FINAL

Site Characterization Investigation Work Plan Addendum, Essex-Hope Site in Jamestown, New York

Site Number 907015

Prepared for

Essex Specialty Products, Inc.

June 2017

ch2m

Professional Engineer Certification

I, Key Rosebrook, certify that I am currently a New York State-registered professional engineer as defined in 6 *New York Codes, Rules, and Regulations* Part 375, and that this *Site Characterization Investigation Work Plan Addendum* was prepared in accordance with all applicable statutes and regulations, and in substantial conformance with NYSDEC *DER-10: Technical Guidance for Site Investigation and Remediation*.

STATE OF NEW YORK
KEY ROSEBROOK
089440-1
LICENSED PROFESSIONAL ENGINEER

Signature: ______________________

Date: 6-16-17

Contents

Acronyms and Abbreviations

bgs	below ground surface
CBTEX	cumene, benzene, toluene, ethylbenzene, and xylene
CH2M	CH2M HILL Engineers, Inc.
CSM	conceptual site model
DPT	direct-push technology
EPA	U.S. Environmental Protection Agency
ESP	Essex Specialty Products, Inc.
MW	monitoring well
LNAPL	light nonaqueous phase liquid
NPLS	North Parking Lot Sump
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
O&M	operations and maintenance
PVC	polyvinyl chloride
PZ	piezometer
QAPP	Quality Assurance Project Plan
SOP	standard operating procedure
TCE	trichloroethene
UST	underground storage tank
VOC	volatile organic compound
WBZ	water-bearing zone

SECTION 1

Introduction

CH2M HILL Engineers, Inc. (CH2M) prepared this Work Plan Addendum on behalf of Essex Specialty Products, Inc. (ESP) to present proposed activities to supplement previous investigations for refining the conceptual site model (CSM) and planning for future remedial activities at the Essex-Hope State Superfund site located at 125 Blackstone Avenue in Jamestown, New York (site; Figure 1). The site, presently owned by Custom Production Manufacturing Inc., is listed under the New York Superfund Program (Site Number 907015) and managed by the New York State Department of Environmental Conservation (NYSDEC).

The work described herein is intended to supplement the investigation that was detailed in the *Site Characterization Investigation Work Plan, Essex-Hope Site in Jamestown, New York* (2016 Work Plan; CH2M, 2016). Results of this investigation were provided in the *2016 Data Gap Investigation Report for the Essex-Hope Site in Jamestown, New York* (2016 Data Gap Investigation Report; CH2M, 2017a), which is an appendix to the *2016 Annual Periodic Review Report, Essex/Hope Site, Jamestown, New York* (CH2M, 2017b). The 2016 Data Gap Investigation Report provides an updated understanding of hydrogeology as well as the nature and extent of the contaminants. As detailed in the report, further delineation of CBTEX (cumene, benzene, toluene, ethylbenzene, and xylene) in the Shallow Water-bearing Zone (WBZ) and trichloroethene (TCE) and its degradation products within both the Shallow and Deep WBZs is needed. Additionally, light nonaqueous phase liquid (LNAPL) was found during a follow-up sampling event, which requires additional assessment. This addendum to the 2016 Work Plan has been prepared to further refine this information. A full update to the CSM will be prepared upon collection of the results from this investigation. This Work Plan Addendum has been developed in general accordance with the NYSDEC's Division of Environmental Remediation (DER) *Technical Guidance for Site Investigation and Remediation* (DER-10), dated May 2010.

1.1 Purpose and Scope

The activities proposed in this Work Plan Addendum are being conducted to meet the following objectives:

- Objective 1 – Define the lateral extent of CBTEX in the Shallow WBZ in the eastern Former Underground Storage Tank (UST) Area.
- Objective 2 – Define the source and extent of the elevated TCE concentrations in the shallow WBZ near MW-104S on the Hope Windows property.
- Objective 3 – Define the extent of the vadose zone soil TCE impacts in the North Parking Lot Sump (NPLS) Area near DPT-005 and MW-111D. Also, define the depth and extent of LNAPL found in PZ-4D.
- Objective 4 – Define the extent of the TCE plume in the upper portion of the Deep WBZ to the north and east of MW-106D and MW-110D. Assess whether some of the existing Deep WBZ monitoring wells are screened too deeply to adequately assess and delineate the deep TCE plume.
- Objective 5 – Collect and analyze samples to assist in assessment of remedial alternatives.
- Objective 6 – Abandon and refurbish selected existing wells and piezometers.

To meet these objectives, the following activities are proposed:

- Task 1: Utility Clearance.

- Task 2: Soil and Groundwater Profiling. Continuous soil sampling at 22 soil borings (Figure 1). Seven shallow borings will be advanced to depths of 15 feet below ground surface (bgs) and an additional 15 deep borings will be advanced to depths of 45 feet bgs. Groundwater grab samples will be collected at 13 locations.
- Task 3: Installation, Development, and Sampling of Monitoring Wells. Installation and development of eight 2-inch monitoring wells (new borings) (Figure 2). Seven monitoring wells will are planned for installation to 45 feet bgs and 1 is planned for 15 feet bgs. Depths provided are estimates and actual depth will depend on field observations. The monitoring wells will be sampled after development. Soil samples will be collected at one location.
- Task 4: Abandonment and Redevelopment of Existing Wells. Abandonment of up to eight monitoring wells (Figure 3). Monitoring wells will be abandoned in accordance with NYSDEC CP-43: *Groundwater Monitoring Well Decommissioning Policy* (NYSDEC, 2009). Three existing monitoring wells and five recovery wells will be redeveloped, and eight wells will be repaired (Figure 4).
- Task 5: Survey the coordinates and elevations of the newly installed monitoring wells and new boring locations..

Proposed investigation and well abandonment/repair locations are shown on Figures 1 through 4.

1.2 Work Plan Organization

This work plan is organized as follows:

- Section 1 – Introduction
- Section 2 – Investigation Scope of Work
- Section 3 – Other Planning Documents
- Section 4 – Reporting and Schedule
- Section 5 – References
- Appendix A – Quality Assurance Project Plan

Supporting material in the form of tables, figures, and the appendix, are presented at the end of this Work Plan Addendum.

Investigation Scope of Work

This section presents a detailed scope of work for addressing the data needs detailed in Section 1.1. Locations of the proposed field investigation activities are shown on Figures 1 through 4.

2.1 Field Investigation Activities

2.1.1 Utility Clearance

At each drilling location, a third-party utility survey will be completed. An area approximately 5-foot-square around each boring as shown on Figure 1 will be evaluated using non-intrusive geophysical utility locator technologies (e.g., magnetic, ground-penetrating radar, or similar) as necessary to identify, mark out, and locate underground utilities and other subsurface obstructions within the survey area. Utilities will be flagged and marked for review prior to drill rig mobilization. CH2M personnel accompanying the utility locating contractor will take photographs of markings and draw rough sketches of the located subsurface utilities in the field logbook.

In addition to the private utility survey/mark out, Dig Safe System, Inc. will be contacted at least three working days and not more than 10 working days before initial mobilization of drilling equipment to the site.

2.1.2 Soil and Groundwater Profiling

A total of 22 soil borings is planned for soil sample collection as part of this task. Depths and information of borings are provided in Table 1. Thirteen locations have been targeted for groundwater profiling. The proposed boring locations are shown on Figure 1. Specifically, the soil and groundwater profiling will include the following:

- Borings will be advanced using a 2-inch-diameter, 4-foot-long Macro-Core® sampler with a basket trap and a clean, disposable, acetate liner. Samples will be collected continuously during the boring and field screened by a CH2M representative using a photoionization detector at 6-inch intervals, in addition to any intervals showing staining or sheens.
- Soil will be logged and field-screened (including for NAPL using a Sudan IV dye test) in accordance with the 2016 Work Plan. To assess the potential of NAPL (found in PZ-4D), a Sudan IV dye test will be administered at locations DPT-24, -25, -26, and -27 at 6-inch intervals starting at 2-feet bgs, to 2-feet below the water table, even if no signs of NAPL are detected.
- Soil samples will be collected for specific analysis dependent on each location as presented in Table 2. Laboratory analytical methods include the following:
  - To be sent to Alpha Analytical, Inc. of Westborough, Massachusetts:
    - Volatile organic compounds (VOCs) using U.S. Environmental Protection Agency (EPA) Method 8260C
    - Polychlorinated biphenyls using EPA Method 8082
  - To be sent to Microbial Insights, Inc. of Knoxville, Tennessee:
    - Magnetic susceptibility
  - To be sent to Test America Applied Sciences Laboratory of Corvallis, Oregon:
    - Total oxidant demand using permanganate

  - Total oxidant demand using alkaline-activated persulfate

- During soil sampling activities, groundwater samples will be collected at three wells (see Table 2) for submittal to Applied Sciences Laboratory for use in the total oxidant demand analyses.
- Up to 25 groundwater grab samples will be taken at 13 boring locations from depths ranging from 15 feet bgs up to 45 feet bgs. Up to three groundwater grab samples may be collected from each boring at different depths. For each groundwater grab, a temporary 5-foot screened interval will be installed at the appropriate depth, as directed by the onsite CH2M representative, and a peristaltic pump and tubing for purging and sampling will be used. Groundwater samples will be sent to Alpha Analytical, Inc. for analysis for VOCs by EPA Method 8260C. Refer to Table 1 for a complete list of locations of groundwater profiling locations and depths of samples.
- Drill cuttings and liners will be containerized as detailed in Section 3.2 of the 2016 Work Plan (CH2M, 2016).
- Drilling equipment will be decontaminated as detailed in Section 3.2 of the 2016 Work Plan.

