REMEDIAL INVESTIGATION –
ALTERNATIVES ANALYSIS REPORT WORK PLAN

BROWNFIELD CLEANUP PROGRAM
For
145 Chandler Street, LLC
125 Chandler Street, Buffalo, New York 14207
BCP # C915358

Prepared For:
145 Chandler Street, LLC
391 Washington Street, Buffalo, New York 14203
WGS Project No: 19209

Prepared By:
Wittman GeoSciences, PLLC
3636 North Buffalo Road
Orchard Park, New York 14127
716-574-1513

March 5, 2020

CERTIFICATIONI, Michele M. Wittman, P.G., certify that I am currently a NYS registered professional geologist and that this Remedial Investigation Work Plan was prepared in accordance with applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

Michele M. Wittman, P.G.
Wittman GeoSciences, PLLC
New York License Number 000726

03/05/2020
Date

TABLE OF CONTENTS

TABLE OF CONTENTS

FIGURES

TABLES

APPENDIX

1.0 INTRODUCTION

1.1 Project Background

This Remedial Investigation (RI) Work Plan presents the proposed scope of work (Work Plan) at 125 Chandler Street Site located at 125 Chandler Street located in the City of Buffalo, New York (Site), as shown on Figure 1 and Figure 2. The Applicant, 145 Chandler Street, LLC, has submitted an application into the Brownfield Cleanup Program (BCP) as a Volunteer, identified as Site Number C915358.

The RI will be completed by Wittman GeoSciences, PLLC (WGS) on behalf of 145 Chandler Street, LLC. The work will be completed in general accordance with New York State Department of Environmental Conservation (NYSDEC) DER-10 guidelines. The work plan provides details on the Site investigation to be undertaken. The Site investigation will include subsurface conditions throughout the Site. Site development will be completed concurrently with remedial investigation work, and areas of concern, if identified, will be addressed as needed. NYSDEC will be notified of any remedial work, if any, completed during Site development activities.

1.2 Site Background

The site is addressed as 125 Chandler Street in the City of Buffalo, Erie County, New York and consists of one approximate 0.75 acre parcel. The site is bound to the north by Chandler Street, to the east by a vacant parcel, to the south by private residences, and to the west by vacant commercial buildings and lots. The property is located within an urban area, utilized for industrial, commercial, and residential purposes.

The 125 Chandler parcel is improved with one approximate 3,500-square foot single-story building located on the western portion of the site. The building was gutted, leaving only steel beams, roof and concrete pad. Historic industrial fill, as well as piles of soil/debris are in portions of the parcel. The site is vacant land, complete with gravel surface or broken concrete, and used for parking associated with the adjoining 155 Chandler and 166 Chandler parcels.

125 Chandler Street was initially identified Chandler Street Playground in 1935, and remained a playground until around 1949 when the site was developed for Direct Winter Transport Ltd. The initial building was located in southern portion of the site, and current building constructed in 1955. The southern building was removed in late 1990s. The 125 Chandler building was also used by Hanson Transport, EJ Scannell Trucking, Acme Steel Co. (storage), Eagle Mold & Mfg. Co, and Mancini auto Sales. The building has been vacant since 2016.

1.3 Summary of Environmental Conditions

During due diligence work prior to property purchase, Hazard Evaluations Inc. completed a limited Phase II investigation in June 2017. The work included completion of 5 soil borings and collection of soil. Based on the soil borings completed, approximately 3 to 8 feet of granular and cohesive fill material is present throughout the site. The fill material extended to depths of 8 feet below grade in the area of the former building on 125 Chandler Site. Silty clay was encountered below the fill material at the 5 soil boring locations, and extended the full depth drilled. Groundwater was generally not encountered during the subsurface investigation work. Appendix

A includes the sample location figure, tables summarizing analytical data and soil boring logs from the June 2017 investigation. A final report was not created for the Phase II work.

1.4 Site Conditions

Based on the soil borings completed, approximately 3 to 8 feet of granular and cohesive fill material is present throughout the Site. Clay and silt was encountered below the fill material and extended the full depth drilled, ranging from 7 to 12 feet below grade. Groundwater was not encountered during the initial investigation work.

The Site is generally flat, however, the building on 125 Chandler Street is at a higher elevation, approximately 3 to 5 feet higher than the remaining areas of the site. The site surface is covered by gravel areas or the one building foundation. Based on a review of the Site topographic conditions as depicted on the USGS 7.5-minute Topographic Quadrangle Map of Buffalo NW, New York, shallow regional groundwater flows is expected to flow in a southwesterly direction toward Scajaquada Creek located approximately 0.4 miles south and toward the Niagara River located approximately one mile west of the Site.

The Site does not have state or federal wetlands within property limits, nor is the Site located within a flood plan. Figure 4, obtained from the Erie County GIS On-line Mapping System, depicts nearby wetlands and/or floodplains which include the floodplain along Scajaquada Creek, located approximately 0.5 miles south of the Site.

The Site is currently serviced by municipal utilities, including potable water, sanitary and storm sewers from the City of Buffalo, natural gas and electric. There are no known groundwater supply wells on-Site and the surrounding area is serviced with potable water.

2.0 PROJECT OBJECTIVES

The Site has not been comprehensively characterized; therefore, the Applicant intends to further investigate the soil/fill and groundwater (if encountered) at the Site. Data collected during the RI will be used to identify potential health risks and to evaluate remedial alternatives. The objectives of the RI include the following:

- Define the nature and extent of on-Site contamination in both soil and groundwater.
- Identify on-Site source areas of contamination, if any.
- Collect data of sufficient quantity and quality to evaluate potential threats to the public health and environment.
- Collect data of sufficient quantity and quality to evaluate remedial alternatives.
- After completion of RI investigation work and laboratory data review, a determination will be made for the need of a soil vapor intrusion (SVI).

2.1 Regulatory Criteria

NYSDEC has applicable standards, criteria and guidance (SCG) values that will be used for this project. These goals are applicable when considering remedial alternatives. For purposes of the RI, the following SCG will be utilized:

- 6 NYCRR Part 375-3 Brownfield Cleanup Program dated December 14, 2006.
- NYSDEC Policy CP-51/Soil Cleanup Guidance dated October 21, 2010.
- NYSDEC "DER-10 Technical guidance for Investigation and Remediation", dated May 2010.
- NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) document "Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations" dated June 1998, amended January 1999 Errata Sheet, April 2000 Addendum and June 2004 Addendum.
- State Department of Health (NYSDOH) "Guidance for Evaluating Soil Vapor Intrusion in the State of New York" dated October 2006.

In addition, sampling data will be used to evaluate remedial alternatives to meet the objectives identified above. Two data confidence levels will be considered, including field screening data and analytical level data. Field screening will include photoionization detector (PID), groundwater elevation measurement, and field groundwater analyses (pH, temperature, specific conductivity, turbidity). Analytical level data will be associated with select soil and groundwater samples submitted for chemical analysis to an independent laboratory.

Soil and groundwater samples will be collected in general accordance with NYSDEC and Environmental Protection Agency (USEPA) sample collection and handling methodologies. Samples selected for laboratory analysis will be submitted to a NYSDOH Environmental Laboratory Accreditation Program (ELAP) Contract Laboratory Protocol (CLP) certified laboratory, with a Category B deliverables package. Additionally, a Data Usability Summary Report (DUSR) will be prepared by a third-party data validator.

2.2 Project Organization

WGS will establish a project team for successful completion of the project. The project team has not been finalized and subcontractors will be determined. Once the team has been finalized, appropriate resumes and information will be provided to NYSDEC. The anticipated project team is listed below:

Company	Name	Role
145 Chandler Street LLC	Rocco Termini	Applicant and Property Owner
Wittman GeoSciences, PLLC	Michele Wittman	Project Director
Schenne & Associates	John Schenne, PE	Project Engineer
Hazard Evaluations	Mark Hanna, CHMM	Environmental Health & Safety Manager
Hazard Evaluations	Eric Betzold	Project Scientist/Site Safety Officer
Alpha Analytical	Candace Fox	Analytical Laboratory
TBD	TBD	Geoprobe/Drilling Contractor
Lazarus Industries, LLC	Frank Lazarus	Excavation Contractor
Vali-Data of WNY	Jodi Zimmerman	Data Usability Summary Report

Michele Wittman – Michele will be the Project Director for the work and will be responsible for completion of each task, including coordination and supervision of field activities, adherence to work plan, schedule and budget. Additionally, Michele will be responsible for development of the work plan, coordination of subcontractors, field project oversight and report preparations.

3.0 INVESTIGATION SCOPE OF WORK

3.1 Introduction

The proposed RI scope of work will include investigation for potential Site contaminants in the soil/fill and groundwater at the Site. The scope of work includes 10 test pits, and 5 soil boring locations, 3 of which will be converted to monitoring wells. Proposed sampling locations are included on Figure and summary of proposed analytical testing is presented on Table 1.

3.2 Site Preparation

Prior to implementation of RI activities, the following Site preparation work will be completed.

General Site Cleanup and Debris Removal – Various debris and garbage is located throughout the surface of the Site. This material will be collected and disposed off-Site as solid waste.

3.3 Field Investigation Activities

Prior to intrusive activities, WGS and appropriate subcontractors will contact Dig Safely New York a minimum of three business days prior to the commencement of the field work. Investigative procedures are described below:

3.3.1 Surface Soil Investigation

The Site is planned for complete development, with final surfaces anticipated to be concrete, asphalt or buildings. Due to planned development and no surface areas remaining, surface soils will not be investigated during the RI work.

3.3.2 Subsurface Soil Investigation

Soil sampling which has been completed on-Site identified the presence of SVOCs and metals within the fill soils at the Site. Subsurface soil sampling will include the soil constituents located beneath the building floor at 125 Chandler Street property, as well as investigation throughout the Site. Two soil borings are planned within the 125 Chandler building and three (3) soil borings will be completed at exterior areas, which will be converted to groundwater wells (total of 5 proposed monitoring wells). Proposed soil boring locations are shown on Figure 5.

Interior soil borings will be cored through the concrete floor or be completed with a drill rig equipped with a concrete core barrel. A drill rig capable of advancing a borehole using direct push method via a Geoprobe drill rig will be used to advance the interior locations that will not be completed as monitoring wells. The drill rig will advance the 1.5-inch diameter, 4-foot long core sample liner to the desired depth and retrieve soil core samples at four-foot intervals. The total depth of interior borings, as well as three exterior borings, is anticipated to be approximately 16 to 25 feet below grade or spoon refusal, whichever is encountered first.

The three monitoring well locations will be advanced using a drill rig or direct-push drill rig capable of advancing hollow-stem augers for installing 1-inch micro-monitoring wells which are expected to be completed with continuous sampling to depths of up to 20 to 25 feet below grade to assess if the native clay extends to greater depths.

Discrete subsurface soil samples will be field screened in approximate two-foot depth intervals the full depth drilled for VOCs with a calibrated organic vapor meter equipped with a photoionization detector (PID). Organic vapor meter results and soil descriptions will be recorded on the field soil boring logs.

Soil samples will be selected for analytical analysis based in field screening results, visual and olfactory observations. During initial investigations, granular and cohesive fill was encountered to depths of approximately 3 to 8 feet below grade throughout the Site. Soil borings will be extended through the fill material to underlying native clay. WGS will collect representative samples from each of the identified fill types, as well as the underlying native clay soils, for appropriate laboratory analysis.

The sample interval identified as the most impacted (i.e., highest PID reading, visual/olfactory evidence of odors, staining, or product) will be selected for analysis. Should fill material be encountered, a discrete sample will be collected from each type of fill soil. In the event that no impacts were identified, the native soils directly below the fill/native interface will be selected for analysis. Additionally, attempt will be made to collected soil samples at vertical variations within the native soil.

Subsurface soil samples collected from the soil borings, likely from under the building, will be selected for analysis for the following as shown on Table 1:
- Two (2) soil samples for TCL VOCs
- Two (2) soil samples for TCL SVOCs
- Two (2) soil samples for TAL metals
- Two (2) soil samples for PCBs
- Two (2) soil samples for pesticides and herbicides

Actual sample locations will be selected in the field based on utility locations, field observations, screening results, and engineering judgment. Subsurface soil samples will be collected using dedicated stainless-steel sampling tools. Select representative soil samples will be place in pre-cleaned laboratory-provided sample bottles, labeled and cooled to 4°C in the field, and transported under chain-of-custody to a NYSDOH ELAP certified analytical laboratory.

3.3.3 Test Pit Excavations

In addition to the soil borings, remedial investigation will also include completion of ten (10) test pits to further investigate and characterize Site soil conditions. Test pits locations are included on Figure 5 and will be completed with a tracked excavator capable of reaching a minimum of 15 feet below grade. The depth of the test pit will extend 2 to 3 feet into underlying native soils.

In accordance with NYSDEC DER-10 Technical Guidance to Site Investigation and Remediation (DER-10), a Community Air Monitoring Plan (CAMP) will be implemented during all ground intrusion activities. A CAMP will be completed to achieve real-time monitoring of volatile organic compounds (VOCs) and particulates (dust). A copy of the CAMP is provided in Attachment A of the Health & Safety Plan (HASP), included in Appendix C.

Discrete subsurface soil samples will be field screened in approximate one to two-foot depth intervals through the excavation for VOCs with a calibrated organic vapor meter equipped with a photoionization detector (PID). Organic vapor meter results and soil descriptions will be recorded on the field soil boring logs.

Soil samples will be selected for analytical analysis based in field screening results, visual and olfactory observations. The sample interval identified as the most impacted (i.e., highest PID reading, visual/olfactory evidence of odors, staining, or product) will be selected for analysis. Should fill material be encountered, a discrete sample will be collected from each type of fill soil.

Subsurface soil samples collected from the test pits will be selected for analysis for the following as shown on Table 1:

- Four (4) soil samples for TCL VOCs
- Six (6) soil samples for TCL SVOCs
- Six (6) soil samples for TAL metals
- Three (3) soil samples for PCBs
- Three (3) soil samples for pesticides and herbicides
- Three (3) soil samples for 1,4-dioxane
- Three (3) soil samples for per- and polyfluoroalkyl substances (PFAS)

Actual sample locations will be selected in the field based on utility locations, field observations, screening results, and engineering judgment. Subsurface soil samples will be collected using dedicated stainless-steel sampling tools. Select representative soil samples will be place in pre-cleaned laboratory-provided sample bottles, labeled and cooled to 4ºC in the field, and transported under chain-of-custody to a NYSDOH ELAP certified analytical laboratory.

3.3.4 Monitoring Well Installation

Three (3) soil boring locations will be converted to monitoring wells. The soil borings will be advanced with a drill-rig capable of advancing hollow-stem augers capable of installing 2-inch monitoring well. The wells will be utilized for measurement of groundwater depth and collection of groundwater samples. The three proposed locations are included on Figure 5.

After completion of the soil borings to depths of approximately 20 to 25 feet below grade, a 2-inch diameter, schedule 40 PVC monitoring well will be installed at each location. Groundwater samples will be evaluated as per NYSDEC DER-10 Technical Guidance for

Site Investigation and Remediation (DER-10) and, if necessary, soil borings/wells will be advanced to the required depths of groundwater. An approximate 10-foot length of 0.010-inch machine slotted well screen will be installed at each location attached to the riser. The well screen depth will be backfilled with silica sand filter pack (estimated at size #0) from the base to approximately 2 feet above the well screen. A bentonite seal will be placed above the sand and hydrated to limit potential for down-hole contamination. The top of the well riser will be flush with the ground surface and completed with a locking J-plug. The well will be finished with a flush-mounted road box.

Groundwater samples will be collected from each of the monitoring wells using low flow sampling techniques. The total depth of the wells is expected to be approximately 20 feet below grade.

3.3.5 Monitoring Well Development

After a minimum of 24-hours from installation, the monitoring wells will be developed using dedicated disposable polyethylene bailers via purge methodology. Field parameters, including pH, temperature, turbidity, and specific conductance will be measured periodically until they become relatively stable (approximately 10% fluctuation or less). A minimum of three well volumes will be removed from each monitoring well, unless dry well conditions are encountered. Development water will be containerized and sampled for future off-Site disposal.

3.3.6 Groundwater Sampling

Prior to sample collection, static groundwater levels will be measured at each of the monitoring wells. The wells will be purged and field measurements of pH, specific conductivity, temperature and turbidity will be recorded and monitored for stabilization prior to sampling. Groundwater samples will be collected using low flow sampling techniques. If insufficient groundwater, new dedicated disposable bailers may be used to collect the groundwater samples.

The three (3) groundwater samples will be analyzed for the following parameters as summarized on Table 1:

- Target Compound List (TCL) VOCs
- TCL semi-volatile organic compounds (SVOCs)
- Target Analyte List (TAL) metals (total)
- Target Analyte List (TAL) metals (dissolved phase)
- Polychlorinated bi-phenyls (PCBs)
- Pesticides
- Herbicides
- 1,4-dioxane
- PFAS

Groundwater samples will be evaluated as per NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation (DER-10) and, if necessary, soil borings/wells will be advanced to the required depths of groundwater.

Groundwater samples will be placed in pre-cleaned laboratory-provided sample bottles, labeled and preserved in accordance with USEPA SW-846 methodology, and transported under chain-of-custody to a NYSDOH ELAP certified analytical laboratory.

Per- and polyfluoroalkyl substances (PFAS) Sampling Protocol

Groundwater sample collection procedure for PFAS will be done in accordance with NYSDEC protocol. At this time acceptable materials for sampling include stainless steel, high density polyethylene (HDPE), PVC, silicone, acetate and polypropylene. Equipment blanks should be generated at least daily. Additional materials may be acceptable if pre-approved by NYSDEC. Requests to use alternate equipment should include clean equipment blanks. NOTE: Grunfos pumps and bladder pumps are known to contain PFC materials (e.g. Teflon™ washers for Grunfos pumps and LDPE bladders for bladder pumps). All sampling equipment components and sample containers should not come in contact with aluminum foil, low density polyethylene (LDPE), glass or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer. Standard two step decontamination using detergent and clean water rinse will be performed for equipment that does come in contact with PFC materials. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFC materials must be avoided. Many food and drink packaging materials and "plumbers thread seal tape" contain PFCs.

All clothing worn by sampling personnel must have been laundered multiple times. The sampler must wear nitrile gloves while filling and sealing the sample bottles.
Pre-cleaned sample bottles with closures, coolers, ice, sample labels and a chain of custody form will be provided by the laboratory.

1. Fill two pre-cleaned 500 mL HDPE or polypropylene bottle with the sample.
2. Cap the bottles with an acceptable cap and liner closure system.
3. Label the sample bottles.
4. Fill out the chain of custody.
5. Place in a cooler maintained at 4 ± 2º Celsius.

Groundwater samples will be analyzed for PFAS via EPA method 537, to achieve reporting limits of 2 ng/l (parts per trillion (ppt)).

3.3.7 Field Specific Quality Assurance/Quality Control Sampling

Field-specific quality assurance/quality control samples will be collected and analyzed, as summarized on Table 1 to support third-party data usability assessment effort. Site-specific QA/QC samples will include blind duplicate, matrix spike/matrix spike duplicate, rinsate blank, and trip blank.

3.4 Investigation- Derived Waste Management

During the completion of soil borings, removed materials will be placed into the borehole. The excess soil cuttings that cannot be replaced into the borehole will be containerized in 55-gallon drums. Based on analytical testing results, the excess soil may be utilized on-Site, or disposed off-

Site. Development/purge water generated during well development and/or sampling activities will be containerized in 55-gallon drums for testing and future off-Site disposal.

3.5 Site Mapping

A base map will be prepared by a New York State-licensed surveyor. The map will include the RI investigation/sampling locations. Soil/fill boring locations will be field located and incorporated within the survey. Elevations of the ground surface and top of PVC riser will be measured for each monitoring well.

3.6 Personnel Decontamination

The degree of decontamination is a function of both the particular task and the physical environment in which it takes place. Decontamination procedures will remain flexible, thereby allowing the decontamination crew to respond appropriately to changing conditions at the Site. On-Site sampling activities will be carried out in such a manner as to avoid gross contamination of Site workers, personal protective equipment, machinery and equipment.

Between sampling locations (or sometimes between samples at one sampling location), and upon the completion of the daily field activities, Site workers will proceed to the Contaminated Reduction Zone (CRZ) or mobile reduction zone area. Equipment (e.g., sampling tubes, shovels, tools, etc.) will be decontaminated in this area. Prior to leaving the Site for breaks, at the end of the work shift, or when PPE has been grossly contaminated, disposable boot covers, gloves, and suits will be removed and placed in a drum designated for the disposal of these materials. After removing PPE, each Site worker will wash with soap and fresh water prior to donning new PPE or leaving the Site for the day. All wash water and rinse water will be collected and disposed of in accordance with appropriate regulations.

3.7 Decontamination of Equipment

Equipment decontamination efforts will be conducted in the CRZ or mobile reduction zone areas. Gross contamination will first be removed with plastic scrapers or other appropriate tools. The equipment will be decontaminated at a temporary equipment decontamination pad in the CRZ via hand washing or pressure washing. Downhole tools and augers can be hand washed or pressure washed.

The decontamination of the direct push drilling rig, excavator, or other heavy equipment will be undertaken as necessary. Initially, scraping of the equipment will remove heavily caked materials prior to washing. Washing will then be accomplished by pressure washing. Water generated during decontamination activities may be allowed to discharge in the ground at the test pit location or may be collected, stored and profiled for future off-Site disposal.

3.8 Disposal of Contaminated Materials

Potentially contaminated materials (gloves, clothing, sample sleeves etc.) will be bagged and segregated for proper disposal. Investigation-derived waste will be managed in accordance with NYSDEC guidance regulations. All fluids collected during groundwater sampling and decontamination will be containerized and managed appropriately subsequent to field activities and decontamination procedures.

4.0 REMEDIAL INVESTIGATION/ALTERNATIVES ANALYSIS REPORT

Upon completion of the RI tasks, a RI/AA Report will be generated in general requirements as identified in DER-10 Section 3.14. The report will include the following information.

- Background and Site information.
- Description of investigation areas.
- Identify and characterize the sources of contamination.
- Comparison with cleanup levels during the alternatives analysis report (AAR).
- Describe the amount, concentration, environmental fate and transport (if necessary), location and other significant characteristics of the contaminants present.
- Define hydraulic factors, as needed.
- Provide a qualitative human exposure assessment.
- Identify actual or potential adverse impacts to fish and wildlife resources

An independent data validation expert will complete a third-party data view of the analytical data generated during the RI work. A Data Usability Summary Report (DUSR) will be prepared, with appropriate data qualifiers added to the results.

The RI report will also include an alternatives analysis to evaluate a remedial approach. The AAR will evaluate the need for further remedial activities.

Remedial action objectives will be evaluated and developed to assure the selected remedy is protective of human health and the environment under the proposed future Site usage. Proposed soil cleanup objectives will be based on proposed future usage. Should further remedial requirements be identified, a list of potentially applicable remedial technologies will be developed and evaluated. Criteria to be evaluated for the remedy and protectiveness to public health and the environment include:

- Overall protection of the public health and the environment
- Standards, criteria and guidance (SCG)
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility or volume of contamination through treatment
- Short-term impact and effectiveness
- Implementability
- Cost effectiveness
- Land use

A remedial alternative will be recommended for the Site, which will include a discussion on the reasons for the selection. Community acceptance and comments will be evaluated within the alternative selection.

5.0 ADDITIONAL PROJECT DOCUMENTS

Various supporting documents have been prepared associated with the RI/AAR work plan and included in the appendix as listed below.

5.1 Quality Assurance Project Plan

The Quality Assurance Project Plan (QAPP) was generated in general accordance with Section 2.4 in DER-10. The QAPP describes the quality assurance/quality control (QA/QC) protocols and guidance associated with the RI/AAR Work Plan to ensure the suitability and verifiable data result from the sampling and analysis. The QAPP also provides procedures to be used during sampling of various media, field activities, and analytical laboratory testing. The QAPP is included in Appendix B.

5.2 Health and Safety Plan

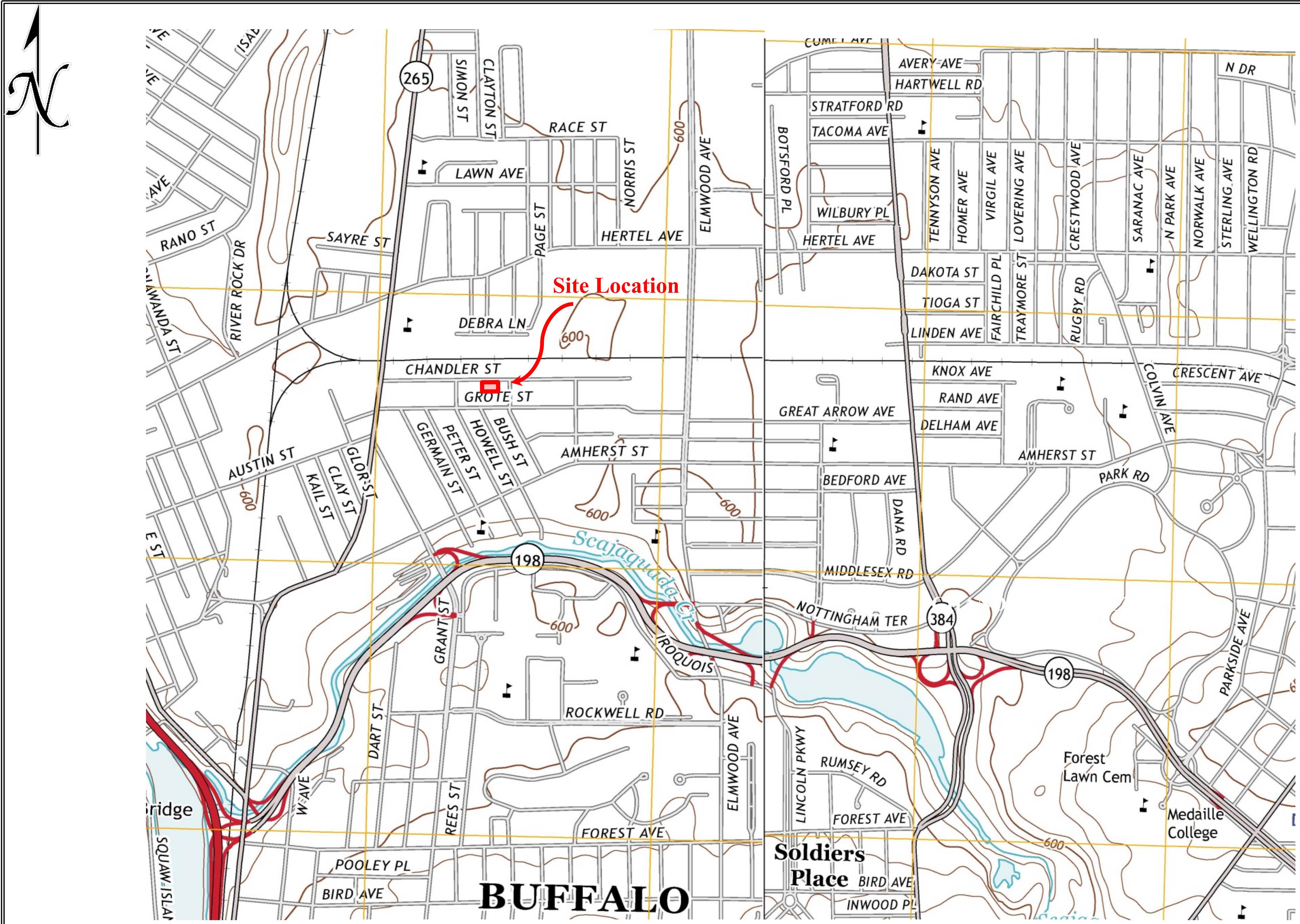
A Site-specific Health and Safety Plan (HASP) has been prepared for this project and included in Appendix C. The HASP will be enforced by WGS and subcontractors associated with the RI field activities. The HASP covers the on-Site investigation and interim remedial work, if any. Subcontractors will be required to develop and implement their health and safety plan.

The HASP will include a Community Air Monitoring Plan (CAMP) to describe particulate and volatile organic vapor monitoring to protect nearby community during the investigative and excavation activities.

6.0 PROJECT SCHEDULE

The Applicant has requested the project be placed on a fast track. Figure 6 presents the tentative schedule for planned activities in order to meet Applicants aggressive schedule. The Applicant plans to utilize parking areas by Summer 2020. A certificate of completion (COC) is anticipated by December 2020.

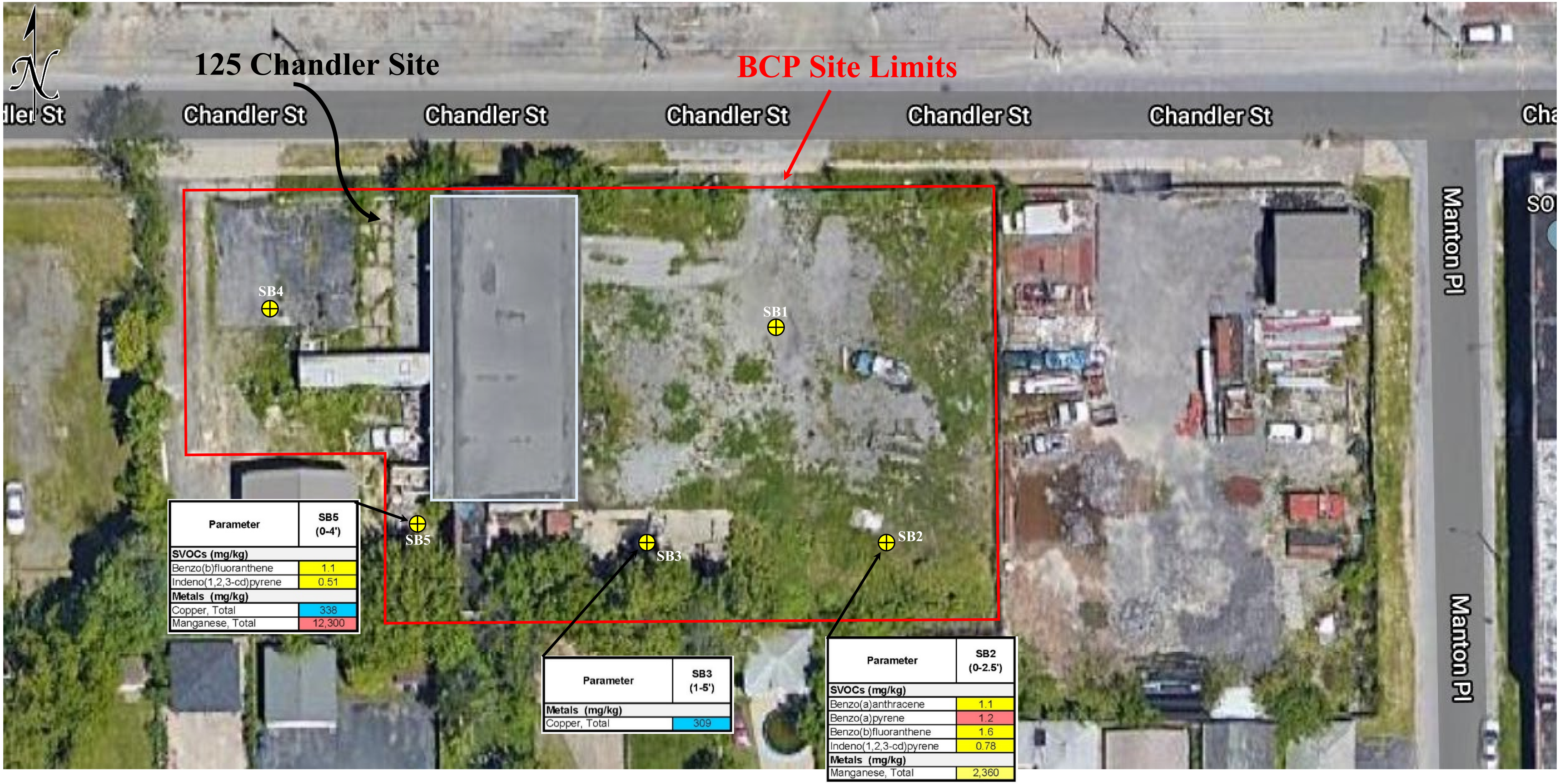
FIGURES



THIS DRAWING IS FOR ILLUSTRATIVE AND INFORMATIONAL PURPOSES ONLY
AND WAS ADAPTED FROM USGS, BUFFALO NE & NW, NEW YORK 2013 QUADRANGLE.

