Honeywell

Remedial Investigation Work Plan

Former Oak Materials Fluorglas Division–John Street
NYSDEC Site No. 442049

Town of Hoosick and
Village of Hoosick Falls, Rensselaer County, New York

Honeywell

August 2019

www.erm.com

The business of sustainability

ERM

REPORT/WORK PLAN

Honeywell

Remedial Investigation Work Plan
Former Oak Materials Fluorglas Division – John Street

Village of Hoosick Falls
Rensselaer County, New York

6 August 2019

NYSDEC Site Number 442049

ERM Consulting and Engineering, Inc.
105 Maxess Road, Suite 316
Melville, New York 11747-3851
www.erm.com

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

Chris W. Wenczel

Chris W. Wenczel, P.G.
ERM Consulting & Engineering, Inc.

Date: 6 August 2019

ERM Consulting and Engineering, Inc.
105 Maxess Road, Suite 316
Melville, New York 11747-3851
www.erm.com

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

ACRONYMS AND ABBREVIATIONS

amsl	above mean sea level
APS	Advanced Profiling System
ASP	Analytical Services Protocol
AOPCs	Areas of Potential Concern
CAMP	Community Air Monitoring Plan
COPCs	Compounds of Potential Concern
CSM	Conceptual Site Model
DER	Division of Environmental Remediation
DSNY	Dig Safely New York
DUSR	Data Usability Summary Report
ERM	ERM Consulting and Engineering, Inc.
FSAP	Field Sampling and Analysis Plan
GAC	Granular Activated Carbon
gpd	gallons per day
IRM	Interim Remedial Measure
ng/L	Nanograms per liter (parts per trillion)
NJDEP	New Jersey Department of Environmental Protection
NPL	National Priorities List
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSGS	New York State Geological Survey
PARCC	Precision, Accuracy, Reproducibility, Completeness, and Comparability
PCBs	Polychlorinated biphenyls
PDI	Pre-Design Investigation
PFAS	Poly- and Per-fluorinated compounds
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctane sulfonic acid
ppt	Parts per trillion
QA/QC	Quality Assurance / Quality Control
QAPP	Quality Assurance Project Plan
RI	Remedial Investigation
SC	Site Characterization
SCGs	Standards, Criteria and Guidance
SCOs	Soil Cleanup Objectives
SOP	Standard Operating Procedure
SVOCs	Semivolatile Organic Compounds
TAL	Target Analyte List
TCL	Target Compound List
TOGS	Technical Operations Guidance Series
TCE	Trichloroethene
µg/kg	Micrograms per Kilogram (parts per billion)
USEPA	United States Environmental Protection Agency
VOCs	Volatile Organic Compounds

1.0 INTRODUCTION

Honeywell International Inc. (Honeywell) entered into an Order on Consent and Administrative Settlement with the New York State Department of Environmental Conservation (NYSDEC) dated 3 June 2016 (the Order; Index Number CO 4-20160415-79). The Order required the performance of a Site Characterization (SC) at the Former Oak Materials Fluorglas Division - John Street (the Site).

The location of this 0.6-acre property is shown on Figures 1 and 2.

In July 2017, the Site was added to the Registry of Inactive Hazardous Waste Sites (the Registry) as a Class 2 site (Site No. 442049).

1.1 PURPOSE AND OBJECTIVES

The initial on- and off-site SC performed during 2016-2018 (Section 2.3) detected the presence of the following compounds at concentrations exceeding potentially applicable NYS Standards, Criteria and Guidance (SCGs: Section 1.2):

- Chlorinated volatile organic compounds (CVOCs), primarily trichloroethene (TCE) and 1,1,1-trichloroethane (1,1,1-TCA) in:
  - soil, soil vapor and groundwater on-site; and
  - soil vapor and groundwater off-site.
- Poly- and per-fluorinated compounds (PFAS) in on- and off-Site soils and groundwater;
- Minor detections of semi-VOCs (SVOCS) in shallow on-and off-site soils; and on-site groundwater and
- Minor detections of metals (copper and nickel) were noted in shallow soils at three on-site locations.

Consequently, additional investigations are required and this Remedial Investigation Work Plan (RIWP) establishes a scope of work intended to complete the SC and fill certain data gaps at the Site to complete a RI.

The elements of the additional investigations described in this RIWP are aligned with NYSDEC DER-10 requirements, and intended to meet the following goals:

- Identify contaminant source areas;
- Define the extent and nature of the contamination;
- Generate data of sufficient quantity and quality to:
  - determine fate and transport of contaminants;
  - evaluate if potential threats to human health and the environment exist; and
  - support the screening/selection process for media/areas where remedial actions might be required.

1.2 STANDARDS, CRITERIA AND GUIDANCE

The following NYS Standards, Criteria and Guidance (SCGs) apply to this project:

- 6 NYCRR Part 375 - Environmental Remediation Programs;
- 6 NYCRR Part 608 - Use and Protection of Waters;
- 6 NYCRR Parts 700-706 - Water Quality Standards; and
- 29 CFR Part 1910.120 - Hazardous Waste Operations and Emergency Response
- DER-10 – Technical Guidance for Site Investigation and Remediation (May 2010);
- USEPA Drinking Water Health Advisory for PFOA and perfluorooctane sulfonic acid (PFOS) dated May 2016 (USEPA, 2016a);
- NYSDEC Division of Spills Management - Sampling Guidelines and Protocols: Technologies Background and Quality Control/Quality Assurance for the NYSDEC Spill Response Program (NYSDEC, 1992);
- TOGS 1.1.1 - Ambient Water Quality Standards & Guidance Values and Groundwater Effluent Limitations (NYSDEC, 1998); and
- Screening and Assessment of Contaminated Sediment, NYSDEC Division of Fish, Wildlife and Marine Resources, Bureau of Habitat dated 24 June 2014 (NYSDEC 2014).

Prior and future sample results were/will be compared to applicable NYS SCGs by media as summarized below.

1.2.1 *Groundwater*

Groundwater results will be compared to NYS Class GA ambient water quality standards and guidance values (NYSDEC, 1998) for target compound list (TCL) organic compounds and target analyte list (TAL) inorganic constituents. NYS does not have ambient water quality standards or guidance values[i] for Perfluorooctanoic acid (PFOA) or Perfluorooctane sulfonic acid (PFOS), and the other PFAS.

The USEPA Lifetime Health Advisories of 70 ng/L for both PFOA and PFOS (individually and in total) are applicable only for drinking water (USEPA, 2016a).

1.2.2 *Soil*

Soil results will be compared to NYS Soil Cleanup Objectives (SCOs; NYSDEC, 2006) for the current land use for TCL and TAL constituents. NYS does not have SCOs for PFOA, PFOS or other PFAS.

In May 2016, the USEPA issued a site-specific Removal Management Level (RML) for Residential Soil for Hoosick Falls of 1,000 µg/kg for the combined level of PFOA and PFOS (USEPA 2016b; USEPA, 2016c). This RML was based on the reference dose used by the USEPA Office of Water to establish the drinking water health advisory of 70 ppt. This RML was used to screen the soil results.

---

[i] Ambient water quality, relates to water bodies such as lakes, rivers, and oceans. New York State has developed standards and guidance values for specific classes of fresh and saline surface waters and fresh groundwaters for protection of the best uses assigned to each class. See TOGS 1.1.1. (NYSDEC, 1998)

1.2.3 Surface Water

Certain grab samples of water present at ground surface were designated surface water. These surface water samples were in: 1) low lying areas where surface water accumulates; 2) areas of potential groundwater discharge; or 3) drainage ditches or small creeks, which may lead to the Hoosic River. Although the locations of these samples do not fit the criterion for surface water as described in 6 NYCRR Part 701.2 through 701.9 (NYSDEC, 2016d), the results of the above-noted grab samples were compared to the surface water Type H(FC): Human Consumption of Fish, Class A/A-S/AA/AA-S/B/C/D SCGs for TCL and TAL constituents. NYSDEC does not have SCGs for PFOA, PFOS or other PFAS.

1.2.4 Sediment

The locations of sediment samples collected during the SC do not specifically fit the descriptions provided in NYSDEC sediment guidance, which is intended for projects that investigate potential risks to aquatic life (NYSDEC, 2014). For the purpose of this investigation, the results of designated sediment samples are compared to the Bioaccumulation-based Sediment Guidance Values (BSGV) for the protection of human health (fish consumption) and wildlife for TCL and TAL constituents and USEPA soil screening values for PFOA and PFOS.

Soil Vapor

Soil vapor results were presented without comparison, as NYS SCG values for soil vapor do not exist.

2.0 PROJECT BACKGROUND

2.1 DESCRIPTION AND HISTORY

Figures 1 and 2 show the location and layout of the Site and surrounding areas.

The approximately 0.6-acre Site is located in the Village of Hoosick Falls in an area of mixed commercial and residential use, bounded on the west by Lyman Street, on the north by John Street, on the west by Woods Brook, and on the south by a residential property. Rensselaer County tax records indicate that the Site is zoned commercial-vacant.

The past uses of the Site were commercial and industrial. A three-story brick, mortar and wood building was constructed in the 1890s and demolished in 2012; there are currently no structures on the Site. The Site is generally flat, gently sloping northward, covered with crushed stone and fenced to prevent unauthorized access. There are currently no plans for future property use.

2.2 PHYSICAL CONDITIONS

2.2.1 Soil

Native soil in the area, mapped by the New York State Geological Survey (NYSGS), is shown primarily as alluvium and lacustrine silt and clay (Caldwell and Dineen, 1987). Localized areas of soil include coarser material associated with channel sand and glacial outwash sand and gravel (Caldwell and Dineen, 1987).

Surface soil at the Site is primarily fill material from grade to between eight and 17 feet below grade. Underlying native soil consists predominantly of Hamlin silt loam (USDA, 2017).

2.2.2 Topography

Topography in the area of the Village of Hoosick Falls and the surrounding Town of Hoosick is characterized by upland hilly areas on either side of the Hoosic River valley, which generally trends from south-southeast to north-northwest (Figure 3). Elevations in this area range from approximately 400 to 1,200 feet above mean sea level (amsl) with the lowest elevations found along the Hoosic River. The elevation of the Site is approximately 420 to 440 feet amsl.

2.2.3 Surface Waters

Surface water bodies in the area of the Village of Hoosick Falls and the surrounding Town of Hoosick include perennial streams, intermittent streams, ponds, and rivers (Figure 3). The major surface-water feature is the Hoosic River, which flows north-northwestward through the center of the valley.

Woods Brook is an intermittent stream that flows towards the Village of Hoosick Falls from the east (Figure 3). The stream is culverted beneath portions of the Village before returning to an aboveground concrete channel located south-southeast of the Site. Woods Brook then flows generally northward along the east side of the Site and discharges into the Hoosic River.

2.2.4 *Geologic/Hydrogeologic Setting*

A typical local stratgraphic column is shown in Figure 4. Area-wide unconsolidated geologic material above bedrock (collectively referred to as overburden) typically consists of the following:

- Fine-grained alluvium (predominantly silt and clay) deposited in the Hoosic River valley.
- Coarse-grained alluvium, consisting predominantly of sand and gravel, also deposited in the Hoosic River valley.
- Glacio-lacustrine brown and gray silt and clay.
- Glacial outwash (predominantly sand and gravel) deposited by glacial meltwaters.
- Glacial till, which is typically a dense, compact, poorly-sorted mixture of silt, clay, sand, gravel, cobbles, and boulders deposited by glaciers.

Bedrock in the area consists predominantly of dark gray to black slate mapped by the NYSGS as the Walloomsac Formation (Potter, 1972). The area has been subject to complex structural deformation including folds and thrust faults (Potter, 1972). The resulting bedrock stratigraphy and structural geology of the area is variable and complex.

Groundwater in the unconsolidated overburden flows toward the Hoosic River. Groundwater flow in bedrock occurs predominantly through joints, fractures, faults, and foliation in the bedrock.

2.2.5 *Local Potable Water Sources*

There are no private or public potable water wells identified within 0.25 mile of the Site.

The Village of Hoosick Falls' municipal well field is located east of the Hoosic River (Figure 3). The system is classified by the New York State Department of Health (NYSDOH) as "groundwater under the direct influence of surface water". The three currently active wells (well numbers 3, 6 and 7) have total well depths of 55, 59, and 70 feet, respectively (CHA, 2006). The system has an approximate capacity of 1.0 million gallons per day (gpd). Produced water is treated through a membrane filtration plant. Additionally, granular activated carbon (GAC) is utilized to remove PFOA from the water since February 2016.

2.3 *PRIOR SITE CHARACTERIZATION ACTIVITIES*

2.3.1 *2016 Site Characterization*

In 2016, two phases of initial Site Characterization (SC) work were performed with NYSDEC oversight in accordance with the NYSDEC-approved ***SC Field Sampling and Analysis Plan*** (ERM, 2016a) and the ***Memorandum on Additional Phase I Site Characterization*** (ERM, 2016b).

Sample/well locations are shown in Figure 5 and the results of the SC are presented in the ***April 2019 Final SC Report, Former Oak Materials Fluorglas Division–John Street*** (John Street SC Report; ERM, 2019). The SC Report describes the field efforts and associated analytical results for environmental media samples.

Initial Site characterization work detected the presence of the following compounds at concentrations above applicable NYS SCG:

- CVOCs, primarily TCE and 1,1,1-TCA in:
    - soil, soil vapor and groundwater on-site; and
    - soil vapor and groundwater off-Site.
- PFAS in on- and off-Site soils and groundwater (primarily PFOA);
- Minor detections of SVOCS (polycyclic aromatic hydrocarbons (PAHs)) in shallow on-and off-site soils; and
- Minor detections of metals were noted in:
    - shallow soils at three on-site locations (copper and nickel);
    - on-site groundwater (iron, manganese, selenium and sodium); and
    - off-site groundwater (barium, cadmium, chromium, iron, lead, manganese, magnesium and sodium).

2.3.2 2019 Shallow Groundwater Interim Remedial Measure

In parallel to the ongoing SC and RI activities, Honeywell elected to undertake an interim remedial measure (IRM) to address VOC contamination. This goal will be achieved via the application of remedial technology that will promote enhanced degradation and/or removal of VOCs in environmental media and reduce VOC concentrations in off-Site groundwater and soil vapor in downgradient areas.

To refine the conceptual IRM, additional Site characterization activities and pre-design studies were performed during 2018 in accordance with the NYSDEC-approved work plan entitled ***Shallow Groundwater Interim Remedial Measure Pre-Design Investigation & Treatability Study Work Plan*** (ERM, 2018). The Pre-Design Investigation (PDI) activities included:

- Delineation of CVOCs in on-site shallow soil,
- Further delineation in on-site groundwater; and
- Collection of additional data to determine the physical and chemical characteristics of the shallow subsurface which included:
    - Infiltration testing (falling head tests)
    - Bench-top oxidant demand and soil mixability testing; and
    - Total oxidant precursor (TOP) assay testing.

The PDI data were used to conduct a technology screening to select an appropriate approach for IRM implementation.

The findings of the PDI and technology screening are presented in the ***Shallow Groundwater IRM Work Plan*** (ERM, 2019) which provides for implementation of an IRM to mitigate the mass flux of CVOCs in shallow groundwater that are migrating off-site in shallow groundwater. This objective will be achieved through implementation of a permeable barrier composed of PlumeStop and

Zero Valent Iron (ZVI) in the form of AquaZVI that will create a zone of enhanced adsorption and degradation of CVOCs to minimize off-site migration.

2.4 *CONCEPTUAL SITE MODEL*

The data obtained from the SC and IRM PDI was used to develop a preliminary conceptual site model (CSM). These preliminary CSM represent the initial understanding of the relationships between various environmental media, the fate and transport of contaminants and potential receptors. Additional data collection will support the further development of these initial CSM in order to make appropriate risk-management decisions.

The preliminary CSM for John Street is presented in Figure 6. This figure illustrates the major environmental features such as: topographic relief; land slope; unsaturated zone thickness; unconsolidated saturated zone; overburden and bedrock interface; and, relationship to surface water (primarily the Hoosic River). This CSM is an important planning tool in targeting additional investigation activities to supplement the work already completed as part of the SC.

As shown in Figure 3, the Site is located at the base of an area of higher topographic relief to the south with a modest land slope trending north toward the Hoosic River. The overburden groundwater zone is considerably thicker at the Site and includes a continuous deposit of clay and silt that appears to act as an aquitard. The underlying bedrock surface at this location steeply slopes upward in a northerly direction to form the base of the Hoosic River.

Additional investigations will focus on continued delineation of contaminants in surface and subsurface soil, in particular the clay and silt unit, up-, side- and downgradient groundwater, and on gaining a better understanding of the hydraulic relations between shallow and deep groundwater, including at the overburden and bedrock interface, and the Hoosic River.

3.0 REMEDIAL INVESTIGATION WORK PLAN

This RIWP describes the additional field efforts completed in 2018 (Section 3.2.1) or that will be undertaken to complete the characterization of environmental conditions at the Site.

The elements of the additional investigations described in this RIWP are aligned with NYSDEC DER-10 requirements, and intended to meet the following goals:

- Identify contaminant source areas;
- Define the extent and nature of the contamination;
- Generate data of sufficient quantity and quality to:
  - determine fate and transport of contaminants;
  - evaluate if potential threats to human health and the environment exist; and
  - support the screening/selection process for media/areas where remedial actions might be required.

The scope of work for the additional investigations to complete an RI at the Site is summarized in Table 2 and Figure 7. The rationale and specifics of the completed or proposed work in each of the site-wide and specific AOPCs are provided in Table 2 and the locations are shown in the figures.

The results of the additional on-site and off-site RI activities outlined in this RIWP will:

- Further develop information to support the CSM by seeking to identify potential source areas and refine the lateral and vertical extent of COPCs that exceed applicable SCGs; and
- Supplement and be combined with the results of the prior SC and PDI investigations to substantially fulfill the requirements for an RI as outlined in Chapter 3 of DER-10 (NYSDEC, 2010a).

3.1 CONTAMINANTS OF POTENTIAL CONCERN/AREAS OF POTENTIAL CONCERN

Contaminants of potential concern (COPCs) and areas of potential concern (AOPCs) were identified for the Site based on SC results.

COPCs include PFAS, VOCs, SVOCs and metals, which have been detected in on-site and off-site soil and/or groundwater at concentrations exceeding potential SCGs. AOPCs and COPCs are summarized in Table 1, and AOPCs are generally shown in Figure 7.

Cyanide, polychlorinated biphynels (PCBs) nor pesticides were not detected in any SC samples at concentrations above potentially applicable NYS SCGs. Therefore, it is recommended that these analytes be removed from future sampling and analysis programs.

3.2 NYSDEC-APPROVED SC TASKS COMPLETED IN 2018

In a letter dated 19 June 2018, Honeywell requested NYSDEC approve certain advanced remedial investigation tasks. NYSDEC subsequently approved the following activities that were completed during July – September 2018. Details are summarized below and in Table 2, and locations are shown in Figure 6.

3.2.1 *Bedrock Well Installations*

The goal of this task was to determine the hydrogeologic relation between the shallow bedrock and the overlying overburden, and groundwater quality in shallow bedrock. Eight bedrock wells (two on-site and six off-site) were installed adjacent to existing overburden well clusters, developed, and completed as flush-mount installations.

3.2.2 *Borehole Geophysical Logging*

The objectives of the borehole geophysical logging program was to determine the depths and orientations (dip azimuths and dip angles) of bedrock fractures intersected by the subject boreholes and depths where water flows into and out of the boreholes under ambient and pumping conditions.

Hager-Richter Geoscience, Inc., dba HR Geological Services in New York performed the borehole geophysical logging program and used the following methods in each bedrock well:

1. Fluid Temperature & Fluid Conductivity/Resistivity,
2. Optical Televiewer;
3. Acoustic Televiewer & Acoustic Caliper;
4. Natural Gamma Ray;
5. Heat Pulse Flow Meter (HPFM) Under Ambient Conditions; and
6. HPFM Under Pumping Conditions.

3.2.3 *Hydrogeological Evaluation*

The objectives of the hydrogeological evaluation task was to:

- Determine groundwater elevations to define horizontal and vertical hydraulic gradients;
- Calculate hydraulic conductivity;
- Estimate transmissivity values and groundwater flow rates; and
- Evaluate potential bedrock fracture interconnectivity between bedrock well locations.

Water level gauging and aquifer slug tests were performed on all existing overburden groundwater monitoring wells screened in the upper and lower sand units.

3.2.4 *On-site Metals Delineation Surface/Subsurface Soil Sampling*

Initial SC results indicated concentrations of copper (JS-B-002 & JS-B-005) and nickel (JS-B-003) exceeding their respective SCOs for Commercial Use at three locations. Five soil borings were performed at each of the three areas to delineate metals concentrations exceeding the Commercial Use SCOs. In addition to targeted metals analyses of soil samples from each area, NYSDEC required all samples to also be analyzed for VOCs, PFAS (21), total organic carbon (TOC), and pH.

3.2.5 *Clay Borings*

As part of the IRM PDI, NYSDEC requested Honeywell install an additional five on-site soil borings (Figure 7) to further characterize PFAS and VOC concentrations in brown/gray clay unit on-site. The brown clay layer overlies the thicker gray clay layer. Recent soil borings indicate that the brown clay layer is not present at all locations near the site, or is very thin (e.g., <12 inches) at some locations. Where possible, soil samples from four depth intervals were collected for VOCs, PFAS plus TOC and pH. Target intervals included top and bottom of brown clay where present and >12-inches thick; otherwise one representative sample was collected where brown clay is present and <12-inches; and the top and bottom of gray clay).

3.2.6 *Sanitary Sewer Utility Trench Borings*

The municipal sanitary sewer lines upstream, beneath and downstream of the Site were evaluated by soil borings/sampling to determine if the sewer lines have leaked to soil and groundwater and/or act as preferential pathways for contaminant movement in groundwater.

Eighteen soil borings were installed at nine locations where soil borings were positioned within four and ten-feet of the sewer line at each location. One soil sample was collected from each boring at a depth corresponding to the one-foot interval below the pipe invert elevation. All soil samples were analyzed for PFAS (21), TOC, pH, Target Analyte List (TAL) VOCs, TAL Metals Plus 3 Samples (20%) were analyzed for full TAL Organics (VOCs, Semi-VOCs, pesticides, polychlorinated biphenyls (PCBs)) and TAL Inorganics (metals and cyanide).

3.3 *SCOPE OF THE REMEDIAL INVESTIGATION*

The proposed scope of work for the additional investigations to complete an RI at the Site is summarized in Table 2 and Figure 7. Colorized symbols are used to correlate work scope items in Table 2 with those corresponding locations shown in Figure 7.

ERM will notify NYSDEC's John Street Project Manager via email a minimum of seven days prior to the start of field activities. The email will describe the scope of fieldwork and timing of activities planned.

3.3.1 *Supporting Project Documents*

The activities described below will be supported by the following appended documents and key ERM project personnel responsible for implementing the work.

3.3.1.1 *RI Community Air Monitoring Plan*

The Community Air Monitoring Plan (CAMP) for the RI is presented in Appendix A. The CAMP is consistent with the requirements of DER-10 Appendix 1A (NYSDEC, 2010a). The CAMP describes monitoring requirements and response action levels associated with monitoring of VOCs and particulates (i.e., dust) downwind of RI activities. The CAMP contains action levels for additional monitoring, corrective actions to abate emissions, and/or work stoppage if necessary.

3.3.1.2 *RI Field Sampling and Analysis Plan*

The Field Sampling and Analysis Plan (FSAP) for the RI is presented in Appendix B. The FSAP is consistent with the requirements of DER-10 Section 2.4. The FSAP describes field operations protocols and sampling and analysis procedures for implementation of the RI.

3.3.1.3 *RI Quality Assurance Project Plan*

The Quality Assurance Project Plan (QAPP) for the RI is presented in Appendix C. The QAPP is consistent with the requirements of DER-10 Section 2.4. The QAPP describes sampling and analysis procedures for implementation of the RI along with QA/QC criteria. The QAPP will facilitate generation of data with acceptable PARCC.

3.3.1.4 *RI Personnel and Qualifications*

The experience and qualifications of key ERM project personnel who will be involved in implementing the RI are presented in Appendix D.

3.3.2 Community Air Monitoring

Community air monitoring for VOCs and particulates will be performed during all intrusive field activities in accordance with the CAMP (Appendix A).

3.3.3 Subsurface Clearance

Dig Safely New York (DSNY) will be notified prior to the initiation of intrusive activities at the properties and requested to identify, locate, and mark member-company utilities in areas proposed for subsurface intrusive investigation. A private utility location subcontractor will be retained to evaluate proposed drilling locations using ground penetrating radar (GPR), magnetometry/metal detection, inductive cable/pipe location, or other appropriate techniques. A minimum 10-foot diameter around each planned drilling location will be scanned for subsurface utilities prior to the initiation of the work.

Proposed sampling locations will be adjusted in the field as necessary based on the results of subsurface clearance efforts.

3.3.4 Potential Former Underground Fuel Oil Storage Tank

A Records Search and document review was performed as part of the SC in conformance with applicable requirements contained in the Order and Appendix 3A of DER-10 NYSDEC, 2010a). The Records Search was undertaken to identify relevant historical environmental documentation and the results thereof presented in the John Street SC Report.

According to the Environmental Data Resources (EDR) report, a tank closed in-place by AlliedSignal Laminate Systems in 1999 was located at Mechanic Street. The separate tank, which was closed and removed in 1995 from John Street

Fluorglas, Allied Signal Inc., plots to the middle of Church Street at the intersection of John and Church Streets by Key Bank, based on the coordinates provided in the EDR report. Historical information indicates that a 10,000-gallon fuel oil underground storage tank (UST) was present at the Site.

Given the footprint of the former John Street building, the UST likely would have been located on the south end of the Site but no specific information is available to document the tank's location. Ground penetrating radar (GPR) surveys on the Site have not identified any UST. Soil borings and soil and groundwater samples collected from the southern portion of the site do not indicate the presence of fuel oil constituents. Honeywell will complete an additional GPR survey on the southern area of the Site to determine if an UST might be present.

3.3.5 *Monitoring Well Installations*

Additional overburden groundwater monitoring wells will be installed. Up to 37 monitoring wells and approximately 18 temporary overburden groundwater sampling points will be installed at the locations proposed in Figure 7 using the direct push or rotosonic drilling methods.

Shallow monitoring wells screened near the water table will be designated "A". Wells screened a short distance below the bottom of the clay and silt unit (i.e., near the top of the lower sand and gravel unit) will be designated "B", and wells screened near the bottom of the lower sand and gravel unit will be designated "C" and/or "D".

Following installation and development, groundwater samples will be collected from the monitoring wells and temporary points. All well installations, drilling, construction, development, testing, and sampling will be directed by a geologist.

Following collection of the groundwater samples, all temporary wells will be removed and soil borings will be backfilled with impermeable material, i.e., bentonite chips or pressure grout to prevent creating a vertical pathway.

3.3.6 *Surface and Near-Surface Soil Sampling*

Surface and near-surface soil samples will be collected at all drilling locations from unpaved areas without visual evidence of soil disturbance for laboratory analysis to include PFAS, TOC, pH, VOCs, and 1,4-dioxane. Surface and near-surface soil samples will be collected for laboratory analysis from all drilling locations for laboratory analysis to evaluate potential historic areal deposition.

Surface and near-surface soil samples will also be collected from beneath the roof driplines at up to ten locations near the Site for PFAS, TOC, pH, VOC, and 1,4-dioxane analyses.

Locations will be selected in coordination with NYSDEC :

- In the four cardinal compass directions from the Site and to the northeast of the Site (as northeast is the presumed prevailing wind direction);
- Close to the river in the northerly direction along Water Street or the Hoosic River Greenway

- Within approximately 1500 feet of the Site; 1500 feet being the approximate farthest distance from the Site to the Hoosic River in the north-northwesterly direction; and
- On the east/south side of the Hoosic River (same side as Site)

Other criteria for selection of locations will be:

- Buildings in place since at least the 1950s/1960s with roofing material estimated or known to be from the same time period, or older
- Soil at the dripline that shows no evidence or reworking or excavation, based on visual observations, interviews, and/or aerial photo review
- No evidence of irrigation with Village water
- No evidence of dumping

Information will be obtained from historical aerial images, property records, property owner interviews, visual inspection of location conditions, etc.

Proposed locations that meet the criteria will be provided to NYSDEC for review. Upon NYSDEC approval of the locations, efforts will be made to contact the property owners to obtain permission to sample. If access cannot be obtained for a specific location(s), the assistance of NYSDEC will be requested to help obtain property access permission or select an alternate location. Good-faith efforts will be made to select and obtain access for ten locations that meet the selection criteria.

3.3.7 *Subsurface Soil Sampling*

Subsurface soil samples will be collected for laboratory analyses from all drilling locations at various depth intervals (Table 2) that may include:

Top of each major stratigraphic layer

- Surficial sand aquifer:
  - Immediately above the water table.
- Glacio-lacustrine aquitard;
- Buried sand aquifer; and
- Till layer when present.

If encountered:

- Top of the native soil at the fill/native soil interface
- Mottled zones (encompassing the total thickness of the observed mottling)
- Subjectively impacted soils (based on visual, olfactory, or other field screening observations).

3.3.8 *Groundwater Sampling*

Two semi-annual groundwater sampling events will be performed; one in the Spring and one in the Fall. Groundwater samples will be collected from all on- and off-site monitoring wells associated with the Site using low-flow well purging/sample collection techniques. All samples will be analyzed in accordance with Table 2. Based on those results, future monitoring requirements and frequencies will be considered.

3.3.9 *Sample Analysis*

The laboratory analysis of samples collected during the RI will be as specified in Table 2 and performed by NYSDOH-approved environmental laboratories using analytical methods consistent with the methods outlined in the QAPP (Appendix C).

The laboratory analytical report will contain NYSDEC Analytical Services Protocol (ASP) Category B deliverables to facilitate data validation or usability evaluation. Electronic data deliverables (EDDs) will also be provided by the project laboratory.

3.3.10 *Hydrogeological Evaluation*

Water level monitoring and aquifer testing will be performed to evaluate hydrogeological conditions in the unconsolidated upper and lower sand units (overburden) and shallow bedrock at Site.

The goals of the hydrogeological evaluation task are to:

- Measure water levels and calculate groundwater elevations for each well location;
- Calculate horizontal hydraulic gradients in the upper and lower sand units and shallow bedrock;
- Calculate vertical hydraulic gradients between the upper and lower sand units and shallow bedrock at each well cluster;
- Obtain a range of hydraulic conductivity values for the upper and lower sand units, and shallow bedrock;
- Estimate a range of transmissivity values for the unconsolidated upper and lower sand units, and shallow bedrock;
- Estimate a range of groundwater flow rates for the unconsolidated upper and lower sand units, and shallow bedrock; and
- Evaluate potential bedrock fracture interconnectivity between bedrock well locations.

Initial hydrogeological evaluation methods include both water level gauging events and single well aquifer slug tests. The data collected from the slug tests will be reduced and analyzed using: 1) the aquifer test analysis software program Aqtesolv™, and 2) analytical methods set forth by Bouwer and Rice (1976, 1989).

If it is determined in the future that further hydrogeological studies are needed, pump testing of test wells would be considered contingent upon procuring an approval from the Village of Hoosick Falls and NYSDEC to discharge treated pump testing effluent to the municipal sewer system. Pump testing effluent would be contained and/or treated, and subsequently released to the municipal sewer upon NYSDEC approval.

3.3.11 *Contingency Plan*

If unknown containers, drums, underground storage tanks, or other previously unidentified sources of potential contaminants are discovered during subsurface intrusive activities, work activities will be suspended until NYSDEC is notified and properly trained personnel are mobilized to address the condition. An exclusion zone will be set up immediately around the work area to control access.

If grossly contaminated media is identified during these investigations, the information will be communicated to the NYSDEC's field representative, or if a NYSDEC field representative is not present, verbally by phone to the NYSDEC's Project Manager. Reportable quantities of petroleum product will also be reported to the NYSDEC Spill Hotline (800-457-7362).

3.3.12 *Data Usability*

Data usability will be evaluated following procedures for the preparation of Data Usability Summary Reports (DUSRs) for all samples. The usability evaluation will be performed consistent with NYSDEC guidance contained in DER-10 Appendix 2B (NYSDEC, 2010a). The results of the data usability evaluation will be presented in an Electronic Data Summary consistent with the requirements of DER-10 Section 3.14.

3.3.13 *Qualitative Human Health Exposure Assessment*

A Qualitative Human Health Exposure Assessment will be completed to meet the substantive requirements of DER-10 paragraph 3.3(c) 4 and Appendix 3B using available data collected during SC and RI activities.

The qualitative exposure assessment will identify populations potentially or currently exposed and describe the reasonably anticipated future land use of the properties. The exposure assessment will evaluate the following elements associated with exposure pathways and describe how each of these elements pertains to the site being evaluated.

1) Source of Contamination - a description of the contaminant source(s) including the location of the contaminant release to the environment or if the original source is unknown, the contaminated environmental medium at the point of exposure;

2) Environmental Media & Transport Mechanisms - an explanation of the contaminant release and transport mechanisms to the exposed population;

3) Point of Exposure - identification of potential exposure point(s) where actual or potential human contact with a contaminated medium may occur;

4) Route of Exposure - description(s) of the route(s) of exposure (i.e., ingestion, inhalation, dermal absorption); and

5) Receptor Population - a characterization of the receptor populations who may be exposed to contaminants at a point of exposure.

The results of the assessment will be summarized to provide an overview of the affected environmental media/exposure route and corresponding current and potential human exposure assessment to those media.

3.3.14 Ecological Resources Assessment

Ecological resources include flora and fauna and the habitats (natural or human-made) that support them, excluding such biota as pets, livestock, agricultural and horticultural crops.

The NYSDEC's decision key contained in Appendix 3C of DER-10 will be utilized to evaluate if a Fish and Wildlife Resources Impact Analysis (FWRIA) is needed. If a FWRIA is required in accordance with Appendix 3C, the analysis will be performed consistent with DER Section 3.10.

The results of the ecological resources assessment will also be used to evaluate whether or not the Protection of Ecological Resources SCOs may be applicable.

3.4 RI REPORT

A Draft RI Report will be prepared at the completion of the RI scope of work. It will present a summary of all historical investigative findings, combining the results of the SC, the IRM PDI and subsequent RI activities to satisfy the requirements of DER-10 Section 3.14. The RI Report will include comparison of the soil, sediment, groundwater and surface water analytical data to relevant Standards, Criteria and Guidance. The RI Report will summarize areas of concern, identify potential exposure pathways, and recommend additional work, if necessary.

3.5 PROGRESS REPORTING

Written monthly progress reports (MPR) will continue to be submitted to the NYSDEC by the tenth day of each month and continuing until termination. The MPRs will include actions, including approved modifications, e.g., changes in work scope and/or schedule relative to the RI during the reporting period, and those actions anticipated for the next reporting period.

4.0 PROJECT SCHEDULE

An estimated project schedule is presented in Table 3.

5.0 REFERENCES CITED

Bierman, P. and Dethier, D., 1986. Lake Bascom and the deglaciation of Northwestern Massachusetts. Northeastern Geology, (1/2): 32-4.

Bouwer, H. and R.C. Rice, 1976. A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells. Water Resources Research, V. 12, pp. 423-428.

Bouwer, Herman, 1989. The Bouwer and Rice Slug Test - An Update. Ground Water, Vol. 27, No. 3. May-June, 1989.

Cadwell, D.H. and Dineen, R.J., 1987. Surficial Geologic Map of New York: Hudson-Mohawk Sheet. New York State Museum and Science Service, Map and Chart Series Number 40, Albany.

CHA, 2006. Water System Improvements – Preliminary Engineering Report, Village of Hoosick Falls, Rensselaer County, New York. Cough Harbor and Associates, Albany.

CRA, 1986a. Site Investigation – River Road Plant Site, Oak Materials Group Inc., Hoosick Falls, New York. Conestoga Rovers & Associates.

CRA, 1987b. Summary of Copper Sludge Evaluation. Conestoga Rovers & Associates.

CRA, 1987c. Thallium Investigation, River Road Plant Site, Oak Materials Group Inc., Hoosick Falls, New York. Conestoga Rovers & Associates.

CT Male, 2015. Preliminary Investigation at McCaffrey Street Facility, Village of Hoosick Falls, Rensselaer County, New York. C.T. Male Associates.

EDR, 2016. EDR Radius Map™ Report with GeoCheck® for River Road Complex, 21410-12 NY 22, Hoosick Falls, New York (p. 39, 195 and 327).

ERM, 2016a. Final Site Characterization Field Sampling and Analysis Plan – Phase 1: Oak Materials – River Road 1, 2 and 3 (No. 442008) and Former Oak Materials Fluorglas Division – John Street (No. 442049): Town of Hoosick and Village of Hoosick Falls, Rensselaer County, New York. ERM Consulting and Engineering, Inc., Syracuse, 20 July 2016.

ERM, 2016b. Memorandum on Additional Phase 1 Site Characterization: Oak Materials – River Road 1, 2 and 3 (No. 442008) and Former Oak Materials Fluorglas Division – John Street (No. 442049): Town of Hoosick and Village of Hoosick Falls, Rensselaer County, New York. ERM Consulting and Engineering, Inc., Syracuse, 19 October 2016.

ERM, 2017. Soil Vapor Intrusion Investigation Report: Former Oak Materials Fluorglas Division-John Street, Village of Hoosick Falls, Rensselaer County, New York. ERM Consulting and Engineering, Inc., July, 2017.

ERM, 2018. Shallow Groundwater Interim Remedial Measure Pre-Design Investigation & Treatability Study Work Plan: Oak Materials Fluorglas

Division – John Street (No. 442049): Village of Hoosick Falls, Rensselaer County, New York. ERM Consulting and Engineering Inc., 19 December 2018.

ERM, 2019. Shallow Groundwater Interim Remedial Measure Work Plan: Oak Materials Fluorglas Division – John Street (No. 442049): Village of Hoosick Falls, Rensselaer County, New York. ERM Consulting and Engineering Inc., 21 June 2019.

HON, 2016. Records Search Report: Oak Materials – River Road 1, 2 and 3 (No. 442008) and Former Oak Materials Fluorglas Division – John Street (No. 442049). Honeywell, 1 July 2016.

NJDEP, 2007. Determination of Perfluorooctanoic Acid (PFOA) in Aqueous Samples: Final Report. NJDEP Division of Water Supply, Trenton, January 2007.

NYSDEC, 1987. Inactive Hazardous Waste Disposal Report, Oak Materials, River Road, Hoosick Falls, New York. New York State Department of Environmental Conservation, Division of Hazardous Waste Remediation.

NYSDEC, 1991. Notification of Deletion from Registry of Inactive Hazardous Waste Disposal Sites. Letter from New York State Department of Environmental Conservation, Division of Hazardous Waste Remediation, to Oak Materials Group. August 22.

NYSDEC, 1992. Sampling Guidelines and Protocols: Technologies Background and Quality Control/Quality Assurance for the NYSDEC Spill Response Program. Division of Spills Management, Albany, September 1992.

NYSDEC, 1994. Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites (FWIA). Division of Fish and Wildlife, Albany, October 1994.

NYSDEC, 1998. Technical and Operational Guidance Series (TOGS) Memorandum 1.1.1 - Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations. Division of Water, Albany, re-issued June 1998.

NYSDEC, 2006. Soil Cleanup Objectives (SCOs) Title 6 Official Compilation of New York Codes, Rules and Regulations (6 NYCRR) Subpart 375-6.8.

NYSDEC, 2010a. DER-10: Technical Guidance for Site Investigation and Remediation. NYSDEC Division of Environmental Remediation, Albany, May 2010.

NYSDEC, 2010b. Water Wells – KML/KMZ File Format. Bureau of Water Resource Management, Albany, 12 December 2010.

NYSDEC, 2014. Screening and Assessment of Contaminated Sediment. Division of Fish, Wildlife, and Marine Resources, Albany, 24 June 2014.

NYSDEC, 2016a. Order on Consent and Administrative Settlement Index Number CO 4-20160415-79: Oak Materials Fluorglas Division – John

Street (No. 442049) and Oak Materials – River Road 1, 2 and 3 (No. 442008). Division of Environmental Remediation, Albany, 3 June 2016.

NYSDEC, 2016b. Order on Consent and Administrative Settlement, Index No. CO 4-20160212-18 for Saint-Gobain McCaffrey Street (DEC Site No. 442046 and Saint-Gobain Liberty Street Site (DEC Site No. 442048).

NYSDEC, 2016c. Letter from NYSDEC to Mayor, Hoosick Falls, and Supervisor, Hoosick, regarding sampling conducted by NYSDEC, dated July 22.

NYSDEC, 2016d. Class A-D Fresh Surface Waters Title 6 Official Compilation of New York Codes, Rules and Regulations (6 NYCRR) Subpart 701.2-9. New York State Department of Environmental Conservation, June 2016.

NYSDOH, 2016. Updated Map of Testing Results, August 3, 2016. New York State Department of Health. http://www.villageofhoosickfalls.com/Water/Documents/NYSDOH-TestingResultsMap-08092016.png

Parsons, 1995. Draft Phase I Environmental Site Assessment - Allied Fluorglas River Road Manufacturing Facility, Hoosick Falls, New York. Parsons Corporation.

Parsons, 1996a. Final Phase I Environmental Site Assessment: AlliedSignal Fluorglas, McCaffrey Street Manufacturing Facility, Hoosick Falls, NY. May. Parsons Corporation.

Parsons, 1996b. Final Phase II Environmental Site Assessment: Furon Company McCaffrey Street Manufacturing Facility, Hoosick Falls, New York. May. Parsons Corporation.

Parsons, 1996c. Final Phase II Environmental Site Assessment Furon Company Liberty Street Manufacturing Facility, Hoosick Falls, New York. Parsons Corporation.

Potter, D.B., 1972. Stratigraphy and Structure of the Hoosick Falls Area, New York-Vermont, East-Central Taconics. New York State Museum and Science Service, Map and Chart Series Number 19, Albany.

Ramboll, 2016. Saint-Gobain performance Plastics McCaffrey Street Facility, Hoosick Falls, New York. Site Sampling Results. February 4. Ramboll Environ, Inc.

USDA, 1987. Natural Resources Conservation Service Soil Survey of Rensselaer County, New York. United States Department of Agriculture.

USDA, 2017. Natural Resources Conservation Service Web Soil Survey for Rensselaer County, New York. United States Department of Agriculture.

USEPA, 1996. Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures. United States Environmental Protection Agency (USEPA), Office of Research and Development. EPA/540/S-95/504.

USEPA, 2001. Sediment Sampling. Technical Standard Operating Procedure (SOP) No. SRC-OGDEN-04 (Revision No. 0): Syracuse Research Corporation, ESC-DVO, 14 June 2001, 8 pp. United States Environmental Protection Agency (USEPA).

USEPA, 2009. Perfluorocarboxylic Acid Content in 116 Articles in Commerce. United States Environmental Protection Agency (USEPA), Office of Research and development. EPA/600/R-09/033, March 2009.

USEPA, 2015. Field Equipment Cleaning and Decontamination at the FEC (Field Equipment Center): Operating Procedures. SESDPROC-206-R3, USEPA Science and Ecosystem Support Division, Region 4, Athens (CLASS GA), December 2015.

USEPA, 2016a. Notice of the Current Proposed National Priorities List (NPL) Rule. Proposed listing of the McCaffrey Street facility on the NPL. 18 FR 62428, 9 September 2016. United States Environmental Protection Agency.

USEPA, 2016b. Hoosick Falls Update: EPA Results Show Ballfields & Athletic Field OK to Use. Community Update No. 3. April. United States Environmental Protection Agency https://www.epa.gov/sites/production/files/2016-04/documents/hoosick_falls_fact_sheet_no_3.pdf

USEPA, 2016c. Hoosick Falls Update: Results from 34 Locations Show No Soil Cleanup Needed at Residential Properties, Football & Recreational Fields. Community Update No. 5, September. United States Environmental Protection Agency. https://www.epa.gov/sites/production/files/2016-09/documents/hoosickfalls_factsheetno5_nearmccaffreystresults_final_v2_0.pdf

USEPA, 2016d. HRS Documentation Record – Saint-Gobain Performance Plastics. EPA ID No. NYD004986741. United States Environmental Protection Agency, September. https://semspub.epa.gov/work/02/363676.pdf

USEPA, 2016e. Lifetime Health Advisories and Health Effects Support Documents for PFOA and PFOS. 18 FR 3325, May 2016. United States Environmental Protection Agency.

USEPA, 2016f. Statement on Private Wells in The Town of Hoosick and Village of Hoosick Falls, NY. United States Environmental Protection Agency, January 28, 2016.

USEPA, 2017a. National Functional Guidelines for Organic Superfund Methods Data Review. United States Environmental Protection Agency Office of Superfund Remediation and Technology Innovation, January 2017.

USEPA, 2017b. National Functional Guidelines for Inorganic Superfund Methods Data Review. United States Environmental Protection Agency Office of Superfund Remediation and Technology Innovation, January 2017.

USEPA, 2017c. Environmental Protection Agency National Priorities Lists. Final Rule. Saint-Gobain Performance Plastics. Federal Register, Vol. 82, No. 148, Thursday, August 3, 2017, p. 36095-36100. https://www.gpo.gov/fdsys/pkg/FR-2017-08-03/pdf/2017-16172.pdf

Village of Hoosick Falls, 2017. Data from the Hoosick Falls Public Water System from individual supply wells and combined water prior to carbon treatment from the period between 2-Oct-2014 and 3-Nov-2016. Website accessed 25-May-2017. http://www.villageofhoosickfalls.com/Water/testing.html

Weston Solutions, 2016. Project Note to Saint-Gobain Performance Plastics File, Subject: Village Well Information; with attached references. Weston Solutions, Inc., June 6, 2016, 82 pp.

FIGURES

LIST OF FIGURES

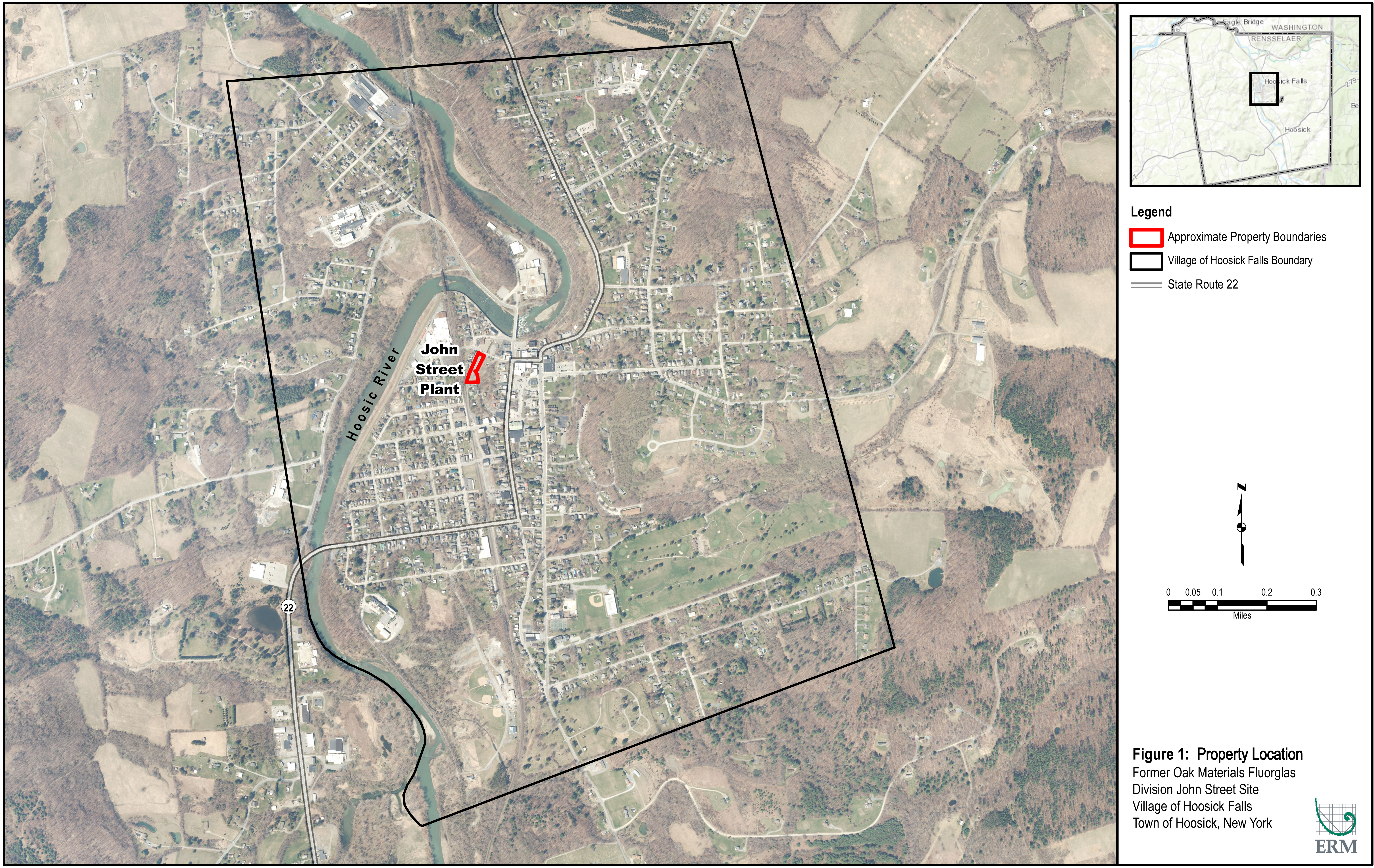


Figure 1: Property Location

Former Oak Materials Fluorglas
Division John Street Site
Village of Hoosick Falls
Town of Hoosick, New York

ERM

Q:\Team\DMM\Clients_A_E\ArnoldandPorter\HoosickFalls\MXD\SC Report\JohnSt_Revision\Figure1_PropertyLocations_20180921.mxd - Dana.Heusinkveld - 10/3/2018

Legend

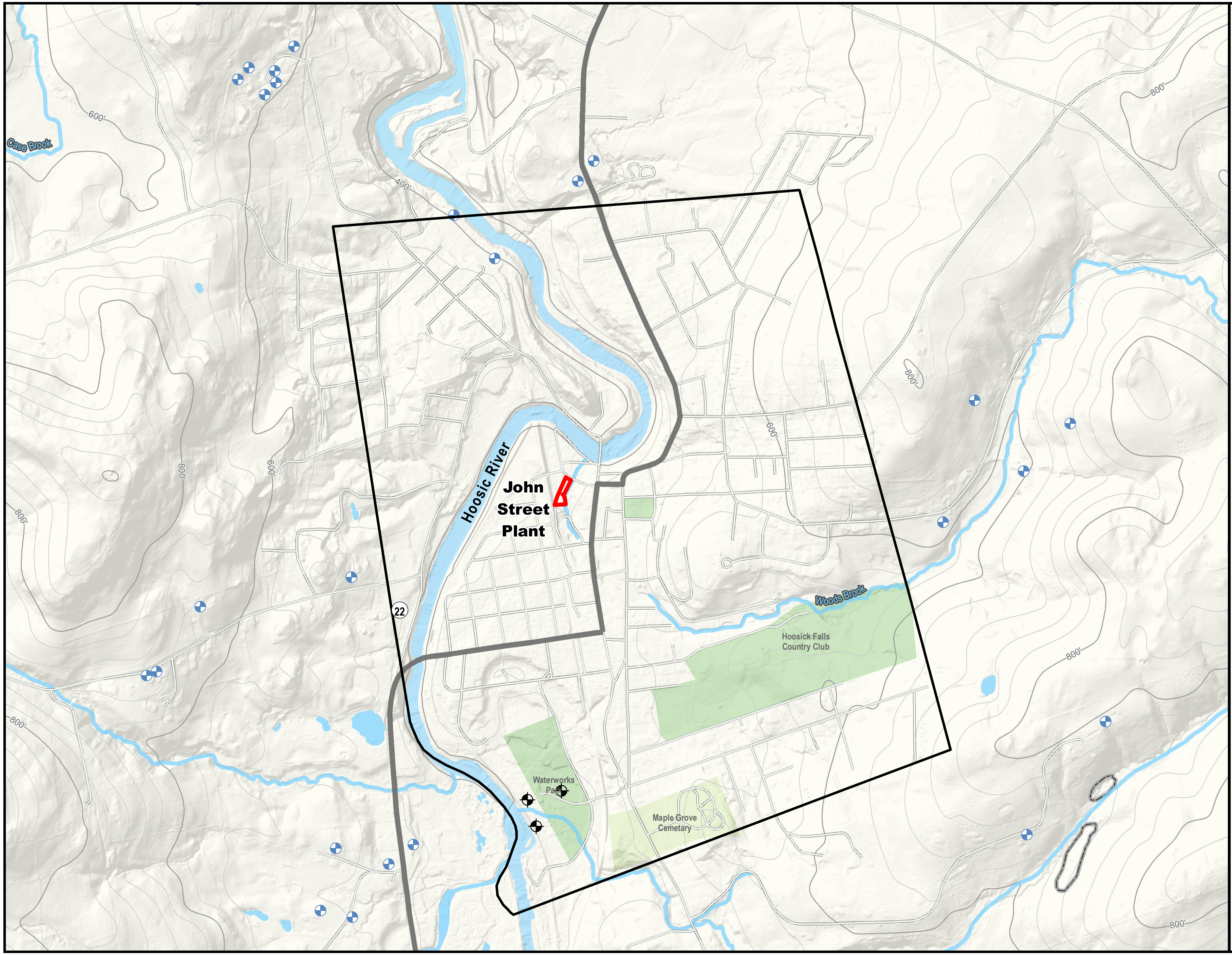
🟥 Approximate Site Boundary
⬛ Village of Hoosick Falls Boundary
🟦 Waterbody
▨ Hoosick Town Boundary
— Elevation Contours (10 foot)
— Elevation Contours (2 foot)

Figure 2: Site Layout

Former Oak Materials Fluorglas
Division John Street Site
Village of Hoosick Falls, NY

ERM

Q:\Team\DMMV\Clients_A_E\ArnoldandPorter\HoosickFalls\MXD\Soil_IRM\Figure2_SiteLayout_20170717.mxd - brett.shaver - 7/17/2017



Legend

- ⯐ Village of Hoosick Falls - Municipal Well Locations
- ◐ DEC-Reported Water Supply Wells
- 🟦 Surface Water
- Stream (NHD)
- 🟥 Approximate Property Boundaries
- ☐ Village of Hoosick Falls Boundary
- State Route

NOTES:
1. Stream data obtained from the National Hydrology Database (NHD) and digitized from 2014 New York State orthoimagery.