Depending on field observations, additional soil borings or soil samples to be collected for offsite analysis may be required. Any deviations to the plan noted above will be provided within the final report.

2.1.3 Monitoring Well Installation, Development, and Sampling

2.1.3.1 Monitoring Well Installations

Eight monitoring wells will be installed on the site and at adjacent properties. Six of the monitoring wells will be new wells and two existing monitoring wells will be replaced (MW-7D and PZ-7D). Potential monitoring well installation locations are shown on Figure 2; however, final locations will be selected based on the results of the DPT sampling. Boreholes at least 4 inches in diameter will be advanced to ensure sufficient annular space for well installation. To minimize potential downward migration of contaminants at MW-118D, a temporary outer casing or hollow stem auger flights may be used to seal off the Shallow WBZ. Monitoring well installation procedures will be consistent with the 2016 Work Plan and are briefly summarized below:

- Monitoring wells will be installed to depths ranging from 15 to 45 feet bgs as detailed in Table 3. Final depths will be based on field observations. Monitoring wells will be constructed with 2-inch-diameter schedule 40 polyvinyl chloride (PVC). Well materials will consist of 0.010-inch machine-slotted, flush-threaded, schedule 40 PVC screens and riser pipe. Screen lengths will generally be 10 feet unless site conditions indicate a 5-foot screen is required.
- At locations with planned soil sampling, as detailed in Section 2.1.2, monitoring wells will be installed to predetermined depths. Otherwise, continuous samples will be collected during monitoring well installations to determine final depth.
- After setting the well screen, riser, filter pack, and bentonite seal, the well will be grouted as the auger or temporary casing is withdrawn, preventing cross-contamination.
- Drill cuttings and liners will be containerized as detailed in Section 3.2 of the 2016 Work Plan.
- Drilling equipment will be decontaminated as detailed in the Section 3.2 of the 2016 Work Plan.

2.1.3.2 Monitoring Well Development

The newly installed monitoring wells will be developed at least 48 hours after installation in accordance with NYSDEC protocols and the procedures outlined in the 2016 Work Plan.

2.1.3.3 Groundwater Sampling

Two rounds of groundwater sampling will be performed at all newly installed and replacement wells and will be submitted to Alpha Analytical, Inc. for analysis for VOCs (SW8260), to supplement the annual performance monitoring groundwater sampling. Groundwater samples will be collected in accordance with the *Low-Flow Groundwater Sampling Procedure* (Standard Operating Procedure [SOP]-07; EPA, 1996) and as detailed in Section 3.1.7 of the 2016 Work Plan.

During one groundwater sampling round, four wells will be sampled and submitted to Microbial Insights, Inc. for QuantArray-Chlor analysis to assess the microbial community composition.

2.1.4 Abandonment and Redevelopment of Existing Wells

2.1.4.1 Monitoring Well Abandonment

Eight monitoring wells will be abandoned, as shown on Figure 3, in accordance with NYSDEC CP-43: *Groundwater Monitoring Well Decommissioning Policy* (NYSDEC, 2009). Construction details on the eight wells to be abandoned are provided in Table 4, as well as recent total depth measurements to provide an estimate of sediment thicknesses within the wells. Abandonment methods will comply with NYSDEC policies; wells will be abandoned by grouting the casing:

- Each well will be abandoned by tremie grouting (utilizing neat cement) to 5 feet bgs, removing well vault and casing materials to at least 5 feet bgs, and backfilling the remaining with materials similar to native materials for the upper 5 feet. The surface will be restored to match the condition of the area surrounding the borehole (i.e., an asphalt patch, concrete patch, or grass).
- The grout will conform with the requirements of NYSDEC CP-43, with a standard grout mix: of 1 bag Portland cement, 3.9 pounds of bentonite, and 7.8 gallons of potable water.

2.1.4.2 Monitoring Well Redevelopment

Eight wells will be redeveloped, which includes all of the active recovery wells. Although these tasks are part of general operations and maintenance (O&M) at the site, these activities have been included within this work plan addendum to allow for a complete record. Monitoring/recovery wells to be redeveloped and repaired are shown on Figure 4 with details provided in Table 5. Redevelopment activities will be performed in accordance with NYSDEC protocols. Development water will be brought to the onsite treatment system for disposal.

2.1.5 Survey

Following installation, a licensed surveyor will survey the completed soil borings and monitoring wells. The horizontal and vertical locations for the monitoring well ground surface, steel flush-mount lid, and top of PVC well riser will be surveyed.

2.2 Waste Management Plan

Waste will be managed in accordance with Section 3.2 of the 2016 Work Plan (CH2M, 2016).

SECTION 3

Other Planning Documents

3.1 Quality Assurance Project Plan

An update to the previous Quality Assurance Project Plan (QAPP) is provided as Appendix A to this Work Plan Addendum.

3.2 Community Air Monitoring Plan

The Community Air Monitoring Plan detailed in the 2016 Work Plan remains relevant. No updates are needed.

3.3 Health and Safety Plan

The Health and Safety Plan detailed in the 2016 Work Plan remains relevant. No updates are needed.

Reporting and Schedule

4.1 Schedule

Schedule milestones have been established based on the assumption that an approved work plan is in place by July 2017. Field activities will not proceed until NYSDEC approves the work plan. In the event of changes in availability of regulatory staff, project approach, or site conditions, a revised schedule will be provided to NYSDEC. The anticipated schedule milestones are as follows:

Date	Milestone
June 2017	Submit work plan to NYSDEC and New York State Department of Health (NYSDOH) for review
July 2017	If necessary, meet with NYSDEC and NYSDOH to go over work plan
July 2017	Obtain NYSDEC approval on work plan
August/September 2017	Mobilize/Complete fieldwork
September 2017	Complete first groundwater sampling event in conjunction with performance monitoring sampling
March 2018	Complete second groundwater sampling event
March/April 2018	Submit report

4.2 Deliverables

CH2M will develop a report describing the investigation activities data and results; this report will be similar to the Data Investigation Report and will supplement that submittal. The report will include a summary of the field activities performed and present boring logs, summary tables and figures (including plume maps), provide updates to the CSM, and provide a preliminary identification of potential alternative remedial actions. The report will be submitted to NYSDEC and NYSDOH. Electronic data deliverables will be submitted to NSYDEC with the report.

A meeting with NYSDEC will be set up to discuss the results and proposed path forward.

SECTION 5

References

CH2M HILL Engineers, Inc. (CH2M). 2016. *Site Characterization Investigation Work Plan, Essex-Hope Site in Jamestown, New York, Site Number 907015*. Prepared for Essex Specialty Products, Inc. July.

CH2M HILL Engineers, Inc. (CH2M). 2017a. *2016 Data Gap Investigation Report for the Essex-Hope Site in Jamestown, New York*. Prepared for Essex Specialty Products, Inc. March.

CH2M HILL Engineers, Inc. (CH2M). 2017b. *2016 Annual Periodic Review Report, Essex/Hope Site, Jamestown, New York*. Prepared for Essex Specialty Products, Inc. March.

New York State Department of Environmental Conservation (NYSDEC). 2009. *CP-43: Groundwater Monitoring Well Decommissioning Policy*.

New York State Department of Environmental Conservation (NYSDEC). 2010. *DER-10 Technical Guidance for Site Investigation and Remediation*. http://www.dec.ny.gov/docs/remediation_hudson_pdf/der10.pdf. May.

U.S. Environmental Protection Agency (EPA). 1996. *Low-flow (minimal drawdown) ground-water sampling procedures*. Office of Solid Waste and Emergency Response, EPA/540/S-95/504. April.

Tables

Table 1. Soil Boring Information

Essex-Hope Site, Jamestown, New York

Sample Location Name	Proposed Final Depth (ft bgs)	GW Profiling Depth (ft bgs)	Rationale
DPT-05A	15	NA	Determine extent of TCE impacts observed at DPT-05. Quick turnaround to determine if need to step out.
DPT-05B	15	NA	
DPT-05C	15	NA	
DPT-05D	15	NA	
DPT-10	45	22-26 32-36	Assess if impacts in upper Deep WBZ, not intersected by well screen of MW-14D, exist.
DPT-11	45	10-15 22-26 32-36	Shallow: Assess level of impacts between MW-101S and 104S. Deep: Assess if impacts at MW-15D are continuous with MW-110D (connected plume) or if location part of capture zone/stagnation zone like MW-22D. Collect deep soil sample for NOD (permanganate).
DPT-12	45	10-15 22-26 32-36	Assess northern extent of plume from MW-104S to west. Assess if any soil impacts from offsite source near MW-104S.
DPT-13	45	10-15 22-26 32-36	Assess northern extent of shallow and deep plume; quick turnaround on deep GW analytical to determine if a deep well will be installed. Deep well may be installed if clean; stepout to north (DPT-16, DPT-17, DPT-18) if impacted.
DPT-14	45	22-26 32-36	Assess northern extent of deep plume – quick turnaround on analytical to determine if a well will be installed. Deep well may be installed if clean; stepout to north (DPT-16, DPT-17, DPT-18) if impacted.
DPT-15	45	22-26 32-36	Assess northern extent of deep plume – quick turnaround on analytical to determine if a well will be installed. Well may be installed if clean; stepout to north (DPT-16, DPT-17, DPT-18) if impacted.
DPT-16	45	22-26 32-36	Install if DPT-13, 14, and 15 indicate impacts; quick turnaround on anayltical results – well may be installed.
DPT-17	45	22-26 32-36	
DPT-18	45	22-26 32-36	
DPT-19	45	22-26	Assess if impacts in upper Deep WBZ, not intersected by well screen MW-25D, exist. Assess magnetic susceptibility of aquifer materials within shallow TCE plume.
DPT-20	15	10-15	Delineate CBTEX impacts observed around MW-26S
DPT-21	15	10-15	
DPT-22	15	10-15	
DPT-23	45	NA	Assess MNA amenability and oxidant demand (persulfate) in deep water bearing zone with high TCE and acetone concentrations
DPT-24	45	NA	Evalute extent of NAPL observed at PZ-4D.
DPT-25	45	NA	
DPT-26	45	NA	
DPT-27	45	NA	
MW-123D	45	NA	Assess vadose zone conditions in northern portion of North Parking Lot; Assess MNA amenability and oxidant demand (permanganate) in Deep WBZ with high TCE concentrations.

