201 Charles Street
Remedial Investigation Work Plan

201 Charles Street, Maybrook
Orange County, New York
Block 5, Portion of Lot 5.22
Block 1, Portion of Lot 1.2
BCP Site No. C336094

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Submitted to:
New York State Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway, 12th Floor
Albany, New York 12233

Prepared for:
201 Charles Street LLC
33 South Plank Road
Newburgh, New York 12550

Prepared by:

TENEN ENVIRONMENTAL

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

SEPTEMBER 2024

TABLE OF CONTENTS

DRAFT

Figures

Tables

Appendices

DRAFT

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 statues and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

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Alana Carroll, PG Date

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1.0 INTRODUCTION

On behalf of 201 Charles Street LLC (the Volunteer), Tenen Environmental, LLC (Tenen) has prepared this Remedial Investigation Work Plan (RIWP) for the property located at 201 Charles Street, in Maybrook, Orange County, New York (the Site) pursuant to the September 2022 Brownfield Cleanup Agreement (BCA) for Brownfield Cleanup Project (BCP) Site No. C336094. 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, including volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), target analyte list (TAL) metals, pesticides, and polychlorinated biphenyls (PCBs) at the Site. The scope of work includes investigation of subsurface soils, surface soils, sub-slab and soil 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

In January 2015, a Phase I Environmental Site Assessment (ESA) was prepared for the Site by Lender Consulting Services, Inc. (LCS). LCS noted the following Recognized Environmental Conditions (RECs) in connection with the Site:

- The subject structure has been utilized as a bus service facility since at least 2008. No floor drains were noted in the service area. Hazardous/regulated materials utilized on-site (including degreaser, antifreeze, paints, and windshield fluid) were noted to be properly stored.
- The subject structure was historically utilized as a light bulb manufacturing facility (Osram Sylvania Products Inc.). This former occupant of the subject structure was identified as a historical generator of hazardous waste in 1985, 1992, 1999, 2004, 2006, and 2007. Based on a Facility Clearance Report dated November 2003, air samples and metal dust samples were performed in conjunction with the closure of the former light bulb manufacturing facility. Analytical results indicated that all air samples and metal wipe samples were below established regulatory guidelines.
- The subject property, listed as Osram Sylvania Products Inc., was identified in the EDR report as an ICIS facility (due to formal enforcement action) and on the AIRS, TRIS, NCDB, and FIS databases. As a result of the above listings, the subject property was identified on the FINDS database.
- The subject property was identified as a registered underground storage tank (UST) facility (Facility ID no. 3-600086) with two 4,000-gallon No. 6 fuel oil USTs listed as installed in 1957 and closed-removed in 1991. No documentation regarding these historic tanks was provided to LCS for review.
- A groundwater monitoring well was noted northeast of the subject structure. The purpose of this monitoring well is unknown.
- Railroad tracks were noted south and east adjacent to the subject property.

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- Adjacent Montgomery Overall Service Inc./Mont Overall, addressed at 110 Homestead Avenue/110-112 Homestead Avenue/Route 208/Route 208 and Volunteer Place was identified as a Small Quantity Generator of hazardous waste (with no unresolved violations reported); on the Manifest database; AIRs database; as a registered aboveground storage tank (AST) facility; and a registered UST facility.

LCS also identified the following Controlled Recognized Environmental Conditions (CRECs) in connection with the Site:

- The subject property was identified as a NY Spill site. Spill No. 9601687, that involved the release of propylene glycol and allyl ether into a storm drain and is classified as ‘inactive.’ Spill No. 9202499 involved a drum that was tipped over in a parking lot and is classified as ‘closed.’
- Adjacent Montgomery Overall Service Inc./Mont Overall, addressed at 110 Homestead Avenue/110-112 Homestead Avenue/Route 208/Route 208 and Volunteer Place, was identified as a NY LTANKS site and Spill site with two spills classified as either ‘closed’ or ‘inactive.’ This site was also identified as a CERCLIS-NFRAP listed hazardous waste site.

In addition, while not considered RECs, LCS noted the following:

- Waste motor oil and antifreeze generated onsite were noted stored in two 275-gallon ASTs in the service area. There was no evidence of a release in the vicinity of the ASTs at the time of the Site inspection.
- Adjacent Village of Maybrook Department of Public Works (DPW) Garage, addressed at 202 Charles Street, was identified as a NY registered AST facility with active tanks.
- Several water-stained ceiling tiles were noted in the subject structure. Such areas may promote mold growth in the future.

Following the Phase I ESA conducted by LCS in January 2015, multiple subsurface investigations were conducted to assess potential impacts associated with the RECs noted in the Phase I ESA. Soil results were compared to NYSDEC Unrestricted Use (UU), Protection of Groundwater (PGW) and Restricted Commercial Use Soil Cleanup Objectives (SCOs) as listed in 6 NYCRR Part 375-6.8(a) and (b) the October 21, 2010 NYSDEC DEC Policy CP-51. UU SCOs are the most stringent cleanup standards and are used for comparison of site-specific proposed cleanup standards. SCOs 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.

Soil

Limited Phase II Investigations were completed in 2015 and 2016 by LCS. Soil sampling indicated the presence of tetrachloroethene (PCE) above applicable regulatory standards. Concentrations of PCE and its daughter products, cis -1,2-Dichloroethene (DCE) and Trichloroethene (TCE) are shown on Figure 5. PCE was found in two soil samples from the same boring (BH10) at concentrations exceeding 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. BH10 was located adjacent to the Site building to the east (see Figure 5). In March 2016, additional sampling conducted by William L. Going & Associates, Inc. (WLG) encountered concentrations of PCE above UUSCOs and PGWSCOs in three samples collected from the eastern boundary of the BCP Site in proximity of the Site building. Chlorinated volatile organic compound (cVOC) detections in all soil samples collected during this investigation are depicted on Figure 6. Comparison of PCE concentrations to Part 375-6.8(b) Commercial SCOs indicate that PCE concentrations for all soil samples are below the Commercial Cleanup Standard.

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Groundwater

Groundwater results were compared to NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1 Ambient Water Quality Standards and Guidance Values (Class GA Standards).

The 2015 and 2016 LCS investigations included the installation of five temporary groundwater monitoring wells. Samples collected from these wells indicated the presence of PCE above Class GA Standards in three of five samples and the presence of DCE and TCE above Class GA Standards in one of five samples. cVOCs detected in groundwater samples during this investigation are depicted on Figure 7. All samples were collected from the eastern portion of the Site adjacent to-and surrounding the site building/eastern site bounadry. The 2016 WLG investigation included the installation of six piezometer's (1" diameter), two monitoring wells (2" diameter) and four bedrock wells (2" diameter). Sampling of the aforementioned wells indicated the presence of PCE above Class GA Standards in nine of twelve wells, the presence of TCE above Class GA Standards in four of twelve wells, the presence of DCE above Class GA Standards in two of twelve wells and the presence of 1,1,1-Trichloroethane (TCA) above Class GA Standards in one of twelve wells. cVOCs detected in groundwater samples during this investigation are depicted on Figure 8. All samples with Class GA exceedances were collected from the eastern portion of the Site adjacent to-and surrounding the site building/eastern site boundary.

A groundwater flow map was prepared by WLG based on elevation of the water table on April 5, 2016. The overburden groundwater flow map is included as Figure 9a and the bedrock groundwater flow map is included as Figure 9b. Based on the map provided by WLG, the groundwater flow for both the overburden and bedrock appears to be southeast. Depth to groundwater, measured during previous investigations, is approximately ten feet below site grade (ft-bsg) in both the overburden and bedrock.

Groundwater Remediation

In June 2016 WLG installed 18 injection wells to the top of bedrock ranging from 14-15 ft-bgs (3-7 ft. into top of fractured bedrock). Injections wells were constructed of 2" diameter PVC and spaced 15 feet apart (see Figure 10). PersulfOx was injected into each well in June 2016 and again in July 2016. 3,400 pounds of powdered PersulfOx was mixed with approximately 1,800 gallons of water per treatment. Initial post-remedial groundwater sampling took place in September 2016 and January 2017 and including the following wells: DMW2, DMW2S, DMW3, DMW5, INJ2, INJ4, INJ7, INJ11, INJ15 AND INJ17. Additional post-remedial sampling occurred on August 5 and August 30, 2019[1] and included an expanded network of wells. Subsequently, Mid-Hudson Geosciences conducted four post-remedial groundwater sampling events at the Site between 2021 and 2023. All groundwater samples were collected from previously installed injection wells. Figure 11 shows the results of the 2016/2017 post-remedial sampling and pre-injection concentrations, where applicable. Figure 12 shows the results of all post-remedial sampling conducted by WLG, including the expanded well network and pre-injection concentrations, where applicable. Figure 13 shows the results of all post-remedial sampling conducted by Mid-Hudson Geosciences. A discussion of the groundwater remediation and post-remedy results is included in Section 2.5.3 of this RIWP.

Sub-Slab Soil Vapor and Indoor Air

In January 2016, LCS installed three sub-slab soil vapor points within the Site building along its eastern perimeter. One indoor air and one ambient air sample were also collected. Results of this sampling indicated

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[1] Contrary to what the WLG RIR states, lab reports indicate that post-remedial groundwater sampling was conducted on two different dates in August 2019.

the presence of PCE in sub-slab vapor and indoor air. Figure 14 shows the locations and results of this sampling event. In March 2016, WLG installed 18 sub-slab soil vapor points throughout the Site building. Three indoor air and one ambient air sample were also collected. Results of this sampling indicated the presence of PCE in sub-slab vapor throughout the buildings, as well as in all three indoor air samples. Figure 15 shows the locations and results of this sampling event.

Soil Vapor Mitigation

According to the November 2020 Remedial Investigation Report (RIR) prepared by Mid-Hudson Geosciences, Anaerobix, & Jansen Engineering PLLC, in May 2016, 18 passive vents were installed in the sub-slab of the northern part of the building (see Figure 16). A vacuum test was conducted to determine if there is any permeability beneath the slab. Reportedly, as there was nearly zero permeability beneath the slab, a passive vapor extraction system consisting of five vents with outdoor wind-blown turbines was installed.

Another round of sub-slab vapor and ambient air testing was conducted on November 23, 2019. No Work Plan or raw analytical data reports were available for this sampling. The methodology, locations and data associated with this sampling is limited to what was documented in the aforementioned RIR and BCP Application. PCE was detected in all nine indoor and all nine sub-slab samples collected from within the Site building. Discussions with the previous consultant indicate that the sub-slab samples were collected from the vent risers.

A succinct discussion of previous sampling events, groundwater remediation and post-remedy results, as well as post-remedial soil vapor sampling is included in Section 2.5 of this RIWP.

1.3 Regulatory Interaction

An onsite PCE spill of unknown quantity affecting soil and groundwater was reported to NYSDEC on May 12, 2016. The spill was assigned number 1601483 and remains open.

A BCP Application was submitted for the Site to NYSDEC DER in March 2021. Following a 30-day public comment period, a BCA was executed between the Volunteer and NYSDEC in September 2022. 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, including analysis of Part 375 VOCs, SVOCs, TAL metals, pesticides, and PCBs;
- To identify if residual contaminant source areas are present on the Site;
- To delineate the vertical and horizontal extent of the PCE source in soil, identified in previous investigations;
- To determine the fate and transport of cVOCs in groundwater, identified in previous investigations;
- To collect data sufficient to perform an on-site and off-site Qualitative Human Health Exposure Assessment; and

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- 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.

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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 201 Charles Street in Maybrook, Orange County, New York. The Site is defined as an approximate 126,324 square foot (SF) parcel comprising portions of two Orange County tax lots on separate, but adjoining, tax blocks: Block 5, Portion of Lot 5.22 and Block 1, Portion of Lot 1.2. The following areas of each lot comprise the BCP Site: Lot 5.22 (1.9 acres or 82,764 SF) and Lot 1.2 (1 acre or 43,560 SF). The Site is bounded by residential housing and Wallace Avenue to the north, Charles Street to the east, parking and Old Creamery Road to the west and railroad tracks of Middletown and New Jersey Railroad to the south.

The northeastern portion of the BCP Site is improved with a one-story slab-on-grade commercial building built circa 1957. In 1990, a two-story slab-on-grade addition was added to west side of the existing one-story building. According to the 2020 RIR, the eastern corner of the original building is a discrete structure. The entire building footprint is approximately 54,000 SF and is currently occupied by contractor rental storage and pet supply wholesaler. The remainder of the Site is paved and used for parking. The Site is zoned I-2, denoting village industry. The area surrounding the Site is predominantly industrial and commercial with nominal residential.

Site location and layout are depicted on Figures 1 and 2, respectively. Figure 2 depicts the approximate location of building features associated with prior cVOC usage, including the aforementioned discrete structure; section 2.4 of this RIWP discusses the relevance of this structure.

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 (USGS 7.5 Minute Maybrook NY Topographic Quadrangle) topographic map, the Site is located at an elevation of approximately 400 feet above mean sea level (msl). The Site is located in a relatively flat area and gently slopes to the southeast.

Site Geology and Hydrogeology

According to the 2020 RIR, the overburden at the Site is composed of fill material and unconsolidated sedimentary surficial deposits (silt and sand). Overburden material ranges in thickness from four feet in the northwestern portion of the Site to fourteen feet in the southeastern portion of the Site. Weathered bedrock is present directly below the overburden and generally consists of laminated siltstone, greywacke sandstone, and gray to dark gray mudstone and shale, identified as the Normanskill Formation.

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Depth to groundwater was measured by WLG in each monitoring well and piezometer on April 15, 2016. Depth to groundwater measured in 2016 indicated that groundwater is present approximately ten ft-bsg within the overburden and bedrock layers. Based on the map provided by WLG, the shallow groundwater flow appears to be southeast in both the overburden and bedrock layers. Based on the contaminant distribution of cVOCs in groundwater, it appears groundwater in the overburden travels vertically down into fractures of the shallow bedrock. Groundwater flow maps based on the 2016 groundwater measurements collected in the overburden and bedrock layers are included as Figures 9a and 9b, respectively.

2.4 Historical Operations

The following description of historical Site operations has been provided by others and can be found in many previous reports included as Appendix A. The assumptions and observations provided in the following paragraphs are not those of Tenen Environmental.

From 1956 to 1984, the property was owned interchangeably by three corporate entities: 3460 Jerome Ave. Realty Corp., Balke Products Inc. and J. Sklar Mfg. Co., Inc. 3460 Jerome Ave. Realty Corp. seems to have been a real-estate holding company owned by John Sklar. The operating "entity" at the Site dating to the 1950s appears to have been Balke Products, Inc. The nature of the relationship between J. Sklar Mfg. and Balke Products is unclear. Historical records document that J. Sklar Mfg. Co., Inc. and Balke Products, Inc. both manufactured surgical-steel tools and instruments. Historical operations included hammerboard drop-forging of steel tools and metal-finishing operations. Research regarding historical drop-forging of steel tools indicates that vapor degreasing was a standard procedure following the forging process. Based on industry standards, degreasers are most often chlorinated solvents. Specifically, operations in the northeast portion of the building included solvent storage, vapor degreasing, finishing, welding, handling and forging.

The southeast portion of the original Site building comprises a discrete structure built with a thick concrete foundation. According to Matt Thorpe, the Department of Public Works Supervisor and neighboring tenant, this building was the "forging /stamping building." Additional interviews with local residents and Maybrook officials indicated that a raised concrete platform was used for solvent storage. The face of the "old" (Balke) building adjacent to the former solvent-storage area has a long row of cantilevered windows, ostensibly for ventilation of the vapor-degreasing operations area. An asphalt patch indicative of a former excavation (date unknown) was discovered in 2020 or 2021 by others and is stated in previous reports to be the PCE source-area. A recent[2] GPR survey confirmed the presence of an old excavation beneath the asphalt patch with an estimated depth of 7-8 ft-bg. No indications of piping leading to the excavation were identified. It is unclear as to whether the excavation area formerly contained a waste-solvent tank or dry well. It is possible that there was piping and that it was removed; alternatively, waste solvents may have been transferred to such a structure manually.

In 1984, Osram purchased the property from J. Sklar Mfg. Co., Inc. Osram, and later Osram-Sylvania (following the merger of these companies), was a leading U.S. manufacturer of light bulbs. According to interviews with local Maybrook authorities, Osram-Sylvania manufactured, warehoused and distributed light bulbs from onsite. Osram-Sylvania's operations reportedly involved soldering/welding of light-bulb components. Reportedly, Osram-Sylvania did not conduct vapor degreasing or otherwise use large quantities of solvents.

During a previous site inspection conducted by Mid-Hudson Geosciences on September 20, 2022, multiple floor drains were noted in the northern portion of the former pet food manufacturer tenant space. Tenen

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[2] No date for the performance of a geophysical was provided. The use of the term "recent" comes from the 2021 BCP Application.

conducted a site inspection on January 8, 2024 and noted that these floor drains had been decommissioned and filled with concrete.

A map depicting the historic Site layout and uses has been included as Figure 3.

2.5 Previous Investigations

Several previous assessments, investigations and remedial actions have been conducted onsite between 2015 and 2023. These assessments, investigations and remedial actions have been documented extensively in the 2020 RIR and 2021 BCP Application, both prepared by others. What follows are condensed outlines and discussions of prior environmental actions at the Site. There is a significant amount of information available associated with the Site and its environmental history, this RIWP is focused on characterizing the nature and extent of the known contamination, as well as completing full scan analysis in all media, consistent with DER-10. Throughout the prior reports, several inconsistencies (specifically sampling designations, compass directions and sampling events) have been noted, there is a lack of complete data sets and/or raw analytical data reports, there is often a lack of detailed sampling methodology and in some cases no work plans or reports associated with the sampling detailed. Tenen has performed a comprehensive review of all prior reports and available documents and has noted inconsistences (in-lined, on figures and in footnotes). Sample designations have been made consistent based on the data available and assumptions that have been made are noted.

Copies of available environmental records and reports are included in their entirety, as received, in Appendix A. The results of historical sampling are summarized on Figures 5-15 and included, as received, in the Tables and data provided in Appendix A. Findings and conclusions from these reports are summarized in the following sections and are not necessarily representative of Tenen's professional opinion.

2.5.1 Supplemental Limited and Focused Subsurface Soil and Groundwater Investigation and Vapor Intrusion Assessment 201 Charles Street, 116 Wallace Avenue, and Two Unaddressed Parcels on Old Creamery Road, Maybrook, New York, Lender Consulting Services, Inc., February 5, 2016

LCS collected soil and groundwater samples on November 17, 2015[3] and January 14, 2016. Soil borings were advanced with a percussion and hydraulically driven drive system equipped with an approximate 2-inch diameter, approximate 48-inch long macro-core sampler. Soil samples were collected within each of boreholes continuously from the ground surface until refusal, a depth of between approximately 3 and 11.5 ft-bsg. Additionally, sub-slab soil vapor, indoor and ambient air samples were collected as part of the 2016 Investigation.

The 2015 Investigation included the advancement of seven soil boring and the collection of soil samples from five of the seven locations. Three soil boring locations were converted to temporary monitoring wells[4] and sampled the same day using bailers. All samples were analyzed for VOCs only. Results of the 2015 soil sampling indicated that no VOCs were present in soil above UU or PGW SCOs. Results of the 2015 groundwater sampling indicated the presence of PCE in one well at a concentration of 614 ug/L exceeding its Class GA Standard of 5 ug/L.

The 2016 Investigation included the advancement of six soil borings and the collection of seven soil samples (one from each boring, with exception to BH10, where 2 samples were collected). Two soil boring locations

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[3] No work plan was provided for this sampling event. Data and descriptions of this event are limited to those provided in the 2016 LCS Report and 2020 RIR.

[4] Well construction details were not provided for the 2015 Investigation.

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were converted to temporary monitoring wells and sampled the same day using bailers. Prior to sample collection, each well was developed by removing at least three well volumes from the well. Generally, the bottoms of the wells were set to approximately 11.5 ft-bsg. Each of the wells was constructed with one-inch diameter PVC screen and riser with a silica filter pack placed around the well screen. Three sub-slab soil vapor samples and one indoor air sample were collected within the Site building during this investigation. One ambient air sample was also collected. Samples were collected in laboratory-provided pre-cleaned evacuated Summa Canisters each equipped with an eight-hour flow regulator. All sample media was analyzed for VOCs only.

Results of the 2016 soil sampling indicate the presence of PCE in above UU and PGW SCOs, but below RCSCOs, in two samples collected from the same boring (BH10). Results of the 2016 groundwater sampling indicated the presence of PCE above Class GA Standards in both wells and the presence of TCE and DCE above Class GA Standards in one well. PCE concentrations were two orders of magnitude higher than the applicable standard. Results of the 2016 soil vapor and indoor air sampling indicate the presence of PCE in all three sub-slab samples and the indoor air sample.

Figure 5 details the locations and results of the 2015 and 2016 LCS soil sampling. Figure 7 details the locations and results of the 2015 and 2016 LCS groundwater sampling. Figure 14 details the locations and results of the 2016 LCS soil vapor and indoor air sampling. All results maps report cVOC detections exclusively.

2.5.2 Site Investigation Report and Proposed Remediation Plan, Spill No. 1601483, 201 Charles Street, Maybrook, New York, William L. Going & Associates Inc., May 12, 2016[5]

A Site Investigation (SI) was conducted in by WLG in March 2016 to further investigate the cVOC impacts identified in soil, groundwater, and soil vapor in the 2015 and 2016 LCS Investigations. The SI consisted of the advancement of thirteen soil borings, the collection of twelve onsite soil samples and one offsite soil sample (WLGSB-1), the installation of six permanent piezometers, two permanent groundwater monitoring wells, four permanent bedrock wells[6] (three onsite and one offsite) the collection of twelve groundwater samples, the collection of 18 sub-slab soil vapor samples, eight indoor air samples and one ambient air sample. A well survey was conducted at the Site as part of this investigation and groundwater in the overburden and bedrock was determined to flow to the southeast. Groundwater contour maps are included as Figures 9a and 9b for the overburden and bedrock groundwater flows, respectively.

<u>Soil Boring Details and Sample Results</u>

Soil borings were advanced to refusal using a Geoprobe. Refusal was identified as bedrock at depths ranging from 4-12 ft-bsg. One sample was collected from each boring "near the bottom" and analyzed for VOCs only. Results of the WLG soil sampling indicated that three of thirteen samples analyzed contained concentrations of PCE exceeding UU/PGW SCOs, but below RC SCOs, with concentrations ranging from 4.0. mg/kg in WLG SB6 to 77.0 mg/kg in WLG SB10[7]. Samples with exceedances were collected along

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[5] The May 2016 report by WLG indicates that 13 soil borings were installed during the January 2016 investigation performed by LCS. The LCS report states that a total of 6 soil borings were advanced. It is assumed that WLG is including the 7 borings advanced in 2015. No report was available for the 2015 investigation and only 5 of the 7 borings advanced were discussed in the 2016 LCS report.

[6] The May 2016 report by WLG incorrectly states that all 13 soil boring were converted to piezometers and that 6 monitoring wells were installed within bedrock.

[7] The May 2016 report by WLG contained pervasive inconstancies specifically regarding sample IDs. More times than not, the sample IDs on the chain of custodies did not match the sample IDs on the maps or in the report narrative. Tenen was able to reasonably deduce corresponding sample IDs based on review of all available documents, however it should be noted that the naming convention used in this RIWP may not completely match the previous reports and that we have attempted to alleviate these inconsistencies by assigning each location a single, consistent sample designation.

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the eastern Site boundary at depths ranging from 8-11 ft-bg. DCE and TCE were not detected in any sample exceeding UU/PGW SCOs. Figure 6 details the locations and results of the 2016 WLG soil sampling.

Groundwater Well Details and Sample Results

Monitoring wells and piezometers were advanced into the top of bedrock (depth of penetration of bedrock ranging from 3-10 ft-bg) with truck-mounted auger and air rotary equipment. Piezometers were constructed of 1-inch inner diameter schedule 40 PVC materials and No. 1 sand installed and within the 2-inch diameter Geoprobe® soil boring. Each well was constructed with five or ten-foot lengths of 0.010-inch slotted screen. Deep monitoring wells (WLG DMW 1, 2, 2S, 3, 4 and 5) were drilled to auger refusal and then drilled with air rotary into the bedrock[8]. A 4-inch steel casing was grouted into the bedrock socket in WLG DMWs 1, 2, 2S and 3 to prevent groundwater contaminant migrating from overburden down into bedrock. Based on either the lack of information or the inconsistency of information, the diameter of the monitoring and bedrock wells are unknown. Steel casings installed in each bedrock well is reported as 4-inch, while the report does not specify, we assume that this 4-inch *diameter*. Steel casing depths within bedrock ranged between two feet and six feet according to the table provided in the 2016 WLG report.

Piezometers and wells were developed and sampled the same day using dedicated disposable bailers. Results of the groundwater sampling indicated concentrations of chlorinated solvents, specifically PCE, TCE, and DCE in exceedance of Class GA Standards in the groundwater samples collected from the eastern boundary of the Site. PCE was also detected in exceedance of Class GA Standards in groundwater collected directly adjacent to the eastern perimeter of the Site building in the areas of former PCE storage and vapor degreasing. PCE was detected at a maximum concentration of 24,0000 ug/L; TCE was detected at a maximum concentration of 3,100 ug/L; and DCE was detected at a maximum concentration of 710 ug/L. All maximum concentrations were detected in the same well, WLG DMW2. TCA was also detected above Class GA Standards in well WLG DMW2 at 7.9 ug/L PCE, TCE, DCE and TCA all have a Class GA Standard of 5 ug/l.

Based on the results of the groundwater sampling, WLG proposed the use of Regenesis products "PersulOx/ISCO" and "PlumeStop" to eliminate PCE in soil and groundwater immediately south of the original portion of the commercial building.

All cVOCs were detected below the Class GA Standards in upgradient permanent monitoring wells (on and offsite). Figure 8 details the locations and results of the 2016 WLG groundwater sampling.

Sub-slab Soil Vapor and Indoor Air Details and Sample Results

Three indoor air samples were collected from the workspace breathing zone inside the commercial building, along with 18 sub-slab soil vapor samples from beneath the commercial building, and one air sample from outside the commercial building (using SUMMA canisters with eight-hour flow controllers). The air samples were collected from inside and beneath the original building and from inside and beneath the addition to the original building, which are on separate concrete slabs. The building was empty at the time, although it was heated and all windows and doors were closed.

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. Results of the indoor air sampling indicated that concentrations of PCE were detected throughout the sub-slab of both building footprints (original and newer addition). However, the concentrations of PCE detected in sub-slab samples collected from the original building were generally one to two orders of magnitude higher that those detected in the

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[8] This statement contradicts the sentence following it (indicating that only wells WLG DMW 1, 2, 2S, and 3 were socketed into bedrock). The preceding statement is also invalidated by the well construction detail tables provided on pages 4 and 5 of the 2016 WLG Report. Wells WLG DMW 4 and 5 are considered monitoring wells, not bedrock wells. Note that no well construction logs were provided.

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addition. PCE was also detected in all three indoor samples collected.

Following a Sub-Slab Depressurization System (SSDS) Test (details included in the 2016 WLG Report), WLG concluded that the original building required mitigation. However, based on the SSDS test results WLG concluded that the sub-slab geology was not appropriate for the installation of an active SSDS and recommended the installation of a passive system.

2.5.3 Status Report, Remediation of PCE Contamination Plume, Spill No. 1601483, 201 Charles Street, Maybrook, New York, William L. Going & Associates Inc., March 3, 2017

Groundwater Remediation

WLG used boring logs to develop a bedrock contour map and suggested in their 2017 Report that the contours depict a trough that is closed at the southwest end and open to the northeast. According to WLG, in the southwest portion of the trough the water table is nearly flat (at about 10 ft-bsg) within saturated sediments that continue down to top of bedrock (at approximately 13 ft-bsg). The water in the trough is fed by groundwater flowing southeast under the building. Water in the trough then flows to the northeast.

In June 2016, WLG installed 18 injection wells directly into the PCE contaminated area (south and east of the Site building). Each well extended to the top of the fractured bedrock and was installed with truck-mounted roller bit; end of boring (auger refusal) ranged from 14-15 ft-bsg (3-7 feet into the fractured bedrock surface). Each injection well was constructed of 2-inch schedule 40 PVC, coarse sand and coarse bentonite. Each well was constructed with 8 feet of 0.020-inch slotted screen and 8 feet of solid riser. Injection wells were spaced 15 feet apart along the approximate centerline of the PCE plume to allow for maximum coverage and distribution of the PersulfOx.

PersulfOx was injected into each well in June 2016 and again in July 2016. Specifically, 3,400 pounds of powdered PersulfOx mixed with approximately 1,800 gallons of water was injected under pressure evenly across the contaminated groundwater trough during each treatment. Frequent field colorimetric analyses using a CHEMets kit and laboratory measurements of oxygen reduction potential in groundwater samples from selected injection wells indicated that PersulfOx concentrations remained high since the initial treatment.

Select injection, monitoring and bedrock wells were sampled post injection in September 2016 and January 2017[9]. Sampling methodology is unknown, but assumed to be disposable bailers, based on previous sampling events. Results from the injection well sampling indicate cVOC rebound, whereas results from samples collected from previously installed monitoring and bedrock wells generally indicate a significant reduction of cVOC concentrations. WLG suggested that the rebound in injection wells could be attributed to a movement of aqueous-phase PCE out of fractures in the top of bedrock and back into the groundwater in the trough. WLG also posited that PCE could be migrating onsite from an upgradient source, however there is no data to support this position.

Figure 10 depicts the locations of the injection wells. Figure 11 shows the results of the 2016/2017 post-remedial sampling and pre-injection concentrations, where applicable.

Soil Vapor Mitigation

In May 2016, 18 passive vents were installed in the sub-slab of the northern part of the building (see Figure 16). A vacuum test was conducted to determine if there is any permeability beneath the slab. Reportedly, as there was nearly zero permeability beneath the slab, a passive vapor extraction system consisting of five vents with outdoor wind-blown turbines was installed. No additional details were provided exclusive of a

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[9] The 2017 WLG Report states that another round of groundwater sampling will take place in April 2017. There is no documentation that this sampling occurred.

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vent location diagram and vent construction diagram. Figure 16 details the passive soil vapor venting system and vent detail per WLGs 2017 Report.

2.5.4 Additional Groundwater, Sub-Slab and Indoor Air Sampling, 201 Charles Street, Maybrook, New York, William L. Going & Associates Inc., August and November, 2019

Additional sampling of groundwater, sub-slab soil vapor and indoor air was performed onsite in 2019. Tenen was not provided with a Work Plan or individual Report detailing this sampling. The methodology, locations and data associated with this sampling is limited to what was documented in the aforementioned RIR and BCP Application.

Groundwater

Additional post-remedial sampling occurred on August 5 and August 30, 2019 and included an expanded network of wells. Figure 12 shows the results of the 2019 sampling and compares those results to previous pre and post remedial sampling that was performed in 2016 and 2017. Note that Figure 12 only includes results from wells that were sampled in 2019. Again, sampling methodology is unknown, as it is not documented. The results of the 2019 sampling indicate that cVOC concentrations are decreasing in most wells, however PCE concentrations were shown to increase in three previously unsampled injection wells (INJ 13, 14 and 16) from August 5 to August 30, 2019. Overall, concentrations of PCE remain two orders of magnitude over the Class GA Standards within the easternmost wells.

Subsequent to the 2019 sampling, the 2020 RIR states that the water quality parameters of the groundwater in the plume area have been changed to anaerobic conditions with the introduction of sodium lactate. It is unknown when sodium lactate was first introduced into the aquifer. Further, Mid-Hudson Geosciences, Anaerobix, & Jansen Engineering PLLC concludes that enhanced bioremediation is a better remedy than chemical oxidation for the Site and implies that bioremediation will replace chemical oxidation moving forward.

Soil Vapor and Indoor Air

Another round of sub-slab vapor and indoor air sampling was conducted on November 23, 2019. PCE in nine indoor air samples ranged from 16.1 to 67.5 µg/m3. PCE concentrations in sub-slab soil vapor ranged from 29.6 to 10,400 µg/m3[10]. Based on this sampling, Mid-Hudson Geosciences, Anaerobix, & Jansen Engineering PLLC concluded that the eastern half of the sub-slab PCE vapor has greatly diminished over the course of three years (since the 2016 sampling). Discussions with the previous consultant indicate that the sub-slab samples were collected from the system vent risers.

2.5.5 Groundwater Sampling Events, 201 Charles Street, Maybrook, New York, Mid-Hudson Geosciences, March and August, 2021; May 2022; and, March 2023.

Four additional post-remedial groundwater sampling events were conducted onsite by Mid-Hudson Geosciences between March 2021 and March 2023. Tenen was provided with the laboratory deliverables from York Analytical Laboratories for each of the four sampling events. The scope of each of the sampling events was as follows: nine previously installed injection wells were sampled during the March 11, 2021 sampling event; eight previously installed injection wells were sampled during the August 21, 2021 sampling event; all 18 previously installed injection wells were sampled during the May 31, 2022 sampling event; and, all 18 previously installed injections wells, one existing groundwater monitoring well, and one existing bedrock monitoring well were sampled during the March 7, 2023 sampling event.

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[10] There was no raw data provided for this sampling event.

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Groundwater

Four additional post-remedial groundwater sampling events were conducted between 2021 and 2023 by Mid-Hudson Geosciences. Figure 13 shows the results of the 2021, 2022, and 2023 sampling events Sampling methodology is unknown, as it is not documented. The results of the sampling indicate that PCE and TCE concentrations have generally decreased across all injection wells, while cis-1,2-DCE and vinyl chloride concentrations have generally remained stable or increased, indicating that reductive dechlorination of PCE is occurring. The maximum concentrations of cVOCs detected during the most recent sampling event conducted in March 2023 were as follows: PCE was detected at a max. concentration of 87.4 ug/L in INJ 16; TCE was detected at a max. concentration of 12.8 ug/L in INJ 16; cis-1,2-DCE was detected at a max. concentration of 2,430 ug/L in INJ 10; and, vinyl chloride was detected at a max. concentration of 357 ug/L in INJ 9. A PCE plume map documenting the most recent post-remedial sampling (March 2023) and areas of former PCE storage are included as Figure 18 for the overburden.

2.6 Previous Investigation Deductions

Based on investigations conducted to date at the Site, the primary contaminants of concern for the Site are cVOCs. Summaries of previous investigation are provided above, within the 2020 RIR and the 2021 BCP Application.

Soil

While there may have been a PCE source removal performed onsite previously, it appears, based on our review of the data that either the source was not fully removed or there are other sources onsite, specifically along the eastern perimeter of the Site building in the areas of former PCE storage and vapor degreasing.

Groundwater

Two rounds of chemical oxidation have been performed onsite. Enhanced bioremediation was performed sometime between 2019 and 2020. Post-remediation sampling, as recent as 2023, indicates that concentrations of cVOCs, specifically PCE and TCE, are decreasing, while concentrations of cis-1,2-DCE and vinyl chloride have generally remained stable or increased, indicating that reductive dechlorination of PCE is occurring.

Sub-Slab Soil Vapor and Indoor Air

A passive soil vapor venting system was installed with the original (or eastern portion) of the Site building in 2016. Sub-slab soil vapor and indoor air sampling as recent as 2019 indicates that the system is not functioning as designed and active mitigation is necessary.

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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 all contaminants in all media beneath and emanating from the Site, including known cVOC contamination in soil, groundwater and soil vapor;
- Evaluate bedrock conditions beneath the Site;
- Identify the extent of onsite soil vapor and indoor air 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;
- Assess potential offsite impacts to groundwater and soil vapor;
- Assess potential impacts to human health as a result of the release of contaminants at the Site; and,
- Conduct a Fish and Wildlife Resources Impact Analysis (FWRIA) for 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 previous environmental assessments, work plans and reports; 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 36 subsurface soil samples from 18 soil borings, collection of eight surface soil samples, installation of nine permanent groundwater monitoring wells (six shallow wells and three bedrock wells), collection of 18 groundwater samples from nine previously installed and nine newly installed groundwater monitoring/bedrock wells, collection of soil vapor from three sub-slab soil vapor points and four exterior soil vapor points within and surrounding the Site, the collection of three co-located indoor air samples, and the collection of one ambient air sample. The type, location, and rationale for each exploration are detailed in the sections below and in summary table included in Section 3.6.

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

DRAFT

of this data, review and evaluation will be performed in order to determine if additional investigation is needed. A FWRIA will also be conducted for the Site to identify any actual or potential impacts to fish and wildlife resources from Site contaminants.

Proposed RI sample locations are shown on Figures 19 through 21.

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 in areas of the Site not previously investigated.

The following scope of work will be implemented:

- Advance eight soil borings to bedrock (approximately 4-11 ft-bsg) to complete the horizontal and vertical delineation of the cVOC area of impacts identified in the southern portion of the Site in previous investigations. One of the soil borings, TESB-12, will be advanced in the potential soil excavation footprint to assess what material is present in the excavation area and to determine if soil excavation adequately removed contaminants in this area;
- Advance five soil borings to bedrock (approximately 4-11 ft-bsg) in exterior portions of the Site to the west and east of the known cVOC area of impacts to characterize soil in areas not previously investigated;
- Advance three soil borings to bedrock (approximately 4-11 ft-bsg) in the vicinity of the pad-mounted electrical transformers in the exterior portion of the Site. Two soil borings will be advanced in the vicinity of the transformers in the northeast portion of the Site, and one soil boring will be advanced in the vicinity of the transformer in the southern portion of the Site, to assess if PCB impacts are present and to characterize soil in these portions of the Site;
- Advance five soil borings to bedrock (approximately 4-11 ft-bsg) within the existing Site building to characterize soil conditions beneath the building slab;
- Collect 42 subsurface soil samples: two from each soil boring. Soil samples will be collected from the two-foot interval exhibiting the highest suspected contamination and the two-foot interval directly above bedrock. If no visual contamination is observed, the sample will be collected from the two-foot interval above the groundwater interface (if encountered). If the groundwater interface is not encountered, the sample will be collected from the interval directly above the bottom sample or the two-foot interval directly below the slab. Generally, samples collected from the two-foot interval directly below the slab will be collected from borings advanced in areas with no known contamination and/or no observed impacts.
- Collect eight surface soil samples from exposed areas of soil or grass onsite to characterize surface soil conditions. Surface soil samples will be collected from zero to two inches below grade.
- If additional delineation of soil impacts is necessary, soil delineation samples will be collected from the two-foot interval that exhibited impacts in the nearest soil boring, as well as each one-foot interval directly below that sample to the top of bedrock. 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 for the previous analyte exceedance until a clean interval is reached;

DRAFT

- Analyze soil samples collected onsite for full scan Part 375 SCOs, 1,4-dioxane, and perfluoroalkyl acids (PFAS) (minimum of two per boring).
- If present, collect a sediment sample from the stormwater catch basin south of the Site building. The sample would be analyzed for VOCs.