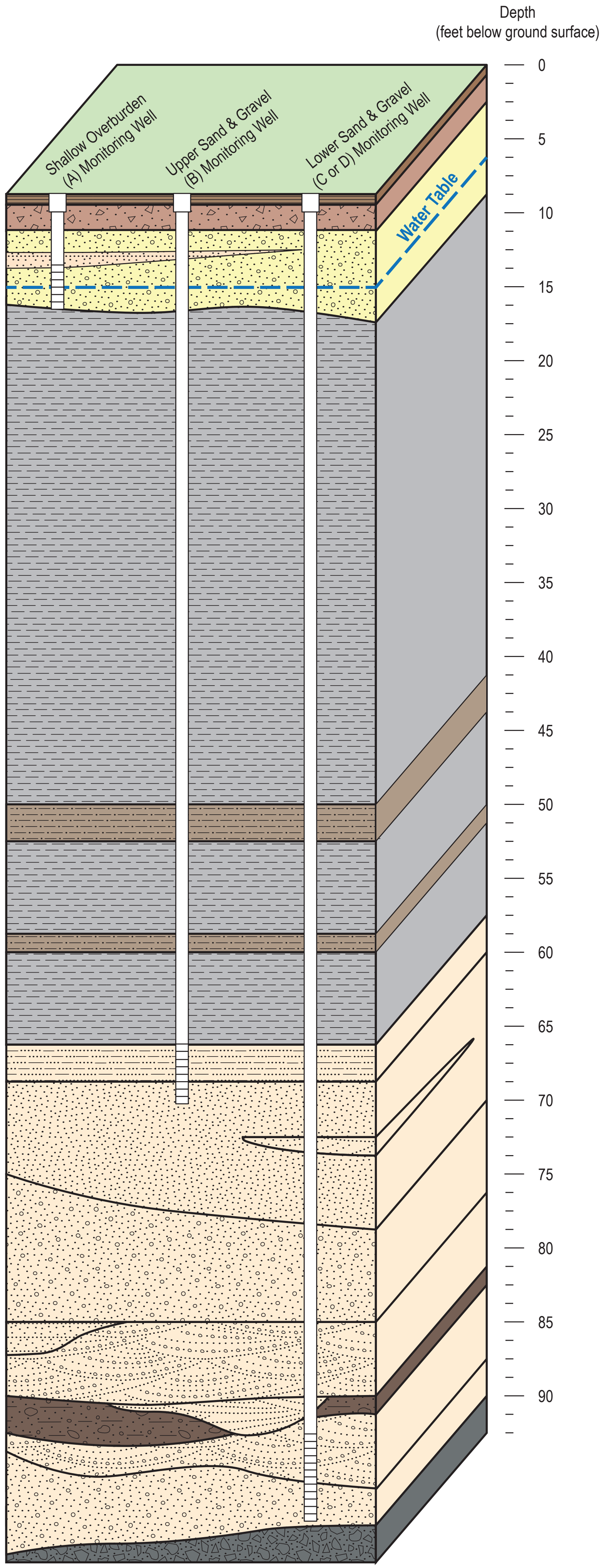
Figure 3: Site Topography and Hydrology
Former Oak Materials Fluorglas
Division John Street Site
Village of Hoosick Falls, NY

ERM

Q:\Team\DMMV\Clients_A_E\ArnoldandPorter\HoosickFalls\MXD\SC Report\JohnSt_Revision\Figure2_PotableWater_Topo_20180921.mxd - Dana.Heusinkveld - 9/21/2018

John Street Section

Hydrogeological Unit	***Geological Unit*** [1]	***Lithology (Thickness)***
Shallow Overburden	Fill	Soil (0 - 1')
		Fill: Mixed Sand & Gravel (0 - 8') Fine to coarse angular gravel in sand and silt matrix. Brick and metal debris present.
	Alluvium (al)	Interbedded Sand & Gravel (1 - 9.8') Fine to medium subangular gravels in sand and silt matrix. Thin interbeds of silt and clay.
Confining Unit	Lacustrine Silt & Clay (lsc)	Clay (5.9 - 66.7') Thinly laminated clay, plastic with variable silt content. Thin to medium silt interbeds common in lower third of unit, trace fine sand.
Sand & Gravel	Outwash Sand & Gravel (og)	Fine Silty Sand (0.5 - 7.5') Thinly laminated, silty fine lithic sand, well sorted.
		Sorted Sand (1 - 15.5') Fine to coarse lithic sand with trace fine gravel.
		Interbedded Gravel & Sand (3.5 - 34') Fine to medium lithic sand with thin sandy silt interbeds. Basal fine to coarse gravel, sub-rounded lithic clasts and sand matrix.
	Till (t)	Diamict (0 - 5') Subangular gravel in silt and clay matrix.
	Outwash Sand & Gravel (og)	Interbedded Gravel & Sand (0 - 9') Fine to coarse gravel and cobbles with lithic sand and silt matrix. Thin zones of sorted lithic sands. Increasing slate/phyllite fragments with depth.
		Weathered Bedrock (0 - 5.2') Slate/phyllite fragments with fine sand and silt matrix.



Notes:

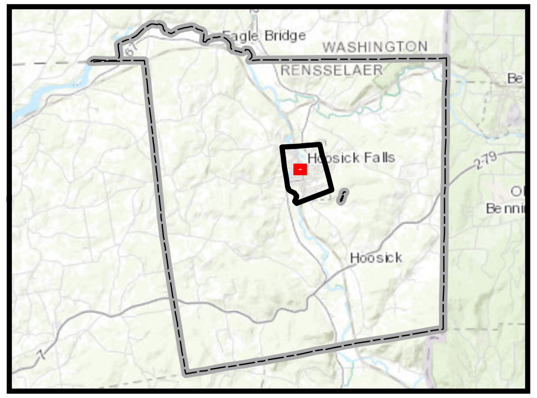
1 - Except for fill, geological unit nomenclature is from the Surficial Geologic Map of New York, Hudson-Mohawk Sheet (Caldwell and Dineen, 1987).

2 - Lithological descriptions, thickness ranges, and approximate water table elevations are from ERM's on-site boring logs.

Explanation

- ▨ Soil
- ▨ Silt
- ▨ Previously Disturbed Gravel & Debris
- ▨ Lower Sand and Gravel
- ▨ Upper Sand and Gravel
- ▨ Diamict
- ▨ Clay
- ▨ Weathered Bedrock
- Monitoring Well Riser
- Monitoring Well Screen Interval

Figure 4: Typical Stratigraphic Section
Former Oak Materials Fluorglas Division
John Street Site
Village of Hoosick Falls, NY



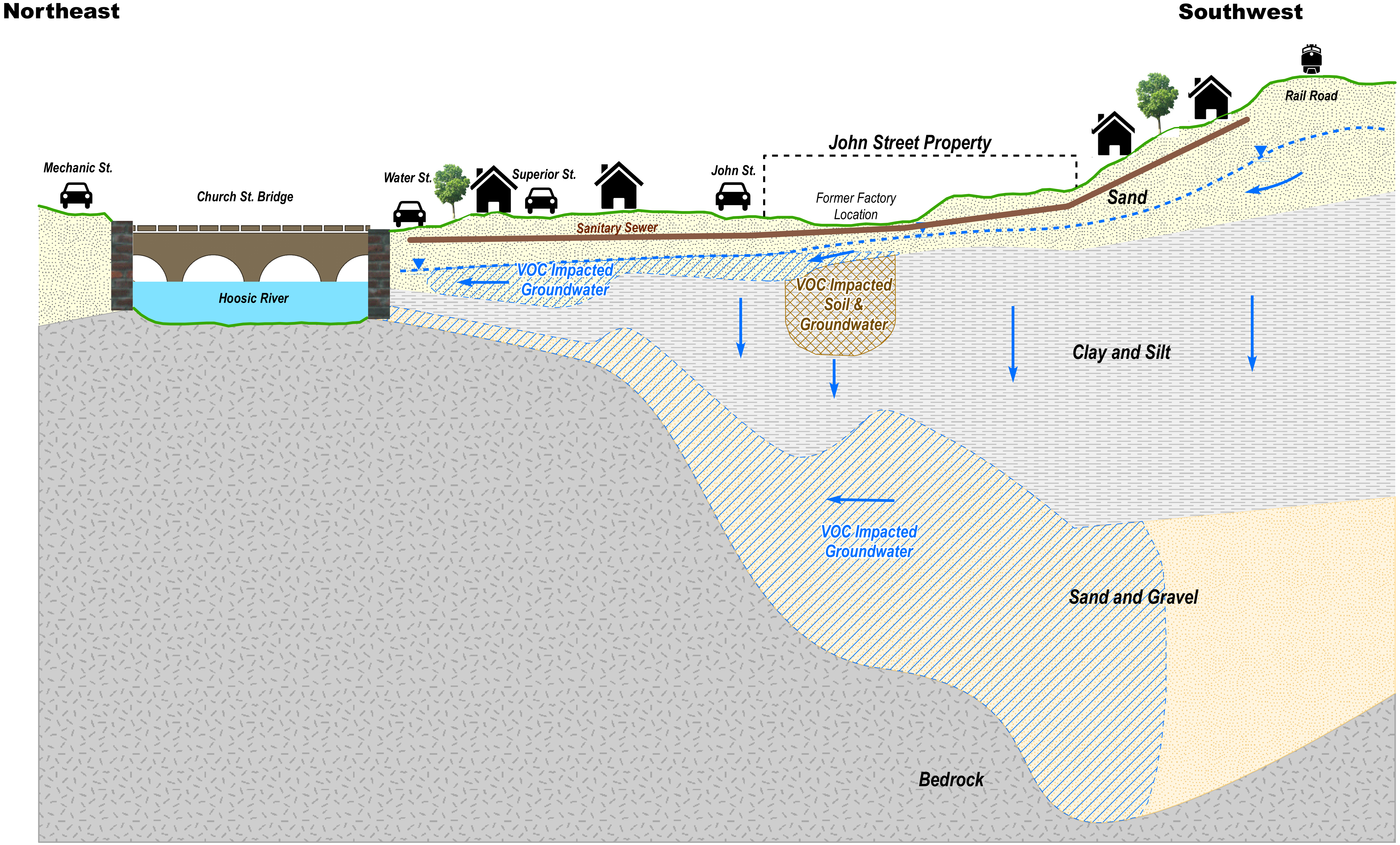
Legend

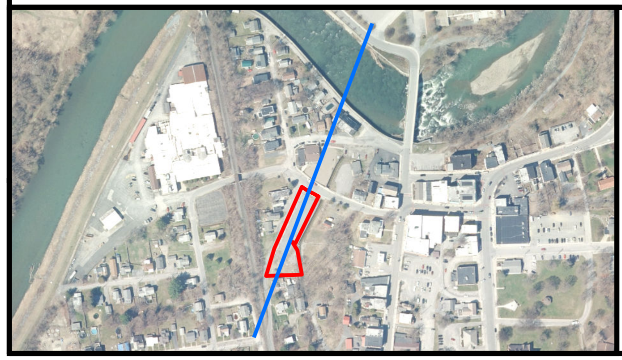
- ⌖ Monitoring Well Location
- 🔷 Surface Water / Sediment Location
- 🟧 Surface Soil Sample Location
- ⬢ Soil Vapor Location
- 🟨 Soil Boring Location
- 🟪 Advanced Profiling System (APS) Location
- ▭ Approximate Property Boundary

Figure 5: Site Characterization Sample Locations
Former Oak Materials Fluorglas Division John Street Site
Village of Hoosick Falls, NY

ERM

Q:\Team\DMMV\Clients_A_E\ArnoldandPorter\HoosickFalls\MXD\SC Report\JohnSt_Revision\Figure4_JS_SC_SampleLocations_20180921.mxd - Dana.Heusinkveld - 10/3/2018





Legend

— Ground Surface
→ Inferred Groundwater Flow Direction
- - Water Table Line

VOC Impacted Areas

▨ VOC Impacted Groundwater
▨ VOC Impacted Soil

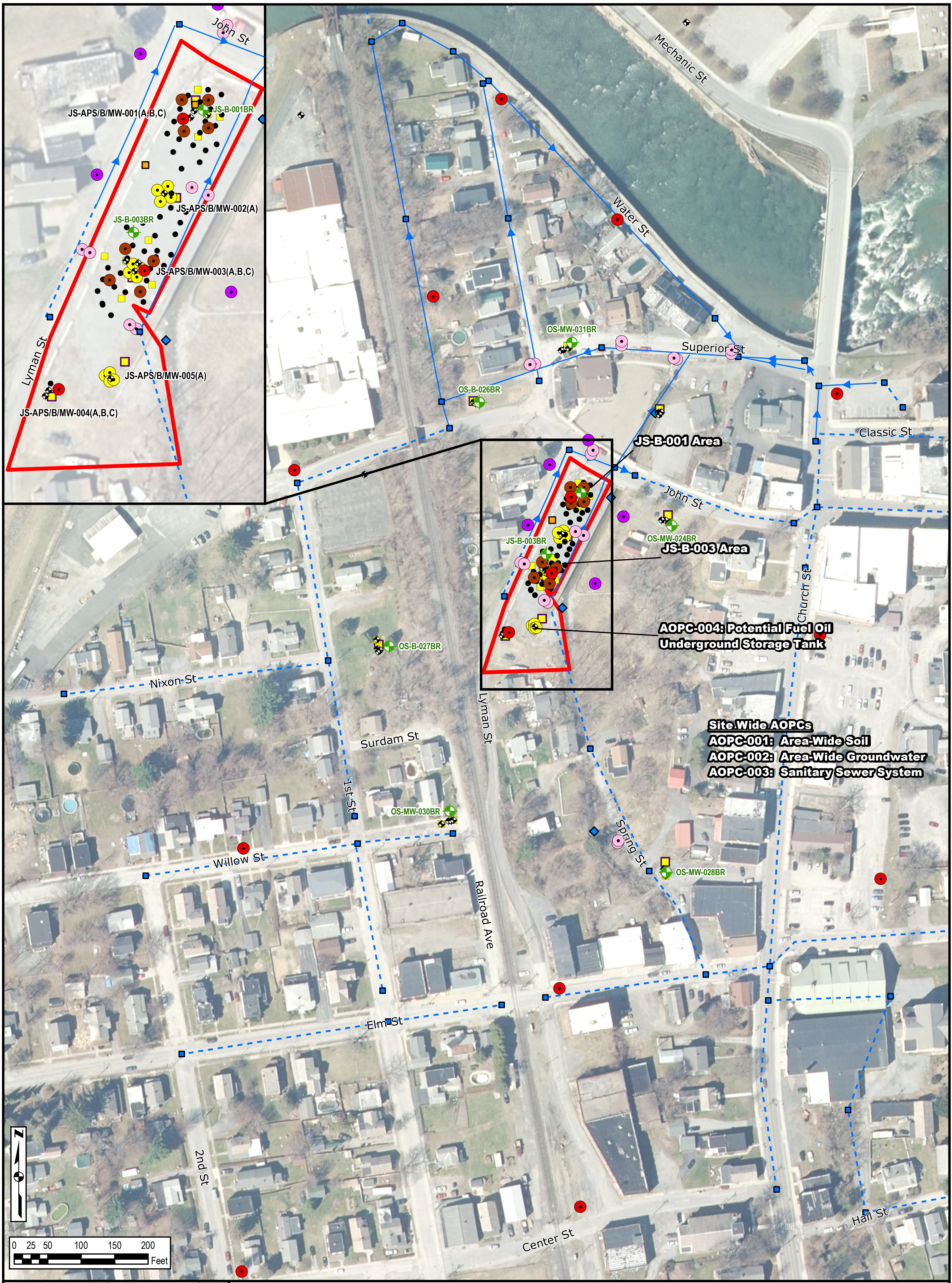
Geology Type

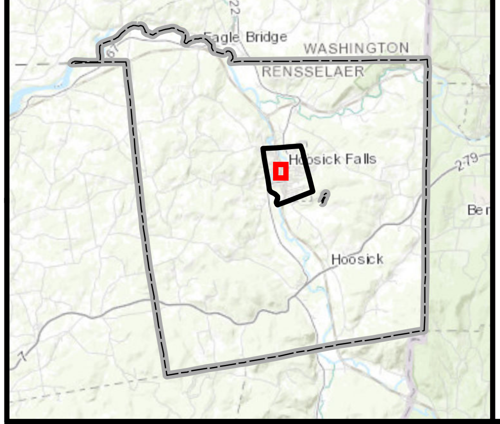
▨ Lower Sand and Gravel
▨ Clay and Silt
▨ Upper Sand and Gravel
▨ Bedrock
▨ Water

Figure 6: Conceptual Site Model

Former Oak Materials Fluorglas
Division John Street Site
Village of Hoosick Falls, NY

Q:\Team\DMMV\Clients_A_E\ArnoldandPorter\HoosickFalls\MXD\RI_WorkPlan\JohnSt\Workplan_Figures\Figure6_CSM_JohnStreet_20190405.mxd - Caldwell.Payne - 4/5/2019





▭ Approximate Property Boundary
■ Approximate Manholes
→ Sewer Lines from detailed CAD Drawing
- - Approximate Sewer Lines

Existing Locations:

⊕ Monitoring Well Location
◆ Surface Water / Sediment Location
■ Surface Soil Sample Location
⊕ Bedrock Well Location
■ Advanced Profiling System (APS) Location

■ Soil Boring Location
● IRM Soil Boring Location
⊙ DEL Soil Boring Location
⊙ Sanitary Sewer Soil Boring Location

Proposed Locations:

⊙ Proposed Overburden Wells
⊙ Proposed Shallow Soil Boring/Temporary Well
⊙ Proposed Shallow and Deep Soil Boring / Temporary Well

Figure 7: Areas of Potential Concern and RI Sample Locations
Former Oak Materials Fluorglas Division
John Street Site
Village of Hoosick Falls, New York

ERM

Q:\Team\DMMV\Clients_A_E\ArnoldandPorter\HoosickFalls\MXD\RI_WorkPlan\JohnSt\Workplan_Figures\Figure7_JohnSt_AOPC_Locations_20190405.mxd - Caldwell.Payne - 4/5/2019

TABLES

LIST OF TABLES

Table 1
Areas of Potential Concern (AOPC) - Descriptions and Recommendations
Former Oak Materials Fluorglas Division - John Street

Location and Description		Recommendation
AOPC-01: Area-Wide Soil		
AOPC-01a Copper at JS-B-005	Copper was detected at JS-B-005 above the Commercial Use SCO in surface soil. This location is south of the footprint of the former John Street building. The extent appears to be limited since copper concentrations were less than the Residential Use SCO in near surface soil at JS-B-005 and all other on- and off-site surface and near surface soil samples. Dimensions: Estimated to be less than 10 ft by 10 ft by 0.5 ft based on available information. Source is unknown.	Collect additional soil samples during the RI to delineate the vertical and horizontal extent of copper impacts in soil.
AOPC-01b Nickel at JS-B-003	Nickel was detected at JS-B-003 above the Commercial Use SCO in near surface soil. This location is within the footprint of the former John Street building. The extent appears to be limited since the nickel concentration was less than the Residential Use SCO in surface soil at JS-B-003 and all other on- and off-site soil samples. Dimensions: Estimated to be less than 10 ft by 10 ft by 0.5 ft based on available information. Source is unknown.	
AOPC-01c Copper at JS-B-002	Copper was detected at JS-B-002 above the Commercial Use SCO in soil at 6 to 8 feet bgs. This location is within the footprint of the former John Street building. The extent appears to be limited since the copper concentration was less than the Residential Use SCO at 9 to 10 and 60 to 64 ft bgs at JS-B-005 and all other on- and off-site subsurface soil samples. Dimensions: Estimated to be less than 10 ft by 10 ft by 2 ft based on available information, Source is unknown.	
AOPC-01d PFAS in on-site and off-site soil	PFOA concentrations ranged from below the detection to 9.8 µg/kg in on-site soil and 5.1 µg/kg in off-site soil. PFOA was detected at one or more depth intervals at all on-site and off-site sampling locations, but with no exceedances of the USEPA screening value of 1,000 µg/kg for the sum of PFOA plus PFOS. Dimensions: 4.7 acres (bounded by detections in off-site boring locations OS-MW-024, -025, -026, -027, and -028). Source is unknown.	Collect additional soil samples during the IRM Pre-Design Investigation and RI to delineate the vertical and horizontal PFAS in surface, near surface and subsurface soil. Collect surface and near-surface soil samples beneath the roof driplines at off-site locations near the John Street property.
AOPC-01e CVOCs at on-site soil	TCE was detected in on-site soil above the Industrial Use SCO at JS-B-003 at 15 to 17 ft bgs and above the Commercial Use SCO at JS-B-001 at 18 to 19 and 60 to 64 ft bgs. TCE and several other CVOCs were detected in groundwater above NYSDEC GA criteria and above the Protection of Groundwater SCO in soil samples from JS-B-001, -002, -003, -006, -007, -008, -009, and -012. Dimensions: Less than 0.3 acres (bounded by borings JS-B-001, -002, -003, -006, -008, -009, and -012). Source is unknown.	Collect additional soil samples from soil borings during IRM Pre-Design Investigation and RI to delineate the extent of CVOC impacts to soil.
AOPC-01f SVOCs in soil	Two PAHs, benzo(a)pyrene and dibenzo(a,h)anthracene, were detected above the Industrial Use SCO for soil in one near-surface soil sample JS-B-004 (2 to 12-inch) and two PAHs, benzo(a)anthracene and benzo(b)fluoranthene, were detected above the Commercial Use SCO in the same soil sample. This location is near the Lyman Street in an area that has been used for parking and may be related to asphalt and/or automotive fuel or emissions. Dimensions: Estimated to be less than 10 ft by 10 ft by 1 ft based on available information. This location is near the Lyman Street in an area that has been used for parking and may be related to asphalt and/or automotive fuel or emissions.	No further action
AOPC-01g Cyanide, PCBs, Pesticides, and metals (except copper and nickel)	No exceedances of cyanide, PCBs, pesticides, and metals (except copper and nickel) observed in on- or off-site soil samples.	No further action
AOPC-02: Area-Wide Groundwater		
AOPC-02a PFAS in on-site and off-site groundwater	PFOA has been detected in all groundwater samples with concentrations ranging form 130 ng/L to 6400 ng/L. Dimensions: 5.8 acres (bounded by detections in off-site monitoring well locations OS-MW-024, -025, -026, -027,-028, -030 and -031. Possibly related to use of PFAS at the former John St facility.	Install shallow bedrock and additional overburden monitoring wells during the RI and collect groundwater samples to delineate the vertical and horizontal extent of PFAS.
AOPC-02b CVOCs in on-site and off-site groundwater	CVOCs including TCE and 1,1,1-TCA have been detected in on-site and off-site groundwater at concentrations that exceed NYS GA criteria. Dimensions: Approximately 1.3 acres in shallow groundwater (bounded by the site and monitoring wells OS-MW-024A and OS-MW-031A); approximately 2.2 acres in overburden groundwater below the silt/clay layer (bounded by the site and monitoring wells OS-MW-024B, -25B, -025C, -026B, and -031B). Source is unknown.	Install shallow bedrock and additional overburden monitoring wells during the RI and collect groundwater samples to delineate the vertical and horizontal extent of PFAS. Perform Soil Vapor Intrusion (SVI) evaluations at properties located downgradient of the John St site. Select and implement an Interim Remedial Measure to reduce migration of CVOCs in shallow groundwater.
AOPC-02c 1,4-dioxane in on-site groundwater	1,4-dioxane was detected in two on-site groundwater samples at JS-APS-001 and JS-APS-004 at low concentrations (2 J and 1 J µg/L). Dimensions: 1,4-dioxane appears to be confined to two locations on site. Dimensions: Detected in an area of less than 0.5 acres (bounded by the site). 1,4-dioxane has been used as a stabilizer in 1,1,1-TCA, which was also detected in groundwater at these locations.	Collect additional groundwater samples from existing and new monitoring wells during the RI and analyze by selective ion monitoring to achieve lower detection limits.

Table 1
Areas of Potential Concern (AOPC) - Descriptions and Recommendations
Former Oak Materials Fluorglas Division - John Street

Location and Description		Recommendation
AOPC-02: Area-Wide Groundwater Continued		
AOPC-002d Selenium and cadmium in on-site groundwater	Selenium was detected in groundwater samples from JS-APS-001 and JS-MW-001A at concentrations (0.0161 J and 0.0345 J mg/L, respectively) above the NYS GA standard of 0.01 mg/L. Cadmium was detected in one groundwater sample from JS-APS-001 at 0.0057 J mg/L above the NYS GA standard of 0.005 mg/L but was not detected the groundwater samples from JS-MW-001A, B, or C. Dimensions: Not estimated since only detected at one location Source: Source is unknown.	Groundwater samples collected from existing and new overburden and bedrock monitoring wells will be analyzed for metals during the RI.
AOPC-02e Iron, manganese and sodium in on- site and off-site groundwater	Iron, manganese and sodium were detected in groundwater samples from most on-site and off-site APS points and monitoring wells at concentrations above NYSDEC GA standards. Iron and manganese are naturally occurring metals that are commonly found in groundwater. Sodium is a naturally occurring metal and its use in road salt commonly contributes to its occurrence in groundwater. are naturally Dimensions: Not estimated. This areas is assumed to be naturally occurring.	No further action
AOPC-002f Barium, chromium, magnesium and lead in off-site groundwater	Barium, chromium, magnesium and lead were detected in groundwater from off-site monitoring wells OS-MW-030B and OS-MW-031B at concentrations above NYS GA standards. No exceedances were observed in groundwater samples from on-site groundwater samples Dimensions: Not estimated. These metals are ssumed to be naturally occurring and not related to the site.	No further action
AOPC-02g Cyanide, PCBs, Pesticides, SVOCs, and metals other than barium, cadmium, chromium, iron, magnesium, manganese, and sodium	Cyanide, PCBs, Pesticides, SVOCs, and metals (except barium, cadmium, chromium, iron, magnesium, manganese, and sodium) were not detected above NYS GA standards or guidance in any of the groundwater samples.	No further action
AOPC-03: Municipal Sewer System		
AOPC-03 Municipal Sewers	The municipal sewers have been identified as a possible source of PFAS or CVOC contamination to soil. Dimensions: No information at this time. The source would be potentially leaking sewers.	Collect soil samples in the vicinity of the municipal sewer sites at selected locations on-site and off-site during the RI and analyze for PFAS (21), TOC, pH, TCL VOCs, TAL Metals plus a subset of samples for Full TCL/TAL.
AOPC-04 Potential Fuel Oil Underground Storage Tank		
AOPC-04 Former Underground Storage Tank (UST)	Historical information indicates that a 10,000-gallon fuel oil UST was present at the John Street property. Ground penetrating radar (GPR) surveys on the John St. property have not identified a UST. Soil borings and soil and groundwater samples collected from the southern portion of the site do not indicate the presence of fuel oil. According to the EDR report, a tank was closed and removed in 1995 from John Street Fluorglas, Allied Signal Inc.; however, coordinates for the tank plot to the middle of Church Street at the intersection of John and Church Streets by Key Bank. The EDR also lists a second UST closed in-place by AlliedSignal Laminate Systems in 1999 was located at Mechanic Street. Given the footprint of the former John St. building, a UST would likely have been located on the south end of the property. Dimensions: None. No fuel oil constituents were detected during the SC. No source known at this time	Conduct an additional GPR survey on the southern area of the property as part of the subsurface clearance activities for new monitoring wells.

Notes and Abbreviations:

PFAS - Perfluoroalkyl Substances
PFOA - Perfluorooctanoic acid
PFOS - Perfluorooctane sulfonic acid
CVOCs - Chlorinated Volatile Organic Compounds
VOCs - Volatile Organic Compounds
SVOCs - Semi-Volatile Organic Compounds

TOC - Total Organic Carbon by the Lloyd Kahn method
PCBs - Polychlorinated Biphenyls
Full TCL/TAL - VOCs/SVOCs/Pesticides/PCBs/Metals/Cyanide
TCL - Target Compound List
TAL - Target Analyte List (Metals & Cyanide)

RI - Remedial Investigation
IRM - Interim Remedial Measure
PDI - Pre-Design Investigation
SVI - Soil Vapor Intrusion

Table 2
RI Sampling and Analysis Plan - Completed and Continued John Street RI Tasks
Former Oak Materials Fluorglas Division - John Street

Sample Matrix	Sampling Location	Methods/Work Scope Summary	Number of Samples (excluding QA/QC)	Analytical Parameters	Sample Type	Sampling Method	Rationale/NYSDEC DER-10 Reference
AOPC-001a-d: Area-Wide Soil (Copper, Nickel, PFAS By Location)							
Surface & Near-Surface Soil ● **TASK COMPLETED**	On site AOPC-01a Copper at JS-B-005	0" - 2" and 2" - 12" near JS-B-005 (4 locations: JS-B-005A-D)	8	Copper, PFAS (21), TOC, pH, VOCs, 1,4-dioxane	1 grab sample at each depth interval at each location	Hand Auger	• Additional characterization of PFASs and VOCs in on-site surface and near surface soil • Characterize soil in areas with exceedances of NYS SCOs for Commercial Use at on-site locations: - Delineate copper in vicinity of JS-B-005 - Delineate copper in subsurface soil in vicinity of JS-B-002 - Delineate nickel in vicinity of JS-B-003 • DER-10 2 § 3.5 Soil, §3.5.1 Site Characterization; (b) 1 through 3, Surface Soil Sampling • DER-10 2 §3.5.2 Remedial Investigation (b) 1 through 2, Surface Soil Sampling
	On site AOPC-01b Nickel at JS-B-003	2" - 12" near JS-B-003 (4 locations: JS-B-003A-D)	4	Nickel, PFAS (21), TOC, pH, VOCs, 1,4-dioxane	1 grab sample at each location	Hand Auger	
Subsurface Soil ● **TASK COMPLETED**	On site AOPC-01a Copper at JS-B-005	5 locations: 1 depth interval (12" - 36") at JS-B-005 and 4 locations near JS-B-005(A-D)	5	Copper, PFAS (21), TOC, pH, VOCs, 1,4-dioxane	Grab Sample	Hand Auger	• Additional characterization of PFASs and VOCs in on-site surface and near surface soil • Characterize soil in areas with exceedances of NYS SCOs for Commercial Use at on-site locations: - Delineate copper in vicinity of JS-B-005 - Delineate copper in subsurface soil in vicinity of JS-B-002 - Delineate nickel in vicinity of JS-B-003 • DER-10 2 § 3.5 Soil, §3.5.1 Site Characterization; (c) 1 through 7, (d) Subsurface Soil Sampling • DER-10 2 § 3.5 Soil, §3.5.2 Remedial Investigation (c) 1 through 3, (d) Subsurface Soil Sampling
	On site AOPC-01b Nickel at JS-B-003	5 locations: 1 depth interval (12" - 36") at JS-B-003 and 4 locations near JS-B-003 (A-D)	5	Nickel, PFAS (21), TOC, pH, VOCs, 1,4-dioxane	Grab Sample	Hand Auger	
	On site AOPC-01c Copper at JS-B-002	5 locations: 1 depth interval (8' - 10') at JS-B-002 and 4 locations (6'-8') near JS-B-002 (A-D)	5	Copper, PFAS (21), TOC, pH, VOCs, 1,4-dioxane	Grab Sample	Direct Push Rig	
	On site AOPC-01d PFAS in on-site and off-site soil	5 locations: JS-B-56, 57 & 58, BB4 depth intervals in clay; top and bottom of brown clay (where present and >12" thick; otherwise 1 representative sample where brown clay is present and <12"); and top and bottom of gray clay.	20	PFAS (21), TOC, pH, VOCs, 1,4-dioxane	Grab Sample	Direct Push Rig	• Characterize PFAS and VOC concentrations in brown/gray clay unit on-site • DER-10 2 § 3.5 Soil, §3.5.1 Site Characterization; (c) 1 through 7, (d) Subsurface Soil Sampling • DER-10 2 § 3.5 Soil, §3.5.2 Remedial Investigation (c) 1 through 3, (d) Subsurface Soil Sampling
Surface & Near-Surface Soil ●	On-site/Off-site AOPC-01d PFAS in on-site and off-site soil	3 new on-site overburden wells and 11 new off-site overburden well cluster locations: 0" to 2" and 2 to 12" (include root mass) Surface and near-surface soil samples will be collected beneath the roof driplines at up to ten locations near the John Street property. Surface soil samples will be collected from the surface (zero to two inches below the surficial vegetative cover), but will include the root mass, as requested by NYSDEC. Near-surface soil samples will be collected at a depth of two- to 12-inches below the surficial vegetative cover.	28	PFAS (21), TOC, pH, VOCs, 1,4-dioxane	1 grab sample at each depth interval	Hand Auger	Additional characterization of PFASs and VOCs in Off-site surface and near surface soil • DER-10 2 § 3.5 Soil, §3.5.1 Site Characterization; (b) 1 through 3, Surface Soil Sampling • DER-10 2 §3.5.2 Remedial Investigation (b) 1 through 2, Surface Soil Sampling
Subsurface Soil ●	On-site/Off-site AOPC-01d PFAS in on-site and off-site soil	3 new on-site overburden wells and 11 new off-site overburden well cluster locations, soil samples will be collected from: o Immediately above the water table. o Glacio-lacustrine aquitard; o Buried sand aquifer; and o Till layer, when present. If encountered: o Top of the native soil at the fill/native soil interface o Mottled zones (encompassing the total thickness of the observed mottling) o Subjectively impacted soils (based on visual, olfactory, or other field screening observations).	42+ (Minimum 3 per location + if encountered stratum noted to the left)	PFAS (21), TOC, pH, VOCs, 1,4-dioxane	One grab sample at each depth interval	Rotosonic Drilling Rig	Additional characterization of PFASs and VOCs in Off-site surface and near surface soil • DER-10 2 § 3.5 Soil, §3.5.1 Site Characterization; (c) 1 through 7, (d) Subsurface Soil Sampling • DER-10 2 § 3.5 Soil, §3.5.2 Remedial Investigation (c) 1 through 3, (d) Subsurface Soil Sampling
Subsurface Soil ●	Off-site AOPC-01d PFAS in on-site and off-site soil	5 locations: o 4 depth intervals in clay at temporary overburden well locations to be installed and sampled east, west and north of John Street property (see AOPC-05 below); top and bottom of brown clay (where present and >12" thick; otherwise 1 representative sample where brown clay is present and <12"); and top and bottom of gray clay. o TCL/TAL, CN, grain size and pH analyses from immediately above the water table from the five (5) proposed temporary well locations surrounding the Site (west, north and east sides) which represents a 25% sampling rate.	20	PFAS (21), TOC, pH, VOCs, 1,4-dioxane TCL/TAL, pH, grain size analyses	One grab sample at each depth interval	Rotosonic Drilling Rig	• Characterize PFAS and VOC concentrations in brown/gray clay unit off-site • DER-10 2 § 3.5 Soil, §3.5.1 Site Characterization; (c) 1 through 7, (d) Subsurface Soil Sampling • DER-10 2 § 3.5 Soil, §3.5.2 Remedial Investigation (c) 1 through 3, (d) Subsurface Soil Sampling

Table 2
RI Sampling and Analysis Plan - Completed and Continued John Street RI Tasks
Former Oak Materials Fluorglas Division - John Street

Sample Matrix	Sampling Location	Methods/Work Scope Summary	Number of Samples (excluding QA/QC)	Analytical Parameters	Sample Type	Sampling Method	Rationale/NYSDEC DER-10 Reference
AOPC-002a-f: Area-Wide Groundwater: PFAS, VOCs, 1,4-dioxane & Metals in Groundwater							
Groundwater In Bedrock ⊕	On site (2 locations)	Shallow bedrock wells were installed at JS-MW-001BR and JS-MW-003BR; borehole geophysical logging completed	2	See Below	Bedrock Groundwater	Rotosonic Drilling Rig See Below	• Characterize vertical flow and groundwater quality in shallow bedrock for PFAS, VOCs and metals. • DER-10 § 3.7 Groundwater, §3.7.1 Site Characterization, §3.7.2 Remedial Investigation
	Off site (6 locations)	Shallow bedrock wells were installed near OS-MW-024BR, 026BR, 027BR, 028BR, 030BR and 031BR; borehole geophysical logging completed	6	See Below	Bedrock Groundwater	Rotosonic Drilling Rig See Below	• Characterize vertical flow and groundwater quality in shallow bedrock for PFAS, VOCs and metals. • DER-10 § 3.7 Groundwater, §3.7.1 Site Characterization, §3.7.2 Remedial Investigation
Groundwater In Overburden ●	On-site	3 locations: install, gauge and sample 3 additional deep overburden monitoring wells at the locations of JS-MW-001, 003 and 004.	3	PFAS (21), TOC, pH, TCL VOCs, 1,4-dioxane, TAL Metals, Field and Geochemical Parameters	Overburden Groundwater	Rotosonic Drilling Rig and Low-flow Sampling	• Supplement existing On-site overburden monitoring well network to complete characterization of overburden groundwater quality and delineate the vertical extent of impacts. • DER-10 § 3.7 Groundwater, §3.7.1 Site Characterization, §3.7.2 Remedial Investigation
⊕	On-site	5 locations: gauge and sample all overburden monitoring wells at JS-MW-001, 002, 003, 004 and 005.	11	PFAS (21), TOC, pH, TCL VOCs, 1,4-dioxane, TAL Metals, Field and Geochemical Parameters	Overburden Groundwater	Low-flow Sampling	• Characterize on-site overburden groundwater quality: • DER-10 § 3.7 Groundwater, §3.7.1 Site Characterization, §3.7.2 Remedial Investigation
●	Off-site	5 locations: install temporary overburden groundwater monitoring wells and collect discrete depth groundwater samples at 2 depths per location (near water table and above refusal) to the east, west and north of John St (locations of subsurface soil sampling).	10	PFAS (21), TOC, pH, TCL VOCs, 1,4-dioxane, TAL Metals, Field and Geochemical Parameters	Overburden Groundwater	Rotosonic Drilling Rig and Low-flow Sampling	• Characterize overburden groundwater quality and delineate extent of off-site impacts adjacent to John Street: • DER-10 § 3.7 Groundwater, §3.7.1 Site Characterization, §3.7.2 Remedial Investigation
●	Off-site	11 locations: install, gauge and sample additional overburden monitoring wells at shallow, intermediate and deep depth intervals.	33	PFAS (21), TOC, pH, TCL VOCs, 1,4-dioxane, TAL Metals, Field and Geochemical Parameters	Overburden Groundwater	Rotosonic Drilling Rig (intermediate and deep) and Low-flow Sampling	• Characterize overburden groundwater quality and delineate extent of off-site impacts: • DER-10 § 3.7 Groundwater, §3.7.1 Site Characterization, §3.7.2 Remedial Investigation
⊕	Off-site	7 locations: gauge and sample all overburden wells at OS-MW-024, 025, 026, 027, 028, 030 and 031.	20	PFAS (21), TOC, pH, TCL VOCs, 1,4-dioxane, TAL Metals, Field and Geochemical Parameters	Bedrock Groundwater	Low-flow Sampling	• Characterize overburden groundwater quality and delineate extent of off-site impacts: • DER-10 § 3.7 Groundwater, §3.7.1 Site Characterization, §3.7.2 Remedial Investigation
Groundwater In Overburden ●	On-site AOPC -02b at JS-B-001	Install 4 temporary small-diameter wells in the shallow sand/gravel layer and collect 1 groundwater sample from each.	4	PFAS (21), TOC, pH, TCL VOCs, 1,4-dioxane, Field Parameters	Overburden Groundwater	Direct Push Rig and Low-flow Sampling	• Delineate VOC impacts in vicinity of JS-B-001 and JS-MW-001A • DER-10 § 3.7 Groundwater, §3.7.1 Site Characterization, §3.7.2 Remedial Investigation
Groundwater In Overburden ●	On-site AOPC-02b at JS-B-003	Install 4 temporary small-diameter wells in the shallow sand/gravel layer and collect 1 groundwater sample from each.	4	PFAS (21), TOC, pH, TCL VOCs, 1,4-dioxane, Field Parameters	Overburden Groundwater	Direct Push Rig and Low-flow Sampling	• Delineate VOC impacts in vicinity of JS-B-003 • DER-10 § 3.7 Groundwater, §3.7.1 Site Characterization, §3.7.2 Remedial Investigation
Groundwater In Bedrock ⊕	On-site (2 locations)	Gauge and sample shallow bedrock wells JS-MW-001BR and JS-MW-003BR.	2	Field parameters PFAS (21), TOC, pH, TCL VOCs, TAL Metals, Geochemical parameters	Bedrock Groundwater	Low-flow Sampling	• Characterize vertical flow and groundwater quality in shallow bedrock for PFAS, VOCs and metals. • DER-10 § 3.7 Groundwater, §3.7.1 Site Characterization, §3.7.2 Remedial Investigation
	Off-site (6 locations)	Gauge and sample shallow bedrock wells OS-MW-024BR, 026BR, 027BR, 028BR, 030BR and 031BR.	6	Field parameters PFAS (21), TOC, pH, TCL VOCs, TAL Metals, Geochemical parameters	Bedrock Groundwater	Low-flow Sampling	• Characterize vertical flow and groundwater quality in shallow bedrock for PFAS, VOCs and metals. • DER-10 § 3.7 Groundwater, §3.7.1 Site Characterization, §3.7.2 Remedial Investigation
AOPC-03: Municipal Sewer System							
Subsurface Soil ●	On-site AOPC-003 Municipal Sewer	2 locations: Samples collected at 4' and 10' from the sewer line from depth below the pipe invert elevation.	4	PFAS (21), TOC, pH, TCL VOCs, TAL Metals plus 1 samples (20%) was analyzed for Full TCL/TAL	Grab sample	Direct Push Rig	• Characterize soil quality in the vicinity of potentially leaking municipal sewer lines and the backfilled trench excavations • DER-10 2 § 3.5 Soil, §3.5.2 Remedial Investigation (c) 1 through 3, (d) Subsurface Soil Sampling
	Off-site AOPC-003 Municipal Sewer	7 locations: Samples collected at 4' and 10' from the sewer line from depth below the pipe invert elevation.	14	PFAS (21), TOC, pH, TCL VOCs, TAL Metals plus 3 samples (20%) were analyzed for Full TCL/TAL	Grab sample	Direct Push Rig	• Characterize soil quality in the vicinity of potentially leaking municipal sewer lines and the backfilled trench excavations • DER-10 2 § 3.5 Soil, §3.5.2 Remedial Investigation (c) 1 through 3, (d) Subsurface Soil Sampling

Table 2
RI Sampling and Analysis Plan - Completed and Continued John Street RI Tasks
Former Oak Materials Fluorglas Division - John Street

Sample Matrix	Sampling Location	Methods/Work Scope Summary	Number of Samples (excluding QA/QC)	Analytical Parameters	Sample Type	Sampling Method	Rationale/NYSDEC DER-10 Reference
AOPC-04: Potential Fuel Oil Underground Storage Tank							
Potential Former Underground Storage Tank	On-site	Conduct an additional GPR survey on the southern area of the property as part of the subsurface clearance activities for new monitoring wells.	0	none	Geophysical Screening	Ground Penetrating Radar and Electromagnetic Scan	• DER-10 § 3.2 General Sampling Considerations (c), §3.7.2 Remedial Investigation (a) 4

Notes and Abbreviations:

DER-10 = DER-10 / Technical Guidance for Site Investigation and Remediation, 5/3/2010.

PFAS - Perfluorinated Alkyl Substances

TCL - Target Compound List

TAL - Target Analyte List (Metals & Cyanide)

VOCs - Volatile Organic Compounds

SVOCs - Semi-Volatile Organic Compounds

TOC = Total Organic Carbon by the Lloyd Kahn method

PCBs = Polychlorinated Biphenyls

Full TCL/TAL = VOCs/SVOCs/Pesticides/PCBs/Metals/Cyanide

Field Parameters - Specific Conductance (SpC), pH, Dissolved Oxygen (DO), and Oxidation-Reduction Potential (ORP)

Geochemical Parameters - Major Cations Calcium, Magnesium, Sodium, and Potassium) and Major Anions (Chloride, Carbonate, Bicarbonate and Sulfate)

Table 3
Estimated Project Schedule for Completion of RIWP and Field Work Initiation
Former Oak Materials Fluorglas Division - John Street

Milestone	*Estimated Completion Date **
Submittal of Revised SC Report and Revised RIWP to NYSDEC	10 May 2019
NYSDEC Approval of Revised SC Report and Revised RIWP	1 August 2019
Filing of RIWP in Document Repositories	12 August 2019
Initiate Field Work	26 August 2019
Complete Field Work	1 November 2019

* The schedule is estimated and is subject to change based on site access and other conditions.

APPENDICES

LIST OF APPENDICES

Appendix A
RI Community Air Monitoring Plan

COMMUNITY AIR MONITORING PLAN
FORMER OAK MATERIALS FLUORGLAS DIVISION - JOHN STREET (442049)
TOWN OF HOOSICK AND VILLAGE OF HOOSICK FALLS
RENSSELAER COUNTY, NEW YORK

This Community Air Monitoring Plan (CAMP) involves real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of the designated work area when intrusive activities are in progress. Intrusive activities include soil or waste excavation, grading, staging, movement, or handling; test pitting or trenching; and/or the installation of soil borings. The CAMP provides a measure of protection for on-Site workers and the downwind community (i.e., off-site receptors including residences, parks, businesses, etc.) not directly involved with the subject work activities. Routine monitoring is required to evaluate concentrations and corrective action and/or work stoppage may be required to abate emissions detected at concentrations above specified action levels. Routine data collected during implementation of the CAMP may also help document that work activities did not spread compounds of potential concern off-site through the air. Reliance on the procedures and action levels described in this CAMP should not preclude simple, common sense measures to keep VOCs, dust, and odors at a minimum around work areas.