WITTMAN GEOSCIENCES, PLLC	Date: 03/2020	**Site Location**	Project: 19209
	Scale: not to scale	125 Chandler Street, Buffalo, NY	Figure: 1

WITTMAN GEOSCIENCES, PLLC	Date: 03/2020 Scale: not to scale	**BCP Site Limits** 125 Chandler Street, Buffalo, NY	Project: 19209 Figure: 2



Parameter	SB5 (0-4')
SVOCs (mg/kg)	
Benzo(b)fluoranthene	1.1
Indeno(1,2,3-cd)pyrene	0.51
Metals (mg/kg)	
Copper, Total	338
Manganese, Total	12,300

Parameter	SB3 (1-5')
Metals (mg/kg)	
Copper, Total	309

Parameter	SB2 (0-2.5')
SVOCs (mg/kg)	
Benzo(a)anthracene	1.1
Benzo(a)pyrene	1.2
Benzo(b)fluoranthene	1.6
Indeno(1,2,3-cd)pyrene	0.78
Metals (mg/kg)	
Manganese, Total	2,360

KEY

⊕ = Soil Boring Locations done June 2017

☐ = Building gutted – frame/roof remains

Notes:

Proposed Cleanup Standards = Restricted Residential

🟨 = exceeds Restricted Residential SCO

🟦 = exceeds Commercial SCO

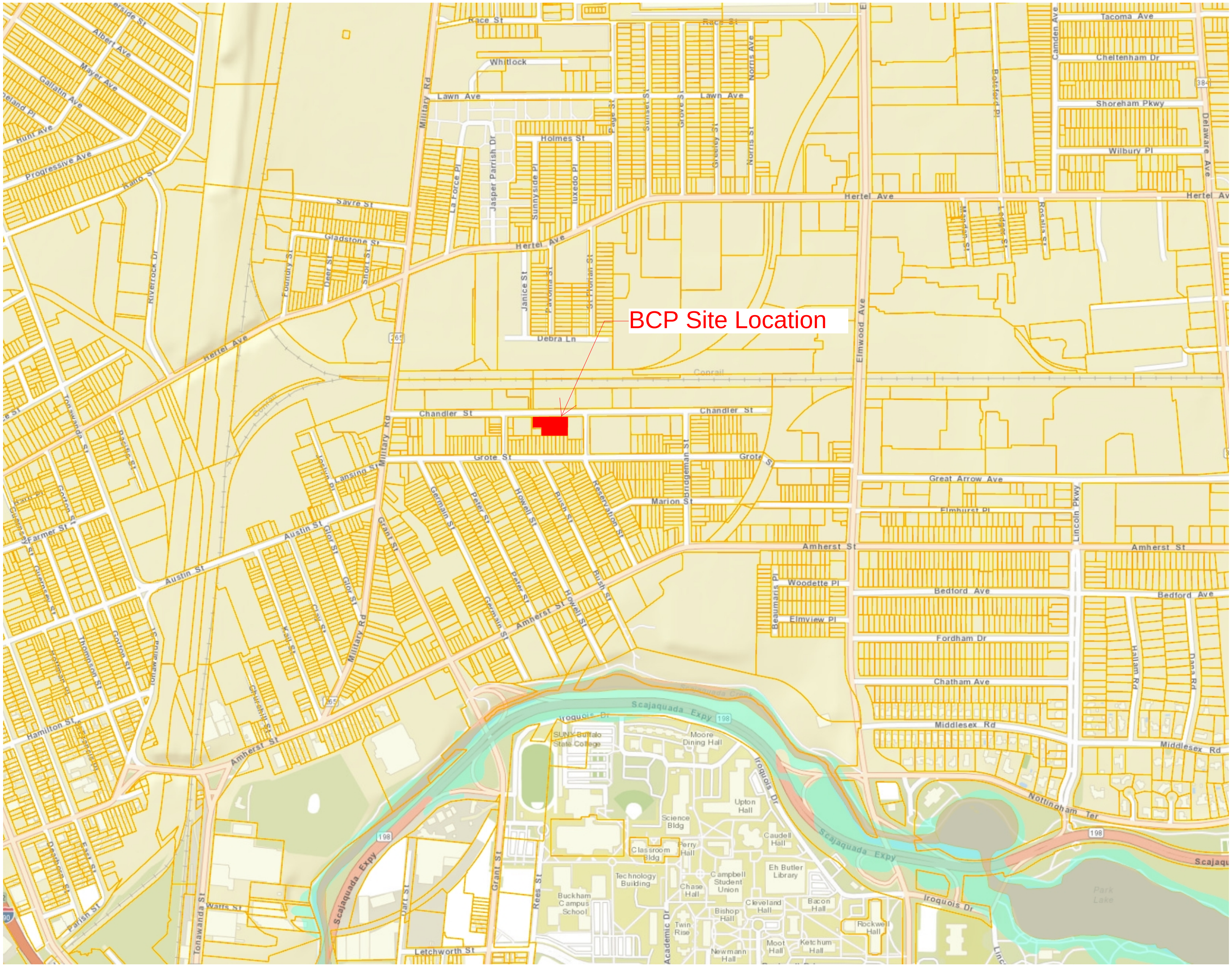
🟥 = exceeds Industrial SCO

Soil samples collect June 2017

WITTMAN GeoSciences, PLLC

WITTMAN GEOSCIENCES, PLLC	**Previous Soil Boring Sampling Locations**	DRAWN BY: MMW	SCALE: NTS	PROJECT: 19209
	125 Chandler, Buffalo, NY	CHECKED BY: MMW	DATE: 03/2020	FIGURE NO: 3

Erie County On-Line Mapping Application



Legend

- ☐ Parcels
- 🟩 DEC Wetlands
- National Wetlands Inventory
  - 🟧 Wetlands
  - 🟥 No Digital Data
- 🟦 FEMA Floodplains
- ☐ Municipal Boundaries

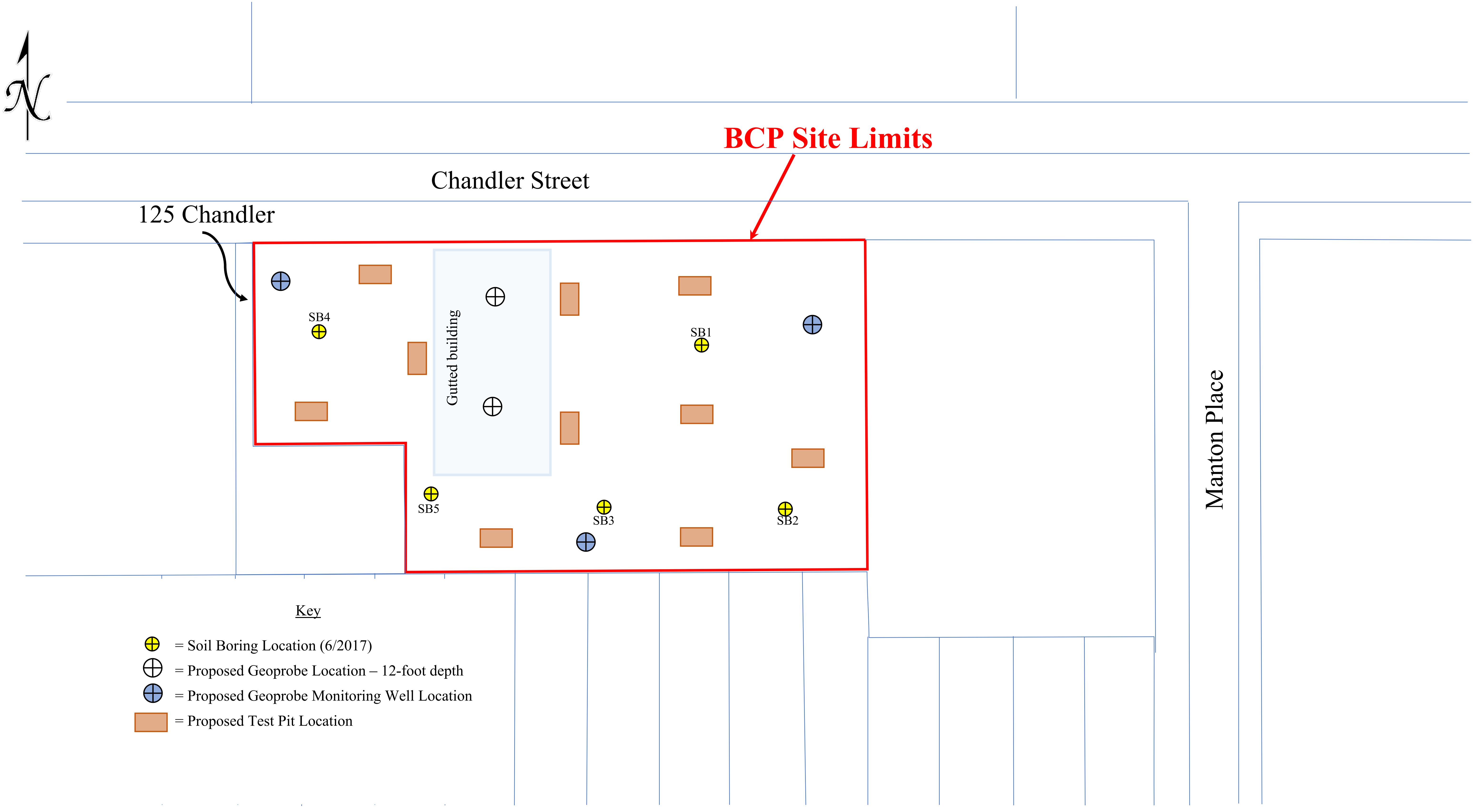
Figure 4
Nearby Wetland and
Floodplain Locations

0 1,504.66 3,009.3 Feet

WGS_1984_Web_Mercator_Auxiliary_Sphere
THIS MAP IS NOT TO BE USED FOR NAVIGATION

ERIE COUNTY
DEPARTMENT OF ENVIRONMENT & PLANNING
OFFICE OF GIS

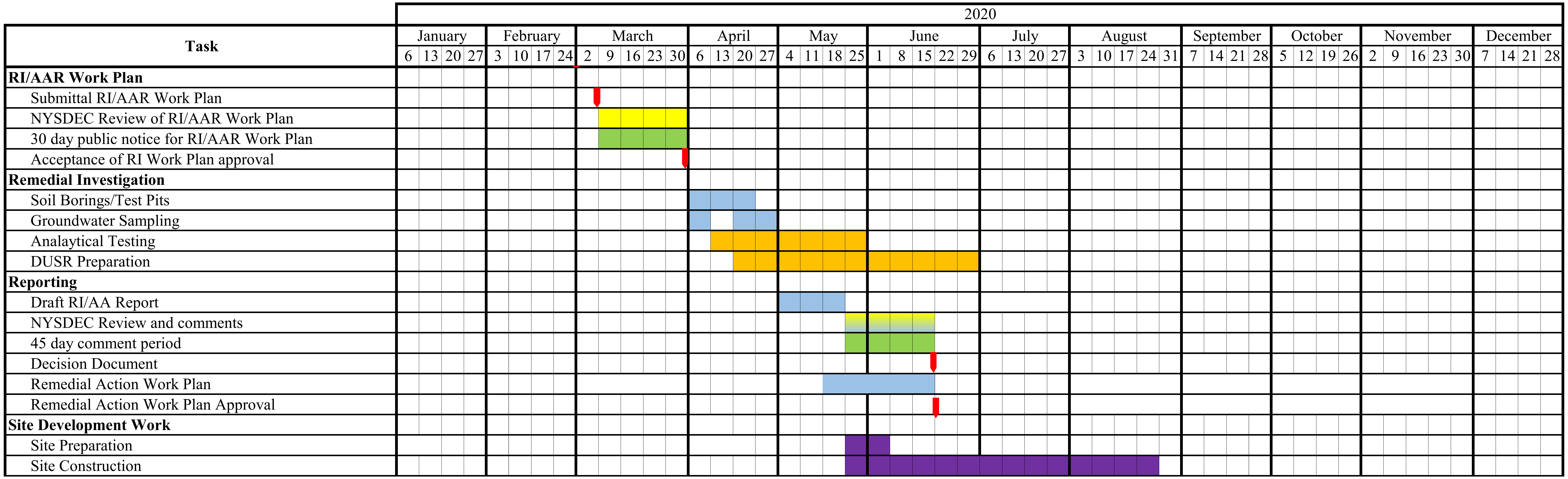
1: 18,056



WITTMAN
GeoSciences, PLLC

WITTMAN GEOSCIENCES, PLLC	**Proposed Subsurface Investigation Locations**	DRAWN BY: MMW	SCALE: 1" = 40'	PROJECT: 19209
	125 Chandler, Buffalo, NY	CHECKED BY: MMW	DATE: 03/2020	FIGURE NO: 5

Figure 6
BCP Project Schedule
125 Chandler Street Site
Buffalo, New York



Task	2020																																																		
	January				February				March					April				May				June					July				August					September				October				November					December			
	6	13	20	27	3	10	17	24	2	9	16	23	30	6	13	20	27	4	11	18	25	1	8	15	22	29	6	13	20	27	3	10	17	24	31	7	14	21	28	5	12	19	26	2	9	16	23	30	7	14	21	28
RI/AAR Work Plan																																																				
Submittal RI/AAR Work Plan									▼																																											
NYSDEC Review of RI/AAR Work Plan										🟨	🟨	🟨	🟨																																							
30 day public notice for RI/AAR Work Plan										🟩	🟩	🟩	🟩																																							
Acceptance of RI Work Plan approval													▼																																							
Remedial Investigation																																																				
Soil Borings/Test Pits														🟦	🟦	🟦																																				
Groundwater Sampling														🟦		🟦	🟦																																			
Analaytical Testing															🟧	🟧	🟧	🟧	🟧	🟧	🟧																															
DUSR Preparation																🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧	🟧																										
Reporting																																																				
Draft RI/AA Report																		🟦	🟦	🟦																																
NYSDEC Review and comments																					🟨	🟨	🟨	🟨																												
45 day comment period																					🟩	🟩	🟩	🟩																												
Decision Document																								▼																												
Remedial Action Work Plan																				🟦	🟦	🟦	🟦	🟦																												
Remedial Action Work Plan Approval																									▼																											
Site Development Work																																																				
Site Preparation																					🟪	🟪																														
Site Construction																					🟪	🟪	🟪	🟪	🟪	🟪	🟪	🟪	🟪	🟪	🟪	🟪	🟪	🟪																		

▼ Milestone Date
🟦 Task by HEI/S&A
🟨 NYSEC Review
🟩 Public Comment
🟧 Laboratory analysis/DUSR by Subcontractor
🟪 Owner/Applicant

TABLES

TABLE 1
Analytical Testing Program Summary
125 Chandler Street Site
125 Chandler Street, Buffalo, NY
NYSDEC Brownfield Cleanup Program

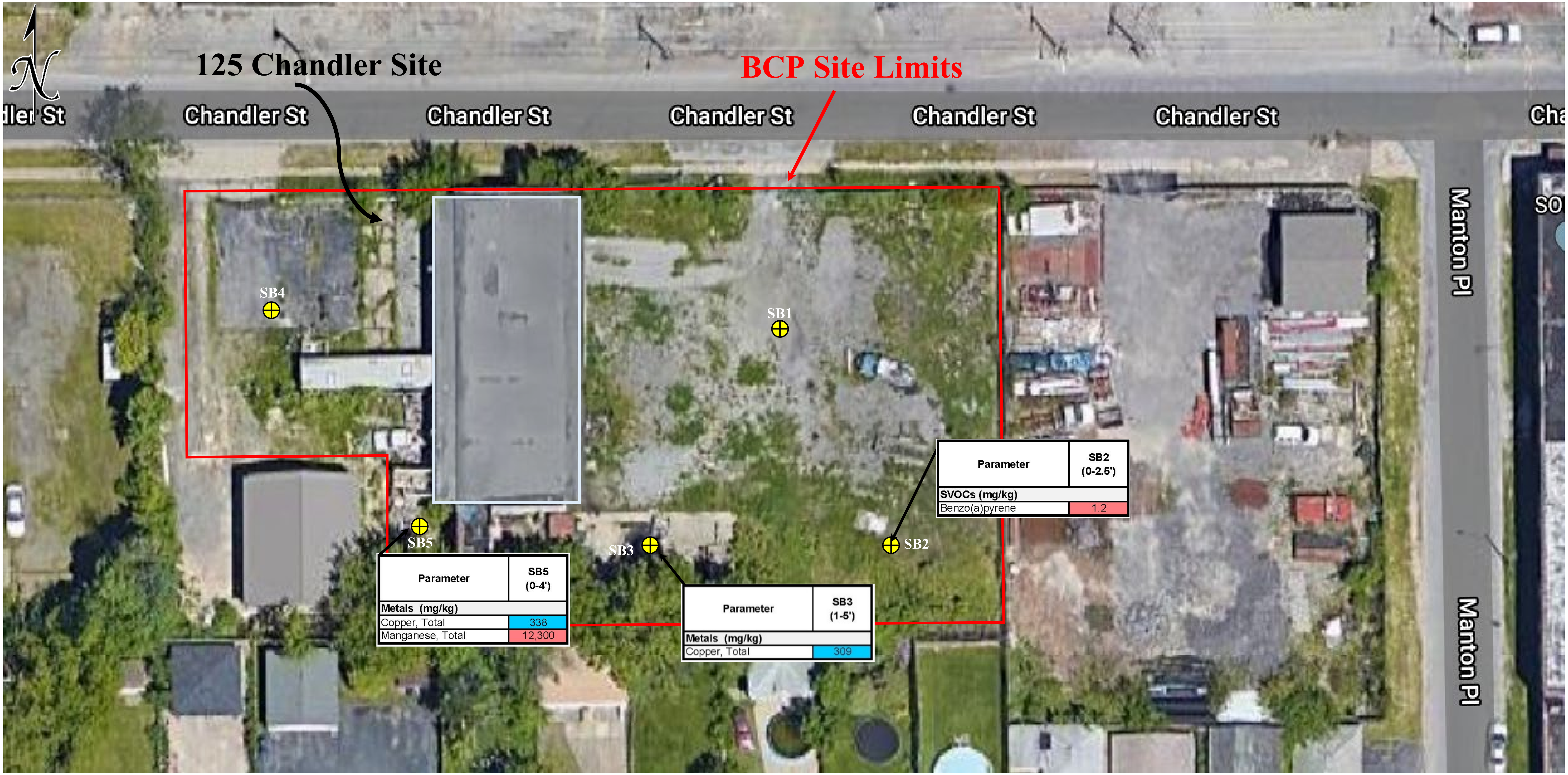
Location	**Number of Proposed Locations**	**Matrix**	**TCL VOCS**	**TCL SVOCs**	**TAL METALS Total**	**TAL METALS dissolved**	**PCBs**	**Pest/ Herbs**	**VOC TO-15**	**1,4-dioxane**	**PFAS**
Surface Soil Samples											
Surface Soil Sample	0	Soil	-	-	-	-	-	-	-	-	-
Duplicate		Soil	-	-	-	-	-	-	-	-	-
MS/MSD		Soil	-	-	-	-	-	-	-	-	-
Rinsate		Water	-	-	-	-	-	-	-	-	-
Total			**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Soil Borings - Subsurface Samples											
Soil Boring Locations	5	Soil	2	2	2	-	2	2	-	-	-
Duplicate		Soil	-	-	-	-	-	-	-	-	-
MS/MSD		Soil	-	-	-	-	-	-	-	-	-
Rinsate		Water	-	-	-	-	-	-	-	-	-
Total			**2**	**2**	**2**	**0**	**2**	**2**	**0**	**0**	**0**
Test Pits - Subsurface Samples											
Test Pit Locations	10	Soil	4	6	6	-	3	3	-	3	3
Duplicate		Soil	1	1	1	-	1	1	-	1	1
MS/MSD		Soil	2	2	2	-	2	2	-	2	2
Rinsate		Water	1	1	1	-	1	1	-	1	1
Total			**8**	**10**	**10**	**0**	**7**	**7**	**0**	**7**	**7**
Monitoring Wells											
Monitoring Well	3	Groundwater	3	3	3	3	3	3	-	3	3
Duplicate		Groundwater	1	1	1	1	1	1	-	1	1
MS/MSD		Groundwater	2	2	2	2	2	2	-	2	2
Rinsate		Water	1	1	1	1	1	1	-	1	1
Trip Blank		Water	1	-	-	-	-	-	-	-	1
Total			**8**	**7**	**7**	**7**	**7**	**7**	**0**	**7**	**8**
Sub-slab/Ambient Air samples											
Sub-slab	0	Air	-	-	-	-	-	-	-	-	-
Ambient Air		Air	-	-	-	-	-	-	-	-	-
Outdoor		Air	-	-	-	-	-	-	-	-	-
Duplicate		Air	-	-	-	-	-	-	-	-	-
Total			**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
			VOCs	SVOCs	METALS	METALS	PCBs	Pest/ Herbs	VOC - TO-15	1,4-dioxane	PFAS
		TOTAL SAMPLES	**18**	**19**	**19**	**7**	**16**	**16**	**0**	**14**	**15**

Notes:

TCL VOCs - Target Compound List Volatile Organic Compounds.
TCL SVOCs - Target Compound List Semi-volatile Organic Compounds.
TAL Metals - Target Analyte List Metals.
TCL PCBs - Target Compound List Polychlorinated Biphenyls.
PFAS - Polyfluoroalkyl Substances

APPENDIX A

HISTORICAL INVESTIGATION INFORMATION



Parameter	SB2 (0-2.5')
SVOCs (mg/kg)	
Benzo(a)pyrene	🟥 1.2

Parameter	SB5 (0-4')
Metals (mg/kg)	
Copper, Total	🟦 338
Manganese, Total	🟥 12,300

Parameter	SB3 (1-5')
Metals (mg/kg)	
Copper, Total	🟦 309

KEY

⊕ = Soil Boring Location done June 2017

☐ = Building gutted – frame/roof remains

Notes:

Proposed Cleanup Standards = Restricted Residential

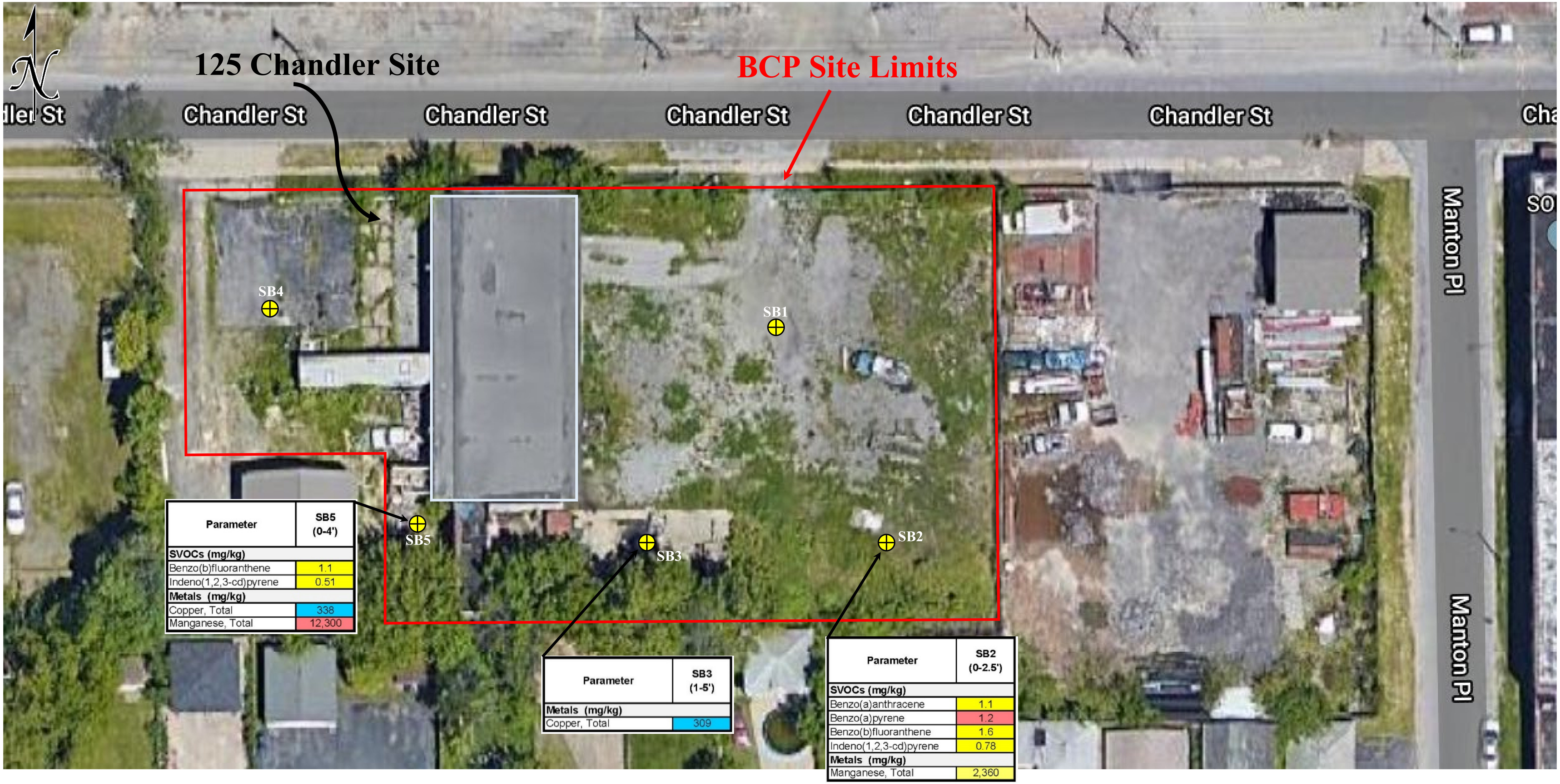
🟦 = exceeds Commercial SCO

🟥 = exceeds Industrial SCO

Soil samples collect June 2017

WITTMAN
GeoSciences, PLLC

WITTMAN GEOSCIENCES, PLLC	**Soil Boring Sampling Locations**	DRAWN BY: MMW	SCALE: NTS	PROJECT: 19209
	125 Chandler, Buffalo, NY	CHECKED BY: MMW	DATE: 03/2020	FIGURE NO: III-A



Parameter	SB5 (0-4')
SVOCs (mg/kg)	
Benzo(b)fluoranthene	1.1
Indeno(1,2,3-cd)pyrene	0.51
Metals (mg/kg)	
Copper, Total	338
Manganese, Total	12,300

Parameter	SB3 (1-5')
Metals (mg/kg)	
Copper, Total	309

Parameter	SB2 (0-2.5')
SVOCs (mg/kg)	
Benzo(a)anthracene	1.1
Benzo(a)pyrene	1.2
Benzo(b)fluoranthene	1.6
Indeno(1,2,3-cd)pyrene	0.78
Metals (mg/kg)	
Manganese, Total	2,360

KEY

⊕ = Soil Boring Locations done June 2017

⬜ = Building gutted – frame/roof remains

Notes:

Proposed Cleanup Standards = Restricted Residential

🟨 = exceeds Restricted Residential SCO

🟦 = exceeds Commercial SCO

🟥 = exceeds Industrial SCO

Soil samples collect June 2017

WITTMAN GeoSciences, PLLC

WITTMAN GEOSCIENCES, PLLC	**Soil Boring Sampling Locations**	DRAWN BY: MMW	SCALE: NTS	PROJECT: 19209
	125 Chandler, Buffalo, NY	CHECKED BY: MMW	DATE: 03/2020	FIGURE NO: III-A

Table 1
Soil Analytical Testing Results Summary
125 Chandler Street , Buffalo, New York
July 2017

Parameter	SB1 (0-2.5')	SB2 (0-2.5')	SB3 (1-5')	SB5 (0-4')	Unrestricted Use	Restricted Residential Use	Commercial Use	Industrial Use
Volatile Organic Compounds EPA Method 8260C TCL + STARS (mg/Kg)								
1,2,4-Trimethylbenzene	NT	NT	0.00022 J	0.0011 J	3.6	52	190	380
1,3,5-Trimethylbenzene	NT	NT	ND	0.00052 J	8.4	52	190	380
2-Butanone	NT	NT	0.013	ND	0.12	100	500	1000
Acetone	NT	NT	0.064	0.0031 J	0.05	100	500	1000
Bromomethane	NT	NT	ND	ND	NV	NV	NV	NV
Chloromethane	NT	NT	ND	ND	NV	NV	NV	NV
Ethylbenzene	NT	NT	0.00030 J	0.0012	1	41	390	780
Methyl cyclohexane	NT	NT	ND	0.00041 J	NV	NV	NV	NV
n-Butylbenzene	NT	NT	ND	0.00037 J	12	100	500	1000
n-Propylbenzene	NT	NT	ND	0.00073 J	3.9	100	500	1000
Naphthalene	NT	NT	0.00047 J	0.0016 J	12	100	500	1000
o-Xylene	NT	NT	ND	ND	0.26	100	500	1000
p/m-Xylene	NT	NT	ND	0.00078 J	0.26	100	500	1000
Toluene	NT	NT	ND	0.00025 J	0.7	100	500	1000
Semi Volatile Organic Compounds EPA Method 8270D TCL (mg/kg)								
2-Methylnaphthalene	0.110 J	0.32	0.110 J	0.120 J	NV	NV	NV	NV
3-Methylphenol/4-Methylphenol	ND	ND	ND	ND	0.33	100	500	1000
Acenaphthene	0.065 J	0.090 J	0.083 J	0.060 J	20	100	500	1000
Acenaphthylene	ND	0.034 J	0.067 J	0.042 J	100	100	500	1000
Anthracene	0.160 J	0.38	0.31	0.17	100	100	500	1000
Benzo(a)anthracene	0.56	1.1	0.62	0.81	1	1	5.6	11
Benzo(a)pyrene	0.43	1.2	0.53	0.82	1	1	1	1.1
Benzo(b)fluoranthene	0.61	1.6	0.72	1.1	1	1	5.6	11
Benzo(ghi)perylene	0.280 J	0.66	0.32	0.49	100	100	500	1000
Benzo(k)fluoranthene	0.190 J	0.55	0.22	0.32	0.8	3.9	56	110
Biphenyl	ND	0.050 J	ND	ND	NV	NV	NV	NV
Butyl benzyl phthalate	0.110 J	ND	ND	ND	NV	NV	NV	NV
Carbazole	0.083 J	0.140 J	0.140 J	0.110 J	NV	NV	NV	NV
Chrysene	0.56	1.1	0.59	0.82	1	3.9	56	110
Dibenzo(a,h)anthracene	0.071 J	0.19	0.091 J	0.17	0.33	0.33	0.56	1.1
Dibenzofuran	0.056 J	0.130 J	0.110 J	0.057 J	7	59	350	1000
Diethyl phthalate	ND	ND	ND	ND	NV	NV	NV	NV
Fluoranthene	0.98	1.9	1.5	1.4	100	100	500	1000
Fluorene	0.080 J	0.140 J	0.150 J	0.079 J	30	100	500	1000
Indeno(1,2,3-cd)pyrene	0.3	0.78	0.36	0.51	0.5	0.5	5.6	11
Naphthalene	0.110 J	0.28	0.140 J	0.100 J	12	100	500	1000
Phenanthrene	0.780	1.4	1.2	0.83	100	100	500	1000
Pyrene	0.960	1.5	1.2	1.2	100	100	500	1000
Metals EPA Method 6010 TAL (mg/kg)								
Aluminum, Total	NT	12,400	8,650	27,200	NV	NV	NV	NV
Antimony, Total	NT	ND	ND	ND	NV	NV	NV	NV
Arsenic, Total	NT	13.0	13.4	10.4	13	16	16	16
Barium, Total	NT	229	102	293	350	400	400	10,000
Beryllium, Total	NT	1.08	0.762	1.74	7.2	72	590	2,700
Cadmium, Total	NT	1.11	1.00	0.865 J	2.5	4.3	9.3	60
Calcium, Total	NT	74,400	48,200	89,200	NV	NV	NV	NV
Chromium, Total	NT	41.4	28.0	147	30	180	1,500	6,800
Cobalt, Total	NT	4.95	4.29	4.69	NV	NV	NV	NV
Copper, Total	NT	109	309	338	50	270	270	10,000
Iron, Total	NT	21,100	52,600	24,800	NV	NV	NV	NV
Lead, Total	NT	133	147	144	63	400	1,000	3,900
Magnesium, Total	NT	8,530	7,550	3,490	NV	NV	NV	NV
Manganese, Total	NT	2,360	1,070	12,300	1,600	2,000	10,000	10,000
Mercury, Total	NT	0.16	0.03 J	0.10	0.18	0.81	2.8	5.7
Nickel, Total	NT	12.0	23.2	9.32	30	310	310	10,000
Potassium, Total	NT	1,200	1,010	3,430	NV	NV	NV	NV
Selenium, Total	NT	2.47	ND	10.8	3.9	180	1,500	6,800
Silver, Total	NT	ND	ND	1.93	2	180	1,500	6,800
Sodium, Total	NT	527	222	1,790	NV	NV	NV	NV
Thallium, Total	NT	3.59	1.70 J	18.4	NV	NV	NV	NV
Vanadium, Total	NT	20.2	14.7	38.4	NV	NV	NV	NV
Zinc, Total	NT	249	176	232	109	10,000	10,000	10,000
Total PCBs USEPA Method 8082 TCL (ug/Kg)								
Aroclor 1254	NT	ND	ND	NT	0.1	1	1	25
Aroclor 1260	NT	0.0296 J	0.0106 J	NT	0.1	1	1	25
Total PCBs	NT	0.0296 J	0.0106 J	NT	0.1	1	1	25

Notes:

1. Analytical testing performed by Alpha Analytical. Compounds detected in one or more samples are presented in this table. Refer to Attachment C for the full analytical report.
2. ug/Kg = parts per billion.
3. ND = not detected; NV= no value.
4. Analytical results compared to NYSDEC Part 375-6; Remedial Program Soil Cleanup Objectives, Table 375-(a) Unrestricted Use Soil Cleanup Objective; and Table 375-6.8(b): Restricted Use Soil Cleanup Objectives.
5. Shading indicates:

▨ exceeds UUSCO	🟦 exceeds CUSCO
🟨 exceeds RRUSCO	🟥 exceeds IUSCO

HAZARD EVALUATIONS

3636 N. Buffalo Road
Orchard Park, NY 14127
716-667-3130

Boring No: SB1

Project Name & Location: 125-145 Chandler
HEI Representative: E. Betzold
Project Number: e1641
Start Date: 6/29/2017
End Date: 6/29/2017
Type of Drill Rig: Track Mind Geoprobe
GW Depth While Drilling:
Drilling Contractor: Matrix Enviro.
GW Depth at Completion:
Sampler Type: MC