3.2.1 Soil Sampling Methodology

A total of 24 soil borings will be advanced as part of this RI; proposed soil sample locations are shown in Figure 19. 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 soil borings will be installed using a direct-push track-mounted Geoprobe® unit. All borings will be advanced to bedrock (approximately 4-11 ft-bsg). Subsurface soil samples will be collected from 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. All descriptions and observations will be documented in a field logbook.

Surface soil samples will be collected from areas of exposed soil or grass onsite from zero to two inches below grade to evaluate surface soil for exposure. Hand tools will be utilized to collect samples from each uncapped area. One five-point composite sample will be collected from the surface per each 900 square foot area of uncapped land, for a total of eight soil samples.

For each soil delineation boring (if necessary), soil delineation samples will be collected from the two-foot interval that exhibited impacts in the nearest soil boring, as well as each one-foot interval directly below that sample to the top of bedrock and 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 next interval will be analyzed for the previous analyte exceedance 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 all borings located onsite. Soil samples will be collected from the two-foot interval exhibiting the highest suspected contamination and the two-foot interval directly above bedrock. If no visual contamination is observed, the sample will be collected from the two-foot interval above the groundwater interface (if encountered). If the groundwater interface is not encountered, the sample will be collected from the interval directly above the bottom sample or the two-foot interval directly below the slab. Generally, samples collected from the two-foot interval directly below the slab will be collected from borings advanced in areas with no known contamination and/or no observed impacts.

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 4ºC 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 and all surface soil samples will be

DRAFT

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 1633; and
- 1,4-Dioxane by USEPA Method 8270.

Proposed RI and previous soil boring locations are shown on Figure 19. 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.

The following scope of work will be implemented:

- Install three sub-slab soil vapor samples with co-located indoor air samples: one pair of samples will be installed within the newer building footprint (western portion of the Site building) and two pairs of samples will be installed within the original building footprint (eastern portion of the Site building). The soil vapor sample probes will be installed within the lowest building level no more than two inches below the building slab;
- Completion of a building questionnaire and product inventory for the structure during the indoor sampling event;
- Install four exterior soil vapor points to approximately 6 ft-bsg (anticipated surrounding basement depths) along the northern, eastern and southern boundaries of the Site to assess potential offsite migration of impacted soil vapor.
- One outdoor ambient air sample will be collected for each soil vapor sampling event; 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 three sub-slab soil vapor samples, four exterior soil vapor samples, three indoor air samples and one 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). One sub-slab soil vapor sample and co-located indoor air sample will be collected from western portion of the Site building, two sub-slab soil vapor samples and co-located indoor air samples will be collected from the eastern portion of the Site building in areas believed to be utilized as offices, four exterior soil vapor samples will be collected from Site boundaries where residential housing and/or occupied spaces surround the Site. Figure 21 depicts proposed soil vapor and indoor air

DRAFT

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. As necessary, EPA Method TO-15 Select Ion Monitoring (SIM) will be utilized for analysis of cVOCs in order to achieve the appropriate minimum reporting limits [1 microgram per cubic meter (ug/m^3) in tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), 1,1-dichloroethene (1,1-DCE), carbon tetrachloride, vinyl chloride, 1,1,1-trichloroethane (1,1,1-TCA), and methylene chloride].

Prior to each soil vapor or sub-slab soil vapor sampling event, the existing sub-slab depressurization system onsite will be shut down to prevent interference with the sample collection.

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.

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A total of three indoor air samples and one outdoor ambient air sample will be collected as part of this RI. All three indoor air samples will be co-located with a sub-slab soil vapor sample. All indoor air samples will be collected from breathing height (three to five feet above the floor) from within the onsite building. 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. A building questionnaire and product inventory will be completed for the structure during the indoor air sampling event, in accordance with NYSDOH's SVI Guidance, and will be included in the RIR.

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. As necessary, EPA Method TO-15 SIM will be utilized for analysis of cVOCs in order to achieve the appropriate minimum reporting limits (0.20 ug/m^3 in TCE, cis-1,2-DCE, 1,1-DCE, carbon tetrachloride, and vinyl chloride and 1 ug/m^3 in PCE, 1,1,1-TCA, and methylene chloride).

Prior to each indoor air sampling event, the existing sub-slab depressurization system onsite will be shut down to prevent interference with the sample collection.

Proposed RI and previous soil vapor and indoor air locations are shown on Figure 21. 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 onsite:

- Geophysics consisting of fluid temperature, fluid conductivity, natural gamma radiation and borehole diameter as well as optical/high resolution imaging of the borehole walls will be completed on existing deep well OBW. The results of the screening will be discussed with the Department to determine if the well should be sampled or sealed. The results will also be used to determine preferential water bearing zones to support the installation of the deep well described below.
- Three permanent groundwater monitoring wells (TEBW-1, TEBW-2, and TEBW-3S) will be installed and screened in shallow bedrock: one will be installed within the Site building within the former Balke Forging space; one will be installed within the area surrounding the anticipated PCE source area and co-located with a newly installed monitoring well screened in deep bedrock (TEBW-3D); and, one will be co-located with a newly installed monitoring well screened in the overburden within the southeastern corner of the Site (TEMW-4) in order to delineate the onsite PCE plume to the east and evaluate portions of the Site not previously investigated. All monitoring wells screened in shallow bedrock will be advanced 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 deeper bedrock fractures. The casing will be set at least five feet into competent rock, with at least five feet of screen or open borehole constructed below the casing;
- One new permanent groundwater monitoring well will be installed and screened in deep bedrock (TEBW-3D). The monitoring well will be co-located with a newly installed monitoring well

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screened in shallow bedrock (TEBW-3S) to vertically delineate cVOC impacts to groundwater. The deep well will be double cased;

- Previously installed groundwater monitoring wells screened in shallow bedrock (WLG DMW2S) and deep bedrock (WLG DMW2 and WLG DMW3) will be sampled as part of this RI to confirm previous sample results;
- Two permanent groundwater monitoring wells (TEMW-1 and TEMW-2) screened in the overburden will be installed within the northern portion of the original Site building to assess upgradient groundwater conditions;
- One permanent groundwater monitoring well (TEMW-3) screened in the overburden will be installed within the original Site building, upgradient of the former vapor degreasing area (assumed) and PCE storage pad;
- One permanent groundwater monitoring well screened (TEMW-4) in the overburden will be installed within the eastern corner of the Site in order to delineate the onsite PCE plume to the east and evaluate portions of the Site not previously investigated. This monitoring well will be co-located with shallow bedrock monitoring well TEBW-2;
- One permanent groundwater monitoring well (TEMW-5) screened in the overburden will be installed within the anticipated PCE source area;
- One permanent groundwater monitoring well (TEMW-6) screened in the overburden will be installed within the western corner of the Site in order to delineate the onsite PCE plume to the west and evaluate portions of the Site not previously investigated;
- All newly installed groundwater monitoring wells screened in the overburden will be set atop bedrock (approximately 4-11 ft-bsg);
- One previously installed 2-inch monitoring well screened in the overburden (WLG DMW5) will be sampled as part of this RI to confirm previous sample results;
- Five previously installed injections wells (2, 6, 13, 15 and 17, all assumed to be 2” diameter) will be sampled as part of this RI to confirm previous sample results;
- One existing supply well which extends into bedrock (OBW) will be sampled as part of this RI to confirm previous sample results;
- Gauge and collect groundwater samples from ten newly installed and ten existing wells;
- Groundwater samples from newly installed wells 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;
- Groundwater samples from previously installed wells will be analyzed for Part 375 VOCs only; 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 20. A summary table of proposed groundwater samples and sampling rationale is included in Section 3.6 of this Work Plan.

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3.4.1 Deep Bedrock Geophysics and Imaging

The purpose of the geophysical logging is to identify preferential water bearing intervals. A fluid probe will be used to measure changes in temperature and conductivity within the water column. A caliper scan will measure the diameter of the borehole and identify fractures. Natural gamma radiation logs will be used to identify lithologic changes in the borehole and for stratigraphic correlation between boring locations (if more than one screen is completed). The temperature/conductivity readings and caliper logs will be verified by a optical/high resolution acoustic televiewer (OPTV/HRAT) survey. The OPTV is a downhole camera equipped with a hyperbolic mirror used to image the borehole walls and create a continuous optical record for analysis. In wells with low visibility (due to groundwater with a high particle load), the HRAT is substituted for the OPTV. The HRAT uses an acoustical signal to build a similar log of the borehole. Magnetometers will determine the orientation of the OPTV/HRAT so that strike and dip of fractures or bedding planes can be measured.

The geophysics and imaging will initially be completed on existing well OBW. If the readings are inconclusive to determine the depth of the additional proposed deep well (TEBW-3D), geophysics and imaging will be completed on a deep borehole installed at TEBW-3D.

3.4.2 Groundwater Well Sampling

Ten previously installed permanent wells and ten newly installed permanent monitoring wells 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 monitoring wells screened in the overburden will be installed using a Geoprobe® direct-push rig and seated above bedrock. All monitoring wells screened in shallow or deep bedrock will be installed using a hydraulic drill rig with coring capabilities. All monitoring wells screened in the overburden will consist of a two-inch inner diameter (ID) PVC casing and riser. A five or ten-foot PVC screen (0.020-inch slot) will be installed depending on the total well depth and presence of groundwater. A two-inch, five-foot screen (0.020-inch slot) will be installed five feet into bedrock for the monitoring wells screened in shallow bedrock or ten feet into bedrock for the monitoring well screened in deep bedrock. The overburden will be cased off from the underlying bedrock to prevent downward migration of cVOC impacts into bedrock fractures. The casing will be set at least five feet into competent rock with at least five feet of screen or open borehole constructed below the casing.

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.

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Newly installed 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. Previously installed wells to be sampled as part of this RI will be surged one week prior to sampling to remove potential blockages and promote the movement of fines and water through the well screens.

All newly installed 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. Groundwater samples from newly installed wells 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 1633.

Emerging contaminants (e.g., PFAS and 1,4-Dioxane) will be sampled in accordance with the current NYSDEC guidance, *Sampling, Analysis, and Assessment of PFAS Under NYSDEC's Part 375 Remedial Programs*, dated April 2023 (PFAS Guidelines).

Groundwater samples collected from previously installed wells will be analyzed for TCL VOCs by EPA Method 8260C, only.

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 10-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.

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Table 1. Proposed Sampling Locations and Analysis

Soil

Sample Location	Media	Sampling Intervals	Analytical Parameters	Sampling Method / Minimum Reporting Levels	Rationale	QA/QC Samples
TESB-1	Soil	From the two-foot interval exhibiting the highest suspected contamination and the two-foot interval directly above bedrock. If no visual contamination is observed, the sample will be collected from the two-foot interval above the groundwater interface (if encountered). If the groundwater interface is not encountered, the sample will be collected from the interval directly above the bottom sample or the two-foot interval directly below the slab.	Part 375 Analytes, PFAS, and 1,4-Dioxane (two samples from each boring) All additional samples: TCL VOCs only	EPA 1633 / MDL less than 1 ug/kg for PFAS; 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	Evaluate soil conditions below the northern Site building.	1 duplicate, 1 field blank, and 1 MS/MSD per 20 samples; 1 trip blank per sample delivery group
TESB-2						
TESB-3						
TESB-4						
TESB-5						
TESB-6					Assess areas not previously investigated. Onsite vertical and horizontal delineation of known chlorinated solvent impacts.	
TESB-7						
TESB-8						
TESB-17						
TESB-18						
TESB-9					Onsite vertical and horizontal delineation of known chlorinated solvent impacts within the anticipated PCE source.	
TESB-10						
TESB-11						
TESB-13						
TESB-14						
TESB-15						
TESB-16						

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Sample Location	Media	Sampling Intervals	Analytical Parameters	Sampling Method / Minimum Reporting Levels	Rationale	QA/QC Samples
TESB-12	Soil	From the two-foot interval exhibiting the highest suspected contamination and the two-foot interval directly above bedrock. If no visual contamination is observed, the sample will be collected from the two-foot interval above the groundwater interface (if encountered). If the groundwater interface is not encountered, the sample will be collected from the interval directly above the bottom sample or the two-foot interval directly below the slab.	Part 375 Analytes, PFAS, and 1,4-Dioxane (two samples from each boring) All additional samples: TCL VOCs only	EPA 1633 / MDL less than 1 ug/kg for PFAS; 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	Onsite vertical and horizontal delineation of known chlorinated solvent impacts within the anticipated PCE source and evaluate soil conditions in the possible former soil excavation area in the exterior portion of the Site.	1 duplicate, 1 field blank, and 1 MS/MSD per 20 samples; 1 trip blank per sample delivery group
TESB-19					Assess soil conditions in the vicinity of the pad-mounted electrical transformers and stormwater catch basin in the exterior portion of the Site.	
TESB-20						
TESB-21						
TESB-22						
TESB-23					Evaluate soil conditions below the southern Site building.	
TESB-24						
SUR-1		0 to 2 inches below grade	Part 375 Analytes, PFAS, and 1,4-Dioxane		Assess surface soil conditions	
SUR-2						
SUR-3						
SUR-4						
SUR-5						
SUR-6						
SUR-7						
SUR-8						

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Groundwater

Sample Location	Media	Sampling Intervals	Analytical Parameters	Sampling Method / Minimum Reporting Levels	Rationale	QA/QC Samples
TEMW-1	Groundwater	5 or 10 ft screen (depending on total well depth) across groundwater interface (if encountered)	Part 375 analytes including total and dissolved metals; 1,4-dioxane; PFAS	EPA 8260C, 8270D, 8270D-SIM Modified, 8081B, 8151A, 7196A, 3050B, 7471B, 9010C/9012B/9014, 3060A/7196 and 1633 / 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 PFAS	Assess onsite groundwater conditions. Confirm/investigate groundwater conditions in shallow aquifer. Delineate PCE plume.	1 duplicate, 1 field blank, and 1 MS/MSD per 20 samples; 1 trip blank per sample delivery group
TEMW-2						
TEMW-3						
TEMW-4						
TEMW-5						
TEMW-5						
TEMW-6						
TEBW-1		5 ft screen in shallow bedrock			Investigate groundwater conditions in shallow bedrock	
TEBW-2						
TEBW-3S						
TEBW-3D		5 ft screen in deep bedrock			Investigate groundwater conditions in deep bedrock	
WLG DMW5		8-18 ft-bg	Part 375 VOCs	EPA 8260C	Confirm previous investigation results	
WLG DMW2S		15-17 ft-bg (within bedrock)				
WLG DMW2		19-23 ft-bg (within bedrock)				

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Sample Location	Media	Sampling Intervals	Analytical Parameters	Sampling Method / Minimum Reporting Levels	Rationale	QA/QC Samples
WLG DMW3	Groundwater	19-23 ft-bg (within bedrock)	Part 375 VOCs	EPA 8260C	Confirm previous investigation results	1 duplicate, 1 field blank, and 1 MS/MSD per 20 samples; 1 trip blank per sample delivery group
INJ2		8-16 ft-bg				
INJ6						
INJ13						
INJ15						
INJ17						
OBW		Unknown (within bedrock)**				

*All previously installed wells (WLG DMW2, WLG DMW2S, WLG DMW3, WLG DMW5, INJ2, INJ6, INJ13, INJ15, INJ17, and OBW) proposed for sampling will be sampled for TCL VOCs, EPA 8260C, only.

**Bedrock well OBW is a previously installed water supply well that was investigated in March 2023 by Mid-Hudson Geosciences. The total depth and screen interval of the well was not provided to Tenen.

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Soil Vapor and Outdoor Air

Sample Location	Media	Sampling Intervals	Analytical Parameters	Sampling Method / Minimum Reporting Levels	Rationale	QA/QC Samples
TESS-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 beneath the newer building slab.	None
TESS-2					Assess sub-slab soil vapor conditions beneath the original building slab.	
TESS-3						
TEIA-1	Co-located Indoor Air	Breathing height (3-5 feet above the ground)			Assess indoor air conditions onsite within the newer Site building.	
TEIA-2					Assess indoor air conditions onsite within the original Site building.	
TEIA-3						
TE-EXSV-1	Exterior Soil Vapor	8-10 ft-bsg			Assess potential offsite migration of impacted soil vapor in areas adjacent to residential or commercial properties.	
TE-EXSV-2						
TE-EXSV-3						
TE-EXSV-4						
TEAA-1	Outdoor Air	Breathing height (3-5 feet above the ground)			Assess ambient air conditions onsite.	

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 PFAS, 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.

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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 the Fugitive Dust and Particulate Monitoring program, included as Appendix 1B of DER-10, 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 and fugitive dust and particulate monitoring program 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 Fish and Wildlife Resources Impact Analysis (FWRIA)

A Fish and Wildlife Resources Impact Analysis (FWRIA) will be completed and included in the RIR in accordance with the requirements of DER-10.

There are no wetlands or surface water bodies onsite; however, multiple federal- and state-protected wetlands were noted surrounding the Site to the east, southeast, southwest, and west. Federal- and state-protected wetlands in close proximity to the Site are depicted on Figure 4.

The following surface water bodies were noted within one half mile of the Site:

1. Unnamed creek – 0.29 mile southeast (downgradient)

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2. Unnamed pond – 0.29 mile north (crossgradient)
3. Unnamed creek – 0.32 mile west (crossgradient)
4. Unnamed lake – 0.35 mile northeast (crossgradient)
5. Unnamed pond – 0.37 mile northeast (crossgradient)

All of the surface water bodies within one half mile of the Site are utilized for recreational purposes and are not utilized for potable water.

The Village of Maybrook is provided with potable water by the Village of Maybrook Water Department. The public drinking water supply is obtained from seven bedrock wells seated at an average depth of 357 ft-bg. None of the seven public drinking water supply wells are located within one half mile of the Site. The nearest public drinking water supply well is located approximately 0.7 mile northeast (crossgradient) of the Site. There are no known private drinking water supply wells within one half mile of the Site.

3.12 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 UU, PGW and RC 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.

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4.0 SCHEDULE

Project activities (Tasks 1-3) will be completed within approximately ten weeks after RIWP approval by NYSDEC. 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	30-Day Public Comment Period	30 (calendar days)	30
1	Mobilization	15	45
2	Soil Boring, Monitoring/Bedrock Well and Soil Vapor Point Installation / Soil Sampling	10	55
3	Groundwater and Soil Vapor Sampling	5	60
4	Laboratory Analysis	15	75
5	Draft Report and Data Validation	30	105
6	Submittal of RI Report	1	106

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5.0 REFERENCES

Additional Groundwater, Sub-Slab and Indoor Air Sampling, 201 Charles Street, Maybrook, NY 12543, William L. Going & Associates Inc., August and November, 2019

All Appropriate Inquiries Phase I Environmental Site Assessment Report, 201 Charles Street, 116 Wallace Avenue, and Two Unaddressed Parcels on Old Creamery Road (Parcel Nos. 112-5-5.2, 112-5-1, 114-1-1, and 114-1-2), Maybrook, NY 12543, Lender Consulting Services, Inc., January 6, 2015.

Groundwater Sampling Events, 201 Charles Street, Maybrook, NY 12543, Mid-Hudson Geosciences, March and August, 2021; May 2022; and, March 2023.

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. April 2023. NYSDEC 2023.

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

Site Investigation Report and Proposed Remediation Plan, 201 Charles Street, Maybrook, NY 12543, William L. Going & Associates, Inc., May 12, 2016.

Status Report, Remediation of PCE Contamination Plume, Spill No. 1601483, 201 Charles Street, Maybrook, NY 12543, William L. Going & Associates Inc., March 3, 2017.

Supplemental Limited and Focused Subsurface Soil and Groundwater Investigation and Vapor Intrusion Assessment Report, 201 Charles Street, 116 Wallace Avenue, and Two Unaddressed Parcels on Old Creamery Road (Parcel Nos. 112-5-5.2, 112-5-1, 114-1-1, and 114-1-2), Maybrook, NY 12543, Lender Consulting Services, Inc., February 5, 2016.

Technical Report 21C0616, 201 Charles Street, Maybrook, NY 12543, York Analytical Laboratories Inc, March 22, 2021.

Technical Report 21H1126, 201 Charles Street, Maybrook, NY 12543, York Analytical Laboratories Inc, August 30, 2021.

Technical Report 22F0087, 201 Charles Street, Maybrook, NY 12543, York Analytical Laboratories Inc, June 13, 2022.

Technical Report 23C0420, 201 Charles Street, Maybrook, NY 12543, York Analytical Laboratories Inc, March 21, 2023.

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Figures

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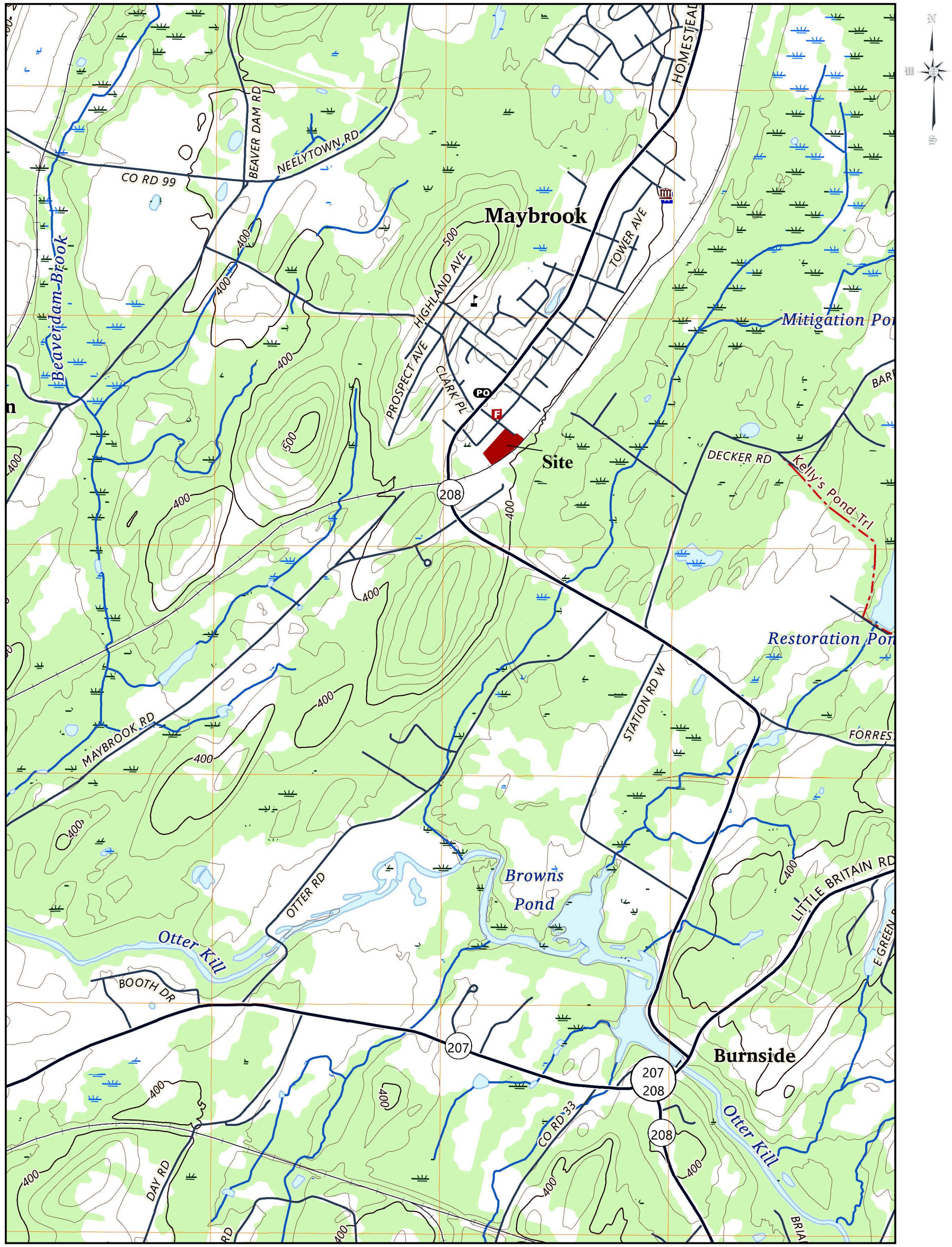
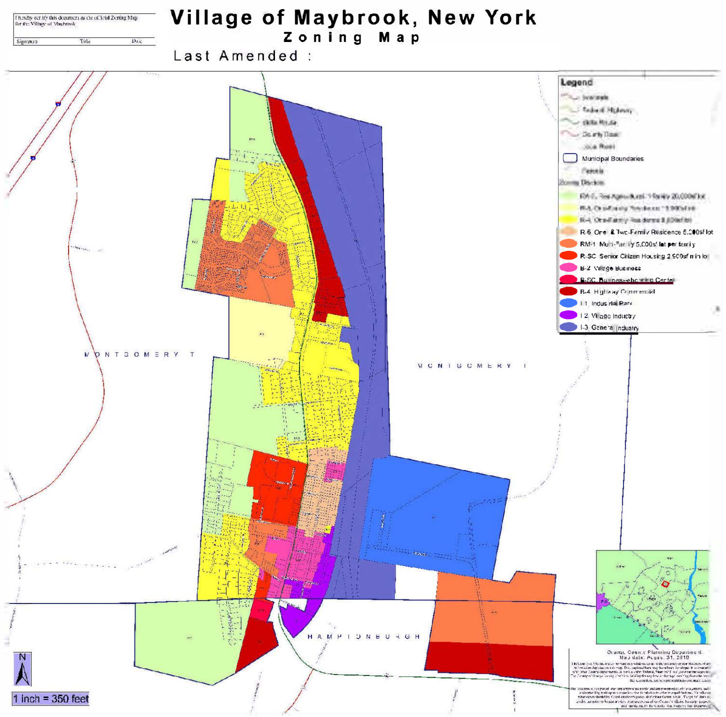


Site Location

0 1,000 2,000 4,000 Feet

Reference:
Basemap: USGS Topographic Map, 7.5 Minute Quadrangle: Maybrook, NY
Parcel Boundaries: Contributing counties, NYS Office of Information Technology Services GIS Program Office (GPO) and NYS Department of Taxation and Finance's Office of Real Property Tax Services (ORPTS).

Orange County, NY Tax Map



Village of Maybrook, NY Zoning Map

BCP Site No. C336094
Remedial Investigation Work Plan
201 Charles Street
Maybrook, New York
Orange County

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	May 2024
Scale	As Noted

Drawing Title
Site Location Map

Drawing No.
Figure 1

Legend

Interior Wall Layout

BCP Site Boundary

Orange County Tax Lots

Approximate Utility Locations

Buried Electric Line

Buried Water Line

Buried Gas Line

Buried Stormwater Line

114-1-1.2 Tax Block and Lot

The northern portion of the building is occupied by a pet supply wholesaler and the southern portion of the building is occupied by contractor rental storage.

0 40 80 160 Feet

Reference:
2021 Aerial: orthos.its.ny.gov
Parcel Boundaries: Contributing counties, NYS Office of Information Technology Services GIS Program Office (GPO) and NYS Department of Taxation and Finance's Office of Real Property Tax Services (ORPTS).

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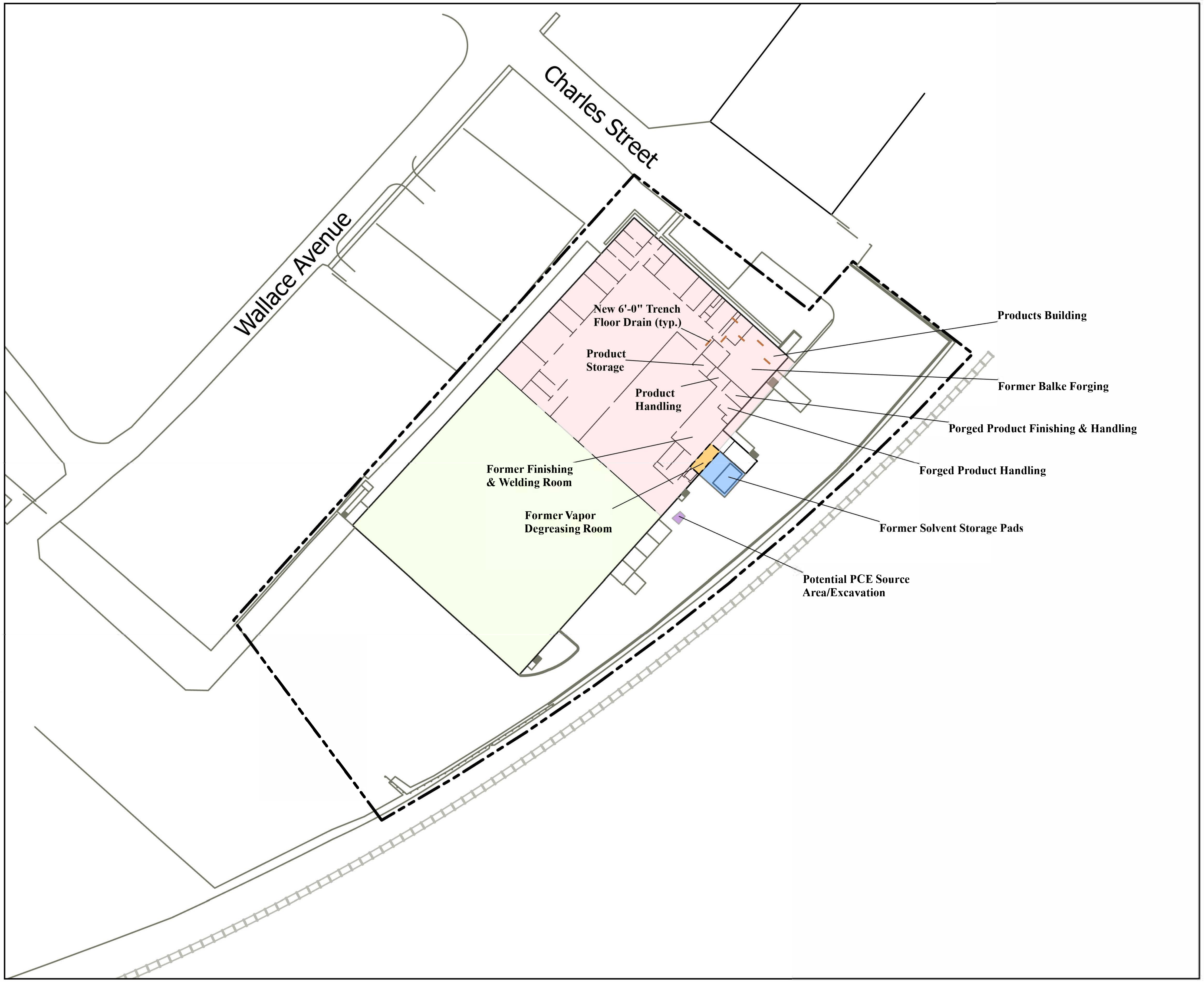
TENEN ENVIRONMENTAL

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	MC
Date	September 2024
Scale	As Noted
Drawing Title	Site Layout and Uses
Drawing No.	Figure 2



Legend

🟩 Light bulb warehouse and distribution (1990-2005); Wood product finishing and distribution (2005-2019)

🟥 Surgical steel manufacturing (1957-1981); Light bulb manufacturing (1984-2005); Commercial

▭ BCP Site Boundary

Reference:
T.M Depuy Engineering & Land Surveying, 4/14/2016 Survey (Interior Walls 4/5/16 Survey)

BCP Site No. C336094
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TENEN ENVIRONMENTAL

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

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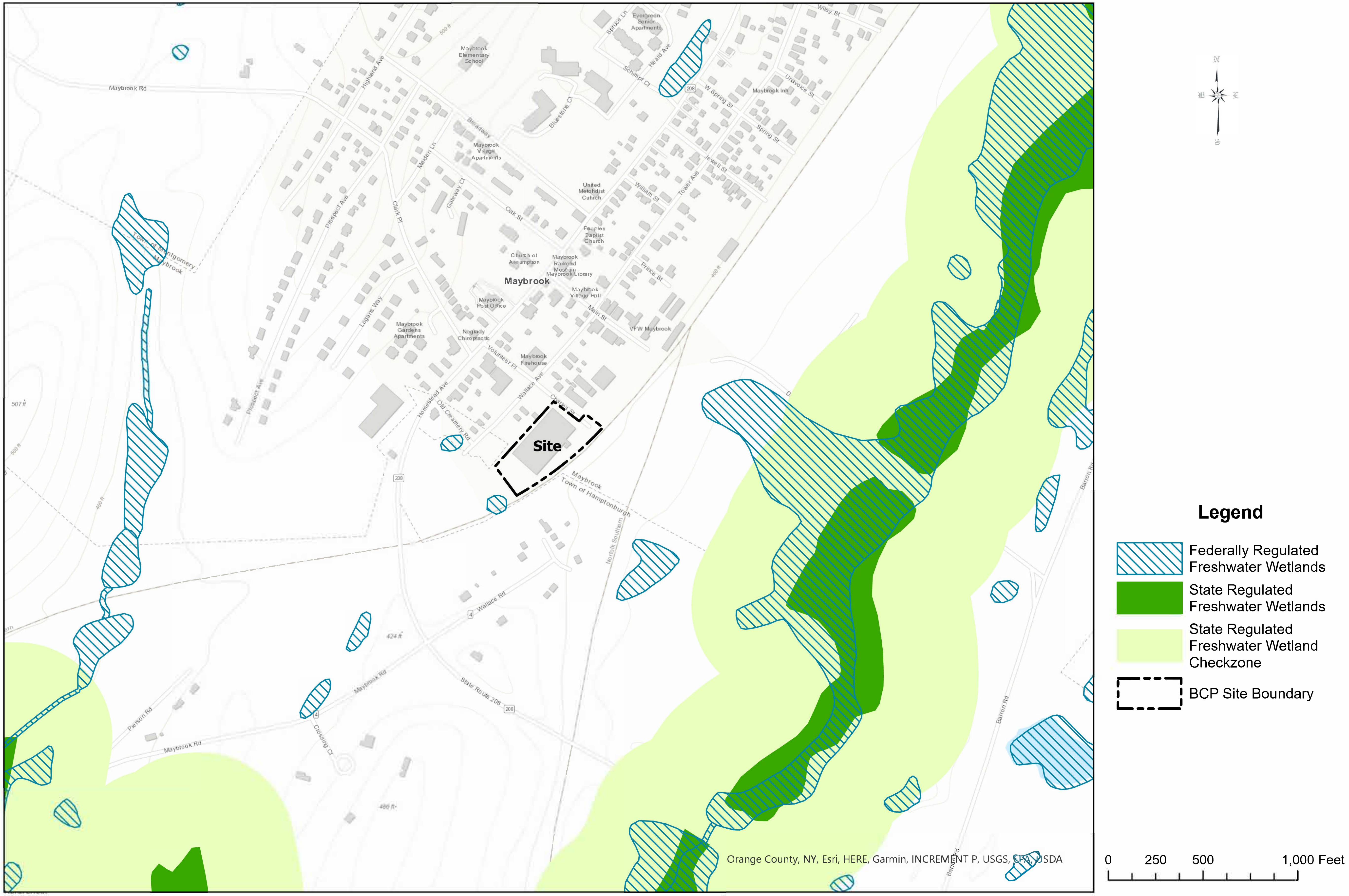
Date	September 2024
Scale	As Noted

Drawing Title
Historic Site Layout and Uses

Drawing No.
Figure 3



National Wetlands Inventory (NWI); NYSDEC State Regulated Freshwater Wetlands
Parcel Boundaries: Contributing counties, NYS Office of Information Technology Services GIS Program Office (GPO) and NYS Department of Taxation and Finance's Office of Real Property Tax Services (ORPTS).