COMMUNITY AIR MONITORING PLAN

VOC concentrations in air will be measured using calibrated photoionization detectors (PIDs). Particulate matter concentrations will be measured using calibrated electronic aerosol monitors.

Relevant weather conditions including wind direction, speed, humidity, temperature, and precipitation will be evaluated and recorded prior to the initiation of subsurface intrusive activities. Background readings of VOCs and particulate matter will be collected on Site prior to the initiation of field work on each day that subsurface intrusive work will be performed. Additional background measurements may be collected if weather conditions change significantly.

Continuous monitoring for VOCs and particulate matter will be performed upwind and downwind of the work area during subsurface intrusive activities.

Periodic monitoring for VOCs will be performed during non-intrusive activities if requested by a New York State Department of Environmental Conservation (NYSDEC) and/or New York State Department of Health (NYSDOH) on-Site representative. Non-intrusive activities include any work activity that does not disturb the subsurface or staged soil piles, including routine site visits, installation of equipment, operations and maintenance, surveying, etc. Periodic monitoring if performed will consist of collecting readings downwind of the work area at the following intervals:

- upon arrival at a sample location or other work activity location;
- during performance of the relevant work activity; and
- prior to leaving a sample location or other work activity location.

VOC MONITORING, RESPONSE LEVELS, AND ACTIONS

VOCs will be monitored at the downwind perimeter on a continuous basis during intrusive activities. Upwind concentrations will be measured continuously or at the start of each workday, during the work activity, and at the end of each work day to establish background conditions. Monitoring equipment that does not require factory calibration will be calibrated at least once a day. Calibration may be performed more frequently if Site conditions or instrument operating conditions are highly variable. The monitoring equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below. The monitoring equipment will be equipped with an alarm to indicate an exceedance of a specified action level.

1. If the ambient air concentration of total VOCs at the downwind perimeter exceeds 5 parts per million (ppm) above background (upwind perimeter) for the 15-minute average, work activities will be temporarily halted and monitoring continued. If the total VOC concentration readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

2. If total VOC concentrations at the downwind perimeter persists at concentrations greater than 5 ppm over background but less than 25 ppm, work activities will be halted, the source of the VOCs identified, corrective action will be taken to abate emissions (if the source is related to site activities), and monitoring will be continued. After these steps, work activities will resume provided that the total VOC concentration 200 feet downwind of the work area, or half the distance to the nearest potential receptor, whichever is less (but in no case less than 20 feet), is below 5 ppm above background for the 15-minute average.

3. If the total VOC concentration is greater than 25 ppm above background at the downwind perimeter, intrusive work activities will be halted and the source of the VOCs will be identified. Work will resume when additional continuous monitoring demonstrates that VOC concentrations have dropped below 25 ppm for a minimum of one-half hour, and the total VOC concentration 200 feet downwind of the work area, or half the distance to the nearest potential

receptor, whichever is less (but in no case less than 20 feet), is below 5 ppm above background for the 15-minute average.

4. All 15-minute readings will be recorded and will be available for review by NYSDEC and/or NYSDOH personnel. Instantaneous VOC readings (if any) used for decision purposes will also be recorded.

PARTICULATE MONITORING, RESPONSE LEVELS, AND ACTIONS

Fugitive dust migration from the work area will be visually assessed during intrusive activities. Particulate concentrations will be monitored continuously at the downwind perimeter during intrusive activities. Particulate monitoring will be performed using real-time electronic aerosol 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 for comparison to the airborne particulate action levels referenced below. The monitoring equipment will be equipped with an alarm to indicate an exceedance of a specified action level.

1. If the downwind PM-10 concentration is 100 micrograms per cubic meter (µg/m^3) greater than background for the 15-minute period, or if airborne dust is observed leaving the work area, dust suppression techniques will be employed. Work may continue with dust suppression techniques provided that downwind PM-10 concentration does not exceed 150 µg/m^3 above background and provided that significant visible dust is not migrating from the work area.

2. If downwind PM-10 concentrations are greater than 150-µg/m^3 above background after the implementation of dust suppression activities, intrusive activities will be stopped and a re-evaluation of the intrusive activities will be initiated. Work can resume provided that dust suppression measures and/or other controls are successful in reducing the downwind PM-10 concentration to within 150 mcg/m^3 of background and in preventing significant visible dust migration.

3. All 15-minute readings will be recorded and will be available for review by NYSDEC and/or NYSDOH personnel. Instantaneous readings (if any) used for decision purposes will also be recorded.

Appendix B
RI Field Sampling & Analysis Plan

Honeywell

Remedial Investigation
Field Sampling and Analysis Plan
Former Oak Materials Fluorglas Division–John Street

Town of Hoosick and
Village of Hoosick Falls, Rensselaer County, New York

Honeywell

August 2019

www.erm.com

ERM

REPORT/WORK PLAN

Honeywell

Remedial Investigation
Field Sampling and Analysis Plan

Former Oak Materials Fluorglas Division – John Street
NYSDEC Site No. 442049

Village of Hoosick Falls `
Rensselaer County, New York

6 August 2019

NYSDEC Site Number 442049

ERM Consulting and Engineering, Inc.
105 Maxess Road, Suite 316
Melville, New York 11747-3851
www.erm.com

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

Chris W. Wenczel

Chris W. Wenczel, P.G.
ERM Consulting & Engineering, Inc.

Date: 6 August 2019

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

CAMP	Community Air Monitoring Plan
DER	Division of Environmental Remediation
DO	Dissolved Oxygen
DQO	Data Quality Objective
DUSR	Data Usability Summary Report
ERM	ERM Consulting and Engineering, Inc.
FSAP	Field Sampling and Analysis Plan
GPS	Global Positioning Equipment
HASP	Health and Safety Plan
HDPE	High Density Polyethylene
IDW	Investigation-Derived Waste
NJDEP	New Jersey Department of Environmental Protection
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
ORP	Oxidation-Reduction Potential
OSHA	Occupational Safety and Health Administration
PARCC	Precision, Accuracy, Reproducibility, Completeness, and Comparability
PCBs	Polychlorinated biphenyls
PFASs	Perfluorinated Compounds
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctane sulfonic Acid
PPE	Personal Protective Equipment
PTFE	Polytetrafluoroethylene
QA/QC	Quality Assurance / Quality Control
QAPP	Quality Assurance Project Plan
SC	Site Characterization
STARS-#1	Spill Technology and Remediation Series Memorandum Number One
SVOCs	Semi-volatile Organic Compounds
TAL	Target Analyte List
TCL	Target Compound List
USEPA	United States Environmental Protection Agency
VOCs	Volatile Organic Compounds

1.0 INTRODUCTION

Honeywell International Inc. (Honeywell) entered into an Order on Consent and Administrative Settlement with the New York State Department of Environmental Conservation (NYSDEC) dated 3 June 2016 (the Order; Index Number CO 4-20160415-79). The Order required the performance of a Site Characterization (SC) at the former Oak Materials Fluorglas Division - John Street Property located in the Village of Hoosick Falls, Hoosick Township, Rensselaer County, New York.

The location of this 0.6-acre property is shown on Figures 1 and 2.

In July 2017, the Former Oak Materials Fluorglas Division - John Street property was added to the Registry of Inactive Hazardous Waste Sites (the Registry) as a Class 2 site (Site No. 442049).

The Site is located in an area of mixed commercial and residential use, bounded on the west by Lyman Street, on the north by John Street, on the west by Woods Brook, and on the south by a residential property. Rensselaer County tax records indicate that the Site is zoned commercial-vacant.

The past uses of the property were commercial and industrial. A three-story brick, mortar and wood building was constructed in the 1890s and demolished in 2012; there are currently no structures on the property. The John Street property is generally flat, gently sloping northward, covered with crushed stone and fenced to prevent unauthorized access. There are currently no plans for future property use.

1.1 PURPOSE AND OBJECTIVES

The initial on- and off-site investigations performed during 2016-2018 (Section 2.3) detected the presence of the following compounds at concentrations exceeding potentially applicable NYS Standards, Criteria and Guidance (SCGs):

- Chlorinated volatile organic compounds (CVOCs), primarily trichloroethene (TCE) and 1,1,1-trichloroethane (1,1,1-TCA) in:
    - soil, soil vapor and groundwater on-site; and
    - soil vapor and groundwater off-Site.
- Poly- and per-fluorinated compounds (PFAS) in on- and off-Site soils and groundwater;
- Minor detections of semi-VOCs (SVOCS) in shallow on-and off-site soils; and on-site groundwater and
- Minor detections of metals (copper and nickel) were noted in shallow soils at three on-site locations.

Consequently, additional investigations are required and the May 2019 Remedial Investigation Work Plan (RIWP) establishes a scope of work intended to complete the SC and fill certain data gaps at the John Street property to complete a RI.

This Field Sampling and Analysis Plan (FSAP) document supplements the RIWP and describes field operation protocols, and sampling and analysis procedures for implementation of the RI. The FSAP is to be used in conjunction with the:

- RWIP;
- Quality Assurance Project Plan (QAPP) that identifies the necessary procedures for an orderly, accurate, and efficient data collection and analysis program for the project, and ensures that data meet data quality objectives (DQOs) and
- Project-specific Health and Safety Plan (HASP).

Brief descriptions of these documents are presented in Section 3.0.

1.2 PROJECT ORGANIZATION

Client

Honeywell	John McAuliffe, P.E.	(315) 552-9782

Counsel

Allen & Desnoyers, LLP	Dale Desnoyers, Esq.	(518) 426-2288

Consultant

ERM	Jim Perazzo, P.G.	(631) 756-8913
	Maureen Leahy, Ph.D.	(860) 466-8523
	Chris W. Wenczel, P.G.	(631) 756-8920

2.0 SCOPE OF REMEDIAL INVESTIGATION

The RI activities will include use of soil borings, temporary monitoring well installations, overburden monitoring well installations, and collection of soil and groundwater samples for laboratory analyses.

The scope of work, environmental media, rationale, analytical parameters, and specifics of the completed or proposed additional investigations in each of the site-wide and specific AOPCs to complete an RI at the Site are summarized in Table 1.

Colorized symbols are used to correlate work scope items in Table 1 with those corresponding soil sampling, soil boring and potential overburden groundwater monitoring well locations shown in Figure 3. These locations include 14 Soil Boring/Potential overburden monitoring wells; 8 shallow Soil Borings/Temporary Wells; and 5 shallow and deep Soil Borings/Temporary Wells. In addition, surface and near-surface soil samples will be collected to determine shallow soil quality at selective locations.

It is anticipated that the field sampling effort will be dynamic and that some locations may require less or more sampling based on geologic formations encountered, physiochemical measurements, visual or olfactory evidence of possible contamination, and the discretion of the field geologist in concert with NYSDEC's field representative.

For NYSDEC field coverage planning purposes, ERM will notify NYSDEC's John Street Project Manager via email a minimum of seven days prior to the start of field activities. The email will describe the scope of fieldwork and timing of activities planned so that appropriate oversight can be performed by NYSDEC.

2.1 DATA QUALITY OBJECTIVES

The QAPP is included as Appendix C of the RIWP and is intended to be used in conjunction with the FSAP. The QAPP identifies the necessary procedures for an orderly, accurate, and efficient data collection and analysis program for the project, and ensures that data meet DQOs.

DQOs are qualitative and quantitative criteria required to support the decision making process. DQOs define the uncertainty in an analytical data set and are expressed in terms of precision, accuracy, representatives, completeness, and comparability (PARCC).

- Precision is a measure of mutual agreement among measurements of the same property usually under prescribed similar conditions. Precision is best expressed in terms of the standard deviation.
- Accuracy is the degree of agreement of a measurement (or an average of measurements) with an accepted reference of "true value". Accuracy is an estimate of potential numerical bias (i.e., low or high) in analytical data.
- Representativeness expresses the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point a process condition, or an environmental condition.
- Completeness is a measure of the amount of valid data obtained compared to the amount that was expected to be obtained under correct normal conditions.
- Comparability expresses the confidence with which one data set can be compared with another. Comparability is a qualitative measurement. Comparability is assessed by reviewing results or procedures for analytical data that do not agree with expected results.

The field team will collect representative samples. The chemist at the laboratory will analyze samples using accepted protocols resulting in data that meet PARCC standards and in accordance with the QAPP.

2.2 COMMUNITY AIR MONITORING

Community air monitoring for VOCs and particulates will be performed during all intrusive field activities. A Community Air Monitoring Plan (CAMP) is presented in Appendix A of the RIWP. The CAMP provides a measure of protection for the downwind community from potential airborne contaminant releases as a result of work activities. The CAMP is consistent with the requirements of DER-10 Appendix 1A (NYSDEC, 2010). The CAMP describes monitoring requirements and response action levels associated with the monitoring of VOCs and particulates (i.e., dust) downwind of intrusive SC activities. The action levels specified in the CAMP require increased monitoring, corrective actions to abate emissions, and/or work stoppage if necessary.

2.3 SUBSURFACE CLEARANCE

2.3.1 Intrusive Activity Utility Clearance

Dig Safely New York will be notified prior to the initiation of intrusive activities at the properties and requested to identify, locate, and mark member-company utilities in areas proposed for subsurface intrusive investigation. Additionally, an independent underground utility locating service will be contracted to evaluate and clear proposed profiling locations prior to the commencement of subsurface intrusive activities. A minimum 10-foot diameter around each planned location will be scanned and cleared of subsurface utilities by the utility location subcontractor prior to the initiation of drilling.

Proposed sampling locations will be adjusted in the field as necessary based on the results of the subsurface clearance effort to facilitate the health and safety of personnel, prevent property damage, and/or to avoid or minimize interference with property operations.

2.3.2 *Potential Former Underground Fuel Oil Storage Tank*

A Records Search and document review was performed as part of the SC in conformance with applicable requirements contained in the Order and Appendix 3A of DER-10 NYSDEC, 2010a). The Records Search was undertaken to identify relevant historical environmental documentation and the results thereof presented in the John Street SC Report.

According to the Environmental Data Resources (EDR) report, a tank closed in-place by AlliedSignal Laminate Systems in 1999 was located at Mechanic Street. The separate tank, which was closed and removed in 1995 from John Street Fluorglas, Allied Signal Inc., plots to the middle of Church Street at the intersection of John and Church Streets by Key Bank, based on the coordinates provided in the EDR report. Historical information indicates that a 10,000-gallon fuel oil underground storage tank (UST) was present at the John Street property. This tank may be the UST referenced in the EDR report.

Given the footprint of the former John Street building, the UST likely would have been located on the south end of the property but no specific information is available to document the tank's location. Ground penetrating radar (GPR) surveys on the John Street property have not identified any UST. Soil borings and soil and groundwater samples collected from the southern portion of the site do not indicate the presence of fuel oil constituents. Honeywell will complete an additional GPR survey on the southern area of the property to determine if an UST might be present.

2.4 *MONITORING WELL INSTALLATIONS*

Additional overburden groundwater monitoring wells will be installed. Up to 37 monitoring wells and approximately 18 temporary overburden groundwater sampling points will be installed at the locations proposed in Figure 3 using the rotosonic drilling method.

An exploratory soil boring will be performed at each drilling location and sampled for geologic description and laboratory analyses using procedures described in Section 2.5.

Stratigraphic conditions at each soil boring location will dictate the criteria for selecting which soil borings will be converted to groundwater monitoring wells and the individual screen intervals, i.e., if groundwater-bearing strata are not encountered within the overburden unit, a monitoring well will not be installed at that location.

Following installation, groundwater samples will be collected from the monitoring wells and temporary points. The results of the samples from the temporary points will be used to select the locations for additional overburden monitoring wells. All well installations, drilling, construction, development, testing, and sampling will be directed by a geologist.

2.4.1 Temporary Point Installation

Approximately 18 one-inch diameter temporary overburden groundwater sampling points will be installed at the locations proposed in Figure 3. Following installation, groundwater samples will be collected from the temporary points using low-flow well purging/sample collection techniques.

Following collection of the groundwater samples, all soil borings will be backfilled with the drill cuttings from that location.

2.4.2 Overburden Monitoring Well Installation

New overburden well locations are shown in Figure 3. A soil boring will be installed at each new well location to allow inspection of overburden stratigraphic profile and select monitoring well screen intervals.

Three or four wells will be installed at each of the 11 off-site locations as follows:

- Shallow monitoring wells screened near the water table will be designated "A";
- Wells screened a short distance below the bottom of the clay and silt unit (i.e., near the top of the lower sand and gravel unit) will be designated "B"; and
- Wells screened near the bottom of the lower sand and gravel unit will be designated "C" and/or "D".

A well will be installed at each of the three on-site locations and screened near the bottom of the lower sand and gravel unit, and designated "D".

Monitoring wells in the lower sand and gravel unit will be double-cased to minimize the potential for downward migration of contaminated groundwater during drilling activities. An eight-inch diameter steel casing will be installed and grouted five-feet into the clay unit. The boring will then be advanced with a six-inch casing and 4-inch core barrel to the planned completion depth or to the top of bedrock. The groundwater monitoring well will then be constructed as described below.

Each new well will be constructed of two-inch PVC. Wells will be constructed using five-foot or ten-foot long 0.010-inch pre-slotted screens based on field observations.

Sand filter packs will be constructed around each well screen using Morie #0 or equivalent sand a minimum of two-feet above the top of the well screen. A minimum two-foot thick bentonite seal will be installed and hydrated above the filter pack of each well. All grouting material and drilling fluids will be mixed with approved potable water. Cement-bentonite grout will be emplaced to backfill the remainder of the borehole to approximately one foot below ground surface. A flush-mounted steel protective casing will then be cemented in place over each well.

2.4.3 *Well Development*

Each new monitoring well will be developed through pumping, surging, air-lift using nitrogen, or bailing to facilitate collection of representative groundwater samples. Water levels and field parameters will be measured and recorded during well development activities using a calibrated multi-parameter meter with a flow cell and a water level indicator. Parameters for measurement include temperature, SpC, DO, pH, turbidity, and ORP.

2.5 *SOIL SAMPLING*

2.5.1 *Surface and Near-Surface Soil Sampling*

Surface and near-surface soil samples will be collected at all drilling locations from unpaved areas without visual evidence of soil disturbance for laboratory analysis to include PFAS, TOC, pH, VOCs, and 1,4-dioxane. Special precautions will be used to avoid or minimize the use of sampling equipment and materials that may contain PFASs. PFAS-specific sampling considerations for all media are presented in Section 2.9 of this FSAP.

Surface soil samples will be collected using a stainless steel hand auger or shovel at a depth of zero to two inches below the surficial vegetative cover, but including the root mass as requested by NYSDEC. Near-surface soil samples will be collected using a stainless steel hand auger at a depth of two- to 12-inches. The depth intervals of the surface and near-surface soil samples will be adjusted if the ground surface is capped with asphalt and/or concrete.

Soil samples for laboratory analyses will be collected into laboratory-provided sampling containers, which will be labeled and stored in a clean pre-chilled cooler. The soil samples for VOCs analysis will be collected using USEPA Method 5035 where five grams of soil will be weighed in the field and added to 40-milliliter vials containing methanol or sodium bisulfate preservative. The remaining sample containers will be unpreserved and filled with soil/root mass from each sampling interval. All samples will be managed under chain-of-custody procedures and submitted to the project laboratory for analysis of parameters indicated in Table 1 using analytical methods listed in Section 2.8.

An additional volume of soil from each sampling interval will be placed directly into sealable HDPE bags that will be labeled with the depth interval on the outside. The soil will be allowed to equilibrate within the bag for approximately five minutes to facilitate VOC headspace screening using a calibrated PID equipped with an 11.7 eV lamp. Soil samples will be visually examined for physical properties including color, texture, composition, moisture content, odor, and visual evidence of staining, discoloration, or product/sheen. Soil descriptions and other field data/observations will be documented on soil boring logs.

2.5.2 *Dripline Soil Sampling Near the John Street Site*

Surface and near-surface soil samples will also be collected from beneath the roof driplines at up to ten locations near the Site for PFAS, TOC, pH, VOC, and 1,4-dioxane analyses. Surface and near-surface soil samples will be collected using the procedures presented in Section 2.5.1.

Locations will be selected:

- In the four cardinal compass directions from the John St property and to the northeast of the John St property (as northeast is the presumed prevailing wind direction, per comments and conversations with NYSDEC);
- Close to the river in the northerly direction along Water Street or the Hoosic River Greenway
- Within approximately 1500 feet of the John St property; 1500 feet being the approximate farthest distance from the John St property to the Hoosic River in the north northwesterly direction;
- On the east/south side of the Hoosic River (same side as John St)\

Other criteria for selection of locations will be:

- Buildings in place since at least the 1950s/1960s with roofing material estimated or known to be from the same time period, or older
- Soil at the dripline that shows no evidence or reworking or excavated, based on visual observations, interviews, and/or aerial photo review
- No evidence of irrigation with Village water
- No evidence of dumping

Information will be obtained from historical aerial images, property records, property owner interviews, visual inspection of location conditions, etc.

Proposed locations that meet the criteria will be provided to NYSDEC for review. Upon NYSDEC approval of the locations, efforts will be made to contact the property owners to obtain permission to sample. If access cannot be obtained for a specific location(s), the assistance of NYSDEC will be requested to help obtain property access permission. Good-faith efforts will be made to select and obtain access for ten locations that meet the selection criteria.

2.5.3 *Subsurface Soil Samples*

Subsurface soil samples will be collected for laboratory analyses to include from all drilling locations at various depth intervals (Table 1) that may include:

Top of each major stratigraphic layer

- Surficial sand aquifer:
    - Immediately above the water table.
- Glacio-lacustrine aquitard;
- Buried sand aquifer; and
- Till layer when present.

If encountered:

- Top of the native soil at the fill/native soil interface
- Mottled zones (encompassing the total thickness of the observed mottling)
- Subjectively impacted soils (based on visual, olfactory, or other field screening observations).

Each soil sample will be analyzed for PFAS, TOC, pH, VOCs, and 1,4-dioxane.

In addition to the above analytical parameters, soil samples collected from immediately above the water table from the five (5) proposed temporary well locations surrounding the Site (west, north and east sides) will be analyzed for Target Compound List (TCL) semi-SVOCs, TCL pesticides, TCL polychlorinated biphenyls (PCBs), Target Analyte List (TAL) inorganics (metals and cyanide), and grain size. This represents a 25% sampling rate of the 19 new overburden soil boring locations; 11 off-site new groundwater monitoring well locations, three new on-site locations (supplementing existing well clusters) and five temporary well locations surrounding the Site.

Soil borings will be advanced to the scheduled completion depths using the rotosonic drilling/sampling method. Each borehole will be sampled continuously using dedicated sample liners and dual tube or equivalent discrete interval sampling methods. Reusable sampling equipment will be cleaned between each borehole location by washing in an Alconox® and potable water solution followed by rinsing with Poland Spring water or laboratory-supplied distilled water.

Subsurface soil will be examined and screened continuously from the ground surface to each soil boring's completion depth. A volume of soil from each two-foot increment of each soil core sampling interval will be placed directly into sealable HDPE bags that will be labeled with the depth interval on the outside. The soil will be allowed to equilibrate within the bag for approximately five minutes to facilitate VOC headspace screening using a calibrated PID equipped with an 11.7 eV lamp. Soil samples will be visually examined for physical properties including color, texture, composition, moisture content, odor, and visual evidence of staining, discoloration, or product/sheen. Soil descriptions and other field data/observations will be documented on soil boring logs.

Soil samples from designated intervals for laboratory analyses will be collected into laboratory-provided sampling containers, which will be labeled and stored in a clean pre-chilled cooler. The soil samples for VOCs analysis will be collected using USEPA Method 5035 where five grams of soil will be weighed in the field and added to 40-milliliter vials containing methanol or sodium bisulfate preservative. The remaining sample containers will be unpreserved and filled with soil/root mass from each sampling interval. All samples will be managed under chain-of-custody procedures and submitted to the project laboratory for analysis of parameters indicated in Table 1 using analytical methods listed in Section 2.8.

2.6 HYDROGEOLOGICAL EVALUATION

Water level monitoring and aquifer testing will be performed to evaluate hydrogeological conditions in the unconsolidated upper and lower sand units (overburden) and shallow bedrock at John Street.

The goals of the hydrogeological evaluation task are to:

- Measure water levels and calculate groundwater elevations for each well location;
- Calculate horizontal hydraulic gradients in the upper and lower sand units and shallow bedrock;
- Calculate vertical hydraulic gradients between the upper and lower sand units and shallow bedrock at each well cluster;

- Obtain a range of hydraulic conductivity values for the upper and lower sand units, and shallow bedrock;
- Estimate a range of transmissivity values for the unconsolidated upper and lower sand units, and shallow bedrock;
- Estimate a range of groundwater flow rates for the unconsolidated upper and lower sand units, and shallow bedrock; and
- Evaluate potential bedrock fracture interconnectivity between bedrock well locations.

Initial hydrogeological evaluation methods include both water level gauging events and single well aquifer slug tests.

The slug test is designed to measure the response of an aquifer to an instantaneous displacement of a known volume of water within a well. Recovery of the water levels to the pre-test condition (static) are measured and stored at frequent time intervals using an electronic programmable data logger equipped with a pressure-sensitive water level transducer. The data set can be analyzed to calculate a hydraulic conductivity value for each well screen interval. A range of hydraulic conductivity values can be obtained for an aquifer unit by performing slug tests in multiple wells across the site.

Wells screened across the water table will be tested using a physical method of water displacement with a physical slug. Wells screened below the water table and bedrock wells will be tested using pneumatic equipment assemblies.

The water level gauging and slug tests will be performed after the additional overburden and bedrock wells are installed so the new wells may be incorporated into the gauging and slug testing activities.

Details of specific tasks will include:

- Prior to the start of water level gauging and slug testing, water level meters, transducers, slugs, and tubing material used during aquifer testing will be rinsed and sampled for PFAS and VOCs.
- Two sets of ground water level measurements will be collected using electronic water level meters: one set before and one set following completion of the slug testing program.
- Either compressed air or nitrogen will be used for the pneumatic slug testing method.
- For wells screened across the water table, dedicated slugs will constructed from low-cost materials such as PVC piping and hardware (i.e., no glue) for single-well use to reduce the potential for cross-contamination of wells.

- All bedrock monitoring wells will be outfitted with remote water level/transducer logging devices to continuously monitor water levels during the bedrock well slug testing in order to evaluate potential bedrock fracture/fault interconnectivity between bedrock well locations.

The data collected from the slug tests will be reduced and analyzed using: 1) the aquifer test analysis software program Aqtesolv™, and 2) analytical methods set forth by Bouwer and Rice (1976, 1989).

If it is determined in the future that further hydrogeological studies are needed, pump testing of test wells would be considered contingent upon procuring an approval from the Village of Hoosick Falls and NYSDEC to discharge treated pump testing effluent to the municipal sewer system. Pump testing effluent would be contained and/or treated, and subsequently released to the municipal sewer upon NYSDEC approval.

2.7 GROUNDWATER SAMPLING

Two semi-annual sampling events are proposed; one in the Spring and one in the Fall, during which all on-site and off-site groundwater monitoring wells will be sampled. Based on those results, future monitoring requirements and frequencies will be considered.

Groundwater sampling will be performed using low-flow well purging/sample collection techniques. The low-flow groundwater purging/sampling technique requires the measurement and recording of water levels and field parameters, which will be measured and recorded during well development activities using a calibrated multi-parameter meter with a flow cell and a water level indicator.

Well construction details and sampling records from previous sampling events will be reviewed prior to this sampling event. Existing well construction information is presented in Table 2 and will be updated with new well construction information when it becomes available.

The condition of each well, including the well's protective cover and casing, will be evaluated in the field prior to sampling. Groundwater levels and the total depth of the well will be measured from the top of each well casing. Observations will be assessed in the field to determine the usability of each well for groundwater sampling.

For all water samples, a calibrated YSI or equivalent electronic field parameter meter will be utilized to collect in situ geochemical parameters including temperature, specific conductance, pH, ORP, and DO. These parameters will be monitored and recorded to provide general geochemical data and evaluate groundwater stabilization criteria prior to sample collection. Stabilization will be considered to be achieved when three consecutive readings are within the following limits:

- DO ≤ 10%
- Turbidity <50 Nephelometric Turbidity Units (NTUs);
- Specific Conductance ≤ 3%;
- Temperature ≤ 3%;
- pH ± 0.1 unit; and
- ORP ± 10 millivolts.

The field parameter meter will be calibrated at the start of each day and will also have documented calibration checks at the middle and end of each day. Fresh calibration solution will be used each day, but may be re-used throughout the day.

All calibration records and checks should be documented in field notes or on sampling records by recording the value of the calibration solution, value the instrument was reading prior to calibration, and documentation if re-calibration was needed. For pH, a three-point calibration shall be used, not two-point.

Once stabilization criteria are achieved, samples will be collected directly into preserved laboratory-supplied sampling containers, which will be stored in a clean, pre-chilled cooler. If stabilization criteria cannot be achieved, the sample will be collected at the discretion of the ERM geologist in consultation with NYSDEC's field representative. Samples will be stored on ice and transported under strict chain-of-custody procedures to a NYSDOH-approved environmental laboratory, for analysis of the parameters indicated in Table 1.

If sample volume for water is an issue, priority of analyses will be followed: PFAS, TOC, TCL VOCs, TAL Metals, remaining TCL/TAL list, CN, and anions.

2.8 SAMPLE ANALYSIS

Analytical methods for soil and groundwater sample analyses are as follow:

- PFAS by USEPA Method 537-1.1 (modified);
- TCL VOCs and NYSDEC Spill Technology and Remedial Series Memorandum Number One (STARS-#1) VOCs plus 10 tentatively identified compounds (TICs) by USEPA Method 8260;
- TCL and NYSDEC STARS-#1 SVOCs plus 20 TICs by USEPA Method 8270C;

- 1,4-dioxane by USEPA Method 8270C with selected ion monitoring (SIM);
- Pesticides by USEPA Method 8081;
- PCBs by USEPA Method 8082;
- TAL metals by USEPA Method 6010B
- Cyanide by USEPA Method 9012B; and
- Mercury by USEPA Method 7471A;
- TOC by Lloyd Kahn method; and
- pH by Standard Method 9045D.

All groundwater samples will be analyzed for the following geochemical parameters, i.e., major cations (calcium, magnesium, sodium, and potassium) and major anions (chloride, carbonate, bicarbonate and sulfate) using USEPA Methods 9056A/ 2320B/ 4500-H+B-2000/ 9045D/5310 C-2000.

All soil and groundwater samples will be analyzed for 21 PFAS by USEPA Method 537 Revision 1.1 (modified). These PFAS include:

Compounds	*CAS Number*	*Acronym*
1. Perfluorobutanoic Acid	375-22-4	PFBA
2. Perfluoropentanoic Acid	2706-90-3	PFPeA
3. Perfluorohexanoic Acid	307-24-4	PFHxA
4. Perfluoroheptanoic Acid	375-85-9	PFHpA
5. Perfluorooctanoic Acid	335-67-1	PFOA
6. Perfluorononanoic Acid	375-95-1	PFNA
7. Perfluorodecanoic Acid	335-76-2	PFDA
8. Perfluoroundecanoic Acid	2058-94-8	PFUnA
9. Perfluorododecanoic Acid	307-55-1	PFDoA
10. Perfluoro-n-tridecanoic Acid	72629-94-8	PFTriA
11. Perfluorotetradecanoic Acid	376-06-7	PFTeA
12. Perfluorobutanesulfonic Acid	375-73-5	PFBS
13. Perfluorohexanesulfonic Acid	355-46-4	PFHxS
14. Perfluoroheptanesulfonic Acid	375-92-8	PFHpS
15. Perfluorooctanesulfonic Acid	1763-23-1	PFOS
16. Perfluorodecanesulfonic Acid	335-77-3	PFDS
17. 6:2 Fluorotelomersulfonic Acid	27619-97-2	6:2FTS
18. 8:2 Fluorotelomersulfonic Acid	39108-34-4	8:2 FTS
19. Perfluorooctanesulfonamide	754-91-6	FOSA
20. N-methyl perfluoro-1-octanesulfonamidoacetic acid	2355-31-9	N-MeFOSAA
21. N-ethyl perfluoro-1-octanesulfonamidoacetic acid	2991-50-6	N-EtFSOSAA

The laboratory analytical report will contain NYSDEC Analytical Services Protocol (ASP) Category B deliverables to facilitate data validation or usability evaluation. Electronic data deliverables (EDDs) will also be provided by the project laboratory.

2.9 PFAS SAMPLING CONSIDERATIONS

In order to avoid or minimize contamination of environmental samples with PFOA or other PFAS from sampling equipment or other materials, guidelines have been developed for sampling procedures and equipment decontamination (NJDEP, 2007; USEPA, 2015). These guidelines involve avoiding the use of or contact with materials that may contain PFAS (USEPA, 2009).

- Do not wear new clothing or clothing that has been treated with stain- or water-resistant coatings. All clothing must be washed three to six times before use.
- Do not wear Tyvek® clothing.
- No Post-It-Notes® will be used during sampling.
- Personnel should not handle pre-wrapped food or snacks while working at the properties.
- Do not use any material or equipment that contains Teflon® (e.g. Teflon® tubing, sample container cap liners, tape, etc.).
- Do not use any materials or equipment that contains PTFE (i.e., PTFE-coated aluminum foil, Gore-Sorbers™) or any other material containing a fluoropolymer.
- Use only laboratory-supplied sampling containers/caps made of either polyethylene, high-density polyethylene (HDPE) or polypropylene for samples to be analyzed for PFOA and other PFAS.
- Field personal must wash hands with soap and potable water prior to sampling activities, especially after contact with any materials potentially containing PFAS.
- Do not use chemical ice packs (“blue ice”).
- Preserve samples on wet ice only; no “blue ice”. Polyethylene bags can be used to store ice.

All water used during the sampling effort will be obtained from a source with non-detectable concentrations of PFAS based on sampling and laboratory analysis prior to mobilization into the field.

Dedicated potable water containers will be used in the field throughout the duration of the project. The containers will be filled with potable water from a source known to have non-detectable concentrations of PFAS prior to mobilization into the field. Aqueous field rinse blank samples will be collected from the containers prior to mobilization and during use in the field for laboratory analysis of PFAS to ensure that the potable water containers are not a potential source of PFAS.

The following NYSDEC special precautions for trace contaminant sampling will also be utilized based on review of Section 5.2.9 of the NYSDEC's Sampling Guidelines and Protocols (NYSDEC, 1992):

- A clean pair of new, disposable nitrile gloves will be worn each time a different point or location is sampled; and
- Sample containers shall be placed into separate re-sealable polyethylene plastic bags immediately after collection and labeling.

2.10 DECONTAMINATION

Temporary decontamination pads will be constructed with two layers of polyethylene sheeting that will be bermed at the sides. Re-usable drilling and sampling equipment and tools will be cleaned with Alconox® and potable water solution followed by PFAS-free bottled water or distilled water rinse between uses. Decontamination water from the pad will be placed into five-gallon buckets and transferred into pre-labeled waste containers.

2.11 INVESTIGATION-DERIVED WASTES

Investigation-derived waste (IDW) is anticipated to consist of the following:

- Water - decontamination fluids and groundwater from well development and purging during sample collection;
- Disposables - personal protective equipment (PPE), HDPE tubing used for groundwater sampling, paper towels, and HDPE plastic; and
- Solids – soil from subsurface clearance activities.

IDW generated from the field sampling efforts will be placed in new Department of Transportation (DOT) approved 55-gallon steel drums or other appropriate containers and staged for as-required waste characterization sampling in advance of disposal. All containers of IDW will be properly labeled per NYSDEC, United States Environmental Protection Agency (USEPA) and/or United States Department of Transportation (USDOT) requirements. The IDW containers will be staged at John Street Site prior to manifesting and shipment for offsite disposal.

2.12 SITE SURVEY

All boring locations will be surveyed initially in the field using GPS equipment and then surveyed by a New York-licensed surveyor.

2.13 CONTINGENCY PLAN

If unknown containers, drums, underground storage tanks, or other previously unidentified sources of potential contaminants are discovered during subsurface intrusive activities, work activities will be suspended until NYSDEC is notified and properly-trained personnel are mobilized to address the condition. An exclusion zone will be set up immediately around the work area to control access.

If grossly contaminated media is identified during these investigations, the information will be communicated to the NYSDEC's field representative, or if a NYSDEC field representative is not present, verbally by phone to the NYSDEC's Project Manager. Reportable quantities of petroleum product will also be reported to the NYSDEC Spill Hotline (800-457-7362).

2.14 DATA USABILITY

Data usability will be evaluated following procedures for the preparation of Data Usability Summary Reports (DUSRs) for all samples. The usability evaluation will be performed consistent with NYSDEC guidance contained in DER-10 Appendix 2B (NYSDEC, 2010a). The results of the data usability evaluation will be presented in an Electronic Data Summary consistent with the requirements of DER-10 Section 3.14.

.

3.0 ASSOCIATED DOCUMENTS

This FSAP document supplements the RIWP and describes field operation protocols, and sampling and analysis procedures for implementation of the RI. The FSAP is to be used in conjunction with the documents briefly described below.

3.1 RI COMMUNITY AIR MONITORING PLAN

The Community Air Monitoring Plan (CAMP) for the RI is presented in Appendix A of the RIWP. The CAMP is consistent with the requirements of DER-10 Appendix 1A (NYSDEC, 2010a). The CAMP describes monitoring requirements and response action levels associated with monitoring of VOCs and particulates (i.e., dust) downwind of RI activities. The CAMP contains action levels for additional monitoring, corrective actions to abate emissions, and/or work stoppage if necessary.

3.2 QUALITY ASSURANCE PROJECT PLAN

The NYSDEC-approved 2018 Quality Assurance Project Plan (QAPP) for the RI is presented in Appendix C of the RIWP. The QAPP is consistent with the requirements of DER-10 Section 2.4. The QAPP describes sampling and analysis procedures for implementation of the RI along with QA/QC criteria. The QAPP will facilitate generation of data with acceptable PARCC.

3.3 HEALTH AND SAFETY PLAN

The project-specific HASP has been previously presented to NYSDEC. The procedures set forth in the HASP are designed to minimize the risk of exposure to chemical and physical hazards that may be present at the properties. These procedures generally conform to applicable federal, state and local regulations, including Occupational Safety and Health Administration (OSHA) requirements governing activities at hazardous waste sites and the requirements in 29 CFR 1910.120 (Hazardous Waste Operations). Specific practices and procedures, including the level of personal protective equipment (PPE), are based on a review of currently-available information for the properties.

4.0 REFERENCES CITED

Cadwell, D.H. and Dineen, R.J., 1987. Surficial Geologic Map of New York: Hudson-Mohawk Sheet. New York State Museum and Science Service, Map and Chart Series Number 40, Albany.

NJDEP, 2007. Determination of Perfluorooctanoic Acid (PFOA) in Aqueous Samples: Final Report. NJDEP Division of Water Supply, Trenton, January 2007.

NYSDEC, 1992. Sampling Guidelines and Protocols: Technologies Background and Quality Control/Quality Assurance for the NYSDEC Spill Response Program. NYSDEC Division of Spills Management, Albany, September 1992.

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

Potter, D.B., 1972. Stratigraphy and Structure of the Hoosick Falls Area, New York-Vermont, East-Central Taconics. New York State Museum and Science Service, Map and Chart Series Number 19, Albany.

USEPA, 2001. Sediment Sampling. Technical Standard Operating Procedure (SOP) No. SRC-OGDEN-04 (Revision No. 0): Syracuse Research Corporation, ESC-DVO, 14 June 2001, 8 pp.

USEPA, 2009. Perfluorocarboxylic Acid Content in 116 Articles in Commerce. United States Environmental Protection Agency (USEPA), Office of Research and development. EPA/600/R-09/033, March 2009.

USEPA, 2015. Field Equipment Cleaning and Decontamination at the FEC (Field Equipment Center): Operating Procedures. SESDPROC-206-R3, USEPA Science and Ecosystem Support Division, Region 4, Athens (GA), December 2015

LIST OF FIGURES

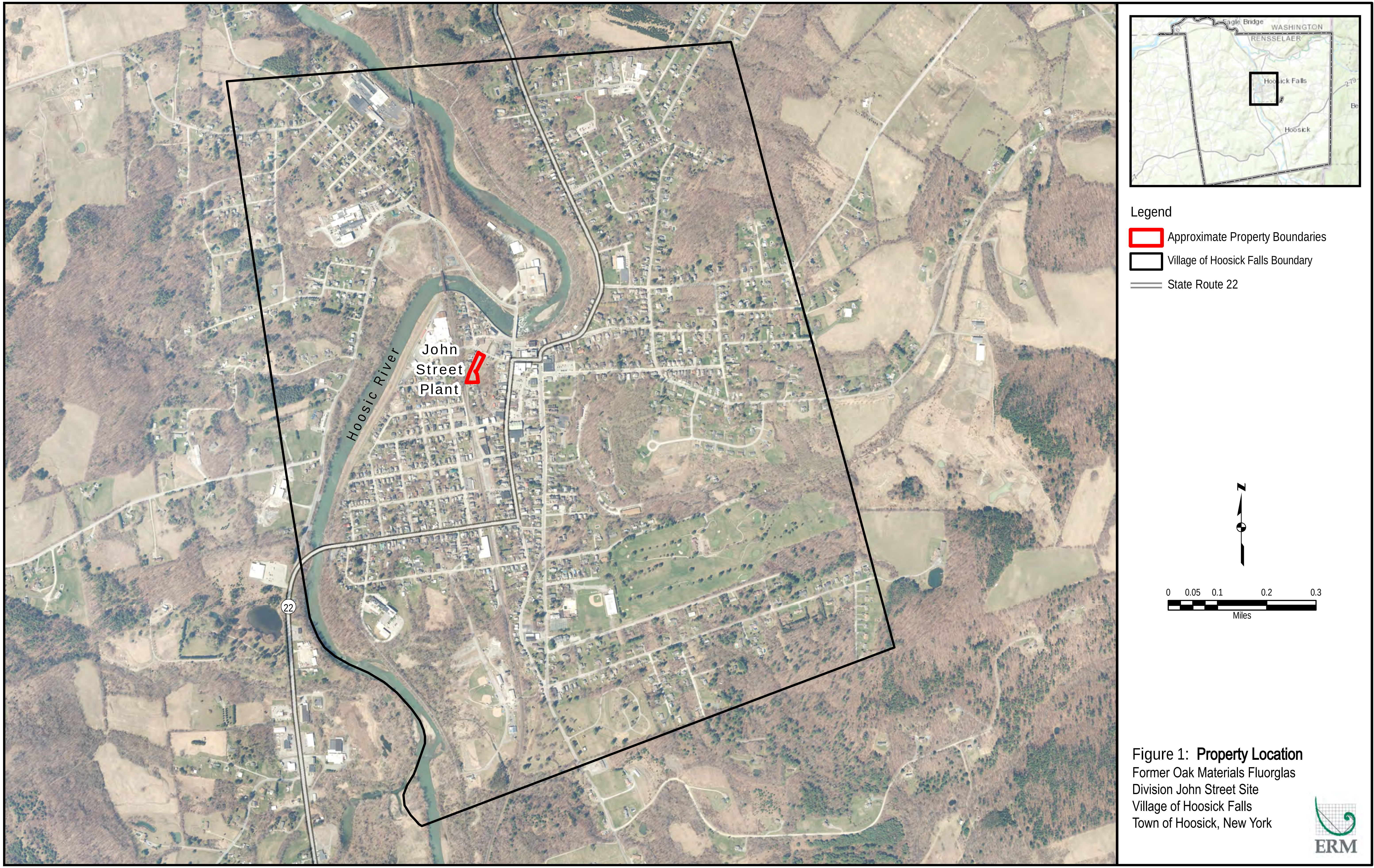


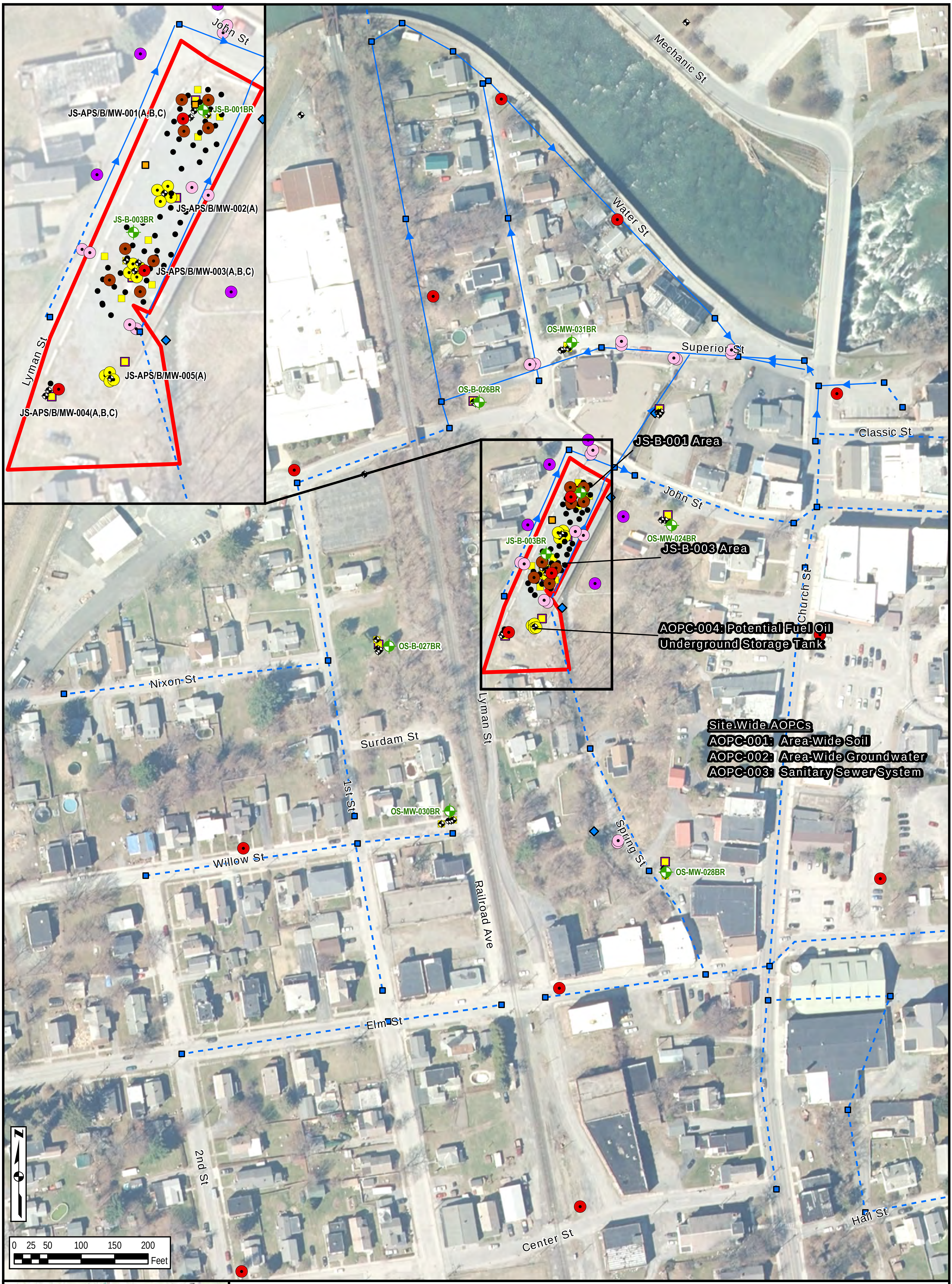
Figure 1: **Property Location**
Former Oak Materials Fluorglas
Division John Street Site
Village of Hoosick Falls
Town of Hoosick, New York

ERM

Q:\Team\DMMV\Clients_A_E\ArnoldandPorter\HoosickFalls\MXD\SC Report\JohnSt_Revision\Figure1_PropertyLocations_20180921.mxd - Dana.Heusinkveld - 10/3/2018

Figure 2: Site Layout
Former Oak Materials Fluorglas
Division John Street Site
Village of Hoosick Falls, NY

Q:\Teams\DMM\Clients_A_E\ArnoldandPorter\HoosickFalls\MXD\Soil_IRM\Figure2_SiteLayout_20170717.mxd - brett.shaver - 7/17/2017



- 🟥 Approximate Property Boundary
- ■ Approximate Manholes
- → Sewer Lines from detailed CAD Drawing
- - - Approximate Sewer Lines

Existing Locations:

- ⊕ Monitoring Well Location
- ◆ Surface Water / Sediment Location
- ■ Surface Soil Sample Location
- ⊕ Bedrock Well Location
- ■ Advanced Profiling System (APS) Location
- ■ Soil Boring Location
- ● IRM Soil Boring Location
- ● DEL Soil Boring Location
- ● Sanitary Sewer Soil Boring Location

Proposed Locations:

- ● Proposed Overburden Wells
- ● Proposed Shallow Soil Boring/Temporary Well
- ● Proposed Shallow and Deep Soil Boring / Temporary Well

Figure 3: Areas of Potential Concern and RI Sample Locations

Former Oak Materials Fluorglas Division
John Street Site
Village of Hoosick Falls, New York

ERM

Q:\Team\DMM\Clients_A_E\ArnoldandPorter\HoosickFalls\MXD\RI_WorkPlan\JohnSt\Workplan_Figures\Figure7_JohnSt_AOPC_Locations_20190405.mxd - Caldwell.Payne - 4/5/2019

TABLES

LIST OF TABLES

Table 1
Areas of Potential Concern (AOPC) - Descriptions and Recommendations
Former Oak Materials Fluorglas Division - John Street

Location and Description		Recommendation
AOPC-01: Area-Wide Soil		
AOPC-01a Copper at JS-B-005	Copper was detected at JS-B-005 above the Commercial Use SCO in surface soil. This location is south of the footprint of the former John Street building. The extent appears to be limited since copper concentrations were less than the Residential Use SCO in near surface soil at JS-B-005 and all other on- and off-site surface and near surface soil samples. Dimensions: Estimated to be less than 10 ft by 10 ft by 0.5 ft based on available information. Source is unknown.	Collect additional soil samples during the RI to delineate the vertical and horizontal extent of copper impacts in soil.
AOPC-01b Nickel at JS-B-003	Nickel was detected at JS-B-003 above the Commercial Use SCO in near surface soil. This location is within the footprint of the former John Street building. The extent appears to be limited since the nickel concentration was less than the Residential Use SCO in surface soil at JS-B-003 and all other on- and off-site soil samples. Dimensions: Estimated to be less than 10 ft by 10 ft by 0.5 ft based on available information. Source is unknown.	
AOPC-01c Copper at JS-B-002	Copper was detected at JS-B-002 above the Commercial Use SCO in soil at 6 to 8 feet bgs. This location is within the footprint of the former John Street building. The extent appears to be limited since the copper concentration was less than the Residential Use SCO at 9 to 10 and 60 to 64 ft bgs at JS-B-005 and all other on- and off-site subsurface soil samples. Dimensions: Estimated to be less than 10 ft by 10 ft by 2 ft based on available information, Source is unknown.	
AOPC-01d PFAS in on-site and off-site soil	PFOA concentrations ranged from below the detection to 9.8 µg/kg in on-site soil and 5.1 µg/kg in off-site soil. PFOA was detected at one or more depth intervals at all on-site and off-site sampling locations, but with no exceedances of the USEPA screening value of 1,000 µg/kg for the sum of PFOA plus PFOS. Dimensions: 4.7 acres (bounded by detections in off-site boring locations OS-MW-024, -025, -026, -027, and -028). Source is unknown.	Collect additional soil samples during the IRM Pre-Design Investigation and RI to delineate the vertical and horizontal PFAS in surface, near surface and subsurface soil. Collect surface and near-surface soil samples beneath the roof driplines at off-site locations near the John Street property.
AOPC-01e CVOCs at on-site soil	TCE was detected in on-site soil above the Industrial Use SCO at JS-B-003 at 15 to 17 ft bgs and above the Commercial Use SCO at JS-B-001 at 18 to 19 and 60 to 64 ft bgs. TCE and several other CVOCs were detected in groundwater above NYSDEC GA criteria and above the Protection of Groundwater SCO in soil samples from JS-B-001, -002, -003, -006, -007, -008, -009, and -012. Dimensions: Less than 0.3 acres (bounded by borings JS-B-001, -002, -003, -006, -008, -009, and -012). Source is unknown.	Collect additional soil samples from soil borings during IRM Pre-Design Investigation and RI to delineate the extent of CVOC impacts to soil.
AOPC-01f SVOCs in soil	Two PAHs, benzo(a)pyrene and dibenzo(a,h)anthracene, were detected above the Industrial Use SCO for soil in one near-surface soil sample JS-B-004 (2 to 12-inch) and two PAHs, benzo(a)anthracene and benzo(b)fluoranthene, were detected above the Commercial Use SCO in the same soil sample. This location is near the Lyman Street in an area that has been used for parking and may be related to asphalt and/or automotive fuel or emissions. Dimensions: Estimated to be less than 10 ft by 10 ft by 1 ft based on available information. This location is near the Lyman Street in an area that has been used for parking and may be related to asphalt and/or automotive fuel or emissions.	No further action
AOPC-01g Cyanide, PCBs, Pesticides, and metals (except copper and nickel)	No exceedances of cyanide, PCBs, pesticides, and metals (except copper and nickel) observed in on- or off-site soil samples.	No further action
AOPC-02: Area-Wide Groundwater		
AOPC-02a PFAS in on-site and off-site groundwater	PFOA has been detected in all groundwater samples with concentrations ranging form 130 ng/L to 6400 ng/L. Dimensions: 5.8 acres (bounded by detections in off-site monitoring well locations OS-MW-024, -025, -026, -027,-028, -030 and -031. Possibly related to use of PFAS at the former John St facility.	Install shallow bedrock and additional overburden monitoring wells during the RI and collect groundwater samples to delineate the vertical and horizontal extent of PFAS.
AOPC-02b CVOCs in on-site and off-site groundwater	CVOCs including TCE and 1,1,1-TCA have been detected in on-site and off-site groundwater at concentrations that exceed NYS GA criteria. Dimensions: Approximately 1.3 acres in shallow groundwater (bounded by the site and monitoring wells OS-MW-024A and OS-MW-031A); approximately 2.2 acres in overburden groundwater below the silt/clay layer (bounded by the site and monitoring wells OS-MW-024B, -25B, -025C, -026B, and -031B). Source is unknown.	Install shallow bedrock and additional overburden monitoring wells during the RI and collect groundwater samples to delineate the vertical and horizontal extent of PFAS. Perform Soil Vapor Intrusion (SVI) evaluations at properties located downgradient of the John St site. Select and implement an Interim Remedial Measure to reduce migration of CVOCs in shallow groundwater.
AOPC-02c 1,4-dioxane in on-site groundwater	1,4-dioxane was detected in two on-site groundwater samples at JS-APS-001 and JS-APS-004 at low concentrations (2 J and 1 J µg/L). Dimensions: 1,4-dioxane appears to be confined to two locations on site. Dimensions: Detected in an area of less than 0.5 acres (bounded by the site). 1,4-dioxane has been used as a stabilizer in 1,1,1-TCA, which was also detected in groundwater at these locations.	Collect additional groundwater samples from existing and new monitoring wells during the RI and analyze by selective ion monitoring to achieve lower detection limits.

