2019 Groundwater Monitoring Results and MNA Performance Evaluation Report

Former Hampshire Chemical Corp. Facility
Waterloo, New York
Site No. 850001A

Prepared for

Hampshire Chemical Corp.

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Acronyms and Abbreviations

µg/L	microgram(s) per liter
Alpha Analytical	Alpha Analytical, Inc.
AOC	area of concern
As III	trivalent arsenite
As V	pentavalent arsenate
canal	Cayuga-Seneca Canal
CH2M	CH2M HILL Engineers, Inc.
COC	constituent of concern
Cr III	trivalent chromium
Cr VI	hexavalent chromium
DER	Division of Environmental Remediation
DO	dissolved oxygen
Eh	redox potential
ELAP	Environmental Laboratory Accreditation Program
EPA	U.S. Environmental Protection Agency
ft/day	feet per day
ft/ft	feet per foot
GWMP	Groundwater Monitoring Work Plan
HAO	hydrous aluminum oxide
HCC	Hampshire Chemical Corp.
HFO	hydrous ferric oxide
ID	identification
IDW	investigation-derived waste
Jacobs	Jacobs Engineering Group Inc.
LTMWP	Long-term Monitoring Work Plan
MDL	method detection limit
mg/L	milligram(s) per liter
MIBK	methyl isobutyl ketone (4-methyl-2-pentanone)
MNA	monitored natural attenuation
MS	matrix spike
MSD	matrix spike duplicate
MW	monitoring well
NaHS	sodium hydrosulfide

NaOH	sodium hydroxide
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OBWZ	overburden water-bearing zone
ORP	oxidation-reduction potential
PAH	polycyclic aromatic hydrocarbon
PZ	piezometer
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RCRA	Resource Conservation and Recovery Act
RFI	Resource Conservation and Recovery Act facility investigation
site	former Hampshire Chemical Corp. facility (now known as the Evans Chemetics Facility) in Waterloo, New York
SU	standard unit
SVOC	semivolatile organic compound
SWMU	solid waste management unit
TAL	target analyte list
TOGS Class GA	Technical Operation Guidance Series New York State Ambient Water Quality Standards and Guidance Values – Class GA
USDOT	U.S. Department of Transportation
USGS	U.S. Geological Survey
VOC	volatile organic compound

SECTION 1

Introduction

This report presents the results of the sitewide groundwater monitoring activities conducted during August and October 2019 (reporting period) at the former Hampshire Chemical Corp. (HCC) facility in Waterloo, New York (site). Additionally, the report summarizes the findings from Year Five of a monitored natural attenuation (MNA) study, involving Areas of Concern (AOCs) B and D at the site. The report discusses how natural hydrologic, biological, mineralogical, and geochemical conditions prevalent in the shallow subsurface reduce concentrations for constituents of concern (COCs), and attenuate COC migration in groundwater.

The site is regulated under Title 6 of the New York Code of Rules and Regulations Part 373 and the Resource Conservation and Recovery Act (RCRA) with the New York State Department of Environmental Conservation (NYSDEC) as the lead agency. RCRA facility investigations (RFIs) have been performed at the site since 1993 to evaluate the nature and extent of releases to the environment. Pursuant to the Administrative Order on Consent executed between HCC and NYSDEC (NYSDEC, 2011), sitewide groundwater monitoring was proposed in the Groundwater Monitoring Work Plan (GWMP; CH2M HILL Engineers, Inc. [CH2M] 2008a), to support evaluating the most appropriate long-term strategy for remediating groundwater. NYSDEC approved the GWMP for the monitoring period running from 2009 through 2013. HCC subsequently submitted a revised Site Groundwater Long-term Monitoring Work Plan (LTMWP; CH2M 2013a, 2013b, 2013d, 2014a) to continue groundwater monitoring, which was approved in early 2016 (NYSDEC 2016). NYSDEC selected MNA as an appropriate interim corrective measure for AOCs B and D in their correspondence dated April 21, 2015 and June 29, 2015 (NYSDEC 2015a, 2015b).

Field data were collected following NYSDEC Division of Environmental Remediation (DER)-10/Technical Guidance for Site Investigation and Remediation (NYSDEC, 2010).

1.1 Site Setting and Background

The site is located at 228 East Main Street in the village of Waterloo, Seneca County, New York. Figure 1-1 shows the site location (all figures and tables are located at the end of this report). The facility is bordered to the north by East Main Street, to the east by Gorham Street, and to the west by East Water Street. The Cayuga-Seneca Canal (canal) flows west to east along the southern boundary of the property. The site is located within the watershed of the Seneca River. The site comprises several interconnected buildings that house offices, a quality control (QC) laboratory, a chemical treatment plant, and manufacturing, maintenance, and shipping/receiving operations (Figure 1-2). The site also includes outside drum storage areas and several tank farms. The RFI Report (CH2M 2006) and RFI Report Addendum (CH2M 2008b) present additional information regarding site setting, history, and manufacturing processes.

The site lies on an alluvial plain, underlain by silts and clays with lenses of sand and gravel overlying glacial till comprised of hard to very hard silt and clay. Historical fill material overlies the native alluvium and till deposits. Bedrock occurs at depths ranging from approximately 15 to 35 feet below ground surface. The bedrock surface depth generally increases with depth from north to south. Groundwater flow in the overburden follows the topography of the land from north to south toward the canal.

Thirty-one groundwater monitoring wells support the LTMWP implementation. Groundwater elevation measurements and samples were previously collected from the Building 4 Pit Sump, which was approved for decommissioning by NYSDEC and then abandoned on December 15-16, 2014, as described in a technical memorandum submitted to NYSDEC on January 25, 2015 (CH2M 2015a). Groundwater elevation measurements from two stilling wells (SG-01 and SG-02) were used prior to 2012 to record water elevations in the Cayuga-Seneca Canal Raceway and Canal, respectively. SG-01 was destroyed in fall 2011 during facility activities, and SG-02 was removed for AOC A remedial activities. Sixteen groundwater monitoring wells were decommissioned as part of the LTMWP during November 2015 and September 2016 (CH2M 2017b).

1.2 Site Activities Performed

The following activities were completed during this reporting period:

- Measured the depth-to-water from 30 groundwater monitoring wells between October 29 and October 31, 2019.
- Conducted groundwater sampling of 23 groundwater monitoring wells for laboratory analysis from August 15 to August 22, 2019, and October 31, 2019 (for wells requiring Level B personal protective equipment).

1.3 Report Organization

This groundwater monitoring and MNA report contains the following sections:

- Section 1, Introduction
- Section 2, Groundwater Monitoring Activities
- Section 3, Groundwater Sampling Results
- Section 4, Monitored Natural Attenuation at the Site
- Section 5, Monitored Natural Attenuation Results for Year Five
- Section 6, Conclusions
- Section 7, References

Supporting tables, figures, and appendixes are included at the end of this report.

SECTION 2

Groundwater Monitoring Activities

This section provides summaries of the groundwater elevation measurements, sampling activities, and activities conducted as part of the data quality review.

2.1 Groundwater Flow Evaluation

On October 29 through October 31, 2019, depth-to-water was measured in groundwater monitoring wells to evaluate the potentiometric surface, groundwater flow directions and hydraulic gradients in the overburden water-bearing zone (OBWZ). Measurements were collected in accordance with the LTMWP (CH2M 2014a) using an electronic water level meter with 0.01-foot graduations, which was decontaminated between wells. The depth-to-water measurements and calculated groundwater elevations are presented and discussed in Section 3.1. A groundwater flow evaluation specific to AOCs B and D with respect to MNA appears in Section 5.1.

2.2 Groundwater Sampling

During August and October 2019, groundwater samples were collected from 23 monitoring wells associated with the site in accordance with LTMWP and the U.S. Environmental Protection Agency (EPA) Region 2 *Groundwater Sampling Procedure—Low Stress (Low Flow) Purging and Sampling* (sampling procedures) (EPA 1998). All sampling activities were conducted in accordance with the project's Quality Assurance Project Plan (QAPP; CH2M 2009a). All groundwater monitoring wells included in the LTMWP are shown on Figure 1-2, of which 23 were scheduled for sampling in 2019. Table 2-1 summarizes information on each groundwater sample collected in 2019. The analytical results for the groundwater samples are included in Appendix A and discussed in Section 3.2.

A variable-speed peristaltic pump equipped with Teflon-lined polyethylene tubing was used to purge groundwater from the monitoring wells. Field chemistry parameters were measured during purging using a Horiba U-52 water quality meter with an inline flow-through cell; the parameters recorded included pH (as standard units [SUs]), temperature (as degrees Celsius), dissolved oxygen (DO; as milligrams per liter [mg/L]), oxidation-reduction potential (ORP; as millivolts), and specific conductance (as milliSiemens per centimeter [mS/cm]). Turbidity was measured in the field using a standalone LaMotte turbidity meter. To avoid cross-contamination, new tubing was used at each sampling location and disposed of after a single use. Field measurements were recorded on groundwater sampling forms, which are included in Appendix B.

In general, groundwater was removed from each well until the water quality parameters stabilized to within criteria established in the sampling procedures; however, several monitoring wells required additional attention to measure field chemistry measurements and collect the laboratory sample. Field chemistry parameters at piezometer 06 (PZ-06) never stabilized because the well failed to recharge at even the lowest purging rates. At monitoring well 18 (MW-18) and MW-31, wells had to recharge several times prior to sampling. In these cases, the wells were purged dry and groundwater samples were collected within 24 hours. Groundwater samples were containerized in separate clean, laboratory-prepared containers, placed in ice-filled insulated coolers, and transported to a laboratory for analysis under chain-of-custody control. Additional sample volume was collected at each monitoring well to measure ferrous iron concentrations in the field using a Hach 8290 field measurement kit and Accuvac ferrous iron reagent ampules. The groundwater samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), polycyclic aromatic hydrocarbons (PAHs), metals, and/or parameters for MNA (Table 2-1).

Additional groundwater samples were collected and analyzed for quality assurance (QA)/QC purposes. QA/QC samples collected during the reporting period included:

- Three field duplicates
- Two matrix spike (MS)/matrix spike duplicates (MSDs)
- One field blanks
- Six trip blanks

The field duplicate and MS/MSD samples were collected from monitoring wells using methodologies described previously and analyzed for parameters listed in Table 2-1. The field blank was collected in the solid waste management unit 1 (SWMU 1) area near MW-16I. The field blank was collected by pouring laboratory-provided deionized water into laboratory-provided sampling containers at a sampling location in that AOC. The field blank was submitted to the laboratory for the same parameters sampled at the AOC. Trip blanks accompanied all samples intended for VOC analysis and each sample cooler containing the empty (pre-sample) and filled (post-sample) VOC bottleware. Trip blanks confirm that the samples were not exposed to VOCs from environmental conditions during sampling or transit to the laboratory. The trip blank remained unopened until received at the laboratory with the samples.

The groundwater and QA/QC water samples were submitted under chain-of-custody to Alpha Analytical, Inc. of Westborough, Massachusetts (Alpha Analytical) (New York State Laboratory Identification [ID] No. 11148). Alpha Analytical is an approved laboratory under the New York State Environmental Laboratory Accreditation Program (ELAP). A copy of the New York State Department of Health (NYSDOH) ELAP certification for Alpha Analytical is included in Appendix C.

Alpha Analytical performed the following analyses as specified in the LTMWP and QAPP (CH2M 2014a, 2009a):

- VOCs by EPA SW-846 Method SW8260C
- PAHs by EPA Method SW8270D SIM
- SVOCs by EPA Method SW8270D
- Target analyte list (TAL) metals by EPA Method SW6020A

Groundwater samples were analyzed for total metals and dissolved metals. Dissolved metals samples were collected after the other sample bottles were filled by passing groundwater through a 0.45-micron filter. In addition, samples from AOCs B and D were collected to assess groundwater for natural attenuation via the following analyses performed by Alpha Analytical:

- Alkalinity by EPA Method SM2320B
- Nitrate by EPA Method E353.2
- Total phosphorus by EPA Method SM4500 P-E
- Chloride and sulfate by EPA Method E300.0
- Total organic carbon by EPA Method SM5310C
- Orthophosphate by EPA Method SM4500 P-E
- Total dissolved solids by EPA Method SM2540C
- Total sulfide by EPA Method SM4500-S2 D
- Total Kjeldahl nitrogen by EPA Method 351.3

2.3 Waste Management

Investigation-derived waste (IDW) from the 2019 field activities was containerized and stored onsite for offsite disposal. Liquid wastes from monitoring well purging and equipment decontamination were containerized in U.S. Department of Transportation (USDOT)-approved 55-gallon drums on wooden pallets in a secondary containment area. Solid wastes from field activities (e.g., personal protective equipment and sample tubing) were also containerized in USDOT-approved 55-gallon drums. The IDW was removed for offsite disposal by Clean Harbors, Inc.

2.4 Data Quality Review

Alpha Analytical performed laboratory analysis of the water samples and provided electronic reports of the results to Jacobs Engineering Group Inc. (Jacobs). A Jacobs chemist reviewed the results and data packages to evaluate the quality and usability of the analytical data. Based on the results of the data quality review, laboratory qualifiers were added to summary tables for specific analytes where appropriate, and the data reported by the laboratory were found to be suitable for its intended purpose. Data quality review technical memoranda are provided in Appendix D and discussed in detail in Section 3.4.

SECTION 3

Groundwater Sampling Results

Section 3 presents the results of the water level monitoring and groundwater sampling field activities described in Section 2.

3.1 Groundwater Flow Evaluation

Table 3-1 summarizes the results of the groundwater elevation monitoring event during the reporting period. Figure 3-1 presents the potentiometric surface map (contour map) in the OBWZ for the 2019 monitoring events. As inferred from the contour map, groundwater flowed south toward the canal, consistent with historical conditions observed at the site. The horizontal hydraulic gradients calculated for selected well pairs were consistent with previous data as follows:

- 0.0031 feet per foot (ft/ft) for the MW-10/09R well pair (east side of site)
- 0.050 ft/ft for the MW-06/18 well pair (west side of site)

A groundwater flow evaluation specific to AOCs B and D with respect to MNA appears in Section 5.1.

3.2 Groundwater Sampling Results

Table 3-2 presents the monitoring wells, sampling frequency, and categories included in the LTMWP (CH2M 2014a). Tables 3-3 through 3-6 provide VOCs, SVOCs, metals, and MNA parameters results for the reporting period. Analytical reports received from the laboratory are included in Appendix A. Additionally, an electronic copy of the analytical data in the format required for the NYSDEC EQuIS database is included in Appendix A. The analytical data tables for this report are grouped by SWMU, AOC, or site-specific areas, as shown in the table.

The following sections summarize groundwater sampling results for each well grouping onsite. The analytical data obtained during this reporting period are discussed in conjunction with historical results from the following reports:

- *RCRA Facility Investigation Report, Former Hampshire Chemical Corp., Waterloo, New York* (CH2M 2006)
- *RCRA Facility Investigation Report Addendum, Former Hampshire Chemical Corp., Waterloo, New York* (CH2M 2008b; revised February 2010)
- *Groundwater Monitoring Results Report – October 2008, April 2009 and October 2009 Sampling Events, Former Hampshire Chemical Corp Facility, Waterloo, New York* (CH2M 2009b)
- *Groundwater Monitoring Results Report, April 2010 and November 2010 Monitoring Events. Former Hampshire Chemical Corp. Facility, Waterloo, New York* (CH2M 2011)
- *Additional Investigation Results Report, Former Hampshire Chemical Corp. Facility, Waterloo, NY* (CH2M 2012a) based on the *Additional Groundwater Investigation Work Plan, Former Hampshire Chemical Corp. Facility, Waterloo, New York* (CH2M 2010)
- *Groundwater Monitoring Results Report, April 2011 and November 2011 Monitoring Events. Former Hampshire Chemical Corp. Facility, Waterloo, New York* (CH2M 2012b)
- *Groundwater Monitoring Results Report, April and October 2012 Monitoring Events, Former Hampshire Chemical Corp. Facility, Waterloo, New York* (CH2M 2013c)

- *Groundwater Monitoring Results Report, April and October 2013 Monitoring Events. Former Hampshire Chemical Corp. Facility, Waterloo, New York* (CH2M 2014b)
- *Groundwater Monitoring Results, November 2014 Monitoring Event, Former Hampshire Chemical Corp. Facility, Waterloo, New York, Site No. 850001A* (CH2M 2015b)
- *Monitored Natural Attenuation Performance Evaluation Report, Year One, Former Hampshire Chemical Corp. Facility, Waterloo, New York, Site No. 850001A* (CH2M 2017b)
- *2016 and 2017 Groundwater Monitoring Results and MNA Performance Evaluation Report, Former Hampshire Chemical Corp. Facility, Waterloo, New York, Site No. 850001A* (CH2M 2018)
- *Monitored Natural Attenuation Performance Evaluation Report, Year Four, Former Hampshire Chemical Corp. Facility, Waterloo, New York, Site No. 850001A* (Jacobs 2019) *Evaluation of Subslab Hydrogen Sulfide and Methane Concentrations* (CH2M 2017c)

Concentrations of analytes except methyl isobutyl ketone (MIBK) were compared to the Technical Operation Guidance Series New York State Ambient Water Quality Standards and Guidance Values Class GA (TOGS Class GA) Standards (NYSDEC 1998 and 2004). However, NYSDEC has not issued a TOGS Class GA Standard for MIBK. Per NYSDEC (2005), the NYSDOH guidance value for MIBK is based on the maximum contaminant level for unspecified organic contaminants Part 5 Sanitary Code for Public Water System and is 50 micrograms per liter (µg/L) (NYSDOH 2011). Figures 3-2 through 3-5 summarize the groundwater analytical exceedances per SWMU, AOC, and other site groupings.

3.2.1 Groundwater Results—SWMU 1

Five monitoring wells (MW-16I, MW-17, MW-18, MW-26, and TW-01) are associated with SWMU 1. All five monitoring wells were sampled during the August 2019 monitoring event. Table 3-3 summarizes the analytical results for groundwater samples collected from SWMU 1 during August 2019. Figure 3-2 summarizes the constituent concentrations exceeding the TOGS Class GA standards for the reporting period.

The following analytes were detected at concentrations exceeding the TOGS Class GA standards in groundwater samples from SWMU 1 wells during the reporting period:

- Benzo(a)anthracene (MW-17), chrysene (MW-17), total arsenic (MW-17), total iron (MW-16I, MW-17, MW-18, MW-26, and TW-01), total magnesium (TW-01), total manganese (MW-16I, MW-17, and MW-18), total sodium (MW-16I, MW-17, MW-18, MW-26, and TW-01), dissolved arsenic (MW-17), dissolved iron (MW-16I, MW-17, MW-18, MW-26, and TW-01) and/or dissolved manganese (MW-16I, MW-17, and MW-18).

As discussed in Section 2.2, MW-18 was allowed to recharge several times during sample collection; because of this, the sample turbidity exceeded 30 NTU.

3.2.2 Groundwater Results—AOC B

Five monitoring wells (MW-01, MW-02, MW-03, MW-33, and MW-34) and five piezometers (PZ-01, PZ-03, PZ-04, PZ-06, and PZ-07/PZ-07R) are associated with AOC B. During the August and October 2019 sampling events, the LTMWP sampling schedule included three monitoring wells (MW-02, MW-03, and MW-33) and three piezometers (PZ-03, PZ-04, and PZ-06). MW-03 was not sampled in 2019 because of health and safety concerns due to high concentrations of hydrogen sulfide and methane in the well casing. Table 3-4 summarizes the analytical results for groundwater samples collected from AOC B during August and October 2019. Figure 3-3 summarizes concentrations of constituents exceeding the TOGS Class GA standards. Section 5.2 evaluates the groundwater chemistry from AOC B regarding COC attenuation since the start of MNA activities in November 2014.

The analytes associated with the following constituent classes were detected at concentrations exceeding the TOGS Class GA standards in groundwater samples from AOC B wells during the reporting period:

- VOCs at MW-33 (1,2-dichloropropane, benzene, and toluene), and PZ-03 (1,2-DCA).
- Total arsenic (MW-33 and PZ-03), total chromium (MW-33), total iron (PZ-03 and PZ-06), total magnesium (MW-33 and PZ-03), total manganese (MW-33), total sodium (all sampled locations), and/or dissolved arsenic (MW-33 and PZ-03), dissolved chromium (MW-33), and dissolved manganese (MW-33).
- Chloride (MW-33, PZ-03 and PZ-04), sulfate (MW-02, MW-33, PZ-03 and PZ-04), and/or sulfide (all sampled locations).

Although multiple analytes (iron, manganese, sodium, chloride, and arsenic) display concentrations exceeding the TOGS Class GA Standards, a large fraction represent constituents that occur naturally in shallow groundwater beneath the area.

3.2.3 Groundwater Results—AOC D

Nine monitoring wells (MW-11S, MW-21, MW-24, MW-29, MW-30, MW-31, MW-35, MW-36, and MW-37) are associated with AOC D. During the August sampling event, the LTMWP schedule included six monitoring wells for sampling in 2019 (MW-11S, MW-21, MW-30, MW-31, MW-35 and MW-36). Table 3-5 summarizes the analytical results for groundwater samples collected from AOC D during August and October 2019. Figure 3-4 shows constituent concentrations exceeding the TOGS Class GA standards for the reporting period. Section 4.2 evaluates the AOC D groundwater results with respect to MNA performance.

Analytes associated with the following constituent classes were detected at concentrations exceeding the TOGS Class GA standards in groundwater samples from AOC D wells during the reporting period:

- Total arsenic (MW-11S, MW-21 and MW-35), total iron (MW-21, MW-31, MW-35, and MW-36), total magnesium (MW-35 and MW-36), total sodium (all sampled locations), dissolved arsenic (MW-11S, MW-21 and MW-35), and dissolved iron (MW-21, MW-30, MW-31, MW-35, and MW-36).
- General chemistry parameters chloride (all sampled locations except MW-35), sulfate (MW-21, MW-30 and MW-31), and/or sulfide (MW-11S, MW-21, MW-30 and MW-31).

3.2.4 Groundwater Results—Supplemental Monitoring Wells

Seven monitoring wells (MW-05I, MW-06, MW-07, MW-09R, MW_10, MW-19, and MW-20) are located outside the boundaries of site AOCs and are classified as supplemental wells in the LTMWP. All seven wells were sampled during the August 2019 monitoring event. Table 3-6 summarizes the analytical results for groundwater samples collected from the supplemental wells during August 2019. Figure 3-5 summarizes constituent concentrations exceeding the TOGS Class GA standards for the reporting period.

The following analytes were detected at concentrations exceeding the TOGS Class GA standards in groundwater samples from supplemental wells during the reporting period:

- Two VOCs (cis-1,2-DCE and trans-1,2-DCE) at MW-19, and chloromethane at MW-05I, MW-10, MW-19, and MW-20.
- Six SVOCs (benzo(a)anthracene, benzo(a)pyrene), benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and indeno(1,2,3-c,d)pyrene, and benzo(a)anthracene at MW-07.

- Total iron (MW-07, MW-09R, MW-19, and MW-20), total magnesium (MW-09R, MW-19, and MW-20), total manganese (MW-09R and MW-19), total sodium (all sampled locations), dissolved iron (MW-09R and MW-19), and dissolved manganese (MW-09R and MW-19).

3.3 Quality Assurance/Quality Control Samples

Table 2-1 presents the sample IDs and sample delivery groups for the QA/QC samples. Table 3-7 presents the analytical results of the field blanks and trip blanks for the reporting period. Acetone was detected above the laboratory detection limits in all trip blanks and the field blank and chloromethane in five out of six trip blanks; the results for these analytes were qualified as described in Appendix D.

3.4 Data Quality Review Summary

Appendix D contains a detailed data quality evaluation for groundwater samples collected during the August and October 2019 sampling events. The following conclusions also appear in the data quality evaluation:

- Precision was generally acceptable; however, acetone was qualified as estimated in four samples due to field duplicate relative percent difference (FD RPD) issues.
- Accuracy was generally acceptable; however, a few analytes were qualified as estimated due to calibration, laboratory control spiking sample, and/or MS/MSD issues. Analytes that were qualified as not detected or rejected due to calibration/method and/or trip blank contamination are tabulated in Appendix D.
- Representativeness of the data was verified through the sample’s collection, storage and preservation procedures and the verification of holding-time compliance. The sample containers associated with the metals, ammonia, TKN and phosphorus analyses were received with a pH greater than criteria for sample MW21-081519, resulting in the data being qualified as estimated. The data were reported from analyses within the EPA recommended holding time.
- The completeness goal of 95 percent was met for all method/analytes combinations except for benzoic acid which was 75 percent complete.
- The data appears acceptable for decision making, other than the rejected data noted above, taking into consideration the validation flags applied.

SECTION 4

Monitored Natural Attenuation at the Site

Natural Attenuation relies on natural processes to attenuate concentrations for COCs to achieve site-specific remediation objectives within a reasonable timeframe as compared with active remedial methods. Natural attenuation comprises a variety of physical, chemical, or biological processes that work without human intervention to reduce the mass, toxicity, mobility, and volume of constituent concentrations in groundwater.

Performance monitoring to evaluate the effectiveness of a remedy and protect human health and the environment forms a critical element of most response actions. This report describes attenuation of critical COCs in groundwater at AOC B and AOC D for Year Five of the MNA program. For the first year of monitoring, sampling was conducted quarterly at AOCs B and D and involved sampling six monitoring wells during each event. Year One sampling at AOC B extended from November 2014 to November 2015. Similarly, sampling was conducted at AOC D in November 2014, followed by a gap of 1 year, and then sampling at a quarterly frequency starting in November 2015, extending to September 2016.

Year One results are described in the *Monitored Natural Attenuation Performance Evaluation Report, Year One, Former Hampshire Chemical Corp. Facility, Waterloo, New York, Site No. 850001A* (CH2M 2017b). Sampling for Year Five was conducted in August and October 2019. Because of ongoing remedial activities at the site, MW-02, PZ-04, and PZ-06 at AOC B, and MW-11S, MW-21, MW-30, MW-31, MW-35, and MW-36 at AOC D were sampled during August 2019. However, remedial activities delayed sampling at MW-33 and PZ-03 at AOC B in Level B personal protective equipment until October 2019.

For the remainder of the performance period, HCC will sample the monitoring wells according to Table 3-2. In addition to annual sampling, four other monitoring wells at AOC B are scheduled for sampling every 5 years.

The following sections describe monitoring wells, sampling frequency, and analytes specific to AOCs B and D.

4.1 AOC B MNA Sampling Summary

Sampling during Year Five at AOC B was conducted as follows:

- Annual groundwater samples were collected at MW-02, PZ-03, PZ-04, PZ-06, and MW-33 in August and October 2019.
- An annual groundwater sample was not collected at MW-03 during Year Five due to high concentrations of hydrogen sulfide in the head space of the monitoring well (CH2M 2017d).

During the Year Five event, samples were analyzed for TAL metals, VOCs, cations, anions, nutrients, and general water quality constituents (Table 2-1). In addition to laboratory analytes, field parameters were measured while purging the monitoring wells, including temperature, pH, DO, specific conductance, ORP, ferrous iron, sulfide, and/or sulfate. Together, the field and laboratory analyses supported evaluating MNA effectiveness at AOC B.

The main COCs in groundwater at AOC B include MIBK, acetone, and chromium. Elevated concentrations of the three COCs appear in the same monitoring wells, forming a smaller groundwater plume beneath Building 4.

4.2 AOC D MNA Sampling Summary

In August 2019, HCC collected groundwater samples at MW-11S, MW-21, MW-30, MW-31, MW-35, and MW-36. Samples were analyzed for TAL metals, cations, anions, nutrients, and general water quality constituents. Field parameters also were measured while purging the monitoring wells, including temperature, pH, DO, specific conductance, ORP, ferrous iron, sulfide, and/or sulfate. Together, the field and laboratory analyses were used to evaluate MNA effectiveness at AOC D.

At AOC D, arsenic in groundwater represents the only COC. Spills of caustic sodium hydroxide (NaOH) and sodium hydrosulfide (NaHS) in Building 3 infiltrated to groundwater, increasing its pH from approximately 6.5 SU to 12 SU. The alkaline pH alters the surface charge on common, metal oxide mineral surfaces like hydrous ferric oxide (HFO) and hydrous aluminum oxide (HAO) from positive to negative. As a result, negatively charged oxyanions, like arsenic, previously adsorbed to these surfaces are repelled, desorbing from the surfaces, and increasing arsenic concentrations in groundwater. Accordingly, laboratory analytes and field chemistry measurements were tailored to evaluate arsenic concentrations with time, constituents that influence its mobility, along with characterizing geochemical conditions beneath AOC D that influence arsenic persistence and migration.

SECTION 5

Monitored Natural Attenuation Results for Year Five

This section describes the results of synoptic surveys and groundwater sampling conducted during Year Five of the MNA performance monitoring at AOCs B and D, performed in August and October 2019. During Year Five, monitoring wells sampled at AOC B comprised MW-02, MW-33, PZ-03, PZ-04, and PZ-06. MW-11S, MW-21, MW-30, MW-31, MW-35, and MW-36 defined the list of monitoring wells sampled at AOC D during Year Five.

5.1 AOC B Monitoring Results

Data from the annual synoptic surveys and groundwater sampling were evaluated as part of the Year Five MNA study. The synoptic survey was conducted to characterize groundwater flow directions, gradients, and velocities across AOC B in October 2019, in association with sampling PZ-03 and MW-33. The survey also documented the range in groundwater elevations in the OBWZ across the AOC.

Groundwater sampling data were evaluated to examine COC concentrations (MIBK and chromium), distribution, and temporal trends. As a product of MIBK degradation, acetone concentrations were also assessed. Concentrations with time were assessed at individual monitoring wells and as part of contiguous COC plumes. Analytical data supported characterizing geochemical conditions in the OBWZ at AOC B, including major ion chemistry, redox potential (Eh), ionic strength, nutrients, and abundance of trace metals. These factors, individually or in combination, can influence the attenuation of COCs at AOC B.

5.1.1 AOC B Hydraulic Monitoring Results

On October 31, 2019, groundwater flowed toward the canal (Figure 5-1) at gradients ranging from 0.04 to 0.08 ft/ft. Like previous water level surveys, the flowable cement mass used in abandoning BLDG4-PIT-SSP influenced the potentiometric surface from October 2019, by elevating equi-potentials behind the structure, while increasing the gradient downgradient of BLDG4-PIT-SSP, inferring a mound. The pattern appeared during every previous synoptic event at AOC B.

Using the average hydraulic conductivity of 4 feet per day (ft/day) determined from aquifer testing conducted at the former BLDG4-PIT-SSP (CH2M 2013a), the hydraulic gradients from the synoptic surveys, and a porosity of 0.35 corresponding to heterogenous material, approximating silty sands (Walton 1989), groundwater velocities across the area during 2019 varied from 0.5 to 0.9 ft/day, relatively rapid velocities, but, consistent with the elevated hydraulic gradients adjacent to a major surface water body (Fetter 1986).

5.1.2 AOC B Groundwater Analytical Results

5.1.2.1 MIBK

Although not sampled in 2019, MIBK concentrations at MW-03 equaled 1,200 µg/L in August 2017, the lowest concentrations exhibited since 2011, when concentrations reached a maximum of 36,000 µg/L. Similarly, MW-33, located upgradient of MW-03, displayed MIBK concentrations around 4,000 µg/L in early 2015, now exhibits concentrations falling below laboratory method detection limits (MDL).

MW-02 located downgradient of MW-03 exhibited concentrations of 1.2 µg/L, continuing a trend where MIBK concentrations have fluctuated around MDL’s since late 2015 (Figure 5-2). Acetone, a degradation product of MIBK, exceeded MIBK concentrations in MW-02 in December 2016, but has remained below MDLs since August 2017. The absence of MIBK in MW-02 demonstrates the success of the MNA program in rapidly attenuating the COC. Maximum concentrations of MIBK in MW-02 had exceeded 500 µg/L in 2014.

Samples collected at MW-02, PZ-04, PZ-06 and PZ-07 (December 2016, only) facilitated characterization of the downgradient edge of the MIBK plume along the canal. MIBK concentrations encountered at monitoring wells, situated along the transect remained below MDLs in 2019, reproducing the concentrations encountered during the 2018 sampling event (Figure 5-3). The absence of MIBK adjacent to the canal, in monitoring wells that previously exhibited concentrations exceeding the 500 µg/L, demonstrates that the MIBK plume is shrinking, receding upgradient toward the source area beneath Building 4.

5.1.2.2 Chromium

Total chromium concentrations in groundwater samples collected in 2019, exceeded the TOGS Class GA Standard in only MW-33 at 202.6 µg/L, significantly lower than 2,844 µg/L, recorded upon beginning the MNA study in November 2014 (Figure 5-4). Although not sampled in 2019, MW-03, once recorded the highest chromium concentrations at 22,700 µg/L but dropped below the TOGS Class GA Standard (50 µg/L) in 2018, at 48 µg/L.

Elsewhere, monitoring wells in AOC B displayed chromium concentrations less than 5.0 µg/L. Chromium concentrations at monitoring wells situated along the canal remained below 10 µg/L (Figure 5-5). Chromium concentrations at MW-02 declined from 200 µg/L in June 2015 to less than 3 µg/L (Figure 5-6) in 2019.

5.1.2.3 Geochemical Conditions

Geochemical conditions remained stable during Year Five, resembling conditions encountered during Years One through Four. Groundwater displayed a circum-neutral to mildly alkaline pH ranging from 7.0 to 8.5 at MW-33 and PZ-06, respectively. Considering the ionic chemistry from Year Five, groundwater samples displayed a sodium–chloride or mixed anion chemistry. The anionic chemistry varied more than cations. PZ-03 and MW-33 exhibited a chloride anionic chemistry, while MW-02, PZ-04 and PZ-06 displayed a mixed anion chemistry (Figure 5-7).

Redox conditions influence the ionic character of chromium in groundwater along with other factors that affect its migration (complexation, adsorption, and precipitation). Hexavalent chromium (Cr VI), the more toxic of the two chromium ions that occur in natural waters, exhibits greater stability under oxic conditions (Palmer et al. 1994), but transitions to trivalent chromium (Cr III) under reducing conditions. Cr III precipitates as a relatively insoluble hydroxide ($Cr[OH]_3$). Accordingly, only Cr VI occurs as a dissolved ion or oxyanion in natural waters.

PHREEPLOT (Kinniburgh and Cooper 2011), a computer program combining the thermodynamic equilibrium model PHREEQC (Parkhurst 1996) with a powerful plotting algorithm, was employed to characterize the chromium-oxygen- -iron system (Figure 5-8). Groundwater chemistry (pH, cations, anions, iron, silica, nutrients) from MW-33, the only monitoring well exhibiting chromium concentrations exceeding the TOGS Class GA Standard, was used as input to the PHREEQC portion of PHREEPLOT.

In addition to considering the phases of chromium, sulfide, carbonate, and iron in this system, PHREEPLOT characterizes the stability of HFO surfaces, a common adsorptive surface in shallow groundwater systems. HFO surfaces display a considerable surface charge. Depending on pH, HFO can adsorb large amounts (Dzomback and Morel 1990) of cationic (cadmium, manganese, cobalt, nickel, lead, and zinc) or anionic metals (chromium, arsenic, uranium, molybdenum, and selenium).

pH and ORP measured in August and October 2019 were plotted on phase diagrams of the chromium and iron system (Figure 5-8). ORP was converted to the standard hydrogen electrode by adding 0.2 volts to the field measurement (Hem 1986). On the chromium diagram, of the five monitoring wells, three plotted in the $Cr(OH_2)^{1+}$ field, one in the chromium(III) hydroxide field, and one in a field in equilibrium with HFO_sOCrOH^{+1}. All the points imply equilibrium with trivalent chromium. Conversely, none of the wells plotted in the Cr VI chromium fields (CrO_4^{1-} or CrO_4^{2-}).

Considering the iron-oxide system, depicted in a separate phase diagram, four of the five points displayed equilibrium with ferrous iron an aqueous phase in groundwater beneath AOC B, implying groundwater chemistry was not equilibrated with HFO (Figure 5-8).

Except for the chemistry in PZ-06, the lack of equilibrium with HFO discounts the potential for chromium adsorbing to HFO surfaces as a mechanism for chromium attenuation in groundwater; however, elevated concentrations of chromium in groundwater conflicts with the equilibrium conditions favoring Cr III. The relationship suggests disequilibrium in the shallow groundwater system, and consequently, that ORP does not provide a reliable indicator to the speciation of chromium in groundwater beneath AOC B.

In the absence of strong reductants, kinetically, the reduction of Cr VI to Cr III occurs relatively slowly in groundwater (Stanin 2004); however, common reductants like ferrous iron at concentrations exceeding 5 mg/L can accelerate reducing Cr VI to Cr III. But, dissolved iron concentrations rarely exceeded 1 mg/L, let alone 5 mg/L, in groundwater samples from AOC B, with most exhibiting concentrations less than 0.5 mg/L.

A computer program developed by U.S. Geological Survey (USGS; Jurgens et al. 2009) characterized the primary redox category and process (Tables 5-1 and 5-2) by evaluating concentrations of redox constituents (DO, nitrate, iron, manganese, sulfate, and sulfide). These constituents were measured as field and laboratory analytical parameters during the August and October 2019 sampling events. The program offers an alternative to ORP measured in the field. ORP measurements represent a simple measure of electrical potential. Yet, disequilibrium in the redox of a system often reduces the effectiveness of ORP as an accurate indicator of redox.

Running the program produced a mixed suboxic to oxic-anoxic chemistry with ferric iron, and sulfate reduction constituting the primary redox processes (Table 5-2). The screens of monitoring wells and piezometers measuring 10 feet or longer, spanning shallow systems can often span several redox zones. Thus, elevated concentrations of DO associated with oxidizing conditions can appear in the same sample that exhibits elevated concentrations of iron, manganese, or sulfide, indicative of reducing conditions.

The mostly reducing conditions in groundwater below AOC B favor the progressive (if not rapid) reduction of Cr VI to Cr III. Conversely, reducing conditions are not documented to attenuate MIBK or acetone in groundwater. However, degradation of MIBK could promote the conditions that reduce Cr VI to Cr III.

In addition to serving as an indicator of redox conditions (nitrate and ammonia), nutrients like orthophosphate can influence the mobility of chromium in groundwater. Orthophosphate effectively competes with oxyanions like chromium and arsenic as they adsorb on HFO and HAO surfaces (competitive adsorption) common in groundwater environments. Orthophosphate can strip other oxyanions from adsorptive surfaces (Manning and Goldberg 1996), increasing their concentration in groundwater.

Orthophosphate concentrations in groundwater samples ranged around MDL's at MW-2, PZ-03, and PZ06, up to exceeding 0.4 mg/L at MW-33 and PZ-04. Thus, orthophosphate should not inhibit the adsorption of chromium at AOC B.

5.1.2.4 Summary of MNA Effectiveness at AOC B

Despite mixed geochemical conditions, MIBK and chromium concentrations have declined over the relatively short time period since starting MNA studies. Concentrations of chromium now only exceed the TOGS Class GA Standard at a single monitoring well, each. MIBK did not exceed the TOGS Class GA Standard at monitoring wells sampled during 2019. As personnel could not sample MW-3, the fate of MIBK remains unknown. Also, MIBK and chromium have declined below MDLs in monitoring wells located adjacent to the canal. Concentration for both constituents have decreased and the contiguous plumes for both constituents have retreated from their maximum downgradient extents, receding to hot spots at individual wells. This indicates that MNA has been effective in reducing the constituent plumes at AOC B.