BCP Site No. C336094
Remedial Investigation Work Plan
201 Charles Street
Maybrook, New York
Orange County

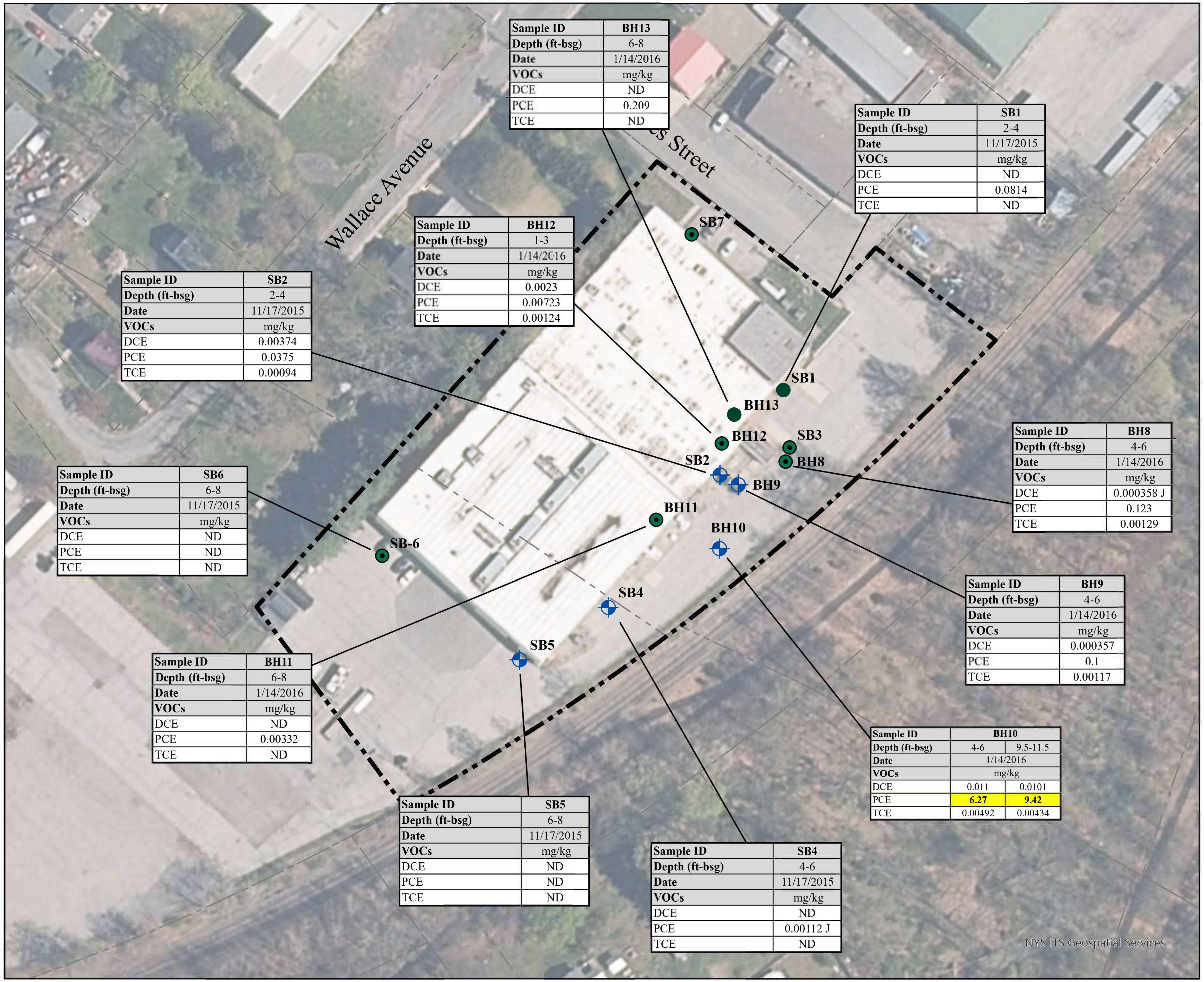
TENEN ENVIRONMENTAL
Tenen Environmental, LLC
121 West 27th Street, Suite 702
New York, NY 10001
O: (646) 606-2332; F: (646) 606-2379

Drawn By LM
Checked By AC
Date May 2024
Scale As Noted

Drawing Title
State and Federally Regulated Wetlands

Drawing No.
Figure 4

BCP Site No. C336094
Remedial Investigation Work Plan
201 Charles Street
Maybrook, New York
Orange County



Sample ID	BH13
Depth (ft-bsg)	6-8
Date	1/14/2016
VOCs	mg/kg
DCE	ND
PCE	0.209
TCE	ND

Sample ID	SB1
Depth (ft-bsg)	2-4
Date	11/17/2015
VOCs	mg/kg
DCE	ND
PCE	0.0814
TCE	ND

Sample ID	BH12
Depth (ft-bsg)	1-3
Date	1/14/2016
VOCs	mg/kg
DCE	0.0023
PCE	0.00723
TCE	0.00124

Sample ID	SB2
Depth (ft-bsg)	2-4
Date	11/17/2015
VOCs	mg/kg
DCE	0.00374
PCE	0.0375
TCE	0.00094

Sample ID	SB6
Depth (ft-bsg)	6-8
Date	11/17/2015
VOCs	mg/kg
DCE	ND
PCE	ND
TCE	ND

Sample ID	BH8
Depth (ft-bsg)	4-6
Date	1/14/2016
VOCs	mg/kg
DCE	0.000358 J
PCE	0.123
TCE	0.00129

Sample ID	BH9
Depth (ft-bsg)	4-6
Date	1/14/2016
VOCs	mg/kg
DCE	0.000357
PCE	0.1
TCE	0.00117

Sample ID	BH11
Depth (ft-bsg)	6-8
Date	1/14/2016
VOCs	mg/kg
DCE	ND
PCE	0.00332
TCE	ND

Sample ID	BH10	
Depth (ft-bsg)	4-6	9.5-11.5
Date	1/14/2016	
VOCs	mg/kg	
DCE	0.011	0.0101
PCE	**6.27**	**9.42**
TCE	0.00492	0.00434

Sample ID	SB5
Depth (ft-bsg)	6-8
Date	11/17/2015
VOCs	mg/kg
DCE	ND
PCE	ND
TCE	ND

Sample ID	SB4
Depth (ft-bsg)	4-6
Date	11/17/2015
VOCs	mg/kg
DCE	ND
PCE	0.00112 J
TCE	ND

Analyte	NY-UUSCOs/ NY-PGWSCOs	NY-RCSCOs
VOCs	mg/kg	
cis -1,2-Dichloroethene (DCE)	0.25	500
Tetrachloroethene (PCE)	1.3	150
Trichloroethene (TCE)	0.47	200

Notes:
No data was available for 2015 borings SB3 and SB7.
Bold and shaded yellow value indictaes concentration exceeds NY-UUSCOs and NY-PGWSCOs
NY-UUSCOs = 6 NYCRR Part 375 Unrestricted Use Soil Cleanup Objectives
NY-PGWSCOs = 6 NYCRR Part 375 Protection of Groundwater Soil Cleanup Objectives
NY-RCSCOs = 6 NYCRR Part 375 Restricted Use Soil Cleanup Objectives
J = Estimated value
ND = Not detected

Legend

● Soil Boring Location
⊕ Soil Boring/Temproary Monitoring Well Location
▭ Orange County Tax Lots
▭ BCP Site Boundary

Note: Sampling locations are approximate

0 40 80 160 Feet

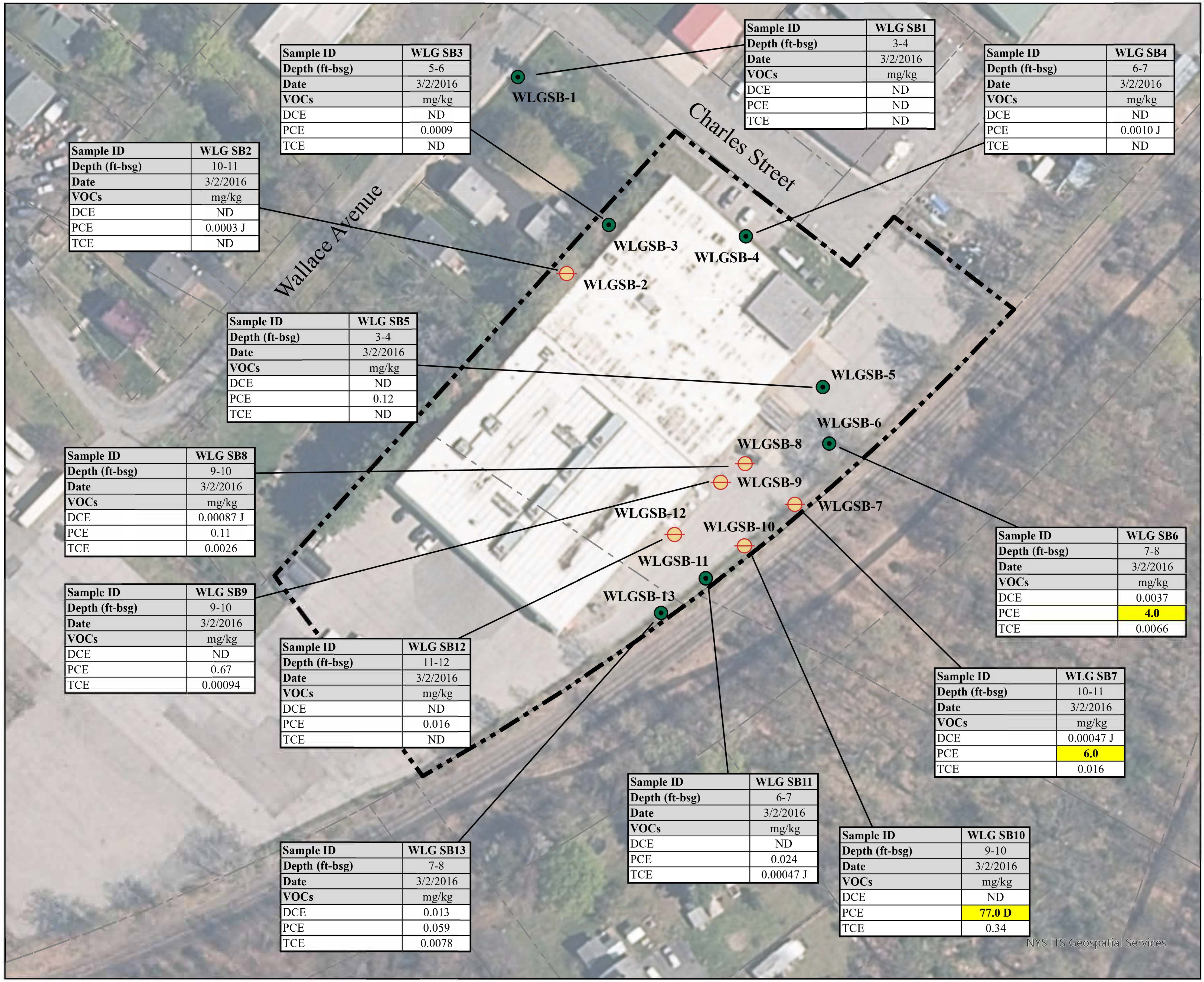
Reference:
2021 Aerial: orthos.its.ny.gov
Parcel Boundaries: Contributing counties, NYS Office of Information Technology Services GIS Program Office (GPO) and NYS Department of Taxation and Finance's Office of Real Property Tax Services (ORPTS).

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	AC
Date	May 2024
Scale	As Noted

Drawing Title
Historical Soil Analytical Results (cVOCs) - 2015/2016 LCS Investigations

Drawing No.
Figure 5



Sample ID	WLG SB1
Depth (ft-bsg)	3-4
Date	3/2/2016
VOCs	mg/kg
DCE	ND
PCE	ND
TCE	ND

Sample ID	WLG SB2
Depth (ft-bsg)	10-11
Date	3/2/2016
VOCs	mg/kg
DCE	ND
PCE	0.0003 J
TCE	ND

Sample ID	WLG SB3
Depth (ft-bsg)	5-6
Date	3/2/2016
VOCs	mg/kg
DCE	ND
PCE	0.0009
TCE	ND

Sample ID	WLG SB4
Depth (ft-bsg)	6-7
Date	3/2/2016
VOCs	mg/kg
DCE	ND
PCE	0.0010 J
TCE	ND

Sample ID	WLG SB5
Depth (ft-bsg)	3-4
Date	3/2/2016
VOCs	mg/kg
DCE	ND
PCE	0.12
TCE	ND

Sample ID	WLG SB6
Depth (ft-bsg)	7-8
Date	3/2/2016
VOCs	mg/kg
DCE	0.0037
PCE	**4.0**
TCE	0.0066

Sample ID	WLG SB7
Depth (ft-bsg)	10-11
Date	3/2/2016
VOCs	mg/kg
DCE	0.00047 J
PCE	**6.0**
TCE	0.016

Sample ID	WLG SB8
Depth (ft-bsg)	9-10
Date	3/2/2016
VOCs	mg/kg
DCE	0.00087 J
PCE	0.11
TCE	0.0026

Sample ID	WLG SB9
Depth (ft-bsg)	9-10
Date	3/2/2016
VOCs	mg/kg
DCE	ND
PCE	0.67
TCE	0.00094

Sample ID	WLG SB10
Depth (ft-bsg)	9-10
Date	3/2/2016
VOCs	mg/kg
DCE	ND
PCE	**77.0 D**
TCE	0.34

Sample ID	WLG SB11
Depth (ft-bsg)	6-7
Date	3/2/2016
VOCs	mg/kg
DCE	ND
PCE	0.024
TCE	0.00047 J

Sample ID	WLG SB12
Depth (ft-bsg)	11-12
Date	3/2/2016
VOCs	mg/kg
DCE	ND
PCE	0.016
TCE	ND

Sample ID	WLG SB13
Depth (ft-bsg)	7-8
Date	3/2/2016
VOCs	mg/kg
DCE	0.013
PCE	0.059
TCE	0.0078

Reference:
2021 Aerial: orthos.its.ny.gov
Parcel Boundaries: Contributing counties, NYS Office of Information Technology Services GIS Program Office (GPO) and NYS Department of Taxation and Finance's Office of Real Property Tax Services (ORPTS).

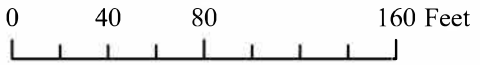
Analyte	NY-UUSCOs/ NY-PGWSCOs	NY-RCSCOs
VOCs	mg/kg	
cis -1,2-Dichloroethene (DCE)	0.25	500
Tetrachloroethene (PCE)	1.3	150
Trichloroethene (TCE)	0.47	200

Notes:
Bold and shaded yellow value indictaes concentration exceeds NY-UUSCOs and NY-PGWSCOs
NY-UUSCOs = 6 NYCRR Part 375 Unrestricted Use Soil Cleanup Objectives
NY-PGWSCOs = 6 NYCRR Part 375 Protection of Groundwater Soil Cleanup Objectives
NY-RCSCOs = 6 NYCRR Part 375 Restricted Use Soil Cleanup Objectives
J = Estimated value
ND = Not detected
ft-bsg = Feet below site grade
Sample locations are approximate

Legend

●	Soil Boring Location
⊖	Soil Boring/Piezometer
▭	BCP Site Boundary
▭	Orange County Tax Lots

Note: Sampling locations are approximate



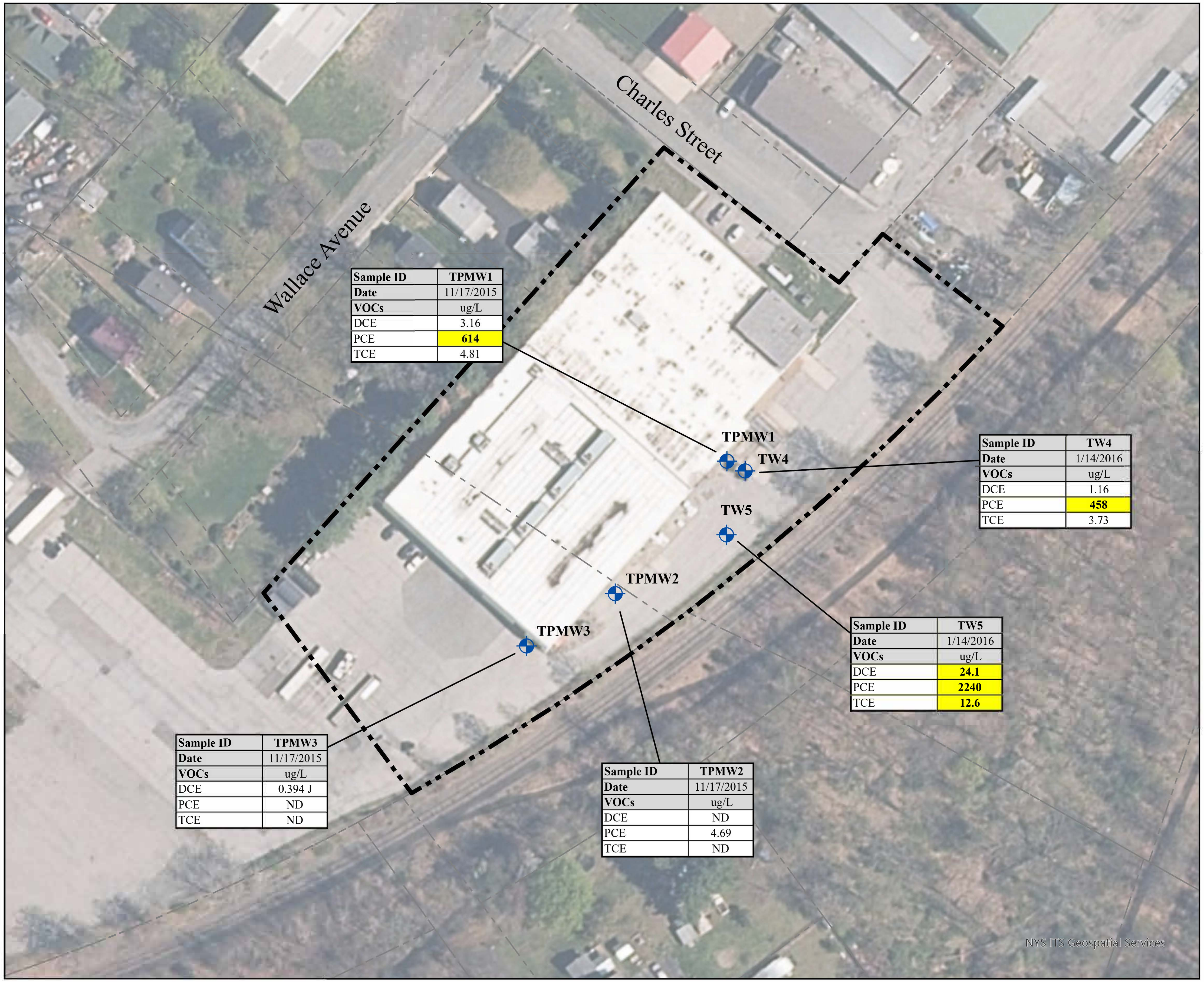
BCP Site No. C336094
Remedial Investigation Work Plan
201 Charles Street
Maybrook, New York
Orange County

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	Checked By	Date	Scale
LM	AC	May 2024	As Noted

Drawing Title
Historical Soil Analytical Results (cVOCs) - 2016 WLG Investigation

Drawing No.
Figure 6



Sample ID	TPMW1
Date	11/17/2015
VOCs	ug/L
DCE	3.16
PCE	**614**
TCE	4.81

Sample ID	TW4
Date	1/14/2016
VOCs	ug/L
DCE	1.16
PCE	**458**
TCE	3.73

Sample ID	TW5
Date	1/14/2016
VOCs	ug/L
DCE	**24.1**
PCE	**2240**
TCE	**12.6**

Sample ID	TPMW2
Date	11/17/2015
VOCs	ug/L
DCE	ND
PCE	4.69
TCE	ND

Sample ID	TPMW3
Date	11/17/2015
VOCs	ug/L
DCE	0.394 J
PCE	ND
TCE	ND

Analyte	NY-AWQS
VOCs	ug/L
cis -1,2-Dichloroethene (DCE)	5
Tetrachloroethene (PCE)	5
Trichloroethene (TCE)	5

Notes:

Bold and shaded yellow value indicates concentration exceeds NY-AWQS

NY-AWQS = NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1 Class GA Ambient Water Quality Standards

J = Estimated value

ND = Not detected

Legend

⊕ Soil Boring/Temproary Monitoring Well Location

▭ Orange County Tax Lots

▭ BCP Site Boundary

Note: Sampling locations are approximate

0 40 80 160 Feet

Reference:
2021 Aerial: orthos.its.ny.gov
Parcel Boundaries: Contributing counties, NYS Office of Information Technology Services GIS Program Office (GPO) and NYS Department of Taxation and Finance's Office of Real Property Tax Services (ORPTS).

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201 Charles Street
Maybrook, New York
Orange County

TENEN ENVIRONMENTAL

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

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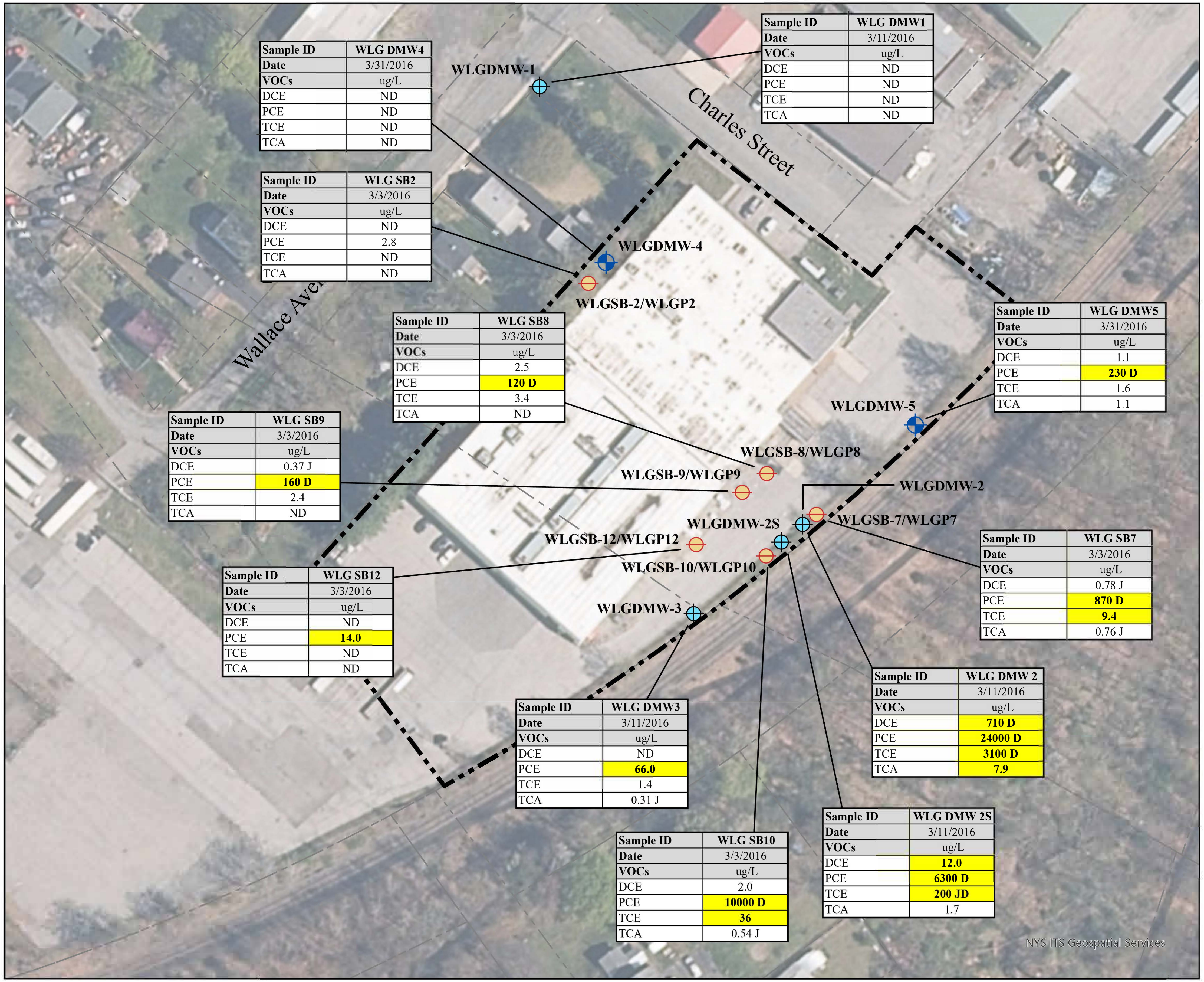
Checked By AC

Date May 2024

Scale As Noted

Drawing Title Historical Groundwater Analytical Results (cVOCs) - 2015/2016 LCS Investigations

Drawing No. Figure 7



Sample ID	**WLG DMW1**
Date	3/11/2016
VOCs	ug/L
DCE	ND
PCE	ND
TCE	ND
TCA	ND

Sample ID	**WLG DMW4**
Date	3/31/2016
VOCs	ug/L
DCE	ND
PCE	ND
TCE	ND
TCA	ND

Sample ID	**WLG SB2**
Date	3/3/2016
VOCs	ug/L
DCE	ND
PCE	2.8
TCE	ND
TCA	ND

Sample ID	**WLG SB8**
Date	3/3/2016
VOCs	ug/L
DCE	2.5
PCE	**120 D**
TCE	3.4
TCA	ND

Sample ID	**WLG SB9**
Date	3/3/2016
VOCs	ug/L
DCE	0.37 J
PCE	**160 D**
TCE	2.4
TCA	ND

Sample ID	**WLG DMW5**
Date	3/31/2016
VOCs	ug/L
DCE	1.1
PCE	**230 D**
TCE	1.6
TCA	1.1

Sample ID	**WLG SB7**
Date	3/3/2016
VOCs	ug/L
DCE	0.78 J
PCE	**870 D**
TCE	**9.4**
TCA	0.76 J

Sample ID	**WLG SB12**
Date	3/3/2016
VOCs	ug/L
DCE	ND
PCE	**14.0**
TCE	ND
TCA	ND

Sample ID	**WLG DMW 2**
Date	3/11/2016
VOCs	ug/L
DCE	**710 D**
PCE	**24000 D**
TCE	**3100 D**
TCA	**7.9**

Sample ID	**WLG DMW3**
Date	3/11/2016
VOCs	ug/L
DCE	ND
PCE	**66.0**
TCE	1.4
TCA	0.31 J

Sample ID	**WLG DMW 2S**
Date	3/11/2016
VOCs	ug/L
DCE	**12.0**
PCE	**6300 D**
TCE	**200 JD**
TCA	1.7

Sample ID	**WLG SB10**
Date	3/3/2016
VOCs	ug/L
DCE	2.0
PCE	**10000 D**
TCE	**36**
TCA	0.54 J

Analyte	**NY-AWQS**
VOCs	**ug/L**
cis -1,2-Dichloroethene (DCE)	5
Tetrachloroethene (PCE)	5
Trichloroethene (TCE)	5
1,1,1-Trichloroethane (TCA)	5

Notes:

Bold and shaded yellow value indicates concentration exceeds NY-AWQS

NY-AWQS = NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1 Class GA Ambient Water Quality Standards

All samples collected using a bailer

All locations are approximate

J = Estimated value

ND = Not detected

D = Diluted

Legend

⊖	Piezometer (1" diameter)
⊕	Monitoring Well (2" diameter)
⊕	Bedrock Well (2" diameter)
▭	BCP Site Boundary
▭	Orange County Tax Lots

Note: Sampling locations are approximate

0 40 80 160 Feet

Reference:
2021 Aerial: orthos.its.ny.gov
Parcel Boundaries: Contributing counties, NYS Office of Information Technology Services GIS Program Office (GPO) and NYS Department of Taxation and Finance's Office of Real Property Tax Services (ORPTS).

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Remedial Investigation Work Plan
201 Charles Street
Maybrook, New York
Orange County

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

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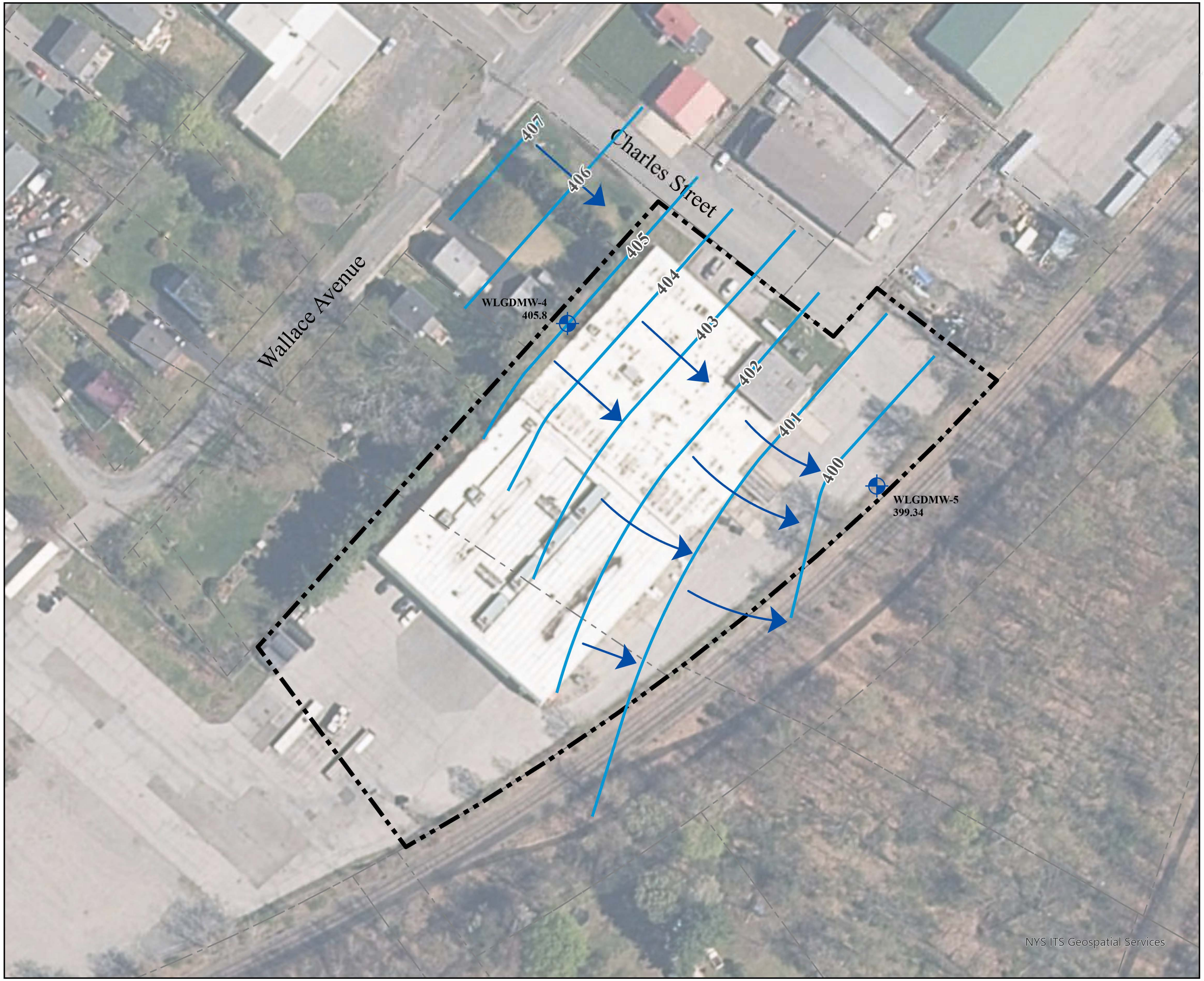
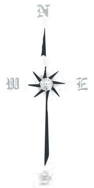
Checked By	AC
Date	May 2024
Scale	As Noted
Drawing Title	Historical Groundwater Analytical Results (cVOCs) - 2016 WLG Investigation
Drawing No.	Figure 8





Legend

⊕ Monitoring Well (2" diameter)
— Groundwater Elevation Contour
→ Groundwater Flow Direction
▭ BCP Site Boundary
▭ Orange County Tax Lots

Note: Sampling locations are approximate

0 40 80 160 Feet

Reference:
2021 Aerial: orthos.its.ny.gov
Groundwater Elevations, Contours and Flow Arrows from William L. Going & Associates, Figure 421, Contour Map of Water Table Elevations showing Hydraulic Gradient and Direction of Groundwater Flow. Measurements taken April 5, 2016..

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201 Charles Street
Maybrook, New York
Orange County

TENEN
ENVIRONMENTAL

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

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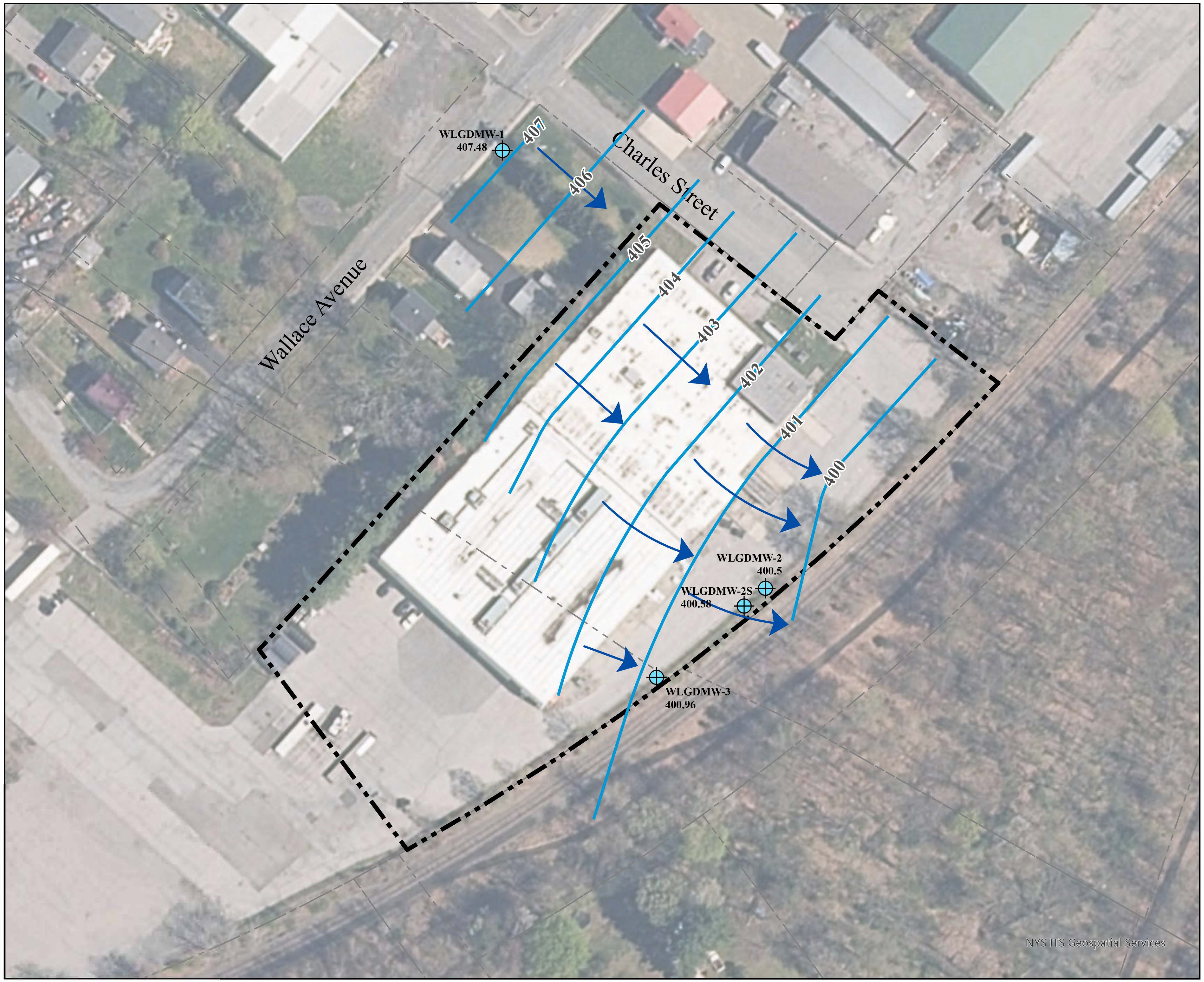
Date	May 2024
Scale	As Noted

Drawing Title
Overburden Groundwater Flow Map -
2016 WLG Investigation

Drawing No.
Figure 9a



Reference:
2021 Aerial: orthos.its.ny.gov
Groundwater Elevations, Contours and Flow Arrows from William L. Going & Associates, Figure 421, Contour Map of Water Table Elevations showing Hydraulic Gradient and Direction of Groundwater Flow. Measurements taken April 5, 2016..

Legend

⊕ Bedrock Well (2" diameter)
→ Groundwater Flow Direction
— Groundwater Elevation Contour
▭ BCP Site Boundary
▭ Orange County Tax Lots

Note: Sampling locations are approximate

0 40 80 160 Feet

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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	AC
Date	May 2024
Scale	As Noted

Drawing Title
Bedrock Groundwater Flow Map -
2016 WLG Investigation

Drawing No.
Figure 9b

Reference:
2021 Aerial: orthos.its.ny.gov
Parcel Boundaries: Contributing counties, NYS Office of Information Technology Services GIS Program Office (GPO) and NYS Department of Taxation and Finance's Office of Real Property Tax Services (ORPTS).

Legend

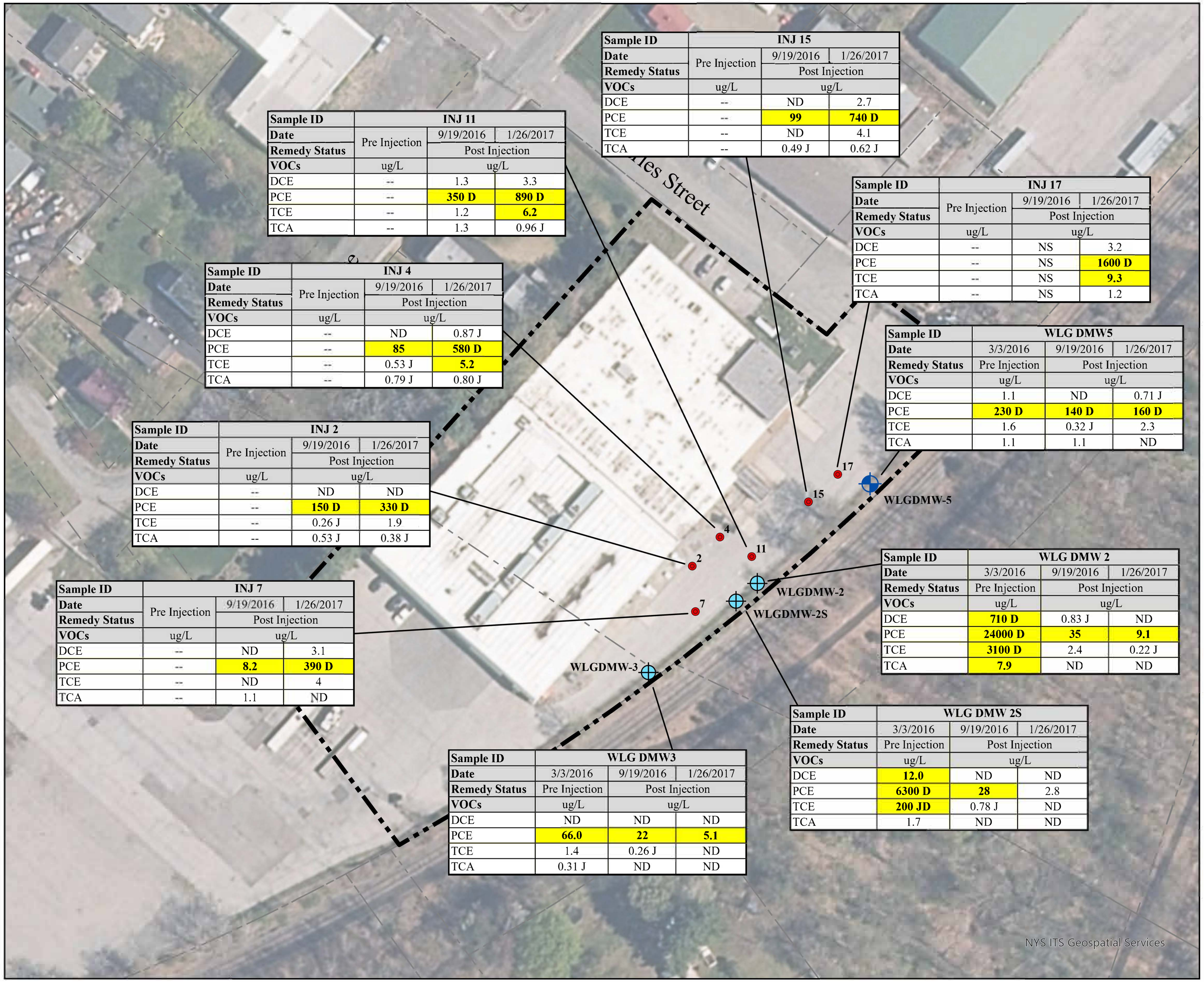
● Injection Wells - 2016-2017 WLG Investigation

Orange County Tax Lots

BCP Site Boundary

0 40 80 160 Feet

Drawing Title Injection Well Location Map	Drawn By LM Checked By AC	TENEN ENVIRONMENTAL Tenen Environmental, LLC 121 West 27th Street, Suite 702 New York, NY 10001 O: (646) 606-2332; F: (646) 606-2379	BCP Site No. C336094 Remedial Investigation Work Plan 201 Charles Street Maybrook, New York Orange County
Drawing No. Figure 10	Date May 2024 Scale As Noted		



Sample ID	INJ 15		
Date	Pre Injection	9/19/2016	1/26/2017
Remedy Status		Post Injection	
VOCs	ug/L	ug/L	
DCE	--	ND	2.7
PCE	--	**99**	**740 D**
TCE	--	ND	4.1
TCA	--	0.49 J	0.62 J

Sample ID	INJ 11		
Date	Pre Injection	9/19/2016	1/26/2017
Remedy Status		Post Injection	
VOCs	ug/L	ug/L	
DCE	--	1.3	3.3
PCE	--	**350 D**	**890 D**
TCE	--	1.2	**6.2**
TCA	--	1.3	0.96 J

Sample ID	INJ 17		
Date	Pre Injection	9/19/2016	1/26/2017
Remedy Status		Post Injection	
VOCs	ug/L	ug/L	
DCE	--	NS	3.2
PCE	--	NS	**1600 D**
TCE	--	NS	**9.3**
TCA	--	NS	1.2

Sample ID	INJ 4		
Date	Pre Injection	9/19/2016	1/26/2017
Remedy Status		Post Injection	
VOCs	ug/L	ug/L	
DCE	--	ND	0.87 J
PCE	--	**85**	**580 D**
TCE	--	0.53 J	**5.2**
TCA	--	0.79 J	0.80 J

Sample ID	WLG DMW5		
Date	3/3/2016	9/19/2016	1/26/2017
Remedy Status	Pre Injection	Post Injection	
VOCs	ug/L	ug/L	
DCE	1.1	ND	0.71 J
PCE	**230 D**	**140 D**	**160 D**
TCE	1.6	0.32 J	2.3
TCA	1.1	1.1	ND

Sample ID	INJ 2		
Date	Pre Injection	9/19/2016	1/26/2017
Remedy Status		Post Injection	
VOCs	ug/L	ug/L	
DCE	--	ND	ND
PCE	--	**150 D**	**330 D**
TCE	--	0.26 J	1.9
TCA	--	0.53 J	0.38 J

Sample ID	WLG DMW 2		
Date	3/3/2016	9/19/2016	1/26/2017
Remedy Status	Pre Injection	Post Injection	
VOCs	ug/L	ug/L	
DCE	**710 D**	0.83 J	ND
PCE	**24000 D**	**35**	**9.1**
TCE	**3100 D**	2.4	0.22 J
TCA	**7.9**	ND	ND

Sample ID	INJ 7		
Date	Pre Injection	9/19/2016	1/26/2017
Remedy Status		Post Injection	
VOCs	ug/L	ug/L	
DCE	--	ND	3.1
PCE	--	**8.2**	**390 D**
TCE	--	ND	4
TCA	--	1.1	ND

Sample ID	WLG DMW 2S		
Date	3/3/2016	9/19/2016	1/26/2017
Remedy Status	Pre Injection	Post Injection	
VOCs	ug/L	ug/L	
DCE	**12.0**	ND	ND
PCE	**6300 D**	**28**	2.8
TCE	**200 JD**	0.78 J	ND
TCA	1.7	ND	ND

Sample ID	WLG DMW3		
Date	3/3/2016	9/19/2016	1/26/2017
Remedy Status	Pre Injection	Post Injection	
VOCs	ug/L	ug/L	
DCE	ND	ND	ND
PCE	**66.0**	**22**	**5.1**
TCE	1.4	0.26 J	ND
TCA	0.31 J	ND	ND

Reference:
2021 Aerial: orthos.its.ny.gov
Parcel Boundaries: Contributing counties, NYS Office of Information Technology Services GIS Program Office (GPO) and NYS Department of Taxation and Finance's Office of Real Property Tax Services (ORPTS).