Table 1
Areas of Potential Concern (AOPC) - Descriptions and Recommendations
Former Oak Materials Fluorglas Division - John Street

Location and Description		Recommendation
AOPC-02: Area-Wide Groundwater Continued		
AOPC-002d Selenium and cadmium in on-site groundwater	Selenium was detected in groundwater samples from JS-APS-001 and JS-MW-001A at concentrations (0.0161 J and 0.0345 J mg/L, respectively) above the NYS GA standard of 0.01 mg/L. Cadmium was detected in one groundwater sample from JS-APS-001 at 0.0057 J mg/L above the NYS GA standard of 0.005 mg/L but was not detected the groundwater samples from JS-MW-001A, B, or C. Dimensions: Not estimated since only detected at one location Source: Source is unknown.	Groundwater samples collected from existing and new overburden and bedrock monitoring wells will be analyzed for metals during the RI.
AOPC-02e Iron, manganese and sodium in on- site and off-site groundwater	Iron, manganese and sodium were detected in groundwater samples from most on-site and off-site APS points and monitoring wells at concentrations above NYSDEC GA standards. Iron and manganese are naturally occurring metals that are commonly found in groundwater. Sodium is a naturally occurring metal and its use in road salt commonly contributes to its occurrence in groundwater. are naturally Dimensions: Not estimated. This areas is assumed to be naturally occurring.	No further action
AOPC-002f Barium, chromium, magnesium and lead in off-site groundwater	Barium, chromium, magnesium and lead were detected in groundwater from off-site monitoring wells OS-MW-030B and OS-MW-031B at concentrations above NYS GA standards. No exceedances were observed in groundwater samples from on-site groundwater samples Dimensions: Not estimated. These metals are ssumed to be naturally occurring and not related to the site.	No further action
AOPC-02g Cyanide, PCBs, Pesticides, SVOCs, and metals other than barium, cadmium, chromium, iron, magnesium, manganese, and sodium	Cyanide, PCBs, Pesticides, SVOCs, and metals (except barium, cadmium, chromium, iron, magnesium, manganese, and sodium) were not detected above NYS GA standards or guidance in any of the groundwater samples.	No further action
AOPC-03: Municipal Sewer System		
AOPC-03 Municipal Sewers	The municipal sewers have been identified as a possible source of PFAS or CVOC contamination to soil. Dimensions: No information at this time. The source would be potentially leaking sewers.	Collect soil samples in the vicinity of the municipal sewer sites at selected locations on-site and off-site during the RI and analyze for PFAS (21), TOC, pH, TCL VOCs, TAL Metals plus a subset of samples for Full TCL/TAL.
AOPC-04 Potential Fuel Oil Underground Storage Tank		
AOPC-04 Former Underground Storage Tank (UST)	Historical information indicates that a 10,000-gallon fuel oil UST was present at the John Street property. Ground penetrating radar (GPR) surveys on the John St. property have not identified a UST. Soil borings and soil and groundwater samples collected from the southern portion of the site do not indicate the presence of fuel oil. According to the EDR report, a tank was closed and removed in 1995 from John Street Fluorglas, Allied Signal Inc.; however, coordinates for the tank plot to the middle of Church Street at the intersection of John and Church Streets by Key Bank. The EDR also lists a second UST closed in-place by AlliedSignal Laminate Systems in 1999 was located at Mechanic Street. Given the footprint of the former John St. building, a UST would likely have been located on the south end of the property. Dimensions: None. No fuel oil constituents were detected during the SC. No source known at this time	Conduct an additional GPR survey on the southern area of the property as part of the subsurface clearance activities for new monitoring wells.

Notes and Abbreviations:

PFAS - Perfluoroalkyl Substances
PFOA - Perfluorooctanoic acid
PFOS - Perfluorooctane sulfonic acid
CVOCs - Chlorinated Volatile Organic Compounds
VOCs - Volatile Organic Compounds
SVOCs - Semi-Volatile Organic Compounds

TOC - Total Organic Carbon by the Lloyd Kahn method
PCBs - Polychlorinated Biphenyls
Full TCL/TAL - VOCs/SVOCs/Pesticides/PCBs/Metals/Cyanide
TCL - Target Compound List
TAL - Target Analyte List (Metals & Cyanide)

RI - Remedial Investigation
IRM - Interim Remedial Measure
PDI - Pre-Design Investigation
SVI - Soil Vapor Intrusion

Table 2
RI Sampling and Analysis Plan - Completed and Continued John Street RI Tasks
Former Oak Materials Fluorglas Division - John Street

Sample Matrix	Sampling Location	Methods/Work Scope Summary	Number of Samples (excluding QA/QC)	Analytical Parameters	Sample Type	Sampling Method	Rationale/NYSDEC DER-10 Reference
AOPC-001a-d: Area-Wide Soil (Copper, Nickel, PFAS By Location)							
Surface & Near-Surface Soil ● TASK COMPLETED	On site AOPC-01a Copper at JS-B-005	0" - 2" and 2" - 12" near JS-B-005 (4 locations: JS-B-005A-D)	8	Copper, PFAS (21), TOC, pH, VOCs, 1,4-dioxane	1 grab sample at each depth interval at each location	Hand Auger	• Additional characterization of PFASs and VOCs in on-site surface and near surface soil • Characterize soil in areas with exceedances of NYS SCOs for Commercial Use at on-site locations: - Delineate copper in vicinity of JS-B-005 - Delineate copper in subsurface soil in vicinity of JS-B-002 - Delineate nickel in vicinity of JS-B-003 • DER-10 2 § 3.5 Soil, §3.5.1 Site Characterization; (b) 1 through 3, Surface Soil Sampling • DER-10 2 §3.5.2 Remedial Investigation (b) 1 through 2, Surface Soil Sampling
	On site AOPC-01b Nickel at JS-B-003	2" - 12" near JS-B-003 (4 locations: JS-B-003A-D)	4	Nickel, PFAS (21), TOC, pH, VOCs, 1,4-dioxane	1 grab sample at each location	Hand Auger	
Subsurface Soil ● TASK COMPLETED	On site AOPC-01a Copper at JS-B-005	5 locations: 1 depth interval (12" - 36") at JS-B-005 and 4 locations near JS-B-005(A-D)	5	Copper, PFAS (21), TOC, pH, VOCs, 1,4-dioxane	Grab Sample	Hand Auger	• Additional characterization of PFASs and VOCs in on-site surface and near surface soil • Characterize soil in areas with exceedances of NYS SCOs for Commercial Use at on-site locations: - Delineate copper in vicinity of JS-B-005 - Delineate copper in subsurface soil in vicinity of JS-B-002 - Delineate nickel in vicinity of JS-B-003 • DER-10 2 § 3.5 Soil, §3.5.1 Site Characterization; (c) 1 through 7, (d) Subsurface Soil Sampling • DER-10 2 § 3.5 Soil, §3.5.2 Remedial Investigation (c) 1 through 3, (d) Subsurface Soil Sampling
	On site AOPC-01b Nickel at JS-B-003	5 locations: 1 depth interval (12" - 36") at JS-B-003 and 4 locations near JS-B-003 (A-D)	5	Nickel, PFAS (21), TOC, pH, VOCs, 1,4-dioxane	Grab Sample	Hand Auger	
	On site AOPC-01c Copper at JS-B-002	5 locations: 1 depth interval (8' - 10') at JS-B-002 and 4 locations (6'-8') near JS-B-002 (A-D)	5	Copper, PFAS (21), TOC, pH, VOCs, 1,4-dioxane	Grab Sample	Direct Push Rig	
	On site AOPC-01d PFAS in on-site and off-site soil	5 locations: JS-B-56, 57 & 58, BB4 depth intervals in clay; top and bottom of brown clay (where present and >12" thick; otherwise 1 representative sample where brown clay is present and <12"); and top and bottom of gray clay.	20	PFAS (21), TOC, pH, VOCs, 1,4-dioxane	Grab Sample	Direct Push Rig	• Characterize PFAS and VOC concentrations in brown/gray clay unit on-site • DER-10 2 § 3.5 Soil, §3.5.1 Site Characterization; (c) 1 through 7, (d) Subsurface Soil Sampling • DER-10 2 § 3.5 Soil, §3.5.2 Remedial Investigation (c) 1 through 3, (d) Subsurface Soil Sampling
Surface & Near-Surface Soil ●	On-site/Off-site AOPC-01d PFAS in on-site and off-site soil	3 new on-site overburden wells and 11 new off-site overburden well cluster locations: 0" to 2" and 2 to 12" (include root mass) Surface and near-surface soil samples will be collected beneath the roof driplines at up to ten locations near the John Street property. Surface soil samples will be collected from the surface (zero to two inches below the surficial vegetative cover), but will include the root mass, as requested by NYSDEC. Near-surface soil samples will be collected at a depth of two- to 12-inches below the surficial vegetative cover.	28	PFAS (21), TOC, pH, VOCs, 1,4-dioxane	1 grab sample at each depth interval	Hand Auger	Additional characterization of PFASs and VOCs in Off-site surface and near surface soil • DER-10 2 § 3.5 Soil, §3.5.1 Site Characterization; (b) 1 through 3, Surface Soil Sampling • DER-10 2 §3.5.2 Remedial Investigation (b) 1 through 2, Surface Soil Sampling
Subsurface Soil ●	On-site/Off-site AOPC-01d PFAS in on-site and off-site soil	3 new on-site overburden wells and 11 new off-site overburden well cluster locations, soil samples will be collected from: o Immediately above the water table. o Glacio-lacustrine aquitard; o Buried sand aquifer; and o Till layer, when present. If encountered: o Top of the native soil at the fill/native soil interface o Mottled zones (encompassing the total thickness of the observed mottling) o Subjectively impacted soils (based on visual, olfactory, or other field screening observations).	42+ (Minimum 3 per location + if encountered stratum noted to the left)	PFAS (21), TOC, pH, VOCs, 1,4-dioxane	One grab sample at each depth interval	Rotosonic Drilling Rig	Additional characterization of PFASs and VOCs in Off-site surface and near surface soil • DER-10 2 § 3.5 Soil, §3.5.1 Site Characterization; (c) 1 through 7, (d) Subsurface Soil Sampling • DER-10 2 § 3.5 Soil, §3.5.2 Remedial Investigation (c) 1 through 3, (d) Subsurface Soil Sampling
Subsurface Soil ●	Off-site AOPC-01d PFAS in on-site and off-site soil	5 locations: o 4 depth intervals in clay at temporary overburden well locations to be installed and sampled east, west and north of John Street property (see AOPC-05 below); top and bottom of brown clay (where present and >12" thick; otherwise 1 representative sample where brown clay is present and <12"); and top and bottom of gray clay. o TCL/TAL, CN, grain size and pH analyses from immediately above the water table from the five (5) proposed temporary well locations surrounding the Site (west, north and east sides) which represents a 25% sampling rate.	20	PFAS (21), TOC, pH, VOCs, 1,4-dioxane TCL/TAL, pH, grain size analyses	One grab sample at each depth interval	Rotosonic Drilling Rig	• Characterize PFAS and VOC concentrations in brown/gray clay unit off-site • DER-10 2 § 3.5 Soil, §3.5.1 Site Characterization; (c) 1 through 7, (d) Subsurface Soil Sampling • DER-10 2 § 3.5 Soil, §3.5.2 Remedial Investigation (c) 1 through 3, (d) Subsurface Soil Sampling

Table 2
RI Sampling and Analysis Plan - Completed and Continued John Street RI Tasks
Former Oak Materials Fluorglas Division - John Street

Sample Matrix	Sampling Location	Methods/Work Scope Summary	Number of Samples (excluding QA/QC)	Analytical Parameters	Sample Type	Sampling Method	Rationale/NYSDEC DER-10 Reference
AOPC-002a-f: Area-Wide Groundwater: PFAS, VOCs, 1,4-dioxane & Metals in Groundwater							
Groundwater In Bedrock ⊕	On site (2 locations)	Shallow bedrock wells were installed at JS-MW-001BR and JS-MW-003BR; borehole geophysical logging completed	2	See Below	Bedrock Groundwater	Rotosonic Drilling Rig See Below	• Characterize vertical flow and groundwater quality in shallow bedrock for PFAS, VOCs and metals. • DER-10 § 3.7 Groundwater, §3.7.1 Site Characterization, §3.7.2 Remedial Investigation
	Off site (6 locations)	Shallow bedrock wells were installed near OS-MW-024BR, 026BR, 027BR, 028BR, 030BR and 031BR; borehole geophysical logging completed	6	See Below	Bedrock Groundwater	Rotosonic Drilling Rig See Below	• Characterize vertical flow and groundwater quality in shallow bedrock for PFAS, VOCs and metals. • DER-10 § 3.7 Groundwater, §3.7.1 Site Characterization, §3.7.2 Remedial Investigation
Groundwater In Overburden ●	On-site	3 locations: install, gauge and sample 3 additional deep overburden monitoring wells at the locations of JS-MW-001, 003 and 004.	3	PFAS (21), TOC, pH, TCL VOCs, 1,4-dioxane, TAL Metals, Field and Geochemical Parameters	Overburden Groundwater	Rotosonic Drilling Rig and Low-flow Sampling	• Supplement existing On-site overburden monitoring well network to complete characterization of overburden groundwater quality and delineate the vertical extent of impacts. • DER-10 § 3.7 Groundwater, §3.7.1 Site Characterization, §3.7.2 Remedial Investigation
⊕	On-site	5 locations: gauge and sample all overburden monitoring wells at JS-MW-001, 002, 003, 004 and 005.	11	PFAS (21), TOC, pH, TCL VOCs, 1,4-dioxane, TAL Metals, Field and Geochemical Parameters	Overburden Groundwater	Low-flow Sampling	• Characterize on-site overburden groundwater quality: • DER-10 § 3.7 Groundwater, §3.7.1 Site Characterization, §3.7.2 Remedial Investigation
●	Off-site	5 locations: install temporary overburden groundwater monitoring wells and collect discrete depth groundwater samples at 2 depths per location (near water table and above refusal) to the east, west and north of John St (locations of subsurface soil sampling).	10	PFAS (21), TOC, pH, TCL VOCs, 1,4-dioxane, TAL Metals, Field and Geochemical Parameters	Overburden Groundwater	Rotosonic Drilling Rig and Low-flow Sampling	• Characterize overburden groundwater quality and delineate extent of off-site impacts adjacent to John Street: • DER-10 § 3.7 Groundwater, §3.7.1 Site Characterization, §3.7.2 Remedial Investigation
●	Off-site	11 locations: install, gauge and sample additional overburden monitoring wells at shallow, intermediate and deep depth intervals.	33	PFAS (21), TOC, pH, TCL VOCs, 1,4-dioxane, TAL Metals, Field and Geochemical Parameters	Overburden Groundwater	Rotosonic Drilling Rig (intermediate and deep) and Low-flow Sampling	• Characterize overburden groundwater quality and delineate extent of off-site impacts: • DER-10 § 3.7 Groundwater, §3.7.1 Site Characterization, §3.7.2 Remedial Investigation
⊕	Off-site	7 locations: gauge and sample all overburden wells at OS-MW-024, 025, 026, 027, 028, 030 and 031.	20	PFAS (21), TOC, pH, TCL VOCs, 1,4-dioxane, TAL Metals, Field and Geochemical Parameters	Bedrock Groundwater	Low-flow Sampling	• Characterize overburden groundwater quality and delineate extent of off-site impacts: • DER-10 § 3.7 Groundwater, §3.7.1 Site Characterization, §3.7.2 Remedial Investigation
Groundwater In Overburden ●	On-site AOPC -02b at JS-B-001	Install 4 temporary small-diameter wells in the shallow sand/gravel layer and collect 1 groundwater sample from each.	4	PFAS (21), TOC, pH, TCL VOCs, 1,4-dioxane, Field Parameters	Overburden Groundwater	Direct Push Rig and Low-flow Sampling	• Delineate VOC impacts in vicinity of JS-B-001 and JS-MW-001A • DER-10 § 3.7 Groundwater, §3.7.1 Site Characterization, §3.7.2 Remedial Investigation
Groundwater In Overburden ●	On-site AOPC-02b at JS-B-003	Install 4 temporary small-diameter wells in the shallow sand/gravel layer and collect 1 groundwater sample from each.	4	PFAS (21), TOC, pH, TCL VOCs, 1,4-dioxane, Field Parameters	Overburden Groundwater	Direct Push Rig and Low-flow Sampling	• Delineate VOC impacts in vicinity of JS-B-003 • DER-10 § 3.7 Groundwater, §3.7.1 Site Characterization, §3.7.2 Remedial Investigation
Groundwater In Bedrock ⊕	On-site (2 locations)	Gauge and sample shallow bedrock wells JS-MW-001BR and JS-MW-003BR.	2	Field parameters PFAS (21), TOC, pH, TCL VOCs, TAL Metals, Geochemical parameters	Bedrock Groundwater	Low-flow Sampling	• Characterize vertical flow and groundwater quality in shallow bedrock for PFAS, VOCs and metals. • DER-10 § 3.7 Groundwater, §3.7.1 Site Characterization, §3.7.2 Remedial Investigation
	Off-site (6 locations)	Gauge and sample shallow bedrock wells OS-MW-024BR, 026BR, 027BR, 028BR, 030BR and 031BR.	6	Field parameters PFAS (21), TOC, pH, TCL VOCs, TAL Metals, Geochemical parameters	Bedrock Groundwater	Low-flow Sampling	• Characterize vertical flow and groundwater quality in shallow bedrock for PFAS, VOCs and metals. • DER-10 § 3.7 Groundwater, §3.7.1 Site Characterization, §3.7.2 Remedial Investigation
AOPC-03: Municipal Sewer System							
Subsurface Soil ●	On-site AOPC-003 Municipal Sewer	2 locations: Samples collected at 4' and 10' from the sewer line from depth below the pipe invert elevation.	4	PFAS (21), TOC, pH, TCL VOCs, TAL Metals plus 1 samples (20%) was analyzed for Full TCL/TAL	Grab sample	Direct Push Rig	• Characterize soil quality in the vicinity of potentially leaking municipal sewer lines and the backfilled trench excavations • DER-10 2 § 3.5 Soil, §3.5.2 Remedial Investigation (c) 1 through 3, (d) Subsurface Soil Sampling
	Off-site AOPC-003 Municipal Sewer	7 locations: Samples collected at 4' and 10' from the sewer line from depth below the pipe invert elevation.	14	PFAS (21), TOC, pH, TCL VOCs, TAL Metals plus 3 samples (20%) were analyzed for Full TCL/TAL	Grab sample	Direct Push Rig	• Characterize soil quality in the vicinity of potentially leaking municipal sewer lines and the backfilled trench excavations • DER-10 2 § 3.5 Soil, §3.5.2 Remedial Investigation (c) 1 through 3, (d) Subsurface Soil Sampling

Table 2
RI Sampling and Analysis Plan - Completed and Continued John Street RI Tasks
Former Oak Materials Fluorglas Division - John Street

Sample Matrix	Sampling Location	Methods/Work Scope Summary	Number of Samples (excluding QA/QC)	Analytical Parameters	Sample Type	Sampling Method	Rationale/NYSDEC DER-10 Reference
AOPC-04: Potential Fuel Oil Underground Storage Tank							
Potential Former Underground Storage Tank	On-site	Conduct an additional GPR survey on the southern area of the property as part of the subsurface clearance activities for new monitoring wells.	0	none	Geophysical Screening	Ground Penetrating Radar and Electromagnetic Scan	• DER-10 § 3.2 General Sampling Considerations (c), §3.7.2 Remedial Investigation (a) 4

Notes and Abbreviations:
DER-10 = DER-10 / Technical Guidance for Site Investigation and Remediation, 5/3/2010.
PFAS - Perfluorinated Alkyl Substances
TCL - Target Compound List
TAL - Target Analyte List (Metals & Cyanide)
VOCs - Volatile Organic Compounds
SVOCs - Semi-Volatile Organic Compounds
TOC = Total Organic Carbon by the Lloyd Kahn method
PCBs = Polychlorinated Biphenyls
Full TCL/TAL = VOCs/SVOCs/Pesticides/PCBs/Metals/Cyanide
Field Parameters - Specific Conductance (SpC), pH, Dissolved Oxygen (DO), and Oxidation-Reduction Potential (ORP)
Geochemical Parameters - Major Cations Calcium, Magnesium, Sodium, and Potassium) and Major Anions (Chloride, Carbonate, Bicarbonate and Sulfate)

ERM has over 140 offices Across the following countries worldwide

Argentina
Australia
Belgium
Brazil
Canada
China
Colombia
France
Germany
Hong Kong
Hungary
India
Indonesia
Ireland
Italy
Japan
Kazakhstan
Korea
Malaysia
Mexico
The Netherlands
New Zealand
Panama
Peru
Poland
Portugal
Puerto Rico
Romania
Russia
Singapore
South Africa
Spain
Sweden
Taiwan
Thailand
United Arab Emirates
UK
USA
Vietnam

ERM's Melville Office

105 Maxess Road – Suite 316
Melville, New York 11747-3857
T: +1 631-756-8900

www.erm.com/US

Appendix C
RI Quality Assurance Project Plan

Quality Assurance Project Plan for Environmental Investigations in the Town of Hoosick and Village of Hoosick Falls, New York

16 March 2018

ERM Consulting and Engineering, Inc.
www.erm.com

TABLE OF CONTENTS

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

AAR	Alternatives Analysis Report
ALS	Australian Laboratory Services
ASP	Analytical Services Protocol
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLP	Contract Laboratory Protocols
COPC	Constituent of Potential Concern
DQOs	Data Quality Objectives
DER	Division of Environmental Remediation
DUP	Duplicate
DUSR	Data Usability Summary Report
ELLE	Eurofins Lancaster Laboratory Environmental
ERM	ERM Consulting and Engineering, Inc.
FB	Field Blank
LCS	Laboratory Control Sample
LFB	Laboratory Fortified Blank
LFSM	Laboratory Fortified Sample Matrix
LFSMD	Laboratory Fortified Sample Matrix Duplicate
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NA	Not applicable
NJDEP	New Jersey Department of Environmental Protection
NYSDEC	New York State Department of Environmental Conservation
PARCC	Precision, Accuracy, Representativeness, Completeness, and Comparability
PCBs	Polychlorinated Biphenyls
PFAS	Per- and Polyfluorinated Alkyl Substances
QAOs	Quality Assurance Objectives
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/ Quality Control
RAWP	Remedial Action Work Plan
RIWP	Remedial Investigation Work Plan
RCRA	Resource Conservation and Recovery Act
RPD	Relative Percent Difference
SOW	Scopes of Work
SC	Site Characterization
SOPs	Standard Operating Procedures
SVOCs	Semi-volatile Organic Compounds
TB	Trip Blank
TOC	Total Organic Compounds
TOP	Total Oxidizable Precursors
TSCA	Toxic Substances Control Act
USEPA	United States Environmental Protection Agency
VOCs	Volatile Organic Compounds

1.0 INTRODUCTION

ERM Consulting and Engineering, Inc. (ERM) has prepared this Quality Assurance Project Plan (QAPP) as part of multiple environmental investigation activities in the Town of Hoosick and Village of Hoosick Falls, Rensselaer County, New York. This QAPP is applicable to the following scopes of work (SOW):

- Site Characterization (SC) Report and Remedial Investigation Work Plan (RIWP) for the Oak Materials – River Road 1, 2, and 3 (No. 442008) and the Former Oak Materials Fluorglas Division – John Street (No. 442049);
- Vapor Intrusion Evaluation Work Plan for and the Former Oak Materials Fluorglas Division – John Street (No. 442049);
- Shallow Groundwater Interim Remedial Measure Pre-Design Investigation & Treatability Study Work Plan for the Former Oak Materials Fluorglas Division – John Street (No. 442049);
- SC Field Sampling and Analysis Plan for the Former Allied Signal Laminate Systems – Mechanic Street (No. 442050); and
- SC Work Plan – Groundwater Investigation for the Former Oak Mitsui – First Street (No. 442052).

The Oak Materials – River Road 1, 2 and 3 property is located in the Town of Hoosick, Rensselaer County, New York. The Former Oak Materials Fluorglas Division – John Street property, Former Allied Signal Laminate Systems – Mechanic Street property, and Former Oak Mitsui – First Street property are located in the Village of Hoosick Falls, Rensselaer County, New York.

1.1 PURPOSE AND OBJECTIVES

The objective of the above referenced work plans is to develop a Conceptual Site Model for the above referenced sites. The work plans are designed to address requirements under Section 3.3 of the NYSDEC's Division of Environmental Remediation (DER) guidance manual DER-10 entitled "Technical Guidance for Site Investigation and Remediation" (NYSDEC, 2010). The SOW will be conducted to identify contaminant source areas, define the extent and nature of the contamination, generate sufficient data to develop a remedial Alternatives Analysis Report (AAR) and Remedial Action Work Plan (RAWP) (if required) and evaluate threats to human health and the environment. A summary of project sampling tasks are included in **Table 1**.

This QAPP identifies the necessary procedures for an orderly, accurate, and efficient data collection and analysis program for the project, and ensures that data meet quality objectives. The objectives for monitoring and ensuring data quality include the following:

- Identify key responsibilities and qualifications of staff responsible for data quality monitoring;
- Ensure that samples are properly managed both in the field and the laboratory;
- Ensure realistic data quality goals that will produce data of known and acceptable quality are established; and
- Ensure that data are accurate, complete, and verifiable.

2.0 QUALITY ASSURANCE OBJECTIVES

Quality objectives ensure that collected data are sufficient to meet the intended project goals. Quality objectives are pre-established goals that are used to monitor and assess the progress and quality of the work performed. It is essential to define quality objectives prior to initiation of any project work to ensure that activities yield data sufficient to meet project objectives.

Quality objectives are divided into two categories: data quality objectives (DQOs) and quality assurance objectives (QAOs). The DQOs are associated with the overall project objective as it relates to data collection. The QAOs define acceptance limits for project generated data as they relate to data quality.

2.1 DATA QUALITY OBJECTIVES

DQOs are qualitative and quantitative criteria that are required to support the decision-making process. DQOs define the uncertainty in a data set and are expressed in terms of precision, accuracy, representativeness, completeness, and comparability (PARCC). The DQOs apply to both characterization and confirmation samples collected as part of the above referenced work plans (Section 1.0). These parameters are defined as follows:

- Precision: a measure of mutual agreement among measurements of the same property usually under prescribed similar conditions. Precision is best expressed in terms of the standard deviation. Various measures of precision exist depending upon the "prescribed similar conditions".
- Accuracy: the degree of agreement of a measurement (or an average of measurements) with an accepted reference of "true value". Accuracy is one estimate of the bias in a system.
- Representativeness: expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.
- Completeness: a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct normal conditions.
- Comparability: expresses the confidence with which one data set can be compared with another. Comparability is a qualitative, not quantitative measurement, as in the case of accuracy and precision. Comparability is assessed by reviewing results or procedures for data that do not agree with expected results.

It is the responsibility of the field team to collect representative and complete samples. It is the responsibility of the field-screening chemist at the laboratory to analyze these samples using accepted protocols resulting in data that meet PARCC standards.

2.2 *FIELD SAMPLING QUALITY OBJECTIVES*

The overall quality of sample results depends on proper sample management. Management of samples begins prior to sample collection and continues throughout the analytical and data validation process. To ensure samples are collected and managed properly and consistently, field procedures for sample collection activities have been developed for the project. The laboratory also has procedures that ensure a proper and consistent analytical process.

Field procedures include descriptions of equipment and procedures required to perform a specific task. The purpose is to increase reproducibility and to document each of the steps required to perform the task. Approved and correctly implemented field procedures should produce data of acceptable quality that meet project DQOs.

2.3 *LABORATORY DATA QUALITY OBJECTIVES*

Samples will be submitted to one or more laboratories over the course of the sampling program. Eurofins Lancaster Laboratory Environmental (ELLE), Australian Laboratory Services (ALS) and Test America, Inc. are the three selected project laboratories. These laboratories will demonstrate analytical precision and accuracy by the analysis of laboratory duplicates and by adherence to accepted manufacture and procedural methodologies.

The performance of the laboratory will be evaluated by the Project Manager and Project Quality Assurance Officer during data reduction. The evaluation will include a review of all deliverables for completeness and accuracy when applicable. This evaluation is outlined in **Tables 2 and 3**.

3.0 QUALITY CONTROL PROCEDURES

This section presents a general overview of the quality assurance quality control (QA/QC) procedures that will be implemented during the activities outlined in the SOW.

These quality control procedures are to be implemented as follows:

- In the field; and
- In the laboratory utilized for selected sample analyses.

Further detail regarding QA/QC samples and procedures can be found in **Table 4**.

3.1 FIELD QC ACTIVITIES

Several types of field QC samples will be collected and submitted for analysis during the project. Each type of QC sample monitors a different aspect of the field effort. Analytical results for QC samples provide information regarding the adequacy of the sample collection and transportation of samples.

The frequency of field QC samples collected will depend on the total number of samples being collected. Specifics of the sampling activities, regarding collection frequency are described in **Table 4**. Sampling procedures are described in the text of each individual work plan. The seven types of field QC samples that will be generated during the project are defined below.

- Trip Blanks – Trip blank samples monitor for contamination due to handling, transport, cross contamination from other samples during storage, or laboratory contamination.
- Temperature Blank – Temperature blanks are used to monitor temperature within a sample cooler. Temperature blank results that are outside of acceptable limits (1° to 10° C) indicate possible sample preservation issues and may require qualification of data or the recollection of samples.
- Blind Field Duplicates (DUP) – Field duplicates are used to monitor field and laboratory precision, as well as matrix heterogeneity.
- Split Samples – Field split samples are used to monitor laboratory precision and accuracy.
- Field Blank (FB) – Field blanks are prepared using laboratory-provided water and poured into sample containers at the sampling location. Field blanks are used to provide information that samples have not been contaminated during field sampling and during transport of containers from and to the laboratory.
- Matrix Spikes and Matrix Spike Duplicates – Matrix Spikes (MS) and MS duplicates (MSD) are used to monitor precision and accuracy of the analytical method on various matrices.

3.2 LABORATORY QC ACTIVITIES

Laboratory QC samples will include the use of method blanks, MS, laboratory control samples (LCS), laboratory duplicates and surrogate spikes. The five types of laboratory QC samples are defined below.

- Method Blanks - Method blanks are used to monitor and ensure that the analytical system is free of contamination due either to carryover from previous samples or from laboratory procedures.
- Laboratory Fortified Blank (LFB) – A volume of reagent water or other blank matrix to which known quantities of the method analytes and all the preservation compounds are added in the laboratory. The LFB is analyzed exactly like a sample, and its purpose is to determine whether the methodology is in control, and whether the laboratory is capable of making accurate and precise measurements.
- Laboratory Fortified Sample Matrix (LFSM) – A preserved field sample to which known quantities of the method analytes are added in the laboratory. The LFSM is processed and analyzed exactly like a sample, and its purpose is to determine whether the sample matrix contributes bias to the analytical results. The background concentrations of the analytes in the sample matrix must be determined in a separate sample extraction and the measured values in the LFSM corrected for background concentrations.
- Laboratory Fortified Sample Matrix Duplicate (LFSMD) – A duplicate of the Field Sample used to prepare the LFSM. The LFSMD is fortified, extracted, and analyzed identically to the LFSM. The LFSMD is used instead of the Field Duplicate to assess method precision when the occurrence of method analytes is low.
- Surrogate Spikes - Surrogate Spikes are utilized to monitor potential interferences from the sample matrix. Surrogate spikes are required for organic analyses only.

Further detail regarding measurement performance criteria can be found in **Tables 5 through 11**.

4.0 ANALYTICAL PROCEDURES AND DATA EVALUATION

Groundwater, surface water, soil and sediment samples will be collected and submitted to the selected project laboratory for analysis of constituents of potential concern (COPCs) to facilitate the NYSDEC's RI process. The COPCs are:

- Per- and Polyfluorinated Alkyl Substances (PFAS);
- Total Oxidizable Precursors (TOP);
- Volatile organic compounds (VOCs)
- Semi-volatile organic compounds (SVOCs);
- Polychlorinated biphenyls (PCBs);
- Pesticides;
- Inorganic compounds (e.g., metals, cyanide);
- Total organic carbon (TOC); and
- pH

Additionally, soil vapor, indoor air and sub-slab air samples will be collected for analysis of VOCs only.

Laboratory analytical procedures will adhere to the methodology and/or the selected project laboratory Standard Operating Procedures (SOPs) outlined in **Table 12**. The laboratory analytical methods, preservations holding times and container requirements are outlined in **Table 13**. The sample custody requirements are included in **Table 14**.

Upon receipt of analytical reports from the laboratory, ERM will evaluate data packages and confirm that samples were analyzed within required holding time and at proper detection limits. The laboratory will provide deliverables in NYSDEC Analytical Services Protocol (ASP) Category B format.

The Project Quality Assurance Officer will review the data packages and prepare a Data Usability Summary Report (DUSR) in accordance with NYSDEC guidance in DER-10 (NYSDEC, 2010). At a minimum, the following information will be evaluated:

- Chain-of-custody forms;
- Date sampled/date analyzed;
- Sample temperature at check-in;
- Raw data;
- Initial and continuing instrument calibrations;
- MS/MSDs;

- Laboratory duplicate analyses;
- Surrogate recoveries (organics); and
- Laboratory control samples (inorganics).

Data reduction will consist of presenting analytical results on summary tables. Data resulting from characterization analyses will then be used to evaluate potential remedial options.

5.0 PROJECT PERSONNEL

ERM will staff this project with persons having expertise in the tasks to be performed and experience working on NYSDEC-regulated sites. The Project Personnel Sign-Off Sheet is located in **Table15** and key project personnel that will be involved with this project are summarized below.

James A. Perazzo P.G. will be the Partner-In-Charge for this project. Mr. Perazzo has over 25 years of experience dealing with legacy environmental problems under CERCLA, RCRA, TSCA and related brownfield environmental programs. As part of the Sustainable Watershed Integrated Management practice, Mr. Perazzo works with clients, regulators and national organizations on assessing impacts in urban waterways and facilitating risk management decisions to address impacts. Aligns technical approaches with business objectives and works with regulators, when necessary. Mr. Perazzo will be responsible for all ERM activities on the project and assists the ERM Project Manager in planning, coordinating and controlling all work performed on this project. He has overall responsibility for developing the QAPP, monitoring the quality of the technical and managerial aspects of the project, and implementing the QAPP and corrective measures, where necessary.

Elena Ponce will be the Project Manager for this project. Ms. Ponce has 14 years of diversified experience in environmental consulting, project engineering, and project management. Experience includes industrial and domestic wastewater treatment, pilot plant design and modeling, field sampling, construction oversight, waste management, Brownfield clean-up programs and insurance engineering support. Ms. Ponce has also assisted in the development and implementation of work plans and associated documents for various state agencies including the NYSDEC and New Jersey Department of Environmental Protection (NJDEP).

Andrew Coenen, will be the QA/QC Officer for this project. Mr. Coenen has 24 years of general analytical chemistry experience, six years of analytical laboratory experience and 15 years of environmental consulting experience, including analytical data validation, sampling and analysis programs, quality assurance programs, technical support and QA oversight for fixed laboratory and field analysis. Mr. Coenen has knowledge of numerous analytical methodologies and experience in data validation of analytical data package deliverables for adherence to the United States Environmental Protection Agency (USEPA) contract laboratory protocols (CLP) and non-CLP and NYSDEC ASP protocols. Mr. Coenen will be responsible for establishing and maintaining an accurate and representative database for data collected during the investigation, monitoring data quality, conducting data review, and preparing a DUSR in accordance with NYSEDC guidelines.

Maureen C. Leahy, Ph.D. has more than 30 years of experience in chemistry, biochemistry and environmental remediation technologies and has served clients in over 30 States in the USA, Canada, Latin America, Europe, Middle East and Asia Pacific. Dr. Leahy's primary areas of expertise are biological and chemical treatment processes and the fate and transport of chemicals in the environment. Dr. Leahy also provides expertise in metal chemistry, emerging and/or persistent contaminants (perchlorate, pharmaceuticals, surfactants, polychlorinated biphenyls, chlorofluorocarbons (CFCs and HCFCs), PFAS and has served as QA Officer responsible for data quality.

Chris Wenczel, P.G. is an ERM Principal Consultant/Hydrogeologist who is also Qualified Environmental Professional and New York State-licensed Professional Geologist who has more than 30 years of diversified experience in the environmental consulting/engineering field specializing in hydrogeology, hazardous waste management/remediation, and water supply. Mr. Wenczel's diverse project experience includes planning and directing large complex projects under CERCLA, RCRA, TSCA, NEPA, SEQRA, NJDEP Site Remediation Program, NJPDES, NYSDEC Voluntary Cleanup, State Superfund and Oil Spill Programs. These activities include preparation of regulatory documentation, strategic advice, regulatory interface/negotiations on behalf of clients, site assessments, remedial investigations, remedial design/remedial actions, and long-term monitoring programs at landfills, and manufacturing, commercial properties and Federal facilities.

Jon Fox P.G. will be the Principal Geologist for this project. Mr. Fox is a Qualified Environmental Professional and licensed Professional Geologist and has more than 28 years of diversified professional scientific and environmental consulting experience including contaminated site investigation and remediation; site management; program and project management; Brownfields program management; regulatory negotiations; geologic and hydrogeologic evaluation; private water well system inspection, sampling, and corrective action; inspection and corrective action of storage tank systems; operations management; expert witness and litigation support; immunoassay field screening; petrographic analyses; geochemistry and geophysics; statistical analysis of geologic data; wetlands evaluation; petroleum exploration geology and development; and professional geologic instruction.

Tables

Table 1
Summary of Project Tasks

Sampling Tasks:

- Collection of samples of potable water to be used in field activities.
- Collection of surface water samples.
- Collection of sediment samples.
- Collection of soil samples and other solid samples.
- Collection of groundwater samples from monitoring wells and temporary points.
- Collection of soil vapor, indoor and outdoor air samples.

Recording groundwater field parameters with YSI during sampling (i.e. pH, conductivity, temperature, dissolved oxygen, oxidation reduction potential, turbidity, etc.).

Recording photoionization detector (PID) headspace readings of soil, soil vapor, and ambient air.

Analysis Tasks: Three (3) laboratories have been selected for sample analyses. Eurofins Lancaster Laboratories Environmental, Australian Laboratory Services (ALS) and/ or Test America, Inc. will perform laboratory analyses. The specific sampling methodologies for project sampling are detailed in the individual SOW. The criteria for the analyses are included within this QAPP.

Quality Control Tasks: QA/QC sampling requirements are outlined in the QAPP. All project personnel are expected to review and comply with the QA/QC protocol and guidance presented within the QAPP.

Secondary Data: Not applicable.

Data Management Tasks: After an appropriate QA/QC review, data will be compiled in an electronic database.

Documentation and Records: All documents will be managed and retained by the ERM Project Manager in the Central Project File.

Assessment/Audit Tasks: QA/QC audits will be performed by the ERM Project Manager, ERM Principal In Charge and ERM QA Officer, or their designees.

Data Review Tasks: QA/QC review and validation of data will be managed by the ERM QA Officer.

Table 2
Assessment Findings and Corrective Action Responses

Assessment Type	*Nature of Deficiencies Documentation*	*Individual(s) Notified of Findings (Name, Title, Organization)*	*Timeframe of Notification*	*Nature of Corrective Action Response Documentation*	*Individual(s) Receiving Corrective Action Response (Name, Title, Org.)*	*Timeframe for Response*
Field Sampling Protocol	Electronic mail that documents the results of the audit will be submitted to the Project Manager.	ERM Project Manager	24 hours after audit	Electronic mail	ERM project personnel listed in Table 15	24 hours after notification
Handling and Custody of Samples	Electronic mail that documents the results of the audit will be submitted to the Project Manager.	ERM Project Manager	24 hours after audit	Electronic mail	ERM project personnel listed in Table 15	24 hours after notification
Analytical Laboratory Performance	Electronic mail that documents the results of the audit will be submitted to the Project Manager.	ERM Project Manager	24 hours after audit	Electronic mail	ERM project personnel listed in Table 15	24 hours after notification

Table 3
Verification Process

Verification Input	*Description*	*Internal/ External*	*Responsible for Verification (Name, Organization)*
Chain of Custody Forms	Chain of Custody (COC) Forms and FedEx shipping papers will be reviewed after the forms have been completed by the ERM sampler but prior to shipping any laboratory samples off-Site. All elements of the COC (requested analysis, bottle qty., project information, etc.) will be compared to the analytical criteria specified in the QAPP and to confirm that the labels and qty. of bottles in the cooler match the information specified on the COC. The FedEx shipping form will be reviewed to certify that the address information is correct, all requested information is provided and that the appropriate shipping method (e.g., priority overnight, Saturday delivery) has been marked so that the samples arrive at the lab according to holding time and temperature preservation requirements specified in the QAPP.	Internal	ERM Field Team Leader
Audit Reports	The results of the audit reports and project assessments presented in Table 2 will be retained in the project file. As specified, the results and findings will be reviewed with the appropriate members of the project team and confirmation that all corrective measures have been completed will be the responsibility of the project manager. Reference Table 2 for further details.	Internal	ERM Project Manager
Field Notes	It is imperative that detailed field notes are recorded real-time in the field to document project field activities.	Internal	ERM Field Team Leader ERM Project Manager
Laboratory Data	All laboratory data will be reviewed internally by the analytical laboratory prior to reporting analytical results to ERM. All analytical laboratory data packages will comply with the 2005 NYSDEC ASP Category B reporting and deliverable requirements presented in Attachment E. Data generated from the Groundwater Monitoring samples will be validated. A Data Usability Assessment will be prepared at the end of the project.	External Internal	Laboratories Project Manager ERM Laboratory QA Officer

Table 4
Quality Control (QC) Check Summary

Quality Control (QC) Checks	*Minimum Frequency*
Trip Blank (TB)	1 per cooler (volatiles only)
Temperature Blank	1 per cooler
Blind Field Duplicate (DUP)	1 per matrix per parameter per 20 samples
Split Sample	1 per matrix for PFAS analysis per 20 samples
Field Blank (FB)	1 per matrix per parameter per day of sample collection (minimum 5% frequency)
Matrix Spike (MS)	1 per matrix per 20 samples or SDG [1, 2]
Matrix Spike Duplicate (MSD)	1 per matrix per 20 samples or SDG (organics only)
Method (Preparation) Blank (MB)	1 per 20 samples or prep/analysis batch per SDG
Surrogate Compound Spike	Every analytical run
Laboratory Control Sample (LCS) or Blank Spike Sample (BS)	1 per analytical batch not to exceed 20 samples
Internal Standard	Every analytical run

Notes:

1. Sample Delivery Group.
2. MS/MSD are not run for TOP assays

Table 5A - Eurofins
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Per- and Polyfluorinated Alkyl Substances (PFAS)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Solid	All Compounds			≤ 50	≤ RL			
	Perfluorobutanoic Acid	375-22-4				70-130	30	70-130
	Perfluoropentanoic Acid	2706-90-3				70-130	30	70-130
	Perfluorohexanoic Acid	307-24-4				70-130	30	70-130
	Perfluoroheptanoic Acid	375-85-9				70-130	30	70-130
	Perfluorooctanoic Acid (PFOA)	335-67-1				70-130	30	70-130
	Perfluorononanoic Acid	375-95-1				70-130	30	70-130
	Perfluorodecanoic Acid	335-76-2				70-130	30	70-130
	Perfluoroundecanoic Acid	2058-94-8				70-130	30	70-130
	Perfluorododecanoic Acid	307-55-1				70-130	30	70-130
	Perfluorotridecanoic Acid	72629-94-8				70-130	30	70-130
	Perfluorotetradecanoic Acid	376-06-7				70-130	30	70-130
	Perfluorobutanesulfonic Acid	375-73-5				70-130	30	70-130
	Perfluorohexanesulfonic Acid	355-46-4				70-130	30	70-130
	Perfluoroheptanesulfonic Acid	375-92-8				70-130	30	70-130
	Perfluorooctanesulfonic Acid (PFOS)	1763-23-1				70-130	30	70-130
	Perfluorodecanesulfonic Acid	335-77-3				70-130	30	70-130
	6:2 Fluorotelomersulfonic Acid	27619-97-2				70-130	30	70-130
	8:2 Fluorotelomersulfonic Acid	39108-34-4				70-130	30	70-130
	Perfluorooctanesulfonamide	754-91-6				70-130	30	70-130
	N-methyl perfluoro-1-octanesulfonamidoacetic acid	2355-31-9				70-130	30	70-130
	N-ethyl perfluoro-1-octanesulfonamidoacetic acid	2991-50-6				70-130	30	70-130

Notes:

1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by Eurofins for USEPA Method 537-1.1 (modified). Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Check Sample; RL = Reporting Limit.

