, 1996 Revised: January 19, 2010). All groundwater samples will be collected directly from dedicated tubing and placed in pre-cleaned, pre-preserved laboratory provided sample bottles, cooled to 4°C in the field, and transported under chain-of-custody command to the designated laboratory for analysis. All groundwater samples will be analyzed for the following analytes on the Part 375 list and emerging contaminants with a Category B deliverable package:

- TCL VOCs by EPA Method 8260C;
- TCL SVOCs by EPA Method 8270D;
- Pesticides by EPA Method 8081B;
- Herbicides by EPA Method 8151A;
- PCBs by EPA Method 8082A;
- Total and Dissolved TAL Metals by EPA Method 6010C/7471B;
- Total and Dissolved Cyanide by EPA Method 9010C; and
- Total and Dissolved Trivalent and Hexavalent Chromium by EPA Method 3060A;
- 1,4-Dioxane by EPA Method 8270D-SIM Modified; and
- PFAS by EPA Method 537.

Emerging contaminants (e.g., PFAS and 1,4-Dioxane) will be sampled in accordance with the current NYSDEC guidance, *Guidelines for Sampling and Analysis of PFAS Under NYSDEC's Part 375 Remedial Programs* (October 2020).

3.5 Quality Assurance / Quality Control (QA/QC)

Samples will be collected in accordance with the Quality Assurance Project Plan (QAPP) included as Appendix B.

Sample analysis will be performed by a NYSDOH ELAP-certified laboratory. The laboratory will report sample results on a 5-day turn-around time. An independent sub-consultant will validate sample results and prepare a Data Usability Summary Report (DUSR).

3.6 Summary Table of Proposed Sampling Locations

As required by Section 3.3(b) 3 of DER-10, below is a table describing all proposed sampling locations and QA/QC samples.

Table 6. Proposed Sampling Locations and AnalysisSoil

Sample Location	Media	Sampling Intervals	Analytical Parameters	Sampling Method / Minimum Reporting Levels	Rationale	QA/QC Samples
SB-2	Soil	From the two-foot interval directly below the basement slab and the two-foot interval directly above bedrock	Part 375 Analytes, PFAAs, and 1,4-Dioxane (two samples from each boring) All additional samples: TCL VOCs only	EPA 537 Modified / MDL less than 1 ug/kg for PFAAs; EPA 8270 / MDL less than 0.1 mg/kg for 1,4-Dioxane; EPA 8260C, 8270D, 8081B, 8082A, 8151A, 7196A, 3050B, 7471B, 9010C/9012B/9014 and 3060A/7196 / MDL less than Unrestricted Use SCOs	Site Coverage	1 duplicate, 1 field blank, and 1 MS/MSD per 20 samples; 1 trip blank per sample delivery group
SB-3						
SB-1		From each one-foot interval directly below the basement slab to the top of bedrock (analysis of more than two samples will depend on preceding interval results)			Onsite vertical and horizontal delineation of known chlorinated solvent impacts	
SB-4						
SB-5						
SB-6						
SB-7						
SB-8						
SB-9						
SB-10		From the zone of highest suspected contamination or, if no contamination is observed, the two-foot interval above the groundwater interface	TCL VOCs	EPA 8260C	Assess offsite soil conditions	

Sample Location	Media	Sampling Intervals	Analytical Parameters	Sampling Method / Minimum Reporting Levels	Rationale	QA/QC Samples
SB-11	Soil	From each one-foot interval directly below the basement slab to the top of bedrock (analysis of more than two samples will depend on preceding interval results)	Part 375 Analytes, PFAAs, and 1,4-Dioxane (two samples from each boring) All additional samples: TCL VOCs only	EPA 537 Modified / MDL less than 1 ug/kg for PFAAs; EPA 8270 / MDL less than 0.1 mg/kg for 1,4-Dioxane; EPA 8260C, 8270D, 8081B, 8082A, 8151A, 7196A, 3050B, 7471B, 9010C/9012B/9014 and 3060A/7196 / MDL less than Unrestricted Use SCOs	Site Coverage	1 duplicate, 1 field blank, and 1 MS/MSD per 20 samples; 1 trip blank per sample delivery group
SB-12						
SB-13						

Groundwater

Sample Location	Media	Sampling Intervals	Analytical Parameters	Sampling Method / Minimum Reporting Levels	Rationale	QA/QC Samples
MW-1	Groundwater	10 ft screen across groundwater interface (4 to 19 ft-bsg)	Part 375 analytes including total and dissolved metals; 1,4-dioxane; PFAAs	EPA 8260C, 8270D, 8270D-SIM Modified, 8081B, 8151A, 7196A, 3050B, 7471B, 9010C/9012B/9014, 3060A/7196 and 537 / MDL less than Class GA Standards for Part 375 analytes; MDL less than 0.28 ug/L for 1,4-dioxane; MDL less than 2 nanograms per liter (ng/L) for PFAAs	Assess offsite groundwater conditions	1 duplicate, 1 field blank, and 1 MS/MSD per 20 samples; 1 trip blank per sample delivery group
MW-2						
MW-3						
MW-4		4 ft pre-packed screen (0 to 4 ft-bbg)				
MW-5						
MW-6						
BW-1		5 ft screen in bedrock (4 to 9 ft-bbg)				

Soil Vapor and Outdoor Air

Sample Location	Media	Sampling Intervals	Analytical Parameters	Sampling Method / Minimum Reporting Levels	Rationale	QA/QC Samples		
SS-1	Sub-slab Soil Vapor	Max 2 inches below floor slab	TO-15 VOCs	EPA TO-15 / MDL less than 1.00 ug/m3	Assess sub-slab soil vapor conditions onsite	None		
SS-2								
SS-3								
SS-4								
SS-5								
SS-6								
SS-7								
SV-1	Exterior Soil Vapor	10 ft-bsg						
SV-2								
SV-3								
IA-6	Indoor Air	Breathing height (3-5 feet above the ground)					Assess indoor air conditions onsite	
IA-7								
IA-8								
IA-9								
IA-10								
IA-11								
IA-12								
AA-1	Outdoor Air			Assess outdoor air conditions onsite				
AA-2				Assess ambient air conditions offsite				
AA-3								

Quality Assurance / Quality Control

Sample Location	Media	Sampling Intervals	Analytical Parameters	Rationale
Trip Blanks	QA / QC	--	Part 375 analytes and/or 1,4-dioxane and PFAAs, as necessary	Quality assurance and quality control
Soil Duplicate				
Soil Blank				
Soil MS/MSD				
Groundwater Duplicate				
Groundwater Blank				
Groundwater MS/MSD				

MDL – Method Detection Limit

Reporting limits are laboratory- and sampling event-specific. The overall objective is to ensure that the minimum reporting levels are such that they can be used to evaluate potential sources, assess risk from detected compounds, and compare detected concentrations against applicable regulatory levels.

3.7 Qualitative Exposure Assessment

Following receipt of the sample results, a QHHEA will be completed in accordance with Section 3.3(c)4 and Appendix B (NYSDOH guidance for preparing a qualitative human health exposure assessment) of DER-10. The QHHEA will utilize the results of the RI to evaluate and document potential exposure routes and identify and characterize potential current and future receptors. The results of the RI will be used to identify potential human exposure scenarios associated with contaminants in sub-slab soil vapor, indoor air, soil, and groundwater. The results of the QHHEA will be included in the RIR.

3.8 Health and Safety Plan (HASP)

All work at the Site will be completed in accordance with the Health and Safety Plan (HASP) included in Appendix C.

3.9 Air Monitoring

The NYSDOH Generic Community Air Monitoring Plan (CAMP), included as Appendix 1A of DER-10 and, will be implemented during all ground-intrusive sampling activities. Special requirements will be implemented during any ground-intrusive work occurring within twenty feet of potentially exposed individuals or building openings (windows, vents, doors, etc.). Also, special requirements will be implemented during all work completed inside an occupied building. Details of the CAMP are included in Appendix D.

Daily CAMP reports will be sent to the NYSDOH and NYSDEC Project Manager via email. Daily reports will include a Site figure depicting Work Zones; activities; wind direction, in addition to CAMP monitor readings and CAMP station locations. Any exceedances of CAMP readings, corrective actions taken, and indication of whether the corrective actions reduced readings to below action levels will be communicated to the NYSDEC and the NYSDOH Project Managers as soon as practicable on the day of occurrence.

3.10 Investigation-Derived Waste (IDW)

Following the completion of sampling, boreholes will be backfilled with clean cuttings or sand. If grossly contaminated soil cuttings are encountered or if excess soil cuttings are generated, they will be placed in 55-gallon drums. Purge water and other investigation-derived waste (IDW) will be containerized in 55-gallon drums. After the investigation is complete, the drum contents will be characterized for offsite disposal and, if cVOC concentrations do not indicate the waste materials need to be disposed of as hazardous waste, a contained-in determination will be requested from NYSDEC.

3.11 Reporting

A RIR will be prepared in accordance with the requirements of DER-10. The report will include details of the sampling, tabulated sample results and an assessment of the data and conclusions. If warranted, recommendations for additional actions will be included.

Soil sample results will be compared to the Protection of Groundwater and Commercial Use SCOs as included in Part 375-6.8 and PFAS results will be compared to NYSDEC's October 2020 PFAS Guidelines. Groundwater sample results will be compared to the Class GA Standards with the exception of the emerging contaminants, which will be compared to NYSDEC's MCL. Sub-slab and indoor air sample results will be compared to NYSDOH Soil Vapor Guidance Matrices. The results of all media will be evaluated comprehensively to determine the need for additional investigation and/or remediation.

The report will also include the qualitative exposure assessment, CAMP results, laboratory data packages, DUSR, geologic logs, well construction diagrams and well purging/sampling logs. All data will also be submitted electronically to NYSDEC via the Environmental Information Management System (EIMS) in EqUIS format.

4.0 SCHEDULE

Project activities (Tasks 1-3) will be completed within approximately nine weeks after RIWP approval by NYSDEC, assuming there are no limitations on work in NYC and that social distancing can be maintained. The following project schedule has been developed:

Work Plan Implementation Schedule

Task Number	Task	Estimated Task Duration (business days)	Total Duration (business days)
0	Work Plan Approval	0	0
1	Mobilization	25 after approval of the RIWP	25
2	Soil Boring, Monitoring Well and Soil Vapor Point Installation / Soil Sampling	3	28
3	Groundwater and Soil Vapor Sampling	2	30
4	Laboratory Analysis	15	45
5	Draft Report and Data Validation	30	75
6	Submittal of RI Report	1	76

5.0 REFERENCES

New York State Department of Environmental Conservation, Division of Environmental Remediation. DER Technical Guidance for Site Investigation and Remediation (DER-10). NYSDEC 2010.

New York State Department of Environmental Conservation DEC Policy. Commissioner's Policy 51 – Soil Cleanup Guidance. October 21, 2010. NYSDEC 2010.

New York State Department of Environmental Conservation. Guidelines for Sampling and Analysis of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs. October 2020. NYSDEC 2020.

New York State Department of Health. Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York (NYSDOH, October 2006 with revisions).

Phase II Environmental Site Assessment, 2925 Westchester Avenue, Bronx, NY 10461, Castleton Environmental, August 2019.

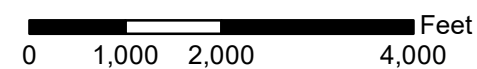
Due Diligence Investigation Report , 2921 Westchester Avenue, Bronx, NY 10461, Tenen Environmental, LLC, May 2020.

Figures



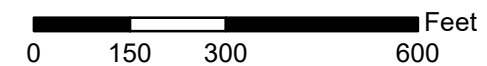
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Site Location



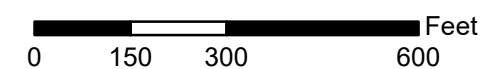
<http://gis.nyc.gov/taxmap/map.htm>

Department of Finance Digital Tax Map



Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community
NYC Department of City Planning, Information Technology Division

Department of City Planning MapPLUTO - 2018 v2.1



Site

TENEN ENVIRONMENTAL

2921 Westchester Avenue
Bronx, New York
Block 4164, Lot 5

Tenen Environmental, LLC
121 West 27th Street
Suite 702
New York, NY 10001
O: (646) 606-2332
F: (646) 606-2379

Drawn By LM

Checked By AP

Date December 2020

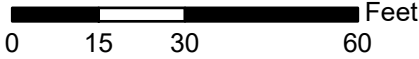
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Site Location Map

Figure 1

Drawing Title

Drawing No



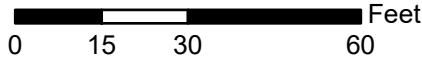
- Legend**
- Site Boundary
 - Home Store
 - Boost Mobile
 - Site (Vacant Space)
 - Barber Shop
 - Block 4164, Tax Lot 5



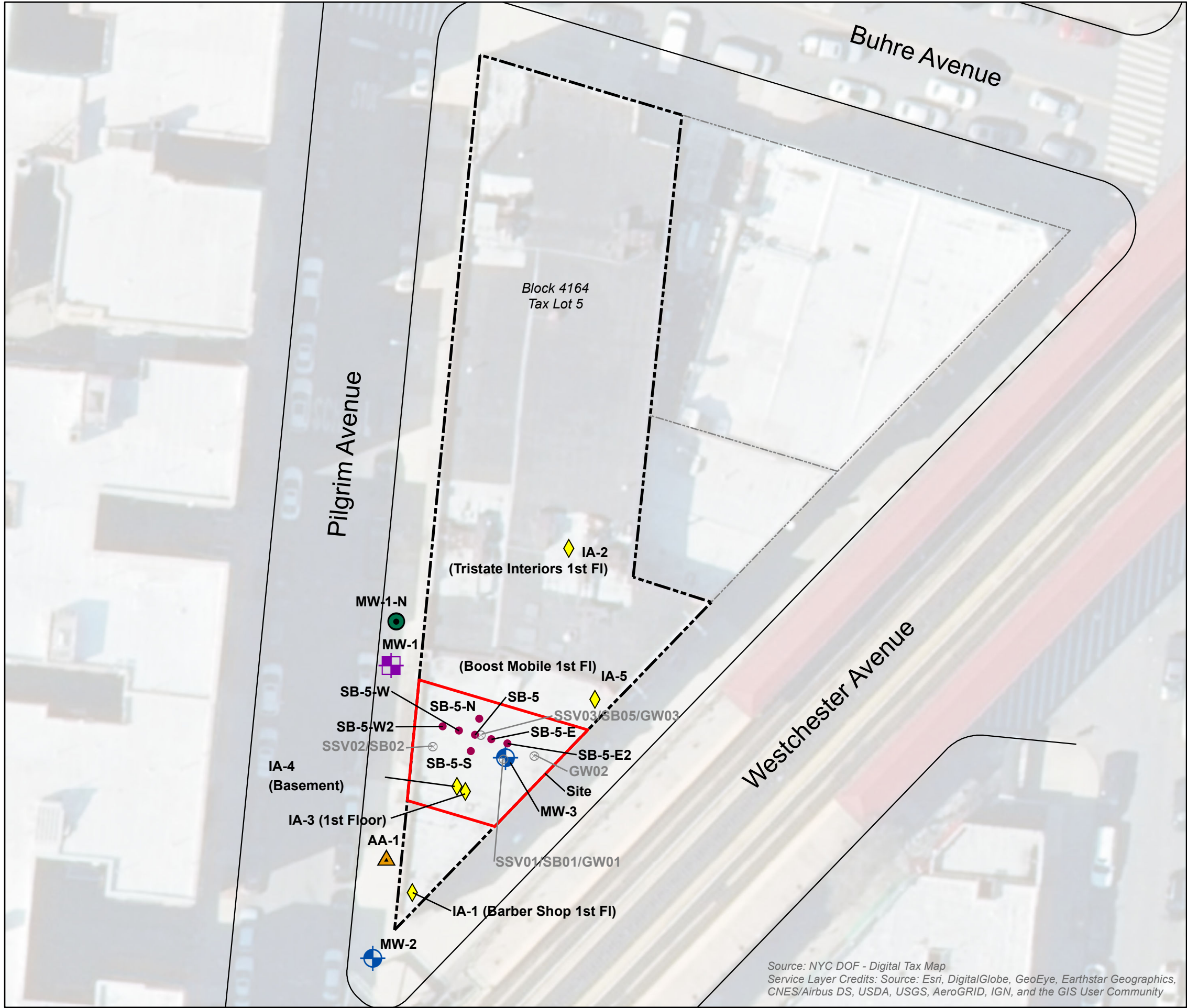
Drawing Title	Commercial Space Layout		Drawing No	Figure 2
	Drawn By	LM		
	Checked By	CZ	Date	December 2020
	Scale	As Noted		
TENEN ENVIRONMENTAL		Tenen Environmental, LLC 121 West 27th Street Suite 702 New York, NY 10001 O: (646) 606-2332 F: (646) 606-2379		
2921 Westchester Avenue Bronx, New York Block 4164, Lot 5		Site		



- Legend**
- Site Boundary
 - Cellar Spaces
 - Home Store
 - Boost Mobile
 - Site (Vacant Space)
 - Barber Shop
 - Block 4164, Tax Lot 5



Drawing Title	Cellar Spaces Layout	
	Figure 3	
Drawing No	2921 Westchester Avenue Bronx, New York Block 4164, Lot 5	
	Site	
Drawn By	LM	<div>TENEN ENVIRONMENTAL</div> Tenen Environmental, LLC 121 West 27th Street Suite 702 New York, NY 10001 O: (646) 606-2332 F: (646) 606-2379
Checked By	CZ	
Date	December 2020	
Scale	As Noted	

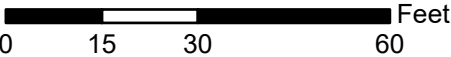


Source: NYC DOF - Digital Tax Map
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Legend

- Soil Delineation Sample Location
- Soil Boring Location
- Groundwater Sampling Location
- Soil and Groundwater Sampling Location
- Indoor Air Sampling Location
- Ambient Air Sampling Location
- Castleton Environmental Soil, GW and SV Sampling Locations, 2019
- Neighboring Tax Lots
- Block 4164, Tax Lot 5
- Site Location
- 2921 Westchester Avenue



Site

TENEN ENVIRONMENTAL

Tenen Environmental, LLC
121 West 27th Street
Suite 702
New York, NY 10001
O: (646) 606-2332
F: (646) 606-2379

Drawn By LM

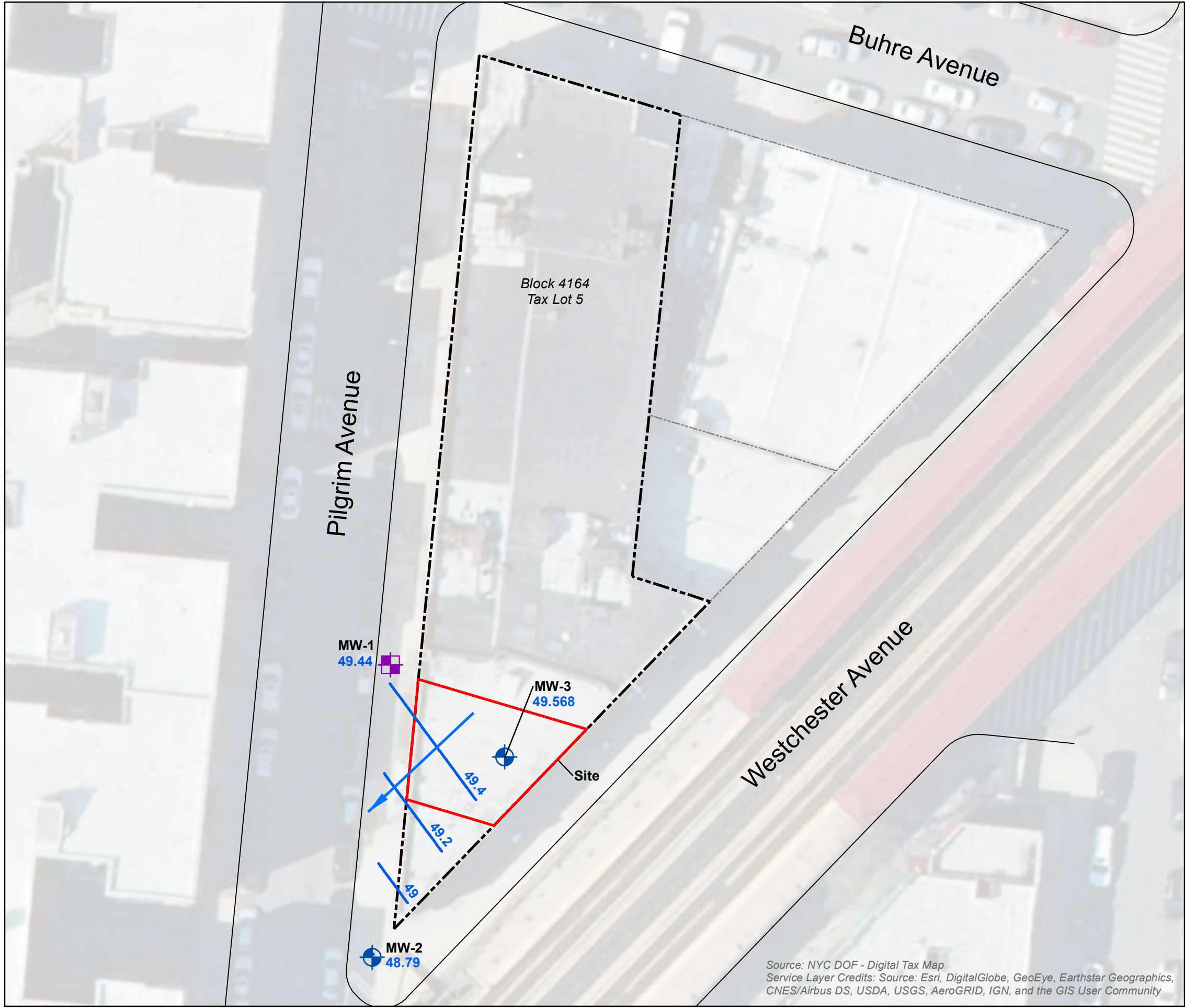
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Date December 2020

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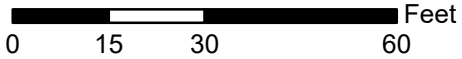
Drawing Title
Historical Sampling Locations

Drawing No
Figure 4



Source: NYC DOF - Digital Tax Map
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics,
CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

- Legend**
- Groundwater Sampling Location
 - Soil and Groundwater Sampling Location
 - Groundwater Elevation Contour
 - Neighboring Tax Lots
 - Block 4164, Lot 5
 - Site Location
 - 2921 Westchester Avenue
 - Groundwater Flow Direction



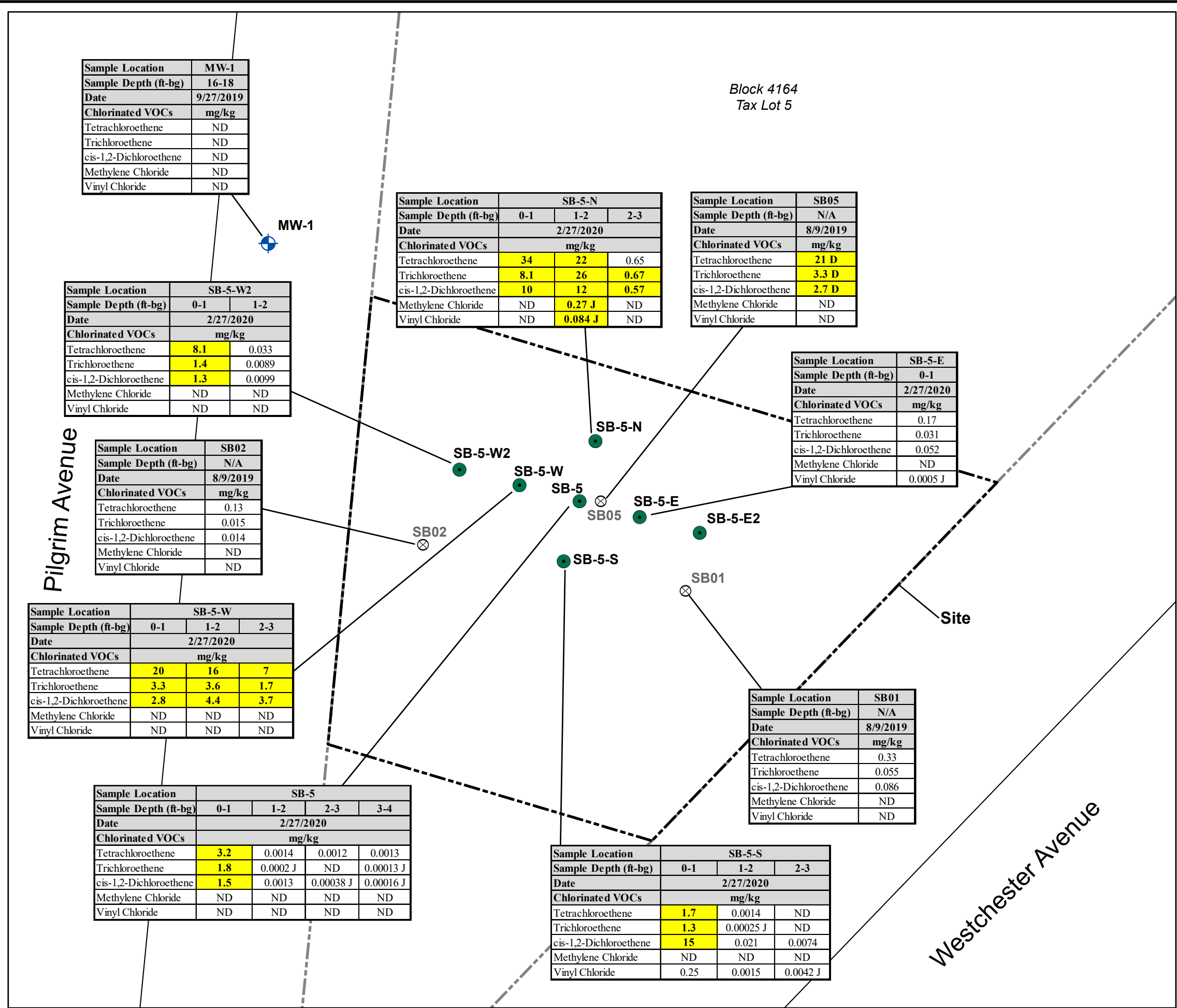
Site

TENEN ENVIRONMENTAL

Tenen Environmental, LLC
121 West 27th Street
Suite 702
New York, NY 10001
O: (646) 606-2332
F: (646) 606-2379

Drawn By	LM
Checked By	AP
Date	December 2020
Scale	As Noted

Drawing Title	Groundwater Flow Map
Drawing No	Figure 5



Analyte	NY-UNRES	NY-PGW
Chlorinated VOCs	mg/kg	
Tetrachloroethene	1.3	1.3
Trichloroethene	0.47	0.47
cis-1,2-Dichloroethene	0.25	0.25
Methylene Chloride	0.05	0.05
Vinyl Chloride	0.02	0.02

- Notes:
1. Bold and shaded yellow value indicates concentration exceeds NY-UNRES and NY-PGW SCO's
 2. NY-UNRES = 6 NYCRR Part 375 Unrestricted Use Soil Cleanup Objectives
 3. NY-PGW = 6 NYCRR Part 375 Restricted Protection of Groundwater Soil Cleanup Objectives
 4. D = Concentration is from an analysis that required a dilution
 5. J = Estimated value
 6. ND = Not detected
 7. NS = No standard
 8. Soil samples SB01, SB02, and SB05 were collected as part of Castleton's Phase II ESI and sample depths were not indicated

- Legend
- Soil Delineation Sample Locations
 - Soil/Groundwater Sample Location
 - Castleton Environmental Soil Sample Locations
 - Block 4164, Tax Lot 5
 - Site Location 2921 Westchester Avenue



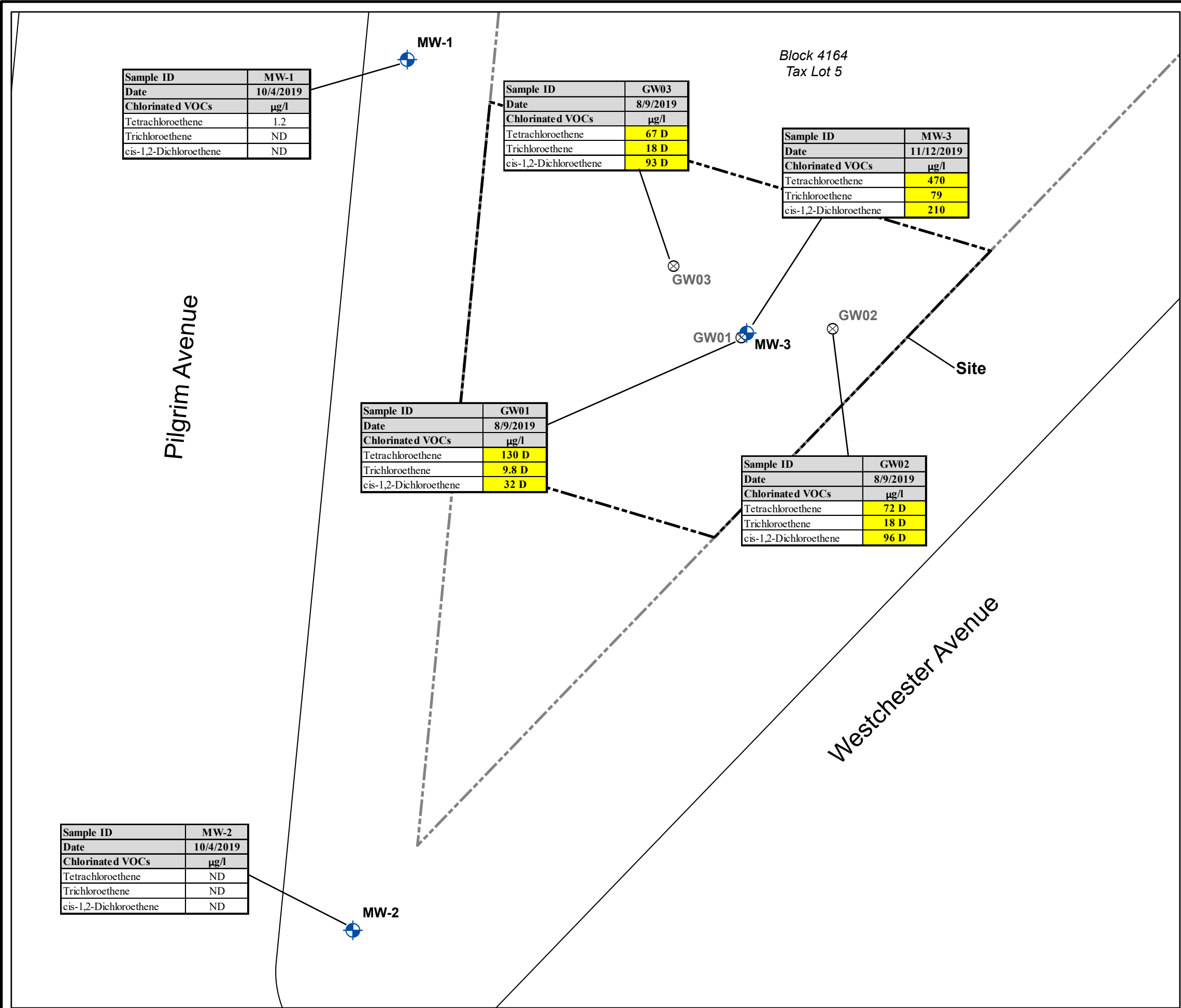
2921 Westchester Avenue
Bronx, New York
Block 4164, Lot 5

TENEN ENVIRONMENTAL
Tenen Environmental, LLC
121 West 27th Street
Suite 702
New York, NY 10001
O: (646) 606-2332
F: (646) 606-2379

LM
AP
December 2020
As Noted

Chlorinated VOCs in Soil

Figure 6



Analyte	NY-AWQS
Chlorinated VOCs	µg/l
Tetrachloroethene	5
Trichloroethene	5
cis-1,2-Dichloroethene	5

- Notes:
- 1. Bold and shaded yellow value indicates concentration exceeds NY-AWQS
 - 2. NY-AWQS = NYSDEC Division of Technical and Operational Guidance Series (TOGS) 1.1.1 Ambient Water Quality Standards (AWQS)
 - 3. J = Estimated value
 - 4. ND = Not detected
 - 5. D = Concentration is from an analysis that required a dilution
 - 6. Groundwater samples GW01, GW02, and GW03 were collected as part of Castleton's Phase II ESI

- Legend
- Soil/Groundwater Sample Location
 - Castleton Environmental
 - Groundwater Sample Locations
 - Block 4164, Tax Lot 5
 - Site Location
 - 2921 Westchester Avenue



2921 Westchester Avenue
Bronx, New York
Block 4164, Lot 5

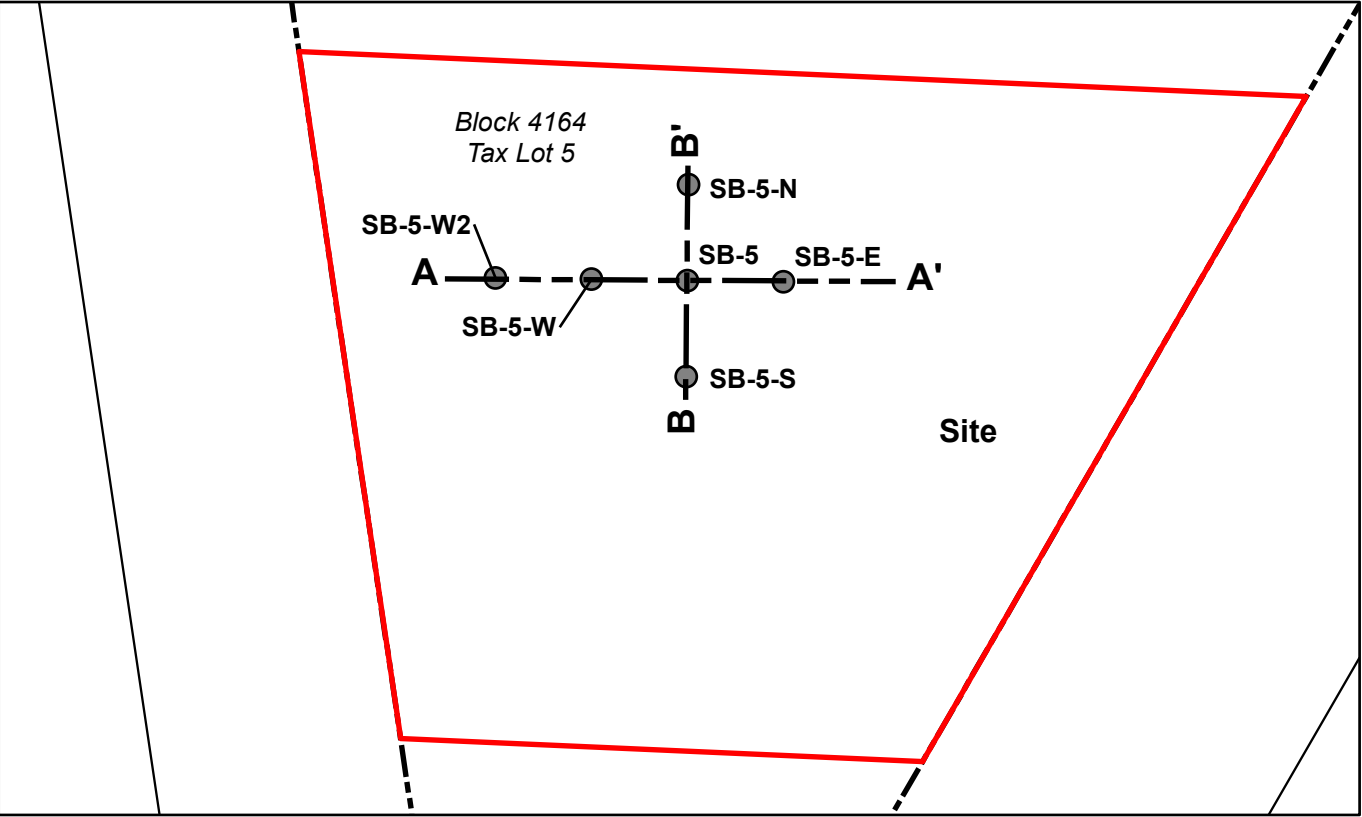
TENEN ENVIRONMENTAL

Tenen Environmental, LLC
121 West 27th Street
Suite 702
New York, NY 10001
O: (646) 606-2332
F: (646) 606-2379

Drawn By	LM
Checked By	AP
Date	December 2020
Scale	As Noted

Chlorinated VOCs
in Groundwater

Figure 7

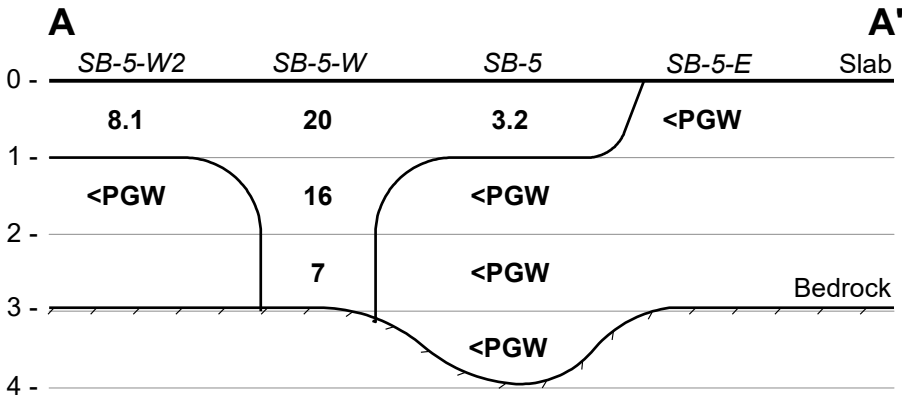


Approximate Areas of PCE in Soil		
Depth	Area > 10 mg/kg	Area <10 mg/kg, >PGW
0-1 ft	50 sf	60 sf
1-2 ft	30 sf	30 sf
2-3 ft	0	15 sf

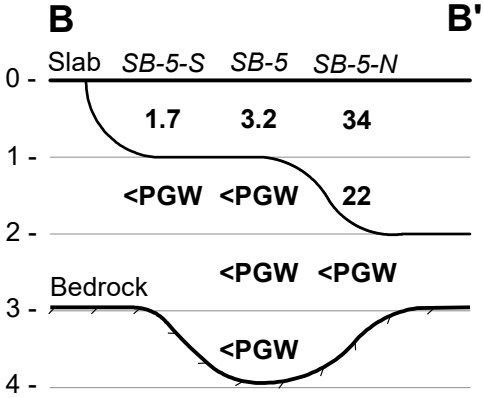
Note:
PGW - Protection of Groundwater Standard

- Legend**
- Soil Delineation Sample Locations
 - Site Location
 - 2921 Westchester Avenue
 - Block 4164, Tax Lot 5

Source: NYC DOF - Digital Tax Map



Section A-A'
Horiz. Scale 1" = 5'
Vert. Scale 1" = 2.5'



Section B-B'
Horiz. Scale 1" = 5'
Vert. Scale 1" = 2.5'

2921 Westchester Avenue
Bronx, New York
Block 4164, Lot 5

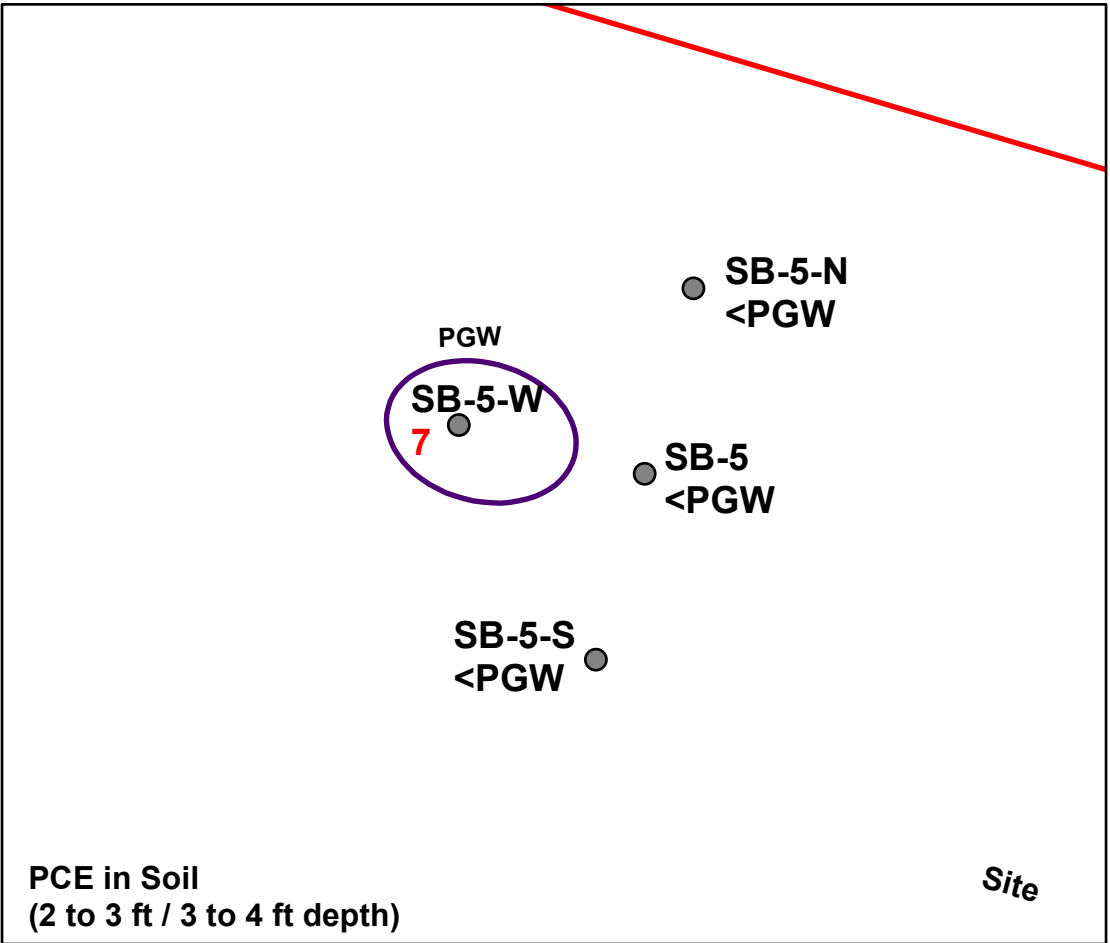
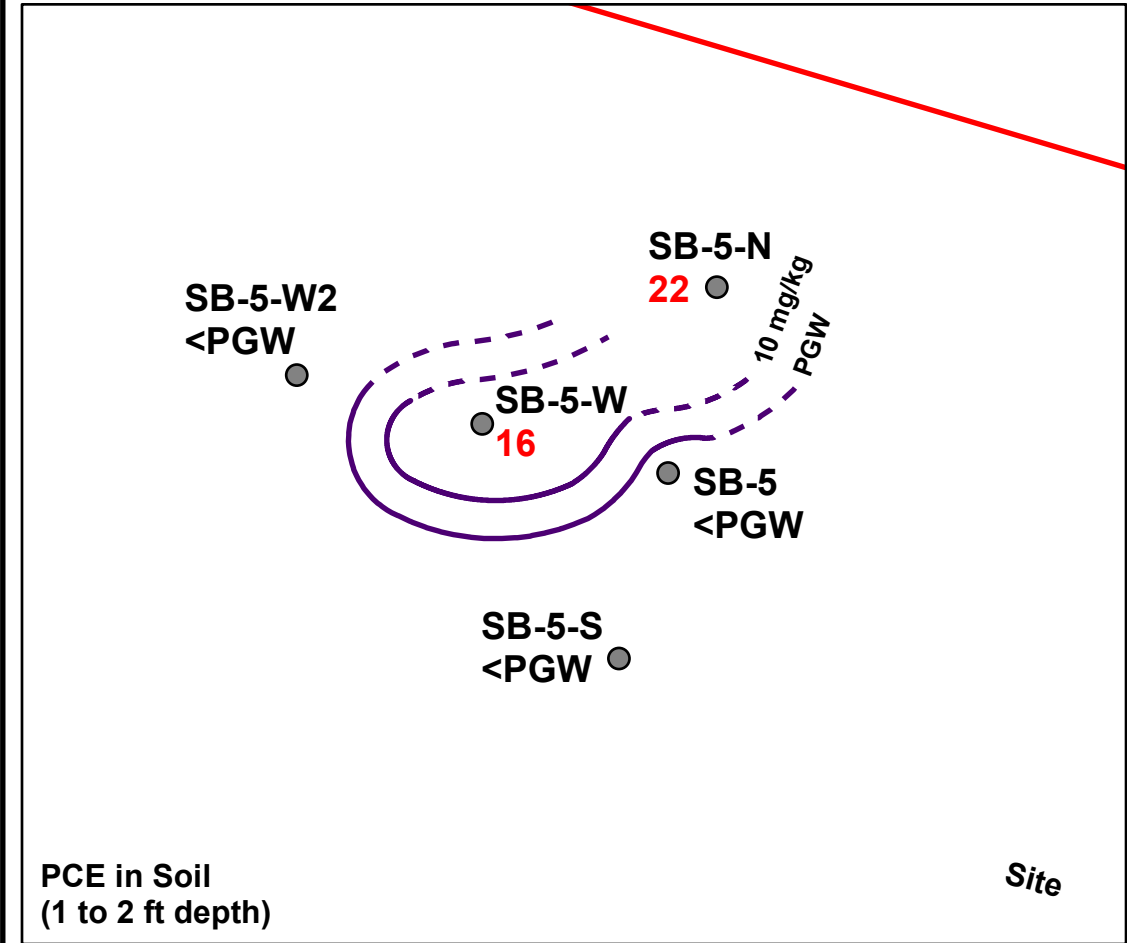
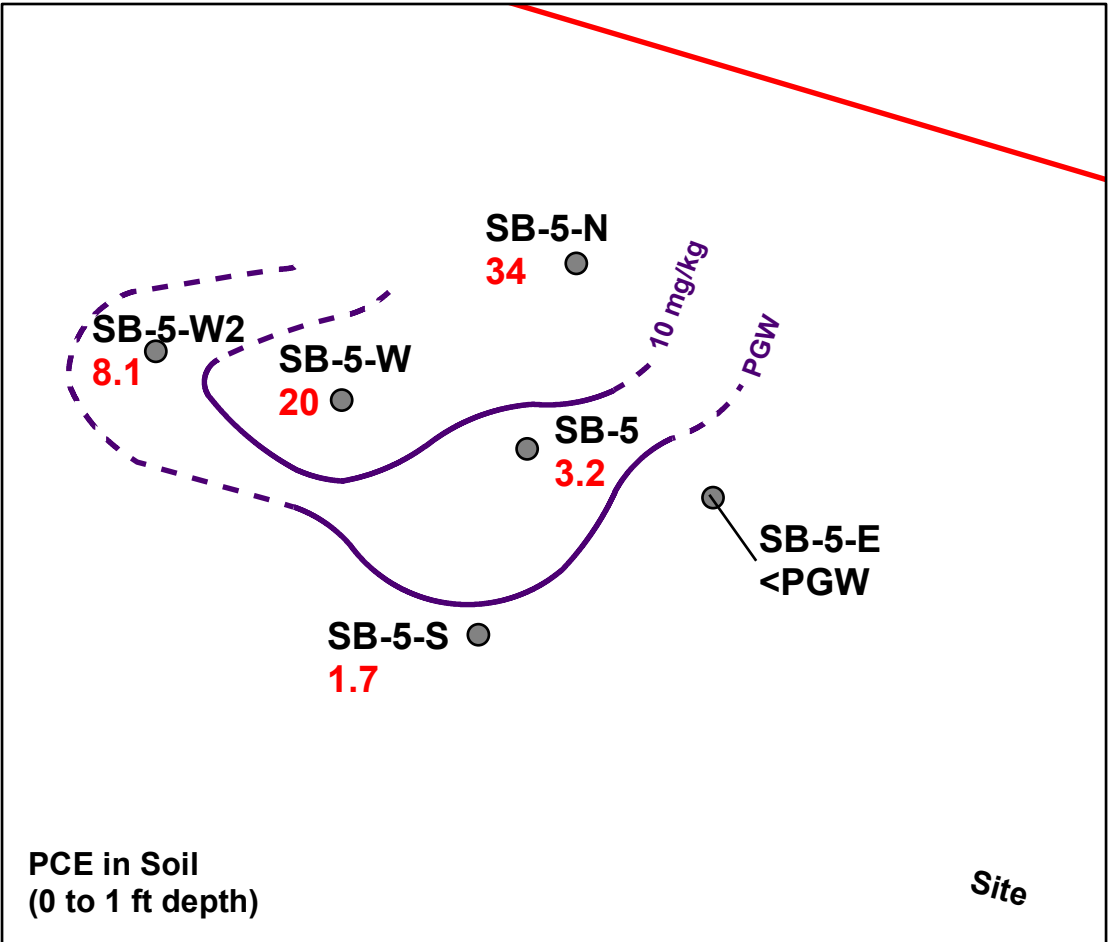
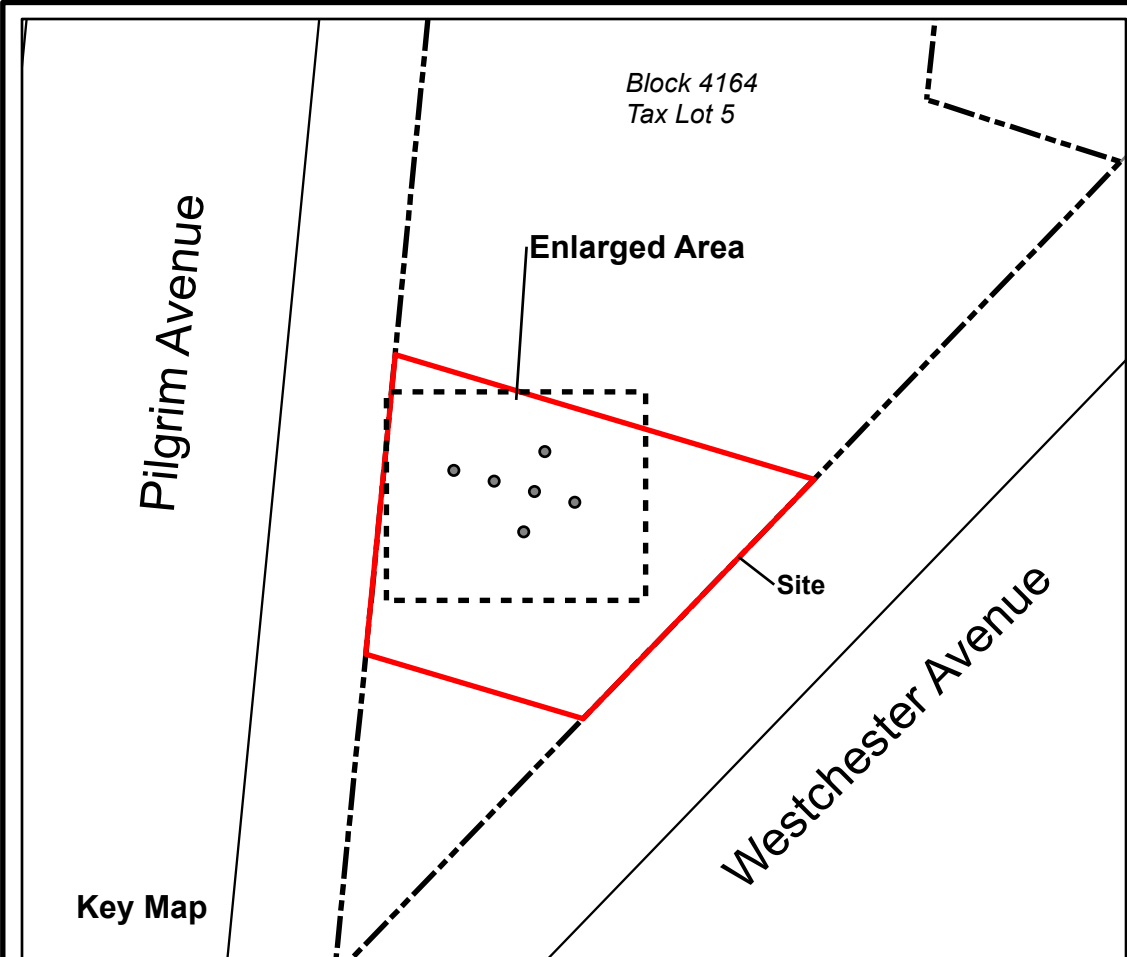
TENEN ENVIRONMENTAL