Analyte	NY-AWQS
VOCs	ug/L
cis -1,2-Dichloroethene (DCE)	5
Tetrachloroethene (PCE)	5
Trichloroethene (TCE)	5
1,1,1-Trichloroethane (TCA)	5

Notes:
Bold and shaded yellow value indicates concentration exceeds NY-AWQS
NY-AWQS = NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1 Class GA Ambient Water Quality Standards
All samples collected using a bailer
PersulfOx injection events occurred in June and July 2016
All locations are approximate
J = Estimated value
ND = Not detected
D = Diluted
-- = Not Installed
NS = Not Sampled

Legend

⊕ Monitoring Well (2" diameter)
⊕ Bedrock Well (2" diameter)
● Injection Well (2" diameter)
BCP Site Boundary
Orange County Tax Lots

Note: Sampling locations are approximate

0 40 80 160 Feet

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

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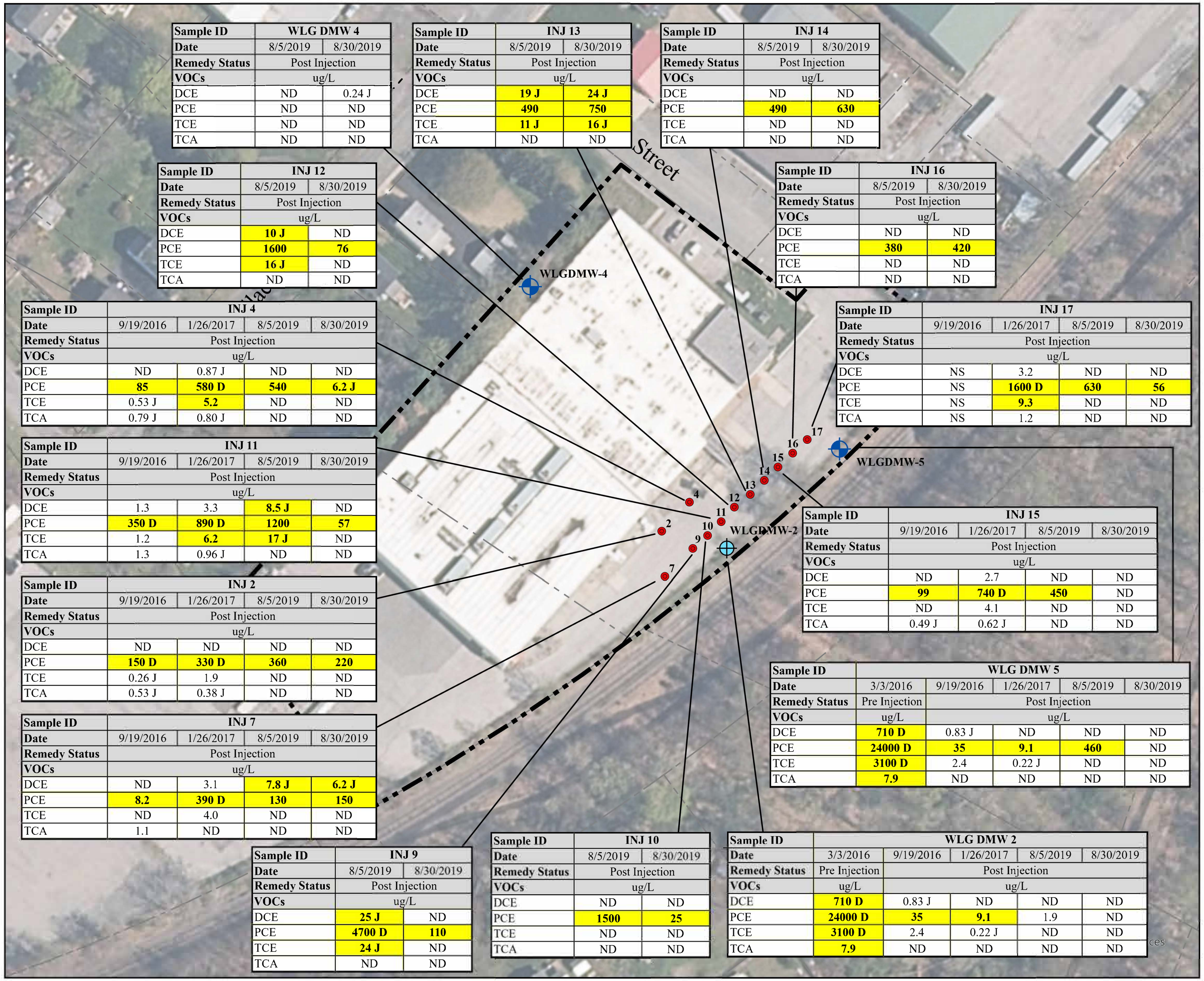
Drawing Title Post Remedial Groundwater Analytical Results (cVOCs) - 2016/2017 WLG Sampling

Drawing No. Figure 11



Sample ID	WLG DMW 4	
Date	8/5/2019	8/30/2019
Remedy Status	Post Injection	
VOCs	ug/L	
DCE	ND	0.24 J
PCE	ND	ND
TCE	ND	ND
TCA	ND	ND

Sample ID	INJ 13	
Date	8/5/2019	8/30/2019
Remedy Status	Post Injection	
VOCs	ug/L	
DCE	**19 J**	**24 J**
PCE	**490**	**750**
TCE	**11 J**	**16 J**
TCA	ND	ND

Sample ID	INJ 14	
Date	8/5/2019	8/30/2019
Remedy Status	Post Injection	
VOCs	ug/L	
DCE	ND	ND
PCE	**490**	**630**
TCE	ND	ND
TCA	ND	ND

Sample ID	INJ 12	
Date	8/5/2019	8/30/2019
Remedy Status	Post Injection	
VOCs	ug/L	
DCE	**10 J**	ND
PCE	**1600**	**76**
TCE	**16 J**	ND
TCA	ND	ND

Sample ID	INJ 16	
Date	8/5/2019	8/30/2019
Remedy Status	Post Injection	
VOCs	ug/L	
DCE	ND	ND
PCE	**380**	**420**
TCE	ND	ND
TCA	ND	ND

Sample ID	INJ 4			
Date	9/19/2016	1/26/2017	8/5/2019	8/30/2019
Remedy Status	Post Injection			
VOCs	ug/L			
DCE	ND	0.87 J	ND	ND
PCE	**85**	**580 D**	**540**	**6.2 J**
TCE	0.53 J	**5.2**	ND	ND
TCA	0.79 J	0.80 J	ND	ND

Sample ID	INJ 17			
Date	9/19/2016	1/26/2017	8/5/2019	8/30/2019
Remedy Status	Post Injection			
VOCs	ug/L			
DCE	NS	3.2	ND	ND
PCE	NS	**1600 D**	**630**	**56**
TCE	NS	**9.3**	ND	ND
TCA	NS	1.2	ND	ND

Sample ID	INJ 11			
Date	9/19/2016	1/26/2017	8/5/2019	8/30/2019
Remedy Status	Post Injection			
VOCs	ug/L			
DCE	1.3	3.3	**8.5 J**	ND
PCE	**350 D**	**890 D**	**1200**	**57**
TCE	1.2	**6.2**	**17 J**	ND
TCA	1.3	0.96 J	ND	ND

Sample ID	INJ 15			
Date	9/19/2016	1/26/2017	8/5/2019	8/30/2019
Remedy Status	Post Injection			
VOCs	ug/L			
DCE	ND	2.7	ND	ND
PCE	**99**	**740 D**	**450**	ND
TCE	ND	4.1	ND	ND
TCA	0.49 J	0.62 J	ND	ND

Sample ID	INJ 2			
Date	9/19/2016	1/26/2017	8/5/2019	8/30/2019
Remedy Status	Post Injection			
VOCs	ug/L			
DCE	ND	ND	ND	ND
PCE	**150 D**	**330 D**	**360**	**220**
TCE	0.26 J	1.9	ND	ND
TCA	0.53 J	0.38 J	ND	ND

Sample ID	WLG DMW 5				
Date	3/3/2016	9/19/2016	1/26/2017	8/5/2019	8/30/2019
Remedy Status	Pre Injection	Post Injection			
VOCs	ug/L	ug/L			
DCE	**710 D**	0.83 J	ND	ND	ND
PCE	**24000 D**	**35**	**9.1**	**460**	ND
TCE	**3100 D**	2.4	0.22 J	ND	ND
TCA	**7.9**	ND	ND	ND	ND

Sample ID	INJ 7			
Date	9/19/2016	1/26/2017	8/5/2019	8/30/2019
Remedy Status	Post Injection			
VOCs	ug/L			
DCE	ND	3.1	**7.8 J**	**6.2 J**
PCE	**8.2**	**390 D**	**130**	**150**
TCE	ND	4.0	ND	ND
TCA	1.1	ND	ND	ND

Sample ID	INJ 9	
Date	8/5/2019	8/30/2019
Remedy Status	Post Injection	
VOCs	ug/L	
DCE	**25 J**	ND
PCE	**4700 D**	**110**
TCE	**24 J**	ND
TCA	ND	ND

Sample ID	INJ 10	
Date	8/5/2019	8/30/2019
Remedy Status	Post Injection	
VOCs	ug/L	
DCE	ND	ND
PCE	**1500**	**25**
TCE	ND	ND
TCA	ND	ND

Sample ID	WLG DMW 2				
Date	3/3/2016	9/19/2016	1/26/2017	8/5/2019	8/30/2019
Remedy Status	Pre Injection	Post Injection			
VOCs	ug/L	ug/L			
DCE	**710 D**	0.83 J	ND	ND	ND
PCE	**24000 D**	**35**	**9.1**	1.9	ND
TCE	**3100 D**	2.4	0.22 J	ND	ND
TCA	**7.9**	ND	ND	ND	ND

Reference:
2021 Aerial: orthos.its.ny.gov
Parcel Boundaries: Contributing counties, NYS Office of Information Technology Services GIS Program Office (GPO) and NYS Department of Taxation and Finance's Office of Real Property Tax Services (ORPTS).

Analyte	NY- AWQS
VOCs	ug/L
cis -1,2-Dichloroethene (DCE)	5
Tetrachloroethene (PCE)	5
Trichloroethene (TCE)	5
1,1,1-Trichloroethane (TCA)	5

Notes:

Bold and shaded yellow value indicates concentration exceeds NY-AWQS

NY-AWQS = NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1 Class GA Ambient Water Quality Standards

Sample collection method is unknown for 2019 samples

Injection wells [designated "INJ"] were not sampled prior to initial injection.

Injection wells: 1, 3, 5, 6, 8, 9, 10, 12, 13 ,14, 16 and mointoring well WLG DMW 4 were not sampled post injection prior to 8/05/2019

PersulfOx injection events occurred in June and July 2016

All locations are approximate

J = Estimated value

ND = Not detected

D = Diluted

NS = Not Sampled

Only wells sampled in 2019 are shown on this map

Legend

- ⊕ Monitoring Well (2" diameter)
- ⊕ Bedrock Well (2" diameter)
- ● Injection Well (2" diameter)
- BCP Site Boundary
- Orange County Tax Lots

Note: Sampling locations are approximate

0 40 80 160 Feet

BCP Site No. C336094
Remedial Investigation Work Plan
201 Charles Street
Maybrook, New York
Orange County

TENEN ENVIRONMENTAL
Tenen Environmental, LLC
121 West 27th Street, Suite 702
New York, NY 10001
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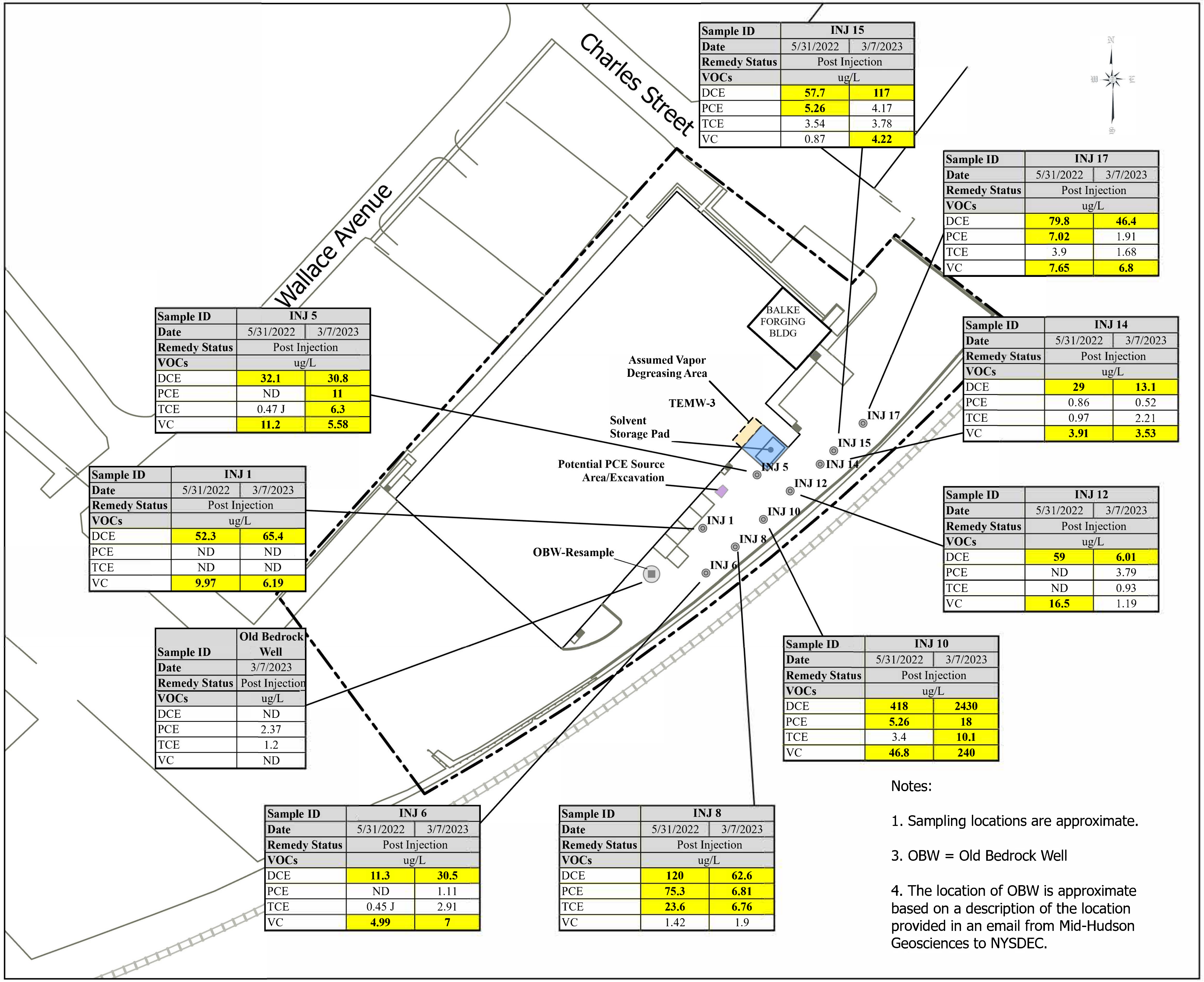
Drawn By LM
Checked By AC
Date May 2024
Scale As Noted

Drawing Title Post-Remedial Groundwater Analytical Results (cVOCs) - 2019 WLG Sampling

Drawing No. Figure 12



Sample ID	INJ 15	
Date	5/31/2022	3/7/2023
Remedy Status	Post Injection	
VOCs	ug/L	
DCE	**57.7**	**117**
PCE	**5.26**	4.17
TCE	3.54	3.78
VC	0.87	**4.22**

Sample ID	INJ 17	
Date	5/31/2022	3/7/2023
Remedy Status	Post Injection	
VOCs	ug/L	
DCE	**79.8**	**46.4**
PCE	**7.02**	1.91
TCE	3.9	1.68
VC	**7.65**	**6.8**

Sample ID	INJ 5	
Date	5/31/2022	3/7/2023
Remedy Status	Post Injection	
VOCs	ug/L	
DCE	**32.1**	**30.8**
PCE	ND	**11**
TCE	0.47 J	**6.3**
VC	**11.2**	**5.58**

Sample ID	INJ 14	
Date	5/31/2022	3/7/2023
Remedy Status	Post Injection	
VOCs	ug/L	
DCE	**29**	**13.1**
PCE	0.86	0.52
TCE	0.97	2.21
VC	**3.91**	**3.53**

Sample ID	INJ 1	
Date	5/31/2022	3/7/2023
Remedy Status	Post Injection	
VOCs	ug/L	
DCE	**52.3**	**65.4**
PCE	ND	ND
TCE	ND	ND
VC	**9.97**	**6.19**

Sample ID	INJ 12	
Date	5/31/2022	3/7/2023
Remedy Status	Post Injection	
VOCs	ug/L	
DCE	**59**	**6.01**
PCE	ND	3.79
TCE	ND	0.93
VC	**16.5**	1.19

Sample ID	Old Bedrock Well
Date	3/7/2023
Remedy Status	Post Injection
VOCs	ug/L
DCE	ND
PCE	2.37
TCE	1.2
VC	ND

Sample ID	INJ 10	
Date	5/31/2022	3/7/2023
Remedy Status	Post Injection	
VOCs	ug/L	
DCE	**418**	**2430**
PCE	**5.26**	**18**
TCE	3.4	**10.1**
VC	**46.8**	**240**

Sample ID	INJ 6	
Date	5/31/2022	3/7/2023
Remedy Status	Post Injection	
VOCs	ug/L	
DCE	**11.3**	**30.5**
PCE	ND	1.11
TCE	0.45 J	2.91
VC	**4.99**	**7**

Sample ID	INJ 8	
Date	5/31/2022	3/7/2023
Remedy Status	Post Injection	
VOCs	ug/L	
DCE	**120**	**62.6**
PCE	**75.3**	**6.81**
TCE	**23.6**	**6.76**
VC	1.42	1.9

Notes:

1. Sampling locations are approximate.

3. OBW = Old Bedrock Well

4. The location of OBW is approximate based on a description of the location provided in an email from Mid-Hudson Geosciences to NYSDEC.

Reference:
2021 Aerial: orthos.its.ny.gov
T.M Depuy Engineering & Land Surveying, 4/14/2016 Survey

Analyte	NY-AWQS
VOCs	ug/L
cis -1,2-Dichloroethene (DCE)	5
Tetrachloroethene (PCE)	5
Trichloroethene (TCE)	5
Vinyl chloride (VC)	2

Notes:
Bold and shaded yellow value indicates concentration exceeds NY AWQS
NY-AWQS = NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1 Class GA Ambient Water Quality Standards
Sample collection method is unknown for all samples
Injection wells [designated "INJ"] were not sampled prior to initial injection.
Injection wells: 1, 5, 6, 8, 10, 12, 14, 15, and 17 were not sampled post injection by Mid-Hudson Geosciences prior to 5/31/2022
Monitoring wells MW-5 and Old Bedrock Well were not sampled post injection by Mid-Hudson Geosciences prior to 3/7/2023
PersulfOx injection events occurred in June and July 2016
All locations are approximate
J = Estimated value
ND = Not detected

◎	Injection Wells - 2016-2017 WLG Investigation (2" diameter)
▣	Bedrock Well (2" diameter)
⬚	BCP Site Boundary

0 40 80 160 Feet

BCP Site No. C336094
Remedial Investigation Work Plan
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Orange County

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Tenen Environmental, LLC
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New York, NY 10001
O: (646) 606-2332; F: (646) 606-2379

Drawn By	LM
Checked By	AP
Date	May 2024
Scale	As Noted

Drawing Title
Post-Remedial Groundwater Analytical Results (cVOCs) – 2021/2022/2023 Mid-Hudson Geosciences Sampling

Drawing No.
Figure 13

Sample ID	Indoor
Date	1/14/2016
VOCs	ug/m^3
Tetrachloroethene	42.6
Trichloroethene	ND
cis-1,2-Dichloroethene	ND
Carbon tetrachloride	0.597 J
Vinyl chloride	ND
Methylene chloride	ND

Sample ID	SS3
Date	1/14/2016
VOCs	ug/m^3
Tetrachloroethene	2360
Trichloroethene	0.725 J
cis-1,2-Dichloroethene	ND
Carbon tetrachloride	0.479 J
Vinyl chloride	ND
Methylene chloride	ND

Sample ID	SS2
Date	1/14/2016
VOCs	ug/m^3
Tetrachloroethene	18.9
Trichloroethene	ND
cis-1,2-Dichloroethene	ND
Carbon tetrachloride	0.490 J
Vinyl chloride	ND
Methylene chloride	ND

Sample ID	Outdoor
Date	1/14/2016
VOCs	ug/m^3
Tetrachloroethene	ND
Trichloroethene	ND
cis-1,2-Dichloroethene	ND
Carbon tetrachloride	0.550 J
Vinyl chloride	ND
Methylene chloride	ND

Sample ID	SS1
Date	1/14/2016
VOCs	ug/m^3
Tetrachloroethene	618
Trichloroethene	7.49
cis-1,2-Dichloroethene	ND
Carbon tetrachloride	0.422 J
Vinyl chloride	ND
Methylene chloride	ND

Reference:
2021 Aerial: orthos.its.ny.gov
Parcel Boundaries: Contributing counties, NYS Office of Information Technology Services GIS Program Office (GPO) and NYS Department of Taxation and Finance's Office of Real Property Tax Services (ORPTS).

Notes:
ND = Not detected
All samples were collected over an 8-hour duration

Legend

▲	Sub-Slab Soil Vapor Sample Location
▲	Indoor Air Sample
▣	Outdoor Air Sample
⬚	Orange County Tax lots
⬚	BCP Site Boundary

Note: Sampling locations are approximate

0 40 80 160 Feet

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Maybrook, New York
Orange County

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O: (646) 606-2332; F: (646) 606-2379

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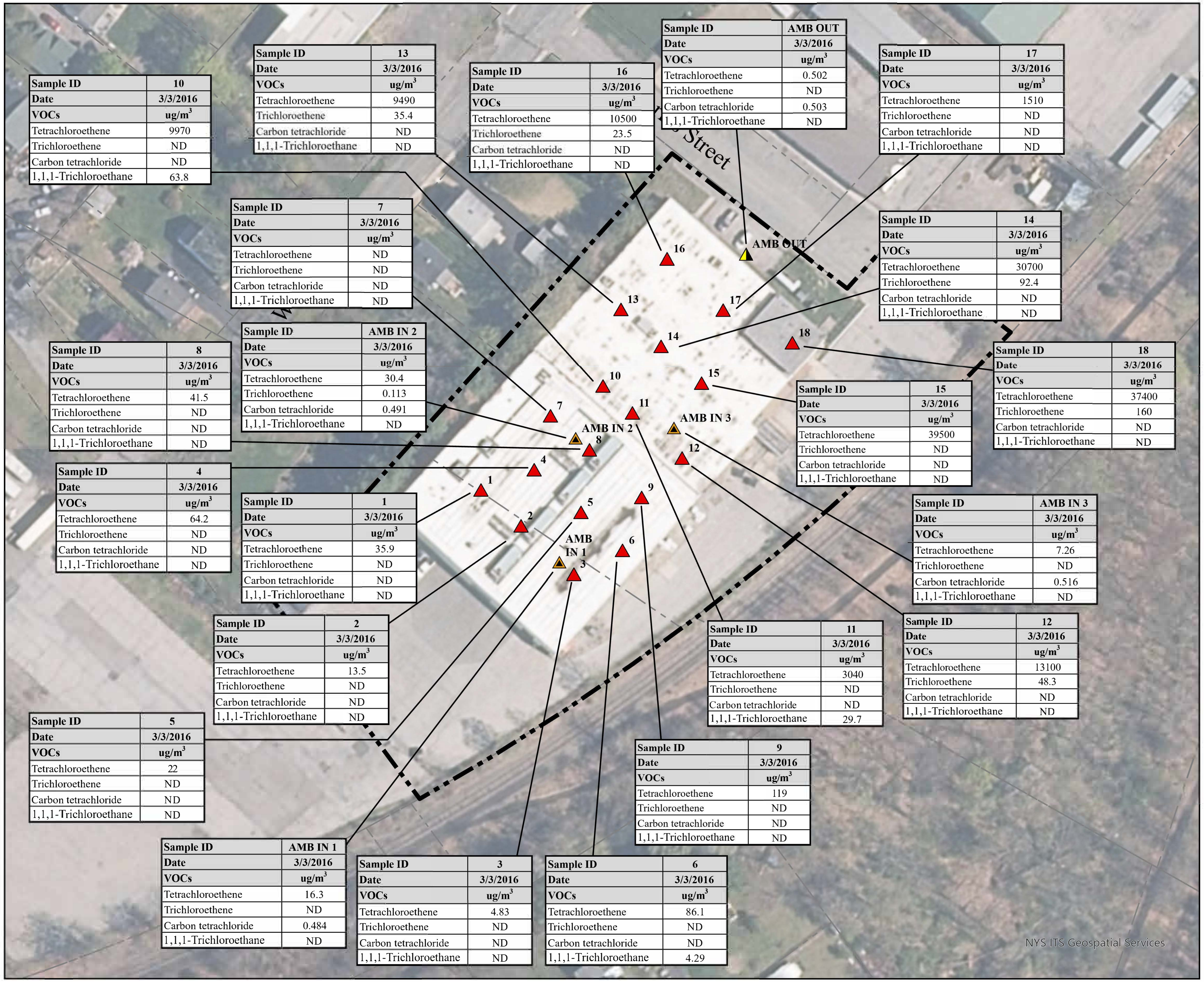
Checked By	AC
Date	May 2024
Scale	As Noted

Drawing Title
Historical Soil Vapor Analytical Results (cVOCs) - 2016 LCS Investigations

Drawing No.
Figure 14



Sample ID	10
Date	3/3/2016
VOCs	ug/m^3
Tetrachloroethene	9970
Trichloroethene	ND
Carbon tetrachloride	ND
1,1,1-Trichloroethane	63.8

Sample ID	13
Date	3/3/2016
VOCs	ug/m^3
Tetrachloroethene	9490
Trichloroethene	35.4
Carbon tetrachloride	ND
1,1,1-Trichloroethane	ND

Sample ID	16
Date	3/3/2016
VOCs	ug/m^3
Tetrachloroethene	10500
Trichloroethene	23.5
Carbon tetrachloride	ND
1,1,1-Trichloroethane	ND

Sample ID	AMB OUT
Date	3/3/2016
VOCs	ug/m^3
Tetrachloroethene	0.502
Trichloroethene	ND
Carbon tetrachloride	0.503
1,1,1-Trichloroethane	ND

Sample ID	17
Date	3/3/2016
VOCs	ug/m^3
Tetrachloroethene	1510
Trichloroethene	ND
Carbon tetrachloride	ND
1,1,1-Trichloroethane	ND

Sample ID	7
Date	3/3/2016
VOCs	ug/m^3
Tetrachloroethene	ND
Trichloroethene	ND
Carbon tetrachloride	ND
1,1,1-Trichloroethane	ND

Sample ID	14
Date	3/3/2016
VOCs	ug/m^3
Tetrachloroethene	30700
Trichloroethene	92.4
Carbon tetrachloride	ND
1,1,1-Trichloroethane	ND

Sample ID	AMB IN 2
Date	3/3/2016
VOCs	ug/m^3
Tetrachloroethene	30.4
Trichloroethene	0.113
Carbon tetrachloride	0.491
1,1,1-Trichloroethane	ND

Sample ID	8
Date	3/3/2016
VOCs	ug/m^3
Tetrachloroethene	41.5
Trichloroethene	ND
Carbon tetrachloride	ND
1,1,1-Trichloroethane	ND

Sample ID	18
Date	3/3/2016
VOCs	ug/m^3
Tetrachloroethene	37400
Trichloroethene	160
Carbon tetrachloride	ND
1,1,1-Trichloroethane	ND

Sample ID	15
Date	3/3/2016
VOCs	ug/m^3
Tetrachloroethene	39500
Trichloroethene	ND
Carbon tetrachloride	ND
1,1,1-Trichloroethane	ND

Sample ID	4
Date	3/3/2016
VOCs	ug/m^3
Tetrachloroethene	64.2
Trichloroethene	ND
Carbon tetrachloride	ND
1,1,1-Trichloroethane	ND

Sample ID	1
Date	3/3/2016
VOCs	ug/m^3
Tetrachloroethene	35.9
Trichloroethene	ND
Carbon tetrachloride	ND
1,1,1-Trichloroethane	ND

Sample ID	AMB IN 3
Date	3/3/2016
VOCs	ug/m^3
Tetrachloroethene	7.26
Trichloroethene	ND
Carbon tetrachloride	0.516
1,1,1-Trichloroethane	ND

Sample ID	2
Date	3/3/2016
VOCs	ug/m^3
Tetrachloroethene	13.5
Trichloroethene	ND
Carbon tetrachloride	ND
1,1,1-Trichloroethane	ND

Sample ID	11
Date	3/3/2016
VOCs	ug/m^3
Tetrachloroethene	3040
Trichloroethene	ND
Carbon tetrachloride	ND
1,1,1-Trichloroethane	29.7

Sample ID	12
Date	3/3/2016
VOCs	ug/m^3
Tetrachloroethene	13100
Trichloroethene	48.3
Carbon tetrachloride	ND
1,1,1-Trichloroethane	ND

Sample ID	5
Date	3/3/2016
VOCs	ug/m^3
Tetrachloroethene	22
Trichloroethene	ND
Carbon tetrachloride	ND
1,1,1-Trichloroethane	ND

Sample ID	9
Date	3/3/2016
VOCs	ug/m^3
Tetrachloroethene	119
Trichloroethene	ND
Carbon tetrachloride	ND
1,1,1-Trichloroethane	ND

Sample ID	AMB IN 1
Date	3/3/2016
VOCs	ug/m^3
Tetrachloroethene	16.3
Trichloroethene	ND
Carbon tetrachloride	0.484
1,1,1-Trichloroethane	ND

Sample ID	3
Date	3/3/2016
VOCs	ug/m^3
Tetrachloroethene	4.83
Trichloroethene	ND
Carbon tetrachloride	ND
1,1,1-Trichloroethane	ND

Sample ID	6
Date	3/3/2016
VOCs	ug/m^3
Tetrachloroethene	86.1
Trichloroethene	ND
Carbon tetrachloride	ND
1,1,1-Trichloroethane	4.29

Reference:
2021 Aerial: orthos.its.ny.gov
Parcel Boundaries: Contributing counties, NYS Office of Information Technology Services GIS Program Office (GPO) and NYS Department of Taxation and Finance's Office of Real Property Tax Services (ORPTS).

Notes:

ND = Not detected
All samples were collected over an 8-hour duration
All locations are approximate
Chlorinated volatile organic compounds listed were detected in at least one sample collected.
Sample designations for indoor and ambient air do not match the various documents provided. It is assumed that sample "A" coorelates to AMB-IN1, "B"= AMB-IN2, "C"=AMB-IN3 and "D"=AMB OUT

Legend

SampleType

▲	Sub-Slab Soil Vapor Sample Location
▲	Indoor Ambient Air Sample Location
▲	Outdoor Ambient Air Sample Location
▭	BCP Site Boundary
▭	Orange County Tax lots

Note: Sampling locations are approximate

0 40 80 160 Feet

BCP Site No. C336094
Remedial Investigation Work Plan
201 Charles Street
Maybrook, New York
Orange County

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 AC
Date May 2024
Scale As Noted

Drawing Title Historical Soil Vapor Analytical Results (cVOCs) - 2016 WLG Investigation

Drawing No. Figure 15

Reference:
2021 Aerial: orthos.its.ny.gov
Parcel Boundaries: Contributing counties, NYS Office of Information Technology Services GIS Program Office (GPO) and NYS Department of Taxation and Finance's Office of Real Property Tax Services (ORPTS).

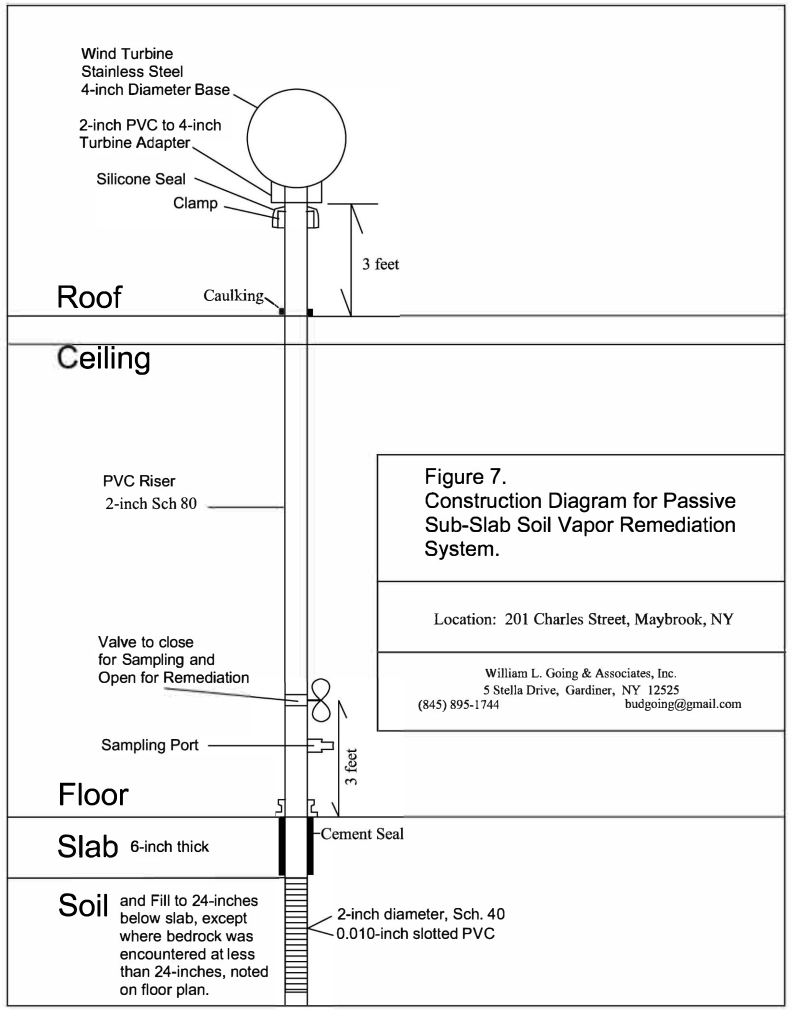


Figure 7.
Construction Diagram for Passive Sub-Slab Soil Vapor Remediation System.

Location: 201 Charles Street, Maybrook, NY

William L. Going & Associates, Inc.
5 Stella Drive, Gardiner, NY 12525
(845) 895-1744 budgoing@gmail.com

Legend

●	Location and Depths of Sub-Slab Vents
⬚	TaxLots_Neighboring
⬚	BCP Site Boundary

Note:
Passive soil vapor venting system layout based on drawings provided by others. Subsequent system modifications have been made and this does not reflect the above-grade conditions.

0 40 80 160 Feet

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Orange County

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Drawn By	Checked By	Date	Scale
LM	AC	May 2024	As Noted

Drawing Title
Soil Vapor Venting System Layout

Drawing No.
Figure 16

Legend

● Injection Wells - 2016-2017 WLG Investigation

▭ BCP Site Boundary

▭ Orange County Tax Lots

PCE in GW µg/L (2016 WLG Investigation)

🟩	5 - 100
🟩	100 - 200
🟨	200 - 400
🟨	400 - 800
🟧	800 - 1600
🟧	1600 - 3200
🟫	3200 - 6400
🟪	6400 - 12800
⬜	12800 - 24000

0 40 80 160 Feet

Reference:
2021 Aerial: orthos.its.ny.gov
Parcel Boundaries: Contributing counties, NYS Office of Information Technology Services GIS Program Office (GPO) and NYS Department of Taxation and Finance's Office of Real Property Tax Services (ORPTS).