Notes:
ft bgs = feet below ground surface
All broundwater profiling samples to be analyzed for VOCs using EPA Method 8260.
DPT = direct-push technology
WBZ = water-bearing zone
TCE = trichloroethene
NOD = natural oxidant demand
MNA = monitored natural attenuation
CBTEX = cumene, benzene, toluene, ethylenzene, and xylene
PZ = piezometer

Table 2. Soil Sample Summary
Essex-Hope Site, Jamestown, New York

Proposed Location Name	Proposed Soil Sample Depth (ft bgs)	VOCs (SW8260)	PCBs (SW8082)	Magnetic Susceptibillity	Total Oxidant Demand
DPT-11 (MW-110D)	30-35				X
DPT-12	2-4 6-8	X			
DPT-19	15-20			X	
DPT-20	2-4 6-8	X			
DPT-21	2-4 6-8	X			
DPT-22	2-4 6-8	X			
DPT-05A	2-4 6-8	X	X		
DPT-05B	2-4 6-8	X	X		
DPT-05C	2-4 6-8	X	X		
DPT-05D	2-4 6-8	X	X		
DPT-23 (MW-021D)	25-35			X	X
DPT-24	Continous based on NAPL observations	X			
DPT-25		X			
DPT-26		X			
DPT-27		X			
MW-123D	2-4 6-8	X	X		
	25-35			X	X

Note:
Additional VOC analysis may be performed at other locations not noted above based on field observations.
ft bgs = feet below ground surface
NAPL = nonaqueous phase liquid
PCB = polychlorinated biphenyl
VOC = volatile organic compound

Table 3. Monitoring Well Construction Details

Essex-Hope Site, Jamestown, New York

Well_ID	Material	Screen Type/Slot Size (in.)	Filter Pack	Top of Screen (ft bgs)	Bottom of Screen (ft bgs)	Well Diameter (in.)
MW-109D	Sched. 40 PVC flush-threaded	PVC/0.01	20/40 sieve size (or equivalent)	35	45	2
MW-118S	Sched. 40 PVC flush-threaded	PVC/0.01	20/40 sieve size (or equivalent)	5	15	2
MW-118D	Sched. 40 PVC flush-threaded	PVC/0.01	20/40 sieve size (or equivalent)	35	45	2
MW-119D	Sched. 40 PVC flush-threaded	PVC/0.01	20/40 sieve size (or equivalent)	35	45	2
MW-120D	Sched. 40 PVC flush-threaded	PVC/0.01	20/40 sieve size (or equivalent)	35	45	2
MW-121D	Sched. 40 PVC flush-threaded	PVC/0.01	20/40 sieve size (or equivalent)	35	45	2
MW-122D	Sched. 40 PVC flush-threaded	PVC/0.01	20/40 sieve size (or equivalent)	35	45	2
MW-123D	Sched. 40 PVC flush-threaded	PVC/0.01	20/40 sieve size (or equivalent)	35	45	2

ft bgs = feet below ground surface

in. = inch

PVC = polyvinyl chloride

Table 4. Wells to Abandon

Essex-Hope Site, Jamestown, New York

Well	Recommendation	Depth to Top of Screen (ft bgs)	Depth to Bottom of Screen (ft bgs)	Reported Depth to Bottom	Well Seal Depths (ft bgs)	Borehole Diam. (in.)	Casing Diameter (in.)	Screen/Riser Type	Outer Casing	Type of Completion	Well Vault	Identified Issue
HW-1	Abandon – Perforate and Grout, Pull or Overdrill	15	20	N/A	Unknown	Unknown	2	PVC	No	Stick up	None	Stick up destroyed, open well
MW-2	Abandon – Grout	9	14	< 9	6.5-8	4.25	2	Stainless Steel	No	Flush mount	Stainless Steel	Filled with sediment above water table
MW-4	Abandon – Grout	13	18	<13	7-10	4.25	2	Stainless Steel	No	Flush mount	Stainless Steel	Filled with sediment above water table
MW-7D	Abandon – Grout, Replace	35	45	19.5	32-33	8	2	PVC	No	Flush mount	Steel	> 20' of sediment, sediment above well screen but within deep WBZ
MW-8	Abandon – Grout	39.6	49.6	Obstruction at 30 and 40 ft bgs	34-35	8	2	PVC	No	Flush mount	Steel	Obstructions at 30 ft bgs and 40 ft bgs.
PZ-7D	Abandon – Grout, Replace	22.0	42.0	33.6	14.5-16.75	4	1	PVC	3 inch PVC, 0-18 ft	Flush mount	Steel	> 8' of sediment
PZ-11D	Abandon – Grout	21.3	41.3	15.8	19-21	2.25	1	PVC	3 inch PVC, 0-24 ft	Flush mount	Steel	> 25' of sediment; sediment above screened interval and confining clay but within sealed outer casing
VP-5D	Abandon – Grout	12.5	34.3	13.0	8-11.5	10 inch to 12.5 ft 4 inch 12.5 to 38 ft bgs	2	PVC	5 inch steel, 0-12.5 ft bgs	Flush mount	Steel	> 20' of sediment, but sediment within screened interval

ft bgs = feet below ground surface

in. = inch

PVC = polyvinyl chloride

Table 5. Wells to Repair and/or Redevelop

Essex-Hope Site, Jamestown, New York

Well	Recommendation
MW-1	Cut down stick up well past "pinch point" and make flush mount well; redevelop
MW-13	Ensure tight-fitting well plug; repair well vault, redevelop
VP-6D	Repair well vault; redevelop
RW-1S	Repair well vault; Redevelop
RW-2S	Recovery Well Redevelop
RW-2D	Recovery Well Redevelop
RW-3S	Recovery Well Redevelop
RW-6D	Recovery Well Redevelop
GP-5D	Replace well vault lid and well plug
MW-6	Replace well vault lid and well plug
MW-7S	Replace well vault lid and well plug
MW-11	Replace well vault lid and well plug
MW-19D	Replace well vault lid and well plug

Figures

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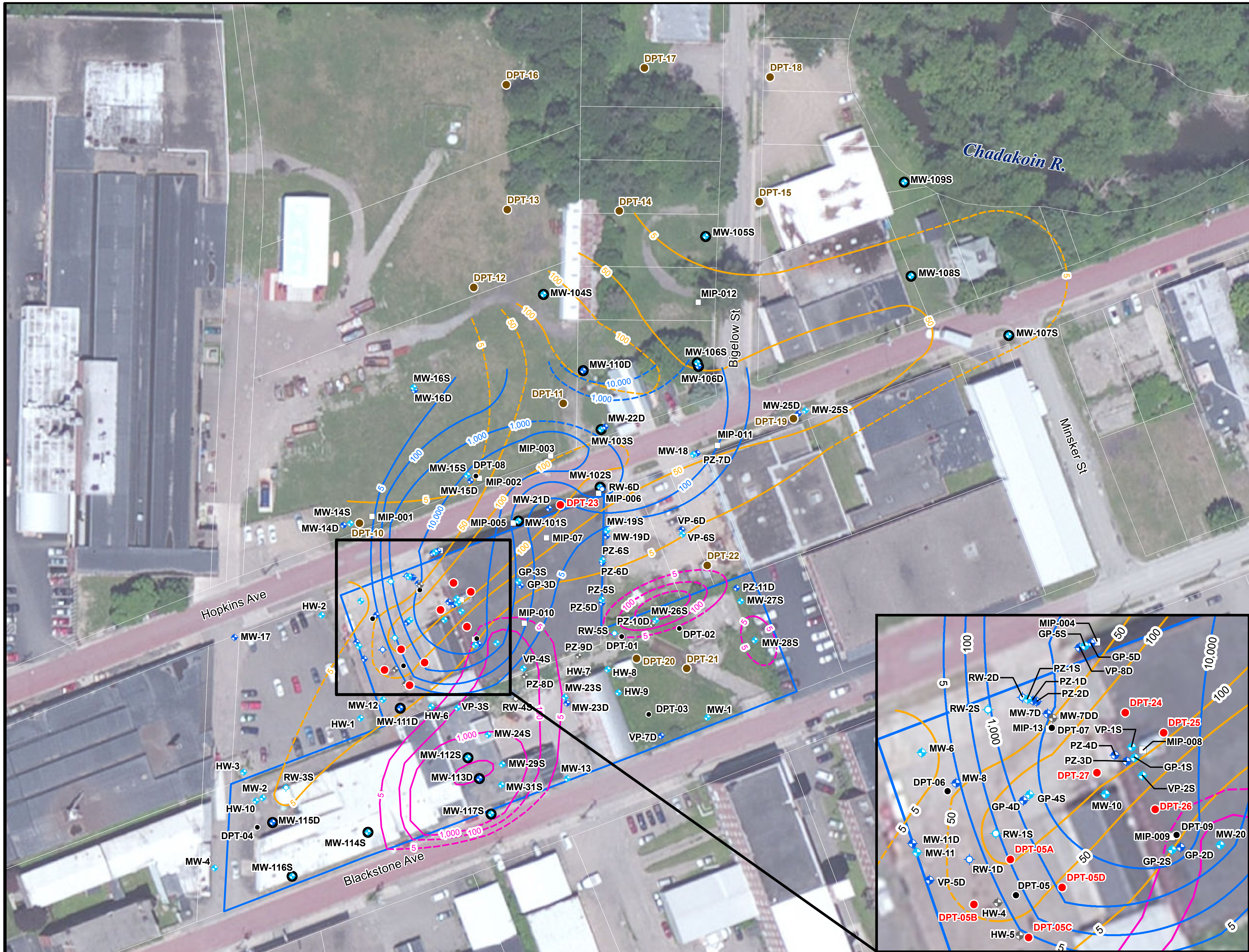