Tenen Environmental, LLC
121 West 27th Street
Suite 702
New York, NY 10001
O: (646) 606-2332
F: (646) 606-2379

Drawn By	LM
Checked By	AP
Date	December 2020
Scale	As Noted

PCE Impacts above Groundwater Standards - Cross-Sections

Figure 9



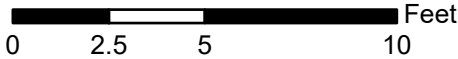
Approximate Areas of PCE in Soil		
Depth	Area > 10 mg/kg	Area <10 mg/kg, >PGW
0-1 ft	50 sf	60 sf
1-2 ft	30 sf	30 sf
2-3 ft	0	15 sf

Note:
PGW - Protection of Groundwater Standard

Legend

- Soil Delineation Sample Locations
- Contour PCE in Soil
- - - Contour PCE in Soil (Inferred)
- - - - - Neighboring Tax Lots
- - - - - Block 4164, Tax Lot 5
- Site Location
2921 Westchester Avenue

Source: NYC DOF - Digital Tax Map



Site

2921 Westchester Avenue
Bronx, New York
Block 4164, Lot 5

TENEN ENVIRONMENTAL

Tenen Environmental, LLC
121 West 27th Street
Suite 702
New York, NY 10001
O: (646) 606-2332
F: (646) 606-2379

Drawn By
LM

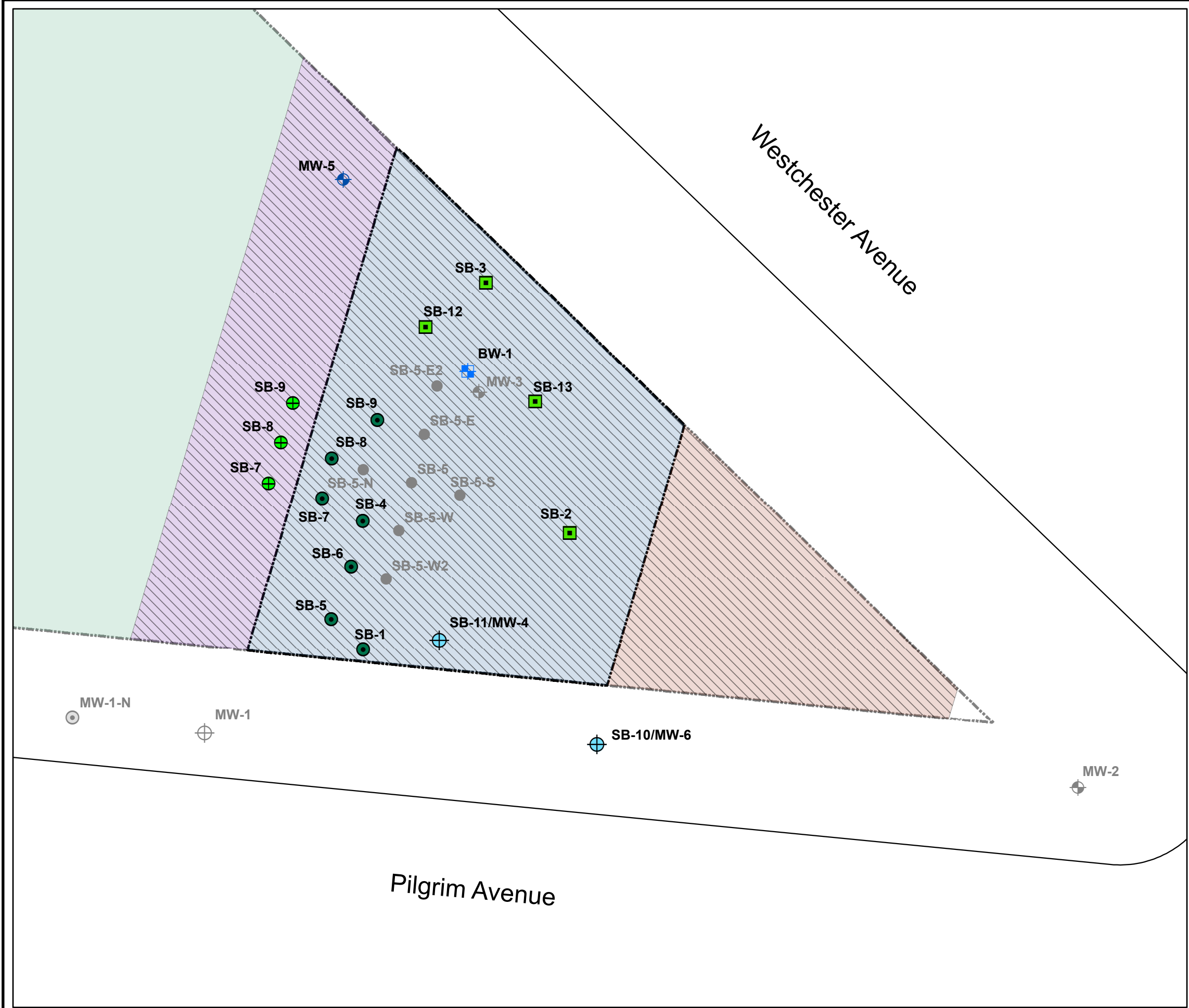
Checked By
AP

Date
December 2020

Scale
As Noted

Drawing Title
PCE Isopleths in Soil (0 to 1 ft,
1 ft to 2 ft, & 2 ft to 3 ft depths)

Drawing No
Figure 10



Legend

Proposed RI Sample Locations

- Delineation Boring Sample Location
- Characterization Boring Sample Location
- Monitoring Well Sample Location
- Monitoring Well Location (Bedrock Well)
- Soil Boring/Monitoring Well Location
- Contingency Borings

Tenen Due Diligence Sample Locations

- Soil Boring Sample Location
- Groundwater Sample Location
- Soil Boring/Groundwater Sample Location
- Soil Delineation Sample Locations

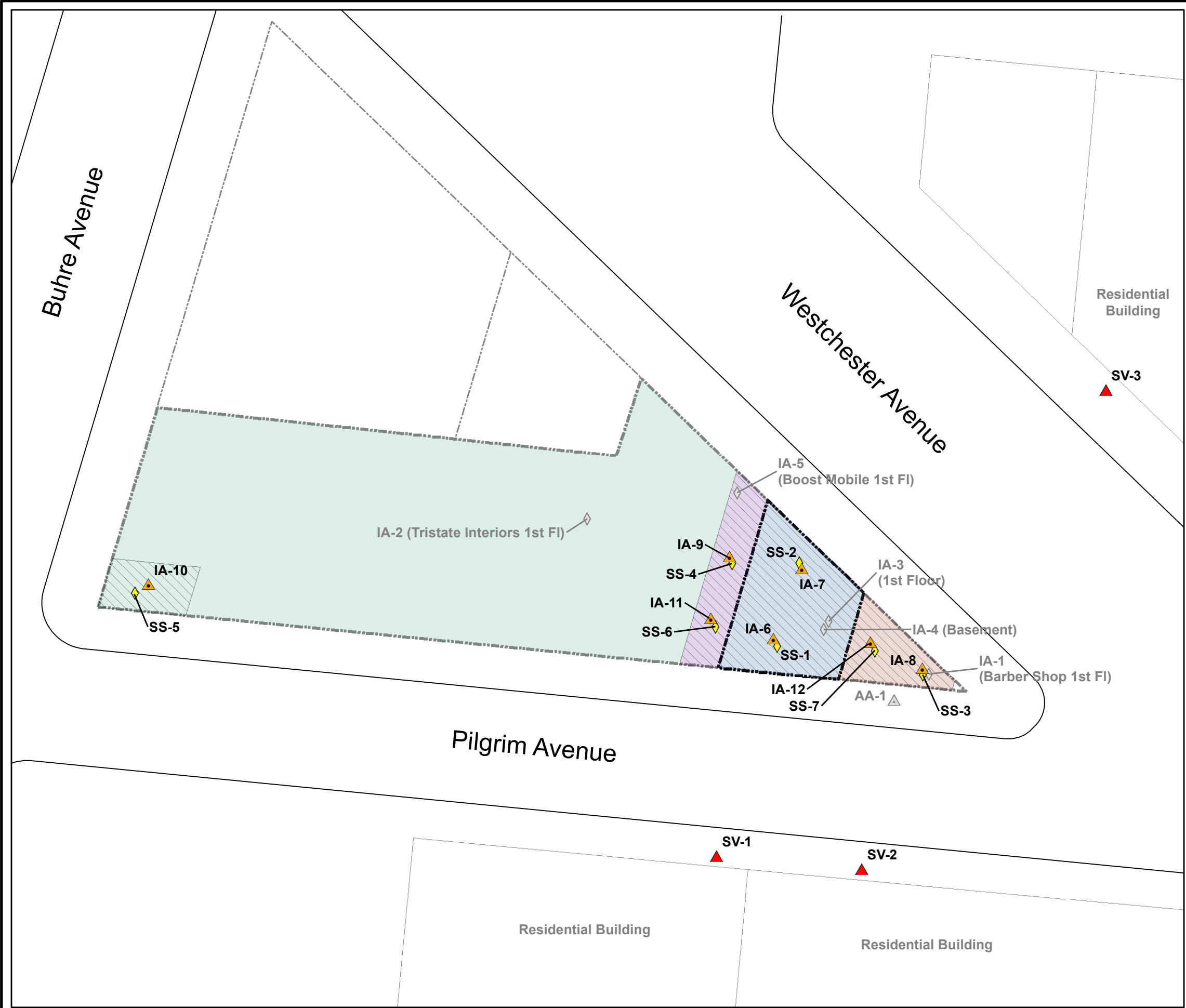
- Cellar Spaces
- Home Store
- Boost Mobile
- Site/Vacant Space
- Barber Shop
- Site Boundary
- Tax Lot

Note: Contingency Borings will be installed if the corresponding Delineation Borings cannot be installed due to the presence of foundational elements.

0 2.5 5 10 15 20 Feet

North

Drawing Title		Proposed Soil and Groundwater Sampling Locations		Drawn By LM		<div>TENEN ENVIRONMENTAL</div>		Site
Drawing No		Figure 11a		Checked By AP		Tenen Environmental, LLC 121 West 27th Street Suite 702 New York, NY 10001 O: (646) 606-2332 F: (646) 606-2379		2921 Westchester Avenue Bronx, New York Block 4164, Lot 5
				Date December 2020				
				Scale As Noted				



Legend

Proposed RI Sample Locations

- ▲ Soil Vapor Sample Location
- ◆ Sub-Slab Soil Vapor Location
- ▲ Indoor Air Sample Location

Tenen Due Diligence Sample Locations

- △ Ambient Air Sample Location
- ◇ Indoor Air Sample Location
- ▨ Cellar Spaces
- Home Store
- Boost Mobile
- Site/Vacant Space
- Barber Shop
- ▭ Site Boundary
- Tax Lot

Drawing Title		Drawing No	
Proposed Soil Vpaor and Indoor Air Sampling Locations		Figure 11b	
Drawn By	LM	Checked By	AP
Date	December 2020	Scale	As Noted
Site		2921 Westchester Avenue Bronx, New York Block 4164, Lot 5	
TENEN ENVIRONMENTAL		Tenen Environmental, LLC 121 West 27th Street Suite 702 New York, NY 10001 O: (646) 606-2332 F: (646) 606-2379	

Tenen Environmental, LLC

2921 Westchester Avenue, Bronx, NY
BCP Site No. C203140

Tables

Table 1. Historic Indoor Air Analytical Data
2921 Westchester Avenue
BCP #C203140

SAMPLE ID: LAB ID: COLLECTION DATE:	NYSDOH AGVs	EPA-VISL- TIACs	Units	AA-1		IA-1		IA-2		IA-3		IA-4		IA-5	
				L1945065-01 9/27/2019		L1945065-02 9/27/2019		L1945065-03 9/27/2019		L1945065-04 9/27/2019		L1945065-05 9/27/2019		L1945065-06 9/27/2019	
				Conc	Q	Conc	Q	Conc	Q	Conc	Q	Conc	Q	Conc	Q
Volatile Organic Compounds															
Dichlorodifluoromethane	NS	440	ug/m ³	1.79		1.67		1.79		1.77		1.75		1.76	
Chloromethane	NS	390	ug/m ³	0.96		1.19		1.06		1.07		0.725		1.11	
Freon-114	NS	NS	ug/m ³	ND		ND		ND		ND		ND		ND	
Vinyl chloride	NS	2.8	ug/m ³	ND		ND		ND		ND		0.054		ND	
1,3-Butadiene	NS	0.41	ug/m ³	ND		ND		0.586		ND		ND		ND	
Bromomethane	NS	22	ug/m ³	ND		ND		ND		ND		ND		ND	
Chloroethane	NS	NS	ug/m ³	ND		ND		ND		ND		ND		ND	
Ethanol	NS	NS	ug/m ³	--		5350		--		--		--		--	
Ethanol	NS	NS	ug/m ³	15.3		4260	E	55.2		315		11.9		64.3	
Vinyl bromide	NS	0.38	ug/m ³	ND		ND		ND		ND		ND		ND	
Acetone	NS	140000	ug/m ³	4.75		59.4		40.6		56.1		7.46		25.9	
Trichlorofluoromethane	NS	NS	ug/m ³	ND		ND		ND		ND		ND		ND	
Isopropanol	NS	880	ug/m ³	--		2160		--		--		--		--	
Isopropanol	NS	880	ug/m ³	1.66		2220	E	3.69		146		11.3		79.4	
1,1-Dichloroethene	NS	880	ug/m ³	ND		ND		ND		ND		ND		ND	
tert-Butyl Alcohol	NS	NS	ug/m ³	ND		12.9		ND		ND		ND		ND	
Methylene chloride	60	1200	ug/m ³	ND		ND		8.69		ND		ND		ND	
3-Chloropropene	NS	NS	ug/m ³	ND		ND		ND		ND		ND		ND	
Carbon disulfide	NS	3100	ug/m ³	ND		ND		ND		ND		ND		ND	
Freon-113	NS	NS	ug/m ³	ND		ND		ND		ND		ND		ND	
trans-1,2-Dichloroethene	NS	NS	ug/m ³	ND		ND		ND		ND		ND		ND	
1,1-Dichloroethane	NS	7.7	ug/m ³	ND		ND		ND		ND		ND		ND	
Methyl tert butyl ether	NS	47	ug/m ³	ND		ND		ND		ND		ND		ND	
2-Butanone	NS	NS	ug/m ³	ND		ND		66.9		ND		ND		4.31	
cis-1,2-Dichloroethene	NS	NS	ug/m ³	ND		ND		ND		0.111		2.05		0.583	
Ethyl Acetate	NS	310	ug/m ³	ND		ND		ND		ND		ND		ND	
Chloroform	NS	0.53	ug/m ³	ND		ND		ND		ND		11.1		2.39	
Tetrahydrofuran	NS	8800	ug/m ³	ND		ND		27.7		ND		ND		2.09	
1,2-Dichloroethane	NS	0.47	ug/m ³	ND		ND		ND		ND		ND		ND	
n-Hexane	NS	3100	ug/m ³	ND		2.67		5		0.772		ND		1.37	
1,1,1-Trichloroethane	NS	22000	ug/m ³	ND		ND		ND		ND		ND		ND	
Benzene	NS	1.6	ug/m ³	ND		1.09		2.36		0.649		ND		0.706	
Carbon tetrachloride	NS	2	ug/m ³	0.34		0.315		0.289		0.333		0.315		0.352	
Cyclohexane	NS	26000	ug/m ³	ND		ND		1.67		ND		ND		ND	
1,2-Dichloropropane	NS	3.3	ug/m ³	ND		ND		ND		ND		ND		ND	
Bromodichloromethane	NS	0.33	ug/m ³	ND		ND		ND		ND		ND		ND	
1,4-Dioxane	NS	2.5	ug/m ³	ND		ND		ND		ND		ND		ND	
Trichloroethene	2	3	ug/m ³	ND		ND		ND		ND		0.822		0.188	
2,2,4-Trimethylpentane	NS	NS	ug/m ³	ND		3.76		3.67		1		ND		0.986	
Heptane	NS	NS	ug/m ³	ND		0.848		2.81		ND		ND		ND	
cis-1,3-Dichloropropene	NS	3.1	ug/m ³	ND		ND		ND		ND		ND		ND	
4-Methyl-2-pentanone	NS	13000	ug/m ³	ND		ND		ND		ND		ND		ND	
trans-1,3-Dichloropropene	NS	3.1	ug/m ³	ND		ND		ND		ND		ND		ND	
1,1,2-Trichloroethane	NS	0.77	ug/m ³	ND		ND		ND		ND		ND		ND	
Toluene	NS	22000	ug/m ³	1.2		3.99		14.1		3.56		0.844		3.13	
2-Hexanone	NS	130	ug/m ³	ND		ND		ND		ND		ND		ND	
Dibromochloromethane	NS	NS	ug/m ³	ND		ND		ND		ND		ND		ND	
1,2-Dibromoethane	NS	0.02	ug/m ³	ND		ND		ND		ND		ND		ND	
Tetrachloroethene	30	47	ug/m ³	0.292		0.461		0.712		1.81		10.2		1.84	
Chlorobenzene	NS	220	ug/m ³	ND		ND		ND		ND		ND		ND	
Ethylbenzene	NS	4.9	ug/m ³	ND		ND		3.37		ND		ND		ND	
p/m-Xylene	NS	440	ug/m ³	ND		ND		12.2		ND		ND		ND	
Bromoform	NS	11	ug/m ³	ND		ND		ND		ND		ND		ND	
Styrene	NS	4400	ug/m ³	ND		ND		ND		ND		ND		ND	
1,1,2,2-Tetrachloroethane	NS	0.21	ug/m ³	ND		ND		ND		ND		ND		ND	
o-Xylene	NS	440	ug/m ³	ND		ND		3.09		ND		ND		ND	
4-Ethyltoluene	NS	NS	ug/m ³	ND		ND		ND		ND		ND		ND	
1,3,5-Trimethylbenzene	NS	260	ug/m ³	ND		ND		ND		ND		ND		ND	
1,2,4-Trimethylbenzene	NS	260	ug/m ³	ND		ND		1.66		ND		ND		ND	
Benzyl chloride	NS	0.25	ug/m ³	ND		ND		ND		ND		ND		ND	
1,3-Dichlorobenzene	NS	NS	ug/m ³	ND		ND		ND		ND		ND		ND	
1,4-Dichlorobenzene	NS	1.1	ug/m ³	ND		ND		ND		ND		ND		ND	
1,2-Dichlorobenzene	NS	880	ug/m ³	ND		ND		ND		ND		ND		ND	
1,2,4-Trichlorobenzene	NS	8.8	ug/m ³	ND		ND		ND		ND		ND		ND	
Hexachlorobutadiene	NS	0.56	ug/m ³	ND		ND		ND		ND		ND		ND	

Notes:

Bold and shaded yellow value indicates indoor air concentration exceeds EPA-VISL-TIACs

NYSDOH AGVs = New York State Department of Health Air Guidance Values, Guidance for Evaluating Soil Vapor Intrusion in the State of NY, Final October 2006 with May 2017 updates

EPA-VISL-TIACs = Environmental Protection Agency Vapor Intrusion Screening Limits, Commercial Target Indoor Air Concentration

Q = Laboratory Data Qualifier

ND = Not Detected

NS = No Standard

Table 2. Historic Soil Vapor Analytical Data
2921 Westchester Avenue
BCP #C203140

CLIENT SAMPLE ID	Units	SSV01		SSV02		SSV03	
SAMPLING DATE		8/1/2019		8/1/2019		8/1/2019	
LAB SAMPLE ID		19H0064-01		19H0064-02		19H0064-03	
		Qual		Qual		Qual	
Volatile Organic Compounds							
1,1,1,2-Tetrachloroethane	ug/m3	ND		ND		ND	
1,1,1-Trichloroethane	ug/m3	ND		ND		ND	
1,1,2,2-Tetrachloroethane	ug/m3	ND		ND		ND	
Freon-113	ug/m3	ND		ND		ND	
1,1,2-Trichloroethane	ug/m3	ND		ND		ND	
1,1-Dichloroethane	ug/m3	ND		ND		ND	
1,1-Dichloroethene	ug/m3	ND		ND		ND	
1,2,4-Trichlorobenzene	ug/m3	ND		ND		24	D
1,2,4-Trimethylbenzene	ug/m3	1.8	D	ND		ND	
1,2-Dibromoethane	ug/m3	ND		ND		ND	
1,2-Dichlorobenzene	ug/m3	ND		ND		ND	
1,2-Dichloroethane	ug/m3	ND		ND		ND	
1,2-Dichloropropane	ug/m3	ND		ND		ND	
1,2-Dichlorotetrafluoroethane	ug/m3	ND		ND		ND	
1,3,5-Trimethylbenzene	ug/m3	ND		ND		ND	
1,3-Butadiene	ug/m3	ND		ND		ND	
1,3-Dichlorobenzene	ug/m3	ND		ND		ND	
1,3-Dichloropropane	ug/m3	ND		ND		ND	
1,4-Dichlorobenzene	ug/m3	ND		ND		ND	
1,4-Dioxane	ug/m3	ND		ND		ND	
2-Butanone	ug/m3	0.66	D	0.78	D	1.3	D
2-Hexanone	ug/m3	ND		ND		ND	
3-Chloropropane	ug/m3	ND		ND		ND	
4-Methyl-2-pentanone	ug/m3	ND		ND		ND	
Acetone	ug/m3	9.6	D	6.7	D	55	D
Acrylonitrile	ug/m3	ND		ND		ND	
Benzene	ug/m3	0.66	D	0.58	D	1.9	D
Benzyl chloride	ug/m3	ND		ND		ND	
Bromodichloromethane	ug/m3	ND		ND		ND	
Bromoform	ug/m3	ND		ND		ND	
Bromomethane	ug/m3	ND		ND		ND	
Carbon disulfide	ug/m3	0.7	D	ND		ND	
Carbon tetrachloride	ug/m3	0.54	D	0.52	D	ND	
Chlorobenzene	ug/m3	ND		ND		ND	
Chloroethane	ug/m3	ND		ND		ND	
Chloroform	ug/m3	5.1	D	3	D	ND	
Chloromethane	ug/m3	0.75	D	1	D	1.7	D
cis-1,2-Dichloroethene	ug/m3	63	D	23	D	ND	
cis-1,3-Dichloropropene	ug/m3	ND		ND		ND	
Cyclohexane	ug/m3	ND		ND		ND	
Dibromochloromethane	ug/m3	ND		ND		ND	
Dichlorodifluoromethane	ug/m3	2.2	D	2	D	ND	
Ethyl acetate	ug/m3	ND		ND		ND	
Ethyl benzene	ug/m3	ND		ND		ND	
Hexachlorobutadiene	ug/m3	ND		ND		ND	
Isopropanol	ug/m3	ND		ND		13	D
Methyl methacrylate	ug/m3	1.2	D	ND		ND	
Methyl tera butyl ether	ug/m3	ND		ND		ND	
Methylene chloride	ug/m3	4.9	D	2	D	3.3	D
n-Heptane	ug/m3	ND		ND		ND	
n-Hexane	ug/m3	ND		ND		ND	
o-Xylene	ug/m3	1.6	D	ND		ND	
p/m-Xylenes	ug/m3	2.4	D	ND		ND	
p-Ethyltoluene	ug/m3	1.1	D	ND		ND	
Propylene	ug/m3	ND		ND		1.1	D
Styrene	ug/m3	0.88	D	ND		ND	
Tetrachloroethene	ug/m3	230	D	100	D	ND	
Tetrahydrofuran	ug/m3	ND		ND		ND	
Toluene	ug/m3	2.8	D	1.5	D	5.4	D
trans-1,2-Dichloroethene	ug/m3	23	D	3.2	D	2.8	D
trans-1,3-Dichloropropene	ug/m3	ND		ND		ND	
Trichloroethene	ug/m3	33	D	11	D	ND	
Trichlorofluoromethane	ug/m3	1.6	D	1.6	D	ND	
Vinyl acetate	ug/m3	ND		ND		ND	
Vinyl bromide	ug/m3	ND		ND		ND	
Vinyl chloride	ug/m3	1.1	D	0.42	D	ND	

Notes:

D = Diluted

ND = Not detected

All samples were collected as part of Castleton's 2019 Phase II ESI

Table 3. Historic Soil Analytical Data
2921 Westchester Avenue
BCP #C203140

CLIENT SAMPLE ID	NY-PGW	NY-RESC	Units	SB01	SB02	SB05
SAMPLING DATE				8/9/2019	8/9/2019	8/9/2019
LAB SAMPLE ID				19H0455-01	19H0455-02	19H0455-05
				Qual	Qual	Qual
General Chemistry						
Solids, Total	NS	NS	%	78.8	77.7	79.6
Volatile Organics by EPA 5035						
1,1,1,2-Tetrachloroethane	NS	NS	mg/kg	ND	ND	ND
1,1,1-Trichloroethane	0.68	500	mg/kg	ND	ND	ND
1,1,2,2-Tetrachloroethane	NS	NS	mg/kg	ND	ND	ND
Freon-113	NS	NS	mg/kg	ND	ND	ND
1,1,2-Trichloroethane	NS	NS	mg/kg	ND	ND	ND
1,1-Dichloroethane	0.27	240	mg/kg	ND	ND	ND
1,1-Dichloroethene	0.33	500	mg/kg	ND	ND	ND
1,1-Dichloropropene	NS	NS	mg/kg	--	--	--
1,2,3-Trichlorobenzene	NS	NS	mg/kg	ND	ND	ND
1,2,3-Trichloropropane	NS	NS	mg/kg	ND	ND	ND
1,2,4,5-Tetramethylbenzene	NS	NS	mg/kg	--	--	--
1,2,4-Trichlorobenzene	NS	NS	mg/kg	ND	ND	ND
1,2,4-Trimethylbenzene	3.6	190	mg/kg	ND	ND	ND
1,2-Dibromo-3-chloropropane	NS	NS	mg/kg	ND	ND	ND
1,2-Dibromoethane	NS	NS	mg/kg	ND	ND	ND
1,2-Dichlorobenzene	1.1	500	mg/kg	ND	ND	ND
1,2-Dichloroethane	0.02	30	mg/kg	ND	ND	ND
1,2-Dichloroethene, Total	NS	NS	mg/kg	--	--	--
1,2-Dichloropropane	NS	NS	mg/kg	ND	ND	ND
1,3,5-Trimethylbenzene	8.4	190	mg/kg	ND	ND	ND
1,3-Dichlorobenzene	2.4	280	mg/kg	ND	ND	ND
1,3-Dichloropropane	NS	NS	mg/kg	--	--	--
1,3-Dichloropropene, Total	NS	NS	mg/kg	--	--	--
1,4-Dichlorobenzene	1.8	130	mg/kg	ND	ND	ND
1,4-Dioxane	0.1	130	mg/kg	ND	ND	ND
2,2-Dichloropropane	NS	NS	mg/kg	--	--	--
2-Butanone	0.12	500	mg/kg	ND	ND	ND
2-Hexanone	NS	NS	mg/kg	ND	ND	ND
4-Methyl-2-pentanone	NS	NS	mg/kg	ND	ND	ND
Acetone	0.05	500	mg/kg	0.011 J	0.012 J	0.013 J
Acrolein	NS	NS	mg/kg	ND	ND	ND
Acrylonitrile	NS	NS	mg/kg	ND	ND	ND
Benzene	0.06	44	mg/kg	ND	ND	ND
Bromobenzene	NS	NS	mg/kg	--	--	--
Bromochloromethane	NS	NS	mg/kg	ND	ND	ND
Bromodichloromethane	NS	NS	mg/kg	ND	ND	ND
Bromoform	NS	NS	mg/kg	ND	ND	ND
Bromomethane	NS	NS	mg/kg	ND	ND	ND
Carbon disulfide	NS	NS	mg/kg	ND	ND	ND
Carbon tetrachloride	0.76	22	mg/kg	ND	ND	ND
Chlorobenzene	1.1	500	mg/kg	ND	ND	ND
Chloroethane	NS	NS	mg/kg	ND	ND	ND
Chloroform	0.37	350	mg/kg	ND	ND	ND
Chloromethane	NS	NS	mg/kg	ND	ND	ND
cis-1,2-Dichloroethene	0.25	500	mg/kg	0.86	0.014	2.7 D
cis-1,3-Dichloropropene	NS	NS	mg/kg	ND	ND	ND
Cyclohexane	NS	NS	mg/kg	ND	ND	ND
Dibromochloromethane	NS	NS	mg/kg	ND	ND	ND

Table 3. Historic Soil Analytical Data
2921 Westchester Avenue
BCP #C203140

CLIENT SAMPLE ID	NY-PGW	NY-RESC	Units	SB01	SB02	SB05
SAMPLING DATE				8/9/2019	8/9/2019	8/9/2019
LAB SAMPLE ID				19H0455-01	19H0455-02	19H0455-05
				Qual	Qual	Qual
Dibromomethane	NS	NS	mg/kg	ND	ND	ND
Dichlorodifluoromethane	NS	NS	mg/kg	ND	ND	ND
Ethyl ether	NS	NS	mg/kg	--	--	--
Ethylbenzene	1	390	mg/kg	ND	ND	ND
Hexachlorobutadiene	NS	NS	mg/kg	ND	ND	ND
Isopropylbenzene	NS	NS	mg/kg	ND	ND	ND
Methyl acetate	NS	NS	mg/kg	ND	ND	ND
Methyl tert butyl ether	0.93	500	mg/kg	ND	ND	ND
Methylcyclohexane	NS	NS	mg/kg	ND	ND	ND
Methylene chloride	0.05	500	mg/kg	ND	ND	ND
n-Butylbenzene	12	500	mg/kg	ND	ND	ND
n-Propylbenzene	3.9	500	mg/kg	ND	ND	ND
Naphthalene	12	500	mg/kg	--	--	--
o-Chlorotoluene	NS	NS	mg/kg	--	--	--
o-Xylene	NS	NS	mg/kg	ND	ND	ND
p-Chlorotoluene	NS	NS	mg/kg	--	--	--
p-Diethylbenzene	NS	NS	mg/kg	--	--	--
p-Ethyltoluene	NS	NS	mg/kg	--	--	--
p-Isopropyltoluene	NS	NS	mg/kg	ND	ND	ND
p/m-Xylene	NS	NS	mg/kg	ND	ND	ND
sec-Butylbenzene	11	500	mg/kg	ND	ND	ND
Styrene	NS	NS	mg/kg	ND	ND	ND
tert-Butyl alcohol	NS	NS	mg/kg	ND	ND	ND
tert-Butylbenzene	5.9	500	mg/kg	ND	ND	ND
Tetrachloroethene	1.3	150	mg/kg	0.33	0.13	21 D
Toluene	0.7	500	mg/kg	ND	ND	ND
trans-1,2-Dichloroethene	0.19	500	mg/kg	ND	ND	0.006 J
trans-1,3-Dichloropropene	NS	NS	mg/kg	ND	ND	ND
trans-1,4-Dichloro-2-butene	NS	NS	mg/kg	ND	ND	ND
Trichloroethene	0.47	200	mg/kg	0.055	0.015	3.3 D
Trichlorofluoromethane	NS	NS	mg/kg	ND	ND	ND
Vinyl acetate	NS	NS	mg/kg	--	--	--
Vinyl chloride	0.02	13	mg/kg	ND	ND	ND
Xylenes, Total	1.6	500	mg/kg	ND	ND	ND
Total Metals						
Arsenic, Total	16	16	mg/kg	--	--	--
Barium, Total	820	400	mg/kg	--	--	--
Cadmium, Total	7.5	9.3	mg/kg	--	--	--
Chromium, Total	NS	NS	mg/kg	--	--	--
Lead, Total	450	1000	mg/kg	--	--	--
Mercury, Total	0.73	2.8	mg/kg	--	--	--
Selenium, Total	4	1500	mg/kg	--	--	--
Silver, Total	8.3	1500	mg/kg	--	--	--

Notes:

Bold and shaded yellow value indicates concentrations exceeds NY-PGW SCO

Concentrations in all samples met NY-RESC SCO for all analytes
NY-PGW = 6 NYCRR Part 375 Restricted Protection of Groundwater
Soil Cleanup Objectives

Table 3. Historic Soil Analytical Data
2921 Westchester Avenue
BCP #C203140

CLIENT SAMPLE ID	NY-PGW	NY-RESC	Units	SB01	SB02	SB05
SAMPLING DATE				8/9/2019	8/9/2019	8/9/2019
LAB SAMPLE ID				19H0455-01	19H0455-02	19H0455-05
				Qual	Qual	Qual

NY-RESC = 6 NYCRR Part 375 Restricted Commercial Use Soil

Cleanup Objectives

J = Estimated value

ND = Not detected

NS = No standard

-- = Not analyzed

Samples SB01, SB02, and SB05 collected as part of Castleton's 2019

Phase II ESI

Table 3. Historic Soil Analytical Data
2921 Westchester Avenue
BCP #C203140

CLIENT SAMPLE ID	NY-PGW	NY-RESC	Units	MW-1 (16-18)	SB-5 (0-1)	SB-5 (1-2)
SAMPLING DATE				9/27/2019	2/27/2020	2/27/2020
LAB SAMPLE ID				L1945056-01	L2008988-01	L2008988-02
				Qual	Qual	Qual
General Chemistry						
Solids, Total	NS	NS	%	93.6	89.3	91.6
Volatile Organics by EPA 5035						
1,1,1,2-Tetrachloroethane	NS	NS	mg/kg	ND	ND	ND
1,1,1-Trichloroethane	0.68	500	mg/kg	ND	ND	ND
1,1,2,2-Tetrachloroethane	NS	NS	mg/kg	ND	ND	ND
Freon-113	NS	NS	mg/kg	--	--	--
1,1,2-Trichloroethane	NS	NS	mg/kg	ND	ND	ND
1,1-Dichloroethane	0.27	240	mg/kg	ND	ND	ND
1,1-Dichloroethene	0.33	500	mg/kg	ND	ND	ND
1,1-Dichloropropene	NS	NS	mg/kg	ND	ND	ND
1,2,3-Trichlorobenzene	NS	NS	mg/kg	ND	ND	ND
1,2,3-Trichloropropane	NS	NS	mg/kg	ND	ND	ND
1,2,4,5-Tetramethylbenzene	NS	NS	mg/kg	ND	ND	ND
1,2,4-Trichlorobenzene	NS	NS	mg/kg	ND	ND	ND
1,2,4-Trimethylbenzene	3.6	190	mg/kg	ND	ND	ND
1,2-Dibromo-3-chloropropane	NS	NS	mg/kg	ND	ND	ND
1,2-Dibromoethane	NS	NS	mg/kg	ND	ND	ND
1,2-Dichlorobenzene	1.1	500	mg/kg	ND	ND	ND
1,2-Dichloroethane	0.02	30	mg/kg	ND	ND	ND
1,2-Dichloroethene, Total	NS	NS	mg/kg	ND	1.5 J	0.0013
1,2-Dichloropropane	NS	NS	mg/kg	ND	ND	ND
1,3,5-Trimethylbenzene	8.4	190	mg/kg	ND	ND	ND
1,3-Dichlorobenzene	2.4	280	mg/kg	ND	ND	ND
1,3-Dichloropropane	NS	NS	mg/kg	ND	ND	ND
1,3-Dichloropropene, Total	NS	NS	mg/kg	ND	ND	ND
1,4-Dichlorobenzene	1.8	130	mg/kg	ND	ND	ND
1,4-Dioxane	0.1	130	mg/kg	ND	ND	ND
2,2-Dichloropropane	NS	NS	mg/kg	ND	ND	ND
2-Butanone	0.12	500	mg/kg	ND	ND	ND
2-Hexanone	NS	NS	mg/kg	ND	ND	ND
4-Methyl-2-pentanone	NS	NS	mg/kg	ND	ND	ND
Acetone	0.05	500	mg/kg	0.0054 J	ND	ND
Acrolein	NS	NS	mg/kg	--	--	--
Acrylonitrile	NS	NS	mg/kg	ND	ND	ND
Benzene	0.06	44	mg/kg	ND	ND	ND
Bromobenzene	NS	NS	mg/kg	ND	ND	ND
Bromochloromethane	NS	NS	mg/kg	ND	ND	ND
Bromodichloromethane	NS	NS	mg/kg	ND	ND	ND
Bromoform	NS	NS	mg/kg	ND	ND	ND
Bromomethane	NS	NS	mg/kg	ND	ND	ND
Carbon disulfide	NS	NS	mg/kg	ND	ND	ND
Carbon tetrachloride	0.76	22	mg/kg	ND	ND	ND
Chlorobenzene	1.1	500	mg/kg	ND	ND	ND
Chloroethane	NS	NS	mg/kg	ND	ND	ND
Chloroform	0.37	350	mg/kg	0.00017 J	ND	ND
Chloromethane	NS	NS	mg/kg	ND	ND	ND
cis-1,2-Dichloroethene	0.25	500	mg/kg	ND	1.5	0.0013
cis-1,3-Dichloropropene	NS	NS	mg/kg	ND	ND	ND
Cyclohexane	NS	NS	mg/kg	--	--	--
Dibromochloromethane	NS	NS	mg/kg	ND	ND	ND

Table 3. Historic Soil Analytical Data
2921 Westchester Avenue
BCP #C203140

CLIENT SAMPLE ID	NY-PGW	NY-RESC	Units	MW-1 (16-18)	SB-5 (0-1)	SB-5 (1-2)
SAMPLING DATE				9/27/2019	2/27/2020	2/27/2020
LAB SAMPLE ID				L1945056-01	L2008988-01	L2008988-02
				Qual	Qual	Qual
Dibromomethane	NS	NS	mg/kg	ND	ND	ND
Dichlorodifluoromethane	NS	NS	mg/kg	ND	ND	ND
Ethyl ether	NS	NS	mg/kg	ND	ND	ND
Ethylbenzene	1	390	mg/kg	ND	ND	ND
Hexachlorobutadiene	NS	NS	mg/kg	ND	ND	ND
Isopropylbenzene	NS	NS	mg/kg	ND	ND	ND
Methyl acetate	NS	NS	mg/kg	--	--	--
Methyl tert butyl ether	0.93	500	mg/kg	ND	ND	ND
Methylcyclohexane	NS	NS	mg/kg	--	--	--
Methylene chloride	0.05	500	mg/kg	ND	ND	ND
n-Butylbenzene	12	500	mg/kg	ND	ND	ND
n-Propylbenzene	3.9	500	mg/kg	ND	ND	ND
Naphthalene	12	500	mg/kg	ND	ND	ND
o-Chlorotoluene	NS	NS	mg/kg	ND	ND	ND
o-Xylene	NS	NS	mg/kg	ND	ND	ND
p-Chlorotoluene	NS	NS	mg/kg	ND	ND	ND
p-Diethylbenzene	NS	NS	mg/kg	ND	ND	ND
p-Ethyltoluene	NS	NS	mg/kg	ND	ND	ND
p-Isopropyltoluene	NS	NS	mg/kg	ND	ND	ND
p/m-Xylene	NS	NS	mg/kg	ND	ND	ND
sec-Butylbenzene	11	500	mg/kg	ND	ND	ND
Styrene	NS	NS	mg/kg	ND	ND	ND
tert-Butyl alcohol	NS	NS	mg/kg	--	--	--
tert-Butylbenzene	5.9	500	mg/kg	ND	ND	ND
Tetrachloroethene	1.3	150	mg/kg	ND	3.2	0.0014
Toluene	0.7	500	mg/kg	ND	ND	ND
trans-1,2-Dichloroethene	0.19	500	mg/kg	ND	0.018 J	ND
trans-1,3-Dichloropropene	NS	NS	mg/kg	ND	ND	ND
trans-1,4-Dichloro-2-butene	NS	NS	mg/kg	ND	ND	ND
Trichloroethene	0.47	200	mg/kg	ND	1.8	0.0002 J
Trichlorofluoromethane	NS	NS	mg/kg	ND	ND	ND
Vinyl acetate	NS	NS	mg/kg	ND	ND	ND
Vinyl chloride	0.02	13	mg/kg	ND	ND	ND
Xylenes, Total	1.6	500	mg/kg	ND	ND	ND
Total Metals						
Arsenic, Total	16	16	mg/kg	0.27 J	--	--
Barium, Total	820	400	mg/kg	43.5	--	--
Cadmium, Total	7.5	9.3	mg/kg	0.11 J	--	--
Chromium, Total	NS	NS	mg/kg	27	--	--
Lead, Total	450	1000	mg/kg	2.17	--	--
Mercury, Total	0.73	2.8	mg/kg	ND	--	--
Selenium, Total	4	1500	mg/kg	ND	--	--
Silver, Total	8.3	1500	mg/kg	ND	--	--

Notes:

Bold and shaded yellow value indicates concentrations exceeds NY-PGW SCOs

Concentrations in all samples met NY-RESC SCOs for all analytes

NY-PGW = 6 NYCRR Part 375 Restricted Protection of Groundwater

Soil Cleanup Objectives

Table 3. Historic Soil Analytical Data
2921 Westchester Avenue
BCP #C203140

CLIENT SAMPLE ID	NY-PGW	NY-RESC	Units	MW-1 (16-18)	SB-5 (0-1)	SB-5 (1-2)
SAMPLING DATE				9/27/2019	2/27/2020	2/27/2020
LAB SAMPLE ID				L1945056-01	L2008988-01	L2008988-02
				Qual	Qual	Qual