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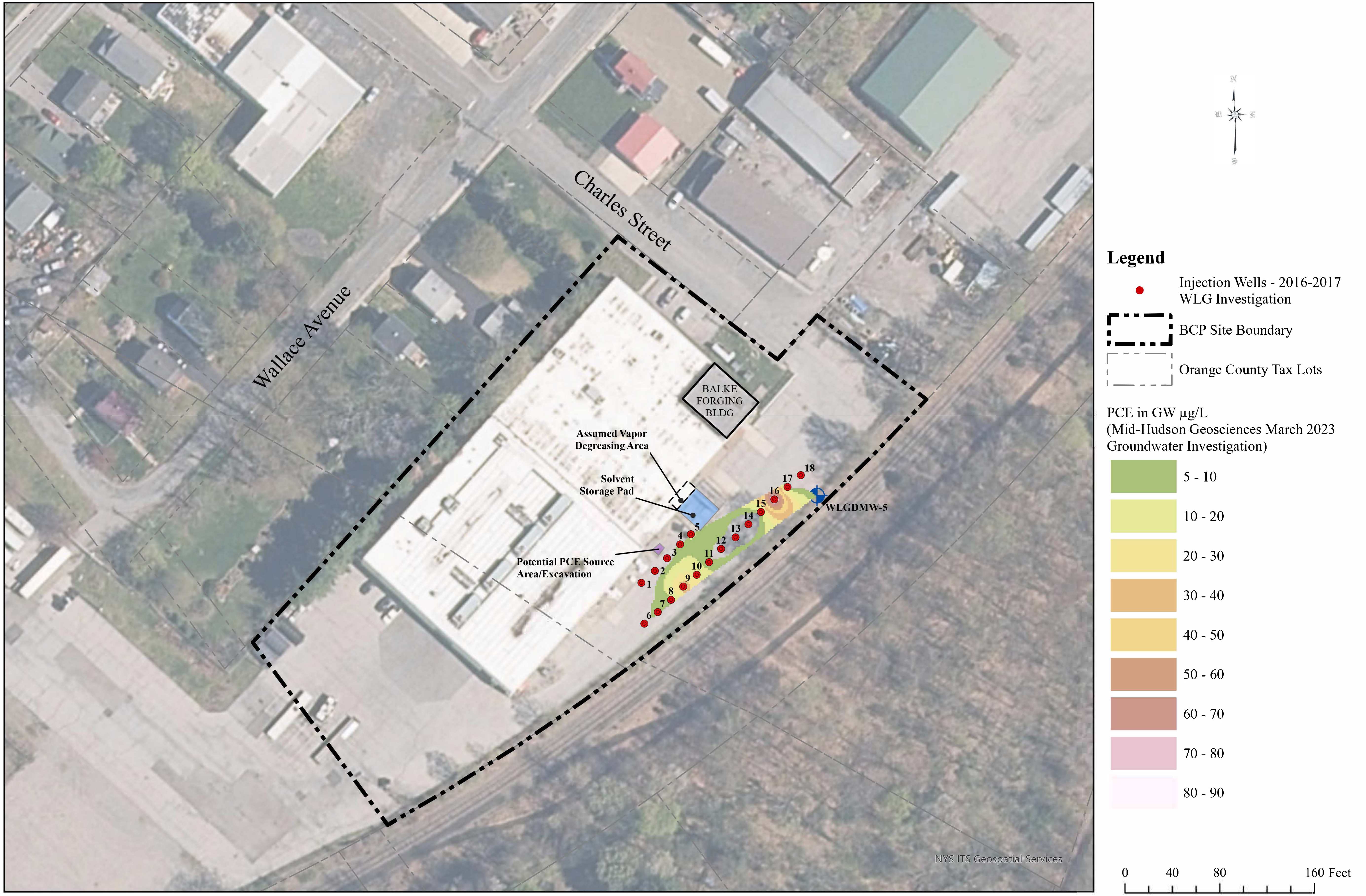
Drawn By LM
Checked By AC
Date May 2024
Scale As Noted

Drawing Title
Pre-Injection Overburden
PCE Plume Map - March 2016

Drawing No.
Figure 17



Reference:
2021 Aerial: orthos.its.ny.gov
Parcel Boundaries: Contributing counties, NYS Office of Information Technology Services GIS Program Office (GPO) and NYS Department of Taxation and Finance's Office of Real Property Tax Services (ORPTS).

BCP Site No. C336094
Remedial Investigation Work Plan
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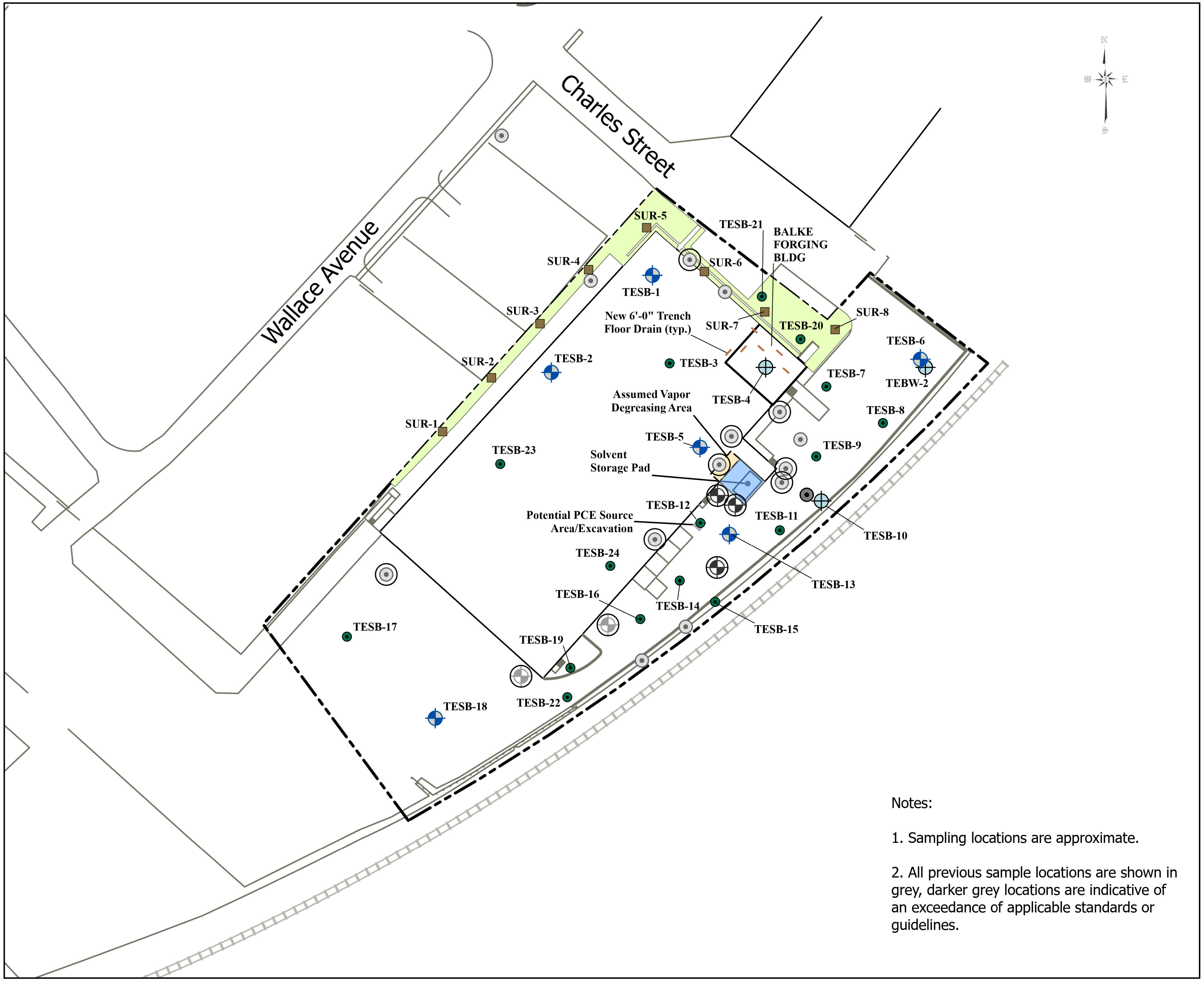
Drawing Title
Post-Injection Overburden
PCE Plume Map - March 2023

Drawing No.
Figure 18



Notes:

1. Sampling locations are approximate.

2. All previous sample locations are shown in grey, darker grey locations are indicative of an exceedance of applicable standards or guidelines.

▭ BCP Site Boundary

🟩 Exposed Soil

WLG Investigations, 2016, 2017, 2019

◉ Soil Boring Location

LCS Investigations, 2015, 2016

◉ Soil Boring Location

⊕ Soil Boring/Temproary Monitoring Well Location

Proposed RI Sample Locations

● Soil Boring Location

⊕ Soil Boring/Monitoring Well Location

⊕ Soil Boring/Bedrock Well Location

■ Surface Soil Sample Location

0 40 80 160 Feet

Reference:
2021 Aerial: orthos.its.ny.gov
T.M Depuy Engineering & Land Surveying, 4/14/2016 Survey

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

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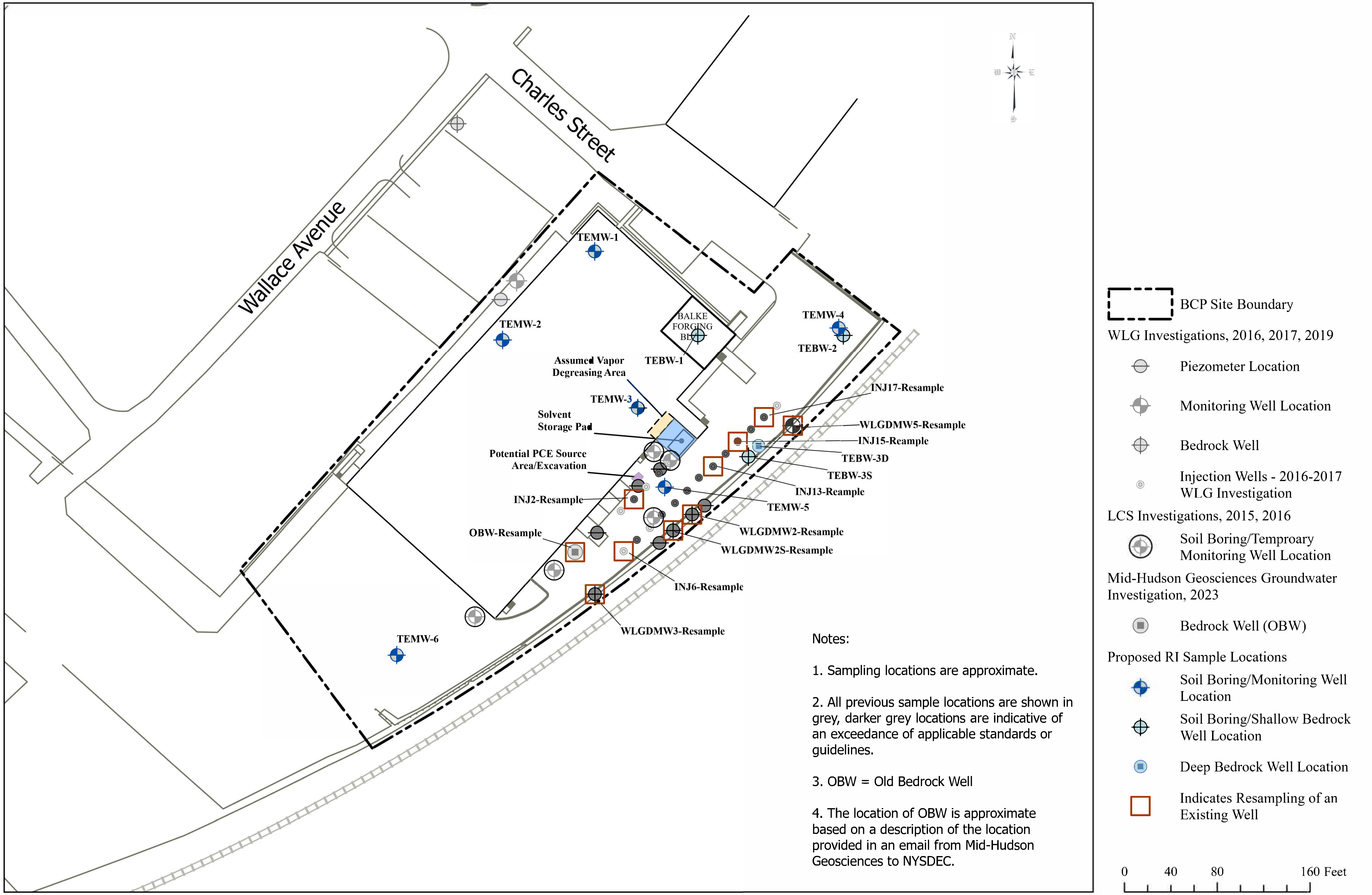
Scale As Noted

Drawing Title
Proposed RI Soil Sample Locations

Drawing No.
Figure 19



Notes:

1. Sampling locations are approximate.

2. All previous sample locations are shown in grey, darker grey locations are indicative of an exceedance of applicable standards or guidelines.

3. OBW = Old Bedrock Well

4. The location of OBW is approximate based on a description of the location provided in an email from Mid-Hudson Geosciences to NYSDEC.

Reference:
2021 Aerial: orthos.its.ny.gov
T.M Depuy Engineering & Land Surveying, 4/14/2016 Survey

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Tenen Environmental, LLC
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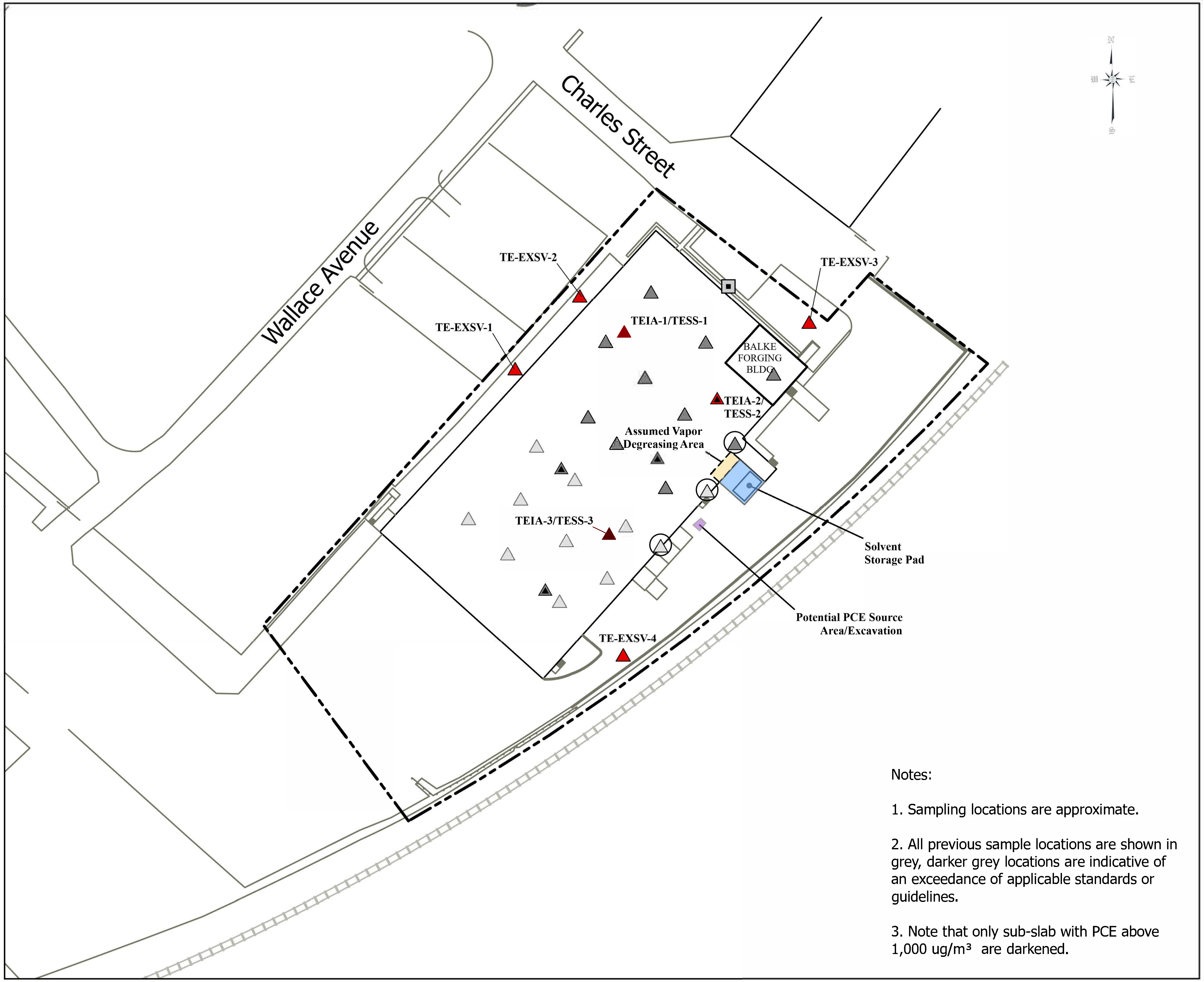
Checked By	AP
Date	May 2024
Scale	As Noted

Drawing Title
Proposed RI Groundwater
Sample Locations

Drawing No.
Figure 20



Notes:

1. Sampling locations are approximate.

2. All previous sample locations are shown in grey, darker grey locations are indicative of an exceedance of applicable standards or guidelines.

3. Note that only sub-slab with PCE above 1,000 ug/m³ are darkened.

▭ BCP Site Boundary

WLG Investigations, 2016, 2017, 2019

△ Sub-Slab Soil Vapor Sample Location

▲ Indoor Air Sample Location

LCS Investigations, 2015, 2016

ⓐ Sub-Slab Soil Vapor Sample Location

Proposed RI Sample Locations

▲ Exterior Soil Vapor Point

▲ Sub-slab Soil Vapor Point and Indoor Air Location

0 40 80 160 Feet

Reference:
2021 Aerial: orthos.its.ny.gov
T.M Depuy Engineering & Land Surveying, 4/14/2016 Survey

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Checked By	AP
Date	May 2024
Scale	As Noted

Drawing Title
Proposed RI Soil Vapor and Indoor Air Sample Locations

Drawing No.
Figure 21

Tables

DRAFT

Table 2 - Existing Monitoring Well and Injection Well Construction Details
201 Charles Street - Maybrook, NY
Remedial Investigation Work Plan
BCP Site No. C336094

Well ID	Well Type	Total Deth (ft-bg)	Diameter (in)	Construction Materials	Screen Length (ft)	Screen Interval (ft-bg)
WLG DMW-1	Monitoring Well - Bedrock	14	2	PVC	5	9-14
WLG DMW-2	Monitoring Well - Bedrock	23	2	PVC	5	18-23
WLG DMW-2S	Monitoring Well - Bedrock	17	2	PVC	5	12-17
WLG DMW-3	Monitoring Well - Bedrock	23	2	PVC	5	18-23
WLG DMW-4	Monitoring Well - Overburden	14	2	PVC	5	9-14
WLG DMW-5	Monitoring Well - Overburden	18	2	PVC	10	8-18
INJ-1	Injection - Overburden	16	2	PVC	8	8-16
INJ-2	Injection - Overburden	16	2	PVC	8	8-16
INJ-3	Injection - Overburden	16	2	PVC	8	8-16
INJ-4	Injection - Overburden	16	2	PVC	8	8-16
INJ-5	Injection - Overburden	16	2	PVC	8	8-16
INJ-6	Injection - Overburden	16	2	PVC	8	8-16
INJ-7	Injection - Overburden	16	2	PVC	8	8-16
INJ-8	Injection - Overburden	16	2	PVC	8	8-16
INJ-9	Injection - Overburden	16	2	PVC	8	8-16
INJ-10	Injection - Overburden	16	2	PVC	8	8-16
INJ-11	Injection - Overburden	16	2	PVC	8	8-16
INJ-12	Injection - Overburden	16	2	PVC	8	8-16
INJ-13	Injection - Overburden	16	2	PVC	8	8-16
INJ-14	Injection - Overburden	16	2	PVC	8	8-16
INJ-15	Injection - Overburden	16	2	PVC	8	8-16
INJ-16	Injection - Overburden	16	2	PVC	8	8-16
INJ-17	Injection - Overburden	16	2	PVC	8	8-16
INJ-18	Injection - Overburden	16	2	PVC	8	8-16

Notes:

1. ft-bg = feet below grade

Appendix A
Previous Reports (on cd)

DRAFT

Appendix B

Quality Assurance Project Plan

DRAFT

Quality Assurance Project Plan

for
201 Charles Street
Remedial Investigation Work Plan

201 Charles Street, Maybrook
Orange County, New York
Block 5, Portion of Lot 5.22
Block 1, Portion of Lot 1.2
BCP Site No. C336094

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:
201 Charles Street LLC
33 South Plank Road
Newburgh, New York 12550

Prepared by:
TENEN ENVIRONMENTAL
121 West 27th Street, Suite 702
New York, NY 10001

September 2024

TABLE OF CONTENTS

Appendices

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) has been developed for the Remedial Investigation Work Plan (RIWP) prepared for the 201 Charles Street property (the Site).

The Site is located at 201 Charles Street in Maybrook, Orange County, New York. The Site is defined as an approximate 126,324 square foot (SF) parcel comprising portions of two Orange County tax lots on separate, but adjoining, tax blocks: Block 5, Portion of Lot 5.22 and Block 1, Portion of Lot 1.2. The following areas of each lot comprise the BCP Site: Lot 5.22 (1.9 acres or 82,764 SF) and Lot 1.2 (1 acre or 43,560 SF). The Site is bounded by residential housing and Wallace Avenue to the north, Charles Street to the east, parking and Old Creamery Road to the west and railroad tracks of Middletown and New Jersey Railroad to the south.

The northeastern portion of the BCP Site is improved with a one-story slab-on-grade commercial building built in 1957. In 1990, a two-story slab-on-grade addition was added to west side of the existing one-story building. According to the 2020 RIR, the eastern corner of the original building is a discrete structure. The entire building footprint is approximately 54,000 SF and is currently occupied by contractor rental storage and pet supply wholesaler. The remainder of the Site is paved and used for parking. The Site is zoned I-2, denoting village industry. The area surrounding the Site is predominantly industrial and commercial with nominal residential.

1.1 Project Scope and QAPP Objective

The proposed scope of work includes the following:

- advancement of borings for soil, installation of monitoring wells, and soil vapor sampling on the Site, and;
- collection of soil, groundwater, soil vapor, and indoor air samples from soil borings, new and existing permanent monitoring wells and temporary 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 Focused 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 201 Charles Street LLC once it has been approved by the New York State Department of Environmental Conservation (NYSDEC).

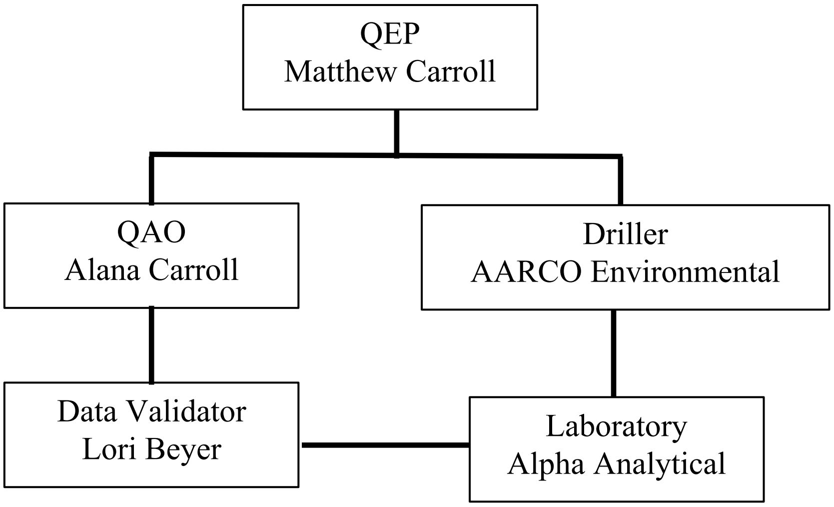
The Project Manager and Qualified Environmental Professional (QEP) will be Mr. Matthew Carroll, P.E., principal at Tenen. Mr. Carroll is an environmental engineer experienced in all aspects of site assessment and development and implementation of remedial strategies. His experience involves projects 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.

The Quality Assurance Officer will be Mrs. Alana Carroll, CPG, managing geologist 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.

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
201 Charles Street LLC, Harry Lipstein, 845.569.0372
Tenen Environmental, Matthew Carroll or Alana 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, and groundwater samples is provided below. Proposed sample locations are shown on Figures 3 through 6 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.

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 borings will be advanced by a direct push Geoprobe©. In general, select soil intervals will be screened between grade and the terminal depth of the boring. All non-disposable sampling equipment will be decontaminated between borings, as described in Section 3.11.

Soil from grade to terminal depth of the boring will be 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.

Surface soil samples will be collected from areas of exposed soil or grass onsite from zero to two inches below grade to evaluate surface soil for exposure. Hand tools will be utilized to collect samples from each uncapped area. One five-point composite sample will be collected from the surface per each 900 square foot area of uncapped land, for a total of eight soil samples.

For each soil delineation boring (if necessary), soil delineation samples will be collected from the two-foot interval that exhibited impacts in the nearest soil boring, as well as each one-foot interval directly below that sample to the top of bedrock and analyzed if evidence of contamination (e.g., elevated PID readings, odors, and/or staining) is observed. All soil delineation 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 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 all borings located onsite. Soil samples will be collected from the two-foot interval exhibiting the highest suspected contamination and the two-foot interval directly above bedrock. If no visual contamination is observed, the sample will be collected from the two-foot interval above the groundwater interface (if encountered). If the groundwater interface is not encountered, the sample will be collected from the interval directly above the bottom sample or the two-foot interval directly below the slab. Generally, samples collected from the two-foot interval directly below the slab will be collected from borings advanced in areas with no known contamination and/or observed impacts.

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.

All soil samples 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 1633 [reporting limit of 0.5 parts per billion (ppb)], and;
- 1,4-Dioxane by USEPA Method 8270.

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.

The following PFAS will be analyzed by EPA Method 1633:

- Perfluorobutanoic Acid (PFBA)
- Perfluoropentanoic Acid (PFPeA)
- Perfluorobutanesulfonic Acid (PFBS)
- 1H,1H,2H,2H-Perfluorohexanesulfonic Acid (4:2FTS)
- Perfluorohexanoic Acid (PFHxA)
- Perfluoropentanesulfonic Acid (PFPeS)
- Perfluoroheptanoic Acid (PFHpA)
- Perfluorohexanesulfonic Acid (PFHxS)
- Perfluorooctanoic Acid (PFOA)
- 1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)

- Perfluoroheptanesulfonic Acid (PFHpS)
- Perfluorononanoic Acid (PFNA)
- Perfluorooctanesulfonic Acid (PFOS)
- Perfluorodecanoic Acid (PFDA)
- 1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)
- Perfluorononanesulfonic Acid (PFNS)
- N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)
- Perfluoroundecanoic Acid (PFUnA)
- Perfluorodecanesulfonic Acid (PFDS)
- Perfluorooctanesulfonamide (FOSA)
- N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)
- Perfluorododecanoic Acid (PFDoA)
- Perfluorotridecanoic Acid (PFTrDA)
- Perfluorotetradecanoic Acid (PFTA)
- 2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-Propanoic Acid (HFPO-DA)
- 4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)
- Perfluorododecane Sulfonic Acid (PFDoDS)
- 9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)
- 11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)
- N-Methyl Perfluorooctane Sulfonamide (NMeFOSA)
- N-Ethyl Perfluorooctane Sulfonamide (NEtFOSA)
- N-Methyl Perfluorooctanesulfonamido Ethanol (NMeFOSE)
- N-Ethyl Perfluorooctanesulfonamido Ethanol (NEtFOSE)
- Perfluoro-3-Methoxypropanoic Acid (PFMPA)
- Perfluoro-4-Methoxybutanoic Acid (PFMBA)
- Perfluoro(2-Ethoxyethane)Sulfonic Acid (PFEESA)
- Nonafluoro-3,6-Dioxaheptanoic Acid (NFDHA)
- 3-Perfluoropropyl Propanoic Acid (3:3FTCA)
- 2H,2H,3H,3H-Perfluorooctanoic Acid (5:3FTCA)
- 3-Perfluoroheptyl Propanoic Acid (7:3FTCA)

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 PFAS by EPA Method 1633, will be performing all PFAS analyses of soil. The laboratory standard operating procedures for PFAS analysis is included in Appendix D.

3.8 Monitoring Well Installation and Development

Ten previously installed permanent wells and ten newly installed permanent monitoring wells will be sampled.

All monitoring wells screened in the overburden will be installed using a Geoprobe® direct-push rig and seated above bedrock. All shallow and deep bedrock wells will be installed using a hydraulic drill rig with coring capabilities. All monitoring wells screened in the overburden will consist of a two-inch inner diameter (ID) PVC casing and riser. A five or ten-foot PVC screen (0.020-inch slot) will be installed depending on the total well depth and presence of groundwater. A two-inch five-foot screen (0.020-inch slot) will be installed five feet into bedrock for the shallow bedrock wells and ten feet into bedrock for the deep bedrock wells. The overburden will be cased off from the underlying bedrock to prevent downward migration of cVOC impacts into bedrock fractures. The casing will be set at least five feet into competent rock with at least five feet of screen or open borehole constructed below the casing.

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 will be sealed with bentonite pellets for an interval of two feet above the filter pack. The annular space above the bentonite pellets to one foot below grade will be backfilled with unimpacted drilling cuttings or clean sand. 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 previously-installed and newly-installed monitoring wells to be sampled. 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.

Wells will be purged and sampled using dedicated high density polyethylene (HDPE) 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 HDPE 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 with a Category B deliverable package, for the following:

- 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 1633 [reporting limit of 2 parts per trillion (ppb)].

Field methods can impact the analysis of PFAS. PFAS samples will be collected using dedicated disposable HDPE tubing. If dedicated disposable sampling equipment cannot be used, equipment will be decontaminated by standard two step decontamination using detergent (Alconox) and clean, PFAS-free water. All sources of water used for equipment decontamination will be verified in advance to be PFAS-free through laboratory analysis or certification. 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.

The following PFAS will be analyzed by EPA Method 1633:

- PFBA
- PFPeA
- PFBS
- 4:2FTS
- PFHxA
- PFPeS
- PFHpA
- PFHxS
- PFOA
- 6:2FTS
- PFHpS
- PFNA
- PFOS
- PFDA
- 8:2FTS

- PFNS
- NMeFOSAA
- PFUnA
- PFDS
- FOSA
- NEtFOSAA
- PFDoA
- PFTrDA
- PFTA
- HFPO-DA
- ADONA
- PFDoDS
- 9Cl-PF3ONS
- 11Cl-PF3OUdS
- NMeFOSA
- NEtFOSA
- NMeFOSE
- NEtFOSE
- PFMPA
- PFMBA
- PFEESA
- NFDH
- 3:3FTCA
- 5:3FTCA
- 7:3FTCA

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 PFAS by EPA Method 1633, will be performing all PFAS analyses of groundwater. The laboratory standard operating procedures for PFAS analysis is included in Appendix D.

3.10 Soil Vapor, Sub-Slab Soil Vapor, Indoor Air, and Ambient Air Sampling

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

Sub-slab soil vapor, exterior soil vapor, indoor air and ambient air samples will be collected as part of the RI. The exterior soil vapor points will be advanced to approximately six ft-bg based on the estimated depth of surrounding basements. The sub-slab soil vapor point will be advanced to a maximum of two inches below the building slab.

Soil vapor samples will be collected using disposable points at the terminal depth of the point. A Geoprobe® direct-push rig will be used to install the exterior soil vapor sampling points and a handheld rotary hammer will be used to install the sub-slab soil vapor points. Once the soil vapor sampling points have been driven to the desired depth, they will be attached to disposable tubing for sample collection.

The borehole above the sampling points 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 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.

The indoor air and ambient air samples will be collected from breathing height (three to five feet above the floor). All indoor air samples will be co-located with sub-slab soil vapor points, from within the Site building. The sampling flow rate will not exceed 0.2 liters per minute (L/min).

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.

All soil vapor, sub-slab soil vapor, indoor air, and ambient air samples will be collected in laboratory-supplied 6-liter Summa canisters using eight-hour regulators. All soil vapor and sub-slab soil vapor samples will be analyzed for VOCs using EPA Method TO-15. Indoor air and ambient air samples will be collected during soil vapor sample collection and will be analyzed for VOCs using EPA Method TO-15.

3.11 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 Parameters	Methods	Preservative	Holding Times	Container
		TB	FB	DUP	MS/MSD						
Soil	56	3	3	3	3	67	VOCs	8260C	Cool to 4°C, No Headspace	14 days to analysis	(3) Encore samplers, or; (1) 2-oz glass jar
	56	0	3	3	3	64	SVOCs	8270D	Cool to 4°C		(2) 250 mL clear glass jar
	56	0	3	3	3	64	Pesticides, Herbicides	8081B, 8151A	Cool to 4°C		
	56	0	3	3	3	64	PCBs	8082A	Cool to 4°C		
	56	0	3	3	3	64	TAL Metals, Total Cyanide, Trivalent and Hexavalent Chromium	6010C/ 7471B, 9010C, 3060A	Cool to 4°C		
	56	0	3	3	3	64	PFAS	1633	Cool to 4°C		(1) 250 mL plastic bottle
	56	0	3	3	3	64	1,4-Dioxane	8270	Cool to 4°C		(2) 1-L amber glass bottle

Groundwater	20	1	1	1	1	24	VOCs	8260C	Cool to 4°C, HCL	14 days to analysis	(3) 40 mL amber glass vials
	20	0	1	1	1	23	SVOCs	8270D	Cool to 4°C		(6) 1 L amber glass bottles
	20	0	1	1	1	23	Pesticides, Herbicides	8081B, 8151A	Cool to 4°C		
	20	0	1	1	1	23	PCBs	8082A	Cool to 4°C		
	20	0	1	1	1	23	Total and Dissolved: TAL Metals, Cyanide, Trivalent and Hexavalent Chromium	6010C/ 7471B, 9010C, 3060A	Cool to 4°C		Total Metals: (1) plastic 500 mL HNO3 preserved bottle; Dissolved Metals: (1) plastic 500 mL unpreserved bottle
	20	0	1	1	1	23	1,4-Dioxane	8270D-SIM Modified	Cool to 4°C		(2) 1 L amber glass bottle
	20	0	1	1	1	23	PFAS	1633	Cool to 4°C, Trizma		(1) 250 mL plastic bottle
Soil Vapor	7	No QA/QC samples				5	VOCs	TO-15	None	30 days	(1) 6-L Summa
Indoor Air	3					3					
Outdoor Air	1					1					

TB – Trip Blank
FB – Field Blank
DUP – Duplicate

°C – degrees Celsius
mL – milliliter
L – liter

3.12 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).

3.13 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 – Unrestricted Use, Protection of Groundwater and Restricted Commercial Use Soil Cleanup Objectives (SCOs) as listed in 6NYCRR Part 375, and PFAS results will be compared to the proposed Unrestricted Use, Protection of Groundwater, and Restricted Commercial Use SCOs as listed in NYSDEC's April 2023 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 with February 2023 updates;
Soil Vapor – NYSDOH Soil Vapor Guidance Matrices.
Indoor Air – NYSDOH Air Guideline Values

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.

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 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.

F**ormer 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 environmental 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

SUNY
WESTCHESTER COMMUNITY COLLEGE
Valhalla, New York 10595

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

Assistant Dean
Professional Development Center

President

The Professional
Development Center

SUNY
WESTCHESTER COMMUNITY COLLEGE
Valhalla, New York 10595

New York State Department of Environmental Conservation
50 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 you 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

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

Elaine Sall
Program Coordinator

ES/bf

Enclosures

SUNY
WESTCHESTER COMMUNITY COLLEGE
Valhalla, New York 10595

Appendix B

PFAS 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 used cosmetics, moisturizers, hand cream, or other related products the morning of sampling
- Do not use unauthorized sunscreen or insect repellant (see reference above for acceptable products)

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

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

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

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ALPHA ANALYTICAL
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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.

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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)
Perfluorobutanoic Acid (PFBA)	0.0504	0.512
Perfluoropentanoic Acid (PFPeA)	0.056	0.428
Perfluorobutanesulfonic Acid (PFBS)	0.0432	0.268
1H,1H,2H,2H-Perfluorohexanesulfonic Acid (4:2FTS)	0.0808	0.836
Perfluorohexanoic Acid (PFHxA)	0.0464	0.236
Perfluoropentanesulfonic Acid (PFPeS)	0.0232	0.14
Perfluoroheptanoic Acid (PFHpA)	0.0232	0.16
Perfluorohexanesulfonic Acid (PFHxS)	0.0592	0.192
Perfluorooctanoic Acid (PFOA)	0.052	0.348
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	0.28	1.08
Perfluoroheptanesulfonic Acid (PFHpS)	0.0368	0.216
Perfluorononanoic Acid (PFNA)	0.0784	0.252
Perfluorooctanesulfonic Acid (PFOS)	0.0792	0.364
Perfluorodecanoic Acid (PFDA)	0.0752	0.324
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	0.3872	1.244
Perfluorononanesulfonic Acid (PFNS)	0.0424	0.248
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	0.1	0.436
Perfluoroundecanoic Acid (PFUnA)	0.0512	0.348
Perfluorodecanesulfonic Acid (PFDS)	0.032	0.184
Perfluorooctanesulfonamide (FOSA)	0.0432	0.216
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	0.0824	0.432
Perfluorododecanoic Acid (PFDoA)	0.0408	0.368
Perfluorotridecanoic Acid (PFTrDA)	0.0528	0.3
Perfluorotetradecanoic Acid (PFTA)	0.1064	0.212
2,3,3,3-Tetrafluoro-2-[1,1,2,2,3,3,3-Heptafluoropropoxy]-Propanoic Acid (HFPO-DA)	0.0984	0.448
4,8-Dioxa-3h-Perfluorononanoic Acid (ADONA)	0.1464	0.504
Perfluorododecane Sulfonic Acid (PFDoDS)	0.0384	0.304
9-Chlorohexadecafluoro-3-Oxanone-1-Sulfonic Acid (9Cl-PF3ONS)	0.196	0.66
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	0.1672	0.66
N-Methyl Perfluorooctane Sulfonamide (NMeFOSA)	0.1	0.348
N-Ethyl Perfluorooctane Sulfonamide (NEtFOSA)	0.112	0.368
N-Methyl Perfluorooctanesulfonamido Ethanol (NMeFOSE)	0.2504	1.88
N-Ethyl Perfluorooctanesulfonamido Ethanol (NEtFOSE)	0.5104	0.98
Perfluoro-3-Methoxypropanoic Acid (PFMPA)	0.0408	0.228
Perfluoro-4-Methoxybutanoic Acid (PFMBA)	0.0312	0.212
Perfluoro(2-Ethoxyethane)Sulfonic Acid (PFEESA)	0.0832	0.176
Nonafluoro-3,6-Dioxaheptanoic Acid (NFDHA)	0.0952	0.944
3-Perfluoropropyl Propanoic Acid (3:3FTCA)	0.144	1.32
2H,2H,3H,3H-Perfluorooctanoic Acid (5:3FTCA)	0.5048	4.68
3-Perfluoroheptyl Propanoic Acid (7:3FTCA)	1.76	3.156

Appendix D

Laboratory Standard Operating Procedures for PFAS Analysis

Method 1633 Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous, Solid, Biosolids and Tissue Samples by LC-MS/MS

References: Method 1633 - Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous, Solid, Biosolids, and Tissue Samples by LC-MS/MS (2nd Draft - June 2022)

DOD QSM (US Department of Defense Quality Systems Manual for Environmental Laboratories, version 5.4, 20221)

1. Scope and Application

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

Definitions: Refer to Alpha Analytical Quality Manual.