Sample Depth (ft)	Sample No.	Sample Interval (feet)	Recovery (inches)	SAMPLE DESCRIPTION	OVM Reading (ppm)
	1	0-4	36	DK Brown f/c Sand, some Gravel, tr. Silt, moist (FILL)	0
				Sub-base Gravel, tr. f/c Sand, moist (FILL)	
1					0
2				DK Brown clay & silt, tr. f/c Sand, tr. Gravel, tr. Salg, moist (FILL)	
				Grades to … Brown	0
				Red/Brown CLAY & SILT, tr. f/c Sand, tr. Gravel, moist	
3					0
4	2	4-8	48		0
5					0
6					0
7					0
8				Bottom of Boring 8' bg	
9					
10					
11					
12					
13					
14					
15					
16					
18					
20					
22					
24					

Notes:

General Notes:
1 - Boundary between soil types represented with stratification line. Transitions may be gradual. Depths are approximate.
2 - Groundwater (GW) depths approximate at time of sampling. Fluctuations in groundwater may occur.
3 - f=fine; m=medium; c=coarse
4 - and (36-50%); some (21-35%); little (11-20%); trace (1-10%)

MC - Geoprobe Macrocore SS - Split Spoon SH - Shelby Tube BC - Bedrock Core

HAZARD EVALUATIONS

3636 N. Buffalo Road
Orchard Park, NY 14127
716-667-3130

Boring No: SB2

Project Name & Location: 125-145 Chandler
HEI Representative: E. Betzold
Project Number: e1641
Start Date: 6/29/2017
End Date: 6/29/2017
Type of Drill Rig: Track Mind Geoprobe
GW Depth While Drilling:
Drilling Contractor: Matrix Enviro.
GW Depth at Completion:
Sampler Type: MC

Sample Depth (ft)	Sample No.	Sample Interval (feet)	Recovery (inches)	SAMPLE DESCRIPTION	OVM Reading (ppm)
	1	0-4	24	Brown topsoil, tr. f/c Sand, tr. Gravel, tr. Slag, moist (FILL)	0
				Brown clay & silt, little Slag, tr. f/c Sand, tr. Gravel, moist (FILL)	
1					
					0
				Grades to … Dk. Brown and Slag, stained	
2					
					0
				Grades to … Brown, tr. Slag, tr. Brick	
3					
					0
	2	4-8	48		
4					
					0
				Red/Brown CLAY & SILT, tr. f/c Sand, tr. Gravel, moist	
5					
					0
6					
					0
7					
					0
8					
					0
9					
					0
10					
					0
11					
					0
12					
				Bottom of Boring 12' bg	
13					
14					
15					
16					
18					
20					
22					
24					

Notes: Sample 0-2.5' for SVOC, Metals

General Notes:
1 - Boundary between soil types represented with stratification line. Transitions may be gradual. Depths are approximate.
2 - Groundwater (GW) depths approximate at time of sampling. Fluctuations in groundwater may occur.
3 - f=fine; m=medium; c=coarse
4 - and (36-50%); some (21-35%); little (11-20%); trace (1-10%)

MC - Geoprobe Macrocore SS - Split Spoon SH - Shelby Tube BC - Bedrock Core

HAZARD EVALUATIONS

3636 N. Buffalo Road
Orchard Park, NY 14127
716-667-3130

Boring No: SB3

Project Name & Location: 125-145 Chandler
HEI Representative: E. Betzold
Project Number: e1641
Start Date: 6/29/2017
End Date: 6/29/2017
Type of Drill Rig: Track Mind Geoprobe
GW Depth While Drilling:
Drilling Contractor: Matrix Enviro.
GW Depth at Completion:
Sampler Type: MC

Sample Depth (ft)	Sample No.	Sample Interval (feet)	Recovery (inches)	SAMPLE DESCRIPTION	OVM Reading (ppm)
				Concrete	0
1	1	0.5-4	24	Brownf/c Sand, some Silt, tr. Gravel, tr. Slag, moist (FILL)	
				Grades to … Dk. Brown	0
2					
					0
3					
				Grades to … little Slag	0
4	2	4-8	48		
				Grades to … and Slag	0
5					
				Grades to … some Gravel, little Slag, wet	0
6					
				Grades to … tr. Gravel, tr. Slag	0
7				Dk. Brown clay & silt, tr. f/c Sand, tr. Gravel, moist	
					0
8	3	8-12	48		
				Red/Brown CLAY & SILT, tr. f/c Sand, tr. Gravel, moist	0
9					
					0
10					
					0
11					
					0
12					
				Bottom of Boring 12' bg	
13					
14					
15					
16					
18					
20					
22					
24					

Notes: Sample 1-5' for SVOC, Metals, VOC

General Notes:
1 - Boundary between soil types represented with stratification line. Transitions may be gradual. Depths are approximate.
2 - Groundwater (GW) depths approximate at time of sampling. Fluctuations in groundwater may occur.
3 - f=fine; m=medium; c=coarse
4 - and (36-50%); some (21-35%); little (11-20%); trace (1-10%)

MC - Geoprobe Macrocore   SS - Split Spoon   SH - Shelby Tube   BC - Bedrock Core

HAZARD EVALUATIONS

3636 N. Buffalo Road
Orchard Park, NY 14127
716-667-3130

Boring No: SB4

Project Name & Location: 125-145 Chandler
HEI Representative: E. Betzold
Project Number: e1641
Start Date: 6/29/2017
End Date: 6/29/2017
Type of Drill Rig: Track Mind Geoprobe
GW Depth While Drilling:
Drilling Contractor: Matrix Enviro.
GW Depth at Completion:
Sampler Type: MC

Sample Depth (ft)	Sample No.	Sample Interval (feet)	Recovery (inches)	SAMPLE DESCRIPTION	OVM Reading (ppm)
				Asphalt	
1	1	0.5-4	36	Sub-base Gravel and Concrete, moist (FILL)	0
				Dk. Brown clay & silt, tr. f/c Sand, tr. Gravel, moist	
2				Grades to … Brown	0
3				Red/Brown CLAY & SILT, tr. f/c Sand, tr. Gravel, moist.	0
4	2	4-8	48		0
5					0
6					0
7					0
8					0
				Bottom of Boring 8' bg	
9					
10					
11					
12					
13					
14					
15					
16					
18					
20					
22					
24					

Notes:

General Notes:
1 - Boundary between soil types represented with stratification line. Transitions may be gradual. Depths are approximate.
2 - Groundwater (GW) depths approximate at time of sampling. Fluctuations in groundwater may occur.
3 - f=fine; m=medium; c=coarse
4 - and (36-50%); some (21-35%); little (11-20%); trace (1-10%)

MC - Geoprobe Macrocore SS - Split Spoon SH - Shelby Tube BC - Bedrock Core

HAZARD EVALUATIONS

3636 N. Buffalo Road
Orchard Park, NY 14127
716-667-3130

Boring No: SB5

Project Name & Location: 125-145 Chandler
HEI Representative: E. Betzold
Project Number: e1641
Start Date: 6/29/2017
End Date: 6/29/2017
Type of Drill Rig: Track Mind Geoprobe
GW Depth While Drilling:
Drilling Contractor: Matrix Enviro.
GW Depth at Completion:
Sampler Type: MC

Sample Depth (ft)	Sample No.	Sample Interval (feet)	Recovery (inches)	SAMPLE DESCRIPTION	OVM Reading (ppm)
	1	0-4	24	Dk. Brown Topsoil, little f/c Sand, tr. Slag, Moist (FILL)	0
				Dk. Brown f/c Sand, some Slag, little Brick, little Gravel, moist (FILL)	
1					
					0
2					
				Brown clay & silt, tr. f/c Sand, tr. Gravel, moist (FILL)	0
3					
				Grades to … and Slag, little Gravel	0
	2	4-8	48		
4					
				Grades to … tr. Slag, tr. Gravel	0
				Red/Brown CLAY & SILT, tr. f/c Sand, tr. Gravel, moist	
5					
					0
6					
					0
7					
					0
8					
				Bottom of Boring 8' bg	
9					
10					
11					
12					
13					
14					
15					
16					
18					
20					
22					
24					

Notes:	Sample 0-4 Metal, VOC, SVOC
General Notes:	1 - Boundary between soil types represented with stratification line. Transitions may be gradual. Depths are approximate. 2 - Groundwater (GW) depths approximate at time of sampling. Fluctuations in groundwater may occur. 3 - f=fine; m=medium; c=coarse 4 - and (36-50%); some (21-35%); little (11-20%); trace (1-10%)

MC - Geoprobe Macrocore SS - Split Spoon SH - Shelby Tube BC - Bedrock Core

APPENDIX B

QUALITY ASSURANCE PROJECT PLAN

QUALITY ASSURANCE PROJECT PLAN

BROWNFIELD CLEANUP PROGRAM
For
145 Chandler Street, LLC
125 Chandler Street, Buffalo, New York 14207
BCP # C915358

Prepared For:
145 Chandler Street, LLC
391 Washington Street, Buffalo, New York 14203
WGS Project No: 19209

Prepared By:
Wittman GeoSciences, PLLC
3636 North Buffalo Road
Orchard Park, New York 14127
716-574-1513

March 4, 2020

WITTMAN
GeoSciences, PLLC

TABLE OF CONTENTS

TABLE OF CONTENTS (CONT'D)

LIST OF TABLES

LIST OF FIGURES

LIST OF ATTACHMENTS

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) has been cooperatively developed by Wittman GeoSciences, PLLC (WGS) as prepared for 125 Chandler Street Site located at 125 Chandler Street in the City of Buffalo, New York. The QAPP was prepared in general accordance with the requirements of Section 2.4 of the NYSDEC DER-10, Technical Guidance for Site Investigation and Remediation, dated May 2010 (DER-10).

The QAPP is designed to produce data of the quality necessary to achieve the project objectives. The objective of the QA/QC protocol and procedures is to ensure the information, data, and decisions associated with the project are technically sound and properly documented.

1.1 Project Scope

This QAPP presents the project scope, objectives, organization, planned activities, data quality objectives, quality assurance/quality control (QA/QC) procedures and sampling procedures. This project involves test borings, test pits, monitoring well installation, monitoring well development, and subsurface soil and groundwater sample collection. Proposed sampling locations are included on Figure 1 and a summary of the anticipated number of samples and analytical testing is included on Table 1. The project goal associated with the RI includes the following:

- Define the nature and extent of on-site contamination in both soil and groundwater.
- Identify on-site source areas of contamination, if any.
- Collect data of sufficient quantity and quality to evaluate potential threats to the public health and environment.
- Collect data of sufficient quantity and quality to evaluate remedial alternatives.

1.2 Project Organization

The general responsibilities of key project personnel are listed below. Resumes are included in Attachment A.

Project Manager:	Ms. Michele Wittman, WGS Principal, will have responsibility for overall program/project management and coordination with NYSDEC and subcontractors.
Engineering:	Mr. John Schenne, PE, is responsible for engineering aspects and responsibilities.
QA Officer:	Mark Hanna, CHMM, HEI Principal, will serve as Quality Assurance Officer (QAO), and will be responsible for laboratory and data validation, subcontractor procurement and assignment, as well as data usability reports. The QAO may conduct audits of the operations at the site to ensure that work is being performed in accordance with the QAAP.
Field Team:	Eric Betzold will have overall responsibility for on-site implementation of the Site Investigation project activities. The technical team will

consist of experienced professionals (i.e.; engineers, geologists, scientists) to gather and analyze data, prepare project documentation and collection of various soil and groundwater samples.

1.3 Project Sub-Contractors

Subcontractor specialists will be contracted for services relating to drilling and monitoring well installation, laboratory/analytical services, data validation services, field surveying, and waste transportation and disposal. The subcontractors will be determined approved by NYSDEC prior to beginning of site work:

Laboratory Analysis -	Alpha Analytical - A laboratory certified under the New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP) will perform the analysis
Data Validation -	Vali-Data of WNY
Test Pit Services -	Lazarus Industries, LLC
Exploration Services -	To be determined.
Surveying -	To be determined

2.0 FIELD INVESTIGATION PROCEDURES

Field sampling at the proposed 125 Chandler Street site has been designed to obtain representative samples of various environmental media to assess impact that the site may have to human health and the environment. The field investigation procedures include sampling for subsurface soils and groundwater.

Proposed sampling locations are included within the RI Work Plan. Environmental sampling and other field activities will be performed in general accordance with the appropriate techniques presented in the following guidance document.

- DER-10: Technical Guidance for Site Investigations and Remediation; NYSDEC Division of Environmental Remediation, May 2010.

Field activities are described in the following sections and in the RI Work Plan.

2.1 Air Monitoring

Air monitoring/screening of volatile compounds for health and safety concerns will be performed with a portable organic vapor meter (OVM) equipped with a photoionization detector (PID) that is using a 10.6 electron volt (eV) bulb. Monitoring will be done during invasive activities such as soil borings, monitoring well installation, well development, sampling, and IRM activities. Detections above background during air monitoring will require that the work be stopped until air monitoring levels decrease to background levels or until health and safety protocol are upgraded and approved by NYSDEC. On-site personnel will be outfitted in modified Level D personnel protection (hardhat, safety glasses, work boots and gloves).

2.2 Soil Screening and Logging

Subsurface soil samples will be collected from direct push macro-core samplers in general accordance with American Society for Testing and Material (ASTM) D6282-98 Standard Guide for Direct Push Soil Samples for Environmental Site Characteristics. Subsurface soil sampling from split-spoon samples advanced ahead of hollow steam augers will be completed in general accordance with ASTM D1586-99. A soil boring log will be prepared for each location to include date, boring location, drill rig type, blow counts, sample identification, sample depth interval, percent recovery, OVM reading, stratigraphic boundaries, and well installation information.

Subsurface soil will be sampled by opening the split spoon sampler (borings) or slicing the core vertically down the middle with a sharp blade. Soil samples will be visually examined for evidence of suspect contamination (e.g., staining, odor) and field screened with a calibrated OVM. Portions of the soil samples may be placed in containers for future analytical testing. Different portions of the soil samples will be placed within sealable plastic bags and will be field screened the same day as collected. Prior to screening, the soil samples will be allowed to equilibrate to ambient temperature. The OVM sampling port will be placed within a corner of the bag. The peak reading will be recorded on the boring log. Portions of the soil samples may be placed in containers for future analytical testing.

2.3 Soil Sample Collection

Soil samples selected for VOC analysis will be collected using an Encore or Terracore sampling kit, limiting headspace by compacting the soil into the container. Samples for VOC will be placed into the appropriate container immediately after opening of sampler, prior to making any field measurements or sample homogenization.

Remaining soil samples will be homogenized using a "coning and quartering" procedure. The soil will be removed from the sampling equipment and transferred to a clean surface (metal foil, steel pan, bowl, etc.) and thoroughly mixed to provide a more homogeneous sample to the lab. An aliquot of the sample will then be transferred to the required sample containers and sealed with the appropriate cap.

Due to emergent contaminant sampling requirements,_at this time acceptable materials for sampling include stainless steel, high density polyethylene (HDPE), PVC, silicone, acetate and polypropylene. Additional materials may be acceptable if pre-approved by NYSDEC. All sampling equipment components and sample containers should not come in contact with aluminum foil, low density polyethylene (LDPE), glass or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer.

Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFC materials must be avoided. Many food and drink packaging materials and “plumbers thread seal tape” contain PFCs.

All clothing worn by sampling personnel must have been laundered multiple times. The sampler must wear nitrile gloves while filling and sealing the sample bottles.

2.4 Soil Borings

Soil borings will be completed using either direct push subsurface investigation techniques or rotary drilling with continuous split spoon sampling and hollow stem augers. Drilling cuttings will be visually inspected and screened with an OVM and managed consistent with DER-10 requirements. Soil sampling will be conducted to define the subsurface conditions. During continuous sampling process, soil samples will be field screened for the presence of VOCs using an OVM. Soil samples for laboratory analysis will be selected in the field based on visual/olfactory observations and OVM screening results.

The drill rig/ soil probe rig, tools, augers, etc. will be decontaminated between holes at an on-site temporary decontamination pad or area. Decontamination will be accomplished using steam cleaning or high pressure wash equipment. Direct push sampling equipment and split spoon sampling devices will be cleaned manually with non-phosphate detergent (i.e., Alconox) wash and potable water followed by a potable water rinse or a second steam cleaning followed by a distilled/deionized water rinse. All equipment will be cleaned prior to leaving the Site.

2.5 Test Pits

Test pits will be completed using a track-mounted excavator and bucket to provide a detailed visual examination of near surface soil, and fill materials present on-site. Samples will be collected from the walls and/or floor through the use of a bucket, steel trowels and bowls. The samples will be placed directly into the appropriate containers, inspected and screened for the presence of VOCs using an OVM, and managed consistent with DER-10 requirements. Soil samples for laboratory analysis will be selected in the field based on visual and olfactory observations and OVM screening results.

Sampling equipment will be cleaned manually with non-phosphate detergent (i.e., Alconox) wash and potable water, followed by a potable water rinse or a second steam cleaning, followed by a distilled/deionized water rinse. All equipment will be cleaned prior to leaving the Site.

2.6 Monitoring Well Installation

Monitoring wells will be constructed of 2-inch ID flush coupled Schedule 40, polyvinyl chloride (PVC) riser and screen. The actual installation depth and screen depth will be selected based on groundwater depth, observation of subsurface materials and headspace screening test results. In general, the screen will consist of a maximum 10 foot length of 0.010-inch machine slotted well screen. A schematic of the well construction detail is provided as Figure 2.

Following placement of the assembled screen and riser, the borehole will be backfilled. The well screen depth will be backfilled with silica sand filter pack (estimated at size #0) from the base to a minimum of one (1) foot above the well screen. A minimum 1-foot layer of bentonite pellets will be placed above the sand filter and allowed to hydrate. A mixture of cement/bentonite water will be placed above the bentonite seal. The monitoring well will be completed by placing a locking steel casing or road box over the riser. Concrete will be then placed in the borehole around the protective casing and sloped away from the casing.

2.7 Monitoring Well Development and Sampling

2.7.1 Monitoring Well Development

Monitoring wells will be developed by utilizing either a dedicated tubing or new dedicated disposable bailer, depending on the field conditions. Fluids will not be added during development process. New, dedicated well development equipment will be utilized prior to development of each well. The well development procedure is listed below.

- Well cover will be unlocked. OVM will be used to survey the ambient air and air directly at the top of the well.
- Take a pre-development static water level measurement.
- Sound the bottom of the well and agitate/loosen accumulated sediment.
- Calculate water volume in the well.
- Obtain initial field water quality measurements, including pH, specific conductance, turbidity, and temperature obtained using a Horiba U-22 water quality meter (or equivalent).
- Alternate water agitation methods such as moving a bailer or pump tubing up and down inside screened interval coupled with water removal methods (pumping or bailing) in order to suspend and remove solids/sediment from the wells.
- Water quality meter measurements should be recorded every one to three gallons of water removed. Record water quantities removed and water quality measurements.
- Development can cease when the following water quality criteria are met, or at least 5 well volumes have been removed.
    - Water is clear and free of sediment and turbidity is less than 50 nephelometric turbity units (NTUs)
    - pH is +/- 0.1 standard unit between readings
    - Specific conductivities is +/-3% between readings
    - Temperature is +/-10% between readings
- Record post-development water level readings. Development information will be recorded on well development logs.

After the water level has returned to its pre-purge level (or within a maximum of two hours, if the well has recharged sufficiently to allow sampling), samples will be collected from the middle of the screened portion of the well for overburden wells. If the water level is slow to recharge and does not reach to its pre-purge level within two hours, then samples can be collected after sufficient water has recharged, and the degree of recharge indicated in field notes with time and depth to water noted.

2.7.2 Groundwater Sampling

Groundwater samples will be collected by utilizing low-flow sampling techniques with dedicated tubing or by conventional methods using a new dedicated disposable bailer. A peristaltic pump and new disposable high-density polyethylene (HDPE) tubing will be used at each location. Tubing and sampling equipment will be clean upon arrival at the Site. The well will be sampled after removal of three well volumes or well purging.

A Well Data Sheet should be completed during groundwater sampling. Each well to be sampled will have designated pre-labeled, certified clean, sample bottles. The following steps describe the groundwater sample procedure.

- Unlock and remove well cap. Test the air at the wellhead with the OVM.
- Measure the static water level. Determine the total well volume.
- Slowly lower the dedicated bailer or tubing into the well. Purge the well, minimum of three well volumes. If the well goes dry during bailing, allow for full recovery and sample. If recovery takes longer than 20 minutes, proceed to next well but return to sample within 24 hours.
- Fill the appropriate sample bottles. Two or three (depending on laboratory-specific requirements) 40-ml glass vials (with Teflon septa) will be used to collect samples for VOCs. Sample collection with the following sample collection order: volatile organic compounds, semi-volatile organic compounds, PCBs/pesticides/herbicides and metals. If the well should go dry during sampling, the well should to be re-sampled the next day. The second attempt to sample the well will proceed with the same sample order.
- Preservative for the various sampling preservatives will be added by the laboratory provided jars. The following parameters required additional special handling.
    - VOC samples must be free of air bubbles. When the container is determined to be bubble free, the sample containers should be immediately chilled.
    - Metals analysis should be preserved with nitric acid to a pH less than 2.
- Record pertinent information in the field logbook and well data sheet.
- Lock well, inspect well site, and note any maintenance required.
- Purge water will be containerized for future disposal.

Per- and polyfluoroalkyl substances (PFAS) Sampling Protocol

Groundwater sample collection procedure for PFAS will be done in accordance with NYSDEC protocol, as included in the Quality Assurance/Quality Control (QAPP) found in Appendix B. At this time acceptable materials for sampling include stainless steel, high density polyethylene (HDPE), PVC, silicone, acetate and polypropylene. Equipment blanks should be generated at least daily. Additional materials may be acceptable if pre-approved by NYSDEC. Requests to use alternate equipment should include clean equipment blanks. NOTE: Grunfos pumps and bladder pumps are known to contain PFC materials (e.g. Teflon™ washers for Grunfos pumps and LDPE bladders for bladder pumps). All sampling equipment components and sample containers should not come in contact with aluminum foil, low density polyethylene (LDPE), glass or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer. Standard two step decontamination using detergent and clean water rinse will be performed for equipment that does come in contact with PFC materials. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFC materials must be avoided. Many food and drink packaging materials and "plumbers thread seal tape" contain PFCs.

All clothing worn by sampling personnel must have been laundered multiple times. The sampler must wear nitrile gloves while filling and sealing the sample bottles.

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

1. Fill two pre-cleaned 500 mL HDPE or polypropylene bottle with the sample.
2. Cap the bottles with an acceptable cap and liner closure system.
3. Label the sample bottles.
4. Fill out the chain of custody.
5. Place in a cooler maintained at 4 ± 2º Celsius.

2.8 Background Samples

Due to the historical industrial usage of the site and industrial nature of the site contaminants, soils and groundwater samples have not been pre-designed as likely to characterize site background conditions.

2.9 Equipment Decontamination

In order to reduce the potential for cross-contamination of samples collected during the project, sampling equipment will be decontaminated to ensure that data is acceptable. It is anticipated that most of the materials used in sample collection will be disposable one-time use materials, such as sampling containers, bailers, tubing, gloves, etc.

Non-dedicated material such as split spoon samples, stainless steel mixing bowls, drill rig, water-level indicator, etc., will be decontaminated by the following methods:

- Steam clean the equipment within a dedicated decontamination area; or
- Decontamination typically involves scrubbing/washing with a laboratory grade detergent (e.g. alconox) to remove visible contamination, followed by potable (tap) water and analyte-free water rinses. Tap water may be used from any treated municipal water system.

The effectiveness of the equipment decontamination of non-dedicated sampling equipment will be evaluated via analytical testing of rinsate blanks. Decontamination liquids, disposable equipment, and PPE will be containerized for future disposal.

2.10 Storage and Disposal of Investigation-Derived Waste

The sampling methods and equipment have been selected to limit the need for decontamination and the volume of waste material to be generated. Investigation-derived material (e.g., drill cuttings and purge water) generated will be presumed to be non-hazardous waste and will be disposed at the boring or well from which the material was derived. Excess auger cuttings will be drummed and stored on-Site for future disposal. Monitoring well development/purge water will be containerized in 55-gallon drums for testing and future off-site disposal.

Personal protective equipment and disposable sampling equipment will be placed in plastic garbage bags for disposal as a non-hazardous waste.

Decontamination water used in steam cleaning and/or spoon washing, and rinse water, including detergent, may be generated during Site work. Tap and analyte-free water used for rinsing will be allowed to percolate back into the ground, or will be disposed into a sanitary system. Non-phosphate detergent and water rinse will be disposed into a sanitary system.

2.11 Survey/Site Mapping

A base map will be prepared by a New York State licensed surveyor. This will allow measurement of the actual exploration locations and elevations. The base map will include property lines, buildings, fence lines, and other key site features. The surveyor may establish the horizontal location and vertical elevations. The map will include the RI investigation/sampling locations. Monitoring well vertical measurements will include the ground surface at exploration locations, plus the top of casing and top of riser at monitoring well locations. The top of riser will serve as the water level monitoring point. Soil/fill boring locations will be field located and incorporated within the survey. Elevations of the ground surface and top of PVC riser will be measured for each monitoring well.

3.0 SAMPLE HANDLING and MANAGEMENT

Various environmental samples will be collected during the RI investigation work. The procedures below will assist in documentation and tracing of the various samples. During sampling, field personnel will wear disposable or latex or nitrile gloves. Gloves will be changed and discarded between sampling locations.

Laboratory analysis samples will be placed in new laboratory-grade containers. Appropriate sample preservatives will be added to the sample containers by the laboratory prior to delivery to the project site. The specific volume and preservation of samples, if any, is summarized on Table 2. Samples will be shipped to the laboratory within 48-hours from sample collection. Samples will be kept in coolers, on ice, for shipment to the analytical laboratory.

3.1 Sample Label and Identification

Each field and QC sample will be identified by a self-adhesive, non-removable label placed on the sample containers. The label information will include, at a minimum, client name, site location, data and time of collection, sample identification number, sampler’s name, and notes, as needed recorded in waterproof ink. All sample bottles within each shipping container will be individually labeled with the laboratory provided label.

Each sample will with a unique identification using the following test location designations:

Designation	Media Type	Sample Location	Example
SB	Soil	Soil boring number with sample depth interval (x-x’)	SB1 (8-10’)
MW	Groundwater	Monitoring well with well number	MW2
EX	Soil	Excavation confirmation sample with sample depth interval	EX3 (1-2’)
TB	Trip blank	None – include day/month/year	TB1 – 10/25/16
RB	Rinsate blank	Any – rinsate of sampling equipment; include day/month/year	RB2 – 10/25/16
MS/MSD	Matrix spike/ matrix spike duplicate	Any – identify original sample location	SB1 MS MW2 MSD

Quality control (QC) field duplicate samples will be submitted blind to the laboratory; a fictitious sample identification will be created using the same system as the original. The sample identifications (of the original sample and its field duplicate) will be marked in the project specific field book and on the copy of the chain-of-custody kept by the sampler and copied to the project manager.

3.2 Chain of Custody

A chain-of-custody form will trace the path of sample containers from the project site to the laboratory. An example Chain of Custody is included in Attachment 2. The chain-of-custody documentation will accompany the samples from their inception until analysis. Pertinent field information will be included on the chain-of-custody, including client name, project name/location, sampler name, sample identification number, date, time, media, grab/composite, number of containers, analysis required, and preservation.

Samples will be packaged into coolers used for shipment. The cooler will be packed with ice (or equivalent) to maintain sample temperature at 4 ºC. The chain of custody forms will be signed and placed in a sealed plastic bag in the cooler. The cooler will be sealed and custody seal placed over the cooler opening, designed to break if opened or disturbed. The custody seal will be signed and dated. Shipping tape will be wrapped around the cooler and over the custody seal. Sample receipt personnel at the laboratory will document whether the custody seals remained intact upon arrival and lab personnel will sign the chain-of-custody form.

4.0 FIELD DOCUMENTATION

Daily field activities will be recorded in a bound field notebook. The field notebook will include the following daily information for Site activities:

- Date, time of arrival, time of departure, weather conditions.
- Field staff, sub-contractors or other personnel on site.
- Description of field activities and location of work area.

- Equipment used on site (such as drill rig, operator)
- Field observations and descriptions, such as soil descriptions, well/piezometer installation information, evidence of contamination, staining, odors, etc.
- Field measurements (OVM, water quality readings) and calibration
- Sampling locations, depths, identification numbers, time, etc.
- Sampling location measurements.
- Chain of custody information
- Modifications to scope of work or issues encountered.

Field notes may be transferred to soil boring logs, or monitoring well forms as part of the RI. Typical forms to be utilized during the field investigation are presented in Attachment 2 and include:

- Daily Field Report
- Soil Boring Log or Test Pit Log
- Monitoring Well Installation Log
- Well Development Data Sheet
- Chain of Custody
- Building Inventory; and
- SVI Sampling Data Sheet

5.0 ANALYTICAL LABORATORY QA/QC PROTOCOLS

This section describes the analytical methods, principles and procedures that will be used to generate quality data. These protocols include laboratory calibration, field equipment calibration, QC sample collection and analysis, quantitative evaluation of data quality protocols and data qualification, if necessary.

5.1 Analytical Methods, Procedures and Calibration

Chemical analysis for samples collected during the field work will be completed by a laboratory capable of performing project specific analysis as included in this QAAP.

5.1.1 Analytical Methods

Sample analytical analysis will be consistent with the NYSDEC ASP Category B requirements. Specific methods and references for each parameter including sample preservation and holding times are shown on Table 2. Quantification and detections limits for all analysis are those specified under the appropriate test methods.

NYSDEC has provided specific laboratory requirements associated with 1,4-dioxane and PFSA analytical methods, which are included in Attachment 3.

5.1.2 Laboratory Instrumentation & Equipment

Laboratory instruments and equipment will be calibrated following SW-846 analytical methods protocol and laboratory requirements.

5.1.3 Field Equipment

Various field equipment will be used during the project. Calibration of the field equipment will be complete in accordance with manufacture's specifications, prior to the start of each day.

Organic Vapor Meter – Real-time monitoring for VOCs will be done with an organic vapor meter (OVM) equipped with a photoionization detector (PID) to evaluate the nature and extent of potential petroleum or solvent impacts at the site. The OVM will be calibrated on a daily basis in accordance with manufacturer's specifications.

Particulate Monitoring Equipment – Particulate air monitoring will be completed during soil excavation activities as part of the IRM as noted in the Community Air Monitoring Program (CAMP). Measurements will be collected along the upwind perimeter of the excavation areas to assess the amount of particulates naturally occurring in the air. The particulate meter will be regularly calibrated in accordance with the manufacturer's specifications.

Additional Field Equipment – Additional field equipment will be used as part of the project including an electric static water level indicator and Horiba U-22 water quality meter that measures pH, specific conductivity, temperature, dissolved oxygen, oxygen reduction potential and turbidity. The meters will be calibrated in accordance with the manufacturer's specifications.

5.2 Quality Control Samples

Analytical methods, summarized on Table 2, to be utilized for laboratory sample analysis address the quality control to be used and the frequency of replicates, blanks and calibration standards for laboratory analytical equipment. Several types of field QC samples will be collected and submitted for laboratory analysis including trip blanks, sample duplicate, matrix spike and matrix spike duplicate.

Trip blanks – A trip blank sample monitors for potential impacts due to handling, transport, cross contamination from other samples during storage or laboratory contamination. The trip blanks, for aqueous VOCs only, will consist of analyte free reagent grade water in VOC sampling containers to be used for the project. Trip blanks will be prepared at the laboratory, sealed, transported to the Site and returned without being opened to assess contamination that may have occurred during transport. Trip blanks will be submitted at a rate of one per cooler when aqueous VOCs are shipped to the laboratory.

Blind duplicates – Blind duplicate samples are used to monitor field and laboratory precision, as well as matrix heterogeneity. The samples are separate aliquots of the same sample, collected from the same location, at the same time, in the same manner as the first, and placed into a separate container. Each duplicate sample will be analyzed for the same parameters as the original sample collected that day. Blind duplicates will be collected at a frequency of 1 per 20 environmental samples of a given matrices (i.e. soil or groundwater).

Matrix spike/matrix spike duplicate (MS/MSD) are used to monitor precision and accuracy of the analytical method on various matrices. The samples are spiked with known quantities of target analytes at the laboratory. The MS/MSD will be collected at a frequency of 1 pair per 20 environmental samples of a given matrices (i.e. soil or groundwater).

Rinsate Blanks – Rinsate blank is used to indicate potential contamination from sample instruments used to collect and/or transfer samples. The rinsate blank will be generated by passing distilled water through and over cleaned sampling equipment. Rinsate blank samples will not be performed when dedicated disposal equipment is used. The rinsate blank will be collected at a frequency of 1 per 20 environmental samples of a given matrices (i.e. soil or groundwater).

5.3 Corrective Actions

If instrument performance or data fall outside acceptable limits, then corrective actions will be taken to resolve problems and restore proper functioning of the analytical system. Actions may include recalibration or standardization of instruments, acquiring new standards, replacing equipment, repairing equipment, and reanalyzing samples or redoing sections of work. Subcontractors providing analytical services should perform their own internal laboratory audits and calibration procedures with data review conducted at a frequency so that errors and problems are detected early, thus avoiding the prospect of redoing large segments of work.