NY-RESC = 6 NYCRR Part 375 Restricted Commercial Use Soil

Cleanup Objectives

J = Estimated value

ND = Not detected

NS = No standard

-- = Not analyzed

Samples SB01, SB02, and SB05 collected as part of Castleton's 2019

Phase II ESI

Table 3. Historic Soil Analytical Data
2921 Westchester Avenue
BCP #C203140

CLIENT SAMPLE ID	NY-PGW	NY-RESC	Units	SB-5 (2-3)	SB-5 (3-4)	SB-5-N (0-1)
SAMPLING DATE				2/27/2020	2/27/2020	2/27/2020
LAB SAMPLE ID				L2008988-03	L2008988-04	L2008988-05
				Qual	Qual	Qual
General Chemistry						
Solids, Total	NS	NS	%	93.5	91.5	77.3
Volatile Organics by EPA 5035						
1,1,1,2-Tetrachloroethane	NS	NS	mg/kg	ND	ND	ND
1,1,1-Trichloroethane	0.68	500	mg/kg	ND	ND	ND
1,1,2,2-Tetrachloroethane	NS	NS	mg/kg	ND	ND	ND
Freon-113	NS	NS	mg/kg	--	--	--
1,1,2-Trichloroethane	NS	NS	mg/kg	ND	ND	ND
1,1-Dichloroethane	0.27	240	mg/kg	ND	ND	ND
1,1-Dichloroethene	0.33	500	mg/kg	ND	ND	ND
1,1-Dichloropropene	NS	NS	mg/kg	ND	ND	ND
1,2,3-Trichlorobenzene	NS	NS	mg/kg	ND	ND	ND
1,2,3-Trichloropropane	NS	NS	mg/kg	ND	ND	ND
1,2,4,5-Tetramethylbenzene	NS	NS	mg/kg	ND	ND	ND
1,2,4-Trichlorobenzene	NS	NS	mg/kg	ND	ND	ND
1,2,4-Trimethylbenzene	3.6	190	mg/kg	ND	ND	ND
1,2-Dibromo-3-chloropropane	NS	NS	mg/kg	ND	ND	ND
1,2-Dibromoethane	NS	NS	mg/kg	ND	ND	ND
1,2-Dichlorobenzene	1.1	500	mg/kg	ND	ND	ND
1,2-Dichloroethane	0.02	30	mg/kg	ND	ND	ND
1,2-Dichloroethene, Total	NS	NS	mg/kg	0.00038 J	0.00016 J	10 J
1,2-Dichloropropane	NS	NS	mg/kg	ND	ND	ND
1,3,5-Trimethylbenzene	8.4	190	mg/kg	ND	ND	ND
1,3-Dichlorobenzene	2.4	280	mg/kg	ND	ND	ND
1,3-Dichloropropane	NS	NS	mg/kg	ND	ND	ND
1,3-Dichloropropene, Total	NS	NS	mg/kg	ND	ND	ND
1,4-Dichlorobenzene	1.8	130	mg/kg	ND	ND	ND
1,4-Dioxane	0.1	130	mg/kg	ND	ND	ND
2,2-Dichloropropane	NS	NS	mg/kg	ND	ND	ND
2-Butanone	0.12	500	mg/kg	ND	ND	ND
2-Hexanone	NS	NS	mg/kg	ND	ND	ND
4-Methyl-2-pentanone	NS	NS	mg/kg	ND	ND	ND
Acetone	0.05	500	mg/kg	ND	ND	ND
Acrolein	NS	NS	mg/kg	--	--	--
Acrylonitrile	NS	NS	mg/kg	ND	ND	ND
Benzene	0.06	44	mg/kg	ND	ND	ND
Bromobenzene	NS	NS	mg/kg	ND	ND	ND
Bromochloromethane	NS	NS	mg/kg	ND	ND	ND
Bromodichloromethane	NS	NS	mg/kg	ND	ND	ND
Bromoform	NS	NS	mg/kg	ND	ND	ND
Bromomethane	NS	NS	mg/kg	ND	ND	ND
Carbon disulfide	NS	NS	mg/kg	ND	ND	ND
Carbon tetrachloride	0.76	22	mg/kg	ND	ND	ND
Chlorobenzene	1.1	500	mg/kg	ND	ND	ND
Chloroethane	NS	NS	mg/kg	ND	ND	ND
Chloroform	0.37	350	mg/kg	ND	ND	ND
Chloromethane	NS	NS	mg/kg	ND	ND	ND
cis-1,2-Dichloroethene	0.25	500	mg/kg	0.00038 J	0.00016 J	10
cis-1,3-Dichloropropene	NS	NS	mg/kg	ND	ND	ND
Cyclohexane	NS	NS	mg/kg	--	--	--
Dibromochloromethane	NS	NS	mg/kg	ND	ND	ND

Table 3. Historic Soil Analytical Data
2921 Westchester Avenue
BCP #C203140

CLIENT SAMPLE ID	NY-PGW	NY-RESC	Units	SB-5 (2-3)	SB-5 (3-4)	SB-5-N (0-1)
SAMPLING DATE				2/27/2020	2/27/2020	2/27/2020
LAB SAMPLE ID				L2008988-03	L2008988-04	L2008988-05
				Qual	Qual	Qual
Dibromomethane	NS	NS	mg/kg	ND	ND	ND
Dichlorodifluoromethane	NS	NS	mg/kg	ND	ND	ND
Ethyl ether	NS	NS	mg/kg	ND	ND	ND
Ethylbenzene	1	390	mg/kg	ND	ND	ND
Hexachlorobutadiene	NS	NS	mg/kg	ND	ND	ND
Isopropylbenzene	NS	NS	mg/kg	ND	ND	ND
Methyl acetate	NS	NS	mg/kg	--	--	--
Methyl tert butyl ether	0.93	500	mg/kg	ND	ND	ND
Methylcyclohexane	NS	NS	mg/kg	--	--	--
Methylene chloride	0.05	500	mg/kg	ND	ND	ND
n-Butylbenzene	12	500	mg/kg	ND	ND	ND
n-Propylbenzene	3.9	500	mg/kg	ND	ND	ND
Naphthalene	12	500	mg/kg	ND	ND	ND
o-Chlorotoluene	NS	NS	mg/kg	ND	ND	ND
o-Xylene	NS	NS	mg/kg	ND	ND	ND
p-Chlorotoluene	NS	NS	mg/kg	ND	ND	ND
p-Diethylbenzene	NS	NS	mg/kg	ND	ND	ND
p-Ethyltoluene	NS	NS	mg/kg	ND	ND	ND
p-Isopropyltoluene	NS	NS	mg/kg	ND	ND	ND
p/m-Xylene	NS	NS	mg/kg	ND	ND	ND
sec-Butylbenzene	11	500	mg/kg	ND	ND	ND
Styrene	NS	NS	mg/kg	ND	ND	ND
tert-Butyl alcohol	NS	NS	mg/kg	--	--	--
tert-Butylbenzene	5.9	500	mg/kg	ND	ND	ND
Tetrachloroethene	1.3	150	mg/kg	0.0012	0.0013	34
Toluene	0.7	500	mg/kg	ND	ND	ND
trans-1,2-Dichloroethene	0.19	500	mg/kg	ND	ND	0.18 J
trans-1,3-Dichloropropene	NS	NS	mg/kg	ND	ND	ND
trans-1,4-Dichloro-2-butene	NS	NS	mg/kg	ND	ND	ND
Trichloroethene	0.47	200	mg/kg	ND	0.00013 J	8.1
Trichlorofluoromethane	NS	NS	mg/kg	ND	ND	ND
Vinyl acetate	NS	NS	mg/kg	ND	ND	ND
Vinyl chloride	0.02	13	mg/kg	ND	ND	ND
Xylenes, Total	1.6	500	mg/kg	ND	ND	ND
Total Metals						
Arsenic, Total	16	16	mg/kg	--	--	--
Barium, Total	820	400	mg/kg	--	--	--
Cadmium, Total	7.5	9.3	mg/kg	--	--	--
Chromium, Total	NS	NS	mg/kg	--	--	--
Lead, Total	450	1000	mg/kg	--	--	--
Mercury, Total	0.73	2.8	mg/kg	--	--	--
Selenium, Total	4	1500	mg/kg	--	--	--
Silver, Total	8.3	1500	mg/kg	--	--	--

Notes:

Bold and shaded yellow value indicates concentrations exceeds NY-PGW SCOs

Concentrations in all samples met NY-RESC SCOs for all analytes

NY-PGW = 6 NYCRR Part 375 Restricted Protection of Groundwater

Soil Cleanup Objectives

Table 3. Historic Soil Analytical Data
2921 Westchester Avenue
BCP #C203140

CLIENT SAMPLE ID	NY-PGW	NY-RESC	Units	SB-5 (2-3)	SB-5 (3-4)	SB-5-N (0-1)
SAMPLING DATE				2/27/2020	2/27/2020	2/27/2020
LAB SAMPLE ID				L2008988-03	L2008988-04	L2008988-05
				Qual	Qual	Qual

NY-RESC = 6 NYCRR Part 375 Restricted Commercial Use Soil

Cleanup Objectives

J = Estimated value

ND = Not detected

NS = No standard

-- = Not analyzed

Samples SB01, SB02, and SB05 collected as part of Castleton's 2019

Phase II ESI

Table 3. Historic Soil Analytical Data
2921 Westchester Avenue
BCP #C203140

CLIENT SAMPLE ID	NY-PGW	NY-RESC	Units	SB-5-N (1-2)	SB-5-N (2-3)	SB-5-W (0-1)
SAMPLING DATE				2/27/2020	2/27/2020	2/27/2020
LAB SAMPLE ID				L2008988-06	L2008988-07	L2008988-08
				Qual	Qual	Qual
General Chemistry						
Solids, Total	NS	NS	%	84.1	90.9	89.5
Volatile Organics by EPA 5035						
1,1,1,2-Tetrachloroethane	NS	NS	mg/kg	ND	ND	ND
1,1,1-Trichloroethane	0.68	500	mg/kg	ND	ND	ND
1,1,2,2-Tetrachloroethane	NS	NS	mg/kg	ND	ND	ND
Freon-113	NS	NS	mg/kg	--	--	--
1,1,2-Trichloroethane	NS	NS	mg/kg	ND	ND	ND
1,1-Dichloroethane	0.27	240	mg/kg	ND	ND	ND
1,1-Dichloroethene	0.33	500	mg/kg	ND	ND	ND
1,1-Dichloropropene	NS	NS	mg/kg	ND	ND	ND
1,2,3-Trichlorobenzene	NS	NS	mg/kg	ND	ND	ND
1,2,3-Trichloropropane	NS	NS	mg/kg	ND	ND	ND
1,2,4,5-Tetramethylbenzene	NS	NS	mg/kg	ND	ND	ND
1,2,4-Trichlorobenzene	NS	NS	mg/kg	ND	ND	ND
1,2,4-Trimethylbenzene	3.6	190	mg/kg	ND	ND	ND
1,2-Dibromo-3-chloropropane	NS	NS	mg/kg	ND	ND	ND
1,2-Dibromoethane	NS	NS	mg/kg	ND	ND	ND
1,2-Dichlorobenzene	1.1	500	mg/kg	ND	ND	ND
1,2-Dichloroethane	0.02	30	mg/kg	ND	ND	ND
1,2-Dichloroethene, Total	NS	NS	mg/kg	12	0.58 J	2.9 J
1,2-Dichloropropane	NS	NS	mg/kg	ND	ND	ND
1,3,5-Trimethylbenzene	8.4	190	mg/kg	ND	ND	ND
1,3-Dichlorobenzene	2.4	280	mg/kg	ND	ND	ND
1,3-Dichloropropane	NS	NS	mg/kg	ND	ND	ND
1,3-Dichloropropene, Total	NS	NS	mg/kg	ND	ND	ND
1,4-Dichlorobenzene	1.8	130	mg/kg	ND	ND	0.039 J
1,4-Dioxane	0.1	130	mg/kg	ND	ND	ND
2,2-Dichloropropane	NS	NS	mg/kg	ND	ND	ND
2-Butanone	0.12	500	mg/kg	ND	ND	ND
2-Hexanone	NS	NS	mg/kg	ND	ND	ND
4-Methyl-2-pentanone	NS	NS	mg/kg	ND	ND	ND
Acetone	0.05	500	mg/kg	0.68 J	ND	ND
Acrolein	NS	NS	mg/kg	--	--	--
Acrylonitrile	NS	NS	mg/kg	ND	ND	ND
Benzene	0.06	44	mg/kg	ND	ND	ND
Bromobenzene	NS	NS	mg/kg	ND	ND	ND
Bromochloromethane	NS	NS	mg/kg	ND	ND	ND
Bromodichloromethane	NS	NS	mg/kg	ND	ND	ND
Bromoform	NS	NS	mg/kg	ND	ND	ND
Bromomethane	NS	NS	mg/kg	ND	ND	ND
Carbon disulfide	NS	NS	mg/kg	ND	ND	ND
Carbon tetrachloride	0.76	22	mg/kg	ND	ND	ND
Chlorobenzene	1.1	500	mg/kg	ND	ND	ND
Chloroethane	NS	NS	mg/kg	ND	ND	ND
Chloroform	0.37	350	mg/kg	ND	ND	ND
Chloromethane	NS	NS	mg/kg	ND	ND	ND
cis-1,2-Dichloroethene	0.25	500	mg/kg	12	0.57	2.8
cis-1,3-Dichloropropene	NS	NS	mg/kg	ND	ND	ND
Cyclohexane	NS	NS	mg/kg	--	--	--
Dibromochloromethane	NS	NS	mg/kg	ND	ND	ND

Table 3. Historic Soil Analytical Data
2921 Westchester Avenue
BCP #C203140

CLIENT SAMPLE ID	NY-PGW	NY-RESC	Units	SB-5-N (1-2)	SB-5-N (2-3)	SB-5-W (0-1)
SAMPLING DATE				2/27/2020	2/27/2020	2/27/2020
LAB SAMPLE ID				L2008988-06	L2008988-07	L2008988-08
				Qual	Qual	Qual
Dibromomethane	NS	NS	mg/kg	ND	ND	ND
Dichlorodifluoromethane	NS	NS	mg/kg	ND	ND	ND
Ethyl ether	NS	NS	mg/kg	ND	ND	ND
Ethylbenzene	1	390	mg/kg	ND	ND	ND
Hexachlorobutadiene	NS	NS	mg/kg	ND	ND	ND
Isopropylbenzene	NS	NS	mg/kg	ND	ND	ND
Methyl acetate	NS	NS	mg/kg	--	--	--
Methyl tert butyl ether	0.93	500	mg/kg	ND	ND	ND
Methylcyclohexane	NS	NS	mg/kg	--	--	--
Methylene chloride	0.05	500	mg/kg	0.27 J	ND	ND
n-Butylbenzene	12	500	mg/kg	ND	ND	ND
n-Propylbenzene	3.9	500	mg/kg	ND	ND	ND
Naphthalene	12	500	mg/kg	ND	ND	0.052 J
o-Chlorotoluene	NS	NS	mg/kg	ND	ND	ND
o-Xylene	NS	NS	mg/kg	ND	ND	ND
p-Chlorotoluene	NS	NS	mg/kg	ND	ND	ND
p-Diethylbenzene	NS	NS	mg/kg	ND	ND	ND
p-Ethyltoluene	NS	NS	mg/kg	ND	ND	ND
p-Isopropyltoluene	NS	NS	mg/kg	0.014 J	ND	ND
p/m-Xylene	NS	NS	mg/kg	ND	ND	ND
sec-Butylbenzene	11	500	mg/kg	ND	ND	ND
Styrene	NS	NS	mg/kg	ND	ND	ND
tert-Butyl alcohol	NS	NS	mg/kg	--	--	--
tert-Butylbenzene	5.9	500	mg/kg	ND	ND	ND
Tetrachloroethene	1.3	150	mg/kg	22	0.65	20
Toluene	0.7	500	mg/kg	ND	ND	ND
trans-1,2-Dichloroethene	0.19	500	mg/kg	0.26	0.0083 J	0.054 J
trans-1,3-Dichloropropene	NS	NS	mg/kg	ND	ND	ND
trans-1,4-Dichloro-2-butene	NS	NS	mg/kg	ND	ND	ND
Trichloroethene	0.47	200	mg/kg	26	0.67	3.3
Trichlorofluoromethane	NS	NS	mg/kg	ND	ND	ND
Vinyl acetate	NS	NS	mg/kg	ND	ND	ND
Vinyl chloride	0.02	13	mg/kg	0.084 J	ND	ND
Xylenes, Total	1.6	500	mg/kg	ND	ND	ND
Total Metals						
Arsenic, Total	16	16	mg/kg	--	--	--
Barium, Total	820	400	mg/kg	--	--	--
Cadmium, Total	7.5	9.3	mg/kg	--	--	--
Chromium, Total	NS	NS	mg/kg	--	--	--
Lead, Total	450	1000	mg/kg	--	--	--
Mercury, Total	0.73	2.8	mg/kg	--	--	--
Selenium, Total	4	1500	mg/kg	--	--	--
Silver, Total	8.3	1500	mg/kg	--	--	--

Notes:

Bold and shaded yellow value indicates concentrations exceeds NY-PGW SCOs

Concentrations in all samples met NY-RESC SCOs for all analytes

NY-PGW = 6 NYCRR Part 375 Restricted Protection of Groundwater

Soil Cleanup Objectives

Table 3. Historic Soil Analytical Data
2921 Westchester Avenue
BCP #C203140

CLIENT SAMPLE ID	NY-PGW	NY-RESC	Units	SB-5-N (1-2)	SB-5-N (2-3)	SB-5-W (0-1)
SAMPLING DATE				2/27/2020	2/27/2020	2/27/2020
LAB SAMPLE ID				L2008988-06	L2008988-07	L2008988-08
				Qual	Qual	Qual

NY-RESC = 6 NYCRR Part 375 Restricted Commercial Use Soil

Cleanup Objectives

J = Estimated value

ND = Not detected

NS = No standard

-- = Not analyzed

Samples SB01, SB02, and SB05 collected as part of Castleton's 2019

Phase II ESI

Table 3. Historic Soil Analytical Data
2921 Westchester Avenue
BCP #C203140

CLIENT SAMPLE ID	NY-PGW	NY-RESC	Units	SB-5-W (1-2)	SB-5-W (2-3)	SB-5-E (0-1)
SAMPLING DATE				2/27/2020	2/27/2020	2/27/2020
LAB SAMPLE ID				L2008988-09	L2008988-10	L2008988-11
				Qual	Qual	Qual
General Chemistry						
Solids, Total	NS	NS	%	85.4	89.4	80.2
Volatile Organics by EPA 5035						
1,1,1,2-Tetrachloroethane	NS	NS	mg/kg	ND	ND	ND
1,1,1-Trichloroethane	0.68	500	mg/kg	ND	ND	ND
1,1,2,2-Tetrachloroethane	NS	NS	mg/kg	ND	ND	ND
Freon-113	NS	NS	mg/kg	--	--	--
1,1,2-Trichloroethane	NS	NS	mg/kg	ND	ND	ND
1,1-Dichloroethane	0.27	240	mg/kg	ND	ND	ND
1,1-Dichloroethene	0.33	500	mg/kg	ND	ND	ND
1,1-Dichloropropene	NS	NS	mg/kg	ND	ND	ND
1,2,3-Trichlorobenzene	NS	NS	mg/kg	ND	ND	ND
1,2,3-Trichloropropane	NS	NS	mg/kg	ND	ND	ND
1,2,4,5-Tetramethylbenzene	NS	NS	mg/kg	ND	ND	ND
1,2,4-Trichlorobenzene	NS	NS	mg/kg	ND	ND	ND
1,2,4-Trimethylbenzene	3.6	190	mg/kg	ND	ND	ND
1,2-Dibromo-3-chloropropane	NS	NS	mg/kg	ND	ND	ND
1,2-Dibromoethane	NS	NS	mg/kg	ND	ND	ND
1,2-Dichlorobenzene	1.1	500	mg/kg	ND	ND	ND
1,2-Dichloroethane	0.02	30	mg/kg	ND	ND	ND
1,2-Dichloroethene, Total	NS	NS	mg/kg	4.5	3.8	0.052 J
1,2-Dichloropropane	NS	NS	mg/kg	ND	ND	ND
1,3,5-Trimethylbenzene	8.4	190	mg/kg	ND	ND	ND
1,3-Dichlorobenzene	2.4	280	mg/kg	ND	ND	ND
1,3-Dichloropropane	NS	NS	mg/kg	ND	ND	ND
1,3-Dichloropropene, Total	NS	NS	mg/kg	ND	ND	ND
1,4-Dichlorobenzene	1.8	130	mg/kg	ND	0.027 J	ND
1,4-Dioxane	0.1	130	mg/kg	ND	ND	ND
2,2-Dichloropropane	NS	NS	mg/kg	ND	ND	ND
2-Butanone	0.12	500	mg/kg	ND	ND	ND
2-Hexanone	NS	NS	mg/kg	ND	ND	ND
4-Methyl-2-pentanone	NS	NS	mg/kg	ND	ND	ND
Acetone	0.05	500	mg/kg	ND	ND	ND
Acrolein	NS	NS	mg/kg	--	--	--
Acrylonitrile	NS	NS	mg/kg	ND	ND	ND
Benzene	0.06	44	mg/kg	ND	ND	ND
Bromobenzene	NS	NS	mg/kg	ND	ND	ND
Bromochloromethane	NS	NS	mg/kg	ND	ND	ND
Bromodichloromethane	NS	NS	mg/kg	ND	ND	ND
Bromoform	NS	NS	mg/kg	ND	ND	ND
Bromomethane	NS	NS	mg/kg	ND	ND	ND
Carbon disulfide	NS	NS	mg/kg	ND	ND	ND
Carbon tetrachloride	0.76	22	mg/kg	ND	ND	ND
Chlorobenzene	1.1	500	mg/kg	ND	ND	ND
Chloroethane	NS	NS	mg/kg	ND	ND	ND
Chloroform	0.37	350	mg/kg	ND	ND	ND
Chloromethane	NS	NS	mg/kg	ND	ND	ND
cis-1,2-Dichloroethene	0.25	500	mg/kg	4.4	3.7	0.052
cis-1,3-Dichloropropene	NS	NS	mg/kg	ND	ND	ND
Cyclohexane	NS	NS	mg/kg	--	--	--
Dibromochloromethane	NS	NS	mg/kg	ND	ND	ND

Table 3. Historic Soil Analytical Data
2921 Westchester Avenue
BCP #C203140

CLIENT SAMPLE ID	NY-PGW	NY-RESC	Units	SB-5-W (1-2)	SB-5-W (2-3)	SB-5-E (0-1)
SAMPLING DATE				2/27/2020	2/27/2020	2/27/2020
LAB SAMPLE ID				L2008988-09	L2008988-10	L2008988-11
				Qual	Qual	Qual
Dibromomethane	NS	NS	mg/kg	ND	ND	ND
Dichlorodifluoromethane	NS	NS	mg/kg	ND	ND	ND
Ethyl ether	NS	NS	mg/kg	ND	ND	ND
Ethylbenzene	1	390	mg/kg	ND	ND	ND
Hexachlorobutadiene	NS	NS	mg/kg	ND	ND	ND
Isopropylbenzene	NS	NS	mg/kg	ND	ND	ND
Methyl acetate	NS	NS	mg/kg	--	--	--
Methyl tert butyl ether	0.93	500	mg/kg	ND	ND	ND
Methylcyclohexane	NS	NS	mg/kg	--	--	--
Methylene chloride	0.05	500	mg/kg	ND	ND	ND
n-Butylbenzene	12	500	mg/kg	ND	ND	ND
n-Propylbenzene	3.9	500	mg/kg	ND	ND	ND
Naphthalene	12	500	mg/kg	ND	ND	ND
o-Chlorotoluene	NS	NS	mg/kg	ND	ND	ND
o-Xylene	NS	NS	mg/kg	ND	ND	ND
p-Chlorotoluene	NS	NS	mg/kg	ND	ND	ND
p-Diethylbenzene	NS	NS	mg/kg	ND	ND	ND
p-Ethyltoluene	NS	NS	mg/kg	ND	ND	ND
p-Isopropyltoluene	NS	NS	mg/kg	ND	ND	ND
p/m-Xylene	NS	NS	mg/kg	ND	ND	ND
sec-Butylbenzene	11	500	mg/kg	ND	ND	ND
Styrene	NS	NS	mg/kg	ND	ND	ND
tert-Butyl alcohol	NS	NS	mg/kg	--	--	--
tert-Butylbenzene	5.9	500	mg/kg	ND	ND	ND
Tetrachloroethene	1.3	150	mg/kg	16	7	0.17
Toluene	0.7	500	mg/kg	ND	ND	ND
trans-1,2-Dichloroethene	0.19	500	mg/kg	0.14	0.084	0.00036 J
trans-1,3-Dichloropropene	NS	NS	mg/kg	ND	ND	ND
trans-1,4-Dichloro-2-butene	NS	NS	mg/kg	ND	ND	ND
Trichloroethene	0.47	200	mg/kg	3.6	1.7	0.031
Trichlorofluoromethane	NS	NS	mg/kg	ND	ND	ND
Vinyl acetate	NS	NS	mg/kg	ND	ND	ND
Vinyl chloride	0.02	13	mg/kg	ND	ND	0.0005 J
Xylenes, Total	1.6	500	mg/kg	ND	ND	ND
Total Metals						
Arsenic, Total	16	16	mg/kg	--	--	--
Barium, Total	820	400	mg/kg	--	--	--
Cadmium, Total	7.5	9.3	mg/kg	--	--	--
Chromium, Total	NS	NS	mg/kg	--	--	--
Lead, Total	450	1000	mg/kg	--	--	--
Mercury, Total	0.73	2.8	mg/kg	--	--	--
Selenium, Total	4	1500	mg/kg	--	--	--
Silver, Total	8.3	1500	mg/kg	--	--	--

Notes:

Bold and shaded yellow value indicates concentrations exceeds NY-PGW SCOs

Concentrations in all samples met NY-RESC SCOs for all analytes

NY-PGW = 6 NYCRR Part 375 Restricted Protection of Groundwater

Soil Cleanup Objectives

Table 3. Historic Soil Analytical Data
2921 Westchester Avenue
BCP #C203140

CLIENT SAMPLE ID	NY-PGW	NY-RESC	Units	SB-5-W (1-2)	SB-5-W (2-3)	SB-5-E (0-1)
SAMPLING DATE				2/27/2020	2/27/2020	2/27/2020
LAB SAMPLE ID				L2008988-09	L2008988-10	L2008988-11
				Qual	Qual	Qual

NY-RESC = 6 NYCRR Part 375 Restricted Commercial Use Soil

Cleanup Objectives

J = Estimated value

ND = Not detected

NS = No standard

-- = Not analyzed

Samples SB01, SB02, and SB05 collected as part of Castleton's 2019

Phase II ESI

Table 3. Historic Soil Analytical Data
2921 Westchester Avenue
BCP #C203140

CLIENT SAMPLE ID	NY-PGW	NY-RESC	Units	SB-5-W2 (0-1)	SB-5-W2 (1-2)	SB-5-S (0-1)
SAMPLING DATE				2/27/2020	2/27/2020	2/27/2020
LAB SAMPLE ID				L2008988-17	L2008988-18	L2008988-20
				Qual	Qual	Qual
General Chemistry						
Solids, Total	NS	NS	%	80.8	88.7	81
Volatile Organics by EPA 5035						
1,1,1,2-Tetrachloroethane	NS	NS	mg/kg	ND	ND	ND
1,1,1-Trichloroethane	0.68	500	mg/kg	ND	ND	ND
1,1,2,2-Tetrachloroethane	NS	NS	mg/kg	ND	ND	ND
Freon-113	NS	NS	mg/kg	--	--	--
1,1,2-Trichloroethane	NS	NS	mg/kg	ND	ND	ND
1,1-Dichloroethane	0.27	240	mg/kg	ND	ND	ND
1,1-Dichloroethene	0.33	500	mg/kg	ND	ND	ND
1,1-Dichloropropene	NS	NS	mg/kg	ND	ND	ND
1,2,3-Trichlorobenzene	NS	NS	mg/kg	ND	ND	ND
1,2,3-Trichloropropane	NS	NS	mg/kg	ND	ND	ND
1,2,4,5-Tetramethylbenzene	NS	NS	mg/kg	ND	ND	ND
1,2,4-Trichlorobenzene	NS	NS	mg/kg	ND	ND	ND
1,2,4-Trimethylbenzene	3.6	190	mg/kg	ND	ND	ND
1,2-Dibromo-3-chloropropane	NS	NS	mg/kg	ND	ND	ND
1,2-Dibromoethane	NS	NS	mg/kg	ND	ND	ND
1,2-Dichlorobenzene	1.1	500	mg/kg	ND	ND	ND
1,2-Dichloroethane	0.02	30	mg/kg	ND	ND	ND
1,2-Dichloroethene, Total	NS	NS	mg/kg	1.3	0.0099	15
1,2-Dichloropropane	NS	NS	mg/kg	ND	ND	ND
1,3,5-Trimethylbenzene	8.4	190	mg/kg	ND	ND	ND
1,3-Dichlorobenzene	2.4	280	mg/kg	ND	ND	ND
1,3-Dichloropropane	NS	NS	mg/kg	ND	ND	ND
1,3-Dichloropropene, Total	NS	NS	mg/kg	ND	ND	ND
1,4-Dichlorobenzene	1.8	130	mg/kg	ND	ND	ND
1,4-Dioxane	0.1	130	mg/kg	ND	ND	ND
2,2-Dichloropropane	NS	NS	mg/kg	ND	ND	ND
2-Butanone	0.12	500	mg/kg	ND	ND	ND
2-Hexanone	NS	NS	mg/kg	ND	ND	ND
4-Methyl-2-pentanone	NS	NS	mg/kg	ND	ND	ND
Acetone	0.05	500	mg/kg	ND	ND	ND
Acrolein	NS	NS	mg/kg	--	--	--
Acrylonitrile	NS	NS	mg/kg	ND	ND	ND
Benzene	0.06	44	mg/kg	ND	ND	ND
Bromobenzene	NS	NS	mg/kg	ND	ND	ND
Bromochloromethane	NS	NS	mg/kg	ND	ND	ND
Bromodichloromethane	NS	NS	mg/kg	ND	ND	ND
Bromoform	NS	NS	mg/kg	ND	ND	ND
Bromomethane	NS	NS	mg/kg	ND	ND	ND
Carbon disulfide	NS	NS	mg/kg	ND	ND	ND
Carbon tetrachloride	0.76	22	mg/kg	ND	ND	ND
Chlorobenzene	1.1	500	mg/kg	ND	ND	ND
Chloroethane	NS	NS	mg/kg	ND	ND	ND
Chloroform	0.37	350	mg/kg	ND	ND	ND
Chloromethane	NS	NS	mg/kg	ND	ND	ND
cis-1,2-Dichloroethene	0.25	500	mg/kg	1.3	0.0099	15
cis-1,3-Dichloropropene	NS	NS	mg/kg	ND	ND	ND
Cyclohexane	NS	NS	mg/kg	--	--	--
Dibromochloromethane	NS	NS	mg/kg	ND	ND	ND

Table 3. Historic Soil Analytical Data
2921 Westchester Avenue
BCP #C203140

CLIENT SAMPLE ID	NY-PGW	NY-RESC	Units	SB-5-W2 (0-1)	SB-5-W2 (1-2)	SB-5-S (0-1)
SAMPLING DATE				2/27/2020	2/27/2020	2/27/2020
LAB SAMPLE ID				L2008988-17	L2008988-18	L2008988-20
				Qual	Qual	Qual
Dibromomethane	NS	NS	mg/kg	ND	ND	ND
Dichlorodifluoromethane	NS	NS	mg/kg	ND	ND	ND
Ethyl ether	NS	NS	mg/kg	ND	ND	ND
Ethylbenzene	1	390	mg/kg	ND	ND	ND
Hexachlorobutadiene	NS	NS	mg/kg	ND	ND	ND
Isopropylbenzene	NS	NS	mg/kg	ND	ND	ND
Methyl acetate	NS	NS	mg/kg	--	--	--
Methyl tert butyl ether	0.93	500	mg/kg	ND	ND	ND
Methylcyclohexane	NS	NS	mg/kg	--	--	--
Methylene chloride	0.05	500	mg/kg	ND	ND	ND
n-Butylbenzene	12	500	mg/kg	ND	ND	ND
n-Propylbenzene	3.9	500	mg/kg	ND	ND	ND
Naphthalene	12	500	mg/kg	ND	ND	ND
o-Chlorotoluene	NS	NS	mg/kg	ND	ND	ND
o-Xylene	NS	NS	mg/kg	ND	ND	ND
p-Chlorotoluene	NS	NS	mg/kg	ND	ND	ND
p-Diethylbenzene	NS	NS	mg/kg	ND	ND	ND
p-Ethyltoluene	NS	NS	mg/kg	ND	ND	ND
p-Isopropyltoluene	NS	NS	mg/kg	ND	ND	ND
p/m-Xylene	NS	NS	mg/kg	ND	ND	ND
sec-Butylbenzene	11	500	mg/kg	ND	ND	ND
Styrene	NS	NS	mg/kg	ND	ND	ND
tert-Butyl alcohol	NS	NS	mg/kg	--	--	--
tert-Butylbenzene	5.9	500	mg/kg	ND	ND	ND
Tetrachloroethene	1.3	150	mg/kg	8.1	0.033	1.7
Toluene	0.7	500	mg/kg	ND	ND	ND
trans-1,2-Dichloroethene	0.19	500	mg/kg	ND	ND	0.17
trans-1,3-Dichloropropene	NS	NS	mg/kg	ND	ND	ND
trans-1,4-Dichloro-2-butene	NS	NS	mg/kg	ND	ND	ND
Trichloroethene	0.47	200	mg/kg	1.4	0.0089	1.3
Trichlorofluoromethane	NS	NS	mg/kg	ND	ND	ND
Vinyl acetate	NS	NS	mg/kg	ND	ND	ND
Vinyl chloride	0.02	13	mg/kg	ND	ND	0.25
Xylenes, Total	1.6	500	mg/kg	ND	ND	ND
Total Metals						
Arsenic, Total	16	16	mg/kg	--	--	--
Barium, Total	820	400	mg/kg	--	--	--
Cadmium, Total	7.5	9.3	mg/kg	--	--	--
Chromium, Total	NS	NS	mg/kg	--	--	--
Lead, Total	450	1000	mg/kg	--	--	--
Mercury, Total	0.73	2.8	mg/kg	--	--	--
Selenium, Total	4	1500	mg/kg	--	--	--
Silver, Total	8.3	1500	mg/kg	--	--	--

Notes:

Bold and shaded yellow value indicates concentrations exceeds NY-PGW SCOs

Concentrations in all samples met NY-RESC SCOs for all analytes

NY-PGW = 6 NYCRR Part 375 Restricted Protection of Groundwater

Soil Cleanup Objectives

Table 3. Historic Soil Analytical Data
2921 Westchester Avenue
BCP #C203140

CLIENT SAMPLE ID	NY-PGW	NY-RESC	Units	SB-5-W2 (0-1)	SB-5-W2 (1-2)	SB-5-S (0-1)
SAMPLING DATE				2/27/2020	2/27/2020	2/27/2020
LAB SAMPLE ID				L2008988-17	L2008988-18	L2008988-20
				Qual	Qual	Qual

NY-RESC = 6 NYCRR Part 375 Restricted Commercial Use Soil

Cleanup Objectives

J = Estimated value

ND = Not detected

NS = No standard

-- = Not analyzed

Samples SB01, SB02, and SB05 collected as part of Castleton's 2019

Phase II ESI

Table 3. Historic Soil Analytical Data
2921 Westchester Avenue
BCP #C203140

CLIENT SAMPLE ID	NY-PGW	NY-RESC	Units	SB-5-S (1-2)	SB-5-S (2-3)
SAMPLING DATE				2/27/2020	2/27/2020
LAB SAMPLE ID				L2008988-21	L2008988-22
				Qual	Qual
General Chemistry					
Solids, Total	NS	NS	%	92	92.4
Volatile Organics by EPA 5035					
1,1,1,2-Tetrachloroethane	NS	NS	mg/kg	ND	ND
1,1,1-Trichloroethane	0.68	500	mg/kg	ND	ND
1,1,2,2-Tetrachloroethane	NS	NS	mg/kg	ND	ND
Freon-113	NS	NS	mg/kg	--	--
1,1,2-Trichloroethane	NS	NS	mg/kg	ND	ND
1,1-Dichloroethane	0.27	240	mg/kg	ND	ND
1,1-Dichloroethene	0.33	500	mg/kg	ND	ND
1,1-Dichloropropene	NS	NS	mg/kg	ND	ND
1,2,3-Trichlorobenzene	NS	NS	mg/kg	ND	ND
1,2,3-Trichloropropane	NS	NS	mg/kg	ND	ND
1,2,4,5-Tetramethylbenzene	NS	NS	mg/kg	ND	ND
1,2,4-Trichlorobenzene	NS	NS	mg/kg	ND	ND
1,2,4-Trimethylbenzene	3.6	190	mg/kg	ND	ND
1,2-Dibromo-3-chloropropane	NS	NS	mg/kg	ND	ND
1,2-Dibromoethane	NS	NS	mg/kg	ND	ND
1,2-Dichlorobenzene	1.1	500	mg/kg	ND	ND
1,2-Dichloroethane	0.02	30	mg/kg	ND	ND
1,2-Dichloroethene, Total	NS	NS	mg/kg	0.021	0.0074
1,2-Dichloropropane	NS	NS	mg/kg	ND	ND
1,3,5-Trimethylbenzene	8.4	190	mg/kg	ND	ND
1,3-Dichlorobenzene	2.4	280	mg/kg	ND	ND
1,3-Dichloropropane	NS	NS	mg/kg	ND	ND
1,3-Dichloropropene, Total	NS	NS	mg/kg	ND	ND
1,4-Dichlorobenzene	1.8	130	mg/kg	ND	ND
1,4-Dioxane	0.1	130	mg/kg	ND	ND
2,2-Dichloropropane	NS	NS	mg/kg	ND	ND
2-Butanone	0.12	500	mg/kg	ND	ND
2-Hexanone	NS	NS	mg/kg	ND	ND
4-Methyl-2-pentanone	NS	NS	mg/kg	ND	ND
Acetone	0.05	500	mg/kg	ND	ND
Acrolein	NS	NS	mg/kg	--	--
Acrylonitrile	NS	NS	mg/kg	ND	ND
Benzene	0.06	44	mg/kg	ND	ND
Bromobenzene	NS	NS	mg/kg	ND	ND
Bromochloromethane	NS	NS	mg/kg	ND	ND
Bromodichloromethane	NS	NS	mg/kg	ND	ND
Bromoform	NS	NS	mg/kg	ND	ND
Bromomethane	NS	NS	mg/kg	ND	ND
Carbon disulfide	NS	NS	mg/kg	ND	ND
Carbon tetrachloride	0.76	22	mg/kg	ND	ND
Chlorobenzene	1.1	500	mg/kg	ND	ND
Chloroethane	NS	NS	mg/kg	ND	ND
Chloroform	0.37	350	mg/kg	ND	ND
Chloromethane	NS	NS	mg/kg	ND	ND
cis-1,2-Dichloroethene	0.25	500	mg/kg	0.021	0.0074
cis-1,3-Dichloropropene	NS	NS	mg/kg	ND	ND
Cyclohexane	NS	NS	mg/kg	--	--
Dibromochloromethane	NS	NS	mg/kg	ND	ND

Table 3. Historic Soil Analytical Data
2921 Westchester Avenue
BCP #C203140

CLIENT SAMPLE ID	NY-PGW	NY-RESC	Units	SB-5-S (1-2)	SB-5-S (2-3)
SAMPLING DATE				2/27/2020	2/27/2020
LAB SAMPLE ID				L2008988-21	L2008988-22
				Qual	Qual
Dibromomethane	NS	NS	mg/kg	ND	ND
Dichlorodifluoromethane	NS	NS	mg/kg	ND	ND
Ethyl ether	NS	NS	mg/kg	ND	ND
Ethylbenzene	1	390	mg/kg	ND	ND
Hexachlorobutadiene	NS	NS	mg/kg	ND	ND
Isopropylbenzene	NS	NS	mg/kg	ND	ND
Methyl acetate	NS	NS	mg/kg	--	--
Methyl tert butyl ether	0.93	500	mg/kg	ND	ND
Methylcyclohexane	NS	NS	mg/kg	--	--
Methylene chloride	0.05	500	mg/kg	ND	ND
n-Butylbenzene	12	500	mg/kg	ND	ND
n-Propylbenzene	3.9	500	mg/kg	ND	ND
Naphthalene	12	500	mg/kg	ND	ND
o-Chlorotoluene	NS	NS	mg/kg	ND	ND
o-Xylene	NS	NS	mg/kg	ND	ND
p-Chlorotoluene	NS	NS	mg/kg	ND	ND
p-Diethylbenzene	NS	NS	mg/kg	ND	ND
p-Ethyltoluene	NS	NS	mg/kg	ND	ND
p-Isopropyltoluene	NS	NS	mg/kg	ND	ND
p/m-Xylene	NS	NS	mg/kg	ND	ND
sec-Butylbenzene	11	500	mg/kg	ND	ND
Styrene	NS	NS	mg/kg	ND	ND
tert-Butyl alcohol	NS	NS	mg/kg	--	--
tert-Butylbenzene	5.9	500	mg/kg	ND	ND
Tetrachloroethene	1.3	150	mg/kg	0.0014	ND
Toluene	0.7	500	mg/kg	ND	ND
trans-1,2-Dichloroethene	0.19	500	mg/kg	ND	ND
trans-1,3-Dichloropropene	NS	NS	mg/kg	ND	ND
trans-1,4-Dichloro-2-butene	NS	NS	mg/kg	ND	ND
Trichloroethene	0.47	200	mg/kg	0.00025 J	ND
Trichlorofluoromethane	NS	NS	mg/kg	ND	ND
Vinyl acetate	NS	NS	mg/kg	ND	ND
Vinyl chloride	0.02	13	mg/kg	0.0015	0.00042 J
Xylenes, Total	1.6	500	mg/kg	ND	ND
Total Metals					
Arsenic, Total	16	16	mg/kg	--	--
Barium, Total	820	400	mg/kg	--	--
Cadmium, Total	7.5	9.3	mg/kg	--	--
Chromium, Total	NS	NS	mg/kg	--	--
Lead, Total	450	1000	mg/kg	--	--
Mercury, Total	0.73	2.8	mg/kg	--	--
Selenium, Total	4	1500	mg/kg	--	--
Silver, Total	8.3	1500	mg/kg	--	--

Notes:

Bold and shaded yellow value indicates concentrations exceeds NY-PGW SCOs

Concentrations in all samples met NY-RESC SCOs for all analytes
NY-PGW = 6 NYCRR Part 375 Restricted Protection of Groundwater
Soil Cleanup Objectives

Table 3. Historic Soil Analytical Data
 2921 Westchester Avenue
 BCP #C203140

CLIENT SAMPLE ID	NY-PGW	NY-RESC	Units	SB-5-S (1-2)	SB-5-S (2-3)
SAMPLING DATE				2/27/2020	2/27/2020
LAB SAMPLE ID				L2008988-21	L2008988-22
				Qual	Qual

NY-RESC = 6 NYCRR Part 375 Restricted Commercial Use Soil

Cleanup Objectives

J = Estimated value

ND = Not detected

NS = No standard

-- = Not analyzed

Samples SB01, SB02, and SB05 collected as part of Castleton's 2019

Phase II ESI

Table 4. Historic Groundwater Analytical Data
2921 Westchester Avenue
BCP #C203140

CLIENT SAMPLE ID	NY-AWQS	Units	GW01	GW02	GW03	MW-2
SAMPLING DATE			8/9/2019	8/9/2019	8/9/2019	10/4/2019
LAB SAMPLE ID			19H0456-01	19H0456-02	19H0456-03	L1946362-01
			Qual	Qual	Qual	Qual
Volatile Organics by GC/MS						
1,1,1,2-Tetrachloroethane	5	ug/l	ND	ND	ND	ND
1,1,1-Trichloroethane	5	ug/l	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	5	ug/l	ND	ND	ND	ND
Freon-113	5	ug/l	ND	ND	ND	--
1,1,2-Trichloroethane	1	ug/l	ND	ND	ND	ND
1,1-Dichloroethane	5	ug/l	ND	ND	ND	ND
1,1-Dichloroethene	5	ug/l	ND	ND	ND	ND
1,1-Dichloropropene	5	ug/l	--	--	--	ND
1,2,3-Trichlorobenzene	5	ug/l	ND	ND	ND	ND
1,2,3-Trichloropropane	0.04	ug/l	ND	ND	ND	ND
1,2,4,5-Tetramethylbenzene	5	ug/l	--	--	--	ND
1,2,4-Trichlorobenzene	5	ug/l	ND	ND	ND	ND
1,2,4-Trimethylbenzene	5	ug/l	ND	ND	ND	ND
1,2-Dibromo-3-chloropropane	0.04	ug/l	ND	ND	ND	ND
1,2-Dibromoethane	0.0006	ug/l	ND	ND	ND	ND
1,2-Dichlorobenzene	3	ug/l	ND	ND	ND	ND
1,2-Dichloroethane	0.6	ug/l	ND	ND	ND	ND
1,2-Dichloroethene, Total	NS	ug/l	--	--	--	ND
1,2-Dichloropropane	1	ug/l	ND	ND	ND	ND
1,3,5-Trimethylbenzene	5	ug/l	ND	ND	ND	ND
1,3-Dichlorobenzene	3	ug/l	ND	ND	ND	ND
1,3-Dichloropropane	5	ug/l	--	--	--	ND
1,3-Dichloropropene, Total	NS	ug/l	--	--	--	ND
1,4-Dichlorobenzene	3	ug/l	ND	ND	ND	ND
1,4-Dioxane	NS	ug/l	ND	ND	ND	ND
2,2-Dichloropropane	5	ug/l	--	--	--	ND
2-Butanone	50	ug/l	7.8 D	ND	ND	ND
2-Hexanone	50	ug/l	ND	ND	ND	ND
4-Methyl-2-pentanone	NS	ug/l	ND	ND	ND	ND
Acetone	50	ug/l	3.2 JD	ND	ND	6
Acrolein	NS	ug/l	ND	ND	ND	--
Acrylonitrile	5	ug/l	ND	ND	ND	ND
Benzene	1	ug/l	ND	ND	ND	ND
Bromobenzene	5	ug/l	--	--	--	ND
Bromochloromethane	5	ug/l	ND	ND	ND	ND
Bromodichloromethane	50	ug/l	ND	ND	ND	ND
Bromoform	50	ug/l	ND	ND	ND	ND
Bromomethane	5	ug/l	ND	ND	ND	ND
Carbon disulfide	60	ug/l	ND	ND	ND	ND
Carbon tetrachloride	5	ug/l	ND	ND	ND	ND
Chlorobenzene	5	ug/l	ND	ND	ND	ND
Chloroethane	5	ug/l	ND	ND	ND	ND
Chloroform	7	ug/l	ND	ND	ND	ND
Chloromethane	NS	ug/l	ND	ND	ND	ND
cis-1,2-Dichloroethene	5	ug/l	32 D	96 D	93 D	ND
cis-1,3-Dichloropropene	0.4	ug/l	ND	ND	ND	ND
Cyclohexane	NS	ug/l	ND	ND	ND	--
Dibromochloromethane	50	ug/l	ND	ND	ND	ND
Dibromomethane	5	ug/l	ND	ND	ND	ND
Dichlorodifluoromethane	5	ug/l	ND	ND	ND	ND
Ethyl ether	NS	ug/l	--	--	--	ND

Table 4. Historic Groundwater Analytical Data
2921 Westchester Avenue
BCP #C203140

CLIENT SAMPLE ID	NY-AWQS	Units	GW01	GW02	GW03	MW-2
SAMPLING DATE			8/9/2019	8/9/2019	8/9/2019	10/4/2019
LAB SAMPLE ID			19H0456-01	19H0456-02	19H0456-03	L1946362-01
			Qual	Qual	Qual	Qual
Ethylbenzene	5	ug/l	ND	ND	ND	ND
Hexachlorobutadiene	0.5	ug/l	ND	ND	ND	ND
Isopropylbenzene	5	ug/l	ND	ND	ND	ND
Methyl acetate	NS	ug/l	ND	ND	ND	--
Methyl tert butyl ether	10	ug/l	ND	ND	ND	ND
Methylcyclohexane	NS	ug/l	ND	ND	ND	--
Methylene chloride	5	ug/l	ND	ND	ND	ND
n-Butylbenzene	5	ug/l	ND	ND	ND	ND
n-Propylbenzene	5	ug/l	ND	ND	ND	ND
Naphthalene	10	ug/l	--	--	--	ND
o-Chlorotoluene	5	ug/l	--	--	--	ND
o-Xylene	5	ug/l	ND	ND	ND	ND
p-Chlorotoluene	5	ug/l	--	--	--	ND
p-Diethylbenzene	NS	ug/l	--	--	--	ND
p-Ethyltoluene	NS	ug/l	--	--	--	ND
p-Isopropyltoluene	5	ug/l	ND	ND	ND	ND
p/m-Xylene	5	ug/l	ND	ND	ND	ND
sec-Butylbenzene	5	ug/l	ND	ND	ND	ND
Styrene	5	ug/l	ND	ND	ND	ND
tert Butyl alcohol	NS	ug/l	ND	ND	ND	--
tert-Butylbenzene	5	ug/l	ND	ND	ND	ND
Tetrachloroethene	5	ug/l	130 D	72 D	67 D	ND
Toluene	5	ug/l	ND	ND	ND	ND
trans-1,2-Dichloroethene	5	ug/l	ND	0.6 JD	0.6 JD	ND
trans-1,3-Dichloropropene	0.4	ug/l	ND	ND	ND	ND
trans-1,4-Dichloro-2-butene	5	ug/l	ND	ND	ND	ND
Trichloroethene	5	ug/l	9.8 D	18 D	18 D	ND
Trichlorofluoromethane	5	ug/l	ND	ND	ND	ND
Vinyl acetate	NS	ug/l	--	--	--	ND
Vinyl chloride	2	ug/l	1.4 D	1.1 D	1.1 D	ND
Xylenes, Total	NS	ug/l	ND	ND	ND	ND