1.1 Method 1633 is for use in the Clean Water Act (CWA) for the determination of the per- and polyfluoroalkyl substances (PFAS) in Table 1 in aqueous, solid (soil, biosolids, sediment) and tissue samples by liquid chromatography/mass spectrometry (LC-MS/MS).

1.2 The method calibrates and quantifies PFAS analytes using isotopically labeled standards. Where linear and branched isomers are present in the sample and either qualitative or quantitative standards containing branched and linear isomers are commercially available, the PFAS analyte is reported as a single analyte consisting of the sum of the linear and branched isomer concentrations

1.3 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, tissue soil and biosolid Matrices. Accuracy and precision data have been generated for the compounds listed in Table 1.

1.4 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.

1.5 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 Environmental samples are prepared and extracted using method-specific procedures. Sample extracts are subjected to cleanup procedures designed to remove interferences. Analyses of the sample extracts are conducted by LC-MS/MS in the multiple reaction monitoring (MRM) mode. Sample concentrations are determined by isotope dilution or extracted internal standard quantification using isotopically labeled compounds added to the samples before extraction.

2.2 Aqueous samples are spiked with isotopically labeled standards, extracted using solid-phase extraction (SPE) cartridges and undergo cleanup using carbon before analysis.

2.3 Solid samples are spiked with isotopically labeled standards, extracted into basic methanol, and cleaned up by carbon and SPE cartridges before analysis

2.4 Tissue samples are spiked with isotopically labeled standards, extracted in potassium hydroxide and acetonitrile followed by basic methanol, and cleaned up by carbon and SPE cartridges before analysis.

2.5 A sample extract is injected 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.

2.6 Method Modifications from Reference

N/A

3. Reporting Limits

The reporting limit for PFAS's are listed in Table 8.

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 1/2 the RL for each method analyte) under the conditions of the analysis by analyzing laboratory reagent blanks as described in Section 9.1. 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) 500-mL or 250-mL high density polyethylene (HDPE) container with an unlined plastic screw cap. All sample containers must have linerless HDPE or polypropylene caps.

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 Maintain all aqueous samples protected from light at 0 - 6 ºC from the time of collection until shipped to the laboratory. Samples must be shipped as soon as practical with sufficient ice to maintain the sample temperature below 6 ºC during transport and be received by the laboratory within 48 hours of collection. The laboratory must confirm that the sample temperature is 0 - 6 ºC upon receipt. Once received by the laboratory, the samples must be stored at ≤ -20 ºC until sample preparation.

6.2 Sample Collection for Soil and Sediment samples.

6.2.1 Grab samples are collected in polypropylene containers. Sample containers and contact surfaces containing PTFE shall be avoided. Samples should fill no more than ¾ full.

6.2.2 Maintain solid samples protected from light (in HDPE containers) at 0 - 6 ºC from the time of collection until receipt at the laboratory. The laboratory must confirm that the sample temperature is 0 - 6 ºC upon receipt. Once received by the laboratory, the samples must be stored at ≤ -20 ºC until sample preparation.

6.3 Sample Collection for fish and other tissue samples

6.3.1 Once received by the laboratory, the samples must be maintained protected from light at ≤ -20 ºC until prepared. Store unused samples in HDPE containers or wrapped in aluminum foil at ≤ -20 ºC.

6.3.2 The nature of the tissues of interest may vary by project. Field sampling plans and protocols should explicitly state the samples to be collected and if any processing will be conducted in the field (e.g., filleting of whole fish or removal of organs). All field procedures must involve materials and equipment that have been shown to be free of PFAS.

6.4 Sample Preservation

Not applicable.

6.5 Sample Shipping

Samples must be chilled during shipment and must not exceed 0 – 6 °C during the first 48 hours after collection. Sample temperature must be confirmed to be at or below 0 – 6 °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 0 – 6 ° 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.

6.6 Sample Handling

6.6.1 Aqueous samples (including leachates) should be analyzed as soon as possible; however, samples may be held in the laboratory for up to 90 days from collection, when stored at ≤ -20 ºC and protected from the light. When stored at 0 - 6 ºC and protected from the light, aqueous samples may be held for up to 28 days, with the caveat that issues were observed with certain perfluorooctane sulfonamide ethanols and perfluorooctane sulfonamidoacetic acids after 7 days. These issues are more likely to elevate the observed concentrations of other PFAS compounds via the transformation of these precursors if they are present in the sample.

6.6.2 Solid samples (soils and sediments) and tissue samples may be held for up to 90 days, if stored by the laboratory in the dark at either 0 - 6 ºC or ≤ -20 ºC, with the caveat that samples may need to be extracted as soon as possible if NFDHA is an important analyte.

6.6.3 Biosolids samples may be held for up to 90 days, if stored by the laboratory in the dark at 0 - 6 ºC or at -20 ºC. Because microbiological activity in biosolids samples at 0 - 6 ºC may lead to production of gases which may cause the sample to be expelled from the container when it is opened, as well as producing noxious odors, EPA recommends that samples be frozen if they need to be stored for more than a few days before extraction. Store sample extracts in the dark at less than 0 - 4 ºC until analyzed. If stored in the dark at less than 0 - 4 ºC, sample extracts may be stored for up to 90 days, with the caveat that issues were observed for some ether sulfonates after 28 days. These issues may elevate the observed concentrations of the ether sulfonates in the extract over time. Samples may need to be extracted as soon as possible if NFDHA is an important analyte.

7. Equipment and Supplies

7.1 SAMPLE CONTAINERS – 500-mL or 250-mL high density polyethylene (HDPE) bottles fitted with unlined screw caps. Sample bottles must be discarded after use.

7.2 SAMPLE JARS – 8-ounce wide mouth high density polyethylene (HDPE) bottles fitted with unlined screw caps. Sample bottles must be discarded after use.

7.3 POLYPROPYLENE BOTTLES – 4-mL narrow-mouth polypropylene bottles.

7.4 CENTRIFUGE TUBES – 50-mL conical polypropylene tubes with polypropylene screw caps for storing standard solutions and for collection of the extracts.

7.5 AUTOSAMPLER VIALS – Polypropylene 0.7-mL autosampler vials with polypropylene caps.

7.5.1 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.

7.6 POLYPROPYLENE GRADUATED CYLINDERS – Suggested sizes include 25, 50, 100 and 1000-mL cylinders.

7.7 Auto Pipets – Suggested sizes include 5, 10, 25, 50, 100, 250, 500, 1000, 5000 and 10,000-µls.

7.8 PLASTIC PIPETS – Polypropylene or polyethylene disposable pipets.

7.9 Silanized glass wool (Sigma-Aldrich, Cat # 20411 or equivalent) – store in a clean glass jar and rinsed with methanol (2 times) prior to use.

7.10 Disposable syringe filter, 25-mm, 0.2-µm Nylon membrane, PALL/Acrodisc or equivalent

7.11 Variable volume pipettes with disposable HDPE or polypropylene tips (10 µL to 5 mL) used for preparation of calibration standards and spiked samples.

7.12 ANALYTICAL BALANCE – Capable of weighing to the nearest 0.0001 g.

7.13 ANALYTICAL BALANCE – Capable of weighing to the nearest 0.1 g.

7.14 SOLID PHASE EXTRACTION (SPE) APPARATUS FOR USING CARTRIDGES

7.14.1 SPE CARTRIDGES – (Waters Oasis WAX 150 mg, Cat # 186002493 or equivalent). The SPE sorbent must have a pKa above 8 so that it remains positively charged during the extraction.

7.14.1.1 Note: SPE cartridges with different bed volume (e.g., 500 mg) may be used; however, the laboratory must demonstrate that the bed volume does not negatively affect analyte absorption and elution, by performing the initial demonstration of capability analyses described in Section.

7.14.2 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.

7.14.3 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 and LCS QC requirements.

7.15 EXTRACT CONCENTRATION SYSTEM – Extracts are concentrated by evaporation with nitrogen using a water bath set no higher than 55 °C.

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

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

7.17.1 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.

7.17.2 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.

7.17.3 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.

7.17.4 INSTRUMENT COLUMNS

7.17.4.1 ANALYTICAL: C18 column, 1.7 µm, 50 x 2.1 mm (Waters Acquity UPLC® BEH or equivalent)

7.17.4.2 OPTIONAL GUARD COLUMN: (Phenomenex Kinetex® Evo C18 or equivalent)

8. Reagents and Standards

8.1 GASES, REAGENTS, AND SOLVENTS – Reagent grade or better chemicals must 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 1/2 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 ($NH_4C_2H_3O_2$, 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 I Liter of REAGENT WATER.

8.1.7 ACETONITRILE – UPLC grade or equivalent, store at room temperature

8.1.8 TOLUENE – HPLC grade or equivalent.

8.1.9 ACETONE – pesticide grade or equivalent

8.1.10 AMMONIUM ACETATE – (Caledon Ultra LC/MS grade or equivalent

8.1.11 AMMONIUM HYDROXIDE (NH_3, CAS#: 1336-21-6) – High purity, demonstrated to be free of analytes and interferences.

8.1.12 METHANOLIC AMMONIUM HYDROXIDE (0.3%) - add ammonium hydroxide (1 mL, 30%) to methanol (99 mL), store at room temperature, replace after 1 month

8.1.13 METHANOLIC AMMONIUM HYDROXIDE (1%) - add ammonium hydroxide (3.3 mL, 30%) to methanol (97 mL), store at room temperature, replace after 1 month

8.1.14 METHANOLIC AMMONIUM HYDROXIDE (2%) - add ammonium hydroxide (6.6 mL, 30%) to methanol (93.4 mL), store at room temperature, replace after 1 month

8.1.15 METHANOLIC POTASSIUM HYDROXIDE (0.05 M) – add 3.3 g of potassium hydroxide to 1 L of methanol, store at room temperature, replace after 3 months

8.1.16 METHANOL WITH 4% WATER, 1% AMMONIUM HYDROXIDE AND 0.625% ACETIC ACID - add ammonium hydroxide (3.3 mL, 30%), reagent water (1.7 mL) and acetic acid (0.625 mL) to methanol (92 mL), store at room temperature, replace after 1 month. This solution is used to prepare the instrument blank and calibration standards (Section 8.3.2).

8.1.17 FORMIC ACID – (greater than 96% purity or equivalent).

8.1.18 FORMIC ACID (aqueous, 0.1 M) - dissolve formic acid (4.6 g) in reagent water (1 L), store at room temperature, replace after 2 years

8.1.19 FORMIC ACID (aqueous, 0.3 M) - dissolve formic acid (13.8 g) in reagent water (1 L), store at room temperature, replace after 2 years

8.1.20 FORMIC ACID (aqueous, 5% v/v) - mix 5 mL formic acid with 95 mL reagent water, store at room temperature, replace after 2 years

8.1.21 FORMIC ACID (methanolic 1:1, 0.1 M formic acid/methanol) - mix equal volumes of methanol and 0.1 M formic acid, store at room temperature, replace after 2 years

8.1.22 FORMIC ACID (aqueous, 50% v/v) - mix 50 mL formic acid with 50 mL reagent water, store at room temperature, replace after 2 years

8.1.23 POTASSIUM HYDROXIDE – certified ACS or equivalent

8.1.24 CARBON - – EnviCarb® 1-M-USP or equivalent, verified by lot number before use, store at room temperature. Loose carbon allows for better adsorption of interferent organics. Note: The single-laboratory validation laboratory achieved better performance with loose carbon than carbon cartridges. Loose carbon will be used for the multi-laboratory validation to set statistically based method criteria.

8.1.25 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).

8.1.26 ARGON – Used as collision gas in some 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 REFERENCE MATRICES - Matrices in which PFAS and interfering compounds are not detected by this method. These matrices are to be used to prepare the batch QC samples.

8.2.1 Reagent water - purified water, Type I

8.2.2 Solid reference matrix Ottawa Sand or equivalent

8.2.3 Tissue Reference matrix – Cod loin or other animal tissue demonstrated to be PFAS free

8.3 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 and are stored at ≤4 °C. 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.

8.3.1 Stock standards and diluted stock standards are stored at ≤4 °C. Prepare a spiking solution, containing the method analytes listed in Table 1, in methanol from prime stocks. The solution is used to prepare the calibration standards and to spike the known reference QC samples that are analyzed with every batch. Quantitative standards containing a mixture of branched and linear isomers must be used for method analytes if they are commercially available. Currently, these include PFOS, PFHxS, NEtFOSAA, and NMeFOSAA.

8.3.2 Calibration standard solutions – A series of calibration solutions containing the target analytes and the Labeled extracted internal standards (EIS) and non-extracted internal standards (NIS) is used to establish the initial calibration of the analytical instrument. Table 4 represents the concentrations of the native, EIS and NIS analytes of the calibration curve. Calibration standard solutions are made using the solution described in section 8.1.16.

8.3.3 ISOTOPE DILUTION EXTRACTED INTERNAL STANDARD (EIS) – Isotopically labelled analogs of the target analytes to be used for the quantification of target analytes. EIS stock standard solutions are purchased in glass ampoules and are stored in accordance with the manufacturer's recommendations. The EIS stock solution to be used for the fortification of samples and QC in accordance with the isotope dilution procedure. Table 2 represents the EIS concentrations and nominal sample amounts added to each field sample and QC element.

8.3.4 ISOTOPE DILUTION NON-EXTRACTED INTERNAL STANDARDS (NIS) – Isotopically labelled analogs to be added post extraction for the measurement of EIS extraction efficiency and is added to the final volume of all extractions. Table 3 represents the EIS concentrations and nominal sample amounts added to each field sample and QC element.

9. Quality Control

9.1 Method Blank

9.1.1 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. An aliquot of reagent water that is treated exactly as a sample including exposure to all glassware, equipment, solvents, reagents and standards. 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.

9.2 Laboratory Control Sample (LCS)

9.2.1 Low Level LCS or OPR (Ongoing Precision Recovery) sample is required with each extraction batch. A LLCS or OPR samples is a method blank spiked with known quantities of analytes. The fortified concentration of the LCS is spiked at 2X the LOQ. Default limits of 70-130% 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:

9.2.2 An LCS or OPR (Ongoing Precision Recovery) sample is required with each extraction batch. A LCS or OPR samples is a method blank spiked with known quantities of analytes. The fortified concentration of the LCS is spiked at the midpoint of the calibration curve. Default limits of 70-130% 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.

9.1.1 Where applicable, in the absence of additional sample volume required to perform matrix specific QC, 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:

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

9.1.2 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.

9.3 Non-extracted Internal Standard Area (NIS)

Each time an initial calibration is performed, use the data from all the initial calibration standards used to meet the linearity test in Section 10.3.3.3 to calculate the mean area response for each of the NIS compounds, using the equation below.

$$\text{Mean Area}_{\text{NISi}} = \sum \text{AREA}_{\text{NISi}} / \text{n}$$

where:

AreaNISi = Area counts for the ith NIS, where i ranges from 1 to 7, for the seven NIS compounds listed in Table 1

n = The number of ICAL standards (the default value is n = 6). If a different number of standards is used for the ICAL, for example, to increase the calibration range or by dropping a point at either end of the range to meet the linearity criterion, change 6 to match the actual number of standards used)

Record the mean areas for each NIS for use in evaluating results for sample analyses. There is no acceptance criterion associated with the mean NIS area data.

9.4 Extracted Internal Standards (EIS)

9.4.1 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.

9.4.2 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.

9.5 Matrix Spike (MS/MSD)

9.5.1 Analysis of an MS is prepared one per preparation batch (if required).

9.5.2 Aliquots of field samples that have been fortified with a known concentration of target compounds, prior to sample preparation and extraction, and analyzed to measure the effect of matrix interferences. The use of MS/MSD samples is generally not required in isotope dilution methods because the labeled compounds added to every sample provide more performance data than spiking a single sample in each preparation batch. Aliquots of field samples

9.5.3 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.

9.6 Laboratory Duplicate

9.6.1 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.

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

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

9.6.3 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.

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

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

9.6.5 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.

9.7 Bile Salt Interference Check

9.7.1 The laboratory must analyze a TDCA standard after the initial calibration, prior to the analysis of tissue samples, to check for interferences caused by bile salts. If an interference is present, the chromatographic conditions must be modified to eliminate the interference from TDCA (e.g., changing the retention time of TDCA such that it falls outside the

9.8 Initial Calibration Verification (ICV)

9.8.1 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 Instrument Sensitivity Check (ISC)

9.9.1 At the start of each 12-hour shift, analyze a standard at the LOQ. The signal-to-noise ratio of the ISC standard must be greater than or equal to 3:1. If the requirements cannot be met, the problem must be corrected before analyses can proceed

9.10 Continuing Calibration Verification (CCV)

9.10.1 CCV Standards must be analyzed at the beginning of each analysis batch, after every 10 Field Samples, and at the end of the analysis batch.

9.10.2 The recovery of native and isotopically labeled compounds for the CVs must be within 70 - 130%

9.10.3

9.11 Method-specific Quality Control Samples

9.11.1 Instrument Blank – During the analysis of a batch of samples, a solvent blank is analyzed after samples containing high level of target compounds (e.g., calibration, CV) to monitor carryover from the previous injection. The injection blank consists of the solution in

Section 8.1.16 fortified with the EIS and NIS for quantitation purposes.

9.12 Example Method Sequence

- INSTRUMENT BLANK
- INSTRUMENT SENSITIVITY CHECK
- CALIBRATION VERIFICATION STANDARD
- QUALITATIVE IDENTIFICATION STANDARDS
- TDCA STANDARD (only if analyzing tissues)
- INSTRUMENT BLANK
- METHOD BLANK
- LOW-LEVEL LCS/OPR
- OPR/LCS
- SAMPLE (10 or fewer)
- CALIBRATION VERIFICATION STANDARD
- INSTRUMENT BLANK
- SAMPLE (10 or fewer)
- CALIBRATION VERIFICATION STANDARD
- INSTRUMENT BLANK

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.

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 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.

10.1.3 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.

10.1.4 All SPE apparatus, including manifolds, tubing and sample ports must be thoroughly rinsed following each use with 1% methanolic ammonium hydroxide, followed by Methanol and then DI water. Additionally, sample manifold ports and transfer tubing should be inspected regularly for signs of wear and/or discoloration. When such observations are made, the associated components should be replaced.

10.1.5 Prior to the start of any extraction, sample site information must be evaluated for any potentially high level PFAS concentrations or sample matrix irregularities that may impact the extraction process. If such samples are identified, aqueous samples may be pre-screened via direct aqueous injection prior to analysis to estimate the potential PFAS concentrations present.

10.1.6 To perform a direct aqueous injection (DAI) screen, the sample should be inverted several times to try and evenly disperse any organic matter present. A 1 ml aliquot (or less depending on the matrix) is to be taken from the parent sample, volume adjusted to 1 ml with reagent water if less than 1ml, fortified with EIS and NIS spiking solutions to match the concentrations of an extracted sample (typically 5 µl per 1 ml DAI), and then analyzed under the same analytical conditions as field samples.

10.2 Sample Preparation of Aqueous Samples

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

10.2.2 Determine sample volume. Weigh all samples to the nearest 1g. If visible sediment is present, centrifuge and decant into a new 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 reagent water with a polypropylene graduated cylinder or filling an HDPE sample bottle to near the top.

10.2.4 Check that the pH is 6.5 ± 0.5. If necessary, adjust pH with 50% formic acid or ammonium hydroxide and 3% aqueous ammonium hydroxide. The extract is now ready for solid-phase extraction (SPE) and cleanup.

10.2.5 Add 20 µL of the EIS 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. Cap and invert each sample to mix.

10.3 Sample Prep and Extraction Protocol for Soils, Solids and Sediments.

10.3.1 Homogenize and weigh 5 grams of sample (measured to the nearest hundredth of a gram) into a 50 ml polypropylene centrifuge tube. For laboratory control blanks and spikes, 5 grams of clean sand is used.

10.3.1.1 For Biosolids and other complex matrices, a small aliquot may be required due to co-extracted matrix interferences.

10.3.1.2 For batch QC samples using 5 g of reference solid, add 2.5 g of reagent water. The addition of reagent water to the sand provides a matrix closer in composition to real-world samples.

10.3.2 Add 20 µL of the EIS to each sample and QC.

10.3.3 If the sample is an LCS, LCSD, MS, or MSD, add the necessary amount of analyte PDS. Cap and invert each sample to mix.

10.3.4 Vortex the samples to evenly disperse the spiking solutions and allow to equilibrate for 30 minutes.

10.3.5 To all samples, add 10 ml of 0.3% methanolic ammonium hydroxide, cap, vortex for 25 seconds.

10.3.6 Following mixing, shake each sample for 30 minutes on a shaker table.

10.3.7 Centrifuge each sample at 2800RPM for 10 minutes.

10.3.8 Remove the supernatant and transfer to a clean 50 ml polypropylene centrifuge tube.

10.3.9 Repeat steps 10.3.4 to 10.3.7, with 15 ml of 0.3% methanolic ammonium hydroxide, combining the supernatants.

10.3.10 Add 5ml of 0.3% methanolic ammonium hydroxide to the sample, vortex for 25 seconds and centrifuge each sample at 2800RPM for 10 minutes.

10.3.11 Remove the supernatant and transfer to the same 50 ml polypropylene centrifuge tube containing eluates from the previous cycles.

10.3.12 Add 10 mg of carbon to the combined extract, mix by occasional hand shaking for no more than five minutes and then centrifuge at 2800 rpm for 10 minutes. Immediately decant the extract into a 50 ml polypropylene centrifuge tube.

10.3.13 Dilute to approximately 35 mL with reagent water. Samples containing more than 50% water may yield extracts that are greater than 35 mL in volume; therefore, do not add water to these. Determine the water content in the sample as follows (percent moisture is determined from the % solids):

Water Content in Sample = (Sample Weight * Percent moisture) / 100

10.3.14 Concentrate each extract at approximately 55 ºC with a gentle N2 flow to a final volume that is based on the water content of the sample (see table below). Allow extracts to concentrate for 10 minutes, then mix (by vortex if the volume is < 20. Continue concentrating and mixing every 5 minutes until the extract has been reduced to the required volume as specified in the table below. If the extract volume appears to stop dropping, the concentration must be stopped and the volume at which it was stopped recorded.

Water Content in Sample	Concentrated Final Volume
< 5 grams	15 ml
5-8 grams	15-20 ml
8-9 grams	20-22.5 ml
9-10 grams	22.5-25 ml

10.3.15 Add 40 - 50 mL of reagent water to the extract and vortex. Check that the pH is 6.5 ±0.5 and adjust as necessary with 50% formic acid or 30% ammonium hydroxide, or with 5% formic acid and 3% aqueous ammonium hydroxide. The extracts are ready for SPE and cleanup.

10.4 Sample Prep and Extraction Protocol for Tissues.

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 tissue is used.

10.4.2 Add 20 µL of the EIS PDS 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. Cap and invert each sample to mix.

10.4.4 Add 10 mL of 0.05M KOH in methanol to each sample. Vortex to disperse the tissue then place tubes on a mixing table to extract for at 16 hours. Centrifuge at 2800 rpm for 10 minutes and collect the supernatant in a 50-mL polypropylene centrifuge tube.

10.4.5 Add 10 mL of acetonitrile to remaining tissue in the 50-mL centrifuge tube, vortex to mix and disperse the tissue. Sonicate for 30 minutes. Centrifuge at 2800 rpm for 10 minutes and collect the supernatant, adding it to the 50-mL centrifuge tube containing the initial extract.

10.4.6 Add 5 mL of 0.05M KOH in methanol to the remaining sample in each centrifuge tube. Vortex to disperse the tissue and hand mix briefly. Centrifuge at 2800 rpm for 10 minutes and collect the supernatant, adding it to the 50-mL centrifuge tube containing the first two extracts.

10.4.7 Add 10 mg of carbon to the combined extract, mix by occasional hand shaking over a period of no more than five minutes and then centrifuge at 2800 rpm for 10 minutes. Immediately decant the extract into a 50-mL centrifuge tube.

10.4.8 Add 1 mL of reagent water to each tube and concentrate each extract at approximately 55 ºC with a gentle N2 flow to a final volume of 2.5 ml.

10.4.9 Add reagent water to each evaporation/concentrator tube to dilute the extracts to 50 mL. Check that the pH = 6.5 ± 0.5 and adjust as needed with 50% formic acid, or ammonium hydroxide or with 5% formic acid and 3% aqueous ammonium hydroxide. The extracts are ready for SPE and cleanup.

10.5 SPE Extract: All matrices

10.5.1 Pack clean silanized glass wool to half the height of the WAX SPE cartridge barrel.

10.5.2 Pre-condition the cartridges by washing them with 3 X 5 mL of 1% methanolic ammonium hydroxide, discarding the wash volumes.

10.5.3 Rinse the cartridge with 5 mL of 0.3M formic acid, allowing the cartridge to drain using gravity only, discarding the rinse volume. Do not allow the cartridge to go dry

10.5.4 Adjust the vacuum so that the approximate flow rate is ~5 mL/min and load the sample across the cartridge. Do not allow the cartridge to go dry before all the sample has passed through.

10.5.5 Once all the sample has passed across the cartridge, rinse the walls of the reservoir with 2 X 5 mL reagent water, loading the rinse across the cartridge.

10.5.6 Rinse the walls of the reservoir with 5 mL of 1:1 0.1M formic acid/methanol and pass the rinse through the cartridge using vacuum. Dry the cartridge by pulling air through for 15 seconds.

10.5.7 Rinse the inside of the sample bottle with 5 mL of 1% methanolic ammonium hydroxide. Use vacuum to pull the elution solvent through the cartridge and into the collection tubes. When the cartridge bed and glass wool are submerged, stop the cartridge flow by closing the valve, keeping the sorbent bed and wool submerged.

10.5.8 Let the wetted sorbent bed and wool soak for 1 minute.

10.5.9 Open the cartridge valve and collect the eluate into a 15 ml polypropylene collection tube.

10.5.10 Add 25 µL of concentrated acetic acid to each sample eluted in the collection tubes and vortex to mix.

10.5.11 Add 10 mg of carbon to each sample and batch QC extract, using a 10-mg scoop. Handshake occasionally for no more than 5 minutes. It is important to minimize the time the sample extract is in contact with the carbon. Immediately vortex (30 seconds) and centrifuge at 2800 rpm for 10 minutes.

10.5.12 Add NIS solution to a clean collection tube. Place a syringe filter (25-mm filter, 0.2-µm nylon membrane) on a 5-mL polypropylene syringe. Take the plunger out and carefully decant the sample supernatant into the syringe barrel. Replace the plunger and filter the entire extract into the new collection tube containing the NIS.

10.5.13 Vortex to mix and transfer a portion of the extract into a .7-mL polypropylene LC vial for LC-MS/MS analysis. Cap the collection tube containing the remaining extract and store at 4 °C

10.6 Sample Volume Determination

10.6.1 If using weight to determine volume, weigh the empty bottle to the nearest 1 g and determine the sample weight by subtraction of the empty bottle weight from the original sample weight. 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.

10.7 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.

10.7.1 ESI-MS/MS TUNE

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

10.7.1.2 Optimize the [M-H]- or [M-CO_2]- 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 (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.

The Mass spec conditions found in Table 7 show the Sciex Triple Quad 5500+ operation conditions used in this method.

10.7.1.3 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.

The conditions found on table 5 are representative of expected tune optimizations for each analyte. If conditions other the ones close to the values provided in table 5 are achieved, the process should be re-performed and/or instrument maintenance performed to resolve the problem.

10.7.2 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.

Table 6 represents the operation conditions of a Sciex Exion LC system when running this method.

10.7.3 Inject 2µl of a mid-level CAL standard under LC/MS conditions to obtain the retention times of each method analyte. 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.

10.7.4 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.

NOTE: PFHxS, PFOS, NMeFOSAA, and NEtFOSAA have multiple chromatographic peaks using the LC conditions in Table 7 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.

10.7.5 Prepare a set of CAL standards as outlined in table 5. The lowest concentration CAL standard must be at or below the LOQ.

10.7.6 The LC/MS/MS system is calibrated using the isotope dilution technique. Target analytes are quantitated against their isotopically labeled analog (Extracted Internal Standard) where commercially available. If a labeled analog is not commercially available, the extracted internal standard with the closest retention time and /or closest chemical similarity is to be used. 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.

10.7.7 CALIBRATION ACCEPTANCE CRITERIA – A linear fit is acceptable if the calculated RSD or RSE for each target analyte is ≤20%. If linear or Quadratic regressions are used, coefficient of determination (r^2) values must be greater than 0.99. When quantitated using the initial calibration curve, each calibration point at or above the LOQ for each analyte must calculate to be within 70-130% of its true value. The calculate value of each EIS analyte must be within 50-150% of its true value. If these criteria cannot be met, corrective action is taken to reanalyze the CAL standards, restrict the range of calibration.

10.7.8 Bile salts interference check - The laboratory must analyze a TDCA standard after the initial calibration, prior to the analysis of tissue samples, to check for interferences caused by bile salts. If an interference is present, the chromatographic conditions must be modified to eliminate the interference from TDCA (e.g., changing the retention time of TDCA such that it falls outside the retention window for PFOS by at least one minute), and the initial calibration repeated.

10.8 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.

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

10.8.2 Calculate the concentration of each analyte and EIS in the CCV. The calculated amount for each native and EIS analyte for medium level CCVs must be within ± 30% of the true. If these conditions do not exist, then all data for the problem analyte must be considered invalid, and remedial action should be taken 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% for a particular method analyte, and Field Sample extracts show no detection for that method analyte, non-detects may be reported without re-analysis.

10.8.3 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 and verification of sensitivity by analyzing a CCV at or below the LOQ.

10.9 EXTRACT ANALYSIS

10.9.1 The same operating conditions used for the initial calibration and summarized in Tables 6 and 7 are to be used.

10.9.2 Prior to analysis of sample extracts, the Instrument mass calibration verification must be performed using standards whose mass range brackets the masses of interest and performed in the negative ion mode. The mass calibration is verified if the calculated mass is within ± .2 daltons of the specified mass.

10.9.3 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 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.

10.9.4 Calibrate the system by either the analysis of a calibration curve or by confirming the initial calibration is still valid by analyzing a CCV.

10.9.5 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.

10.9.6 For concentrations at or above the method LOQ, the total (branched and linear isomer) quantification ion response to the total (branched and linear isomer) confirmation ion response ratio must fall within ± 50% of the ratio observed in the midpoint initial calibration standard.

10.9.7 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.

10.9.8 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 ensure 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.3

10.9.9 In instances where re-extraction is not an option, dilute a subsample of the sample extract with 0.1% acetic acid by a factor no greater than 10x adjust the amount of the NIS in the diluted extract, and analyze the diluted extract. If the responses for each EIS in the diluted extract meet the S/N and retention time, and the EIS recoveries from the analysis of the diluted extract are greater than 5%, then the compounds associated with those EISs may be quantified using isotope dilution. Use the EIS recoveries from the original analysis to select the dilution factor, with the objective of keeping the EIS recoveries in the dilution above that 5% lower limit. If the adjusted EIS recoveries are below 5%, the dilution is assumed invalid. If the adjusted EIS recoveries are greater than 5%, adjust the compound concentrations, detection limits, and minimum levels to account for the dilution.

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 9.

11.2 Calculate analyte concentrations using the multipoint calibration established in Section 10.9. 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 10.8

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

C_s = (C_{ex} / 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 7 due to the linear and branch isomers of these compounds (Sect. 10.10.4.). 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 Refer to Alpha SOP ID 1739 for further information regarding IDC/DOC Generation.

13.2.2 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 1: Names, Abbreviations, and CAS Registry Numbers for Target PFAS, Extracted Internal Standards and Non-extracted Internal Standards

Parameter	Acronym	CAS
PER- and POLYFLUOROALKYLETHER CARBOXYLIC ACIDS (PFECAs)		
Tetrafluoro-2-(heptafluoropropoxy)propanoic acid	HFPO-DA	13252-13-6
4,8-dioxa-3H-perfluorononanoic acid	ADONA	919005-14-4
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6
PERFLUOROALKYLCARBOXILIC 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	PFDoA	307-55-1
Perfluorotridecanoic acid	PFTrDA	72629-94-8
Perfluoorotetradecanoic acid	PFTeDA	376-06-7
PERFLUOROALKYL SULFONIC ACIDS (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
CHLORO-PERFLUOROALKYLSULFONATE		
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	11Cl-PF3OUdS	763051-92-9
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid	9Cl-PF3ONS	756426-58-1
FLUOROTELOMER CARBOXYLIC ACIDS		
3-Perfluoropropyl propanoic acid	3:3FTCA	356-02-5
2H,2H,3H,3H-Perfluorooctanoic acid	5:3FTCA	914637-49-3
Perfluoroheptyl propanoic acid	7:3FTCA	812-70-4
PERFLUOROOCTANESULFONAMIDES		
Perfluorooctanesulfonamide	PFOSA	754-91-6
N-methylperfluoro-1-octanesulfonamide	NMeFOSA	31506-32-8
N-ethylperfluoro-1-octanesulfonamide	NEtFOSA	4151-50-2
PERFLUOROCTANE SULFONAMIDE ETHANOLS		
N-Methyl perfluorooctanesulfonamidoethanol	NMeFOSE	24448-09-7
N-ethyl perfluorooctanesulfonamidoethanol	NEtFOSE	1691-99-2
TELOMER SULFONIC ACIDS		

1H,1H,2H,2H-perfluorohexanesulfonic acid (4:2)	4:2FTS	757124-72-4
1H,1H,2H,2H-perfluorooctanesulfonic acid (6:2)	6:2FTS	27619-97-2
1H,1H,2H,2H-perfluorodecanesulfonic acid (8:2)	8:2FTS	39108-34-4
PERFLUOROOCTANESULFONAMIDOACETIC ACIDS		
N-methyl perfluorooctanesulfonamidoacetic acid	NMeFOSAA	2355-31-9
N-ethyl perfluorooctanesulfonamidoacetic acid	NEtFOSAA	2991-50-6
PERFLUOROETHER AND POLYETHER CARBOXYLIC ACIDS		
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6

Table 2: Stock and Nominal Extracted Internal Standard Concentrations

Isotope Labeled Standard	Conc. of EIS Stock (ng/mL)	Nominal amount of EIS added to extracts (ng)
M4PFBA	2000	40
M5PFPeA	1000	20
M5PFHxA	500	10
M4PFHpA	500	10
M8PFOA	500	10
M9PFNA	250	5
M6PFDA	250	5
M7PFUdA	250	5
MPFDoA	250	5
M2PFTeDA	250	5
M3PFBS	466	9.32
M3PFHxS	474	9.48
M8PFOS	479	9.58
M2-4:2FTS	938	18.8

Isotope Labeled Standard	Conc. of EIS Stock (ng/mL)	Nominal amount of EIS added to extracts (ng)
M2-6:2FTS	951	19
M2-8:2FTS	960	19.2
M8FOSA	500	10
d3-N-MeFOSA	500	10
d5-N-EtFOSA	500	10
d3-N-MeFOSAA	1000	20
d5-N-EtFOSAA	1000	20
d7-N-MeFOSE	5000	100
d9-N-EtFOSE	5000	100
M3HFPO-DA	2000	40

Table 3: Stock and Nominal Non-Extracted Internal Standard Concentrations

Isotope Labeled Standard	Conc. of EIS Stock (ng/mL)	Nominal amount of EIS added to extracts (ng)
M3PFBA	1000	40
M2PFHxA	500	10
M4PFOA	500	10
M5PFNA	250	5
M2PFDA	250	5
18O2PFHxS	474	9.48
M4PFOS	479	9.58

Table 4: Initial Calibration levels and Concentrations

Analyte	Cal A	Cal B (LOQ)	CAL C	Cal D	Cal E (CCV)	Cal F	Cal G	Cal H	Cal I
PFBA	.4	.8	2	5	10	20	50	250	500
PFPeA	.2	.4	1	2.5	5	10	25	125	250
PFHxA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
PFHpA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
PFOA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
PFNA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
PFDA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
PFUnA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
PFDoA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
PFTrDA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
PFTA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
PFBS	0.089	0.177	0.444	1.11	2.22	4.44	11.1	55.4	111
PFPeS	0.094	0.188	0.471	1.18	2.35	4.71	11.8	58.8	118

PFHxS	0.091	0.183	0.457	1.14	2.29	4.57	11.4	57.1	114
PFHpS	0.095	0.191	0.477	1.19	2.38	4.77	11.9	59.6	119
PFOS	0.093	0.186	0.464	1.16	2.32	4.64	11.6	58	116
PFNS	0.096	0.192	0.481	1.20	2.41	4.81	12	60.1	120
PFDS	0.097	0.193	0.483	1.21	2.41	4.83	12.1	60.3	121
PFDOS	0.097	0.194	0.485	1.21	2.43	4.85	12.1	60.6	121.
4:2FTS	0.375	0.75	1.88	4.69	9.38	18.8	46.9	234	469
6:2FTS	0.38	0.76	1.9	4.75	9.5	19	47.5	238	475
8:2FTS	0.384	0.768	1.92	4.8	9.6	19.2	48	240	480
PFOSA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
NMeFOSA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
NEtFOSA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
NMeFOSAA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
NEtFOSAA	.1	.2	.5	1.25	2.5	5	12.5	62.5	125
NMeFOSE	1	2	5	12.5	25	50	125	625	1250
NEtFOSE	1	2	5	12.5	25	50	125	625	1250
HFPO-DA	.4	.8	2	5	10	20	50	250	500
ADONA	0.378	0.756	1.89	4.73	9.45	18.9	47.3	236	473
9Cl-PFONS	0.374	0.748	1.87	4.68	9.35	18.7	46.8	234	468
11Cl-PFOUdS	0.378	0.756	1.89	4.73	9.45	18.9	47.3	236	473
PFMPA	.2	.4	1	2.5	5	10	25	125	250
PFMBA	.2	.4	1	2.5	5	10	25	125	250
PFEESA	0.178	0.356	0.89	2.23	4.45	8.9	22.3	111	223
NFDHA	.2	.4	1	2.5	5	10	25	125	250
3:3FTCA	.5	1	2.5	6.25	12.5	25	62.5	312	624
5:3FTCA	2.5	5	12.5	31.3	62.5	125	312	1560	3120
7:3FTCA	2.5	5	12.5	31.3	62.5	125	312	1560	3125
M4PFBA	10	10	10	10	10	10	10	10	10
M5PFPeA	5	5	5	5	5	5	5	5	5
M5PFHxA	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
M4PFHpA	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
M8PFOA	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
M9PFNA	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
M6PFDA	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
M7PFUdA	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
MPFDoA	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25

M2PFTeDA	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
M3PFBS	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33
M3PFHxS	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37
M8PFOS	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
M2-4:2FTS	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69
M2-6:2FTS	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76
M2-8:2FTS	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8
M8FOSA	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
d3-N-MeFOSA	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
d5-N-EtFOSA	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
d3-N-MeFOSAA	5	5	5	5	5	5	5	5	5
d5-N-EtFOSAA	5	5	5	5	5	5	5	5	5
d7-N-MeFOSE	25	25	25	25	25	25	25	25	25
d9-N-EtFOSE	25	25	25	25	25	25	25	25	25
M3HFPO-DA	10	10	10	10	10	10	10	10	10
M3PFBA	5	5	5	5	5	5	5	5	5
M2PFHxA	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
M4PFOA	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
M5PFNA	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
M2PFDA	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
18O2PFHxS	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37
M4PFOS	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4

Table 5: Expected Mass Transitions and instrument conditions.