5.2 AOC D MNA Evaluation

Year Five of the MNA study at AOC D, like previous years, focused on evaluating data from a synoptic survey and groundwater sampling event. The synoptic survey was conducted to determine the groundwater flow direction, gradients, and velocities across AOC D during October 2019.

5.2.1 AOC D Hydraulic Monitoring Results

During October 2019, groundwater flowed through AOC D toward the canal (Figure 5-1) at a gradient around 0.03 ft/ft. Unlike the mounding at AOC B, equi-potential contours appeared relatively straight trending subparallel to the orientation of the canal. Applying the average hydraulic conductivity of 6 ft/day determined from slug tests conducted at AOC D (CH2M 2014a), the hydraulic gradients from the synoptic survey, and a porosity of 0.35 for silty sands (Walton 1989), the groundwater velocities across the area during 2019 ranged around 0.2 ft/day, a relatively rapid rate, but typical considering elevated gradients proximal to a large surface water body (Fetter 1986).

5.2.2 AOC D Groundwater Results

5.2.2.1 Arsenic

At MW-21, the monitoring well historically exhibiting the greatest impact from arsenic, concentrations declined to less than 2,200 µg/L (Figure 5-9), the lowest concentration ever observed at the monitoring well. At MW-11S, the second most affected monitoring well, arsenic concentrations remained around 1,000 µg/L. Plotted on a transect trending parallel to the canal, arsenic concentrations varied by monitoring well (Figure 5-10). Arsenic concentrations also fell significantly at MW-30 from over 30 µg/L to less than 3 µg/L. Concentrations remained roughly the same at MW-31, yet one order of magnitude less than its historic maximum observed in 2012.

Spills of caustic products including NaOH and NaHS increased the pH of groundwater from circum-neutral pH (6.5 to 7.5 SU) to over 11. At the elevated pH, the charge on adsorptive HFO surfaces changes from positive to negative, repelling negatively charged oxyanions like arsenic (desorption), thus increasing the arsenic concentration in groundwater.

During the Year Five sampling event, pH measurements from October 2019 all fell below 10 (Figure 5-11). Since evaluating pH measurements starting in Year One, pH values have not exceeded 11 at MW-21 since June 2016, and 10 at MW-11S since 2009. Thus, data from Year Five of the MNA study reinforces a fluctuating, yet declining profile for pH at AOC D.

5.2.2.2 Geochemical Conditions at AOC D

Like AOC B, geochemical conditions remained stable over the study period and resembled conditions described by sampling events since the Year One sampling event. Groundwater displayed a strongly sodium to mixed cation (MW-35 and MW-36)—bicarbonate-mixed anion-chloride chemistry (Figure

5-12). The chemistry of groundwater samples remained roughly equivalent during October 2019 and compared favorably with samples from during the Year One study. The strongly sodic chemistry likely reflects the influence of released NaOH and NaHS on the groundwater chemistry at AOC D.

Redox conditions at AOC D were evaluated using the computer program developed by USGS. Redox conditions strongly influence the ionic character of arsenic in groundwater; however, unlike other oxyanions, both ions of arsenic, including trivalent arsenite (As III) and pentavalent arsenate (As V), remain soluble under normal (pH 6 to 8 SU; Eh -100 to +300 millivolts) physiochemical conditions in groundwater (Hem 1986), rather than the reduced ion (As III) precipitating as an insoluble oxide, hydroxide, or sulfide. Arsenic-bearing minerals can precipitate under conditions more severe than normally encountered in a natural groundwater environment. As an example, a zero valent-iron environment can co-precipitate arsenic and iron in oxide minerals. The redox program developed by USGS (Jurgens et al. 2009) produced mostly anoxic redox (Table 5-3) with ferric iron-, and sulfate-reducing conditions describing the prevailing redox processes.

In addition to the redox program, PHREEPLOT was employed to assess arsenic equilibria. The chemistry (pH, cations, anions, iron, silica, and nutrients) from MW-21 was used as input to PHREEPLOT. In addition to arsenic, iron, carbonate, and sulfide were considered as dissolved and mineral phases in this system. Although As III and As V do not readily precipitate under groundwater conditions, adsorption to HFO attenuates arsenic migration in groundwater. Databases available in PHREEQC contain many equations and thermodynamic data for simulating the adsorption of As III and As V to HFO surfaces.

The pH and ORP measurement of samples were plotted on phase diagrams that evaluate arsenic speciation, the stability of HFO, common adsorbent surfaces in groundwater, iron, and the potential for oxyanions of arsenic to adsorb to HFO. Iron was plotted separately to check that HFO corresponds to a mineral phase in the iron and arsenic systems. Figure 5-13 shows that the area of the $Fe(OH)_3(a)$ field (~HFO) on the iron diagram coincides with the range of the HFO field on the diagram of the arsenic-sulfide-water system.

At pH less than 8.5 SU, the As V fields like $NaAsO_4^{-2}$ appear in equilibrium with HFO surfaces. The diagram conveys the mechanism for arsenic mobilization at AOC D with elevated arsenic concentrations in groundwater appearing at pH greater than 8.5 SU. The phase diagram suggests As V is not in equilibrium with HFO at a pH greater than 8.5 SU and thus may desorb from these surfaces. Also, the higher sodium concentrations in groundwater at AOC D have affected arsenic speciation at more alkaline pH values. Points from MW-11S, MW-21, and single samples from other monitoring wells (MW-30, MW-31, and MW-35) plot in the sodium arsenate ($NaAsO_4^{2-}$) field, suggesting arsenic in these samples is dominated by As V, and that $NaAsO_4^{2-}$ may comprise the dominating arsenic oxyanion.

5.2.2.3 MNA and Arsenic at AOC D

The results of the MNA Year Five study, including equilibrium plots of arsenic and iron, correspond with the findings from an arsenic adsorption study conducted in 2012 (CH2M 2013d). Samples tested during the adsorption study exhibited measurable capacity to adsorb arsenic, ranging from 0.07 to 1.77 milligrams of arsenic per gram of soil. Modeling showed that even the minimum capacity could more than sufficiently adsorb all arsenic presently found in groundwater and reduce concentrations to less than the TOGS Class GA Standard. Moreover, arsenic adsorption capacity correlated well with the sample's (correlation coefficient – 0.78) iron content, replicating the relationship between oxyanions of As and HFO seen on the phase diagrams.

Findings during the MNA Year Five study regarding arsenic concentrations and pH show measurable stability or declines compared to the Year Four results. In the absence of further NaOH and NaHS spills that elevate groundwater pH, ambient groundwater flow through the area should continue to lower the pH to less than 7.0 SU, improving the adsorption capacity of soils, while attenuating arsenic concentrations in groundwater.

SECTION 6

Conclusions

The following conclusions were developed from the MNA Year Five study at AOCs B and D.

6.1 AOC B

- Although personnel could not collect groundwater samples in MW-03, MIBK displayed concentrations exceeding laboratory method detections in only MW-33. However, MIBK concentrations in MW-33 fell below 50 µg/L, which is considered as a surrogate TOGS Class GA Standard for the MNA study.
- MIBK concentrations remained below MDLs in monitoring wells located adjacent to the canal.
- The reducing redox conditions favor the reduction of Cr VI to Cr III, a relatively insoluble precipitate.
- Chromium concentrations remained below 10 µg/L in monitoring wells situated adjacent to the canal for Year Five.
- Chromium only remains above the TOGS Class GA Standard in MW-33, although over an order of magnitude less than its maximum concentration of 9,200 µg/L recorded in 2013.
- Although field personnel did not sample MW-03 during the Year Five event, chromium concentrations had declined from 22,700 µg/L in 2013 to less than 1.0 µg/L by 2015.

6.2 AOC D

- Arsenic displayed significantly lower concentrations in MW-21 during the Year Five event, compared to Year Four.
- Arsenic concentrations at MW-11S remained approximately 1,000 µg/L, roughly the concentrations recorded during Year Four.
- Despite recent fluctuations, arsenic concentrations have decreased nearly an order of magnitude at MW-11S since 2005.
- The pH in groundwater at AOC D continued its declining trend with samples no longer displaying measurements exceeding 10.
- The geochemical conditions in groundwater at AOC D appeared mixed, when considering the attenuation of arsenic. Although declining since 2005, the pH remains alkaline at MW-11S and MW-21, the most impacted monitoring wells.
- Managing the groundwater pH by preventing spills of NaOH and NaHS will allow pH to return to ambient levels, improving the adsorption capacity of saturated soils.
- The oxic redox conditions in groundwater favors the stability of HFO surfaces for re-adsorbing arsenic as pH declines.

6.3 SWMU 1 and Sitewide Wells

- The groundwater monitoring results for management and assessment of the remedial action objectives for SMWU 1 and sitewide groundwater are stable. No new releases were detected to the groundwater.

SECTION 7

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Tables

Table 2-1. Summary of Groundwater Samples Collected

2019 Groundwater Monitoring Results and Monitored Natural Attenuation Performance Evaluation Report

Former Hampshire Chemical Corp. Facility, Waterloo, New York

Sampling Location	Sample Identification	Laboratory Analysis	Sample Delivery Group	Sample Type	Sampling Method	Pump Placement Depth (ft. from TIC)	Sample Date	Sample Time
MW-02	MW02-081519	VOCs, Metals(T/D), MNA	L1936991	N	Peristaltic	9.5	08/15/2019	11:38
MW-02	DUP-GW-081519	VOCs, Metals(T/D)	L1936991	FD	Peristaltic	9.5	08/15/2019	09:00
MW-11S	MW11S-081519	Metals(T/D), MNA	L1936991	N	Peristaltic	12	08/15/2019	15:00
MW-21	MW21-081519	Metals(T/D), MNA	L1936991	N	Peristaltic	10	08/15/2019	16:16
MW-30	MW30-081519	Metals(T/D), MNA	L1936991	N	Peristaltic	10	08/15/2019	14:46
PZ-04	PZ04-081519-MSD	VOCs, Metals(T/D), MNA	L1936991	SD	Peristaltic	8	08/15/2019	11:30
PZ-04	PZ04-081519	VOCs, Metals(T/D), MNA	L1936991	N	Peristaltic	8	08/15/2019	11:30
PZ-04	PZ04-081519-MS	VOCs, Metals(T/D), MNA	L1936991	MS	Peristaltic	8	08/15/2019	11:30
TB	TB-081519	VOCs	L1936991	TB	N/A	N/A	08/15/2019	08:00
MW-05I	MW05I-081919	VOCs, Metals(T/D), SVOCs, Low-Level SVOCs	L1937417	N	Peristaltic	27.5	08/19/2019	15:15
MW-09R	MW09R-081919	VOCs, Metals(T/D), SVOCs, Low-Level SVOCs	L1937417	N	Peristaltic	12	08/19/2019	15:35
MW-31	MW31-081919	Metals(T/D), MNA	L1937417	N	Peristaltic	12	08/19/2019	16:10
TB	TB-081919	VOCs	L1937417	TB	N/A	N/A	08/19/2019	08:00
MW-06	MW06-082019	VOCs, Metals(T/D), SVOCs, Low-Level SVOCs	L1937677	N	Peristaltic	9	08/20/2019	13:30
MW-07	MW07-082019	VOCs, Metals(T/D), SVOCs, Low-Level SVOCs	L1937677	N	Peristaltic	8.5	08/20/2019	15:00
MW-10	MW10-082019-MSD	Metals(T/D), SVOCs, Low-Level SVOCs	L1937677	SD	Peristaltic	12	08/20/2019	10:30
MW-10	MW10-082019	VOCs, Metals(T/D), SVOCs, Low-Level SVOCs	L1937677	N	Peristaltic	12	08/20/2019	10:30
MW-10	MW10-082019-MS	Metals(T/D), SVOCs, Low-Level SVOCs	L1937677	MS	Peristaltic	12	08/20/2019	10:30
MW-17	MW17-082019	VOCs, Metals(T/D), Low-Level SVOCs	L1937677	N	Peristaltic	13.5	08/20/2019	13:43
MW-17	DUP-GW-082019	VOCs, Metals(T/D), Low-Level SVOCs	L1937677	FD	Peristaltic	13.5	08/20/2019	12:00
MW-18	MW18-082019	VOCs, Metals(T/D), Low-Level SVOCs	L1937677	N	Peristaltic	12	08/20/2019	11:00
MW-20	MW20-082019	VOCs, Metals(T/D), SVOCs, Low-Level SVOCs	L1937677	N	Peristaltic	13.5	08/20/2019	16:20
PZ-06	PZ06-082019	VOCs, Metals(T/D), MNA	L1937677	N	Peristaltic	8	08/20/2019	16:00
TW-01	TW01-082019	VOCs, Metals(T/D), Low-Level SVOCs	L1937677	N	Peristaltic	18	08/20/2019	15:07
TB	TB-082019	VOCs	L1937677	TB	N/A	N/A	08/20/2019	09:00
MW-26	MW-26-082119	VOCs, Metals(T/D), Low-Level SVOCs	L1937929	N	Peristaltic	14.5	08/21/2019	15:12
MW-35	MW-35-082119	Metals(T/D), MNA	L1937929	N	Peristaltic	9	08/21/2019	12:08
MW-36	MW-36-082119	Metals(T/D), MNA	L1937929	N	Peristaltic	9	08/21/2019	10:35
TB	TB-082119	VOCs	L1937929	TB	N/A	N/A	08/21/2019	08:00
FB	FB-082219	VOCs	L1938123	FB	N/A	N/A	08/22/2019	11:20
MW-16I	MW16I-082219	VOCs, Metals(T/D), Low-Level SVOCs	L1938123	N	Bladder Pump	29	08/22/2019	10:58
MW-19	MW19-082219	VOCs, Metals(T/D), SVOCs, Low-Level SVOCs	L1938123	N	Peristaltic	15.5	08/22/2019	12:50
MW-19	DUP-GW-082219	Metals(T/D), SVOCs, Low-Level SVOCs	L1938123	FD	Peristaltic	15.5	08/22/2019	12:00
TB	TB-082219	VOCs	L1938123	TB	N/A	N/A	08/22/2019	08:00
MW-33	MW33-103119	VOCs, Metals(T/D), MNA	L1951626	N	Peristaltic	8	10/31/2019	11:30
PZ-03	PZ03-103119	VOCs, Metals(T/D), MNA	L1951626	N	Peristaltic	8	10/31/2019	15:30
TB	TB-103119	VOCs	L1951626	TB	N/A	N/A	10/31/2019	08:00

Table 2-1. Summary of Groundwater Samples Collected

2019 Groundwater Monitoring Results and Monitored Natural Attenuation Performance Evaluation Report

Former Hampshire Chemical Corp. Facility, Waterloo, New York

Notes:

MNA - Natural Attenuation Parameters, and includes sulfates, nitrates, methane, carbon dioxide, alkalinity, phosphorus, and total organic carbon
PAH - Polycyclic Aromatic Hydrocarbons
VOC - Volatile Organic Compounds
SVOC - Semivolatile Organic Compounds
TOC - Total Organic Carbon
TDS - Total Dissolved Solids
TIC - Top of Inner Casing
TB - Trip Blank

ft - feet
FB - Field Blank
FD - Field Duplicate Sample
N - Normal Environmental Sample
MS - Matrix Spike
SD - Matrix Spike Duplicate
N/A - Not Applicable

T - Total
D - Dissolved

TABLE 3-1

Groundwater Elevation Measurements

2019 Groundwater Monitoring Results and Monitored Natural Attenuation Performance Evaluation Report

Former Hampshire Chemical Corp. Facility, Waterloo, New York

Well Number	Date	Ground Elevation (ft amsl)	Inner Casing Elevation (ft amsl)	Depth to Water (ft from TIC)	Groundwater Elevation (ft amsl)
MW-01	10/29/19	434.03	433.80	4.83	428.97
MW-02	10/29/19	433.33	432.93	3.95	428.98
MW-03[a]	--	434.44	434.02	NM	NA
MW-05I	10/29/19	445.24	444.79	10.86	433.93
MW-06	10/29/19	446.57	446.21	3.02	443.19
MW-07	10/29/19	437.88	437.37	4.86	432.51
MW-09R	10/29/19	434.84	434.40	5.43	428.97
MW-10	10/29/19	445.34	445.06	2.92	442.14
MW-11S	10/29/19	433.52	432.95	1.29	431.66
MW-16I	10/29/19	454.27	455.99	24.59	431.40
MW-17	10/29/19	449.92	452.13	20.96	431.17
MW-18	10/29/19	440.04	442.07	11.96	430.11
MW-19	10/29/19	445.64	445.25	12.54	432.71
MW-20	10/29/19	448.76	448.53	4.99	443.54
MW-21	10/29/19	433.46	433.10	3.74	429.36
MW-23	10/29/19	432.67	432.35	3.37	428.98
MW-24	10/29/19	433.98	433.75	4.49	429.26
MW-25[b]	--	441.47	441.14	NM	NA
MW-26	10/29/19	439.29	441.76	10.25	431.51
MW-30	10/29/19	433.38	433.02	4.45	428.57
MW-31	10/29/19	433.13	432.65	4.18	428.47
MW-33[a]	10/31/19	434.29	433.87	0.93	432.94
MW-34[a]	10/29/19	434.36	433.79	4.15	429.64
MW-35	10/29/19	433.60	433.43	1.89	431.54
MW-36	10/29/19	433.26	432.80	1.15	431.65
MW-37	10/29/19	433.32	433.02	1.54	431.48
PZ-01[a]	10/31/19	434.49	434.25	2.20	432.05
PZ-03[a]	10/31/19	434.41	434.06	2.50	431.56
PZ-04	10/29/19	432.73	432.14	3.23	428.91
PZ-06	10/29/19	433.06	432.77	3.36	429.41
PZ-07R	10/29/19	433.07	432.57	4.05	428.52
TW-01	10/29/19	447.33	449.01	16.67	432.34

Notes:

[a] Water level measurements were collected in Level B PPE due to wellhead hydrogen sulfide and/or methane. Water level measurements were not collected from MW-03 due to crystallaization inside of the well vault.

[b] Water level measurements were not collected because the well could not be located.

1. Water level measurements were collected on October 29th through October 31, 2019.
2. All wells were surveyed to the New York Central state plane coordinate system (NAD 1983).

amsl - above mean sea level
bgs - below ground surface
ft - feet

NA - not available
NM - not measured
TIC - top of inner casing

Table 3-2

LTMWP Groundwater Sampling Locations, Sampling Frequency, and Corresponding Analytical Results Tables

2019 Groundwater Monitoring Results and Monitored Natural Attenuation Performance Evaluation Report
Former Hampshire Chemical Corp. Facility, Waterloo, New York

SWMU 1 Monitoring Wells		**AOC B** Monitoring Wells		**AOC D** Monitoring Wells		**Supplemental** Monitoring Wells	
Annual Sampling	MW-16I MW-17 MW-18 MW-26 TW-01	Annual Sampling	MW-02 MW-03 MW-33 PZ-03 PZ-04 PZ-06	Annual Sampling	MW-11S MW-21 MW-30 MW-31 MW-35 MW-36	Annual Sampling	MW-05I MW-06 MW-07 MW-09R MW-10 MW-19 MW-20
		Sampling Every 5 Years	MW-01 MW-34 PZ-01 PZ-07R	Sampling Every 5 Years	MW-23 MW-24 MW-37		
Results in Table 3-3		Results in Table 3-4		Results in Table 3-5		Results in Table 3-6	

Table 3-3a. Groundwater Sampling Results for SWMU 1 — Volatile Organic Compounds, August 2019

2019 Groundwater Monitoring Results and Monitored Natural Attenuation Performance Evaluation Report

Former Hampshire Chemical Corp. Facility, Waterloo, New York

		Location:	MW-16I	MW-17		MW-18	MW-26	TW-01
		Sample ID:	MW16I-082219	MW17-082019	DUP-GW-082019	MW18-082019	MW-26-082119	TW01-082019
		Sample Date:	08/22/2019	08/20/2019	08/20/2019	08/20/2019	08/21/2019	08/20/2019
Analyte	**CAS#**	**TOGS 1.1.1 GA***						
VOC (ug/l)								
1,1,1-Trichloroethane	71-55-6	5	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
1,1,2,2-Tetrachloroethane	79-34-5	5	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	--	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
1,1,2-Trichloroethane	79-00-5	1	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethane	75-34-3	5	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
1,1-Dichloroethene	75-35-4	5	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U
1,2,3-Trichlorobenzene	87-61-6	--	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
1,2,4-Trichlorobenzene	120-82-1	5	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
1,2-Dibromo-3-chloropropane	96-12-8	--	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
1,2-Dibromoethane	106-93-4	--	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U
1,2-Dichlorobenzene	95-50-1	3	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
1,2-Dichloroethane	107-06-2	0.6	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U
1,2-Dichloroethene, cis-	156-59-2	5	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
1,2-Dichloroethene, trans-	156-60-5	5	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
1,2-Dichloroethene, Total	540-59-0	--	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
1,2-Dichloropropane	78-87-5	1	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U
1,3-Dichlorobenzene	541-73-1	3	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
1,3-Dichloropropene, cis-	10061-01-5	0.4	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U
1,3-Dichloropropene, trans-	10061-02-6	0.4	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U
1,3-Dichloropropene, Total	542-75-6	--	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U
1,4-Dichlorobenzene	106-46-7	3	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
2-Butanone	78-93-3	50	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U
2-Hexanone	591-78-6	50	1 U	1 U	1 U	1 U	1 U	1 U
4-Methyl-2-Pentanone (MIBK)	108-10-1	50	1 U	1 U	1 U	1 U	1 U	1 U
Acetone	67-64-1	50	17 U	6.1 U	22 U	14 U	17 U	16 U
Benzene	71-43-2	1	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U
Bromochloromethane	74-97-5	--	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
Bromodichloromethane	75-27-4	50	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Bromoform	75-25-2	50	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U
Bromomethane	74-83-9	5	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
Carbon Disulfide	75-15-0	60	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Tetrachloride	56-23-5	5	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U
Chlorobenzene	108-90-7	5	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
Chloroethane	75-00-3	5	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
Chloroform	67-66-3	7	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
Chloromethane	74-87-3	5	0.7 U	1.3 U	0.7 U	0.98 U	1.3 U	0.82 U
Cyclohexane	110-82-7	--	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U
Dibromochloromethane	124-48-1	50	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U

Table 3-3a. Groundwater Sampling Results for SWMU 1 — Volatile Organic Compounds, August 2019

2019 Groundwater Monitoring Results and Monitored Natural Attenuation Performance Evaluation Report

Former Hampshire Chemical Corp. Facility, Waterloo, New York

		Location:	MW-16I	MW-17		MW-18	MW-26	TW-01
		Sample ID:	MW16I-082219	MW17-082019	DUP-GW-082019	MW18-082019	MW-26-082119	TW01-082019
		Sample Date:	08/22/2019	08/20/2019	08/20/2019	08/20/2019	08/21/2019	08/20/2019
Analyte	**CAS#**	**TOGS 1.1.1 GA***						
Dichlorodifluoromethane	75-71-8	--	1 U	1 U	1 U	1 U	1 U	1 U
Ethylbenzene	100-41-4	5	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
Isopropylbenzene	98-82-8	--	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
Methyl Acetate	79-20-9	--	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U
Methylcyclohexane	108-87-2	--	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
Methylene Chloride	75-09-2	5	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
Styrene	100-42-5	5	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
tert-Butyl Methyl Ether	1634-04-4	--	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
Tetrachloroethene	127-18-4	5	0.18 U	0.18 U	0.18 U	0.18 U	0.18 U	0.18 U
Toluene	108-88-3	5	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
Trichloroethene	79-01-6	5	0.18 U	0.18 U	0.18 U	0.18 U	0.18 U	0.18 U
Trichlorofluoromethane	75-69-4	--	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
Vinyl Chloride	75-01-4	2	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U
Xylene, m- and p-	179601-23-1	--	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
Xylene, o-	95-47-6	--	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
Xylene, Total	1330-20-7	--	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
VOC TICs (ug/l)								
Isopropanol	67-63-0	--	- -	- -	**1.41 NJ**	**1.33 NJ**	- -	**1.34 NJ**
Unknown With Highest Concentration	UNKNOWN1	--	- -	- -	- -	- -	**1.64 NJ**	- -
Total Unknown VOCs	TOTAL VOC TICS	--	- -	- -	**1.41 NJ**	**1.33 NJ**	**1.64 NJ**	**1.34 NJ**

Notes:

* - Technical & Operational Guidance Series (TOGS) 1.1.1, New York State Ambient Water Quality Standards and Guidance Values, and Ground Water Effluent Limitations (Class GA). June 1998; modified January 1999; modified April 2000; modified June 2004.

** - There is no TOGS Class GA Standard for MIBK. Per the NYSDEC (2005), the New York State Department of Health (NYSDOH) guidance value for MIBK

Bold indicates the analyte was detected

- - = Not analyzed

-- = Not available

CAS = Chemical Abstracts Service

MIBK = Methyl Isobutyl Ketone

NJ = The TIC numerical value is an approximate concentration.

SWMU = solid waste management unit

TIC = Tentatively Identified Compound

U = The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

ug/l = micrograms per liter

VOC = Volatile Organic Compound

Table 3-3b. Groundwater Sampling Results for SWMU 1 — Semivolatile Organic Compounds, August 2019

2019 Groundwater Monitoring Results and Monitored Natural Attenuation Performance Evaluation Report

Former Hampshire Chemical Corp. Facility, Waterloo, New York

		Location:	MW-16I	MW-17		MW-18	MW-26	TW-01
		Sample ID:	MW16I-082219	MW17-082019	DUP-GW-082019	MW18-082019	MW-26-082119	TW01-082019
		Sample Date:	08/22/2019	08/20/2019	08/20/2019	08/20/2019	08/21/2019	08/20/2019
Analyte	**CAS#**	**TOGS 1.1.1 GA***						
Low-Level SVOC (ug/l)								
2-Chloronaphthalene	91-58-7	10	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
2-Methylnaphthalene	91-57-6	--	0.02 U	**0.03 J**	0.02 U	**0.26**	0.02 U	0.02 U
Acenaphthene	83-32-9	20	0.01 U	0.01 U	0.01 U	**0.06 J**	0.01 U	0.01 U
Acenaphthylene	208-96-8	--	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Anthracene	120-12-7	50	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Benzo(a)anthracene	56-55-3	0.002	0.02 U	**0.02 J**	0.02 U	0.02 U	0.02 U	0.02 U
Benzo(a)pyrene	50-32-8	0.002	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Benzo(b)fluoranthene	205-99-2	0.002	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Benzo(g,h,i)perylene	191-24-2	--	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	**0.02 J**
Benzo(k)fluoranthene	207-08-9	0.002	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Chrysene	218-01-9	0.002	0.01 U	**0.01 J**	0.01 U	0.01 U	0.01 U	0.01 U
Dibenzo(a,h)anthracene	53-70-3	--	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Fluoranthene	206-44-0	50	0.02 U	**0.04 J**	0.02 U	0.02 U	0.02 U	0.02 U
Fluorene	86-73-7	50	0.01 U	0.01 U	**0.02 J**	**0.06 J**	0.01 U	0.01 U
Indeno(1,2,3-c,d)pyrene	193-39-5	0.002	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Naphthalene	91-20-3	10	0.05 U	0.05 U	**0.07 J**	**2.3**	0.05 U	**0.12**
Phenanthrene	85-01-8	50	0.02 U	0.02 U	**0.04 J**	**0.07 J**	0.02 U	**0.03 J**
Pyrene	129-00-0	50	0.02 U	**0.04 J**	0.02 U	0.02 U	0.02 U	0.02 U

Notes:

* - Technical & Operational Guidance Series (TOGS) 1.1.1, New York State Ambient Water Quality Standards and Guidance Values, and Ground Water Effluent Limitations (Class GA). June 1998; modified January 1999; modified April 2000; modified June 2004.

-- = Not available

CAS = Chemical Abstracts Service

J = The analyte was positively identified; the associated numerical value is the approximate concentration.

SVOC = Semivolatile Organic Compound

SWMU = solid waste management unit

U = The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

ug/l = micrograms per liter

Table 3-3c. Groundwater Sampling Results for SWMU 1 — Metals, August 2019

2019 Groundwater Monitoring Results and Monitored Natural Attenuation Performance Evaluation Report

Former Hampshire Chemical Corp. Facility, Waterloo, New York

		Location:	MW-16I	MW-17		MW-18	MW-26	TW-01
		Sample ID:	MW16I-082219	MW17-082019	DUP-GW-082019	MW18-082019	MW-26-082119	TW01-082019
		Sample Date:	08/22/2019	08/20/2019	08/20/2019	08/20/2019	08/21/2019	08/20/2019
Analyte	**CAS#**	**TOGS 1.1.1 GA***						
Metals (ug/l)								
Aluminum	7429-90-5	--	3.27 U	3.27 U	3.27 U	**45**	3.27 U	**10.1**
Arsenic	7440-38-2	25	**1.73**	**25.96**	**25.58**	**2.46**	**0.79**	**4.31**
Calcium	7440-70-2	--	**96,400**	**136,000**	**137,000**	**153,000**	**65,100**	**166,000**
Iron	7439-89-6	300	**8,380**	**10,600**	**10,700**	**8,470**	**436**	**57,800**
Magnesium	7439-95-4	35,000	**15,900**	**28,800**	**28,800**	**17,000**	**12,500**	**43,600**
Manganese	7439-96-5	300	**583.4**	**1,545**	**1,561**	**678.7**	**276.2**	**212.6**
Potassium	7440-09-7	--	**4,620**	**7,740**	**7,680**	**10,000**	**3,460**	**12,100**
Sodium	7440-23-5	20,000	**79,900**	**105,000**	**105,000**	**173,000**	**85,700**	**122,000**
**Metals, Dissolved (ug/l) ** **								
Aluminum, Dissolved	7429-90-5	--	3.27 U	**11.1**	**18.9**	**4.38 J**	3.27 U	3.27 U
Arsenic, Dissolved	7440-38-2	25	**1.43**	**25.81**	**25.98**	**2.21**	0.76 U	**4.46**
Iron, Dissolved	7439-89-6	300	**7,120**	**10,400**	**10,200**	**7,890**	**432**	**59,300**
Manganese, Dissolved	7439-96-5	300	**582.7**	**1,314**	**1,374**	**625.8**	**273.9**	**233.8**

Notes:

* - Technical & Operational Guidance Series (TOGS) 1.1.1, New York State Ambient Water Quality Standards and Guidance Values, and Ground Water Effluent Limitations (Class GA). June 1998; modified January 1999; modified April 2000; modified June 2004.

** - The TOGS Class GA Standards for total metals were used as screening criteria for dissolved metals

Bold indicates the analyte was detected

Shading indicates the result exceeded screening criteria

-- = Not available

CAS = Chemical Abstracts Service

J = The analyte was positively identified; the associated numerical value is the approximate concentration.

SWMU = solid waste management unit

U = The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

ug/l = micrograms per liter

Table 3-4a. Groundwater Sampling Results for AOC B — Volatile Organic Compounds, August and October 2019

2019 Groundwater Monitoring Results and Monitored Natural Attenuation Performance Evaluation Report

Former Hampshire Chemical Corp. Facility, Waterloo, New York

		Location:	MW-02		MW-33	PZ-03	PZ-04	PZ-06
		Sample ID:	MW02-081519	DUP-GW-081519	MW33-103119	PZ03-103119	PZ04-081519	PZ06-082019
		Sample Date:	08/15/2019	08/15/2019	10/31/2019	10/31/2019	08/15/2019	08/20/2019
Analyte	**CAS#**	**TOGS 1.1.1 GA***						
VOC (ug/l)								
1,1,1-Trichloroethane	71-55-6	5	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
1,1,2,2-Tetrachloroethane	79-34-5	5	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	--	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
1,1,2-Trichloroethane	79-00-5	1	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethane	75-34-3	5	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
1,1-Dichloroethene	75-35-4	5	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U
1,2,3-Trichlorobenzene	87-61-6	--	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
1,2,4-Trichlorobenzene	120-82-1	5	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
1,2-Dibromo-3-chloropropane	96-12-8	--	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
1,2-Dibromoethane	106-93-4	--	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U
1,2-Dichlorobenzene	95-50-1	3	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
1,2-Dichloroethane	107-06-2	0.6	0.13 U	0.13 U	0.13 UJ	**2.4 J**	0.13 U	0.13 U
1,2-Dichloroethene, cis-	156-59-2	5	0.7 U	0.7 U	**1.8 J**	0.7 U	0.7 U	0.7 U
1,2-Dichloroethene, trans-	156-60-5	5	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
1,2-Dichloroethene, Total	540-59-0	--	0.7 U	0.7 U	**1.8 J**	0.7 U	0.7 U	0.7 U
1,2-Dichloropropane	78-87-5	1	0.14 U	0.14 U	**1**	**0.14 J**	0.14 U	0.14 U
1,3-Dichlorobenzene	541-73-1	3	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
1,3-Dichloropropene, cis-	10061-01-5	0.4	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U
1,3-Dichloropropene, trans-	10061-02-6	0.4	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U
1,3-Dichloropropene, Total	542-75-6	--	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U
1,4-Dichlorobenzene	106-46-7	3	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
2-Butanone	78-93-3	50	1.9 U	1.9 U	**2.4 J**	1.9 U	1.9 U	**2.3 J**
2-Hexanone	591-78-6	50	1 U	1 U	**1.2 J**	1 U	1 U	1 U
4-Methyl-2-Pentanone (MIBK)	108-10-1	50	1 U	1 U	**29 J**	1 U	1 U	1 U
Acetone	67-64-1	50	32 U	21 U	11 U	3.1 U	23 U	25 U
Benzene	71-43-2	1	0.16 U	0.16 U	**2 J**	0.16 UJ	0.16 U	0.16 U
Bromochloromethane	74-97-5	--	0.7 U	0.7 U	0.7 UJ	0.7 UJ	0.7 U	0.7 U
Bromodichloromethane	75-27-4	50	0.19 U	0.19 U	0.19 UJ	0.19 UJ	0.19 U	0.19 U
Bromoform	75-25-2	50	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U
Bromomethane	74-83-9	5	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
Carbon Disulfide	75-15-0	60	**4.7 J**	**4.2 J**	**1.7 J**	1 UJ	**11 J**	1 U
Carbon Tetrachloride	56-23-5	5	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U
Chlorobenzene	108-90-7	5	0.7 U	0.7 U	**2 J**	0.7 U	0.7 U	0.7 U
Chloroethane	75-00-3	5	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
Chloroform	67-66-3	7	0.7 U	0.7 U	0.7 UJ	0.7 UJ	0.7 U	0.7 U
Chloromethane	74-87-3	5	1.2 U	0.99 U	0.7 U	0.7 U	0.75 U	0.7 U
Cyclohexane	110-82-7	--	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U
Dibromochloromethane	124-48-1	50	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U
Dichlorodifluoromethane	75-71-8	--	1 U	1 U	1 UJ	1 UJ	1 U	1 U

Ethylbenzene	100-41-4	5	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
Isopropylbenzene	98-82-8	--	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
Methyl Acetate	79-20-9	--	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U
Methylcyclohexane	108-87-2	--	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
Methylene Chloride	75-09-2	5	0.7 U	0.7 U	0.7 UJ	0.7 UJ	**3.4**	0.7 U
Styrene	100-42-5	5	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
tert-Butyl Methyl Ether	1634-04-4	--	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
Tetrachloroethene	127-18-4	5	0.18 U	0.18 U	0.18 U	0.18 U	0.18 U	0.18 U
Toluene	108-88-3	5	0.7 U	0.7 U	**6.9**	0.7 U	0.7 U	0.7 U
Trichloroethene	79-01-6	5	0.18 U	0.18 U	0.18 U	0.18 U	0.18 U	0.18 U
Trichlorofluoromethane	75-69-4	--	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
Vinyl Chloride	75-01-4	2	0.07 U	0.07 U	**0.29 J**	0.07 U	0.07 U	0.07 U
Xylene, m- and p-	179601-23-1	--	0.7 U	0.7 U	0.7 U	0.7 U	**0.87 J**	0.7 U
Xylene, o-	95-47-6	--	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
Xylene, Total	1330-20-7	--	0.7 U	0.7 U	0.7 U	0.7 U	**0.87 J**	0.7 U
VOC TICs (ug/l)								
Isopropanol	67-63-0	--	**2.65 NJ**	- -	- -	- -	**1.77 NJ**	**1.31 NJ**
Unknown With Highest Concentration	UNKNOWN1	--	**46 NJ**	**39.7 NJ**	**10 NJ**	**1.83 NJ**	**18.2 NJ**	- -
Unknown With Second Highest Concentration	UNKNOWN2	--	**19.9 NJ**	**18 NJ**	**3.95 NJ**	- -	**16.7 NJ**	- -
Unknown With Third Highest Concentration	UNKNOWN3	--	**11.4 NJ**	**10.1 NJ**	**2.64 NJ**	- -	**8.38 NJ**	- -
Unknown With Fourth Highest Concentration	UNKNOWN4	--	**9.4 NJ**	**8.06 NJ**	- -	- -	**3.64 NJ**	- -
Unknown With Fifth Highest Concentration	UNKNOWN5	--	**6.93 NJ**	**6.04 NJ**	- -	- -	**3.07 NJ**	- -
Unknown With Sixth Highest Concentration	UNKNOWN6	--	**6.92 NJ**	**5.9 NJ**	- -	- -	**2.85 NJ**	- -
Unknown With Seventh Highest Concentration	UNKNOWN7	--	**3.44 NJ**	**3.06 NJ**	- -	- -	**2.73 NJ**	- -
Unknown With Eighth Highest Concentration	UNKNOWN8	--	**3 NJ**	**2.7 NJ**	- -	- -	**1.41 NJ**	- -
Unknown With Ninth Highest Concentration	UNKNOWN9	--	**2.53 NJ**	**2.22 NJ**	- -	- -	**1.21 NJ**	- -
Unknown With Tenth Highest Concentration	UNKNOWN10	--	- -	**2.2 NJ**	- -	- -	- -	- -
Total Unknown VOCs	TOTAL VOC TICS	--	**112 NJ**	**98 NJ**	**80.8 NJ**	**1.83 NJ**	**60 NJ**	**1.31 NJ**

Notes:

* - Technical & Operational Guidance Series (TOGS) 1.1.1, New York State Ambient Water Quality Standards and Guidance Values, and Ground Water Effluent Limitations (Class GA), June 1998. Modified January 1999, April 2000, and June 2004.

** - There is no TOGS Class GA Standard for MIBK. Per the NYSDEC (2005), the New York State
Department of Health (NYSDOH) guidance value for MIBK

Bold indicates the analyte was detected

Shading indicates the result exceeded screening criteria

-- = Not available

AOC = area of concern

CAS = Chemical Abstracts Service

J = The analyte was positively identified; the associated numerical value is the approximate concentration.

MIBK = Methyl Isobutyl Ketone

NJ = The TIC numerical value is an approximate concentration.