Legend

Approximate Site Boundary

Sample Type

- Proposed Direct Push Location
- GW Profiling Depths
- Monitoring Well
- Piezometer
- Recovery Well
- Direct Push Location
- MIP Location

Sample Depth

- NA (Abandoned)
- Shallow
- Deep

Contours (dashed where inferred)

- Shallow TCE Contours
- Deep TCE Contours
- Shallow Xylene Contours

N

0 90 180 Feet

1 inch = 92 feet

FIGURE 1
PROPOSED DPT LOCATIONS
2017 WORK PLAN
JAMESTOWN, NEW YORK

ch2m

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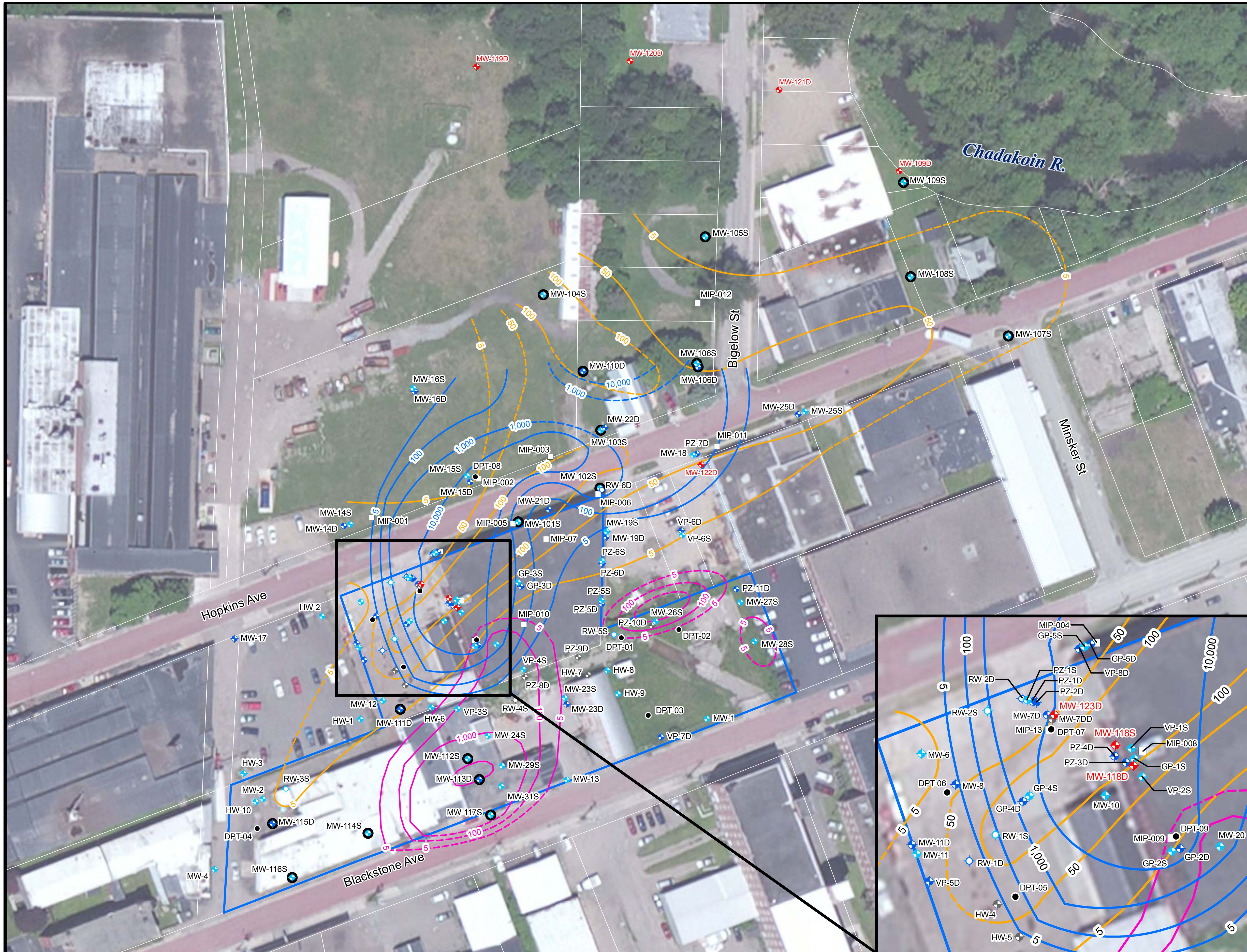

Legend

Approximate Site Boundary

Sample Type

- Proposed Monitoring Well Location
- Monitoring Well
- Piezometer
- Recovery Well
- Direct Push Location
- MIP Location

Sample Depth

- NA (Abandoned)
- Shallow
- Deep

Contours (dashed where inferred)

- Shallow TCE Contours
- Deep TCE Contours
- Shallow Xylene Contours

MW-119D, MW-120, and MW-121D locations will be based on DPT results and are approximate.

N

0 90 180 Feet

1 inch = 92 feet

FIGURE 2
PROPOSED WELL INSTALLATIONS
2017 WORK PLAN
JAMESTOWN, NEW YORK

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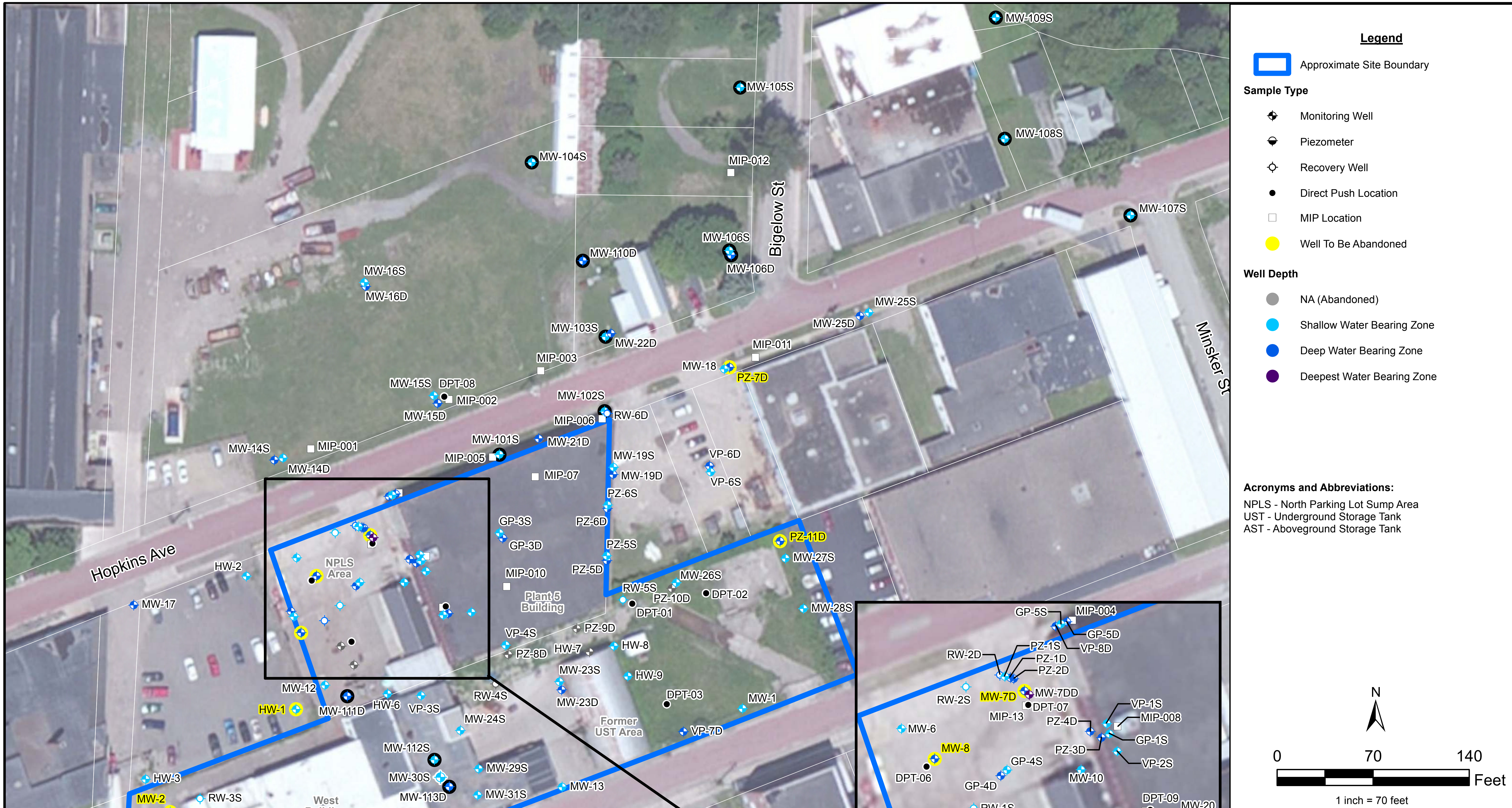