Table 5B - Eurofins
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Per- and Polyfluorinated Alkyl Substances (PFAS)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)*[2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)*[2]	*MS/MSD Precision (% RPD)*[2]	*LCS Accuracy (% Rec.)*[2]
Aqueous	All Compounds			≤ 20	≤ RL	70-130	30	70-130
	Perfluorobutanoic Acid	375-22-4				70-130	30	70-130
	Perfluoropentanoic Acid	2706-90-3				70-130	30	70-130
	Perfluorohexanoic Acid	307-24-4				70-130	30	70-130
	Perfluoroheptanoic Acid	375-85-9				70-130	30	70-130
	Perfluorooctanoic Acid (PFOA)	335-67-1				70-130	30	70-130
	Perfluorononanoic Acid	375-95-1				70-130	30	70-130
	Perfluorodecanoic Acid	335-76-2				70-130	30	70-130
	Perfluoroundecanoic Acid	2058-94-8				70-130	30	70-130
	Perfluorododecanoic Acid	307-55-1				70-130	30	70-130
	Perfluorotridecanoic Acid	72629-94-8				70-130	30	70-130
	Perfluorotetradecanoic Acid	376-06-7				70-130	30	70-130
	Perfluorobutanesulfonic Acid	375-73-5				70-130	30	70-130
	Perfluorohexanesulfonic Acid	355-46-4				70-130	30	70-130
	Perfluoroheptanesulfonic Acid	375-92-8				70-130	30	70-130
	Perfluorooctanesulfonic Acid (PFOS)	1763-23-1				70-130	30	70-130
	Perfluorodecanesulfonic Acid	335-77-3				70-130	30	70-130
	6:2 Fluorotelomersulfonic Acid	27619-97-2				70-130	30	70-130
	8:2 Fluorotelomersulfonic Acid	39108-34-4				70-130	30	70-130
	Perfluorooctanesulfonamide	754-91-6				70-130	30	70-130
	N-methyl perfluoro-1-octanesulfonamidoacetic acid	2355-31-9				70-130	30	70-130
	N-ethyl perfluoro-1-octanesulfonamidoacetic acid	2991-50-6				70-130	30	70-130

Notes:

1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by Eurofins for USEPA Method 537-1.1 (modified). Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Check Sample; RL = Reporting Limit.

Table 5C - ALS
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Per- and Polyfluorinated Alkyl Substances (PFAS) and Total Oxidizable Precursor (TOP) Assay

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Solid	All Compounds			≤ 50	≤ RL			
	Perfluorobutanoic Acid	375-22-4				50-150	50	50-150
	Perfluoropentanoic Acid	2706-90-3				50-150	50	50-150
	Perfluorohexanoic Acid	307-24-4				50-150	50	50-150
	Perfluoroheptanoic Acid	375-85-9				50-150	50	50-150
	Perfluorooctanoic Acid (PFOA)	335-67-1				50-150	50	50-150
	Perfluorononanoic Acid	375-95-1				50-150	50	50-150
	Perfluorodecanoic Acid	335-76-2				50-150	50	50-150
	Perfluoroundecanoic Acid	2058-94-8				50-150	50	50-150
	Perfluorododecanoic Acid	307-55-1				50-150	50	50-150
	Perfluorotridecanoic Acid	72629-94-8				50-150	50	50-150
	Perfluorotetradecanoic Acid	376-06-7				50-150	50	50-150
	Perfluorobutanesulfonic Acid	375-73-5				50-150	50	50-150
	Perfluorohexanesulfonic Acid	355-46-4				50-150	50	50-150
	Perfluoroheptanesulfonic Acid	375-92-8				50-150	50	50-150
	Perfluorooctanesulfonic Acid (PFOS)	1763-23-1				50-150	50	50-150
	Perfluorodecanesulfonic Acid	335-77-3				50-150	50	50-150
	6:2 Fluorotelomersulfonic Acid	27619-97-2				50-150	50	50-150
	8:2 Fluorotelomersulfonic Acid	39108-34-4				50-150	50	50-150
	Perfluorooctanesulfonamide	754-91-6				50-150	50	50-150
	N-methyl perfluoro-1-octanesulfonamidoacetic acid	2355-31-9				50-150	50	50-150
	N-ethyl perfluoro-1-octanesulfonamidoacetic acid	2991-50-6				50-150	50	50-150

Notes:

1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by ALS for USEPA Method 537-1.1 (modified). Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Check Sample; RL = Reporting Limit.

Table 5D - ALS
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Per- and Polyfluorinated Alkyl Substances (PFAS) and Total Oxidizable Precursor (TOP) Assay

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Aqueous	All Compounds			≤ 20	≤ RL			
	Perfluorobutanoic Acid	375-22-4				76-136	30	76-136
	Perfluoropentanoic Acid	2706-90-3				77-123	30	77-123
	Perfluorohexanoic Acid	307-24-4				68-141	30	68-141
	Perfluoroheptanoic Acid	375-85-9				67-142	30	67-142
	Perfluorooctanoic Acid (PFOA)	335-67-1				72-130	30	72-130
	Perfluorononanoic Acid	375-95-1				77-127	30	77-127
	Perfluorodecanoic Acid	335-76-2				68-135	30	68-135
	Perfluoroundecanoic Acid	2058-94-8				66-131	30	66-131
	Perfluorododecanoic Acid	307-55-1				70-133	30	70-133
	Perfluorotridecanoic Acid	72629-94-8				31-174	30	31-174
	Perfluorotetradecanoic Acid	376-06-7				32-171	30	32-171
	Perfluorobutanesulfonic Acid	375-73-5				70-127	30	70-127
	Perfluorohexanesulfonic Acid	355-46-4				71-130	30	71-130
	Perfluoroheptanesulfonic Acid	375-92-8				69-148	30	69-148
	Perfluorooctanesulfonic Acid (PFOS)	1763-23-1				74-135	30	74-135
	Perfluorodecanesulfonic Acid	335-77-3				69-128	30	69-128
	6:2 Fluorotelomersulfonic Acid	27619-97-2				74-132	30	74-132
	8:2 Fluorotelomersulfonic Acid	39108-34-4				51-144	30	51-144
	Perfluorooctanesulfonamide	754-91-6				74-174	30	74-174
	N-methyl perfluoro-1-octanesulfonamidoacetic acid	2355-31-9				TBD	30	TBD
	N-ethyl perfluoro-1-octanesulfonamidoacetic acid	2991-50-6				TBD	30	TBD

Notes:

1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by ALS for USEPA Method 537-1.1 (modified). Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Check Sample; RL = Reporting Limit; TBD = To be Determined.

Table 5E – Test America
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Per- and Polyfluorinated Alkyl Substances (PFAS)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Solid	All Compounds			≤ 50	≤ RL			
	Perfluorobutanoic Acid	375-22-4				81-133	30	81-133
	Perfluoropentanoic Acid	2706-90-3				79-120	30	79-120
	Perfluorohexanoic Acid	307-24-4				75-125	30	75-125
	Perfluoroheptanoic Acid	375-85-9				76-124	30	76-124
	Perfluorooctanoic Acid (PFOA)	335-67-1				76-121	30	76-121
	Perfluorononanoic Acid	375-95-1				74-126	30	74-126
	Perfluorodecanoic Acid	335-76-2				74-124	30	74-124
	Perfluoroundecanoic Acid	2058-94-8				74-114	30	74-114
	Perfluorododecanoic Acid	307-55-1				75-123	30	75-123
	Perfluorotridecanoic Acid	72629-94-8				43-116	30	43-116
	Perfluorotetradecanoic Acid	376-06-7				22-129	30	22-129
	Perfluorobutanesulfonic Acid	375-73-5				73-142	30	73-142
	Perfluorohexanesulfonic Acid	355-46-4				75-121	30	75-121
	Perfluoroheptanesulfonic Acid	375-92-8				78-146	30	78-146
	Perfluorooctanesulfonic Acid (PFOS)	1763-23-1				69-131	30	69-131
	Perfluorodecanesulfonic Acid	335-77-3				54-113	30	54-113
	6:2 Fluorotelomersulfonic Acid	27619-97-2				65-135	30	65-135
	8:2 Fluorotelomersulfonic Acid	39108-34-4				65-135	30	65-135
	Perfluorooctanesulfonamide	754-91-6				62-135	30	62-135
	N-methyl perfluoro-1-octanesulfonamidoacetic acid	2355-31-9				65-135	30	65-135
	N-ethyl perfluoro-1-octanesulfonamidoacetic acid	2991-50-6				65-135	30	65-135

Notes:

1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by Test America for USEPA Method 537 (modified). Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Check Sample; RL = Reporting Limit.

Table 5F – Test America
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
***Per- and Polyfluorinated Alkyl Substances (PFAS)** and Total Oxidizable Precursor (TOP) Assay*

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Aqueous	All Compounds			≤ 20	≤ RL			
	Perfluorobutanoic Acid	375-22-4				70-130	30	70-130
	Perfluoropentanoic Acid	2706-90-3				66-126	30	66-126
	Perfluorohexanoic Acid	307-24-4				66-126	30	66-126
	Perfluoroheptanoic Acid	375-85-9				66-126	30	66-126
	Perfluorooctanoic Acid (PFOA)	335-67-1				64-124	30	64-124
	Perfluorononanoic Acid	375-95-1				68-128	30	68-128
	Perfluorodecanoic Acid	335-76-2				69-129	30	69-129
	Perfluoroundecanoic Acid	2058-94-8				60-120	30	60-120
	Perfluorododecanoic Acid	307-55-1				71-131	30	71-131
	Perfluorotridecanoic Acid	72629-94-8				72-132	30	72-132
	Perfluorotetradecanoic Acid	376-06-7				68-128	30	68-128
	Perfluorobutanesulfonic Acid	375-73-5				73-133	30	73-133
	Perfluorohexanesulfonic Acid	355-46-4				63-123	30	63-123
	Perfluoroheptanesulfonic Acid	375-92-8				68-128	30	68-128
	Perfluorooctanesulfonic Acid (PFOS)	1763-23-1				73-133	30	73-133
	Perfluorodecanesulfonic Acid	335-77-3				68-128	30	68-128
	6:2 Fluorotelomersulfonic Acid	27619-97-2				66-126	30	66-126
	8:2 Fluorotelomersulfonic Acid	39108-34-4				67-127	30	67-127
	Perfluorooctanesulfonamide	754-91-6				70-130	30	70-130
	N-methyl perfluoro-1-octanesulfonamidoacetic acid	2355-31-9				67-127	30	67-127
	N-ethyl perfluoro-1-octanesulfonamidoacetic acid	2991-50-6				65-125	30	65-125

Notes:

1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by Test America for USEPA Method 537 (modified). Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Check Sample; RL = Reporting Limit.

Table 6A - Eurofins
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Volatile Organic Compounds (VOCs)

Matrix	*QC Compounds*	*CAS Number[1]*	*Surrogate Accuracy (% Rec.)[2]*	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)[2]*	*MS/MSD Precision (% RPD)[2]*	*LCS Accuracy (% Rec.)[2]*
Solid	All compounds			≤ 50	≤ RL			
	1,1,1-Trichloroethane	71-55-6				66-128	30	66-128
	1,1,2,2-Tetrachloroethane	79-34-5				67-121	30	67-121
	1,1,2-Trichloroethane	79-00-5				80-120	30	80-120
	1,1-Dichloroethane	75-34-3				77-120	30	77-120
	1,1-Dichloroethene	75-35-4				73-129	30	73-129
	1,2,4-Trichlorobenzene	120-82-1				55-120	30	55-120
	1,2-Dibromo-3-chloropropane	96-12-8				54-120	30	54-120
	1,2-Dibromoethane	106-93-4				80-120	30	80-120
	1,2-Dichlorobenzene	95-50-1				80-120	30	80-120
	1,2-Dichloroethane	107-06-2				77-130	30	77-130
	1,2-Dichloropropane	78-87-5				76-120	30	76-120
	1,3-Dichlorobenzene	541-73-1				80-120	30	80-120
	1,4-Dichlorobenzene	106-46-7				80-120	30	80-120
	2-Butanone	78-93-3				54-129	30	54-129
	2-Hexanone	591-78-6				39-120	30	39-120
	4-Methyl-2-pentanone	108-10-1				50-120	30	50-120
	Acetone	67-64-1				46-139	30	46-139
	Benzene	71-43-2				80-120	30	80-120
	Bromodichloromethane	75-27-4				75-120	30	75-120
	Bromoform	75-25-2				64-120	30	64-120
	Bromomethane	74-83-9				16-200	30	16-200
	Carbon Disulfide	75-15-0				60-120	30	60-120
	Carbon Tetrachloride	56-23-5				69-130	30	69-130
	Chlorobenzene	108-90-7				80-120	30	80-120
	Chloroethane	75-00-3				11-200	30	11-200
	Chloroform	67-66-3				80-120	30	80-120
	Chloromethane	74-87-3				56-120	30	56-120
	Cyclohexane	110-82-7				58-120	30	58-120
	Dibromochloromethane	124-48-1				77-120	30	77-120
	Dichlorodifluoromethane	75-71-8				28-131	30	28-131
	Ethylbenzene	100-41-4				80-120	30	80-120

Table 6A (continued) - Eurofins
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Volatile Analysis (VOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Solid	All compounds			≤ 50	≤ RL			
	Freon 113	76-13-1				57-141	30	57-141
	Isopropylbenzene	98-82-8				70-120	30	70-120
	Methyl Acetate	79-20-9				52-146	30	52-146
	Methyl Tertiary Butyl Ether	1634-04-4				72-120	30	72-120
	Methylcyclohexane	108-87-2				52-128	30	52-128
	Methylene Chloride	75-09-2				76-122	30	76-122
	Styrene	100-42-5				76-120	30	76-120
	Tetrachloroethene	127-18-4				78-120	30	78-120
	Toluene	108-88-3				80-120	30	80-120
	Trichloroethene	79-01-6				80-120	30	80-120
	Trichlorofluoromethane	75-69-4				54-140	30	54-140
	Vinyl Chloride	75-01-4				59-120	30	59-120
	Xylenes (Total)	1330-20-7				80-120	30	80-120
	cis-1,2-Dichloroethene	156-59-2				80-120	30	80-120
	cis-1,3-Dichloropropene	10061-01-5				74-120	30	74-120
	trans-1,2-Dichloroethene	156-60-5				80-125	30	80-125
	trans-1,3-Dichloropropene	10061-02-6				76-120	30	76-120
	Dibromofluoromethane	1868-53-7	50-141					
	1,2-Dichloroethane-d4	17060-07-0	54-135					
	Toluene-d8	2037-26-5	52-141					
	4-Bromofluorobenzene	460-00-4	50-131					

Notes:

1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by Eurofins for USEPA Method SW-846 8260C. Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Check Sample; RL = Reporting Limit.

Table 6B - Eurofins
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Volatile Organic Compounds (VOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Aqueous	All Compounds			≤ 20	≤ RL			
	1,1,1-Trichloroethane	71-55-6				66-126	30	66-126
	1,1,2,2-Tetrachloroethane	79-34-5				72-120	30	72-120
	1,1,2-Trichloroethane	79-00-5				80-120	30	80-120
	1,1-Dichloroethane	75-34-3				80-120	30	80-120
	1,1-Dichloroethene	75-35-4				76-124	30	76-124
	1,2-Dichloroethane	107-06-2				72-127	30	72-127
	1,2-Dichloropropane	78-87-5				80-120	30	80-120
	2-Butanone	78-93-3				62-131	30	62-131
	2-Hexanone	591-78-6				35-138	30	35-138
	4-Methyl-2-pentanone	108-10-1				47-133	30	47-133
	Acetone	67-64-1				58-138	30	58-138
	Benzene	71-43-2				78-120	30	78-120
	Bromodichloromethane	75-27-4				80-120	30	80-120
	Bromoform	75-25-2				67-120	30	67-120
	Bromomethane	74-83-9				53-130	30	53-130
	Carbon Disulfide	75-15-0				58-120	30	58-120
	Carbon Tetrachloride	56-23-5				74-130	30	74-130
	Chlorobenzene	108-90-7				80-120	30	80-120
	Chloroethane	75-00-3				56-120	30	56-120
	Chloroform	67-66-3				80-120	30	80-120
	Chloromethane	74-87-3				65-129	30	65-129
	Cyclohexane	110-82-7				65-123	30	65-123
	Dibromochloromethane	124-48-1				78-120	30	78-120
	Ethylbenzene	100-41-4				78-120	30	78-120
	Methylene Chloride	75-09-2				77-121	30	77-121
	Styrene	100-42-5				80-120	30	80-120
	Tetrachloroethene	127-18-4				80-129	30	80-129
	Toluene	108-88-3				80-120	30	80-120
	Trichloroethene	79-01-6				80-120	30	80-120
	Vinyl Chloride	75-01-4				69-120	30	69-120

Table 6B (continued) - Eurofins
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Volatile Organic Compounds (VOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Aqueous	All Compounds			≤ 20	≤ RL			
	m+p-Xylene	179601-23-1				80-120	30	80-120
	o-Xylene	95-47-6				80-120	30	80-120
	cis-1,2-Dichloroethene	156-59-2				80-120	30	80-120
	cis-1,3-Dichloropropene	10061-01-5				80-120	30	80-120
	trans-1,2-Dichloroethene	156-60-5				80-120	30	80-120
	trans-1,3-Dichloropropene	10061-02-6				76-120	30	76-120
	Dibromofluoromethane	1868-53-7						
	1,2-Dichloroethane-d4	17060-07-0						
	Toluene-d8	2037-26-5						
	4-Bromofluorobenzene	460-00-4						

Notes:

1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by Eurofins for USEPA Method SW-846 8260C. Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Check Sample; RL = Reporting Limit.

Table 6C - ALS
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Volatile Organic Compounds (VOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Solid	All compounds			≤ 50	≤ RL			
	1,1,1-Trichloroethane	71-55-6				51-132	30	40-140
	1,1,2,2-Tetrachloroethane	79-34-5				53-134	30	40-140
	1,1,2-Trichloroethane	79-00-5				62-126	30	40-140
	1,1-Dichloroethane	75-34-3				53-131	30	40-140
	1,1-Dichloroethene	75-35-4				61-139	30	40-140
	1,2,4-Trichlorobenzene	120-82-1				10-179	30	40-140
	1,2-Dibromo-3-chloropropane	96-12-8				27-163	30	40-140
	1,2-Dibromoethane	106-93-4				52-137	30	40-140
	1,2-Dichlorobenzene	95-50-1				22-156	30	40-140
	1,2-Dichloroethane	107-06-2				59-125	30	40-140
	1,2-Dichloropropane	78-87-5				67-126	30	40-140
	1,3-Dichlorobenzene	541-73-1				29-146	30	40-140
	1,4-Dichlorobenzene	106-46-7				10-172	30	40-140
	2-Butanone	78-93-3				43-134	30	40-140
	2-Hexanone	591-78-6				37-146	30	40-140
	4-Methyl-2-pentanone	108-10-1				47-145	30	40-140
	Acetone	67-64-1				11-183	30	40-140
	Benzene	71-43-2				63-126	30	40-140
	Bromodichloromethane	75-27-4				47-141	30	40-140
	Bromoform	75-25-2				26-157	30	40-140
	Bromomethane	74-83-9				10-137	30	40-140
	Carbon Disulfide	75-15-0				35-135	30	40-140
	Carbon Tetrachloride	56-23-5				46-137	30	40-140
	Chlorobenzene	108-90-7				51-132	30	40-140
	Chloroethane	75-00-3				45-132	30	40-140
	Chloroform	67-66-3				61-124	30	40-140
	Chloromethane	74-87-3				50-136	30	40-140
	Cyclohexane	110-82-7				40-142	30	40-140
	Dibromochloromethane	124-48-1				40-146	30	40-140
	Dichlorodifluoromethane	75-71-8				44-138	30	40-140
	Ethylbenzene	100-41-4				44-131	30	40-140

Table 6C (continued) - ALS
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Volatile Analysis (VOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Solid	All compounds			≤ 50	≤ RL			
	Freon 113	76-13-1				45-136	30	40-140
	Isopropylbenzene	98-82-8				36-148	30	40-140
	Methyl Acetate	79-20-9				34-173	30	40-140
	Methyl Tertiary Butyl Ether	1634-04-4				62-130	30	40-140
	Methylcyclohexane	108-87-2				33-148	30	40-140
	Methylene Chloride	75-09-2				64-120	30	40-140
	Styrene	100-42-5				39-149	30	40-140
	Tetrachloroethene	127-18-4				45-141	30	40-140
	Toluene	108-88-3				50-140	30	40-140
	Trichloroethene	79-01-6				54-136	30	40-140
	Trichlorofluoromethane	75-69-4				47-129	30	40-140
	Vinyl Chloride	75-01-4				53-128	30	40-140
	Xylenes (Total)	1330-20-7				37-141	30	40-140
	cis-1,2-Dichloroethene	156-59-2				56-126	30	40-140
	cis-1,3-Dichloropropene	10061-01-5				31-150	30	40-140
	trans-1,2-Dichloroethene	156-60-5				52-128	30	40-140
	trans-1,3-Dichloropropene	10061-02-6				23-160	30	40-140
	Dibromofluoromethane	1868-53-7	63-138					
	1,2-Dichloroethane-d4	17060-07-0	67-128					
	Toluene-d8	2037-26-5	66-138					
	4-Bromofluorobenzene	460-00-4	51-136					

Notes:

1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by ALS for USEPA Method SW-846 8260C. Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Check Sample; RL = Reporting Limit.

Table 6D - ALS
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Volatile Organic Compounds (VOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Aqueous	All Compounds			≤ 20	≤ RL			
	1,1,1-Trichloroethane	71-55-6				74-127	30	74-120
	1,1,2,2-Tetrachloroethane	79-34-5				72-122	30	78-122
	1,1,2-Trichloroethane	79-00-5				79-119	30	82-118
	1,1-Dichloroethane	75-34-3				74-132	30	78-117
	1,1-Dichloroethene	75-35-4				68-130	30	71-127
	1,2-Dichloroethane	107-06-2				68-130	30	71-127
	1,2-Dichloropropane	78-87-5				79-124	30	80-119
	2-Butanone	78-93-3				46-141	30	61-137
	2-Hexanone	591-78-6				56-132	30	63-124
	4-Methyl-2-pentanone	108-10-1				60-141	30	66-124
	Acetone	67-64-1				29-151	30	40-161
	Benzene	71-43-2				76-129	30	76-118
	Bromodichloromethane	75-27-4				76-127	30	78-126
	Bromoform	75-25-2				58-133	30	71-136
	Bromomethane	74-83-9				10-162	30	42-166
	Carbon Disulfide	75-15-0				34-162	30	65-127
	Carbon Tetrachloride	56-23-5				65-135	30	68-125
	Chlorobenzene	108-90-7				76-125	30	80-121
	Chloroethane	75-00-3				70-140	30	70-127
	Chloroform	67-66-3				75-130	30	76-120
	Chloromethane	74-87-3				55-160	30	69-145
	Cyclohexane	110-82-7				52-145	30	63-121
	Dibromochloromethane	124-48-1				72-128	30	77-128
	Ethylbenzene	100-41-4				72-134	30	76-120
	Methylene Chloride	75-09-2				75-121	30	73-122
	Styrene	100-42-5				34-156	30	80-124
	Tetrachloroethene	127-18-4				67-137	30	78-124
	Toluene	108-88-3				79-125	30	77-120
	Trichloroethene	79-01-6				62-142	30	78-123
	Vinyl Chloride	75-01-4				60-157	30	69-133

Table 6D (continued) - ALS
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Volatile Organic Compounds (VOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Aqueous	All Compounds			≤ 20	≤ RL			
	Xylenes (Total)	1330-20-7				68-137	30	78-121
	cis-1,2-Dichloroethene	156-59-2				72-133	30	80-121
	cis-1,3-Dichloropropene	10061-01-5				52-134	30	74-126
	trans-1,2-Dichloroethene	156-60-5				77-125	30	80-120
	trans-1,3-Dichloropropene	10061-02-6				50-142	30	67-135
	Dibromofluoromethane	1868-53-7	89-119					
	1,2-Dichloroethane-d4	17060-07-0	73-125					
	Toluene-d8	2037-26-5	87-121					
	4-Bromofluorobenzene	460-00-4	85-122					

Notes:

1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by ALS for USEPA Method SW-846 8260C. Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Check Sample; RL = Reporting Limit.

Table 6E – Test America
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Volatile Organic Compounds (VOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Solid	All compounds			≤ 50	≤ RL			
	1,1,1-Trichloroethane	71-55-6				77-121	30	77-121
	1,1,2,2-Tetrachloroethane	79-34-5				80-120	30	80-120
	1,1,2-Trichloroethane	79-00-5				78-122	30	78-122
	1,1-Dichloroethane	75-34-3				73-126	30	73-126
	1,1-Dichloroethene	75-35-4				59-125	30	59-125
	1,2,4-Trichlorobenzene	120-82-1				64-120	30	64-120
	1,2-Dibromo-3-chloropropane	96-12-8				63-124	30	63-124
	1,2-Dibromoethane	106-93-4				78-120	30	78-120
	1,2-Dichlorobenzene	95-50-1				75-120	30	75-120
	1,2-Dichloroethane	107-06-2				77-122	30	77-122
	1,2-Dichloropropane	78-87-5				75-124	30	75-124
	1,3-Dichlorobenzene	541-73-1				74-120	30	74-120
	1,4-Dichlorobenzene	106-46-7				73-120	30	73-120
	2-Butanone	78-93-3				70-134	30	70-134
	2-Hexanone	591-78-6				59-130	30	59-130
	4-Methyl-2-pentanone	108-10-1				65-133	30	65-133
	Acetone	67-64-1				61-137	30	61-137
	Benzene	71-43-2				79-127	30	79-127
	Bromodichloromethane	75-27-4				80-122	30	80-122
	Bromoform	75-25-2				68-126	30	68-126
	Bromomethane	74-83-9				37-149	30	37-149
	Carbon Disulfide	75-15-0				64-131	30	64-131
	Carbon Tetrachloride	56-23-5				75-135	30	75-135
	Chlorobenzene	108-90-7				76-124	30	76-124
	Chloroethane	75-00-3				69-135	30	69-135
	Chloroform	67-66-3				80-120	30	80-120
	Chloromethane	74-87-3				63-127	30	63-127
	Cyclohexane	110-82-7				65-120	30	65-120
	Dibromochloromethane	124-48-1				76-125	30	76-125
	Dichlorodifluoromethane	75-71-8				57-142	30	57-142
	Ethylbenzene	100-41-4				80-120	30	80-120

Table 6E (continued) – Test America
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Volatile Analysis (VOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Solid	All compounds			≤ 50	≤ RL			
	Freon 113	76-13-1				60-140	30	60-140
	Isopropylbenzene	98-82-8				72-120	30	72-120
	Methyl Acetate	79-20-9				55-136	30	55-136
	Methyl Tertiary Butyl Ether	1634-04-4				63-125	30	63-125
	Methylcyclohexane	108-87-2				60-140	30	60-140
	Methylene Chloride	75-09-2				61-127	30	61-127
	Styrene	100-42-5				80-120	30	80-120
	Tetrachloroethene	127-18-4				74-122	30	74-122
	Toluene	108-88-3				74-128	30	74-128
	Trichloroethene	79-01-6				77-129	30	77-129
	Trichlorofluoromethane	75-69-4				65-146	30	65-146
	Vinyl Chloride	75-01-4				61-133	30	61-133
	Xylenes (Total)	1330-20-7				NA	30	NA
	cis-1,2-Dichloroethene	156-59-2				81-120	30	81-120
	cis-1,3-Dichloropropene	10061-01-5				80-120	30	80-120
	trans-1,2-Dichloroethene	156-60-5				78-126	30	78-126
	trans-1,3-Dichloropropene	10061-02-6				73-123	30	73-123
	Dibromofluoromethane	1868-53-7	60-140				30	
	1,2-Dichloroethane-d4	17060-07-0	64-126					
	Toluene-d8	2037-26-5	71-125					
	4-Bromofluorobenzene	460-00-4	72-126					

Notes:

1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by Test America for USEPA Method SW-846 8260C. Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Check Sample; RL = Reporting Limit; Not Available = Not Available.

Table 6F – Test America
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Volatile Organic Compounds (VOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Aqueous	All Compounds			≤ 20	≤ RL			
	1,1,1-Trichloroethane	71-55-6				73-126	15	73-126
	1,1,2,2-Tetrachloroethane	79-34-5				76-120	15	76-120
	1,1,2-Trichloroethane	79-00-5				76-122	15	76-122
	1,1-Dichloroethane	75-34-3				77-120	20	77-120
	1,1-Dichloroethene	75-35-4				66-127	16	66-127
	1,2-Dichloroethane	107-06-2				75-120	20	75-120
	1,2-Dichloropropane	78-87-5				76-120	20	76-120
	2-Butanone	78-93-3				57-140	20	57-140
	2-Hexanone	591-78-6				65-127	15	65-127
	4-Methyl-2-pentanone	108-10-1				71-125	35	71-125
	Acetone	67-64-1				56-142	15	56-142
	Benzene	71-43-2				71-124	13	71-124
	Bromodichloromethane	75-27-4				80-122	15	80-122
	Bromoform	75-25-2				61-132	15	61-132
	Bromomethane	74-83-9				55-144	15	55-144
	Carbon Disulfide	75-15-0				59-134	15	59-134
	Carbon Tetrachloride	56-23-5				72-134	15	72-134
	Chlorobenzene	108-90-7				80-120	25	80-120
	Chloroethane	75-00-3				69-136	15	69-136
	Chloroform	67-66-3				73-127	20	73-127
	Chloromethane	74-87-3				68-124	15	68-124
	Cyclohexane	110-82-7				59-135	20	59-135
	Dibromochloromethane	124-48-1				75-125	15	75-125
	Ethylbenzene	100-41-4				77-123	15	77-123
	Methylene Chloride	75-09-2				75-124	15	75-124
	Styrene	100-42-5				80-120	20	80-120
	Tetrachloroethene	127-18-4				74-122	20	74-122
	Toluene	108-88-3				80-122	15	80-122
	Trichloroethene	79-01-6				74-123	16	74-123
	Vinyl Chloride	75-01-4				65-133	15	65-133

Table 6F (continued) – Test America
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Volatile Organic Compounds (VOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Aqueous	All Compounds			≤ 20	≤ RL			
	Xylenes (Total)	1330-20-7				NA	NA	NA
	cis-1,2-Dichloroethene	156-59-2				74-124	15	74-124
	cis-1,3-Dichloropropene	10061-01-5				74-124	15	74-124
	trans-1,2-Dichloroethene	156-60-5				73-127	20	73-127
	trans-1,3-Dichloropropene	10061-02-6				80-120	15	80-120
	Dibromofluoromethane	1868-53-7	75-123				20	
	1,2-Dichloroethane-d4	17060-07-0	77-120					
	Toluene-d8	2037-26-5	80-120					
	4-Bromofluorobenzene	460-00-4	73-120					

Notes:

1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by Test America for USEPA Method SW-846 8260C. Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Check Sample; RL = Reporting Limit; NA = Not Available.

Table 6G - Eurofins
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Volatile Organic Compounds (VOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*LCS Accuracy (% Rec.)* [2]	*LCS Precision (% RPD)* [2]
Air	All Compounds			≤ 20	≤ RL		
	1,1,1-Trichloroethane	71-55-6				73-124	25
	1,1,2,2-Tetrachloroethane	79-34-5				72-133	25
	1,1,2-Trichloroethane	79-00-5				76-127	25
	1,1-Dichloroethane	75-34-3				74-129	25
	1,1-Dichloroethene	75-35-4				70-129	25
	1,2-Dichlorobenzene	95-50-1				71-126	25
	1,2-Dichloroethane	107-06-2				72-138	25
	1,2-Dichloropropane	78-87-5				75-127	25
	1,2,3-Trichloropropane	96-18-4				NA	NA
	1,3-Dichlorobenzene	541-73-1				75-129	25
	1,4-Dichlorobenzene	106-46-7				74-123	25
	Bromodichloromethane	75-27-4				75-134	25
	Carbon Disulfide	75-15-0				72-128	25
	Carbon Tetrachloride	56-23-5				72-127	25
	Chlorobenzene	108-90-7				76-117	25
	Chlorodifluoromethane	75-45-6				NA	NA
	Chloroethane	75-00-3				76-129	25
	Chloroform	67-66-3				75-127	25
	Chloromethane	74-87-3				65-140	25
	Dibromochloromethane	124-48-1				74-131	25
	Dichlorodifluoromethane	75-71-8				74-133	25
	Freon 113	76-13-1				66-119	25
	Freon 114	76-14-2				66-126	25
	Methylene Chloride	75-09-2				69-128	25
	Tetrachloroethene	127-18-4				68-123	25
	Toluene	108-88-3				78-119	25
	Trichloroethene	79-01-6				76-118	25
	Vinyl Chloride	75-01-4				75-130	25

Table 6G (continued) - Eurofins
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Volatile Organic Compounds (VOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*LCS Accuracy (% Rec.)* [2]	*LCS Precision (% RPD)* [2]
Air	All Compounds			≤ 20	≤ RL		
	Trichlorofluoromethane	75-69-4				73-132	25
	cis-1,2-Dichloroethene	156-59-2				76-126	25
	cis-1,3-Dichloropropene	10061-01-5				51-120	25
	trans-1,2-Dichloroethene	156-60-5				77-128	25
	trans-1,3-Dichloropropene	10061-02-6				72-119	25

Notes:

1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by Eurofins for Method TO-15. Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; LCS = Laboratory Check Sample; RL = Reporting Limit; NA = Not Available.

Table 6H – Test America
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Volatile Organic Compounds (VOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*LCS Accuracy (% Rec.)* [2]	*LCS Precision (% RPD)* [2]
Air	All Compounds			≤ 20	≤ RL		
	1,1,1-Trichloroethane	71-55-6				70-130	25
	1,1,2,2-Tetrachloroethane	79-34-5				69-129	25
	1,1,2-Trichloroethane	79-00-5				69-129	25
	1,1-Dichloroethane	75-34-3				66-126	25
	1,1-Dichloroethene	75-35-4				67-127	25
	1,2-Dichloroethane	107-06-2				67-132	25
	1,2-Dichlorobenzene	95-50-1				67-127	25
	1,2-Dichloropropane	78-87-5				67-127	25
	1,2,3-Trichloropropane	96-18-4				NA	NA
	1,3-Dichlorobenzene	541-73-1				67-127	25
	1,4-Dichlorobenzene	106-46-7				66-126	25
	Bromodichloromethane	75-27-4				69-129	25
	Carbon Disulfide	75-15-0				81-141	25
	Carbon Tetrachloride	56-23-5				62-143	25
	Chlorobenzene	108-90-7				68-128	25
	Chlorodifluoromethane	75-45-6				64-128	25
	Chloroethane	75-00-3				65-125	25
	Chloroform	67-66-3				69-129	25
	Chloromethane	74-87-3				57-126	25
	Dibromochloromethane	124-48-1				66-130	25
	Dichlorodifluoromethane	75-71-8				68-128	25
	Freon 113	76-13-1				68-128	25
	Freon 114	76-14-2				78-138	25
	Methylene Chloride	75-09-2				62-122	25
	Tetrachloroethene	127-18-4				70-130	25
	Toluene	108-88-3				67-127	25
	Trichloroethene	79-01-6				68-128	25
	Vinyl Chloride	75-01-4				62-125	25

Table 6H (continued) – Test America
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Volatile Organic Compounds (VOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*LCS Accuracy (% Rec.)* [2]	*LCS Precision (% RPD)* [2]
Air	All Compounds			≤ 20	≤ RL		
	Trichlorofluoromethane	75-69-4				67-127	25
	cis-1,2-Dichloroethene	156-59-2				67-127	25
	cis-1,3-Dichloropropene	10061-01-5				70-130	25
	trans-1,2-Dichloroethene	156-60-5				72-132	25
	trans-1,3-Dichloropropene	10061-02-6				69-129	25

Notes:
1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by Test America for Method TO-15. Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; LCS = Laboratory Check Sample; RL = Reporting Limit; NA = Not Available.

Table 6I - ALS
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Volatile Organic Compounds (VOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*LCS Accuracy (% Rec.)* [2]	*LCS Precision (% RPD)* [2]
Air	All Compounds			≤ 20	≤ RL		
	1,1,1-Trichloroethane	71-55-6				72-115	25
	1,1,2,2-Tetrachloroethane	79-34-5				69-130	25
	1,1,2-Trichloroethane	79-00-5				75-119	25
	1,1-Dichloroethane	75-34-3				69-111	25
	1,1-Dichloroethene	75-35-4				76-118	25
	1,2-Dichloroethane	107-06-2				69-113	25
	1,2-Dichlorobenzene	95-50-1				67-136	25
	1,2-Dichloropropane	78-87-5				71-115	25
	1,2,3-Trichloropropane	96-18-4				NA	NA
	1,3-Dichlorobenzene	541-73-1				65-136	25
	1,4-Dichlorobenzene	106-46-7				66-141	25
	Bromodichloromethane	75-27-4				75-118	25
	Carbon Disulfide	75-15-0				73-123	25
	Carbon Tetrachloride	56-23-5				57-102	25
	Chlorobenzene	108-90-7				71-113	25
	Chlorodifluoromethane	75-45-6				NA	NA
	Chloroethane	75-00-3				68-120	25
	Chloroform	67-66-3				69-122	25
	Chloromethane	74-87-3				70-109	25
	Dibromochloromethane	124-48-1				74-136	25
	Dichlorodifluoromethane	75-71-8				68-109	25
	Freon 113	76-13-1				73-114	25
	Freon 114	76-14-2				66-114	25
	Methylene Chloride	75-09-2				60-118	25
	Tetrachloroethene	127-18-4				65-130	25
	Toluene	108-88-3				59-118	25
	Trichloroethene	79-01-6				68-114	25
	Vinyl Chloride	75-01-4				61-125	25

Table 6I (continued) - ALS
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Volatile Organic Compounds (VOCs)

Matrix	*QC Compounds*	*CAS Number[1]*	*Surrogate Accuracy (% Rec.) [2]*	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*LCS Accuracy (% Rec.) [2]*	*LCS Precision (% RPD) [2]*
Air	All Compounds			≤ 20	≤ RL		
	Trichlorofluoromethane	75-69-4				63-98	25
	cis-1,2-Dichloroethene	156-59-2				72-117	25
	cis-1,3-Dichloropropene	10061-01-5				77-126	25
	trans-1,2-Dichloroethene	156-60-5				74-123	25
	trans-1,3-Dichloropropene	10061-02-6				79-125	25

Notes:

1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by ALS for Method TO-15. Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; LCS = Laboratory Check Sample; RL = Reporting Limit; NA = Not Available.

Table 7A - Eurofins
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Semi-Volatile Organic Compounds (SVOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Solid	All Compounds			≤ 50	≤ RL			
	1,1'-Biphenyl	92-52-4				76-111	30	76-111
	1,4'-Dioxane	123-91-1				36-90	30	36-90
	2,2'-oxybis(1-Chloropropane)	108-60-1				61-134	30	61-134
	2,4,5-Trichlorophenol	95-95-4				86-123	30	86-123
	2,4,6-Trichlorophenol	88-06-2				81-123	30	81-123
	2,4-Dichlorophenol	120-83-2				86-125	30	86-125
	2,4-Dimethylphenol	105-67-9				83-120	30	83-120
	2,4-Dinitrophenol	51-28-5				16-132	30	16-132
	2,4-Dinitrotoluene	121-14-2				81-122	30	81-122
	2,6-Dinitrotoluene	606-20-2				86-125	30	86-125
	2-Chloronaphthalene	91-58-7				63-146	30	63-146
	2-Chlorophenol	95-57-8				85-123	30	85-123
	2-Methylnaphthalene	91-57-6				83-109	30	83-109
	2-Methylphenol	95-48-7				80-133	30	80-133
	2-Nitroaniline	88-74-4				84-126	30	84-126
	2-Nitrophenol	88-75-5				83-120	30	83-120
	3,3'-Dichlorobenzidine	91-94-1				10-116	30	10-116
	3-Nitroaniline	99-09-2				66-119	30	66-119
	3/4-Methylphenol	65794-96-9				73-125	30	73-125
	4,6-Dinitro-2-methylphenol	534-52-1				46-134	30	46-134
	4-Bromophenyl-phenylether	101-55-3				84-120	30	84-120
	4-Chloro-3-methylphenol	59-50-7				79-127	30	79-127
	4-Chloroaniline	106-47-8				10-100	30	10-100
	4-Chlorophenyl-phenylether	7005-72-3				81-120	30	81-120
	4-Nitroaniline	100-01-6				44-110	30	44-110
	4-Nitrophenol	100-02-7				52-133	30	52-133
	Acenaphthene	83-32-9				83-116	30	83-116
	Acenaphthylene	208-96-8				83-119	30	83-119
	Acetophenone	98-86-2				74-116	30	74-116
	Anthracene	120-12-7				82-118	30	82-118
	Atrazine	1912-24-9				62-143	30	62-143

Table 7A (continued) - Eurofins
Analytical Laboratory Data Quality Objectives (DQOs)

Precision and Accuracy
Semi-Volatile Organic Compounds (SVOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Solid	All Compounds			≤ 50	≤ RL			
	Benzaldehyde	100-52-7				10-93	30	10-93
	Benzo(a)anthracene	56-55-3				76-119	30	76-119
	Benzo(a)pyrene	50-32-8				85-117	30	85-117
	Benzo(b)fluoranthene	205-99-2				78-129	30	78-129
	Benzo(g,h,i)perylene	191-24-2				77-118	30	77-118
	Benzo(k)fluoranthene	207-08-9				79-120	30	79-120
	Butylbenzylphthalate	85-68-7				80-118	30	80-118
	Caprolactam	105-60-2				73-119	30	73-119
	Carbazole	86-74-8				78-117	30	78-117
	Chrysene	218-01-9				80-121	30	80-121
	Di-n-butylphthalate	84-74-2				84-120	30	84-120
	Di-n-octylphthalate	117-84-0				80-140	30	80-140
	Dibenz(a,h)anthracene	53-70-3				81-123	30	81-123
	Dibenzofuran	132-64-9				85-115	30	85-115
	Diethylphthalate	84-66-2				81-118	30	81-118
	Dimethylphthalate	131-11-3				82-113	30	82-113
	Fluoranthene	206-44-0				81-117	30	81-117
	Fluorene	86-73-7				86-118	30	86-118
	Hexachlorobenzene	118-74-1				79-116	30	79-116
	Hexachlorobutadiene	87-68-3				72-120	30	72-120
	Hexachlorocyclopentadiene	77-47-4				64-137	30	64-137
	Hexachloroethane	67-72-1				78-114	30	78-114
	Indeno(1,2,3-cd)pyrene	193-39-5				81-118	30	81-118
	Isophorone	78-59-1				77-118	30	77-118
	N-Nitroso-di-n-propylamine	621-64-7				67-121	30	67-121
	N-Nitrosodiphenylamine	86-30-6				83-118	30	83-118
	Naphthalene	91-20-3				82-112	30	82-112
	Nitrobenzene	98-95-3				70-122	30	70-122
	Pentachlorophenol	87-86-5				57-126	30	57-126
	Phenanthrene	85-01-8				80-114	30	80-114
	Phenol	108-95-2				73-122	30	73-122
	Pyrene	129-00-0				81-114	30	81-114

Table 7A (continued) - Eurofins
Analytical Laboratory Data Quality Objectives (DQOs)

Precision and Accuracy
Semi-Volatile Organic Compounds (SVOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Solid	All Compounds			≤ 50	≤ RL			
	bis(2-Chloroethoxy)methane	111-91-1				77-116	30	77-116
	bis(2-Chloroethyl)ether	111-44-4				77-115	30	77-115
	bis(2-Ethylhexyl)phthalate	117-81-7				81-121	30	81-121
	Phenol-d6	13127-88-3	58-122					
	2-Fluorophenol	367-12-4	57-126					
	2,4,6-Tribromophenol	118-79-6	35-136					
	Nitrobenzene-d5	4165-60-0	54-123					
	2-Fluorobiphenyl	321-60-8	63-117					
	Terphenyl-d14	1718-51-0	59-129					

Notes:

1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by Eurofins for USEPA Method SW-846 8270C/D SIM. Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Check Sample; RL = Reporting Limit.

Table 7B - Eurofins
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Semi-Volatile Organic Compounds (SVOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)*[2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)*[2]	*MS/MSD Precision (% RPD)*[2]	*LCS Accuracy (% Rec.)*[2]
Aqueous	All Compounds			≤ 20	≤ RL			
	1,1'-Biphenyl	92-52-4				59-124	30	59-124
	1,4′-Dioxane	123-91-1				33-87	30	33-87
	2,2'-oxybis(1-Chloropropane)	108-60-1				56-128	30	56-128
	2,4,5-Trichlorophenol	95-95-4				68-126	30	68-126
	2,4,6-Trichlorophenol	88-06-2				71-130	30	71-130
	2,4-Dichlorophenol	120-83-2				66-126	30	66-126
	2,4-Dimethylphenol	105-67-9				63-117	30	63-117
	2,4-Dinitrophenol	51-28-5				42-129	30	42-129
	2,4-Dinitrotoluene	121-14-2				71-131	30	71-131
	2,6-Dinitrotoluene	606-20-2				71-133	30	71-133
	2-Chloronaphthalene	91-58-7				57-126	30	57-126
	2-Chlorophenol	95-57-8				59-120	30	59-120
	2-Methylnaphthalene	91-57-6				61-117	30	61-117
	2-Methylphenol	95-48-7				54-122	30	54-122
	2-Nitroaniline	88-74-4				68-130	30	68-130
	2-Nitrophenol	88-75-5				67-131	30	67-131
	3,3'-Dichlorobenzidine	91-94-1				39-111	30	39-111
	3-Nitroaniline	99-09-2				58-122	30	58-122
	4,6-Dinitro-2-methylphenol	534-52-1				64-124	30	64-124
	4-Bromophenyl-phenylether	101-55-3				64-129	30	64-129
	4-Chloro-3-methylphenol	59-50-7				65-125	30	65-125
	4-Chloroaniline	106-47-8				45-115	30	45-115
	4-Chlorophenyl-phenylether	7005-72-3				67-125	30	67-125
	4-Methylphenol	65794-96-9				56-109	30	56-109
	4-Nitroaniline	100-01-6				61-111	30	61-111
	4-Nitrophenol	100-02-7				20-89	30	20-89
	Acenaphthene	83-32-9				69-123	30	69-123
	Acenaphthylene	208-96-8				67-125	30	67-125
	Acetophenone	98-86-2				61-124	30	61-124
	Anthracene	120-12-7				68-126	30	68-126
	Atrazine	1912-24-9				62-140	30	62-140

Table 7B (continued) - Eurofins
Analytical Laboratory Data Quality Objectives (DQOs)

Precision and Accuracy
Semi-Volatile Organic Compounds (SVOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Aqueous	All Compounds			≤ 20	≤ RL			
	Benzaldehyde	100-52-7				10-123	30	10-123
	Benzo(a)anthracene	56-55-3				69-133	30	69-133
	Benzo(a)pyrene	50-32-8				68-126	30	68-126
	Benzo(b)fluoranthene	205-99-2				71-131	30	71-131
	Benzo(g,h,i)perylene	191-24-2				62-132	30	62-132
	Benzo(k)fluoranthene	207-08-9				72-128	30	72-128
	Butylbenzylphthalate	85-68-7				68-119	30	68-119
	Caprolactam	105-60-2				11-51	30	11-51
	Carbazole	86-74-8				64-126	30	64-126
	Chrysene	218-01-9				71-136	30	71-136
	Di-n-butylphthalate	84-74-2				61-125	30	61-125
	Di-n-octylphthalate	117-84-0				73-131	30	73-131
	Dibenz(a,h)anthracene	53-70-3				64-133	30	64-133
	Dibenzofuran	132-64-9				67-120	30	67-120
	Diethylphthalate	84-66-2				55-124	30	55-124
	Dimethylphthalate	131-11-3				26-133	30	26-133
	Fluoranthene	206-44-0				68-129	30	68-129
	Fluorene	86-73-7				71-127	30	71-127
	Hexachlorobenzene	118-74-1				64-128	30	64-128
	Hexachlorobutadiene	87-68-3				23-129	30	23-129
	Hexachlorocyclopentadiene	77-47-4				10-101	30	10-101
	Hexachloroethane	67-72-1				23-121	30	23-121
	Indeno(1,2,3-cd)pyrene	193-39-5				62-128	30	62-128
	Isophorone	78-59-1				68-125	30	68-125
	N-Nitroso-di-n-propylamine	621-64-7				63-121	30	63-121
	N-Nitrosodiphenylamine	86-30-6				80-115	30	80-115
	Naphthalene	91-20-3				62-121	30	62-121
	Nitrobenzene	98-95-3				77-119	30	77-119
	Pentachlorophenol	87-86-5				53-133	30	53-133
	Phenanthrene	85-01-8				65-120	30	65-120
	Phenol	108-95-2				19-82	30	19-82
	Pyrene	129-00-0				68-118	30	68-118

Table 7B (continued) - Eurofins
Analytical Laboratory Data Quality Objectives (DQOs)

Precision and Accuracy
Semi-Volatile Organic Compounds (SVOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Aqueous	All Compounds			≤ 20	≤ RL			
	bis(2-Chloroethoxy)methane	111-91-1				67-124	30	67-124
	bis(2-Chloroethyl)ether	111-44-4				65-120	30	65-120
	bis(2-Ethylhexyl)phthalate	117-81-7				66-130	30	66-130
	Phenol-d6	13127-88-3	10-85					
	2-Fluorophenol	367-12-4	10-103					
	2,4,6-Tribromophenol	118-79-6	22-150					
	Nitrobenzene-d5	4165-60-0	46-128					
	2-Fluorobiphenyl	321-60-8	61-112					
	Terphenyl-d14	1718-51-0	41-125					

Notes:

1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by Eurofins for USEPA Method SW-846 8270C/D SIM. Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Check Sample; RL = Reporting Limit.