TIC = Tentatively Identified Compound

U = The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

UJ = The analyte was below the reported sample quantitation limit. However, the reported value is approximate.

ug/l = micrograms per liter

VOC = Volatile Organic Compound

Table 3-4b. Groundwater Sampling Results for AOC B — Semivolatile Organic Compounds, August and October 2019

2019 Groundwater Monitoring Results and Monitored Natural Attenuation Performance Evaluation Report

Former Hampshire Chemical Corp. Facility, Waterloo, New York

		Location:	MW-02		MW-33	PZ-03	PZ-04	PZ-06
		Sample ID:	MW02-081519	DUP-GW-081519	MW33-103119	PZ03-103119	PZ04-081519	PZ06-082019
		Sample Date:	08/15/2019	08/15/2019	10/31/2019	10/31/2019	08/15/2019	08/20/2019
Analyte	**CAS#**	**TOGS 1.1.1 GA***						
Metals (ug/l)								
Aluminum	7429-90-5	--	**17.2**	**17.4**	**36.7 J**	16.4 U	**65.6 J**	**1,200**
Arsenic	7440-38-2	25	**0.36 J**	**0.42 J**	**29.46 J**	**31.89**	**0.74**	**6.1**
Calcium	7440-70-2	--	**163,000**	**170,000**	**432,000**	**191,000**	**142,000 J**	**34,500**
Chromium	7440-47-3	50	**2.48**	- -	**202.6**	**0.98 J**	**3.69**	**6.37**
Iron	7439-89-6	300	**242**	**259**	95.5 U	**2,410**	105 U	**2,010**
Magnesium	7439-95-4	35,000	**13,400**	**14,000**	**112,000**	**105,000**	**27,600 J**	**7,470**
Manganese	7439-96-5	300	**39.47**	**41.27**	**615.9**	**245.6**	**18.95**	**57.23**
Potassium	7440-09-7	--	**5,320**	**5,520**	**29,900**	**9,560**	**14,000 J**	**3,900**
Silica	7631-86-9	--	**27,300**	**27,400**	**28,600**	**28,400**	**77,100**	**19,300**
Sodium	7440-23-5	20,000	**355,000**	**368,000**	**1,980,000**	**1,130,000**	**942,000**	**345,000**
Metals, Dissolved (ug/l) **								
Aluminum, Dissolved	7429-90-5	--	**4.29 J**	**5.49 J**	**31.6**	3.27 U	**5.38 J**	**25.8**
Arsenic, Dissolved	7440-38-2	25	**0.35 J**	**0.52**	**34.05 J**	**34.01**	**0.9**	**4.07**
Chromium, Dissolved	7440-47-3	50	**1.78**	- -	**154.8**	0.17 U	**2.5**	**0.2 J**
Iron, Dissolved	7439-89-6	300	84.4 U	81.9 U	81 U	2,260 U	42.8 U	**116**
Manganese, Dissolved	7439-96-5	300	**37.16**	**35.74**	**548.8**	**262.4**	**15.49**	**12.05**

Notes:

* - Technical & Operational Guidance Series (TOGS) 1.1.1, New York State Ambient Water Quality Standards and Guidance Values, and Ground Water Effluent Limitations (Class GA). June 1998 modified January 1999; modified April 2000; modified June 2004.

** - The TOGS Class GA Standards for total metals were used as screening criteria for dissolved metals

Bold indicates the analyte was detected

Shading indicates the result exceeded screening criteria

-- = Not available

AOC = area of concern

CAS = Chemical Abstracts Service

J = The analyte was positively identified; the associated numerical value is the approximate concentration

U = The analyte was analyzed for, but was not detected above the reported sample quantitation limit

Table 3-4c. Groundwater Sampling Results for AOC B — General Chemistry, August and October 2019

2019 Groundwater Monitoring Results and Monitored Natural Attenuation Performance Evaluation Report

Former Hampshire Chemical Corp. Facility, Waterloo, New York

		Location:	MW-02		MW-33	PZ-03	PZ-04	PZ-06
		Sample ID:	MW02-081519	DUP-GW-081519	MW33-103119	PZ03-103119	PZ04-081519	PZ06-082019
		Sample Date:	08/15/2019	08/15/2019	10/31/2019	10/31/2019	08/15/2019	08/20/2019
Analyte	**CAS#**	**TOGS 1.1.1 GA***						
Wet Chemistry (ug/l)								
Alkalinity, Total	ALK	--	**442,000**	- -	**1,110,000**	**445,000**	**1,280,000**	**276,000**
Ammonia	7664-41-7	--	**1,970**	- -	**30,800**	**1,300**	**8,090**	**860**
Chloride	16887-00-6	250,000	**180,000**	- -	**2,840,000**	**1,980,000**	**496,000 J**	**92,600**
Nitrate	14797-55-8	--	**35 J**	- -	**80 J**	**61 J**	33 U	**380**
Nitrogen, Total Kjeldahl	KN	--	**2,170**	- -	**31,700**	**1,610**	**8,160**	**1,770**
Orthophosphate	PORTHO	--	250 U	- -	**447**	2 U	**425 J**	**24**
Phosphorus, Total	7723-14-0	--	**218**	- -	**435**	**145**	**226**	**428**
Sulfate	14808-79-8	250,000	**383,000**	- -	**251,000**	**296,000**	**411,000**	**45,600**
Sulfide	18496-25-8	50	**27,000**	- -	**86,000**	**180 J**	**33,000**	**2,000**
Total Dissolved Solids	TDS	--	**1,400,000**	- -	**6,300,000**	**4,000,000**	**3,000,000**	**510,000**
Total Organic Carbon	TOC	--	**8,260**	- -	**46,700**	**11,700**	**13,800**	**4,830**

Notes:

* - Technical & Operational Guidance Series (TOGS) 1.1.1, New York State Ambient Water Qualit
Standards and Guidance Values, and Ground Water Effluent Limitations (Class GA). June 1998
modified January 1999; modified April 2000; modified June 2004.

Bold indicates the analyte was detected

Shading indicates the result exceeded screening criteri

-- = Not available

AOC = area of concern

CAS = Chemical Abstracts Service

J = The analyte was positively identified; the associated numerical value is the approximate concentration

U = The analyte was analyzed for, but was not detected above the reported sample quantitation limit

ug/l = micrograms per liter

Table 3-5a. Groundwater Sampling Results for AOC D — Metals, August 2019

2019 Groundwater Monitoring Results and Monitored Natural Attenuation Performance Evaluation Report

Former Hampshire Chemical Corp. Facility, Waterloo, New York

		Location:	MW-11S	MW-21	MW-30	MW-31	MW-35	MW-36
		Sample ID:	MW11S-081519	MW21-081519	MW30-081519	MW31-081919	MW-35-082119	MW-36-082119
		Sample Date:	08/15/2019	08/15/2019	08/15/2019	08/19/2019	08/21/2019	08/21/2019
Analyte	**CAS#**	**TOGS 1.1.1 GA***						
Metals (ug/l)								
Aluminum	7429-90-5	--	**8.85 J**	**1,200 J**	**31.5**	**788**	**102**	**20.5**
Arsenic	7440-38-2	25	**924.4**	**2,123 J**	**2.24**	**11.6**	**194**	**9.56**
Calcium	7440-70-2	--	**23,200**	**6,520 J**	**61,500**	**6,450**	**114,000**	**179,000**
Iron	7439-89-6	300	134 U	**425 J**	181 U	**1,690**	**4,590**	**1,380**
Magnesium	7439-95-4	35,000	**22,100**	**2,140 J**	**19,700**	**5,260**	**86,900**	**97,400**
Manganese	7439-96-5	300	**46.26**	**23.57 J**	**42.8**	**28.37**	**29.68 J**	**181**
Potassium	7440-09-7	--	**3,910**	**3,620 J**	**12,600**	**8,920**	**5,090**	**4,760**
Silica	7631-86-9	--	**19,300**	**18,100**	**22,300**	**22,200**	**24,700**	**19,300**
Sodium	7440-23-5	20,000	**645,000**	**6,090,000 J**	**634,000**	**2,250,000**	**173,000**	**263,000**
Metals, Dissolved (ug/l) **								
Aluminum, Dissolved	7429-90-5	--	3.27 U	**978 J**	**21.8**	**826**	**7.15 J**	3.27 U
Arsenic, Dissolved	7440-38-2	25	**907.8**	**2,074 J**	**1.7**	**9.93**	**174.7**	**6.76**
Iron, Dissolved	7439-89-6	300	48.3 U	**382 J**	**134**	**1,380**	**4,090**	**965**
Manganese, Dissolved	7439-96-5	300	**34.74**	8.29 U	**36.88**	**14.93**	**68.08 J**	**181.3**

Notes:

* - Technical & Operational Guidance Series (TOGS) 1.1.1, New York State Ambient Water Quality Standards and Guidance Values, and Ground Water Effluent Limitations (Class GA). June 1998; modified January 1999; modified April 2000; modified June 2004.

** - The TOGS Class GA Standards for total metals were used as screening criteria for dissolved metals

Bold indicates the analyte was detected

Shading indicates the result exceeded screening criteria

-- = Not available

AOC = area of concern

J = The analyte was positively identified; the associated numerical value is the approximate concentration.

U = The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

Table 3-5b. Groundwater Sampling Results for AOC D — General Chemistry, August 2019

2019 Groundwater Monitoring Results and Monitored Natural Attenuation Performance Evaluation Report

Former Hampshire Chemical Corp. Facility, Waterloo, New York

		Location:	MW-11S	MW-21	MW-30	MW-31	MW-35	MW-36
		Sample ID:	MW11S-081519	MW21-081519	MW30-081519	MW31-081919	MW-35-082119	MW-36-082119
		Sample Date:	08/15/2019	08/15/2019	08/15/2019	08/19/2019	08/21/2019	08/21/2019
Analyte	**CAS#**	**TOGS 1.1.1 GA***						
Wet Chemistry (ug/l)								
Alkalinity, Total	ALK	--	**308,000**	**13,200,000**	**509,000**	**3,550,000**	**399,000**	**336,000**
Ammonia	7664-41-7	--	**414**	**12,500 J**	**548**	**3,600 J**	**284 J**	**180**
Chloride	16887-00-6	250,000	**642,000**	**288,000**	**369,000**	**605,000 J**	**245,000**	**547,000**
Nitrate	14797-55-8	--	**34 J**	330 U	**33 J**	160 U	**54 J**	33 U
Nitrogen, Total Kjeldahl	KN	--	**614**	**26,800 J**	**856**	**10,800**	669 U	387 U
Orthophosphate	PORTHO	--	**153**	**682**	**166**	**5,650**	3 U	2 U
Phosphorus, Total	7723-14-0	--	**414**	**17,200 J**	**187**	**5,910**	**86**	**16**
Sulfate	14808-79-8	250,000	**175,000**	**794,000**	**404,000**	**254,000**	**193,000**	**182,000**
Sulfide	18496-25-8	50	**490**	**6,500**	**1,100**	**1,300**	100 U	100 UJ
Total Dissolved Solids	TDS	--	**1,800,000**	**16,000,000**	**1,800,000**	**5,400,000**	**1,100,000**	**1,400,000**
Total Organic Carbon	TOC	--	**770**	**222,000**	**5,170**	**65,800**	**1,660**	**971**

Notes:

* - Technical & Operational Guidance Series (TOGS) 1.1.1, New York State Ambient Water Quality Standards and Guidance Values, and Ground Water Effluent Limitations (Class GA). June 1998; modified January 1999; modified April 2000; modified June 2004.

Bold indicates the analyte was detected

Shading indicates the result exceeded screening criteria

-- = Not available

AOC = area of concern

J = The analyte was positively identified; the associated numerical value is the approximate concentration.

U = The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

UJ = The analyte was below the reported sample quantitation limit. However, the reported value is approximate.

Table 3-6a. Groundwater Sampling Results for Supplemental Wells — Volatile Organic Compounds, August 2019

2019 Groundwater Monitoring Results and Monitored Natural Attenuation Performance Evaluation Report

Former Hampshire Chemical Corp. Facility, Waterloo, New York

		Location:	MW-05I	MW-06	MW-07	MW-09R	MW-10	MW-19		MW-20
		Sample ID:	MW05I-081919	MW06-082019	MW07-082019	MW09R-081919	MW10-082019	MW19-082219	DUP-GW-082219	MW20-082019
		Sample Date:	08/19/2019	08/20/2019	08/20/2019	08/19/2019	08/20/2019	08/22/2019	08/22/2019	08/20/2019
Analyte	**CAS#**	**TOGS 1.1.1 GA***								
VOC (ug/l)										
1,1,1-Trichloroethane	71-55-6	5	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	- -	0.7 U
1,1,2,2-Tetrachloroethane	79-34-5	5	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	- -	0.17 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	--	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	- -	0.7 U
1,1,2-Trichloroethane	79-00-5	1	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	- -	0.5 U
1,1-Dichloroethane	75-34-3	5	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	- -	0.7 U
1,1-Dichloroethene	75-35-4	5	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	- -	0.17 U
1,2,3-Trichlorobenzene	87-61-6	--	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	- -	0.7 U
1,2,4-Trichlorobenzene	120-82-1	5	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	- -	0.7 U
1,2-Dibromo-3-chloropropane	96-12-8	--	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	- -	0.7 U
1,2-Dibromoethane	106-93-4	--	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	- -	0.65 U
1,2-Dichlorobenzene	95-50-1	3	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	- -	0.7 U
1,2-Dichloroethane	107-06-2	0.6	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	- -	0.13 U
1,2-Dichloroethene, cis-	156-59-2	5	0.7 U	0.7 U	0.7 U	**0.72 J**	0.7 U	**5.4**	- -	0.7 U
1,2-Dichloroethene, trans-	156-60-5	5	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	**7.5**	- -	0.7 U
1,2-Dichloroethene, Total	540-59-0	--	0.7 U	0.7 U	0.7 U	**0.72 J**	0.7 U	**13**	- -	0.7 U
1,2-Dichloropropane	78-87-5	1	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	- -	0.14 U
1,3-Dichlorobenzene	541-73-1	3	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	- -	0.7 U
1,3-Dichloropropene, cis-	10061-01-5	0.4	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	- -	0.14 U
1,3-Dichloropropene, trans-	10061-02-6	0.4	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	- -	0.16 U
1,3-Dichloropropene, Total	542-75-6	--	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	- -	0.14 U
1,4-Dichlorobenzene	106-46-7	3	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	- -	0.7 U
2-Butanone	78-93-3	50	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	- -	1.9 U
2-Hexanone	591-78-6	50	1 U	1 U	1 U	1 U	1 U	1 U	- -	1 U
4-Methyl-2-Pentanone (MIBK)	108-10-1	50	1 U	1 U	1 U	1 U	1 U	1 U	- -	1 U
1,4-Dioxane	123-91-1	--	61 UJ	61 UJ	61 UJ	61 UJ	61 UJ	61 UJ	- -	61 UJ
Acetone	67-64-1	50	27 U	19 U	21 U	18 U	22 U	23 U	- -	22 U
Benzene	71-43-2	1	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	- -	0.16 U
Bromochloromethane	74-97-5	--	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	- -	0.7 U
Bromodichloromethane	75-27-4	50	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	- -	0.19 U
Bromoform	75-25-2	50	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	- -	0.65 U
Bromomethane	74-83-9	5	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	- -	0.7 U
Carbon Disulfide	75-15-0	60	1 U	1 U	1 U	1 U	1 U	1 U	- -	1 U
Carbon Tetrachloride	56-23-5	5	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	- -	0.13 U
Chlorobenzene	108-90-7	5	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	- -	0.7 U
Chloroethane	75-00-3	5	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	- -	0.7 U
Chloroform	67-66-3	7	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	- -	0.7 U
Chloromethane	74-87-3	5	**5.4**	0.89 U	2.9 U	1 U	**7**	**8.4**	- -	**6.7**
Cyclohexane	110-82-7	--	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U	- -	0.27 U
Dibromochloromethane	124-48-1	50	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	- -	0.15 U
Dichlorodifluoromethane	75-71-8	--	1 U	1 U	1 U	1 U	1 U	**27**	- -	1 U
Ethylbenzene	100-41-4	5	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	- -	0.7 U
Isopropylbenzene	98-82-8	--	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	- -	0.7 U

Table 3-6a. Groundwater Sampling Results for Supplemental Wells — Volatile Organic Compounds, August 2019

2019 Groundwater Monitoring Results and Monitored Natural Attenuation Performance Evaluation Report

Former Hampshire Chemical Corp. Facility, Waterloo, New York

		Location:	MW-05I	MW-06	MW-07	MW-09R	MW-10	MW-19		MW-20
		Sample ID:	MW05I-081919	MW06-082019	MW07-082019	MW09R-081919	MW10-082019	MW19-082219	DUP-GW-082219	MW20-082019
		Sample Date:	08/19/2019	08/20/2019	08/20/2019	08/19/2019	08/20/2019	08/22/2019	08/22/2019	08/20/2019
Analyte	**CAS#**	**TOGS 1.1.1 GA***								
Methyl Acetate	79-20-9	--	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	- -	0.23 U
Methylcyclohexane	108-87-2	--	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	- -	0.4 U
Methylene Chloride	75-09-2	5	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	- -	0.7 U
Styrene	100-42-5	5	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	- -	0.7 U
tert-Butyl Methyl Ether	1634-04-4	--	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	- -	0.7 U
Tetrachloroethene	127-18-4	5	0.18 U	0.18 U	0.18 U	0.18 U	0.18 U	0.18 U	- -	0.18 U
Toluene	108-88-3	5	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	- -	0.7 U
Trichloroethene	79-01-6	5	0.18 U	0.18 U	0.18 U	0.18 U	0.18 U	**0.47 J**	- -	0.18 U
Trichlorofluoromethane	75-69-4	--	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	- -	0.7 U
Vinyl Chloride	75-01-4	2	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U	**0.71 J**	- -	0.07 U
Xylene, m- and p-	179601-23-1	--	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	- -	0.7 U
Xylene, o-	95-47-6	--	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	- -	0.7 U
Xylene, Total	1330-20-7	--	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	- -	0.7 U
VOC TICs (ug/l)										
Isopropanol	67-63-0	--	**1.56 NJ**	**1.29 NJ**	**1.51 NJ**	**1.62 NJ**	**1.17 NJ**	- -	- -	**2.2 NJ**
Unknown With Highest Concentration	UNKNOWN1	--	- -	- -	- -	**21.4 NJ**	- -	- -	- -	- -
Total Unknown VOCs	TOTAL VOC TICS	--	**1.56 NJ**	**1.29 NJ**	**1.51 NJ**	**23 NJ**	**1.17 NJ**	- -	- -	**3.84 NJ**

Notes:

* - Technical & Operational Guidance Series (TOGS) 1.1.1, New York State Ambient Water Quality Standards and Guidance Values, and Ground Water Effluent Limitations (Class GA), June 1998. Modified January 1999, April 2000, and June 2004.

** - There is no TOGS Class GA Standard for MIBK. Per the NYSDEC (2005), the New York State Department of Health (NYSDOH) guidance value for MIBK

Bold indicates the analyte was detected

Shading indicates the result exceeded screening criteria

- - = Not analyzed

-- = Not available

CAS = Chemical Abstracts Service

J = The analyte was positively identified; the associated numerical value is the approximate concentration.

MIBK = Methyl Isobutyl Ketone

NJ = The TIC numerical value is an approximate concentration.

TIC = Tentatively Identified Compound

U = The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

UJ = The analyte was below the reported sample quantitation limit. However, the reported value is approximate.

ug/l = micrograms per liter

VOC = Volatile Organic Compound

Table 3-6b. Groundwater Sampling Results for Supplemental Wells — Semivolatile Organic Compounds, August 2019

2019 Groundwater Monitoring Results and Monitored Natural Attenuation Performance Evaluation Report

Former Hampshire Chemical Corp. Facility, Waterloo, New York

		Location:	MW-05I	MW-06	MW-07	MW-09R	MW-10	MW-19		MW-20
		Sample ID:	MW05I-081919	MW06-082019	MW07-082019	MW09R-081919	MW10-082019	MW19-082219	DUP-GW-082219	MW20-082019
		Sample Date:	08/19/2019	08/20/2019	08/20/2019	08/19/2019	08/20/2019	08/22/2019	08/22/2019	08/20/2019
Analyte	**CAS#**	**TOGS 1.1.1 GA***								
SVOC (ug/l)										
1,1'-Biphenyl	92-52-4	--	0.46 U	0.46 U	0.46 U	0.46 U	0.46 U	0.46 U	0.46 U	0.46 U
2,4,5-Trichlorophenol	95-95-4	--	0.77 U	0.77 U	0.77 U	0.77 U	0.77 U	0.77 U	0.77 U	0.77 U
2,4,6-Trichlorophenol	88-06-2	--	0.61 U	0.61 U	0.61 U	0.61 U	0.61 U	0.61 U	0.61 U	0.61 U
2,4-Dichlorophenol	120-83-2	5	0.41 U	0.41 U	0.41 U	0.41 U	0.41 U	0.41 U	0.41 U	0.41 U
2,4-Dimethylphenol	105-67-9	50	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U
2,4-Dinitrophenol	51-28-5	1	6.6 U	6.6 U	6.6 U	6.6 U	6.6 U	6.6 U	6.6 U	6.6 U
2,4-Dinitrotoluene	121-14-2	5	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U
2,6-Dinitrotoluene	606-20-2	5	0.93 U	0.93 U	0.93 U	0.93 U	0.93 U	0.93 U	0.93 U	0.93 U
2-Chlorophenol	95-57-8	--	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
2-Nitroaniline	88-74-4	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
2-Nitrophenol	88-75-5	--	0.85 U	0.85 U	0.85 U	0.85 U	0.85 U	0.85 U	0.85 U	0.85 U
3,3'-Dichlorobenzidine	91-94-1	5	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U
3-Nitroaniline	99-09-2	5	0.81 U	0.81 U	0.81 U	0.81 U	0.81 U	0.81 U	0.81 U	0.81 U
4-Bromophenyl Phenyl Ether	101-55-3	--	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U
4-Chloroaniline	106-47-8	5	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U
4-Nitrophenol	100-02-7	--	0.67 U	0.67 U	0.67 U	0.67 U	0.67 U	0.67 U	0.67 U	0.67 U
Benzoic Acid	65-85-0	--	2.6 U	2.6 U	**6.1 J**	2.6 U	2.6 U	2.6 R	2.6 R	**5.6 J**
Benzyl Alcohol	100-51-6	--	0.59 U	0.59 U	0.59 U	0.59 U	0.59 U	0.59 U	0.59 U	0.59 U
Bis (2-Chloroethoxy) Methane	111-91-1	5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bis (2-Chloroethyl) Ether	111-44-4	1	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Bis (2-Ethylhexyl) Phthalate	117-81-7	5	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U
Butyl Benzyl Phthalate	85-68-7	50	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U
Carbazole	86-74-8	--	0.49 U	0.49 U	0.49 U	0.49 U	0.49 U	0.49 U	0.49 U	0.49 U
Dibenzofuran	132-64-9	--	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Diethylphthalate	84-66-2	50	0.38 U	0.38 U	0.38 U	0.38 U	0.38 U	**0.79 J**	**0.71 J**	0.38 U
Dimethylphthalate	131-11-3	50	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U
Di-n-Butylphthalate	84-74-2	50	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U
Di-n-Octylphthalate	117-84-0	50	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U
Hexachlorocyclopentadiene	77-47-4	5	0.69 U	0.69 U	0.69 U	0.69 U	0.69 U	0.69 U	0.69 U	0.69 U
Isophorone	78-59-1	50	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U
Methylphenol, 2-	95-48-7	--	0.49 U	0.49 U	0.49 U	0.49 U	0.49 U	0.49 U	0.49 U	0.49 U
Methylphenol, 3- and 4-	65794-96-9	--	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U	0.48 U
Nitrobenzene	98-95-3	0.4	0.77 U	0.77 U	0.77 U	0.77 U	0.77 U	0.77 U	0.77 U	0.77 U
Nitrosodiphenylamine, n-	86-30-6	50	0.42 U	0.42 U	0.42 U	0.42 U	0.42 U	0.42 U	0.42 U	0.42 U
Phenol	108-95-2	1	0.57 U	0.57 U	0.57 U	0.57 U	0.57 U	0.57 U	0.57 U	0.57 U
Low-Level SVOC (ug/l)										
2-Chloronaphthalene	91-58-7	10	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
2-Methylnaphthalene	91-57-6	--	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	**0.06 J**
Acenaphthene	83-32-9	20	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.05 U	0.04 U	**0.02 J**
Acenaphthylene	208-96-8	--	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Anthracene	120-12-7	50	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.02 U	0.02 U	0.01 U
Benzo(a)anthracene	56-55-3	0.002	0.02 U	0.02 U	**0.04 J**	0.02 U	**0.02 J**	0.02 U	0.02 U	0.02 U

Table 3-6b. Groundwater Sampling Results for Supplemental Wells — Semivolatile Organic Compounds, August 2019

2019 Groundwater Monitoring Results and Monitored Natural Attenuation Performance Evaluation Report

Former Hampshire Chemical Corp. Facility, Waterloo, New York

		Location:	MW-05I	MW-06	MW-07	MW-09R	MW-10	MW-19		MW-20
		Sample ID:	MW05I-081919	MW06-082019	MW07-082019	MW09R-081919	MW10-082019	MW19-082219	DUP-GW-082219	MW20-082019
		Sample Date:	08/19/2019	08/20/2019	08/20/2019	08/19/2019	08/20/2019	08/22/2019	08/22/2019	08/20/2019
Analyte	**CAS#**	**TOGS 1.1.1 GA***								
Benzo(a)pyrene	50-32-8	0.002	0.02 U	0.02 U	**0.04 J**	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Benzo(b)fluoranthene	205-99-2	0.002	0.01 U	0.01 U	**0.08 J**	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Benzo(g,h,i)perylene	191-24-2	--	0.01 U	0.01 U	**0.08 J**	0.01 U	**0.02 J**	0.01 U	0.01 U	0.01 U
Benzo(k)fluoranthene	207-08-9	0.002	0.01 U	0.01 U	**0.04 J**	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Chrysene	218-01-9	0.002	0.01 U	0.01 U	**0.03 J**	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Dibenzo(a,h)anthracene	53-70-3	--	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Fluoranthene	206-44-0	50	0.02 U	0.02 U	**0.04 J**	0.02 U	0.02 U	**0.31**	**0.25**	0.02 U
Fluorene	86-73-7	50	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	**0.03 J**
Hexachlorobenzene	118-74-1	0.04	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Hexachlorobutadiene	87-68-3	0.5	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Hexachloroethane	67-72-1	5	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U
Indeno(1,2,3-c,d)pyrene	193-39-5	0.002	0.01 U	0.01 U	**0.08 J**	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Naphthalene	91-20-3	10	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U	**0.94**
Pentachlorophenol	87-86-5	1	0.01 UJ	0.01 U	0.01 U	0.01 UJ	0.01 U	0.01 U	0.01 U	0.01 U
Phenanthrene	85-01-8	50	0.02 U	0.02 U	**0.03 J**	0.02 U	0.02 U	0.02 U	0.03 U	**0.03 J**
Pyrene	129-00-0	50	0.02 U	0.02 U	**0.03 J**	0.02 U	0.02 U	**0.24**	**0.19**	0.02 U
SVOC TICs (ug/l)										
Cyclic Octaatomic Sulfur	10544-50-0	--	- -	- -	- -	**200 NJ**	- -	- -	- -	- -
Unknown With Highest Concentration	UNKNOWN1	--	**2.65 NJ**	**1.67 NJ**	- -	**696 NJ**	**1.96 NJ**	- -	- -	**7.96 NJ**
Unknown With Second Highest Concentration	UNKNOWN2	--	- -	**1.56 NJ**	- -	**71.1 NJ**	**1.49 NJ**	- -	- -	**6.29 NJ**
Unknown With Third Highest Concentration	UNKNOWN3	--	- -	- -	- -	**16.5 NJ**	- -	- -	- -	**1.71 NJ**
Unknown With Fourth Highest Concentration	UNKNOWN4	--	- -	- -	- -	**15.7 NJ**	- -	- -	- -	- -
Unknown With Fifth Highest Concentration	UNKNOWN5	--	- -	- -	- -	**7.09 NJ**	- -	- -	- -	- -
Total Unknown SVOCs	ADR-01-001	--	**45.8 NJ**	**132 NJ**	**172 NJ**	**1,040 NJ**	**23 NJ**	- -	- -	**84 NJ**

Notes:

* - Technical & Operational Guidance Series (TOGS) 1.1.1, New York State Ambient Water Quality Standards and Guidance Values, and Ground Water Effluent Limitations (Class GA), June 1998. Modified January 1999, April 2000, and June 2004.

Bold indicates the analyte was detected

- - = Not analyzed

-- = Not available

CAS = Chemical Abstracts Service

J = The analyte was positively identified; the associated numerical value is the approximate concentration.

NJ = The TIC numerical value is an approximate concentration.

R = The analyte was analyzed for, but rejected for data quality reasons.

SVOC = Semivolatile Organic Compound

TIC = Tentatively Identified Compound

U = The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

UJ = The analyte was below the reported sample quantitation limit. However, the reported value is approximate.

ug/l = micrograms per liter

Table 3-6c. Groundwater Sampling Results for Supplemental Wells — Metals, August 2019

2019 Groundwater Monitoring Results and Monitored Natural Attenuation Performance Evaluation Report

Former Hampshire Chemical Corp. Facility, Waterloo, New York

		Location:	MW-05I	MW-06	MW-07	MW-09R	MW-10	MW-19		MW-20
		Sample ID:	MW05I-081919	MW06-082019	MW07-082019	MW09R-081919	MW10-082019	MW19-082219	DUP-GW-082219	MW20-082019
		Sample Date:	08/19/2019	08/20/2019	08/20/2019	08/19/2019	08/20/2019	08/22/2019	08/22/2019	08/20/2019
Analyte	**CAS#**	**TOGS 1.1.1 GA***								
Metals (ug/l)										
Aluminum	7429-90-5	--	**35.7**	**27.9**	**232**	**203**	**68.2**	**24**	**17.1**	**385**
Arsenic	7440-38-2	25	**0.36 J**	**0.8**	**1.76**	**14.13**	**1.52**	**4.24 J**	**4.13**	**0.69**
Calcium	7440-70-2	--	**72,000**	**140,000**	**91,300**	**307,000**	**93,100**	**150,000**	**150,000**	**123,000**
Iron	7439-89-6	300	**189**	**140**	**489**	**5,290 J**	**190 J**	**1,770**	**1,820**	**684**
Magnesium	7439-95-4	35,000	**8,740**	**28,400**	**11,700**	**103,000**	**11,800**	**43,300**	**43,300**	**36,100**
Manganese	7439-96-5	300	**12.03**	**48.45**	**254.1**	**405.7**	**6.35**	**762**	**760.1**	**255.8**
Potassium	7440-09-7	--	**3,530**	**2,530**	**3,550**	**7,320**	**961**	**985**	**1,010**	**3,200**
Sodium	7440-23-5	20,000	**74,400**	**47,900**	**445,000**	**720,000**	**128,000**	**131,000**	**133,000**	**28,800**
Metals, Dissolved (ug/l) **										
Aluminum, Dissolved	7429-90-5	--	**3.89 J**	3.27 U	**4.39 J**	**11.4**	3.27 U	3.27 U	3.27 U	3.27 U
Arsenic, Dissolved	7440-38-2	25	**0.49 J**	**0.64**	**1.28**	**15.55**	**1.37**	**4.76 J**	**4.16**	**0.26 J**
Iron, Dissolved	7439-89-6	300	19.1 U	76.9 U	57.3 U	**6,150 J**	**139**	**1,990**	**1,860**	20.1 U
Manganese, Dissolved	7439-96-5	300	**9.29**	**39.8**	**277**	**459**	**5.88**	**792.1**	**774.3**	**220.4**

Notes:

* - Technical & Operational Guidance Series (TOGS) 1.1.1, New York State Ambient Water Quality Standards and Guidance Values, and Ground Water Effluent Limitations (Class GA). June 1998; modified January 1999; modified April 2000; modified June 2004.

** - The TOGS Class GA Standards for total metals were used as screening criteria for dissolved metals

Bold indicates the analyte was detected

Shading indicates the result exceeded screening criteria

-- = Not available

CAS = Chemical Abstracts Service

J = The analyte was positively identified; the associated numerical value is the approximate concentration.

U = The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

ug/l = micrograms per liter

Table 3-7. Summary of QA/QC Water Sample Results

2019 Groundwater Monitoring Results and Monitored Natural Attenuation Performance Evaluation Report

Former Hampshire Chemical Corp. Facility, Waterloo, New York

	Sample ID:	FB-082219	TB-081519	TB-081919	TB-082019	TB-082119	TB-082219	TB-103119
	Sample Date:	08/22/2019	08/15/2019	08/19/2019	08/20/2019	08/21/2019	08/22/2019	10/31/2019
Analyte	**CAS#**							
VOC (µg/l)								
1,1,1-Trichloroethane	71-55-6	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
1,1,2,2-Tetrachloroethane	79-34-5	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
1,1,2-Trichloroethane	79-00-5	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
1,1-Dichloroethane	75-34-3	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
1,1-Dichloroethene	75-35-4	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U
1,2,3-Trichlorobenzene	87-61-6	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
1,2,4-Trichlorobenzene	120-82-1	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
1,2-Dibromo-3-chloropropane	96-12-8	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
1,2-Dibromoethane	106-93-4	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U
1,2-Dichlorobenzene	95-50-1	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
1,2-Dichloroethane	107-06-2	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U
1,2-Dichloroethene, cis-	156-59-2	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
1,2-Dichloroethene, trans-	156-60-5	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
1,2-Dichloroethene, Total	540-59-0	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
1,2-Dichloropropane	78-87-5	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U
1,3-Dichlorobenzene	541-73-1	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
1,3-Dichloropropene, cis-	10061-01-5	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U
1,3-Dichloropropene, trans-	10061-02-6	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U
1,3-Dichloropropene, Total	542-75-6	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U
1,4-Dichlorobenzene	106-46-7	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
2-Butanone	78-93-3	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U
2-Hexanone	591-78-6	1 U	1 U	1 U	1 U	1 U	1 U	1 U
4-Methyl-2-Pentanone (MIBK)	108-10-1	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Acetone	67-64-1	**18**	**11**	**3.9 J**	**7.4**	**7.3**	**6.4**	**7.5**
Benzene	71-43-2	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U
Bromochloromethane	74-97-5	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
Bromodichloromethane	75-27-4	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Bromoform	75-25-2	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U	0.65 U
Bromomethane	74-83-9	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
Carbon Disulfide	75-15-0	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Tetrachloride	56-23-5	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U
Chlorobenzene	108-90-7	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
Chloroethane	75-00-3	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
Chloroform	67-66-3	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
Chloromethane	74-87-3	0.7 U	**1.7 J**	**0.81 J**	**1.1 J**	**1 J**	**0.92 J**	0.7 U
Cyclohexane	110-82-7	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U	0.27 U
Dibromochloromethane	124-48-1	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U	0.15 U
Dichlorodifluoromethane	75-71-8	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethylbenzene	100-41-4	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
Isopropylbenzene	98-82-8	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
Methyl Acetate	79-20-9	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U
Methylcyclohexane	108-87-2	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
Methylene Chloride	75-09-2	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
Styrene	100-42-5	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
tert-Butyl Methyl Ether	1634-04-4	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
Tetrachloroethene	127-18-4	0.18 U	0.18 U	0.18 U	0.18 U	0.18 U	0.18 U	0.18 U
Toluene	108-88-3	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
Trichloroethene	79-01-6	0.18 U	0.18 U	0.18 U	0.18 U	0.18 U	0.18 U	0.18 U
Trichlorofluoromethane	75-69-4	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
Vinyl Chloride	75-01-4	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U
Xylene, m- and p-	179601-23-1	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
Xylene, o-	95-47-6	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
Xylene, Total	1330-20-7	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U
VOC TICs (µg/l)								
Isopropanol	67-63-0	- -	- -	- -	- -	- -	- -	**1.24 NJ**

Total Unknown VOCs	TOTAL VOC TICS	- -	- -	- -	- -	- -	- -	**1.24 J**

Notes:
Bold indicates the analyte was detected
- - = Not analyzed
-- = Not available
CAS = Chemical Abstracts Service
J = The analyte was positively identified; the associated numerical value is the approximate concentration.
MIBK = Methyl Isobutyl Ketone
NJ = The TIC numerical value is an approximate concentration.
TIC = Tentatively Identified Compound
U = The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
ug/l = micrograms per liter
VOC = Volatile Organic Compound

Table 4-1
Summary of Groundwater Quality Parameters
2019 Groundwater Monitoring Results and Monitored Natural Attenuation Performance Evaluation Report
Former Hampshire Chemical Corp. Facility, Waterloo, New York

Sampling Location	**Date**	**pH** (std units)	**Conductivity** (mS/cm)	**Turbidity** (NTU)	**DO** (mg/L)	**Temp** (Celsius)	**ORP** (mV)	**Ferrous Iron** (mg/L)
MW-02	8/15/2019	7.05	2.17	2.29	0.56	23.44	-343	0.00
MW-05I	8/19/2019	11.4	0.521	10.60	3.52	16.22	-15	NA
MW-06	8/20/2019	6.47	0.887	3.08	2.87	25.80	3	NA
MW-07	8/20/2019	6.40	2.38	10.60	1.29	23.41	109	NA
MW-09R	8/19/2019	6.69	4.34	0.99	0.41	21.60	-275	>3
MW-10	8/20/2019	6.73	0.988	4.52	6.80	19.49	49	NA
MW-11S	8/15/2019	9.45	3.12	1.85	0.00	24.27	-204	0.04
MW-16I	8/22/2019	6.82	1.010	8.45	0.41	20.13	-121	NA
MW-17	8/20/2019	6.97	0.916	3.20	0.00	15.20	-106	>3
MW-18	8/20/2019	7.44	1.07	34.4	0.00	21.87	-131	>3
MW-19	8/22/2019	6.65	1.57	7.84	0.53	19.20	-67	NA
MW-20	8/20/2019	6.68	0.908	10.68	0.27	16.53	-51	NA
MW-21	8/15/2019	9.99	16.2	0.84	0.64	25.56	-450	NA
MW-26	8/21/2019	6.81	0.819	5.02	0.16	25.26	-61	NA
MW-30	8/15/2019	7.23	3.00	4.01	0.49	22.20	-283	NA
MW-31	8/19/2019	9.2	6.50	3.88	0.17	25.03	-401	NA
MW-33	10/31/2019	7.03	9.91	0.00	1.56	20.52	-363	NA
MW-35	8/21/2019	6.93	1.89	6.99	0.28	20.66	-116	2.00
MW-36	8/21/2019	6.74	2.58	11.40	0.24	20.72	-53	0.91
PZ-03	10/31/2019	7.27	12.8	0.00	0.47	19.58	-286	2.21
PZ-04	8/15/2019	7.81	4.81	8.20	0.11	23.97	-382	0.06
PZ-06	8/19/2019	8.51	1.12	24.4	0.70	23.91	-237	0.10
TW-01	8/20/2019	7.64	1.52	6.20	0.00	14.82	-174	>3

Notes:

1. The data above were recorded after groundwater quality parameters stabilized, immediately before the groundwater sample was collected.