FIGURE 3
PROPOSED WELL ABANDONMENT LOCATIONS
2017 WORK PLAN
JAMESTOWN, NEW YORK

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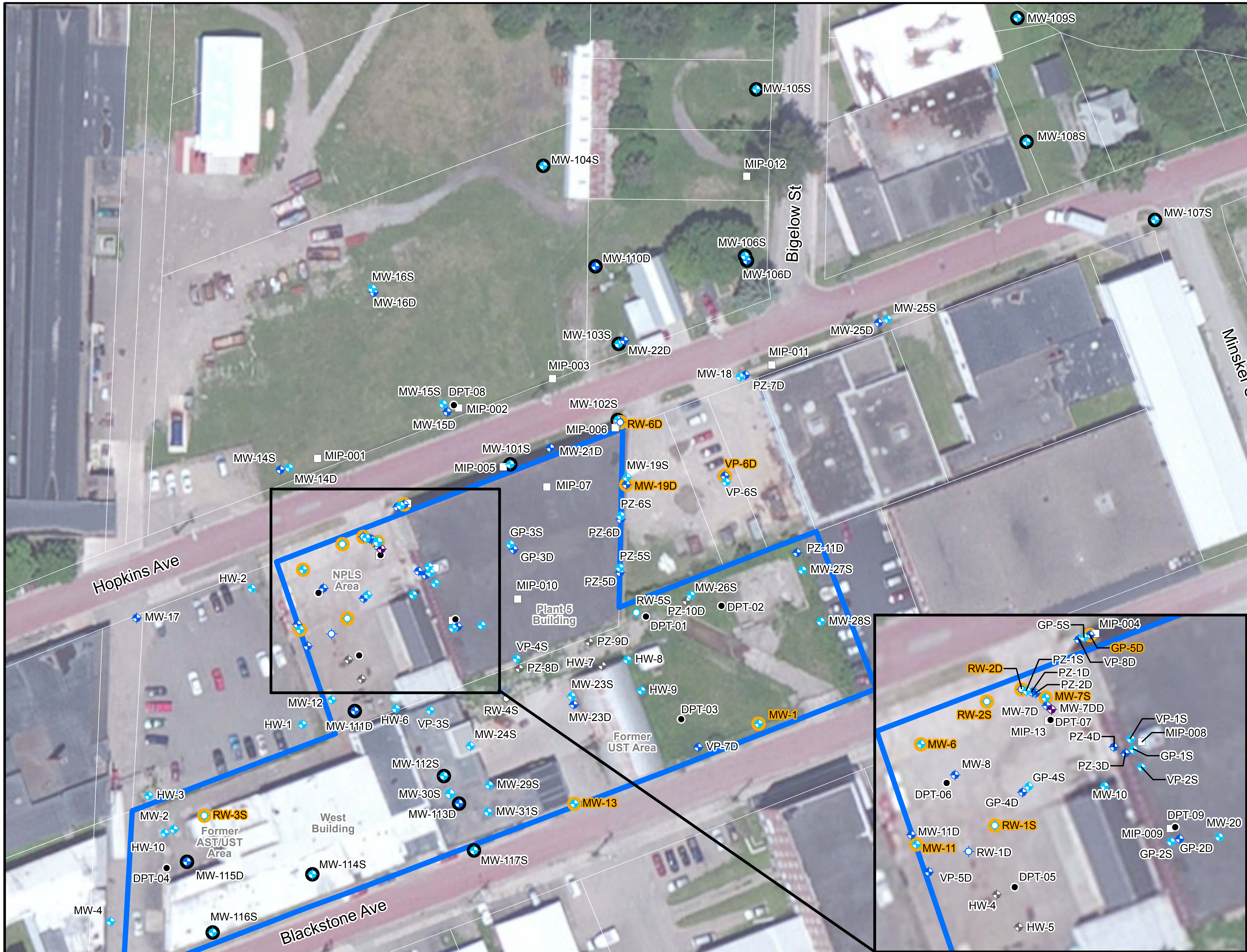

Legend

- Approximate Site Boundary

Sample Type

- Monitoring Well
- Piezometer
- Recovery Well
- Direct Push Location
- MIP Location
- New Monitoring Well Installed October 2016
- Well To Be Redeveloped or Repaired

Well Depth

- NA (Abandoned)
- Shallow Water Bearing Zone
- Deep Water Bearing Zone
- Deepest Water Bearing Zone

Acronyms and Abbreviations:

NPLS - North Parking Lot Sump Area
UST - Underground Storage Tank
AST - Aboveground Storage Tank

N

0 70 140 Feet

1 inch = 70 feet

FIGURE 4
WELL REDEVELOPMENT AND REPAIR LOCATIONS
2017 WORK PLAN
JAMESTOWN, NEW YORK

ch2m

Appendix A
Quality Assurance Project Plan Addendum

Quality Assurance Project Plan Addendum

Site Characterization Investigation Activities

Essex-Hope Site, Jamestown, New York

Prepared for

Essex Specialty Products, Inc.

June 2017

Contents

QUALITY ASSURANCE PROJECT PLAN ADDENDUM

Essex Specialty Products, Inc., Essex-Hope Site

Jamestown, New York

Site Characterization Investigation Activities

June 2017

Rev. 0

Prepared by: CH2M HILL Date: June 2017

Approved by:

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Introduction

This *Quality Assurance Project Plan Addendum* (QAPP Addendum) presents revisions to various sections of the *Quality Assurance Project Plan, Site Characterization Investigation Activities, Essex-Hope Site, Jamestown, New York* (CH2M HILL 2016) (QAPP) and presents additions and/or modifications to the quality assurance (QA)/quality control (QC) requirements specified in the QAPP (CH2M HILL 2016). The additions and/or modifications are necessary for current site investigation activities being conducted at The Essex Specialty Products, Inc. (ESP) Essex-Hope State Superfund site in Jamestown, New York.

The section numbers presented in this QAPP Addendum correspond to the pertinent sections in the QAPP (CH2M HILL 2016). All other sections of the QAPP (CH2M HILL 2016) will be followed by the project team.

1.1 Project Objectives and Background

The project objectives and background are provided in detail in Section 2 of the Site Characterization Investigation Work Plan (CH2M Hill 2016) (Work Plan).

1.3 Project Task/Organization

The investigation SOW and related project tasks are provided in detail in Sections 1.1 and 3 of the Work Plan.

3.3 Sampling Process Design and Rationale

Project-specific sampling plans will be developed following the logical process provided in USEPA's *Guidance on Systemic Planning using the Data Quality Objective Process* (USEPA 2006). The sampling design is a function of the matrix sampled, information about the sampling site, the type of data to be collected, and how the data are to be used. These sampling plans will be incorporated in the Work Plan.

3.4 Sample Handling and Custody Requirements

Laboratories will provide the required sample containers for all environmental and associated QC samples. Containers will be certified free of the analytes of concern for this project. No sample containers will be reused. The contract laboratory will add preservatives, if required, before shipping the sample containers to the field. Upon receipt of the samples, the laboratory will verify the adequacy of the preservation and add additional preservatives if necessary. Adjustments made by the laboratory will be documented on the appropriate sample receipt forms and noted in the case narrative. The analytical methods, sample containers, minimum quantities, required preservatives, and maximum holding times for select parameters are shown in Table 3-1. Extraction and preparatory methods are shown in Table 3-2. Tables are located at the end of this document.

Sample custody procedures will be followed as outlined in Section 3.5 of the QAPP (CH2M Hill 2016).

3.6 Analytical Method Requirements

Analytical methods will be performed in accordance with the QAPP (CH2M Hill 2016) and this QAPP Addendum, and will be reported as definitive data results. The following analytical methods will be used:

- SW8260C; Volatile organic compounds (VOCs) in groundwater/soil

In addition, the following methods, which are not included in the QAPP (CH2M Hill 2016), will be performed:

- SW8082; Polychlorinated Biphenyls (PCB) in soil
- Quantarray-Chlor; qPCR[1] in groundwater
- Magnetic Suspectibility in soil
- Total Oxidant Demand in soil

Target analyte lists and RL objectives for each method are specified in Attachment A. Requested RLs will be based on meeting New York State Department of Environmental Conservation (NYSDEC) unrestricted use soil cleanup objectives or water quality standards.

[1] qPCR = quantitative polymerase chain reaction

3.8 Quality Control Requirements

The QC samples to be included in the site investigation activities are outlined in Section 3.8 of the QAPP (CH2M Hill 2016).

Required QC checks, minimum frequencies, acceptance criteria, and corrective actions are included in Attachment A, when applicable. No specific QC checks are required for Quantarray-Chlor, magnetic suspectibility, or total oxidant demand.

5.2 Data Verification and Validation Methods

All analytical results of the data collection effort associated with the site investigation activities will be validated by CH2M. All data for this program will undergo **Level 3** validation unless otherwise noted as specified in Section 5.2.3 of the QAPP (CH2M Hill 2016).

References

CH2M HILL (CH2M). 2016. *Site Characterization Investigation Work Plan, Essex-Hope Site in Jamestown, New York*. June.

CH2M HILL (CH2M). 2016. *Quality Assurance Project Plan, Site Characterization Investigation Activities, Essex-Hope Site in Jamestown, New York*. June.