Notes:

Bold and shaded yellow value indicates concentration exceeds NY-AWQS

NY-AWQS = NYSDEC Division of Water Technical and Operational Guidance Series 1.1.1 Class GA Ambient Water Quality Standards

J = Estimated value

D = Diluted

ND = Not detected

NS = No Standard

-- = Not analyzed

Samples GW01, GW02, and GW03 collected as part of Castleton's 2019 Phase II ESI

Table 4. Historic Groundwater Analytical Data
2921 Westchester Avenue
BCP #C203140

CLIENT SAMPLE ID	NY-AWQS	Units	MW-1	MW-3
SAMPLING DATE			10/4/2019	11/12/2019
LAB SAMPLE ID			L1946362-02	L1953890-01
			Qual	Qual
Volatile Organics by GC/MS				
1,1,1,2-Tetrachloroethane	5	ug/l	ND	ND
1,1,1-Trichloroethane	5	ug/l	ND	ND
1,1,2,2-Tetrachloroethane	5	ug/l	ND	ND
Freon-113	5	ug/l	--	--
1,1,2-Trichloroethane	1	ug/l	ND	ND
1,1-Dichloroethane	5	ug/l	ND	ND
1,1-Dichloroethene	5	ug/l	ND	ND
1,1-Dichloropropene	5	ug/l	ND	ND
1,2,3-Trichlorobenzene	5	ug/l	ND	ND
1,2,3-Trichloropropane	0.04	ug/l	ND	ND
1,2,4,5-Tetramethylbenzene	5	ug/l	ND	ND
1,2,4-Trichlorobenzene	5	ug/l	ND	ND
1,2,4-Trimethylbenzene	5	ug/l	ND	ND
1,2-Dibromo-3-chloropropane	0.04	ug/l	ND	ND
1,2-Dibromoethane	0.0006	ug/l	ND	ND
1,2-Dichlorobenzene	3	ug/l	ND	ND
1,2-Dichloroethane	0.6	ug/l	ND	ND
1,2-Dichloroethene, Total	NS	ug/l	ND	210
1,2-Dichloropropane	1	ug/l	ND	ND
1,3,5-Trimethylbenzene	5	ug/l	ND	ND
1,3-Dichlorobenzene	3	ug/l	ND	ND
1,3-Dichloropropane	5	ug/l	ND	ND
1,3-Dichloropropene, Total	NS	ug/l	ND	ND
1,4-Dichlorobenzene	3	ug/l	ND	ND
1,4-Dioxane	NS	ug/l	ND	ND
2,2-Dichloropropane	5	ug/l	ND	ND
2-Butanone	50	ug/l	ND	ND
2-Hexanone	50	ug/l	ND	ND
4-Methyl-2-pentanone	NS	ug/l	ND	ND
Acetone	50	ug/l	1.5 J	ND
Acrolein	NS	ug/l	--	--
Acrylonitrile	5	ug/l	ND	ND
Benzene	1	ug/l	ND	ND
Bromobenzene	5	ug/l	ND	ND
Bromochloromethane	5	ug/l	ND	ND
Bromodichloromethane	50	ug/l	ND	ND
Bromoform	50	ug/l	ND	ND
Bromomethane	5	ug/l	ND	ND
Carbon disulfide	60	ug/l	ND	ND
Carbon tetrachloride	5	ug/l	ND	ND
Chlorobenzene	5	ug/l	ND	ND
Chloroethane	5	ug/l	ND	ND
Chloroform	7	ug/l	ND	ND
Chloromethane	NS	ug/l	ND	ND
cis-1,2-Dichloroethene	5	ug/l	ND	210
cis-1,3-Dichloropropene	0.4	ug/l	ND	ND
Cyclohexane	NS	ug/l	--	--
Dibromochloromethane	50	ug/l	ND	ND
Dibromomethane	5	ug/l	ND	ND
Dichlorodifluoromethane	5	ug/l	ND	ND
Ethyl ether	NS	ug/l	ND	ND

Table 4. Historic Groundwater Analytical Data
2921 Westchester Avenue
BCP #C203140

CLIENT SAMPLE ID	NY-AWQS	Units	MW-1	MW-3
SAMPLING DATE			10/4/2019	11/12/2019
LAB SAMPLE ID			L1946362-02	L1953890-01
			Qual	Qual
Ethylbenzene	5	ug/l	ND	ND
Hexachlorobutadiene	0.5	ug/l	ND	ND
Isopropylbenzene	5	ug/l	ND	ND
Methyl acetate	NS	ug/l	--	--
Methyl tert butyl ether	10	ug/l	ND	ND
Methylcyclohexane	NS	ug/l	--	--
Methylene chloride	5	ug/l	ND	ND
n-Butylbenzene	5	ug/l	ND	ND
n-Propylbenzene	5	ug/l	ND	ND
Naphthalene	10	ug/l	ND	ND
o-Chlorotoluene	5	ug/l	ND	ND
o-Xylene	5	ug/l	ND	ND
p-Chlorotoluene	5	ug/l	ND	ND
p-Diethylbenzene	NS	ug/l	ND	ND
p-Ethyltoluene	NS	ug/l	ND	ND
p-Isopropyltoluene	5	ug/l	ND	ND
p/m-Xylene	5	ug/l	ND	ND
sec-Butylbenzene	5	ug/l	ND	ND
Styrene	5	ug/l	ND	ND
tert Butyl alcohol	NS	ug/l	--	--
tert-Butylbenzene	5	ug/l	ND	ND
Tetrachloroethene	5	ug/l	1.2	470
Toluene	5	ug/l	ND	ND
trans-1,2-Dichloroethene	5	ug/l	ND	ND
trans-1,3-Dichloropropene	0.4	ug/l	ND	ND
trans-1,4-Dichloro-2-butene	5	ug/l	ND	ND
Trichloroethene	5	ug/l	ND	79
Trichlorofluoromethane	5	ug/l	ND	ND
Vinyl acetate	NS	ug/l	ND	ND
Vinyl chloride	2	ug/l	ND	0.54 J
Xylenes, Total	NS	ug/l	ND	ND

Notes:

Bold and shaded yellow value indicates concentration exceeds NY-AWQS

NY-AWQS = NYSDEC Division of Water Technical and Operational Guidance Series 1.1.1 Class GA Ambient Water Quality Standards

J = Estimated value

D = Diluted

ND = Not detected

NS = No Standard

-- = Not analyzed

Samples GW01, GW02, and GW03 collected as part of Castleton's 2019 Phase II ESI

Table 5. Project Staff Organization
2921 Westchester Avenue
BCP #C203140

Tenen Staff	Title	Role
Alana Carroll, PG	Project Manager and Qualified Environmental Professional	Responsible for overall coordination and management of the project
Matthew Carroll, PE	Quality Assurance Officer	Responsible for quality assurance of sampling procedures and laboratory data
Ashley Platt	Environmental Scientist	Responsible for the day-to-day field monitoring and sampling activities, including boring and monitoring well installation, soil, groundwater, soil vapor and indoor air sampling, dust monitoring, and PID monitoring

Tenen Environmental, LLC

2921 Westchester Avenue, Bronx, NY
BCP Site No. C203140

Appendix A
Previous Reports (on cd)

Tenen Environmental, LLC

2921 Westchester Avenue, Bronx, NY
BCP Site No. C203140

Appendix B
Quality Assurance Project Plan

Quality Assurance Project Plan
for
2921 Westchester Avenue
Remedial Investigation Work Plan

2921 Westchester Avenue – Bronx, NY
Block 4164, Lot 5
BCP Site # C203140

Submitted to:

New York State Department of Environmental Conservation
Division of Environmental Remediation
Remedial Bureau A
625 Broadway, 12th Floor
Albany, NY 12233-7016

Prepared for:

Ralford Realty Corp.
8 West 40th Street
New York, NY 10018

Prepared by:



121 West 27th Street, Suite 702
New York, NY 10001

December 2020

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Figure 1a – Site Map and Proposed Soil and Groundwater Sampling Locations

Figure 1b – Proposed Soil Vapor and Indoor Air Sampling Locations

Appendices

Appendix A – Resumes

Appendix B – EPA 537 Field Sampling Guidelines

Appendix C – PFAS Compounds to be Analyzed and Associated MDLs

Appendix D – Laboratory Standard Operating Procedures for PFAS Analysis

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) has been developed for the Remedial Investigation Work Plan (RIWP) prepared for the 2921 Westchester Avenue property (the Site).

The Site, located at 2921 Westchester Avenue, is an irregularly-shaped parcel of land located on the west side of Westchester Avenue, between Pilgrim Avenue and Buhre Avenue in the Pelham Bay section of the Bronx, New York.

The Site is improved with one two-story commercial building with a partial basement that occupies the entire Site lot. The Site consists of one tenant space of the building and a portion of the partial basement. The Site is an irregularly-shaped 525 square foot parcel located in the Bronx Community Board 10 and is generally identified as a portion of Block 4164 and Lot 5. The Site is currently occupied by a tutor and afterschool program, but was historically utilized as a dry cleaning facility.

1.1 Project Scope and QAPP Objective

The proposed scope of work includes the following:

- advancement of borings for soil and soil vapor sampling on the Site;
- installation of new groundwater monitoring wells; and,
- collection of soil, groundwater, soil vapor, and ambient air samples from soil borings, new and existing permanent monitoring wells and permanent soil vapor points.

The objective of the QAPP is to detail the policies, organization, objectives, functional activities and specific quality assurance/quality control activities designed to achieve the data quality goals or objectives of the Remedial Investigation Work Plan. This QAPP addresses how the acquisition and handling of samples and the review and reporting of data will be documented for quality control (QC) purposes. Specifically, this QAPP addresses the following:

- The procedures to be used to collect, preserve, package, and transport samples;
- Field data collection and record keeping;
- Data management;
- Chain-of-custody procedures; and,
- Determination of precision, accuracy, completeness, representativeness, decision rules, comparability and level of quality control effort.

2.0 PROJECT ORGANIZATION

The personnel detailed are responsible for the implementation of the QAPP. Tenen Environmental, LLC (Tenen) will implement the RIWP on behalf of Ralford Realty Corp. (the Participant) once it has been approved by the New York State Department of Environmental Conservation (NYSDEC).

The Project Manager and Qualified Environmental Professional (QEP) will be Mrs. Alana Carroll, CPG, managing scientist at Tenen. Mrs. Carroll is a certified professional geologist with experience in all aspects of site assessment, development and implementation of remedial strategies. Her experience involves projects from inception through investigation, remediation and closure. Her expertise includes soil, soil vapor and groundwater remediation; remedial selection and design; field/health and safety oversight and preparation of work plans and reports to satisfy the requirements of various regulatory agencies. Mrs. Carroll received her BS in Geology from Hofstra University; her resume is included in Appendix A.

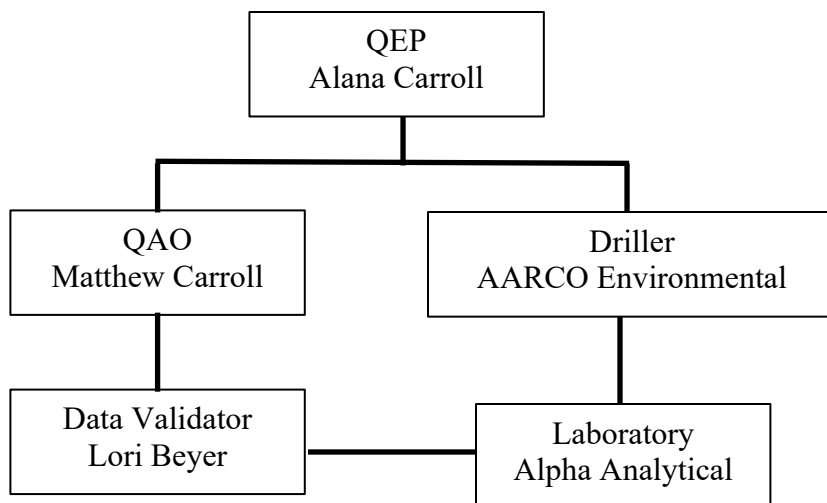
The Quality Assurance Officer will be Mr. Matthew Carroll, P.E., principal at Tenen. Mr. Carroll is an environmental engineer experienced in all aspects of site assessment and development and implementation of remedial strategies. His experience involves projects from inception through investigation, remediation and closure. His expertise includes soil, soil vapor and groundwater remediation; remedial selection and design; field/health and safety oversight and preparation of work plans and reports to satisfy the requirements of various regulatory agencies. Mr. Carroll received his Bachelor of Engineering from Stevens Institute of Technology and Bachelor of Science in Chemistry from New York University and is a New York State professional engineer; his resume is included in Appendix A.

In addition, Tenen will utilize subcontractors for drilling (AARCO Environmental Services of Lindenhurst, NY), laboratory services (Alpha Analytical of Westborough, MA) and data validation (L.A.B. Validation Corp. of East Northport, NY). The resume for the DUSR preparer, Ms. Lori Beyer, is included in Appendix A.

Contact Information

Remedial Party (Ralford Realty Corp.), Anthony Scovotti, 718.824.1700
Tenen Environmental, Alana Carroll or Matthew Carroll, 646.606.2332

An organization chart for the implementation of the Remedial Investigation Work Plan and QAPP is below.



3.0 SAMPLING AND DECONTAMINATION PROCEDURES

A detailed description of the procedures to be used during this program for collection of the soil, soil vapor, indoor air, ambient air and groundwater samples is provided below. Proposed sample locations are shown on Figures 1a and 1b of the Work Plan. An Analytical Methods/Quality Assurance Summary is provided in Table 1, included in Section 3.11.

3.1 Level of Effort for QC Samples

Field blank, trip blank, field duplicate and matrix spike (MS) / matrix spike duplicate (MSD) samples will be analyzed to assess the quality of the data resulting from the field sampling and analytical programs. Each type of QC sample is discussed below.

- Field and trip blanks consisting of distilled water will be submitted to the analytical laboratories to provide the means to assess the quality of the data resulting from the field-sampling program. Field (equipment) blank samples are analyzed to check for procedural chemical constituents that may cause sample contamination. Trip blanks are used to assess the potential for contamination of samples due to contaminant migration during sample shipment and storage.
- Duplicate samples are analyzed to check for sampling and analytical reproducibility.
- MS/MSD samples provide information about the effect of the sample matrix on the digestion and measurement methodology.

The general level of QC effort will be one field duplicate and one field blank (when non-dedicated equipment is used) for every 20 or fewer investigative samples of a given matrix. Additional sample volume will also be provided to the laboratory to allow one site-specific MS/MSD for every 20 or fewer investigative samples of a given matrix. One trip blank will be included along with each sample delivery group of volatile organic compound (VOC) samples. If non-dedicated sampling equipment is used to collect PFAS samples, one equipment blank will be collected at a frequency of one per day that PFAS samples are collected for a given matrix.

The analytical laboratory, Alpha Analytical, is certified under the New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP) as Lab IDs 11148 and 11627. NYSDEC Analytical Services Protocol (ASP) Category B deliverables will be prepared by the laboratory.

3.2 Sample Handling

Samples will either be picked up by the laboratory, delivered to the laboratory in person by the sampler, or transported to the laboratory by overnight courier. All samples will be shipped to the laboratory to arrive within 48 hours after collection, and the laboratory will adhere to the analytical holding times for these analyses, as listed in the current version of the New York State ASP.

3.3 Custody Procedures

Sample custody will be controlled and maintained through the chain-of-custody procedures. The chain of custody is the means by which the possession and handling of samples is tracked from the site to the laboratory. Sample containers will be cleaned and preserved at the laboratory before shipment to the Site. The following sections (Sections 3.4 and 3.5) describe procedures for maintaining sample custody from the time samples are collected to the time they are received by the analytical laboratory.

3.4 Sample Storage

Samples will be stored in secure limited-access areas. Walk-in coolers or refrigerators will be maintained at 4°C, +/- 2°C, or as required by the applicable regulatory program. The temperatures of all refrigerated storage areas are monitored and recorded a minimum of once per day. Deviations of temperature from the applicable range require corrective action, including moving samples to another storage location, if necessary.

3.5 Sample Custody

Sample custody is defined by this QAPP as the following:

- The sample is in someone's actual possession;
- The sample is in someone's view after being in his or her physical possession;
- The sample was in someone's possession and then locked, sealed, or secured in a manner that prevents unsuspected tampering; or,
- The sample is placed in a designated and secured area.

Samples will be removed from storage areas by the sample custodian or laboratory personnel and transported to secure laboratory areas for analysis. Access to the laboratory and sample storage areas is restricted to laboratory personnel and escorted visitors only; all areas of the laboratory are therefore considered secure.

Laboratory documentation used to establish chain of custody and sample identification may include the following:

- Field chains of custody or other paperwork that arrives with the sample;
- Laboratory chain of custody;
- Sample labels or tags attached to each sample container;
- Sample custody seals;
- Sample preparation logs (i.e., extraction and digestion information) recorded in hardbound laboratory books, filled out in legible handwriting, and signed and dated by the chemist;
- Sample analysis logs (e.g., metals, GC/MS, etc.) information recorded in hardbound laboratory books that are filled out in legible handwriting, and signed and dated by the chemist;

- Sample storage log (same as the laboratory chain of custody); and,
- Sample disposition log, which documents sample disposal by a contracted waste disposal company.

3.6 Sample Tracking

All samples will be maintained in the appropriate coolers prior to and after analysis. Laboratory analysts will remove and return their samples, as needed. Samples that require internal chain of custody procedures will be relinquished to the analysts by the sample custodians. The analyst and sample custodian will sign the original chain of custody relinquishing custody of the samples from the sample custodian to the analyst. When the samples are returned, the analyst will sign the original chain of custody returning sample custody to the sample custodian. Sample extracts will be relinquished to the instrumentation analysts by the preparatory analysts. Each preparation department will track internal chain of custody through their logbooks/spreadsheets.

Any change in the sample during the time of custody will be noted on the chain of custody (e.g., sample breakage or depletion).

3.7 Soil Sampling

Soil samples from borings will be collected from plastic liners collected by a direct-push Geoprobe® or manual sampling hammer. In general, select soil intervals will be screened between grade and the terminal depth of the boring. New, dedicated disposable acetate liners will be used for all soil samples collected using the Geoprobe or manual sampling hammer. All casings will be decontaminated between borings, as described in Section 3.11.

The liner for each sample interval will be opened and the soil within scanned for volatile organic compounds (VOCs) using a photoionization detector (PID) and geologically described using the Unified Soil Classification System, including documentation of observations regarding potential contamination such as odors, staining, etc. All descriptions and observations will be documented in a field notebook.

At all soil boring locations, the collected soil volumes will be screened with a PID and visual (e.g., source areas – sumps, floor drains, stains, sheens, blebs, presence of NAPL, etc.) and olfactory observations will be recorded. If evidence of VOC impacts is detected and drilling conditions allow, the borehole will be extended until no impacts are detected. The full extent of the boring will be screened and samples will be collected based on the field observations and readings. For each soil delineation boring (SB-1 and SB-4 through SB-9), samples will be collected from each one-foot interval of the soil column, from directly below the basement slab to the top of bedrock (approximately 3 to 4 feet below basement grade [ft-bbg]). Soil delineation samples will be analyzed on a stepwise basis: the one-foot interval directly below the slab will be analyzed first, if this interval contains concentrations of chlorinated VOCs (cVOCs) in excess of applicable standards, then the next interval will be analyzed (VOCs, only) until a clean interval is reached. A minimum of two soil samples will be analyzed from borings located onsite. Analysis of soil samples collected from offsite soil delineation samples (if any) will terminate when a

clean interval is present. For each characterization boring (SB-2, SB-3, SB-11, SB-12, and SB-13), soil samples will be collected from the two-foot interval directly below the basement slab and the two-foot interval directly above bedrock. For the exterior offsite soil boring, one soil sample will be collected from the interval of highest suspected contamination based upon PID readings, visual and olfactory methods. If not contamination is observed, the sample will be collected from the two-foot interval directly above the groundwater interface. Samples will be collected at the intervals detailed above (e.g., based on screening, visual and olfactory indicators) to delineate the vertical and horizontal extent of site contaminants.

Soil samples to be analyzed will be collected directly from the plastic sleeves or hand tools. All collected soil samples will be placed in pre-cleaned, pre-preserved laboratory provided sample bottles or En Core samplers (En Novative Technologies, Inc.), cooled to 4°C in the field, and transported under chain-of-custody command to the designated laboratory for analysis.

A minimum of two soil samples collected from each onsite boring will be analyzed for the following analytes on the Part 375 list with a Category B deliverable package:

- Target Compound List (TCL) VOCs by EPA Method 8260C;
- TCL Semivolatile Organic Compounds (SVOCs) by EPA Method 8270C;
- Polychlorinated Biphenyls (PCBs) by EPA Method 8082A;
- Pesticides by EPA Method 8081B;
- Herbicides by EPA Method 8151A;
- Target Analyte List (TAL) Metals by EPA Method 6010C / 7471B;
- Trivalent and Hexavalent Chromium by EPA Method 3060A;
- Total Cyanide by EPA Method 9010C;
- PFAS by EPA Method 537 Modified (reporting limit of 0.5 microgram per kilogram [ug/kg]) via liquid chromatography with tandem mass spectrometry (LC-MS/MS) using methodologies based on EPA Method 537.1; and
- 1,4-Dioxane by EPA Method 8270.

All offsite samples will be analyzed for the following analytes on the Part 375 list with a Category B deliverable package:

- TCL VOCs by EPA Method 8260C.

Field methods can impact the analysis of PFAS. PFAS samples will be collected using dedicated disposable sampling equipment when possible. If dedicated disposable sampling equipment cannot be used, samples will be collected with stainless steel tools (spoons, bowls, etc.) and decontaminated using detergent (Alconox) and clean, PFAS-free water. Sampling containers for PFAS will be made of high density polyethylene (HDPE) with caps that will not be lined with polytetrafluoroethylene (PTFE). PFAS sampling containers will be kept in separate coolers from all other sampling containers and only regular ice will be used to cool the samples. Field staff conducting the sampling will not wear clothing that contains PTFE material or that has been waterproofed with PFAS material during sampling and all clothing worn will be laundered multiple times. Any bug spray or sunscreen utilized by field staff conducting the sampling will

be PFAS free. A sampling guide is included in Appendix B. A list of PFAS compounds to be analyzed and associated method detection limits (MDLs) is included in Appendix C. The laboratory standard operating procedures for PFAS analysis is included in Appendix D.

3.8 Monitoring Well Installation and Development

Four new groundwater well locations are proposed (MW-4 through MW-6 and BW-1). The offsite and exterior well will be installed and screened approximately five feet into the shallow aquifer, as determined based on field readings. The interior non-bedrock wells will be installed with a four-foot pre-packed PVC screen and seated above bedrock. The bedrock well will be installed and screened approximately five feet into bedrock. For the bedrock well, the overburden will be cased off from the underlying bedrock to prevent downward migration of cVOC impacts into bedrock fractures.

The exterior monitoring well will be installed using a direct-push Geoprobe®, the interior non-bedrock monitoring wells will be installed using a manual sampling hammer, and the bedrock monitoring well will be installed using a hydraulic drill rig with coring capabilities. A two-inch, ten-foot PVC screen (0.020-inch slot) will be installed in all exterior wells; a pre-packed, two-inch, four-foot PVC screen (0.020-inch slot) will be installed in all interior non-bedrock wells; and a two-inch five-foot screen (0.020-inch slot) will be installed five feet into bedrock for the bedrock well.

A filter of sand (US Std. sieve sizes 30 to 8) will be installed in the annular space around the screen (minimum 2-inches around the circumference of the well) and will be extended two feet above the screen. The annular area around the well casing will be sealed with bentonite pellets for an interval of two feet above the filter pack in the shallow and deep wells. The annular space above the bentonite pellets to one foot below grade will be backfilled with drilling cuttings. The remaining one foot will be sealed with a concrete cap and well apron (expanding cement). A locking well cap will be installed upon completion of each well.

Following installation, at least three well volumes of the water column will be removed using a submersible pump. All permanent wells will be surveyed to a common site datum.

3.9 Groundwater Sampling

Prior to sample collection, static water levels will be measured and recorded from all monitoring wells. Monitoring wells will also be gauged for the presence of non-aqueous phase liquid (NAPL). In the event that NAPL is detected, Tenen will record the thickness and will not collect a sample. If NAPL is not detected, Tenen will purge and sample monitoring wells using low-flow/minimal drawdown purge and sample collection procedures (peristaltic pump system). Prior to sample collection, groundwater will be evacuated from each well at a low-flow rate (typically less than 0.1 L/min). Field measurements for pH, temperature, turbidity, dissolved oxygen, specific conductance, oxidation-reduction potential and water level, as well as visual and olfactory field observations, will be periodically recorded and monitored for stabilization. Purging will be considered complete when pH, specific conductivity, dissolved oxygen and

temperature stabilize and when turbidity measurements fall below 50 Nephelometric Turbidity Units (NTU) or become stable above 50 NTU.

Stability is defined as variation between field measurements of 10 percent or less and no overall upward or downward trend in the measurements. Upon stabilization of field parameters, groundwater samples will be collected and analyzed as discussed below.

Field methods can impact the analysis of perfluoroalkyl acids (PFAS). A sampling guide is included in Appendix B.

Wells will be purged and sampled using dedicated pump tubing following low-flow/minimal drawdown purge and sample collection procedures, as described above. The pump will be decontaminated between samples.

Groundwater samples will be collected for analysis through dedicated tubing. Prior to, and immediately following collection of groundwater samples, field measurements for pH, specific conductance, temperature, dissolved oxygen, turbidity and depth-to-water, as well as visual and olfactory field observations will be recorded. All collected groundwater samples will be placed in pre-cleaned, pre-preserved laboratory provided sample bottles, cooled to 4°C in the field, and transported under chain-of-custody command to the designated laboratory for analysis.

All groundwater samples will be analyzed for the following analytes on the Part 375 list and emerging contaminants with a Category B deliverable package:

- TCL VOCs by EPA Method 8260C;
- TCL SVOCs by EPA Method 8270C;
- PCBs by EPA Method 8082A;
- Pesticides by EPA Method 8081B;
- Herbicides by EPA Method 8151A;
- Total and Dissolved TAL Metals by EPA Method 6010C / 7471B;
- Total and Dissolved Trivalent and Hexavalent Chromium by EPA Method 3060A;
- Total and Dissolved Cyanide by EPA Method 9010C;
- 1,4-dioxane by EPA Method 8270D-SIM Modified; and
- PFAS by EPA Method 537 Modified (reporting limit of 2 nanograms per liter [ng/l]) via LC-MS/MS using methodologies based on EPA Method 537.1.

Field methods can impact the analysis of PFAS. PFAS samples will be collected using dedicated disposable HDPE tubing. Sampling containers for PFAS will be made of HDPE with caps that will not be lined with PTFE. PFAS sampling containers will be kept in separate coolers from all other sampling containers and only regular ice will be used to cool the samples. Field staff conducting the sampling will not wear clothing that contains PTFE material or that has been waterproofed with PFAS material during sampling and all clothing worn will be laundered multiple times. Any bug spray or sunscreen utilized by field staff conducting the sampling will be PFAS free. A sampling guide is included in Appendix B. A list of PFAS compounds to be analyzed and associated MDLs is included in Appendix C. Alpha Analytical, an ELAP-certified

lab for PFOA and PFOS in drinking water by EPA Method 537, will be performing all PFAS analyses of groundwater. The laboratory standard operating procedures for PFAS analysis is included in Appendix D.

3.10 Sub-Slab Vapor and Soil Vapor Installation and Sampling

Sub-slab vapor and soil vapor samples will be collected in accordance with the NYSDOH *Guidance for Evaluating Soil Vapor Intrusion In the State of New York*, dated October 2006.

Seven sub-slab soil vapor points (SS-1 to SS-7) will be installed within the Site basement and the three other partial basements on the Site lot to characterize onsite and offsite interior conditions. The soil vapor points will be installed within the lowest building level no more than two inches below the building slab. Three offsite and exterior soil vapor points (SV-1 through SV-3) will be installed within the sidewalks of Pilgrim Avenue and Westchester Avenue in front of residential housing to characterize offsite soil vapor conditions. The soil vapor points will be advanced to approximately 10 ft-bg.

Exterior soil vapor samples will be collected using disposable points at a depth of approximately ten feet below grade (ft-bg). A Geoprobe® direct-push rig will be used to install the exterior soil vapor sampling probes. Indoor soil vapor probes will be installed using a hand-held hammer core drill. Once the soil vapor sampling probe has been driven to the desired depth, it will be attached to disposable tubing for sample collection.

The borehole above the sampling probe to grade will be sealed using an inert sealant to prevent ambient air mixing with the soil vapor. Ambient air will be purged from the boring hole by attaching the surface end of the ¼-inch diameter Teflon® tube to an air valve and then to a vacuum pump. The vacuum pump will remove three volumes of air (volume of the sample probe and tube) prior to sample collection. The flow rate for both purging and sample collection will not exceed 0.2 liter per minute (L/min).

The sub-slab and soil vapor samples will be first screened for organic vapors using a PID. A tracer gas will be used in accordance with NYSDOH protocols to verify the integrity of the soil vapor probe seal. Helium will be used as the tracer gas and a bucket will serve to keep it in contact with the probe during testing. A portable monitoring device will be used to analyze a sample of soil vapor for the tracer prior to sampling. If the tracer sample results show a significant presence of the tracer, the probe seals will be adjusted to prevent infiltration.

A sample log sheet will be maintained summarizing sample identification, date and time of sample collection, sampling depth, identity of samplers, sampling methods and devices, soil vapor purge volumes, volume of the soil vapor extracted, vacuum of canisters before and after the samples are collected, apparent moisture content of the sampling zone and chain of custody.

Sub-slab soil vapor samples will be collected in laboratory-supplied and batch-certified 6-liter Summa canisters using eight-hour regulators in commercial structures. Soil vapor samples will be collected in laboratory-supplied and batch-certified 6-liter Summa canisters using two-hour

regulators. All soil vapor samples will be analyzed for VOCs using EPA Method TO-15.

3.11 Indoor and Ambient Air Sampling Methodology

All samples will be collected in accordance with the NYSDOH Soil Vapor Guidance. Some sample locations may be adjusted based on field observations or conditions.

Indoor air samples will be co-located with sub-slab soil vapor samples. The indoor and ambient air samples will be collected from breathing height (three to five feet above the floor) from within the Site buildings. The sampling flow rate will not exceed 0.2 L/min. Sampling will occur for eight-hours in commercial and industrial structures. A sample log sheet will be maintained summarizing 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, vacuum of canisters before and after the samples are collected, apparent moisture content of the sampling zone, and chain of custody protocols.

Seven indoor air samples and three ambient air samples will be collected in laboratory-supplied and individually-certified 6-liter canisters using eight-hour regulators during soil vapor sample collection. Indoor and ambient air samples will be collected during soil vapor sample collection and will be analyzed for VOCs using EPA Method TO-15.

3.12 Analytical Methods/Quality Assurance Summary Table

A summary of the analytical methods and quality assurance methods are included in Table 1, below.

Table 1
Analytical Methods/Quality Assurance Summary

Matrix	Proposed Samples	QA/QC Samples				Total # Samples	Analytical Parameter	Method	Preservative	Holding Times	Container
		TB	FB	DUP	MS/MSD						
Soil	39	2	2	2	2 / 2	49	VOCs	8260C	Cool to 4°C, No Headspace	14 days	(3) Encore samplers; (1) 2-oz plastic bottle
	24	0	2	2	2 / 2	32	SVOCs	8270D	Cool to 4°C		(1) 4-oz amber glass bottle
	24	0	2	2	2 / 2	32	Pesticides / Herbicides	8081B			
	24	0	2	2	2 / 2	32	PCBs	8082A			
	24	0	2	2	2 / 2	32	TAL Metals (plus Cyanide and Chromium)	8151A, 7196A, 3050B, 7471B, 9010C/9012B/ 9014, 3060A/7196		28 days for mercury; 30 days to extraction for hexavalent chromium (plus 7 days for analysis); 6 months for all others	
	24	0	2	2	2 / 2	32	1,4-Dioxane	8270		14 days	
	24	0	2	2	2 / 2	32	PFAS	537 Modified		14 days to extraction, 28 days following extraction	

Matrix	Proposed Samples	QA/QC Samples				Total # Samples	Analytical Parameter	Method	Preservative	Holding Times	Container
		TB	FB	DUP	MS/MSD						
Groundwater	7	1	1	1	1 / 1	12	VOCs	8260C	Cool to 4°C, HCL	14 days	(3) 40 mL amber glass vials
	7	0	1	1	1 / 1	11	SVOCs	8270D	Cool to 4°C	7 days to extraction, 40 days following extraction	(2) 1 L amber glass bottle
	7	0	1	1	1 / 1	11	Pesticides / Herbicides	8081B			(2) 1 L amber glass bottle
	7	0	1	1	1 / 1	11	PCBs	8082A			
	7	0	1	1	1 / 1	11	Total TAL Metals (plus Cyanide and Chromium)	200.7, 200.8, 245.2, 6010C, 6020A, 7470A, 7472, 9010C/9012B/ 9014, 7196A	Cool to 4°C, HNO3	24 hours for hexavalent chromium, 14 days for cyanide, 28 days for mercury, 180 days for all others	(2) Plastic 500 mL bottles, HNO3 preserved
	7	0	1	1	1 / 1	11	Dissolved TAL Metals (plus Cyanide and Chromium)	200.7, 200.8, 245.2, 6010C, 6020A, 7470A, 7472, 9010C/9012B/ 9014, 7196A	Cool to 4°C		(1) 500 mL plastic bottle
	7	0	1	1	1 / 1	11	1,4-Dioxane	8270D-SIM Modified		7 days to extraction, 40 days following extraction	
	7	0	1	1	1 / 1	11	PFAS	537	Cool to 4°C	14 days to extraction	(2) 250 mL HDPE bottle

Matrix	Proposed Samples	QA/QC Samples				Total # Samples	Analytical Parameter	Method	Preservative	Holding Times	Container
		TB	FB	DUP	MS/MSD						
Sub-slab Soil Vapor	7	0	0	0	0	7	VOCs	TO-15	None	30 days	(1) 6-L Summa
Soil Vapor	3	0	0	0	0	3					(1) 6-L Summa
Indoor Air	7	0	0	0	0	7					(1) 6-L Summa
Ambient Air	3	0	0	0	0	3					(1) 6-L Summa

TB – Trip Blank

FB – Field Blank

DUP – Duplicate

°C – degrees Celsius

mL – milliliter

L – liter

3.13 Decontamination

Where possible, samples will be collected using new, dedicated sampling equipment so that decontamination is not required. All non-dedicated drilling tools and equipment will be decontaminated between boring locations using potable tap water and a phosphate-free detergent (e.g., Alconox) and/or a steam cleaner. All non-dedicated sampling equipment will also have a final rinse with deionized water. Decontamination water will be collected and disposed as investigation-derived waste (IDW).

3.14 Data Review and Reporting

The NYSDEC ASP Category B data package will be validated by an independent data validation subconsultant and a DUSR summarizing the results of the data validation process will be prepared. All reported analytical results will be qualified as necessary by the data validation and will be reviewed and compared against background concentrations and/or applicable New York State criteria:

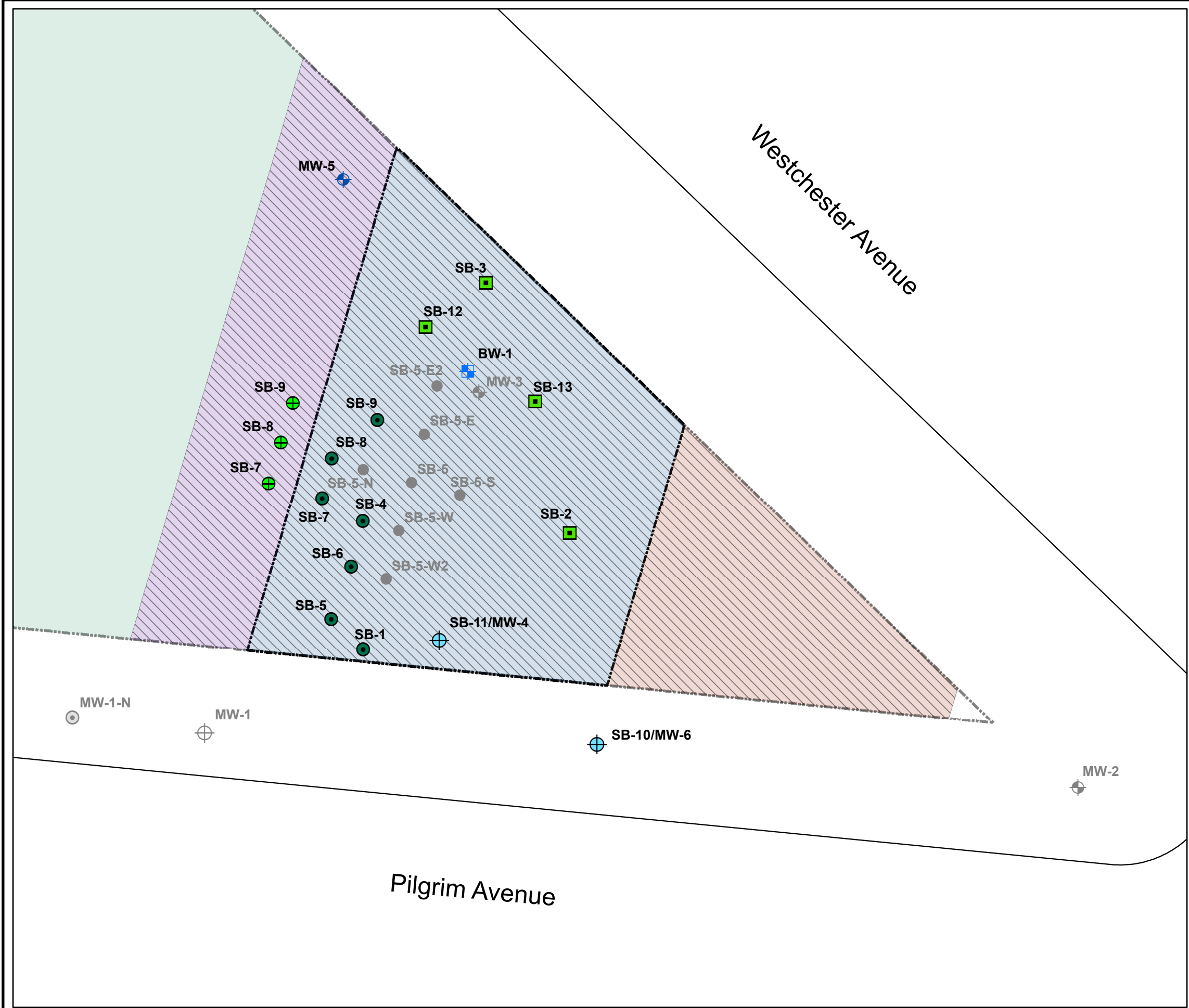
Soil –Protection of Groundwater and Restricted Commercial Use Soil Cleanup Objectives (SCOs) as listed in 6NYCRR Part 375 and NYSDEC's October 2020 PFAS Guidelines;

Groundwater – Class GA groundwater standards and guidance values for groundwater as listed in NYSDEC Technical and Operations Guidance Series (TOGS) 1.1.1 and NYSDEC's January 2020 PFAS Guidelines; and,

Soil Vapor – NYSDOH Matrices and Air Guidance Values (AGVs).

A report documenting the Remedial Investigation will be prepared, and will describe Site conditions and document applicable observations made during the sample collection. In addition, the report will include a description of the sampling procedures, tabulated sample results and an assessment of the data and conclusions. The laboratory data packages, DUSR, geologic logs, well construction diagrams, and field notes will be included in the report as appendices. All data will also be submitted electronically to NYSDEC via the Environmental Information Management System (EIMS) in EqUIS format.

Figures



Legend

Proposed Sample Locations

- Delineation Boring Sample Location
- Characterization Boring Sample Location
- Monitoring Well Sample Location
- Monitoring Well Location (Bedrock Well)
- Soil Boring/Monitoring Well Location
- Contingency Borings

Tenen Due Diligence Sample Locations

- Soil Boring Sample Location
- Groundwater Sample Location
- Soil Boring/Groundwater Sample Location
- Soil Delineation Sample Locations

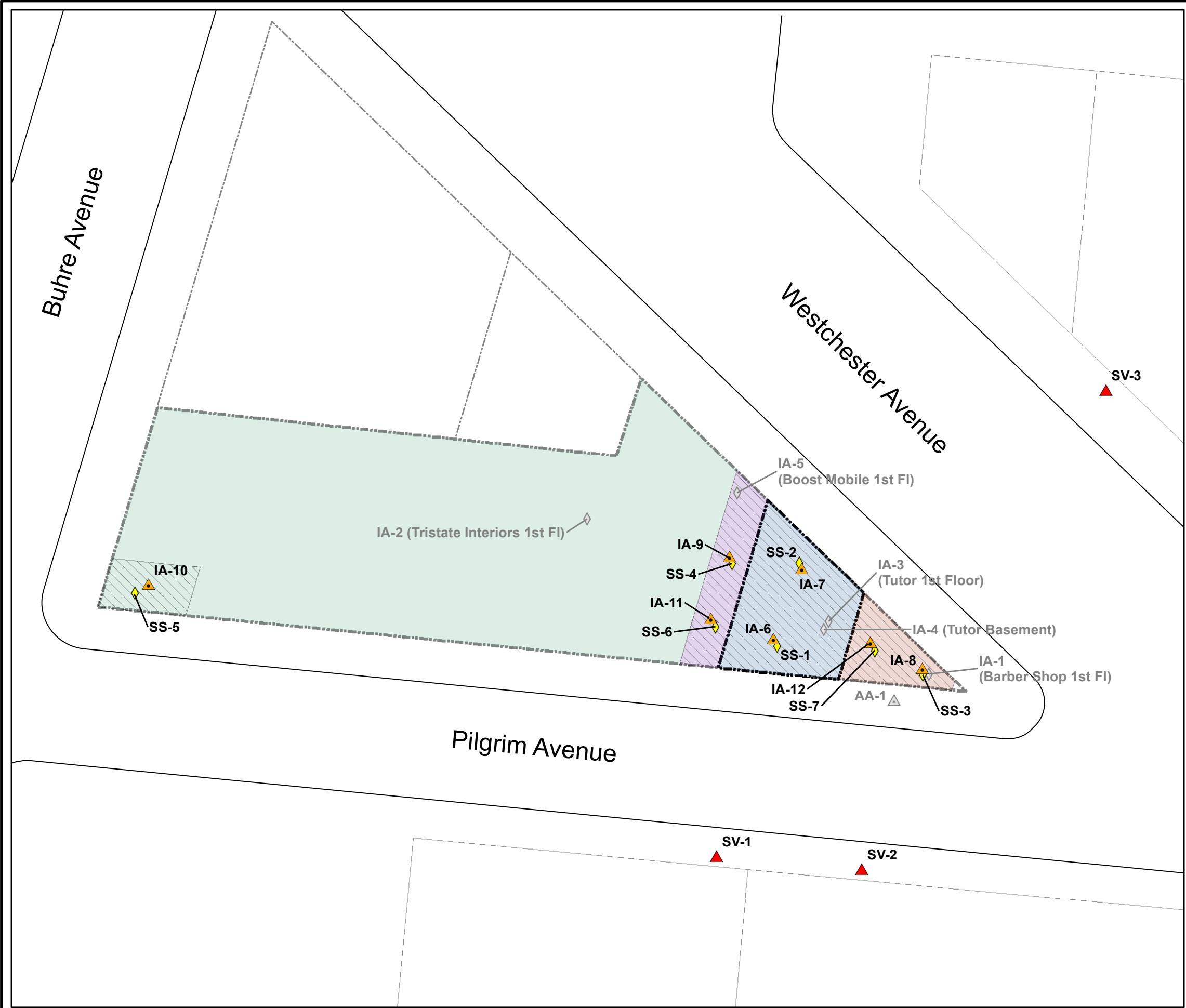
- Cellar Spaces
- Home Store
- Boost Mobile
- Vacant Space
- Barber Shop
- Site Boundary
- Tax Lot

Note: Contingency Borings will be installed if the corresponding Delineation Borings cannot be installed due to foundational elements.

0 2.5 5 10 15 20 Feet

North

Drawing Title		Proposed Soil and Groundwater Sampling Locations		Site		2921 Westchester Avenue Bronx, New York Block 4164, Lot 5	
Drawing No		Figure 1a		TENEN ENVIRONMENTAL		Tenen Environmental, LLC 121 West 27th Street Suite 702 New York, NY 10001 O: (646) 606-2332 F: (646) 606-2379	
		Drawn By LM		Checked By AP		Date December 2020	
		Scale As Noted					



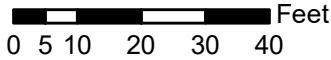
Legend

Proposed Sample Locations

- ▲ Soil Vapor Sample Location
- ◆ Sub-Slab Soil Vapor Location
- ▲ Indoor Air Sample Location

Tenen Due Diligence Sample Locations

- ▲ Ambient Air Sample Location
- ◆ Indoor Air Sample Location
- ▨ Cellar Spaces
- Home Store
- Boost Mobile
- Vacant Space
- Barber Shop
- ▭ Site Boundary
- ⋯ Tax Lot



Drawing Title		Drawing No	
Proposed Soil Vpaor and Indoor Air Sampling Locations		Figure 1b	
Drawn By	LM	Checked By	AP
Date	December 2020	Scale	As Noted
TENEN ENVIRONMENTAL			
Tenen Environmental, LLC 121 West 27th Street Suite 702 New York, NY 10001 O: (646) 606-2332 F: (646) 606-2379			
Site			
2921 Westchester Avenue Bronx, New York Block 4164, Lot 5			

Appendix A
Resumes

Alana M. Carroll, PG
Senior Project Manager

PROFESSIONAL PROFILE

Ms. Alana Carroll is a professional geologist with experience managing a variety of environmental consulting projects in the New York metropolitan area and specializing in remedial investigations, conceptual site modeling, and remedial design and implementation. She provides analytical, technical, and regulatory guidance to clients, including developers and environmental attorneys, on a variety of projects in various stages of investigation, remediation, and redevelopment. Ms. Carroll has managed projects from inception through investigation, remediation, and closure in the New York State Brownfield Cleanup Program, the New York State Department of Environmental Conservation (NYSDEC) Spills and Voluntary Cleanup Programs, the New York State Superfund Program, and the New York City E-Designation Program.