Table 7C - ALS
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Semi-Volatile Organic Compounds (SVOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Solid	All Compounds			≤ 50	≤ RL			
	1,1'-Biphenyl	92-52-4				22-91	30	35-131
	1,4′-Dioxane	123-91-1				50-150	30	50-150
	2,2'-oxybis (1-Chloropropane)	108-60-1				21-142	30	38-138
	2,4,5-Trichlorophenol	95-95-4				12-109	30	47-131
	2,4,6-Trichlorophenol	88-06-2				13-149	30	46-136
	2,4-Dichlorophenol	120-83-2				16-98	30	39-135
	2,4-Dimethylphenol	105-67-9				10-98	30	31-135
	2,4-Dinitrophenol	51-28-5				10-129	30	10-148
	2,4-Dinitrotoluene	121-14-2				10-124	30	29-117
	2,6-Dinitrotoluene	606-20-2				13-112	30	30-115
	2-Chloronaphthalene	91-58-7				22-89	30	41-124
	2-Chlorophenol	95-57-8				14-99	30	39-123
	2-Methylnaphthalene	91-57-6				17-84	30	33-125
	2-Methylphenol	95-48-7				14-99	30	38-123
	2-Nitroaniline	88-74-4				10-111	30	30-104
	2-Nitrophenol	88-75-5				18-92	30	34-93
	3,3'-Dichlorobenzidine	91-94-1				10-118	30	19-111
	3-Nitroaniline	99-09-2				10-104	30	43-106
	4,6-Dinitro-2-methylphenol	534-52-1				10-123	30	10-78
	4-Bromophenyl-phenylether	101-55-3				19-107	30	45-137
	4-Chloro-3-methylphenol	59-50-7				10-108	30	42-140
	4-Chloroaniline	106-47-8				10-91	30	34-101
	4-Chlorophenyl-phenylether	7005-72-3				19-100	30	39-100
	4-Methylphenol	106-44-5				11-101	30	42-114
	4-Nitroaniline	100-01-6				10-137	30	27-102
	4-Nitrophenol	100-02-7				10-126	30	10-130
	Acenaphthene	83-32-9				17-95	30	43-133
	Acenaphthylene	208-96-8				23-93	30	45-133
	Acetophenone	98-86-2				12-99	30	44-114
	Anthracene	120-12-7				15-108	30	48-129
	Atrazine	1912-24-9				10-220	30	27-227

Table 7C (continued) - ALS
Analytical Laboratory Data Quality Objectives (DQOs)

Precision and Accuracy
Semi-Volatile Organic Compounds (SVOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)*[2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)*[2]	*MS/MSD Precision (% RPD)*[2]	*LCS Accuracy (% Rec.)*[2]
Solid	All Compounds			≤ 50	≤ RL			
	Benzaldehyde	100-52-7				10-258	30	36-258
	Benzo(a)anthracene	56-55-3				10-122	30	32-105
	Benzo(a)pyrene	50-32-8				10-124	30	32-108
	Benzo(b)fluoranthene	205-99-2				14-143	30	32-108
	Benzo(g,h,i)perylene	191-24-2				11-152	30	34-112
	Benzo(k)fluoranthene	207-08-9				13-133	30	43-131
	Butylbenzylphthalate	85-68-7				13-164	30	35-119
	Caprolactam	105-60-2				10-112	30	28-99
	Carbazole	86-74-8				15-152	30	40-140
	Chrysene	218-01-9				10-158	30	34-104
	Di-n-butylphthalate	84-74-2				14-174	30	40-114
	Di-n-octylphthalate	117-84-0				10-140	30	37-119
	Dibenz(a,h)anthracene	53-70-3				10-123	30	34-111
	Dibenzofuran	132-64-9				19-92	30	38-91
	Diethylphthalate	84-66-2				10-113	30	36-104
	Dimethylphthalate	131-11-3				10-113	30	39-99
	Fluoranthene	206-44-0				15-162	30	37-109
	Fluorene	86-73-7				16-100	30	46-134
	Hexachlorobenzene	118-74-1				14-107	30	41-138
	Hexachlorobutadiene	87-68-3				12-84	30	10-142
	Hexachlorocyclopentadiene	77-47-4				10-101	30	10-133
	Hexachloroethane	67-72-1				16-114	30	10-129
	Indeno(1,2,3-cd)pyrene	193-39-5				10-125	30	32-110
	Isophorone	78-59-1				15-95	30	39-86
	N-Nitroso-di-n-propylamine	621-64-7				11-98	30	37-87
	N-Nitrosodiphenylamine	86-30-6				14-114	30	40-102
	Naphthalene	91-20-3				18-84	30	31-123
	Nitrobenzene	98-95-3				20-84	30	35-134
	Pentachlorophenol	87-86-5				10-152	30	17-150
	Phenanthrene	85-01-8				11-115	30	45-140
	Phenol	108-95-2				10-109	30	10-144
	Pyrene	129-00-0				10-130	30	41-115

Table 7C (continued) - ALS
Analytical Laboratory Data Quality Objectives (DQOs)

Precision and Accuracy
Semi-Volatile Organic Compounds (SVOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Solid	All Compounds			≤ 50	≤ RL			
	bis(2-Chloroethoxy)methane	111-91-1				16-93	30	39-87
	bis(2-Chloroethyl)ether	111-44-4				18-130	30	37-86
	bis(2-Ethylhexyl)phthalate	117-81-7				13-164	30	35-119
	Phenol-d6	13127-88-3	10-145					
	2-Fluorophenol	367-12-4	16-129					
	2,4,6-Tribromophenol	118-79-6	10-109					
	Nitrobenzene-d5	4165-60-0	11-91					
	2-Fluorobiphenyl	321-60-8	14-102					
	Terphenyl-d14	1718-51-0	16-120					

Notes:

1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by ALS for USEPA Method SW-846 8270C/D SIM. Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Check Sample; RL = Reporting Limit.

Table 7D - ALS
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Semi-Volatile Organic Compounds (SVOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Aqueous	All Compounds			≤ 20	≤ RL			
	1,1'-Biphenyl	92-52-4				30-126	30	30-126
	1,4′-Dioxane	123-91-1				33-166	30	50-184
	2,2'-oxybis(1-Chloropropane)	108-60-1				43-116	30	44-112
	2,4,5-Trichlorophenol	95-95-4				62-117	30	62-117
	2,4,6-Trichlorophenol	88-06-2				62-115	30	62-115
	2,4-Dichlorophenol	120-83-2				62-109	30	62-109
	2,4-Dimethylphenol	105-67-9				36-137	30	28-100
	2,4-Dinitrophenol	51-28-5				28-196	30	40-156
	2,4-Dinitrotoluene	121-14-2				69-147	30	69-122
	2,6-Dinitrotoluene	606-20-2				48-125	30	48-125
	2-Chloronaphthalene	91-58-7				62-102	30	47-98
	2-Chlorophenol	95-57-8				37-112	30	42-112
	2-Methylnaphthalene	91-57-6				45-109	30	34-102
	2-Methylphenol	95-48-7				49-103	30	59-104
	2-Nitroaniline	88-74-4				60-119	30	60-119
	2-Nitrophenol	88-75-5				60-113	30	60-113
	3,3'-Dichlorobenzidine	91-94-1				11-146	30	44-114
	3-Nitroaniline	99-09-2				46-115	30	50-112
	4,6-Dinitro-2-methylphenol	534-52-1				27-200	30	65-141
	4-Bromophenyl-phenylether	101-55-3				63-124	30	63-124
	4-Chloro-3-methylphenol	59-50-7				22-136	30	42-124
	4-Chloroaniline	106-47-8				26-118	30	40-111
	4-Chlorophenyl-phenylether	7005-72-3				59-112	30	59-112
	4-Methylphenol	106-44-5				48-96	30	50-111
	4-Nitroaniline	100-01-6				49-133	30	62-127
	4-Nitrophenol	100-02-7				16-89	30	10-126
	Acenaphthene	83-32-9				57-104	30	54-125
	Acenaphthylene	208-96-8				57-109	30	69-111
	Acetophenone	98-86-2				10-187	30	42-126
	Anthracene	120-12-7				55-116	30	55-116
	Atrazine	1912-24-9				10-113	30	10-160

Table 7D (continued) - ALS
Analytical Laboratory Data Quality Objectives (DQOs)

Precision and Accuracy
Semi-Volatile Organic Compounds (SVOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Aqueous	All Compounds			≤ 20	≤ RL			
	Benzaldehyde	100-52-7				48-200	30	46-200
	Benzo(a)anthracene	56-55-3				66-110	30	66-110
	Benzo(a)pyrene	50-32-8				44-114	30	44-114
	Benzo(b)fluoranthene	205-99-2				64-122	30	64-122
	Benzo(g,h,i)perylene	191-24-2				60-127	30	60-127
	Benzo(k)fluoranthene	207-08-9				49-133	30	49-133
	Butylbenzylphthalate	85-68-7				41-148	30	41-148
	Caprolactam	105-60-2				10-41	30	10-41
	Carbazole	86-74-8				71-121	30	66-117
	Chrysene	218-01-9				57-118	30	57-118
	Di-n-butylphthalate	84-74-2				57-139	30	57-139
	Di-n-octylphthalate	117-84-0				44-151	30	72-146
	Dibenz(a,h)anthracene	53-70-3				58-132	30	58-132
	Dibenzofuran	132-64-9				58-105	30	58-105
	Diethylphthalate	84-66-2				65-122	30	65-122
	Dimethylphthalate	131-11-3				69-115	30	69-115
	Fluoranthene	206-44-0				62-123	30	62-123
	Fluorene	86-73-7				60-112	30	60-112
	Hexachlorobenzene	118-74-1				51-132	30	76-119
	Hexachlorobutadiene	87-68-3				10-111	30	16-95
	Hexachlorocyclopentadiene	77-47-4				13-120	30	10-99
	Hexachloroethane	67-72-1				12-101	30	15-92
	Indeno(1,2,3-cd)pyrene	193-39-5				64-126	30	64-126
	Isophorone	78-59-1				61-128	30	61-128
	N-Nitroso-di-n-propylamine	621-64-7				25-120	30	51-119
	N-Nitrosodiphenylamine	86-30-6				73-126	30	45-123
	Naphthalene	91-20-3				28-113	30	36-95
	Nitrobenzene	98-95-3				51-113	30	51-113
	Pentachlorophenol	87-86-5				64-147	30	56-146
	Phenanthrene	85-01-8				58-118	30	58-118
	Phenol	108-95-2				25-56	30	10-113
	Pyrene	129-00-0				45-125	30	67-118

Table 7D (continued) - ALS
Analytical Laboratory Data Quality Objectives (DQOs)

Precision and Accuracy
Semi-Volatile Organic Compounds (SVOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Aqueous	All Compounds			≤ 20	≤ RL			
	bis(2-Chloroethoxy)methane	111-91-1				49-156	30	53-142
	bis(2-Chloroethyl)ether	111-44-4				56-106	30	56-106
	bis(2-Ethylhexyl)phthalate	117-81-7				62-124	30	62-124
	Phenol-d6	13127-88-3	10-107					
	2-Fluorophenol	367-12-4	10-105					
	2,4,6-Tribromophenol	118-79-6	28-157					
	Nitrobenzene-d5	4165-60-0	37-117					
	2-Fluorobiphenyl	321-60-8	39-119					
	Terphenyl-d14	1718-51-0	40-133					

Notes:

1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by ALS for USEPA Method SW-846 8270C/D SIM. Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Check Sample; RL = Reporting Limit.

Table 7E – Test America
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Semi-Volatile Organic Compounds (SVOCs)

Matrix	*QC Compounds*	*CAS Number[1]*	*Surrogate Accuracy (% Rec.)[2]*	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)[2]*	*MS/MSD Precision (% RPD)[2]*	*LCS Accuracy (% Rec.)[2]*
Solid	All Compounds			≤ 50	≤ RL			
	1,1'-Biphenyl	92-52-4				58-120	20	59-120
	1,4′-Dioxane	123-91-1				13-120	50	23-120
	2,2'-oxybis(1-Chloropropane)	108-60-1				31-120	24	44-120
	2,4,5-Trichlorophenol	95-95-4				46-120	18	59-126
	2,4,6-Trichlorophenol	88-06-2				41-123	19	59-123
	2,4-Dichlorophenol	120-83-2				45-120	19	61-120
	2,4-Dimethylphenol	105-67-9				52-120	42	59-120
	2,4-Dinitrophenol	51-28-5				41-146	22	41-146
	2,4-Dinitrotoluene	121-14-2				63-125	20	63-120
	2,6-Dinitrotoluene	606-20-2				66-120	15	66-120
	2-Chloronaphthalene	91-58-7				57-120	21	57-120
	2-Chlorophenol	95-57-8				43-120	25	53-120
	2-Methylnaphthalene	91-57-6				55-120	21	59-120
	2-Methylphenol	95-48-7				48-120	27	54-120
	2-Nitroaniline	88-74-4				61-120	15	61-120
	2-Nitrophenol	88-75-5				37-120	18	56-120
	3,3'-Dichlorobenzidine	91-94-1				37-126	25	54-120
	3-Nitroaniline	99-09-2				48-120	19	48-120
	4,6-Dinitro-2-methylphenol	534-52-1				23-149	15	49-122
	4-Bromophenyl-phenylether	101-55-3				58-120	15	58-120
	4-Chloro-3-methylphenol	59-50-7				49-125	27	61-120
	4-Chloroaniline	106-47-8				38-120	22	38-120
	4-Chlorophenyl-phenylether	7005-72-3				63-124	16	63-124
	4-Methylphenol	106-44-5				50-120	24	55-120
	4-Nitroaniline	100-01-6				47-120	24	56-120
	4-Nitrophenol	100-02-7				31-147	25	43-147
	Acenaphthene	83-32-9				60-120	35	62-120
	Acenaphthylene	208-96-8				58-121	18	58-121
	Acetophenone	98-86-2				47-120	20	54-120
	Anthracene	120-12-7				62-120	15	62-120
	Atrazine	1912-24-9				60-150	20	60-127

Table 7E (continued) – Test America
Analytical Laboratory Data Quality Objectives (DQOs)

Precision and Accuracy
Semi-Volatile Organic Compounds (SVOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Solid	All Compounds			≤ 50	≤ RL			
	Benzaldehyde	100-52-7				10-150	20	10-150
	Benzo(a)anthracene	56-55-3				65-120	15	65-120
	Benzo(a)pyrene	50-32-8				64-120	15	64-120
	Benzo(b)fluoranthene	205-99-2				64-120	15	64-120
	Benzo(g,h,i)perylene	191-24-2				45-145	15	45-145
	Benzo(k)fluoranthene	207-08-9				65-120	22	65-120
	Butylbenzylphthalate	85-68-7				61-20	16	61-129
	Caprolactam	105-60-2				37-133	20	47-120
	Carbazole	86-74-8				59-120	20	65-120
	Chrysene	218-01-9				64-120	15	64-120
	Di-n-butylphthalate	84-74-2				58-130	15	58-130
	Di-n-octylphthalate	117-84-0				57-133	16	57-133
	Dibenz(a,h)anthracene	53-70-3				54-132	15	54-132
	Dibenzofuran	132-64-9				62-120	15	63-120
	Diethylphthalate	84-66-2				66-120	15	66-120
	Dimethylphthalate	131-11-3				65-124	15	65-124
	Fluoranthene	206-44-0				62-120	15	62-120
	Fluorene	86-73-7				63-120	15	63-120
	Hexachlorobenzene	118-74-1				60-120	15	60-120
	Hexachlorobutadiene	87-68-3				45-120	44	45-120
	Hexachlorocyclopentadiene	77-47-4				31-120	49	47-120
	Hexachloroethane	67-72-1				21-120	46	41-120
	Indeno(1,2,3-cd)pyrene	193-39-5				56-134	15	56-134
	Isophorone	78-59-1				56-120	17	56-120
	N-Nitroso-di-n-propylamine	621-64-7				46-120	31	52-120
	N-Nitrosodiphenylamine	86-30-6				20-128	15	51-128
	Naphthalene	91-20-3				46-120	29	55-120
	Nitrobenzene	98-95-3				49-120	24	54-120
	Pentachlorophenol	87-86-5				25-136	35	51-120
	Phenanthrene	85-01-8				60-122	15	60-120
	Phenol	108-95-2				50-120	35	53-120
	Pyrene	129-00-0				61-133	35	61-133

Table 7E (continued) – Test America
Analytical Laboratory Data Quality Objectives (DQOs)

Precision and Accuracy
Semi-Volatile Organic Compounds (SVOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Solid	All Compounds			≤ 50	≤ RL			
	bis(2-Chloroethoxy)methane	111-91-1				52-120	17	55-120
	bis(2-Chloroethyl)ether	111-44-4				45-120	21	45-120
	bis(2-Ethylhexyl)phthalate	117-81-7				61-133	15	61-133
	Phenol-d5	4165-62-2	54-120					
	2-Fluorophenol	367-12-4	52-120					
	2,4,6-Tribromophenol	118-79-6	54-120					
	Nitrobenzene-d5	4165-60-0	53-120					
	2-Fluorobiphenyl	321-60-8	60-120					
	Terphenyl-d14	1718-51-0	65-121					

Notes:

1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by Test America for USEPA Method SW-846 8270C/D SIM. Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Check Sample; RL = Reporting Limit.

Table 7F – Test America
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Semi-Volatile Organic Compounds (SVOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Aqueous	All Compounds			≤ 20	≤ RL			
	1,1'-Biphenyl	92-52-4				57-120	20	59-120
	1,4′-Dioxane	123-91-1				10-137	30	10-137
	2,2'-oxybis (1-Chloropropane)	108-60-1				28-121	24	21-136
	2,4,5-Trichlorophenol	95-95-4				65-126	18	65-126
	2,4,6-Trichlorophenol	88-06-2				64-120	19	64-120
	2,4-Dichlorophenol	120-83-2				48-132	19	63-120
	2,4-Dimethylphenol	105-67-9				39-130	42	47-120
	2,4-Dinitrophenol	51-28-5				21-150	22	31-137
	2,4-Dinitrotoluene	121-14-2				54-138	20	69-120
	2,6-Dinitrotoluene	606-20-2				17-150	15	68-120
	2-Chloronaphthalene	91-58-7				52-124	21	58-120
	2-Chlorophenol	95-57-8				48-120	25	48-120
	2-Methylnaphthalene	91-57-6				34-140	21	59-120
	2-Methylphenol	95-48-7				46-120	27	39-120
	2-Nitroaniline	88-74-4				44-136	15	54-127
	2-Nitrophenol	88-75-5				38-141	18	52-125
	3,3'-Dichlorobenzidine	91-94-1				10-150	25	49-135
	3-Nitroaniline	99-09-2				32-150	19	51-120
	4,6-Dinitro-2-methylphenol	534-52-1				38-150	15	46-136
	4-Bromophenyl-phenylether	101-55-3				63-126	15	65-120
	4-Chloro-3-methylphenol	59-50-7				64-127	27	61-123
	4-Chloroaniline	106-47-8				16-124	22	30-120
	4-Chlorophenyl-phenylether	7005-72-3				61-120	16	62-120
	4-Methylphenol	106-44-5				36-120	24	29-131
	4-Nitroaniline	100-01-6				32-150	24	65-120
	4-Nitrophenol	100-02-7				23-132	48	45-120
	Acenaphthene	83-32-9				48-120	24	60-120
	Acenaphthylene	208-96-8				63-120	18	63-120
	Acetophenone	98-86-2				53-120	20	45-120
	Anthracene	120-12-7				65-122	15	67-120
	Atrazine	1912-24-9				50-150	20	71-130

Table 7F (continued) – Test America
Analytical Laboratory Data Quality Objectives (DQOs)

Precision and Accuracy
Semi-Volatile Organic Compounds (SVOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Aqueous	All Compounds			≤ 20	≤ RL			
	Benzaldehyde	100-52-7				10-150	20	10-140
	Benzo(a)anthracene	56-55-3				43-124	15	70-121
	Benzo(a)pyrene	50-32-8				23-125	15	60-123
	Benzo(b)fluoranthene	205-99-2				27-127	15	66-126
	Benzo(g,h,i)perylene	191-24-2				16-147	15	66-150
	Benzo(k)fluoranthene	207-08-9				20-124	22	65-124
	Butylbenzylphthalate	85-68-7				51-140	16	70-129
	Caprolactam	105-60-2				10-120	20	22-120
	Carbazole	86-74-8				16-148	20	66-123
	Chrysene	218-01-9				44-122	15	69-120
	Di-n-butylphthalate	84-74-2				65-1129	15	69-131
	Di-n-octylphthalate	117-84-0				16-150	16	63-140
	Dibenz(a,h)anthracene	53-70-3				16-139	15	65-135
	Dibenzofuran	132-64-9				60-120	15	66-120
	Diethylphthalate	84-66-2				53-133	15	59-127
	Dimethylphthalate	131-11-3				59-123	15	68-120
	Fluoranthene	206-44-0				63-129	15	69-126
	Fluorene	86-73-7				62-120	15	66-120
	Hexachlorobenzene	118-74-1				57-121	15	61-120
	Hexachlorobutadiene	87-68-3				37-120	44	35-120
	Hexachlorocyclopentadiene	77-47-4				21-120	49	31-120
	Hexachloroethane	67-72-1				16-130	46	43-120
	Indeno(1,2,3-cd)pyrene	193-39-5				16-140	15	69-146
	Isophorone	78-59-1				48-133	17	55-120
	N-Nitroso-di-n-propylamine	621-64-7				49-120	31	32-140
	N-Nitrosodiphenylamine	86-30-6				39-138	15	61-120
	Naphthalene	91-20-3				45-120	29	57-120
	Nitrobenzene	98-95-3				45-123	24	53-123
	Pentachlorophenol	87-86-5				23-149	37	29-136
	Phenanthrene	85-01-8				65-122	15	68-120
	Phenol	108-95-2				16-120	34	17-120
	Pyrene	129-00-0				58-128	19	70-125

Table 7F (continued) – Test America
Analytical Laboratory Data Quality Objectives (DQOs)

Precision and Accuracy
Semi-Volatile Organic Compounds (SVOCs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Aqueous	All Compounds			≤ 20	≤ RL			
	bis(2-Chloroethoxy)methane	111-91-1				44-128	17	50-128
	bis(2-Chloroethyl)ether	111-44-4				45-120	21	44-120
	bis(2-Ethylhexyl)phthalate	117-81-7				16-150	15	63-139
	Aniline-d5	4165-61-1	NA					
	o-Toluidine-d9	194423-47-7	NA					
	Phenol-d5	4165-62-2	22-120					
	2-Fluorophenol	367-12-4	35-120					
	2,4,6-Tribromophenol	118-79-6	41-120					
	Nitrobenzene-d5	4165-60-0	46-120					
	2-Fluorobiphenyl	321-60-8	48-120					
	Terphenyl-d14	1718-51-0	59-136					

Notes:

1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by Test America for USEPA Method SW-846 8270C/D SIM. Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Check Sample; RL = Reporting Limit; NA = Not Available.

Table 8A - Eurofins
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Polychlorinated Biphenyls (PCBs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Solid	All Compounds			≤ 50	≤ RL			
	Aroclor-1016	12674-11-2				76-121	50	76-121
	Aroclor -1221	11104-28-2				NA	NA	NA
	Aroclor -1232	11141-16-5				NA	NA	NA
	Aroclor -1242	53469-21-9				NA	NA	NA
	Aroclor -1248	12672-29-6				NA	NA	NA
	Aroclor -1254	11097-69-1				50-130	50	50-130
	Aroclor -1260	11096-82-5				79-130	50	79-130
	Tetrachloro-m-xylene	877-09-8	53-140					
	Decachlorobiphenyl	2051-24-3	45-143					

Notes:

1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by Eurofins for USEPA Method SW-846 8082A. Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Check Sample; RL = Reporting Limit; NA = Not Available.

Table 8B - Eurofins
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Polychlorinated Biphenyls (PCBs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Aqueous	All Compounds			≤ 20	≤ RL			
	Aroclor-1016	12674-11-2				60-117	30	60-117
	Aroclor -1221	11104-28-2				80-120	30	NA
	Aroclor -1232	11141-16-5				80-120	30	NA
	Aroclor -1242	53469-21-9				75-125	30	75-125
	Aroclor -1248	12672-29-6				68-149	30	58-112
	Aroclor -1254	11097-69-1				50-130	30	NA
	Aroclor -1260	11096-82-5				57-134	30	57-134
	Tetrachloro-m-xylene	877-09-8	33-137					
	Decachlorobiphenyl	2051-24-3	10-148					

Notes:

1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by Eurofins for USEPA Method SW-846 8082A. Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Check Sample; RL = Reporting Limit; NA = Not Available.

Table 8C - ALS
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Polychlorinated Biphenyls (PCBs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Solid	All Compounds			≤ 50	≤ RL			
	Aroclor-1016	12674-11-2				26-147	30	37-107
	Aroclor -1221	11104-28-2				50-150	30	43-170
	Aroclor -1232	11141-16-5				50-150	30	45-162
	Aroclor -1242	53469-21-9				40-139	30	27-145
	Aroclor -1248	12672-29-6				49-140	30	37-157
	Aroclor -1254	11097-69-1				32-159	30	39-161
	Aroclor -1260	11096-82-5				10-175	30	40-130
	Tetrachloro-m-xylene	877-09-8	14-119					
	Decachlorobiphenyl	2051-24-3	22-128					

Notes:

1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by ALS for USEPA Method SW-846 8082A. Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Check Sample; RL = Reporting Limit.

Table 8D - ALS
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Polychlorinated Biphenyls (PCBs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Aqueous	All Compounds			≤ 20	≤ RL			
	Aroclor-1016	12674-11-2				40-140	30	53-122
	Aroclor -1221	11104-28-2				50-150	30	64-112
	Aroclor -1232	11141-16-5				50-150	30	83-124
	Aroclor -1242	53469-21-9				65-118	30	77-129
	Aroclor -1248	12672-29-6				56-119	30	56-119
	Aroclor -1254	11097-69-1				60-143	30	60-143
	Aroclor -1260	11096-82-5				13-177	30	45-134
	Tetrachloro-m-xylene	877-09-8	15-131					
	Decachlorobiphenyl	2051-24-3	10-149					

Notes:

1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by ALS for USEPA Method SW-846 8082A. Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Check Sample; RL = Reporting Limit; NA = Not Available.

Table 8E – Test America
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Polychlorinated Biphenyls (PCBs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Solid	All Compounds			≤ 50	≤ RL			
	Aroclor-1016	12674-11-2				50-177	50	51-185
	Aroclor -1221	11104-28-2				NA	NA	NA
	Aroclor -1232	11141-16-5				NA	NA	NA
	Aroclor -1242	53469-21-9				NA	NA	NA
	Aroclor -1248	12672-29-6				NA	NA	NA
	Aroclor -1254	11097-69-1				NA	NA	NA
	Aroclor -1260	11096-82-5				33-200	50	61-184
	Tetrachloro-m-xylene	877-09-8	60-154					
	Decachlorobiphenyl	2051-24-3	65-174					

Notes:

1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by Test America for USEPA Method SW-846 8082A. Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Check Sample; RL = Reporting Limit; NA = Not Available.

Table 8F – Test America
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Polychlorinated Biphenyls (PCBs)

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Aqueous	All Compounds			≤ 20	≤ RL			
	Aroclor-1016	12674-11-2				28-150	50	62-130
	Aroclor -1221	11104-28-2				NA	NA	NA
	Aroclor -1232	11141-16-5				NA	NA	NA
	Aroclor -1242	53469-21-9				NA	NA	NA
	Aroclor -1248	12672-29-6				NA	NA	NA
	Aroclor -1254	11097-69-1				NA	NA	NA
	Aroclor -1260	11096-82-5				25-131	50	56-123
	Tetrachloro-m-xylene	877-09-8	39-121					
	Decachlorobiphenyl	2051-24-3	19-120					

Notes:

1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by Test America for USEPA Method SW-846 8082A. Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Check Sample; RL = Reporting Limit; NA = Not Available.

Table 9A - Eurofins
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Pesticides

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Solid	All Compounds			≤ 50	≤ RL			
	Aldrin	309-00-2				60-117	50	60-117
	Alpha BHC	319-84-6				65-124	50	65-124
	Alpha Chlordane	5103-71-9				73-131	50	73-131
	Beta BHC	319-85-7				68-129	50	68-129
	Delta BHC	319-86-8				45-151	50	45-151
	Dieldrin	60-57-1				63-126	50	63-126
	Endosulfan I	959-98-8				62-119	50	62-119
	Endosulfan II	33213-65-9				65-126	50	65-126
	Endosulfan Sulfate	1031-07-8				71-132	50	71-132
	Endrin	72-20-8				65-125	50	65-125
	Endrin Aldehyde	7421-93-4				59-122	50	59-122
	Endrin Ketone	53494-70-5				64-121	50	64-121
	Gamma BHC - Lindane	58-89-9				47-140	50	47-140
	Gamma Chlordane	5103-74-2				76-134	50	76-134
	Heptachlor	76-44-8				66-118	50	66-118
	Heptachlor Epoxide	1024-57-3				74-128	50	74-128
	Methoxychlor	72-43-5				65-131	50	65-131
	Toxaphene	8001-35-2				70-120	50	75-125
	p,p-DDD	72-54-8				69-138	50	69-138
	p,p-DDE	72-55-9				68-146	50	68-146
	p,p-DDT	50-29-3				67-135	50	67-135
	Tetrachloro-m-xylene	877-09-8	26-145					
	Decachlorobiphenyl	2051-24-3	39-152					

Notes:

1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by Eurofins for USEPA Method SW-846 8081B. Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Check Sample; RL = Reporting Limit.

Table 9B - Eurofins
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Pesticides

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Aqueous	All Compounds			≤ 20	≤ RL			
	Aldrin	309-00-2				28-119	30	28-119
	Alpha BHC	319-84-6				47-132	30	47-132
	Alpha Chlordane	5103-71-9				53-126	30	53-126
	Beta BHC	319-85-7				56-125	30	56-125
	Delta BHC	319-86-8				76-126	30	76-126
	Dieldrin	60-57-1				54-126	30	54-126
	Endosulfan I	959-98-8				51-118	30	51-118
	Endosulfan II	33213-65-9				54-124	30	54-124
	Endosulfan Sulfate	1031-07-8				41-133	30	41-133
	Endrin	72-20-8				35-143	30	35-143
	Endrin Aldehyde	7421-93-4				40-135	20	40-135
	Endrin Ketone	53494-70-5				44-136	30	44-136
	Gamma BHC - Lindane	58-89-9				51-132	30	51-132
	Gamma Chlordane	5103-74-2				53-130	30	53-130
	Heptachlor	76-44-8				38-135	30	38-135
	Heptachlor Epoxide	1024-57-3				56-132	30	56-132
	Methoxychlor	72-43-5				39-143	30	39-143
	Toxaphene	8001-35-2				48-148	30	48-148
	p,p-DDD	72-54-8				67-123	30	67-123
	p,p-DDE	72-55-9				51-129	30	51-129
	p,p-DDT	50-29-3				66-119	30	66-119
	Tetrachloro-m-xylene	877-09-8	29-129					
	Decachlorobiphenyl	2051-24-3	32-149					

Notes:

1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by Eurofins for USEPA Method SW-846 8081B. Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Check Sample; RL = Reporting Limit.

Table 9C - ALS
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Pesticides

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Solid	All Compounds			≤ 50	≤ RL			
	Aldrin	309-00-2				10-167	30	10-103
	Alpha BHC	319-84-6				10-149	30	19-126
	Alpha Chlordane	5103-71-9				10-180	30	31-104
	Beta BHC	319-85-7				10-176	30	28-123
	Delta BHC	319-86-8				17-138	30	17-126
	Dieldrin	60-57-1				24-140	30	22-120
	Endosulfan I	959-98-8				13-145	30	30-108
	Endosulfan II	33213-65-9				12-178	30	26-122
	Endosulfan Sulfate	1031-07-8				15-157	30	22-121
	Endrin	72-20-8				16-153	30	42-133
	Endrin Aldehyde	7421-93-4				10-161	30	10-73
	Endrin Ketone	53494-70-5				17-161	30	36-116
	Gamma BHC - Lindane	58-89-9				10-141	30	23-125
	Gamma Chlordane	5103-74-2				10-180	30	31-104
	Heptachlor	76-44-8				10-160	30	31-115
	Heptachlor Epoxide	1024-57-3				10-166	30	27-131
	Methoxychlor	72-43-5				10-192	30	32-148
	Toxaphene	8001-35-2				33-122	30	33-122
	p,p-DDD	72-54-8				10-165	30	17-138
	p,p-DDE	72-55-9				10-165	30	35-125
	p,p-DDT	50-29-3				10-163	30	34-123
	Tetrachloro-m-xylene	877-09-8	10-123					
	Decachlorobiphenyl	2051-24-3	10-122					

Notes:

1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by ALS for USEPA Method SW-846 8081B. Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Check Sample; RL = Reporting Limit.

Table 9D - ALS
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Pesticides

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Aqueous	All Compounds			≤ 20	≤ RL			
	Aldrin	309-00-2				15-148	30	15-148
	Alpha BHC	319-84-6				40-147	30	40-147
	Alpha Chlordane	5103-71-9				46-137	30	46-137
	Beta BHC	319-85-7				49-136	30	49-136
	Delta BHC	319-86-8				32-147	30	32-147
	Dieldrin	60-57-1				55-141	30	55-141
	Endosulfan I	959-98-8				52-142	30	52-142
	Endosulfan II	33213-65-9				56-147	30	56-147
	Endosulfan Sulfate	1031-07-8				44-146	30	44-146
	Endrin	72-20-8				53-144	30	53-144
	Endrin Aldehyde	7421-93-4				10-166	30	10-166
	Endrin Ketone	53494-70-5				54-143	30	54-143
	Gamma BHC - Lindane	58-89-9				44-142	30	44-142
	Gamma Chlordane	5103-74-2				46-137	30	46-137
	Heptachlor	76-44-8				28-151	30	28-151
	Heptachlor Epoxide	1024-57-3				57-128	30	57-128
	Methoxychlor	72-43-5				50-142	30	50-142
	Toxaphene	8001-35-2				46-130	30	46-130
	p,p-DDD	72-54-8				53-143	30	53-143
	p,p-DDE	72-55-9				39-144	30	39-144
	p,p-DDT	50-29-3				46-137	30	46-137
	Tetrachloro-m-xylene	877-09-8	10-147					
	Decachlorobiphenyl	2051-24-3	10-164					

Notes:

1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by ALS for USEPA Method SW-846 8081B. Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Check Sample; RL = Reporting Limit.

Table 9E – Test America
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Pesticides

Matrix	QC Compounds	CAS Number[1]	Surrogate Accuracy (% Rec.) [2]	Blind Field Duplicate Precision (% RPD)	Method Blanks	MS/MSD Accuracy (% Rec.) [2]	MS/MSD Precision (% RPD) [2]	LCS Accuracy (% Rec.) [2]
Solid	All Compounds			≤ 50	≤ RL			
	Aldrin	309-00-2				37-125	12	38-120
	Alpha BHC	319-84-6				39-120	15	39-120
	Alpha Chlordane	5103-71-9				35-120	23	47-120
	Beta BHC	319-85-7				36-120	19	40-120
	Delta BHC	319-86-8				34-120	14	45-120
	Dieldrin	60-57-1				45-120	12	58-120
	Endosulfan I	959-98-8				39-120	18	49-120
	Endosulfan II	33213-65-9				34-126	26	55-120
	Endosulfan Sulfate	1031-07-8				27-130	35	49-124
	Endrin	72-20-8				47-121	20	58-120
	Endrin Aldehyde	7421-93-4				33-123	47	37-121
	Endrin Ketone	53494-70-5				43-126	37	46-123
	Gamma BHC - Lindane	58-89-9				50-120	12	50-120
	Gamma Chlordane	5103-74-2				31-120	15	48-120
	Heptachlor	76-44-8				42-120	22	50-120
	Heptachlor Epoxide	1024-57-3				40-120	15	50-120
	Methoxychlor	72-43-5				44-150	24	58-133
	Toxaphene	8001-35-2				NA	NA	NA
	p,p-DDD	72-54-8				37-126	21	56-120
	p,p-DDE	72-55-9				34-120	18	44-120
	p,p-DDT	50-29-3				43-123	25	38-120
	Tetrachloro-m-xylene	877-09-8	30-124					
	Decachlorobiphenyl	2051-24-3	45-120					

Notes:

1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by Test America for USEPA Method SW-846 8081B. Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Check Sample; RL = Reporting Limit; NA = Not Available.

Table 9F – Test America
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Pesticides

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Aqueous	All Compounds			≤ 20	≤ RL			
	Aldrin	309-00-2				39-125	25	40-125
	Alpha BHC	319-84-6				48-120	24	52-125
	Alpha Chlordane	5103-71-9				44-120	23	52-120
	Beta BHC	319-85-7				49-120	24	51-120
	Delta BHC	319-86-8				50-120	24	51-120
	Dieldrin	60-57-1				56-130	24	66-128
	Endosulfan I	959-98-8				40-126	30	57-120
	Endosulfan II	33213-65-9				59-140	40	66-131
	Endosulfan Sulfate	1031-07-8				60-134	24	66-136
	Endrin	72-20-8				54-135	24	65-135
	Endrin Aldehyde	7421-93-4				50-142	28	61-134
	Endrin Ketone	53494-70-5				57-138	26	71-133
	Gamma BHC - Lindane	58-89-9				50-120	24	56-120
	Gamma Chlordane	5103-74-2				42-120	24	54-120
	Heptachlor	76-44-8				56-120	25	58-120
	Heptachlor Epoxide	1024-57-3				58-125	23	65-125
	Methoxychlor	72-43-5				40-150	26	50-150
	Toxaphene	8001-35-2				NA	NA	NA
	p,p-DDD	72-54-8				57-130	23	64-129
	p,p-DDE	72-55-9				39-120	22	50-120
	p,p-DDT	50-29-3				37-130	24	59-120
	Tetrachloro-m-xylene	877-09-8	44-120					
	Decachlorobiphenyl	2051-24-3	20-120					

Notes:

1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by Test America for USEPA Method SW-846 8081B. Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Check Sample; RL = Reporting Limit; NA = Not Available.

Table 10A - Eurofins
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Inorganic Constituents

QC Analytes	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS Accuracy (% Rec.)[1] Water*	*MS Accuracy (% Rec.)[1] Soil*	*LCS Accuracy (% Rec.) Water*	*LCS Accuracy (% Rec.) Soil*
All Analytes	≤ 50 % for Soil Samples	≤ RL				
Aluminum			75-125	75-125	80-120	80-120
Antimony			75-125	75-125	80-120	80-120
Arsenic			75-125	75-125	80-120	80-120
Barium	≤ 20 % for Aqueous Samples		75-125	75-125	80-120	80-120
Beryllium			75-125	75-125	80-120	80-120
Cadmium			75-125	75-125	80-120	80-120
Calcium			75-125	75-125	80-120	80-120
Chromium			75-125	75-125	80-120	80-120
Cobalt			75-125	75-125	80-120	80-120
Copper			75-125	75-125	80-120	80-120
Cyanide			72-114	45-145	90-110	90-110
Iron			75-125	75-125	80-120	80-120
Lead			75-125	75-125	80-120	80-120
Magnesium			75-125	75-125	80-120	80-120
Manganese			75-125	75-125	80-120	80-120
Mercury			80-120	80-120	80-120	80-120
Nickel			75-125	75-125	80-120	80-120
Potassium			75-125	75-125	80-120	80-120
Selenium			75-125	75-125	80-120	80-120
Silver			75-125	75-125	80-120	80-120
Sodium			75-125	75-125	80-120	80-120
Thallium			75-125	75-125	80-120	80-120
Vanadium			75-125	75-125	80-120	80-120
Zinc			75-125	75-125	80-120	80-120

Notes:

1. QC limits as established by Eurofins for USEPA Method SW-846 6010C for metals, SW-846 7470A/7471B for mercury and SW-846 9012B for cyanide. Subject to change.
   QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Check Sample; RL = Reporting Limit.

Table 10B - ALS
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Inorganic Constituents

QC Analytes	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS Accuracy (% Rec.)* [1] *Water*	*MS Accuracy (% Rec.)* [1] *Soil*	*LCS Accuracy (% Rec.) Water*	*LCS Accuracy (% Rec.) Soil*
All Analytes	≤ 50 % for Soil Samples	≤ RL				
Aluminum			75-125	75-125	80-120	80-120
Antimony			75-125	75-125	80-120	80-120
Arsenic			75-125	75-125	80-120	80-120
Barium	≤ 20 % for Aqueous Samples		75-125	75-125	80-120	80-120
Beryllium			75-125	75-125	80-120	80-120
Cadmium			75-125	75-125	80-120	80-120
Calcium			75-125	75-125	80-120	80-120
Chromium			75-125	75-125	80-120	80-120
Cobalt			75-125	75-125	80-120	80-120
Copper			75-125	75-125	80-120	80-120
Cyanide			NA	NA	0-10	0-10
Iron			75-125	75-125	80-120	80-120
Lead			75-125	75-125	80-120	80-120
Magnesium			75-125	75-125	80-120	80-120
Manganese			75-125	75-125	80-120	80-120
Mercury			75-125	75-125	80-120	80-120
Nickel			75-125	75-125	80-120	80-120
Potassium			75-125	75-125	80-120	80-120
Selenium			75-125	75-125	80-120	80-120
Silver			75-125	75-125	80-120	80-120
Sodium			75-125	75-125	80-120	80-120
Thallium			75-125	75-125	80-120	80-120
Vanadium			75-125	75-125	80-120	80-120
Zinc			75-125	75-125	80-120	80-120

Notes:

1. QC limits as established by ALS for USEPA Method SW-846 6010C for metals, SW-846 7470A/7471B for mercury and SW-846 9012B for cyanide. Subject to change.
   QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Check Sample; RL = Reporting Limit; NA = Not Available.

Table 10C – Test America
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
Inorganic Constituents

QC Analytes	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS Accuracy (% Rec.)* [1] *Water*	*MS Accuracy (% Rec.)* [1] *Soil*	*LCS Accuracy (% Rec.) Water*	*LCS Accuracy (% Rec.) Soil*
All Analytes	≤ 50 % for Soil Samples ≤ 20 % for Aqueous Samples	≤ RL				
Aluminum			75-125	75-125	80-120	41-160
Antimony			75-125	75-125	80-120	25-272
Arsenic			75-125	75-125	80-120	69-131
Barium			75-125	75-125	80-120	72-127
Beryllium			75-125	75-125	80-120	73-127
Cadmium			75-125	75-125	80-120	73-127
Calcium			75-125	75-125	80-120	74-126
Chromium			75-125	75-125	80-120	68-132
Cobalt			75-125	75-125	80-120	75-125
Copper			75-125	75-125	80-120	74-126
Cyanide			90-110	85-115	90-110	29-122
Iron			75-125	75-125	80-120	31-169
Lead			75-125	75-125	80-120	70-130
Magnesium			75-125	75-125	80-120	64-136
Manganese			75-125	75-125	80-120	74-125
Mercury			80-120	80-120	80-120	51-149
Nickel			75-125	75-125	80-120	70-130
Potassium			75-125	75-125	80-120	61-139
Selenium			75-125	75-125	80-120	64-137
Silver			75-125	75-125	80-120	66-135
Sodium			75-125	75-125	80-120	27-174
Thallium			75-125	75-125	80-120	67-132
Vanadium			75-125	75-125	80-120	54-146
Zinc			75-125	75-125	80-120	67-133

Notes:

1. QC limits as established by Test America for USEPA Method SW-846 6010C for metals, SW-846 7470A/7471B for mercury and SW-846 9012B for cyanide. Subject to change.

   QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Check Sample; RL = Reporting Limit.

Table 11A - Eurofins
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
General Chemistry

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)*[2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)*[2]	*MS/MSD Precision (% RPD)*[2]	*LCS Accuracy (% Rec.)*[2]
Solid	All Compounds			≤ 50	≤ RL			
	Alkalinity (Carbonate)					NA	NA	NA
	Alkalinity (Bicarbonate)					NA	NA	NA
	Chloride	16887-00-6				90-110	15	90-110
	Sulfate	14808-79-8				90-110	15	90-110
	pH					75-125	100	95-105
	TOC					47-143	20	47-143
Aqueous	All Compounds			≤ 20	≤ RL			
	Alkalinity (Carbonate)					NA	NA	NA
	Alkalinity (Bicarbonate)					NA	NA	NA
	Chloride	16887-00-6				90-110	20	90-110
	Sulfate	14808-79-8				90-110	20	90-110
	pH					75-125	20	95-105
	TOC					91-113	20	80-120

Notes:

1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by Eurofins for USEPA Method SM 2320B for alkalinity, SW-846 9056A for chloride and sulfate, SW-846 SM 4500-H+B-2000/ 9045D for pH and SW-846 SM 5310 C-2000/ Lloyd Kahn Method for TOC. Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Check Sample; RL = Reporting Limit; TOC = Total Organic Carbon.

Table 11B - ALS
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
General Chemistry

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Solid	All Compounds			≤ 50	≤ RL			
	Alkalinity (Carbonate)					10-162	20	76-110
	Alkalinity (Bicarbonate)					10-162	20	76-110
	Chloride	16887-00-6				69-146	15	80-120
	Sulfate	14808-79-8				38-181	15	80-120
	pH					NA	±0.10	NA
	TOC					33-171	30	75-127
Aqueous	All Compounds			≤ 20	≤ RL			
	Alkalinity (Carbonate)					69-114	20	81-112
	Alkalinity (Bicarbonate)					69-114	20	81-112
	Chloride	16887-00-6				80-120	15	80-120
	Sulfate	14808-79-8				80-120	15	80-120
	pH					NA	±0.10	NA
	TOC					48-135	20	81-118

Notes:

1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by ALS for USEPA Method SM 2320B for alkalinity, SW-846 9056A for chloride and sulfate, SW-846 SM 4500-H+B-2000/ 9045D for pH and SW-846 SM 5310 C-2000/ Lloyd Kahn Method for TOC. Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Check Sample; RL = Reporting Limit; TOC = Total Organic Carbon; NA = Not Available.

Table 11C – Test America
Analytical Laboratory Data Quality Objectives (DQOs)
Precision and Accuracy
General Chemistry

Matrix	*QC Compounds*	*CAS Number*[1]	*Surrogate Accuracy (% Rec.)* [2]	*Blind Field Duplicate Precision (% RPD)*	*Method Blanks*	*MS/MSD Accuracy (% Rec.)* [2]	*MS/MSD Precision (% RPD)* [2]	*LCS Accuracy (% Rec.)* [2]
Solid	All Compounds			≤ 50	≤ RL			
	Alkalinity (Carbonate)					NA	NA	NA
	Alkalinity (Bicarbonate)					NA	NA	NA
	Chloride	16887-00-6				80-120	20	90-110
	Sulfate	14808-79-8				80-120	20	90-110
	pH					NA	NA	99-101
	TOC					75-125	20	75-125
Aqueous	All Compounds			≤ 20	≤ RL			
	Alkalinity (Carbonate)					NA	NA	NA
	Alkalinity (Bicarbonate)					NA	NA	NA
	Chloride	16887-00-6				81-120	20	90-110
	Sulfate	14808-79-8				80-120	20	90-110
	pH					NA	NA	99-101
	TOC					54-131	20	90-110

Notes:

1. Chemical Abstracts Service (CAS) Registry Number.
2. QC limits as established by Test America for USEPA Method SM 2320B for alkalinity, SW-846 9056A for chloride and sulfate, SW-846 SM 4500-H+B-2000/ 9045D for pH and SW-846 SM 5310 C-2000/ Lloyd Kahn Method for TOC. Subject to change.

QC = Quality Control; % Rec. = Percent Recovery; % RPD = Relative Percent Difference; MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Check Sample; RL = Reporting Limit; TOC = Total Organic Carbon; NA = Not Available.