Q1	Q2	Analyte	DP Volts	CE Volts
213.032	169.022	PFBA	-50	-14
263.039	219.03	PFPeA	-55	-12
263.039	68.9	PFPeA_2	-55	-55
313.047	269.037	PFHxA	-45	-12
313.047	119	PFHxA_2	-45	-28
363.055	319.045	PFHpA	-60	-12
363.055	169.022	PFHpA_2	-60	-24
413.063	369.053	PFOA	-65	-14
413.063	169.022	PFOA_2	-65	-23
463.071	419.061	PFNA	-70	-14
463.071	219.03	PFNA_2	-70	-24

513.078	469.069	PFDA	-80	-16
513.078	219.03	PFDA_2	-80	-30
563.086	519.076	PFUnA	-85	-18
563.086	269.037	PFUnA_2	-85	-25
613.094	569.084	PFDoA	-85	-18
613.094	319.045	PFDoA_2	-85	-28
663.102	619.092	PFTrDA	-85	-20
663.102	169.022	PFTrDA_2	-85	-36
713.11	669.1	PFTA	-70	-22
713.11	169.022	PFTA_2	-70	-38
299.092	80.062	PFBS	-100	-65
299.092	99.061	PFBS_2	-100	-40
349.1	80.062	PFPeS	-100	-75
349.1	99.061	PFPeS_2	-100	-60
399.107	80.062	PFHxS	-120	-75
399.107	99.061	PFHxS_2	-120	-80
449.115	80.062	PFHpS	-140	-95
449.115	99.061	PFHpS_2	-140	-80
499.113	80.062	PFOS	-145	-108
499.113	99.061	PFOS_2	-145	-85
549.131	80.062	PFNS	-180	-100
549.131	99.061	PFNS_2	-180	-100
599.139	80.062	PFDS	-170	-110
599.138	99.061	PFDS_2	-170	-100
699.154	80.062	PFDoS	-160	-150
699.154	99.061	PFDoS_2	-160	-130
327.146	307.139	4:2FTS	-100	-28
327.146	81.07	4:2FTS_2	-100	-50
427.161	407.155	6:2FTS	-120	-33
427.161	81.07	6:2FTS_2	-120	-65
527.177	507.17	8:2FTS	-140	-39
527.177	81.07	8:2FTS_2	-140	-85
498.146	78.07	FOSA	-150	-90
498.146	478	FOSA_2	-150	-35
512.163	219.03	NMeFOSA	-130	-35
512.163	169.022	NMeFOSA_2	-130	-40
526.192	219.03	NEtFOSA	-140	-35
526.192	169.022	NEtFOSA_2	-140	-35
570.202	419.061	NMeFOSAA	-100	-28

570.202	483	NMeFOSAA_2	-100	-22
584.229	419.061	NEtFOSAA	-100	-28
584.229	526.192	NEtFOSAA_2	-100	-38
616.1	58.9	NMeFOSE	-90	-70
630	58.9	NEtFOSE	-80	-75
285.035	169.022	HFPO-DA	-60	-12
285.035	184.9	HFPO-DA_2	-60	-18
377.06	251.028	ADONA	-65	-18
377.06	84.8	ADONA_2	-65	-48
530.8	351.05	9Cl-PFONS	-130	-38
532.8	353	9Cl-PFONS_2	-130	-38
630.9	451.031	11Cl-PFOUdS	-145	-41
632.9	452.9	11Cl-PFOUdS_2	-145	-41
241.085	177.069	3:3FTCA	-60	-12
241.085	117	3:3FTCA_2	-60	-50
341.101	237.072	5:3FTCA	-70	-20
341.101	217	5:3FTCA_2	-70	-35
441.117	316.9	7:3FTCA	-85	-30
441.117	337.088	7:3FTCA_2	-85	-20
315.093	135.013	PFEESA	-100	-35
315.093	82.9	PFEESA_2	-100	-25
229.032	85.006	PFMPA	-40	-25
279.042	85.006	PFMBA	-45	-25
295.032	201	NFDHA	-30	-15
295.032	84.9	NFDHA_2	-30	-40
217.001	171.999	MPFBA	-50	-14
268.001	222.999	M5PFPeA	-55	-12
318.009	273.007	M5PFHxA	-45	-12
367.024	322.022	M4PFHpA	-60	-12
421.002	376	M8PFOA	-65	-14
472.002	427	M9PFNA	-70	-14
519.033	474.03	M6PFDA	-80	-16
570.033	525.031	M7-PFUdA	-85	-18
615.079	570.033	MPFDoA	-85	-18
715.094	670.092	M2PFTeDA	-70	-22
302.069	80.062	M3PFBS	-100	-65
402.084	80.062	M3PFHxS	-120	-74
507.062	80.062	M8PFOS	-145	-85
329.13	81.07	M2-4:2FTS	-100	-50

429.162	81.07	M2-6:2FTS	-120	-65
529.162	81.07	M2-8:2FTS	-140	-85
506.077	78.07	M8FOSA	-150	-90
515.183	219.03	d3-NMeFOSA	-130	-35
531.222	219.03	d5-NEtFOSA	-140	-35
573.22	419.061	d3-NMeFOSAA	-75	-28
589.259	419.061	d5-NEtFOSAA	-90	-28
623.2	58.9	d7-NMeFOSE	-100	-28
639.2	58.9	d9-NEtFOSE	-100	-28
287.02	169.022	M3HFPO-DA	-60	-12
216.009	171.999	M3PFBA	-50	-14
315.032	270.03	M2PFHxA	-45	-12
417.032	372.03	M4PFOA	-65	-14
468.032	423.03	M5PFNA	-70	-14
515.063	470.061	M2PFDA	-80	-16
403.107	84.062	18O2-PFHxS	-120	-74
503.093	80.062	M4PFOS	-145	-85

Table 6: LC Method Conditions

Time (min)	2 mM Ammonium Acetate (5:95 CH/H_2O)	100% Acetonitrile	Gradient Curve
Initial	100.0	0.0	0
.2	100.0	0.0	2
4	70	30	7
7	45	55	8
9	25	80	8
10	5	95	6
10.4	98	2	10
11.8	100	0	7
12	100	0	1
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 µL injection			

Table 7: ESI-MS Method Conditions

ESI Conditions	
Polarity	Negative ion
Curtain Gas	30
Collision gas	9
Ion Spray Voltage	-4500
Desolvation gas temp.	500 ºC
Ion Source Gas 1	30
Ion Source Gas 2	50
Entrance Poitential	-10
Exic Cell Potential	-11

Table 8. Reporting limits by Matrix

Compound	Aqueous (ng/L)	Solid (ng/g)	Tissue (ng/g)
PFBA	6.4	0.8	2
PFPeA	3.2	0.4	1
PFHxA	1.6	0.2	0.5
PFHpA	1.6	0.2	0.5
PFOA	1.6	0.2	0.5
PFNA	1.6	0.2	0.5
PFDA	1.6	0.2	0.5
PFUnA	1.6	0.2	0.5
PFDoA	1.6	0.2	0.5
PFTrDA	1.6	0.2	0.5
PFTA	1.6	0.2	0.5
PFBS	1.6	0.2	0.5
PFPeS	1.6	0.2	0.5
PFHxS	1.6	0.2	0.5
PFHpS	1.6	0.2	0.5
PFOS	1.6	0.2	0.5
PFNS	1.6	0.2	0.5
PFDS	1.6	0.2	0.5
PFDoS	1.6	0.2	0.5
4:2FTS	6.4	0.8	2
6:2FTS	6.4	0.8	2
8:2FTS	6.4	0.8	2
FOSA	1.6	0.2	2
NMeFOSA	1.6	0.2	0.5

NEtFOSA	1.6	0.2	0.5
NMeFOSAA	1.6	0.2	0.5
NEtFOSAA	1.6	0.2	0.5
NMeFOSE	16	2	5
NEtFOSE	16	2	5
HFPO-DA	6.4	0.8	2
ADONA	6.4	0.8	2
9Cl-PFONS	6.4	0.8	2
11Cl-PFOUdS	6.4	0.8	2
3:3FTCA	8	1	2.5
5:3FTCA	40	5	12.5
7:3FTCA	40	5	12.5
PFEESA	3.2	0.4	1
PFMPA	3.2	0.4	1
PFMBA	3.2	0.4	1
NFDHA	3.2	0.4	1

Appendix C

Health and Safety Plan

DRAFT

Health and Safety Plan

for
201 Charles Street
Remedial Investigation Work Plan

201 Charles Street, Maybrook
Orange County, New York
Block 5, Portion of Lot 5.22
Block 1, Portion of Lot 1.2
BCP Site No. C336094

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:
201 Charles Street LLC
33 South Plank Road
Newburgh, New York 12550

Prepared by:
TENEN ENVIRONMENTAL
121 West 27th Street, Suite 702
New York, NY 10001

May 2024

TABLE OF CONTENTS

Figures

Tables

Appendices

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 Focused Remedial Investigation.

The Site is located at 201 Charles Street in Maybrook, Orange County, New York. The Site is defined as an approximate 126,324 square foot (SF) parcel comprising portions of two Orange County tax lots on separate, but adjoining, tax blocks: Block 5, Portion of Lot 5.22 and Block 1, Portion of Lot 1.2. The following areas of each lot comprise the BCP Site: Lot 5.22 (1.9 acres or 82,764 SF) and Lot 1.2 (1 acre or 43,560 SF). The Site is bounded by residential housing and Wallace Avenue to the north, Charles Street to the east, parking and Old Creamery Road to the west and railroad tracks of Middletown and New Jersey Railroad to the south.

The northeastern portion of the BCP Site is improved by a one-story slab-on-grade commercial building built circa 1957. In 1990, a two-story slab-on-grade addition was added to west side of the existing one-story building. According to the 2020 RIR, the eastern corner of the original building is a discrete structure. The entire building footprint is approximately 54,000 SF and is currently occupied by contractor rental storage and pet supply wholesaler. The remainder of the Site is paved and used for parking. The Site is zoned I-2, denoting village industry. The area surrounding the Site is predominantly industrial and commercial with nominal residential.

1.1 Scope of HASP

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

- Collection of soil samples from soil borings;
- Collection of groundwater samples from groundwater monitoring wells;
- Collection of soil vapor samples from temporary soil vapor points; and,
- Collection of indoor and outdoor 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 following description of historical Site operations has been provided by others and can be found in many previous reports included as Appendix A. The assumptions and observations provided in the following paragraphs are not those of Tenen Environmental.

From 1956 to 1984, the property was owned interchangeably by three corporate entities: 3460 Jerome Ave. Realty Corp., Balke Products Inc. and J. Sklar Mfg. Co., Inc. 3460 Jerome Ave. Realty Corp. seems to have been a real-estate holding company owned by John Sklar. The operating "entity" at the Site dating to the 1950s appears to have been Balke Products, Inc. The nature of the relationship between J. Sklar Mfg. and Balke Products is unclear. Historical records document that J. Sklar Mfg. Co., Inc. and Balke Products, Inc. both manufactured surgical-steel tools and instruments. Historical operations included hammerboard drop-forging of steel tools and metal-finishing operations. Research regarding historical drop-forging of steel tools indicates that vapor degreasing was a standard procedure following the forging process. Based on industry standards, degreasers are most often chlorinated solvents.

The southeast portion of the original Site building comprises a discrete structure built with a thick concrete foundation. According to Matt Thorpe, the Department of Public Works Supervisor and neighboring tenant, this building was the "forging /stamping building." Additional interviews with local residents and Maybrook officials indicated that a raised concrete platform was used for solvent storage. The face of the "old" (Balke) building adjacent to the former solvent-storage area has a long row of cantilevered windows, ostensibly for ventilation of the vapor-degreasing operations area. An asphalt patch indicative of a former excavation (date unknown) was discovered in 2020 or 2021 by others and is stated in previous reports to be the PCE source-area. A recent[1] GPR survey confirmed the presence of an old excavation beneath the asphalt patch with an estimated depth of 7-8 ft-bg. No indications of piping leading to the excavation were identified. It is unclear as to whether the excavation area formerly contained a waste-solvent tank or dry well. It is possible that there was piping and that it was removed; alternatively, waste solvents may have been transferred to such a structure manually.

In 1984, Osram purchased the property from J. Sklar Mfg. Co., Inc. Osram, and later Osram-Sylvania (following the merger of these companies), was a leading U.S. manufacturer of light bulbs. According to interviews with local Maybrook authorities, Osram-Sylvania manufactured, warehoused and distributed light bulbs from onsite. Osram-Sylvania's operations reportedly involved soldering/welding of light-bulb components. Reportedly, Osram-Sylvania did not conduct vapor degreasing or otherwise use large quantities of solvents.

Summary

Soil results were compared to NYSDEC Unrestricted Use (UU), Protection of Groundwater (PGW) and Restricted Commercial Use Soil Cleanup Objectives (SCOs) as listed in 6 NYCRR Part 375-6.8(a) and (b) the October 21, 2010 NYSDEC DEC Policy CP-51. UU SCOs are the most stringent cleanup standards and are used for comparison of site-specific proposed cleanup standards. SCOs 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.

Soil

Limited Phase II Investigations were completed in 2015 and 2016 by Lender Consulting Services, Inc. (LCS). Soil sampling indicated the presence of tetrachloroethene (PCE) above applicable regulatory standards. Concentrations of PCE and its daughter products, cis -1,2-Dichloroethene (DCE) and Trichloroethene (TCE) are shown on Figure 3. PCE was found in two soil samples from the same boring (BH10) at concentrations exceeding NYSDEC 6 NYCRR Part 375-6.8(a) Unrestricted Use (UU) Soil Cleanup

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[1] No date for the performance of a geophysical was provided. The use of the term "recent" comes from the 2021 BCP Application.

Objectives (SCOs) and Part 375-6.8(b) Protection of Groundwater (PGW) SCOs. BH10 was located adjacent to the Site building to the east (see Figure 3). In March 2016, additional sampling conducted by William L. Going & Associates, Inc. (WLG) encountered concentrations of PCE above UUSCOs and PGWSCOs in three samples collected from the eastern boundary of the BCP Site in proximity of the Site building. Chlorinated volatile organic compound (cVOC) detections in all soil samples collected during this investigation are depicted on Figure 4. Comparison of PCE concentrations to Part 375-6.8(b) Commercial SCOs indicate that PCE concentrations for all soil samples are below the Commercial Cleanup Standard.

Groundwater

Groundwater results were compared to NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1 Ambient Water Quality Standards and Guidance Values (Class GA Standards).

The 2015 and 2016 LCS investigations included the installation of five temporary groundwater monitoring wells. Samples collected from these wells indicated the presence of PCE above Class GA Standards in three of five samples and the presence of DCE and TCE above Class GA Standards in one of five samples. cVOCs detected in groundwater samples during this investigation are depicted on Figure 5. All samples were collected from the eastern portion of the Site adjacent to-and surrounding the site building/eastern site bounadry. The 2016 WLG investigation included the installation of six piezometer's (1" diameter), two monitoring wells (2" diameter) and four bedrock wells (2" diameter). Sampling of the aforementioned wells indicated the presence of PCE above Class GA Standards in nine of twelve wells, the presence of TCE above Class GA Standards in four of twelve wells, the presence of DCE above Class GA Standards in two of twelve wells and the presence of 1,1,1-Trichloroethane (TCA) above Class GA Standards in one of twelve wells. cVOCs detected in groundwater samples during this investigation are depicted on Figure 6. All samples with Class GA exceedances were collected from the eastern portion of the Site adjacent to-and surrounding the site building/eastern site boundary.

A groundwater flow map was prepared by WLG based on elevation of the water table on April 5, 2016 and is included as Figure 7. Based on the map provided by WLG, the groundwater flow appears to be southeast. Depth to groundwater, measured during previous investigations, is approximately ten feet below site grade (ft-bsg).

Groundwater Remediation

In June 2016 WLG installed 18 injection wells to the top of bedrock ranging from 14-15 ft-bgs (3-7 ft. into top of fractured bedrock). Injections wells were constructed of 2" diameter PVC and spaced 15 feet apart (see Figure 8). PersulfOx was injected into each well in June 2016 and again in July 2016. 3,400 pounds of powdered PersulfOx was mixed with approximately 1,800 gallons of water per treatment. Initial post-remedial groundwater sampling took place in September 2016 and January 2017 and including the following wells: DMW2, DMW2S, DMW3, DMW5, INJ2, INJ4, INJ7, INJ11, INJ15 AND INJ17. Additional post-remedial sampling occurred on August 5 and August 30, 2019[2] and included an expanded network of wells. Figure 9 shows the results of the 2016/2017 post-remedial sampling and pre-injection concentrations, where applicable. Figure 10 shows the results of all post-remedial sampling including the expanded well network and pre-injection concentrations, where applicable. A discussion of the groundwater remediation and post-remedy results is included in Section 2.5.3 of this RIWP.

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[2] Contrary to what the WLG RIR states, lab reports indicate that post-remedial groundwater sampling was conducted on two different dates in August 2019.

Sub-Slab Soil Vapor and Indoor Air

In January 2016, LCS installed three sub-slab soil vapor points within the Site building along its eastern perimeter. One indoor air and one ambient air sample were also collected. Results of this sampling indicated the presence of PCE in sub-slab vapor and indoor air. Figure 11 shows the locations and results of this sampling event. In March 2016, WLG installed 18 sub-slab soil vapor points throughout the Site building. Three indoor air and one ambient air sample were also collected. Results of this sampling indicated the presence of PCE in sub-slab vapor throughout the buildings, as well as in all three indoor air samples. Figure 12 shows the locations and results of this sampling event.

Soil Vapor Mitigation

According to the November 2020 Remedial Investigation Report (RIR) prepared by Mid-Hudson Geosciences, Anaerobix, & Jansen Engineering PLLC, in May 2016, 18 passive vents were installed in the sub-slab of the northern part of the building (see Figure 13). A vacuum test was conducted to determine if there is any permeability beneath the slab. Reportedly, as there was nearly zero permeability beneath the slab, a passive vapor extraction system consisting of five vents with outdoor wind-blown turbines was installed.

Another round of sub-slab vapor and ambient air testing was conducted on November 23, 2019. No Work Plan or raw analytical data reports were available for this sampling. The methodology, locations and data associated with this sampling is limited to what was documented in the aforementioned RIR and BCP Application. PCE was detected in all nine indoor and all nine sub-slab samples collected from within the Site building. Discussions with the previous consultant indicate that the sub-slab samples were collected from the vent risers.

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
- PCE
- TCE
- 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.

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 Yourselves 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 or composite-toed shoes, long pants, nitrile gloves

Modified Level D-2
Respiratory Protection: Cloth face covering
Protective Clothing: Hard hat, steel or composite-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

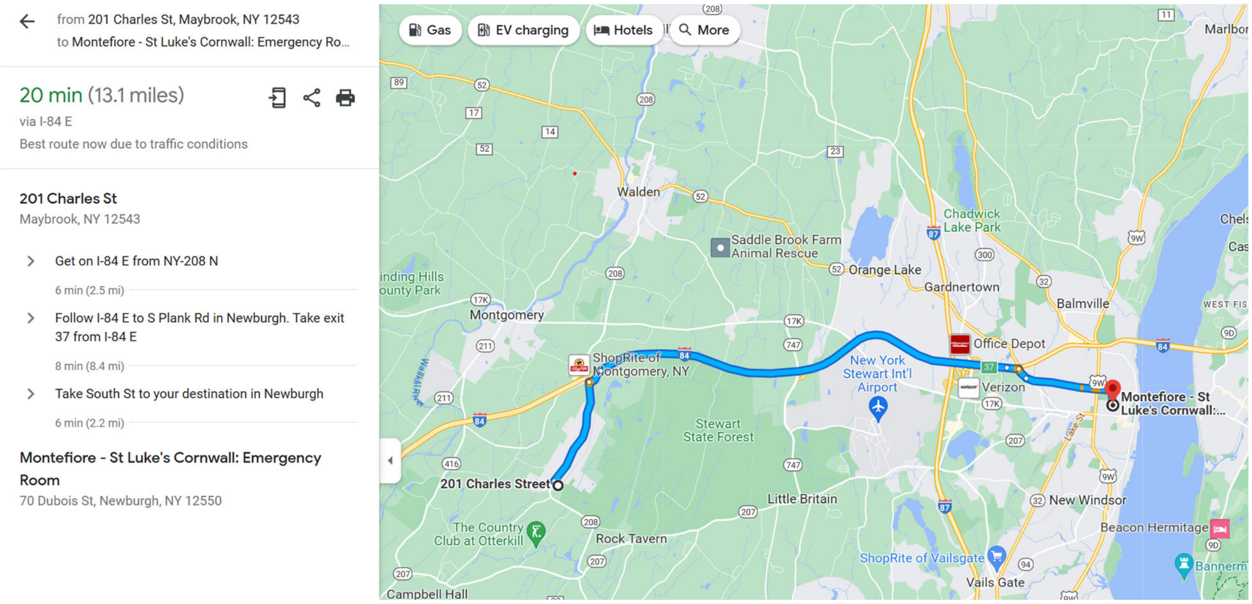
To protect the health and safety of the field personnel, all field personnel will adhere to the guidelines listed below during activities involving subsurface disturbance.

- 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 Montefiore – St. Luke's Cornwall: Emergency Room. The phone number is (845) 568-2305.** The route to the hospital is shown and detailed on the next page.

12.1 Route to Hospital



from 201 Charles St, Maybrook, NY 12543
to Montefiore - St Luke's Cornwall: Emergency Ro...

20 min (13.1 miles)
via I-84 E
Best route now due to traffic conditions

201 Charles St
Maybrook, NY 12543

- Get on I-84 E from NY-208 N
  6 min (2.5 mi)
- Follow I-84 E to S Plank Rd in Newburgh. Take exit 37 from I-84 E
  8 min (8.4 mi)
- Take South St to your destination in Newburgh
  6 min (2.2 mi)

Montefiore - St Luke's Cornwall: Emergency Room
70 Dubois St, Newburgh, NY 12550

Driving directions to **Montefiore – St. Luke's Cornwall: Emergency Room** from **201 Charles Street, Maybrook, NY.**

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	(845) 568-2305
NYSDEC Spill Hotline	(800) 457-7362
NYSDEC	(518) 402-8013
Project Manager, Alana Carroll	(917) 428-2094
On-site Personnel, Ashley Platt	(908) 892-1354

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 201 Charles Street site in East Elmhurst, 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: ________________________________ Date: _________________
Signature: ________________________________ Date: _________________
Signature: ________________________________ Date: _________________
Signature: ________________________________ Date: _________________
Signature: ________________________________ Date: _________________

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.

Year 20__ __

U.S. Department of Labor
Occupational Safety and Health Administration

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.

Form approved OMB no. 1218-0176

Establishment name ____________________

City ____________________ State ____________

Identify the person			**Describe the case**			**Classify the case** **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				(M)					
(A) Case no.	(B) Employee's name	(C) Job title (*e.g., Welder*)	(D) Date of injury or onset of illness	(E) Where the event occurred (*e.g., Loading dock north end*)	(F) Describe injury or illness, parts of body affected, and object/substance that directly injured or made person ill (*e.g., Second degree burns on right forearm from acetylene torch*)	**Death** (G)	**Days away from work** (H)	**Job transfer or restriction** (I)	**Other record-able cases** (J)	**Away from work** (K)	**On job transfer or restriction** (L)	Injury (1)	Skin disorder (2)	Respiratory condition (3)	Poisoning (4)	Hearing loss (5)	All other illnesses (6)
____	____	____	___/___ month/day	____	____	☐	☐	☐	☐	____ days	____ days	☐	☐	☐	☐	☐	☐
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					Page totals➤	____	____	____	____	____	____	____	____	____	____	____	____
												Injury (1)	Skin disorder (2)	Respiratory condition (3)	Poisoning (4)	Hearing loss (5)	All other illnesses (6)

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

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.

Page ___ **of** ___

Appendix C

Material Safety Data Sheets (MSDS)

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

1,2-DICHLOROETHENE
CAS # 540-59-0, 156-59-2, and 156-60-5

Agency for Toxic Substances and Disease Registry ToxFAQs **September 1997**

This fact sheet answers the most frequently asked health questions (FAQs) about 1,2-dichloroethene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to 1,2-dichloroethene occurs mainly in workplaces where it is made or used. Breathing high levels of 1,2-dichloroethene can make you feel nauseous, drowsy, and tired. *cis*-1,2-Dichloroethene has been found in at least 146 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA). *trans*-1,2-Dichloroethene was found in at least 563 NPL sites. 1,2-Dichloroethene was found at 336 sites, but the isomer (*cis*- or *tran*s-) was not specified.

What is 1,2-dichloroethene?
(Pronounced 1,2-dī-klôr′ ō-ĕth′ēn)

1,2-Dichloroethene, also called 1,2-dichloroethylene, is a highly flammable, colorless liquid with a sharp, harsh odor. It is used to produce solvents and in chemical mixtures. You can smell very small amounts of 1,2-dichloroethene in air (about 17 parts of 1,2-dichloroethene per million parts of air [17 ppm]).

There are two forms of 1,2-dichloroethene; one is called *cis*-1,2-dichloroethene and the other is called *trans*-1,2-dichloroethene. Sometimes both forms are present as a mixture.

What happens to 1,2-dichloroethene when it enters the environment?

- ☐ 1,2-Dichloroethene evaporates rapidly into air.
- ☐ In the air, it takes about 5-12 days for half of it to break down.
- ☐ Most 1,2-dichloroethene in the soil surface or bodies of water will evaporate into air.
- ☐ 1,2-Dichloroethene can travel through soil or dissolve in water in the soil. It is possible that it can contaminate groundwater.
- ☐ In groundwater, it takes about 13-48 weeks to break down.
- ☐ There is a slight chance that 1,2-dichloroethene will break down into vinyl chloride, a different chemical which is believed to be more toxic than 1,2-dichloroethene.

How might I be exposed to 1,2-dichloroethene?

- ☐ Breathing 1,2-dichloroethene that has leaked from hazardous waste sites and landfills.
- ☐ Drinking contaminated tap water or breathing vapors from contaminated water while cooking, bathing, or washing dishes.
- ☐ Breathing 1,2-dichloroethene, touching it, or touching contaminated materials in the workplace.

How can 1,2-dichloroethene affect my health?

Breathing high levels of 1,2-dichloroethene can make you feel nauseous, drowsy, and tired; breathing very high levels can kill you.

When animals breathed high levels of *trans*-1,2-dichloroethene for short or longer periods of time, their livers and lungs were damaged and the effects were more severe with longer exposure times. Animals that breathed very high levels of *trans*-1,2-dichloroethene had damaged hearts.

Animals that ingested extremely high doses of *cis*- or *trans*-1,2-dichloroethene died.

Lower doses of *cis*-1,2-dichloroethene caused effects on the blood, such as decreased numbers of red blood cells, and also effects on the liver.

The long-term (365 days or longer) human health effects after exposure to low concentrations of 1,2-dichloroethene aren't known. One animal study suggested that an exposed fetus may not grow as quickly as one that hasn't been exposed.

Exposure to 1,2-dichloroethene hasn't been shown to affect fertility in people or animals.

How likely is 1,2-dichloroethene to cause cancer?

The EPA has determined that *cis*-1,2-dichloroethene is not classifiable as to its human carcinogenicity.

No EPA cancer classification is available for *trans*-1,2-dichloroethene.

Is there a medical test to show whether I've been exposed to 1,2-dichloroethene?

Tests are available to measure concentrations of the breakdown products of 1,2-dichloroethene in blood, urine, and tissues. However, these tests aren't used routinely to determine whether a person has been exposed to this compound. This is because after you are exposed to 1,2-dichloroethene, the breakdown products in your body that are detected with these tests may be the same as those that come from exposure to other chemicals. These tests aren't available in most doctors' offices, but can be done at special laboratories that have the right equipment.

Has the federal government made recommendations to protect human health?

The EPA has set the maximum allowable level of *cis*-1,2-dichloroethene in drinking water at 0.07 milligrams per liter of water (0.07 mg/L) and *trans*-1,2-dichloroethene at 0.1 mg/L.

The EPA requires that any spills or accidental release of 1,000 pounds or more of 1,2-dichloroethene must be reported to the EPA.

The Occupational Health Safety and Health Administration (OSHA) has set the maximum allowable amount of 1,2-dichloroethene in workroom air during an 8-hour workday in a 40-hour workweek at 200 parts of 1,2-dichloroethene per million parts of air (200 ppm).

Glossary

Carcinogenicity: Ability of a substance to cause cancer.

CAS: Chemical Abstracts Service.

Fertility: Ability to reproduce.

Ingest: To eat or drink something.

Milligram (mg): One thousandth of a gram.

ppm: Parts per million.

Solvent: A chemical that can dissolve other substances.

References

This ToxFAQs information is taken from the 1996 Toxicological Profile for 1,2-Dichloroethene produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Tetrachloroethylene - ToxFAQs™

CAS # 127-18-4

This fact sheet answers the most frequently asked health questions (FAQs) about tetrachloroethylene. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Tetrachloroethylene is a manufactured chemical used for dry cleaning and metal degreasing and in the aerospace industry. Exposure to very high concentrations of tetrachloroethylene can cause dizziness headaches, sleepiness, incoordination confusion, nausea, unconsciousness, and even death. Tetrachloroethylene has been found in at least 949 of the 1,854 National Priorities List sites identified by U.S. Environmental Protection Agency (EPA).

What is tetrachloroethylene?

Tetrachloroethylene is a nonflammable colorless liquid. Other names for tetrachloroethylene include perchloroethylene, PCE, perc, tetrachloroethene, and perchlor. Most people can smell tetrachloroethylene when it is present in the air at a level of 1 part in 1 million parts of air (1 ppm) or more.

Tetrachloroethylene is used as a dry cleaning agent and metal degreasing solvent. It is also used as a starting material (building block) for making other chemicals and is used in some consumer products.

What happens to tetrachloroethylene when it enters the environment?

- Tetrachloroethylene can be released into air, water, and soil at places where it is produced or used.
- Tetrachloroethylene breaks down very slowly in the air and so it can be transported long distances in the air. Half of the amount in the air will degrade in approximately 100 days.
- Tetrachloroethylene evaporates quickly from water into air. It is generally slow to break down in water.
- Tetrachloroethylene may evaporate quickly from shallow soils or may filter through the soil and into the groundwater below. It is generally slow to break down in soil.

How might I be exposed to tetrachloroethylene?

- When you bring clothes from the dry cleaners, they will release small amounts of tetrachloroethylene into the air.
- When you drink water containing tetrachloroethylene, you are exposed to it. You might also be exposed to tetrachloroethylene that is released into the air during showering and bathing.
- People residing near contaminated sites or dry cleaning locations may be exposed to higher levels than the general population.
- People working in the dry cleaning industries or using metal degreasing products may be exposed to elevated levels of tetrachloroethylene.

How can tetrachloroethylene affect my health?

Breathing high levels of tetrachloroethylene for a brief period may cause dizziness or drowsiness, headache, and incoordination; higher levels may cause unconsciousness and even death.

Exposure for longer periods to low levels of tetrachloroethylene may cause changes in mood, memory, attention, reaction time, and vision.

Studies in animals exposed to tetrachloroethylene have shown liver and kidney effects, and changes in brain chemistry, but we do not know what these findings mean for humans.

Agency for Toxic Substances and Disease Registry
Division of Toxicology and Human Health Sciences

Tetrachloroethylene

CAS # 127-18-4

How likely is tetrachloroethylene to cause cancer?

Studies in humans suggest that exposure to tetrachloroethylene might lead to a higher risk of getting bladder cancer, multiple myeloma, or non-Hodgkin's lymphoma.

In animals, tetrachloroethylene has been shown to cause cancers of the liver, kidney, and blood system.

The Department of Health and Human Services (DHHS) considers tetrachloroethylene to be reasonably anticipated to be a human carcinogen. EPA considers tetrachloroethylene likely to be carcinogenic to humans by all routes of exposure. The International Agency for Research on Cancer (IARC) considers tetrachloroethylene probably carcinogenic to humans.

How can tetrachloroethylene affect children?

It is not known whether children are more susceptible than adults to the effects of tetrachloroethylene.

A few studies in humans have suggested that exposure to tetrachloroethylene increased the numbers of babies with birth defects, but these studies were not large enough to clearly answer the question. Studies in animals exposed by inhalation or stomach tube have not shown clear evidence of specific birth defects.

How can families reduce the risk of exposure to tetrachloroethylene?

- Tetrachloroethylene has been found in low levels in some food. You can minimize the risk of your family's exposure by peeling and thoroughly washing fruits and vegetables before cooking.
- Use bottled water if you have concerns about the presence of tetrachloroethylene in your tap water. You may also contact local drinking water authorities and follow their advice.
- Prevent children from playing in dirt or eating dirt if you live near a waste site that has tetrachloroethylene.
- Tetrachloroethylene is widely used as a scouring solvent that removes oils from fabrics, as a carrier solvent, as a fabric finish or water repellant, and as a metal degreaser/cleaner. Follow instructions on product labels to minimize exposure to tetrachloroethylene.

Is there a medical test to determine whether I've been exposed to tetrachloroethylene?

Tetrachloroethylene and its breakdown products (metabolites) can be measured in blood and urine. However, the detection of tetrachloroethylene or its metabolites cannot predict the kind of health effects that might develop from that exposure. Because tetrachloroethylene and its metabolites leave the body fairly rapidly, the tests need to be conducted within days after exposure.

Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) has set an 8-hour time weighted average permissible exposure limit of 100 ppm, an acceptable ceiling exposure limit of 200 ppm, and a maximum peak of 300 ppm (not to be exceeded for more than 5 minutes of any 3-hour period).

The National Institute for Occupational Safety and Health (NIOSH) recommends that workplace exposure to tetrachloroethylene be minimized due to concerns about its carcinogenicity.

Reference

This ToxFAQs™ information is taken from the 2019 Toxicological Profile for Tetrachloroethylene produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636

ToxFAQs™ on the web: www.atsdr.cdc.gov/ToxFAQs

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Trichloroethylene - ToxFAQs™

CAS # 79-01-6

This fact sheet answers the most frequently asked health questions (FAQs) about trichloroethylene. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Trichloroethylene is used as a solvent for cleaning metal parts. Exposure to very high concentrations of trichloroethylene can cause dizziness headaches, sleepiness, incoordination, confusion, nausea, unconsciousness, and even death. Trichloroethylene has been found in at least 1,051 of the 1,854 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is trichloroethylene?

Trichloroethylene is a colorless, volatile liquid. Liquid trichloroethylene evaporates quickly into the air. It is nonflammable and has a sweet odor.

The two major uses of trichloroethylene are as a solvent to remove grease from metal parts and as a chemical that is used to make other chemicals, especially the refrigerant, HFC-134a.

What happens to trichloroethylene when it enters the environment?

- Trichloroethylene can be released to air, water, and soil at places where it is produced or used.
- Trichloroethylene is broken down quickly in air.
- Trichloroethylene breaks down very slowly in soil and water and is removed mostly through evaporation to air.
- It is expected to remain in groundwater for long time since it is not able to evaporate.
- Trichloroethylene does not build up significantly in plants or animals.

How might I be exposed to trichloroethylene?

- Breathing trichloroethylene in contaminated air.
- Drinking contaminated water.
- Workers at facilities using this substance for metal degreasing are exposed to higher levels of trichloroethylene.
- If you live near such a facility or near a hazardous waste site containing trichloroethylene, you may also have higher exposure to this substance.

How can trichloroethylene affect my health?

Trichloroethylene was once used as an anesthetic for surgery. Exposure to moderate amounts of trichloroethylene may cause headaches, dizziness, and sleepiness; large amounts may cause coma and even death. Eating or breathing high levels of trichloroethylene may damage some of the nerves in the face. Exposure to high levels can also result in changes in the rhythm of the heartbeat, liver damage, and evidence of kidney damage. Skin contact with concentrated solutions of trichloroethylene can cause skin rashes. There is some evidence exposure to trichloroethylene in the work place may cause scleroderma (a systemic autoimmune disease) in some people. Some men occupationally-exposed to trichloroethylene and other chemicals showed decreases in sex drive, sperm quality, and reproductive hormone levels.

How likely is trichloroethylene to cause cancer?

There is strong evidence that trichloroethylene can cause kidney cancer in people and some evidence for trichloroethylene-induced liver cancer and malignant lymphoma. Lifetime exposure to trichloroethylene resulted in increased liver cancer in mice and increased kidney cancer and testicular cancer in rats.

The Department of Health and Human Services (DHHS) considers trichloroethylene to be a known human carcinogen. The International Agency for Research on Cancer (IARC) classified trichloroethylene as carcinogenic to humans. The EPA has characterized trichloroethylene as carcinogenic to humans by all routes of exposure.

Trichloroethylene

CAS # 79-01-6

How can trichloroethylene affect children?

It is not known whether children are more susceptible than adults to the effects of trichloroethylene.

Some human studies indicate that trichloroethylene may cause developmental effects such as spontaneous abortion, congenital heart defects, central nervous system defects, and small birth weight. However, these people were exposed to other chemicals as well.

In some animal studies, exposure to trichloroethylene during development caused decreases in body weight, increases in heart defects, changes to the developing nervous system, and effects on the immune system.

How can families reduce the risk of exposure to trichloroethylene?

- Avoid drinking water from sources that are known to be contaminated with trichloroethylene. Use bottled water if you have concerns about the presence of chemicals in your tap water. You may also contact local drinking water authorities and follow their advice.
- Prevent children from playing in dirt or eating dirt if you live near a waste site that has trichloroethylene.
- Trichloroethylene is used in many industrial products. Follow instructions on product labels to minimize exposure to trichloroethylene.

Is there a medical test to determine whether I've been exposed to trichloroethylene?

Trichloroethylene and its breakdown products (metabolites) can be measured in blood and urine. However, the detection of trichloroethylene or its metabolites cannot predict the kind of health effects that might develop from that exposure. Because trichloroethylene and its metabolites leave the body fairly rapidly, the tests need to be conducted within days after exposure.

Has the federal government made recommendations to protect human health?

The EPA set a maximum contaminant goal (MCL) of 0.005 milligrams per liter (mg/L; 5 ppb) as a national primary drinking standard for trichloroethylene.

The Occupational Safety and Health Administration (OSHA) set a permissible exposure limit (PEL) of 100 ppm for trichloroethylene in air averaged over an 8-hour work day, an acceptable ceiling concentration of 200 ppm provided the 8 hour PEL is not exceeded, and an acceptable maximum peak of 300 ppm for a maximum duration of 5 minutes in any 2 hours.