>3 - over range (greater than 3 mg/L)
DO - dissolved oxygen
mg/L - milligrams per liter
mS/cm - millisiemens per centimeter
mV - millivolts
NTU - nephelometric turbidity unit
ORP - oxidation reduction potential
std units - standard units

Table 5-1

Criteria and Threshold Concentrations for Identifying Redox Processes in Groundwater

2019 Groundwater Monitoring Results and Monitored Natural Attenuation Performance Evaluation Report

Former Hampshire Chemical Corp. Facility, Waterloo, New York

Redox category	**Redox process**	**Electron acceptor (reduction) half-reaction**	**Criteria for inferring process from water-quality data**					
			Dissolved Oxygen (mg/L)	**Nitrate, as Nitrogen** (mg/L)	**Manganese** (mg/L)	**Iron** (mg/L)	**Sulfate** (mg/L)	**Iron/sulfide** (mass ratio)
Oxic	O2	$O_2 + 4H^+ + 4e^- \rightarrow 2H_2O$	≥0.5	—	<0.05	<0.1	—	
Suboxic	Suboxic	Low O2; additional data needed to define redox process	<0.5	<0.5	<0.05	<0.1	—	
Anoxic	NO_3	$2NO_3^- + 12H^+ + 10e^- \rightarrow N_2(g) + 6\ H_2O$; $NO_3^- + 10H^+ + 8e^- \rightarrow NH_4^+ + 3H_2O$	<0.5	≥0.5	<0.05	<0.1	—	
Anoxic	Mn(IV)	$MnO_{2(s)} + 4H^+ + 2e^- \rightarrow Mn^{2+} + 2H_2O$	<0.5	<0.5	≥0.05	<0.1	—	
Anoxic	Fe(III)/SO_4	Fe(III) and (or) SO_4^{2-} reactions as described in individual element half reactions	<0.5	<0.5	—	≥0.1	≥0.5	no data
Anoxic	Fe(III)	$Fe(OH)_{3(s)} + H^+ + e^- \rightarrow Fe^{2+} + H_2O$; $FeOOH_{(s)} + 3H^+ + e^- \rightarrow Fe^{2+} + 2H_2O$	<0.5	<0.5	—	≥0.1	≥0.5	>10
Mixed(anoxic)	Fe(III)-SO_4	Fe(III) and SO_4^{2-} reactions as described in individual element half reactions	<0.5	<0.5	—	≥0.1	≥0.5	≥0.3, ≤10
Anoxic	SO_4	$SO_4^{2-} + 9H^+ + 8e^- \rightarrow HS^- + 4H_2O$	<0.5	<0.5	—	≥0.1	≥0.5	<0.3
Anoxic	CH_4gen	$CO_2(g) + 8H^+ + 8e^- \rightarrow CH_4(g) + 2H_2O$	<0.5	<0.5	—	≥0.1	<0.5	

Notes

Table was modified from McMahon and Chapelle, 2008

Abbreviations:

mg/L, milligram per liter

—, criteria do not apply because the species concentration is not affected by the redox process

≤, less than or equal to

≥, greater than or equal to

<, less than

>, greater than

Redox process:

CH_4gen, methanogenesis

O2, oxygen reduction

NO_3, nitrate reduction

Mn(IV), manganese reduction

Fe(III), iron reduction

SO_4, sulfate reduction

Chemical species:

$CH_4(g)$, methane gas.

$CO_2(g)$, carbon dioxide gas

$Fe(OH)_3(s)$, iron hydroxide with iron in 3+ oxidation state

FeOOH(s), iron oxyhydroxide with iron in 3+ oxidation state

O2, dissolved oxygen

NO_3^-, dissolved nitrate

$MnO_2(s)$, manganese oxide with manganese in 4+ oxidation state

SO_4^{2-}, dissolved sulfate

Table 5-2
Redox Assignments for Groundwater Samples in AOC B

2019 Groundwater Monitoring Results and Monitored Natural Attenuation Performance Evaluation Report

Former Hampshire Chemical Corp. Facility, Waterloo, New York

Sample Location	**Dissolved O_2**	**NO_3-** (as Nitrogen)	**Mn^{2+}**	**Fe^{2+}**	**SO_4^{2-}**	**Sulfide** (sum of H_2S, HS^-, S^{2-})	**Redox Assignment**			**Fe2+/ Sulfide, ratio**	**ORP** (mV)	**Eh** (mV)	**TOC** (mg/L)
	(mg/L)	(mg/L)	(µg/L)	(µg/L)	(mg/L)	(mg/L)							
	0.5	**0.5**	**50**	**100**	**0.5**	**none**	Num of Params	General Redox Category	Redox Process				
MW-02	0.01	0.035	37	42	383	27	6	Suboxic	Suboxic		-343	-143	8.3
MW-33	0.01	0.08	549	41	251	86	6	Anoxic	Mn(IV)		-363	-163	46.7
PZ-03	0.01	0.06	262	1130	296	0.18	6	Mixed (Anoxic)	Fe(III)-SO_4	6.28	-286	-86	11.7
PZ-04	0.01	0.02	15.5	21.4	411	33	6	Suboxic	Suboxic		-382	-182	13.8
PZ-06	0.01	0.04	12.1	58	45.6	2	6	Suboxic	Suboxic		-237	-37	4.8

Abbreviations

Eh, oxidation/reduction potential
mg/L, milligram per liter
mV, millivolts
TOC, total organci carbon
µg/L, micrograms per liter

Redox process

O_2, oxygen reduction
NO_3, nitrate reduction
Mn(IV), manganese reduction
Fe(III), iron reduction
SO_4, sulfate reduction

Table 5-3

Redox Assignments for Groundwater Samples in AOC D

2019 Groundwater Monitoring Results and Monitored Natural Attenuation Performance Evaluation Report

Former Hampshire Chemical Corp. Facility, Waterloo, New York

Sample Location	**Dissolved O_2**	**NO_3^-** (as Nitrogen)	**Mn^{2+}**	**Fe^{2+}**	**SO_4^{2-}**	**Sulfide** (sum of H_2S, HS^-, S^{2-})	**Redox Assignment**			**Fe^{2+}/ Sulfide, ratio**	**ORP** (mV)	**Eh** (mV)	**TOC** (mg/L)
	(mg/L)	(mg/L)	(µg/L)	(µg/L)	(mg/L)	(mg/L)							
	0.5	**0.5**	**50**	**100**	**0.5**	**none**	Num of Params	General Redox Category	Redox Process				
MW-11S	0	0.036	45	130	175	0.49	6	Anoxic	SO_4	0.27	-204	-4	0.77
MW-21	0	0.3	23	400	794	6.5	6	Anoxic	SO_4	0.06	-450	-250	222
MW-30	0	0.16	40	180	634	1.1	6	Anoxic	SO4	0.16	-283	-83	5.17
MW-31	0	0.16	31.7	1690	254	0.5	6	Mixed (anoxic)	Fe(III)-SO_4	3.38	-401	-201	65.8
MW-35	0	0.047	30	49	193	0.1	6	Suboxic	Suboxic		-116	84	1.66
MW-36	0.2	0.033	18	1400	182	0.1	6	Anoxic	Fe(III)	14.00	-53	147	0.97

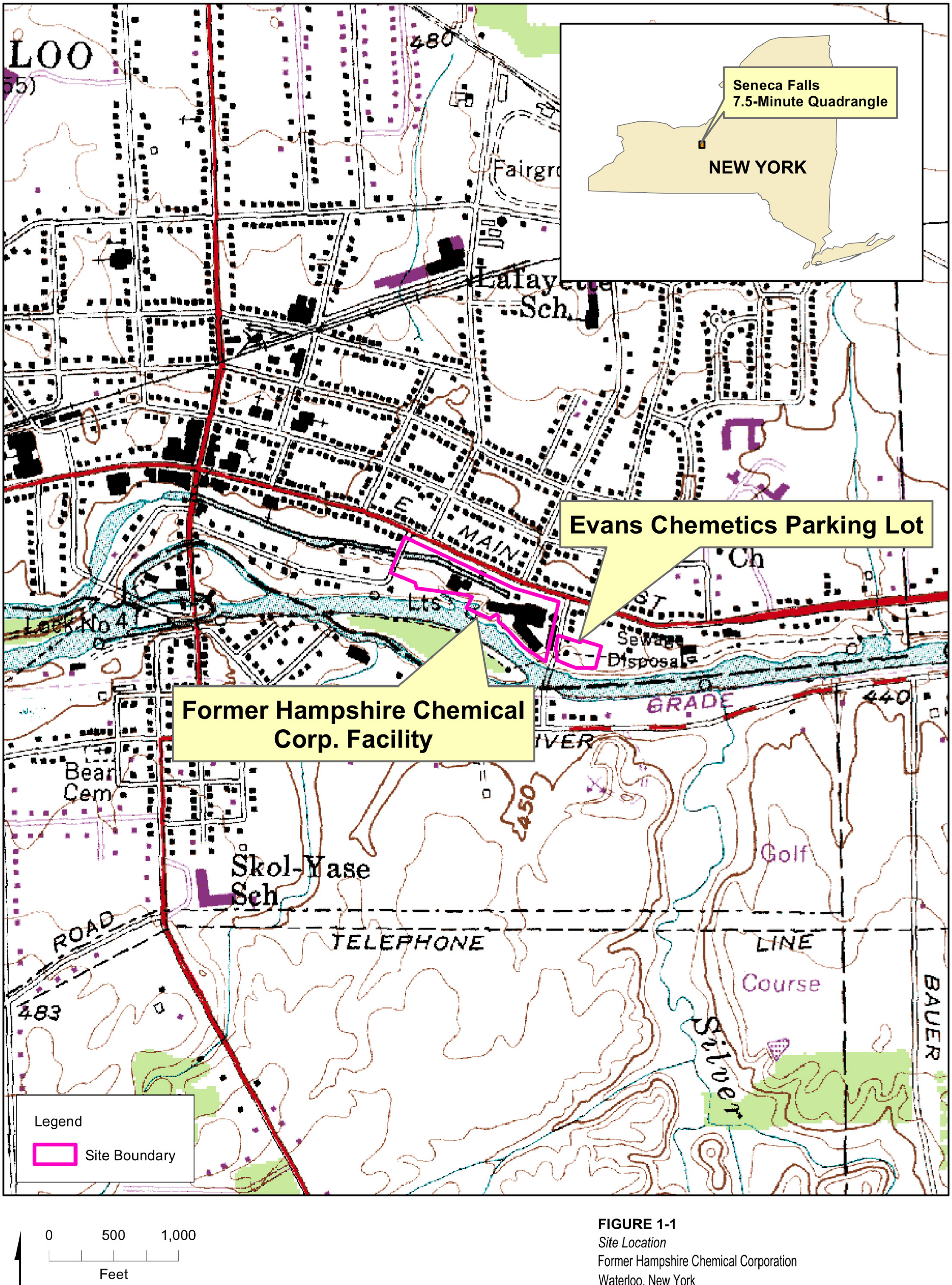
<u>Abbreviations</u>

Eh, oxidation/reduction potential
mg/L, milligram per liter
mV, millivolts
TOC, total organci carbon
ug/L, micrograms per liter

<u>Redox process</u>

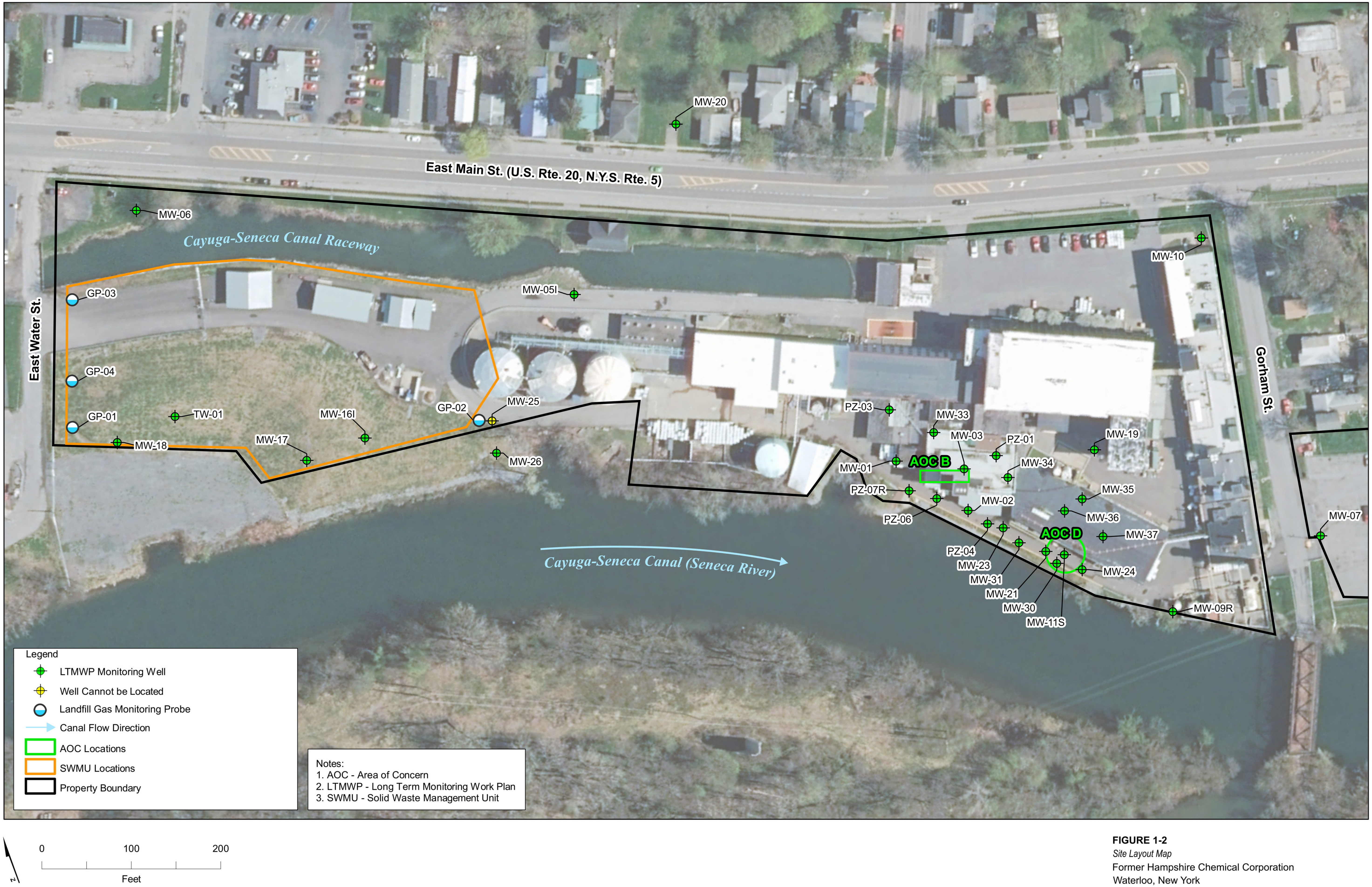
O_2, oxygen reduction
NO_3, nitrate reduction
Mn(IV), manganese reduction
Fe(III), iron reduction
SO_4, sulfate reduction

Figures



Seneca Falls, NY 1953 Photo Revised 1978

FIGURE 1-1
Site Location
Former Hampshire Chemical Corporation
Waterloo, New York



Notes:
1. AOC - Area of Concern
2. LTMWP - Long Term Monitoring Work Plan
3. SWMU - Solid Waste Management Unit

FIGURE 1-2

Site Layout Map

Former Hampshire Chemical Corporation

Waterloo, New York

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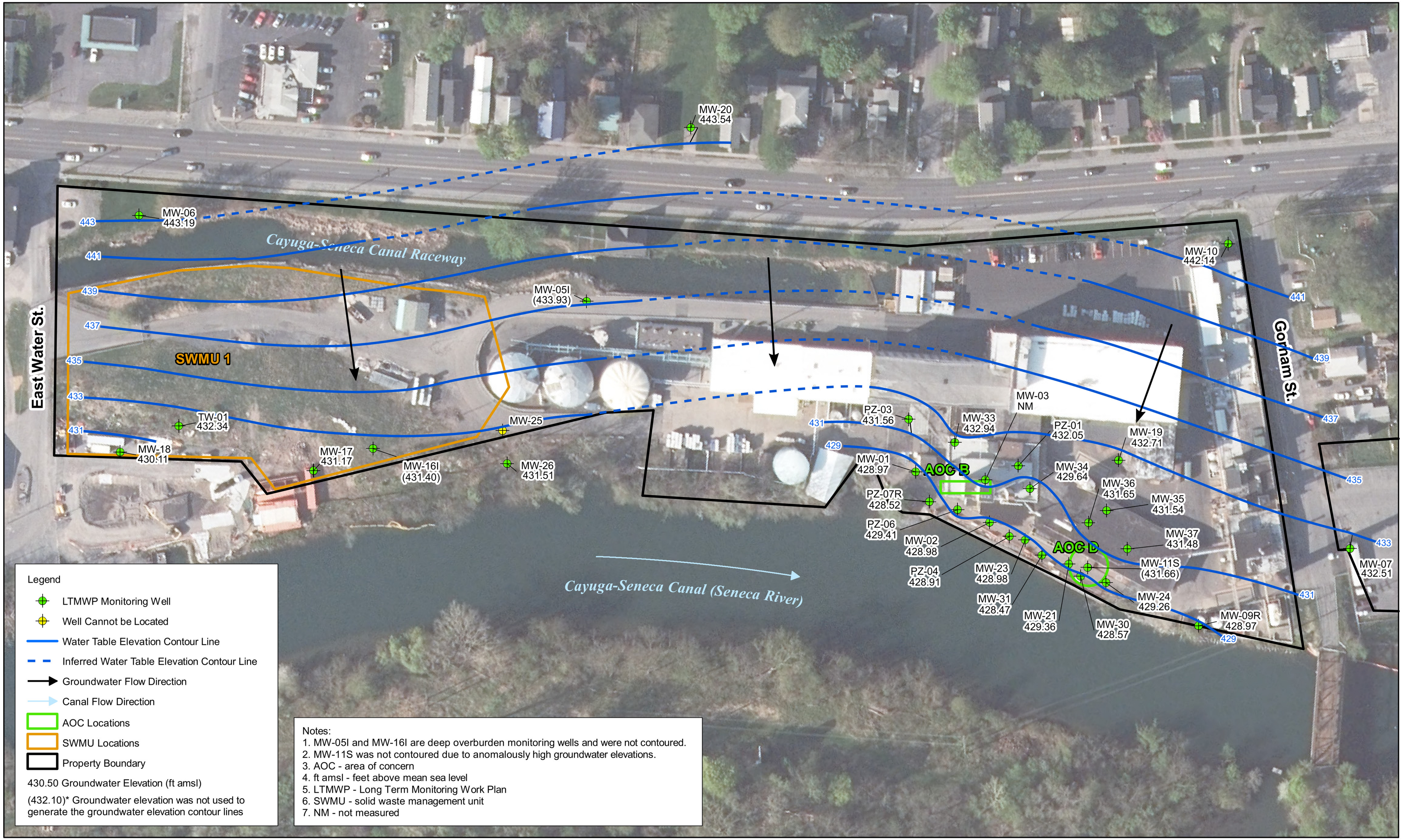


Legend

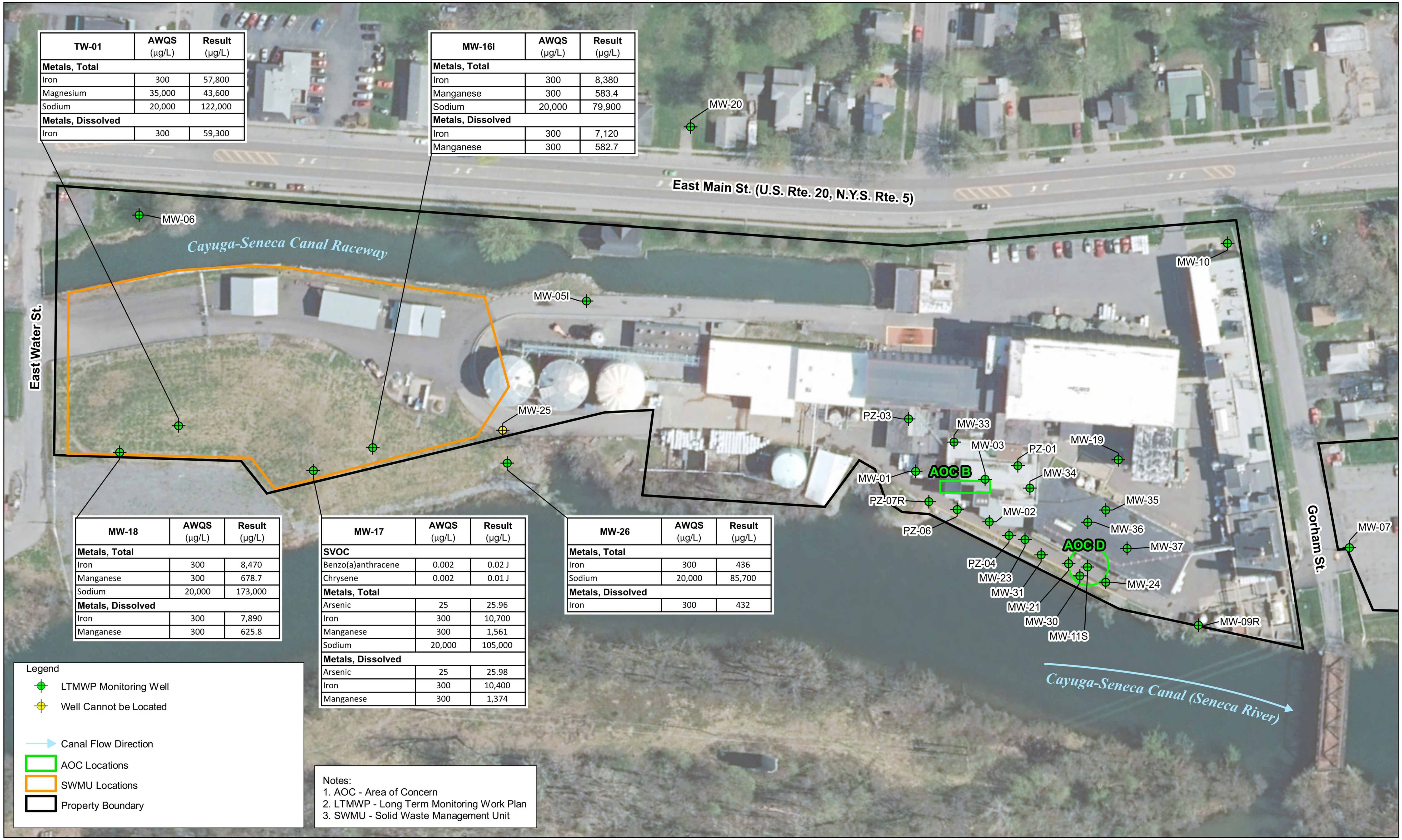
- ⊕ LTMWP Monitoring Well
- ⊕ Well Cannot be Located
- — Water Table Elevation Contour Line
- - - Inferred Water Table Elevation Contour Line
- → Groundwater Flow Direction
- → Canal Flow Direction
- 🟩 AOC Locations
- 🟧 SWMU Locations
- ⬛ Property Boundary

430.50 Groundwater Elevation (ft amsl)

(432.10)* Groundwater elevation was not used to generate the groundwater elevation contour lines

Notes:
1. MW-05I and MW-16I are deep overburden monitoring wells and were not contoured.
2. MW-11S was not contoured due to anomalously high groundwater elevations.
3. AOC - area of concern
4. ft amsl - feet above mean sea level
5. LTMWP - Long Term Monitoring Work Plan
6. SWMU - solid waste management unit
7. NM - not measured

Figure 3-1. Groundwater Elevation Contour Map, October 2019
2019 Groundwater Monitoring Results and
Year 4 Monitoring Natural Attenuation Performance Evaluation Report
Former Hampshire Chemical Corp. Facility
Waterloo, New York



TW-01	AWQS (µg/L)	Result (µg/L)
Metals, Total		
Iron	300	57,800
Magnesium	35,000	43,600
Sodium	20,000	122,000
Metals, Dissolved		
Iron	300	59,300

MW-16I	AWQS (µg/L)	Result (µg/L)
Metals, Total		
Iron	300	8,380
Manganese	300	583.4
Sodium	20,000	79,900
Metals, Dissolved		
Iron	300	7,120
Manganese	300	582.7

MW-18	AWQS (µg/L)	Result (µg/L)
Metals, Total		
Iron	300	8,470
Manganese	300	678.7
Sodium	20,000	173,000
Metals, Dissolved		
Iron	300	7,890
Manganese	300	625.8

MW-17	AWQS (µg/L)	Result (µg/L)
SVOC		
Benzo(a)anthracene	0.002	0.02 J
Chrysene	0.002	0.01 J
Metals, Total		
Arsenic	25	25.96
Iron	300	10,700
Manganese	300	1,561
Sodium	20,000	105,000
Metals, Dissolved		
Arsenic	25	25.98
Iron	300	10,400
Manganese	300	1,374

MW-26	AWQS (µg/L)	Result (µg/L)
Metals, Total		
Iron	300	436
Sodium	20,000	85,700
Metals, Dissolved		
Iron	300	432

Notes:
1. AOC - Area of Concern
2. LTMWP - Long Term Monitoring Work Plan
3. SWMU - Solid Waste Management Unit

FIGURE 3-2. Groundwater Analytical Exceedances at SWMU 1 Wells
2019 Groundwater Monitoring Results and
Monitored Natural Attenuation Evaluation Report
Former Hampshire Chemical Corporation
Waterloo, New York

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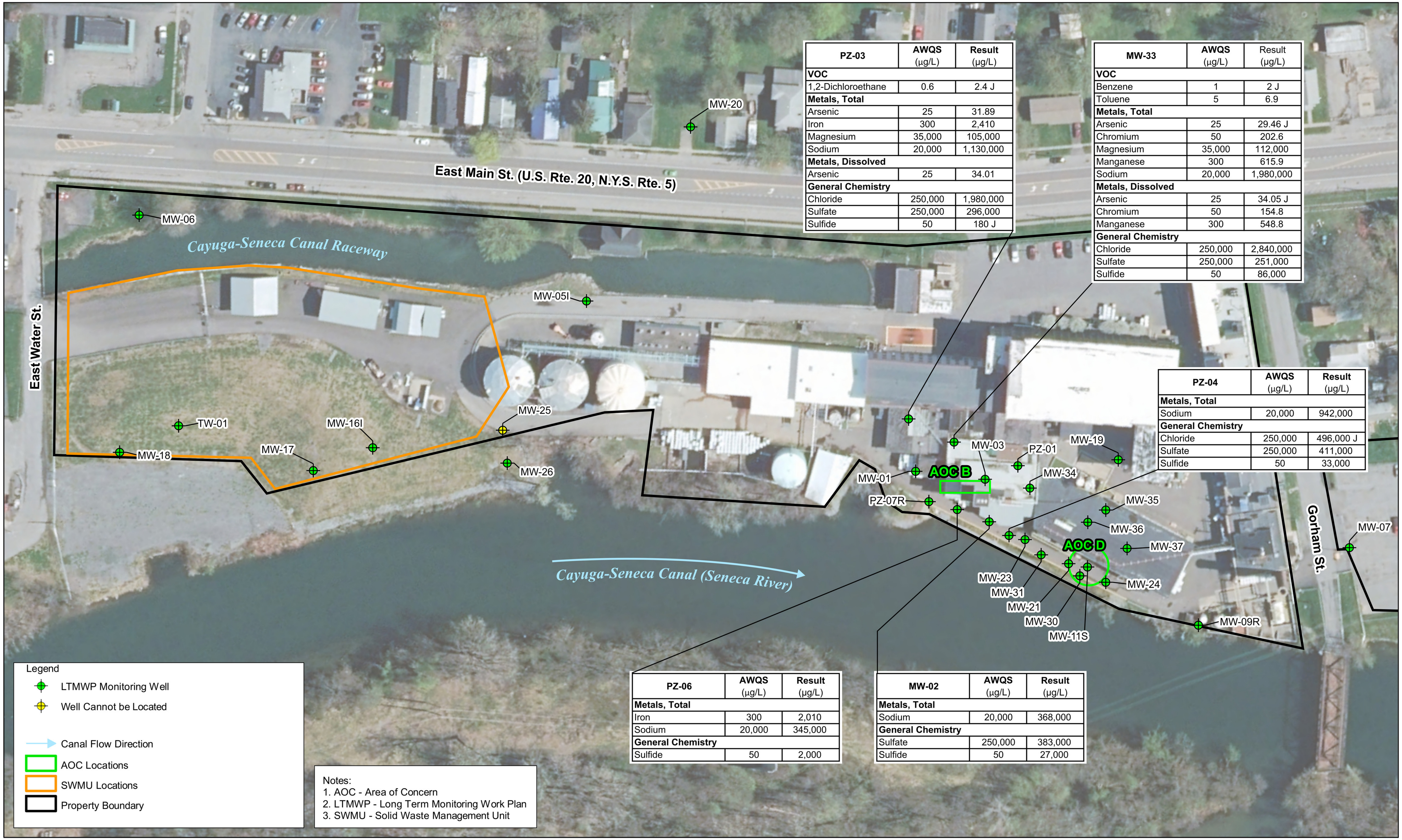


PZ-03	AWQS (µg/L)	Result (µg/L)
VOC		
1,2-Dichloroethane	0.6	2.4 J
Metals, Total		
Arsenic	25	31.89
Iron	300	2,410
Magnesium	35,000	105,000
Sodium	20,000	1,130,000
Metals, Dissolved		
Arsenic	25	34.01
General Chemistry		
Chloride	250,000	1,980,000
Sulfate	250,000	296,000
Sulfide	50	180 J

MW-33	AWQS (µg/L)	Result (µg/L)
VOC		
Benzene	1	2 J
Toluene	5	6.9
Metals, Total		
Arsenic	25	29.46 J
Chromium	50	202.6
Magnesium	35,000	112,000
Manganese	300	615.9
Sodium	20,000	1,980,000
Metals, Dissolved		
Arsenic	25	34.05 J
Chromium	50	154.8
Manganese	300	548.8
General Chemistry		
Chloride	250,000	2,840,000
Sulfate	250,000	251,000
Sulfide	50	86,000

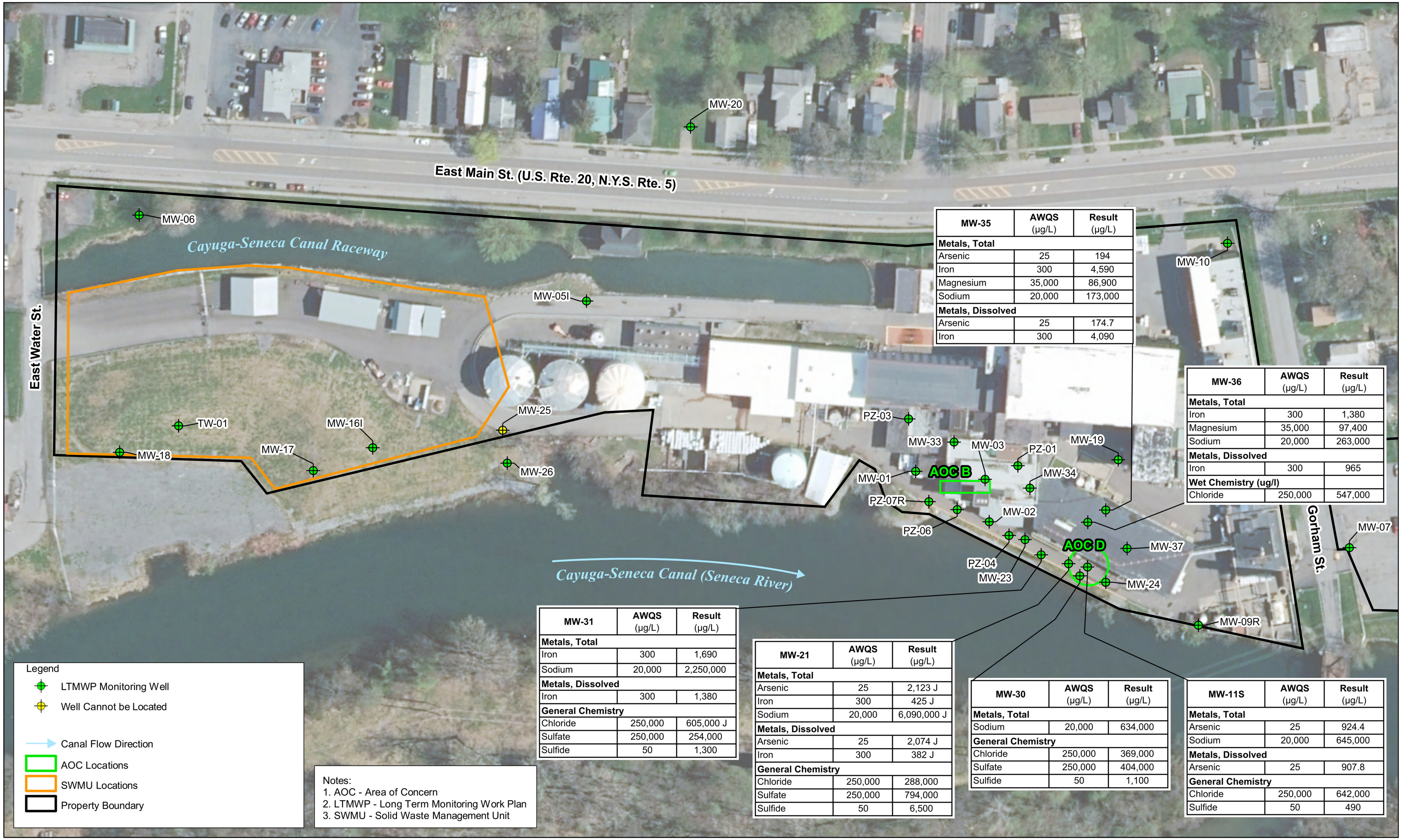
PZ-04	AWQS (µg/L)	Result (µg/L)
Metals, Total		
Sodium	20,000	942,000
General Chemistry		
Chloride	250,000	496,000 J
Sulfate	250,000	411,000
Sulfide	50	33,000

PZ-06	AWQS (µg/L)	Result (µg/L)
Metals, Total		
Iron	300	2,010
Sodium	20,000	345,000
General Chemistry		
Sulfide	50	2,000

MW-02	AWQS (µg/L)	Result (µg/L)
Metals, Total		
Sodium	20,000	368,000
General Chemistry		
Sulfate	250,000	383,000
Sulfide	50	27,000

Notes:
1. AOC - Area of Concern
2. LTMWP - Long Term Monitoring Work Plan
3. SWMU - Solid Waste Management Unit

FIGURE 3-3. Groundwater Analytical Exceedances at AOC B Wells
2019 Groundwater Monitoring Results and
Monitored Natural Attenuation Evaluation Report
Former Hampshire Chemical Corporation
Waterloo, New York



MW-35	AWQS (µg/L)	Result (µg/L)
Metals, Total		
Arsenic	25	194
Iron	300	4,590
Magnesium	35,000	86,900
Sodium	20,000	173,000
Metals, Dissolved		
Arsenic	25	174.7
Iron	300	4,090

MW-36	AWQS (µg/L)	Result (µg/L)
Metals, Total		
Iron	300	1,380
Magnesium	35,000	97,400
Sodium	20,000	263,000
Metals, Dissolved		
Iron	300	965
Wet Chemistry (ug/l)		
Chloride	250,000	547,000

MW-31	AWQS (µg/L)	Result (µg/L)
Metals, Total		
Iron	300	1,690
Sodium	20,000	2,250,000
Metals, Dissolved		
Iron	300	1,380
General Chemistry		
Chloride	250,000	605,000 J
Sulfate	250,000	254,000
Sulfide	50	1,300

MW-21	AWQS (µg/L)	Result (µg/L)
Metals, Total		
Arsenic	25	2,123 J
Iron	300	425 J
Sodium	20,000	6,090,000 J
Metals, Dissolved		
Arsenic	25	2,074 J
Iron	300	382 J
General Chemistry		
Chloride	250,000	288,000
Sulfate	250,000	794,000
Sulfide	50	6,500

MW-30	AWQS (µg/L)	Result (µg/L)
Metals, Total		
Sodium	20,000	634,000
General Chemistry		
Chloride	250,000	369,000
Sulfate	250,000	404,000
Sulfide	50	1,100

MW-11S	AWQS (µg/L)	Result (µg/L)
Metals, Total		
Arsenic	25	924.4
Sodium	20,000	645,000
Metals, Dissolved		
Arsenic	25	907.8
General Chemistry		
Chloride	250,000	642,000
Sulfide	50	490

Legend

⊕	LTMWP Monitoring Well
⊕	Well Cannot be Located
→	Canal Flow Direction
🟩	AOC Locations
🟧	SWMU Locations
⬛	Property Boundary

Notes:
1. AOC - Area of Concern
2. LTMWP - Long Term Monitoring Work Plan
3. SWMU - Solid Waste Management Unit

FIGURE 3-4. Groundwater Analytical Exceedances at AOC D Wells
2019 Groundwater Monitoring Results and
Monitored Natural Attenuation Evaluation Report
Former Hampshire Chemical Corporation
Waterloo, New York

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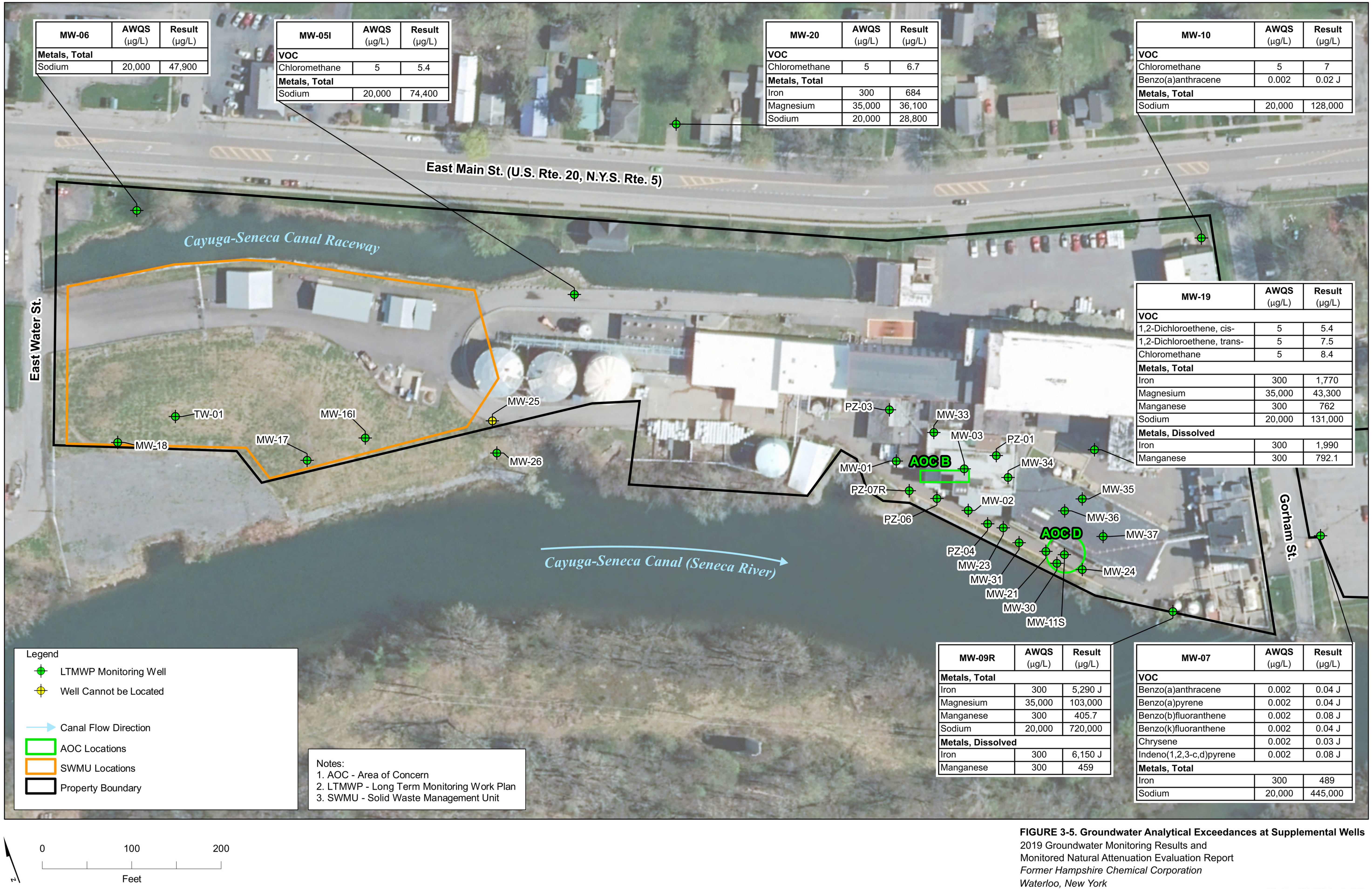