Tables

Table 3-1. Required Analytical Method, Sample Containers, Preservation, and Holding Times
Essex-Hope Site, Jamestown, New York

Analyses	Analytical Method	Sample Matrix[a]	Container[b]	Qty	Preservative[c]	Holding Time [d]
Volatile Organic Compounds	SW-846 8260C	W	40-mL, glass	3	HCl, pH<2; cool to 4°C	14 days
		S	5 g–Encore or equivalent sampling technique	3	Cool 4°C	48 hours from collection to preservation, 14 days to analysis
Polychlorinated Biphenyls	SW-846 8082	S	4-oz glass	1	Cool 4°C	14 days to extraction; 40 days from extraction to analysis
Quantarray-Chlor	Lab SOP	W	1-L, poly	1	Cool 4°C	24 – 48hours
Magnetic Suspectibility	Lab SOP	S	TBD	1	None	None
Total Oxidant Demand	Lab SOP	S	Large Ziplock Bag containing 2 kg soil	1	Cool 4°C	None

Notes:

Sample container, and volume requirements will be specified by the analytical laboratory performing the tests.

Three times the required volume should be collected for samples designated as MS/MSD samples.

[a] Sample matrix: S = surface soil, subsurface soil; W = surface water

[b] All containers will be sealed with Teflon-lined screw caps.

[c] All samples will be stored promptly at 4°C in an insulated chest.

[d] Holding times are from the time of sample collection unless otherwise specified.

°C = Degrees Celsius
g = Grams

mL = Milliliter

kg = Kilograms

HCl = Hydrochloric acid

oz = Ounce

TBD = to be determined

Table 3-2. Extraction and Digestion Methods
Essex-Hope Site, Jamestown, New York

Analytical Method	Parameter	Preparatory Methods
SW8082	Polychlorinated Biphenyls (water and soil)	SW3010C, SW3050C
SW8260C	Volatile Organic Compounds (water and soil)	SW5030C, SW5035
Quantarray-Chlor	qPCR (water)	See analytical method
Lab SOP	Magnetic Suspectibility	See analytical method
Lab SOP	Total Oxidant Demand	See analytical method

Attachment A

Table A-1. Reporting Limit Objectives for Volatile Organic Compounds in Groundwater by Method SW8260C
Essex-Hope Site, Jamestown, New York

Parameter	CAS Number	Site-Specific Remedial Action Objective	NYSDEC Water Quality Standards[a] (µg/L)	Method Detection Limit (µg/L)	Reporting Limit (µg/L)
1,1,1,2-Tetrachloroethane	630-20-6		--	0.7	2.5
1,1,1-Trichloroethane	71-55-6		5.0	0.7	2.5
1,1,2,2-Tetrachloroethane	79-34-5		5.0	0.14	0.5
1,1,2-Trichloroethane	79-00-5		1.0	0.5	1.5
1,1-Dichloroethane	75-34-3		5.0	0.7	2.5
1,1-Dichloroethene	75-35-4		5.0	0.14	0.5
1,1-Dichloropropene	563-58-6		--	0.7	2.5
1,2,3-Trichlorobenzene	87-61-6		5.0	0.7	2.5
1,2,3-Trichloropropane	96-18-4		--	0.7	2.5
1,2,4-Trichlorobenzene	120-82-1		5.0	0.7	2.5
1,2,4-Trimethylbenzene	95-63-6		--	0.7	2.5
1,2-Dibromo-3-chloropropane	96-12-8		0.04	0.7	2.5
1,2-Dibromoethane	106-93-4		0.0006	0.65	2.0
1,2-Dichlorobenzene	95-50-1		3.0	0.7	2.5
1,2-Dichloroethane	107-06-2		0.6	0.13	0.5
1,2-Dichloropropane	78-87-5		1.0	0.13	1.0
1,3,5-Trimethylbenzene	108-67-8		--	0.7	2.5
1,3-Dichlorobenzene	541-73-1		3.0	0.7	2.5
1,3-Dichloropropane	142-28-9		--	0.7	2.5
1,4-Dichlorobenzene	106-46-7		3.0	0.7	2.5
1,4-Dioxane	123-91-1		--	41	250
2,2-Dichloropropane	594-20-7		--	0.7	2.5
2-Butanone	78-93-3		50	1.9	5.0
2-Chlorotoluene	95-49-8		--	0.7	2.5
2-Hexanone	591-78-6		50	1.0	5.0
4-Chlorotoluene	106-43-4		--	0.7	2.5
4-Methyl-2-pentanone	108-10-1		--	1.0	5.0
Acetone	67-64-1		50	1.5	5.0
Benzene	71-43-2		1.0	0.16	0.5
Bromobenzene	108-86-1		--	0.7	2.5
Bromochloromethane	74-97-5		5.0	0.7	2.5
Bromodichloromethane	75-27-4		50	0.19	0.5
Bromoform	75-25-2		50	0.65	2.0
Bromomethane	74-83-9		5.0	0.7	2.5
Carbon disulfide	75-15-0		60	1.0	5.0
Carbon tetrachloride	56-23-5		5.0	0.13	0.5
Chlorobenzene	108-90-7		5.0	0.7	2.5
Chloroethane	75-00-3		5.0	0.7	2.5
Chloroform	67-66-3		7.0	0.7	2.5
Chloromethane	74-87-3		--	0.7	2.5

Table A-1. Reporting Limit Objectives for Volatile Organic Compounds in Groundwater by Method SW8260C
Essex-Hope Site, Jamestown, New York

Parameter	CAS Number	Site-Specific Remedial Action Objective	NYSDEC Water Quality Standards[a] (µg/L)	Method Detection Limit (µg/L)	Reporting Limit (µg/L)
cis-1,2-Dichloroethene	156-59-2		5.0	0.7	2.5
cis-1,3-Dichloropropene	10061-01-5		0.4	0.14	0.5
Chlorodibromomethane	124-48-1		50	0.15	0.5
Dibromomethane	74-95-3		--	1.0	5.0
Dichlorodifluoromethane	75-71-8		5.0	1.0	5.0
Ethylbenzene	100-41-4	5.0	5.0	0.7	2.5
Hexachlorobutadiene	87-68-3		--	0.7	2.5
Isopropylbenzene	98-82-8		5.0	0.7	2.5
m-,p-Xylene	179601-23-1	5.0	5.0	0.7	2.5
Methylene chloride	75-09-2		5.0	0.7	2.5
Methyl t-Butyl Ether (MTBE)	1634-04-4		--	0.7	2.5
n-Butylbenzene	104-51-8		--	0.7	2.5
n-Propylbenzene	103-65-1		--	0.7	2.5
Naphthalene	91-20-3		--	0.7	2.5
o-Xylene	95-47-6	5.0	5.0	0.7	2.5
p-Isopropyltoluene	99-87-6		--	0.7	2.5
sec-Butylbenzene	135-98-8		--	0.7	2.5
Styrene	100-42-5		5.0	0.7	2.5
tert-Butylbenzene	98-06-6		--	0.7	2.5
Tetrachloroethene	127-18-4		5.0	0.18	0.5
Toluene	108-88-3	5.0	5.0	0.7	2.5
trans-1,2-Dichloroethene	156-60-5	5.0	5.0	0.7	2.5
trans-1,3-Dichloropropene	10061-02-6		0.4	0.16	0.5
Trichloroethene	79-01-6	5.9	5.0	0.18	0.5
Trichlorofluoromethane	75-69-4		5.0	0.7	2.5
Vinyl acetate	108-05-4		--	1.0	5.0
Vinyl chloride	75-01-4	5.0	2.0	0.07	1

[a] NYSDEC Ambient Water Quality Standards and Guidance Values (1998) and 2000 Addendum
µg/L – micrograms per liter

Table A-2. Reporting Limit Objectives for Volatile Organic Compounds in Soils by Method SW8260C
Essex-Hope Site, Jamestown, New York

Parameter	CAS Number	Site Specific Remedial Action Objective	NYSDEC Unrestricted Use SCO[a] Screening Criteria (µg/kg)	Method Detection Limit (µg/kg)	Reporting Limit (µg/kg)
1,1,1,2-Tetrachloroethane	630-20-6	1,000	--	0.32	1.0
1,1,1-Trichloroethane	71-55-6	1,000	680	0.11	1.0
1,1,2,2-Tetrachloroethane	79-34-5	1,000	--	0.10	1.0
1,1,2-Trichloroethane	79-00-5	1,000	--	0.30	1.5
1,1-Dichloroethane	75-34-3	1,000	270	0.086	1.5
1,1-Dichloroethene	75-35-4	1,000	330	0.26	1.0
1,1-Dichloropropene	563-58-6	1,000	--	0.14	5.0
1,2,3-Trichlorobenzene	87-61-6	1,000	--	0.15	5.0
1,2,3-Trichloropropane	96-18-4	1,000	--	0.16	10
1,2,4-Trichlorobenzene	120-82-1	1,000	--	0.18	2.0
1,2,4-Trimethylbenzene	95-63-6	1,000	3,600	0.14	5.0
1,2-Dibromo-3-chloropropane	96-12-8	1,000	--	0.40	5.0
1,2-Dibromoethane	106-93-4	1,000	--	0.17	4.0
1,2-Dichlorobenzene	95-50-1	1,000	1,100	0.15	5.0
1,2-Dichloroethane	107-06-2	1,000	20	0.11	1.0
1,2-Dichloropropane	78-87-5	1,000	--	0.23	3.5
1,3,5-Trimethylbenzene	108-67-8	1,000	8,400	0.14	5.0
1,3-Dichlorobenzene	541-73-1	1,000	2,400	0.14	5.0
1,3-Dichloropropane	142-28-9	1,000	--	0.15	5.0
1,4-Dichlorobenzene	106-46-7	1,000	1,800	0.14	5.0
1,4-Dioxane	123-91-1	1,000	100	14	100
2,2-Dichloropropane	594-20-7	1,000	--	0.23	5.0
2-Butanone	78-93-3	1,000	120	0.27	10
2-Chlorotoluene	95-49-8	1,000	--	0.16	5.0
2-Hexanone	591-78-6	1,000	--	0.67	10
4-Chlorotoluene	106-43-4	1,000	--	0.13	5.0
4-Methyl-2-pentanone	108-10-1	1,000	--	0.24	10
Acetone	67-64-1	1,000	50	1.0	10
Benzene	71-43-2	1,000	60	0.12	1.0
Bromobenzene	108-86-1	1,000	--	0.21	5.0
Bromochloromethane	74-97-5	1,000	--	0.28	5.0
Bromodichloromethane	75-27-4	1,000	--	0.17	1.0
Bromoform	75-25-2	1,000	--	0.24	4.0
Bromomethane	74-83-9	1,000	--	0.34	2.0
Carbon disulfide	75-15-0	1,000	--	1.1	10
Carbon tetrachloride	56-23-5	1,000	760	0.21	1.0
Chlorobenzene	108-90-7	1,000	1,100	0.35	1.0
Chloroethane	75-00-3	1,000	--	0.32	2.0
Chloroform	67-66-3	1,000	370	0.37	1.5