6.0 DATA USABILITY

The main objective of the DUSR is to determine whether the data presented meets the project-specific needs for data quality and data use. Data validation will be performed and a Data Usability Summary Report (DUSR) will be prepared to meet the NYSDEC requirements for analytical data generated during the RI. The DUSR will be completed in general accordance with Appendix 2B of DER-10. The findings of the DUSR will be incorporated in the RI/AAR report. Waste characterization and/or delineation samples will not be validated.

TABLES

TABLE 1
Analytical Testing Program Summary
125 Chandler Street Site
125 Chandler Street, Buffalo, NY
NYSDEC Brownfield Cleanup Program

Location	**Number of Proposed Locations**	**Matrix**	**TCL VOCS**	**TCL SVOCs**	**TAL METALS Total**	**TAL METALS dissolved**	**PCBs**	**Pest/ Herbs**	**VOC TO-15**	**1,4-dioxane**	**PFAS**
Surface Soil Samples											
Surface Soil Sample	0	Soil	-	-	-	-	-	-	-	-	-
Duplicate		Soil	-	-	-	-	-	-	-	-	-
MS/MSD		Soil	-	-	-	-	-	-	-	-	-
Rinsate		Water	-	-	-	-	-	-	-	-	-
Total			**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Soil Borings - Subsurface Samples											
Soil Boring Locations	5	Soil	2	2	2	-	1	1	-	-	-
Duplicate		Soil	-	-	-	-	-	-	-	-	-
MS/MSD		Soil	-	-	-	-	-	-	-	-	-
Rinsate		Water	-	-	-	-	-	-	-	-	-
Total			**2**	**2**	**2**	**0**	**1**	**1**	**0**	**0**	**0**
Test Pits - Subsurface Samples											
Test Pit Locations	10	Soil	4	6	6	-	3	3	-	3	3
Duplicate		Soil	1	1	1	-	1	1	-	1	1
MS/MSD		Soil	2	2	2	-	2	2	-	2	2
Rinsate		Water	1	1	1	-	1	1	-	1	1
Total			**8**	**10**	**10**	**0**	**7**	**7**	**0**	**7**	**7**
Monitoring Wells											
Monitoring Well	3	Groundwater	3	3	3	3	3	3	-	3	3
Duplicate		Groundwater	1	1	1	1	1	1	-	1	1
MS/MSD		Groundwater	2	2	2	2	2	2	-	2	2
Rinsate		Water	1	1	1	1	1	1	-	1	1
Trip Blank		Water	1	-	-	-	-	-	-	-	1
Total			**8**	**7**	**7**	**7**	**7**	**7**	**0**	**7**	**8**
Sub-slab/Ambient Air samples											
Sub-slab	0	Air	-	-	-	-	-	-	-	-	-
Ambient Air		Air	-	-	-	-	-	-	-	-	-
Outdoor		Air	-	-	-	-	-	-	-	-	-
Duplicate		Air	-	-	-	-	-	-	-	-	-
Total			**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
			VOCs	SVOCs	METALS	METALS	PCBs	Pest/ Herbs	VOC - TO-15	1,4-dioxane	PFAS
		TOTAL SAMPLES	**18**	**19**	**19**	**7**	**15**	**15**	**0**	**14**	**15**

Notes:

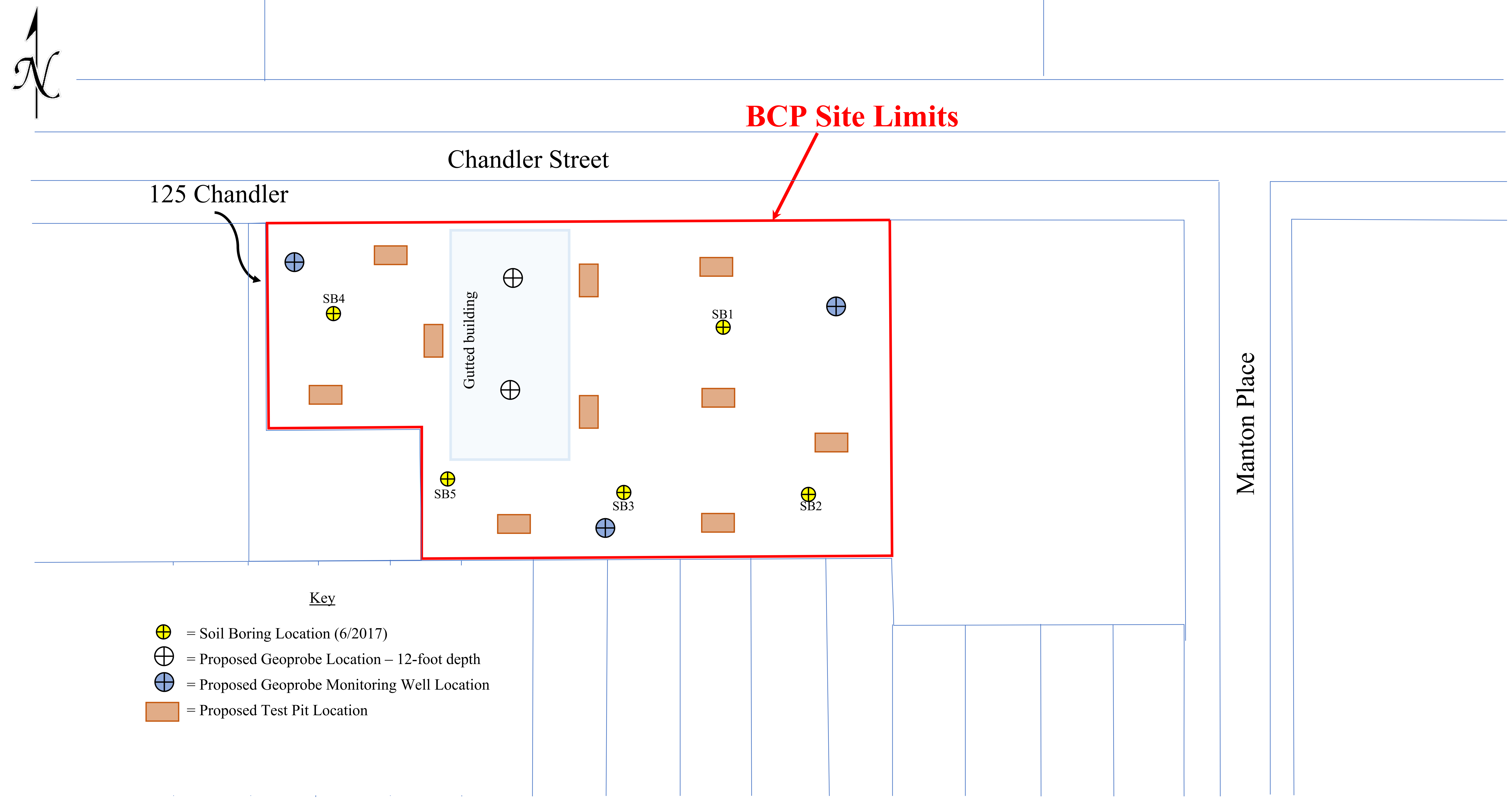
TCL VOCs - Target Compound List Volatile Organic Compounds.
TCL SVOCs - Target Compound List Semi-volatile Organic Compounds.
TAL Metals - Target Analyte List Metals.
TCL PCBs - Target Compound List Polychlorinated Biphenyls.
PFAS - Polyfluoroalkyl Substances

TABLE 2
Sample Container, Volume, Preserving and Holding Time Requirements
125 Chandler Street Site
125 Chandler Street, Buffalo, NY
NYSDEC Brownfield Cleanup Program

PARAMETER DESCRIPTION	MATRIX	METHOD NO.	Quantity/ Bottle Type	Preservation	Holding Time
Soil Samples					
Volatiles, TCL list	Soil	5035/3035A/8260	Encore or Terracore Samplers	Freeze withint 48 hours	Freeze within 48 hours 14 days
Semi-Volatiles, TCL list	Soil	8270	(1) 4oz glass jar	Cool, 4 C	14 days
Metals, TAL (no CN)	Soil	6010/7000	(1) 4oz glass jar	none	180 days, Mercury 28 days
PCBs	Soil	8082	(1) 4oz glass jar	Cool, 4 C	365 days/40 days from extraction
Pesticides	Soil	8081	(1) 4oz glass jar	Cool, 4 C	14 days/40 days from extraction
Herbicides	Soil	8151	(1) 4oz glass jar	Cool, 4 C	14 days/40 days from extraction
1,4-Dioxane	Soil	8270-SIM	(1) 8oz glass jar	Cool, 4 C	14 days
Polyfluoroalkl Substances (PFAS)	Soil	Method 537	(1) 8oz glass jar	Cool, 4 C	28 days
Monitoring Wells					
Volatiles, TCL list	Water	8260	(3) 40ml vial	Cool, 4 C, HCL	14 days
Semi-Volatiles, TCL list	Water	8270	(2) 1 liter amber	Cool, 4 C	7 days
PCBs	Water	8082	(2) 1 liter amber	Cool, 4 C	7 days/40 days from extraction
Pesticides	Water	8081	(2) 500ml amber	Cool, 4 C	7 days/40 days from extraction
Herbicides	Water	8151	(2) 1 liter amber	Cool, 4 C	7 days/40 days from extraction
Metals, TAL	Water	6010	(1) 250ml plastic	HNO3	180 days
Mercury, Total	Water	7000	(1) 250ml plastic	HNO3	28 days
Metals, TAL (dissolved) field filtered	Water	6010	(1) 250ml plastic	HNO3	180 days
Mercury, Dissolved	Water	7000	(1) 250ml plastic	HNO3	28 days
1,4-Dioxane	Water	8270-SIM	(2) 500ml amber	Cool, 4 C	7 days
Polyfluoroalkl Substances (PFAS)	Water	Method 537	2 plastic/1 plastic/1 H20 plastic*	Cool, 4 C	14 days
Air Samples - Sub-slab; Ambient Air; Soil Vapor					
Volatiles	Air	TO-15	1 liter canister	none	30 days

* Three bottles in kit provided b lab. These bottles will be kept separate from other bottles that may have teflon lids.

FIGURES

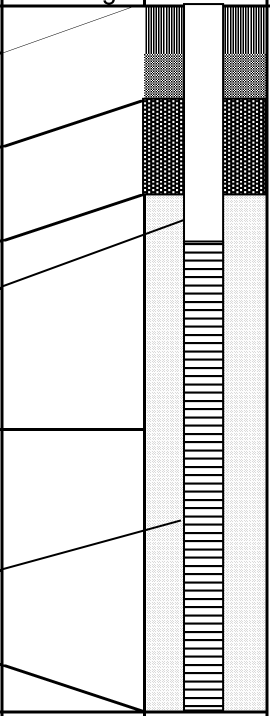


WITTMAN GEOSCIENCES, PLLC	**Proposed Subsurface Investigation Locations**	DRAWN BY: MMW	SCALE: 1" = 40'	PROJECT: 19209
	125 Chandler, Buffalo, NY	CHECKED BY: MMW	DATE: 03/2020	FIGURE NO: 1

Wittman GeoSciences, PLLC	Date started: Date finished:	Hole No.: Sheet 1 of 1

location:
Location:

Project No.: Proj. Mgr:	Drilling Co. Driller: Drill Rig:	Weather:



Depth (ft.)	Sample No.	Sample Depth (ft.)	Sample Blows /6"	Well Construction Details	Field Analytical Readings	Well Details	Groundwater and Other Observations
				1" well completed w/ flush road box			
				Cement/bentonite mix (1' - 2')			
4	2	4-8					
				Bentonite pellets (2'-4')			
				1" sch. 40 PVC riser (0'-5')			
8	3	8-12					
				#0 sand (4'-15')			
12	4	12-15		1" sch. 40 PVC (.010 slot screen).			
			N/A: Well completed w/ geoprobe drill rig				
				Bottom of screen 15 feet bg.			
				Bottom of borehole 15 feet bg.			
16							
24							
30							

S=Split Spoon: ________ T= Shelby Tube: ________
R= Rock Core: ________ WH = Weight of Hammer
N = ASTM D1586

Backfill Well Key:

▥	Grout	▒	Cement/ Bentonite
░	Sand	▓	Bentonite

Attachment 1

Resumes

Michele M. Wittman, P.G.
Principal

Education

B.A., 1994, Geology, State University of New York at Buffalo

B.S., 1994, Social Sciences-Environmental Studies, State University of New York at Buffalo

Professional Registrations

2018, Professional Geologist, New York, #000726

2002, Professional Geologist, Washington, #1772

Affiliations and Certifications

New York State Council of Professional Geologists, Member
Buffalo Association of Professional Geologists, Member
Air and Waste Management Association of Western New York, Member
OSHA 40 Hour 29 CFR 1910. (HAZWOPER) Certification

Ms. Wittman is a Professional Geologist with over 24 years of professional experience in conducting a variety of environmental projects for both private and public clients. Clients have included industry, governmental agencies, developers, legal firms, financial institutions, and engineering firms. Project work has included conducting and managing Phase I and Phase II Environmental Site Assessments throughout New York and surrounding states, Brownfield Cleanup Program project investigations and site remediation, hydrogeologic investigations, remedial option evaluation and cost estimating, and remediation of soil and groundwater.

Ms. Wittman's responsibilities have ranged from supervising field and technical activities, completion of field work including soil classification, well installation, collection of environmental laboratory samples, excavation oversight; training staff, data analysis, report preparation and review, and client contact. Additionally, responsible for developing and maintaining client relationships, account and project management, bidding, contracting and scheduling and financial management including budgets, proposals, profit/loss assessment. Ms. Wittman has also acted as business manager which included business development and client management, generation of marketing materials; supervising administration staff, and office management.

Ms. Wittman also previously held the position as Assistant Vice President and Environmental Risk Analysis Officer at an international financial institution. During her tenure at this position, Ms. Wittman reviewed hundreds of environmental reports and provided remedial cost estimates to evaluate the potential risk and future losses.

Areas of Specialization

- ✓ Brownfield Cleanup Program
- ✓ Remedial Investigations
- ✓ Feasibility Studies
- ✓ Hydrogeologic Investigations
- ✓ Petroleum and Chemical Bulk Storage
- ✓ Environmental Site Assessments
- ✓ Geologic Evaluations
- ✓ Soil Testing
- ✓ Budgeting & Cost Controls
- ✓ Subcontractor/Crew Management

Environmental Project Highlights

Phase I Environmental Site Assessments – Various
Ms. Wittman has performed, completed, managed or reviewed over 1,500 Phase I Environmental Site Assessments (ESAs) from areas throughout the United States, with focus in the north east and Western New York area. Site assessments have ranged from small, vacant properties, apartment complexes, office buildings, commercial buildings, shopping plaza, automotive dealerships, gasoline stations, as well as small to large 1,000,000-square foot manufacturing and industrial facilities. Ms. Wittman has completed all aspects of Phase I ESAs including site visits, historical review, municipal agency review, database evaluations, and report preparation.

Phase II Environmental Site Assessments – Various
Ms. Wittman has been involved with hundreds of Phase II ESAs at various commercial, manufacturing, industrial and gasoline station properties. Work has included completion of soil borings and/or test pits, installation of groundwater monitoring wells, collection of soil and/or groundwater samples, and vapor intrusion sampling. Ms. Wittman completes data evaluation including with a final report with conclusions and recommendations, if appropriate.

Brownfield Cleanup Program – Commercial Facility, Cheektowaga, New York
Project Coordinator/Manager and Geologist for the investigation and remediation of a former gasoline station for future commercial and residential usage. Completed appropriate BCP application and work plans as required. Site work involved remedial investigation and an interim remedial measure including removal of two underground storage tanks and petroleum impacted soil. Completed required reporting and received certificate of completion in December 2018.

Brownfield Cleanup Program – Commercial Facility, Buffalo, New York
Project Coordinator/Manager and Geologist for the investigation and remediation of a former industrial facility for future proposed brewery, restaurant, commercial and residential usage. Completed appropriate BCP application and work plans. Oversight for site work that included remedial investigation, and removal of over 3,000 tons of historical industrial fill, removal of underground storage tank, and removal of impacted soil within the building. Completed final reporting and facility received certificate of completion in December 2018.

Brownfield Cleanup Program – Commercial Facility, Buffalo, New York
Project Coordinator/Manager and Geologist for the investigation and remediation of a former industrial facility for future proposed commercial and residential usage. Completed BCP application and work plans. Site work included remedial investigation, which identified high concentrations of PCBs and hazardous concentrations of lead within site soil. Remedial design included removal and out-of-state disposal of PCB soils and on-site stabilization and off-site disposal of lead impacted soils. Remedial work also included excavation of underground storage tank, and removal of impacted soil and concrete within the building. Additionally, significant asbestos abatement was completed. Remedial design included installation of a sub-slab vapor mitigation system. Completed final reporting. Facility received certificate of completion in December 2017 in less than nine months from work plan approval.

Brownfield Cleanup Program – Commercial/Industrial Facility, Buffalo, New York
Project Coordinator/Manager and Geologist for the investigation and remediation of a former industrial facility for future development as athletic fields. Completed BCP application and work plans. Site work included remedial investigation with over 100 soil borings, test pits, hand auger samples, and vapor intrusion locations. Historical fill with depths ranging up to 19 feet below ground surface was present in portions of the site. VOC impacts were identified in groundwater in limited area of the site, as well as vapor intrusion. Remedial designs included installation of sub-slab depressurization system, groundwater remediation, and management of historical industrial fill. Project remediation and development planned for spring/summer 2019.

Brownfield Cleanup Program – Commercial Facility, Buffalo, New York
Project Coordinator/Manager and Geologist for the investigation and remediation of a former industrial facility for future usage as incubator space within the City of Buffalo. Completed BCP application, as well as remedial investigation and interim remedial measures work plan. Site investigation work planned for Spring 2019.

Brownfield Cleanup Program – Future Commercial Facility, Orchard Park, New York
Project Coordinator/Manager and Geologist for the investigation and remediation of a former county incineration facility with process pond. Completed BCP applications and remedial investigation work plan. Site investigation work planned for Spring 2019.

Remedial Cleanup - Commercial Facility, Amherst, New York
Project Manager and Geologist for the remedial oversight during new building construction, which resulted in identifying former oil/water separator pits, hydraulic lifts, and underground tanks. Each underground structure was evaluated upon discovery, removed, and appropriate samples collected for laboratory analysis. NYSDEC oversight was present during the construction process and one NY Spill was assigned to the site. Upon completion of the project, a final report was done to summarize the findings and the NY Spill was closed.

Remedial Action Plan Evaluation – Former Bulk Petroleum Terminal, Rochester, New York
Developed Remedial Action Plan for former terminal property that underwent extensive subsurface investigations resulting in over 70 borings and 80 soil sample analyses. Initial remedial estimates (by others) included significant soil excavation and remedial costs. Our evaluation included comparison to NYSDEC CP-51 soil guidance for assessment of potential remediation. As such, based on minimal groundwater contamination and identification of significant impacts at greater depths, and negotiation with NYSDEC, no soil remediation was needed.

Management of Environmental Conditions – Retail Gasoline Chain, Western New York
Evaluated environmental concerns associated with 75 different retail gasoline stations. Reviewed regulatory information, previous reports, and data analysis to assess current environmental status. Developed a summary of findings and recommendation of action for each property. Further evaluations included Phase II investigation and continued monitoring of remedial efforts. Developed remedial cost estimate ranges for locations current undergoing remedial work.

Voluntary Cleanup Program - Commercial Facility, Hamburg, New York
Completed a Phase I ESA and identified historical dry cleaner. Conducted investigation and identified contamination beneath the building floor slab and behind the building (i.e. back door). Interim remedial measures (IRM) included soil removal, resulting in approximately 200 tons of soil that was disposed at a hazardous waste landfill. A soil vapor intrusion study was done and identified the presence of compounds To achieve site closure, negotiated a remedial solution that included confirmation sampling of soils around the building structure and installation of a sub-slab depressurization/vent system.

Contract to Closure, Remedial Activities, Commercial Facility, Rochester, New York.
Two former gasoline stations were located at adjoining properties. Our client wanted to develop the Site for commercial use. Completed a Site Investigation and identified subsurface soil contamination, groundwater contamination and separate phase product. Developed a Remedial Work Plan that included removal of separate phase product and implementation of in-situ chemical oxidation via hydrogen peroxide injections to further reduce contaminants in soil and groundwater. Remedial action also included asbestos abatement and building. The Site received a “no further action” letter and has been developed as a retail bank.

True Bethel Baptist Church – Technical Consultant
Senior Project Manager on the NYSDEC first ever Technical Assistance Grant (TAG) to a community group impacted by a brownfield site. Reviewed site technical documents, attended public meetings and interacted on behalf of the community with NYSDEC and its representatives and contractors on the Site.

HAZARD EVALUATIONS

C. Mark Hanna, CHMM
President, Principal

Mr. Hanna has over 34 years of experience in environmental pollution control and health/safety services. As principal for Hazard Evaluations, Inc., Mr. Hanna is responsible for all technical services. He specializes in hazardous materials/wastes management, site assessment and remediation, industrial compliance auditing, chemical exposure assessment, safety program development and implementation, and Process Safety Management and Risk Management Planning programs.

Mr. Hanna's career has included over 40 federal/state Superfund projects and over 1,500 due diligence projects. His industrial experience focuses on air, water, waste and chemical management compliance aspects at metal working, wood working, foundry, electroplating, printing and food production facilities.

Education

B.A., 1975, Biology, S.U.C. at Oswego, N.Y.

M.S., 1977, Natural Sciences (Toxicology Concentration), S.U.N.Y. at Buffalo, N.Y.

MEPC, 1982, Pollution Control, Pennsylvania State University

M.S., 1983 Forest Hydrology (Hydrogeology Minor), Pennsylvania State University

Professional Registrations

1985, Certified Hazardous Materials Manager, Senior Level

1989-1998, Registered Environmental Professional

1997, Certified Hazardous Materials Manager, Master Level

Key Skills

- Industrial Emission Permits and Controls
- Hazardous/Solid Waste Management
- Industrial Wastewater Pretreatment and Discharge Permits
- Waste Reduction and Pollution Prevention Programs
- Petroleum and Chemical Bulk Storage
- Industrial Stormwater Management
- Environmental Site Assessments
- Environmental Compliance Assessment
- Industrial Risk Management Program and Audit
- Remedial Investigations
- Brownfield Cleanup Program
- Budgeting & Cost Controls

Affiliations and Certifications

Academy of Hazardous Materials Management, Member
Erie County Local Emergency Planning Committee, Member
New York Water Environment Association, Member
International Institute of Ammonia Refrigeration, Member
OSHA 40 Hour 29 CFR 1910. (HAZWOPER) Certification

Environmental Project Highlights

- Performed site characterization for subsurface TCE contamination from historical improper disposal via septic system. Developed Interim Remedial Measures and Remedial Alternatives Reports and Work Plan for this Voluntary Brownfield Cleanup. Installed two banks of piezometers to allow both extraction of contaminated groundwater and injection of Potassium permanganate using continuously operating metering pumps. Recovered over 60 gallons of free product and significantly reduced contamination in groundwater in one year.

- Project Manager for the remediation of numerous (85+) underground petroleum storage tank sites located throughout Western New York. The primary method of remediation has been excavation/removal with appropriate management of tank contents and/or residues, cleaning and scrapping of the tanks and piping, and site restoration. Where petroleum releases were detected, excavation/removal of contaminated soil/fill was completed the majority of the time, with soil management including off-site disposal or on-site bio-treatment. In several cases, on-site vapor extraction systems or chemical oxidation systems with groundwater monitoring have been installed as the recommended remedial method.

- Project Manager for industrial site restoration project which involved the characterization of Lead-contaminated kiln brick surfaces. Appropriate characterization allowed demolition debris from kiln to be disposed of in-place on-site as solid waste material as authorized by NYSDEC. Area was then backfilled with structural flowable fill to allow reuse of floor space for manufacturing.

- Completed investigation and remediation (excavate and remove) of subsurface Lead contamination at an historical industrial site in Buffalo (NY).

- Project Manager for non-hazardous aspects of site remediation at former Frontier Chemical-Pendleton Site. Remedial tasks included sampling/analysis of wastes, emptying, cleaning and scrapping of bulk storage tanks and collecting/disposing of various on-site residuals.

- Project Manager for the installation of groundwater monitoring wells at AL Tech Specialty Steel's solid waste management unit located in Watervliet, NY. Prepared Closure Plan and Bid Specifications for the related RCRA surface impoundment. Addressed technical impact of surface run-off from adjacent landfill, steep terrain and on-site source for cover material. Prepared response package required by NYSDEC regarding the basis of design and construction practices completed during closure.

- Project Manager for the remediation of a cutting oil spill at a Lockport, NY machine shop. Cleanup activities included an underground storage tank removal, scarification of surface soils and inoculation of contaminated soils with petroleum biodegrading bacteria. Responsibilities included coordination of subcontractors, soil sampling, and preparation of report certifying contamination removal.

- Project Manager for industrial site restoration project for solid waste materials abandoned on-site in the on-site production of flowable fill as authorized by a NYSDEC Beneficial Use Determination. Flowable fill produced was used as structural fill to backfill subfloor tanks and large vaults to grade within the facility to allow reuse of the floor space. Tasks included CBS-registered process tank fluid removal and management, basement vault water management, chemical lab packing and disposal, PCBs-contaminated concrete characterization and disposal, UST closure and soil management, scrap and demolition debris management, and subsequent SEQR filing and Phase I Environmental Site Assessment.

Regulatory Compliance Project Highlights

- Project Manager for the development of numerous Process Safety Management and/or Risk Management Plan programs utilizing anhydrous ammonia for refrigeration, including Sorrento Lactalis, Inc.'s South Park (Buffalo, NY), Goshen, NY, Nampa, ID and San Jose, CA facilities, Upstate Niagara Cooperative, Inc.'s Culture (West Seneca, NY), Dale Road (Cheektowaga, NY) and Fulton (Rochester, NY) facilities, as well as Rosina Foods, Inc. (West Seneca, NY), Steuben Foods, Inc. (Elma, NY), Elmhurst Dairy, Inc. (Jamaica, NY), and Sodus Cold Storage, Inc. (Sodus, NY). Responsibilities included coordinating written program preparation, Process Hazard Analysis development, preparing release scenarios, evaluating and upgrading SOPs, developing MOC methods, etc.

- Provided consulting services to over 75 facilities nationwide regarding SARA Title III reporting requirements. Services included regulations and process reviews, mass balance calculations, purchasing and process data evaluation, database development and USEPA Tier Two and Form R preparation.

- Project Manager for numerous environmental compliance audits including, Mod-Pac Corp., Buffalo, NY (commercial printing), Sahlen Packing Co., Inc., Buffalo, NY (meat packing), Upstate Niagara Cooperative, Inc., Buffalo, NY (dairy products), MoldTech, Inc., Lancaster, NY (plastics), Sorrento Lactalis, Inc., Buffalo, NY (cheese manufacturing), Chautauqua Hardware Corp., Jamestown, NY (brass hardware), Thomson Professional Publishing, Webster, NY (printed media), Buffalo China, Inc., Buffalo, NY (lead glazed china), Brainerd Manufacturing Co., East Rochester, NY (electroplating and finishing), Falconer Die Casting Co., Inc., Lakewood, NY (aluminum and zinc casting), and Jensen Fittings Corp., North Tonawanda, NY (stainless pipe fittings). These audits emphasized the inspection of all manufacturing operations, hazardous materials and hazardous waste handling, wastewater treatment operations, air emissions and facility records to evaluate current practices with regard to RCRA, SARA, New York State Parts 200 (air), 360 (solid waste) and 370 (hazardous waste) regulations, USEPA Categorical Pretreatment Standards, UIC NESHAP & CFATS regulations, New York State SPDES regulations, and local sewer authority and fire and building department codes.

- Oversaw the modification of an industrial wastewater pre-treatment system for Whiting Door Manufacturing. Evaluated plant manufacturing wastewater sources, modified existing pretreatment system, developed wastewater pretreatment schedule, and completed wastewater discharge monitoring. Developed a Toxic Organics Management Plan to reduce cost of wastewater monitoring. Evaluated and assisted with the revision of municipal Industrial User Permit.

- Project Manager for Title V Clean Air Act permit development for Whiting Door Manufacturing Corp., Dinaire, Inc., Metalico Aluminum Recovery, Inc. and Flexo Transparent, Inc. Continued services include annual emission statements, 12-month rolling emissions determinations and semi-annual compliance reporting.

- Project Manager for Clean Air Act and/or NYSDEC Part 228 determinations and State Air Facility Permit or Air Facility Registration development for numerous industrial clients including Niagara Ceramics Corporation, Buffalo Metal Casting Co., Inc., ITT Standard/XYLEM, Metalico Rochester, Inc., Ulrich Planfiling Equipment Corp., United Silicone, Inc., U.S. Chrome Corp., Metalico Aluminum Recovery, Inc., Truck-Lite Co., Inc., Jensen Fittings Corp., API Delavan, Inc., Tapecon Inc., Dura-Plating, Inc., Buffalo China, Inc., Forsyth Industries, Inc., Jamestown Laminating Co., Classic Brass Inc., Ivaco Steel Processing (New York), LLC, Innovative Tool & Machine Co., Inc., and Whiting Door Manufacturing, Inc.

JOHN A. SCHENNE, P.E.

REGISTRATION

Registered Professional Engineer -- Texas, New York and Florida
Licensed Fire Protection II Contractor - Florida

EDUCATION/ TRAINING

BS - Civil Engineering - Clarkson University (1975)
BA - Geology - State University of New York at Potsdam (1976)
MS - Environmental Engineering - Clarkson University (1977)
Architectural and Planning Courses - State University of New York at Buffalo (1982-87)
U.S. Army Corps of Engineers – Engineer Officer Basic Course (1977)
Earth and Rock fill Dam Construction (1979)
Contract Management (1979)
Oil Field and Hazardous Environment Safety (1986)
Petroleum Production Repair (1984-1986)
Engineer Officer Advanced Course (1987)
U.S. Army Medical Service Corps – Officer Advanced Course (1993)

PUBLICATIONS

Earthen Manure Storage Design Considerations, US NRCS, 1997, co Author

MILITARY EXPIERENCE

23 years of experience, 2LT thru LTC, USAR officer, retired 1999 as 0-5. Various staff and command positions including Equipment officer responsible the maintenance of 4000 Army vehicles, to include Humves, Trucks to 80 ton, heavy equipment, bridging equipment, NBC decontamination equipment, repair equipment, generators air compressors, and various other diesel and gas fire equipment. I was also a safety engineer for the US Army for 12 years.

EXPERIENCE SUMMARY

Thirty five years of professional experience in design, construction, and management of multi-disciplined projects involving major earthworks, tunnels, buildings, treatment plants, and site developments. Responsibility as Project Engineer/Manager for feasibility, environmental, and design studies, supervision of field and laboratory investigations, field inspections, providing technical support, and liaison with regulatory agencies. Areas of experience and training include: Environmental Engineering, Sanitary Engineering, Hydrology, Geological Exploration and Mapping; Site Investigation and Assessment, Hazardous Waste Remediation & Testing; Earthwork; Rock Excavation and Blasting; Concrete Design and Construction; Structural Design; Mechanical Design, Corrosion Protection; Facility Planning and Design, and Construction Management.

As a Licensed Fire Protection Contractor I have designed hundreds of water and chemical based fire sprinkler systems and coordinated the work with various fire departments and water utilities. I am familiar with NFPA specifications and codes including rating and testing of potable water systems and fire services. I am very familiar with the New York State Building Code as it relates to fire safety in structures.

<u>KEY PROJECTS</u>

Project-Engineer - Responsible for Draft Environmental Impact Study for 100 unit Residential Development in Orchard Park, New York. Work included traffic studies and investigation of Electro-Magnetic Radiation near power lines.

Project Engineer-Responsible for completion of a chrominum contamination study on twenty (20) miles of Cattaraugus Creek.

Project Engineer – Phase II Environmental hazardous waste investigation and remediation for the Seneca Nation of Indians Elderly Housing Complex, (former U.S. Leather Tannery Site).

Project Engineer - Responsible for the design and construction certification for the U. S. Army Corps of Engineers for over 80 miles of small diameter (four to eight inch) water and sewer lines. Work included approximately 50 lift stations, three 50,000 gpd package water treatment plants, and five land application sewage treatment systems.

Design Engineer - Responsible for the structural design of a high capacity sewage lift station handling extremely corrosive industrial sewage. Project was designed using 8000 psi chemically resistant concrete.

Project Engineer - Responsible for repairs to a 200 mgd water intake in Buffalo Harbor for the City of Buffalo. Repairs included underwater grouting of a 110 year old concrete foundation and installation of a zebra mussel suppression system.

Senior Design Engineer - Erie County Water Authority Sturgeon Point Water Treatment Plant, upgrade of sedimentation basins, sludge removal system and rehabilitation of rapid sand filters at a 100 mgd water plant.

Senior Design Engineer - Responsible for plant and structural design of slow sand water filtration plants at Ripley and Woodridge, New York. Plant sizes 0.3 mgd and 0.5 mgd

Project Engineer - Underwater inspection and emergency repairs to 70 mgd, 90 year old concrete and timber drinking water intake in the Niagara River for the City of Niagara Falls. Work included analysis of intake structure to resist dynamic water and ice loads

Design Engineer - Responsible for investigations and preparation of Phase I Site Assessments for Residential and Commercial Properties in Western New York.

Design Engineer - Responsible for foundation design for a 100 foot tall 300,000 gallon elevated water storage tank.

Design Engineer – Prepared design specifications for more than 50 fire pumps and more than 200 fire sprinkler systems in New York and Florida.

Design Engineer – Prepared designs for 10 –FM 200 fire suppression systems

Design Engineer – Prepared designs for s more than 250 commercial fire detection and alarms systems.