Table 12
Analytical Method/SOP References

Analytical Group	*Matrix*	*Analytical Method/SOP Title*	*Analytical SOP Document Number*	*Analytical SOP Revision Number*	*Analytical SOP Revision Date*	*Organization Performing Analysis*	*Definitive or Screening Data*	*Modified for Project Work?*
PFAS	Soil/ Aqueous	USEPA Method 537-1.1 (modified)	T-PFAS-WI12031 T-PFAS-WI14355	4 6	2/24/2018 3/1/2018	Eurofins	Definitive	No
	Soil/ Aqueous		LCP-PFC	8.0	1/15/2018	ALS	Definitive	No
	Soil/ Aqueous		WS-LC-0025	2.9	11/22/2017	Test America	Definitive	No
TOP Assay	Soil/ Aqueous	Extraction and Oxidation followed by PFAS Analysis by USEPA Method 537-1.1 (modified)	LCP-TOP LCP-PFC	8.0 0.0	1/15/2018 3/5/2018	ALS	Definitive	No
	Aqueous		WS-LC-0025	2.9	11/22/2017	Test America	Definitive	No
VOCs	Soil/ Aqueous	USEPA Method SW-846 8260C	T-VOA-WI8236 T-VOA-WI8194	4 5	6/24/2016 6/29/2016	Eurofins	Definitive	No
	Soil/ Aqueous		VOC-8260	14	10/3/2016	ALS	Definitive	No
	Soil/ Aqueous		BF-MV-013	2	2/2/2017	Test America	Definitive	No
SVOCs	Soil/ Aqueous	USEPA Method SW-846 8270C/D SIM	T-SVOA-WI9617 T-SVOA-WI9995	7 12	4/27/2017 9/8/2016	Eurofins	Definitive	No
	Soil/ Aqueous		SOC-8270 SOC-1,4-Dioxane	11 1	11/9/2015 1/27/2014	ALS	Definitive	No
	Soil/ Aqueous		BF-MB-003	8	12/14/2016	Test America	Definitive	No
PCBs	Soil/ Aqueous	USEPA Method SW-846 8082A	T-PEST-WI10004 T-PEST-WI9238	8 5	7/26/2016 11/4/2015	Eurofins	Definitive	No
	Soil/ Aqueous		SOC-8082	9	3/14/2016	ALS	Definitive	No
	Soil/ Aqueous		BF-GE-013	3	8/17/2016	Test America	Definitive	No

Table 12 (continued)
Analytical Method/SOP References

Analytical Group	*Matrix*	*Analytical Method/SOP Title*	*Analytical SOP Document Number*	*Analytical SOP Revision Number*	*Analytical SOP Revision Date*	*Organization Performing Analysis*	*Definitive or Screening Data*	*Modified for Project Work?*
Pesticides	Soil/ Aqueous	USEPA Method SW-846 8081B	T-PEST-WI9232 T-PEST-WI9999	5.1 5	4/17/2017 10/20/2015	Eurofins	Definitive	No
	Soil/ Aqueous		SOC-8081	12	7/27/2015	ALS	Definitive	No
	Soil/ Aqueous		BF-GE-011	4	8/17/2016	Test America	Definitive	No
Inorganics	Soil/ Aqueous	USEPA Method SW-846 6010C/7470A /7471B/9012B	T-MET-WI11931 T-MET-WI7965 T-WC-WI11629	9 16 17	11/20/2015 11/27/2015 4/28/2014	Eurofins	Definitive	No
	Soil/ Aqueous		MET-200.7 MET-HG GEN-9012	16 1 9	5/17/2016 3/14/2016 3/21/2016	ALS	Definitive	No
	Soil/ Aqueous		BF-ME-009 BF-ME-011 BF-WC-015	8 10 10	2/1/2016 10/14/2016 8/25/2016	Test America	Definitive	No
General Chemistry	Soil/ Aqueous	USEPA Method 9056A/ 2320B/ 4500-H+B-2000/ 9045D/5310 C-2000/ Lloyd Kahn	T-WC-WI11475 T-WC-WI11626 T-WC-WI11627 T-WC-WI11637 T-WC-WI11475 T-WC-WI11518	9 21 15 15 9 11	11/23/2015 5/26/2015 10/30/2013 5/22/2015 11/23/2015 10/13/2016	Eurofins	Definitive	No
	Soil/ Aqueous		GEN-300r13 GEN-2320B MET-200_7r16 SMO-PH GEN-5310 GEN-TOCLK	NA 1 NA 0 2 7	12/14/2016 2/10/2014 12/14/2016 3/24/2014 4/28/2014 8/17/2015	ALS	Definitive	No
	Soil/ Aqueous		BF-MB-007 BF-WC-009 BF-WC-018 BF-WC-051 BR-WC-008	8 9 7 1 15	3/27/2017 5/16/2017 10/28/2016 7/21/2016 10/14/2014	Test America	Definitive	No

Table 13
Laboratory Analytical Methods, Preservatives, Holding Times and Containers

Analytical Parameters	*Matrix*	*Analytical Method Reference*	*Sample Preservation*[7]	*Holding Time*	*Minimum Sample Volume*
PFAS	Soil Aqueous	USEPA Method 537-1.1 (modified) and TOP Assay	Soil: Cool to 4 ± 2° C Water: Trizma® (for chlorinated waters) or No Preservation	14 days to extraction/ 40 days after extraction	2 x 250 mL HDPE plastic
TOP Assay	Soil Aqueous	TOP Assay	Soil: Cool to 4 ± 2° C	14 days to extraction[9]/ 40 days after extraction	2 x 250 mL HDPE plastic
VOCs	Soil Aqueous Air	USEPA Method SW-846 8260C/ 5035 USEPA TO-15	Soil: Cool, ≤ 6° C or freeze, in coring tool, 2 x 40 mL DI + 1 x 40 mL MeOH within 48 hours Water: Cool, ≤ 6° C, no headspace, HCl to pH < 2 Air: No Preservation	14 days 14 days 30 days	2 x 40 mL DI vials + 1 x 40 mL MeOH vial at 5 gram cores 3 x 40 mL vials 1-6 L SUMMA® canister
SVOCs	Soil Aqueous	USEPA Method SW-846 8270C	Soil: Cool, ≤ 6° C, store in dark Water: Cool, ≤ 6° C, store in dark	14 days to extraction/ 40 days after extraction 7 days until extraction/ 40 days after extraction	4 oz. glass 2 x 1000 mL glass
PCBs	Soil Aqueous	USEPA Method SW-846 8082A	Soil: Cool, ≤ 6° C Water: Cool, ≤ 6° C	1 year until extraction and analysis	4 oz. glass 2 x 1000 mL glass
Pesticides	Soil Aqueous	USEPA Method SW-846 8081B	Soil: Cool, ≤ 6° C Water: Cool, ≤ 6° C, adjust pH to 5-9 unless extracted within 72 hours	14 days to extraction/ 40 days after extraction 7 days until extraction/ 40 days after extraction	4 oz. glass 2 x 1000 mL glass
Metals	Soil Aqueous	USEPA Method SW-846 6010C	Soil: Cool, ≤ 6° C Water: HNO_3 to pH < 2	180 days	4 oz. glass 250 mL glass
Cyanide	Soil Aqueous	USEPA Method SW-846 9012B	Soil: Cool, ≤ 6° C Water: Cool, ≤ 6° C, NaOH to pH > 12	14 days	250 mL plastic/ glass 250 mL plastic/ glass

Table 13 (continued)
Laboratory Analytical Methods, Preservatives, Holding Times and Containers

Analytical Parameters	*Matrix*	*Analytical Method Reference*	*Sample Preservation*[7]	*Holding Time*	*Minimum Sample Volume*
Mercury	Soil Aqueous	USEPA Method SW-846 7471B/7470A	Soil: Cool, ≤ 6° C Water: HNO_3 to pH < 2	28 days	4 oz. plastic/ glass 250 mL plastic/ glass
Total Organic Carbon	Soil Aqueous	USEPA Method SW-846 5310C/ Lloyd Kahn Method	Soil: Cool, ≤ 6° C, no headspace Water: Cool, ≤ 6° C, H2SO4 to pH < 2	14 days 28 days	4 oz. glass 250 mL amber
Alkalinity	Soil Aqueous	USEPA Method SM2320B	Soil: NA Water: Cool, ≤ 6° C, no headspace	14 days	250 mL plastic or glass
Chloride Sulfate	Soil Aqueous	USEPA Method 9056A	Soil: Cool, ≤ 6° C (not required) Water: Cool, ≤ 6° C (not required)	None Listed/ 28 days 28 days	4 oz. plastic or glass 250 mL plastic or glass

Notes:

1. Total analytical samples not including QA/QC samples.
2. Blind Field Duplicates will be collected at a minimum frequency of five percent (1 per 20 field samples). More frequent collection may be warranted based on field conditions/observations and/or at the discretion of the Field Leader.
3. Field Blanks will be collected at a minimum frequency of five percent (1 per 20 field samples). More frequent collection may be warranted based on field conditions/observations and/or at the discretion of the Field Leader.
4. MS/MSD Pairs (two samples) will be collected at a minimum frequency of five percent (1 per 20 field samples). More frequent collection may be warranted based on field conditions/observations and/or at the discretion of the Field Leader.
5. Split Samples will be collected at a minimum frequency of five percent (1 per 20 field samples). More frequent collection may be warranted based on field conditions/observations and/or at the discretion of the Field Leader.
6. Trip Blank and Temperature Blank one per cooler.
7. Samples must be < 10°C, greater than 0°C (not frozen) upon lab receipt.
8. Field sampling criteria in Table 13 derived from ALS Quality Assurance Manual (QAM), Rev. 27, 10/26/2016.
9. Although the holding time for TOP Assay extraction is nominally 14 days, in order to select samples based on other analytical results, certain samples may be extracted outside of holding times.

Table 14
Sample Custody Requirements

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory):

The following documentation procedures will be used during sampling and analysis to provide custody control during transfer of samples from collection through storage. A sample is defined as being under a person's custody if any of the following conditions exist: 1) it is in their possession, 2) it is in their view, after being in their possession, 3) it was in their possession and they locked it up, or 4) it is in a designated secure area. Recordkeeping documentation will include the use of the following:

- a field logbook (bound, with dated pages) to document sampling activities in the field,
- labels to identify individual samples,
- and- chain-of-custody forms to document the analyses to be performed

In the field the sampler will record in the field logbook the following information for each sample collected:

- sample identification,
- sample matrix,
- name of the sampler,
- sample location,
- sample time and date,
- additional pertinent data,
- analysis to be conducted,
- sampling method,
- sample appearance (e.g., color, turbidity),
- preservative (if required),
- number of sample bottles an types, and- weather conditions

Samples will be packaged in a manner to prevent breakage of sample containers in a pre-chilled cooler. Custody of the samples and cooler will be the responsibility of the sampling personnel. Samples will be picked up by an Accutest courier or shipped via Federal Express Priority Overnight service to the analytical laboratory the same day samples are collected.

Laboratory Sample Custody Procedures (receipt of samples, archiving, and disposal): Each sample or group of samples shipped to the laboratory for analysis will be given a unique identification number. The laboratory sample custodian will record the client name, number of samples and date of receipt of the samples. The remaining sample aliquots not used by the laboratory for analysis will be archived for a period of 30 days. After the archive period has passed the sample will be disposed of by the laboratory unless a request to hold the sample is made by ERM.

Table 14
Sample Custody Requirements (continued)

Sample Identification Procedures: Each sample collected will be designated by an alpha-numeric code that will identify the sampling location and depth. Sample designations will be assigned as indicated in the following example:

LOC-01 (25)= Location ID (Collection Depth)

Additionally, eight digits will follow all sample designations to represent the date; therefore, LOC-01 (25)(04012016) would represent a groundwater sample collected at Location 01 at a depth of 25 feet on 01 April 2016.

In the case of QC samples such as field blanks, trip blanks and blind field duplicate samples, FB, TB and DUP respectively will be followed by the eight-digit date. For matrix spike/matrix spike duplicate samples, MS/MSD will be added following the applicable sample identification.

Chain-of-custody Procedures: The sampling crew shall maintain chain-of-custody records for all field and field QC samples.

The following information concerning the sample shall be documented on the chain of custody form:

- Unique sample identification for each container,
- Date and time of sample collection,
- Source of sample (including name, location, and sample type),
- Designation of MS/MSD;
- Preservative used;
- Analyses required;
- Name of collector(s);
- Serial numbers of custody seals and transportation cases (if used);
- Custody transfer signatures and dates and times of sample transfer from the field to transporters and to the laboratory or laboratories; and
- Bill of lading or transporter tracking number (if applicable).

Table 15
Project Personnel Sign-Off Sheet

Organization: ERM

Project Personnel	*Title*	*Telephone Number*	*Signature*	*Date QAPP Read*
Jim Perazzo	Partner in Charge (PIC)	631-756-8913		
Jon Fox Elena Ponce	Project Manager	315-233-3035 631-756-8905		
Andrew Coenen	QA/QC Officer	631-756-8959		
Chris Wenczel	Principal Hydrogeologist	516-315-8221		
Jon Fox	Principal Geologist	315-233-3035		
Maureen C. Leahy	Principal Chemist	860-466-8500		
Al Wiedow	Principal Toxicologist	860-466-8504		
Jason Reynolds Tim Daniluk Heather Usle	ERM Field Team Leader(s)	716-725-5369 315-445-2554 802-272-3876		
Matthew Botzler	ERM Health and Safety Officer	484-913-0339		

Organization: Eurofins Lancaster Laboratories Environmental LLC

Project Personnel	*Title*	*Telephone Number*	*Signature*	*Date QAPP Read*
Kay Hower	Laboratory Project Manager	717-556-7364		

Organization: Australian Laboratories Services (ALS)

Project Personnel	*Title*	*Telephone Number*	*Signature*	*Date QAPP Read*
Janice Jaeger	Laboratory Project Manager	585-672-7472		

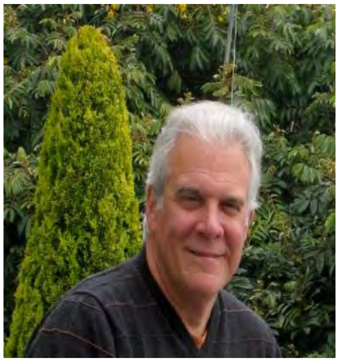
Organization: Test America, Inc.

Project Personnel	*Title*	*Telephone Number*	*Signature*	*Date QAPP Read*
Melissa Deyo	Laboratory Project Manager	716-504-9874		

Appendix D
RI Personnel and Qualifications

Jim Perazzo

Partner Principal
North America



Mr. Perazzo advises clients in making strategic business decisions regarding legacy environmental liabilities as part of portfolio management including evaluation of practical realistic cash flows and exit strategies. He has provided expert support in cost recovery claims under CERCLA, navigation law and other environmental statues in arbitrations, mediations and litigation. By combining technical and financial analysis, he enables clients to assess short long-term costs of environmental liabilities and obligations for financial reporting. Mr. Perazzo also works with clients, regulators and other stakeholders to assess sediment impacts in urban waterways to facilitating risk management decisions that address resource impacts.

Experience: Over 25 years of experience dealing with legacy environmental problems under CERCLA, RCRA, TSCA and related brownfield environmental programs.

Email: Jim.Perazzo@erm.com

LinkedIn: https://www.linkedin.com/in/jim-perazzo-79a4159/

Education

- M.B.A. , Long Island University (C.W. Post), New York, 2006
- M.S. Earth Science, Adelphi University, New York, 1981
- B.S. Geology, The State University of New York at Stony Brook, 1978

Professional Affiliations and Registrations

- Professional Geologist in Pennsylvania

Languages

- English, native speaker

Fields of Competence

- CERCLA RI/FS and removal actions
- RCRA (RFA, RFI CMS and CMI)
- TSCA (PCBs & lead)
- UST assessment and hydrocarbon remediation
- UST assessment and hydrocarbon remediation
- Soil and ground water investigations
- Hydrogeological assessments
- Regulatory negotiation and strategic guidance
- Financial analysis (legacy environmental and compliance costs)
- Expert witness (CERCLA cost recovery, Navigation Law claims)

Key Industry Sectors

- Mining
- Chemical
- Manufacturing
- Oil & Gas

Publications

- “The Intersection of Governance, Performance, Assurance and Reporting in Asset Retirement Obligations Related to Mine Reclamation & Closure” Perazzo, James, A. & Eddy, Stuart , SME Conference, Seattle, WA February 22, 2012
- “Financial Reporting of Environmental Matters & the Influence on a Company’s Sustainable Business Strategy” AWMA/NYEWA Seminar, Rochester Institute of Technology Conference Center, February 12, 2009.If this list is extensive, relocate this entire sub-section to the end (after Key Projects)
- “Real Estate Transactions & Brownfield’s” NYSBA CLE Program, May 24, 2004
- "CERCLA - The Technical Perspective," Environmental Regulations Course, Executive Enterprises, Inc., June ‘95, October ‘95, and February ‘96.

- “Remedial Investigation and Feasibility Study Process," New York Hazardous Regulation Course, Executive Enterprises, Inc., November 16 17, 1990.
- “Groundwater Remediation; Performance Goals," Haztech International, Cleveland, Ohio, September 20 22, 1988.
- "Remedial Design Needs to Consider in Planning Hazardous Waste Site Investigations," with J. Iannone and J. Mack; Haztech International, St. Louis, Missouri, August 26 27, 1987.
- "Long Term Confidence in Ground Water Monitoring Systems," Groundwater Monitoring Review, Vol. 4, No. 4, all 1984.

Key Projects

Principal-in-Charge involving a major urban waterbody project in the Superfund program in USEPA Region 2.
Coordinates a diverse staff of environmental professionals in support of a contributing PRP. Also, liaison with common consultant, USEPA and NYC to advance PRP group objectives and initiatives with the intent of assuring a comprehensive, technically supported and protective and practical RI/FS and eventual RA.

Project Director to develop environmental liability estimates for the purpose of financial re-statement to facilitate registrant’s filing of an S-1 with the SEC.
The portfolio involved review and assessment of over 2500 properties (historic and current) with projected environmental liabilities and asset retirement obligations in excess of $700MM. Financial estimates were developed in accordance with US GAAP.

Project Director for federal superfund site involving PCE impacts to regional aquifer and allegations of public supply well impacts.
Developed technical strategy and coordinated implementation of a RI/FS leading to a ROD that narrowly defined impacts from client site versus regional impacts from other sources of similar contamination. Direct RD/RA effort to implement the selected remedy and, together with post-ROD information and support from local municipality, resulted in EPA issuing a modified ROD.

Part of a multi-disciplined team providing technical consultation to a city planning board to ensure development of a comprehensive draft and final environmental impact assessment.
Ensured that residual environmental impacts at properties within a project area in both federal and state Superfund programs were addressed and/or incorporated into a 50+ acre regional waterfront redevelopment in the northeast with significant public amenities. The effort led to a successful adoption of a FEIS and issuance of Findings that ensured the integrity of future site plans.

Project Principal for responsible for a former industrial facility requiring completion of an RI/FS at a NYS Superfund site.
Secured a ROD that was used to facilitate transfer of the property into the NYS Brownfield Cleanup Program and, combined with a finite risk insurance policy enabled the responsible party to cap environmental liabilities.

Project Director for Chapter 11 bankruptcy settlement and re-organization involving major mining company.
Lead team to develop environmental liability and asset retirement estimates for a portfolio of formerly owed, non-operating sites. Provided proffer and testimony in support of debtor’s settlement of outstanding liabilities that was affirmed by the court.

Project Director for large Superfund site affected from former lead and copper recovery operations.
Project responsibilities included work plan preparation, RI implementation, coordination of human health risk and ecological assessments, a feasibility study, and remedial design and construction of the remediation action.

Provided Director for conversion of former industrial facility to multi-tenant commercial space.

Successfully completed cleanup obligations at NYC manufacturing site under the Voluntary Cleanup Program involving disassembly of manufacturing lines, and soil/ground water remediation (combined ex-situ and in-situ) beneath a facility adjacent the East River to enable re-development to commercial use.

Developed a tank management program for 36 locations in New York and Connecticut.

Planned site assessments and remedial programs. Formulated monitoring programs for early warning of potential environmental problems. Negotiated financial estimates and justification for outstanding environmental liability allowing owner to divest with protection against future liabilities.

Served as a technical expert for one airline in litigation with multiple airlines over a claim of $100 MM in environmental cleanup costs at JFK airport.

Engaged in mediation on behalf of client setting out technical positions that were used as the basis for cost allocation potions in mediation.

Project Director for three removal actions under CERCLA 106at two separate Superfund sites in receivership.

Performed removal of anhydrous ammonia vessel, ASTs, laboratory chemicals, drums, PCB oils, transformers, and closure of USTs. Also directed a radiological survey with a health physicist to locate and remove materials exhibiting anomalous levels of radiation. These efforts were done on behalf of a Savings and Loan in receivership.

Project Director for development and implementation of remedial system to extract chlorinated VOCs from soil and ground water from a source area at a Superfund site.

Coordinated program involving dewatering and vacuum extraction. Established basis for performance analysis and effectiveness evaluation to determine proper time for system termination.

RI/FS and ROD critiques, in support of petition to amend.

After EPA rejection of the petition a corresponding US claim for cost recovery enabled a client to file a cross-claim that resulted in client recovering one-third of the of the ROD remedy costs via a mixed funding application secured by ERM.

Developed technical approach to ongoing cases for the New York State Environmental Protection Bureau of the Attorney General's office.

Prepared scientific reports and represented the Attorney General in adversarial discussions, public meetings, and court hearings. As part of a multi-disciplined technical team, developed a comprehensive remedial program at a dioxin-contaminated landfill in Western New York.
The program involved collection and treatment of dissolved and non-aqueous phase liquids (NAPLs) in overburden and bedrock.

Technical representative for the AG Office in developing a comprehensive soil and aquifer remediation project in Nassau County, New York.

The project involved a soil and ground water remediation program including installation of a slurry wall via the vibrating beam technique, soil flushing system and staged ground water recovery from a shallow and deep aquifer. Maintained a key role in establishing performance criteria for cleanup and effectiveness monitoring.

Maureen C. Leahy, Ph.D.

Technical Fellow

Dr. Leahy has more than 30 years of experience in chemistry, biochemistry and environmental remediation technologies and has served clients in over 30 States in the USA, Canada, Latin America, Europe, Middle East and Asia Pacific, and Africa.   Dr. Leahy provides technical support in the application of biological, chemical, and physical treatments for contaminated soil and groundwater. Dr. Leahy's primary areas of expertise are biological and chemical treatment processes. Dr. Leahy also provides expertise in metal chemistry (emerging and/or persistent contaminants hand per- and poly-fluorinated alkyl substances (PFAS, PFOA, PFOS, etc.) and has served as QA officer responsible for data quality.

Experience: Over 30 years' experience site investigation, remediation technologies, and environmental chemistry.
LinkedIn: https://www.linkedin.com/in/mcleahy/
Email: Maureen.Leahy@erm.com

Professional Affiliations & Registrations

- American Chemical Society

Fields of Competence

- Per- and poly-fluorinated alkyl substances (PFAS)
- Anaerobic and aerobic biological remediation
- Cometabolic biological processes
- Natural attenuation evaluations
- Environmental chemistry
- Feasibility studies and technology selection

Education

- Ph.D. Molecular Biophysics and Biochemistry, Yale University, USA
- M. Phil. Molecular Biophysics and Biochemistry, Yale University, USA
- B.S. Chemistry, Fordham University, USA

Languages

- English, native speaker

Key Industry Sectors

- Chemical
- Pharmaceutical
- Manufacturing
- Oil & Gas

Publications

- Thomas, A.O., M.C. Leahy, J.N.N.Smith, and M.J. Spence. 2017. Natural Attenuation of Fatty Acid Methyl Esters (FAME) in Soil and Groundwater. Quarterly Journal of Engineering Geology. 15 June.
- Leahy, M.C. 2017. Per- & Polyfluorinated Alkyl Substances (PFAS) – Chemistry, Use, regulatory, Fate & Transport, Sites. Presentation at Long Island Association of Professional Geologists. Melville, NY. May.
- Leahy, M.C. 2017. Emerging Contaminants – Per- and Polyfluorinated Alkyl Substances (PFAS). Presentation at the Ohio Chemical & Technology Council Meeting. May 1.
- Smith, et al. 2016. The Natural Attenuation of Fatty Acid Methyl Esters (FAME) in Soil and Groundwater. CONCAWE Report No. 5/16. Brussels, March.
- Leahy, M.C. 2015. Emerging Contaminants – Perfluorinated Alkyl Compounds. Workshop on the regulatory status, strategies and potential remediation alternatives for PFOA, PFOS and other

PFAS. March (Alaska) and November (Connecticut).

- Pascale, B.G. D. Ross, S. Loebmann, M. Leahy, and C. Baroni. 2015 Case Study: Negotiations with the Environmental Agency for the Use of Monitored Natural Attenuation at a Pharmaceutical Manufacturing Facility in Brazil. Presented at the International Conference on Bioremediation and Sustainable Remediation Technologies. Miami, FL May.
- Harkness, M., M.C. Leahy, R. Lewis, M. Ryan, and S. Meier. 2014. TCE Source Treatment with Biological Barriers for Plume Control. Presented at the International Conference on Remediation of Chlorinated and Recalcitrant Compounds, Monterey, CA, May.
- Leahy, M.C., R. Lewis, M. Ryan, M. Harkness, and S. Meier. 2013. Sequential Treatment of a High-Strength TCE Source by Potassium Permanganate Followed by Anaerobic Bioremediation. Presented at Cleanup 2013, Melbourne, Australia, Sept.
- Leahy, M., A. Herch, and U. Desery. 2013. Treatment of Chlorinated Ethenes at a Landfill in Germany. Presented at Cleanup 2013, Melbourne, Australia, Sept..
- Morris, K., D. Ross, M. Leahy, and W. Butler. 2012. Biobarrier Combined with Source Area Bioremediation to Expedite Site Closure of a Large TCE Plume. Presented at the International Conference on Remediation of Chlorinated and Recalcitrant Compounds, Monterey, CA, May.
- Byrd, J. E. Hollifield, B. Hodge, M. Leahy and J. Haselow. 2012. Comparison of Bioremediation Pilot Test Data for Chlorinated Ethenes at Three Sites within the Southeast. Presented at the International Conference on Remediation of Chlorinated and Recalcitrant Compounds, Monterey, CA, May.
- Leahy, M.C., R. Lewis, M. Ryan, M. Harkness, and S. Meier. 2012. Biological Treatment of a High-Strength TCE Source Area after Application of Sodium Permanganate. Presented at the International Conference on Remediation of Chlorinated and Recalcitrant Compounds, Monterey, CA, May.
- Leahy, M.C., E. Rossano, and N. Repetti. 2011. Bioremediation via Enhanced Reductive Dechlorination in a Fractured Bedrock Environment. Presentation at the Seventh International Symposium on Bioremediation and Sustainable Environmental Technologies, Reno, NV. June.
- Morris, K.A., D. Ross, M. Leahy, and W. A. Butler. 2011. Applying Source and Barrier Bioremediation for TCE in Groundwater to Expedite Site Closure. Presentation at the Seventh International Symposium on Bioremediation and Sustainable Environmental Technologies, Reno, NV. June.
- Herch, A., M. Leahy, and U. Desery. 2010. Erfahrungen bei der Stimulation der reduktiven Dechlorierung von TCE im Bereich des Schadensherdes [Experience with Enhanced Reductive Dechlorination of a TCE Source]; Proceedings Dechema Conference, November 2010.
- Herch, A., M. Leahy, and U. Desery. 2010. Decision Pathway for in situ Remediation of a Dichlorobenzene Source Area; Proceedings Dechema Conference, November 2010.
- Warner, J., B. Bjorklund, D. Brown, and M. Leahy. 2010. Natural and Enhanced Degradation of Perchlorate and TCE in Groundwater. Presentation at the Seventh International Conference on Remediation of Chlorinated and Recalcitrant Compounds, Monterey, CA, May.
- Morris, K. A., M. Leahy, D. Ross, and W. A. Butler. 2010. Full-Scale Biostimulation Source and Barrier Remediation for TCE in Groundwater. Presentation at the Seventh International Conference on Remediation of Chlorinated and Recalcitrant Compounds, Monterey, CA, May.
- Eccarius, B. U. Desery, M. C. Leahy and G. Demers. 2010. CVOC Source Differentiation with CSIA in Groundwater and Soil Vapor. Presentation at the Seventh International Conference on Remediation of Chlorinated and Recalcitrant Compounds, Monterey, CA, May.
- Leahy, M.C., V. Chen, S. Chang, and J. Leu. 2009. Full-Scale Biological Barrier in Taiwan Using Emulsified Oil. Tenth International Symposium on In

Situ & On-Site Bioremediation, Baltimore, MD, May 5-8.

- Leahy, M. C. and J. Perazzo. 2008. Using Monte Carlo Analyses to Evaluate Financial Reserves for Environmental Obligations. Sixth International Conference on Remediation of Chlorinated and Recalcitrant Compounds. May 19-22. Monterey, CA.
- Herch, A., U. Desery, and M. C. Leahy. 2008. TCE Source Reduction Using Strategic Application of SVE, ERD and Groundwater Recovery. Sixth International Conference on Remediation of Chlorinated and Recalcitrant Compounds. May 19-22. Monterey, CA.
- Chen, V., S. Chang, J. Leu, and M.C. Leahy. 2008. Experience in Taiwan Using Emulsified Oil for Bioremediation. Sixth International Conference on Remediation of Chlorinated and Recalcitrant Compounds. May 19-22. Monterey, CA.
- Butler, W. A., D. Ross, S. Walsh, M. C. Leahy, and B. Jeffers. 2008. Enhanced Bioremediation Pilot Test Results at a Site in Northwestern Georgia. Sixth International Conference on Remediation of Chlorinated and Recalcitrant Compounds. May 19-22. Monterey, CA.
- Kappen, B. J., B. Meinen, J. Roberts, M. Seaman, and M. C. Leahy. 2008. The Effects of Organic Soils on Attenuation and Treatment of a Trichloroethene Plume in Glacial Sediments. Sixth International Conference on Remediation of Chlorinated and Recalcitrant Compounds. May 19-22. Monterey, CA.
- Skladany, G.J., and M.C. Leahy. 2007. Global Acceptance of Biostimulation and Bioaugmentation. Ninth International Symposium on In Situ & On-Site Bioremediation, Baltimore, MD, May 7-10.
- Thompson, S., J. Riggenbach, A. Slayton, and M.C. Leahy. 2007. Remediation of PCE at an Active Bulk Storage Terminal. Ninth International Symposium on In Situ & On-Site Bioremediation, Baltimore, MD, May 7-10.
- Leahy, M.C., G.J. Skladany, P. Chang, and M. Lee. 2007. The Impact of pH on Natural and Enhanced Reductive Dechlorination. Ninth International Symposium on In Situ & On-Site Bioremediation. Baltimore, MD, May 7-10.
- Leahy, M.C. 2006. The 18th Annual Conference on Environmental Engineering. The Chinese Institute of Environmental Engineering. Taunghaie University, Taiwan, Nov. 17-18.
- Leahy, M.C. 2006. Time Trend Analysis of MtBE Detections in Public Water Systems in Connecticut. The 22nd Annual International Conference on Soils, Sediments and Water. University of Massachusetts, Amherst, October 16-19.
- Hines, J M., D. Nuyens, B. Vanhove, and M.C. Leahy. 2006. Biotic and Abiotic Attenuation Due to Temperature, Peat and Iron. Fifth International Conference on Remediation of Chlorinated and Recalcitrant Compounds. May 22-25. Monterey, CA.
- Taege, D., J. Dablow, R. Lewis, R. Luhrs, and M.C. Leahy. 2006. Geochemical and Biological Monitoring During Remediation with Permanganate. Fifth International Conference on Remediation of Chlorinated and Recalcitrant Compounds. May 22-25. Monterey, CA.
- Herch, A., Desery, U., M. Schröder, and M.C. Leahy. 2006. Sequential Anaerobic-Aerobic Treatment of Chlorinated Ethenes at a Landfill in Germany. Fifth International Conference on Remediation of Chlorinated and Recalcitrant Compounds. May 22-25. Monterey, CA.
- Hines, R., J. Cho, M.C. Leahy, and R.A. Brown. 2006. Abiotic and Biotic Pathways in Chlorinated Solvent Natural Attenuation. Fifth International Conference on Remediation of Chlorinated and Recalcitrant Compounds. May 22-25. Monterey, CA.
- Leahy, M. C., and B. Holdt. 2006. Impact of MtBE Ban on Connecticut Public Water Systems. Fifth International Conference on Remediation of Chlorinated and Recalcitrant Compounds. May 22-25. Monterey, CA.
- Brown, R., M.C. Leahy, R. Lewis, and J. Fiacco. 2006. The Technical Basis for In Situ Chemical Reduction. Fifth International Conference on Remediation of Chlorinated and Recalcitrant Compounds. May 22-25. Monterey, CA.
- Dablow, J., D. Taege, R. Lewis, M.C. Leahy, and R C. Luhrs. 2006. Innovative Permanganate Injection/ Infiltration Strategy for TCE Remediation. Fifth

International Conference on Remediation of Chlorinated and Recalcitrant Compounds. May 22-25. Monterey, CA.

- Leahy, M.C., M. Seaman, and C. Weber. 2006. Retrospective of Remediation of Tars under the US Superfund Program. Fifth International Conference on Remediation of Chlorinated and Recalcitrant Compounds. May 22-25. Monterey, CA.
- Leahy, M.C., R. Hines, and R. Brown. 2005. The Role of Degradation Processes in Natural Attenuation of Chlorinated Solvents. SETAC, Baltimore, MD.
- Ram, N.M., M. Leahy, E. Carey, and J. Cawley. 1999. Environmental Sleuth at Work: A Combination of Technical Approaches and Forensic Tools Can Determine Historic Cause, Timing and Impacts of Site Contamination. Environ. Sci. Technol. 4(11):464-469A.
- Brown, R., M.C. Leahy and B. Molnaa. 1999. Bioremediation: A Powerful and Resilient Co-Treatment Technology. Pollution Engineering 31(10):26-29.
- Brown, R. A., M.C. Leahy, and R.Z. Pyrih. 1998. In Situ Remediation of Metals Comes of Age. Remediation: The Journal of Environmental Cleanup Costs, Technologies & Techniques, Summer, pp. 81-96.
- Leahy, M.C. and G.J. Skladany. 1998. Assessment of Intrinsic Biodegradation of Multiple Chlorinated Hydrocarbons. Battelle Symposium on Chlorinated Organics, Monterey, CA, May.
- Leahy, M.C. 1997. Intrinsic Bioremediation as a Tool for Contaminant Control. NERM '97. 27th Northeast Regional Meeting of the American Chemical Society, Jun 22-25, Saratoga Springs, NY.
- Brown, R.A., C. Nelson and M. Leahy. 1997. Combining Oxidation and Bioremediation for the Treatment of Recalcitrant Organics. In: In Situ and On-Site Bioremediation, Volume 4. (B. C. Alleman and A. Leeson), Battelle Press, Columbus, OH, pp. 457-462.
- Leahy, M.C., C.H. Nelson, A.M. Fiorentine and R. J. Schmitz. 1997. Ozonation as a Polish Technology for In Situ Bioremediation. In: In Situ and On-Site Bioremediation, Volume 3, (B. C. Alleman and A. Leeson, eds.), Battelle Press, Columbus, OH, pp. 479-483.
- Leahy, M.C., B.W. Ahrens, T.L. Blazicek and G.B. Maybach. 1997. Bioreactor Treatment Comparison for Groundwater at a Former MGP Facility. In: In Situ and On-Site Bioremediation, Volume 3, (B. C. Alleman and A. Leeson, eds.), Battelle Press, Columbus, OH, pp. 463-467.
- Leahy, M.C., A.M. Fiorentine and R.J. Schmitz. 1997. Biosparging for In Situ Treatment of Manufactured Gas Plant Residuals. In: In Situ and On-Site Bioremediation, Volume 3, (B. C. Alleman and A. Leeson), Battelle Press, Columbus, OH, pp. 445-450.
- Rouse, J. V., M.C. Leahy and R.A. Brown. 1996. A Geochemical Way to Keep Metals at Bay. Environmental Engineering World. May/June.
- Leahy, M.C. and G. Erickson. 1995. Bioventing Reduces Soil Cleanup Costs. Hydrocarbon Processing 74(8):63-66.
- Leahy, M.C., R.A. Brown and D. Cacciatore. 1995. Complications in the Analysis of Performance During the Biodegradation of Complex Compounds in Soil. Presented at Air & Waste Management Assoc. June 20-23. San Antonio, TX.
- Brown, R.A., P.M. Hicks, R.J. Hicks and M.C. Leahy. 1995. Post Remediation Bioremediation. In: Intrinsic Bioremediation. (Hinchee, R.E., J.T. Wilson and D.C. Downey, eds.). Battelle Press, Columbus, Ohio, pp. 77-84.
- Leahy, M.C., W.C. Leonard and R.A. Brown, April 24-27, 1995. Air Sparging for In Situ Bioremediation of Toluene. In: In Situ Aeration: Air Sparging, Bioventing and Related Remediation Processes, (R.E. Hinchee, R.N. Miller and P.C. Johnson, eds.) Battelle Press, Columbus, Ohio, pp. 185-190.
- Leahy, M.C., and R.A. Brown. 1994. Bioremediation: Optimizing Results. Chem. Eng. 101(4):108-116.
- Ram, N.M., D. Bass, R. Falotico, and M. Leahy. 1993. Decision Framework for Remediation at Hydrocarbon Contaminated Sites. J. Soil Contamination 2(2):167-189.
- Fogel, S., M.C. Leahy, M. Jones, and R. Butts. 1990. Bioremediation of a No. 6 Fuel Oil Spill:

Comparison of Laboratory Treatability Data with Field Remediation Data. 5th Petroleum Contaminated Soil Conference, Sept. 24-27. Amherst, MA.

Key Projects

PFOA at Former Polymer Coating Facilities, USA. Technical lead for investigation of PFOA impacts to municipal and private drinking water wells potentially released from historical manufacturing operations and other sources.

Technical Lead, Biotic/Abiotic Attenuation After Thermal Treatment, Japan. CSIA and biological markers to assess attenuation processes after thermal treatment.

Technical Lead, Biological Treatability Study for Complex Solvent Mixture, CA. Designed laboratory tests of enhancement of anaerobic bioremediation using carbon amendment and bioaugmentation to degrade mixture of EDB, 1,2-DCA and other solvents.

PFOA at Polymer Manufacturing Facility, Germany. Technical lead for a detailed site investigation for perfluorooctanoic acid impacts to soil and groundwater related to permitted historical air emissions and discharge of wastewater to surface water.

Former Automotive Parts Manufacturer, Toronto, Canada. Technical oversight for remediation, indoor air monitoring, risk assessment and development of property-specific standards for soil and groundwater impacted with TCA and other chlorinated solvents.

Potential Treatments for PFOA. Technical lead for developing a workplan to test the treatment of PFOA by combined biological and chemical oxidation technologies.

Technical Lead for Work Plan for CSIA in Support of MNA. CSIA data were collected to provide evidence in support of selection of a remedy at a site with chlorinated and aromatic solvent impacts. The changes observed in isotopic ratios of carbon and hydrogen for benzene and chlorobenzene confirmed that degradation was occurring.

Technical Support, ISCR Treatment and MNA of Hexavalent Chromium. Hexavalent chromium related to chrome-plating operations impacted soil and groundwater; initial response was enhanced fluid recovery for containment, followed by chemical reduction with calcium polysulfide/carbon substrate injection; lab testing for attenuation capacity in support of MNA.

Manufacturing Facility, Toronto, Canada. Technical oversight for remediation of TCE and daughter products by enhanced reductive dechlorination; concentrations decreased to below MOE standards in majority of wells.

Technical Review of 3 Remediation Sites, Canada. Participated in a “red team” review of the technical, strategical, and financial aspects of three remediation projects using chemical oxidation to treat chlorinated solvents in groundwater.

Technical Lead for CVOC Source Differentiation with CSIA in Groundwater and Soil Vapor, Germany. Compound specific isotope analyses were used to provide evidence of the contribution of an off-site source to a groundwater plume, which was being remediated by groundwater extraction with soil vapor extraction for unsaturated zone soils.

Specialty Chemical Production Facility, Germany. Technical oversight and support for baseline site investigation and selection of chemicals of concern for toxicological risk assessment.

Chlorinated Solvents and Heavy Oil at Manufacturing Facility, Toronto, Canada. Conducted an evaluation of natural attenuation and contaminant trends; providing technical oversight for continued remediation and monitoring.

Technical Oversight, TCE and Perchlorate, California. Natural attenuation evaluation of perchlorate and TCE in groundwater through biotic and abiotic mechanisms.

DNAPL Source Area at Former Manufacturing Site, New Jersey. Conducted feasibility study for remediation of TCE DNAPL source area. Due to ongoing redevelopment, rapid implementation and remediation was required and chemical oxidation with permanganate using in situ mixing was selected. Designed a treatability study to determine oxidant demand and soil stabilization amendments. Over 5000 cubic yards were treated with >40,000 lbs permanganate, with reductions in groundwater concentrations to below the closure goals

Manufacturing Facility, Austria.
Feasibility study for chlorinated hydrocarbons including TCE in crystalline rock aquifer.

Landfill Associated with Pharmaceutical Wastes, Switzerland. Technical support for detailed investigation of landfill and subsurface soil beneath landfill. Feasibility study for remediation of impacted soil and groundwater beneath landfill; chemicals of concern included persistent herbicides, pesticides, pharmaceuticals, CVOCs, chemical intermediates, etc.

Peer Review for EDB Site, Germany. Review of site investigation data for EDB manufacturing site and recommendations for further investigation.

Technical Oversight, CT. Release of hexavalent chromium from a plating tank. Field implementation of biological reduction and stabilization of hexavalent chromium in soil and groundwater using carbon substrate injection.

In Situ Persulfate Oxidation of Chlorobenzenes, Germany. Designed and provided technical oversight for implementation of a full-scale treatment of mono- and di-chlorobenzenes using alkali-activated persulfate to reduce source mass; monitoring has demonstrated a significant decreases in flux and the site received notification of no further action required.

CVOC Source Differentiation using CSIA. Compound specific isotopic analysis was used on groundwater and soil vapor samples to differentiate several sources of PCE and TCE and show the contributions from several upgradient sources to an on-site plume.

Bioremediation in Fractured Rock, Manufacturing Facility, NJ. Designed pilot test of enhanced reductive dechlorination using lactate as a carbon source to treat a mixed chlorinated solvent plume in fractured bedrock; used tracer testing with fluorescent dyes to map transport; potassium and sodium salts of lactate now being used as tracers during pilot testing.

Air National Guard, 174th FW, Syracuse, New York Developed a focused feasibility study and injection pilot study for the petroleum impacts at Site 15. After the IRAC for source area soil removal of approximately 2,890-tons of soil, treatment of the residual contamination, including the 7 sampling locations above cleanup levels, involved the application of approxi-mately 4,000 pounds of PermeOx® Plus was applied within the floor of the excavation areas.

Feasibility Study and Fate & Transport Evaluation for CFCs and HCFCs, Germany. Manufacturing facility in Germany with groundwater impacted with chlorofluorohydrocarbons; desk top evaluation of fate and transport properties; evaluation of potentially applicable remediation technologies.

Technical Lead, Manufacturing Facility, Taiwan. Implementation of a biological barrier using emulsified oil to stimulate enhanced reductive dechlorination of a mixed chlorinated solvent plume, with natural attenuation of downgradient plume.

Technical Oversight, Landfill, Germany. Providing technical design and oversight for implementation of anaerobic bioremediation of a TCE release from a monofill landfill using molasses to stimulate the reductive dechlorination of TCE and cisDCE.

Chemist, Industrial Complex, France. Providing technical guidance to support the investigation of a site impacted with PAH, metals, cyanides, and specialty chemicals that relate to many distinct chemical processes that have occurred on site.

Monte Carlo to Evaluate Financial Reserves, USA. Developed Monte Carlo simulations using Crystal Ball® software to develop a range of estimates for environmental liabilities for a portfolio of sites.

Technical Oversight, Manufacturing Facility, IN. Technology selection and implementation of full-scale anaerobic bioremediation using emulsified oil as a carbon substrate to treat chlorinated ethanes and ethenes.

MNA Evaluation, Industrial Facility, Belgium. Evaluated several distinct plumes of chlorinated solvents with 1,1,1-TCA, PCE, and TCE that appear to be undergoing both biotic and abiotic degradation; the primary factors contributing to rapid degradation appear to be the presence of peat, warm groundwater temperatures and very high dissolved iron concentrations.

Senior Technical Advisor, Manufacturing Facility, MA. Oversight of anaerobic bioremediation for treatment of TCA, TCE and other chlorinated solvents using lactate as a carbon source.

Chemist, Perchlorate Method Evaluation, OR. Evaluated analytical methods available for the analysis of perchlorate in groundwater containing high concentrations of potentially interfering substances. Developed a laboratory testing program to evaluate two analytical methods relative to this potential matrix interference. The result of the study provided assurance that the common less expensive method would be sufficient for most site samples.

Technical Oversight, Manufacturing Facility, MA. Designed a treatability to evaluate anaerobic bioremediation using lactate, emulsified oil, or whey, in situ chemical oxidation using persulfate catalyzed by heat or ferrous iron, and in situ chemical reduction using dithionite and persulfate, in support of technology selection for a mixed chlorinated solvent plume.

Chemist, Former Aerospace Facility, OR. Providing technical oversight for an anaerobic bioremediation treatability study for the treatment of perchlorate in groundwater.

Technical Oversight, Petroleum Bulk Terminal, NY. On-going project to oversee a natural attenuation monitoring program under RCRA for petroleum products at a bulk terminal.

Coauthor, API Protocol Document for Natural Attenuation of MtBE. Project with the American Petroleum Institute (API) to develop a protocol for incorporating natural attenuation into strategies for sites impacted with MtBE..

Feasibility Study for Drum Disposal Site Impacted with Wastes from Dye Manufacture, MA. Assessed remedial options including soil vapor extraction, groundwater recovery, chemical oxidation, natural attenuation and other technologies for treating soil, groundwater, sediments and surface water. Contaminants included lead, beryllium, 1,2,4-trichlorobenzene, chlorobenzene, toluene, trichloroethene, PAH, pesticides and other organics.

Task Manager, Design of Fluidized Bed Reactor Treatability Study to Treat Consolidation Water from Sludges, CT. Design and technical oversight of treatability study to simulate existing groundwater treatment plant (fluidized bed bioreactor, solids removal, UV/oxidation) and evaluate capacity of system to treat additional waste streams impacted with solvents, metals and semivolatile constituents including 1,4-dioxane, benzidines, chlorobenzenes, and anilines.

Technical Oversight, Remediation Technology Selection and Natural Attenuation Monitoring Program for Site Impacted with Chlorobenzene, NY. Technical oversight for remediation of soil and groundwater impacted with chlorobenzene using aerobic biodegradation to enhance natural attenuation processes under a NYSDEC Voluntary Agreement.

Lead Author, Impact of Military Maneuvers and Smoke/Soot Plumes on Terrestrial Desert Environments. Conducted literature review for the Kingdom of Saudi Arabia on the ecological damage to terrestrial deserts caused by smoke and military activities such as tank maneuvers and the strategies to repair these damages.

Technical Support, Assessment and Preliminary Evaluation of Chemical, Physical and Thermal Technologies for Oil-Impacted Shoreline, Saudi Arabia. Conducted literature study to evaluate soil vapor extraction, chemical oxidation, thermal desorption, soil washing, and other chemical and physical treatment technologies applicable to oil-impacted sands and sediments (PAH and TPH) under desert conditions; developed treatability protocols for chemical oxidation and thermal treatment.

Technical Support, Feasibility Options for Treating Soils at a Disposal Site in MA. Assessed remedial options including natural attenuation, soil vapor extraction, air sparging, chemical oxidation and other technologies for treating soils impacted with TCE, toluene, naphthalene, PAH, trichlorobenzene and other organics.

Project Manager, Former Chemical Plants Impacted with Mixed Solvents, Argentina. Wrote work plan for SVE and chemical oxidation pilot testing in support of technology selection. Developed remediation alternatives (incorporating the results of pilot testing) for soil and groundwater impacted with multiple solvents including toluene, xylenes, vinyl chloride, 1,2-DCA, trichloroethene, chloroform, and methylene chloride to meet Argentine standards or site-specific risk-based closure goals.

Technical Lead, Chlorinated Solvent, Hydrocarbons, Explosives and Metal Impacts at Army Ammunition Plant, Missouri. Data gap evaluation, development of technology alternatives, data collection and pilot test work plans for a 4000-acre Army ammunition plant impacted with TCE, DCE, methylene chloride, and other chlorinated solvents, explosives, chromium and arsenic.

Task Manager, Feasibility Study for Chemical Plant Impacted Chlorinated and Non-Chlorinated Solvents, Brazil. Developed remediation alternatives for soil and groundwater impacted with multiple solvents including toluene, TCE, 1,2-DCA and cis-1,2-DCE. Incorporated SVE pilot test data into the alternative development. Dual phase extraction utilizing groundwater recovery to lower the water table with mass removal by soil vapor extraction was the preferred remedy.

QA/QC Officer for Voluntary RCRA Corrective Action at a Defense Contractor Site, CT. Overall responsibility for QA/QC activities associated with the data collection during site remediation for VOCs, PAH, SVOCs, pesticides, metals and PCBs to ensure that all procedures and methodologies were conducted according to the QAPP, including laboratory audits, review of data validation, and coordination with project team.

Technical Oversight, Remediation of Gasoline/Diesel Pipeline Release, NC. Directed treatability studies and provided technical oversight for remediation of an 8-acre petroleum plume. Remediation system consisted of 17 recovery wells, over 90 sparge/vent wells, and a mobile product recovery system. Over a half million gallons of petroleum have been removed within 8 years of system operation.

Technical Oversight, Remediation of Petroleum Releases at Pipeline Pump Station, NC. Provided technical oversight for site investigation and natural attenuation monitoring for petroleum releases from a UST and a sump associated with a pipeline pump station.

Technical Lead, Petroleum Release Associated with Pipeline, Alabama. Provided technical oversight for remediation technology selection, design and monitoring for site impacted with gasoline from an historic pipeline release in Alabama. Applied technologies included soil vapor extraction and natural attenuation, with technology assessments for further source reduction.

Technical Support, Feasibility Study for Industrial Site Impacted with PCBs, NY. Provided technical oversight for technology selection, treatability studies, congener analysis, and additional investigation for river-front site impacted with PCBs.

Technical Lead, Natural Attenuation and Technology Alternatives for Solvent Impacted Site, MA. Developed treatability study workplan to evaluate natural attenuation of chlorinated solvents (including TCE and methylene chloride) and possible technologies to enhance the rate of attenuation. Evaluated site geochemical data and estimated natural attenuation rates and times to closure.

Technical Support, Former Junkyard, MA. Provided technical oversight for remediation of oils contain PCBs by thermally enhanced in situ remediation.

Technical Support, Phthalate Manufacturing Facility, MA. Provided technical oversight for treatability studies, technology selection and implementation at a site impacted with a mixture of phthalates, PAH, PCBs, and alcohols. Technologies include soil vapor extraction for bioremediation, chemical oxidation, capping and excavation.

Technical Lead, Intrinsic Biodegradation of Hydrocarbons (Multiple Sites). Initiation and oversight of natural attenuation monitoring programs at numerous sites impacted with gasoline and/or fuel oil hydrocarbon.

Technical Oversight, RCRA Monitoring Program and ICM at Petroleum Terminal, NY. Oversight of monitoring program for disposal area at RCRA site; feasibility analysis for interim corrective measures for site.

Technical Oversight, Design of Soil Treatment Facility, Terminal, NY. Provided technical oversight for the design and monitoring of an engineered biopile treatment facility for petroleum-impacted soils at a small terminal.

Technical Lead, Soil Vapor Extraction and Air Sparging of Gasoline and other Petroleum Products (Multiple Sites). Technology selection and oversight of soil vapor extraction and air sparging systems to remediated gasoline and other light petroleum products at numerous sites in 19 States across the US. Work included development of pilot test work plans, contributions to system design and oversight of system operation and closure.

Technical Lead, Use of MTBE to TBA Ratios at Petroleum Sites. Conducted literature review and reaction rate analysis to predict the ratios of MTBE to TBA that might be expected at sites where releases of MTBE- and TBA-containing gasolines had occurred.

QA Officer for Industrial Site Impacted with Chlorinated Organics, NY. Data quality review of soil and groundwater analyses conducted for RI; prepared data usability reports; review of field sampling quality and adherence to QAPP and RI/FS work plan.

Technical Lead, Feasibility for Remediation of Mixed Pesticides, United Kingdom. Investigated the feasibility of in situ bioremediation and chemical oxidation of a mixture of organochloride and organophosphate pesticides at a former pesticide manufacturing facility.

Technical Support, Fate of Cyanide from MGP Wastes in Environment, MI. Investigated the fate of iron cyanide complexes from purifier box wastes at a manufactured gas plant site impacted with coal tar constituents including PAH. Remedial action plan prepared.

Technical Support, Feasibility of Reducing Copper Migration, CT. Investigated in situ chemical fixation of copper as a means of reducing the migration of copper in the subsurface.