CREDENTIALS AND PROFESSIONAL HONORS

New York State Licensed Professional Geologist #000979
Adjunct Professor, Manhattan College, School of Engineering
M.A., Earth and Environmental Sciences, Brooklyn College, New York
B.S., Geology, Hofstra University, Uniondale, New York

CONTINUING EDUCATION AND TRAINING

OSHA 10-Hour Construction Training (2015)
Hazardous Waste Operations and Emergency Response 40-Hour Certification
(2004; refreshers 2005, 2006, 2007, 2009, 2010, 2011, 2012, 2013, 2014, and 2015)
First Aid and CPR Certified (2012)
Amtrak Contractor Safety Training (2010 and 2011)

PROFESSIONAL AFFILIATIONS

Member of Geologic Society of America
Member of New Partners for Community Revitalization

RELEVANT EXPERIENCE

New York State Brownfield Cleanup Program, Former West 18th Street MGP Site, Block 690, Lots 20 and 29, West Chelsea, Manhattan, New York—Successfully guided the client into the Brownfield Cleanup Program at the remediation stage. Prepared detailed remedial cost estimates for several redevelopment scenarios. Assisted in negotiating cleanup costs on behalf of the developer with the entity responsible for onsite contamination from former manufactured gas plant (MGP) operations. Designed and managed a pre-design investigation that delineated onsite coal tar impacts and differentiated petroleum impacts. Served on a team that designed an *in situ* stabilization treatability study. Prepared the Remedial Action Work Plan and Alternatives Analysis that included the excavation and removal of coal tar source material within two MGP gas holders and the encapsulation of residual coal tar. Performed an essential role on the construction and design team, coordinating with the structural, foundation, mechanical, and architectural contractors.

New York State Brownfield Cleanup Program, 520 West 28th Street, West Chelsea, Manhattan, New York—Managed several investigations to address New York State Spills, New York City E-Designation, and New York State Brownfield Cleanup programs. Prepared scopes of work to address requirements of both State and City regulatory agencies. Served as an essential member of the construction and design team, coordinating with the structural, foundation, mechanical, and architectural contractors. Managed access with adjacent property owners for full-scale excavation. Coordinated with State and City agencies for the satisfaction of air, noise, and hazardous waste requirements. Coordinated and managed the characterization and disposal of over 35,000 tons of hazardous material and historic fill. Designed and managed the remedial action necessary to obtain a successful Track 1 Cleanup. Assisted in negotiating a nuanced approach to support excavation that allowed for a Track 1 Cleanup. Prepared the final engineering report that expedited the certificate of completion.

New York State Brownfield Cleanup Program, Teitelbaum Dry Cleaner, Long Island City, New York—Designed and managed multiple onsite and offsite investigations to address NYSDEC and New York State Department of Health (NYSDOH) regulatory requirements with respect to chlorinated solvent impacts to groundwater and soil vapor. Designed and managed chlorinated solvent plume delineation and remediation in both groundwater and soil vapor. Prepared a technical memorandum on the fate and transport of the onsite chlorinated solvent groundwater plume that established limited liability for downgradient impacts and identified a secondary source. Coordinated with multiple adjacent parties for access. Designed a remedial approach for the site building that included source removal, groundwater injection, and a retro-fitted sub-slab depressurization system (SSDS).

Confidential Project, Steuben County, NY—Performed a forensic review and analysis of environmental records associated with five parcels of land that the State deemed as illegal solid waste dumps. Prepared and presented two technical arguments to NYSDEC and NYSDOH detailing illegal dumping, historic fill material, human health exposure pathways, bioavailability of historic fill constituents and remedial alternatives. Designed a full-scale remedial investigation of soil, groundwater and sediments for five parcels of historically industrial land.

New York City Voluntary Cleanup Program, Gallery Row, West Chelsea, Manhattan, New York—Managed multiple investigations over five tax lots to address New York City E-Designation and Voluntary Cleanup Program requirements. Designed a remedial action that incorporates a phased and targeted excavation below Highline Park. Coordinated with State and City agencies for the satisfaction of air, noise, and hazardous waste requirements. Served as an integral part of the construction and design team.

New York State Brownfield Cleanup Program, Former Nu-Brite Dry Cleaner, 1299 First Avenue, East Side, Manhattan, New York—Designed and managed multiple investigations to address onsite chlorinated solvent impacts to soil, groundwater, and soil vapor. Site challenges included investigation and remedial action within existing, occupied building sites. Designed and managed a bedrock fracture investigation to address potential impacts to bedrock. Designed and managed offsite delineation of chlorinated solvent plume in soil vapor. Directed multiple offsite soil vapor investigations within adjacent properties; assisted in negotiating several nuanced access agreements. Managed an onsite interim remedial measure including the installation of a retro coat vapor barrier and retro-fitted SSDS within the site building.

New York State Brownfield Cleanup Program, 34th Street and 42nd Street, West Side, Manhattan, New York—Designed and managed multiple investigations to address New York State Spills and Brownfield Cleanup programs. Prepared scopes of work to address requirements of both state regulations and those agreed to by the former owner. Coordinated

with NYSDEC to modify scopes based on field observations and limitations, which resulted in not having to mobilize for additional investigations. Coordinated with multiple entities for access to perform investigations, including Javits Convention Center, Amtrak, New York City Department of Transportation, Metropolitan Transit Authority, and their contractors. Developed a three-phase analysis plan with the laboratory to determine the minimum required extent of excavation next to an Amtrak line while limiting analytical costs, decreasing in the extent of excavation, and lowering disposal and structural support requirement costs.

New York State Brownfield Cleanup Program, 388 Bridge Street, Downtown Brooklyn, New York—Designed and managed all onsite and offsite investigations of soil, soil gas, groundwater, and indoor air, including coordination of staff and subcontractors. Prepared investigation reports for submittal to client, project team, NYSDEC, and NYSDOH. Participated in project team decision making with clients, lawyers, construction manager, and other consultants. Managed New York City Transit approvals for subsurface investigations near subway lines. Coordinated offsite access in residences, commercial spaces, and a private school. Participated in soil vapor extraction pilot test implementation and reporting. Assisted with implementation of an offsite SSDS in an existing building; activities included system design/layout, installation oversight, testing, and long-term operation and maintenance. Responsible for NYSDEC/NYSDOH coordination and reporting for all investigations. Tracked project activities for inclusion in NYSDEC/NYSDOH programmatic submittals, including monthly reports and remedial schedules.

New York Department of Environmental Remediation, Class 2 State Superfund, Laurel Hill Site, Queens, New York—Managed multiphase, multiparcel project involving design, installation, and ongoing operation, maintenance, and monitoring of six remedial caps. Site challenges included the division of the site into individual parcels that were independent of one another; subsequently, each parcel had a stormwater management design individual to the surrounding parcels. Other challenges included the site's position in a wetlands area fronting Newtown Creek, and working with the New York City Department of Transportation to facilitate its schedule for the adjacent Kosciusko Bridge restoration.

New York State Brownfield Cleanup Program, Willets Point Development, Queens, New York—Managed the Brownfield Cleanup Program application and Phase I environmental site assessment effort for 45 parcels of industrialized land. Coordinated with multiple interested parties, including New York City Department of Housing Preservation and Development and the Economic Development Corporation for access and contracting.

New York State Brownfield Cleanup Program, Uniforms for Industry, Queens, New York—Designed and managed an alternative approach to the offsite soil vapor intrusion investigation. Utilized soil vapor modeling to evaluate potential human health risks and migration probabilities. Provided support for the design of a retrofitted passive venting system.

New York State Spills Program, Gotham Center, Queens, New York—Responsible for proposal and budget development, subcontractor selection and coordination, negotiation, and preparation of subcontractor terms and agreements, budget, and invoice review for a comprehensive subsurface investigation. Prepared and implemented scope of work for delineation of soil contamination and calculation of contaminant mass estimates. Subsequent to interpretation of site data and subgrade characteristics, developed and presented remedial alternatives and associated costs for internal and client project teams. Prepared remedial investigation report in coordination with the New York City Economic Development Corporation and the client for submittal to state regulators.

Mohamed Ahmed, Ph.D., C.P.G.
Sr. Geologist/Principal

Experience Summary

Mohamed Ahmed is a certified professional geologist with nearly 23 years of experience in the New York City metropolitan area. He has designed and implemented subsurface investigations and is proficient in groundwater modeling, design of groundwater treatment systems and soil remediation. He has managed numerous projects focused on compliance with the New York State Brownfield Cleanup and Spills programs and the New York City “e” designation program. Dr. Ahmed also has extensive experience in conducting regulatory negotiations with the New York State Department of Environmental Conservation, the NYC Office of Housing Preservation and Development, and the Mayor’s Office of Environmental Remediation.

Selected Project Experience

Willoughby Square, Downtown Brooklyn

As Project Manager, directs all regulatory interaction and investigation on this joint public-private sector redevelopment that will include a public park and four-level underground parking garage. Prepared the remedial investigation work plan and remedial action work plan, conducted investigation activities and waste characterization, and negotiated with the NYC Department of Environmental Protection and the Mayor’s Office of Environmental Remediation to transition the site into the NYC Voluntary Cleanup Program.

School Facility, Borough Park, Brooklyn

Managed all regulatory agency coordination, work plan and report preparation and remedial oversight; worked with OER to determine measures to retroactively address the hazardous materials and air quality E-designations on a previously constructed school building and prepared supporting documentation to justify the use of electrical units rather than natural gas.

LGA Hotel Site, East Elmhurst, Queens

Project manager for all work conducted at this former gasoline service station which is being remediated under the NYS Brownfield Cleanup Program; technical oversight of work plans, reports, and design and implementation of field and soil disposal characterization.

436 10th Avenue, Manhattan

As project manager and technical lead, assisted client in developing remedial cost estimates used for property transaction, developed regulatory strategy to address NYS Spills and NYC E-designation requirements, and currently overseeing remedial activities which include removal and disposal of petroleum-contaminated bedrock and dewatering and disposal of impacted groundwater.

Brownfield Cleanup Program Site, Downtown Brooklyn

Managed investigation and remediation under the BCP program for a proposed mixed-use development; designed the remedial investigation and prepared the remedial action work plan which includes an SVE system monitored natural attenuation. Prepared remedial cost

estimates for several scenarios. The project will include a 53-story mixed-use structure and parking garage.

Queens West Development, Long Island City

Directed project team and subcontractors for soil investigation/remediation studies on multiple properties; provided technical support for negotiations with NYSDEC during investigation and remediation.

Former Creosote Site, Long Island City

Designed and implemented a complex investigation to assess the nature and extent of historic creosote contamination at this former industrial site; conducted studies to optimize recovery of LNAPL and DNAPL and developed strategies using bioremediation and natural attenuation in conjunction with conventional remedial approaches. Performed pilot tests for soil vapor extraction system design and coordinated with NYSDEC and NYSDOH to implement sub-slab soil vapor sampling.

NYSDEC Spill Site – Far West Side, Manhattan

Developed a detailed remedial cost estimate for to support client negotiations with a major oil company. The estimate included costs pertaining to: chipping, removal and disposal of petroleum-impacted bedrock; removal/disposal of recycled concrete; costs for dewatering and disposal of impacted groundwater during construction; and design and installation of a vapor barrier below the redevelopment.

Active Industrial Facility, Newburgh, New York

Designed remedial investigation of soil and groundwater contaminated with trichloroethane; performed soil vapor pilot test and pump test to aid in design of soil and groundwater remediation alternatives; conducted sub-slab vapor sampling in accordance with NYSDOH guidance.

Former Dry Cleaning Facility, New York City

Conducted soil and groundwater investigations, designed and installed a soil vapor extraction system and performed extensive testing of indoor air. Negotiated the scope of the RI and IRM with NYSDEC.

Waterfront Redevelopment, Yonkers, NY

Designed and performed geophysics survey of six parcels to determine locations of subsurface features; supervised test pit excavation to confirm geophysics results and evaluate and classify soil conditions prior to development activities.

Prince's Point, Staten Island, New York

Performed soil, groundwater and sediment sampling to delineate the extent of contamination; used field-screening techniques to control analytical costs and supervised soil excavation and disposal.

Apartment Complex, New York City, New York

Coordinated with Con Edison, the owner of the adjacent property and NYSDEC to determine oil recovery protocol; assessed hydrogeological conditions and conducted pilot tests to design cost-effective recovery system; designed and supervised installation of recovery system.

Publications

“Impact of Toxic Waste Dumping on the Submarine Environment: A Case Study from the New York Bight”. Northeastern Geology and Environmental Sciences, V. 21, No. 12, p. 102-120. (With G. Friedman)

Metals Fluxes Across the Water/Sediment Interface and the Influence of pH. Northeastern Geology and Environmental Sciences, in press. (With G. Friedman)

“Water and Organic Waste Near Dumping Ground in the New York Bight”. International Journal of Coal Geology, volume 43. (With G. Friedman)

Education and Certifications

Ph.D., Earth and Environmental Sciences, Graduate Center of the City of New York (2001)

M.Ph., Earth and Environmental Sciences, City University of New York (1998)

M.A. Geology, Brooklyn College (1993)

B.S. Geology, Alexandria University, Egypt (1982)

American Institute of Professional Geologists, Certified Professional Geologist, 1997-2015

Matthew Carroll, P.E.
Environmental Engineer/Principal

Experience Summary

Matthew Carroll is an environmental engineer experienced in all aspects of site assessment and development and implementation of remedial strategies. He has managed projects from inception through investigation, remediation and closure. His expertise includes soil, soil gas, and groundwater remediation, preparation of cost estimates, remedial alternative selection and design, soil characterization for disposal, field safety oversight, and preparation of work plans and reports to satisfy New York and New Jersey state requirements, and New York City "e" designation and restrictive declarations. Mr. Carroll's project management experience includes past management of a New York City School Construction Authority hazardous materials contract. He is responsible for all engineering work performed by Tenen and is currently the project manager and remedial engineer for several New York State Brownfield Cleanup Program sites.

Selected Project Experience

470 Kent Avenue, Brooklyn

As project manager, supported the client in due diligence and transactional activities, including a Phase I ESA, preliminary site investigation, and remedial cost estimate; preparation of BCP application and remedial investigation work plan. The former manufactured gas plant, sugar refinery and lumberyard will be developed as a mixed-use project with market rate and affordable housing and public waterfront access. As remedial engineer, will be responsible for development of remedial alternatives and oversight and certification of all remedial activities.

500 Exterior Street, Bronx

Designed and implemented the investigation of this former lumberyard and auto repair shop that will be redeveloped as mixed use development with an affordable housing component; prepared BCP application and subsequent work plans and reports. Designed a remedial strategy incorporating both interim remedial measures (IRMs) and remediation during the development phase.

Gateway Elton I and II, Brooklyn

Conducted soil disposal characterization, prepared Remedial Action Work Plans and designed methane mitigation systems for two phases of a nine-building residential development and commercial space; prepared and oversaw implementation of a Stormwater Pollution Prevention Plan during construction and prepared and certified the remedial closure reports for the project.

Affordable Housing Development, Rye, NY

Consultant to the City of Rye on environmental issues pertaining to a county-owned development site slated for an afford senior housing; reviewed environmental documentation for the project and prepared summary memorandum for City Council review; recommended engineering controls to address potential exposure to petroleum constituents, presented report findings at public meetings and currently providing ongoing environmental support during project implementation.

Queens West Development BCP Site, Long Island City, New York

Assistant Project Manager for two developers involved in the site.

- Responsible for oversight of remediation under the New York State Brownfield Cleanup Program
- Technical review of work plans and reports and coordination of the Applicant's investigation and oversight efforts
- Provided input for mass calculations and well placement for an in-situ oxidation remedy implemented on a proposed development parcel and within a City street
- Conducted technical review of work pertaining to a former refinery. Documents reviewed included work plans for characterization and contaminant delineation; pilot test (chemical oxidation); remediation (excavation and groundwater treatment). Managed field personnel conducting full time oversight and prepared progress summaries for distribution to project team
- Following implementation of remedial action, implemented the Site Management Plan and installation/design of engineering controls (SSDS, vapor barrier/concrete slab, NAPL recovery). Also responsible for coordination with NYSDEC

Brownfield Cleanup Program Redevelopment Sites – West Side, New York City

Managed remediation of a development consisting of four parcels being addressed under one or more State and city regulatory programs (NYS Brownfield Cleanup Program, NYS Spills, and NYC "e" designation program). Remediation includes soil removal, screening and disposal; treatment of groundwater during construction dewatering and implementation of a worker health and safety plan and community air monitoring plan (HASP/CAMP)

Managed an additional BCP site, supported the Applicant in coordination with MTA to create station access for the planned No. 7 subway extension; also provided support the client in coordination with Amtrak to obtain access for remedial activities on the portion of the site that is within an Amtrak easement. The site will eventually be used for construction of a mixed-use high-rise building.

BCP Site, Downtown Brooklyn, New York

Performed investigation on off-site properties and designed an SSDS for an adjacent building, retrofitting the system within the constraints of the existing structure; coordinated the installation of the indoor HVAC controls and vapor barrier; provided input to the design of a SVE system to address soil vapor issues on the site.

West Chelsea Brownfield Cleanup Program Site

Designed an in-situ remediation program and sub-slab depressurization system to address contamination remaining under the High Line Viaduct; SSDS design included specification of sub-grade components, fan modeling and selection, identifying exhaust location within building constraints and performance modeling; prepared the Operations Maintenance and Monitoring Plan and Site Management Plan sections pertaining to the SSDS.

Historic Creosote Spill Remediation – Queens, New York – New York State Voluntary Cleanup Program

Modeled contamination volume and extent and prepared mass estimates of historic fill constituents and creosote-related contamination; designed a soil vapor extraction (SVE) and dewatering system to address historic creosote release both above and below static

Matthew Carroll, Environmental Engineer/Principal
Tenen Environmental

water table; coordinated with the Metropolitan Transit Authority and prepared drawings to secure approval to drill in the area of MTA subway tunnels.

NYSDEC Spill Site- Far West Side, Manhattan

Provided support to client during negotiations with a major oil company regarding allocation of remedial costs. Worked with client's attorney to develop a regulatory strategy to address the client's obligations under the NYSDEC Spills Program and the New York City "e" designation requirements.

Affordable Housing Site, Brooklyn, New York

Modified prior work plans for soil, soil vapor and groundwater investigation to address requirements for site entry into the New York City Brownfield Cleanup Program. Prepared technical basis for use of prior data previously disallowed by OER. Currently conducting site investigation.

New York City School Construction Authority Hazardous Materials Contract

Provided work scopes and cost estimates, managed and implemented concurrent projects, including Phase I site assessments, Phase II soil, groundwater and soil gas investigations, review of contractor bid documents, preparation of SEQR documents, specifications and field oversight for above- and underground storage tank removal, and emergency response and spill control.

Former Manufacturing Facility, Hoboken, New Jersey

Evaluated site investigation data to support a revision of the current property use to unrestricted; modified the John & Ettinger vapor intrusion model to apply the model to a site-specific, mixed use commercial/residential development; implemented a Remedial Action Work Plan that included the characterization, removal and separation of 9,500 cubic yards of historic fill; designed and implemented a groundwater characterization/delineation program using a real-time Triad approach; designed and implemented an innovative chemical oxidation technology for the property.

Former Varnish Manufacturer - Newark, New Jersey

Prepared a Phase I environmental site assessment; implemented soil and groundwater sampling to assess presence of petroleum and chlorinated compounds; prepared alternate cost remediation scenarios for settlement purposes and implemented a groundwater investigation plan, including pump tests and piezometer installation to assess the effect of subsurface utilities and unique drainage pathways upon contaminant transport.

Education and Certifications

Professional Engineer, New York

Bachelor of Engineering, Environmental; Stevens Institute of Technology, 2002

Bachelor of Science, Chemistry, New York University, 2002

Technical and Regulatory Training in Underground Storage Tanks, Cook College, Rutgers University, 2006

L.A.B. Validation Corp., 14 West Point Drive, East Northport, New York 11731

Lori A. Beyer

SUMMARY:

General Manager/Laboratory Director with a solid technical background combined with Management experience in environmental testing industry. Outstanding organizational, leadership, communication and technical skills. Customer focused, quality oriented professional with consistently high marks in customer/employee satisfaction.

EXPERIENCE:

1998-Present L.A.B. Validation Corporation, 14 West Point Drive, East Northport, NY

President

- Perform Data Validation activities relating to laboratory generated Organic and Inorganic Environmental Data.

1998-Present American Analytical Laboratories, LLC. 56 Toledo Street, Farmingdale, NY

Laboratory Director/Technical Director

- Plan, direct and control the operation, development and implementation of programs for the entire laboratory in order to meet AAL's financial and operational performance standards.
- Ensures that all operations are in compliance with AAL's QA manual and other appropriate regulatory requirements.
- Actively maintains a safe and healthy working environment that is demanded by local laws/regulations.
- Monitors and manages group's performance with respect to data quality, on time delivery, safety, analyst development/goal achievement and any other key performance indices.
- Reviews work for accuracy and completeness prior to release of results to customers.

1996-1998 Nytest Environmental, Inc. (NEI) Port Washington, New York

General Manager

- Responsible for controlling the operation of an 18,000 square foot facility to meet NEI's financial and operational performance standards.
- Management of 65 FTEs including Sales and Operations
- Ensure that all operations are in compliance with NEI's QA procedures
- Ensures that productivity indicators, staffing levels and other cost factors are held within established guidelines
- Maintains a quantified model of laboratory's capacity and uses this model as the basis for controlling the flow of work into and through the lab so as to ensure that customer requirements and lab's revenue and contribution targets are achieved.

1994-1996 Nytest Environmental, Inc. (NEI) Port Washington, New York

Technical Project Manager

- Responsible for the coordination and implementation of environmental testing programs requirements between NEI and their customers
- Supervise Customer Service Department
- Assist in the development of major proposals
- Complete management of all Federal and State Contracts and assigned commercial contracts
- Provide technical assistance to the customer, including data validation and interpretation
- Review and Implement Project specific QAPP's.

1995-1996 Nytest Environmental, Inc. (NEI) Port Washington, New York

Corporate QA/QC Officer

- Responsible for the implementation of QA practices as required in the NJDEP and EPA Contracts
- Primary contact for NJDEP QA/QC issues including SOP preparation, review and approval
- Responsible for review, verification and adherence to the Contract requirements and NEI QA Plan

1992-1994 Nytest Environmental, Inc. (NEI) Port Washington, New York

Data Review Manager

- Responsible for the accurate compilation, review and delivery of analytical data to the company's customers. Directly and effectively supervised a department of 22 personnel.
- Managed activities of the data processing software including method development, form creation, and production
- Implement new protocol requirements for report and data management formats
- Maintained control of data storage/archival areas as EPA/CLP document control officer

1987-1991 Nytest Environmental, Inc. (NEI) Port Washington, New York

Data Review Specialist

- Responsible for the review of GC, GC/MS, Metals and Wet Chemistry data in accordance with regulatory requirements
- Proficient with USEPA, NYSDEC, NJDEP and NEESA requirements
- Review data generated in accordance with SW846, NYSDEC ASP, EPA/CLP and 40 CFR Methodologies

1986-1987 Nytest Environmental, Inc. (NEI) Port Washington, New York

GC/MS VOA Analyst

EDUCATION:

1982-1985 State University of New York at Stony Brook, New York; BS Biology/Biochemistry

1981-1982 University of Delaware; Biology/Chemistry

5/91 Rutgers University; Mass Spectral Data Interpretation Course, GC/MS Training

8/92 Westchester Community College; Organic Data Validation Course

9/93 Westchester Community College; Inorganic Data Validation Course

Westchester Community College

Professional Development Center

Awards this Certificate of Achievement To


LORI BEYER

for Successfully Completing

ORGANIC DATA VALIDATION COURSE (35 HOURS)

Dr. John Samuelian

Date AUGUST 1992


Assistant Dean
Professional Development Center


President



The Professional
Development Center

Westchester Community College

Professional Development Center

Awards this Certificate of Achievement To

LORI BEYER

for Successfully Completing

INORGANIC DATA VALIDATION

Instructor: Dale Boshart

Date MARCH 1993

Arch O'Neil

Assistant Dean

Professional Development Center

J. Boshart

President



The Professional
Development Center

New York State Department of Environmental Conservation
60 Wolf Road, Albany, New York 12233



Thomas C. Jorling
Commissioner

July 8, 1992

Ms. Elaine Sall
Program Coordinator
Westchester Community College
Valhalla, NY 10595-1698

Dear Elaine,

Thank you for your letter of June 29, 1992. I have reviewed the course outline for organic data validation, qualifications for teachers and qualifications for students. The course that you propose to offer would be deemed equivalent to that which is offered by EPA. The individuals who successfully complete the course and pass the final written exam would be acceptable to perform the task of organic data validation for the Department of Environmental Conservation, Division of Hazardous Waste Remediation.

As we have discussed in our conversation of July 7, 1992, you will forward to me prior to the August course deadline, the differences between the EPA SOW/90 and the NYSDEC ASP 12/91. You stated these differences will be compiled by Mr. John Samulian.

I strongly encourage you to offer an inorganic data validation course. I anticipate the same list of candidates would be interested in an inorganic validation course as well, since most of the data to be validated consists of both organic and inorganic data.

Thank you for your efforts and please contact me if I can be of any further assistance.

Sincerely,

Maureen P. Serafini

Maureen P. Serafini
Environmental Chemist II
Division of Hazardous Waste
Remediation

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The Professional
Development Center
AT
WESTCHESTER COMMUNITY COLLEGE

914 285-6619

October 2, 1992

Ms. Lori Beyer
3 sparkill Drive
East Northport, NY 11731

Dear Ms. Beyer:

Congratulations upon successful completion of the Organic Data Validation course held August 17 - 21, 1992, through Westchester Community College, Professional Development Center. This course has been deemed by New York State Department of Environmental Conservation as equivalent to EPA's Organic Data Validation Course.

Enclosed is your Certificate. Holders of this Certificate are deemed competent to perform organic data validation for the New York State DEC Division of Hazardous Waste Remediation.

The Professional Development Center at Westchester Community College plans to continue to offer courses and seminars which will be valuable to environmental engineers, chemists and related personnel. Current plans include a TCLP seminar on November 17th and a conference on Environmental Monitoring Regulations on November 18th.

We look forward to seeing you again soon at another environmental program or event. Again, congratulations.

Very truly yours,

Passing Grade is 70%
Your Grade is 99%

Elaine Sall
Program Coordinator

ES/bf



SUNY
WESTCHESTER COMMUNITY COLLEGE
Valhalla, New York 10595



The Professional
Development Center
AT
WESTCHESTER COMMUNITY COLLEGE

914 285-6619

June 21, 1993

Dear Ms. Beyer:

Enclosed is your graded final examination in the Inorganic Data Validation course you completed this past March. A score of 70% was required in order to receive a certificate of satisfactory completion. Persons holding this certificate are deemed acceptable to perform Inorganic Data Validation for the New York State Department of Environmental Conservation, Division of Hazardous Waste Remediation.

I am also enclosing a course evaluation for you to complete if you have not already done so. The information you provide will greatly aid us in structuring further courses. We wish to make these course offerings as relevant, targeted and comprehensive as possible. Your evaluation is vital to that end.

Congratulations on your achievement. I look forward to seeing you again at another professional conference or course. We will be co-sponsoring an environmental monitoring conference on October 21, 1993 with the New York Water Pollution Control Association, Lower Hudson Chapter, at IBM's Yorktown Heights, NY site. Information regarding this event will be going out in August.

Very truly yours,

Elaine Sall
Program Coordinator

ES/bf

Enclosures

Appendix B

EPA 537 Field Sampling Guidelines



EPA 537 (PFAS) Field Sampling Guidelines

PLEASE READ INSTRUCTIONS ENTIRELY PRIOR TO SAMPLING EVENT

Sampling for PFAS via EPA 537 can be challenging due to the prevalence of these compounds in consumer products. The following guidelines are strongly recommended when conducting sampling.

Reference-NHDES <https://www.des.nh.gov/organization/divisions/waste/hwrb/documents/pfc-stakeholder-notification-20161122.pdf>

FIELD CLOTHING and PPE

- No clothing or boots containing Gore-Tex®
- All safety boots made from polyurethane and PVC
- No materials containing Tyvek®
- Do not use fabric softener on clothing to be worn in field
- Do not use cosmetics, moisturizers, hand cream, or other related products the morning of sampling
- Do not use unauthorized sunscreen or insect repellent (see reference above for acceptable products)

FOOD CONSIDERATIONS

No food or drink on-site with exception of bottled water and/or hydration drinks (i.e., Gatorade and Powerade) that is available for consumption only in the staging area

OTHER RECOMMENDATIONS

Sample for PFAS first! Other containers for other methods may have PFAS present on their sampling containers

SAMPLE CONTAINERS

- All sample containers made of HDPE or polypropylene
- Caps are unlined and made of HDPE or polypropylene (no Teflon®-lined caps)

WET WEATHER (AS APPLICABLE)

Wet weather gear made of polyurethane and PVC only

EQUIPMENT DECONTAMINATION

- "PFAS-free" water on-site for decontamination of sample equipment. No other water sources to be used
- Only Alconox and Liquinox can be used as decontamination materials

FIELD EQUIPMENT

- Must not contain Teflon® (aka PTFE) or LDPE materials
- All sampling materials must be made from stainless steel, HDPE, acetate, silicon, or polypropylene
- No waterproof field books can be used
- No plastic clipboards, binders, or spiral hard cover notebooks can be used
- No adhesives (i.e. Post-It® Notes) can be used
- Sharpies and permanent markers not allowed; regular ball point pens are acceptable
- Aluminum foil must not be used
- Keep PFC samples in separate cooler, away from sampling containers that may contain PFAS
- Coolers filled with regular ice only - Do not use chemical (blue) ice packs





EPA 537 (PFAS) Field Sampling Guidelines

PLEASE READ INSTRUCTIONS ENTIRELY PRIOR TO SAMPLING EVENT

Sampler must wash hands before wearing nitrile gloves in order to limit contamination during sampling. Each sample set requires a set of containers to comply with the method as indicated below. **Sample set is composed of samples collected from the same sample site and at the same time.*

Container Count	Container Type	Preservative
3 Sampling Containers - Empty	250 mL container	Pre preserved with 1.25 g Trizma
1 Reagent Water for Field Blank use	250 mL container	Pre preserved with 1.25 g Trizma
P1 Field Blank (FRB) - Empty	250 mL container	Unpreserved

Sampling container must be filled to the neck. For instructional purposes a black line has been drawn to illustrate the required fill level for each of the 3 Sample containers

Field blanks are recommended and the containers have been provided, please follow the instructions below.

Field Blank Instructions:

1. Locate the Reagent Water container from the bottle order. The Reagent Water container will be pre-filled with PFAS-free water and is preserved with Trizma.
2. Locate the empty container labeled "Field Blank".
3. Open both containers and proceed to transfer contents of the "Reagent Water" container into the "Field Blank" container.
4. If field blanks are to be analyzed, they need to be noted on COC, and will be billed accordingly as a sample.



Both the empty Reagent Water container and the filled Field Blank container must be returned to the lab along with the samples taken.

Sampling Instructions:

1. Each sampling event requires 3 containers to be filled to the neck of the provided containers for each sampling location.
2. Before sampling, remove faucet aerator, run water for 5 min, slow water to flow of pencil to avoid splashing and fill sample containers to neck of container (as previously illustrated) and invert 5 times.
3. Do not overfill or rinse the container.
4. Close containers securely. Place containers in sealed ZipLoc® bags, and in a separate cooler (no other container types).
5. Ensure Chain-of-Custody and all labels on containers contain required information. Place sample, Field Blank and empty Reagent Blank containers in ice filled cooler (do not use blue ice) and return to the laboratory. Samples should be kept at 4°C ±2. Samples must not exceed 10°C during first 48 hours after collection. Hold time is 14 days.

Please contact your Alpha Analytical project manager with additional questions or concerns.

Appendix C

PFAS Compounds to be Analyzed and Associated MDLs

Appendix C
PFAS Compounds to be Analyzed and Associated MDLs

Analyte	Soil MDL (ng/g)	Groundwater MDL (ng/l)
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	0.275	0.2908
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	0.198	0.194
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	0.09	0.3728
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	0.103	0.2504
Perfluorobutanesulfonic Acid (PFBS)	0.0635	0.38
Perfluorobutanoic Acid (PFBA)	0.0213	0.3732
Perfluorodecanesulfonic Acid (PFDS)	0.097	0.386
Perfluorodecanoic Acid (PFDA)	0.072	0.62
Perfluorododecanoic Acid (PFDoA)	0.086	0.592
Perfluoroheptanesulfonic Acid (PFHpS)	0.136	0.52
Perfluoroheptanoic Acid (PFHpA)	0.064	0.372
Perfluorohexanesulfonic Acid (PFHxS)	0.057	0.436
Perfluorohexanoic Acid (PFHxA)	0.064	0.492
Perfluorononanoic Acid (PFNA)	0.083	0.436
Perfluorooctanesulfonamide (FOSA)	0.1025	0.556
Perfluorooctanesulfonic Acid (PFOS)	0.1205	0.56
Perfluorooctanoic Acid (PFOA)	0.04105	0.46
Perfluoropentanoic Acid (PFPeA)	0.01035	0.464
Perfluorotetradecanoic Acid (PFTA)	0.07	0.988
Perfluorotridecanoic Acid (PFTrDA)	0.062	0.314
Perfluoroundecanoic Acid (PFUnA)	0.056	0.424

Appendix D

Laboratory Standard Operating Procedures for PFAS Analysis

Determination of Selected Perfluorinated Alkyl Substances by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry Isotope Dilution (LC/MS/MS)

Reference: EPA Method 537, Version 1.1, September 2009, EPA Document #: EPA/600/R-08/09

EPA Method 537.1, Version 1, November 2018, EPA Document #: EPA/600/R-18/352

Department of Defense, Quality Systems Manual for Environmental Laboratories, Version 5.2, .2019

1. Scope and Application

Matrices: Drinking water, Non-potable Water, and Soil Matrices

Definitions: Refer to Alpha Analytical Quality Manual.

- 1.1 This is a liquid chromatography/tandem mass spectrometry (LC/MS/MS) method for the determination of selected perfluorinated alkyl substances (PFAS) in Non-Drinking Water and soil Matrices. Accuracy and precision data have been generated in reagent water, and finished ground and surface waters for the compounds listed in Table 1.
- 1.2 The data report packages present the documentation of any method modification related to the samples tested. Depending upon the nature of the modification and the extent of intended use, the laboratory may be required to demonstrate that the modifications will produce equivalent results for the matrix. Approval of all method modifications is by one or more of the following laboratory personnel before performing the modification: Area Supervisor, Department Supervisor, Laboratory Director, or Quality Assurance Officer.
- 1.3 This method is restricted to use by or under the supervision of analysts experienced in the operation of the LC/MS/MS and in the interpretation of LC/MS/MS data. Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability.

2. Summary of Method

- 2.1 A 250-mL water sample is fortified with extracted internal standards (EIS) and passed through a solid phase extraction (WAX) cartridge containing a mixed mode, Weak Anion Exchange, reversed phase, water-wettable polymer to extract the method analytes and isotopically-labeled compounds. The compounds are eluted from the solid phase in two fractions with methanol followed by a small amount of 2% ammonium hydroxide in methanol solution. The extract is concentrated with nitrogen in a heated water bath, and then adjusted to a 1-mL volume with 80:20% (vol/vol) methanol:water. A 3 µL injection is made into an LC equipped with a C18 column that is interfaced to an MS/MS. The analytes are separated and identified by comparing the acquired mass spectra and retention times to reference spectra and retention times for calibration standards acquired under identical LC/MS/MS conditions. The concentration of each analyte is determined by using the isotope dilution technique. Extracted Internal Standards (EIS) analytes are used to monitor the extraction efficiency of the method analytes.

2.2 Method Modifications from Reference

None.

Table 1

Parameter	Acronym	CAS
PERFLUOROALKYL ETHER CARBOXYLIC ACIDS (PFECAs)		
Tetrafluoro-2-(heptafluoropropoxy)propanoic acid	HFPO-DA	62037-80-3
4,8-dioxa-3H-perfluorononanoic acid	ADONA	919005-14-4
PERFLUOROALKYLCARBOXYLIC ACIDS (PFCAs)		
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	PFUnA *	2058-94-8
Perfluorododecanoic acid	PFDaA *	307-55-1
Perfluorotridecanoic acid	PFTTrDA *	72629-94-8
Perfluorotetradecanoic acid	PFTA *	376-06-7
Perfluorohexadecanoic acid	PFHxDA	67905-19-5
Perfluorooctadecanoic acid	PFODA	16517-11-6
PERFLUOROALKYLSULFONATES (PFASs)		
Perfluorobutanesulfonic acid	PFBS *	375-73-5
Perfluoropentanesulfonic acid	PFPeS	2706-91-4
Perfluorohexanesulfonic acid	PFHxS *	355-46-4
Perfluoroheptanesulfonic acid	PFHpS	375-92-8
Perfluorooctanesulfonic acid	PFOS *	1763-23-1
Perfluorononanesulfonic acid	PFNS	68259-12-1
Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluorododecanesulfonic acid	PFDoS	79780-39-5

* also reportable via the standard 537 method

Table 1 Cont.

Parameter	Acronym	CAS
CHLORO-PERFLUOROALKYLSULFONATE		
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	11Cl-PF3OUdS	763051-92-9
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid	9Cl-PF3ONS	756426-58-1
PERFLUOROOCTANESULFONAMIDES (FOSAs)		
Perfluorooctanesulfonamide	PFOSA	754-91-6
N-methylperfluoro-1-octanesulfonamide	NMeFOSA	31506-32-8
N-ethylperfluoro-1-octanesulfonamide	NEtFOSA	4151-50-2
TELOMER SULFONATES		
1H,1H,2H,2H-perfluorohexane sulfonate (4:2)	4:2FTS	27619-93-8
1H,1H,2H,2H-perfluorooctane sulfonate (6:2)	6:2FTS	27619-97-2
1H,1H,2H,2H-perfluorodecane sulfonate (8:2)	8:2FTS	39108-34-4
1H,1H,2H,2H-perfluorododecane sulfonate (10:2)	10:2FTS	120226-60-0
PERFLUOROOCTANESULFONAMIDOACETIC ACIDS		
N-methyl perfluorooctanesulfonamidoacetic acid	NMeFOSAA *	2355-31-9
N-ethyl perfluorooctanesulfonamidoacetic acid	NEtFOSAA *	2991-50-6
NATIVE PERFLUOROOCTANESULFONAMIDOETHANOLS (FOSEs)		
2-(N-methylperfluoro-1-octanesulfonamido)-ethanol	NMeFOSE	24448-09-7
2-(N-ethylperfluoro-1-octanesulfonamido)-ethanol	NEtFOSE	1691-99-2

* also reportable via the standard 537 method

3. Reporting Limits

The reporting limit for PFAS's is 2 ng/L for aqueous samples (20 ng/L for HFPO-DA) and 1 ng/g (10 ng/g for HFPO-DA) for soil samples.

4. Interferences

- 4.1 PFAS standards, extracts and samples should not come in contact with any glass containers or pipettes as these analytes can potentially adsorb to glass surfaces. PFAS analyte and EIS standards commercially purchased in glass ampoules are acceptable; however, all subsequent transfers or dilutions performed by the analyst must be prepared and stored in polypropylene containers.
- 4.2 Method interferences may be caused by contaminants in solvents, reagents (including reagent water), sample bottles and caps, and other sample processing hardware that lead to discrete artifacts and/or elevated baselines in the chromatograms. The method analytes in this method can also be found in many common laboratory supplies and equipment, such

as PTFE (polytetrafluoroethylene) products, LC solvent lines, methanol, aluminum foil, SPE sample transfer lines, etc. All items such as these must be routinely demonstrated to be free from interferences (less than 1/3 the RL for each method analyte) under the conditions of the analysis by analyzing laboratory reagent blanks as described in Section 9.2. **Subtracting blank values from sample results is not permitted.**

- 4.3** Matrix interferences may be caused by contaminants that are co-extracted from the sample. The extent of matrix interferences will vary considerably from source to source, depending upon the nature of the water. Humic and/or fulvic material can be co-extracted during SPE and high levels can cause enhancement and/or suppression in the electrospray ionization source or low recoveries on the SPE sorbent. Total organic carbon (TOC) is a good indicator of humic content of the sample.
- 4.4** SPE cartridges can be a source of interferences. The analysis of field and laboratory reagent blanks can provide important information regarding the presence or absence of such interferences. Brands and lots of SPE devices should be tested to ensure that contamination does not preclude analyte identification and quantitation.

5. Health and Safety

- 5.1** The toxicity or carcinogenicity of each reagent and standard used in this method is not fully established; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. A reference file of material safety data sheets is available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available in the Chemical Hygiene Plan.
- 5.2** All personnel handling environmental samples known to contain or to have been in contact with municipal waste must follow safety practices for handling known disease causative agents.
- 5.3** PFOA has been described as "likely to be carcinogenic to humans." Pure standard materials and stock standard solutions of these method analytes should be handled with suitable protection to skin and eyes, and care should be taken not to breathe the vapors or ingest the materials.

6. Sample Collection, Preservation, Shipping and Handling

6.1 Sample Collection for Aqueous Samples

- 6.1.1** Samples must be collected in two (2) 250-mL high density polyethylene (HDPE) container with an unlined plastic screw cap.
- 6.1.2** The sample handler must wash their hands before sampling and wear nitrile gloves while filling and sealing the sample bottles. PFAS contamination during sampling can occur from a number of common sources, such as food packaging and certain foods and beverages. Proper hand washing and wearing nitrile gloves will aid in minimizing this type of accidental contamination of the samples.
- 6.1.3** Open the tap and allow the system to flush until the water temperature has stabilized (approximately 3 to 5 min). Collect samples from the flowing system.

6.1.4 Fill sample bottles. Samples do not need to be collected headspace free.

6.1.5 After collecting the sample and cap the bottle. Keep the sample sealed from time of collection until extraction.

6.1.6 Field Reagent Blank (FRB)

6.1.6.1 A FRB must be handled along with each sample set. The sample set is composed of samples collected from the same sample site and at the same time. At the laboratory, fill the field blank sample bottle with reagent water and preservatives, seal, and ship to the sampling site along with the sample bottles. For each FRB shipped, an empty sample bottle (no preservatives) must also be shipped. At the sampling site, the sampler must open the shipped FRB and pour the reagent water into the empty shipped sample bottle, seal and label this bottle as the FRB. The FRB is shipped back to the laboratory along with the samples and analyzed to ensure that PFAS's were not introduced into the sample during sample collection/handling.

The reagent water used for the FRBs must be initially analyzed for method analytes as a MB and must meet the MB criteria in Section 9.2.1 prior to use. This requirement will ensure samples are not being discarded due to contaminated reagent water rather than contamination during sampling.

6.2 Sample Collection for Soil and Sediment samples.

Grab samples are collected in polypropylene containers. Sample containers and contact surfaces containing PTFE shall be avoided.

6.3 Sample Preservation

Not applicable.

6.4 Sample Shipping

Samples must be chilled during shipment and must not exceed 10 °C during the first 48 hours after collection. Sample temperature must be confirmed to be at or below 10 °C when the samples are received at the laboratory. Samples stored in the lab must be held at or below 6 °C until extraction, but should not be frozen.

NOTE: Samples that are significantly above 10° C, at the time of collection, may need to be iced or refrigerated for a period of time, in order to chill them prior to shipping. This will allow them to be shipped with sufficient ice to meet the above requirements.

6.5 Sample Handling

6.5.1 Holding Times

6.5.1.1 Water samples should be extracted as soon as possible but must be extracted within 14 days. Soil samples should be extracted within 28 days. Extracts are stored at < 10 ° C and analyzed within 28 days after extraction.

7. Equipment and Supplies

- 7.1** SAMPLE CONTAINERS – 250-mL high density polyethylene (HDPE) bottles fitted with unlined screw caps. Sample bottles must be discarded after use.
- 7.2** POLYPROPYLENE BOTTLES – 4-mL narrow-mouth polypropylene bottles.
- 7.3** CENTRIFUGE TUBES – 50-mL conical polypropylene tubes with polypropylene screw caps for storing standard solutions and for collection of the extracts.
- 7.4** AUTOSAMPLER VIALS – Polypropylene 0.7-mL autosampler vials with polypropylene caps.
- 7.4.1** NOTE: Polypropylene vials and caps are necessary to prevent contamination of the sample from PTFE coated septa. However, polypropylene caps do not reseal, so evaporation occurs after injection. Thus, multiple injections from the same vial are not possible.
- 7.5** POLYPROPYLENE GRADUATED CYLINDERS – Suggested sizes include 25, 50, 100 and 1000-mL cylinders.
- 7.6** Auto Pipets – Suggested sizes include 5, 10, 25, 50, 100, 250, 500, 1000, 5000 and 10,000- μ ls.
- 7.7** PLASTIC PIPETS – Polypropylene or polyethylene disposable pipets.
- 7.8** ANALYTICAL BALANCE – Capable of weighing to the nearest 0.0001 g.
- 7.9** SOLID PHASE EXTRACTION (SPE) APPARATUS FOR USING CARTRIDGES
- 7.9.1** SPE CARTRIDGES – 0.5 g SPE cartridges containing a reverse phase copolymer characterized by a weak anion exchanger (WAX) sorbent phase.
- 7.9.2** VACUUM EXTRACTION MANIFOLD – A manual vacuum manifold with large volume sampler for cartridge extractions, or an automatic/robotic sample preparation system designed for use with SPE cartridges, may be used if all QC requirements discussed in Section 9 are met. Extraction and/or elution steps may not be changed or omitted to accommodate the use of an automated system. Care must be taken with automated SPE systems to ensure the PTFE commonly used in these systems does not contribute to unacceptable analyte concentrations in the MB (Sect. 9.2.1).
- 7.9.3** SAMPLE DELIVERY SYSTEM – Use of a polypropylene transfer tube system, which transfers the sample directly from the sample container to the SPE cartridge, is recommended, but not mandatory. Standard extraction manifolds come equipped with PTFE transfer tube systems. These can be replaced with 1/8" O.D. x 1/16" I.D. polypropylene or polyethylene tubing cut to an appropriate length to ensure no sample contamination from the sample transfer lines. Other types of non-PTFE tubing may be used provided it meets the MB (Sect. 9.2.1) and LCS (Sect. 9.3) QC requirements. The PTFE transfer tubes may be used, but an MB must be run on each PTFE transfer tube and the QC requirements in Section 13.2.2 must be met. In the case of automated SPE, the removal of PTFE lines may not be feasible; therefore, MBs will need to be rotated among the ports and must meet the QC requirements of Sections 13.2.2 and 9.2.1.
- 7.10** Extract Clean-up Cartridge – 250 mg 6ml SPE Cartridge containing graphitized polymer carbon

7.11 EXTRACT CONCENTRATION SYSTEM – Extracts are concentrated by evaporation with nitrogen using a water bath set no higher than 65 °C.

7.12 LABORATORY OR ASPIRATOR VACUUM SYSTEM – Sufficient capacity to maintain a vacuum of approximately 10 to 15 inches of mercury for extraction cartridges.

7.13 LIQUID CHROMATOGRAPHY (LC)/TANDEM MASS SPECTROMETER (MS/MS) WITH DATA SYSTEM

7.13.1 LC SYSTEM – Instrument capable of reproducibly injecting up to 10-µL aliquots, and performing binary linear gradients at a constant flow rate near the flow rate used for development of this method (0.4 mL/min). The LC must be capable of pumping the water/methanol mobile phase without the use of a degasser which pulls vacuum on the mobile phase bottle (other types of degassers are acceptable). Degassers which pull vacuum on the mobile phase bottle will volatilize the ammonium acetate mobile phase causing the analyte peaks to shift to earlier retention times over the course of the analysis batch. The usage of a column heater is optional.

NOTE: During the course of method development, it was discovered that while idle for more than one day, PFAS's built up in the PTFE solvent transfer lines. To prevent long delays in purging high levels of PFAS's from the LC solvent lines, they were replaced with PEEK tubing and the PTFE solvent frits were replaced with stainless steel frits. It is not possible to remove all PFAS background contamination, but these measures help to minimize their background levels.

7.13.2 LC/TANDEM MASS SPECTROMETER – The LC/MS/MS must be capable of negative ion electrospray ionization (ESI) near the suggested LC flow rate of 0.4 mL/min. The system must be capable of performing MS/MS to produce unique product ions for the method analytes within specified retention time segments. A minimum of 10 scans across the chromatographic peak is required to ensure adequate precision.