Attachment 2

Field Forms

Wittman GeoSciences, PLLC
3636 N. Buffalo Road, Orchard Park, NY 14127
michelewittmangeo@gmail.com 716-574-1513

Boring No:

Project Name & Location ____________________
WGS Project Number: ____________________
Start Date __________ End Date __________
GW Depth While Drilling __________
GW Depth at Completion __________
WGS Representative: __________
WGS Reviewed & Approved by: M. Wittman, P.G.
Drilling Contractor __________
Type of Drill Rig __________
Sampler Type: __________

Sample Depth (ft)	Sample No.	Sample Depth (feet)	Recovery (%)	SAMPLE DESCRIPTION	OVM Reading (ppm)
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
18					
20					
22					
24					

Notes:	1) Organic vapor meter used to field screen and headspace soil samples. 2) ND - non detect on OVM
General Notes:	1) Stratification lines represent approximate boundary between soil. Transitions may be gradual. Depths are approximate. 2) Groundwater (GW) depths approximate at time of sampling. Fluctuations in groundwater may occur. 3) f=fine; m=medium; c=coarse 4) and (36-50%); some (21-35%); little (11-20%); trace (1-10%)

MC - Geoprobe Macrocore SS - Split Spoon SH - Shelby Tube BC - Bedrock Core

HAZARD
EVALUATIONS

3752 N. Buffalo Rd.
Orchard Park, NY 14127
P (716) 667-3130
F (716) 667-3156

Date: ____________ Project No.: ____________
Client: ____________
Project: ____________
Site: ____________
Weather: ____________

FIELD INVESTIGATION REPORT

(Start typing here making sure underline is on and text is justified. Hit tab at the end of the very last row to extend the underline to the right margin).

Signature ____________ Title ____________

Well Data Sheet

Date: Job #:

Crew:

Well Depth:

Initial *Phase* Level:

Initial *Water* Level:

Volume Calculation:

DTB-DTW*__________=1-well vol

Purge Record

Time	Volume	pH	Cond.	Temp.	Turbidity

Purge Method: Bailer/Submersible Pump

Initial Water Quality

Final Water Quality

SAMPLE RECORD

Date:

Time:

Crew:

Method:

Sample ID:

Water Quality:

pH:

Conductivity:

Temperature:

Turbidity:

Volume:

Analysis:

Chain of Custody #:

Sample Type:

Diameter	Multiply by
1"	0.041
2"	0.163
3"	0.367
4"	0.653
6"	1.468
8"	2.61

Comments:

Signature:

NEW YORK CHAIN OF CUSTODY

Westborough, MA 01581
8 Walkup Dr.
TEL: 508-898-9220
FAX: 508-898-9193

Mansfield, MA 02048
320 Forbes Blvd
TEL: 508-822-9300
FAX: 508-822-3288

Service Centers
Mahwah, NJ 07430: 35 Whitney Rd, Suite 5
Albany, NY 12205: 14 Walker Way
Tonawanda, NY 14150: 275 Cooper Ave, Suite 105

Page
of

Date Rec'd in Lab

ALPHA Job #

Client Information

Client:
Address:
Phone:
Fax:
Email:

Project Information

Project Name:
Project Location:
Project #
(Use Project name as Project #) ☐
Project Manager:
ALPHAQuote #:

Turn-Around Time

Standard ☐ Due Date:
Rush (only if pre approved) ☐ # of Days:

Deliverables

☐ ASP-A ☐ ASP-B
☐ EQuIS (1 File) ☐ EQuIS (4 File)
☐ Other

Regulatory Requirement

☐ NY TOGS ☐ NY Part 375
☐ AWQ Standards ☐ NY CP-51
☐ NY Restricted Use ☐ Other
☐ NY Unrestricted Use
☐ NYC Sewer Discharge

Billing Information

☐ Same as Client Info
PO #

Disposal Site Information

Please identify below location of applicable disposal facilities.

Disposal Facility:
☐ NJ ☐ NY
☐ Other:

These samples have been previously analyzed by Alpha ☐

Other project specific requirements/comments:

Please specify Metals or TAL.

ANALYSIS

Sample Filtration
☐ **Done**
☐ **Lab to do**
Preservation
☐ **Lab to do**

(Please Specify below)

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials									Sample Specific Comments	Total Bottle

Preservative Code:
A = None
B = HCl
C = HNO_3
D = H_2SO_4
E = NaOH
F = MeOH
G = $NaHSO_4$
H = $Na_2S_2O_3$
K/E = Zn Ac/NaOH
O = Other

Container Code
P = Plastic
A = Amber Glass
V = Vial
G = Glass
B = Bacteria Cup
C = Cube
O = Other
E = Encore
D = BOD Bottle

Westboro: Certification No: MA935
Mansfield: Certification No: MA015

Container Type								
Preservative								

Relinquished By:	Date/Time	Received By:	Date/Time

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. BY EXECUTING THIS COC, THE CLIENT HAS READ AND AGREES TO BE BOUND BY ALPHA'S TERMS & CONDITIONS. (See reverse side.)

Form No: 01-25 HC (rev. 30-Sept-2013)

Soil Vapor Intrusion - Structure Sampling Building Questionnaire

Structure ID : ______________

Site No. : ______________________ **Site Name** : ____

Date: ______________________ **Time:** ____

Structure Address : ____

Preparer's Name & Affiliation : ____

Residential ? ☐ **Yes** ☐ **No** **Owner Occupied ?** ☐ **Yes** ☐ **No** **Owner Interviewed ?** ☐ **Yes** ☐ **No**

Commercial ? ☐ **Yes** ☐ **No** **Industrial ?** ☐ **Yes** ☐ **No** **Mixed Uses ?** ☐ **Yes** ☐ **No**

Identify all non-residential use(s) : ____

Owner Name : ____ **Owner Phone** : ( ) __________ - ___________

Secondary Owner Phone : ( ) __________ - ___________

Owner Address (if different) : ____

Occupant Name : ______________________________________ **Occupant Phone** : ( ) __________ - __________

Secondary Occupant Phone : ( ) __________ - ___________

Number & Age of All Persons Residing at this Location : ____

Additional Owner/Occupant Information : ____

Describe Structure (style, number floors, size) : ____

____

Approximate **Year Built** : ______________________ Is the building **Insulated**? ☐ Yes ☐ No

Lowest level : ☐ Slab-on-grade ☐ Basement ☐ Crawlspace

Describe Lowest Level (finishing, use, time spent in space) : ____

____

Floor Type: ☐ Concrete Slab ☐ Dirt ☐ Mixed : ____

Floor Condition : ☐ Good (few or no cracks) ☐ Average (some cracks) ☐ Poor (broken concrete or dirt)

Sumps/Drains? ☐ Yes ☐ No Describe : ____

Identify other floor penetrations & details : ____

____

Wall Construction : ☐ Concrete Block ☐ Poured Concrete ☐ Laid-Up Stone

Identify any wall penetrations : ____

____

Identify water, moisture, or seepage: location & severity (sump, cracks, stains, etc) : ________________________________

____

Heating Fuel : ☐ Oil ☐ Gas ☐ Wood ☐ Electric ☐ Other : ___________________________

Heating System : ☐ Forced Air ☐ Hot Water ☐ Other : ____________________________________

Hot Water System : ☐ Combustion ☐ Electric ☐ Boilermate ☐ Other: _________________________

Clothes Dryer : ☐ Electric ☐ Gas Where is dryer **vented** to? _____________________________

If combustion occurs, describe where air is drawn from (cold air return, basement, external air, etc.) : __________________

____

Fans & Vents (identify where fans/vents pull air from and where they vent/exhaust to) : ___________________________________

____

Describe factors that may affect indoor air quality (chemical use/storage, unvented heaters, smoking, workshop):

____

Attached garage ? ☐ Yes ☐ No Air fresheners ? ☐ Yes ☐ No

New carpet or furniture ? ☐ Yes ☐ No What/Where ? ______________________

Recent **painting** or **staining** ? ☐ Yes ☐ No Where ? : ______________________

Any **solvent** or **chemical-like** odors ? ☐ Yes ☐ No Describe : ______________________

____

Last time **Dry Cleaned** fabrics brought in ? __________________ What / Where ? ______________________

Do any building occupants use solvents at work ? ☐ Yes ☐ No Describe : ______________________

Any testing for Radon ? ☐ Yes ☐ No Results : ______________________

Radon System/Soil Vapor Intrusion Mitigation System present ? ☐ Yes ☐ No If yes, describe below

____

Lowest Building Level Layout Sketch

- Identify and label the locations of all sub-slab, indoor air, and outdoor air samples on the layout sketch.
- Measure the distance of all sample locations from identifiable features, and include on the layout sketch.
- Identify room use (bedroom, living room, den, kitchen, etc.) on the layout sketch.
- Identify the locations of the following features on the layout sketch, using the appropriate symbols:

B or **F**	Boiler or Furnace	o	Other floor or wall penetrations (label appropriately)
HW	Hot Water Heater	**xxxxxxx**	Perimeter Drains (draw inside or outside outer walls as appropriate)
FP	Fireplaces	**######**	Areas of broken-up concrete
WS	Wood Stoves	● SS-1	Location & label of sub-slab vapor samples
W/D	Washer / Dryer	● IA-1	Location & label of indoor air samples
S	Sumps	● OA-1	Location & label of outdoor air samples
@	Floor Drains	● PFET-1	Location and label of any pressure field test holes.

Structure Sampling - Product Inventory

Page _____ of _____

Homeowner Name & Address: ______________________________ **Date:** __________

Samplers & Company: ______________________________ **Structure ID:** __________

Site Number & Name: ______________________________ **Phone Number:** __________

Make & Model of PID: ________________________ **Date of PID Calibration:** __________

Identify any Changes from Original Building Questionnaire : ______________________________

Product Name/Description	Quantity	Chemical Ingredients	PID Reading	Location

HAZARD EVALUATIONS

AIR/VAPOR SAMPLING FIELD DATA SHEET

Client: ______________________________ Project No.: ___________________

Site Name & Address: ____

Person(s) Performing Sampling: ____

Sample Identification: ________________

Sample Type: ☐Indoor Air (ambient) ☐Outdoor Air ☐Soil Vapor ☐Sub-slab Vapor

Date of Collection: _________________ Setup Time:____________ Stop Time:____________

Sample Depth: ______________________

Sample Height: ______________________

Sampling Method(s) & Device(s): ____

Purge Volume: ______________________

Sample Volume: ____________________

Sampling Canister Type & Size (if applicable): ___________________________________

Canister # ____________________ Regulator # ____________________

Vacuum Pressure of Canister Prior to Sampling: ___________________

Vacuum Pressure of Canister After Sampling: ____________________

Temperature in Sampling Zone: ____________________

Apparent Moisture Content of Sampling Zone: __________________________

Soil Type in Sampling Zone: ________________________

Standard Chain of Custody Procedures Used for Handling & Delivery of Samples to Laboratory:

☐Yes ☐No. If no, provide reason(s) why?_________________________

Laboratory Name:____

Analysis:____

Comments:

____

____

____

____

Sampler’s Signature _____________________________________ Date:_________________

Attachment 3

Emergent Contaminant Sampling and Laboratory Analysis

February 2019

Sampling for 1,4-Dioxane and Per- and Polyfluoroalkyl Substances (PFAS) Under DEC's Part 375 Remedial Programs

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Objective

The Department of Environmental Conservation (DEC) is requiring sampling of all environmental media and subsequent analysis for the emerging contaminants 1,4-Dioxane and PFAS as part of all remedial programs implemented under 6 NYCRR Part 375, as further described in the guidance below.

Sample Planning

The number of samples required for emerging contaminant analyses is to be the same number of samples where "full TAL/TCL sampling" would typically be required in an investigation or remedial action compliance program.

Upon a new site being brought into any program (e.g., SSF, BCP), PFAS and 1,4-dioxane will be incorporated into the investigation of potentially affected media, including soil, groundwater, surface water, and sediment as an addition to the standard "full TAL/TCL sampling." Biota sampling may be necessary based upon the potential for biota to be affected as determined pursuant to a Fish and Wildlife Impact analysis. Soil vapor sampling for PFAS and 1,4-dioxane is not required.

Upon an emerging contaminant being identified as a contaminant of concern (COC) for a site, those compounds must be assessed as part of the remedy selection process in accordance with Part 375 and DER-10 and included as part of the monitoring program upon entering the site management phase.

Soil imported to a site for use in a soil cap, soil cover, or as backfill must be sampled for 1,4-dioxane and PFAS contamination in general conformance with DER-10, section 5.4(e). Assessment of the soil data will be made on a site-specific basis to determine appropriateness for use.

The work plan should explicitly describe analysis and reporting requirements, including laboratory analytical procedures for modified methods discussed below.

Analysis and Reporting

Labs should provide a full category B deliverable, and a DUSR should be prepared by an independent 3rd party data validator. QA/QC samples should be collected as required in DER-10, Section 2.3(c). The electronic data submission should meet the requirements provided at: https://www.dec.ny.gov/chemical/62440.html.

PFAS analysis and reporting: DEC has developed a *PFAS Analyte List* (below) for remedial programs. It is expected that reported results for PFAS will include, at a minimum, all the compounds listed. If lab and/or matrix specific issues are encountered for any compounds, the DEC project manager, in consultation with the DEC remedial program chemist, will make case-by-case decisions as to whether certain analytes may be temporarily or permanently discontinued from analysis at each site.

Currently, ELAP does not offer certification for PFAS compounds in matrices other than finished drinking water. However, laboratories analyzing environmental samples (e.g., soil, sediments, and groundwater) are required by DER to hold ELAP certification for PFOA and PFOS in drinking water by EPA Method 537 or ISO 25101.

Modified EPA Method 537 is the preferred method to use for environmental samples due to its ability to achieve very low detection limits. Reporting limits for PFAS in groundwater and soil are to be 2 ng/L (ppt) and 1 ug/kg (ppb), respectively. If contract labs or work plans submitted by responsible parties indicate that they are not able to achieve these reporting limits for the entire list of 21 PFAS, site-specific decisions will need to be made by the DEC project manager in consultation with the DEC remedial program chemist. Note: Reporting limits for PFOA and PFOS in groundwater should not exceed 2 ng/L.

Additional laboratory methods for analysis of PFAS may be warranted at a site. These methods include Synthetic Precipitation Leaching Procedure (SPLP) by EPA Method 1312 and Total Oxidizable Precursor Assay (TOP Assay).

SPLP is a technique for determining the potential for chemicals in soil to leach to groundwater and may be helpful in determining the need for addressing PFAS-containing soils or other solid material as part of the remedy. SPLP sampling need not be considered if there are no elevated PFAS levels in groundwater. If elevated levels of PFAS are detected in water, and PFAS are also seen in soil, then an SPLP test should be considered to better understand the relationship between the PFAS in the two media.

The TOP Assay can assist in determining the potential PFAS risk at a site. For example, some polyfluoroalkyl substances may transform to form perfluoroalkyl substances, resulting in an increase in perfluoroalkyl substance concentrations as contaminated groundwater moves away from the site. To conceptualize the amount and type of oxidizable perfluoroalkyl substances which could be liberated in the environment, a “TOP Assay” analysis can be performed, which approximates the maximum concentration of perfluoroalkyl substances that could be generated if all polyfluoroalkyl substances were oxidized.

PFAS-containing materials can be made up of per- and polyfluoroalkyl substances that are not analyzable by routine analytical methodology (LC-MS/MS). The TOP assay converts, through oxidation, polyfluoroalkyl substances (precursors) into perfluoroalkyl substances that can be detected by current analytical methodology. Please note that analysis of highly contaminated samples, such as those from an AFFF site, can result in incomplete oxidation of the samples and an underestimation of the total perfluoroalkyl substances. Please consult with a DEC remedial program chemist for assistance interpreting the results.

1,4-Dioxane analysis and reporting: The reporting limit for 1,4-dioxane in groundwater should be no higher than 0.35 µg/L (ppb) and no higher than 0.1 mg/kg (ppm) in soil. Although ELAP offers certification for both EPA Method 8260 SIM and EPA Method 8270 SIM in waters, DER is advising the use of Method 8270 SIM because it provides a more robust extraction procedure, uses a larger sample volume, and is less vulnerable to interference from chlorinated solvents. The analysis currently performed for SVOCs in soil is adequate for evaluation of 1,4-dioxane in soil, which already has an established SCO.

Refinement of sample analyses

As with other contaminants that are analyzed for at a site, the emerging contaminant analyte list may be refined for future sampling events based on investigative findings. Initially, however, sampling using this PFAS Analyte List and 1,4-dioxane is needed to understand the nature of contamination.

PFAS Analyte List

Group	Chemical Name	Abbreviation	CAS Number
Perfluoroalkyl sulfonates	Perfluorobutanesulfonic acid	PFBS	375-73-5
	Perfluorohexanesulfonic acid	PFHxS	355-46-4
	Perfluoroheptanesulfonic acid	PFHpS	375-92-8
	Perfluorooctanessulfonic acid	PFOS	1763-23-1
	Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluoroalkyl carboxylates	Perfluorobutanoic acid	PFBA	375-22-4
	Perfluoropentanoic acid	PFPeA	2706-90-3
	Perfluorohexanoic acid	PFHxA	307-24-4
	Perfluoroheptanoic acid	PFHpA	375-85-9
	Perfluorooctanoic acid	PFOA	335-67-1
	Perfluorononanoic acid	PFNA	375-95-1
	Perfluorodecanoic acid	PFDA	335-76-2
	Perfluoroundecanoic acid	PFUA/PFUdA	2058-94-8
	Perfluorododecanoic acid	PFDoA	307-55-1
	Perfluorotridecanoic acid	PFTriA/PFTrDA	72629-94-8
	Perfluorotetradecanoic acid	PFTA/PFTeDA	376-06-7
Fluorinated Telomer Sulfonates	6:2 Fluorotelomer sulfonate	6:2 FTS	27619-97-2
	8:2 Fluorotelomer sulfonate	8:2 FTS	39108-34-4
Perfluorooctane-sulfonamides	Perfluroroctanesulfonamide	FOSA	754-91-6
Perfluorooctane-sulfonamidoacetic acids	N-methyl perfluorooctanesulfonamidoacetic acid	N-MeFOSAA	2355-31-9
	N-ethyl perfluorooctanesulfonamidoacetic acid	N-EtFOSAA	2991-50-6

February 2019

Laboratory Guidance for Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Non-Potable Water and Solids

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The Division of Environmental Remediation (DER) developed the following guidance for laboratories submitting PFAS data to DER. If laboratories cannot comply with any of the following requirements, they must contact Dana Maikels at dana.maikels@dec.ny.gov prior to analysis of samples.

1. Standards containing both branched and linear isomers must be used when standards are commercially available. Currently, quantitative standards are available for PFHxS, PFOS, NMeFOSAA, and NEtFOSAA. All isomer peaks present in the standard must be integrated and the areas summed. Samples must be integrated in the same manner as the standards.

   Since a quantitative standard does not exist for branched isomers of PFOA, the instrument must be calibrated using just the linear isomer and a technical (qualitative) PFOA standard must be used to identify the retention time of the branched PFOA isomers in the sample. The total response of PFOA branched and linear isomers must be integrated in the samples and quantitated using the calibration curve of the linear standard.

2. Quantifier and qualifier ions must be monitored for all target analytes (PFPeA and PFBA are an exception). The ratio of quantifier ion response to qualifier ion response must be calculated for each target analyte and the ratio compared to standards. Lab derived criteria can be used to determine if the ratios are acceptable.

3. The ion transitions below must be used for the following PFASs:

PFOA	413 > 369
PFOS	499 > 80
PFHxS	399 > 80
PFBS	299 > 80
6:2 FTS	427 > 407
8:2 FTS	527 > 507
NEtFOSAA	584 > 419
NMeFOSAA	570 > 419

4. For all target analyte ions used for quantification, signal to noise ratio must be 3:1 or greater.

5. For water samples, the entire sample bottle must be extracted, and the sample bottle rinsed with appropriate solvent to remove any residual PFAS.

6. Detections below the reporting limit should be reported and qualified with a J qualifier.

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

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

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

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

1. Scope and Application

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

Definitions: Refer to Alpha Analytical Quality Manual.

1.1 This is a liquid chromatography/tandem mass spectrometry (LC/MS/MS) method for the determination of selected perfluorinated alkyl substances (PFAS) in Non-Drinking Water and soil Matrices. Accuracy and precision data have been generated in reagent water, and finished ground and surface waters for the compounds listed in Table 1.

1.2 The data report packages present the documentation of any method modification related to the samples tested. Depending upon the nature of the modification and the extent of intended use, the laboratory may be required to demonstrate that the modifications will produce equivalent results for the matrix. Approval of all method modifications is by one or more of the following laboratory personnel before performing the modification: Area Supervisor, Department Supervisor, Laboratory Director, or Quality Assurance Officer.

1.3 This method is restricted to use by or under the supervision of analysts experienced in the operation of the LC/MS/MS and in the interpretation of LC/MS/MS data. Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability.

2. Summary of Method

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

2.2 Method Modifications from Reference

None.

Table 1

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

*** also reportable via the standard 537 method**

Table 1 Cont.

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

*** also reportable via the standard 537 method**

3. Reporting Limits

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

4. Interferences

4.1 PFAS standards, extracts and samples should not come in contact with any glass containers or pipettes as these analytes can potentially adsorb to glass surfaces. PFAS analyte and EIS standards commercially purchased in glass ampoules are acceptable; however, all subsequent transfers or dilutions performed by the analyst must be prepared and stored in polypropylene containers.

4.2 Method interferences may be caused by contaminants in solvents, reagents (including reagent water), sample bottles and caps, and other sample processing hardware that lead to discrete artifacts and/or elevated baselines in the chromatograms. The method analytes in this method can also be found in many common laboratory supplies and equipment, such as PTFE (polytetrafluoroethylene) products, LC solvent lines, methanol, aluminum foil, SPE sample transfer lines, etc. All items such as these must be routinely demonstrated to be free from interferences (less than 1/3 the RL for each method analyte) under the conditions of the analysis by analyzing laboratory reagent blanks as described in Section 9.2. **Subtracting blank values from sample results is not permitted.**

4.3 Matrix interferences may be caused by contaminants that are co-extracted from the sample. The extent of matrix interferences will vary considerably from source to source, depending upon the nature of the water. Humic and/or fulvic material can be co-extracted during SPE and high levels can cause enhancement and/or suppression in the electrospray ionization source or low recoveries on the SPE sorbent. Total organic carbon (TOC) is a good indicator of humic content of the sample.

4.4 SPE cartridges can be a source of interferences. The analysis of field and laboratory reagent blanks can provide important information regarding the presence or absence of such interferences. Brands and lots of SPE devices should be tested to ensure that contamination does not preclude analyte identification and quantitation.

5. Health and Safety

5.1 The toxicity or carcinogenicity of each reagent and standard used in this method is not fully established; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. A reference file of material safety data sheets is available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available in the Chemical Hygiene Plan.

5.2 All personnel handling environmental samples known to contain or to have been in contact with municipal waste must follow safety practices for handling known disease causative agents.

5.3 PFOA has been described as “likely to be carcinogenic to humans.” Pure standard materials and stock standard solutions of these method analytes should be handled with suitable protection to skin and eyes, and care should be taken not to breathe the vapors or ingest the materials.

6. Sample Collection, Preservation, Shipping and Handling

6.1 Sample Collection for Aqueous Samples

6.1.1 Samples must be collected in two (2) 250-mL high density polyethylene (HDPE) container with an unlined plastic screw cap.

6.1.2 The sample handler must wash their hands before sampling and wear nitrile gloves while filling and sealing the sample bottles. PFAS contamination during sampling can occur from a number of common sources, such as food packaging and certain foods and beverages. Proper hand washing and wearing nitrile gloves will aid in minimizing this type of accidental contamination of the samples.

6.1.3 Open the tap and allow the system to flush until the water temperature has stabilized (approximately 3 to 5 min). Collect samples from the flowing system.

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

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

6.1.6 Field Reagent Blank (FRB)

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

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

6.2 Sample Collection for Soil and Sediment samples.

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

6.3 Sample Preservation

Not applicable.

6.4 Sample Shipping

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

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

6.5 Sample Handling

6.5.1 Holding Times

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

7. Equipment and Supplies

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

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

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

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

7.4.1 NOTE: Polypropylene vials and caps are necessary to prevent contamination of the sample from PTFE coated septa. However, polypropylene caps do not reseal, so evaporation occurs after injection. Thus, multiple injections from the same vial are not possible.

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

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

7.7 PLASTIC PIPETS – Polypropylene or polyethylene disposable pipets.

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

7.9 SOLID PHASE EXTRACTION (SPE) APPARATUS FOR USING CARTRIDGES

7.9.1 SPE CARTRIDGES – 0.5 g SPE cartridges containing a reverse phase copolymer characterized by a weak anion exchanger (WAX) sorbent phase.

7.9.2 VACUUM EXTRACTION MANIFOLD – A manual vacuum manifold with large volume sampler for cartridge extractions, or an automatic/robotic sample preparation system designed for use with SPE cartridges, may be used if all QC requirements discussed in Section 9 are met. Extraction and/or elution steps may not be changed or omitted to accommodate the use of an automated system. Care must be taken with automated SPE systems to ensure the PTFE commonly used in these systems does not contribute to unacceptable analyte concentrations in the MB (Sect. 9.2.1).

7.9.3 SAMPLE DELIVERY SYSTEM – Use of a polypropylene transfer tube system, which transfers the sample directly from the sample container to the SPE cartridge, is recommended, but not mandatory. Standard extraction manifolds come equipped with PTFE transfer tube systems. These can be replaced with 1/8" O.D. x 1/16" I.D. polypropylene or polyethylene tubing cut to an appropriate length to ensure no sample contamination from the sample transfer lines. Other types of non-PTFE tubing may be used provided it meets the MB (Sect. 9.2.1) and LCS (Sect. 9.3) QC requirements. The PTFE transfer tubes may be used, but an MB must be run on each PFTE transfer tube and the QC requirements in Section 13.2.2 must be met. In the case of automated SPE, the removal of PTFE lines may not be feasible; therefore, MBs will need to be rotated among the ports and must meet the QC requirements of Sections 13.2.2 and 9.2.1.

7.10 Extract Clean-up Cartridge – 250 mg 6ml SPE Cartridge containing graphitized polymer carbon

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

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

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

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

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

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

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

7.13.4 ANALYTICAL COLUMN – An LC BEH C_{18} column (2.1 x 50 mm) packed with 1.7 µm d_p C_{18} solid phase particles was used. Any column that provides adequate resolution, peak shape, capacity, accuracy, and precision (Sect. 9) may be used.

8. Reagents and Standards

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

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

8.1.2 METHANOL (CH_3OH, CAS#: 67-56-1) – High purity, demonstrated to be free of analytes and interferences.

8.1.3 AMMONIUM ACETATE ($NH_4C_2H_3O_2$, 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 Methanol/Water (80:20) – To prepare a 1 Liter bottle, mix 200 ml of REAGENT WATER with 800 ml of METHANOL.

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

8.1.9 Sodium Acetate ($NaOOCCH_3$, CAS#: 127-09-3) – High purity, demonstrated to be free of analytes and interferences.

8.1.10 25 mM Sodium Acetate Buffer – To prepare 250mls, dissolve .625 grams of sodium acetate into 100 mls of reagent water. Add 4 mls Acetic Acid and adjust the final volume to 250 mls with reagent water.

8.1.11 NITROGEN – Used for the following purposes: Nitrogen aids in aerosol generation of the ESI liquid spray and is used as collision gas in some MS/MS instruments. The nitrogen used should meet or exceed instrument manufacturer's specifications. In addition, Nitrogen is used to concentrate sample extracts (Ultra High Purity or equivalent).

8.1.12 ARGON – Used as collision gas in MS/MS instruments. Argon should meet or exceed instrument manufacturer's specifications. Nitrogen gas may be used as the collision gas provided sufficient sensitivity (product ion formation) is achieved.

8.2 STANDARD SOLUTIONS – When a compound purity is assayed to be 96% or greater, the weight can be used without correction to calculate the concentration of the stock standard. PFAS analyte and IS standards commercially purchased in glass ampoules are acceptable; however, all subsequent transfers or dilutions performed by the analyst must be prepared and stored in polypropylene containers. Standards for sample fortification generally should be prepared in the smallest volume that can be accurately measured to minimize the addition of excess organic solvent to aqueous samples.

NOTE: Stock standards and diluted stock standards are stored at ≤4 °C.

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

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

Table 2

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

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

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

Table 3

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

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

Table 4

Analyte	Conc. of IS Stock (ng/mL)	Vol. of IS Stock (mL)	Final Vol. of IS PDS (mL)	Final Conc. of IS PDS (ng/mL)
ADONA	2000	1	4	500
PFHxDA	2000	1	4	500
PFODA	2000	1	4	500
HFPO-DA	100,000	.4	4	10,000
9ClPF3ONS	50,000	0.04	4	500
11ClPF3OUdS	50,000	0.04	4	500

8.2.6 LOW, MEDIUM AND HIGH LEVEL LCS – The LCS's will be prepared at the following concentrations and rotated per batch; 2 ng/L, 40 ng/L, 500 ng/l for drinking waters. The analyte PDS contains all the method analytes of interest at various concentrations in methanol. The analyte PDS has been shown to be stable for six months when stored at ≤4 °C.

8.2.7 Isotope Dilution Labeled Recovery Stock Solutions (ID REC) – ID REC Stock solutions are stable for at least 6 months when stored at 4 °C. The stock solution is purchased at a concentration of 1000 ng/mL.

8.2.8 Isotope Dilution Labeled Recovery Primary Dilution Standard (ID REC PDS) - Prepare the ID REC PDS at a concentration of 500 ng/mL. The ID REC PDS is prepared in 80:20% (vol/vol) methanol:water. The ID REC PDS is stable for at least six months when stored in polypropylene centrifuge tubes at ≤4 °C.

Table 5

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

8.2.9 CALIBRATION STANDARDS (CAL) –

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

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

Table 6

Calibration Standard Concentration	Final Aqueous Cal STD Level Concentration	Final Soil Cal STD Level Concentration	24 compound stock added (ul)	PFHxDA Stock added (ul)	500 ng/ml PFHxDA dilution added (ul)	PFODA Stock added (ul)	500 ng/ml PFODA dilution added (ul)	ADONA, HFPO-DA, 11Cl-PF3OUdS, 9Cl-PF3ONS Stock added (ul)	500 ng/ml ADONA dilution added (ul)	Final Volume in $MeOH/H_2O$ (82:20)
.5 ng/ml	2 ng/L	.25 ng/g	6.25		25		25		25	25 mls
1 ng/ml	4 ng/L	.5 ng/g	5		20		20		20	10 mls
5 ng/ml	20 ng/L	1 ng/g	25		100		100		100	10 mls
10 ng/ml	40 ng/L	5 ng/g	125	5		5		5		25 mls

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

9. Quality Control

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

9.1 MINIMUM REPORTING LIMIT (MRL) CONFIRMATION

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

$$HR_{PIR} = 3.963s$$

Where:

s = the standard deviation
3.963 = a constant value for seven replicates.

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

The Upper PIR Limit must be ≤150% recovery.

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

The Lower PIR Limit must be ≥ 50% recovery.

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

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

9.2 Blank(s)

9.2.1 **METHOD BLANK (MB)** - A Method Blank (MB) is required with each extraction batch to confirm that potential background contaminants are not interfering with the identification or quantitation of method analytes. Prep and analyze a MB for every 20 samples. If the MB produces a peak within the retention time window of any analyte that would prevent the determination of that analyte, determine the source of contamination and eliminate the interference before processing samples. Background contamination must be reduced to an acceptable level before proceeding. Background from method analytes or other contaminants that interfere with the measurement of method analytes must be below the RL. If the method analytes are detected in the MB at concentrations equal to or greater than this level, then all data for the problem analyte(s) must be considered invalid for all samples in the extraction batch. Because background contamination is a significant problem for several method analytes, it is highly recommended that the analyst maintain a historical record of MB data.

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

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

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

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

Where:

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

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

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

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

9.4 Labeled Recovery Standards (REC)

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

9.5 Extracted Internal Standards (EIS)

9.5.1 The EIS standard is fortified into all samples, CCVs, MBs, LCSs, MSs, MSDs, FD, and FRB prior to extraction. It is also added to the CAL standards. The EIS is a means of assessing method performance from extraction to final chromatographic measurement. Calculate the recovery (%R) for the EIS using the following equation

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

Where:

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

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

9.6 Matrix Spike (MS)

9.6.1 Analysis of an MS is required in each extraction batch and is used to determine that the sample matrix does not adversely affect method accuracy. Assessment of method precision is accomplished by analysis of a Field Duplicate (FD) (Sect. 9.6); however, infrequent occurrence of method analytes would hinder this assessment. If the occurrence of method analytes in the samples is infrequent, or if historical trends are unavailable, a second MS, or MSD, must be prepared, extracted, and analyzed from a duplicate of the Field Sample. Extraction batches that contain MSDs will not require the extraction of a field sample duplicate. If a variety of different sample matrices are analyzed regularly, for example, drinking water from groundwater and surface water sources, method performance should be established for each. Over time, MS data should be documented by the laboratory for all routine sample sources.