Table A-2. Reporting Limit Objectives for Volatile Organic Compounds in Soils by Method SW8260C
Essex-Hope Site, Jamestown, New York

Parameter	CAS Number	Site Specific Remedial Action Objective	NYSDEC Unrestricted Use SCO[a] Screening Criteria (µg/kg)	Method Detection Limit (µg/kg)	Reporting Limit (µg/kg)
Chloromethane	74-87-3	1,000	--	0.29	5.0
cis-1,2-Dichloroethene	156-59-2	1,000	250	0.14	1.0
cis-1,3-Dichloropropene	10061-01-5	1,000	--	0.12	1.0
Chlorodibromomethane	124-48-1	1,000	--	0.15	1.0
Dibromomethane	74-95-3	1,000	--	0.16	10
Dichlorodifluoromethane	75-71-8	1,000	--	0.19	10
Ethylbenzene	100-41-4	1,000	1,000	0.13	1.0
Hexachlorobutadiene	87-68-3	1,000	--	0.23	5.0
Isopropylbenzene	98-82-8	1,000	2,300	0.10	1.0
m-,p-Xylene	179601-23-1	1,000	260	0.20	2.0
Methylene chloride	75-09-2	1,000	50	1.1	10
Methyl t-Butyl Ether (MTBE)	1634-04-4	1,000	930	0.084	2.0
n-Butylbenzene	104-51-8	1,000	12,000	0.11	1.0
n-Propylbenzene	103-65-1	1,000	3,900	0.11	1.0
Naphthalene	91-20-3	1,000	12,000	0.14	5.0
o-Xylene	95-47-6	1,000	260	0.17	2.0
p-Isopropyltoluene	99-87-6	1,000	10,000	0.13	1.0
sec-Butylbenzene	135-98-8	1,000	11,000	0.12	1.0
Styrene	100-42-5	1,000	--	0.40	2.0
tert-Butylbenzene	98-06-6	1,000	5,900	0.14	5.0
Tetrachloroethene	127-18-4	1,000	1,300	0.14	1.0
Toluene	108-88-3	1,000	700	0.19	1.5
trans-1,2-Dichloroethene	156-60-5	1,000	190	0.21	1.5
trans-1,3-Dichloropropene	10061-02-6	1,000	--	0.12	1.0
Trichloroethene	79-01-6	1,000	470	0.13	1.0
Trichlorofluoromethane	75-69-4	1,000	--	0.39	5.0
Vinyl acetate	108-05-4	1,000	--	0.13	10
Vinyl chloride	75-01-4	1,000	20	0.12	2.0

[a] NYSDEC Soil Cleanup Objectives (SCO) for Unrestricted Use (NYSDEC 2006, 2010) are presented for selecting appropriate Method Detection Limits and Reporting Limits. Site-specific RAOs were presented in the 1994 ROD and are the site cleanup goals
µg/kg – micrograms per kilogram

Table A-3. Reporting Limit Objectives for Polychlorinated Biphenyls in Soil by Method SW8082
Essex-Hope Site, Jamestown, New York

Analyte	NYSDEC Unrestricted Use SCO[a] Screening Criteria (µg/kg)	Method Detection Limits (µg/kg)	Reporting Limits (µg/kg)
Aroclor 1016	100	2.6	33.5
Aroclor 1221	100	3.1	33.5
Aroclor 1232	100	3.9	33.5
Aroclor 1242	100	4.1	33.5
Aroclor 1248	100	2.8	33.5
Aroclor 1254	100	2.8	33.5
Aroclor 1260	100	2.6	33.5
Aroclor 1262	100	1.7	33.5
Aroclor 1268	100	4.9	33.5

[a] NYSDEC Soil Cleanup Objectives (SCO) for Unrestricted Use (NYSDEC 2006 and 2010) are presented for selecting appropriate Method Detection Limits and Reporting Limits. Site-specific RAOs were presented in the 1994 ROD and are the site cleanup goals
µg/kg – micrograms per kilogram

Table A-4. Reporting Limit Objectives for Other Parameters in Groundwater/Soil by Various Methods
Essex-Hope Site, Jamestown, New York

Analyte	Method	NYSDEC Water Quality Standards[a]	NYSDEC Unrestricted Use SCO[b] Screening Criteria	Reporting Limits
Dehalococcoides spp. (DHC)	QuantArray-Chlor	---	---	4.2 cells/mL
tceA Reductase (TCE)	QuantArray-Chlor	---	---	4.2 cells/mL
BAV1 Vinyl Chloride Reductase (BVC)	QuantArray-Chlor	---	---	4.2 cells/mL
Vinyl Chloride Reductase (VCR)	QuantArray-Chlor	---	---	4.2 cells/mL
Dehalobacter sp. (DHBt)	QuantArray-Chlor	---	---	4.2 cells/mL
Dehalobacter DCM (DCM)	QuantArray-Chlor	---	---	4.2 cells/mL
Dehalogenimonas spp. (DHG)	QuantArray-Chlor	---	---	4.2 cells/mL
Desulfitobacterium spp (DSB)	QuantArray-Chlor	---	---	4.2 cells/mL
Dehalobium chlorocoercia (DECO)	QuantArray-Chlor	---	---	4.2 cells/mL
Desulfuromonas spp. (DSM)	QuantArray-Chlor	---	---	4.2 cells/mL
Chloroform reductase (CFR)	QuantArray-Chlor	---	---	4.2 cells/mL
1,1-DCA Reductase (DCA)	QuantArray-Chlor	---	---	4.2 cells/mL
1,2-DCA Reductase (DCAR)	QuantArray-Chlor	---	---	4.2 cells/mL
Soluble Methane Monooxygenase (SMMO)	QuantArray-Chlor	---	---	4.2 cells/mL
Particulate Methane Monooxygenase (PMMO)	QuantArray-Chlor	---	---	4.2 cells/mL
Toluene Dioxygenase (TOD)	QuantArray-Chlor	---	---	4.2 cells/mL
Phenol Hydroxylase (PHE)	QuantArray-Chlor	---	---	4.2 cells/mL
Trichlorobenzene Dioxygenase (TCBO)	QuantArray-Chlor	---	---	4.2 cells/mL
Toluene Monooxygenase 2 (RDEG)	QuantArray-Chlor	---	---	4.2 cells/mL
Toluene Monooxygenase (RMO)	QuantArray-Chlor	---	---	4.2 cells/mL
Ethene Monooxygenase (EtnC)	QuantArray-Chlor	---	---	4.2 cells/mL
Epoxyalkane transferase (EtnE)	QuantArray-Chlor	---	---	4.2 cells/mL
Dichlormethane dehalogenase (DCMA)	QuantArray-Chlor	---	---	4.2 cells/mL
Total Eubacteria (EBAC)	QuantArray-Chlor	---	---	4.2 cells/mL
Sulfate Reducing Bacteria (APS)	QuantArray-Chlor	---	---	4.2 cells/mL
Methanogens (MGN)	QuantArray-Chlor	---	---	4.2 cells/mL
Total Oxidant Demand	Lab SOP	---	--	0.5 g/Kg

[a] NYSDEC Water Quality Standards and Guidance Values (1998)

[b] NYSDEC Soil Cleanup Objectives (SCO) for Unrestricted Use (NYSDEC 2006 and 2010) are presented for selecting appropriate Method Detection Limits and Reporting Limits.
g – grams

Kg – kilograms
mL – milliliter

Table A-5. Accuracy and Precision for Volatile Organic Compounds by Method SW8260C