Technical Support, Reduction of O&M Costs Associated with Groundwater Recovery and

Treatment at Superfund Site, OH. Investigated cause and treatment for fouling (biological and chemical) in treatment train and natural attenuation as means for reducing costs to recover and treat groundwater by over 50%.

Technical Lead, Pilot-Scale Comparison of Two Bioreactors to Activated Carbon for the Treatment of Groundwater Impacted with MGP Wastes, NY. Compared the performances of a fixed film bioreactor and a fluidized bed bioreactor with conventional treatment with activated carbon for the treatment of groundwater impacted with coal tar constituents (BTEX and PAH) at a former manufactured gas plant (MGP) facility.

Uptake of Metals from Composted Sludges into Plants and Cattle, CA. Researched literature to estimate metal uptake by cattle fed plants grown on land treated with composted sludges, in support of a risk analysis.

Technical Lead, Bioventing Pilot Testing for Treatment of Phthalates at a Superfund Site in Indiana. Design of laboratory and field pilot testing to evaluate the feasibility of using soil vapor extraction to introduce oxygen to treat mixed phthalates in vadose zone soils by bioventing.

Technical Lead, Demonstration Project Using Biovent/Biosparge Followed by Ozone for Coal Tar Impacted Soil and Groundwater for a Utility, NY. Demonstrated the use of soil vapor extraction and air sparging, followed by ozone sparging, for the treatment of soil and groundwater impacted with coal tar constituents (including BTEX and PAH) by a combination of volatilization, aerobic biodegradation, and chemical oxidation. The demonstration project involved a laboratory feasibility study and an extended pilot test.

Technical Lead, Intrinsic Bioremediation of Halogenated Hydrocarbons, NY. Technical lead on a project to demonstrate the attenuation and mass reduction of chlorinated aliphatics (including PCE, TCA, TCE, 1,1-DCA, 1,1-DCE, EDB, carbon tetrachloride, and methylene chloride) by naturally occurring intrinsic biological mechanisms. The site involves multiple overlapping groundwater plumes.

Technical Support, Intrinsic Attenuation of Pentachlorophenol, MI and FL. Providing technical oversight of two projects to follow intrinsic attenuation of pentachlorophenol in groundwater.

Project Scientist, Soil Vapor Extraction to Support Bioventing of Diesel At a Rail Yard, CT. Designed laboratory treatability and field pilot testing for using SVE to introduce oxygen into the subsurface to treat diesel contamination in shallow soil. Provided conceptual design and oversight of full-scale remediation system.

Expert Witness for Applicability of Bioremediation, KY. Served as an expert witness and testified in court to support client’s choice of bioremediation as the remediation technology for mineral spirits.

Task Manager, Feasibility Study for Treatment of Wastes from Steel and Coke Manufacture, NY. Designed and managed a feasibility study for the selection of treatment technologies for the remediation of materials from steel and coke manufacturing operations containing a mixture of volatile hydrocarbons, tars with PAH, and metals. Technologies investigated included soil vapor extraction, steam stripping, bioremediation, solidification and thermal treatments for both in situ and ex situ application.

Litigation Support, Estimation of Timing of Petroleum Release, Iowa. Estimated timing and/or source(s) of petroleum releases at over twenty sites for a major petroleum company based on site data including occurrence of separate phase hydrocarbon, ratios of BTEX constituents, natural attenuation rates, chromatographic fingerprint data and presence of various gasoline additives (MTBE, TBA and alkyl leads).

Project Manager, Risk Evaluation and Remediation Technology Selection, Connecticut and Illinois.

Assessed the environmental contamination and associated risk to human health at two metal pipe manufacturing facilities impacted with TCE, copper sludges, PAH and TPH; calculated risk-based cleanup objectives; evaluated applicable remediation technologies and estimated costs.

Project Scientist, Feasibility Study for the Use of Nitrate to Support in situ Bioremediation, OH. Investigated nitrate as an electron acceptor to support in situ biodegradation of gasoline in an anaerobic aquifer. Nitrate was under consideration since an aerobic process would be difficult to implement due to the impermeability and degree of stratification in the aquifer.

Technical Support and Design, Biostabilization of #6 Fuel Contamination in the Vadose Zone, NH. Provided technical support and design services for the remediation of TPH, PAH, and other compounds in #6 fuel oil by biostabilization. The bioremediation system includes soil venting for aeration and bimonthly nutrient injection via vertical injection points and a lateral injection gallery. The goal of the project was to reduce the mobile constituents of the fuel in order to protect the groundwater.

Technical Support, Bioremediation under Nitrate-Reducing Conditions, OH. Provided technical support on a project to investigate the use of nitrate-reducing bacteria for the bioremediation of petroleum hydrocarbons. Nitrate was shown to stimulate biological degradation in soil and groundwater from the site.

Technical Support, Treatment of a Gasoline/Diesel Mixture using Vent/Sparge Aeration, NC. Technology selection and conceptual design of an in situ remediation system for gasoline/diesel contamination resulting from an aboveground pipeline spill. A system of 90+ combined soil vapor extraction/air sparging points has been installed throughout the 8-acre plume to extract hydrocarbon vapors and to provide oxygen to support biological degradation. Work included review of data for volatilization and biodegradation rates and changes in petroleum composition in support of closure.

QA Officer, Biological Treatability Testing, SUPERFUND Site. Responsible for QA/QC of organic and inorganic laboratory analyses conducted as part of a bioremediation feasibility study.

Project Manager, Bioreactor for Treatment of Chlorinated Solvents, MA. Developed a bioreactor for the treatment of water contaminated with chlorinated ethenes. During the initial National Science Foundation (NSF) sponsored phase, Dr. Leahy directed the development testing of a bench-scale reactor utilizing methanotrophic bacteria capable of oxidizing chlorinated solvents. In a second phase sponsored by the Gas Research Institute (GRI), the feasibility of full-scale implementation of this technology was evaluated.

Technical Support, in situ Bioreclamation of Gasoline Contamination, CA. Provided technical and laboratory support for the design and operation of an in situ bioreclamation system using soil vapor extraction for gasoline at the site of a former service station. Hydrocarbon and BTEX concentrations in soils and groundwater below detection within six months.

Project Supervision, Land Treatment of No. 6 Fuel Oil Contaminated Soils, FL. Provided oversight management of a land treatment project for a southern utility company for the biological remediation of soils heavily contaminated with No. 6 fuel oil with a comprehensive monitoring program for PAH, TPH and other compounds. Laboratory feasibility testing provided design parameters. Comparison of field and lab data showed excellent correlation.

Technical Support, Forced Aeration Soil Pile for the Remediation of Diesel-Contaminated soil, CA. Provided technical and laboratory support for the design and maintenance of a forced aeration soil pile for the remediation of soil contaminated with diesel fuel. Process monitoring data provided evidence of insufficient aeration in a portion of the pile and allowed remedial measures to be undertaken.

Bioremediation Team Lead, Feasibility of Biotreatment of Methylmethacrylate at a SUPERFUND site, NJ. Designed the bioremediation component of a feasibility study to evaluate an effective treatment train for the remediation of methylmethacrylate contamination in soils at a SUPERFUND site.

Treatability Study Leader, Feasibility of Using In Situ Bioremediation for Toluene and Acrylonitrile, CT. Designed and conducted a biological treatability study to assess the feasibility of treating soil and groundwater contaminated with toluene and acrylonitrile. Laboratory testing showed rapid biological degradation of toluene and acrylonitrile under aerobic conditions and supported design of in situ bioremediation for soil and groundwater.

Biodegradation Potential of Acetone, Benzene and Toluene in Soils, MA. Data supporting the attenuation of plume of acetone, benzene and toluene by naturally occurring biological degradation in a contaminated aquifer were generated using laboratory microcosms. Rates of mineralization of C14, radiolabeled compounds were measured in unamended soil/water samples.

Research Manager, Biodegradation of 4- and 5-ring PAH in Coal Tar, MA. Managed an NSF-funded project to develop innovative strategies to stimulate the biological degradation of 4- and 5-ring PAH, constituents of coal tar and petroleum products, which are normally recalcitrant to bacterial oxidation. The use of co-metabolites and agents to increase solubility and desorption of these compounds were investigated.

Technical Support, Sequential Anaerobic/Aerobic Treatment of Chlorinated Aliphatics, MA. Provided technical support on a research and development project to investigate the use of sequential anaerobic/aerobic biological processes to treat chlorinated solvents such as tetrachloroethene in aquifer environments. The two-step process involves first reductive dechlorination under anaerobic conditions followed by methanotrophic degradation in the presence of methane and oxygen.

Project Manager, Laboratory Treatability Studies for Gasoline, Multiple Sites. Designed and conducted treatability studies for bioremediation of gasoline releases for over 20 sites across the country.

Technical Support, Composting of Coal Tar Impacted Soils, MA. Provided technical support for a project co-funded by the EPA and a utility company to demonstrate the feasibility of biological treating coal tar impacted soil by composting at bench- and pilot-scale.

Project Manager, Biodegradation of Adsorbed Jet Fuel, MA. Managed a project funded by the US Air Force to investigate the potential of the biological remediation of jet fuel adsorbed to soil particles. The study covered both saturated and vadose zone systems.

Technical Support, In Situ Biological Treatment of Coal Tar for a Utility, Vermont. Design and implementation of an in situ bioremediation system for a New England utility to control seeps of a light mobile coal tar fraction to an adjacent river. The composition of the seeps showed a high percentage of monoaromatic compounds with PAH and was demonstrated in laboratory feasibility testing to be amenable to biological degradation.

Technical Support, Land Treatment of Coal Tar Impacted Soils, CT. Provided technical support for a project funded by the EPA and a New England utility company to demonstrate the feasibility of biological treating soil impacted with PAH in coal tar by land treatment on a pilot scale.

Project Manager, Metabolic By-products and Mechanism of Chlorinated Ethene Degradation, MA. Investigated the intermediates and products of the co-oxidation of chlorinated aliphatic compounds (TCE, DCE, TCA, chloroform, methylene chloride) by methane oxidizing bacteria for an NSF-sponsored study.

Christopher W. Wenczel, P.G.

Principal Consultant/Hydrogeologist
North America

Mr. Wenczel is an ERM Principal Consultant/Hydrogeologist and a New York State-licensed Professional Geologist who has more than 30 years of diversified experience in the environmental consulting/engineering field specializing in hydrogeology, hazardous waste management/remediation, and water supply. Mr. Wenczel's diverse project experience includes planning and directing large complex projects under CERCLA, RCRA, TSCA, NEPA, SEQRA, NJDEP Site Remediation Program, NJPDES, NYSDEC Voluntary Cleanup, State Superfund and Oil Spill Programs. These activities include preparation of regulatory documentation, strategic advice, regulatory interface/negotiations on behalf of clients, site assessments, remedial investigations, remedial design/remedial actions, and long-term monitoring programs at landfills, manufacturing/commercial properties and Federal facilities.

Email: Chris.Wenczel@erm.com

LinkedIn: https://www.linkedin.com/in/chris-wenczel-821a8b10/

Education

- M.S. Earth Sciences/Hydrogeology, Adelphi University, New York, 1990
- B.S. Geology, State University of New York at Oneonta, 1985
- NJDEP UST License Renewal Courses, 1998 - 2013
- State of New Jersey Certified Cleanup Star Program Participant, 2004
- 40-Hour OSHA 1910.120 Health and Safety Training, 1987, and 8-Hour OSHA Annual Refresher Training, 1987 – 2016
- 8-Hour OSHA Supervisory Training For Level B Activities, 1989
- 10-Hour OSHA Construction Safety Training 2008
- ERM Subsurface Clearance/Field Safety Officer Certified
- International Symposium on Environmental Geotechnology, Lehigh University and the International Committee on Environmental Geotechnology, Allentown, PA, 21 -23 April 1986
- Theory and Application of Vadose Zone Monitoring, Sampling and Remediation, NGWA, Somerville, MA, 7-9 April 1992
- Assessment, Control and Remediation of LNAPL Contaminated Sites, API/USEPA, East Brunswick, NJ, 20 October 1994
- Environmental Horizontal Well Symposium, NGWA, Indianapolis, IA, 28-30 October 1995,
- Petroleum Hydrocarbons & Organic Chemicals in Ground Water: Prevention, Detection and Remediation, NGWA, Houston, TX, 13-15 November 1996
- NJDEP Technical Requirements For Site Remediation Seminar, Cook College @ Rutgers, 27 May 1998
- DNAPLs in Fractured Geologic Media: Monitoring, Remediation & Natural Attenuation, Univ. of Waterloo, San Francisco, CA, 8-10 December 1999
- Hydrogeology of Fractured Rock: Characterization, Monitoring, Assessment & Remediation, Fractured Rock Educational Services, Princeton, NJ, 19-22 May 2003
- Systematic Approach To Ground Water Capture Zone Analysis, USEPA Region 2 Headquarters, New York City, New York, 21 August 2007
- Environmental Forensics: Current Methods of Contaminant Age Dating, Cook College @

Rutgers University, New Brunswick, NJ 6 October 2011

- Marcellus Shale: New Regulations and Challenges, New York State Bar Association, Concierge Conference Center, New York City, New York, 22 June 2012
- Emerging Contaminants Summit, Westminster, Colorado, 6-7 March 2018

Professional Affiliations and Registrations

- New York State Professional Geologist, License No. 000744
- Qualified Environmental Professional (New York)
- National Groundwater Association
- New York State Council of Professional Geologists, Outreach Committee Member
- Long Island Association of Professional Geologists, President, 2016-Present

Languages

- English, native speaker

Fields of Competence

- Site Investigation/Remediation Strategy & Implementation
- Ground Water Resource Development
- Multi-Media Sampling & Remediation
- Hydrogeologic Testing, Analyses & Interpretation
- Analysis of Surface & Ground Water Flow Systems
- Surface & Ground Water Quality Monitoring
- Vapor Intrusion Assessment & Mitigation
- Applied Geophysics
- RCRA Closure Planning, Decommissioning, Dismantling, Decontamination & Demolition
- UST Assessment, Removal & Remediation
- Soil Vapor Extraction/Air Sparging
- Ground Water Pumping & Treatment
- Subsurface Clearance
- CPR/First Aid

Key Industry Sectors

- Manufacturing
- Oil & Gas
- Chemical
- Government
- Real Estate & Land Development

Key Projects

USEPA Superfund Program: Participated in Remedial Investigations/Feasibility Studies (RI/FS), Remedial Design (RD) and/or Remedial Operations programs at the following NPL Sites:

- Lipari Landfill
- Lone Pine Landfill
- Vestal Well 1-1
- Robintech Inc./ National Pipe Co.
- Combe Landfill South
- Swope Oil & Chemical Company
- Port Washington Landfill
- Fulton Avenue
- AES/Shore Realty Site
- Sinclair Refinery
- Pfohl Bros. Landfill
- New Cassel/Hicksville Groundwater Contamination Site
- Islip Municipal Sanitary Landfill
- Sarney Farm

Brookhaven National Laboratory: Project Manager responsible for execution of multiple projects at Brookhaven National Laboratory, Upton, NY (BNL), with revenues in excess of $2.8 million. These projects include extensive ground water delineation projects for volatile organic compounds, metals, and radionuclides. These ground water surveys include Operable Unit 3 and Operable Unit 5, the High Flux Beam Reactor emergency response tritium delineation project conducted in March 1997. In a six-week period, ERM's team installed and sampled a total of 72 temporary ground water vertical profile wells to depths ranging between 200 and 300 feet below grade. In addition, these projects have included walk-over radiation surveys for landscape soils across the site and at the former Low-Mass Criticality Facility, and geotechnical studies for BNL's sewage treatment plant.

Long Island Solar Farm (LISF) at BNL: Principal Consultant/Senior ERM Project Team Member assisting ERM's confidential client to develop the Long Island Solar Farm (LISF) in Upton, New York, which is the largest photovoltaic (PV) solar project in the Northeast United States. The facility is located on an approximately 200-acre easement at the US Department of Energy's (DOE) Brookhaven National Laboratory (BNL) on Long Island, New York. The arrays utilized, where possible, areas already cleared (agricultural field, firebreaks, and brownfields) at BNL. Power generated at the 32-MW facility is sold to the Long Island Power Authority (LIPA) under a 20-year power purchase agreement. The project is noteworthy for success in a region that is considered an unlikely geographic location, as large-scale solar farms are more typically located in the Southwest. In addition, the site has had to overcome a number of challenges because of its proximity to World War II artifacts, environmentally sensitive habitat (wetlands), radiological contamination and the presence of the endangered Tiger Salamander.

Mr. Wenczel's involvement included working collaboratively worked with the DOE to prepare a National Environmental Protection Act (NEPA)-required Environmental Assessment (EA) Report, and with LIPA to complete necessary New York State Environmental Quality Review (SEQR) assessments and documents for this private PV Solar Farm demonstration project. Specific studies related to the EA and NYSEQR processes, and due diligence/project financing/investor assurance activities included:

- Analysis of potential:
  - visual impacts (ViewShed/Desktop Visual/field reconnaissance);
  - construction noise impacts (Noise Sound Studies); and
  - impacts to wetlands and ecosystems;
- Assessments for the potential of radiological impacts adjacent to and within easement areas at BNL.

- Phase I and Phase IA site investigations in order to determine if any chemical constituent and/or radiological contamination resulting from past practices at the property, which had long been in use both as a military base and a US Atomic Energy Commission/DOE research facility, might be detrimental to the construction and operation of a PV solar facility at BNL;
- Third-party oversight of radiological impact ("hotspot") remedial actions undertaken by DOE within the 200-acre project footprint, and review/comment on resultant post-remedial action reports.

RCRA Closure/Corrective Action (NYS Part 373) or TSCA (40 CFR Part 761) Cleanup Projects: that were successfully, safely and profitably implemented. These projects involved provision of turn-key DDD services for our clients which were completed in advance of lease exits, property divestures, structure demolition and/or commercial redevelopment. Services provided spanning the entire project life cycle included: regulatory/health/safety planning, competitive procurement and contract management of the remedial subcontractors, implementation/oversight/effectiveness verification sampling, resultant waste disposal, and reporting for regulatory approval and closeouts.

Brooklyn Navy Yard, Brooklyn, New York: A TSCA Interim Remedial Measure (IRM) conducted on former electrical substation that had suffered a major fire to mitigate PCB contamination resulting from releases of electrical transformer dielectric fluids. The IRM included characterizing the extent of PCB contamination on concrete surfaces and soils/sediments associated with the former transformers. The IRM included the removal, containment and disposal of soils/sediments containing high levels of PCBs from a subsurface vault, cleaning, scarification, and final encapsulation of all effected concrete surfaces within the vault and other concrete surfaces associated with the former transformers. A Final Remediation Report was prepared and submitted to NYSDEC for review and official acknowledgment that "no further action" is required at this electrical substation.

Konica Minolta Graphic Imaging USA, Inc., Glen Cove, New York: RCRA Closure of five separate areas. The planning phase of this work involved an appropriate survey and development of project specific Health & Safety Plan, and a RCRA Closure Plan that was approved by the NYSDEC. All tanks, remaining equipment, trenches, pits, floors, walls and appurtenances were accessed, cleaned, and dismantled. The areas included:

- 1,000-Gallon Fiberglass Hazardous Waste Photographic Fixer Tank;
- 750-Gallon Fiberglass Hazardous Waste Photographic Fixer Tank;
- Spill Area Surrounding the Hazardous Waste (Silver) Photographic Fixer Drainpipe located in the Fixer-Developer Lab;
- Hazardous Waste (Silver) Emulsion Spill Area in the Basement; and
- Flammable Hazardous Waste Storage Pad/Shed.

Time Equities, Westbury, New York: A pre-demolition RCRA Closure of a former wastewater treatment (WWT) building. The planning phase of this work involved an appropriate survey and development of project specific Health & Safety Plan, and a RCRA Closure Plan that was approved by the NYSDEC. All tanks, remaining equipment, trenches, pits, floors, walls and appurtenances were accessed, cleaned, and dismantled. The areas included:

- The former 4-inch diameter wastewater line running from the Main Building to the concrete receiving vault of the WWT Building;
- The concrete receiving vault of the WWT Building;
- The three 10,000-gallon steel ASTs in the WWT Building;
- The 1,000-gallon fiberglass process sludge tank in the vault within the WWT Building;

- All secondary containment structures that may have come into contact with wastewater including the concrete and tiled floors, the concrete block walls of the WWT Building, the concrete piping trenches and associated protective steel grating, concrete sludge tank vault; and
- All associated polyvinyl chloride (PVC) and steel piping systems within the WWT Building.
- Residual wastes, sludges and washwaters were handled for disposal as scrap or containerized, characterized and disposed of at properly permitted waste disposal facilities. The decontamination procedures were then followed by visual inspection to confirm the absence of, and finally confirmation sampling and analysis. Some minor soil excavation and disposal was performed. The final report was reviewed and approved by the NYSDEC with a no further action letter allowing subsequent demolition to proceed.

Stewart Stamping EFI, Yonkers, New York: A pre-demolition RCRA Closure of a former metals stamping facility. The planning phase of this work involved an appropriate survey to identify areas requiring closure and development of project specific Health & Safety Plan, and a RCRA Closure Plan. Applicable areas and the basic work scope for each area included:

- Tumbling Room
- Chemical Storage Areas
- Plating Areas
- Drum Cleaning Area
- Waste Oil Collection/Storage Areas
- Compressor Room
- Wastewater Treatment Areas
- PVC Piping (1000'+)

Residual wastes, sludges and washwaters were handled for disposal as scrap or containerized, characterized and disposed of at properly permitted waste disposal facilities. The decontamination procedures were followed by visual inspection to confirm the absence of, and finally confirmation sampling and analysis. Some minor soil excavation and disposal was performed.

Former Pall Corporation Facility, East Hills, New York: Supported due diligence activities for a major New York area commercial developer client - Steel Equities whom was purchasing this facility for commercial redevelopment. Retained to review and opine the adequacy of extensive RCRA Closure/Corrective Action work performed by others. Xerox Corporation, Rochester, New York – Developed a RCRA Partial Closure Plan for a wastewater treatment facility in Building 208. The document was approved by the NYSDEC but ERM RCM was not the successful bidder to implement the DDD work.

Involved in due diligence/site investigation (Phase I & II Environmental Site Assessments), and DDD services throughout my career. Developed good experience in recognition of potential ACM, lead (lead-based paint {LBP}, PCBs, radiation, hazardous materials and universal wastes, and can perform these surveys. Also know the requirements for sampling, testing, abatement/abatement monitoring (ACM), and disposal thereof.

Radionuclides: Extensive experience in leading various types of radiation surveys at multiple sites including Brookhaven National Laboratory, Upton, NY, the Phohl Brothers Inactive Hazardous Waste Site in Williamsville, NY, and multiple commercial property acquisitions for a major developer in the New York City area.

Land Disturbance/Subsurface Structure/Soil Remediation Projects: Extensive experience managing or providing senior technical support on land disturbance/subsurface structure/soil remediation projects. These projects have involved excavation and disposal of large quantities of soil/sediments impacted with VOCs, SVOCS, PCBs, and metals related to discharges from chemical and petroleum bulk storage (ASTs/USTs), manufacturing process areas, vapor degreasing operations, roof ventilation, septic tanks, septic system leaching pools, stormwater drywell and drains, and recharge basins.

Examples of larger projects that resulted in 500+ tons of material for disposal include:

- **Former Parker Hannifin Facility, Dayton, New Jersey:** Septic systems, stormwater systems (15+ structures), USTs (petroleum), and an AST (TCE).
- **Anderol (fka Royal Lubricants) East Hanover, New Jersey:** Fuel Oil UST that was subsequently used for storage of waste oil, spent solvents, PCBs and mercury.
- **Becton Dickenson, East Rutherford, New Jersey:** Remedial excavation of petroleum, chlorinated solvent and mercury-impacted soil, some of which originated from USTs.
- **Brooklyn Navy Yard, Brooklyn, New York:** Petroleum (10+USTs) and PCB impacts (electrical substation transformer releases).
- **Genesco Inc., 150 Fulton Avenue Superfund Site, Garden City Park, New York:** Significant quantities of PCE discharged to a stormwater drywell
- **Steel Equities, Emjay Boulevard, Brentwood, New York:** Facility-wide stormwater drywell and on-site septic system structure cleanouts (40+ structures) plus a stormwater recharge basin cleanout. Sediments and soils were impacted with VOCs, SVOCs, and metals.
- **Steel Equities, Alkier Street, Brentwood, New York:** Facility-wide stormwater drywell and on-site septic system structure cleanouts (10+ structures). Sediments and soils were impacted with VOCs, SVOCs, and metals.
- **Steel Equities, 2200 Northern Boulevard, East Hills, New York:** Facility-wide stormwater drywell and on-site septic system structure cleanouts (50+ structures) plus a large stormwater recharge basin cleanout. Sediments and soils were impacted with VOCs, SVOCs, and metals.
- **Northrop Grumman, Melville Park Road, Melville, New York:** Facility-wide stormwater drywell and on-site septic system structure cleanouts (10+ structures). Sediments and soils were impacted with VOCs, SVOCs, and metals.

Chemical & Petroleum Bulk Storage: Maintained a New Jersey UST License Since 1993. Provided turn-key services and managed those projects primarily in New York and New Jersey that involved the cleaning and proper removal of ASTs, and cleaning and removal or abandonment in-place of several dozen USTs. ERM's turnkey approach provided the clients with a single entity to properly investigate and close the USTs/ASTs in a safe and environmentally responsible manner meeting the substantive requirements of Federal, State and County regulations. All work was completed in a manner to cause the least disruption to facility client operations. ERM met with, and facilitated inspections by the Federal, State, County agencies and Fire Departments, and prepared final comprehensive closure reports for submittal to, and approval by the lead agencies. These services included:

- Pre-closure site investigations at each UST location using geophysical methods such as cable avoidance tools, terrain conductivity and ground penetrating radar, installation of soil borings with the collection of soil and ground water samples for laboratory analyses to assess pre-closure conditions;
- Preparation of UST Closure Work Plans; Sampling and Analysis/Quality Assurance Project Plans, and a Health and Safety Plans;
- Notification of interested regulatory agencies (Federal, State, County (Health), and Fire Departments);
- Procurement of all necessary permits;
- Procurement and contract management of the remedial subcontractors;
- Engineering support services for the implementation of the on-site closure activities;
- Closure by in-place abandonment, excavation and removal of the USTs and effected soils;
- On-site health and safety oversight;
- All end-point soil sampling;

- Complete restoration of each former UST location; and
- Preparation of a final comprehensive UST Closure Report for submittal to regulatory agency.

UST/AST Project Examples:

- 6,000-gallon heating/waste oil USTs - Anderol (fka Royal Lubricants) East Hanover New Jersey
- 10+ Gasoline/Heating Oil USTs up to 20,000-gallons capacity - Brooklyn Navy Yard – Brooklyn NY
- 1,000-gallon and 750-gallon Fiberglass Hazardous Waste Photographic Fixer ASTs - Konica Minolta Graphic Imaging USA, Inc., Glen Cove, New York
- 5,000-gallon heating oil USTs - Commercial Property - Oceanside, NY
- 8,000-gallon heating oil USTs - Elmsford Associates (Commercial Property), Elmsford NY
- 1,000-gallon heating oil USTs- Workman's Benefit Fund, Hicksville, NY
- 500-gallon gasoline and heating oil USTs - Steel Equities - Little Neck, NY
- 10,000-gallon & 5,000-gallon heating oil, 1,000-gallon gasoline Former Parker Hannifin facility – Dayton, NJ
- 3 10,000-gallon wastewater ASTs -Time Equities, Westbury, NY

Delta Airlines, John F. Kennedy International Airport (JFK) in Jamaica, NY: Directed all phases of multiple petroleum spill investigations on behalf of Delta Airlines. Coordinated the regulatory approval and execution of detailed investigative work plans. Obtained approvals from the Port Authority of NY & NJ (PA) for Tenant Alteration Applications (TAA), for soil and groundwater investigations along several hundred feet of subsurface aircraft fuel piping and hydrants on the airside of the aircraft terminal. Coordinated PA and subcontractors to perform, subsurface clearance, multi-phase extraction, soil borings, groundwater sampling, and disposal of investigative derived waste. All work to date has been successfully and safely completed in concert with the PA and local client operations teams.

TRW Aeronautical Systems, Utica, New York: Project Manager responsible for execution of multiple projects at this major aeronautical systems manufacturing facility in Utica, New York. These projects include a NYSDEC RCRA Corrective Action program, facility relocation support and permitting, and implementation of multiple Interim Remedial Measures (IRM). The RCRA Corrective Action included the regulatory negotiation, development, and implementation of key program documents including the RCRA Facility Assessment and the RCRA Facility Investigation Work Plan. Both on-site and off-site investigations were required to characterize impacted media including soils, ground water, storm water, surface water, and building materials such as concrete and metals. Contaminants of concern at the facility included volatile organic compounds, semi-volatile organic compounds, polychlorinated biphenyls (PCBs), metals, and cyanide. IRMs included removal and disposal of structures, vent stacks, stormwater conveyance systems, soil, and concrete. Facility relocation support included procurement of permits/registrations for sanitary wastewater discharges, air discharges, petroleum bulk storage tanks, waste management, development of a spill control, containment and countermeasures plan (SPCC), and revisions to both waste management and emergency control procedure plans.

Fulton Avenue Superfund Site, Garden City Park, New York: Designated Project Coordinator/Manager responsible for the implementation of an extensive RI/FS, Soil IRM, Remedial Design and Remedial Action at the Fulton Avenue Superfund Site. The Fulton Avenue site is listed on both the NYSDEC Registry of Inactive Hazardous Waste Sites and the USEPA NPL. Past discharges of chlorinated solvents (tetrachloroethene) have caused extensive ground water contamination in the Upper Glacial and

Magothy aquifers. The ground water contaminant plume has allegedly migrated a distance of 2 miles from the site to depths of up to 500 feet to affect up to 5 public supply wells encompassing an area of approximately 5 square miles within Nassau County. The RI/FS focuses on a ground water vertical profiling task using temporary wells to further define the extent of ground water contamination within the upper glacial aquifer and the Magothy aquifer, and to select permanent ground water monitoring well locations and screen settings; installation of permanent conventional and multi-level ground water monitoring wells to act as permanent monitoring and/or compliance points within the upper glacial aquifer and the Magothy aquifer; collection of ground water samples from over 60 ground water monitoring wells; collection of several rounds of synoptic ground water level data; a three-dimensional ground water flow computer model; a risk assessment for ground water; and a feasibility study for ground water. The soil IRM is comprised of a source area soil removal action, and the installation of a soil vapor extraction (SVE) and air sparging (AS) to remove contaminants from the vadose zone soils and the shallow ground water table. Since the SVE/as system went online in October 1998, approximately 10,000 pounds of tetrachloroethene has been removed from the ground. The post-IRM Site closure included indoor air sampling and installation of a sub-slab venting system beneath the building at the Site.

Former Parker Hannifin Facility, Dayton, New Jersey: Project Manager/Senior Hydrogeologist responsible for the coordination and performance of a major off-site hydrogeologic investigation for a manufacturing facility and ISRA site (NJDEP Site Remediation) in South Brunswick, NJ. Conducted an extensive volatile organic compound plume delineation task in a dual aquifer ground water system which utilized the terrain conductivity, resistivity and VLF geophysical mapping techniques and the Hydropunch ground water sampling technique. Other site investigative activities have included: the phased installation of an extensive ground water monitoring well network, performance of multiple aquifer tests, characterization of the subsurface geologic and hydrogeologic regime, test pitting, soil sampling, an UST investigation, ground water sampling, performance of a soil vapor extraction pilot study, design/installation/testing of a ground water recovery well, data analyses, interpretation, and preparation of an Site Assessment Report, an extensive Pump Test Report, Soil and Ground Water Remedial Action Work Plans, a Comprehensive Hydrogeologic Report, a SVE Pilot Study Report. Remedial Action Work Plans proposed the use of SVE, biosparging, and pump and treat technologies. All three systems are currently in operation and effectively remediating soil and ground water contamination at the site.

Ashland Chemical, Fords, New Jersey: Management and supervision of hydrogeologic investigation at an Ashland Drum Landfill Site, Fords, New Jersey (NJDEP Site Remediation). The investigation included: the installation of a ground water monitoring well network, characterization of the subsurface geologic and hydrogeologic regime, a study of tidal influence on ground water flow, test pitting, soil sampling, ground water sampling, drum sampling, data analyses and preparation of an RI Report.

NYSDEC Pfohl Brothers State Superfund, Williamsville, NY: Senior Hydrogeologist responsible for the coordination and supervision of a comprehensive RI at the Pfohl Brothers NYSDEC State Superfund site (120 acres) located in Williamsville, NY. The site investigation of Pfohl Brothers Landfill included: preparation of a RI work plan, Health and Safety Plan (HASP), a Quality Assurance Plan (QAPP), geophysical surveys using terrain conductivity, magnetometry and ground penetrating radar, soil borings, ground water monitoring well installation in both bedrock and overburden aquifers, soil sampling, sludge sampling, hydrologic monitoring of surface water bodies, surface water sampling, ground water sampling, landfill leachate sampling, test pitting and drum sampling. In addition to the overall site characterization, evaluated the presence of low-level radionuclide contamination on the site, delineated, and mapped over 450 radioactive "hot- spots" using scintillometers. Radionuclides found at the site included radium-226, thorium-232, cesium-132 and uranium-238 in the form of discarded machine parts, radioluminescent badges, and ore rocks.

Port Washington Municipal Landfill Superfund Site, Port Washington, New York: Installation of ground water and landfill gas monitoring wells as part of an RI. Additionally, participated in the development and implementation of a landfill gas sampling program using flux boxes, landfill gas monitoring wells and summa canisters.

Wickland Oil, San Nicholas, Aruba: Senior Hydrogeologist responsible for the coordination and performance of a comprehensive environmental assessment at the former ESSO petroleum refinery, San Nicholas, Aruba, N.V. The investigation included: the installation of a ground water monitoring well network, characterization of the subsurface geologic and hydrogeologic regime, test pitting, soil sampling, an above ground storage tank investigation, ground water sampling, mapping of extensive LNAPL bodies, data analyses/interpretation, and preparation of an Site Assessment Report.

Participated in two NPL site RD programs, Vestal Well 1-1, Vestal, New York and the Lipari Landfill, Pitman, New Jersey. Activities for the Vestal Well 1-1 site included the preparation of a Remedial Design work plan, HASP and QAPP, performance of a soil boring program and design of a 1,000-gpm air stripper. Activities for the Lipari Landfill included the design of an automated extraction/injection well network and a 300-gpm production well.

Brooklyn Navy Yard, Brooklyn, New York: Project Manager responsible for execution several major environmental investigative/cleanup tasks at the former Brooklyn Navy Yard (Brooklyn Navy Yard Industrial Park {BNYIP}), that have included: Phase I & II Site Assessment/Investigation Services Related To a NYSDEC Voluntary Cleanup Agreement, Implementation of Interim Remedial Measures, and Investigation/Closure of Underground Storage Tanks

ERM performed a Phase I Preliminary Site Assessment data gathering and evaluation process in conjunction with a Phase II Site Investigation to address key data gaps for potential area and activity-specific sources of hazardous substances. The Phase I Preliminary Site Assessment included site inspections, review of all historic data/records, previous investigations performed at the BNYIP to date, inspection of BNYIP facilities, interviews of facility personnel regarding current and past operations.

The Phase II investigation included the sampling and characterization of environmental conditions at electrical substations/transformer areas, drum storage areas, dry docks, and facility-wide ground water characterization. The Phase II Investigative findings were then integrated with the Phase I Site Assessment information to prepare a Comprehensive Environmental Assessment Report (CEAR) for the BNYIP.

ERM provided complete turnkey services for investigation and closure of 10 underground petroleum storage tanks located in seven separate areas at the BNYIP. These services included pre-closure site investigations at each tank locations, preparation of all regulatory required work plan documents, notification of interested regulatory agencies (NYSDEC, NYCFD), procurement of necessary permits, closure by excavation and removal of the USTs and effected soils, complete restoration of each former tank location, and preparation of a final comprehensive UST Closure Report for submittal to NYSDEC.

ERM performed an Interim Remedial Measure (IRM) at former electrical substation to mitigate PCB contamination resulting from releases of electrical transformer dielectric fluids. The IRM included characterizing the extent of PCB contamination on concrete surfaces and soils/sediments associated with the former transformers. The IRM included the removal, containment and disposal of soils/sediments containing high levels of PCBs from a subsurface vault, cleaning, scarification, and final encapsulation of all effected concrete surfaces within the vault and other concrete surfaces associated with the former transformers. A Final Remediation Report was prepared and submitted to NYSDEC for review and official acknowledgment that “no further action” is required at this electrical substation.

NYSDEC Utility Manufacturing State Superfund Site, New Cassel, New York: Project Manager responsible for the implementation of an off-Site RI/FS at the NYSDEC Utility Manufacturing State Superfund Site. The Utility Manufacturing Site is listed on the NYSDEC Registry of Inactive Hazardous Waste Sites. Past discharges of chlorinated solvents have caused extensive ground water contamination in the Upper Glacial and Magothy aquifers affecting several deep public supply wells in the Bowling Green Water District. The RI features the off-site installation of soil borings to collect both lithologic samples to characterize off-site stratigraphic conditions, and groundwater samples using a Hydropunch to characterize off-site groundwater quality/impacts (i.e. determine if site-related contaminants have migrated off-site); installation of groundwater monitoring wells to confirm the results of the Hydropunch sampling; and the collection of soil gas samples to evaluate potential risks from soil vapor migration.

Project Manager responsible for third-party oversight on behalf of ERM’s client to ensure responsible parties (former owners) comply with all applicable NJDEP soil and ground water remediation standards and the NJDEP-approved Remedial Action Plan for an NJDEP ISRA site in Paramus, New Jersey. Additional activities include oversight of an asbestos removal action at the same site.

AES/Shore Realty NPL & State Superfund Site, Glenwood Landing, New York: Project Coordinator/Principal Consultant/Hydrogeologist responsible for the continued operation and assessment of remedial systems Applied Environmental Services/Shore Realty Site (Site) in Glenwood Landing, New York. The Site, a 3.2 acre parcel located adjacent to Hempstead Harbor, is listed on both the NYSDEC Registry of Inactive Hazardous Waste Sites and the USEPA NPL. Past discharges of petroleum have caused extensive shallow soil and ground water contamination in the Upper Glacial aquifers where groundwater discharges to the adjacent Hempstead Harbor. Remedial systems consist of air sparge/soil vapor extraction (AS/SVE), groundwater pump and treat with bioremediation facilitated by adding nutrient amendments to treated groundwater that is reinjected on-Site up at an upgradient infiltration gallery. The remedial systems have operated since 1995 and the NYSDEC/USEPA required a subsurface site investigation to evaluate remedial progress, the occurrence and distribution of remaining contaminants, concurrent groundwater movement and interaction with the adjacent surface water body. Responsible for planning and negotiating the investigative scope of work that included a tidal influence study using remote pressure transducer/data loggers to evaluate hydrodynamic response to tidal flux in shallow, intermediate and deep aquifer zones beneath the Site, and Site-wide comprehensive groundwater sampling. The tidal influence study results were analyzed to confirm significant tidal influence in the intermediate and deep zones. The tidal influence study results and the groundwater results were used to develop and updated conceptual site model, identify recalcitrant pockets of contamination (hotspots) and develop a plan for remedial systems optimization that was presented in a Remedial Effectiveness Report that was review and approved by NYSDEC and USEPA. The optimization plan included soil borings for stratigraphic definition at the locations of two new groundwater recovery wells, collection of soil samples for geotechnical analyses to design the new recovery wells intended to collect groundwater as well as depress the water table to enhance the efficacy of the AS/SVE systems, installation of the new recovery wells, pulsed-remedial operations and continued groundwater and remedial system monitoring.

Confidential Client, Hoosick Falls, New York: Principal Consultant/Hydrogeologist embedded into a team of senior scientists as a senior hydrogeologist/technical resource responsible for the planning, implementation of characterization/remedial investigations for perfluorinated compounds and chlorinated VOCs at multiple sites listed or under consideration for list on the New York State Registry of Inactive Hazardous Waste Sites in a complex regional bedrock, post-glacial and fluvial depositional geologic environment. Responsible for a regional bedrock lineament analyses using topographic maps, aerial photographs and high resolution LIDAR imagery, oversight of geophysical subcontractor for multi-site seismic, resistivity and VLF surveys – interpretation of the results thereof, stratigraphic correlation/hydrogeologic interpretation, preparation of geologic cross-sections/isoconcentration plots, speciation analysis, a conceptual site model to understand the distribution and movement of groundwater and contaminants. Responsible for development of multiple site investigation scopes/work plans that include surface geophysical methods for subsurface clearance, the installation of soil borings to collect lithologic samples to characterize off-site stratigraphic conditions, installation of groundwater monitoring wells, and multi-media via sampling of soil, groundwater, sediment, surface water and soil vapor. Use of geoprobe direct push rigs, Waterloo APS (groundwater and estimate hydraulic conductivity), hollow-stem auger and rotosonic drilling methods.

Andrew Coenen

Senior Project Manager
North America

Mr. Coenen has knowledge of numerous analytical methodologies and experience in data validation of analytical data package deliverables for adherence to USEPA CLP and non-CLP, NYSDEC ASP, and NJDEP protocols. He is proficient with GIS/Key environmental management software and has operated a mobile gas chromatograph laboratory used to test soil and water samples for quick-turn volatile analysis.

Experience Mr. Coenen has 19 years of general analytical chemistry experience, 6 years of analytical laboratory experience, and 13 years of environmental consulting experience, including analytical data validation, sampling and analysis programs, quality assurance programs, technical support, laboratory audits, and QA oversight for fixed laboratory and field analysis. Mr. Coenen is an expert in GIS Solutions GIS\Key software. GIS\Key is a comprehensive, environmental data management and reporting tool. The software suite includes specific modules for storing and presenting Chemistry, Geology, Hydrology, NPDES, and Radiology data and has implemented the system's cutting edge data management protocols and processes for numerous large and small scale site investigation and remediation projects throughout the United States.

Email: Andrew.Coenen@erm.com

Education

- Rutgers University/Cook College - NJDEP Using GIS for Environmental Evaluations, October 1999
- 8-Hour OSHA Annual Refresher Training, 1999 current
- 40-Hour OSHA [29 CFR 1910.120 (e) (2)] Health and Safety Training, 1998
- Computer Aided Drafting, 50-Hour Course, Island Drafting and Technical Institute, 1998
- Immunoassay Testing Training Program, Strategic Diagnostics Inc., 1998
- B.S. Chemistry, University of Michigan, 1991

Languages

- English, native speaker
- Knowledge of German and Spanish

Fields of Competence

- Analytical data review and validation
- Environmental Database Management (GIS/Key)
- Laboratory Subcontractor Management
- Analytical protocols for pollutants by USEPA methodologies
- Methods of analysis of organic and inorganic parameters
- Review and preparation of QA/QC plans
- Field analytical techniques
- Multi-Media Sampling
- Briefly list areas of specialization

Key Projects

Environmental Data Management: Contaminated Site Management.
Data validation for numerous projects located in New York, New Jersey, California, Connecticut, Illinois, Iowa, Indiana, Maryland, Massachusetts, Michigan, Pennsylvania, Rhode Island, and Wisconsin, involving evaluation of aqueous, soil, sediment, leachate, and air samples analyzed by USEPA Contract Laboratory Protocols, State Protocols and numerous methodologies for organic, inorganic, wet chemistry parameters, TPH, and various other analyses.
Reviewed sampling and laboratory chemical data for adherence to New Jersey Department of Environmental Protection protocols and New York State Department of Environmental Conservation on numerous projects. Constructed electronic deliverables for submission to NJDEP and NYSDEC in required electronic formats.

Database construction & management for numerous investigations utilizing GIS/Key software.
Compiled field and laboratory data and generated result summary tables, contours, isopleths, contaminant plume maps, cross-sections, and boring logs.

Project Manager responsible for the coordination and performance of a major hydrogeologic investigation for an ISRA site (NJDEP Site Remediation) in East Rutherford, NJ.
Conducted an extensive volatile organic compound plume delineation, a vapor intrusion investigation, installation of an extensive ground water monitoring well network, ground water sampling.

Quality Assurance Officer.
responsible for review of all data collected at several sites including the former Brooklyn Navy Yard Industrial Park, several NYSDEC Standby Contract Projects, Sherwin Williams Superfund Site, Hydrite Chemical Company in Waterloo, Iowa.

Project management and technical support.
Special Analytical Services required to delineate low-level PAH contamination at a Superfund Site. This included method development and validation of a Selected Ion Monitoring (SIM) GC/MS technique.

Utilized Immunoassay test kits for field measurement of PCB contamination at the former Brooklyn Navy Yard, Brooklyn, New York.
Performed data validation of all field analytical samples and off-site laboratory samples and compared off-site results to test kits.

Prepared numerous Sampling and Analysis Plans (SAPs) and Quality Assurance Project Plans (QAPPs) for adherence to state and federal guidelines.

Conducted subsurface investigations with a Geoprobe. Performed various field tests.

Supervision of tank removal and subsequent soils evaluation for contamination.

Matthew W Botzler, PG, CPS, OHST

Senior Project Manager and H&S Lead

Matthew is a Senior Project Manager based in ERM's Malvern, Pennsylvania office. His primary focus has been in the practice of site investigation and remediation and has taken active roles in assisting with the management of contaminated sites for a wide range of industries including chemical, Oil and Gas, and light and heavy manufacturing. Matthew is also a practicing Health and Safety professional and currently serves as ERM's H&S Leader for the eastern Business Units. He supports employee-training, implementation of health and safety programs and initiatives, risk assessment and mitigation, and management of safety related incidents. He has performed H&S compliance audits within the manufacturing and food and beverage industries.

Experience: 11 years of experience in field of environmental consulting with emphases on hydrogeology, and safety program management.

Email: matthew.botzler@erm.com

LinkedIn: https://www.linkedin.com/in/matthew-botzler-pg-csp-51178931/

Education

- MS, Ocean, Earth and Atmospheric Sciences, Old Dominion University, VA, USA, 2007
- BS, Geology, Old Dominion University, VA, USA, 2004

Professional Affiliations and Registrations

- Pennsylvania Professional Geologist No: PG005066
- Board of Safety Professionals - Occupational Health and Safety Technologist No: 5537
- Board of Safety Professionals - Safety Trained Supervisor No: IEX10056
- Occupational Safety and Health Administration (OSHA) 40-hour Hazardous Waste Site Operations (HAZWOPER)
- Certified as an inspector for Geosynthetic material and compacted clay liners, "GCI-ICP Certified Inspector"

Languages

- English, native speaker

Fields of Competence

- Ergonomics
- Construction and Workplace Health & Safety
- H&S Assurance and Compliance
- Health and Safety program development and instruction
- Geological Investigations
- Site remediation
- Hydrologic testing
- Project management and oversight
- Soil erosion and sediment control practices
- Geosynthetic Liner Installation and QA/QC
- Technical report preparation and data analysis

Key Industry Sectors

- Transport
- Construction and Engineering
- Manufacturing
- Oil and Gas

Honors and Awards

- National Safety Council – Rising Star of Safety 2016

Key Projects

Remediation Management, Wilmington, DE
Matthew was a project manager at an active petroleum recycling facility. He coordinated site characterization and remediation efforts through free-product recovery, implementation of phytoremediation, and installation of administration and engineering controls.

Site Investigation & Risk Assessment, Baltimore, MD
Project Health and Safety Consultant for a former chromium ore processing facility with related impacts to soil and groundwater. He developed and maintained compliance with management programs that addressed the exposure pathways of concern for potential airborne dust from intrusive activities resulting in incidental inhalation, ingestion or dermal contact, including contact with contaminated materials and liquids while handling during construction. He performed multiple on site audits of the ongoing Health and Safety management system, working with general contractors, third party subcontractors, and regulatory agencies.

Safety Services & Remediation Management, Front Royal, VA.
Matthew was Lead QC Inspector during the Geosynthetic capping project. His responsibilities included health and safety oversite, cap installation, and cover soil placement. He was directly responsible for liner quality control testing and reporting to site contractor and EPA site representative. Matthew led and managed field personnel during the installation of multiple deep bedrock extraction and monitoring wells, several long-term pumping tests, multiple geophysical investigations of hazardous waste depositional basins, and multiple well installation for PCB sampling and remediation. He was an engineering team member for the design and construction of long-term, multi-well, groundwater and leachate extraction system.

ITW EHS Compliance Audits
Matthew was a contributing member of the Audit program, addressing ITW's compliance with environmental and key health & safety regulations. By the end of 2016, ERM will have performed more than 240 EHS compliance audits in 35 different countries for ITW.

Management Systems & Compliance Support, Hometown, PA.
Matthew was the on-site consultant during wetland excavation, remediation, and stream restoration. He monitored and delegated construction processes and minimized ecological impact. He was the ERM representative for long term construction and geosynthetic capping processes. Matthew managed time and materials and field construction. He was the QC officer for Geosynthetic liner installation for the in-place capping closure of a 250,000-cubic yard pile of wire chop fluff at a northeastern Pennsylvania Superfund site. He conducted numerous soil and groundwater sampling events. Matthew also communicated with contractor, sub-contractor, federal, and state regulatory agencies during the process.

Safety Services, Newark, NJ.
Matthew was the Task manager and Health and Safety technician, provided oversight and direction for the installation of a multi-channel HDPE groundwater recovery system, conveyance piping, and associated pumping components.

Impact Assessment, Langhorne, Pennsylvania
As Project Manager, Matthew coordinated an investigation and reporting for a site contaminated with petroleum from a historical tank leak. He managed soil and groundwater sampling and remediation.

ERM has over 140 offices
Across the following
countries worldwide

Argentina
Australia
Belgium
Brazil
Canada
China
Colombia
France
Germany
Hong Kong
Hungary
India
Indonesia
Ireland
Italy
Japan
Kazakhstan
Korea
Malaysia
Mexico
The Netherlands
New Zealand
Panama
Peru
Poland
Portugal
Puerto Rico
Romania
Russia
Singapore
South Africa
Spain
Sweden
Taiwan
Thailand
United Arab Emirates
UK
USA
Vietnam

ERM's Melville Office

105 Maxess Road – Suite 316
Melville, New York 11747-3857
T: +1 631-756-8900

www.erm.com/US