9.6.2 Within each extraction batch, a minimum of one Field Sample is fortified as an MS for every 20 Field Samples analyzed. The MS is prepared by spiking a sample with an appropriate amount of the Analyte Stock Standard (Sect. 8.2.3). Use historical data and rotate through the low, mid and high concentrations when selecting a fortifying concentration. Calculate the percent recovery (%*R*) for each analyte using the equation

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

Where:

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

9.6.3 Analyte recoveries may exhibit matrix bias. For samples fortified at or above their native concentration, recoveries should range between 50-150%. If the accuracy of any analyte falls outside the designated range, and the laboratory performance for that analyte is shown to be in control in the LCS, the recovery is judged to be matrix biased. The result for that analyte in the unfortified sample is labeled suspect/matrix to inform the data user that the results are suspect due to matrix effects.

9.7 Laboratory Duplicate

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

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

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

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

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

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

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

9.8 Initial Calibration Verification (ICV)

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

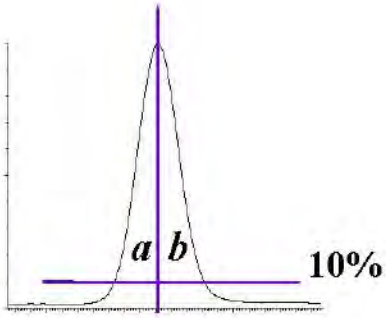
30% of the expected value. If measured analyte concentrations are not of acceptable accuracy, check the entire analytical procedureto locate and correct the problem.

9.9 Continuing Calibration Verification (CCV)

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

9.10 Method-specific Quality Control Samples

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



$$A_s = b / a$$

Where:

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

9.11 Method Sequence

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

10. Procedure

10.1 Equipment Set-up

10.1.1 This procedure may be performed manually or in an automated mode using a robotic or automatic sample preparation device. If an automated system is used to prepare samples, follow the manufacturer's operating instructions, but all extraction and elution steps must be the same as in the manual procedure. Extraction and/or elution steps may not be changed or omitted to accommodate the use of an automated system. If an automated system is used, the MBs should be rotated among the ports to ensure that all the valves and tubing meet the MB requirements (Sect. 9.2).

10.1.2 Some of the PFAS's adsorb to surfaces, including polypropylene. Therefore, the aqueous sample bottles must be rinsed with the elution solvent (Sect 10.3.4) whether extractions are performed manually or by automation. The bottle rinse is passed through the cartridge to elute the method analytes and is then collected (Sect. 10.3.4).

10.1.3 **NOTE:** The SPE cartridges and sample bottles described in this section are designed as single use items and should be discarded after use. They may not be refurbished for reuse in subsequent analyses.

10.2 Sample Preparation and Extraction of Aqueous Samples

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

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

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

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

10.2.3 The MB, LCS and FRB may be prepared by measuring 250 mL of reagent water with a polypropylene graduated cylinder or filling a 250-mL sample bottle to near the top.

10.2.4 Adjust the QC and sample pH to 3 by adding acetic acid in water dropwise

10.2.5 Add 20 µL of the EIS PDS (Sect. 8.2.2) to each sample and QC, cap and invert to mix.

10.2.6 If the sample is an LCS, LCSD, MS, or MSD, add the necessary amount of analyte PDS (Sect. 8.2.3). Cap and invert each sample to mix.

10.3 Cartridge SPE Procedure

10.3.1 CARTRIDGE CLEAN-UP AND CONDITIONING – DO NOT allow cartridge packing material to go dry during any of the conditioning steps. Rinse each cartridge with 3 X 5 mL of 2% ammonium hydroxide in methanol, followed by 5mls of methanol. Next, rinse each cartridge with 5 mls of the 25 mM acetate buffer, followed by 15 mL of reagent water, without allowing the water to drop below the top edge of the packing. If the cartridge goes dry during the conditioning phase, the conditioning must be started over. Add 4-5 mL of reagent water to each cartridge, attach the sample transfer tubes (Sect. 7.9.3), turn on the vacuum, and begin adding sample to the cartridge.

10.3.2 SAMPLE EXTRACTON – Adjust the vacuum so that the approximate flow rate is approximately 4 mL/min. Do not allow the cartridge to go dry before all the sample has passed through.

10.3.3 SAMPLE BOTTLE AND CARTRIDGE RINSE – After the entire sample has passed through the cartridge, rinse the sample bottles with 4 ml reagent water followed by 4 ml 25 mM acetate buffer at pH 4 and draw the aliquot through the sample transfer tubes and the cartridges. Draw air or nitrogen through the cartridge for 5-10 min at high vacuum (10-15 in. Hg). **NOTE: If empty plastic reservoirs are used in place of the sample transfer tubes to pass the samples through the cartridges, these reservoirs must be treated like the transfer tubes. After the entire sample has passed through the cartridge, the reservoirs must be rinsed to waste with reagent water.**

10.3.4 SAMPLE BOTTLE AND CARTRIDGE ELUTION, Fraction 1 – Turn off and release the vacuum. Lift the extraction manifold top and insert a rack with collection tubes into the extraction tank to collect the extracts as they are eluted from the cartridges. Rinse the sample bottles with 12 mls of methanol and draw the aliquot through the sample transfer tubes and cartridges. Use a low vacuum such that the solvent exits the cartridge in a dropwise fashion.

SAMPLE BOTTLE AND CARTRIDGE ELUTION, Fraction 2 In a separate collection vial, rinse the sample bottles with 12 mL of 2% ammonium hydroxide in methanol and elute the analytes from the cartridges by pulling the 4 mL of methanol through the sample transfer tubes and the cartridges. Use a low vacuum such that the solvent exits the cartridge in a dropwise fashion. To the final extract, add 50 ul of acetic acid.

NOTE: If empty plastic reservoirs are used in place of the sample transfer tubes to pass the samples through the cartridges, these reservoirs must be treated like the transfer tubes. After the reservoirs have been rinsed in Section 10.3.3, the elution solvent used to rinse the sample bottles must be swirled down the sides of the reservoirs while eluting the cartridge to ensure that any method analytes on the surface of the reservoirs are transferred to the extract.

CLEAN-UP CARTRIDGE ELUTION, Elute the clean-up cartridge with 8 additional mls of methanol and draw the aliquot through the cartridge. Use a low vacuum such that the solvent exits the cartridge in a dropwise fashion.

10.3.5 Fractions 1 and 2 are to be combined during the concentration stage (section10.6)

10.4 Sample Prep and Extraction Protocol for Soils

10.4.1 Homogenize and weigh 2 grams of sample (measured to the nearest hundredth of a gram) intoa 50 ml polypropylene centrifuge tube. For laboratory control blanks and spikes, 2 grams of clean sand is used.

10.4.2 Add 20 µL of the EIS PDS (Sect. 8.2.2) to each sample and QC.

10.4.3 If the sample is an LCS, LCSD, MS, or MSD, add the necessary amount of analyte PDS (Sect. 8.2.3). Cap and invert each sample to mix.

10.4.4 To all samples, add 10 mls of methanol, cap, vortex for 25 seconds at 3000RPM and mix for 30 minutes using a shaker table of tumbler at 120RPM.

10.4.5 Following mixing, sonicate each sample for 30 minutes and let samples sit overnight (at least 2 hours is required for RUSH samples).

10.4.6 Centrifuge each sample at 3500RPM for 10 minutes.

10.4.7 Remove supernatant, and reserve for clean-up.

10.5 Extract Clean-up

10.5.1 CARTRIDGE CLEAN-UP AND CONDITIONING –. Rinse each cartridge with 15 mL of methanol and discard. If the cartridge goes dry during the conditioning phase, the conditioning must be started over. Attach the sample transfer tubes (Sect. 7.9.3), turn on the vacuum, and begin adding sample to the cartridge.

10.5.2 Adjust the vacuum so that the approximate flow rate is 1-2 mL/min. Do not allow the cartridge to go dry before all the sample has passed through.

10.5.3 SAMPLE BOTTLE AND CARTRIDGE RINSE – After the entire sample has passed through the cartridge, rinse the sample collection vial with two 1-mL aliquots of methanol and draw each aliquot through the cartridges. Draw air or nitrogen through the cartridge for 5 min at high vacuum (10-15 in. Hg).

10.5.4 If extracts are not to be immediately evaporated, cover collection tubes and store at ambient temperature till concentration.

10.6 Extract Concentration

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

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

10.7 Sample Volume Determination

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

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

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

10.8.1 ESI-MS/MS TUNE

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

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

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

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

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

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

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

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

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

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

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

10.8.7 **CALIBRATION ACCEPTANCE CRITERIA** – A linear fit is acceptable if the coefficient of determination (r^2) is greater than 0.99. When quantitated using the initial calibration curve, each calibration point, except the lowest point, for each analyte should calculate to be within 70-130% of its true value. The lowest CAL point should calculate to be within 50-150% of its true value. If these criteria cannot be met, the analyst will have difficulty meeting ongoing QC criteria. It is recommended that corrective action is taken to reanalyze the CAL standards, restrict the range of calibration, or select an alternate method of calibration (forcing the curve through zero is still required).

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

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

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

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

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

10.10 EXTRACT ANALYSIS

10.10.1 Establish operating conditions equivalent to those summarized in Tables 6-8 of Section 16. Instrument conditions and columns should be optimized prior to the initiation of the IDC.

10.10.2 Establish an appropriate retention time window for each analyte. This should be based on measurements of actual retention time variation for each method analyte in CAL standard solutions analyzed on the LC over the course of time. A value of plus or minus three times the standard deviation of the retention time obtained for each method analyte while establishing the initial calibration and completing the IDC can be used to calculate a suggested window size. However, the experience of the analyst should weigh heavily on the determination of the appropriate retention window size.

10.10.3 Calibrate the system by either the analysis of a calibration curve (Sect. 10.6) or by confirming the initial calibration is still valid by analyzing a CCV as described in Section 10.7. If establishing an initial calibration, complete the IDC as described in Section 13.2.

10.10.4 Begin analyzing Field Samples, including QC samples, at their appropriate frequency by injecting the same size aliquots under the same conditions used to analyze the CAL standards.

10.10.5 At the conclusion of data acquisition, use the same software that was used in the calibration procedure to identify peaks of interest in predetermined retention time windows. Use the data system software to examine the ion abundances of the peaks in the chromatogram. Identify an analyte by comparison of its retention time with that of the corresponding method analyte peak in a reference standard.

10.10.6 The analyst must not extrapolate beyond the established calibration range. If an analyte peak area exceeds the range of the initial calibration curve, the sample should be re-extracted with a reduced sample volume in order to bring the out of range target analytes into the calibration range. If a smaller sample size would not be representative of the entire sample, the following options are recommended. Re-extract an additional aliquot of sufficient size to insure that it is representative of the entire sample. Spike it with a higher concentration of internal standard. Prior to LC/MS analysis, dilute the sample so that it has a concentration of internal standard equivalent to that present in the calibration standard. Then, analyze the diluted extract.

11. Data Evaluation, Calculations and Reporting

11.1 Complete chromatographic resolution is not necessary for accurate and precise measurements of analyte concentrations using MS/MS. In validating this method, concentrations were calculated by measuring the product ions listed in Table 7.

11.2 Calculate analyte concentrations using the multipoint calibration established in Section 10.6. Do not use daily calibration verification data to quantitate analytes in samples. Adjust final analyte concentrations to reflect the actual sample volume determined in Section 10.6 where:

C_{ex} = (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 5 due to the linear and branch isomers of these compounds (Sect. 10.6.4.1). The areas of all the linear and branched isomer peaks observed in the CAL standards for each of these analytes must be summed and the concentrations reported as a total for each of these analytes.

11.5 Calculations must utilize all available digits of precision, but final reported concentrations should be rounded to an appropriate number of significant figures (one digit of uncertainty), typically two, and not more than three significant figures.

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

12.1 Section 9.0 outlines sample batch QC acceptance criteria. If non-compliant organic compound results are to be reported, the Organic Section Head and/or the Laboratory Director, and the Operations Manager must approve the reporting of these results. The laboratory Project Manager shall be notified, and may choose to relay the non-compliance to the client, for approval, or other corrective action, such as re-sampling and re-analysis. The analyst, Data Reviewer, or Department Supervisor performing the secondary review initiates the project narrative, and the narrative must clearly document the non-compliance and provide a reason for acceptance of these results.

12.2 All results for the organic compounds of interest are reportable without qualification if extraction and analytical holding times are met, preservation requirements (including cooler temperatures) are met, all QC criteria are met, and matrix interference is not suspected during extraction or analysis of the samples. If any of the below QC parameters are not met, all associated samples must be evaluated for re-extraction and/or re-analysis.

13. Method Performance

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

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

13.2 Demonstration of Capability Studies

13.2.1 The IDC must be successfully performed prior to analyzing any Field Samples. Prior to conducting the IDC, the analyst must first generate an acceptable Initial Calibration following the procedure outlined in Section 10.6.

13.2.2 INITIAL DEMONSTRATION OF LOW SYSTEM BACKGROUND – Any time a new lot of SPE cartridges, solvents, centrifuge tubes, disposable pipets, and autosampler vials are used, it must be demonstrated that an MB is reasonably free of contamination and that the criteria in Section 9.2.1 are met. If an automated extraction system is used, an MB should be extracted on each port to ensure that all the valves and tubing are free from potential PFAS contamination.

13.2.3 INITIAL DEMONSTRATION OF PRECISION (IDP) – Prepare, extract, and analyze four to seven replicate LCSs fortified near the midrange of the initial calibration curve according to the procedure described in Section 10. Sample preservatives as described in Section 6.2.1 must be added to these samples. The relative standard deviation (RSD) of the results of the replicate analyses must be less than 20%.

13.2.4 INITIAL DEMONSTRATION OF ACCURACY (IDA) – Using the same set of replicate data generated for Section 13.2.3, calculate average recovery. The average recovery of the replicate values must be within ± 30% of the true value.

13.2.5 INITIAL DEMONSTRATION OF PEAK ASYMMETRY FACTOR – Peak asymmetry factors must be calculated using the equation in Section 9.10.1 for the first two eluting peaks (if only two analytes are being analyzed, both must be evaluated) in a mid-level CAL standard. The peak asymmetry factors must fall in the range of 0.8 to 1.5. See guidance in Section 10.6.4.1 if the calculated peak asymmetry factors do not meet the criteria.

13.2.6 Refer to Alpha SOP ID 1739 for further information regarding IDC/DOC Generation.

13.2.7 The analyst must make a continuing, annual, demonstration of the ability to generate acceptable accuracy and precision with this method.

14. Pollution Prevention and Waste Management

14.1 Refer to Alpha's Chemical Hygiene Plan and Hazardous Waste Management and Disposal SOP for further pollution prevention and waste management information.

14.2 This method utilizes SPE to extract analytes from water. It requires the use of very small volumes of organic solvent and very small quantities of pure analytes, thereby minimizing the potential hazards to both the analyst and the environment as compared to the use of large volumes of organic solvents in conventional liquid-liquid extractions.

14.3 The analytical procedures described in this method generate relatively small amounts of waste since only small amounts of reagents and solvents are used. The matrices of concern are finished drinking water or source water. However, laboratory waste management practices must be conducted consistent with all applicable rules and regulations, and that laboratories protect the air, water, and land by minimizing and controlling all releases from fume hoods and bench operations. Also, compliance is required with any sewage discharge permits and regulations, particularly the hazardous waste identification rules and land disposal restrictions.

15. Referenced Documents

Chemical Hygiene Plan – ID 2124

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

SOP ID 1739 Demonstration of Capability (DOC) Generation SOP

SOP ID 1728 Hazardous Waste Management and Disposal SOP

16. Attachments

Table 7: LC Method Conditions

Time (min)	2 mM Ammonium Acetate (5:95 MeOH/H$_2$O)	100% Methanol
Initial	100.0	0.0
1.0	100.0	0.0
2.2	85.0	15.0
11	20.0	80.0
11.4	0.0	100.0
12.4	100.0	00.0
15.5	100.0	0.0
Waters Aquity UPLC ® BEHC$_{18}$ 2.1 x 50 mm packed with 1.7 µm BEH C$_{18}$ stationary phase Flow rate of 0.4 mL/min 2-5 µL injection		

Table 8: ESI-MS Method Conditions

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

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

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

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

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

1,4-Dioxane

By Gas Chromatography / Mass Spectrometry in Selected Ion Mode (GC/MS-SIM) with Isotope Dilution Modification

References:

Method 8270D, Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS), Revision 4, February 2007, Test Methods for Evaluating Solid Waste, SW-846.

EPA 8000C, SW-846,Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846. Update III, March 2003.

1,4-Dioxane Analytical Notes, Appendix II-B-4, WSC-CAM-II-B, Revision 1, July 2010, (Massachusetts Department of Environmental Protection Bureau of Waste Site Cleanup).

1. Scope and Application

Matrices: Aqueous, soil/sediment and non-aqueous waste matrices

Definitions: Refer to Alpha Analytical Quality Manual.

This method is applicable to the quantification of 1,4-Dioxane extracted from aqueous samples in methylene chloride and analyzed by GC/MS-SIM. The extraction method is listed below and should be referenced for more details. Detection limits will vary with instrument calibration range, and volume of sample analyzed. 1,4-Dioxane detected over the calibration ranges of the instrument it is being analyzed on will be diluted and re-analyzed for accurate quantification.

The following extraction method applies:

- *Extraction of Water Samples by Separatory Funnel* (SOP 2165)
- *Microscale Solvent Extraction (MSE)* (SOP 2172)
- *Organic Waste Dilution Extraction* (SOP 2265)

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.

This method is restricted to use by or under the supervision of analysts experienced in the operation of the GC/MS-SIM and in the interpretation of GC/MS-SIM 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

Generally 1000 or 500ml of aqueous samples are serially extracted with methylene chloride in a 2 Liter Separatory Funnel (Method 3510) at a neutral pH. The extract is concentrated in MeCl2 to a 10 or 5ml final volume respectively depending on the volume of sample extracted. Soil/sediment samples are extracted by Microscale Solvent Extraction (MSE Method 3570). Approximately 5g of sample is extracted and concentrated to a 4mL final volume. Non-aqueous waste samples are extracted by Organic Waste Dilution Extraction (Method 3580). Approximately 1g is diluted to 10mL final volume.

Analytes are introduced into the GC/MS using a large volume injector and injecting 3ul of the calibration standards, quality control samples, and sample extracts into the GC equipped with a narrow-bore capillary column. The GC column is temperature programmed to separate the analytes, which are then detected with a mass spectrometer (MS) in selective ion mode. Identification of target analytes is accomplished by comparing their mass spectra with the electron impact spectra of the calibration standards. Concentrations are determined using mean relative response factors from a multi-level calibration curve. Response factors for target analytes and surrogate compounds are determined relative to the internal standards.

Isotope dilution quantification is achieved by spiking 1,4-Dioxane-d8 at extraction which is then in turn used as both an internal standard (IS) and surrogate. For quantification, the 1,4-Dioxane-d8 IS quantifies 1,4-Dioxane in samples. An additional IS added prior to analysis, 1,4-Dichlorobenzene-d4, quantifies 1,4-Dioxane-d8 as a surrogate.

2.1 Method Modifications from Reference

SIM option with Isotope dilution is utilized to increase sensitivity for this analyte. Note that while this method may be used for the evaluation of 1,4-Dioxane in soil/sediment samples, the MA DEP CAM does not approve of this method for determining presumptive certainty for MA DEP cleanup sites. Method 8260 should be employed in these cases.

3. Reporting Limits

Concentrations for 1,4-Dioxane can be detected in water samples in the range of 150ng/L to 100,000ng/L. Soil/sediment samples can be detected in the range of 8ug/Kg to 8,000ug/Kg. Standard reporting limits for aqueous samples are 150ng/L and for soil/sediment samples 8ug/kg respectively.

4. Interferences

4.1 Phthalate esters can be a major source of contamination if any material containing plasticizers (phthalates) comes in contact with the sample during the extraction process. Use of plastic or any material containing plasticizers (phthalates) should be avoided during extraction or analysis.

4.2 The injection port of the gas chromatograph can become contaminated with high boiling compounds resulting in the loss of sensitivity. It may be necessary to replace the injection port liner routinely to prevent this loss of sensitivity. Clipping off approximately four inches of the column at the injection end may also increase sensitivity. Low instrument response can be detected during the daily tuning procedure by including pentachlorophenol and benzidine in the daily tuning mix.

4.3 Raw GC/MS data from all blanks, samples, and spikes must be evaluated for interferences or carryover. Contamination by carryover can occur whenever high-concentration and low-concentration samples are sequentially analyzed.

4.4 Solvents, reagents and glassware may introduce interferences. These must be demonstrated to be free of interferences by the analysis of a method blank. See the SOP *Reagent, Solvent and Standard Control* (G-008) and *Laboratory Glassware Cleaning* (G-002), for additional details.

4.5 It should be noted that there are some chromatographic consequences observed due to the acetone used in the MSE extraction process. This is characterized by a shift in retention time for 1,4-Dioxane and the 1,4-Dioxane-d8 surrogate (~0.4minutes), as well as the presence of a large peak (likely acetone) in all chromatograms.

5. Health and Safety

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.

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.

6. Sample Collection, Preservation, Shipping and Handling

6.1 Sample Collection

Solid samples; A minimum of 100grams of sample must be collected in a glass jar with a Teflon lined screw cap.

Water samples: A minimum of 0.5 to 2 liters of sample must be collected in amber glass bottles.

6.2 Sample Preservation

Solid samples: The sample must be refrigerated and maintained at 4±2 °C until extraction and analysis. Sediment samples can be frozen at -20±5 °C until extraction to extend hold time. The extracts must be refrigerated and maintained at 4±2 °C until analysis.

Water samples: The samples must not be preserved except by refrigeration at 4±2 °C until extraction and analysis. The extracts must be refrigerated and maintained at 4±2 °C until analysis.

Non-aqueous waste samples: Concentrated sample extracts must be stored in contaminant-free containers and preserved in a refrigerator when not used for more than four hours.

6.3 Sample Shipping

No special shipping requirements.

6.4 Sample Handling

Solid samples: All solid samples must be extracted within 14 days from the date of collection. Frozen sample hold times are monitored up to 14 days from the date removed from freezer. The extracts must be refrigerated and maintained at 4±2 °C until analysis. Sample extracts must be analyzed within 40 days from date of extraction.

Water samples: All water samples must be extracted within 7 days from the date of collection. Sample extracts must be analyzed within 40 days from date of extraction.

Non-aqueous waste samples: Hold times do not apply to neat oils/NAPL/product samples.

7. Equipment and Supplies

7.1 Gas chromatograph – Programmable, heating range from 40C to 350C; splitless-type inlet system, (Hewlett Packard 6890N Series II or similar); mass selective detector (Hewlett

Packard 5973, or similar); automatic injector (Hewlett Packard 7683B or similar).

7.2 Chromatography Column – Fused silica capillary column, 0.25mm ID x 60m length, 0.25um film thickness RTX-5, Restek Corporation, 5% diphenyl-95% dimethyl polysiloxane, Fused silica capillary column, 0.18mm ID x 60m length, 0.18um film thickness RTX-PCB, Restek Corporation, Fused silica capillary column, 0.25mm ID x 30m length, .25um film thickness (Zebron ZB-SemiVolatiles, Phenomenex Corporation, 5% Polysilarylene - 95% Polydimethylsiloxane) , or equivalent.

7.3 Gerstel Large Volume Injection System – Temperature programmable range from 0C to 350C; pressure programmable; capable of split or splitless injection; Injection volumes range from 1 to 50uL and Cryo cooling availability to allow for cold injections.

7.4 Agilent Split/Splitless injector System

7.5 Data Acquisition System - Computerized system for collecting, storing, and processing detector output (Hewlett Packard Enviroquant target software) or equivalent.

7.6 Gases - BIP Ultra high purity helium (99.9995%); Compressed nitrogen for N-Evap. Carbon dioxide (siphon type) for Gerstel.

7.7 Syringes – 10uL to 1.0mL

7.8 Vials- including 2ml, 4ml, 10ml, 40ml and other sizes as necessary.

7.9 Hamilton Gas tight Syringes - varying sizes

7.10 Gerstel Single baffle injection port liners- packed lightly with glass wool.

7.11 GC Injection Port Liner: Phenomenex Direct Connect Top Hole

7.12 Class A Volumetric flasks: Including 10ml, 20 ml, 50 ml, 100ml and other sizes as necessary

8. Reagents and Standards

Use reagent grade chemicals for all reagents. Deionized (DI) water is ASTM Type II laboratory reagent grade water.

8.1 Solvents: All solvent expirations determined as indicated by manufacturer guidelines

8.1.1 Methylene Chloride, ACS approved, Pesticide grade, see SOP *Reagent, Solvent and Standard Control* (SOP 1816) for additional details regarding solvent purity. Used to extract samples and prepare instrument/analytical standards.

8.1.2 Acetone, ACS approved, Pesticide grade, see SOP *Reagent, Solvent and Standard Control* (SOP 1816) for additional details regarding solvent purity. This water soluble solvent is used for surrogate and LCS/MS preparation.

8.1.3 Methanol, ACS approved, Pesticide grade, *Reagent, Solvent and Standard Control SOP* (SOP 1816) for additional details regarding solvent purity.

8.2 Analytical Standards: Standards should be stored at –10C or less, away from light when not in use. They should be discarded after 1 year unless the vendor expiration date states otherwise or, if degradation is observed. Stock standards are given a 1 year expiration from the preparation date or the expiration of the primary vendor solution, whichever occurs first. Working standards are given six month expiration from the preparation date or the expiration of the primary solution whichever occurs first. All analytical standards are made up in Methylene Chloride. All prep standards are made up in Acetone.

8.3 Surrogate/Internal Standard (IS):

8.3.1 A 1,4-Dioxane-d8 Primary neat standard is commercially obtained from Cambridge Isotope (Cat #DLM-28-10 or equivalent). A stock surrogate/internal standard solution is prepared by weighing 0.1 g of the primary neat standard and diluting volumetrically in 10 mls methylene chloride (or equivalent preparation) to obtain a concentration of ~10,000 ug/ml.

8.3.2 From this stock (Section 8.3.1), the Surrogate spiking solution is made by a serial dilution (1 ml diluted up in a 50 ml volumetric flask, followed by a 0.5 ml of this solution diluted up in a 20 ml volumetric flask or equivalent preparations) in Acetone to achieve a concentration of 5 ug/mL. Of this surrogate solution, 1 mL is spiked into each water sample, and 0.4 mL is spiked into each soil/sediment sample for a surrogate/IS concentration of 500 ng/mL in samples.

8.3.3 The initial stock solution (Section 8.3.1) is diluted volumetrically (250 uL diluted up in a 100 ml volumetric flask or equivalent preparation) in methylene chloride to obtain an IS solution at a concentration of 25 ug/ml for the spiking of only the analytical standards (i.e. calibration curve and continuing calibration).

8.4 Internal Standard: 1,4-Dichlorobenzene-d4 commercially obtained from Restek (Cat #31206 or equivalent). This primary solution is at 2000 ug/mL and contains other Semivolatile Internal standards, however this method only utilizes the 1,4-Dichlorobenzene-d4. This solution is diluted volumetrically (250 uL diluted up in a 50 ml volumetric flask or equivalent preparation) in methylene chloride to obtain a SIM-IS solution at a concentration of 25 ug/ml. All samples and standards are spiked with 20uL of internal standard before analysis. This IS is intended to be used for both quantitation (of the surrogate 1,4-Dioxane-d8) and the establishment of relative retention times.

8.5 Matrix Spike/Laboratory Control Spike Solutions (MS/LCS) – 1,4-Dioxane primary spike solution is commercially obtained from Restek at 2000 ug/mL (Cat #31853 or equivalent). To prepare the working spike solution, syringe measure 0.25 mL of stock and bring to 100 mL in acetone (or equivalent preparation) for a 5 ug/mL concentration. From this solution, 1 mL is spiked into each MS/LCS QC water sample and 0.4 mL is spiked into each soil/sediment sample. The final concentration in a 10 mL water extract and in a 4 mL soil/sediment sample will be 500 ng/mL.

8.6 Stock Calibration Standards are prepared from a primary standard commercially obtained from Restek at a concentration of 2000 ug/ml (Cat #31853 or equivalent). The primary standard is used to appropriately prepare a stock standard at a concentration of 10,000 ng/ml (125 uL diluted up in a 25 ml volumetric flask or equivalent preparation). The stock solution is generally made up in 25 ml increments. The stock solution then doubles as a high level standard for the calibration curve, as well as a stock solution by which to serially dilute to prepare the other calibration standards. Except for the high level standard, the calibration curve levels are generally each made at 10 ml. Refer to the table below for example calibration curve levels. All the calibration curve levels, once aliquoted at 1 ml increments for injection, have 20 ul of 1,4 Dichlorobenzene IS (SIM IS – Section 8.4) added as well as 20 uL of 1,4 Dioxane-d8 IS/Surrogate (Section 8.3.3) added.

8.7 Curve Preparation:

The following 7 levels are the possible levels that can be analyzed for an ICAL.

Calibration Level	*Volume of Stock Std Added Into 10 ml of DCM*
Level 1 (10 ng/mL)	10 uL
Level 2 (50 ng/mL)	50 uL
Level 3 (100 ng/mL)	100 uL
Level 4 (500 ng/mL)	500 uL
Level 5 (1000 ng/mL) - CCV	1.0 mL
Level 6 (5000 ng/mL)	5.0 mL
Level 7 (10,000 ng/mL)	NA

8.8 The Independent Check Verification Standard

is prepared from a Primary standard solution commercially obtained from Ultra (Cat NV-150-1 or equivalent) at a concentration of 100 ug/ml. The primary solution is diluted volumetrically (100 ul diluted up in a 10 ml volumetric flask or equivalent preparation) in methylene chloride to create a working ICV solution at a concentration of 1000 ng/ml. The working ICV solution is aliquoted into 1 ml increments as needed to inject with each calibration curve. Additionally, 20 ul of SIM IS (Section 8.4) and 20 ul of 1,4-Dioxane-d8 IS (Section 8.3.3) is added into the 1 ml aliquot.

9. Quality Control

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

9.1 Blank(s)

A method blank must be prepared once per every 20 samples or per extraction batch, whichever is more frequent.

Organic compounds of interest must not be detectable in the method blank at a concentration greater than the reporting limit.

Corrective Action: For contaminated blanks, all efforts must be made to identify and eliminate the source of contamination. The presence of analytes at concentrations at or above the reporting limit will warrant application of a "B" qualifier to that target compound(s) on all associated report forms, and perhaps re-extraction of all associated samples. Re-extraction of the method blank and all associated samples must be performed until the blank is in control. Surrogate recoveries must meet the QC limits for the method blank. Re-extraction must be initiated immediately so that minimum time is wasted before re-extraction can occur - if at all possible-this re-extraction should take place within holding time. Re-extraction *corrective action* that would exceed the sample holding time criteria should be discussed with the Organics Supervisor, Project Manager, client, and Operations Manager prior to implementation. Exceptions may be made with approval of the Organics Section Supervisor if the samples associated with an out of control method blank are non-detect for the affected compound(s) or if the concentration of the affected compound(s)in the sample is greater than 10x the blank level. In such cases, the sample results are accepted without corrective action for the high method blank result. The client must be notified, via the project narrative, of any method blank non-compliance associated with sample results

9.2 Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD)

Laboratory control samples (LCS/LCSD) must be prepared once per every 20 samples or per extraction batch, whichever is more frequent, and spiked with 1,4 Dioxane spike solution (Section 8.5) and surrogate (Section 8.3.2) before extraction. The IS (Section 8.4) is spiked after extraction and before the analysis.

Acceptable Recovery limits are 40% - 140%. The relative percent difference (RPD) between the LCS/LCSD is 30%. Limits are adapted from MCP protocol and are generally monitored and documented in-house through control charts.

Corrective Action: Analysis must be repeated if an analytical error is suspected. If the LCS/LCSD recoveries and/or %RPD are still out of control, re-extract and re-analyze the LCS/LCSD and all associated samples. Samples cannot be reported until an acceptable LCS is obtained.

9.3 Initial Calibration Verification (ICV)

Refer to Section 10.2.

9.4 Continuing Calibration Verification (CCV)

Refer to Section 10.4.

9.5 Matrix Spike / Matrix Spike Duplicate (MS/MSD)

Matrix spike / matrix spike duplicate (MS/MSD) samples are performed upon project specifications. They are performed per client request. The sample is spiked with 1,4-Dioxane spike solution (Section 8.5) and surrogate (Section 8.3.2) before extraction. The IS (Section 8.4) is spiked after extraction and before the analysis. The recovery limits are 40% - 140% and the RPD limit is 30%. Limits are adapted from MCP protocol and are generally monitored and documented in-house through control charts.

Corrective Action: Analysis must be repeated if an analytical error is suspected. If the % recovery and/or %RPD still exceeds the control limits and the LCS/LCSD is compliant; include a project narrative with the results to client noting that there may be potential matrix effects on the accuracy or precision of the reported results as evidenced by MS/MSD recoveries and/or %RPD outside of QC limits.

9.6 Laboratory Duplicate

Duplicate analyses are performed upon client and/or workplan request. *For Organic analyses, the matrix duplicate is usually in the form of the matrix spike duplicate, see Section 9.5.*

Acceptable relative percent difference (RPD) of duplicates is 30%. Acceptance criterion is not applicable to sample concentrations less than 5 times the reporting limit. Calculate the RPD as follows:

$$\text{RPD} = \frac{R1 - R2}{\frac{[R1 + R2]}{2}} \times 100$$

where:

R1 = sample Replicate #1
R2 = sample Replicate #2

The RPD limits should be monitored and documented in-house through control charts and updated as needed.

Corrective Action: Analysis must be repeated if an analytical error is suspected.. If the % RPD still exceeds the control limits; include a project narrative with the results to client noting that there may be potential matrix effects on the precision of the reported results as evidenced by the matrix duplicate % RPD exceedence.