7.13.3 DATA SYSTEM – An interfaced data system is required to acquire, store, reduce, and output mass spectral data. The computer software should have the capability of processing stored LC/MS/MS data by recognizing an LC peak within any given retention time window. The software must allow integration of the ion abundance of any specific ion within specified time or scan number limits. The software must be able to calculate relative response factors, construct linear regressions or quadratic calibration curves, and calculate analyte concentrations.

7.13.4 ANALYTICAL COLUMN – An LC BEH C₁₈ column (2.1 x 50 mm) packed with 1.7 µm d_p C₁₈ solid phase particles was used. Any column that provides adequate resolution, peak shape, capacity, accuracy, and precision (Sect. 9) may be used.

8. Reagents and Standards

8.1 GASES, REAGENTS, AND SOLVENTS – Reagent grade or better chemicals should be used.

8.1.1 REAGENT WATER – Purified water which does not contain any measurable quantities of any method analytes or interfering compounds greater than 1/3 the RL for each method analyte of interest. Prior to daily use, at least 3 L of reagent water should be flushed from the purification system to rinse out any build-up of analytes in the system's tubing.

- 8.1.2 METHANOL (CH_3OH , CAS#: 67-56-1) – High purity, demonstrated to be free of analytes and interferences.
 - 8.1.3 AMMONIUM ACETATE ($\text{NH}_4\text{C}_2\text{H}_3\text{O}_2$, CAS#: 631-61-8) – High purity, demonstrated to be free of analytes and interferences.
 - 8.1.4 ACETIC ACID (H_3CCOOH , CAS#: 64-19-7) - High purity, demonstrated to be free of analytes and interferences.
 - 8.1.5 1M AMMONIUM ACETATE/REAGENT WATER – High purity, demonstrated to be free of analytes and interferences.
 - 8.1.6 2mM AMMONIUM ACETATE/METHANOL:WATER (5:95) – To prepare, mix 2 ml of 1M AMMONIUM ACETATE, 1 ml ACETIC ACID and 50 ml METHANOL into 1 Liter of REAGENT WATER.
 - 8.1.7 Methanol/Water (80:20) – To prepare a 1 Liter bottle, mix 200 ml of REAGENT WATER with 800 ml of METHANOL.
 - 8.1.8 AMMONIUM HYDROXIDE (NH_3 , CAS#: 1336-21-6) – High purity, demonstrated to be free of analytes and interferences.
 - 8.1.9 Sodium Acetate (NaOOCCH_3 , CAS#: 127-09-3) – High purity, demonstrated to be free of analytes and interferences.
 - 8.1.10 25 mM Sodium Acetate Buffer – To prepare 250mls, dissolve .625 grams of sodium acetate into 100 mls of reagent water. Add 4 mls Acetic Acid and adjust the final volume to 250 mls with reagent water.
 - 8.1.11 NITROGEN – Used for the following purposes: Nitrogen aids in aerosol generation of the ESI liquid spray and is used as collision gas in some MS/MS instruments. The nitrogen used should meet or exceed instrument manufacturer's specifications. In addition, Nitrogen is used to concentrate sample extracts (Ultra High Purity or equivalent).
 - 8.1.12 ARGON – Used as collision gas in MS/MS instruments. Argon should meet or exceed instrument manufacturer's specifications. Nitrogen gas may be used as the collision gas provided sufficient sensitivity (product ion formation) is achieved.
- 8.2 STANDARD SOLUTIONS – When a compound purity is assayed to be 96% or greater, the weight can be used without correction to calculate the concentration of the stock standard. PFAS analyte and IS standards commercially purchased in glass ampoules are acceptable; however, all subsequent transfers or dilutions performed by the analyst must be prepared and stored in polypropylene containers. Standards for sample fortification generally should be prepared in the smallest volume that can be accurately measured to minimize the addition of excess organic solvent to aqueous samples.

NOTE: Stock standards and diluted stock standards are stored at $\leq 4^\circ\text{C}$.

8.2.1 ISOTOPE DILUTION Extracted Internal Standard (ID EIS) STOCK SOLUTIONS
 - ID EIS stock standard solutions are stable for at least 6 months when stored at 4 °C. The stock solution is purchased at a concentration of 1000 ng/mL.

8.2.2 ISOTOPE DILUTION Extracted Internal Standard PRIMARY DILUTION STANDARD (ID EIS PDS) – Prepare the ID EIS PDS at a concentration of 500 ng/mL. The ID PDS is prepared in 80:20% (vol/vol) methanol:water. The ID PDS is stable for 6 months when stored at ≤4 °C.

Table 2

Isotope Labeled Standard	Conc. of EIS Stock (ng/mL)	Vol. of EIS Stock (mL)	Final Vol. of EIS PDS (mL)	Final Conc. of EIS PDS (ng/mL)
M4PFBA	1000	1.0	2.0	500
M5PFPeA	1000	1.0	2.0	500
M5PFHxA	1000	1.0	2.0	500
M4PFHpA	1000	1.0	2.0	500
M8PFOA	1000	1.0	2.0	500
M9PFNA	1000	1.0	2.0	500
M6PFDA	1000	1.0	2.0	500
M7PFUdA	1000	1.0	2.0	500
MPFDoA	1000	1.0	2.0	500
M2PFTeDA	1000	1.0	2.0	500
M2PFHxDA	50,000	.02	2.0	500
d3-N-MeFOSA	50,000	.02	2.0	500
d5-N-EtFOSA	50,000	.02	2.0	500
d7-N-MeFOSE	50,000	.02	2.0	500
d9-N-EtFOSE	50,000	.02	2.0	500
M8FOSA	1000	1.0	2.0	500
d3-N-MeFOSAA	1000	1.0	2.0	500
d5-N-EtFOSAA	1000	1.0	2.0	500
M3PFBS	929	1.0	2.0	464.5
M3PFHxS	946	1.0	2.0	473
M8PFOS	957	1.0	2.0	478.5
M2-4:2FTS	935	1.0	2.0	467.5
M2-6:2FTS	949	1.0	2.0	474.5
M2-8:2FTS	958	1.0	2.0	479
M3HFPO-DA	50,000	.4	2.0	10,000

8.2.3 ANALYTE STOCK STANDARD SOLUTION – Analyte stock standards are stable for at least 6 months when stored at 4 °C. When using these stock standards to prepare a PDS, care must be taken to ensure that these standards are at room temperature and adequately vortexed.

8.2.4 Analyte Secondary Spiking Standard Prepare the spiking solution of additional add on components for project specific requirements only. ANALYTE PRIMARY SPIKING STANDARD – Prepare the spiking standard at a concentration of 500 ng/mL in methanol. The spiking standard is stable for at least two months when stored in polypropylene centrifuge tubes at room temperature.

Table 3

Analyte	Conc. of IS Stock (ng/mL)	Vol. of IS Stock (mL)	Final Vol. of IS PDS (mL)	Final Conc. of IS PDS (ng/mL)
PFBA	2000	1	4	500
PFPeA	2000	1	4	500
PFHxA	2000	1	4	500
PFHpA	2000	1	4	500
PFOA	2000	1	4	500
PFNA	2000	1	4	500
PFDA	2000	1	4	500
PFUdA	2000	1	4	500
PFDoA	2000	1	4	500
PFTTrDA	2000	1	4	500
PFTeDA	2000	1	4	500
FOSA	2000	1	4	500
N-MeFOSAA	2000	1	4	500
N-EtFOSAA	2000	1	4	500
L-PFBS	1770	1	4	442.5
L-PFPeS	1880	1	4	470
L-PFHxSK	1480	1	4	370
Br-PFHxSK	344	1	4	86
L-PFHpS	1900	1	4	475
L-PFOSK	1460	1	4	365
Br-PFOSK	391	1	4	97.75
L-PFNS	1920	1	4	480
L-PFDS	1930	1	4	482.5
4:2FTS	1870	1	4	467.5
6:2FTS	1900	1	4	475
8:2FTS	1920	1	4	480

8.2.5 Analyte Secondary Spiking Standard Prepare the spiking solution of additional add on components for project specific requirements only.

Table 4

Analyte	Conc. of IS Stock (ng/mL)	Vol. of IS Stock (mL)	Final Vol. of IS PDS (mL)	Final Conc. of IS PDS (ng/mL)
ADONA	2000	1	4	500
PFHxDA	2000	1	4	500
PFODA	2000	1	4	500
HFPO-DA	100,000	.4	4	10,000
9CIPF3ONS	50,000	0.04	4	500
11CIPF3OUdS	50,000	0.04	4	500

- 8.2.6** LOW, MEDIUM AND HIGH LEVEL LCS – The LCS's will be prepared at the following concentrations and rotated per batch; 2 ng/L, 40 ng/L, 500 ng/L for drinking waters. The analyte PDS contains all the method analytes of interest at various concentrations in methanol. The analyte PDS has been shown to be stable for six months when stored at ≤ 4 °C.
- 8.2.7** Isotope Dilution Labeled Recovery Stock Solutions (ID REC) – ID REC Stock solutions are stable for at least 6 months when stored at 4 °C. The stock solution is purchased at a concentration of 1000 ng/mL.
- 8.2.8** Isotope Dilution Labeled Recovery Primary Dilution Standard (ID REC PDS) - Prepare the ID REC PDS at a concentration of 500 ng/mL. The ID REC PDS is prepared in 80:20% (vol/vol) methanol:water. The ID REC PDS is stable for at least six months when stored in polypropylene centrifuge tubes at ≤ 4 °C.

Table 5

Analyte	Conc. of REC Stock (ng/mL)	Vol. of REC Stock (mL)	Final Vol. of REC PDS (mL)	Final Conc. of REC PDS (ng/mL)
M2PFOA	2000	1	4	500
M2PFDA	2000	1	4	500
M3PFBA	2000	1	4	500
M4PFOS	2000	1	4	500

8.2.9 CALIBRATION STANDARDS (CAL) –

Current Concentrations (ng/mL): 0.5, 1.0, 5.0, 10.0, 50.0, 125, 150, 250, 500

Prepare the CAL standards over the concentration range of interest from dilutions of the analyte PDS in methanol containing 20% reagent water. 20 μ l of the EIS PDS and REC PDS are added to the CAL standards to give a constant concentration of 10 ng/ml. The lowest concentration CAL standard must be at or below the RL (2 ng/L), which may depend on system sensitivity. The CAL standards may also be used as CCVs (Sect. 9.8). To make calibration stock standards:

Table 6

Calibration Standard Concentration	Final Aqueous Cal STD Level Concentration	Final Soil Cal STD Level Concentration	24 compound stock added (ul)	PFHxDA Stock added (ul)	500 ng/ml PFHxDA dilution added (ul)	PFODA Stock added (ul)	500 ng/ml PFODA dilution added (ul)	ADONA, HFPO-DA, 11Cl-PF3OUdS, 9Cl-PF3ONS Stock added (ul)	500 ng/ml ADONA dilution added (ul)	Final Volume in MeOH/H ₂ O (82:20)
.5 ng/ml	2 ng/L	.25 ng/g	6.25		25		25		25	25 mls
1 ng/ml	4 ng/L	.5 ng/g	5		20		20		20	10 mls
5 ng/ml	20 ng/L	1 ng/g	25		100		100		100	10 mls
10 ng/ml	40 ng/L	5 ng/g	125	5		5		5		25 mls

50 ng/ml	200 ng/L	25 ng/g	250	10		10		10		10 mls
125 ng/ml	500 ng/L	62.5 ng/g	625	25		25		25		10 mls
150 ng/ml	600 ng/L	75 ng/g	750	30		30		30		10 mls
250 ng/ml	1000 ng/L	125 ng/g	625							5 mls
500 ng/ml	2000 ng/L	250 ng/g	1250							5 mls

9. Quality Control

The laboratory must maintain records to document the quality of data that is generated. Ongoing data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method.

9.1 MINIMUM REPORTING LIMIT (MRL) CONFIRMATION

- 9.1.1** Fortify, extract, and analyze seven replicate LCSs at 2 ng/l. Calculate the mean measured concentration (*Mean*) and standard deviation for these replicates. Determine the Half Range for the prediction interval of results (HR_{PIR}) using the equation below

$$HR_{PIR} = 3.963s$$

Where:

s = the standard deviation

3.963 = a constant value for seven replicates.

- 9.1.2** Confirm that the upper and lower limits for the Prediction Interval of Result ($PIR = Mean \pm HR_{PIR}$) meet the upper and lower recovery limits as shown below

The Upper PIR Limit must be $\leq 150\%$ recovery.

$$\frac{Mean + HR_{PIR}}{Fortified\ Concentration} \times 100\% \leq 150\%$$

The Lower PIR Limit must be $\geq 50\%$ recovery.

$$\frac{Mean - HR_{PIR}}{Fortified\ Concentration} \times 100\% \geq 50\%$$

- 9.1.3** The RL is validated if both the Upper and Lower PIR Limits meet the criteria described above. If these criteria are not met, the RL has been set too low and must be determined again at a higher concentration.

9.2 Blank(s)

- 9.2.1 METHOD BLANK (MB)** - A Method Blank (MB) is required with each extraction batch to confirm that potential background contaminants are not interfering with the identification or quantitation of method analytes. Prep and analyze a MB for every 20 samples. If the MB produces a peak within the retention time window of any analyte that would prevent the determination of that analyte, determine the source of contamination and eliminate the interference before processing samples. Background contamination must be reduced to an acceptable level before proceeding. Background from method analytes or other contaminants that

interfere with the measurement of method analytes must be below the RL. If the method analytes are detected in the MB at concentrations equal to or greater than this level, then all data for the problem analyte(s) must be considered invalid for all samples in the extraction batch. Because background contamination is a significant problem for several method analytes, it is highly recommended that the analyst maintain a historical record of MB data.

- 9.2.2 FIELD REAGENT BLANK (FRB)** - The purpose of the FRB is to ensure that PFAS's measured in the Field Samples were not inadvertently introduced into the sample during sample collection/handling. Analysis of the FRB is required only if a Field Sample contains a method analyte or analytes at or above the RL. The FRB is processed, extracted and analyzed in exactly the same manner as a Field Sample.

9.3 Laboratory Control Sample (LCS) and Laboratory Control Sample Duplicates (LCSD)

- 9.3.1** An LCS is required with each extraction batch. The fortified concentration of the LCS may be rotated between low, medium, and high concentrations from batch to batch. Default limits of 50-150% of the true value may be used for analytes until sufficient replicates have been analyzed to generate proper control limits. Calculate the percent recovery (%R) for each analyte using the equation

$$\%R = \frac{A \times 100}{B}$$

Where:

A = measured concentration in the fortified sample
B = fortification concentration.

- 9.3.2** Where applicable, LCSD's are to be extracted and analyzed. The concentration and analyte recovery criteria for the LCSD must be the same as the batch LCS. The RSD's must fall within ≤30% of the true value for medium and high level replicates, and ≤50% for low level replicates. Calculate the relative percent difference (RPD) for duplicate MSs (MS and MSD) using the equation

$$RPD = \frac{|LCS - LCSD|}{(LCS + LCSD) / 2} \times 100$$

- 9.3.3** If the LCS and or LCSD results do not meet these criteria for method analytes, then all data for the problem analyte(s) must be considered invalid for all samples in the extraction batch.

9.4 Labeled Recovery Standards (REC)

The analyst must monitor the peak areas of the REC(s) in all injections during each analysis day.

9.5 Extracted Internal Standards (EIS)

- 9.5.1** The EIS standard is fortified into all samples, CCVs, MBs, LCSs, MSs, MSDs, FD, and FRB prior to extraction. It is also added to the CAL standards. The EIS is a means of assessing method performance from extraction to final

chromatographic measurement. Calculate the recovery (%R) for the EIS using the following equation

$$\%R = (A / B) \times 100$$

Where:

A = calculated EIS concentration for the QC or Field Sample
B = fortified concentration of the EIS.

- 9.5.2** Default limits of 50-150% may be used for analytes until sufficient replicates have been analyzed to generate proper control limits. A low or high percent recovery for a sample, blank, or CCV does not require discarding the analytical data but it may indicate a potential problem with future analytical data. When EIS recovery from a sample, blank, or CCV are outside control limits, check 1) calculations to locate possible errors, 2) standard solutions for degradation, 3) contamination, and 4) instrument performance. For CCVs and QC elements spiked with all target analytes, if the recovery of the corresponding target analytes meet the acceptance criteria for the EIS in question, the data can be used but all potential biases in the recovery of the EIS must be documented in the sample report. If the associated target analytes do not meet the acceptance criteria, the data must be reanalyzed.

9.6 Matrix Spike (MS)

- 9.6.1** Analysis of an MS is required in each extraction batch and is used to determine that the sample matrix does not adversely affect method accuracy. Assessment of method precision is accomplished by analysis of a Field Duplicate (FD) (Sect. 9.6); however, infrequent occurrence of method analytes would hinder this assessment. If the occurrence of method analytes in the samples is infrequent, or if historical trends are unavailable, a second MS, or MSD, must be prepared, extracted, and analyzed from a duplicate of the Field Sample. Extraction batches that contain MSDs will not require the extraction of a field sample duplicate. If a variety of different sample matrices are analyzed regularly, for example, drinking water from groundwater and surface water sources, method performance should be established for each. Over time, MS data should be documented by the laboratory for all routine sample sources.
- 9.6.2** Within each extraction batch, a minimum of one Field Sample is fortified as an MS for every 20 Field Samples analyzed. The MS is prepared by spiking a sample with an appropriate amount of the Analyte Stock Standard (Sect. 8.2.3). Use historical data and rotate through the low, mid and high concentrations when selecting a fortifying concentration. Calculate the percent recovery (%R) for each analyte using the equation

$$\%R = \frac{(A - B)}{C} \times 100$$

Where:

A = measured concentration in the fortified sample
B = measured concentration in the unfortified sample
C = fortification concentration.

- 9.6.3** Analyte recoveries may exhibit matrix bias. For samples fortified at or above their native concentration, recoveries should range between 50-150%. If the accuracy of any analyte falls outside the designated range, and the laboratory performance for that analyte is shown to be in control in the LCS, the recovery is judged to be

matrix biased. The result for that analyte in the unfortified sample is labeled suspect/matrix to inform the data user that the results are suspect due to matrix effects.

9.7 Laboratory Duplicate

9.7.1 FIELD DUPLICATE OR LABORATORY FORTIFIED SAMPLE MATRIX DUPLICATE (FD or MSD) – Within each extraction batch (not to exceed 20 Field Samples), a minimum of one FD or MSD must be analyzed. Duplicates check the precision associated with sample collection, preservation, storage, and laboratory procedures. If method analytes are not routinely observed in Field Samples, an MSD should be analyzed rather than an FD.

9.7.2 Calculate the relative percent difference (RPD) for duplicate measurements (FD1 and FD2) using the equation

$$RPD = \frac{|FD1 - FD2|}{(FD1 + FD2) / 2} \times 100$$

9.7.3 RPDs for FDs should be ≤30%. Greater variability may be observed when FDs have analyte concentrations that are within a factor of 2 of the RL. At these concentrations, FDs should have RPDs that are ≤50%. If the RPD of any analyte falls outside the designated range, and the laboratory performance for that analyte is shown to be in control in the CCV, the recovery is judged to be matrix biased. The result for that analyte in the unfortified sample is labeled suspect/matrix to inform the data user that the results are suspect due to matrix effects.

9.7.4 If an MSD is analyzed instead of a FD, calculate the relative percent difference (RPD) for duplicate MSs (MS and MSD) using the equation

$$RPD = \frac{|MS - MSD|}{(MS + MSD) / 2} \times 100$$

9.7.5 RPDs for duplicate MSs should be ≤30% for samples fortified at or above their native concentration. Greater variability may be observed when MSs are fortified at analyte concentrations that are within a factor of 2 of the RL. MSs fortified at these concentrations should have RPDs that are ≤50% for samples fortified at or above their native concentration. If the RPD of any analyte falls outside the designated range, and the laboratory performance for that analyte is shown to be in control in the LCSD where applicable, the result is judged to be matrix biased. If no LCSD is present, the associated MS and MSD are to be re-analyzed to determine if any analytical has occurred. If the resulting RPDs are still outside control limits, the result for that analyte in the unfortified sample is labeled suspect/matrix to inform the data user that the results are suspect due to matrix effects.

9.8 Initial Calibration Verification (ICV)

9.8.1 As part of the IDC (Sect. 13.2), and after each ICAL, analyze a QCS sample from a source different from the source of the CAL standards. If a second vendor is not available, then a different lot of the standard should be used. The QCS should be prepared and analyzed just like a CCV. Acceptance criteria for the QCS are identical to the CCVs; the calculated amount for each analyte must be ±

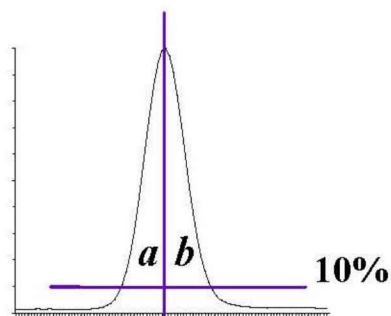
30% of the expected value. If measured analyte concentrations are not of acceptable accuracy, check the entire analytical procedure to locate and correct the problem.

9.9 Continuing Calibration Verification (CCV)

9.9.1 CCV Standards are analyzed at the beginning of each analysis batch, after every 10 Field Samples, and at the end of the analysis batch. See Section 10.7 for concentration requirements and acceptance criteria.

9.10 Method-specific Quality Control Samples

9.10.1 PEAK ASYMMETRY FACTOR – A peak asymmetry factor must be calculated using the equation below during the IDL and every time a calibration curve is generated. The peak asymmetry factor for the first two eluting peaks in a midlevel CAL standard (if only two analytes are being analyzed, both must be evaluated) must fall in the range of 0.8 to 1.5. Modifying the standard or extract composition to more aqueous content to prevent poor shape is not permitted. See guidance in Section 10.6.4.1 if the calculated peak asymmetry factors do not meet the criteria.



$$A_s = b / a$$

Where:

A_s = peak asymmetry factor

b = width of the back half of the peak measured (at 10% peak height) from the trailing edge of the peak to a line dropped perpendicularly from the peak apex

a = the width of the front half of the peak measured (at 10% peak height) from the leading edge of the peak to a line dropped perpendicularly from the apex.

9.11 Method Sequence

- CCV-LOW
- MB
- LCS
- LCSD
- MS
- Duplicate or MSD
- Field Samples (1-10)
- CCV-MID
- Field Samples (11-20)
- CCV-LOW

10. Procedure

10.1 Equipment Set-up

- 10.1.1** This procedure may be performed manually or in an automated mode using a robotic or automatic sample preparation device. If an automated system is used to prepare samples, follow the manufacturer's operating instructions, but all extraction and elution steps must be the same as in the manual procedure. Extraction and/or elution steps may not be changed or omitted to accommodate the use of an automated system. If an automated system is used, the MBs should be rotated among the ports to ensure that all the valves and tubing meet the MB requirements (Sect. 9.2).
- 10.1.2** Some of the PFAS's adsorb to surfaces, including polypropylene. Therefore, the aqueous sample bottles must be rinsed with the elution solvent (Sect 10.3.4) whether extractions are performed manually or by automation. The bottle rinse is passed through the cartridge to elute the method analytes and is then collected (Sect. 10.3.4).
- 10.1.3 NOTE:** The SPE cartridges and sample bottles described in this section are designed as single use items and should be discarded after use. They may not be refurbished for reuse in subsequent analyses.

10.2 Sample Preparation and Extraction of Aqueous Samples

- 10.2.1** Samples are preserved, collected and stored as presented in Section 6.

The entire sample that is received must be sent through the SPE cartridge. In addition, the bottle must be solvent rinsed and this rinse must be sent through the SPE cartridge as well. The method blank (MB) and laboratory control sample (LCS) must be extracted in exactly the same manner (i.e., must include the bottle solvent rinse). It should be noted that a water rinse alone is not sufficient. This does not apply to samples with high concentrations of PFAS that are prepared using serial dilution and not SPE.

- 10.2.2** Determine sample volume. Weigh all samples to the nearest 1g. If visible sediment is present, centrifuge and decant into a new 250mL HDPE bottle and record the weight of the new container.

NOTE: Some of the PFAS's adsorb to surfaces, thus the sample volume may **NOT** be transferred to a graduated cylinder for volume measurement.

- 10.2.3** The MB, LCS and FRB may be prepared by measuring 250 mL of reagent water with a polypropylene graduated cylinder or filling a 250-mL sample bottle to near the top.
- 10.2.4** Adjust the QC and sample pH to 3 by adding acetic acid in water dropwise
- 10.2.5** Add 20 µL of the EIS PDS (Sect. 8.2.2) to each sample and QC, cap and invert to mix.
- 10.2.6** If the sample is an LCS, LCSD, MS, or MSD, add the necessary amount of analyte PDS (Sect. 8.2.3). Cap and invert each sample to mix.

10.3 Cartridge SPE Procedure

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- 10.3.1 CARTRIDGE CLEAN-UP AND CONDITIONING – DO NOT** allow cartridge packing material to go dry during any of the conditioning steps. Rinse each cartridge with 3 X 5 mL of 2% ammonium hydroxide in methanol, followed by 5mls of methanol. Next, rinse each cartridge with 5 mls of the 25 mM acetate buffer, followed by 15 mL of reagent water, without allowing the water to drop below the top edge of the packing. If the cartridge goes dry during the conditioning phase, the conditioning must be started over. Add 4-5 mL of reagent water to each cartridge, attach the sample transfer tubes (Sect. 7.9.3), turn on the vacuum, and begin adding sample to the cartridge.
- 10.3.2 SAMPLE EXTRACTON –** Adjust the vacuum so that the approximate flow rate is approximately 4 mL/min. Do not allow the cartridge to go dry before all the sample has passed through.
- 10.3.3 SAMPLE BOTTLE AND CARTRIDGE RINSE –** After the entire sample has passed through the cartridge, rinse the sample bottles with 4 ml reagent water followed by 4 ml 25 mM acetate buffer at pH 4 and draw the aliquot through the sample transfer tubes and the cartridges. Draw air or nitrogen through the cartridge for 5-10 min at high vacuum (10-15 in. Hg). **NOTE: If empty plastic reservoirs are used in place of the sample transfer tubes to pass the samples through the cartridges, these reservoirs must be treated like the transfer tubes. After the entire sample has passed through the cartridge, the reservoirs must be rinsed to waste with reagent water.**
- 10.3.4 SAMPLE BOTTLE AND CARTRIDGE ELUTION, Fraction 1 –** Turn off and release the vacuum. Lift the extraction manifold top and insert a rack with collection tubes into the extraction tank to collect the extracts as they are eluted from the cartridges. Rinse the sample bottles with 12 mls of methanol and draw the aliquot through the sample transfer tubes and cartridges. Use a low vacuum such that the solvent exits the cartridge in a dropwise fashion.
- SAMPLE BOTTLE AND CARTRIDGE ELUTION, Fraction 2 In a separate collection vial, rinse the sample bottles with 12 mL of 2% ammonium hydroxide in methanol and elute the analytes from the cartridges by pulling the 4 mL of methanol through the sample transfer tubes and the cartridges. Use a low vacuum such that the solvent exits the cartridge in a dropwise fashion. To the final extract, add 50 ul of acetic acid.
- NOTE: If empty plastic reservoirs are used in place of the sample transfer tubes to pass the samples through the cartridges, these reservoirs must be treated like the transfer tubes. After the reservoirs have been rinsed in Section 10.3.3, the elution solvent used to rinse the sample bottles must be swirled down the sides of the reservoirs while eluting the cartridge to ensure that any method analytes on the surface of the reservoirs are transferred to the extract.**
- CLEAN-UP CARTRIDGE ELUTION, Elute the clean-up cartridge with 8 additional mls of methanol and draw the aliquot through the cartridge. Use a low vacuum such that the solvent exits the cartridge in a dropwise fashion.
- 10.3.5** Fractions 1 and 2 are to be combined during the concentration stage (section 10.6)

10.4 Sample Prep and Extraction Protocol for Soils

- 10.4.1 Homogenize and weigh 2 grams of sample (measured to the nearest hundredth of a gram) into a 50 ml polypropylene centrifuge tube. For laboratory control blanks and spikes, 2 grams of clean sand is used.
- 10.4.2 Add 20 µL of the EIS PDS (Sect. 8.2.2) to each sample and QC.
- 10.4.3 If the sample is an LCS, LCSD, MS, or MSD, add the necessary amount of analyte PDS (Sect. 8.2.3). Cap and invert each sample to mix.
- 10.4.4 To all samples, add 10 mls of methanol, cap, vortex for 25 seconds at 3000RPM and mix for 30 minutes using a shaker table or tumbler at 120RPM.
- 10.4.5 Following mixing, sonicate each sample for 30 minutes and let samples sit overnight (at least 2 hours is required for RUSH samples).
- 10.4.6 Centrifuge each sample at 3500RPM for 10 minutes.
- 10.4.7 Remove supernatant, and reserve for clean-up.

10.5 Extract Clean-up

- 10.5.1 CARTRIDGE CLEAN-UP AND CONDITIONING – Rinse each cartridge with 15 mL of methanol and discard. If the cartridge goes dry during the conditioning phase, the conditioning must be started over. Attach the sample transfer tubes (Sect. 7.9.3), turn on the vacuum, and begin adding sample to the cartridge.
- 10.5.2 Adjust the vacuum so that the approximate flow rate is 1-2 mL/min. Do not allow the cartridge to go dry before all the sample has passed through.
- 10.5.3 SAMPLE BOTTLE AND CARTRIDGE RINSE – After the entire sample has passed through the cartridge, rinse the sample collection vial with two 1-mL aliquots of methanol and draw each aliquot through the cartridges. Draw air or nitrogen through the cartridge for 5 min at high vacuum (10-15 in. Hg).
- 10.5.4 If extracts are not to be immediately evaporated, cover collection tubes and store at ambient temperature till concentration.

10.6 Extract Concentration

- 10.6.1 Concentrate the extract to dryness under a gentle stream of nitrogen in a heated water bath (60-65 °C) to remove all the water/methanol mix. Add the appropriate amount of 80:20% (vol/vol) methanol:water solution and 20 µl of the ID REC PDS (Sect. 8.2.7) to the collection vial to bring the volume to 1 mL and vortex. Transfer two aliquots with a plastic pipet (Sect. 7.6) into 2 polypropylene autosampler vials.

NOTE: It is recommended that the entire 1-mL aliquot not be transferred to the autosampler vial because the polypropylene autosampler caps do not reseal after injection. Therefore, do not store the extracts in the autosampler vials as evaporation losses can occur occasionally in these autosampler vials. Extracts can be split between 2 X 700 µl vials (Sect. 7.4).

10.7 Sample Volume Determination

10.7.1 If the level of the sample was marked on the sample bottle, use a graduated cylinder to measure the volume of water required to fill the original sample bottle to the mark made prior to extraction. Determine to the nearest 10 mL.

10.7.2 If using weight to determine volume, weigh the empty bottle to the nearest 10 g and determine the sample weight by subtraction of the empty bottle weight from the original sample weight (Sect. 10.2.2). Assume a sample density of 1.0 g/mL. In either case, the sample volume will be used in the final calculations of the analyte concentration (Sect. 11.2).

10.8 Initial Calibration - Demonstration and documentation of acceptable initial calibration is required before any samples are analyzed. After the initial calibration is successful, a CCV is required at the beginning and end of each period in which analyses are performed, and after every tenth Field Sample.

10.8.1 ESI-MS/MS TUNE

10.8.1.1 Calibrate the mass scale of the MS with the calibration compounds and procedures prescribed by the manufacturer.

10.8.1.2 Optimize the [M-H]⁻ for each method analyte by infusing approximately 0.5-1.0 µg/mL of each analyte (prepared in the initial mobile phase conditions) directly into the MS at the chosen LC mobile phase flow rate (approximately 0.4 mL/min). This tune can be done on a mix of the method analytes. The MS parameters (voltages, temperatures, gas flows, etc.) are varied until optimal analyte responses are determined. The method analytes may have different optima requiring some compromise between the optima.

10.8.1.3 Optimize the product ion for each analyte by infusing approximately 0.5-1.0 µg/mL of each analyte (prepared in the initial mobile phase conditions) directly into the MS at the chosen LC mobile phase flow rate (approximately 0.4 mL/min). This tune can be done on a mix of the method analytes. The MS/MS parameters (collision gas pressure, collision energy, etc.) are varied until optimal analyte responses are determined. Typically, the carboxylic acids have very similar MS/MS conditions and the sulfonic acids have similar MS/MS conditions.

10.8.2 Establish LC operating parameters that optimize resolution and peak shape. Modifying the standard or extract composition to more aqueous content to prevent poor shape is not permitted.

Cautions: LC system components, as well as the mobile phase constituents, contain many of the method analytes in this method. Thus, these PFAS's will build up on the head of the LC column during mobile phase equilibration. To minimize the background PFAS peaks and to keep background levels constant, the time the LC column sits at initial conditions must be kept constant and as short as possible (while ensuring reproducible retention times). In addition, prior to daily use, flush the column with 100% methanol for at least 20 min before initiating a sequence. It may be necessary on some systems to flush other LC components such as wash syringes, sample needles or any other system components before daily use.

10.8.3 Inject a mid-level CAL standard under LC/MS conditions to obtain the retention times of each method analyte. If analyzing for PFTA, ensure that the LC

conditions are adequate to prevent co-elution of PFTA and the mobile phase interferants. These interferants have the same precursor and products ions as PFTA, and under faster LC conditions may co-elute with PFTA. Divide the chromatogram into retention time windows each of which contains one or more chromatographic peaks. During MS/MS analysis, fragment a small number of selected precursor ions ([M-H]-) for the analytes in each window and choose the most abundant product ion. For maximum sensitivity, small mass windows of ± 0.5 daltons around the product ion mass were used for quantitation.

10.8.4 Inject a mid-level CAL standard under optimized LC/MS/MS conditions to ensure that each method analyte is observed in its MS/MS window and that there are at least 10 scans across the peak for optimum precision.

10.8.4.1 If broad, split or fronting peaks are observed for the first two eluting chromatographic peaks (if only two analytes are being analyzed, both must be evaluated), change the initial mobile phase conditions to higher aqueous content until the peak asymmetry ratio for each peak is 0.8 – 1.5. The peak asymmetry factor is calculated as described in Section 9.9.1 on a mid-level CAL standard. The peak asymmetry factor must meet the above criteria for the first two eluting peaks during the IDL and every time a new calibration curve is generated. Modifying the standard or extract composition to more aqueous content to prevent poor shape is not permitted.

NOTE: PFHxS, PFOS, NMeFOSAA, and NEtFOSAA have multiple chromatographic peaks using the LC conditions in Table 5 due to chromatographic resolution of the linear and branched isomers of these compounds. Most PFAS's are produced by two different processes. One process gives rise to linear PFAS's only while the other process produces both linear and branched isomers. Thus, both branched and linear PFAS's can potentially be found in the environment. For the aforementioned compounds that give rise to more than one peak, all the chromatographic peaks observed in the standard must be integrated and the areas totaled. Chromatographic peaks in a sample must be integrated in the same way as the CAL standard.

10.8.5 Prepare a set of CAL standards as described in Section 8.2.5. The lowest concentration CAL standard must be at or below the RL (2 ng/L), which may depend on system sensitivity.

10.8.6 The LC/MS/MS system is calibrated using the IS technique. Use the LC/MS/MS data system software to generate a linear regression or quadratic calibration curve for each of the analytes. This curve **must always** be forced through zero and may be concentration weighted, if necessary. Forcing zero allows for a better estimate of the background levels of method analytes. A minimum of 5 levels are required for a linear calibration model and a minimum of 6 levels are required for a quadratic calibration model.

10.8.7 CALIBRATION ACCEPTANCE CRITERIA – A linear fit is acceptable if the coefficient of determination (r^2) is greater than 0.99. When quantitated using the initial calibration curve, each calibration point, except the lowest point, for each analyte should calculate to be within 70-130% of its true value. The lowest CAL point should calculate to be within 50-150% of its true value. If these criteria cannot be met, the analyst will have difficulty meeting ongoing QC criteria. It is

recommended that corrective action is taken to reanalyze the CAL standards, restrict the range of calibration, or select an alternate method of calibration (forcing the curve through zero is still required).

10.8.7.1 CAUTION: When acquiring MS/MS data, LC operating conditions must be carefully reproduced for each analysis to provide reproducible retention times. If this is not done, the correct ions will not be monitored at the appropriate times. As a precautionary measure, the chromatographic peaks in each window must not elute too close to the edge of the segment time window.

10.9 CONTINUING CALIBRATION CHECK (CCV) – Minimum daily calibration verification is as follows. Verify the initial calibration at the beginning and end of each group of analyses, and after every tenth sample during analyses. In this context, a “sample” is considered to be a Field Sample. MBs, CCVs, LCSs, MSs, FDs FRBs and MSDs are not counted as samples. The beginning CCV of each analysis batch must be at or below the RL in order to verify instrument sensitivity prior to any analyses. If standards have been prepared such that all low CAL points are not in the same CAL solution, it may be necessary to analyze two CAL standards to meet this requirement. Alternatively, the analyte concentrations in the analyte PDS may be customized to meet these criteria. Subsequent CCVs should alternate between a medium and Low concentration CAL standard.

10.9.1 Inject an aliquot of the appropriate concentration CAL standard and analyze with the same conditions used during the initial calibration.

10.9.2 Calculate the concentration of each analyte and EIS in the CCV. The calculated amount for each analyte for medium level CCVs must be within $\pm 30\%$ of the true value with an allowance of 10% of the reported analytes to be greater than 30%, but less than 40%. The calculated amount for each EIS must be within $\pm 50\%$ of the true value. The calculated amount for the lowest calibration point for each analyte must be within $\pm 50\%$. If these conditions do not exist, then all data for the problem analyte must be considered invalid, and remedial action should be taken (Sect. 10.7.4) which may require recalibration. Any Field or QC Samples that have been analyzed since the last acceptable calibration verification should be reanalyzed after adequate calibration has been restored, with the following exception. **If the CCV fails because the calculated concentration is greater than 130% (150% for the low-level CCV) for a particular method analyte, and Field Sample extracts show no detection for that method analyte, non-detects may be reported without re-analysis.**

10.9.3 REMEDIAL ACTION – Failure to meet CCV QC performance criteria may require remedial action. Major maintenance, such as cleaning the electrospray probe, atmospheric pressure ionization source, cleaning the mass analyzer, replacing the LC column, etc., requires recalibration (Sect 10.6) and verification of sensitivity by analyzing a CCV at or below the RL (Sect 10.7).

10.10 EXTRACT ANALYSIS

- 10.10.1** Establish operating conditions equivalent to those summarized in Tables 6-8 of Section 16. Instrument conditions and columns should be optimized prior to the initiation of the IDC.
- 10.10.2** Establish an appropriate retention time window for each analyte. This should be based on measurements of actual retention time variation for each method analyte in CAL standard solutions analyzed on the LC over the course of time. A value of plus or minus three times the standard deviation of the retention time obtained for each method analyte while establishing the initial calibration and completing the IDC can be used to calculate a suggested window size. However, the experience of the analyst should weigh heavily on the determination of the appropriate retention window size.
- 10.10.3** Calibrate the system by either the analysis of a calibration curve (Sect. 10.6) or by confirming the initial calibration is still valid by analyzing a CCV as described in Section 10.7. If establishing an initial calibration, complete the IDC as described in Section 13.2.
- 10.10.4** Begin analyzing Field Samples, including QC samples, at their appropriate frequency by injecting the same size aliquots under the same conditions used to analyze the CAL standards.
- 10.10.5** At the conclusion of data acquisition, use the same software that was used in the calibration procedure to identify peaks of interest in predetermined retention time windows. Use the data system software to examine the ion abundances of the peaks in the chromatogram. Identify an analyte by comparison of its retention time with that of the corresponding method analyte peak in a reference standard.
- 10.10.6** The analyst must not extrapolate beyond the established calibration range. If an analyte peak area exceeds the range of the initial calibration curve, the sample should be re-extracted with a reduced sample volume in order to bring the out of range target analytes into the calibration range. If a smaller sample size would not be representative of the entire sample, the following options are recommended. Re-extract an additional aliquot of sufficient size to insure that it is representative of the entire sample. Spike it with a higher concentration of internal standard. Prior to LC/MS analysis, dilute the sample so that it has a concentration of internal standard equivalent to that present in the calibration standard. Then, analyze the diluted extract.

11. Data Evaluation, Calculations and Reporting

- 11.1** Complete chromatographic resolution is not necessary for accurate and precise measurements of analyte concentrations using MS/MS. In validating this method, concentrations were calculated by measuring the product ions listed in Table 7.
- 11.2** Calculate analyte concentrations using the multipoint calibration established in Section 10.6. Do not use daily calibration verification data to quantitate analytes in samples. Adjust final analyte concentrations to reflect the actual sample volume determined in Section 10.6 where:

$$C_{ex} = (\text{Area of target analyte} * \text{Concentration of Labeled analog}) / (\text{area of labeled analog} * \text{CF})$$

$$C_s = (C_{ex} / \text{sample volume in ml}) * 1000$$

C_{ex} = The concentration of the analyte in the extract

CF = calibration factor from calibration.

- 11.3** Prior to reporting the data, the chromatogram should be reviewed for any incorrect peak identification or poor integration.
- 11.4** PFHxS, PFOS, PFOA, NMeFOSAA, and NEtFOSAA have multiple chromatographic peaks using the LC conditions in Table 5 due to the linear and branch isomers of these compounds (Sect. 10.6.4.1). The areas of all the linear and branched isomer peaks observed in the CAL standards for each of these analytes must be summed and the concentrations reported as a total for each of these analytes.
- 11.5** Calculations must utilize all available digits of precision, but final reported concentrations should be rounded to an appropriate number of significant figures (one digit of uncertainty), typically two, and not more than three significant figures.

12. Contingencies for Handling Out-of-Control Data or Unacceptable Data

- 12.1** Section 9.0 outlines sample batch QC acceptance criteria. If non-compliant organic compound results are to be reported, the Organic Section Head and/or the Laboratory Director, and the Operations Manager must approve the reporting of these results. The laboratory Project Manager shall be notified, and may choose to relay the non-compliance to the client, for approval, or other corrective action, such as re-sampling and re-analysis. The analyst, Data Reviewer, or Department Supervisor performing the secondary review initiates the project narrative, and the narrative must clearly document the non-compliance and provide a reason for acceptance of these results.
- 12.2** All results for the organic compounds of interest are reportable without qualification if extraction and analytical holding times are met, preservation requirements (including cooler temperatures) are met, all QC criteria are met, and matrix interference is not suspected during extraction or analysis of the samples. If any of the below QC parameters are not met, all associated samples must be evaluated for re-extraction and/or re-analysis.

13. Method Performance

13.1 Detection Limit Study (DL) / Limit of Detection Study (LOD) / Limit of Quantitation (LOQ)

- 13.1.1** The laboratory follows the procedure to determine the DL, LOD, and/or LOQ as outlined in Alpha SOP ID 1732. These studies performed by the laboratory are maintained on file for review.

13.2 Demonstration of Capability Studies

- 13.2.1** The IDC must be successfully performed prior to analyzing any Field Samples. Prior to conducting the IDC, the analyst must first generate an acceptable Initial Calibration following the procedure outlined in Section 10.6.
- 13.2.2** INITIAL DEMONSTRATION OF LOW SYSTEM BACKGROUND – Any time a new lot of SPE cartridges, solvents, centrifuge tubes, disposable pipets, and autosampler vials are used, it must be demonstrated that an MB is reasonably free of contamination and that the criteria in Section 9.2.1 are met. If an automated extraction system is used, an MB should be extracted on each port to ensure that all the valves and tubing are free from potential PFAS contamination.
- 13.2.3** INITIAL DEMONSTRATION OF PRECISION (IDP) – Prepare, extract, and analyze four to seven replicate LCSs fortified near the midrange of the initial calibration curve according to the procedure described in Section 10. Sample preservatives as described in Section 6.2.1 must be added to these samples. The relative standard deviation (RSD) of the results of the replicate analyses must be less than 20%.
- 13.2.4** INITIAL DEMONSTRATION OF ACCURACY (IDA) – Using the same set of replicate data generated for Section 13.2.3, calculate average recovery. The average recovery of the replicate values must be within $\pm 30\%$ of the true value.
- 13.2.5** INITIAL DEMONSTRATION OF PEAK ASYMMETRY FACTOR – Peak asymmetry factors must be calculated using the equation in Section 9.10.1 for the first two eluting peaks (if only two analytes are being analyzed, both must be evaluated) in a mid-level CAL standard. The peak asymmetry factors must fall in the range of 0.8 to 1.5. See guidance in Section 10.6.4.1 if the calculated peak asymmetry factors do not meet the criteria.
- 13.2.6** Refer to Alpha SOP ID 1739 for further information regarding IDC/DOC Generation.
- 13.2.7** The analyst must make a continuing, annual, demonstration of the ability to generate acceptable accuracy and precision with this method.

14. Pollution Prevention and Waste Management

- 14.1** Refer to Alpha's Chemical Hygiene Plan and Hazardous Waste Management and Disposal SOP for further pollution prevention and waste management information.
- 14.2** This method utilizes SPE to extract analytes from water. It requires the use of very small volumes of organic solvent and very small quantities of pure analytes, thereby minimizing the potential hazards to both the analyst and the environment as compared to the use of large volumes of organic solvents in conventional liquid-liquid extractions.
- 14.3** The analytical procedures described in this method generate relatively small amounts of waste since only small amounts of reagents and solvents are used. The matrices of concern are finished drinking water or source water. However, laboratory waste management practices must be conducted consistent with all applicable rules and regulations, and that laboratories protect the air, water, and land by minimizing and controlling all releases from fume hoods and bench operations. Also, compliance is required with any sewage discharge permits and regulations, particularly the hazardous waste identification rules and land disposal restrictions.