Essex-Hope Site, Jamestown, New York

Parameter	LCS/LCSD/MS/MSD Accuracy Water (%R) LCL	LCS/LCSD/MS/MSD Accuracy Water (%R) UCL	Precision Water (%RPD)	LCS/LCSD/MS/MSD Accuracy Soil (%R) LCL	LCS/LCSD/MS/MSD Accuracy Soil (%R) UCL	Precision Soil (%RPD)
1,1,1,2-Tetrachloroethane	64	130	≤ 20	70	130	≤ 30
1,1,1-Trichloroethane	67	130	≤ 20	70	130	≤ 30
1,1,2,2-Tetrachloroethane	67	130	≤ 20	70	130	≤ 30
1,1,2-Trichloroethane	70	130	≤ 20	70	130	≤ 30
1,1-Dichloroethane	70	130	≤ 20	65	135	≤ 30
1,1-Dichloroethene	61	145	≤ 20	70	130	≤ 30
1,1-Dichloropropene	70	130	≤ 20	70	130	≤ 30
1,2,3-Trichlorobenzene	70	130	≤ 20	70	130	≤ 30
1,2,3-Trichloropropane	64	130	≤ 20	68	130	≤ 30
1,2,4-Trichlorobenzene	70	130	≤ 20	70	130	≤ 30
1,2,4-Trimethylbenzene	70	130	≤ 20	70	130	≤ 30
1,2-Dibromo-3-chloropropane	41	144	≤ 20	68	130	≤ 30
1,2-Dibromoethane	70	130	≤ 20	70	130	≤ 30
1,2-Dichlorobenzene	70	130	≤ 20	70	130	≤ 30
1,2-Dichloroethane	70	130	≤ 20	70	130	≤ 30
1,2-Dichloropropane	70	130	≤ 20	70	130	≤ 30
1,3,5-Trimethylbenzene	64	130	≤ 20	70	130	≤ 30
1,3-Dichlorobenzene	70	130	≤ 20	70	130	≤ 30
1,3-Dichloropropane	70	130	≤ 20	69	130	≤ 30
1,4-Dichlorobenzene	70	130	≤ 20	70	130	≤ 30
1.4-Dioxane	56	162	≤ 20	65	136	≤ 30
2,2-Dichloropropane	63	133	≤ 20	70	130	≤ 30
2-Butanone (MEK)	63	138	≤ 20	70	130	≤ 30
2-Chlorotoluene	70	130	≤ 20	70	130	≤ 30
2-Hexanone	57	130	≤ 20	70	130	≤ 30
4-Chlorotoluene	70	130	≤ 20	70	130	≤ 30
4-Methyl-2-pentanone (MIBK)	59	130	≤ 20	70	130	≤ 30
Acetone	58	148	≤ 20	54	140	≤ 30
Benzene	70	130	≤ 20	70	130	≤ 30
Bromobenzene	70	130	≤ 20	70	130	≤ 30
Bromochloromethane	70	130	≤ 20	70	130	≤ 30
Bromodichloromethane	67	130	≤ 20	70	130	≤ 30
Bromoform	54	136	≤ 20	70	130	≤ 30
Bromomethane	39	139	≤ 20	57	147	≤ 30
Carbon disulfide	51	130	≤ 20	59	130	≤ 30
Carbon tetrachloride	63	132	≤ 20	70	130	≤ 30
Chlorobenzene	75	130	≤ 20	70	130	≤ 30
Chlorodibromomethane	63	130	≤ 20	70	130	≤ 30
Chloroethane	55	138	≤ 20	50	151	≤ 30

Table A-5. Accuracy and Precision for Volatile Organic Compounds by Method SW8260C
Essex-Hope Site, Jamestown, New York

Parameter	LCS/LCSD/MS/MSD Accuracy Water (%R) LCL	LCS/LCSD/MS/MSD Accuracy Water (%R) UCL	Precision Water (%RPD)	LCS/LCSD/MS/MSD Accuracy Soil (%R) LCL	LCS/LCSD/MS/MSD Accuracy Soil (%R) UCL	Precision Soil (%RPD)
Chloroform	70	130	≤ 20	70	130	≤ 30
Chloromethane	64	130	≤ 20	52	130	≤ 30
cis-1,2-Dichloroethene	70	130	≤ 20	70	130	≤ 30
cis-1,3-Dichloropropene	70	130	≤ 20	70	130	≤ 30
Dibromomethane	70	130	≤ 20	70	130	≤ 30
Dichlorodifluoromethane	36	147	≤ 20	30	146	≤ 30
Ethylbenzene	70	130	≤ 20	70	130	≤ 30
Hexachlorobutadiene	63	130	≤ 20	67	130	≤ 30
Isopropylbenzene	70	130	≤ 20	70	130	≤ 30
Methylene Chloride	70	130	≤ 20	70	130	≤ 30
Methyl-t butyl ether	63	130	≤ 20	66	130	≤ 30
m,p-xylene	70	130	≤ 20	70	130	≤ 30
n-Butylbenzene	53	136	≤ 20	70	130	≤ 30
N-Propylbenzene	69	130	≤ 20	70	130	≤ 30
Naphthalene	70	130	≤ 20	70	130	≤ 30
o-xylene	70	130	≤ 20	70	130	≤ 30
p-Isopropyltoluene	70	130	≤ 20	70	130	≤ 30
sec-Butylbenzene	70	130	≤ 20	70	130	≤ 30
Styrene	70	130	≤ 20	70	130	≤ 30
tert-Butylbenzene	70	130	≤ 20	70	130	≤ 30
Tetrachloroethene	70	130	≤ 20	70	130	≤ 30
Toluene	70	130	≤ 20	70	130	≤ 30
trans-1,2-Dichloroethene	70	130	≤ 20	70	130	≤ 30
trans-1,3-Dichloropropene	70	130	≤ 20	70	130	≤ 30
Trichloroethene	70	130	≤ 20	70	130	≤ 30
Trichlorofluoromethane	62	150	≤ 20	70	139	≤ 30
Vinyl Acetate	70	130	≤ 20	70	130	≤ 30
Vinyl chloride	55	140	≤ 20	67	130	≤ 30
Surrogates						
1,2-Dichloroethane-d4	70	130	--	70	130	--
4-Bromofluorobenzene	70	130	--	70	130	--
Dibromofluoromethane	70	130	--	70	130	--
Toluene-d8	70	130	--	70	130	--

%R = percent recovery
RPD = relative percent difference

Table A-6. Accuracy and Precision Limits for Polychlorinated Biphenyls by Method SW8082 (Soil)
Essex-Hope Site, Jamestown, New York

Analyte	LCS/MS/MSD Accuracy Soil (%R)		Precision Soil (% RPD)
	LCL	UCL	
Aroclor 1016	40	140	≤ 50
Aroclor 1260	40	140	≤ 50
Surrogates			
2,4,5,6-Tetrachloro-m-xylene	30	150	
Decachlorobiphenyl	30	150	

%R = percent recovery
RPD = relative percent difference

Table A-7. Calibration and QC Requirements for Volatile Organic Compounds by SW8260C
Essex-Hope Site, Jamestown, New York

QC Check	Frequency	Criteria	Corrective Action
BFB Tuning	Prior to initial calibration and calibration verification (every 12 hours)	Refer to criteria listed in the method	Retune instrument and verify
Multi-point initial calibration (minimum five points)	Prior to sample analysis, or when calibration verification fails	Average RF for all analytes ≥ 0.10[a] and one option below: Option 1: %RSD for all analytes ≤ 20% Option 2: Least squares regression r ≥ 0.990	Correct the problem and repeat the initial calibration.
Second-source calibration verification	Once for each multi-point initial calibration	All analytes within ±30% of expected value	Correct the problem and repeat initial calibration.
Continuing calibration verification	At the start of each analytical sequence and every 12 hours thereafter	Average RF for all analytes ≥ 0.10[a] All analytes within + 20% of expected value.	Correct the problem, then recalibrate and reanalyze all samples since the last acceptable continuing calibration verification.
Retention time window calculated for each analyte	Each analyte	Relative retention time of each analyte within + 0.06 relative retention time units of the continuing calibration verification	Not applicable (used for identification of analyte)
Internal Standards	Each sample and QC sample, method blank, MS/MSD and LCS	Retention time within ±30 seconds from retention time of the daily continuing calibration verification standard. EICP area within –50% to +100% of the daily continuing calibration verification standard	Inspect mass spectrometer and gas chromatography for malfunctions; reanalyze all affected samples
Method Blank	At least one per analytical batch	No analytes detected at or above the reporting limit	Correct the problem, then re-prep and reanalyze all associated samples
Surrogate spike	Every standard, sample, method blank, MS/MSD and LCS	All surrogates in samples, method blank and LCS within limits specified in Accuracy and Precision table	Correct the problem and reanalyze (re-prep if necessary).
MS/MSD	One set per 20 project-specific samples	Within limits specified in Accuracy and Precision table	None
LCS	At least one per analytical batch	Within limits specified in Accuracy and Precision table	Correct the problem, then re-prep and reanalyze the LCS and all samples in the analytical batch.

[a]Average relative response factor (RRF) specific for each comment. See Table 4 in SW8260C method.

Table A-8. Calibration and QC Requirements for Polychlorinated Biphenyls by SW8082
Essex-Hope Site, Jamestown, New York

QC Check	Frequency	Criteria	Corrective Action
Multi-point initial calibration (minimum five points) for Aroclors 1016/1260 only	Prior to sample analysis, or when calibration verification fails	Option 1: %RSD for all analytes ≤ 20% Option 2: Least squares regression r ≥ 0.990	Correct the problem and repeat the initial calibration.
Second-source calibration verification	Once for each multi-point initial calibration	All analytes within ±20% of expected value	Correct the problem and repeat initial calibration.
Continuing calibration verification	At the start of each analytical sequence and every 12 hours thereafter	All analytes within ±15% of expected value.	Correct the problem, then recalibrate and reanalyze all samples since the last acceptable continuing calibration verification.
Method Blank	At least one per analytical batch	No analytes detected at or above the reporting limit	Correct the problem, then re-prep and reanalyze all associated samples
Surrogate spike	Every standard, sample, method blank, MS/MSD and LCS	All surrogates in samples, method blank and LCS within limits specified in Accuracy and Precision table	Correct the problem and reanalyze (re-prep if necessary).
MS/MSD	One set per 20 project-specific samples	Within limits specified in Accuracy and Precision table	None
LCS	At least one per analytical batch	Within limits specified in Accuracy and Precision table	Correct the problem, then re-prep and reanalyze the LCS and all samples in the analytical batch.