9.7 Method-specific Quality Control Samples

9.7.1 Surrogates

Surrogate spikes (Section 8.3.2 and Section 8.3.3) must be added to QC and field samples to evaluate the extraction method performance.

The acceptable surrogate recovery limits are 15% - 110%. Limits are adapted from MCP protocol.

Corrective Action: Analysis must be repeated if an analytical error is suspected. If the % recovery still exceeds the control limits the sample must be re-extracted and re-analyzed to confirm the sample matrix. If *obvious* matrix interferences are noted, consultation with the Organic Supervisor or Operations Manager may be in order to confirm the need for sample re-extraction. If no re-extraction occurs, the surrogate results and reasons for the decision not to re-extract must be discussed in the project narrative to the client. Due to the isotope dilution nature of this method, the analyst must pay close attention to surrogate recoveries and areas as this recovery is then used to surrogate correct (as an Internal standard) the response of 1,4-Dioxane.

9.7.2 Internal Standards

Internal standards must be added to all sample extracts, QC samples and standards for quantitation purposes. For sample extracts, only the 1,4-Dichlorbenzene-d4 IS (SIM IS – Section 8.4) should be added since the extraction surrogate is then used as an Internal Standard upon analysis. However, all Calibration standards must be spiked with both 1,4-Dichlorobenzene-d4 as well as 1,4-Dioxane-d8 (Section 8.3.3). In the sample extracts the area counts for 1,4-Dioxane-d8 will vary based on the extraction, however the 1,4-Dichlorobenzene-d4 area counts should remain fairly constant. The 1,4-Dichlorobenzene-d4 internal standard should also remain constant with respect to the continuing calibration analyzed at the beginning of the run. Sample IS areas must be –50% to +100% of the Internal Standards in the Continuing Calibration – applies only to 1,4-Dichlorobenzene-d4. Additionally, the IS retention times should not differ more than 30 seconds from the Continuing Calibration.

Corrective Action: Analysis must be repeated once unless there are obvious samples matrix interferences, i.e., the sample extract was very colored and viscous, or there are obvious chromatographic interferences. If *obvious* matrix interferences are noted, consultation with the Organic Supervisor or Operations Manager may be in order to confirm the need for sample re-analysis or re-extraction.

9.8 Method Sequence

- Tune
- CCV
- Method Blank
- LCS
- LCSD
- Samples

10. Procedure

10.1 Equipment Set-up

10.1.1 The instrument used for the analysis is a HP 6890N Series gas chromatograph. The HP system is equipped with a Gerstel large volume injection system, and a 7683B-type autosampler or equivalent. The mass spectrometer is an HP 5973 or 5975 with the HP Enviroquant data system. The method is modified for selective ion monitoring. The table below lists the ions monitored in one SIM window. This method must only be set up and analyzed by an experienced mass spectrometrist.

Compound	*Primary Ion*	*Secondary Ion*
1,4-Dioxane	88	58, 43
1,4-Dioxane-d8	64	96
1,4-Dichlorobenzene-d4	152	115

10.1.2 The basic GC parameters are as follows for the Gerstel Large Volume Injection System:

Oven Equib Time: 0.10 min
Oven Max: 325
Initial Temp.: 45°C
Initial Time: 6.00 min

Level	Rate (°C/min)	Final Temp. (°C)	Final Time (min)
1	19.00	120	1.0
2	11.00	150	1.00
3	19.00	305	4.00

Final Time: 26.83

10.1.3 The basic injection port parameters are as follows for the Gerstel Large Volume Injection System:

“Splitless” mode
Initial Temp: 46 °C
Initial Time: 0.30 min
Ramp Rate: 300°/second
Final Temp: 300°C
Final Time: 30.0
Cryo: ON
Cryo Use temp: 25 °C
Cryo Timeout: 30.0 min
Cryo Fault: ON

Purge Flow: 25 ml/min
Purge Time: 2.50 min
Gas Saver: off
Gas: Helium

Mode: Constant Pressure
Average Velocity: 30cm/sec
Initial flow: 1.3 ml/min

10.1.4 The basic GC parameters are as follows for the Agilent Split/Splitless injector System:

Oven Equib Time: 0.20 min
Oven Max: 325°C
Initial Temp.: 30°C

Level	Rate (°C/min)	Final Temp. (°C)	Final Time (min)
1	0	30	2.00
2	5	50	0.00
3	50	300	2.00

Final Time: 13.00

10.1.5 The basic injection port parameters are as follows for the Agilent Split/Splitless injector System:

:

Mode: Splitless
Temperatuire: 200 °C
Flow: 1.0 mL/min
Velocity: 36.074 cm/sec
Septum Purge: 3mL/min
Purge Flow to Split Vent: 60 mL/min at 0.3 min

10.1.6 MS Acquisition Information:

Tune file: dftpp.u
Acquisition Mode: SIM
Solvent Delay: 7.70 min
MS Source temp: 280°C

10.1.7 Tuning

10.1.7.1 Before the analytical standards are analyzed the mass spectrometer must be adjusted to meet the proper ion criteria for DFTPP. This is demonstrated by injecting into the GC/MS system 1uL of a 50ug/mL DFTPP solution. After the analysis of the DFTPP, evaluate the tune as follows:

- Enter into the “Environmental Data Analysis” (off-line) screen.
- Go to “File” and select the tune data file.
- Go into “Tuner” and select “Eval DFTPP”, then select “AutoFind DFTPP to Screen,” to evaluate the tune file, based on the pre-set SW-846 criteria. The

software will evaluate the tune by selecting three scans of the DFTPP peak and will display the ion intensities on the screen. That is, one scan at the apex, one scan directly preceding the apex and one scan following the apex and averages them, then takes one background subtracted scan, 20 seconds before the beginning of the DFTPP peak. If the criteria below are met, repeat, select "AutoFind to Printer", for a hardcopy of the tune evaluation for the record.

If the "AutoFind" tune evaluation does not meet the criteria below, manual evaluation of the tune can be performed by attempting either of the options below:

- Blow up the DFTPP peak on the screen and select either one single scan at the apex of the peak, or a scan immediately preceding or following the apex. Go into "Tuner" and select "Evaluate DFTPP to Screen," or "Evaluate DFTPP to Printer," as described above, OR,
- Take the average of the scans across the entire peak. Go into "Tuner" and select "Evaluate DFTPP to Screen," or "Evaluate DFTPP to Printer," as described above.

10.1.7.2 The following DFTPP mass intensity criteria should be used.

DFTPP KEY MASSES AND ABUNDANCE CRITERIA

Mass	m/z Abundance criteria
51	10-80 percent of mass 198.
68	Less than 2 percent of mass 69.
70	Less than 2 percent of mass 69.
127	10-80 percent of mass 198.
197	Less than 2 percent of mass 198.
198	Base peak, or >50 percent of Mass 442.
199	5-9 percent of mass 198.
275	10-60 percent of mass 198.
365	Greater than 1 percent of mass 198.
441	Present but less than 24 percent of mass 442.
442	Base Peak, or > 50 percent of mass 198.
443	15-24 percent of mass 442.

10.1.8 Tune acceptance should be verified at the beginning of every 12 hour analytical shift. The DFTPP may be combined with the calibration verification standard as long as both tuning and calibration acceptance criteria are met.

10.2 Initial Calibration

10.2.1 After the DFTPP passes criteria, a set of multi-level calibration standards listed in Section 8.7 are analyzed, from low concentration to high. A minimum of five calibration levels are analyzed. The calibration standards are stored in amber vials in the standards freezer. The labeling convention allows each standard to have a unique identifier which distinguishes it from field samples. The naming convention used throughout the laboratory identifies the standard as semivolatile, hydrocarbon, pesticide/PCB or volatile. An example of this would be SW042407E, meaning it is a semivolatile (S) working (W) standard made on April 24, 2007 and that it was the fifth standard made that day. All certificates of analysis that are shipped with standards are filed with their receipt ID written on it to insure traceability.

10.2.2 Once the standards have been analyzed, they are reduced by the search software of the Enviroquant data system. Once all the components are identified, a linear curve is calculated for the components. The criteria for evaluation are as follows:

10.2.2.1 The average RF for each compound must be greater than 0.05.

10.2.2.2 The %RSD of each compound must not exceed 20%. If they do this may be an indication that the chromatographic system is too reactive for analysis to begin. This indicates the instrument may need maintenance.

10.2.2.3 Alternatively, a linear regression model may be employed, provided that the coefficient of determination (COD or r2) is $\geq$0.99. Otherwise, construct a nonlinear calibration of no more than a third order equation. Statistical considerations in developing a non-linear calibration model require more data than the more traditional linear approach. A quadratic (second order) model requires six standards, and a third order polynomial requires seven standards. In setting model parameters, do not force the line through the origin. The COD or r^2 must be greater than or equal to 0.99.

10.2.2.4 Once the calibration curve is reviewed, an Initial Calibration Checklist must be completed.

10.2.3 All samples and standards are spiked with Internal Standards (IS) before analysis. Refer to section 8.4 for specific internal standard spiking information. The IS is intended to be used for both quantitation and the establishment of relative retention times. Internal standard acceptance criteria can be found in Section 9.7.2.

10.2.4 Independent check standards (Section 8.8) from a separate source or different lot are analyzed after every initial calibration for evaluation against calibration standard solutions. The % Difference (%D) should not be greater than ±30%.

10.3 Equipment Operation and Sample Processing

10.3.1 Tuning

A DFTPP standard must be analyzed and pass criteria before a continuing calibration verification standard or any samples are analyzed. The DFTPP may be combined with the calibration verification standard as long as both tuning and calibration acceptance criteria are met. A DFTPP tune standard must be analyzed before each 12 hour analytical shift. Please refer to Section 10.1.5 for tuning criteria and other information.

10.3.2 Daily Calibration

On a daily basis after the DFTPP has passed, a mid-level (usually 1000 ng/mL) continuing calibration standard which contains all of the analytes of interest is analyzed. The criteria for acceptance are:

10.3.2.1 All analytes must have response factors greater than 0.05.

10.3.2.2 The % D must be ±20% D from the initial calibration.

10.3.3 Sample Analysis

10.3.3.1 The prep lab staff will transfer the samples to the instrument laboratory. The samples are generally brought to a 10 mL final volume for liquids or 4 ml for soil samples; 1 mL is transferred and the remaining sample volume is archived. One aliquot of each sample is then placed in the sample extract holding refrigerator located in the instrument laboratory.

10.3.3.2 All of the samples at 1 mL (including the batch QC samples) are spiked with 20 uL internal standard (see section 8.4 for specifics regarding the internal standard). The samples are shaken briefly after the internal standard is added to ensure mixing. A sample will need a dilution for target analytes that are over calibration.

10.3.3.3 After the daily tune and CCAL have passed criteria, the analyst places the samples onto the autosampler tray. (Generally, the samples will be analyzed in order of color (lightest to darkest.) with QC samples being analyzed first. The instrument sequence is typed into the HP Chemstation Software. Next run "Simulate Sequence" (also under the "Sequence" dropdown list) without clicking the "Overwrite Files" box. Compare the order of the vials on the instrument versus the sequence to confirm all the samples and standards are in the right places. Next click "Run Sequence" also under the HP Chemstation "Sequence" dropdown list.

10.3.3.4 After the samples have been analyzed, the data files from the MS are quantitated versus the proper quantitation method. The QCPRN1.MAC macro creates a form with which to easily check internal standard and surrogate criteria are met. The following should be reviewed initially:

10.3.3.4.1 Are all the surrogates within QC criteria? Please see Section 9.7.1 for surrogate information.

10.3.3.4.2 Is the internal standard- 1,4 Dichlorobenzene-d4, within 50-200% of the daily CCAL? If not, the samples should be checked for matrix interferences that may be causing these issues. The IS peaks should also be evaluated for peak splitting or incorrect integration by the software. A sample may not need to be reanalyzed if it can be determined (with guidance from a supervisor) that the QC is exceeded due to matrix interference.

10.3.3.4.3 Are all target analytes within calibration range? If not, the sample(s) should be diluted and re-analyzed. If a dilution is performed after the internal standard has already been added, it will be necessary to add additional IS in order to make up for the impact of the original IS added also being diluted. Conversely, if a sample has been over-diluted, it may need to be analyzed at less of a dilution to detect target analytes that may have been diluted out. Note: for this method, due to the isotope dilution, it is necessary to refer to area counts to determine if dilution is required. The area response for 1,4-Dioxane should be compared to the area of the highest level of the ICAL standard for that target. If the area of 1,4-Dioxane in the extract is greater than the area of 1,4-Dioxane in the Highest level of the Calibration Curve, then a dilution is necessary. The analyst **CAN NOT** use the concentration of 1,4-Dioxane found in the extract to determine if dilution is required because the concentration of 1,4-Dioxane in the sample is surrogate corrected in Chemstation based on the use of the extraction surrogate as an Internal Standard. Once it is determined based on the peak area that a sample requires a dilution, the analyst must pay attention to the concentration of IS in the dilution. Although the analyst will adjust the 1,4-Dichlorobenzene-d4 concentration by adding the appropriate amount of additional IS to the dilution, there is no way for the analyst to make up for the dilution of the extraction surrogate 1,4 dioxane-d8 (also used as internal standard). To account for this the analyst must change the concentration of the 1,4-Dioxane-d8 within the calibration table to a value which accounts for the dilution. (Example: If the analyst performs a 10x dilution then the concentration of 1,4-Dioxane–d8 must be changed within the ICAL to 50.) The analyst must ensure that only the diluted sample is calculated against this value and that the method is returned to the proper concentration once the analysis of the dilution is complete.

10.3.3.4.4 Are all analyses within 12 hour tune time? If a sample is analyzed outside tune time, it will need to be re-analyzed in another tune clock.

10.3.3.4.5 The sequence should also be printed out from Chemstation, initialed and dated, and placed in the logbook.

10.3.3.4.5.1 If anything in the initial review of the data indicates that there should be a re-analysis, the reason for re-analysis should be noted on the sequence.

10.3.3.4.5.2 Also, note the time the tune standard was analyzed, the time of the last sample analysis. If there are samples analyzed outside tune time, the time the last sample within tune time ran should be noted, as well as the last sample analyzed.

10.3.3.4.5.3 If a re-extract is required, the “Request for Repreparation/Reclean” book should be filled out and a photocopy of the appropriate page should be given to the Preparation Group leader or the Organics Section Head.

10.4 Continuing Calibration

Continuing Calibration Criteria is outlined in section 10.3.2

10.5 Preventive Maintenance

If performing any maintenance on any piece of equipment it must be documented in the *Instrument Maintenance Logbook* located in the laboratory specific to each instrument.

Daily

Injection port maintenance: Maintenance should be done when the daily CCAL starts to demonstrate degradation either by %D outliers or area responses <50% as compared to the ICAL areas. Several tune clocks may be injected before maintenance is needed. The type of samples analyzed will have an effect on how soon maintenance should be performed. Injection port maintenance should be done as needed. General maintenance includes replacing the single baffle liner packed lightly with glass wool, cutting about 2-4 inches off the head of the column, and replacing the septa. Refer to maintenance log for more specific information.

The Gerstel Injection port should be handled with care. The liners are quite thin. Do not force the Gerstel weldmen into place as the threads are soft metal and will cross thread. Always make sure the weldmen goes on straight. The Gerstel injection port does not require significant tightening of either the weldmen or column nut, tighten enough to seal but there is no need to crank down on it.

11. Data Evaluation, Calculations and Reporting

11.1 Qualitative Analysis

11.1.1 The qualitative identification of compounds determined by this method is based on retention time and on comparison of mass spectrum, after background correction, with characteristic ions in a reference mass spectrum. The reference mass spectrum must be generated by the laboratory using the conditions of this method. The characteristic ions from the reference mass spectrum are defined as the two ions of greatest relative intensity, and are over 30% relative intensity. Compounds are identified when the following criteria are met.

11.1.2 The intensities of the characteristic ions of a compound must maximize in the same scan or within one scan of each other. A peak selected by the data system, based on the presence of target specific ions at a target specific retention time will be accepted as meeting these criteria.

11.1.3 The relative retention time of the sample component is within ± 0.06 RRT units of the RRT of the standard component.

11.1.4 The relative intensities of the characteristic ions agree within 30% of the relative intensities of these ions in the reference spectrum (Example: For an ion with an abundance of 50% in the reference spectrum, the corresponding abundance in a sample spectrum can range between 20% and 80%.) The relative intensities are monitored daily. The relative intensities will be updated when they exceed established values from the reference spectrum.

11.1.5 Structural isomers that produce very similar mass spectra should be identified as individual isomers if they have sufficiently different GC retention times. Sufficient GC resolution is achieved if the height of the valley between two isomer peaks is less than 25% of the sum of the two peak heights. Otherwise, structural isomers are identified as isomeric pairs.

11.1.6 Identification is hampered when sample components are not resolved chromatographically and produce mass spectra containing ions contributed by more than one analyte. When gas chromatographic peaks obviously represent more than one sample component (i.e. a broadened peak with shoulder(s) or a valley between two or more maxima), appropriate selection of analyte spectra and background spectra is important. Selective ion monitoring eliminates this potential.

11.2 Quantitative Analysis

11.2.1 Response factors and % RSD to evaluate Initial Calibration acceptability.

Calculate RF by:

$$RF = \frac{area_{cmp}}{area_{is}} \times \frac{conc_{is}}{conc_{cmp}}$$

where:

area cmp = Area of the characteristic ion for the compound being measured.
area is = Area of the characteristic ion for the specific internal standard.
conc is = Concentration of the specific internal standard.
conc cmp = Concentration of the compound being measured.

Calculate % RSD by:

$$\%RSD = \frac{SD}{\overline{x}} \times 100 \qquad SD = \sqrt{\sum_{i=1}^{N} \frac{(x_i - \overline{x})^2}{N-1}}$$

where:

% RSD = percent relative standard deviation
x = average of RF's
SD = standard deviation
xi = analytical results of each level in the final reporting units
N = number of results (levels)

11.2.2 Calculate % Difference (%D) by:

$$\%D = \frac{\overline{RF_i} - RF_c}{\overline{RF_i}} \times 100$$

where:

RFi - Initial Calibration average RF
RFc = Continuing Calibration RF

11.2.3 Results of Water Analysis - calculation as performed in report form:

$$\text{Concentration (ug/L)} = \frac{\text{(Conc) (Vf) (DF)} \times 1000}{\text{(Vi)}}$$

11.2.4 Results of Soil/Sediment Analysis – calculation as performed in report form:

$$\text{Concentration (ug/Kg)} = \frac{\text{(Conc) (Vf) (DF)}}{\text{(Vi) \%S}} \times 1000$$

where:
Conc = Raw on-column concentration obtained from the quantitation report using Initial Calibration results.
Vf = Final volume of extract (mL)
Vi = Volume of sample extracted (mL), or weight of sample extracted in grams (g)
DF = Dilution factor, for manually prepared dilutions, not instrumental "dilutions".
%S = percent solids, as a decimal

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

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 chose 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.

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 defined in the table below 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.

QC Parameter	Acceptance Criteria
Method Blank	No analyte above the reporting limit The results are qualified with a "B" for any associated sample concentrations that are less than 10x the blank concentration for this analyte
Surrogate Recovery	15% - 110%
Laboratory Control Samples	40% - 140% and 30% RPD
Matrix Duplicate	30% RPD
Matrix Spike	40% - 140%
Matrix Spike Duplicate	30% - 140% and 30% RPD

13. Method Performance

13.1 Method Detection Limit Study (MDL) / Limit of Detection Study (LOD) / Limit of Quantitation (LOQ)

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

13.2 Demonstration of Capability Studies

Refer to Alpha SOP 1739 for further information regarding IDC/DOC Generation.

13.2.1 Initial (IDC)

The analyst must make an initial, one-time, demonstration of the ability to generate acceptable accuracy and precision with this method, prior to the processing of any samples.

13.2.2 Continuing (DOC)

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

Refer to Alpha's Chemical Hygiene Plan and Waste Management and Disposal SOP for further pollution prevention and waste management information.

15. Referenced Documents

Chemical Hygiene Plan

SOP 1732 Detection Limit (DL), Limit of Detection (LOD) & Limit of Quantitation (LOQ)
SOP 1739 Demonstration of Capability (DOC) Generation
SOP 1731 Manual Integration & Compound Rejection
SOP 1797 Hazardous Waste and Sample Disposal

SOP 1816 Reagent, Solvent and Standard Control

16. Attachments

None

APPENDIX C

HEALTH AND SAFETY PLAN

HEALTH AND SAFETY PLAN

BROWNFIELD CLEANUP PROGRAM
For
145 Chandler Street, LLC
125 Chandler Street, Buffalo, New York 14207
BCP # C915358

Prepared For:
145 Chandler Street, LLC
391 Washington Street, Buffalo, New York 14203
WGS Project No: 19209

Prepared By:
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3636 North Buffalo Road
Orchard Park, New York 14127
716-574-1513

March 4, 2020

WITTMAN
GeoSciences, PLLC

TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

LIST OF ATTACHMENTS

1.0 INTRODUCTION

This Health & Safety Plan (HASP) has been developed for the Remedial Investigation/ Alternatives Analysis Report (RI/ AAR) to be completed by Wittman GeoSciences, PLLC (WGS) behalf of 145 Chandler Street, LLC (Applicant) as part of the Brownfield Cleanup Program (BCP). The proposed work will include completion of soil borings, test pits, installation of monitoring wells, soil and groundwater sampling, and report preparation. Such activities mandate the performance of tasks with a potential to expose remediation workers to various environmental contaminants previously identified on-site, primarily involving historical industrial fill potentially including semi-volatile organic compounds (SVOCs) and metals. Limited exposure potential may be related to commercial substances used for equipment decontamination. A general listing of the work tasks to be completed is as follows:

1. Soil sampling using a direct push method (Geoprobe) and hollow stem auger equipment
2. Test pit excavation with a track mounted excavator and bucket
3. Soil sample collection and analysis
4. Monitoring well installation, purging and development
5. Groundwater sampling using disposable bailers, and analysis
6. Soil vapor intrusion sampling and analysis

The intent of this HASP is to identify and present appropriate safety procedures to be followed by investigation/remediation workers involved with project activities throughout the performance of the RI. Such procedures are designed to reduce the risk of remediation worker exposure to the primary substances of concern.

The procedures also address several other physical hazards that may be encountered during the RI activities. Recommended safety procedures presented herein may be modified as the RI proceeds based upon conditions encountered at the site, with the mutual agreement of WGS, NYSDEC, NYSDOH and Applicant. A copy of this HASP (including any modifications) will be maintained on-site throughout the RI field work to be used as a reference by WGS and their subcontractors. An initial safety meeting will be conducted at the site prior to the initiation of the sampling activities to inform all affected remediation workers of potential exposures and hazards.

2.0 SITE DESCRIPTION AND HISTORY

2.1 Site Description

The site is addressed as 125 Chandler Street in the City of Buffalo, Erie County, New York and consists of one approximate 0.75 acre parcel. The site is bound to the north by Chandler Street, to the east by vacant parcel, to the south by private residences, and to the west by vacant commercial buildings and lots. The property is located within an urban area, utilized for industrial, commercial, and residential purposes.

The 125 Chandler parcel is improved with one approximate 3,500-square foot single-story building located on the western portion of the site. The building was gutted, leaving only steel beams, roof and concrete pad. Historic industrial fill, as well as piles of soil/debris are in portions of the parcel.

2.2 Site History

125 Chandler Street was initially identified Chandler Street Playground in 1935, and remained a playground until around 1949 when the site was developed for Direct Winter Transport Ltd. The initial building was located in southern portion of the site, and current building constructed in 1955. The southern building was removed in late 1990s. The 125 Chandler building was also used by Hanson Transport, EJ Scannell Trucking, Acme Steel Co. (storage), Eagle Mold & Mfg. Co, and Mancini auto Sales. The building has been vacant since 2016.

Prior remedial measures have not been completed at the site. Hazard Evaluations Inc. completed a limited Phase II investigation in June 2017. The work included completion of 5 soil borings and collection of soil samples. Based on the soil borings completed, approximately 3 to 8 feet of granular and cohesive fill material is present throughout the site. The fill material extended to depths of 8 feet below grade in the area of the former building on 125 Chandler Site. Silty clay was encountered below the fill material at the 5 soil boring locations, and extended the full depth drilled. Groundwater was generally not encountered.

3.0 ASSIGNED RESPONSIBILITIES

Specific safety responsibilities have been established for the performance of the RI as indicated below:

3.1 Environmental Health & Safety Manager

The Environmental Health & Safety Manager (EHSM) has the authority to commit any resources necessary to implement an effective RI safety program, thereby protecting the health of affected site workers. The EHSM will delegate responsibilities, as necessary, to the Project Manager (PM) in order to facilitate various aspects of this HASP. The resolution of any on-site safety issues encountered during the RI will be coordinated by the EHSM.

3.2 Project Manager

The Project Manager (PM) will be responsible for the overall project including implementation of the HASP. The PM will coordinate with the Site Safety Officer (SSO) to ensure that project goals of the project are met in a manner consistent with the HASP requirements.

3.3 Site Safety Officer

The Site Safety Officer (SSO) will be responsible for ensuring that the recommended safety procedures are followed during sampling activities. The SSO will supervise HEI/WGS employees and subcontractors throughout the field work. The SSO is knowledgeable of general construction safety practices and remediation worker protection techniques. Responsibilities will include:

- Ensuring day to day compliance with HASP safety procedures;
- Maintaining adequate PPE supplies
- Calibration and maintenance of monitoring instruments
- Authority to stop work activities any time unsafe work conditions are identified;
- Implementing personnel decontamination procedures;
- Initiate emergency response procedures; and
- Maintain a diary of activities with safety relevance;
- Establishing and assuring adequate records of all:
    - Occupational injuries and illnesses;
    - Accident investigations;
    - Reports to insurance carrier or state compensation agencies;
    - Records and reports required by local, state and/or federal agencies;
    - Property or equipment damage.

3.4 Site Workers

Affected site workers will include WGS employee and subcontractor employees. Site workers must comply with aspects of the HASP and its safety procedures. Personnel entering the site will have completed training requirements for hazardous waste site operations in accordance with OSHA 29CFR 1910.120 (c); 29CRF 1910.146 (d) and 29CFR 1910.147 (c). Site workers and SSO must have completed appropriate medical surveillance as required by OSHA 29CRF 1910.120(f).

3.5 Subcontractors

Various subcontractors will be utilized on the site during RI activities, such as driller and excavation contractor. Subcontractors are responsible for development of their own HASP that is at least as stringent. A copy of this HASP will be provided to the subcontractors for information purposes. Subcontractors will be informed of potential health and safety hazards, as well as environmental monitoring data collected during field activities.

4.0 TRAINING and SAFTETY MEETINGS

4.1 Training

Site personnel assigned to the site will be in compliance with the training requirements of 29 CFR 1910and 1926 as listed below. Site personnel will have met one of the following requirements prior to the start of on-site activities.

- A 40 hour minimum hazardous materials safety and health course, as stipulated in 29 CFR 1926.65 e(3); and
- An 8 hour minimum refresher course per year after the 40 hour minimum training has occurred (29 CFR 1926.65.e[8]).

On-site managers and supervisors must be in compliance with the additional supervisory training requirements of 29 CFR 1926.65.e(4). Emergency responders must be in compliance with the additional training requirements of 29 CFR 1926.65.e(7). Appropriate certificates of participating in training programs will be maintained at WGS offices.

4.2 Safety Meetings

Site workers and subcontractors will be familiar with the site and facility layout, have an understanding of known and potential hazards, and details within this HASP. On-site safety meetings will occur daily, or as needed to assist site workers and subcontractors in conducting activities safely. Attending personnel must sign an attendance sheet. Site workers must attend a safety meeting prior to being allowed to work on-site.

5.0 PERSONAL PROTECTIVE EQUIPMENT

An important aspect for site worker safety is correct selection of personal protective equipment (PPE). The levels of protection listed below are based on 29 DFR 1910.120. The majority of site activities will be conducted in Level D protection. This level of protection was selected based on the types and measured concentrations of the hazardous substances in the samples previously collected and their associated hazards and/or toxicity; and potential or measured exposure to substances in air, splashes of liquids or others indirect contact with material due to the task being performed.

- Level D will generally consist of the following:
  - Coveralls; or long pants and long sleeve shirt to provide protection from dermal contact with soil
  - High visibility safety vest
  - Steel toe work boots
  - Safety glasses
  - Hard hat
  - Chemical-resistant gloves

  Additional equipment can be donned at SSO requirements, including disposable boots, hearing protection, safety vest, or disposable outer chemical coveralls (Tyvek suits).

- Level C will generally consist of the following:
  - Full or half face air purifying respirator (APR) equipped with appropriate organic vapor canisters and/or other chemical cartridges.
  - Chemical resistant clothing, such as Tyvek suit. Suits will be one piece with booties, hood, and elastic wristbands.
  - High visibility safety vest (disposable)
  - Outer chemical-resistant gloves (i.e. nitrile or neoprene) and inner latex gloves
  - Steel toe work boots
  - Hard hat

- Level B will generally consist of the following:
  - Self-contained breathing apparatus (SCBA) in a pressure demand mode, or supplied air with escape SCBA.
  - Chemical resistant closing, such as Tyvek suit. Suits will be one piece with booties, hood, and elastic wristbands.
  - High visibility safety vest (disposable)

- Outer chemical-resistant gloves (i.e. nitrile or neoprene) and inner latex gloves
- Chemical resistant tape over PPE as needed (i.e. at glove/Tyvek location)
- Steel toe work boots
- Hard hat

6.0 HAZARD ANALYSIS

Many hazards are associated with environmental work on a site. The hazards listed below deal specifically with those hazards associated with the management of potentially contaminated soil, air, and groundwater, physical hazards, as well as environmental hazards.

6.1 Chemical Hazards

The primary contaminants of concern in the soil include semi-volatile organic compounds (SVOCs) including nzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and indeno(1,2,3-cd)pyrene; and metals including copper and manganese, primarily within the fill which varies from 3 to 8 feet below ground surface. A summary of hazards associated with these chemicals is include on Table 1. The list has been developed based on planned activities and potential site conditions. The most likely routes of chemical exposure during site work includes skin absorption and inhalation of airborne dust particles. The information was used to develop the levels of personal protective equipment (PPE) to be used during the duration of the RI field work on-site.

6.2 Physical/General Hazards

Based on the proposed scope of work to be completed, the following potential physical hazards have been identified:

- Slip/Trip/Fall – Due to the timing of the project, some areas may have icy surfaces that will increase the possibility of accidental falls. Additionally, good housekeeping practices such as cleaning up garbage, and stored materials from the work area are essential to reduce the occurrence of trips and falls the trip hazards.

- Vehicle and machinery in motion hazards – A drill rig will be utilized for soil sample collection. To minimize potential hazards, the drilling subcontractor will be responsible for health and safety of its personnel, equipment and operations. Utilities must be called in via Dig Safely New York and/or site owner. Cones and flags will be set up around each work area, as necessary. Workers must be aware of pinch points when setting the rig and lowering mast/pull rods. PPE must be worn to prevent eye injury. All body parts, clothing and manual tools must be kept 3-5 feet from moving equipment when possible. Gloves and PPE must be worn when working with rods and cleaning equipment. Monitoring of the breathing zone will be completed as necessary to ensure vapors are below action levels. Each worker must have an awareness of muscle strain. All sampling liners must be opened in a motion away from body and hands. The rig cannot be moved with the mast in a raised position.

- Electrical – Heavy equipment (e.g., excavator, backhoe, drill rig) shall not be operated within 10 feet of high voltage lines. Working near wet areas should also be taken into consideration when working with electrical equipment; Surge protectors and ground fault protectors must be used in such conditions.

- Noise – Heavy machinery creates excessive and loud noise levels. Over exposure can result in hearing damage or loss. Proper hearing protection shall be worn during exposure to noise from heavy equipment.

- Underground utilities– The proper utility clearance will be obtained before conducting any digging or drilling operations.

- Excavation and soil sampling through use of heavy equipment – Excavations that are greater than 4 feet in depth require a protective system prior to entry into the excavation. The Project Manager will be responsible for determining if the excavation requires safety shoring. Personnel will not be permitted to work under suspended or raised loads, and shall always wear highly visible clothing. Personal protective equipment (PPE), including steel-toed boots, safety glasses, hard hats must be worn; personnel should not walk directly in back of, or to the side of, heavy equipment without the operator's knowledge. Engineering controls can be implemented such as water for particulate control.

- Cold Stress – Site work is scheduled during the early spring to summer months; therefore cold weather are not anticipated. Frostbite and hypothermia can occur quickly and the signs and symptoms of such should be known. Signs of hypothermia include slurred speech, confusion, and an overall warm sensation. Frostbite can be identified by red/frozen skin, numbness, and lack of sensation on the skin. In each case, the victim should be moved to a warm place. With frostbite, the affected area should be placed in warm water and wrapped with a warm towel. Medical attention is necessary after initial treatment.

- Heat stress - Site work is scheduled during the early spring to early summer months; therefore extreme hot weather is not anticipated. Heat stress is a severe hazard that can result in heat fatigue or even heat stroke. Signs and symptoms of heat stroke include red, dry, and hot skin as well as confusion, a rapid pulse, and nausea. Adequate shade and drinking liquids should be provided to personnel working in hot weather conditions. If a person is suspected to be suffering from heat fatigue or stroke, transport to a cool place and place cold compresses on the neck and armpits; call 911 immediately.