15. Referenced Documents

Chemical Hygiene Plan – ID 2124

SOP ID 1732 Detection Limit (DL), Limit of Detection (LOD) & Limit of Quantitation (LOQ) SOP

SOP ID 1739 Demonstration of Capability (DOC) Generation SOP

SOP ID 1728 Hazardous Waste Management and Disposal SOP

16. Attachments

Table 7: LC Method Conditions

Time (min)	2 mM Ammonium Acetate (5:95 MeOH/H ₂ O)	100% Methanol
Initial	100.0	0.0
1.0	100.0	0.0
2.2	85.0	15.0
11	20.0	80.0
11.4	0.0	100.0
12.4	100.0	00.0
15.5	100.0	0.0
Waters Aquity UPLC ® BEHC ₁₈ 2.1 x 50 mm packed with 1.7 µm BEH C ₁₈ stationary phase Flow rate of 0.4 mL/min 2-5 µL injection		

Table 8: ESI-MS Method Conditions

ESI Conditions	
Polarity	Negative ion
Capillary needle voltage	.5 kV
Cone Gas Flow	25 L/hr
Nitrogen desolvation gas	1000 L/hr
Desolvation gas temp.	500 °C

Table 9: Method Analyte Source, Retention Times (RTs), and EIS References

#	Analyte	Transition	RT	IS	Type
1	M3PBA	216>171	2.65		REC
2	PFBA	213 > 169	2.65	2: M4PFBA	
3	M4PFBA	217 > 172	2.65	1: M3PBA	EIS
4	PFPeA	263 > 219	5.67	4: M5PFPEA	
5	M5PFPEA	268 > 223	5.66	1: M3PBA	EIS
6	PFBS	299 > 80	6.35	6: M3PFBS	
7	M3PFBS	302 > 80	6.35	29:M4PFOS	EIS
8	FtS 4:2	327 > 307	7.47	9: M2-4:2FTS	

#	Analyte	Transition	RT	IS	Type
9	M2-4:2FTS	329 > 81	7.47	29:M4PFOS	EIS
10	PFHxA	303 > 269	7.57	10: M5PFHxA	
11	M5PFHxA	318 > 273	7.57	19:M2PFOA	EIS
12	PFPeS	349 > 80	7.88	18: M3PFHxS	
13	PFHpA	363 > 319	8.80	14: M4PFHpA	
14	M4PFHpA	367 > 322	8.80	19:M2PFOA	EIS
15	L-PFHxS	399 > 80	8.94	18: M3PFHxS	
16	br-PFHxS	399 > 80	8.72	18: M3PFHxS	
17	PFHxS Total	399 > 80	8.94	18: M3PFHxS	
18	M3PFHxS	402 > 80	8.94	29:M4PFOS	EIS
19	MPFOA	415 > 370	9.7		REC
20	PFOA	413 > 369	9.7	23: M8PFOA	
21	br-PFOA	413 > 369	9.48	23: M8PFOA	
22	PFOA Total	413 > 369	9.7	23: M8PFOA	
23	M8PFOA	421 > 376	9.7	19: M2PFOA	EIS
24	FtS 6:2	427 > 407	9.66	25: M2-6:2FTS	
25	M2-6:2FTS	429 > 409	9.66	29:M4PFOS	EIS
26	PFHpS	449 > 80	9.78	33: M8PFOS	
27	PFNA	463 > 419	10.41	33: M8PFOS	
28	M9PFNA	472 > 427	10.41	19: M2PFOA	EIS
29	M4PFOS	501 > 80	10.45		REC
30	PFOS	499 > 80	10.45	33: M8PFOS	
31	br-PFOS	499 > 80	10.27	33: M8PFOS	
32	PFOS Total	499 > 80	10.45	33: M8PFOS	
33	M8PFOS	507 > 80	10.45	29: M4PFOS	EIS
34	FtS 8:2	527 > 507	10.99	38: M2-8:2FTS	
35	M2-8:2FTS	529 > 509	10.99	29:M4PFOS	EIS
36	M2PFDA	515 > 470	11.00		REC
37	PFDA	513 > 469	11.00	38: M6PFDA	
38	M6PFDA	519 > 474	11.00	36: M2PFDA	EIS
39	PFNS	549 > 80	11.02	33:M8PFOS	
40	NMeFOSAA	570 > 419	11.41	41: D3-NMeFOSAA	
41	d3-NMeFOSAA	573 > 419	11.41	36: M2PFDA	EIS
42	PFOSA	498 > 78	11.48	29: M8FOSA	
43	M8FOSA	506 > 78	11.48	19: M2PFOA	EIS
44	PFUnDA	563 > 519	11.51	41: M7-PFUDA	
45	M7-PFUDA	570 > 525	11.51	36: M2PFDA	EIS
46	PFDS	599 > 80	11.51	33:M8PFOS	
47	NEtFOSAA	584 > 419	11.68	48: d5-NEtFOSAA	

#	Analyte	Transition	RT	IS	Type
48	d5-NEtFOSAA	589 > 419	11.68	36: M2PFDA	EIS
49	PFDaA	613 > 569	11.96	50: MPFDOA	
50	MPFDOA	615 > 570	11.96	36: M2PFDA	EIS
51	PFTriA	663 > 619	12.34	50: MPFDOA	
52	PFTeA	713 > 669	12.6	53: M2PFTEDA	
53	M2PFTEDA	715 > 670	12.6	36: M2PFDA	EIS
54	M3HFPO-DA	329>285	7.97	19: M2PFOA	EIS
55	HFPO-DA	332>287	7.97	54: M3HFPO-DA	
56	ADONA	377>251	8.00	23: M8PFOA	
57	PFHxDA	813>769	13.20	59: M2PFHxDA	
58	PFODA	913>869	13.50	59: M2PFHxDA	
59	M2PFHxDA	815>770	13.20	36:M2PFDA	EIS
60	NEtFOSA	526>169	11.00	61: NMeFOSA	
61	NMeFOSA	512>169	10.50	63: d3-NMeFOSA	
62	d3-NMeFOSA	515>169	10.50	29: M4PFOS	EIS
63	d5-NEtFOSA	531>169	11.00	29: M4PFOS	EIS
64	NMeFOSE	556>122	11.25	66: d7-NMeFOSE	
65	NEtFOSE	570>136	10.75	67: d9-NEtFOSE	
66	d7-NMeFOSE	563>126	11.25	29: M4PFOS	EIS
67	d9-NEtFOSE	579>142	10.75	29: M4PFOS	EIS
68	FtS 10:2	627>607	11.50	25: M2-6:2FTS	
69	PFDoS	699>99	12.50	33: M8PFOS	

Tenen Environmental, LLC

2921 Westchester Avenue, Bronx, NY
BCP Site No. C203140

Appendix C
Health and Safety Plan

Health and Safety Plan
for
2921 Westchester Avenue
Remedial Investigation Work Plan

2921 Westchester Avenue
Bronx, New York 10461
BCP Site # C203140

Submitted to:
New York State Department of Environmental Conservation
Division of Environmental Remediation
Remedial Bureau B
625 Broadway, 12th Floor
Albany, NY 12233-7016

Prepared for:
Ralford Realty Corp.
8 West 40th Street
New York, NY 10018

Prepared by:



121 West 27th Street, Suite 702
New York, NY 10001

January 2021

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1.0 INTRODUCTION

This Health and Safety Plan (HASP) has been prepared in conformance with the Occupational Safety and Health Administration (OSHA) standards and guidance that govern site investigation activities, other applicable regulations, and Tenen Environmental LLC (Tenen) health and safety policies and procedures. The purpose of this HASP is the protection of Tenen field personnel and others during the implementation of a Remedial Investigation.

The Site is located on the west side of Westchester Avenue, between Pilgrim Avenue and Buhre Avenue, in the Pelham Bay section of the Bronx, New York.

The Site is improved with one two-story commercial building with a partial basement that occupies the entire Site lot. The Site consists of one tenant space of the building and a portion of the partial basement. The Site is an irregularly shaped 1,415 square foot parcel located in the Bronx Community Board 10 and is generally identified as a portion of Block 4164 and Lot 5. The Site is currently occupied by a tutor and afterschool program, but was historically utilized as a dry cleaning facility.

1.1 Scope of HASP

This HASP includes safety procedures to be used by Tenen staff during the following activities:

- Soil borings and collection of soil samples;
- Installation of monitoring wells and collection of groundwater samples; and,
- Installation of soil vapor probes and collection of soil vapor samples, indoor air samples, and ambient air samples.

Subcontractors will ensure that performance of the work is in compliance with this HASP and applicable laws and regulations.

2.0 PROJECT SAFETY AUTHORITY

The following personnel are responsible for project health and safety under this HASP.

- Project Manager, Alana Carroll
- Health and Safety Officer (HSO), Ashley Platt

In addition, each individual working at the Site will be responsible for compliance with this HASP and general safe working practices. All Site workers will have the authority to stop work if a potentially hazardous situation or event is observed.

2.1 Designated Personnel

The Project Manager is responsible for the overall operation of the project, including compliance with the HASP and general safe work practices. The Project Manager may also act as the Health and Safety Officer (HSO) for this project.

Tenen will appoint one of its on-site personnel as the on-site HSO. This individual will be responsible for the implementation of the HASP. The HSO will have a 4-year college degree in occupational safety or a related science/engineering field, and at least two (2) years of experience in implementation of air monitoring and hazardous materials sampling programs. The HSO will have completed a 40-hour training course that meets OSHA requirements of 29 CFR Part 1910, Occupational Safety and Health Standards.

The HSO will be present on-site during all field operations involving drilling or other subsurface disturbance, and will be responsible for all health and safety activities and the delegation of duties to the field crew. The HSO has stop-work authorization, which he/she will execute on his/her determination of an imminent safety hazard, emergency situation, or other potentially dangerous situation. If the HSO must be absent from the field, a replacement who is familiar with the Construction Health and Safety Plan, air monitoring and personnel protective equipment (PPE) will be designated.

3.0 HAZARD ASSESSMENT AND CONTROL MEASURES

The Site was initially developed sometime prior to 1950 with the existing two-story building with a partial basement. The Site operated as a dry cleaning facility from 1988 to 2000. The Site is currently operated as a tutoring facility. The following previous investigations summarize contaminants of concern detected on the site:

Phase II Environmental Site Assessment, 2925 Westchester Avenue, Bronx, NY 10461, Castleton Environmental, August 2019.

Castleton Environmental conducted a soil, groundwater, and soil vapor investigation at the Site in 2019, which included the collection of three soil samples, three groundwater samples, and three sub-slab soil vapor samples from the basement of the former dry cleaner for laboratory analysis. The results were as follows:

- Chlorinated VOCs (cVOCs), specifically tetrachloroethene (PCE), trichloroethene (TCE), and cis-1,2-dichloroethene (cis-1,2-DCE) were detected in exceedance of their respective Unrestricted Use Soil Cleanup Objectives (SCOs) and Protection of Groundwater SCOs in one of three soil samples collected;
- cVOCs, specifically PCE, TCE, and cis-1,2-DCE, were detected in exceedance of their NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1 Ambient Water Quality Standards and Guidance Values (Class GA Standards) in all three groundwater samples collected; and,
- Elevated concentrations of cVOCs, specifically PCE, TCE, and cis-1,2-DCE, were detected in two of three soil vapor samples collected.

Groundwater and Indoor Air Investigation and Soil Delineation Sampling Letter Report, 2925 Westchester Avenue, Bronx, NY 10461, Tenen Environmental, LLC, May 2020.

Tenen conducted a groundwater and indoor air investigation and soil delineation sampling at the Site in 2019 and 2020, which included the collection of 22 onsite soil samples and one offsite soil sample, one onsite groundwater sample and two offsite groundwater samples, and two onsite indoor air samples and three offsite indoor air samples for laboratory analysis. The results were as follows:

- Concentrations of PCE were detected in exceedance of its Unrestricted Use and Protection of Groundwater SCOs at 0-1 feet below basement grade (ft-bbg) at five boring locations, at 1-2 ft-bbg at two boring locations, and at 2-3 ft-bbg at one boring location. In addition, TCE and cis-1,2-DCE were detected in exceedance of Unrestricted Use and Protection of Groundwater SCOs at 0-1 ft-bbg at five boring locations, at 1-2 ft-bbg at two boring locations, and at 2-3 ft-bbg at two boring locations; vinyl chloride was detected in exceedance of its Unrestricted Use and Protection of Groundwater SCOs at 0-1 ft-bbg at one boring location and at 1-2 ft-bbg at one boring location; and methylene chloride was detected in exceedance of its Unrestricted Use and Protection of Groundwater SCOs at 1-2 ft-bbg at one boring location;
- A PCE hotspot in soil was horizontally and vertically delineated at the Site and is approximately 7 cubic yards in volume;

- Concentrations of cVOCs, specifically PCE, TCE, and cis-1,2-DCE were detected in exceedance of Class GA Standards in the groundwater sample collected from the basement of the Site;
- Concentrations of VOCs were not detected in exceedance of NYSDOH Air Guidance Values (AGVs) in any onsite or offsite indoor air samples collected. However, low concentrations of cVOCs were detected in all five indoor air samples collected, with the highest concentrations generally occurring in the sample collected from the basement of the Site; and,
- Concentrations of cVOCs were not detected in exceedance of applicable standards in any offsite soil or groundwater samples collected;

3.1 Human Exposure Pathways

The media of concern at the Site include potentially-impacted soil, groundwater and soil vapor. Potential exposure pathways include dermal contact, incidental ingestion and inhalation of vapors. The risk of dermal contact and incidental ingestion will be minimized through general safe work practices, a personal hygiene program and the use of PPE. The risk of inhalation will be minimized through the use of an air monitoring program for VOCs and particulates.

3.2 Chemical Hazards

Based on historic uses, the following contaminants of concern may be present at the Site:

Chlorinated Solvents

- Tetrachloroethene (PCE)
- Trichloroethene (TCE)
- Cis-1,2-dichloroethene (cis-1,2-DCE)

Material Safety Data Sheets (MSDSs) for each contaminant of concern are included in Appendix C. All personnel are required to review the MSDSs included in this HASP.

3.3 Physical Hazards

The physical hazards associated with the field activities likely present a greater risk of injury than the chemical constituents at the Site. Activities within the scope of this project shall comply with New York State and Federal OSHA construction safety standards.

Head Trauma

To minimize the potential for head injuries, field personnel will be required to wear National Institutes of Occupational Safety and Health (NIOSH)-approved hard hats during field activities. Hats must be worn properly and not altered in any way that would decrease the degree of protection provided.

Foot Trauma

To avoid foot injuries, field personnel will be required to wear steel-toed safety shoes while field activities are being performed. To afford maximum protection, all safety shoes must meet

American National Standards Institute (ANSI) standards.

Eye Trauma

Field personnel will be required to wear eye protection (safety glasses with side shields) while field activities are being performed to prevent eye injuries caused by contact with chemical or physical agents.

Noise Exposure

Field personnel will be required to wear hearing protection (ear plugs or muffs) in high noise areas (noise from heavy equipment) while field activities are being performed.

Buried Utilities and Overhead Power Lines

Boring locations will be cleared by an underground utility locator service. In addition, prior to intrusive activities, the drilling subcontractor will contact the One Call Center to arrange for a utility mark-out, in accordance with New York State requirements. Protection from overhead power lines will be accomplished by maintaining safe distances of at least 15 feet at all times.

Thermal Stress

The effects of ambient temperature can cause physical discomfort, personal injury, and increase the probability of accidents. In addition, heat stress due to lack of body ventilation caused by protective clothing is an important consideration. Heat-related illnesses commonly consist of heat stroke and heat exhaustion.

The symptoms of heat stroke include: sudden onset; change in behavior; confusion; dry, hot and flushed skin; dilated pupils; fast pulse rate; body temperature reaching 105° or more; and/or, deep breathing later followed by shallow breathing.

The symptoms of heat exhaustion include: weak pulse; general weakness and fatigue; rapid shallow breathing; cold, pale and clammy skin; nausea or headache; profuse perspiration; unconsciousness; and/or, appearance of having fainted.

Heat-stress monitoring will be conducted if air temperatures exceed 70 degrees Fahrenheit. The initial work period will be set at 2 hours. Each worker will check his/her pulse at the wrist for 30 seconds early in each rest period. If the pulse rate exceeds 110 beats per minute, the next work period will be shortened by one-third.

One or more of the following precautions will reduce the risk of heat stress on the Site:

- Provide plenty of liquids to replace lost body fluids; water, electrolytic drinks, or both will be made available to minimize the risk of dehydration and heat stress
- Establish a work schedule that will provide appropriate rest periods
- Establish work regimens consistent with the American Conference of Governmental Industrial Hygienists (ACGIH) guidelines
- Provide adequate employee training on the causes of heat stress and preventive measures

In the highly unlikely event of extreme low temperatures, reasonable precautions will be made to avoid risks associated with low temperature exposure.

Traffic

Field activities will occur near public roadways. As a result, vehicular traffic will be a potential hazard during these activities and control of these areas will be established using barricades or traffic cones. Additional staff will be assigned, as warranted, for the sole purpose of coordinating traffic. Personnel will also be required to wear high-visibility traffic vests while working in the vicinity of the public roadways and local requirements for lane closure will be observed as needed. All work in public rights-of-way will be coordinated with local authorities and will adhere to their requirements for working in traffic zones.

Hazardous Weather Conditions

All Site workers will be made aware of hazardous weather conditions, specifically including extreme heat, and will be requested to take the precautions described herein to avoid adverse health risks. All workers are encouraged to take reasonable, common sense precautions to avoid potential injury associated with possible rain or high wind, sleet, snow or freezing.

Slip, Trip and Fall

Areas at the Site may be slippery from mud or water. Care should be taken by all Site workers to avoid slip, trip, and fall hazards. Workers shall not enter areas that do not have adequate lighting. Additional portable lighting will be provided at the discretion of the HSO.

Biological Hazards

Drugs and alcohol are prohibited from the Site. Any on-site personnel violating this requirement will be immediately expelled from the site.

Any worker or oversight personnel with a medical condition that may require attention must inform the HSO of such condition. The HSO will describe appropriate measures to be taken if the individual should become symptomatic.

Due to the Site location in an urban area, it is highly unlikely that poisonous snakes, spiders, plants and insects will be encountered. However, other animals (dogs, cats, etc.) may be encountered and care should be taken to avoid contact.

4.0 COVID-19 HEALTH AND SAFETY

The following requirements apply to all Tenen employees working on project sites for the duration of the COVID-19 pandemic. These guidelines are based on information provided by the Centers for Disease Control, the Occupational Safety and Health Administration and the New York State “New York Forward” Covid-19 management plans. Information regarding the health status of Tenen employees will be kept confidential, with the exception of required notifications to health authorities. The following are guidelines. **As with any potential workplace hazard, employees should report any concerns related to potential Covid-19 exposure to the Project Manager.**

Communication/Reporting:

Employees should not report to work and should notify the Project Manager immediately in the event of the following:

- You are exhibiting flu-like symptoms (fever, body aches, cough, difficulty breathing). Contact your health care provider and follow their instructions.
- You do not exhibit symptoms but have a sick (i.e., diagnosed with Covid-19 or exhibiting flu-like symptoms) family member at home. Remember that the virus can be spread by asymptomatic individuals.
- You have been exposed to someone who has been diagnosed with Covid-19.

In each of the above cases, inform your Project Manager regarding others who may have been exposed in order to facilitate any necessary notification or contact tracing efforts.

Hygiene

- Wash hands frequently with soap and water for at least 20 seconds or use hand sanitizer with at least 60% alcohol if soap and water are not available. Key times for employees to clean their hands include:
 - Before and after work shifts
 - Before and after work breaks
 - After blowing the nose, coughing, or sneezing
 - After using the restroom
 - Before eating or preparing food
 - After putting on, touching, or removing face coverings
- Avoid touching the eyes, nose, and mouth with unwashed hands.
- Practice good respiratory etiquette, including covering coughs and sneezes.
- To the extent possible, avoid sharing tools and sampling equipment. Shared tools and equipment should be regularly disinfected.

Physical Distancing

- Minimize contact with others, maintaining a distance of at least six feet to the extent possible
- Employees should wear masks over their nose and mouth to prevent spread of the virus; this is especially important when a minimum 6-foot distance cannot be maintained.
- Maintain the 6-foot distance to the extent possible during sampling efforts and pickup and delivery of sampling equipment and containers.
- Keep job site meetings to a minimum and of short duration; limit the number of people involved and maintain social distance.

5.0 AIR MONITORING

The NYSDOH Generic Community Air Monitoring Plan (CAMP), included as Appendix 1A of DER-10, will be implemented during all ground-intrusive sampling activities.

VOC Monitoring, Response Levels, and Actions

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

1. If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.
2. If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.
3. If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shut down.
4. All 15-minute readings must be recorded and be available for State (NYSDEC and NYSDOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

Particulate Monitoring, Response Levels, and Actions

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

1. If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m³) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10

- particulate levels do not exceed 150 mcg/m³ above the upwind level and provided that no visible dust is migrating from the work area.
2. If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m³ above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m³ of the upwind level and in preventing visible dust migration.
 3. All readings must be recorded and be available for State (NYSDEC and NYSDOH) personnel to review.

A site-specific CAMP is included as Appendix D of the RIWP.

6.0 PERSONAL PROTECTIVE EQUIPMENT

The personal protection equipment required for various kinds of site investigation tasks is based on 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response, “General Description and Discussion of the Levels of Protection and Protective Gear” and the Centers for CDC COVID-19 “Guidelines on How to Protect Yourself and Others”.

Tenen field personnel and other site personnel will wear Modified Level D-1 personal protective equipment. During activities such as drilling, well installation, or sampling, where there is a chance of contact with contaminated materials, Modified Level D-2 equipment will be worn. The protection will be upgraded to Level C if warranted by the results of the air monitoring. A six-foot minimum distance between individuals (both workers and non-workers) will be maintained at all times. A description of the personnel protective equipment for Levels D and C is provided below.

Modified Level D-1

Respiratory Protection: Cloth face covering

Protective Clothing: Hard hat, steel-toed shoes, long pants, nitrile gloves

Modified Level D-2

Respiratory Protection: Cloth face covering

Protective Clothing: Hard hat, steel-toed shoes, coveralls/tyvek, nitrile gloves

Level C

Respiratory Protection: Air purifying respirator with organic vapor cartridges and filters.

Protective Clothing: Same as Modified Level D-2

7.0 EXPOSURE MONITORING

7.1 Hazardous Materials

Selective monitoring of workers in the exclusion area may be conducted, as determined by the HSO, if sources of hazardous materials are identified. Personal monitoring may be conducted in the breathing zone at the discretion of the Project Manager or HSO. All monitoring will comply with the CDCs Guidance on Social Distancing.

7.2 COVID-19

For any employee that may have come into contact with a person who has COVID-19, a 14-day quarantine will be imposed for that individual and any employee that individual was in contact with.

8.0 SITE ACCESS

Access to the Site during the investigation will be controlled by the Project Manager or HSO. Unauthorized personnel will not be allowed access to the sampling areas.

9.0 WORK AREAS

During any activities involving drilling or other subsurface disturbance, the work area must be divided into various zones to prevent the spread of contamination, clarify the type of protective equipment needed, and provide an area for decontamination.

The Exclusion Zone is defined as the area where potentially contaminated materials are generated as the result of drilling, sampling, or similar activities. The Contamination Reduction Zone (CRZ) is the area where decontamination procedures take place and is located adjacent to the Exclusion Zone. The Support Zone is the area where support facilities such as vehicles, a field phone, fire extinguisher and/or first aid supplies are located. The emergency staging area (part of the Support Zone) is the area where all Site workers will assemble in the event of an emergency. These zones shall be designated daily, depending on that day's activities. All field personnel will be informed of the location of these zones before work begins.

Control measures such as "Caution" tape and traffic cones will be placed around the perimeter of the work area when work is being done in the areas of concern (i.e., areas with exposed soil) to prevent unnecessary access.

10.0 DECONTAMINATION PROCEDURES

Personnel Decontamination

Personnel decontamination (decon), if deemed necessary by the HSO, will take place in the designated decontamination area delineated for each sampling location. Personnel decontamination will consist of the following steps:

- Soap and potable water wash and potable water rinse of gloves;
- Tyvek removal;
- Glove removal;
- Disposable clothing removal; and
- Field wash of hands and face.

Equipment Decontamination

Sampling equipment, such as split-spoons and bailers, will be decontaminated in accordance with U.S. Environmental Protection Agency methodologies, as described in the work plan.

Disposal of Materials

Purged well water, water used to decontaminate any equipment and well cuttings will be containerized and disposed off-site in accordance with federal, state and local regulations.

11.0 GENERAL SAFE WORK PRACTICES

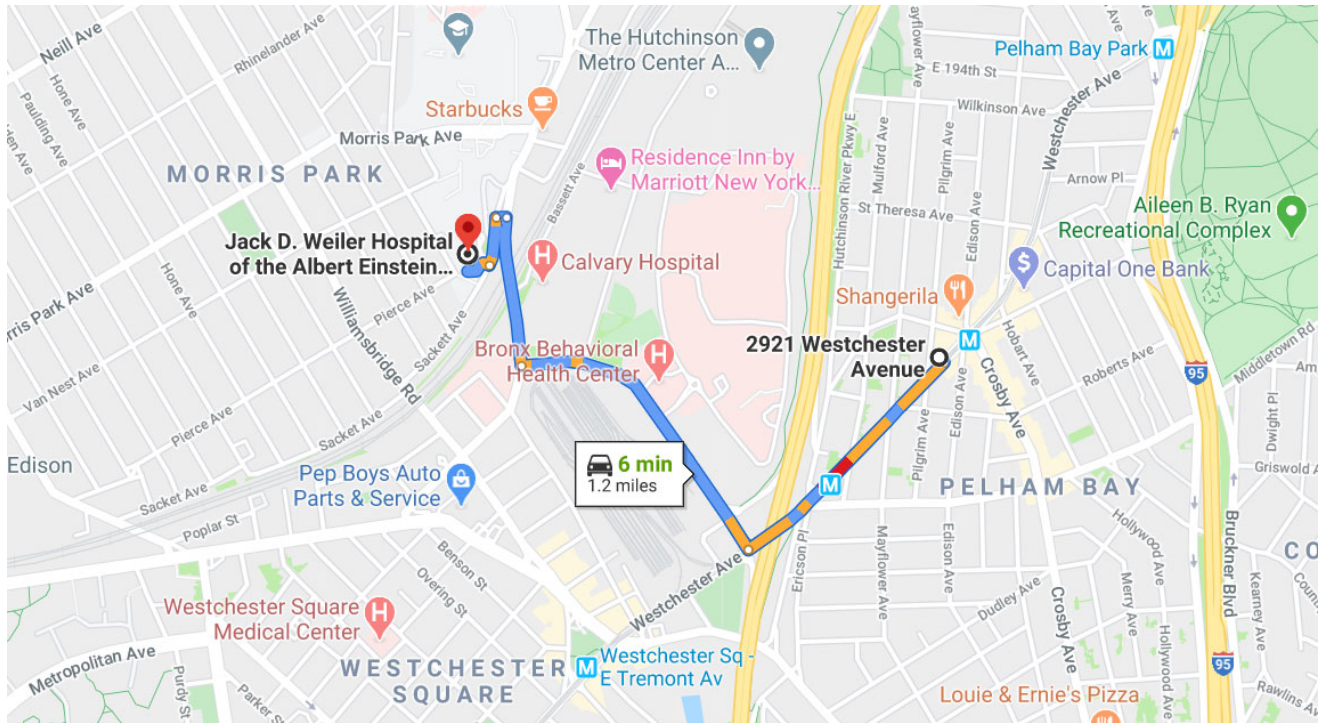
To protect the health and safety of the field personnel, all field personnel will adhere to the guidelines listed below during activities involving subsurface disturbance.

- Eating, drinking, chewing gum or tobacco, and smoking are prohibited, except in designated areas on the site. These areas will be designated by the HSO.
- Workers must wash their hands and face thoroughly on leaving the work area and before eating, drinking, or any other such activity. The workers should shower as soon as possible after leaving the site.
- Removal of potential contamination from PPE and equipment by blowing, shaking or any means that may disperse materials into the air is prohibited.
- Contact with contaminated or suspected surfaces should be avoided.
- The buddy system should always be used; each buddy should watch for signs of fatigue, exposure, and heat stress.
- Personnel will be cautioned to inform each other of symptoms of chemical exposure such as headache, dizziness, nausea, and irritation of the respiratory tract and heat stress.
- No excessive facial hair that interferes with a satisfactory fit of the face-piece of the respirator to the face will be allowed on personnel required to wear respiratory protective equipment.
- On-site personnel will be thoroughly briefed about the anticipated hazards, equipment requirements, safety practices, emergency procedures, and communications methods.

12.0 EMERGENCY PROCEDURES

The field crew will be equipped with emergency equipment, such as a first aid kit and disposable eye washes. In the case of a medical emergency, the HSO will determine the nature of the emergency and will have someone call for an ambulance, if needed. If the nature of the injury is not serious—i.e., the person can be moved without expert emergency medical personnel—onsite personnel should drive injured person to a hospital. **The nearest emergency room is located at the Jack D. Weiler Hospital of the Albert Einstein College of Medicine located at 1825 Westchester Road, Bronx, NY 10461. The phone number is (718) 904-3333.** The route to the hospital is shown and detailed on the next page.

12.1 Route to Hospital



Driving directions to **Jack D. Weiler Hospital of the Albert Einstein College of Medicine** from **2921 Westchester Avenue, Bronx, New York**.

Driving Directions

1. Head southwest on Westchester Avenue towards Pilgrim Avenue (0.4 mi).
2. Turn right onto Waters Place (0.5 mi).
3. Turn right onto Eastchester Road (0.2 mi).
4. Turn left toward Sackett Avenue (75 ft).
5. Turn left onto Sackett Avenue (364 ft).
6. Turn right (194 ft). Destination will be on the right.

12.2 Emergency Contacts

There will be an on-site field phone. Emergency and contact telephone numbers are listed below:

Table 1 – Emergency Contacts

Ambulance	911
Emergency Room	(718) 918-5000
NYSDEC Spill Hotline	(800) 457-7362
NYSDEC	(518) 402-8013
Project Manager, Matthew Carroll	(917) 510-6767
On-site Personnel, Ashley Platt	(908) 892-1354
Client representative, Anthony Scovotti	(718) 824-1700

13.0 TRAINING

All personnel performing the field activities described in this HASP will have received the initial safety training required by 29 CFR, 1910.120. Current refresher training status also will be required for all personnel engaged in field activities.

All those who enter the work area while intrusive activities are being performed must recognize and understand the potential hazards to health and safety. All field personnel must attend a training program covering the following areas:

- potential hazards that may be encountered;
- the knowledge and skills necessary for them to perform the work with minimal risk to health and safety;
- the purpose and limitations of safety equipment; and
- protocols to enable field personnel to safely avoid or escape from emergencies.

Each member of the field crew will be instructed in the above objectives before he/she goes onto the site. The HSO will be responsible for conducting the training program.

14.0 MEDICAL SURVEILLANCE

All Tenen and subcontractor personnel performing field work involving drilling or other subsurface disturbance at the site are required to have passed a complete medical surveillance examination in accordance with 29 CFR 1910.120 (f). The medical examination for Tenen employees will, at a minimum, be provided annually and upon termination of hazardous waste site work.

Appendix A

Acknowledgement of HASP

ACKNOWLEDGMENT OF HASP

Below is an affidavit that must be signed by all Tenen Environmental employees who enter the site. A copy of the HASP must be on-site at all times and will be kept by the HSO.

AFFIDAVIT

I have read the Construction Health and Safety Plan (HASP) for the 2921 Westchester Avenue site in the Bronx, NY. I agree to conduct all on-site work in accordance with the requirements set forth in this HASP and understand that failure to comply with this HASP could lead to my removal from the site.

Signature: _____
Signature: _____
Signature: _____
Signature: _____
Signature: _____

Date: _____
Date: _____
Date: _____
Date: _____
Date: _____

Tenen Environmental, LLC
Health and Safety Plan

2921 Westchester Avenue – Bronx, NY
BCP Site # C203140

Appendix B

Injury Reporting Form (OSHA Form 300)

OSHA’s Form 300 (Rev. 01/2004)

Log of Work-Related Injuries and Illnesses

Attention: This form contains information relating to employee health and must be used in a manner that protects the confidentiality of employees to the extent possible while the information is being used for occupational safety and health purposes.

Form approved OMB no. 1218-0176

You must record information about every work-related death and about every work-related injury or illness that involves loss of consciousness, restricted work activity or job transfer, days away from work, or medical treatment beyond first aid. You must also record significant work-related injuries and illnesses that are diagnosed by a physician or licensed health care professional. You must also record work-related injuries and illnesses that meet any of the specific recording criteria listed in 29 CFR Part 1904.8 through 1904.12. Feel free to use two lines for a single case if you need to. You must complete an Injury and Illness Incident Report (OSHA Form 301) or equivalent form for each injury or illness recorded on this form. If you're not sure whether a case is recordable, call your local OSHA office for help.

Establishment name _____

City _____ State _____

Identify the person			Describe the case			Classify the case												
(A) Case no.	(B) Employee's name	(C) Job title <i>(e.g., Welder)</i>	(D) Date of injury or onset of illness	(E) Where the event occurred <i>(e.g., Loading dock north end)</i>	(F) Describe injury or illness, parts of body affected, and object/substance that directly injured or made person ill <i>(e.g., Second degree burns on right forearm from acetylene torch)</i>	CHECK ONLY ONE box for each case based on the most serious outcome for that case:				Enter the number of days the injured or ill worker was:	Check the "Injury" column or choose one type of illness:							
						Remained at Work				Away from work	On job transfer or restriction	(M)						
						Death	Days away from work	Job transfer or restriction	Other record-able cases	(K)	(L)	Injury	Skin disorder	Respiratory condition	Poisoning	Hearing loss	All other illnesses	
						(G)	(H)	(I)	(J)			(1)	(2)	(3)	(4)	(5)	(6)	
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Public reporting burden for this collection of information is estimated to average 14 minutes per response, including time to review the instructions, search and gather the data needed, and complete and review the collection of information. Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number. If you have any comments about these estimates or any other aspects of this data collection, contact: US Department of Labor, OSHA Office of Statistical Analysis, Room N-3644, 200 Constitution Avenue, NW, Washington, DC 20210. Do not send the completed forms to this office.

Be sure to transfer these totals to the Summary page (Form 300A) before you post it.

Page ____ of ____

Injury

Skin disorder

Respiratory condition

Poisoning

Hearing loss

All other illnesses

(1)

(2)

(3)

(4)

(5)

(6)

Appendix C

Material Safety Data Sheets (MSDS)

SAFETY DATA SHEET

Creation Date 22-Sep-2009

Revision Date 23-Jan-2018

Revision Number 3

1. Identification

Product Name cis-1,2-Dichloroethylene

Cat No. : AC113380000; AC113380025; AC113380100; AC113380500

Synonyms cis-Acetylene dichloride.

Recommended Use Laboratory chemicals.

Uses advised against Food, drug, pesticide or biocidal product use.

Details of the supplier of the safety data sheet

Company

Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

Emergency Telephone Number

For information **US** call: 001-800-ACROS-01 / **Europe** call: +32 14 57 52 11
Emergency Number **US**:001-201-796-7100 / **Europe**: +32 14 57 52 99
CHEMTREC Tel. No.**US**:001-800-424-9300 / **Europe**:001-703-527-3887

2. Hazard(s) identification

Classification

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Flammable liquids	Category 2
Acute oral toxicity	Category 4
Acute Inhalation Toxicity - Vapors	Category 4
Skin Corrosion/Irritation	Category 2
Serious Eye Damage/Eye Irritation	Category 2
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Respiratory system.	

Label Elements

Signal Word

Danger

Hazard Statements

Highly flammable liquid and vapor
Harmful if swallowed
Harmful if inhaled

Causes serious eye irritation
Causes skin irritation
May cause respiratory irritation



Precautionary Statements

Prevention

Wear protective gloves/protective clothing/eye protection/face protection
Use only outdoors or in a well-ventilated area
Avoid breathing dust/fume/gas/mist/vapors/spray
Keep away from heat/sparks/open flames/hot surfaces. - No smoking
Keep container tightly closed
Ground/bond container and receiving equipment
Take precautionary measures against static discharge
Do not eat, drink or smoke when using this product

Response

Call a POISON CENTER or doctor/physician if you feel unwell

Inhalation

IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Call a POISON CENTER or doctor/physician if you feel unwell

Skin

IF ON SKIN: Wash with plenty of soap and water
Take off contaminated clothing and wash before reuse
If skin irritation occurs: Get medical advice/attention

Eyes

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention

Ingestion

Rinse mouth
IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell

Fire

Explosion risk in case of fire
Fight fire with normal precautions from a reasonable distance
Evacuate area

Storage

Store in a well-ventilated place. Keep cool
Store in a closed container
Store locked up

Disposal

Dispose of contents/container to an approved waste disposal plant

Hazards not otherwise classified (HNOC)

None identified

3. Composition/Information on Ingredients

Component	CAS-No	Weight %
cis-1,2-Dichloroethylene	156-59-2	97

4. First-aid measures

Eye Contact	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Get medical attention.
Skin Contact	Wash off immediately with plenty of water for at least 15 minutes. Get medical attention.
Inhalation	Remove to fresh air. Get medical attention. If not breathing, give artificial respiration.
Ingestion	Do NOT induce vomiting. Get medical attention.
Most important symptoms and effects	Difficulty in breathing. Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting
Notes to Physician	Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media	Water spray. Carbon dioxide (CO ₂). Dry chemical. Water mist may be used to cool closed containers. Chemical foam. Water mist may be used to cool closed containers.
Unsuitable Extinguishing Media	No information available
Flash Point	6 °C / 42.8 °F
Method -	No information available
Autoignition Temperature	440 °C / 824 °F
Explosion Limits	
Upper	12.80%
Lower	9.70%
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical

Flammable. Vapors may travel to source of ignition and flash back. Containers may explode when heated. Vapors may form explosive mixtures with air.

Hazardous Combustion Products

Carbon monoxide (CO). Carbon dioxide (CO₂). Hydrogen chloride gas.

Protective Equipment and Precautions for Firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health
2

Flammability
3

Instability
0

Physical hazards
N/A

6. Accidental release measures

Personal Precautions	Ensure adequate ventilation. Use personal protective equipment as required. Remove all sources of ignition. Take precautionary measures against static discharges. Avoid contact with skin, eyes or clothing.
Environmental Precautions	See Section 12 for additional Ecological Information. Do not flush into surface water or sanitary sewer system.
Methods for Containment and Clean Up	Soak up with inert absorbent material (e.g. sand, silica gel, acid binder, universal binder, sawdust). Keep in suitable, closed containers for disposal. Remove all sources of ignition. Use spark-proof tools and explosion-proof equipment.

7. Handling and storage

Handling	Ensure adequate ventilation. Wear personal protective equipment/face protection. Use spark-proof tools and explosion-proof equipment. Use only non-sparking tools. Avoid contact with skin, eyes or clothing. Avoid breathing dust/fume/gas/mist/vapors/spray. Avoid ingestion and inhalation. Keep away from open flames, hot surfaces and sources of ignition. Take precautionary measures against static discharges. To avoid ignition of vapors by static electricity discharge, all metal parts of the equipment must be grounded.
Storage	Keep in a dry, cool and well-ventilated place. Refer product specification and/or product label for specific storage temperature requirement. Keep container tightly closed. Keep away from heat, sparks and flame. Flammables area. Keep container tightly closed in a dry and well-ventilated place.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL (TWA)
cis-1,2-Dichloroethylene	TWA: 200 ppm			TWA: 200 ppm

Legend

ACGIH - American Conference of Governmental Industrial Hygienists

Engineering Measures	Ensure adequate ventilation, especially in confined areas. Use explosion-proof electrical/ventilating/lighting/equipment. Ensure that eyewash stations and safety showers are close to the workstation location.
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Personal Protective Equipment

Eye/face Protection	Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin and body protection	Wear appropriate protective gloves and clothing to prevent skin exposure.
Respiratory Protection	No protective equipment is needed under normal use conditions.
Hygiene Measures	Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Colorless
Odor	aromatic
Odor Threshold	No information available
pH	No information available
Melting Point/Range	-80 °C / -112 °F
Boiling Point/Range	60 °C / 140 °F @ 760 mmHg
Flash Point	6 °C / 42.8 °F
Evaporation Rate	No information available
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	12.80%
Lower	9.70%
Vapor Pressure	201 mmHg @ 25 °C
Vapor Density	3.34 (Air = 1.0)
Specific Gravity	1.280
Solubility	No information available
Partition coefficient; n-octanol/water	No data available

Autoignition Temperature	440 °C / 824 °F
Decomposition Temperature	No information available
Viscosity	No information available
Molecular Formula	C2 H2 Cl2
Molecular Weight	96.94

10. Stability and reactivity

Reactive Hazard	None known, based on information available
Stability	Stable under normal conditions.
Conditions to Avoid	Keep away from open flames, hot surfaces and sources of ignition. Exposure to air. Exposure to light. Incompatible products. Exposure to moist air or water.
Incompatible Materials	Bases
Hazardous Decomposition Products	Carbon monoxide (CO), Carbon dioxide (CO ₂), Hydrogen chloride gas
Hazardous Polymerization	Hazardous polymerization does not occur.
Hazardous Reactions	None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information

Component Information

Toxicologically Synergistic Products	No information available
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Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation	Irritating to eyes, respiratory system and skin
Sensitization	No information available
Carcinogenicity	The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
cis-1,2-Dichloroethylene	156-59-2	Not listed	Not listed	Not listed	Not listed	Not listed

Mutagenic Effects	No information available
Reproductive Effects	No information available.
Developmental Effects	No information available.
Teratogenicity	No information available.
STOT - single exposure	Respiratory system
STOT - repeated exposure	None known
Aspiration hazard	No information available
Symptoms / effects, both acute and delayed	Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting
Endocrine Disruptor Information	No information available
Other Adverse Effects	The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity

Do not empty into drains. Do not flush into surface water or sanitary sewer system. Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment. The product contains following substances which are hazardous for the environment.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
cis-1,2-Dichloroethylene	Not listed	Not listed	EC50 = 721 mg/L 5 min EC50 = 905 mg/L 30 min	Not listed

Persistence and Degradability Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility Will likely be mobile in the environment due to its volatility.

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

DOT

UN-No UN1150
 Proper Shipping Name 1,2-DICHLOROETHYLENE
 Hazard Class 3
 Packing Group II

TDG

UN-No UN1150
 Proper Shipping Name 1,2-DICHLOROETHYLENE
 Hazard Class 3
 Packing Group II

IATA

UN-No UN1150
 Proper Shipping Name 1,2-DICHLOROETHYLENE
 Hazard Class 3
 Packing Group II

IMDG/IMO

UN-No UN1150
 Proper Shipping Name 1,2-DICHLOROETHYLENE
 Hazard Class 3
 Packing Group II

15. Regulatory information

United States of America Inventory

Component	CAS-No	TSCA	TSCA Inventory notification - Active/Inactive	TSCA - EPA Regulatory Flags
cis-1,2-Dichloroethylene	156-59-2	X	ACTIVE	-

Legend:

TSCA - Toxic Substances Control Act, (40 CFR Part 710)

X - Listed

'-' - Not Listed

TSCA 12(b) - Notices of Export Not applicable

International Inventories

Canada (DSL/NDL), Europe (EINECS/ELINCS/NLP), Philippines (PICCS), Japan (ENCS), Australia (AICS), China (IECSC), Korea (ECL).

Component	CAS-No	DSL	NDSL	EINECS	PICCS	ENCS	AICS	IECSC	KECL
cis-1,2-Dichloroethylene	156-59-2	-	X	205-859-7	-	X	X	X	KE-10124

U.S. Federal Regulations

SARA 313	Not applicable
SARA 311/312 Hazard Categories	See section 2 for more information
CWA (Clean Water Act)	Not applicable
Clean Air Act	Not applicable
OSHA - Occupational Safety and Health Administration	Not applicable

CERCLA

California Proposition 65	This product does not contain any Proposition 65 chemicals.
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U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
cis-1,2-Dichloroethylene	X	-	X	-	-

U.S. Department of Transportation

Reportable Quantity (RQ):	N
DOT Marine Pollutant	N
DOT Severe Marine Pollutant	N

U.S. Department of Homeland Security	This product does not contain any DHS chemicals.
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Other International Regulations

Mexico - Grade	No information available
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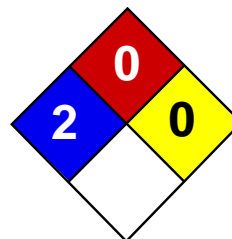
16. Other information

Prepared By	Regulatory Affairs Thermo Fisher Scientific Email: EMSDS.RA@thermofisher.com
Creation Date	22-Sep-2009
Revision Date	23-Jan-2018
Print Date	23-Jan-2018
Revision Summary	This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

End of SDS



Health	2
Fire	0
Reactivity	0
Personal Protection	G

Material Safety Data Sheet

Tetrachloroethylene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Tetrachloroethylene

Catalog Codes: SLT3220

CAS#: 127-18-4

RTECS: KX3850000

TSCA: TSCA 8(b) inventory: Tetrachloroethylene

CI#: Not available.

Synonym: Perchloroethylene; 1,1,2,2-Tetrachloroethylene; Carbon bichloride; Carbon dichloride; Ankilostin; Didakene; Dilatin PT; Ethene, tetrachloro-; Ethylene tetrachloride; Perawin; Perchlor; Perclene; Perclene D; Percosolve; Tetrachloroethene; Tetraleno; Tetralen; Tetralex; Tetravec; Tetrogue; Tetropil

Chemical Name: Ethylene, tetrachloro-

Chemical Formula: C₂-Cl₄

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

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

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

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

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Tetrachloroethylene	127-18-4	100

Toxicological Data on Ingredients: Tetrachloroethylene: ORAL (LD50): Acute: 2629 mg/kg [Rat]. DERMAL (LD): Acute: >3228 mg/kg [Rabbit]. MIST(LC50): Acute: 34200 mg/m 8 hours [Rat]. VAPOR (LC50): Acute: 5200 ppm 4 hours [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:

Hazardous in case of skin contact (irritant), of inhalation. Slightly hazardous in case of skin contact (permeator), of eye contact (irritant), of ingestion.

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH. Classified 2A (Probable for human.) by IARC, 2 (anticipated carcinogen) by NTP. MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to kidneys, liver, peripheral nervous system, respiratory tract, skin, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

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

Skin Contact:

In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:

Absorb with an inert material and put the spilled material in an appropriate waste disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Do not ingest. Do not breathe gas/fumes/ vapor/spray. Avoid contact with skin. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, metals, acids, alkalis.

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

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value.

Personal Protection:

Safety glasses. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 25 (ppm) from OSHA (PEL) [United States] TWA: 25 STEL: 100 (ppm) from ACGIH (TLV) [United States] TWA: 170 (mg/m3) from OSHA (PEL) [United States] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Ethereal.

Taste: Not available.

Molecular Weight: 165.83 g/mole

Color: Clear Colorless.

pH (1% soln/water): Not available.

Boiling Point: 121.3°C (250.3°F)

Melting Point: -22.3°C (-8.1°F)

Critical Temperature: 347.1°C (656.8°F)

Specific Gravity: 1.6227 (Water = 1)

Vapor Pressure: 1.7 kPa (@ 20°C)

Vapor Density: 5.7 (Air = 1)

Volatility: Not available.

Odor Threshold: 5 - 50 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 3.4

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:

Miscible with alcohol, ether, chloroform, benzene, hexane. It dissolves in most of the fixed and volatile oils. Solubility in water: 0.015 g/100 ml @ 25 deg. C It slowly decomposes in water to yield Trichloroacetic and Hydrochloric acids.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials

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

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:

Oxidized by strong oxidizing agents. Incompatible with sodium hydroxide, finely divided or powdered metals such as zinc, aluminum, magnesium, potassium, chemically active metals such as lithium, beryllium, barium. Protect from light.

Special Remarks on Corrosivity: Slowly corrodes aluminum, iron, and zinc.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:

WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 2629 mg/kg [Rat]. Acute dermal toxicity (LD50): >3228 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 5200 4 hours [Mouse].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH. Classified 2A (Probable for human.) by IARC, 2 (Some evidence.) by NTP. MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast. May cause damage to the following organs: kidneys, liver, peripheral nervous system, upper respiratory tract, skin, central nervous system (CNS).

Other Toxic Effects on Humans:

Hazardous in case of skin contact (irritant), of inhalation. Slightly hazardous in case of skin contact (permeator), of ingestion.

Special Remarks on Toxicity to Animals:

Lowest Published Lethal Dose/Conc: LDL [Rabbit] - Route: Oral; Dose: 5000 mg/kg LDL [Dog] - Route: Oral; Dose: 4000 mg/kg LDL [Cat] - Route: Oral; Dose: 4000 mg/kg

Special Remarks on Chronic Effects on Humans:

May cause adverse reproductive effects and birth defects (teratogenic). May affect genetic material (mutagenic). May cause cancer.

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects: Skin: Causes skin irritation with possible dermal blistering or burns. Symptoms may include redness, itching, pain, and possible dermal blistering or burns. It may be absorbed through the skin with possible systemic effects. A single prolonged skin exposure is not likely to result in the material being absorbed in harmful amounts. Eyes: Contact causes transient eye irritation, lacrimation. Vapors cause eye/conjunctival irritation. Symptoms may include redness and pain. Inhalation: The main route to occupational exposure is by inhalation since it is readily absorbed through the lungs. It causes respiratory tract irritation, . It can affect behavior/central nervous system (CNS depressant and anesthesia ranging from slight inebriation to death, vertigo, somnolence, anxiety, headache, excitement, hallucinations, muscle incoordination, dizziness, lightheadness, disorientation, seizures, emotional instability, stupor, coma). It may cause pulmonary edema. Ingestion: It can cause nausea, vomiting, anorexia, diarrhea, bloody stool. It may affect the liver, urinary system (proteinuria, hematuria, renal failure, renal tubular disorder), heart (arrhythmias). It may affect behavior/central nervous system with symptoms similar to that of inhalation. Chronic Potential Health Effects: Skin: Prolonged or repeated skin contact may result in excessive drying of the skin, and irritation. Ingestion/Inhalation: Chronic exposure can affect the liver (hepatitis, fatty liver degeneration), kidneys, spleen, and heart (irregular heartbeat/arrhythmias, cardiomyopathy, abnormal EEG), brain, behavior/central nervous system/peripheral nervous system (impaired memory, numbness of extremities, peripheral neuropathy and other

Section 12: Ecological Information

Ecotoxicity:

Ecotoxicity in water (LC50): 18.4 mg/l 96 hours [Fish (Fathead Minnow)]. 18 mg/l 48 hours [Daphnia (daphnia)]. 5 mg/l 96 hours [Fish (Rainbow Trout)]. 13 mg/l 96 hours [Fish (Bluegill sunfish)].