MW-06	AWQS (µg/L)	Result (µg/L)
Metals, Total		
Sodium	20,000	47,900

MW-05I	AWQS (µg/L)	Result (µg/L)
VOC		
Chloromethane	5	5.4
Metals, Total		
Sodium	20,000	74,400

MW-20	AWQS (µg/L)	Result (µg/L)
VOC		
Chloromethane	5	6.7
Metals, Total		
Iron	300	684
Magnesium	35,000	36,100
Sodium	20,000	28,800

MW-10	AWQS (µg/L)	Result (µg/L)
VOC		
Chloromethane	5	7
Benzo(a)anthracene	0.002	0.02 J
Metals, Total		
Sodium	20,000	128,000

MW-19	AWQS (µg/L)	Result (µg/L)
VOC		
1,2-Dichloroethene, cis-	5	5.4
1,2-Dichloroethene, trans-	5	7.5
Chloromethane	5	8.4
Metals, Total		
Iron	300	1,770
Magnesium	35,000	43,300
Manganese	300	762
Sodium	20,000	131,000
Metals, Dissolved		
Iron	300	1,990
Manganese	300	792.1

MW-09R	AWQS (µg/L)	Result (µg/L)
Metals, Total		
Iron	300	5,290 J
Magnesium	35,000	103,000
Manganese	300	405.7
Sodium	20,000	720,000
Metals, Dissolved		
Iron	300	6,150 J
Manganese	300	459

MW-07	AWQS (µg/L)	Result (µg/L)
VOC		
Benzo(a)anthracene	0.002	0.04 J
Benzo(a)pyrene	0.002	0.04 J
Benzo(b)fluoranthene	0.002	0.08 J
Benzo(k)fluoranthene	0.002	0.04 J
Chrysene	0.002	0.03 J
Indeno(1,2,3-c,d)pyrene	0.002	0.08 J
Metals, Total		
Iron	300	489
Sodium	20,000	445,000

Notes:
1. AOC - Area of Concern
2. LTMWP - Long Term Monitoring Work Plan
3. SWMU - Solid Waste Management Unit

FIGURE 3-5. Groundwater Analytical Exceedances at Supplemental Wells
2019 Groundwater Monitoring Results and
Monitored Natural Attenuation Evaluation Report
Former Hampshire Chemical Corporation
Waterloo, New York

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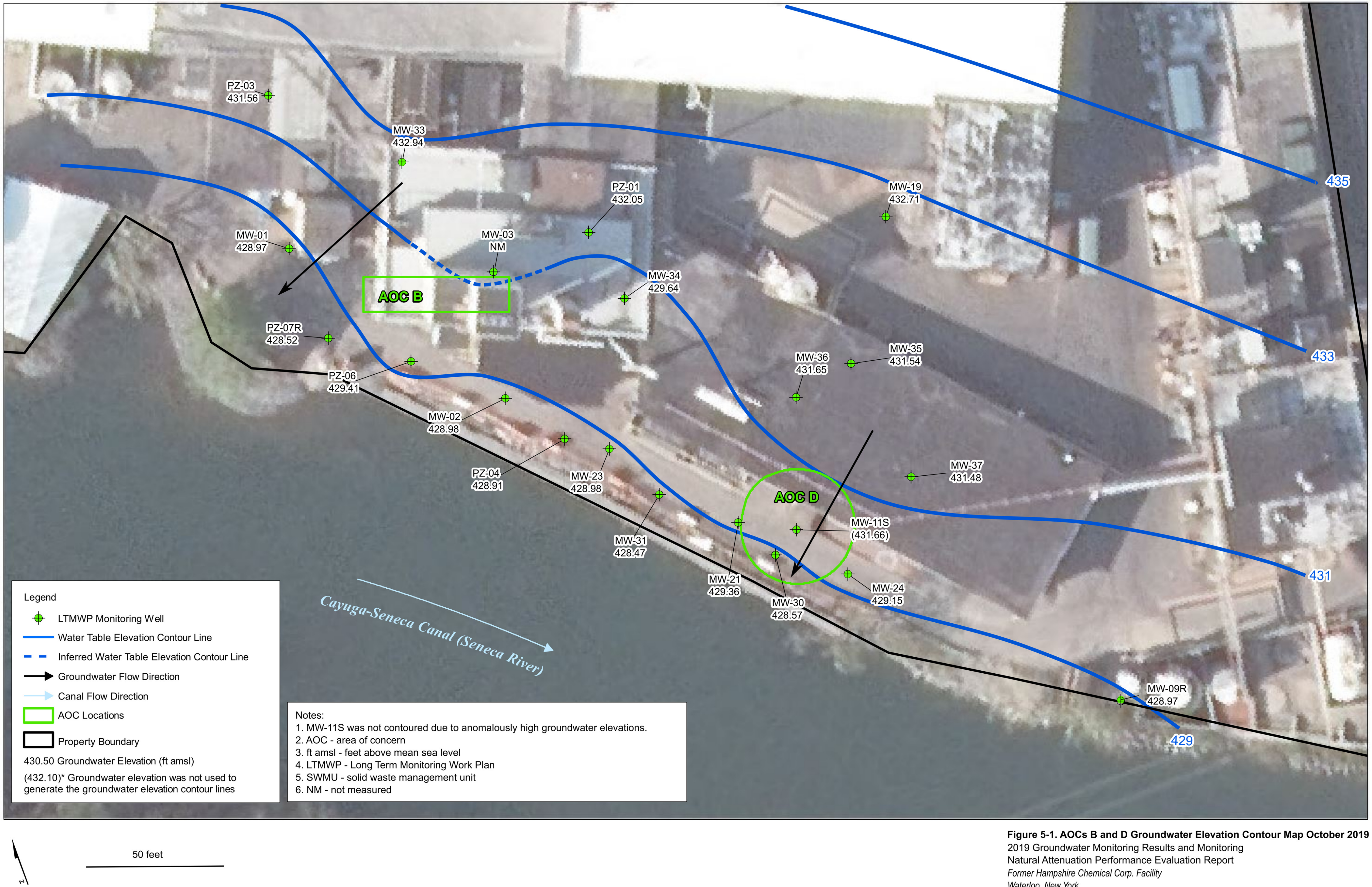


Legend

- ⊕ LTMWP Monitoring Well
- ━ Water Table Elevation Contour Line
- ╍ Inferred Water Table Elevation Contour Line
- → Groundwater Flow Direction
- → Canal Flow Direction
- ▭ AOC Locations
- ▭ Property Boundary

430.50 Groundwater Elevation (ft amsl)

(432.10)* Groundwater elevation was not used to generate the groundwater elevation contour lines

Notes:
1. MW-11S was not contoured due to anomalously high groundwater elevations.
2. AOC - area of concern
3. ft amsl - feet above mean sea level
4. LTMWP - Long Term Monitoring Work Plan
5. SWMU - solid waste management unit
6. NM - not measured

Figure 5-1. AOCs B and D Groundwater Elevation Contour Map October 2019
2019 Groundwater Monitoring Results and Monitoring
Natural Attenuation Performance Evaluation Report
Former Hampshire Chemical Corp. Facility
Waterloo, New York

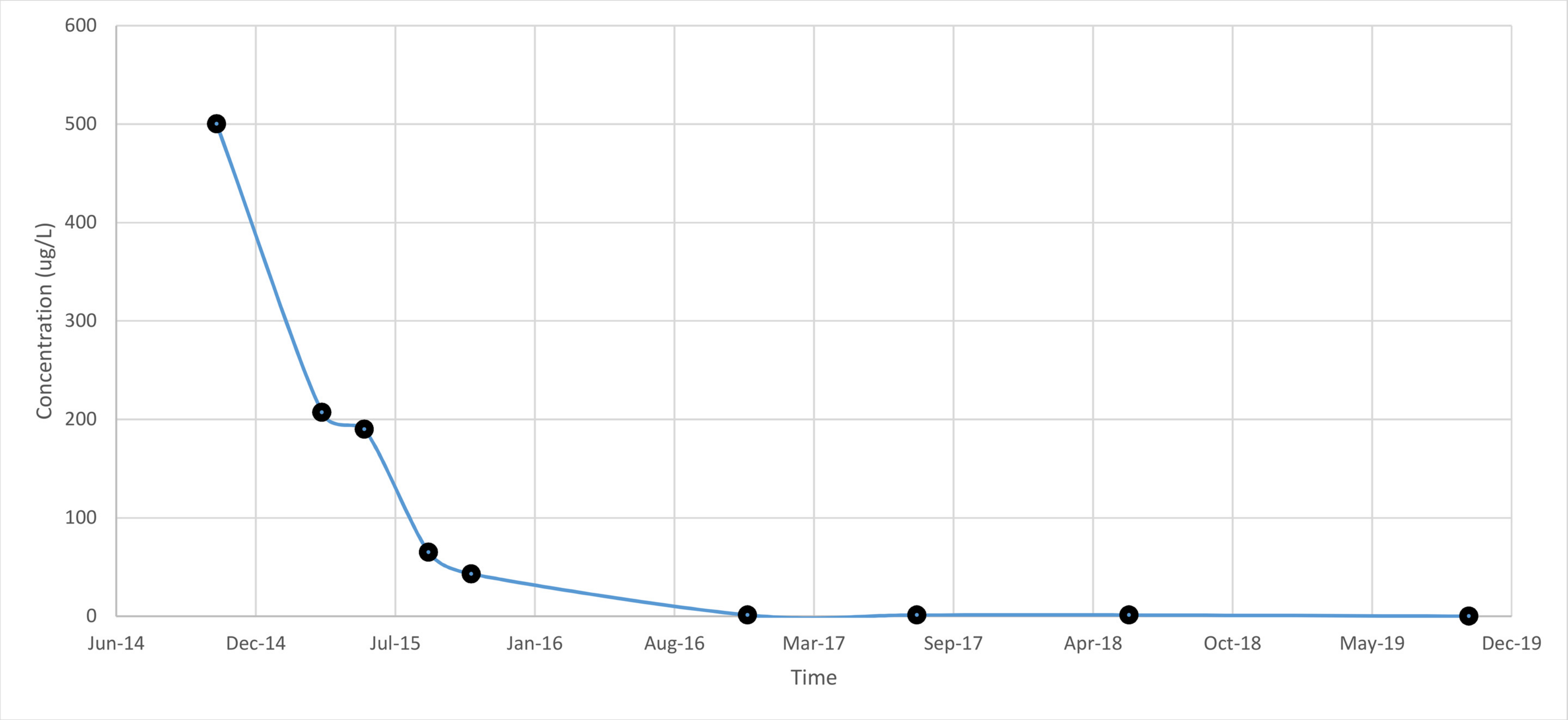


FIGURE 5-2. Time-Series Graph of MIBK Concentrations at MW-02
2019 Groundwater Monitoring Results and
Monitored Natural Attenuation Report
Former Hampshire Chemical Coporation
Waterloo, New York

JACOBS

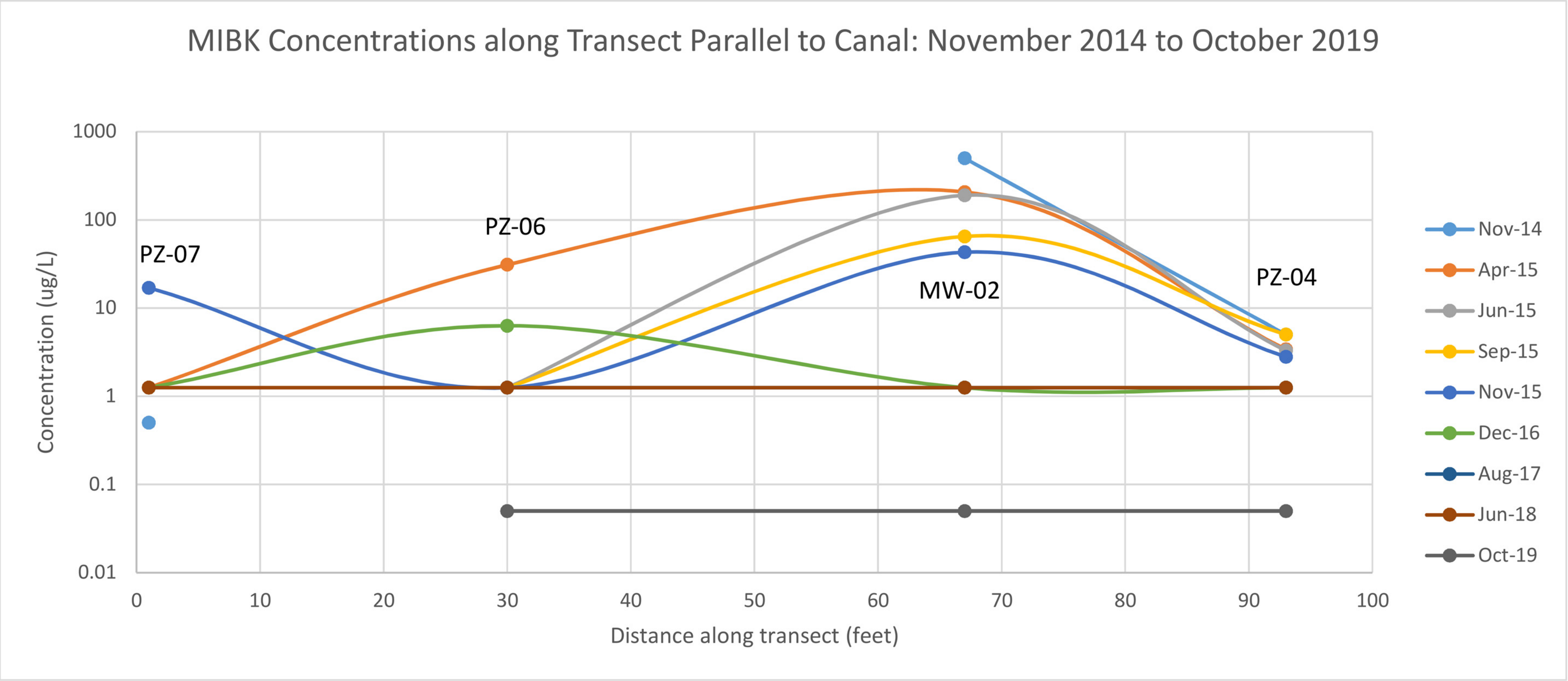


FIGURE 5-3. MIBK Concentrations Along Transect Parallel to the Canal, November 2014 to October 2019

2019 Groundwater Monitoring Results and
Monitored Natural Attenuation Report

Former Hampshire Chemical Coporation
Waterloo, New York

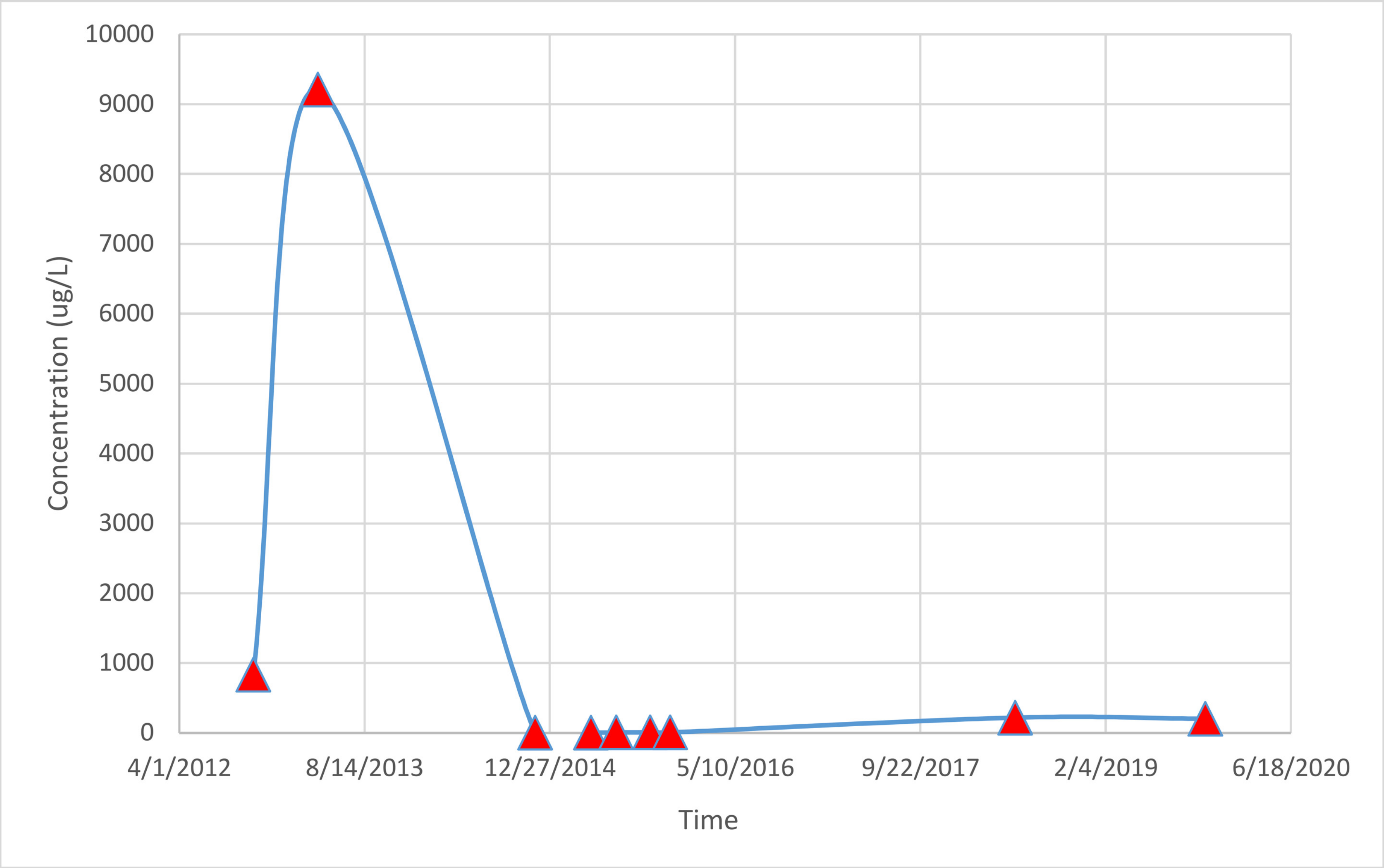


FIGURE 5-4. Time-Series Graph of Chromium Concentrations at MW-33
2019 Groundwater Monitoring Results and
Monitored Natural Attenuation Report
Former Hampshire Chemical Coporation
Waterloo, New York

JACOBS

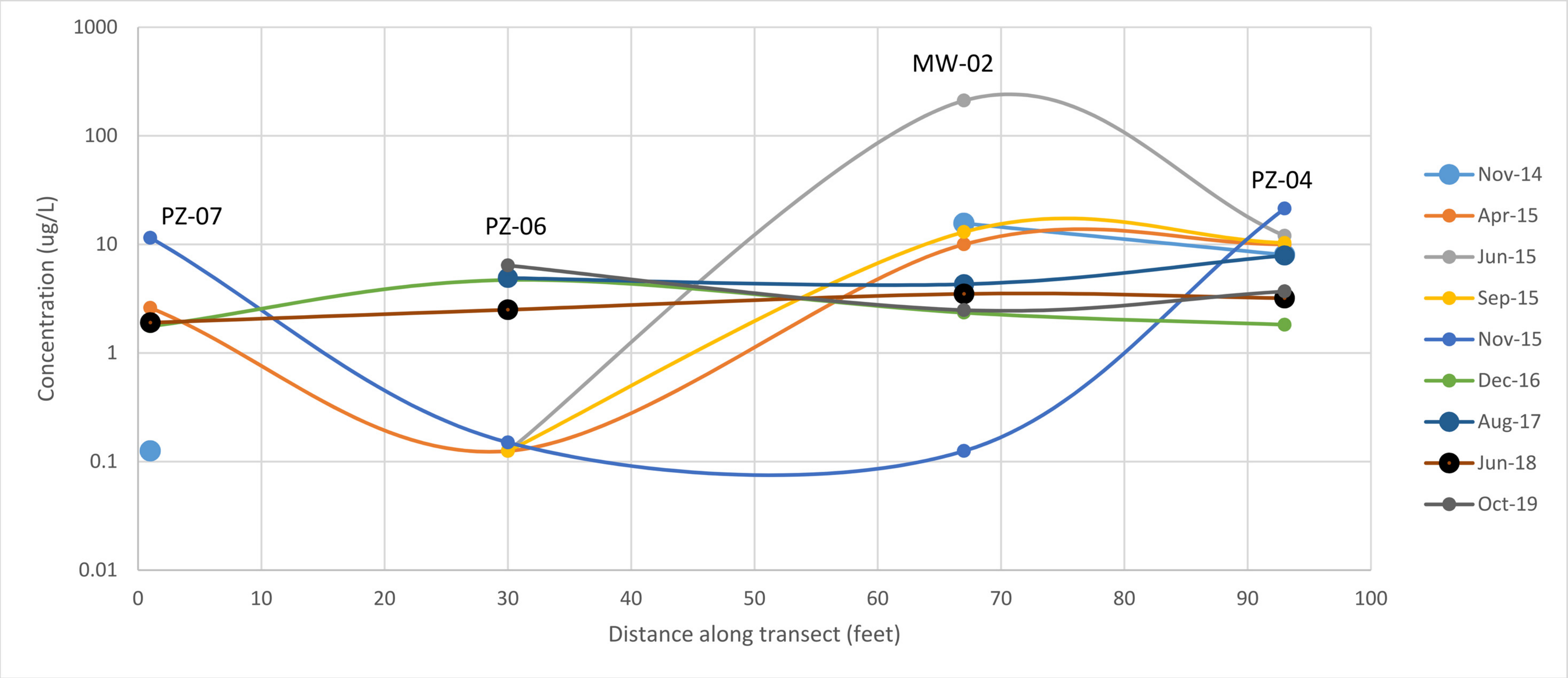


FIGURE 5-5. Chromium Concentrations Along Transect Parallel to the Canal, November 2014 to October 2019

2019 Groundwater Monitoring Results and
Monitored Natural Attenuation Report
Former Hampshire Chemical Coporation
Waterloo, New York

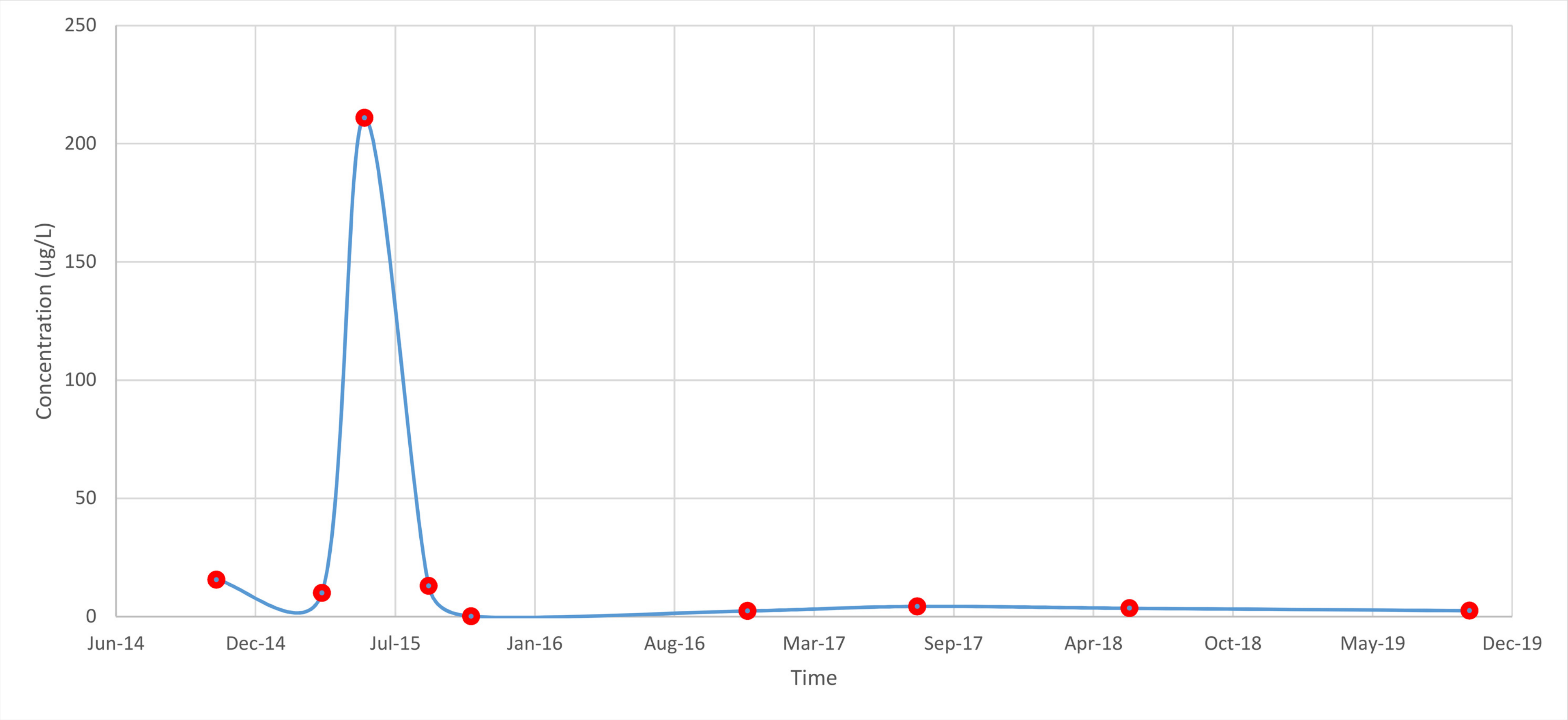


FIGURE 5-6. Time-Series Graph of Chromium Concentrations at MW-02
2019 Groundwater Monitoring Results and
Monitored Natural Attenuation Report
Former Hampshire Chemical Coporation
Waterloo, New York

JACOBS

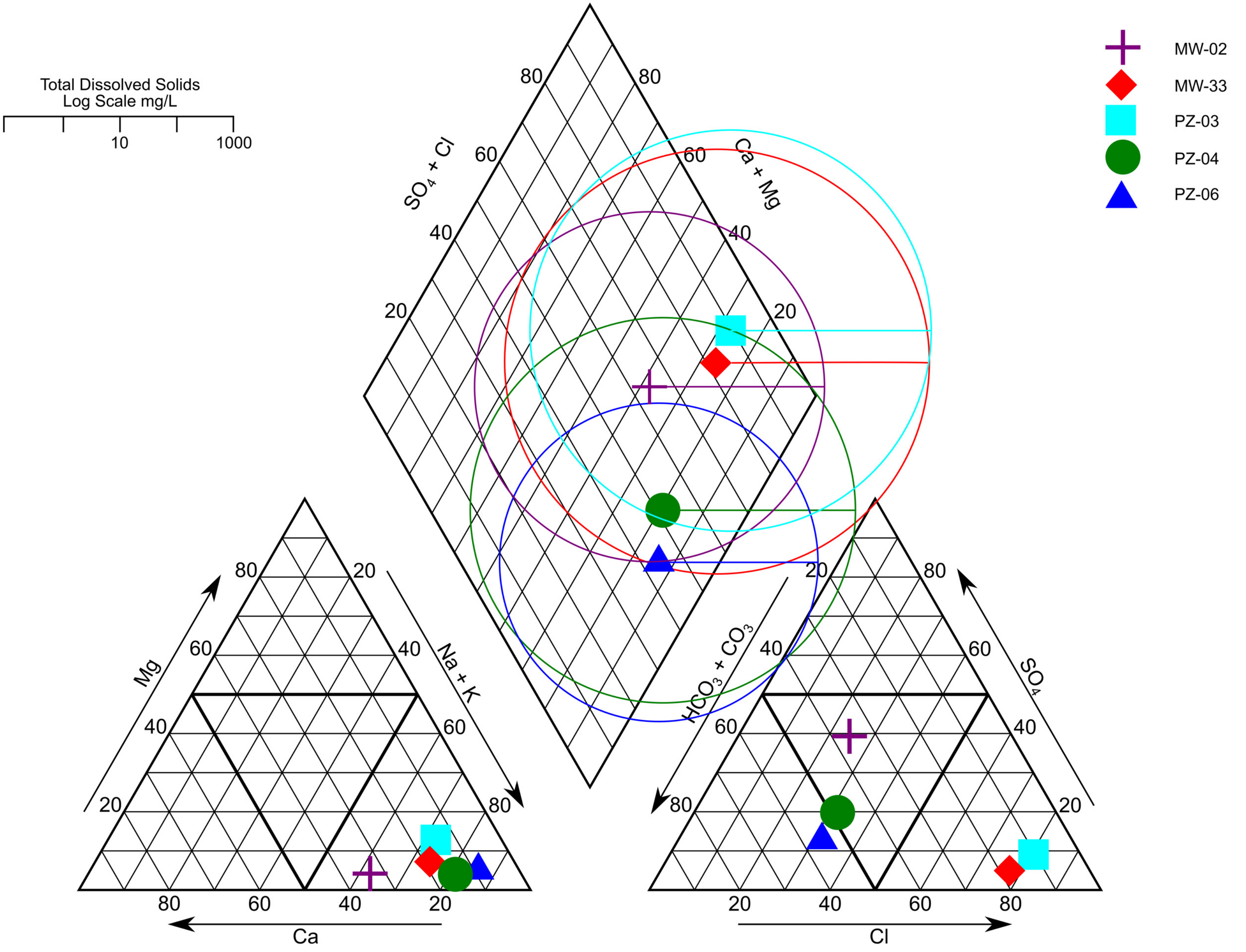
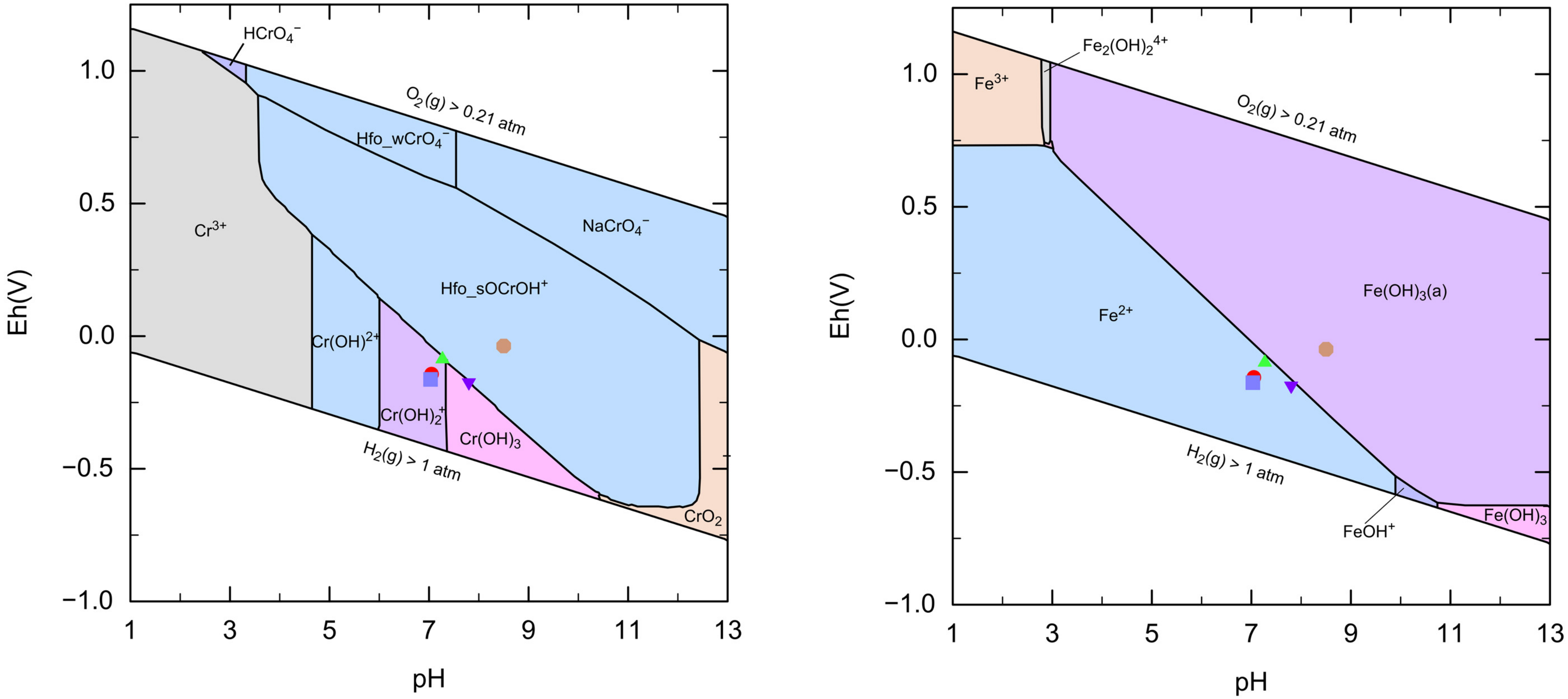


FIGURE 5-7. Piper Diagram of Major Ions in Groundwater at AOC B
2019 Groundwater Monitoring Results and
Monitored Natural Attenuation Report
Former Hampshire Chemical Coporation
Waterloo, New York



● MW-02

■ MW-33

▲ PZ-03

▼ PZ-04

● PZ-06

FIGURE 5-8. PhreePlot Diagram of Chromium-Iron-Oxide System for AOC B
2019 Groundwater Monitoring Results and
Monitored Natural Attenuation Evaluation Report
Former Hampshire Chemical Corporation
Waterloo, New York

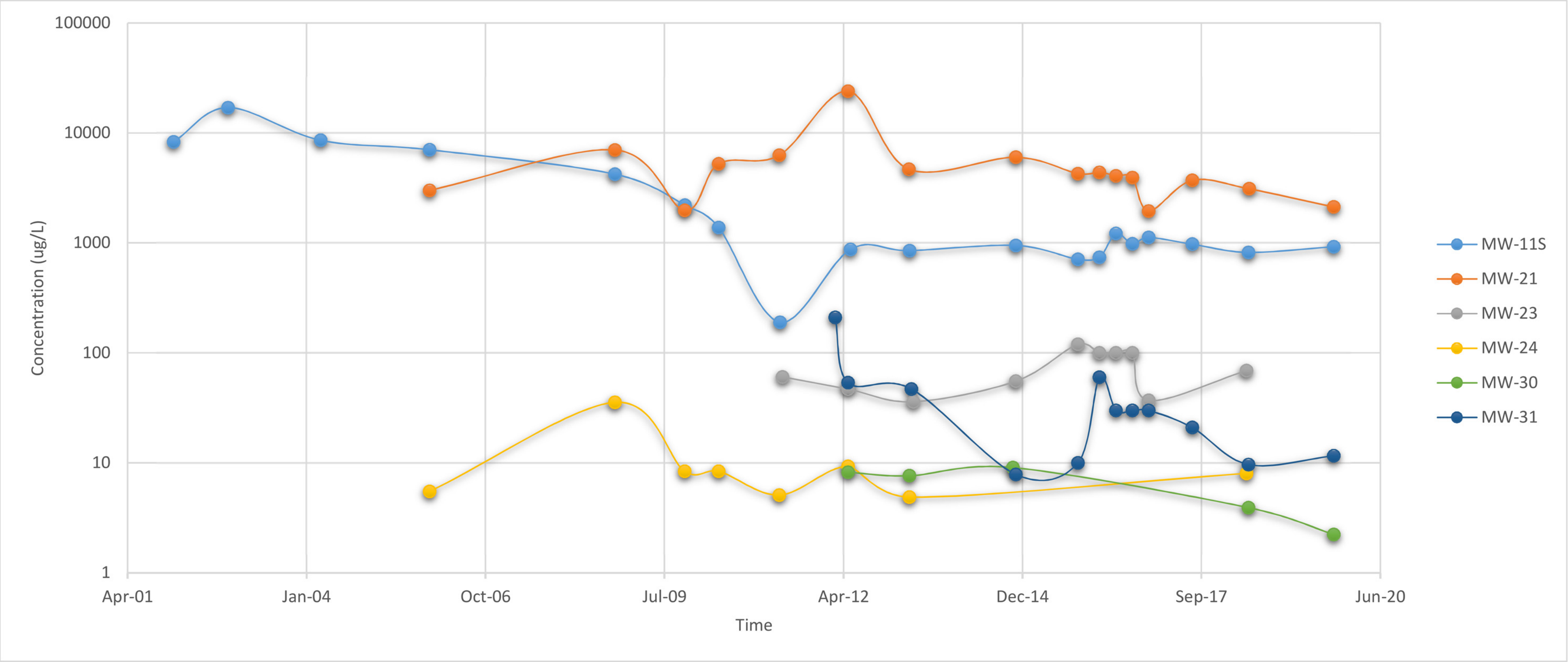


FIGURE 5-9. Time-Series Graph of Arsenic Concentrations in AOC D Monitoring Wells

2019 Groundwater Monitoring Results and
Monitored Natural Attenuation Report
Former Hampshire Chemical Coporation
Waterloo, New York

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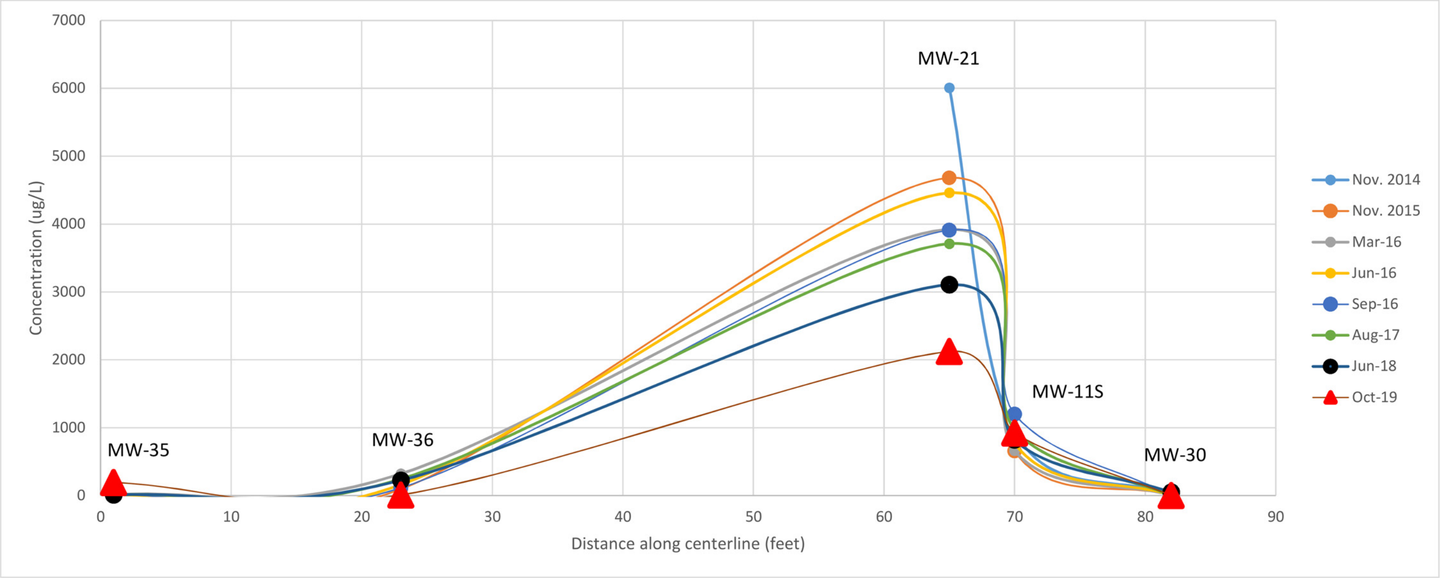