The National Institute for Occupational Safety and Health (NIOSH) considers trichloroethylene to be a potential occupational carcinogen and established a recommended exposure limit (REL) of 2 ppm (as a 60-minute ceiling) during its use as an anesthetic agent and 25 ppm (as a 10-hour TWA) during all other exposures.

Reference

This ToxFAQs™ information is taken from the 2019 Toxicological Profile for Trichloroethylene produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636

ToxFAQs™ on the web: www.atsdr.cdc.gov/ToxFAQs

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Appendix D
Community Air Monitoring Plan

DRAFT

Appendix 1A
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 mcg/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 mcg/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 mcg/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.

December 2009

Appendix 1B
Fugitive Dust and Particulate Monitoring

A program for suppressing fugitive dust and particulate matter monitoring at hazardous waste sites is a responsibility on the remedial party performing the work. These procedures must be incorporated into appropriate intrusive work plans. The following fugitive dust suppression and particulate monitoring program should be employed at sites during construction and other intrusive activities which warrant its use:

1. Reasonable fugitive dust suppression techniques must be employed during all site activities which may generate fugitive dust.

2. Particulate monitoring must be employed during the handling of waste or contaminated soil or when activities on site may generate fugitive dust from exposed waste or contaminated soil. Remedial activities may also include the excavation, grading, or placement of clean fill. These control measures should not be considered necessary for these activities.

3. Particulate monitoring must be performed using real-time particulate monitors and shall monitor particulate matter less than ten microns (PM10) with the following minimum performance standards:

(a) Objects to be measured: Dust, mists or aerosols;
(b) Measurement Ranges: 0.001 to 400 mg/m3 (1 to 400,000 :ug/m3);
(c) Precision (2-sigma) at constant temperature: +/- 10 :g/m3 for one second averaging; and +/- 1.5 g/m3 for sixty second averaging;
(d) Accuracy: +/- 5% of reading +/- precision (Referred to gravimetric calibration with SAE fine test dust (mmd= 2 to 3 :m, g= 2.5, as aerosolized);
(e) Resolution: 0.1% of reading or 1g/m3, whichever is larger;
(f) Particle Size Range of Maximum Response: 0.1-10;
(g) Total Number of Data Points in Memory: 10,000;
(h) Logged Data: Each data point with average concentration, time/date and data point number
(i) Run Summary: overall average, maximum concentrations, time/date of maximum, total number of logged points, start time/date, total elapsed time (run duration), STEL concentration and time/date occurrence, averaging (logging) period, calibration factor, and tag number;
(j) Alarm Averaging Time (user selectable): real-time (1-60 seconds) or STEL (15 minutes), alarms required;
(k) Operating Time: 48 hours (fully charged NiCd battery); continuously with charger;
(l) Operating Temperature: -10 to 50^{o} C (14 to 122^{o} F);
(m) Particulate levels will be monitored upwind and immediately downwind at the working site and integrated over a period not to exceed 15 minutes.

4. In order to ensure the validity of the fugitive dust measurements performed, there must be appropriate Quality Assurance/Quality Control (QA/QC). It is the responsibility of the remedial party to adequately supplement QA/QC Plans to include the following critical features: periodic instrument calibration, operator training, daily instrument performance (span) checks, and a record keeping plan.

5. The action level will be established at 150 ug/m3 (15 minutes average). While conservative,

this short-term interval will provide a real-time assessment of on-site air quality to assure both health and safety. If particulate levels are detected in excess of 150 ug/m3, the upwind background level must be confirmed immediately. If the working site particulate measurement is greater than 100 ug/m3 above the background level, additional dust suppression techniques must be implemented to reduce the generation of fugitive dust and corrective action taken to protect site personnel and reduce the potential for contaminant migration. Corrective measures may include increasing the level of personal protection for on-site personnel and implementing additional dust suppression techniques (see paragraph 7). Should the action level of 150 ug/m3 continue to be exceeded work must stop and DER must be notified as provided in the site design or remedial work plan. The notification shall include a description of the control measures implemented to prevent further exceedances.

6. It must be recognized that the generation of dust from waste or contaminated soil that migrates off-site, has the potential for transporting contaminants off-site. There may be situations when dust is being generated and leaving the site and the monitoring equipment does not measure PM10 at or above the action level. Since this situation has the potential to allow for the migration of contaminants off-site, it is unacceptable. While it is not practical to quantify total suspended particulates on a real-time basis, it is appropriate to rely on visual observation. If dust is observed leaving the working site, additional dust suppression techniques must be employed. Activities that have a high dusting potential--such as solidification and treatment involving materials like kiln dust and lime--will require the need for special measures to be considered.

7. The following techniques have been shown to be effective for the controlling of the generation and migration of dust during construction activities:

(a) Applying water on haul roads;
(b) Wetting equipment and excavation faces;
(c) Spraying water on buckets during excavation and dumping;
(d) Hauling materials in properly tarped or watertight containers;
(e) Restricting vehicle speeds to 10 mph;
(f) Covering excavated areas and material after excavation activity ceases; and
(g) Reducing the excavation size and/or number of excavations.

Experience has shown that the chance of exceeding the 150ug/m3 action level is remote when the above-mentioned techniques are used. When techniques involving water application are used, care must be taken not to use excess water, which can result in unacceptably wet conditions. Using atomizing sprays will prevent overly wet conditions, conserve water, and provide an effective means of suppressing the fugitive dust.

8. The evaluation of weather conditions is necessary for proper fugitive dust control. When extreme wind conditions make dust control ineffective, as a last resort remedial actions may need to be suspended. There may be situations that require fugitive dust suppression and particulate monitoring requirements with action levels more stringent than those provided above. Under some circumstances, the contaminant concentration and/or toxicity may require additional monitoring to protect site personnel and the public. Additional integrated sampling and chemical analysis of the dust may also be in order. This must be evaluated when a health and safety plan is developed and when appropriate suppression and monitoring requirements are established for protection of health and the environment.

Appendix E

Soil Boring and Monitoring Well Construction Logs from Previous Investigations

DRAFT

LCS Inc.

SUBSURFACE LOG

PROJECT/ LOCATION: 201 Charles Street, 116 Wallace Avenue, and Two Unaddressed Parcels on Old Creamery Road, Maybrook, New York
PROJECT No. 15N6714.22

CLIENT: West Port Management, LLC
BORING/WELL No. BH8
DATE STARTED: 1/14/2016
DATE COMPLETED: 1/14/2016
RECORDED BY: MN
GROUNDWATER DEPTH WHILE DRILLING: NA
AFTER COMPLETION: NA
WEATHER: 21 °F Sunny
DRILL RIG: Geoprobe
DRILLER: TREC
DRILL SIZE/TYPE: Macro-core
SAMPLE HAMMER: WEIGHT NA
FALL NA

Sample No.	PID/HNu Reading (ppm)	Depth (Feet)	Type *	Blows/6”	N	Recovery (Inches)	Material Classification and Description (Unified Soil Classification System-Visual Manual Method)
1	0.0	0-2	U	-	-	14	0 – 0.4 ft: Asphalt
2	0.0	2-4	U	-	-	14	0.4 – 2 ft: Gray gravel (coarse, angular, loose, moist)
3	0.0	4-6	U	-	-	15	2 – 8 ft: Brown silty sand (medium, loose, moist) (weathered rock)
4	0.0	6-8	U	-	-	15	Refusal encountered at ~8 ft. bgs.

NOTES
NA = Not Applicable
ft. bgs = feet below ground surface
Fill to ~2 ft. bgs
No suspect odors detected

*SS - SPLIT-SPOON SAMPLE U - UNDISTURBED TUBE P - PISTON TUBE C - CORE

LCS Inc.

SUBSURFACE LOG

PROJECT/ LOCATION: 201 Charles Street, 116 Wallace Avenue, and Two Unaddressed Parcels on Old Creamery Road, Maybrook, New York

PROJECT No. 15N6714.22

CLIENT: West Port Management, LLC

BORING/WELL No. BH9/TPMW4

DATE STARTED: 1/14/2016

DATE COMPLETED: 1/14/2016

RECORDED BY: MN

GROUNDWATER DEPTH WHILE DRILLING: ~10 ft. bgs.

AFTER COMPLETION: ~10 ft. bgs.

WEATHER: 21 °F Sunny

DRILL RIG: Geoprobe

DRILLER: TREC

DRILL SIZE/TYPE: Macro-core

SAMPLE HAMMER: WEIGHT NA

FALL NA

Sample No.	PID/HNu Reading (ppm)	Depth (Feet)	Type *	Blows/6”	N	Recovery (Inches)	Material Classification and Description (Unified Soil Classification System-Visual Manual Method)
1	0.0	0-2	U	-	-	20	0 – 0.4 ft: Asphalt
2	0.0	2-4	U	-	-	20	0.4 – 2 ft: Gray gravelly silt (low plasticity, dry)
3	0.0	4-6	U	-	-	24	2 – 10 ft: Brown silt (low plasticity, moist) (weathered rock)
4	0.0	6-8	U	-	-	24	10 – 11.5 ft: Brown silt (low plasticity, wet)
5	0.0	8-10	U	-	-	15	Refusal encountered at ~11.5 ft. bgs.
6	0.0	10-12	U	-	-	15	

NOTES NA = Not Applicable

ft. bgs = feet below ground surface

Fill to ~2 ft. bgs

No suspect odors detected

*SS - SPLIT-SPOON SAMPLE U - UNDISTURBED TUBE P - PISTON TUBE C - CORE

LCS Inc.

SUBSURFACE LOG

PROJECT/ LOCATION: 201 Charles Street, 116 Wallace Avenue, and Two Unaddressed Parcels on Old Creamery Road, Maybrook, New York

PROJECT No. 15N6714.22

CLIENT: West Port Management, LLC

BORING/WELL No. BH10/TPMW5

DATE STARTED: 1/14/2016

DATE COMPLETED: 1/14/2016

RECORDED BY: MN

GROUNDWATER DEPTH WHILE DRILLING: ~10 ft. bgs

AFTER COMPLETION: ~10 ft. bgs

WEATHER: 21 °F Sunny

DRILL RIG: Geoprobe

DRILLER: TREC

DRILL SIZE/TYPE: Macro-core

SAMPLE HAMMER: WEIGHT NA

FALL NA

Sample No.	PID/HNu Reading (ppm)	Depth (Feet)	Type *	Blows/6”	N	Recovery (Inches)	Material Classification and Description (Unified Soil Classification System-Visual Manual Method)
1	0.0	0-2	U	-	-	22	0 – 0.4 ft: Asphalt
2	0.0	2-4	U	-	-	22	0.4 – 2 ft: Gray gravelly silt (low plasticity, dry)
3	41.5	4-6	U	-	-	24	2 – 10 ft: Brown silty sand (medium, loose, moist) (weathered rock)
4	6.3	6-8	U	-	-	24	10 – 11.5 ft: Brown silty sand (medium, loose, moist) (weathered rock)
5	0.0	8-10	U	-	-	6	
							Refusal encountered at ~11.5 ft. bgs.
6	0.0	10-12	U	-	-	6	

NOTES NA = Not Applicable

ft. bgs = feet below ground surface

Fill to ~2 ft. bgs

No suspect odors detected

*SS - SPLIT-SPOON SAMPLE U - UNDISTURBED TUBE P - PISTON TUBE C - CORE

LCS Inc.

SUBSURFACE LOG

PROJECT/ LOCATION: 201 Charles Street, 116 Wallace Avenue, and Two Unaddressed Parcels on Old Creamery Road, Maybrook, New York

PROJECT No. 15N6714.22

CLIENT: West Port Management, LLC

BORING/WELL No. BH11

DATE STARTED: 1/14/2016 DATE COMPLETED: 1/14/2016 RECORDED BY: MN

GROUNDWATER DEPTH WHILE DRILLING: NA AFTER COMPLETION: NA

WEATHER: 21 °F Sunny DRILL RIG: Geoprobe DRILLER: TREC

DRILL SIZE/TYPE: Macro-core SAMPLE HAMMER: WEIGHT NA FALL NA

Sample No.	PID/HNu Reading (ppm)	Depth (Feet)	Type *	Blows/6”	N	Recovery (Inches)	Material Classification and Description (Unified Soil Classification System-Visual Manual Method)
1	0.0	0-2	U	-	-	13	0 – 3 ft: Gray gravelly silt (low plasticity, dry)
2	0.0	2-4	U	-	-	13	3 – 8 ft: Brown gravelly silty sand (medium, loose, dry) (weathered rock
3	0.0	4-6	U	-	-	20	Refusal encountered at ~8 ft. bgs.
4	0.0	6-8	U	-	-	20	

NOTES NA = Not Applicable

ft. bgs = feet below ground surface

Fill to ~3 ft. bgs

No suspect odors detected

*SS - SPLIT-SPOON SAMPLE U - UNDISTURBED TUBE P - PISTON TUBE C - CORE

LCS Inc.

SUBSURFACE LOG

PROJECT/ LOCATION: 201 Charles Street, 116 Wallace Avenue, and Two Unaddressed Parcels on Old Creamery Road, Maybrook, New York

PROJECT No. 15N6714.22

CLIENT: West Port Management, LLC

BORING/WELL No. BH12

DATE STARTED: 1/14/2016

DATE COMPLETED: 1/14/2016

RECORDED BY: MN

GROUNDWATER DEPTH WHILE DRILLING: NA

AFTER COMPLETION: NA

WEATHER: 21 °F Sunny

DRILL RIG: Geoprobe

DRILLER: TREC

DRILL SIZE/TYPE: Macro-core

SAMPLE HAMMER: WEIGHT NA

FALL NA

Sample No.	PID/HNu Reading (ppm)	Depth (Feet)	Type *	Blows/6”	N	Recovery (Inches)	Material Classification and Description (Unified Soil Classification System-Visual Manual Method)
1	0.0	0-2	U	-	-	11	0 – 2 ft: Brown Gravelly silt (low plasticity, dry)
2	0.0	2-4	U	-	-	11	2 – 3 ft: Gray clay (low plasticity, stiff, dry)
							Refusal encountered at ~3 ft. bgs.

NOTES

NA = Not Applicable

ft. bgs = feet below ground surface

Fill to ~2 ft. bgs

No suspect odors detected

*SS - SPLIT-SPOON SAMPLE U - UNDISTURBED TUBE P - PISTON TUBE C - CORE

LCS Inc.

SUBSURFACE LOG

PROJECT/ LOCATION: 201 Charles Street, 116 Wallace Avenue, and Two Unaddressed Parcels on Old Creamery Road, Maybrook, New York

PROJECT No. 15N6714.22

CLIENT: West Port Management, LLC

BORING/WELL No. BH13

DATE STARTED: 1/14/2016

DATE COMPLETED: 1/14/2016

RECORDED BY: MN

GROUNDWATER DEPTH WHILE DRILLING: NA

AFTER COMPLETION: NA

WEATHER: 21 °F Sunny

DRILL RIG: Geoprobe

DRILLER: TREC

DRILL SIZE/TYPE: Macro-core

SAMPLE HAMMER: WEIGHT NA

FALL NA

Sample No.	PID/HNu Reading (ppm)	Depth (Feet)	Type *	Blows/6”	N	Recovery (Inches)	Material Classification and Description (Unified Soil Classification System-Visual Manual Method)
1	0.0	0-2	U	-	-	23	0 – 3 ft: Gray gravelly silt (low plasticity, dry)
2	0.0	2-4	U	-	-	23	3 – 8 ft: Brown gravelly silty sand (medium, loose, dry) (weathered rock
3	0.0	4-6	U	-	-	21	
							Refusal encountered at ~8 ft. bgs.
4	0.0	6-8	U	-	-	21	

NOTES NA = Not Applicable

ft. bgs = feet below ground surface

Fill to ~3 ft. bgs

No suspect odors detected

*SS - SPLIT-SPOON SAMPLE U - UNDISTURBED TUBE P - PISTON TUBE C - CORE

LCS, Inc.

WELL CONSTRUCTION DETAIL

PROJECT/LOCATION: 201 Charles Street, 116 Wallace Avenue, and Two Unaddressed Parcels on Old Creamery Road, Maybrook, New York

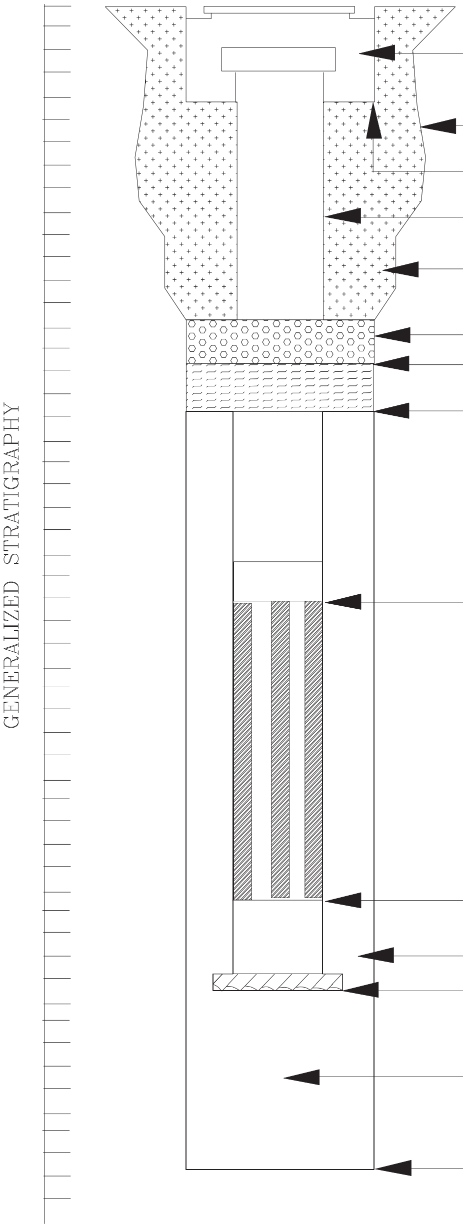
PROJECT No. 15N6714.22

CLIENT: West Port Management, LLC

WELL No. TW4

DATE COMPLETED: 1/14/2016

SUPERVISED BY: MN



REFERENCE POINT
Elevation/Depth: NA

SURFACE SEAL
Type/Depth: NA

DEPTH OF SURFACE CASING: NA

RISER PIPE Size/Type: 1.0 inch/Schedule 40 PVC

DIAMETER OF BOREHOLE: 2.2 inches

TYPE OF FILL: NA

TOP OF SEAL Elevation/Depth: 0.0 ft. bgs
TYPE OF SEAL: Hydrated bentonite

TOP OF FILTER PACK Elevation/Depth: 1.0 ft. bgs
FILTER PACK MATERIAL: #00N silica sand

TOP OF SCREEN Elevation/Depth: 1.3 ft. bgs
SCREEN SIZE/TYPE: 0.010 inch/Schedule 40 PVC

BOTTOM OF SCREEN Elevation/Depth: 11.3 ft. bgs

BOTTOM OF FILTER PACK
Elevation/Depth: 11.5 ft. bgs

BOTTOM OF PLUGGED BLANK SECTION
Elevation/Depth: 11.5 ft. bgs

TYPE OF FILLER
BELOW PLUGGED BLANK: NA

BOTTOM OF BOREHOLE
Elevation/Depth: 11.5 ft. bgs

NOTES

LCS, Inc. WELL CONSTRUCTION DETAIL

PROJECT/LOCATION: 201 Charles Street, 116 Wallace Avenue, and Two Unaddressed Parcels on Old Creamery Road, Maybrook, New York

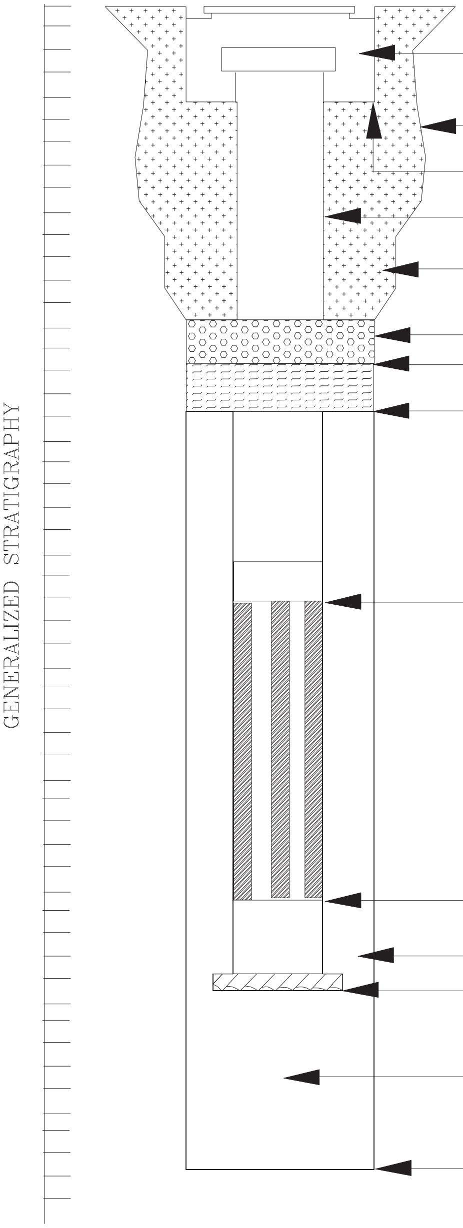
PROJECT No. 15N6714.22

CLIENT: West Port Management, LLC

WELL No. TW5

DATE COMPLETED: 1/14/2016

SUPERVISED BY: MN



REFERENCE POINT
Elevation/Depth: NA

SURFACE SEAL
Type/Depth: NA

DEPTH OF SURFACE CASING: NA

RISER PIPE Size/Type: 1.0 inch/Achedule 40 PVC

DIAMETER OF BOREHOLE: 2.2 inches

TYPE OF FILL: NA

TOP OF SEAL Elevation/Depth: 0.0 ft.bgs
TYPE OF SEAL: Hydrated bentonite

TOP OF FILTER PACK Elevation/Depth: 1.0 ft. bgs
FILTER PACK MATERIAL: #00N silica sand

TOP OF SCREEN Elevation/Depth: 1.3 ft. bgs
SCREEN SIZE/TYPE: 0.010 inch/Schedule 40 PVC

BOTTOM OF SCREEN Elevation/Depth: 11.3 ft.bgs

BOTTOM OF FILTER PACK
Elevation/Depth: 11.5 ft. bgs

BOTTOM OF PLUGGED BLANK SECTION
Elevation/Depth: 11.5 ft.bgs

TYPE OF FILLER
BELOW PLUGGED BLANK: NA

BOTTOM OF BOREHOLE
Elevation/Depth: 11.5 ft. bgs

NOTES

SOILTESTING, INC.
90 DONOVAN RD.
OXFORD, CT 06478
CT (203) 262-9328
NY (914) 946-4850

CLIENT: **William Going & Associates, Inc.**

PROJECT NO. **E7-0323-16**

PROJECT NAME **201 Charles Street**

LOCATION **Maybrook, NY**

SHEET 1 OF 1

HOLE NO. MW-5

BORING LOCATIONS as Directed

FOREMAN - DRILLER **TP/ad**

INSPECTOR **Bud**

GROUND WATER OBSERVATIONS
AT 10 FT AFTER 0 HOURS
AT __ FT AFTER __ HOURS

	CASING	SAMPLER	CORE BAR
TYPE	HSA	SS	
SIZE I.D.	4¼"	1 3/8"	
HAMMER WT.		140#	BIT
HAMMER FALL		30"	

OFFSET
DATE START 3/31/16
DATE FINISH 3/31/16
SURFACE ELEV.
GROUND WATER ELEV.

DEPTH	CASING BLOWS PER FOOT	SAMPLE NO	SAMPLE Type	SAMPLE PEN	SAMPLE REC	SAMPLE DEPTH @ BOT	BLOWS PER 6 IN ON SAMPLER (FORCE ON TUBE) 0 - 6	6 - 12	12 - 18	CORE TIME PER FT (MIN)	DENSITY OR CONSIST / MOIST	STRATA CHANGE DEPTH / ELEV	FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.
													Brn FM SAND, sm silt, lit F gravel, tr roots
5													
													Brn FM SAND & SILT, F GRAVEL
10											moist/wet		
												11'0"	
													weathered BEDROCK
												14'0"	AUGER REFUSAL
15													**E.O.B. 14'0"**
													Set 2" Well at 14'
20													
25													
30													
35													
40													

NOTE: Subsoil conditions revealed by this investigation represent conditions at specific locations and may not represent conditions at other locations or times.

GROUND SURFACE TO ________FT. USED ______________CASING THEN _______ CASING TO ______FT.

HOLE NO. MW-5

A = AUGER UP = UNDISTURBED PISTON T = THINWALL V = VANE TEST
WOR = WEIGHT OF RODS WOH = WEIGHT OF HAMMER & RODS
SS = SPLIT TUBE SAMPLER H.S.A. = HOLLOW STEM AUGER
PROPORTIONS USED: TRACE = 0 - 10% LITTLE = 10 - 20% SOME = 20 - 35% AND =35 - 50%

C = COARSE
M = MEDIUM
F = FINE

Phone
(203) 262-9328

Telefax
(203) 264-3414

WHITE PLAINS, N.Y.
(914) 946-4850

SOILTESTING, INC.

90 DONOVAN ROAD - OXFORD, CONN. 06478-1028

GEOTECHNICAL / ENVIRONMENTAL SUBSURFACE INVESTIGATIONS - Test Borings - Core Drilling
Monitoring Wells - Recovery Wells - Direct Push/Probe Sampling
UNDERPINNING - HELICAL PILES - SOIL NAILS

CLIENT: William Going & Associates, Inc.
JOB #: E7-0323-16

Monitor Well # MW-5

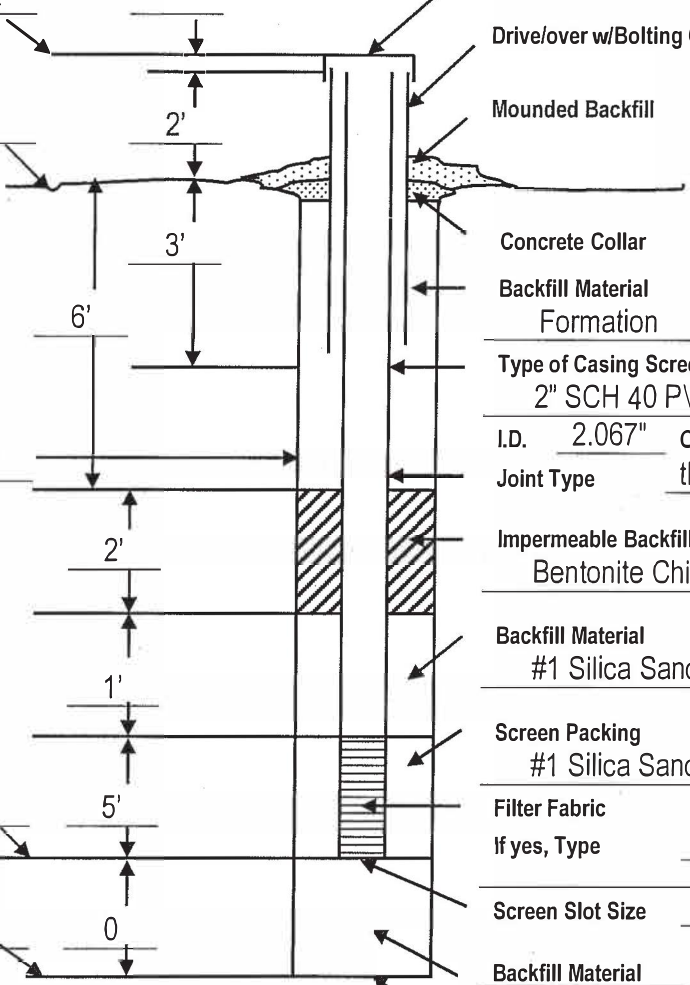
Top of Casing Elevation +2'

Ground Surface Elevation 0

Borehole Diameter 8"

Well Point Elevation 14'

Bottom of Boring Elevation 14'



Stick Up Vented Locking Steel Cap X Yes ____ No

Drive/over w/Bolting Cover ____ Yes X No

Mounded Backfill X Yes ____ No

Concrete Collar X Yes ____ No

Backfill Material Formation

Type of Casing Screen 2" SCH 40 PVC

I.D. 2.067" O.D. 2.375"

Joint Type thd'd F.J.

Impermeable Backfill Bentonite Chips

Backfill Material #1 Silica Sand

Screen Packing #1 Silica Sand

Filter Fabric ____ Yes X No

If yes, Type

Screen Slot Size .010

Backfill Material

Refusal at 14'0" X Yes ____ No

Screen	5'	Bentonite Pellets		Locking Exp. Plug	1
Riser	15'	Bentonite Chips	1	Lock	
Plug	1	Concrete Mix	1	D/O	
Slip Cap		Portland Cement		S/U	1
Silica Sand	200#				
Powdered Bentonite					

SOILTESTING, INC.
90 DONOVAN RD.
OXFORD, CT 06478
CT (203) 262-9328
NY (914) 946-4850

CLIENT: **William Going & Associates, Inc.**

SHEET 1 OF 1
HOLE NO. **MW-6**

PROJECT NO. **E7-0323-16**

PROJECT NAME **201 Charles Street**

BORING LOCATIONS as Directed

FOREMAN - DRILLER **TP/ad**

LOCATION **Maybrook, NY**

INSPECTOR **Bud**

OFFSET

GROUND WATER OBSERVATIONS
AT 12 FT AFTER 0 HOURS
AT __ FT AFTER __ HOURS

	CASING	SAMPLER	CORE BAR
TYPE	HSA	SS	AR
SIZE I.D.	4¼"	1 3/8"	6" / 4"
HAMMER WT.		140#	BIT
HAMMER FALL		30"	DTH

DATE START 3/31/16
DATE FINISH 3/31/16
SURFACE ELEV.
GROUND WATER ELEV.

DEPTH	CASING BLOWS PER FOOT	SAMPLE NO	SAMPLE Type	SAMPLE PEN	SAMPLE REC.	SAMPLE DEPTH @ BOT	BLOWS PER 6 IN ON SAMPLER (FORCE ON TUBE) 0 - 6	6 - 12	12- 18	CORE TIME PER FT (MIN)	DENSITY OR CONSIST / MOIST	STRATA CHANGE DEPTH / ELEV	FIELD IDENTIFICATION OF SOIL REMARKS INCL. COLOR, LOSS OF WASH WATER, SEAMS IN ROCK, ETC.
													Brn FM SAND, sm silt, lit FC gravel, tr cobbles
5													
													Brn SILT & FMC SAND, F GRAVEL
10													
											wet		weathered BEDROCK
												14'0"	AUGER REFUSAL
15		1	AR	4'0"	N/A	18'0"							BEDROCK
												18'0"	
													E.O.B. 18'0"
20													
													Set 2" Well at 18'
25													
30													
35													
40													

NOTE: Subsoil conditions revealed by this investigation represent conditions at specific locations and may not represent conditions at other locations or times.

GROUND SURFACE TO ________FT. USED ____________CASING THEN ______ CASING TO ______FT.

HOLE NO. MW-6

A = AUGER UP = UNDISTURBED PISTON T = THINWALL V = VANE TEST
WOR = WEIGHT OF RODS WOH = WEIGHT OF HAMMER & RODS C = COARSE
SS = SPLIT TUBE SAMPLER H.S.A. = HOLLOW STEM AUGER M = MEDIUM
PROPORTIONS USED: TRACE = 0 - 10% LITTLE = 10 - 20% SOME = 20 - 35% AND =35 - 50% F = FINE

Phone
(203) 262-9328

Telefax
(203) 264-3414

WHITE PLAINS, N.Y.
(914) 946-4850

SOILTESTING, INC.

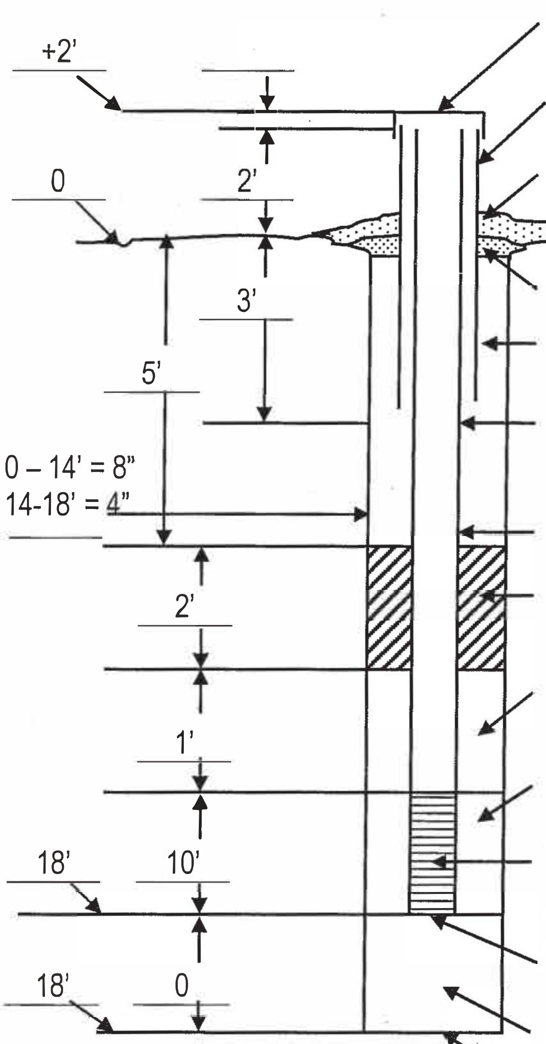
90 DONOVAN ROAD - OXFORD, CONN. 06478-1028

GEOTECHNICAL / ENVIRONMENTAL SUBSURFACE INVESTIGATIONS - Test Borings - Core Drilling
Monitoring Wells - Recovery Wells - Direct Push/Probe Sampling
UNDERPINNING - HELICAL PILES - SOIL NAILS

CLIENT: William Going & Associates, Inc.
JOB #: E7-0323-16

Monitor Well # MW-6

Top of Casing Elevation +2'
Ground Surface Elevation 0
Borehole Diameter 0 – 14' = 8" 14-18' = 4"
Well Point Elevation 18'
Bottom of Boring Elevation 18'

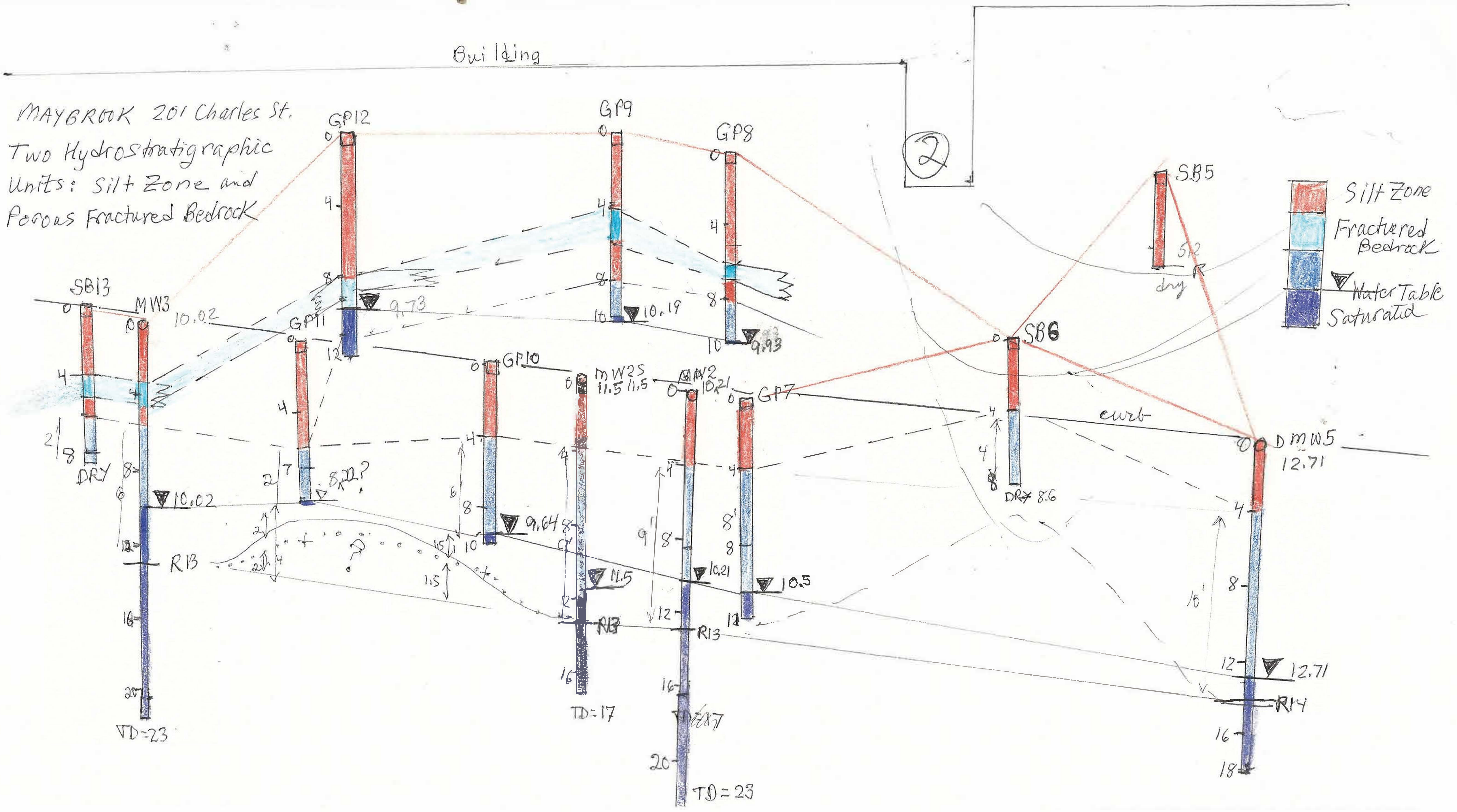


Stick Up Vented Locking Steel Cap [✓ Yes] No
Drive/over w/Bolting Cover Yes [✓ No]
Mounded Backfill [✓ Yes] No
Concrete Collar [✓ Yes] No
Backfill Material Formation
Type of Casing Screen 2" SCH 40 PVC
I.D. 2.067" O.D. 2.375"
Joint Type thd'd F.J.
Impermeable Backfill Bentonite Chips
Backfill Material #1 Silica Sand
Screen Packing #1 Silica Sand
Filter Fabric Yes [✓ No]
If yes, Type
Screen Slot Size .010
Backfill Material
Refusal at 14'0" Yes [✓ No]

Screen 10'
Riser 10'
Plug 1
Slip Cap
Silica Sand 300#
Powdered Bentonite

Bentonite Pellets
Bentonite Chips 1
Concrete Mix 1
Portland Cement

Locking Exp. Plug 1
Lock
D/O
S/U 1



MAYBROOK 201 Charles St.
Two Hydrostratigraphic
Units: Silt Zone and
Porous Fractured Bedrock