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

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

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

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

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Tetrachloroethylene UNNA: 1897 PG: III

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Tetrachloroethylene California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Tetrachloroethylene Connecticut hazardous material survey.: Tetrachloroethylene Illinois toxic substances disclosure to employee act: Tetrachloroethylene Illinois chemical safety act: Tetrachloroethylene New York release reporting list: Tetrachloroethylene Rhode Island RTK hazardous substances: Tetrachloroethylene Pennsylvania RTK: Tetrachloroethylene Minnesota: Tetrachloroethylene Michigan critical material: Tetrachloroethylene Massachusetts RTK: Tetrachloroethylene Massachusetts spill list: Tetrachloroethylene New Jersey: Tetrachloroethylene New Jersey spill list: Tetrachloroethylene Louisiana spill reporting: Tetrachloroethylene California Director's List of Hazardous Substances: Tetrachloroethylene TSCA 8(b) inventory: Tetrachloroethylene TSCA 8(d) H and S data reporting: Tetrachloroethylene: Effective date: 6/1/87; Sunset date: 6/1/97 SARA 313 toxic chemical notification and release reporting: Tetrachloroethylene CERCLA: Hazardous substances.: Tetrachloroethylene: 100 lbs. (45.36 kg)

Other Regulations:

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:**WHMIS (Canada):**

CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC). CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):

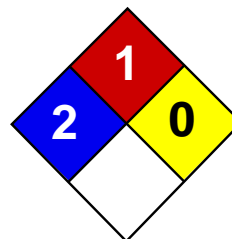
R40- Possible risks of irreversible effects. R51/53- Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. S23- Do not breathe gas/fumes/vapour/spray S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S37- Wear suitable gloves. S61- Avoid release to the environment. Refer to special instructions/Safety data sheets.

HMIS (U.S.A.):**Health Hazard:** 2**Fire Hazard:** 0**Reactivity:** 0**Personal Protection:** g**National Fire Protection Association (U.S.A.):****Health:** 2**Flammability:** 0**Reactivity:** 0**Specific hazard:****Protective Equipment:**

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

Section 16: Other Information**References:** Not available.**Other Special Considerations:** Not available.**Created:** 10/10/2005 08:29 PM**Last Updated:** 05/21/2013 12:00 PM

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall ScienceLab.com be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if ScienceLab.com has been advised of the possibility of such damages.



Health	2
Fire	1
Reactivity	0
Personal Protection	H

Material Safety Data Sheet

Trichloroethylene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Trichloroethylene

Catalog Codes: SLT3310, SLT2590

CAS#: 79-01-6

RTECS: KX4560000

TSCA: TSCA 8(b) inventory: Trichloroethylene

CI#: Not available.

Synonym:

Chemical Formula: C₂HCl₃

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:

1-800-424-9300

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

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

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Trichloroethylene	79-01-6	100

Toxicological Data on Ingredients: Trichloroethylene: ORAL (LD50): Acute: 5650 mg/kg [Rat]. 2402 mg/kg [Mouse].
DERMAL (LD50): Acute: 20001 mg/kg [Rabbit].

Section 3: Hazards Identification

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

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Classified + (PROVEN) by OSHA. Classified A5 (Not suspected for human.) by ACGIH.

MUTAGENIC EFFECTS: Not available. **TERATOGENIC EFFECTS:** Not available. **DEVELOPMENTAL TOXICITY:** Not

available. The substance is toxic to kidneys, the nervous system, liver, heart, upper respiratory tract. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

Skin Contact:

After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:

Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: 420°C (788°F)

Flash Points: Not available.

Flammable Limits: LOWER: 8% UPPER: 10.5%

Products of Combustion: These products are carbon oxides (CO, CO₂), halogenated compounds.

Fire Hazards in Presence of Various Substances: Not available.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:

Absorb with an inert material and put the spilled material in an appropriate waste disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Keep locked up Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/

spray. Wear suitable protective clothing In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes

Storage:

Keep container dry. Keep in a cool place. Ground all equipment containing material. Carcinogenic, teratogenic or mutagenic materials should be stored in a separate locked safety storage cabinet or room.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:

Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 50 STEL: 200 (ppm) from ACGIH (TLV) TWA: 269 STEL: 1070 (mg/m³) from ACGIH Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Not available.

Taste: Not available.

Molecular Weight: 131.39 g/mole

Color: Clear Colorless.

pH (1% soln/water): Not available.

Boiling Point: 86.7°C (188.1°F)

Melting Point: -87.1°C (-124.8°F)

Critical Temperature: Not available.

Specific Gravity: 1.4649 (Water = 1)

Vapor Pressure: 58 mm of Hg (@ 20°C)

Vapor Density: 4.53 (Air = 1)

Volatility: Not available.

Odor Threshold: 20 ppm

Water/Oil Dist. Coeff.: The product is equally soluble in oil and water; log(oil/water) = 0

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol, diethyl ether, acetone.

Solubility:

Easily soluble in methanol, diethyl ether, acetone. Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity:

Extremely corrosive in presence of aluminum. Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:

Acute oral toxicity (LD50): 2402 mg/kg [Mouse]. Acute dermal toxicity (LD50): 20001 mg/kg [Rabbit].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified + (PROVEN) by OSHA. Classified A5 (Not suspected for human.) by ACGIH. The substance is toxic to kidneys, the nervous system, liver, heart, upper respiratory tract.

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

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Passes through the placental barrier in human. Detected in maternal milk in human.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Trichloroethylene : UN1710 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Trichloroethylene California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Trichloroethylene Pennsylvania RTK: Trichloroethylene Florida: Trichloroethylene Minnesota: Trichloroethylene Massachusetts RTK: Trichloroethylene New Jersey: Trichloroethylene TSCA 8(b) inventory: Trichloroethylene CERCLA: Hazardous substances.: Trichloroethylene

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):

CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC). CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):

R36/38- Irritating to eyes and skin. R45- May cause cancer.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 1

Reactivity: 0

Personal Protection: h

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

Health: 2

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:54 PM

Last Updated: 05/21/2013 12:00 PM

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Tenen Environmental, LLC

2921 Westchester Avenue, Bronx, NY
BCP Site No. C203140

Appendix D
Community Air Monitoring Plan

**Community Air Monitoring Plan
(CAMP)**

for

2921 Westchester Avenue

Remedial Investigation Work Plan

2921 Westchester Avenue
Bronx, New York
BCP Site # C203140

Submitted to:
New York State Department of Environmental Conservation
Division of Environmental Remediation
Remedial Bureau B
625 Broadway, 12th Floor
Albany, NY 12233-7016

Prepared for:
Ralford Realty Corp.
c/o Anthony Scovotti
Eifert French & Ketchum
330 Fifth Avenue
Pelham, NY 10803

Prepared by:



121 West 27th Street, Suite 702
New York, NY 10001

January 2021

New York State Department of Health Generic Community Air Monitoring Plan

Overview

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical-specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for VOCs and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring.

If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate DEC/NYSDOH staff.

Continuous monitoring will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. Periodic monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

VOC Monitoring, Response Levels, and Actions

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

1. If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

2. If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

3. If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.

4. All 15-minute readings must be recorded and be available for State (DEC and NYSDOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

Particulate Monitoring, Response Levels, and Actions

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

1. If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed $150 \text{ mcg}/\text{m}^3$ above the upwind level and provided that no visible dust is migrating from the work area.

2. If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than $150 \text{ mcg}/\text{m}^3$ above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within $150 \text{ mcg}/\text{m}^3$ of the upwind level and in preventing visible

dust migration.

3. All readings must be recorded and be available for State (DEC and NYSDOH) and County Health personnel to review.

Special Requirements for Work Within 20 Feet of Potentially Exposed Individuals or Structures

When work areas are within 20 feet of potentially exposed populations or occupied structures, the continuous monitoring locations for VOCs and particulates must reflect the nearest potentially exposed individuals and the location of ventilation system intakes for nearby structures. The use of engineering controls such as vapor/dust barriers, temporary negative-pressure enclosures, or special ventilation devices should be considered to prevent exposures related to the work activities and to control dust and odors.

Consideration should be given to implementing the planned activities when potentially exposed populations are at a minimum, such as during weekends or evening hours in non-residential settings.

If total VOC concentrations opposite the walls of occupied structures or next to intake vents exceed 1 ppm, monitoring should occur within the occupied structure(s). Background readings in the occupied spaces must be taken prior to commencement of the planned work. Any unusual background readings should be discussed with NYSDOH prior to commencement of the work.

If total particulate concentrations opposite the walls of occupied structures or next to intake vents exceed 150 mcg/m³, work activities should be suspended until controls are implemented and are successful in reducing the total particulate concentration to 150 mcg/m³ or less at the monitoring point.

Depending upon the nature of contamination and remedial activities, other parameters (e.g., explosivity, oxygen, hydrogen sulfide, carbon monoxide) may also need to be monitored. Response levels and actions should be pre-determined, as necessary, for each site.

Special Requirements for Indoor Work with Occupied Co-Located Residences or Facilities

Unless a self-contained, negative-pressure enclosure with proper emission controls will encompass the work area, all individuals not directly involved with the planned work must be absent from the room in which the work will occur. Monitoring requirements shall be as stated

above under “Special Requirements for Work Within 20 Feet of Potentially Exposed Individuals or Structures” except that in this instance “nearby/occupied structures” would be adjacent occupied rooms. Additionally, the location of all exhaust vents in the room and their discharge points, as well as potential vapor pathways (openings, conduits, etc.) relative to adjoining rooms, should be understood and the monitoring locations established accordingly. In these situations, it is strongly recommended that exhaust fans or other engineering controls be used to create negative air pressure within the work area during remedial activities. Additionally, it is strongly recommended that the planned work be implemented during hours (e.g. weekends or evenings) when building occupancy is at a minimum.

Appendix E

NYSDOH Air Quality Inventory and Building Questionnaire

**NEW YORK STATE DEPARTMENT OF HEALTH
INDOOR AIR QUALITY QUESTIONNAIRE AND BUILDING INVENTORY
CENTER FOR ENVIRONMENTAL HEALTH**

This form must be completed for each residence involved in indoor air testing.

Preparer's Name _____ Date/Time Prepared _____

Preparer's Affiliation _____ Phone No. _____

Purpose of Investigation _____

1. OCCUPANT:

Interviewed: Y / N

Last Name: _____ First Name: _____

Address: _____

County: _____

Home Phone: _____ Office Phone: _____

Number of Occupants/persons at this location _____ Age of Occupants _____

2. OWNER OR LANDLORD: (Check if same as occupant ____)

Interviewed: Y / N

Last Name: _____ First Name: _____

Address: _____

County: _____

Home Phone: _____ Office Phone: _____

3. BUILDING CHARACTERISTICS

Type of Building: (Circle appropriate response)

Residential
Industrial

School
Church

Commercial/Multi-use
Other: _____

If the property is residential, type? (Circle appropriate response)

Ranch	2-Family	3-Family
Raised Ranch	Split Level	Colonial
Cape Cod	Contemporary	Mobile Home
Duplex	Apartment House	Townhouses/Condos
Modular	Log Home	Other: _____

If multiple units, how many? _____

If the property is commercial, type?

Business Type(s) _____

Does it include residences (i.e., multi-use)? Y / N If yes, how many? _____

Other characteristics:

Number of floors _____ Building age _____

Is the building insulated? Y / N How air tight? Tight / Average / Not Tight

4. AIRFLOW

Use air current tubes or tracer smoke to evaluate airflow patterns and qualitatively describe:

Airflow between floors

Airflow near source

Outdoor air infiltration

Infiltration into air ducts

5. BASEMENT AND CONSTRUCTION CHARACTERISTICS (Circle all that apply)

- a. Above grade construction: wood frame concrete stone brick
- b. Basement type: full crawlspace slab other _____
- c. Basement floor: concrete dirt stone other _____
- d. Basement floor: uncovered covered covered with _____
- e. Concrete floor: unsealed sealed sealed with _____
- f. Foundation walls: poured block stone other _____
- g. Foundation walls: unsealed sealed sealed with _____
- h. The basement is: wet damp dry moldy
- i. The basement is: finished unfinished partially finished
- j. Sump present? Y / N
- k. Water in sump? Y / N / not applicable

Basement/Lowest level depth below grade: _____(feet)

Identify potential soil vapor entry points and approximate size (e.g., cracks, utility ports, drains)

6. HEATING, VENTING and AIR CONDITIONING (Circle all that apply)

Type of heating system(s) used in this building: (circle all that apply – note primary)

Hot air circulation	Heat pump	Hot water baseboard	
Space Heaters	Steam radiation	Radiant floor	
Electric baseboard	Wood stove	Outdoor wood boiler	Other _____

The primary type of fuel used is:

Natural Gas	Fuel Oil	Kerosene
Electric	Propane	Solar
Wood	Coal	

Domestic hot water tank fueled by: _____

Boiler/furnace located in: Basement Outdoors Main Floor Other _____

Air conditioning: Central Air Window units Open Windows None

Are there air distribution ducts present? Y / N

Describe the supply and cold air return ductwork, and its condition where visible, including whether there is a cold air return and the tightness of duct joints. Indicate the locations on the floor plan diagram.

7. OCCUPANCY

Is basement/lowest level occupied? Full-time Occasionally Seldom Almost Never

Level **General Use of Each Floor (e.g., familyroom, bedroom, laundry, workshop, storage)**

Basement	<hr/>
1 st Floor	<hr/>
2 nd Floor	<hr/>
3 rd Floor	<hr/>
4 th Floor	<hr/>

8. FACTORS THAT MAY INFLUENCE INDOOR AIR QUALITY

- | | |
|--|------------------------------------|
| a. Is there an attached garage? | Y / N |
| b. Does the garage have a separate heating unit? | Y / N / NA |
| c. Are petroleum-powered machines or vehicles stored in the garage (e.g., lawnmower, atv, car) | Y / N / NA
Please specify <hr/> |
| d. Has the building ever had a fire? | Y / N When? <hr/> |
| e. Is a kerosene or unvented gas space heater present? | Y / N Where? <hr/> |
| f. Is there a workshop or hobby/craft area? | Y / N Where & Type? <hr/> |
| g. Is there smoking in the building? | Y / N How frequently? <hr/> |
| h. Have cleaning products been used recently? | Y / N When & Type? <hr/> |
| i. Have cosmetic products been used recently? | Y / N When & Type? <hr/> |

- j. Has painting/staining been done in the last 6 months? Y / N Where & When? _____
- k. Is there new carpet, drapes or other textiles? Y / N Where & When? _____
- l. Have air fresheners been used recently? Y / N When & Type? _____
- m. Is there a kitchen exhaust fan? Y / N If yes, where vented? _____
- n. Is there a bathroom exhaust fan? Y / N If yes, where vented? _____
- o. Is there a clothes dryer? Y / N If yes, is it vented outside? Y / N
- p. Has there been a pesticide application? Y / N When & Type? _____

Are there odors in the building?

Y / N

If yes, please describe: _____

Do any of the building occupants use solvents at work?

Y / N

(e.g., chemical manufacturing or laboratory, auto mechanic or auto body shop, painting, fuel oil delivery, boiler mechanic, pesticide application, cosmetologist)

If yes, what types of solvents are used? _____

If yes, are their clothes washed at work?

Y / N

Do any of the building occupants regularly use or work at a dry-cleaning service? (Circle appropriate response)

Yes, use dry-cleaning regularly (weekly)

No

Yes, use dry-cleaning infrequently (monthly or less)

Unknown

Yes, work at a dry-cleaning service

Is there a radon mitigation system for the building/structure? Y / N Date of Installation: _____

Is the system active or passive? Active/Passive

9. WATER AND SEWAGE

Water Supply: Public Water Drilled Well Driven Well Dug Well Other: _____

Sewage Disposal: Public Sewer Septic Tank Leach Field Dry Well Other: _____

10. RELOCATION INFORMATION (for oil spill residential emergency)

a. Provide reasons why relocation is recommended: _____

b. Residents choose to: remain in home relocate to friends/family relocate to hotel/motel

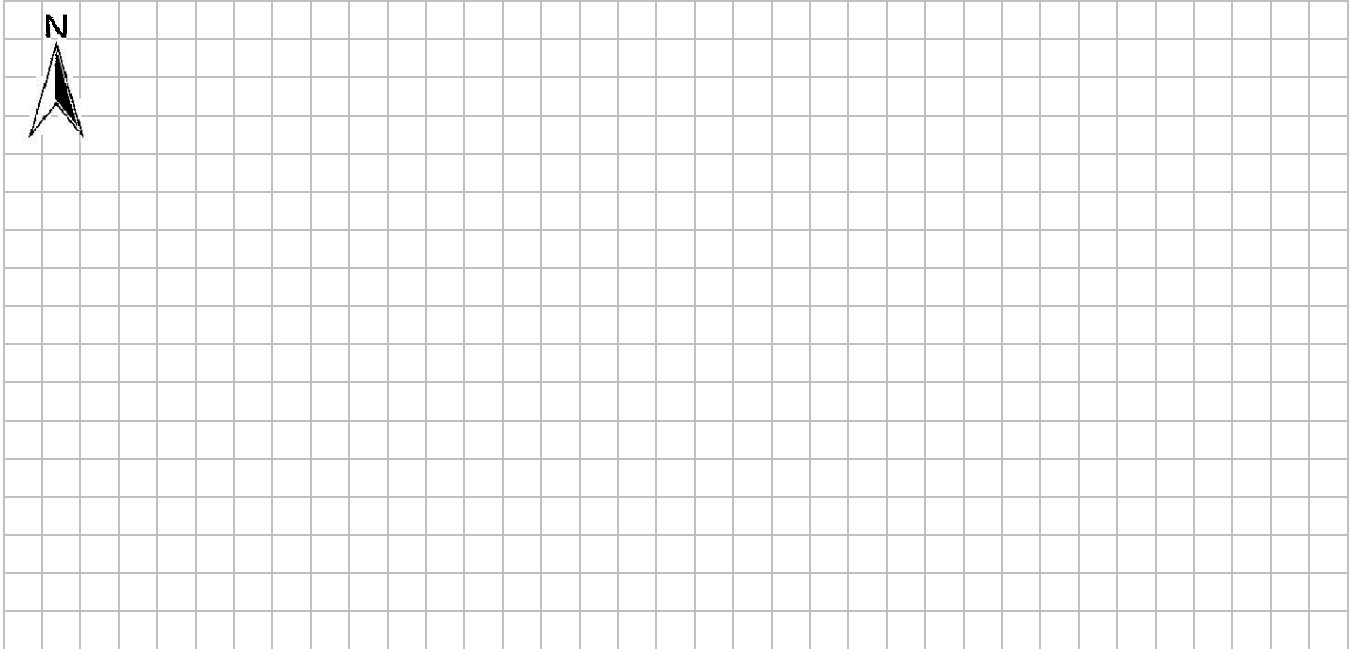
c. Responsibility for costs associated with reimbursement explained? Y / N

d. Relocation package provided and explained to residents? Y / N

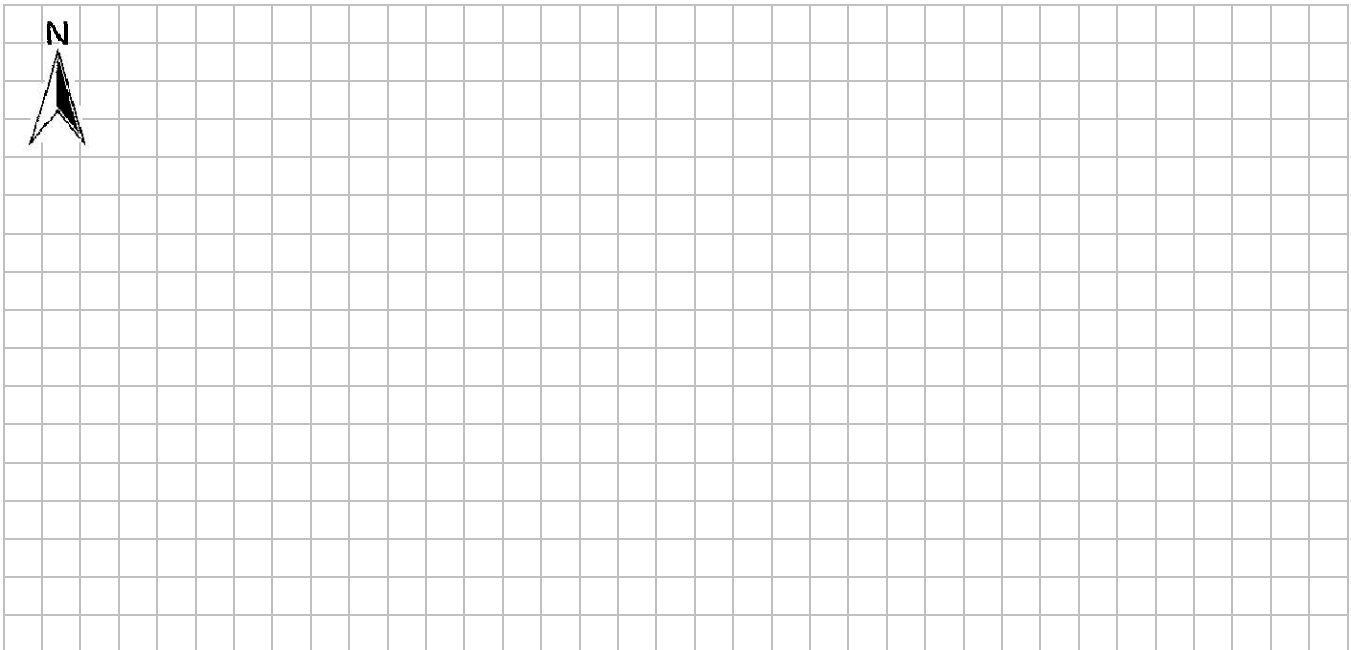
11. FLOOR PLANS

Draw a plan view sketch of the basement and first floor of the building. Indicate air sampling locations, possible indoor air pollution sources and PID meter readings. If the building does not have a basement, please note.

Basement:



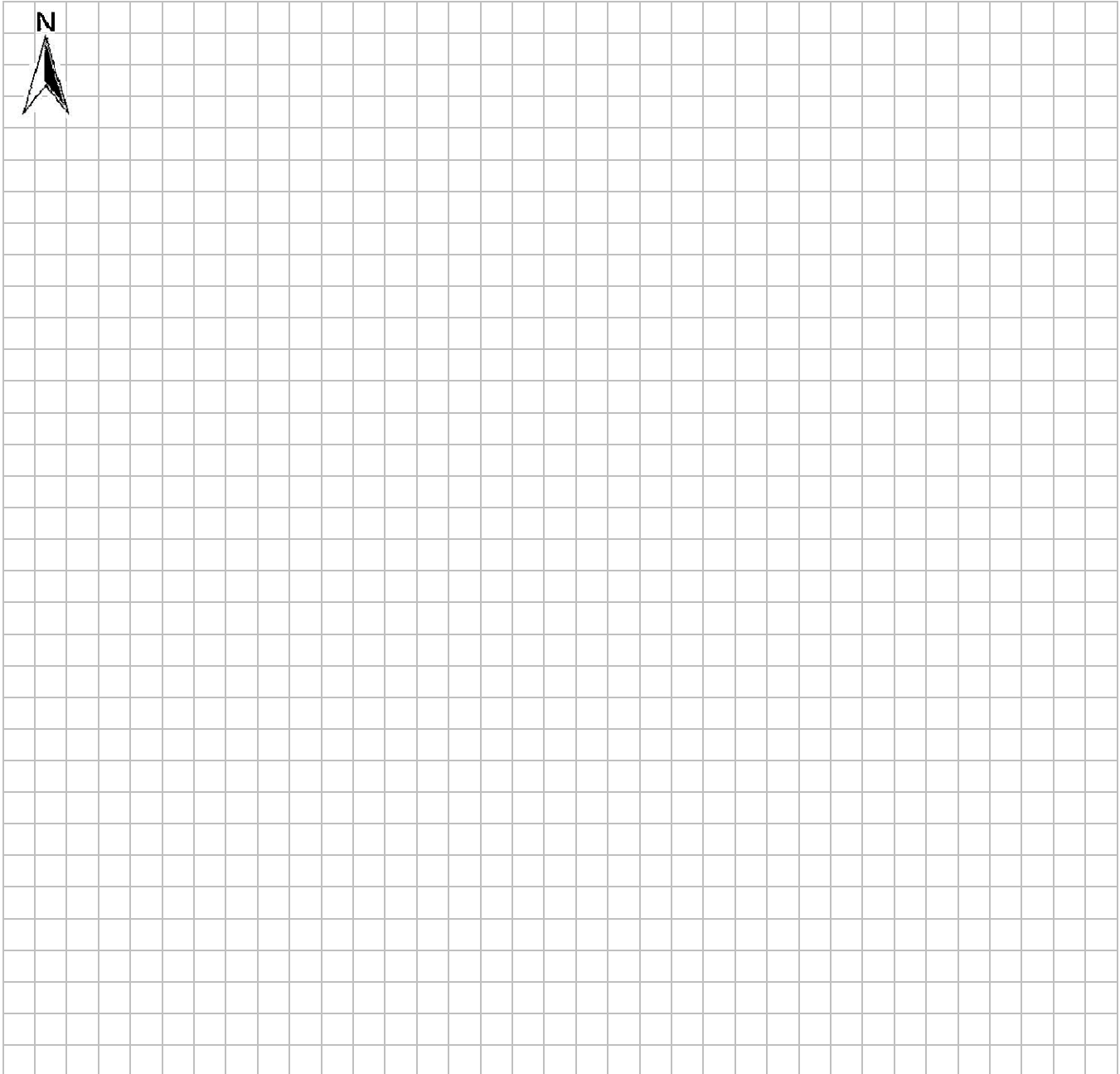
First Floor:



12. OUTDOOR PLOT

Draw a sketch of the area surrounding the building being sampled. If applicable, provide information on spill locations, potential air contamination sources (industries, gas stations, repair shops, landfills, etc.), outdoor air sampling location(s) and PID meter readings.

Also indicate compass direction, wind direction and speed during sampling, the locations of the well and septic system, if applicable, and a qualifying statement to help locate the site on a topographic map.



13. PRODUCT INVENTORY FORM

Make & Model of field instrument used: _____

List specific products found in the residence that have the potential to affect indoor air quality.

[illegible]

* Describe the condition of the product containers as **Unopened (UO)**, **Used (U)**, or **Deteriorated (D)**

**** Photographs of the front and back of product containers can replace the handwritten list of chemical ingredients. However, the photographs must be of good quality and ingredient labels must be legible.**

Tenen Environmental, LLC

2921 Westchester Avenue, Bronx, NY
BCP Site No. C203140

Appendix F
Project Staff Resumes

Alana M. Carroll, PG
Senior Project Manager

PROFESSIONAL PROFILE

Ms. Alana Carroll is a professional geologist with experience managing a variety of environmental consulting projects in the New York metropolitan area and specializing in remedial investigations, conceptual site modeling, and remedial design and implementation. She provides analytical, technical, and regulatory guidance to clients, including developers and environmental attorneys, on a variety of projects in various stages of investigation, remediation, and redevelopment. Ms. Carroll has managed projects from inception through investigation, remediation, and closure in the New York State Brownfield Cleanup Program, the New York State Department of Environmental Conservation (NYSDEC) Spills and Voluntary Cleanup Programs, the New York State Superfund Program, and the New York City E-Designation Program.

CREDENTIALS AND PROFESSIONAL HONORS

New York State Licensed Professional Geologist #000979
Adjunct Professor, Manhattan College, School of Engineering
M.A., Earth and Environmental Sciences, Brooklyn College, New York
B.S., Geology, Hofstra University, Uniondale, New York

CONTINUING EDUCATION AND TRAINING

OSHA 10-Hour Construction Training (2015)
Hazardous Waste Operations and Emergency Response 40-Hour Certification
(2004; refreshers 2005, 2006, 2007, 2009, 2010, 2011, 2012, 2013, 2014, and 2015)
First Aid and CPR Certified (2012)
Amtrak Contractor Safety Training (2010 and 2011)

PROFESSIONAL AFFILIATIONS

Member of Geologic Society of America
Member of New Partners for Community Revitalization

RELEVANT EXPERIENCE

New York State Brownfield Cleanup Program, Former West 18th Street MGP Site, Block 690, Lots 20 and 29, West Chelsea, Manhattan, New York—Successfully guided the client into the Brownfield Cleanup Program at the remediation stage. Prepared detailed remedial cost estimates for several redevelopment scenarios. Assisted in negotiating cleanup costs on behalf of the developer with the entity responsible for onsite contamination from former manufactured gas plant (MGP) operations. Designed and managed a pre-design investigation that delineated onsite coal tar impacts and differentiated petroleum impacts. Served on a team that designed an *in situ* stabilization treatability study. Prepared the Remedial Action Work Plan and Alternatives Analysis that included the excavation and removal of coal tar source material within two MGP gas holders and the encapsulation of residual coal tar. Performed an essential role on the construction and design team, coordinating with the structural, foundation, mechanical, and architectural contractors.

New York State Brownfield Cleanup Program, 520 West 28th Street, West Chelsea, Manhattan, New York—Managed several investigations to address New York State Spills, New York City E-Designation, and New York State Brownfield Cleanup programs. Prepared scopes of work to address requirements of both State and City regulatory agencies. Served as an essential member of the construction and design team, coordinating with the structural, foundation, mechanical, and architectural contractors. Managed access with adjacent property owners for full-scale excavation. Coordinated with State and City agencies for the satisfaction of air, noise, and hazardous waste requirements. Coordinated and managed the characterization and disposal of over 35,000 tons of hazardous material and historic fill. Designed and managed the remedial action necessary to obtain a successful Track 1 Cleanup. Assisted in negotiating a nuanced approach to support excavation that allowed for a Track 1 Cleanup. Prepared the final engineering report that expedited the certificate of completion.

New York State Brownfield Cleanup Program, Teitelbaum Dry Cleaner, Long Island City, New York—Designed and managed multiple onsite and offsite investigations to address NYSDEC and New York State Department of Health (NYSDOH) regulatory requirements with respect to chlorinated solvent impacts to groundwater and soil vapor. Designed and managed chlorinated solvent plume delineation and remediation in both groundwater and soil vapor. Prepared a technical memorandum on the fate and transport of the onsite chlorinated solvent groundwater plume that established limited liability for downgradient impacts and identified a secondary source. Coordinated with multiple adjacent parties for access. Designed a remedial approach for the site building that included source removal, groundwater injection, and a retro-fitted sub-slab depressurization system (SSDS).

Confidential Project, Steuben County, NY—Performed a forensic review and analysis of environmental records associated with five parcels of land that the State deemed as illegal solid waste dumps. Prepared and presented two technical arguments to NYSDEC and NYSDOH detailing illegal dumping, historic fill material, human health exposure pathways, bioavailability of historic fill constituents and remedial alternatives. Designed a full-scale remedial investigation of soil, groundwater and sediments for five parcels of historically industrial land.

New York City Voluntary Cleanup Program, Gallery Row, West Chelsea, Manhattan, New York—Managed multiple investigations over five tax lots to address New York City E-Designation and Voluntary Cleanup Program requirements. Designed a remedial action that incorporates a phased and targeted excavation below Highline Park. Coordinated with State and City agencies for the satisfaction of air, noise, and hazardous waste requirements. Served as an integral part of the construction and design team.

New York State Brownfield Cleanup Program, Former Nu-Brite Dry Cleaner, 1299 First Avenue, East Side, Manhattan, New York—Designed and managed multiple investigations to address onsite chlorinated solvent impacts to soil, groundwater, and soil vapor. Site challenges included investigation and remedial action within existing, occupied building sites. Designed and managed a bedrock fracture investigation to address potential impacts to bedrock. Designed and managed offsite delineation of chlorinated solvent plume in soil vapor. Directed multiple offsite soil vapor investigations within adjacent properties; assisted in negotiating several nuanced access agreements. Managed an onsite interim remedial measure including the installation of a retro coat vapor barrier and retro-fitted SSDS within the site building.

New York State Brownfield Cleanup Program, 34th Street and 42nd Street, West Side, Manhattan, New York—Designed and managed multiple investigations to address New York State Spills and Brownfield Cleanup programs. Prepared scopes of work to address requirements of both state regulations and those agreed to by the former owner. Coordinated

with NYSDEC to modify scopes based on field observations and limitations, which resulted in not having to mobilize for additional investigations. Coordinated with multiple entities for access to perform investigations, including Javits Convention Center, Amtrak, New York City Department of Transportation, Metropolitan Transit Authority, and their contractors. Developed a three-phase analysis plan with the laboratory to determine the minimum required extent of excavation next to an Amtrak line while limiting analytical costs, decreasing in the extent of excavation, and lowering disposal and structural support requirement costs.

New York State Brownfield Cleanup Program, 388 Bridge Street, Downtown Brooklyn, New York—Designed and managed all onsite and offsite investigations of soil, soil gas, groundwater, and indoor air, including coordination of staff and subcontractors. Prepared investigation reports for submittal to client, project team, NYSDEC, and NYSDOH. Participated in project team decision making with clients, lawyers, construction manager, and other consultants. Managed New York City Transit approvals for subsurface investigations near subway lines. Coordinated offsite access in residences, commercial spaces, and a private school. Participated in soil vapor extraction pilot test implementation and reporting. Assisted with implementation of an offsite SSDS in an existing building; activities included system design/layout, installation oversight, testing, and long-term operation and maintenance. Responsible for NYSDEC/NYSDOH coordination and reporting for all investigations. Tracked project activities for inclusion in NYSDEC/NYSDOH programmatic submittals, including monthly reports and remedial schedules.

New York Department of Environmental Remediation, Class 2 State Superfund, Laurel Hill Site, Queens, New York—Managed multiphase, multiparcel project involving design, installation, and ongoing operation, maintenance, and monitoring of six remedial caps. Site challenges included the division of the site into individual parcels that were independent of one another; subsequently, each parcel had a stormwater management design individual to the surrounding parcels. Other challenges included the site's position in a wetlands area fronting Newtown Creek, and working with the New York City Department of Transportation to facilitate its schedule for the adjacent Kosciusko Bridge restoration.

New York State Brownfield Cleanup Program, Willets Point Development, Queens, New York—Managed the Brownfield Cleanup Program application and Phase I environmental site assessment effort for 45 parcels of industrialized land. Coordinated with multiple interested parties, including New York City Department of Housing Preservation and Development and the Economic Development Corporation for access and contracting.

New York State Brownfield Cleanup Program, Uniforms for Industry, Queens, New York—Designed and managed an alternative approach to the offsite soil vapor intrusion investigation. Utilized soil vapor modeling to evaluate potential human health risks and migration probabilities. Provided support for the design of a retrofitted passive venting system.

New York State Spills Program, Gotham Center, Queens, New York—Responsible for proposal and budget development, subcontractor selection and coordination, negotiation, and preparation of subcontractor terms and agreements, budget, and invoice review for a comprehensive subsurface investigation. Prepared and implemented scope of work for delineation of soil contamination and calculation of contaminant mass estimates. Subsequent to interpretation of site data and subgrade characteristics, developed and presented remedial alternatives and associated costs for internal and client project teams. Prepared remedial investigation report in coordination with the New York City Economic Development Corporation and the client for submittal to state regulators.

Mohamed Ahmed, Ph.D., C.P.G.
Sr. Geologist/Principal

Experience Summary

Mohamed Ahmed is a certified professional geologist with nearly 23 years of experience in the New York City metropolitan area. He has designed and implemented subsurface investigations and is proficient in groundwater modeling, design of groundwater treatment systems and soil remediation. He has managed numerous projects focused on compliance with the New York State Brownfield Cleanup and Spills programs and the New York City “e” designation program. Dr. Ahmed also has extensive experience in conducting regulatory negotiations with the New York State Department of Environmental Conservation, the NYC Office of Housing Preservation and Development, and the Mayor’s Office of Environmental Remediation.

Selected Project Experience

Willoughby Square, Downtown Brooklyn

As Project Manager, directs all regulatory interaction and investigation on this joint public-private sector redevelopment that will include a public park and four-level underground parking garage. Prepared the remedial investigation work plan and remedial action work plan, conducted investigation activities and waste characterization, and negotiated with the NYC Department of Environmental Protection and the Mayor’s Office of Environmental Remediation to transition the site into the NYC Voluntary Cleanup Program.

School Facility, Borough Park, Brooklyn

Managed all regulatory agency coordination, work plan and report preparation and remedial oversight; worked with OER to determine measures to retroactively address the hazardous materials and air quality E-designations on a previously constructed school building and prepared supporting documentation to justify the use of electrical units rather than natural gas.

LGA Hotel Site, East Elmhurst, Queens

Project manager for all work conducted at this former gasoline service station which is being remediated under the NYS Brownfield Cleanup Program; technical oversight of work plans, reports, and design and implementation of field and soil disposal characterization.

436 10th Avenue, Manhattan

As project manager and technical lead, assisted client in developing remedial cost estimates used for property transaction, developed regulatory strategy to address NYS Spills and NYC E-designation requirements, and currently overseeing remedial activities which include removal and disposal of petroleum-contaminated bedrock and dewatering and disposal of impacted groundwater.

Brownfield Cleanup Program Site, Downtown Brooklyn

Managed investigation and remediation under the BCP program for a proposed mixed-use development; designed the remedial investigation and prepared the remedial action work plan which includes an SVE system monitored natural attenuation. Prepared remedial cost

estimates for several scenarios. The project will include a 53-story mixed-use structure and parking garage.

Queens West Development, Long Island City

Directed project team and subcontractors for soil investigation/remediation studies on multiple properties; provided technical support for negotiations with NYSDEC during investigation and remediation.

Former Creosote Site, Long Island City

Designed and implemented a complex investigation to assess the nature and extent of historic creosote contamination at this former industrial site; conducted studies to optimize recovery of LNAPL and DNAPL and developed strategies using bioremediation and natural attenuation in conjunction with conventional remedial approaches. Performed pilot tests for soil vapor extraction system design and coordinated with NYSDEC and NYSDOH to implement sub-slab soil vapor sampling.

NYSDEC Spill Site – Far West Side, Manhattan

Developed a detailed remedial cost estimate for to support client negotiations with a major oil company. The estimate included costs pertaining to: chipping, removal and disposal of petroleum-impacted bedrock; removal/disposal of recycled concrete; costs for dewatering and disposal of impacted groundwater during construction; and design and installation of a vapor barrier below the redevelopment.

Active Industrial Facility, Newburgh, New York

Designed remedial investigation of soil and groundwater contaminated with trichloroethane; performed soil vapor pilot test and pump test to aid in design of soil and groundwater remediation alternatives; conducted sub-slab vapor sampling in accordance with NYSDOH guidance.

Former Dry Cleaning Facility, New York City

Conducted soil and groundwater investigations, designed and installed a soil vapor extraction system and performed extensive testing of indoor air. Negotiated the scope of the RI and IRM with NYSDEC.

Waterfront Redevelopment, Yonkers, NY

Designed and performed geophysics survey of six parcels to determine locations of subsurface features; supervised test pit excavation to confirm geophysics results and evaluate and classify soil conditions prior to development activities.

Prince's Point, Staten Island, New York

Performed soil, groundwater and sediment sampling to delineate the extent of contamination; used field-screening techniques to control analytical costs and supervised soil excavation and disposal.

Apartment Complex, New York City, New York

Coordinated with Con Edison, the owner of the adjacent property and NYSDEC to determine oil recovery protocol; assessed hydrogeological conditions and conducted pilot tests to design cost-effective recovery system; designed and supervised installation of recovery system.

Publications

“Impact of Toxic Waste Dumping on the Submarine Environment: A Case Study from the New York Bight”. Northeastern Geology and Environmental Sciences, V. 21, No. 12, p. 102-120. (With G. Friedman)

Metals Fluxes Across the Water/Sediment Interface and the Influence of pH. Northeastern Geology and Environmental Sciences, in press. (With G. Friedman)

“Water and Organic Waste Near Dumping Ground in the New York Bight”. International Journal of Coal Geology, volume 43. (With G. Friedman)

Education and Certifications

Ph.D., Earth and Environmental Sciences, Graduate Center of the City of New York (2001)

M.Ph., Earth and Environmental Sciences, City University of New York (1998)

M.A. Geology, Brooklyn College (1993)

B.S. Geology, Alexandria University, Egypt (1982)

American Institute of Professional Geologists, Certified Professional Geologist, 1997-2015

Matthew Carroll, P.E.
Environmental Engineer/Principal

Experience Summary

Matthew Carroll is an environmental engineer experienced in all aspects of site assessment and development and implementation of remedial strategies. He has managed projects from inception through investigation, remediation and closure. His expertise includes soil, soil gas, and groundwater remediation, preparation of cost estimates, remedial alternative selection and design, soil characterization for disposal, field safety oversight, and preparation of work plans and reports to satisfy New York and New Jersey state requirements, and New York City "e" designation and restrictive declarations. Mr. Carroll's project management experience includes past management of a New York City School Construction Authority hazardous materials contract. He is responsible for all engineering work performed by Tenen and is currently the project manager and remedial engineer for several New York State Brownfield Cleanup Program sites.

Selected Project Experience

470 Kent Avenue, Brooklyn

As project manager, supported the client in due diligence and transactional activities, including a Phase I ESA, preliminary site investigation, and remedial cost estimate; preparation of BCP application and remedial investigation work plan. The former manufactured gas plant, sugar refinery and lumberyard will be developed as a mixed-use project with market rate and affordable housing and public waterfront access. As remedial engineer, will be responsible for development of remedial alternatives and oversight and certification of all remedial activities.

500 Exterior Street, Bronx

Designed and implemented the investigation of this former lumberyard and auto repair shop that will be redeveloped as mixed use development with an affordable housing component; prepared BCP application and subsequent work plans and reports. Designed a remedial strategy incorporating both interim remedial measures (IRMs) and remediation during the development phase.

Gateway Elton I and II, Brooklyn

Conducted soil disposal characterization, prepared Remedial Action Work Plans and designed methane mitigation systems for two phases of a nine-building residential development and commercial space; prepared and oversaw implementation of a Stormwater Pollution Prevention Plan during construction and prepared and certified the remedial closure reports for the project.

Affordable Housing Development, Rye, NY

Consultant to the City of Rye on environmental issues pertaining to a county-owned development site slated for an afford senior housing; reviewed environmental documentation for the project and prepared summary memorandum for City Council review; recommended engineering controls to address potential exposure to petroleum constituents, presented report findings at public meetings and currently providing ongoing environmental support during project implementation.

Queens West Development BCP Site, Long Island City, New York

Assistant Project Manager for two developers involved in the site.

- Responsible for oversight of remediation under the New York State Brownfield Cleanup Program
- Technical review of work plans and reports and coordination of the Applicant's investigation and oversight efforts
- Provided input for mass calculations and well placement for an in-situ oxidation remedy implemented on a proposed development parcel and within a City street
- Conducted technical review of work pertaining to a former refinery. Documents reviewed included work plans for characterization and contaminant delineation; pilot test (chemical oxidation); remediation (excavation and groundwater treatment). Managed field personnel conducting full time oversight and prepared progress summaries for distribution to project team
- Following implementation of remedial action, implemented the Site Management Plan and installation/design of engineering controls (SSDS, vapor barrier/concrete slab, NAPL recovery). Also responsible for coordination with NYSDEC

Brownfield Cleanup Program Redevelopment Sites – West Side, New York City

Managed remediation of a development consisting of four parcels being addressed under one or more State and city regulatory programs (NYS Brownfield Cleanup Program, NYS Spills, and NYC "e" designation program). Remediation includes soil removal, screening and disposal; treatment of groundwater during construction dewatering and implementation of a worker health and safety plan and community air monitoring plan (HASP/CAMP)

Managed an additional BCP site, supported the Applicant in coordination with MTA to create station access for the planned No. 7 subway extension; also provided support the client in coordination with Amtrak to obtain access for remedial activities on the portion of the site that is within an Amtrak easement. The site will eventually be used for construction of a mixed-use high-rise building.

BCP Site, Downtown Brooklyn, New York

Performed investigation on off-site properties and designed an SSDS for an adjacent building, retrofitting the system within the constraints of the existing structure; coordinated the installation of the indoor HVAC controls and vapor barrier; provided input to the design of a SVE system to address soil vapor issues on the site.

West Chelsea Brownfield Cleanup Program Site

Designed an in-situ remediation program and sub-slab depressurization system to address contamination remaining under the High Line Viaduct; SSDS design included specification of sub-grade components, fan modeling and selection, identifying exhaust location within building constraints and performance modeling; prepared the Operations Maintenance and Monitoring Plan and Site Management Plan sections pertaining to the SSDS.

Historic Creosote Spill Remediation – Queens, New York – New York State Voluntary Cleanup Program

Modeled contamination volume and extent and prepared mass estimates of historic fill constituents and creosote-related contamination; designed a soil vapor extraction (SVE) and dewatering system to address historic creosote release both above and below static

Matthew Carroll, Environmental Engineer/Principal
Tenen Environmental

water table; coordinated with the Metropolitan Transit Authority and prepared drawings to secure approval to drill in the area of MTA subway tunnels.

NYSDEC Spill Site- Far West Side, Manhattan

Provided support to client during negotiations with a major oil company regarding allocation of remedial costs. Worked with client's attorney to develop a regulatory strategy to address the client's obligations under the NYSDEC Spills Program and the New York City "e" designation requirements.

Affordable Housing Site, Brooklyn, New York

Modified prior work plans for soil, soil vapor and groundwater investigation to address requirements for site entry into the New York City Brownfield Cleanup Program. Prepared technical basis for use of prior data previously disallowed by OER. Currently conducting site investigation.

New York City School Construction Authority Hazardous Materials Contract

Provided work scopes and cost estimates, managed and implemented concurrent projects, including Phase I site assessments, Phase II soil, groundwater and soil gas investigations, review of contractor bid documents, preparation of SEQR documents, specifications and field oversight for above- and underground storage tank removal, and emergency response and spill control.

Former Manufacturing Facility, Hoboken, New Jersey

Evaluated site investigation data to support a revision of the current property use to unrestricted; modified the John & Ettinger vapor intrusion model to apply the model to a site-specific, mixed use commercial/residential development; implemented a Remedial Action Work Plan that included the characterization, removal and separation of 9,500 cubic yards of historic fill; designed and implemented a groundwater characterization/delineation program using a real-time Triad approach; designed and implemented an innovative chemical oxidation technology for the property.

Former Varnish Manufacturer - Newark, New Jersey

Prepared a Phase I environmental site assessment; implemented soil and groundwater sampling to assess presence of petroleum and chlorinated compounds; prepared alternate cost remediation scenarios for settlement purposes and implemented a groundwater investigation plan, including pump tests and piezometer installation to assess the effect of subsurface utilities and unique drainage pathways upon contaminant transport.

Education and Certifications

Professional Engineer, New York

Bachelor of Engineering, Environmental; Stevens Institute of Technology, 2002

Bachelor of Science, Chemistry, New York University, 2002

Technical and Regulatory Training in Underground Storage Tanks, Cook College, Rutgers University, 2006