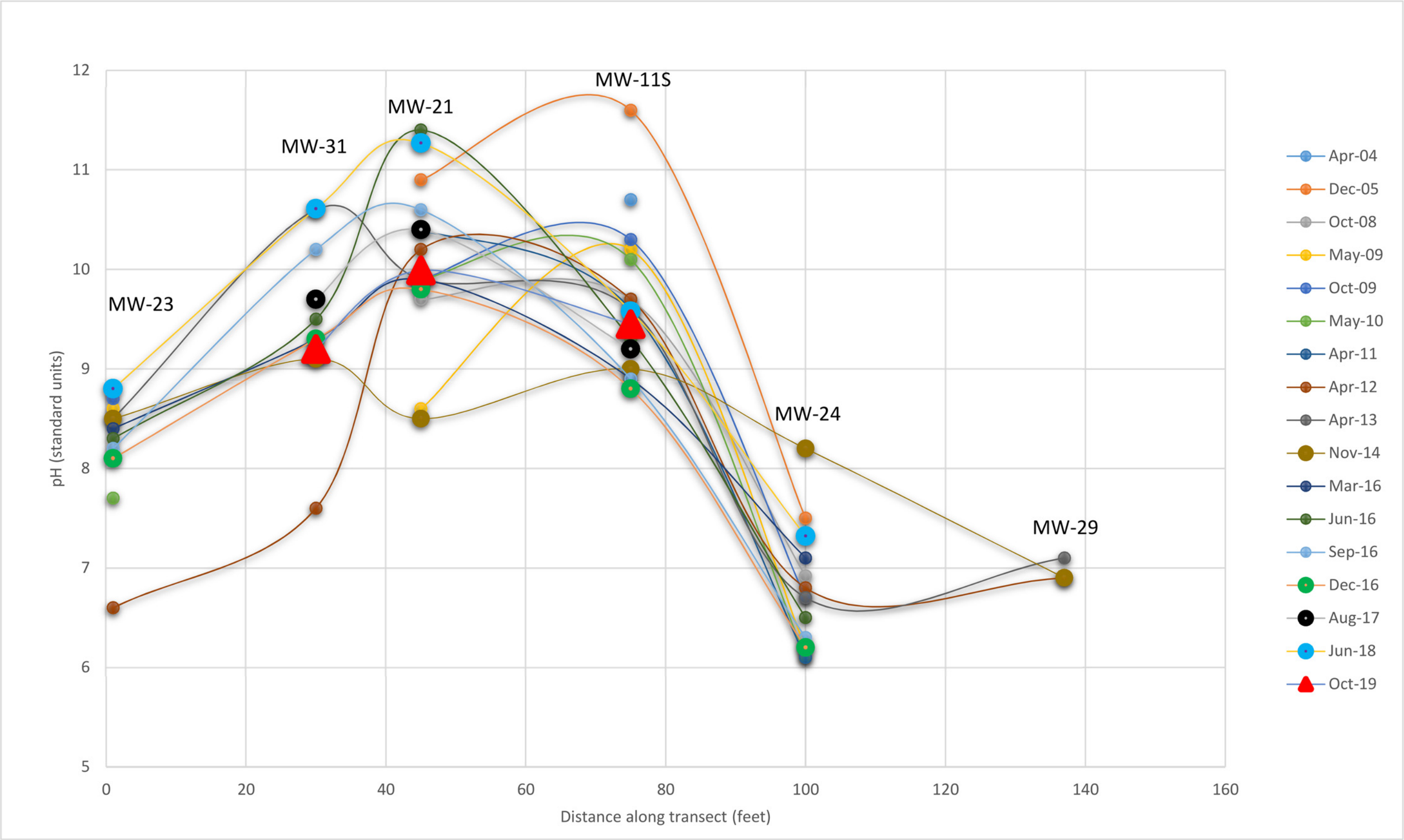

FIGURE 5-10. Arsenic Concentrations Along Transects Parallel and Perpendicular to Orientation of Plume
2019 Groundwater Monitoring Results and
Monitored Natural Attenuation Report
Former Hampshire Chemical Coporation
Waterloo, New York

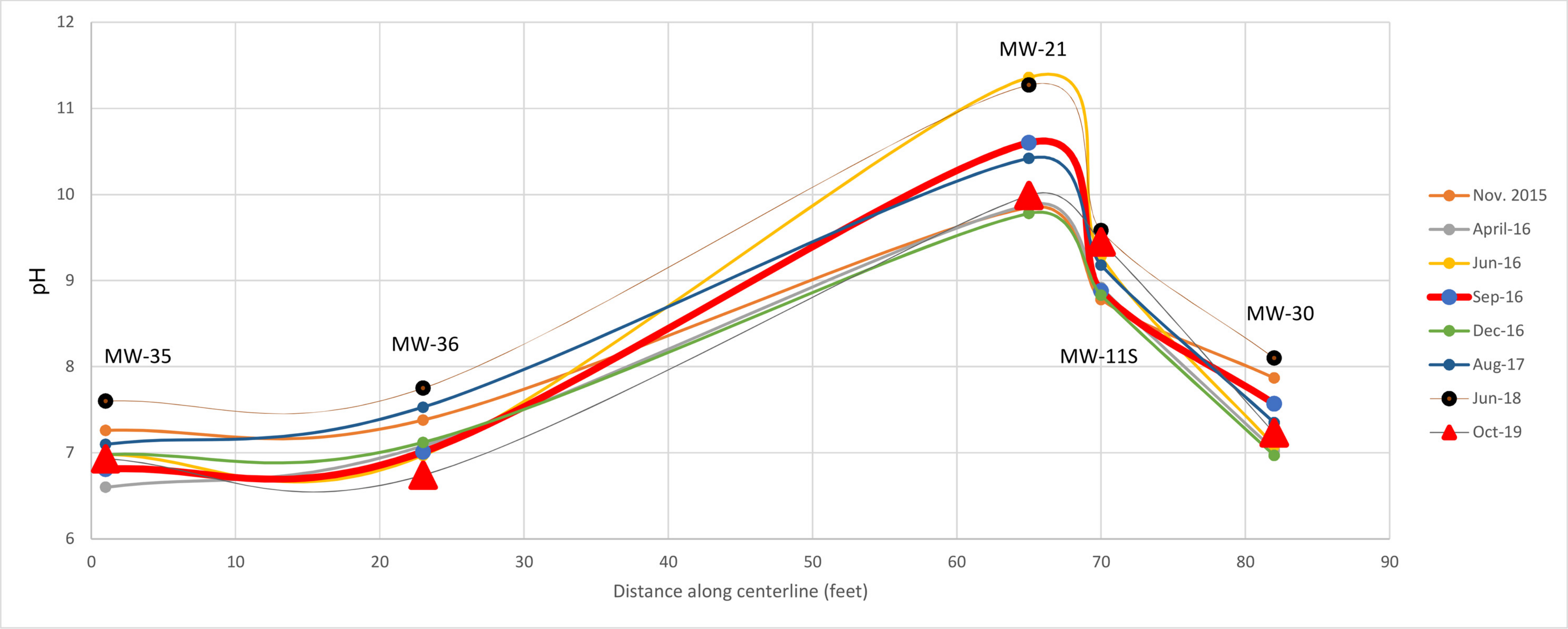

FIGURE 5-11. pH Along Center Line of Arsenic Plume
2019 Groundwater Monitoring Results and
Monitored Natural Attenuation Report
Former Hampshire Chemical Coporation
Waterloo, New York

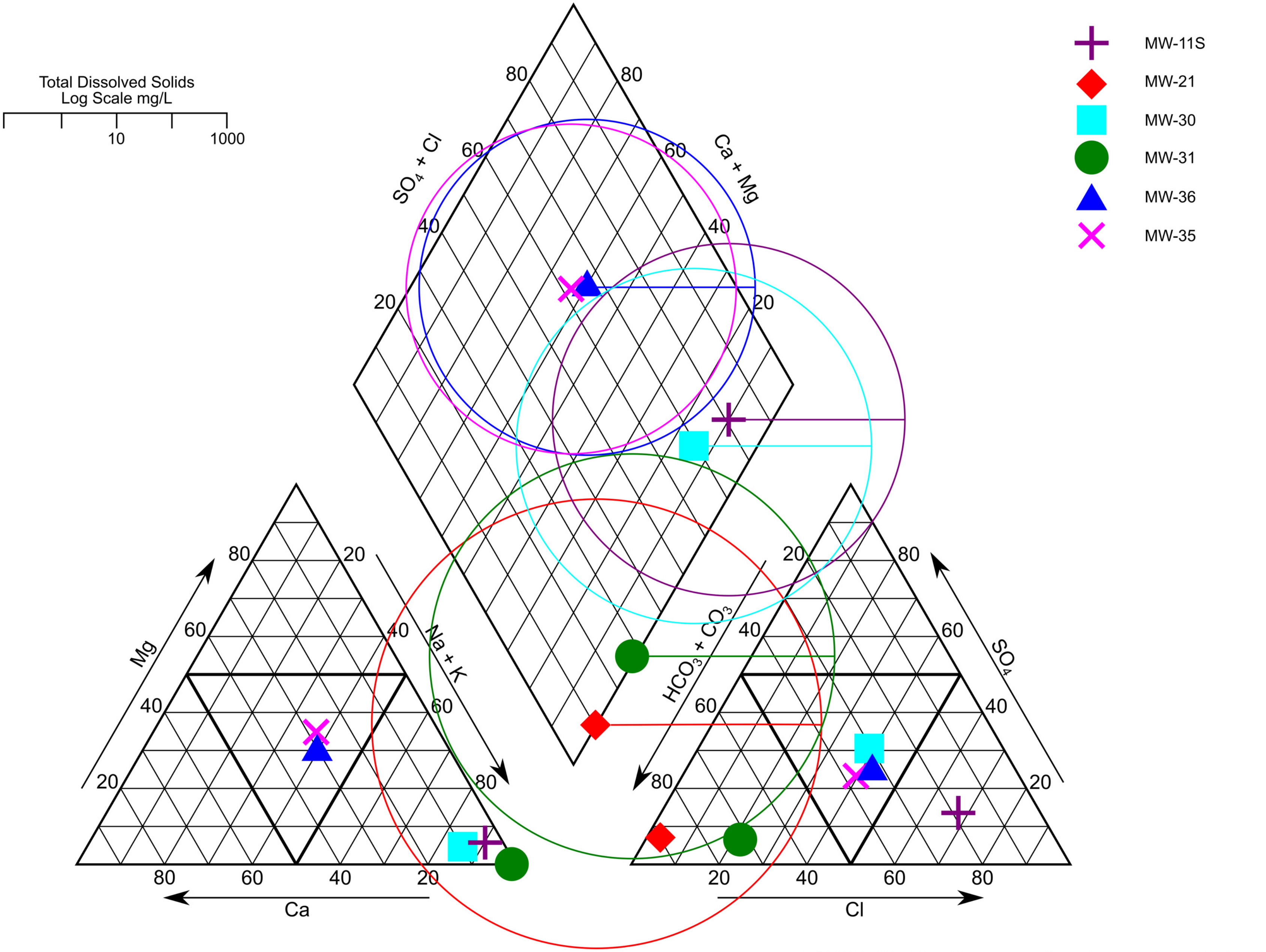

FIGURE 5-12. Piper Diagram of Major Ions in Groundwater at AOC D

2019 Groundwater Monitoring Results and
Monitored Natural Attenuation Report
Former Hampshire Chemical Coporation
Waterloo, New York

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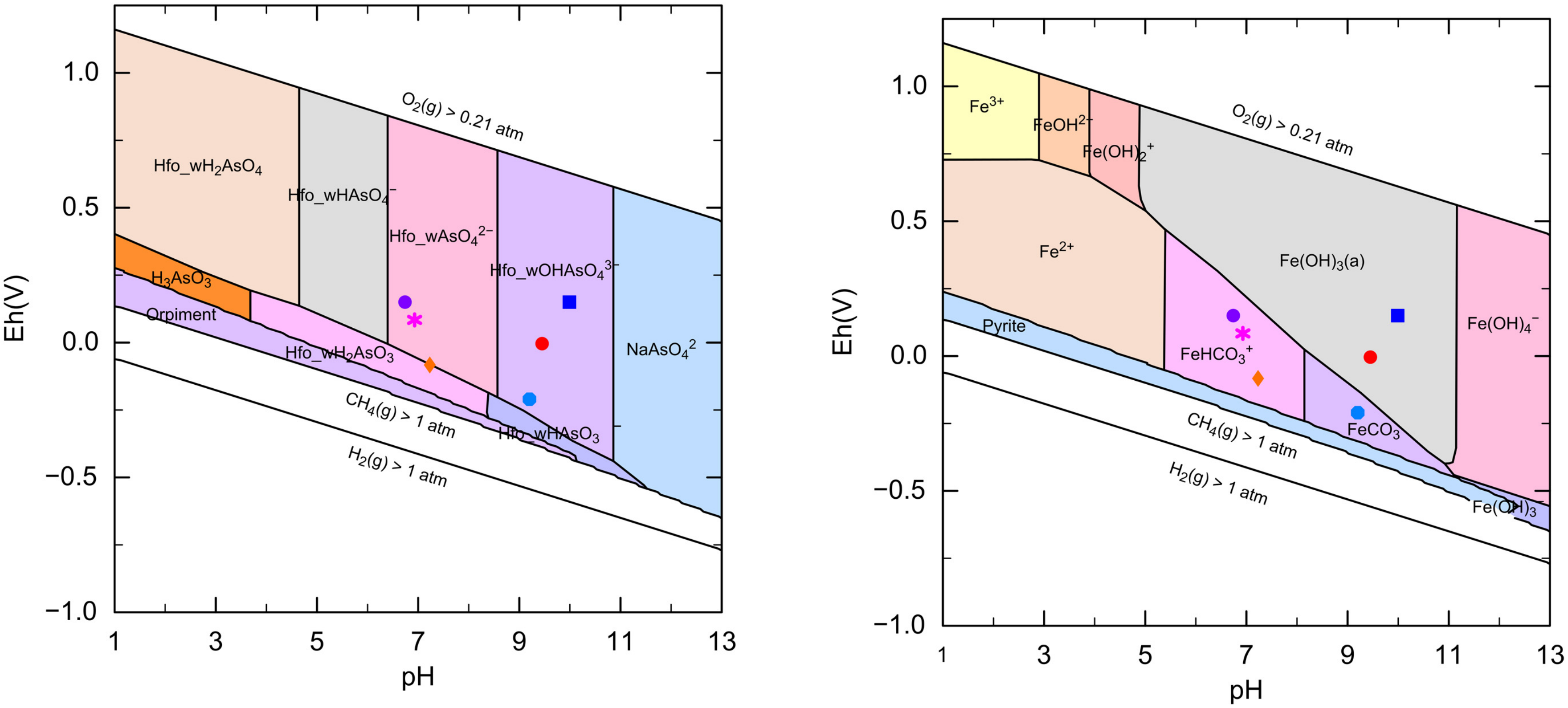

FIGURE 5-13. PhreePlot Diagram of Arsenic-Iron-Sulfide System for AOC D
2019 Groundwater Monitoring Results and
Monitored Natural Attenuation Evaluation Report
Former Hampshire Chemical Corporation
Waterloo, New York

Appendix A

Analytical Data Packages and EQuIS Reports

(provided on compact disc)

Appendix B
Groundwater Sampling Field Data Sheets

JACOBS

Former Hampshire Chemical Corp., 228 E. Main St., Waterloo, NY, Project DWWAT002

LOW-FLOW GROUNDWATER SAMPLING LOG, 2019 ANNUAL LTM EVENT

WELL: MW-02

SCREEN INTERVAL (ft BTOC):

START DATE: 8/15/19

WELL DIAMETER (INCHES): 2

FIELD CREW: SALSBURG

EQUIPMENT: *Peristaltic pump with one-time-use 0.25" x 0.170" Teflon-lined high-density polyethylene tubing*

METER MAKE & MODEL: *Horiba U-52 with flow-through cell*

METER CALIBRATION DATE: 8/15/19

DTW BEFORE PURGING (ft BTOC): 3.89

DEPTH TO BOTTOM (ft BTOC): 16.00

___ Soft / [✓ Hard]

REFERENCE: 1" well ≈ 0.16 liter/ft or 0.041 gal/ft   2-inch well ≈ 0.617 liter/ft or 0.163 gal/ft   1 gallon = 3.785 liters   1 liter = 0.264 gallons

WATER COLUMN (FT):

WELL VOLUME (LITERS):

3 WELL VOLUMES (LITERS):

FIELD PARAMETERS COLLECTED DURING LOW-FLOW PURGING

TIME 4 minute readings	WATER LEVEL (ft BTOC)	FLOW RATE (ml/min)	TOTAL VOLUME (Liters)	TEMP. (°C)	pH (std. units)	ORP (mV)	CONDUC-TIVITY (mS/cm)	DO (mg/L)	LaMOTTE TURBIDITY (NTU)	REMARKS (color, odor, sheen, sediment, etc.)
Stability:	< 0.3 ft	300 – 500	NA	NA	± 0.1	± 10 mV	± 3 %	± 10 %	± 10 %	
1103	3.91	300	—	20.28	7.00	-284	15.4	0.67	2.16	Initial state. CLEAR
1108	3.91	300	1.5	20.46	6.97	-303	20.4	0.57	1.88	CLEAR
1113	3.91	300	3.0	21.68	7.01	-353	6.39	0.57	2.40	CLEAR
1118	3.92	300	4.5	22.77	7.00	-337	2.36	0.55	2.55	
1123	3.92	300	6	23.16	7.02	-339	2.21	0.55	3.00	CLEAR
1128	3.92	300	7.5	23.30	7.04	-341	2.19	0.56	2.45	
1133	3.92	300	9	23.44	7.05	-343	2.17	0.56	2.29	CLEAR
1138	SAMPLE									
				--	--	--	--	--		Final state.

NOTES:

FIELD ANALYSES AND LABORATORY SAMPLING INFORMATION

PRIMARY SAMPLE ID: MW02-081519

PRIMARY SAMPLE DATE & TIME: 8/15/19 1138

PRIMARY SAMPLE PARAMETERS (check): ___ *VOCs*, ___ *TAL metals*, ___ *MNA*, ___ *SVOCs*, ___ *PAH*, ___ *Sulfur*, ___ *Sulfite*

QA/QC SAMPLE ID: DUP-GW-081519

QA/QC SAMPLE DATE & TIME: 8/15/19 900

QA/QC SAMPLE PARAMETERS (check): ___ *VOCs*, ___ *TAL metals*, ___ *MNA*, ___ *SVOCs*, ___ *PAH*, ___ *Sulfur*, ___ *Sulfite*

FERROUS IRON FIELD KIT CONCENTRATION (mg/L): 0.0

SAMPLER'S SIGNATURE:

6°

JACOBS Former Hampshire Chemical Corp., 228 E. Main St., Waterloo, NY, Project DWWAT002

LOW-FLOW GROUNDWATER SAMPLING LOG, 2019 ANNUAL LTM EVENT

WELL: MWOSI

SCREEN INTERVAL (ft BTOC):

START DATE: 8/19/19

WELL DIAMETER (INCHES): 2

FIELD CREW: C. Lettich

EQUIPMENT: *Peristaltic pump with one-time-use 0.25" x 0.170" Teflon-lined high-density polyethylene tubing*

METER MAKE & MODEL: *Horiba U-52 with flow-through cell*

METER CALIBRATION DATE: 8/19/19

DTW BEFORE PURGING (ft BTOC): 11.02

DEPTH TO BOTTOM (ft BTOC): 29.85 ___ Soft / ? Hard

REFERENCE: 1" well = 0.16 liter/ft or 0.041 gal/ft 2-inch well = 0.617 liter/ft or 0.163 gal/ft 1 gallon = 3.785 liters 1 liter = 0.264 gallons

WATER COLUMN (FT): 18.83

WELL VOLUME (LITERS): 12.4

3 WELL VOLUMES (LITERS): 37.3

FIELD PARAMETERS COLLECTED DURING LOW-FLOW PURGING

TIME 4 minute readings	WATER LEVEL (ft BTOC)	FLOW RATE (ml/min)	TOTAL VOLUME (Liters)	TEMP. (°C)	pH (std. units)	ORP (mV)	CONDUCTIVITY (mS/cm)	DO (mg/L)	LaMOTTE TURBIDITY (NTU)	REMARKS (color, odor, sheen, sediment, etc.)
Stability:	< 0.3 ft	300 – 500	NA	NA	± 0.1	± 10 mV	± 3 %	± 10 %	± 10 %	
1431	11.02	250	0	21.62	11.93	76	0.770	8.17	0.03	Initial state. clear, no odor
1435	12.55	300	1	18.18	13.11	-62	0.749	7.02	0.35	
1439	14.10	↓	2.2	16.43	13.21	-55	0.760	6.54	5.59	
1443	-		3.4	16.44	13.17	-47	0.754	6.21	9.45	
1447	16.63		4.6	16.35	13.13	-40	0.759	6.19	9.77	
1451	17.70		5.8	16.38	13.08	-35	0.761	6.30	10.08	
1455	17.87	250	7.0	17.21	13.00	-34	0.747	6.41	1.35	
1459	18.36	↓	8.0	17.81	13.01	-33	0.745	6.26	2.06	
1503	18.80		9.0	17.36	13.04	-32	0.733	5.90	1.54	
1507	20.70	300	10.0	16.26	13.06	-32	0.737	6.51	2.10	see notes
1515	21.20	250	11.0	18.32	12.42	-29	0.625	6.10	12.82	
1519	21.92		12.0	16.47	12.26	-17	0.574	5.10	10.52	
1523	23.91		13.0	16.35	12.00	-15	0.584	3.97	11.0	
1527	24.01		14.0	16.33	11.90	-18	0.524	3.71	11.9	
1531	24.21		15.0	16.22	11.40	-15	0.521	3.52	10.6	
1548	25.01			--	--	--	--	--		Final state.

NOTES: 1507 Pump stopped / lost flow. Found tubing not at target depth added tubing and got past possible PVC joint.

FIELD ANALYSES AND LABORATORY SAMPLING INFORMATION

PRIMARY SAMPLE ID: MWOSI-081919

PRIMARY SAMPLE DATE & TIME: 8/19/19 1515

PRIMARY SAMPLE PARAMETERS (check): ✓ *VOCs*, ✓ *TAL metals*, ___ *MNA*, ✓ *SVOCs*, ✓ *PAH*, ___ *Sulfur*, ___ *Sulfite*

QA/QC SAMPLE ID:

QA/QC SAMPLE DATE & TIME:

QA/QC SAMPLE PARAMETERS (check): ___ *VOCs*, ___ *TAL metals*, ___ *MNA*, ___ *SVOCs*, ___ *PAH*, ___ *Sulfur*, ___ *Sulfite*

FERROUS IRON FIELD KIT CONCENTRATION (mg/L): NA

SAMPLER'S SIGNATURE:

JACOBS

Former Hampshire Chemical Corp., 228 E. Main St., Waterloo, NY, Project DWWAT002

LOW-FLOW GROUNDWATER SAMPLING LOG, 2019 ANNUAL LTM EVENT

WELL: MW-046

SCREEN INTERVAL (ft BTOC):

START DATE: 8/20/19

WELL DIAMETER (INCHES): 2

FIELD CREW: Cilettich

EQUIPMENT: *Peristaltic pump with one-time-use 0.25" x 0.170" Teflon-lined high-density polyethylene tubing*

METER MAKE & MODEL: *Horiba U-52 with flow-through cell*

METER CALIBRATION DATE: 8/20/19

DTW BEFORE PURGING (ft BTOC): 3.31

DEPTH TO BOTTOM (ft BTOC): 13.10

___ Soft / X Hard

REFERENCE: 1" well ≈ 0.16 liter/ft or 0.041 gal/ft 2-inch well ≈ 0.617 liter/ft or 0.163 gal/ft 1 gallon = 3.785 liters 1 liter = 0.264 gallons

WATER COLUMN (FT): 9.79

WELL VOLUME (LITERS): 6.5

3 WELL VOLUMES (LITERS): 19.4

FIELD PARAMETERS COLLECTED DURING LOW-FLOW PURGING

TIME 4 minute readings	WATER LEVEL (ft BTOC)	FLOW RATE (ml/min)	TOTAL VOLUME (Liters)	TEMP. (°C)	pH (std. units)	ORP (mV)	CONDUC-TIVITY (mS/cm)	DO (mg/L)	LaMOTTE TURBIDITY (NTU)	REMARKS (color, odor, sheen, sediment, etc.)
Stability:	< 0.3 ft	300 – 500	NA	NA	± 0.1	± 10 mV	± 3 %	± 10 %	± 10 %	
1253	3.31	300	0	31.82	6.92	93	0.766	0.87	2.15	Initial state.
1257	3.90		1.2	28.53	6.84	103	0.802	4.31	1.40	clear, no odor
1301	4.26		2.4	25.62	6.58	125	0.850	4.25	1.34	
1305	4.61		3.6	27.22	6.48	137	0.841	3.76	8.41	
1309	4.89		4.8	26.88	6.48	141	0.846	3.84	9.45	
1313	5.07		6.0	26.44	6.48	140	0.858	3.89	12.85	
1317	5.13	↓	7.2	26.17	6.47	68	0.867	3.72	15.8	
1321	5.71	250	8.4	26.02	6.47	38	0.876	3.40	12.6	
1325	6.19		9.4	25.80	6.47	12	0.884	2.99	3.44	
1329	6.23		10.4	25.81	6.47	5	0.886	2.77	3.04	
1333	6.37	↓	11.4	25.80	6.47	3	0.887	2.87	3.08	
1340	7.01			--	--	--	--	--	2.01	Final state.

NOTES: Well box full of dirt and ants & eggs.

FIELD ANALYSES AND LABORATORY SAMPLING INFORMATION

PRIMARY SAMPLE ID: MW06-082019

PRIMARY SAMPLE DATE & TIME: 8/20/19 1330

PRIMARY SAMPLE PARAMETERS (check): ✓ VOCs, ✓ TAL metals, ___ MNA, ✓ SVOCs, ✓ PAH, ___Sulfur, ___Sulfite

QA/QC SAMPLE ID: None

QA/QC SAMPLE DATE & TIME: None

QA/QC SAMPLE PARAMETERS (check): ___ VOCs, ___ TAL metals, ___ MNA, ___ SVOCs, ___ PAH, ___Sulfur, ___Sulfite

FERROUS IRON FIELD KIT CONCENTRATION (mg/L): NA

SAMPLER'S SIGNATURE:

JACOBS

Former Hampshire Chemical Corp., 228 E. Main St., Waterloo, NY, Project DWWAT002

LOW-FLOW GROUNDWATER SAMPLING LOG, 2019 ANNUAL LTM EVENT

WELL: MW07

SCREEN INTERVAL (ft BTOC):

START DATE: 8/20/19

WELL DIAMETER (INCHES): 2"

FIELD CREW: C. Lottich

EQUIPMENT: *Peristaltic pump with one-time-use 0.25" x 0.170" Teflon-lined high-density polyethylene tubing*

METER MAKE & MODEL: *Horiba U-52 with flow-through cell*

METER CALIBRATION DATE: 8/20/19

DTW BEFORE PURGING (ft BTOC): 4.75

DEPTH TO BOTTOM (ft BTOC): 12.24

___ Soft / ? Hard

REFERENCE: 1" well ≈ 0.16 liter/ft or 0.041 gal/ft 2-inch well ≈ 0.617 liter/ft or 0.163 gal/ft 1 gallon = 3.785 liters 1 liter = 0.264 gallons

WATER COLUMN (FT):

WELL VOLUME (LITERS):

3 WELL VOLUMES (LITERS):

FIELD PARAMETERS COLLECTED DURING LOW-FLOW PURGING

TIME 4 minute readings	WATER LEVEL (ft BTOC)	FLOW RATE (ml/min)	TOTAL VOLUME (Liters)	TEMP. (°C)	pH (std. units)	ORP (mV)	CONDUC-TIVITY (mS/cm)	DO (mg/L)	LaMOTTE TURBIDITY (NTU)	REMARKS (color, odor, sheen, sediment, etc.)
Stability:	< 0.3 ft	300 – 500	NA	NA	± 0.1	± 10 mV	± 3 %	± 10 %	± 10 %	
1418	5.05	300	1.0	23.07	6.48	2	1.25	3.21	878	Initial state. brown
1422	5.68	↓	2.2	22.44	6.39	48	1.17	7.10	OR	brown suspended solids
1426	6.21		3.4	22.78	6.31	88	1.26	3.39	421	
1430	6.35		4.6	23.01	6.29	96	1.35	2.97	45.8	clearing
1434	6.58		5.8	23.09	6.30	106	1.43	2.61	30.8	
1438	6.78		7.0	23.20	6.32	113	1.39	2.20	22.6	
1442	7.03		8.2	23.17	6.33	114	1.51	1.81	14.7	
1446	7.20		9.4	23.27	6.36	113	1.95	1.56	12.88	
1450	7.65	250	10.6	23.31	6.40	111	2.25	1.47	11.35	
1454	7.84	↓	11.6	23.47	6.42	110	2.36	1.37	11.13	
1458	7.93		12.6	23.41	6.40	109	2.38	1.29	10.60	
1510	8.40			--	--	--	--	--		Final state. clear, no solids

NOTES:

FIELD ANALYSES AND LABORATORY SAMPLING INFORMATION

PRIMARY SAMPLE ID: MW07-082019

PRIMARY SAMPLE DATE & TIME: 8/20/19 1500

PRIMARY SAMPLE PARAMETERS (check): ✓ *VOCs,* ✓ *TAL metals,* ___ *MNA,* ✓ *SVOCs,* ✓ *PAH,* ___*Sulfur,* ___*Sulfite*

QA/QC SAMPLE ID: None

QA/QC SAMPLE DATE & TIME:

QA/QC SAMPLE PARAMETERS (check): ___ *VOCs,* ___ *TAL metals,* ___ *MNA,* ___ *SVOCs,* ___ *PAH,* ___*Sulfur,* ___*Sulfite*

FERROUS IRON FIELD KIT CONCENTRATION (mg/L): NA

SAMPLER'S SIGNATURE:

JACOBS Former Hampshire Chemical Corp., 228 E. Main St., Waterloo, NY, Project DWWAT002

LOW-FLOW GROUNDWATER SAMPLING LOG, 2019 ANNUAL LTM EVENT

WELL: MW-09R

SCREEN INTERVAL (ft BTOC):

START DATE: 8/19/19

WELL DIAMETER (INCHES): 2

FIELD CREW: SALSBURG

EQUIPMENT: *Peristaltic pump with one-time-use 0.25" x 0.170" Teflon-lined high-density polyethylene tubing*

METER MAKE & MODEL: *Horiba U-52 with flow-through cell*

METER CALIBRATION DATE: 8/19/19

DTW BEFORE PURGING (ft BTOC): 5.42

DEPTH TO BOTTOM (ft BTOC): ___ Soft / ___ Hard

REFERENCE: 1" well = 0.16 liter/ft or 0.041 gal/ft 2-inch well = 0.617 liter/ft or 0.163 gal/ft 1 gallon = 3.785 liters 1 liter = 0.264 gallons

WATER COLUMN (FT):

WELL VOLUME (LITERS):

3 WELL VOLUMES (LITERS):

FIELD PARAMETERS COLLECTED DURING LOW-FLOW PURGING

TIME 4 minute readings	WATER LEVEL (ft BTOC)	FLOW RATE (ml/min)	TOTAL VOLUME (Liters)	TEMP. (°C)	pH (std. units)	ORP (mV)	CONDUC-TIVITY (mS/cm)	DO (mg/L)	LaMOTTE TURBIDITY (NTU)	REMARKS (color, odor, sheen, sediment, etc.)
Stability:	< 0.3 ft	300 – 500	NA	NA	± 0.1	± 10 mV	± 3 %	± 10 %	± 10 %	
1420	5.75	300	–	25.19	6.93	-140	5.55	2.45	3.80	Initial state. CLEAR
1425	5.95	300	1	22.26	6.67	-173	4.60	1.83	2.99	CLEAR
1430	6.10	300	2	22.10	6.58	-211	4.63	2.98	3.04	CLEAR
1435	6.35	350	3.5	22.13	6.51	-215	4.76	2.44	5.41	CLEAR
1440	7.04	350	4.5	21.97	6.50	-216	4.81	1.90	3.04	CLEAR
1445	7.70	350	6.5	21.90	6.51	-215	4.82	1.80	1.44	
1450	8.10	350	8	21.82	6.54	-214	4.78	1.74	2.22	CLEAR
1455	8.45	300	9	21.73	6.57	-204	4.81	1.34	2.04	
1500	8.80	300	10	21.62	6.58	-206	4.80	0.21	0.90	CLEAR
1505	9.05	250	11.5	21.67	6.60	-216	4.73	0.21	1.12	
1510	9.30	250	12.5	21.63	6.62	-231	4.60	0.24	1.40	H_2S ODOR
1515	9.60	250	13.5	21.59	6.63	-247	4.54	0.38	0.43	
1520	10.04	250	14.5	21.41	6.68	-269	4.36	0.40	1.21	
1525	10.25	250	15.5	21.50	6.69	-273	4.35	0.40	2.02	
1530	10.50	250	16.5	21.60	6.69	-275	4.34	0.41	0.99	CLEAR w/ H_2S ODOR
1535	SAMPLE									
				--	--	--	--	--		Final state.

NOTES:

FIELD ANALYSES AND LABORATORY SAMPLING INFORMATION

PRIMARY SAMPLE ID: MW09R-081919

PRIMARY SAMPLE DATE & TIME: ~~10.~~ 15:35 8/19/19

PRIMARY SAMPLE PARAMETERS (check): ✓ *VOCs,* ✓ *TAL metals,* ___ *MNA,* ✓ *SVOCs,* ✓ *PAH,* ___ *Sulfur,* ___ *Sulfite*

QA/QC SAMPLE ID: —

QA/QC SAMPLE DATE & TIME: —

QA/QC SAMPLE PARAMETERS (check): ___ *VOCs,* ___ *TAL metals,* ___ *MNA,* ___ *SVOCs,* ___ *PAH,* ___ *Sulfur,* ___ *Sulfite*

FERROUS IRON FIELD KIT CONCENTRATION (mg/L): OVER RANGE.

SAMPLER'S SIGNATURE:

JACOBS

Former Hampshire Chemical Corp., 228 E. Main St., Waterloo, NY, Project DWWAT002

LOW-FLOW GROUNDWATER SAMPLING LOG, 2019 ANNUAL LTM EVENT

WELL: MW-10

SCREEN INTERVAL (ft BTOC):

START DATE: 8/20/19

WELL DIAMETER (INCHES): 2

FIELD CREW: C. Lettich

EQUIPMENT: *Peristaltic pump with one-time-use 0.25" x 0.170" Teflon-lined high-density polyethylene tubing*

METER MAKE & MODEL: *Horiba U-52 with flow-through cell*

METER CALIBRATION DATE: 8/20/19

DTW BEFORE PURGING (ft BTOC): 2.90

DEPTH TO BOTTOM (ft BTOC): 12.65

___ Soft / [✓ Hard]

REFERENCE: 1" well ≈ 0.16 liter/ft or 0.041 gal/ft 2-inch well ≈ 0.617 liter/ft or 0.163 gal/ft 1 gallon = 3.785 liters 1 liter = 0.264 gallons

WATER COLUMN (FT): 9.75

WELL VOLUME (LITERS): 6.4

3 WELL VOLUMES (LITERS): 19.3

FIELD PARAMETERS COLLECTED DURING LOW-FLOW PURGING

TIME 4 minute readings	WATER LEVEL (ft BTOC)	FLOW RATE (ml/min)	TOTAL VOLUME (Liters)	TEMP. (°C)	pH (std. units)	ORP (mV)	CONDUCTIVITY (mS/cm)	DO (mg/L)	LaMOTTE TURBIDITY (NTU)	REMARKS (color, odor, sheen, sediment, etc.)
Stability:	< 0.3 ft	300 – 500	NA	NA	± 0.1	± 10 mV	± 3 %	± 10 %	± 10 %	
0952	2.90	300	0	18.60	6.39	-28	1.83	1.31	9.69	Initial state. clear, no odor
0956	3.36	↓	1.2	17.37	6.79	-42	1.33	2.82	2.64	
1000	3.72	↓	2.4	18.68	6.62	35	0.986	5.51	2.08	
1004	4.13	↓	3.6	19.21	6.63	49	0.962	5.65	2.18	
1008	4.45	250	4.8	19.34	6.64	35	0.961	5.50	3.17	
1012	4.71	↓	5.8	19.48	6.66	47	0.961	5.52	4.68	
1016	5.15	↓	6.8	19.44	6.68	51	0.977	6.01	4.01	
1020	5.39	↓	7.8	19.48	6.70	53	0.986	6.50	4.26	
1024	5.48	↓	8.8	19.49	6.73	49	0.988	6.80	4.52	
1100	7.10			--	--	--	--	--		Final state.

NOTES:

FIELD ANALYSES AND LABORATORY SAMPLING INFORMATION

PRIMARY SAMPLE ID: MW10-082019

PRIMARY SAMPLE DATE & TIME: 8/20/19 10:30

PRIMARY SAMPLE PARAMETERS (check): ✓ *VOCs*, ✓ *TAL metals*, ___ *MNA*, ✓ *SVOCs*, ✓ *PAH*, ___ *Sulfur*, ___ *Sulfite*

QA/QC SAMPLE ID: MW10-082019 MS/MSD

QA/QC SAMPLE DATE & TIME: 8/20/19 1030

QA/QC SAMPLE PARAMETERS (check): ___ *VOCs*, ✓ *TAL metals*, ___ *MNA*, ✓ *SVOCs*, ✓ *PAH*, ___ *Sulfur*, ___ *Sulfite*

FERROUS IRON FIELD KIT CONCENTRATION (mg/L): NA

SAMPLER'S SIGNATURE:

JACOBS

Former Hampshire Chemical Corp., 228 E. Main St., Waterloo, NY, Project DWWAT002

LOW-FLOW GROUNDWATER SAMPLING LOG, 2019 ANNUAL LTM EVENT

WELL: MW11S	SCREEN INTERVAL (ft BTOC): 4-14	START DATE: 8.15.19	
	WELL DIAMETER (INCHES): 2	FIELD CREW: C. Lettich	

EQUIPMENT: *Peristaltic pump with one-time-use 0.25" x 0.170" Teflon-lined high-density polyethylene tubing*

METER MAKE & MODEL: *Horiba U-52 with flow-through cell* METER CALIBRATION DATE: 8/15/19

DTW BEFORE PURGING (ft BTOC): 1.45 DEPTH TO BOTTOM (ft BTOC): 13.35 ___Soft / X Hard

REFERENCE: 1" well ≈ 0.16 liter/ft or 0.041 gal/ft 2-inch well ≈ 0.617 liter/ft or 0.163 gal/ft 1 gallon = 3.785 liters 1 liter = 0.264 gallons

WATER COLUMN (FT): 11.9 WELL VOLUME (LITERS): 7.34 3 WELL VOLUMES (LITERS): 22

FIELD PARAMETERS COLLECTED DURING LOW-FLOW PURGING

TIME 4 minute readings	WATER LEVEL (ft BTOC)	FLOW RATE (ml/min)	TOTAL VOLUME (Liters)	TEMP. (°C)	pH (std. units)	ORP (mV)	CONDUC-TIVITY (mS/cm)	DO (mg/L)	LaMOTTE TURBIDITY (NTU)	REMARKS (color, odor, sheen, sediment, etc.)
Stability:	< 0.3 ft	300 – 500	NA	NA	± 0.1	± 10 mV	± 3 %	± 10 %	± 10 %	
1419	2.21	300	0.5	29.34	9.42	-137	3.23	1.82	8.35	Initial state. clear, minor sulfur odor
1423	3.85	↓	1.7	27.70	9.19	-126	3.20	0.92	2.52	minor brown solids
1427	flow stopped. Pulled tubing. Found stuck at joint. Reinserted									
1431	3.69	250	2.7	26.92	9.36	-143	3.68	0.25	1.66	
1435	4.52	|	3.7	24.98	10.15	-220	3.66	0.00	2.47	
1439	4.57	|	4.9	24.51	10.04	-228	3.45	0.00	3.12	
1443	5.11	|	5.9	24.15	9.73	-216	3.24	0.00	2.41	
1447	5.35	|	6.9	24.09	9.55	-206	3.14	0.00	2.36	
1451	5.40	|	7.9	24.21	9.46	-203	3.12	0.00	2.15	
1455	5.50	↓	8.9	24.27	9.45	-204	3.12	0.00	1.85	
1515	5.60	250	13.9	--	--	--	--	--	1.05	Final state.