- Weather (i.e. lightning storm) – On-site personnel shall cease operation at the first sign of a thunderstorm/lightning strike. Workers should seek shelter within a permanent building and stay away from tall structures trees, telephone poles, and drill rigs/equipment.

6.3 Biological Hazards

Biological hazards can be caused by contact with land animals, birds, insects, and plants. Irritation, illness, and, in extreme cases, permanent disability or death can occur. The site is located in an urban area within the City of Buffalo and field work will occur in spring/early summer. Rodents are considered the most likely biological hazards at this site. Contact with rodents, more specifically rats, shall be avoided. If bitten or scratched by any type of rodent or fur-bearing animal, medical treatment should be sought immediately. Insect bites and stings are not considered a serious threat due to time of year. Insect bites and stings can cause irritation and transmit disease. If stung by an insect, apply cold water and soap and immediately apply a cold compress to the area to limit swelling. If the victim is allergic to such bite or sting, immediate medical care may be necessary.

7.0 SITE MONITORING

Air monitoring will be performed on-site in order to track contamination levels. By knowing these levels, safety is insured for personnel working on-site. A Photoionization Detector (PID) equipped with a 10.6 eV lamp will be utilized during field monitoring.

7.1 Soil Borings, Test Pits and Monitoring Wells

On-site monitoring will be completed by the SSO or site worker assigned to oversee drilling operations, soil sampling and monitoring well installation/sampling. The PID will be utilized to monitor the breathing zone, the borehole, and subsurface samples for the presence of volatile organic compounds (VOCs). Auger spoils will also be monitored. Fluids produced from monitoring well development and sampling will also be monitored with the PID.

7.2 Action Levels

Work area ambient air monitoring for VOCs will be completed within the breathing zone periodically. Action levels will be based on the PID readings. The action level assumes that background level of organics is close to non-detect. Background VOC readings will be recorded daily. Action levels are listed below.

Sustained PID Reading	Action	Minimum Respiratory Protection
0 to 10 ppm	None	None – Level D
10 to 25 ppm	Monitor for 15 minutes; if concentration does not decrease to under 10 ppm, upgrade PPE; consider venting area	Full-face Air-purifying respirator with organic vapor cartridges – Level C
>25 ppm	Monitor for 15 minutes; Consider venting area, upgrade PPE	Suspend work or supplied-air full face respirator – Level B

7.3 Particulate Monitoring

Monitoring for particulates will be completed periodically in the site worker breathing zone. The decision to upgrade levels of PPE will be made in conjunction with consideration for weather conditions, wind conditions and anticipated duration of field activity. Background particulate concentrations will be measured and recorded on a daily basis.

8.0 COMMUNITY AIR MONITORING PLAN

A Community Air Monitoring Program (CAMP) requires monitoring of VOCs and particulates at downwind locations and is intended to provide a level of protection for neighboring residences and businesses. Continuous monitoring will during ground intrusive activities. The completed CAMP is attached in Attachment A.

9.0 SITE ACTIVITY AREAS AND ACCESS CONTROL

Prior to the initiation of the RI, three work zones will be established to facilitate the implementation of the HASP. Prior to commencement of field work, a further definition of where these zones will be set up will be established. Guidelines for establishing work areas follows.

- Exclusion Zone (EZ) – Primary exclusion zones will be established around each intrusive field activity, such as soil boring or excavation area. Locations will be identified by the placement of orange cones. Site workers in these areas must wear appropriate PPE. Upon leaving Work Zone, if PPE becomes contaminated, site workers must remove and dispose of gloves and any other disposable PPE. After removing the PPE, site workers should thoroughly wash their hands. Access to the EZ will be limited to site workers only for both safety and data integrity purposes.

- Contamination Reduction Zone (CRZ) – A CRZ will be established between the EX and property limit, and provides an area for decontamination of site equipment. The specific location of this pad will be field determined, but will be out of the way of site activities and sampling activities. Portable wash stations will be set up in the CRZ and will consist of a potable water supply, hand soap and disposable towels. An Alconox solution will be available to decontaminate equipment used in the sampling locations. The SSO will monitor equipment cleaning procedures to ensure their effectiveness. Equipment will be adequately cleaned and site workers will remove contaminated PPE prior to either entering the Support Zone or leaving the site for the day once sampling activities have been completed. A fire extinguisher and first aid kit will be located in this area.

- Support Zone (SZ) – The SZ is considered to be clean, and PPE are not required. The SZ will be an area on-site adjacent to the CRZ in which supplies or equipment are stored and maintained. PPE is donned in the SZ prior to entering the CRZ.

10.0 DECONTAMINATION PROCEDURES

Decontamination procedures for personal and equipment will be implemented when exiting work area. Decontamination involves physically removing contaminants and general include removal of contamination, avoiding spreading contamination from the work zone, and avoiding exposure of unprotected personnel outside the work zone to contaminants.

10.1 Prevention of Contamination

The first step in decontamination is to establish standard operating procedures that minimize contact with hazardous substances, and thereby the potential for contamination. Site workers should be aware of the importance of minimizing contact with hazardous substances and the use of appropriate practices and procedures for site operations. WGS utilizes this approach by ensuring site workers:

- Stress work practices that minimize contact with hazardous substances (e.g., do not walk through areas of obvious contamination, do not directly touch potentially hazardous substances, etc.);
- Protect sampling instruments from gross contamination by bagging; make openings in the bag for sample ports and sensors that contact site materials;
- Wear disposable outer garments and use disposable equipment where appropriate.

10.2 Personal Decontamination

The degree of contamination exposure is a function of both a particular task and the physical environment in which it takes place. The following decontamination procedures will remain flexible, thereby allowing the decontamination crew to respond appropriately to changing conditions at the site. It is expected that site workers will be exposed to soil/fill potentially contaminated with SVOCs, metals, PCBs, and petroleum compounds. On-site sampling activities will be carried out in such a manner as to avoid gross contamination of site workers, personal protective equipment, machinery and equipment.

Between sampling locations (or sometimes between samples at one sampling location), and upon the completion of the daily field activities, site workers will proceed to the CRZ. Equipment (e.g., sampling tubes, shovels, tools, etc.) will be decontaminated in this area. Prior to leaving the site for breaks, at the end of the work shift, or when PPE has been grossly contaminated, disposable boot covers, gloves, and suits will be removed and placed in a drum designated for the disposal of these materials. After removing PPE, each site worker will wash with soap and fresh water prior to donning new PPE or leaving the site for the day. All wash water and rinse water will be collected and disposed of in accordance with appropriate regulations.

10.3 Decontamination during Medical Emergencies

In the event of a minor, non-life-threatening injury or medical problem, site workers should follow the decontamination procedures as defined above and then administer first aid. If prompt, live-saving first aid is required, decontamination procedures should be omitted and immediate first aid should be administered, unless the environmental conditions are considered immediately dangerous to Life or Health (IDLH). In this case, the victim should be moved to a clean area and life-saving care should be instituted immediately without considering decontamination.

Outside garments can be removed (depending on the weather) if they do not cause delays, interfere with treatment or aggravate the problem. Respirators and backpacks must always be removed. Chemical-resistant clothing can be cut away. If the outer contaminated garments cannot be safely removed, the individual should be wrapped in plastic, rubber or blankets to help prevent contaminating the insides of ambulances and medical personnel. Outside garments will then be removed at the medical facility. No attempt should be made to wash or rinse the victim at the site. One exception would be if it is known that the individual has been contaminated with an extremely toxic or corrosive material which could also cause severe injury or loss of life.

10.4 Decontamination of Equipment

Decontamination efforts will be conducted in the CRZ. Gross contamination will first be removed with plastic scrapers or other appropriate tools. The equipment will be decontaminated at a temporary equipment decontamination pad in the CRZ via hand washing or pressure washing, as needed. Alconox and water will then be used to wash the equipment with a cleaning brush. The equipment will then be rinsed with deionized water. The equipment will then be allowed to air dry for a sufficient time prior to reuse or removal from the site. Downhole tools and augers can be hand washed or pressure washed.

The decontamination of the direct push drilling rig will be undertaken (if necessary) when all on-site activities have been completed. Initially, scraping of the equipment will remove heavily caked materials prior to washing. Washing will then be accomplished Alconox and water or pressure washing. Water generated during decontamination activities will be collected, stored and profiled for future off-site disposal.

10.5 Disposal of the Contaminated Materials

Potentially contaminated materials (gloves, clothing, sample sleeves etc.) will be bagged and segregated for proper disposal. Investigation derived waste will be managed in accordance with NYSDEC guidance regulations. All fluids collected during groundwater sampling will be containerized and managed appropriately subsequent to field activities.

11.0 EMERGENCY RESPONSE

In the event of an emergency, the SSO will coordinate on-site emergency response activities. Appropriate authorities will be immediately notified of the nature and extent of the emergency. Emergency contact list is included on Table 2. The route and directions to the hospital are included as Figure 2.

11.1 Response Procedures

In the event of an emergency or acute exposure symptom, remediation workers will signal distress to the SSO. The SSO will be responsible for the response to emergencies and must:

- Have available a summary of the associated risk potential of the project so that it can be provided to any authorities or response personnel in the event of an emergency;
- Maintain an Emergency Contact List (Table 2) and post in a visible location a map detailing directions to the nearest hospital (Figure 2); and
- Ensure appropriate safety equipment is available at the site.

11.2 Communications

Cell phones will be the primary means of communicating with emergency support services/facilities.

11.3 Evacuation

In the event of an emergency situation, such as fire, explosion, etc., all personnel will evacuate and assemble in a designated assembly area. The SSO will contact outside services (i.e. police, fire, etc.) as required. Under no circumstances will personnel be allowed to re-enter the area once the emergency signal has been given. The SSO must see that emergency equipment is available and emergency personnel notified.

11.4 Fire or Explosion

Immediately evaluate the site. The Buffalo Fire Department will then be notified immediately, and advised of the situation and the identification of any hazardous materials involved.

11.5 Personal Injury

Only basic emergency first aid will be applied on-site as deemed necessary. The SSO will supply available chemical specific information to appropriate medical personnel, as requested. First Aid kits supplied by HEI/WGS and its subcontractors will conform to Red Cross and other applicable good health standards, and will consist of a weatherproof container with individually sealed packages for each type of item. First Aid kits will be fully equipped before being sent to the site.

11.6 Adverse Weather Conditions

In the event of adverse weather conditions, the SSO will determine if work can continue without sacrificing the safety of remediation workers. Some of the items to be considered prior to determining if work should continue are the potential for heat stress, inclement weather-related working conditions (heavy snow) and the operation of field instruments.

11.7 Traffic, Heavy Equipment & Machinery

Site workers must remain aware of the heavy equipment and machinery being used during RI activities. Site workers will be required to wear a high visibility safety vest during on-site work activities.

11.8 Utilities

Prior to the beginning site activities, all available drawings of the facility will be examined to determine the presence of underground or sub-slab utilities. HEI anticipates that a magnetic pipe and cable locator will be effective in the prevention of encountering underground utilities.

11.9 Emergency Contingency Plan

In the case of a spill emergency (e.g., tank/drum release, spill, fire, etc.), this section will describe the procedures to be followed during the event.

11.9.1 Contamination Emergency

It is unlikely that a contamination emergency will occur; however, if such an emergency does occur, the specific work area shall be shut down and immediately secured. The area in which the contamination occurred shall not be entered until the arrival of trained personnel who are properly equipped with the appropriate PPE and monitoring instrumentation.

11.9.2 Spill/Air Release

In the event of a spill or air release of hazardous materials on-site, the specific area of the spill or release shall be shut down and immediately secured. The area in which the spill or release occurred shall not be entered until the cause can be determined and site safety can be evaluated. The NYSDEC Spill Response unit shall be notified immediately. The spilled material shall be immediately contained.

11.9.3 Unknown Drums or USTs

In the event that unidentified containerized substances, including USTs, are discovered during soil sampling or soil excavation, work will be ceased immediately until hazards are addressed. The SSO will then visually assess the situation and identify any leaks or releases from the container. If leaking is identified, the spilled material shall be immediately contained. Upon visual assessment of releases and safety, properly trained personnel will then sample and remove/dispose of the waste/container.

11.10 Additional Safety Practices

The following are important safety precautions and practices that will be enforced during the field activities.

- Eating, drinking, smoking, chewing gum or tobacco or any activity that increases the probability of hand-to mouth transfer and ingestion of hazardous substances is prohibited during the RI activities.
- Remediation worker hands and face must be thoroughly washed before leaving the CRZ or before eating, drinking or other activity.
- Contact with potentially contaminated surfaces should be avoided whenever possible.
- The number of remediation workers and the amount of equipment should be minimized.
- Alcoholic beverages will not be consumed during work hours by site personnel; Personnel using prescription drugs may be limited in performing specific task (i.e. operating heavy equipment) without written authorization from physician.

12.0 RECORDS AND REPORTING

The SSO will be responsible for establishing and maintaining adequate records of activities which take place at the site. The records will pertain to site workers involved in the project, regardless of their employer, as well as any agency personnel. A basic list of the information to be maintained is as follows:

- Occupational injuries or illnesses.
- Accident investigations.

- Reports to insurance carrier or State Compensation agencies.
- Records and reports required by local, state and federal agencies.
- Property or equipment damage.
- Third party injury or damage claims.
- Environmental testing logs.
- Explosive and hazardous substances inventories and records.
- Records of inspections and citations.
- Related correspondence.
- Safety training level.

Tables

Table 1
Hazard Characteristics of Potential Contaminants of Concern

Contaminant	Potentially Impacted Media	Carcinogenicity/Symptoms of Acute Exposure	Occupational Exposure Values* ACGIH TLV OSHA PEL NIOSH IDLH
Benzene	Soil, Groundwater	Confirmed human carcinogen. Symptoms include irritation to eyes, skin, nose, respiratory system; headache; nausea; giddiness, fatigue.	PEL - 10 ppm; IDLH - 500 ppm; TLV - 0.5 ppm; STEL - 2.5 ppm
Chlorinated Organic Compounds	Soil, Groundwater	Exposure to the vapors of many chlorinated organic compounds such as vinyl chloride, tetrachloroethylene, 1,1,1-trichloroethane, trichloroethylene and 1,2-dichloroethylene and other chlorinated hydrocarbons may result in various symptoms including irritation of the eyes, nose and throat, drowsiness, dizziness, headache, blurred vision, uncoordination, mental confusion, flushed skin, tremors, nausea, vomiting, fatigue and cardiac arrhythmia. The liquid if splashed in the eyes, may cause burning irritation and damage. Repeated or prolonged skin contact with the liquid may cause dermatitis. Some of these compounds are considered to be potential human car-cinogens.	Refer to 29 CFR 1910.1017 for exposure values
Toluene	Soil, Groundwater	Insufficient data from carcinogenic studies to classify substance as a potential carcinogen. Symptoms include irritation to eyes, nose; fatigue; weakness; euphoria; headache; lacrimation.	PEL - 10 ppm; IDLH - 500 ppm; TLV - 20 ppm; STEL - 150 ppm
Ethyl Benzene	Soil, Groundwater	Confirmed animal carcinogen with unknown relevance to humans. Symptoms include irritation to eyes, skin, mucous membranes; headache; narcosis.	PEL - 5 ppm; IDLH - 800 ppm; TLV - 20 ppm; STEL - 30 ppm
o-, m-, and p-Xylenes	Soil, Groundwater	Insufficient data from carcinogenic studies to classify substance as a potential carcinogen. Symptoms include irritation to eyes, nose, throat; dizziness; excitement; drowsiness; nausea; vomiting.	PEL - 100 ppm; IDLH - 900 ppm; TLV - 100 ppm; STEL - 150 ppm
Polynuclear Aromatic Hydrocarbons (PAH's)	Soil, Groundwater	Many PAH's found in fuel oil and coal tar pitch volatiles (creosote) are confirmed human carcinogens. Symptoms include dermatitis and bronchitis.	Some PAH's have no established exposure values. Others considered coal tar pitch volatiles have an ACGIH TLV and OSHA PEL value of 0.2 mg/m^3.
Cadmium	Soil	Suspected human carcinogen. Symptoms include pulmonary edema; difficulty breathing; cough; tightness in chest; substernal pain; headache; chills; nausea; vomiting; diarrhea; asnosmia.	PEL - 0.2 mg/m3; IDLH - 50 mg/m3; TLV - 0.01 mg/m3 (these limits are expressed for Cd dust)
Chromium	Soil	Hexavalent chromium compounds are confirmed human carcinogens. Symptoms include irritation to the respiratory system; nasal septum perforation; sensitization dermatitis (hexavalents). Irritation to the eyes; sensitization dermatitis (trivalents).	PEL - 0.5 mg/m3; IDLH - 250 mg/m3; TLV - mg/m3 (insoluable)
Lead	Soil	Confirmed animal carcinogen with unknown relevance to humans. Symptoms include weakness; tremor; irritation to eye; constipation; abdominal pain.	PEL - 0.05 mg/m3; IDLH - 100 mg/m3; TLV - 0.5 mg/m3
Mercury	Soil	Insufficient data from carcinogenic studies to classify substance as a potential carcinogen. Symptoms include irritation to eyes, skin; cough; chest pain; difficulty breathing; irritability; indecision; headache; fatigue; weakness; salivation.	PEL - 0.025 mg/m3 (acceptable ceiling concentration); IDLH - 2 mg/m3; TLV - 0.025 mg/m3 (elemental/inorganic)
Polychlorinated Biphenyl (PCBs)	Soil	Confirmed human carcinogen. Symptoms include dermal and ocular lesions, irregular menstrual cycles and a lowered immune response. Other symptoms included fatigue, headache, cough, and unusual skin sores	PEL - 1 mg/m3; IDLH - 5 mg/m3; TLV - 1 mg/m3

ACGIH TLV – American Conference of Governmental Industrial Hygienists Threshold Limit Value; Concentrations in ppm of mg/m3 based on an 8-hour TWA

OSHA PEL – Occupational Safety and Health Admiration Permissible Exposure Limits; Concentrations are shown in parts per million (ppm) or milligrams per cubic meter (mg/m3) based on an 8-hour time weighted average (TWA)

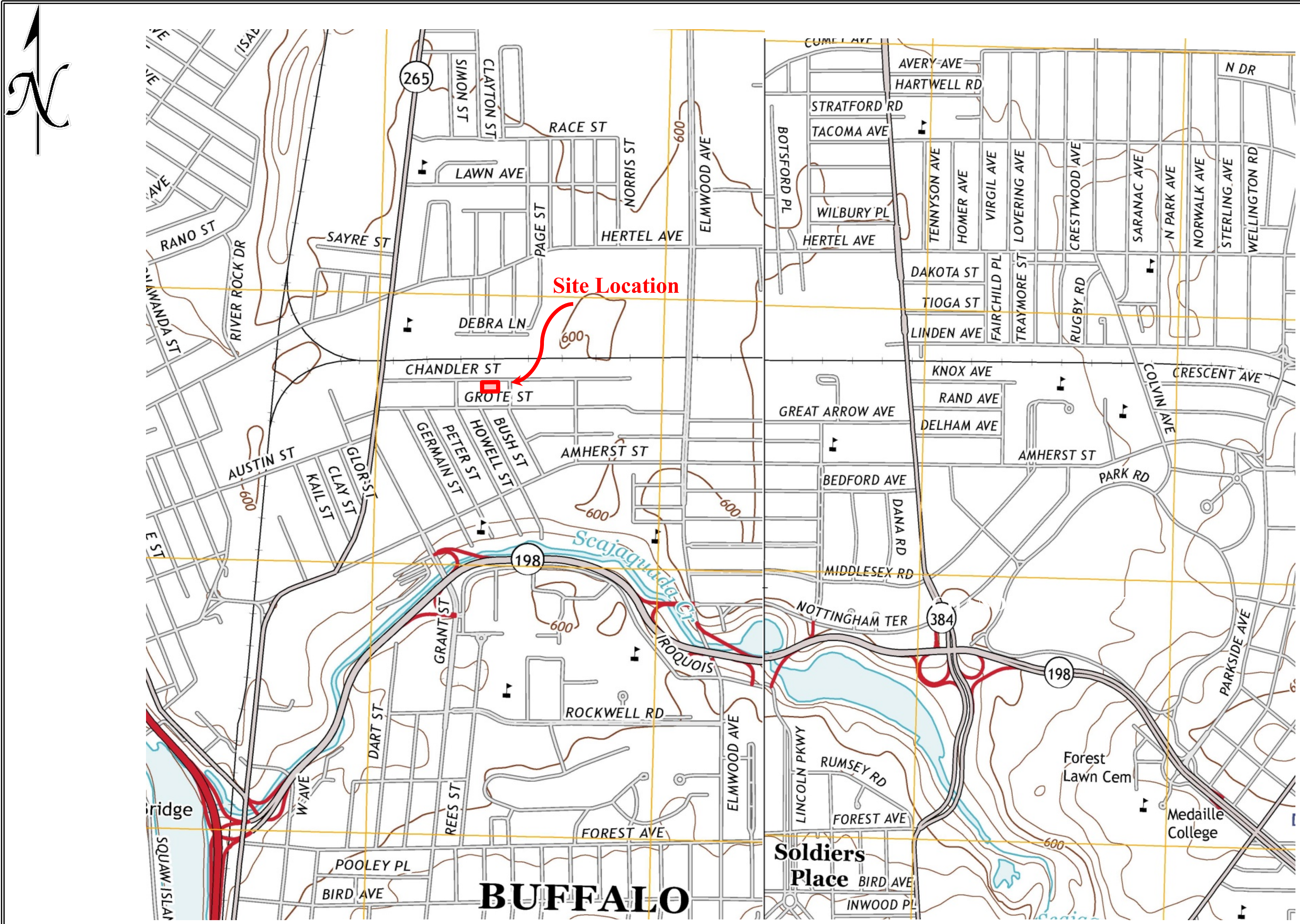
NIOSH IDLH – National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health; Concentrations in ppm or mg/m3

OSHA STEL - Short Term Exposure Limit

Table 2
Emergency Contacts

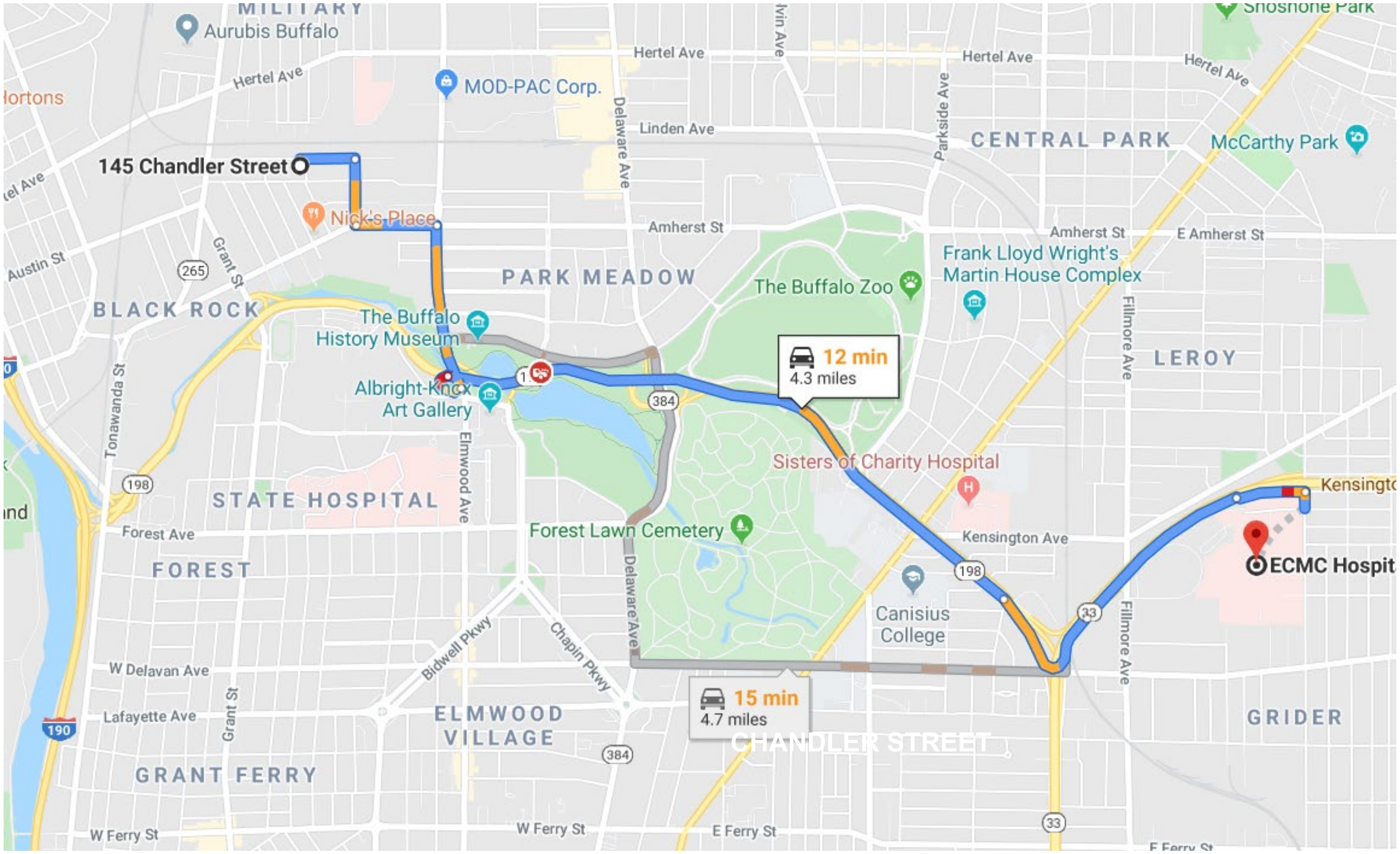
Agency	Contact	Phone Number
Buffalo Police	Emergency	911
Buffalo Fire/First Aid	Emergency	911
Ambulance	Emergency	911
Poison Control Center	Emergency	911
Hospital	Erie County Medical Center 462 Grider Street Buffalo, NY 14215	(716) 898-3000
NYSDOH	Krista Anders Empire State Plaza, Corning Tower Room 1787 Albany, NY 12237	(866) 881-2809
NYSDEC	Jaspal Walia 270 Michigan Ave. Buffalo, NY 14203	(716) 851-7220
NYSDEC	SPILL Hotline	(800) 457-7362
Wittman GeoSciences, PLLC	Michele Wittman, PG 3636 N. Buffalo Rd. Orchard Park, NY 14127	Cell: (716) 574-1513
Hazard Evaluations	Mark Hanna, CHMM 3636 N. Buffalo Rd. Orchard Park, NY 14127	Office: (716) 667-3130
Schenne & Associates	John Schenne,PE 391 Washington St. Suite 800, Buffalo, NY 14203	(716) 655-4991
145 Chandler Street, LLC (Owner)	Rocco Termini 391 Washington St. Buffalo, NY 14203	(716) 861-5385

Figures



THIS DRAWING IS FOR ILLUSTRATIVE AND INFORMATIONAL PURPOSES ONLY
AND WAS ADAPTED FROM USGS, BUFFALO NE & NW, NEW YORK 2013 QUADRANGLE.

WITTMAN GEOSCIENCES, PLLC	Date: 03/2020	**Site Location**	Project: 19209
	Scale: not to scale	125 Chandler Street, Buffalo, NY	Figure: 1



Directions: Head south on Manton Street. Turn left onto Grout Street. Take Grout Street to the end and turn right onto Elmwood Avenue. Turn right to merge onto NY-198E. Use the right 2 lanes to take the NY-33 E exit toward Airport. Keep right, follow signs for Fillmore Ave. Turn left onto Fillmore Ave. Turn right at the 1st cross street onto Kensington Ave. ECMC entrance is located on the right.

WITTMAN
GeoSciences, PLLC

WITTMAN GEOSCIENCES, PLLC	Date: 03/2020	**Directions to Hospital**	Project: 19209
	Scale: not to scale	125 Chandler Street, Buffalo, NY	Figure: 2

Attachment A

Community Air Monitoring Plan

COMMUNITY AIR MONITORING PLAN

BROWNFIELD CLEANUP PROGRAM
For
145 Chandler Street, LLC
125 Chandler Street, Buffalo, New York 14207
BCP # C915358

Prepared For:
145 Chandler Street, LLC
391 Washington Street, Buffalo, New York 14203
WGS Project No: 19209

Prepared By:
Wittman GeoSciences, PLLC
3636 North Buffalo Road
Orchard Park, New York 14127
716-574-1513

March 4, 2020

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF ATTACHMENTS

1.0 INTRODUCTION

This Community Air Monitoring Plan (CAMP) has been developed for the Remedial Investigation /Alternatives Analysis Report (RI/AAR) Work Plan to be completed by Wittman GeoSciences, PLLC (WGS) for 125 Chandler Street Site located at 125 Chandler Street, Buffalo, Erie County, New York, on behalf of 145 Chandler Street, LLC (Applicant) as part of the Brownfield Cleanup Program (BCP).

The CAMP requires real-time monitoring of volatile organic compounds (VOCs) and particulates (dust) at downwind perimeter of each designated work area. The CAMP will be implemented during the excavation and removal of soils from the courtyard and vacant lot areas of the subject site. This CAMP will be completed in general accordance with NYSDEC DER-10 Appendix 1A, as included in Attachment A. A figure showing proposed monitoring points is included as Figure 1.

2.0 VOLATILE ORGANIC COMPOUND AIR MONITORING

VOCs will be monitored at the downwind perimeter of the work are on a continuous basis and periodically during non-intrusive activities. VOC monitoring will be done using an organic vapor meter (OVM) equipped with a photoionization detector (PID) to provide real-time recordable air monitoring data.

VOCs will also be monitored and recorded at the downwind perimeter of the immediate work area(s). Upwind concentrations will be measured at the beginning of each day before activities begin and periodically throughout the day to establish background conditions. The downwind VOC monitoring device will also be checked periodically throughout the day to assess emissions and the need for corrective action. VOC monitoring action levels as per *DER-10 Technical Guidance for Site Investigations and Remediation* is as follows:

- 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.

- If the organic vapor level at the perimeter of the work area 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 take 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 than that 20 feet, is below 5 ppm over background for the 15-minute average.

- If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shut down.

3.0 PARTICULATE AIR MONITORING

The remediation crew will make all efforts to suppress dust and particulate matter during the handling of contaminated soil. Fugitive dust and particulate monitoring will be completed in accordance with DER-10 Appendix 1B, as included in Attachment B. The following techniques have been shown to be effective for the controlling 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/or
(g) Reducing the excavation size and/or number of excavations.

Care will be taken not to use excess water, which can result in unacceptably wet site conditions. Use of atomizing sprays will prevent overly wet conditions, conserve water and provide an effective means of suppressing fugitive dust.

Weather conditions will be evaluated during remedial work. When extreme wind conditions make dust control ineffective, as a last resort, remedial actions may need to be suspended.

Dust and particulate monitoring will be conducted near approximate upwind and downwind perimeters of the work area, when possible. If visual evidence of dust is apparent in other locations, monitoring equipment will be placed where necessary. Dust monitoring may be suspended during period of precipitation and snow cover.

Particulate air monitoring will be done with a DataRAM-4 (or similar), which will be capable of reading particles less than 10 micrometers in size (PM-10) and equipped with an audible alarm feature which will indicate exceedances. Dust monitoring devices will be recorded periodically throughout the day to assess emissions and the need for corrective actions. Particulate monitoring action levels as per *DER-10 Technical Guidance for Site Investigations and Remediation* is as follows:

- If the downwind PM-10 particulate level is 100 micrograms per cubic meter ($\mu g/m^3$) greater than background 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 ($\mu g/m^3$) above the upwind level and provided that no visible dust is migrating from the work area.

- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 ($\mu g/m^3$) 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/m3 of the upwind level and in preventing visible dust migration.

4.0 DOCUMENTATION

All 15-minute readings will be recorded and be available for or State (NYSDEC and NYSDOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

5.0 WIND DIRECTION

Prevailing wind direction will be recorded at the beginning of each work day by visual observations of an on-site windsock. As wind direction may change throughout the work day, direction will be reestablished if a significant change in direction is observed. The wind direction results will be utilized to determine the placement of the monitoring equipment.

Figures

WITTMAN
GeoSciences, PLLC

WITTMAN GEOSCIENCES, PLLC	Date: 03/2020	**Potential Air Monitoring Device Locations**	Project: 19209
	Scale: not to scale	125 Chandler Street, Buffalo, NY	Figure: 1

Attachment A

NYSDEC DER-10 Appendix 1A
New York State Department of Health
Generic Community Air Monitoring Plan

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

Attachment B

NYSDEC DER-10 Appendix 1B
Fugitive Dust and Particulate Monitoring

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 1C
DEC Permits Subject to Exemption

In accordance with section 1.10, exemptions from the following permit programs may be granted to the person responsible for conducting the remedial programs undertaken pursuant to section 1.2:

Air - Title 5 permits
Air - State permits
Air - Registrations
Ballast Discharge
Chemical Control
Coastal Erosion Hazard Areas
Construction of Hazardous Waste Management Facilities
Construction of Solid Waste Management Facilities
Dams
Excavation and Fill in Navigatable Waters (Article 15)
Flood Hazard Area Development
Freshwater Wetland
Hazardous Waste
Long Island Wells
Mined Land Reclamation
Navigation Law - Docks
Navigation Law - Floating Objects
Navigation Law - Marinas
Non-Industrial Waste Transport
Operation of Solid Waste Management Facilities
Operation of Hazardous Waste Management Facilities
State Pollution Discharge Elimination Systems (SPDES)
Stream Disturbance
Tidal Wetlands
Water Quality Certification
Water Supply
Wild, Scenic and Recreational Rivers