NOTES:

FIELD ANALYSES AND LABORATORY SAMPLING INFORMATION

PRIMARY SAMPLE ID: MW11S-081519 PRIMARY SAMPLE DATE & TIME: 8/15/19 1500

PRIMARY SAMPLE PARAMETERS (check): ___ *VOCs*, ✓ *TAL metals*, ✓ *MNA*, ___ *SVOCs*, ___ *PAH*, ✓ *Sulfur*, ___ *Sulfite*

QA/QC SAMPLE ID: None QA/QC SAMPLE DATE & TIME:

QA/QC SAMPLE PARAMETERS (check): ___ *VOCs*, ___ *TAL metals*, ___ *MNA*, ___ *SVOCs*, ___ *PAH*, ___ *Sulfur*, ___ *Sulfite*

FERROUS IRON FIELD KIT CONCENTRATION (mg/L): 0.04 mg/L SAMPLER'S SIGNATURE:

JACOBS

Former Hampshire Chemical Corp., 228 E. Main St., Waterloo, NY, Project DWWAT002

LOW-FLOW GROUNDWATER SAMPLING LOG, 2019 ANNUAL LTM EVENT

WELL: MW-16I

SCREEN INTERVAL (ft BTOC):

START DATE: 8/22/19

WELL DIAMETER (INCHES): 2

FIELD CREW: SALSBURG

EQUIPMENT: *Peristaltic pump with one-time-use 0.25" x 0.170" Teflon-lined high-density polyethylene tubing*

METER MAKE & MODEL: *Horiba U-52 with flow-through cell*

METER CALIBRATION DATE: 8/22/19

DTW BEFORE PURGING (ft BTOC): 26.25

DEPTH TO BOTTOM (ft BTOC): ___ Soft / ___ Hard

REFERENCE: 1" well = 0.16 liter/ft or 0.041 gal/ft; 2-inch well = 0.617 liter/ft or 0.163 gal/ft; 1 gallon = 3.785 liters; 1 liter = 0.264 gallons

WATER COLUMN (FT):

WELL VOLUME (LITERS):

3 WELL VOLUMES (LITERS):

FIELD PARAMETERS COLLECTED DURING LOW-FLOW PURGING

TIME 4 minute readings	WATER LEVEL (ft BTOC)	FLOW RATE (ml/min)	TOTAL VOLUME (Liters)	TEMP. (°C)	pH (std. units)	ORP (mV)	CONDUC-TIVITY (mS/cm)	DO (mg/L)	LaMOTTE TURBIDITY (NTU)	REMARKS (color, odor, sheen, sediment, etc.)
Stability:	< 0.3 ft	300 – 500	NA	NA	± 0.1	± 10 mV	± 3 %	± 10 %	± 10 %	
1023	26.31	300	–	21.38	6.53	-113	1.09	3.09	28.L	Initial state CLEAR
1028	26.54	300	1	20.54	6.68	-114	1.05	1.38	17.3	CLEAR
1033	26.35	250	2	20.22	6.72	-112	1.01	0.83	12.4	CLEAR
1038	26.35	250	3	20.14	6.78	-117	1.01	0.53	10.1	
1043	26.35	250	4	20.12	6.80	-118	1.01	0.50	9.68	
1048	26.36	250	5	20.14	6.82	-121	1.01	0.43	9.90	
1053	26.35	250	6	20.13	6.82	-121	1.01	0.41	8.45	
1058	SAMPLE									
				--	--	--	--	--		Final state

NOTES:

FIELD ANALYSES AND LABORATORY SAMPLING INFORMATION

PRIMARY SAMPLE ID: MW 16I-082219

PRIMARY SAMPLE DATE & TIME: 8/22/19 10:58

PRIMARY SAMPLE PARAMETERS (check): ✓ *VOCs*, ✓ *TAL metals*, ___ *MNA*, ___ *SVOCs*, ✓ *PAH*, ___ *Sulfur*, ___ *Sulfite*

QA/QC SAMPLE ID: FB-082219

QA/QC SAMPLE DATE & TIME: 1120 8/22/19

QA/QC SAMPLE PARAMETERS (check): ✓ *VOCs*, ___ *TAL metals*, ___ *MNA*, ___ *SVOCs*, ___ *PAH*, ___ *Sulfur*, ___ *Sulfite*

FERROUS IRON FIELD KIT CONCENTRATION (mg/L): ✓

SAMPLER'S SIGNATURE:

JACOBS

Former Hampshire Chemical Corp., 228 E. Main St., Waterloo, NY, Project DWWAT002

LOW-FLOW GROUNDWATER SAMPLING LOG, 2019 ANNUAL LTM EVENT

WELL: MW-19

SCREEN INTERVAL (ft BTOC):

START DATE: 8/22/19

WELL DIAMETER (INCHES): 2

FIELD CREW: SALSBURG

EQUIPMENT: *Peristaltic pump with one-time-use 0.25" x 0.170" Teflon-lined high-density polyethylene tubing*

METER MAKE & MODEL: *Horiba U-52 with flow-through cell*

METER CALIBRATION DATE: 8/22/19

DTW BEFORE PURGING (ft BTOC): 8.92

DEPTH TO BOTTOM (ft BTOC): ___ Soft / ___ Hard

REFERENCE: 1" well ≈ 0.16 liter/ft or 0.041 gal/ft 2-inch well ≈ 0.617 liter/ft or 0.163 gal/ft 1 gallon = 3.785 liters 1 liter = 0.264 gallons

WATER COLUMN (FT):

WELL VOLUME (LITERS):

3 WELL VOLUMES (LITERS):

FIELD PARAMETERS COLLECTED DURING LOW-FLOW PURGING

TIME 4 minute readings	WATER LEVEL (ft BTOC)	FLOW RATE (ml/min)	TOTAL VOLUME (Liters)	TEMP. (°C)	pH (std. units)	ORP (mV)	CONDUC-TIVITY (mS/cm)	DO (mg/L)	LaMOTTE TURBIDITY (NTU)	REMARKS (color, odor, sheen, sediment, etc.)
Stability:	< 0.3 ft	300 – 500	NA	NA	± 0.1	± 10 mV	± 3 %	± 10 %	± 10 %	
1200	9.05	300	–	21.73	6.73	-58	1.48	1.89	40.4	Initial state. CLEAR
1205	9.45	300	1	19.80	6.59	-58	1.52	0.53	28.9	
1210	9.60	250	2	19.83	6.54	-57	1.52	0.73	16.4	CLEAR
1215	9.95	250	3	19.83	6.53	-58	1.53	1.83	18.2	
1220	10.05	250	4	20.03	6.58	-64	1.57	2.23	12.0	CLEAR
1225	10.20	250	5	18.84	6.63	-65	1.55	1.05	11.4	
1230	10.38	250	6	18.39	6.59	-65	1.55	0.89	10.4	
1235	10.50	250	7	18.71	6.57	-65	1.54	0.79	8.82	
1240	10.54	250	8	18.99	6.63	-67	1.55	0.59	8.90	CLEAR
1245	10.57	250	9	19.20	6.65	-67	1.57	0.53	7.84	
1250	SAMPLE									
				--	--	--	--	--		Final state.

NOTES:

D.O. FLUCTUATED FREQUENTLY BUT STABILIZED BOUNCING BETWEEN 0.80 TO 0.44 mg/L

FIELD ANALYSES AND LABORATORY SAMPLING INFORMATION

PRIMARY SAMPLE ID: MW19-082219

PRIMARY SAMPLE DATE & TIME: 8/22/19 12:50

PRIMARY SAMPLE PARAMETERS (check): ___ *VOCs*, ___ *TAL metals*, ___ *MNA*, ___ *SVOCs*, ___ *PAH*, ___ *Sulfur*, ___ *Sulfite*

QA/QC SAMPLE ID: DUP-GW-082219

QA/QC SAMPLE DATE & TIME: 8/22/19 1200

QA/QC SAMPLE PARAMETERS (check): ✓ *VOCs*, ✓ *TAL metals*, ___ *MNA*, ✓ *SVOCs*, ✓ *PAH*, ___ *Sulfur*, ___ *Sulfite*

FERROUS IRON FIELD KIT CONCENTRATION (mg/L): —

SAMPLER'S SIGNATURE:

JACOBS

Former Hampshire Chemical Corp., 228 E. Main St., Waterloo, NY, Project DWWAT002

LOW-FLOW GROUNDWATER SAMPLING LOG, 2019 ANNUAL LTM EVENT

WELL: MW20	SCREEN INTERVAL (ft BTOC):	START DATE:	8/20/19
	WELL DIAMETER (INCHES): 2	FIELD CREW:	C. Leflich

EQUIPMENT: *Peristaltic pump with one-time-use 0.25" x 0.170" Teflon-lined high-density polyethylene tubing*

METER MAKE & MODEL: *Horiba U-52 with flow-through cell* METER CALIBRATION DATE: 8/20/19

DTW BEFORE PURGING (ft BTOC): 8.29 DEPTH TO BOTTOM (ft BTOC): 15.55 ___ Soft / [✓ Hard]

REFERENCE: 1" well ≈ 0.16 liter/ft or 0.041 gal/ft 2-inch well ≈ 0.617 liter/ft or 0.163 gal/ft 1 gallon = 3.785 liters 1 liter = 0.264 gallons

WATER COLUMN (FT): 7.26 WELL VOLUME (LITERS): 4.8 3 WELL VOLUMES (LITERS): 14.3

FIELD PARAMETERS COLLECTED DURING LOW-FLOW PURGING

TIME 4 minute readings	WATER LEVEL (ft BTOC)	FLOW RATE (ml/min)	TOTAL VOLUME (Liters)	TEMP. (°C)	pH (std. units)	ORP (mV)	CONDUC-TIVITY (mS/cm)	DO (mg/L)	LaMOTTE TURBIDITY (NTU)	REMARKS (color, odor, sheen, sediment, etc.)
Stability:	< 0.3 ft	300 – 500	NA	NA	± 0.1	± 10 mV	± 3 %	± 10 %	± 10 %	
1540	8.29	300	0	21.97	6.99	97	0.955	1.70	31.8	Initial state. clear, no odor
1544	9.11		1.2	16.50	6.75	108	0.971	0.87	24.7	fine white particles
1548	9.60		2.4	16.39	6.60	93	0.964	0.45	31.8	
1552	9.86		3.6	16.89	6.55	-40	0.973	0.66	18.9	clear no solids
1556	10.01		4.8	16.99	6.55	-71	0.975	0.61	12.6	
1600	10.32		6.0	17.03	6.57	-83	0.959	0.45	12.3	
1604	10.61		7.2	17.36	6.60	-82	0.935	0.35	9.60	
1608	10.80		8.4	16.66	6.61	-78	0.925	0.33	10.67	
1612	11.15	250	9.6	16.82	6.63	-61	0.908	0.30	10.16	
1616	11.35		10.8	16.74	6.66	-50	0.908	0.29	9.62	
1620	11.56		12.0	16.53	6.68	-51	0.908	0.27	10.68	
1630	12.01			--	--	--	--	--		Final state.

NOTES:

FIELD ANALYSES AND LABORATORY SAMPLING INFORMATION

PRIMARY SAMPLE ID: MW20-082019 PRIMARY SAMPLE DATE & TIME: 8/20/19 1620

PRIMARY SAMPLE PARAMETERS (check): ✓ *VOCs*, ✓ *TAL metals*, ___ *MNA*, ✓ *SVOCs*, ✓ *PAH*, ___ *Sulfur*, ___ *Sulfite*

QA/QC SAMPLE ID: None QA/QC SAMPLE DATE & TIME: NA

QA/QC SAMPLE PARAMETERS (check): ___ *VOCs*, ___ *TAL metals*, ___ *MNA*, ___ *SVOCs*, ___ *PAH*, ___ *Sulfur*, ___ *Sulfite*

FERROUS IRON FIELD KIT CONCENTRATION (mg/L): NA SAMPLER'S SIGNATURE:

JACOBS

Former Hampshire Chemical Corp., 228 E. Main St., Waterloo, NY, Project DWWAT002

LOW-FLOW GROUNDWATER SAMPLING LOG, 2019 ANNUAL LTM EVENT

WELL: MW-17

SCREEN INTERVAL (ft BTOC):

START DATE: 8/20/19

WELL DIAMETER (INCHES): 2

FIELD CREW: SALSBURG

EQUIPMENT: *Peristaltic pump with one-time-use 0.25" x 0.170" Teflon-lined high-density polyethylene tubing*

METER MAKE & MODEL: *Horiba U-52 with flow-through cell*

METER CALIBRATION DATE: 8/20/19

DTW BEFORE PURGING (ft BTOC): 22.10

DEPTH TO BOTTOM (ft BTOC): 26 ___ Soft / ___ Hard

REFERENCE: 1" well = 0.16 liter/ft or 0.041 gal/ft 2-inch well = 0.617 liter/ft or 0.163 gal/ft 1 gallon = 3.785 liters 1 liter = 0.264 gallons

WATER COLUMN (FT):

WELL VOLUME (LITERS):

3 WELL VOLUMES (LITERS):

FIELD PARAMETERS COLLECTED DURING LOW-FLOW PURGING

TIME 4 minute readings	WATER LEVEL (ft BTOC)	FLOW RATE (ml/min)	TOTAL VOLUME (Liters)	TEMP. (°C)	pH (std. units)	ORP (mV)	CONDUCTIVITY (mS/cm)	DO (mg/L)	LaMOTTE TURBIDITY (NTU)	REMARKS (color, odor, sheen, sediment, etc.)
Stability:	< 0.3 ft	300 – 500	NA	NA	± 0.1	± 10 mV	± 3 %	± 10 %	± 10 %	
1303	22.30	300	—	24.05	7.52	-113	1.03	1.46	7.91	Initial state CLEAR
1308	22.40	225	1.5	17.88	7.39	-115	1.12	0.00	7.76	CLEAR
1313	22.50	225	3	15.66	7.26	-113	1.10	0.00	2.45	CLEAR
1318	22.56	225	4	15.62	7.18	-110	1.01	0.00	4.03	
1323	22.60	225	5	15.61	7.07	-109	0.925	0.00	3.45	CLEAR
1328	22.61	225	6	15.32	6.99	-109	0.920	0.00	3.58	
1333	22.62	225	7	15.27	6.98	-107	0.917	0.00	2.99	
1338	22.62	225	8	15.20	6.97	-106	0.916	0.00	3.20	CLEAR
1343	SAMPLE									
				--	--	--	--	--		Final state:

NOTES:

FIELD ANALYSES AND LABORATORY SAMPLING INFORMATION

PRIMARY SAMPLE ID: MW17-082019

PRIMARY SAMPLE DATE & TIME: 8/20/19 1343

PRIMARY SAMPLE PARAMETERS (check): ✓ *VOCs*, ✓ *TAL metals*, ___ *MNA*, ___ *SVOCs*, ✓ *PAH*, ___ *Sulfur*, ___ *Sulfite*

QA/QC SAMPLE ID: DUP-GW-082019

QA/QC SAMPLE DATE & TIME: 8/20/19 1200

QA/QC SAMPLE PARAMETERS (check): ✓ *VOCs*, ✓ *TAL metals*, ___ *MNA*, ___ *SVOCs*, ✓ *PAH*, ___ *Sulfur*, ___ *Sulfite*

FERROUS IRON FIELD KIT CONCENTRATION (mg/L): OVER +++

SAMPLER'S SIGNATURE:

JACOBS Former Hampshire Chemical Corp., 228 E. Main St., Waterloo, NY, Project DWWAT002

LOW-FLOW GROUNDWATER SAMPLING LOG, 2019 ANNUAL LTM EVENT

WELL: MW-18	SCREEN INTERVAL (ft BTOC):	START DATE:	8/20/19
	WELL DIAMETER (INCHES): 2	FIELD CREW:	SALSBURG

EQUIPMENT: *Peristaltic pump with one-time-use 0.25" x 0.170" Teflon-lined high-density polyethylene tubing*

METER MAKE & MODEL: *Horiba U-52 with flow-through cell* METER CALIBRATION DATE: 8/20/19

DTW BEFORE PURGING (ft BTOC): 11.99 DEPTH TO BOTTOM (ft BTOC): 13.50 ___ Soft / ✓ Hard

REFERENCE: 1" well = 0.16 liter/ft or 0.041 gal/ft 2-inch well = 0.617 liter/ft or 0.163 gal/ft 1 gallon = 3.785 liters 1 liter = 0.264 gallons

WATER COLUMN (FT): WELL VOLUME (LITERS): 3 WELL VOLUMES (LITERS):

FIELD PARAMETERS COLLECTED DURING LOW-FLOW PURGING

TIME 4 minute readings	WATER LEVEL (ft BTOC)	FLOW RATE (ml/min)	TOTAL VOLUME (Liters)	TEMP. (°C)	pH (std. units)	ORP (mV)	CONDUC-TIVITY (mS/cm)	DO (mg/L)	LaMOTTE TURBIDITY (NTU)	REMARKS (color, odor, sheen, sediment, etc.)
Stability:	< 0.3 ft	300 – 500	NA	NA	± 0.1	± 10 mV	± 3 %	± 10 %	± 10 %	
1017	12.55	300	–	22.60	6.00	162	0.830	0.19	20.7	Initial state: CLEAR
1021	13.10	250	1	19.74	6.97	-5	0.853	0.00	34.4	CLEAR
→ 1026	13.40	150	2	19.84	7.20	-80	0.855	0.00	36.4	CLEAR
→ 1037	12.55	150	2.5	20.85	7.40	-121	0.856	0.00	62.2	LT BROWN
1047	12.60	150	3	21.22	7.41	-128	1.10	0.00	50.4	
→ 1052	13.11	150	3.5	21.80	7.42	-130	1.15	0.00	38.8	CLEAR
1058	13.00	150	4	21.87	7.44	-131	1.07	0.00	34.4	
1100	SAMPLE									
				--	--	--	--	--	--	Final state:

NOTES: → ALLOW TO RECHARGE DUE TO INSUFFICIENT WATER COLUMN SEVERAL TIMES, PERISTALTIC WOULD NOT RUN SLOWER THAN 150 ML/MIN

FIELD ANALYSES AND LABORATORY SAMPLING INFORMATION

PRIMARY SAMPLE ID: MW18-082019 PRIMARY SAMPLE DATE & TIME: 8/20/19 1100

PRIMARY SAMPLE PARAMETERS (check): ✓ *VOCs*, ✓ *TAL metals*, ___ *MNA*, ___ *SVOCs*, ✓ *PAH*, ___ *Sulfur*, ___ *Sulfite*

QA/QC SAMPLE ID: – QA/QC SAMPLE DATE & TIME: –

QA/QC SAMPLE PARAMETERS (check): ___ *VOCs*, ___ *TAL metals*, ___ *MNA*, ___ *SVOCs*, ___ *PAH*, ___ *Sulfur*, ___ *Sulfite*

FERROUS IRON FIELD KIT CONCENTRATION (mg/L): OVER +++ SAMPLER'S SIGNATURE:

JACOBS

Former Hampshire Chemical Corp., 228 E. Main St., Waterloo, NY, Project DWWAT002

LOW-FLOW GROUNDWATER SAMPLING LOG, 2019 ANNUAL LTM EVENT

WELL: MW-21

SCREEN INTERVAL (ft BTOC):

START DATE: 8/15/19

WELL DIAMETER (INCHES): 2

FIELD CREW: SALSBURG

EQUIPMENT: *Peristaltic pump with one-time-use 0.25" x 0.170" Teflon-lined high-density polyethylene tubing*

METER MAKE & MODEL: *Horiba U-52 with flow-through cell*

METER CALIBRATION DATE: 8/15/19

DTW BEFORE PURGING (ft BTOC): 3.92

DEPTH TO BOTTOM (ft BTOC): ___ Soft / [✓ Hard]

REFERENCE: 1" well ≈ 0.16 liter/ft or 0.041 gal/ft 2-inch well ≈ 0.617 liter/ft or 0.163 gal/ft 1 gallon = 3.785 liters 1 liter = 0.264 gallons

WATER COLUMN (FT):

WELL VOLUME (LITERS):

3 WELL VOLUMES (LITERS):

FIELD PARAMETERS COLLECTED DURING LOW-FLOW PURGING

TIME 4 minute readings	WATER LEVEL (ft BTOC)	FLOW RATE (ml/min)	TOTAL VOLUME (Liters)	TEMP. (°C)	pH (std. units)	ORP (mV)	CONDUC-TIVITY (mS/cm)	DO (mg/L)	LaMOTTE TURBIDITY (NTU)	REMARKS (color, odor, sheen, sediment, etc.)
Stability:	< 0.3 ft	300 – 500	NA	NA	± 0.1	± 10 mV	± 3 %	± 10 %	± 10 %	
1541	4.80	300	—	27.10	10.10	-390	17.1	0.38	0.82	Initial state: BROWN
1546	5.40	250	1.0	24.26	10.09	-449	18.5	0.27	0.08	COLA, DARKER THAN
1551	5.92	250	2.0	24.00	10.04	-459	16.8	0.50	0.25	MW-30
1556	6.41	225	3	24.97	10.04	-446	16.0	0.70	0.91	COLA
1601	6.82	225	4	25.56	10.03	-448	16.0	0.72	0.44	
1606	7.22	225	5	25.71	10.01	-447	16.1	0.68	0.62	COLA
1611	7.45	200	5.5	25.56	9.99	-450	16.2	0.64	0.84	
1616	SAMPLE									
				--	--	--	--	--		Final state:

NOTES:

FIELD ANALYSES AND LABORATORY SAMPLING INFORMATION

PRIMARY SAMPLE ID: MW21-081519

PRIMARY SAMPLE DATE & TIME: 8/15/19 16:16

PRIMARY SAMPLE PARAMETERS (check): ___ *VOCs*, ___ *TAL metals*, ___ *MNA*, ___ *SVOCs*, ___ *PAH*, ___*Sulfur*, ___*Sulfite*

QA/QC SAMPLE ID: —

QA/QC SAMPLE DATE & TIME: —

QA/QC SAMPLE PARAMETERS (check): ___ *VOCs*, ___ *TAL metals*, ___ *MNA*, ___ *SVOCs*, ___ *PAH*, ___*Sulfur*, ___*Sulfite*

FERROUS IRON FIELD KIT CONCENTRATION (mg/L): TOO DARK COLOR FOR METER TO READ

SAMPLER'S SIGNATURE:

JACOBS

Former Hampshire Chemical Corp., 228 E. Main St., Waterloo, NY, Project DWWAT002

LOW-FLOW GROUNDWATER SAMPLING LOG, 2019 ANNUAL LTM EVENT

WELL: MW-26

SCREEN INTERVAL (ft BTOC):

START DATE: 8/21/19

WELL DIAMETER (INCHES): 2

FIELD CREW: SALSBURG

EQUIPMENT: *Peristaltic pump with one-time-use 0.25" x 0.170" Teflon-lined high-density polyethylene tubing*

METER MAKE & MODEL: *Horiba U-52 with flow-through cell*

METER CALIBRATION DATE: 8/21/19

DTW BEFORE PURGING (ft BTOC): 11.92

DEPTH TO BOTTOM (ft BTOC): ___ Soft / ___ Hard

REFERENCE: 1" well ≈ 0.16 liter/ft or 0.041 gal/ft 2-inch well ≈ 0.617 liter/ft or 0.163 gal/ft 1 gallon = 3.785 liters 1 liter = 0.264 gallons

WATER COLUMN (FT):

WELL VOLUME (LITERS):

3 WELL VOLUMES (LITERS):

FIELD PARAMETERS COLLECTED DURING LOW-FLOW PURGING

TIME 4 minute readings	WATER LEVEL (ft BTOC)	FLOW RATE (ml/min)	TOTAL VOLUME (Liters)	TEMP. (°C)	pH (std. units)	ORP (mV)	CONDUC-TIVITY (mS/cm)	DO (mg/L)	LaMOTTE TURBIDITY (NTU)	REMARKS (color, odor, sheen, sediment, etc.)
Stability:	< 0.3 ft	300 – 500	NA	NA	± 0.1	± 10 mV	± 3 %	± 10 %	± 10 %	
11.60	14:37	400	–	24.10	6.81	-53	0.820	0.67	29.0	Initial state. CLEAR
1442	11.85	300	2	24.48	6.81	-56	0.821	0.43	6.34	CLEAR
1447	11.86	300	3.5	24.63	6.83	-60	0.824	0.31	5.20	CLEAR
1452	11.86	300	5	24.80	6.82	-61	0.824	0.25	5.10	
1457	11.87	300	6.5	24.98	6.81	-61	0.824	0.20	4.90	CLEAR
1502	11.87	300	8	25.18	6.81	-61	0.821	0.17	4.40	
1507	11.88	300	9	25.26	6.81	-61	0.819	0.16	5.02	
1512	SAMPLE									
				--	--	--	--	--		Final state.

NOTES:

FIELD ANALYSES AND LABORATORY SAMPLING INFORMATION

PRIMARY SAMPLE ID: MW26-082119

PRIMARY SAMPLE DATE & TIME: 8/21/19 15:12

PRIMARY SAMPLE PARAMETERS (check): ✓ *VOCs*, ✓ *TAL metals*, ___ *MNA*, ___ *SVOCs*, ✓ *PAH*, ___ *Sulfur*, ___ *Sulfite*

QA/QC SAMPLE ID: —

QA/QC SAMPLE DATE & TIME: —

QA/QC SAMPLE PARAMETERS (check): ___ *VOCs*, ___ *TAL metals*, ___ *MNA*, ___ *SVOCs*, ___ *PAH*, ___ *Sulfur*, ___ *Sulfite*

FERROUS IRON FIELD KIT CONCENTRATION (mg/L):

SAMPLER'S SIGNATURE:

JACOBS

Former Hampshire Chemical Corp., 228 E. Main St., Waterloo, NY, Project DWWAT002

LOW-FLOW GROUNDWATER SAMPLING LOG, 2019 ANNUAL LTM EVENT

WELL: MW-30

SCREEN INTERVAL (ft BTOC):

START DATE: 8/15/19

WELL DIAMETER (INCHES): 2

FIELD CREW: SALSBURG

EQUIPMENT: *Peristaltic pump with one-time-use 0.25" x 0.170" Teflon-lined high-density polyethylene tubing*

METER MAKE & MODEL: *Horiba U-52 with flow-through cell*

METER CALIBRATION DATE: 8/15/19

DTW BEFORE PURGING (ft BTOC): 4.53

DEPTH TO BOTTOM (ft BTOC): 13.07

___ Soft / [✓ Hard]

REFERENCE: 1" well ≈ 0.16 liter/ft or 0.041 gal/ft 2-inch well ≈ 0.617 liter/ft or 0.163 gal/ft 1 gallon = 3.785 liters 1 liter = 0.264 gallons

WATER COLUMN (FT):

WELL VOLUME (LITERS):

3 WELL VOLUMES (LITERS):

FIELD PARAMETERS COLLECTED DURING LOW-FLOW PURGING

TIME 4 minute readings	WATER LEVEL (ft BTOC)	FLOW RATE (ml/min)	TOTAL VOLUME (Liters)	TEMP. (°C)	pH (std. units)	ORP (mV)	CONDUC-TIVITY (mS/cm)	DO (mg/L)	LaMOTTE TURBIDITY (NTU)	REMARKS (color, odor, sheen, sediment, etc.)
Stability:	< 0.3 ft	300 – 500	NA	NA	± 0.1	± 10 mV	± 3 %	± 10 %	± 10 %	
1411	4.68	300	—	24.13	7.49	-183	5.52	0.83	2.25	Initial state. BROWN COLA COLA
1416	4.67	300	1.5	21.49	7.49	-248	5.62	0.55	3.05	COLA
1421	4.67	300	3	21.68	7.39	-285	3.76	0.92	2.21	COLA
1426	4.66	300	4.5	21.99	7.25	-285	3.22	0.68	2.66	
1431	4.66	300	6	22.26	7.24	-284	3.09	0.55	3.82	COLA
1436	4.65	360	7.5	22.25	7.24	-284	3.01	0.50	3.25	
1441	4.65	300	9	22.20	7.23	-283	3.00	0.49	4.01	COLA
1446	SAMPLE									
				--	--	--	--	--		Final state.

NOTES:

FIELD ANALYSES AND LABORATORY SAMPLING INFORMATION

PRIMARY SAMPLE ID: MW30-081519

PRIMARY SAMPLE DATE & TIME: 8/15/19 1446

PRIMARY SAMPLE PARAMETERS (check): ___ *VOCs*, ___ *TAL metals*, ___ *MNA*, ___ *SVOCs*, ___ *PAH*, ___*Sulfur*, ___*Sulfite*

QA/QC SAMPLE ID:

QA/QC SAMPLE DATE & TIME:

QA/QC SAMPLE PARAMETERS (check): ___ *VOCs*, ___ *TAL metals*, ___ *MNA*, ___ *SVOCs*, ___ *PAH*, ___*Sulfur*, ___*Sulfite*

FERROUS IRON FIELD KIT CONCENTRATION (mg/L):

SAMPLER'S SIGNATURE:

JACOBS

Former Hampshire Chemical Corp., 228 E. Main St., Waterloo, NY, Project DWWAT002

LOW-FLOW GROUNDWATER SAMPLING LOG, 2019 ANNUAL LTM EVENT

WELL: MW-31

SCREEN INTERVAL (ft BTOC):

START DATE:

WELL DIAMETER (INCHES):

FIELD CREW:

EQUIPMENT: *Peristaltic pump with one-time-use 0.25" x 0.170" Teflon-lined high-density polyethylene tubing*

METER MAKE & MODEL: *Horiba U-52 with flow-through cell*

METER CALIBRATION DATE:

DTW BEFORE PURGING (ft BTOC): 3.33

DEPTH TO BOTTOM (ft BTOC): ___ Soft / ___ Hard

REFERENCE: 1" well = 0.16 liter/ft or 0.041 gal/ft 2-inch well = 0.617 liter/ft or 0.163 gal/ft 1 gallon = 3.785 liters 1 liter = 0.264 gallons

WATER COLUMN (FT):

WELL VOLUME (LITERS):

3 WELL VOLUMES (LITERS):

FIELD PARAMETERS COLLECTED DURING LOW-FLOW PURGING

TIME 4 minute readings	WATER LEVEL (ft BTOC)	FLOW RATE (ml/min)	TOTAL VOLUME (Liters)	TEMP. (°C)	pH (std. units)	ORP (mV)	CONDUC-TIVITY (mS/cm)	DO (mg/L)	LaMOTTE TURBIDITY (NTU)	REMARKS (color, odor, sheen, sediment, etc.)
Stability:	< 0.3 ft	300 – 500	NA	NA	± 0.1	± 10 mV	± 3 %	± 10 %	± 10 %	
1435	4.10	200	—	26.56	9.18	-303	7.31	0.55	0.63	Initial state. COLA / ODOROUS
1440	5.11	200	0.5	25.70	9.19	-373	7.59	0.25	0.80	BLEBS OF BLACK SEDIMENT
1445	6.09	150	1.5	24.52	9.19	-395	7.77	0.25	0.74	" "
1450	7.10	150	2.5	23.90	9.19	-396	7.55	0.25	0.71	" "
1455	8.20	150	3.5	23.72	9.19	-401	6.91	0.20	1.21	" "
1500	9.06	150	4	23.73	9.20	-394	6.58	0.19	2.45	" "
1505	10.10	150	5	25.03	9.20	-401	6.50	0.17	3.88	COLA / ODOROUS
1510	LET	RECHARGE								
1615	SAMPLE									
				--	--	--	--	--		Final state.

NOTES:

FIELD ANALYSES AND LABORATORY SAMPLING INFORMATION

PRIMARY SAMPLE ID: MW31-081919

PRIMARY SAMPLE DATE & TIME: 16:10 8/19/19

PRIMARY SAMPLE PARAMETERS (check): ___ *VOCs,* ___ *TAL metals,* ___ *MNA,* ___ *SVOCs,* ___ *PAH,* ___*Sulfur,* ___*Sulfite*

QA/QC SAMPLE ID: —

QA/QC SAMPLE DATE & TIME: —

QA/QC SAMPLE PARAMETERS (check): ___ *VOCs,* ___ *TAL metals,* ___ *MNA,* ___ *SVOCs,* ___ *PAH,* ___*Sulfur,* ___*Sulfite*

FERROUS IRON FIELD KIT CONCENTRATION (mg/L): WOULD NOT ZERO W/ BROWN WATER

SAMPLER'S SIGNATURE:

JACOBS

Former Hampshire Chemical Corp., 228 E. Main St., Waterloo, NY, Project DWWAT002

LOW-FLOW GROUNDWATER SAMPLING LOG, 2019 ANNUAL LTM EVENT

WELL: MW-35	SCREEN INTERVAL (ft BTOC):	START DATE:	8/21/19
	WELL DIAMETER (INCHES): 2	FIELD CREW:	SAC SB RG

EQUIPMENT: *Peristaltic pump with one-time-use 0.25" x 0.170" Teflon-lined high-density polyethylene tubing*

METER MAKE & MODEL: *Horiba U-52 with flow-through cell* METER CALIBRATION DATE: 8/21/19

DTW BEFORE PURGING (ft BTOC): 1.11 DEPTH TO BOTTOM (ft BTOC): ___ Soft / ___ Hard

REFERENCE: 1" well ≈ 0.16 liter/ft or 0.041 gal/ft 2-inch well ≈ 0.617 liter/ft or 0.163 gal/ft 1 gallon = 3.785 liters 1 liter = 0.264 gallons

WATER COLUMN (FT): WELL VOLUME (LITERS): 3 WELL VOLUMES (LITERS):

FIELD PARAMETERS COLLECTED DURING LOW-FLOW PURGING

TIME 4 minute readings	WATER LEVEL (ft BTOC)	FLOW RATE (ml/min)	TOTAL VOLUME (Liters)	TEMP. (°C)	pH (std. units)	ORP (mV)	CONDUC-TIVITY (mS/cm)	DO (mg/L)	LaMOTTE TURBIDITY (NTU)	REMARKS (color, odor, sheen, sediment, etc.)
Stability:	< 0.3 ft	300 – 500	NA	NA	± 0.1	± 10 mV	± 3 %	± 10 %	± 10 %	
1133	2.02	300	–	20.70	6.95	-117	1.96	0.48	29.2	Initial state. Clear
1138	2.55	300	1	20.63	6.91	-123	1.92	0.35	18.2	
1143	2.90	250	2	20.75	6.91	-122	1.90	0.29	12.8	
1148	3.18	250	3	20.71	6.92	-119	1.90	0.31	8.40	
1153	3.17	250	4	20.71	6.93	-117	1.89	0.30	7.42	
1158	3.18	250	5	20.67	6.93	-117	1.89	0.29	8.20	
1203	3.18	250	6	20.66	6.93	-116	1.89	0.28	6.99	
1208	SAMPLE									
				--	--	--	--	--		Final state.

NOTES:

FIELD ANALYSES AND LABORATORY SAMPLING INFORMATION

PRIMARY SAMPLE ID: MW35-082119 PRIMARY SAMPLE DATE & TIME: 8/21/19 1208

PRIMARY SAMPLE PARAMETERS (check): ___ *VOCs*, ___ *TAL metals*, ___ *MNA*, ___ *SVOCs*, ___ *PAH*, ___*Sulfur*, ___*Sulfite*

QA/QC SAMPLE ID: – QA/QC SAMPLE DATE & TIME: –

QA/QC SAMPLE PARAMETERS (check): ___ *VOCs*, ___ *TAL metals*, ___ *MNA*, ___ *SVOCs*, ___ *PAH*, ___*Sulfur*, ___*Sulfite*

FERROUS IRON FIELD KIT CONCENTRATION (mg/L): 3.07 SAMPLER'S SIGNATURE:

JACOBS

Former Hampshire Chemical Corp., 228 E. Main St., Waterloo, NY, Project DWWAT002

LOW-FLOW GROUNDWATER SAMPLING LOG, 2019 ANNUAL LTM EVENT

WELL: MW-36

SCREEN INTERVAL (ft BTOC):

START DATE: 8/21/19

WELL DIAMETER (INCHES):

FIELD CREW:

EQUIPMENT: *Peristaltic pump with one-time-use 0.25" x 0.170" Teflon-lined high-density polyethylene tubing*

METER MAKE & MODEL: *Horiba U-52 with flow-through cell*

METER CALIBRATION DATE:

DTW BEFORE PURGING (ft BTOC): 1.48

DEPTH TO BOTTOM (ft BTOC):

___ Soft / ___ Hard

REFERENCE: 1" well ≈ 0.16 liter/ft or 0.041 gal/ft 2-inch well ≈ 0.617 liter/ft or 0.163 gal/ft 1 gallon = 3.785 liters 1 liter = 0.264 gallons

WATER COLUMN (FT):

WELL VOLUME (LITERS):

3 WELL VOLUMES (LITERS):

FIELD PARAMETERS COLLECTED DURING LOW-FLOW PURGING

TIME 4 minute readings	WATER LEVEL (ft BTOC)	FLOW RATE (ml/min)	TOTAL VOLUME (Liters)	TEMP. (°C)	pH (std. units)	ORP (mV)	CONDUC-TIVITY (mS/cm)	DO (mg/L)	LaMOTTE TURBIDITY (NTU)	REMARKS (color, odor, sheen, sediment, etc.)
Stability:	< 0.3 ft	300 – 500	NA	NA	± 0.1	± 10 mV	± 3 %	± 10 %	± 10 %	
955	2.04	250	—	22.22	6.57	-26	2.47	0.68	58.0	Initial state. LT BROWN
1000	2.80	225	1	21.21	6.70	-51	2.50	0.35	42.1	CLEAR
1005	3.09	200	2	20.97	6.71	-51	2.48	0.38	44.0	CLEAR
1010	3.20	200	3	20.93	6.73	-46	2.47	0.41	22.1	
1015	3.31	200	3.5	20.85	6.73	-47	2.51	0.34	14.2	
1020	3.35	200	4	20.80	6.74	-50	2.53	0.30	14.0	
1025	3.39	200	4.5	20.74	6.74	-52	2.56	0.26	12.6	CLEAR
1030	3.40	200	5	20.72	6.74	-53	2.58	0.24	11.4	
1035	SAMPLE									
				--	--	--	--	--		Final state.

NOTES:

FIELD ANALYSES AND LABORATORY SAMPLING INFORMATION

PRIMARY SAMPLE ID: MW36-082119

PRIMARY SAMPLE DATE & TIME: 8/21/19 1035

PRIMARY SAMPLE PARAMETERS (check): ___ *VOCs*, ___ *TAL metals*, ___ *MNA*, ___ *SVOCs*, ___ *PAH*, ___ *Sulfur*, ___ *Sulfite*

QA/QC SAMPLE ID: —

QA/QC SAMPLE DATE & TIME: —

QA/QC SAMPLE PARAMETERS (check): ___ *VOCs*, ___ *TAL metals*, ___ *MNA*, ___ *SVOCs*, ___ *PAH*, ___ *Sulfur*, ___ *Sulfite*

FERROUS IRON FIELD KIT CONCENTRATION (mg/L): 0.91

SAMPLER'S SIGNATURE:

038
0900

JACOBS

Former Hampshire Chemical Corp., 228 E. Main St., Waterloo, NY, Project DWWAT002

LOW-FLOW GROUNDWATER SAMPLING LOG, 2019 ANNUAL LTM EVENT

WELL: P204	SCREEN INTERVAL (ft BTOC):	START DATE: 8/15/19	
	WELL DIAMETER (INCHES): 1	FIELD CREW: C. Lettich	

EQUIPMENT: *Peristaltic pump with one-time-use 0.25" x 0.170" Teflon-lined high-density polyethylene tubing*

METER MAKE & MODEL: *Horiba U-52 with flow-through cell* METER CALIBRATION DATE: 8/15/19

DTW BEFORE PURGING (ft BTOC): 3.23 DEPTH TO BOTTOM (ft BTOC): 9.40 ___ Soft / [✓ Hard]

REFERENCE: 1" well = 0.16 liter/ft or 0.041 gal/ft 2-inch well = 0.617 liter/ft or 0.163 gal/ft 1 gallon = 3.785 liters 1 liter = 0.264 gallons

WATER COLUMN (FT): WELL VOLUME (LITERS): 3 WELL VOLUMES (LITERS):

FIELD PARAMETERS COLLECTED DURING LOW-FLOW PURGING

TIME 4 minute readings	WATER LEVEL (ft BTOC)	FLOW RATE (ml/min)	TOTAL VOLUME (Liters)	TEMP. (°C)	pH (std. units)	ORP (mV)	CONDUCTIVITY (mS/cm)	DO (mg/L)	LaMOTTE TURBIDITY (NTU)	REMARKS (color, odor, sheen, sediment, etc.)
Stability:	< 0.3 ft	300 – 500	NA	NA	± 0.1	± 10 mV	± 3 %	± 10 %	± 10 %	
1054	3.23	300	0	24.53	8.18	-247	5.12	0.65	52.4	Initial state. Black solid
1100	3.53	↓	1.8	23.81	8.14	-339	4.70	0.00	34.8	sulfur odor strong
1104	3.64		3.0	23.46	7.87	-349	4.58	0.00	22.0	solids decreasing
1108	↓		4.2	23.59	7.81	-354	4.64	0.0	11.9	water grey
1112			5.4	23.65	7.80	-364	4.69	0.0	9.57	
1117			6.9	23.81	7.79	-369	4.73	0.05	8.31	
1121	3.60		8.1	23.85	7.80	-373	4.77	0.09	11.64	no solid. lt. grey yellow
1125	↓		9.3	23.89	7.80	-378	4.80	0.10	10.1	
1129		↓	10.50	23.97	7.80	-382	4.81	0.11	8.2	
1205	3.67			--	--	--	--	--	8.2	Final state.

NOTES: 28 ppm H_2S in bucket. 0 ppm breathing zone

Some reaction with HCl preservative

FIELD ANALYSES AND LABORATORY SAMPLING INFORMATION

PRIMARY SAMPLE ID: P204-081519 PRIMARY SAMPLE DATE & TIME: 1130 8/15/19

PRIMARY SAMPLE PARAMETERS (check): ✓ *VOCs,* ✓ *TAL metals,* ✓ *MNA,* ___ *SVOCs,* ___ *PAH,* ✓ *Sulfur,* ___ *Sulfite*

QA/QC SAMPLE ID: P204-081519/MS & MSD QA/QC SAMPLE DATE & TIME: 8/15/19 1130

QA/QC SAMPLE PARAMETERS (check): ✓ *VOCs,* ✓ *TAL metals,* ___ *MNA,* ___ *SVOCs,* ___ *PAH,* ___ *Sulfur,* ___ *Sulfite*

FERROUS IRON FIELD KIT CONCENTRATION (mg/L): 0.06 SAMPLER'S SIGNATURE:

JACOBS Former Hampshire Chemical Corp., 228 E. Main St., Waterloo, NY, Project DWWAT002

LOW-FLOW GROUNDWATER SAMPLING LOG, 2019 ANNUAL LTM EVENT

WELL: PZ-06	SCREEN INTERVAL (ft BTOC):	START DATE:	8/19/19
	WELL DIAMETER (INCHES): 1	FIELD CREW:	SALSBURG

EQUIPMENT: *Peristaltic pump with one-time-use 0.25" x 0.170" Teflon-lined high-density polyethylene tubing*

METER MAKE & MODEL: *Horiba U-52 with flow-through cell* METER CALIBRATION DATE: 8/19/19

DTW BEFORE PURGING (ft BTOC): 3.14 DEPTH TO BOTTOM (ft BTOC): ___ Soft / ___ Hard

REFERENCE: 1" well ≈ 0.16 liter/ft or 0.041 gal/ft 2-inch well = 0.617 liter/ft or 0.163 gal/ft 1 gallon = 3.785 liters 1 liter = 0.264 gallons

WATER COLUMN (FT): WELL VOLUME (LITERS): 3 WELL VOLUMES (LITERS):

FIELD PARAMETERS COLLECTED DURING LOW-FLOW PURGING

TIME 4 minute readings	WATER LEVEL (ft BTOC)	FLOW RATE (ml/min)	TOTAL VOLUME (Liters)	TEMP. (°C)	pH (std. units)	ORP (mV)	CONDUCTIVITY (mS/cm)	DO (mg/L)	LaMOTTE TURBIDITY (NTU)	REMARKS (color, odor, sheen, sediment, etc.)
Stability:	< 0.3 ft	300 – 500	NA	NA	± 0.1	± 10 mV	± 3 %	± 10 %	± 10 %	
1316	6.41	200	/	23.52	8.80	-244	1.58	0.74	28.8	Initial state.
1321	9.02	150	0.5	23.91	8.51	-237	1.12	0.70	24.4	CLEAR
1323	DRY									
				--	--	--	--	--		Final state.

NOTES: LET RECHARGE 3 TIMES FOR SAMPLING

FIELD ANALYSES AND LABORATORY SAMPLING INFORMATION

PRIMARY SAMPLE ID: PZ06-082019 PRIMARY SAMPLE DATE & TIME: 8/20/19 1600

PRIMARY SAMPLE PARAMETERS (check): ✓ *VOCs*, ✓ *TAL metals*, ✓ *MNA*, ✓ *SVOCs*, ✓ *PAH*, ✓ *Sulfur*, ✓ *Sulfite*

QA/QC SAMPLE ID: QA/QC SAMPLE DATE & TIME:

QA/QC SAMPLE PARAMETERS (check): ___ *VOCs*, ___ *TAL metals*, ___ *MNA*, ___ *SVOCs*, ___ *PAH*, ___ *Sulfur*, ___ *Sulfite*

FERROUS IRON FIELD KIT CONCENTRATION (mg/L): 0.10 SAMPLER'S SIGNATURE:

JACOBS

Former Hampshire Chemical Corp., 228 E. Main St., Waterloo, NY, Project DWWAT002

LOW-FLOW GROUNDWATER SAMPLING LOG, 2019 ANNUAL LTM EVENT

WELL: TW-07	SCREEN INTERVAL (ft BTOC):	START DATE:	8/20/19
	WELL DIAMETER (INCHES):	FIELD CREW:	SALSBURG

EQUIPMENT: *Peristaltic pump with one-time-use 0.25" x 0.170" Teflon-lined high-density polyethylene tubing*

METER MAKE & MODEL: *Horiba U-52 with flow-through cell* METER CALIBRATION DATE: 8/20/19

DTW BEFORE PURGING (ft BTOC): 16.98 DEPTH TO BOTTOM (ft BTOC): ___ Soft / ___ Hard

REFERENCE: 1" well = 0.16 liter/ft or 0.041 gal/ft 2-inch well = 0.617 liter/ft or 0.163 gal/ft 1 gallon = 3.785 liters 1 liter = 0.264 gallons

WATER COLUMN (FT): WELL VOLUME (LITERS): 3 WELL VOLUMES (LITERS):

FIELD PARAMETERS COLLECTED DURING LOW-FLOW PURGING

TIME 4 minute readings	WATER LEVEL (ft BTOC)	FLOW RATE (ml/min)	TOTAL VOLUME (Liters)	TEMP. (°C)	pH (std. units)	ORP (mV)	CONDUCTIVITY (mS/cm)	DO (mg/L)	LaMOTTE TURBIDITY (NTU)	REMARKS (color, odor, sheen, sediment, etc.)
Stability:	< 0.3 ft	300 – 500	NA	NA	± 0.1	± 10 mV	± 3 %	± 10 %	± 10 %	
1432 ~~17.10~~	17.10	300	—	16.05	7.53	-146	1.61	0.14	52.0	Initial state CLEAR
1437	17.12	300	1.5	15.80	7.62	-159	1.60	0.02	19.1	
1442	17.12	250	3	15.26	7.64	-165	1.56	0.00	20.0	CLEAR
1447	17.13	250	4	15.10	7.66	-170	1.54	0.00	9.92	
1452	17.13	250	5.5	15.03	7.66	-174	1.53	0.00	8.21	CLEAR
1457	17.13	250	6.5	14.82	7.64	-174	1.52	0.00	6.20	
1502										
1507	SAMPLE									
					--	--	--	--		Final state:

NOTES:

FIELD ANALYSES AND LABORATORY SAMPLING INFORMATION

PRIMARY SAMPLE ID: TW01-082019 PRIMARY SAMPLE DATE & TIME: 8/20/19 15:07

PRIMARY SAMPLE PARAMETERS (check): ✓ *VOCs*, ✓ *TAL metals*, ___ *MNA*, ___ *SVOCs*, ✓ *PAH*, ___ *Sulfur*, ___ *Sulfite*

QA/QC SAMPLE ID: — QA/QC SAMPLE DATE & TIME: —

QA/QC SAMPLE PARAMETERS (check): ___ *VOCs*, ___ *TAL metals*, ___ *MNA*, ___ *SVOCs*, ___ *PAH*, ___ *Sulfur*, ___ *Sulfite*

FERROUS IRON FIELD KIT CONCENTRATION (mg/L): 3.03 SAMPLER'S SIGNATURE:

JACOBS

Former Hampshire Chemical Corp., 228 E. Main St., Waterloo, NY, Project DWWAT002

LOW-FLOW GROUNDWATER SAMPLING LOG, 2019 ANNUAL LTM EVENT

WELL: MW33	SCREEN INTERVAL (ft BTOC):	START DATE:	10/31/19
	WELL DIAMETER (INCHES): 2	FIELD CREW:	C. Lettich

EQUIPMENT: *Peristaltic pump with one-time-use 0.25" x 0.170" Teflon-lined high-density polyethylene tubing*

METER MAKE & MODEL: *Horiba U-52 with flow-through cell* METER CALIBRATION DATE: 10/31/19

DTW BEFORE PURGING (ft BTOC): 0.81' DEPTH TO BOTTOM (ft BTOC): 11.97 ___ Soft / ✓ Hard

REFERENCE: 1" well ≈ 0.16 liter/ft or 0.041 gal/ft 2-inch well ≈ 0.617 liter/ft or 0.163 gal/ft 1 gallon = 3.785 liters 1 liter = 0.264 gallons

WATER COLUMN (FT): 11.16 WELL VOLUME (LITERS): 6.9 3 WELL VOLUMES (LITERS): 20.7

FIELD PARAMETERS COLLECTED DURING LOW-FLOW PURGING

TIME 4 minute readings	WATER LEVEL (ft BTOC)	FLOW RATE (ml/min)	TOTAL VOLUME (Liters)	TEMP. (°C)	pH (std. units)	ORP (mV)	CONDUC-TIVITY (mS/cm)	DO (mg/L)	LaMOTTE TURBIDITY (NTU)	REMARKS (color, odor, sheen, sediment, etc.)
Stability:	< 0.3 ft	300 – 500	NA	NA	± 0.1	± 10 mV	± 3 %	± 10 %	± 10 %	
1053	0.81	–	0	–	–	–	–	–	–	Initial state.
1056	1.40		1.2	20.78	6.29	-283	9.89	1.66	0	clear
1100	–		2.4	20.26	6.93	-324	10.4	0.52	0	
1104	2.19		3.6	20.24	7.00	-333	10.3	0.37	0	
1108	2.60		4.8	20.34	7.03	-339	10.0	0.30	↓	
1112	2.70		5.0	20.51	7.04	-345	9.47	0.20		
1116	2.90		6.2	20.65	7.04	-352	9.43	0.20		
1120	3.07		7.5	20.68	7.04	-357	9.59	0.46		
1124	3.28		8.7	20.58	7.04	-360	9.51	0.94		
1128	3.32		9.9	20.45	7.13	-362	9.63	1.41		
1132	3.45		11.0	20.51	7.05	-363	9.76	1.54		
1136	3.60		12.2	20.52	7.03	-363	9.91	1.56		
1210	4.06			--	--	--	--	--		Final state.

NOTES: Performing sampling in Level B airline PPE

FIELD ANALYSES AND LABORATORY SAMPLING INFORMATION

PRIMARY SAMPLE ID: MW33-103119 PRIMARY SAMPLE DATE & TIME: 10/31/19 1130

PRIMARY SAMPLE PARAMETERS (check): ✓ *VOCs*, ✓ *TAL metals*, ✓ *MNA*, ___ *SVOCs*, ___ *PAH*, ✓ *Sulfur*, ✓ *Sulfite*

QA/QC SAMPLE ID: None QA/QC SAMPLE DATE & TIME: –

QA/QC SAMPLE PARAMETERS (check): ✓ *VOCs*, ✓ *TAL metals*, ___ *MNA*, ___ *SVOCs*, ___ *PAH*, ___ *Sulfur*, ___ *Sulfite*

FERROUS IRON FIELD KIT CONCENTRATION (mg/L): SAMPLER'S SIGNATURE:

JACOBS

Former Hampshire Chemical Corp., 228 E. Main St., Waterloo, NY, Project DWWAT002

LOW-FLOW GROUNDWATER SAMPLING LOG, 2019 ANNUAL LTM EVENT

WELL: PZ-03

SCREEN INTERVAL (ft BTOC):

START DATE: 10/31/19

WELL DIAMETER (INCHES): 1"

FIELD CREW: A. Stapleton / T. Salsburg

EQUIPMENT: *Peristaltic pump with one-time-use 0.25" x 0.170" Teflon-lined high-density polyethylene tubing*

METER MAKE & MODEL: *Horiba U-52 with flow-through cell*

METER CALIBRATION DATE: 10/31/19

DTW BEFORE PURGING (ft BTOC): 2.5'

DEPTH TO BOTTOM (ft BTOC): — ___ Soft / ___ Hard

REFERENCE: 1" well ≈ 0.16 liter/ft or 0.041 gal/ft 2-inch well ≈ 0.617 liter/ft or 0.163 gal/ft 1 gallon = 3.785 liters 1 liter = 0.264 gallons

WATER COLUMN (FT):

WELL VOLUME (LITERS):

3 WELL VOLUMES (LITERS):

FIELD PARAMETERS COLLECTED DURING LOW-FLOW PURGING

TIME 4 minute readings	WATER LEVEL (ft BTOC)	FLOW RATE (ml/min)	TOTAL VOLUME (Liters)	TEMP. (°C)	pH (std. units)	ORP (mV)	CONDUC-TIVITY (mS/cm)	DO (mg/L)	LaMOTTE TURBIDITY (NTU)	REMARKS (color, odor, sheen, sediment, etc.)
Stability:	< 0.3 ft	300 – 500	NA	NA	± 0.1	± 10 mV	± 3 %	± 10 %	± 10 %	
1425	2.78	—	—	20.38	6.84	-317	33.8	2.69	91.5	Initial state. Looks Clear
1430	2.86	—	1.5	19.88	7.03	-292	28.9	1.42	13.8	
1435	2.82	—	3.0	19.76	7.13	-287	23.2	1.03	3.6	
1440	2.88	—	4.5	19.66	7.20	-286	18.7	0.68	3.3	
1445	2.88	—	6.0	19.61	7.24	-286	15.2	0.55	7.2	
1450	2.86	—	7.5	19.58	7.27	-286	12.8	0.47	0.0	
1500	Collect Sample									
				--	--	--	--	--		Final state.

NOTES: Start in Level B, No readings of H_2S in well headspace or once purging began. Took level B off to sample well. Purging @ ~ 300 mL/min

FIELD ANALYSES AND LABORATORY SAMPLING INFORMATION

PRIMARY SAMPLE ID: PZ03-103119

PRIMARY SAMPLE DATE & TIME: 10/31/19 1530 (on bottles)

PRIMARY SAMPLE PARAMETERS (check): ✓ VOCs, ✓ TAL metals, ✓ MNA, ___ SVOCs, ___ PAH, ✓ Sulfur, ✓ Sulfite

QA/QC SAMPLE ID: None

QA/QC SAMPLE DATE & TIME: —

QA/QC SAMPLE PARAMETERS (check): ___ VOCs, ___ TAL metals, ___ MNA, ___ SVOCs, ___ PAH, ___ Sulfur, ___ Sulfite

FERROUS IRON FIELD KIT CONCENTRATION (mg/L): 2.21

SAMPLER'S SIGNATURE: Andy

Appendix C
Laboratory NYSDOH ELAP Certifications

(provided on compact disc)

Appendix D
Data Quality Evaluation

JACOBS

Memorandum

Data Quality Evaluation for the 2019 Groundwater Monitoring at the Former Hampshire Chemical Corporation Facility

PREPARED FOR:	Dow Chemical Company
PREPARED BY:	Jacobs
DATE:	February 10, 2020

Introduction

The objective of this data quality evaluation (DQE) report is to assess the data quality of analytical results for groundwater samples collected from the Union Carbide Corporation (UCC) Dow Waterloo site in Waterloo, New York. Jacobs collected samples August 15 through August 22, 2019 and October 31, 2019. Guidance for this DQE report came from the following: *Quality Assurance Project Plan, RCRA Facility Investigation, Former Hampshire Chemical Corporation Facility, Waterloo, New York* (Waterloo QAPP, June 2010); the *U.S. Environmental Protection Agency* (EPA) *National Functional Guidelines (NFG) for Superfund Organic Methods Data Review* (January 2017); the *USEPA Contract Laboratory NFG for Inorganic Superfund Methods Data Review, (*January 2017)*;* and, individual method requirements.

The analytical results were evaluated using the criteria of precision, accuracy, representativeness, comparability and completeness (PARCC) as described in the QAPP. This report is intended as a general data quality assessment designed to summarize data issues.

Analytical Data

This DQE report covers 23 groundwater samples, 3 field duplicates (FD), 2 matrix spike (MS)/matrix spike duplicate (MSD) samples, one field blank (FB) and 6 trip blanks (TB). The samples were reported in six sample delivery groups identified in Table 1.

TABLE 1. Sample Delivery Groups

2019 Groundwater Monitoring, Dow Waterloo

L1936691	L1937417
L1937677	L1937929
L1938123	L1951626

Samples were collected and delivered to Alpha Analytical in Westborough, Massachusetts. The samples were analyzed by one or more of the methods listed in Table 2.

TABLE 2. Analytical Parameters

2019 Groundwater Monitoring, Dow Waterloo

Parameter	**Method**
Volatile Organic Compounds (VOC)	SW8260C

TABLE 2. Analytical Parameters

2019 Groundwater Monitoring, Dow Waterloo

Parameter	Method
Semivolatile Organic Compounds (SVOC)	SW8270D/SW8270D SIM
Polyaromatic Hydrocarbons (PAH)	SW8270D SIM
Select Metals (total/dissolved)	SW6020A
Chloride and Sulfate	E300.0
Alkalinity	SM2320B
Nitrate	E353.2
Total Phosphorus	SM4500 P-E
Orthophosphate	SM4500 P-E
Total Organic Carbon (TOC)	SM5310 C
Total Dissolved Solids (TDS)	SM2540C
Ammonia	EPA 350.1
Total Kjeldahl Nitrogen (TKN)	EPA 351.3
Sulfide	SM4500-S2 D
Silica	EPA 200.7

The sample delivery groups were assessed by reviewing the following: the chain of custody documentation; holding-time compliance; initial and continuing calibration criteria; method blanks/field blanks; laboratory control spiking sample/laboratory control spiking sample duplicate (LCS/LCSD) recoveries and precision; MS/MSD recoveries and precision, surrogate spike recoveries, internal standard recoveries, FD precision, and the required quality control (QC) samples at the specified frequencies.

Data flags were assigned according to the QAPP. Multiple flags are routinely applied to specific sample method/matrix/analyte combinations, but there will only be one final flag. A final flag is applied to the data and is the most conservative of the applied validation flags. The final flag also includes matrix and blank sample impacts.

The data flags are those listed in the QAPP and are defined below:

- J = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
- R = The sample result was rejected due to serious deficiencies in the ability to analyze the sample and meet the QC criteria. The presence or absence of the analyte could not be verified.
- U = The analyte was analyzed for but was not detected above the reported sample quantitation limit.
- UJ = The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

Findings

The overall summaries of the data validation are contained in the following sections. Qualified data are presented in Table 3.

Holding Time and Preservation

Holding time and preservation criteria were met with the following exception:

- Sample MW21-081519 was received with a pH that exceeded the criteria of pH<2 for the ammonia, dissolved/total metals, phosphorus and TKN analyses. The data were qualified as estimated detected results and flagged “J” in the sample.

Calibration

Initial and continuing calibration analyses were performed as required by the methods and acceptance criteria were met with the following exceptions:

- The percent difference (%D) for bromodichloromethane was less than criteria in one VOC initial calibration verification (ICVS) standard indicating a possible low bias. The data were qualified as estimated non-detected results and flagged “UJ” in the associated samples. In addition, the %D for bromomethane was greater than criteria in a few ICVS, indicating a possible high bias. The data were not qualified because the associated samples did not contain reportable levels of bromomethane.
- The %Ds for several analytes were less than criteria in a few VOC continuing calibration verification standards (CCV), indicating a possible low bias. The data were qualified as estimated detected and non-detected results and flagged “J” and “UJ”, respectively, in the associated samples. In addition, the %Ds for a few analytes were greater than criteria in several CCVs, indicating a possible high bias. Detected results were qualified as estimated and flagged “J” in the associated samples. Non-detected results were not qualified.
- The relative response factor (RRF) for 1,4-dioxane was less than criteria in one VOC CCV, indicating a possible low bias. The data were qualified as estimated non-detected results and flagged “UJ” in the associated samples.
- The %D for pentachlorophenol was less than criteria in one SVOC CCV, indicating a possible low bias. The data were qualified as estimated non-detects and flagged “UJ” in the associated samples. In addition, the %D for pentachlorophenol was greater than criteria in one CCV, indicating a possible high bias. The data were not qualified because the associated samples did not contain reportable levels of pentachlorophenol.
- Total and/or dissolved iron were detected at concentrations greater and/or less than the reporting limit (RL) in a few initial calibration blanks (ICBs) and continuing calibration blanks (CCBs) associated with the metals analysis. In addition, total arsenic was detected at concentrations less than the RL in one ICB and CCB. The data were qualified as not detected at the concentration measured and flagged “U” when the associated sample concentrations were less than five times the blank concentrations.

Method Blanks

Method blanks were analyzed at the required frequency and were free of contamination with the following exception:

- Multiple analytes were detected at concentrations greater and/or less than the RLs in a few PAH method blanks. The data were qualified as not detected at the concentration measured and flagged “U” when the associated sample concentrations were less than five times the blank concentration.

- Dissolved manganese was detected at a concentration less than the RL in one method blank associated with the metals analysis. The result was qualified as not detected at the concentration measured and flagged “U” in the associated sample.
- Orthophosphate and total phosphorus were detected at concentrations less than the RL in a few method blanks. The data were qualified as not detected at the concentration measured and flagged “U” when the associated sample concentrations were less than five times the blank concentrations.
- TKN was detected at a concentration less than the RL in one method blank. The data were qualified as not detected at the concentration measured and flagged “U” when the associated sample concentrations were less than five times the blank concentrations.

Laboratory Control Samples

LCS/LCSDs were analyzed as required and accuracy and precision criteria were met with the following exceptions:

- Benzene and 1,2-dichloroethane were recovered less than the lower control limits in one VOC LCS/LCSD, indicating a possible low bias. The data were qualified as estimated detected and non-detect results and flagged “J” and “UJ”, respectively, in the associated samples. In addition, chloroethane and cis-1,3-dichloropropene were recovered greater than the upper control limits in a few VOC LCS/LCSDs, indicating a possible high bias. The data were not qualified because the associated samples did not contain reportable levels of these analytes.
- Benzoic acid was not recovered in one SVOC LCS/LCSD, indicating a possible significant low bias. The data were rejected for project use and flagged “R” in the associated samples. In addition, the recovery of 4-nitrophenol was greater than the upper control limits in a few LCS/LCSDs, indicating a possible high bias. The data were not qualified because the associated samples did not contain reportable levels of 4-nitrophenol.
- The relative percent differences (RPD) for hexachloroethane and pentachlorophenol exceeded criteria in one SVOC LCS/LCSD. The data were not qualified because the associated samples did not contain reportable levels of these analytes.

Internal Standards

Internal standards were added to the samples for methods requiring their use and acceptance criteria were met.

Surrogates

Surrogates were added to the samples for methods requiring their use and acceptance criteria were met with the following exception:

- The acid surrogate associated with the SVOC analysis by Method SW8270D SIM was recovered greater than the upper control limit in sample MW07-082019, indicating a possible high bias. The data were not qualified because the sample did not contain reportable levels of the associated analytes.

Matrix Spikes

MS/MSD samples were analyzed as required and accuracy and precision criteria were met with the following exceptions:

- Several analytes were recovered less than the lower control limits in multiple MS/MSDs, indicating a possible low bias. The data were qualified as estimated detected and non-detected results and flagged “J” and “UJ”, respectively, in the associated parent samples.

- Multiple analytes were recovered greater than the upper control limit in several MS/MSDs indicating a possible high bias. Detected results were qualified as estimated and flagged “J” in the respective parent samples. Non-detected results were not qualified.

- The RPDs for multiple analytes exceeded criteria in the MS/MSD for sample MW10-082019. The data were not qualified because the parent sample did not contain reportable levels of these analytes.

Field Duplicates

FDs were collected as required and precision criteria were met with the following exceptions:

- The RPD for acetone exceeded criteria in FD pairs MW02-081519 / DUP-GW-081519 and MW17-082019/DUP-GW-082019. The data were qualified as estimated and flagged “J” in the FD pairs.

Laboratory Duplicates

Laboratory duplicates were analyzed as required and precision criteria were met.

Field Blanks

FBs and TBs were collected, analyzed and were free of contamination with the following exceptions:

- Acetone and/or chloromethane were detected at concentrations greater and/or less than the RL in the VOC TBs. The data were qualified as not detected and flagged “U” when the associated sample concentrations were less than 5x (10x for acetone) the blank concentrations.

Sample Quantitation

The RPD between the dissolved and total concentrations for arsenic, iron and/or manganese exceeded criteria in samples MW09R-081919, MW-35-082119, MW19-082219 and MW33-103119, where the dissolved concentration was greater than the total concentration. The data were qualified as estimated and flagged “J” in the samples.

Tentatively Identified Compounds

Tentatively identified compounds were reported in the VOC and SVOC analyses to determine the presence/absence of the following analytes in the samples: epichlorohydrin, thioglycolic acid, dithiodiglycolic acid, mercaptopropionic acid, thiodipropionic acid, and dithiodipropionic acid. The library search did not identify these analytes in the samples.

Chain of Custody

Required procedures were followed and COCs were free of errors.

Overall Assessment

The goal of this assessment is to demonstrate that a sufficient number of representative samples were collected, and the resulting analytical data can be used to support the decision-making process. The following summary highlights the PARCC findings for the above-defined events:

Precision of the data was verified through the review of the field and laboratory data quality indicators that include: FD, LCS/LCSD, MS/MSD, and laboratory duplicates RPDs. Precision was generally acceptable; however, acetone was qualified as estimated in four samples due to FD RPD issues. Data users should consider the impact to any result that is qualified as estimated as it may contain a bias which could affect the decision-making process.

Accuracy of the data was verified through the review of the calibration data, LCS/LCSD, internal standard, surrogate, and MS/MSD recoveries, as well as the evaluation of method/calibration/field blank data. Accuracy was generally acceptable; however, a few analytes were qualified as estimated due to calibration, LCS, and/or MS/MSD issues. In addition, benzoic acid was rejected for project use in two SVOC samples due to LCS/LCSD issues. Several analytes were qualified as not detected in multiple samples due to calibration/method and/or trip blank contamination.

Representativeness of the data was verified through the sample's collection, storage and preservation procedures and the verification of holding-time compliance. The sample containers associated with the metals, ammonia, TKN and phosphorus analyses were received with a pH greater than criteria for sample MW21-081519, resulting in the data being qualified as estimated. The data were reported from analyses within the EPA recommended holding time.

Comparability of the data was verified through the use of standard EPA analytical procedures and standard units for reporting. Results obtained are comparable to industry standards in that the collection and analytical techniques followed approved, documented procedures.

Completeness is a measure of the number of valid measurements obtained in relation to the total number of measurements planned. Completeness is expressed as the percentage of valid or usable measurements compared to planned measurements. Valid data are defined as all data that are not rejected for project use. All data were considered valid with the exception of benzoic acid. The completeness goal of 95 percent was met for all method/analytes combinations except for benzoic acid which was 75 percent complete.

The data can be used for project decisions taking into consideration the validation flags applied to the samples.

TABLE 3. Data Qualification Summary

2019 Groundwater Monitoring, Dow Waterloo

Field ID	Method	Analyte	Units	Final Result	Validation Flag	Validation Reason
DUP-GW-081519	SW6020B	Iron, Dissolved	mg/l	0.0819	U	ICB<RL, CCB<RL
DUP-GW-081519	SW8260C	Acetone	ug/l	21	U	TB>RL, FD>RPD (J), CCV>UCL (J)
DUP-GW-081519	SW8260C	Chloromethane	ug/l	0.99	U	TB<RL
DUP-GW-082019	SW8260C	Acetone	ug/l	22	U	TB>RL, FD>RPD (J), CCV>UCL (J)
DUP-GW-082219	SW8270D	Benzoic Acid	ug/l	2.6	R	LCS<LCL, LCSD<LCL
DUP-GW-082219	SW8270DSIM	Acenaphthene	ug/l	0.04	U	LB<RL
DUP-GW-082219	SW8270DSIM	Anthracene	ug/l	0.02	U	LB<RL
DUP-GW-082219	SW8270DSIM	Phenanthrene	ug/l	0.03	U	LB<RL
MW02-081519	SM4500-P E	Phosphorus, Orthophosphate	mg/l	0.25	U	LB<RL
MW02-081519	SW6020B	Iron, Dissolved	mg/l	0.0844	U	ICB<RL

TABLE 3. Data Qualification Summary

2019 Groundwater Monitoring, Dow Waterloo

Field ID	Method	Analyte	Units	Final Result	Validation Flag	Validation Reason
MW02-081519	SW8260C	Acetone	ug/l	32	U	TB>RL, FD>RPD (J), CCV>UCL (J)
MW02-081519	SW8260C	Chloromethane	ug/l	1.2	U	TB<RL
MW05I-081919	SW8260C	1,4-Dioxane	ug/l	61	UJ	CCV<LCL
MW05I-081919	SW8260C	Acetone	ug/l	27	U	TB<RL, CCV>UCL (J)
MW05I-081919	SW8270DSIM	Pentachlorophenol	ug/l	0.01	UJ	CCV<LCL
MW06-082019	SW6020B	Iron, Dissolved	mg/l	0.0769	U	ICB<RL
MW06-082019	SW8260C	1,4-Dioxane	ug/l	61	UJ	CCVRRF, CCV<LCL
MW06-082019	SW8260C	Acetone	ug/l	19	U	TB>RL, CCV>UCL (J)
MW06-082019	SW8260C	Chloromethane	ug/l	0.89	U	TB<RL
MW07-082019	SW6020B	Iron, Dissolved	mg/l	0.0573	U	ICB<RL
MW07-082019	SW8260C	1,4-Dioxane	ug/l	61	UJ	CCVRRF, CCV<LCL
MW07-082019	SW8260C	Acetone	ug/l	21	U	TB<RL, CCV>UCL (J)
MW07-082019	SW8260C	Chloromethane	ug/l	2.9	U	TB<RL
MW09R-081919	SW6020B	Iron, Total	mg/l	5.29	J	D_MET>T_MET
MW09R-081919	SW6020B	Iron, Dissolved	mg/l	6.15	J	D_MET>T_MET
MW09R-081919	SW8260C	1,4-Dioxane	ug/l	61	UJ	CCV<LCL
MW09R-081919	SW8260C	Acetone	ug/l	18	U	TB<RL, CCV>UCL (J)
MW09R-081919	SW8260C	Chloromethane	ug/l	1	U	TB<RL
MW09R-081919	SW8270DSIM	Pentachlorophenol	ug/l	0.01	UJ	CCV<LCL
MW10-082019	SW6020B	Iron, Total	mg/l	0.19	J	MS>UCL
MW10-082019	SW8260C	1,4-Dioxane	ug/l	61	UJ	CCVRRF, CCV<LCL
MW10-082019	SW8260C	Acetone	ug/l	22	U	TB<RL, CCV>UCL (J)
MW11S-081519	SW6020B	Iron, Total	mg/l	0.134	U	ICB<RL, CCB<RL
MW11S-081519	SW6020B	Iron, Dissolved	mg/l	0.0483	U	ICB<RL, CCB<RL

TABLE 3. Data Qualification Summary

2019 Groundwater Monitoring, Dow Waterloo

Field ID	Method	Analyte	Units	Final Result	Validation Flag	Validation Reason
MW16I-082219	SW8260C	Acetone	ug/l	17	U	TB<RL, CCV>UCL (J)
MW16I-082219	SW8270DSIM	Pyrene	ug/l	0.02	U	LB<RL
MW17-082019	SW8260C	Acetone	ug/l	6.1	U	TB>RL, FD>RPD (J), CCV>UCL (J)
MW17-082019	SW8260C	Chloromethane	ug/l	1.3	U	TB<RL
MW18-082019	SW8260C	Acetone	ug/l	14	U	TB>RL, CCV>UCL (J)
MW18-082019	SW8260C	Chloromethane	ug/l	0.98	U	TB<RL
MW19-082219	SW6020B	Arsenic, Total	mg/l	0.00424	J	D_MET>T_MET
MW19-082219	SW6020B	Arsenic, Dissolved	mg/l	0.00476	J	D_MET>T_MET
MW19-082219	SW8260C	1,4-Dioxane	ug/l	61	UJ	CCV<LCL
MW19-082219	SW8260C	Acetone	ug/l	23	U	TB>RL, CCV>UCL (J)
MW19-082219	SW8270D	Benzoic Acid	ug/l	2.6	R	LCS<LCL, LCSD<LCL
MW19-082219	SW8270DSIM	Acenaphthene	ug/l	0.05	U	LB<RL
MW19-082219	SW8270DSIM	Anthracene	ug/l	0.02	U	LB<RL
MW19-082219	SW8270DSIM	Phenanthrene	ug/l	0.02	U	LB<RL
MW20-082019	SW6020B	Iron, Dissolved	mg/l	0.0201	U	ICB<RL
MW20-082019	SW8260C	1,4-Dioxane	ug/l	61	UJ	CCVRRF, CCV<LCL
MW20-082019	SW8260C	Acetone	ug/l	22	U	TB>RL, CCV>UCL (J)
MW21-081519	E350.1	Nitrogen, Ammonia	mg/l	12.5	J	pH
MW21-081519	E351.3	Nitrogen, Total Kjeldahl	mg/l	26.8	J	pH
MW21-081519	SM4500-P E	Phosphorus, Total	mg/l	17.2	J	pH
MW21-081519	SW6020B	Aluminum, Total	mg/l	1.2	J	pH
MW21-081519	SW6020B	Arsenic, Total	mg/l	2.123	J	pH
MW21-081519	SW6020B	Calcium, Total	mg/l	6.52	J	pH
MW21-081519	SW6020B	Iron, Total	mg/l	0.425	J	pH

TABLE 3. Data Qualification Summary

2019 Groundwater Monitoring, Dow Waterloo

Field ID	Method	Analyte	Units	Final Result	Validation Flag	Validation Reason
MW21-081519	SW6020B	Magnesium, Total	mg/l	2.14	J	pH
MW21-081519	SW6020B	Manganese, Total	mg/l	0.02357	J	pH
MW21-081519	SW6020B	Potassium, Total	mg/l	3.62	J	pH
MW21-081519	SW6020B	Sodium, Total	mg/l	6090	J	pH
MW21-081519	SW6020B	Aluminum, Dissolved	mg/l	0.978	J	pH
MW21-081519	SW6020B	Arsenic, Dissolved	mg/l	2.074	J	pH
MW21-081519	SW6020B	Iron, Dissolved	mg/l	0.382	J	pH
MW21-081519	SW6020B	Manganese, Dissolved	mg/l	0.00829	U	LB<RL, pH (J)
MW-26-082119	SW6020B	Arsenic, Dissolved	mg/l	0.00076	U	CCB<RL
MW-26-082119	SW8260C	Acetone	ug/l	17	U	TB>RL, CCV>UCL (J)
MW-26-082119	SW8260C	Chloromethane	ug/l	1.3	U	TB<RL
MW30-081519	SW6020B	Iron, Total	mg/l	0.181	U	ICB<RL, CCB<RL
MW31-081919	E300	Chloride	mg/l	605	J	MS<LCL
MW31-081919	E350.1	Nitrogen, Ammonia	mg/l	3.6	J	MS<LCL
MW33-103119	SW6020B	Arsenic, Total	mg/l	0.02946	J	D_MET>T_MET, MS<LCL
MW33-103119	SW6020B	Arsenic, Dissolved	mg/l	0.03405	J	D_MET>T_MET
MW33-103119	SW6020B	Iron, Dissolved	mg/l	0.081	U	ICB<RL, CCB<RL
MW33-103119	SW8260C	1,2-Dichloroethane	ug/l	0.13	UJ	CCV<LCL, LCS<LCL, LCSD<LCL
MW33-103119	SW8260C	2-Hexanone	ug/l	1.2	J	CCV>UCL
MW33-103119	SW8260C	4-Methyl-2-pentanone	ug/l	29	J	CCV>UCL
MW33-103119	SW8260C	Acetone	ug/l	11	U	TB>RL
MW33-103119	SW8260C	Benzene	ug/l	2	J	CCV<LCL, LCSD<LCL
MW33-103119	SW8260C	Bromochloromethane	ug/l	0.7	UJ	CCV<LCL
MW33-103119	SW8260C	Bromodichloromethane	ug/l	0.19	UJ	ICVS<LCL

TABLE 3. Data Qualification Summary

2019 Groundwater Monitoring, Dow Waterloo

Field ID	Method	Analyte	Units	Final Result	Validation Flag	Validation Reason
MW33-103119	SW8260C	Carbon disulfide	ug/l	1.7	J	CCV<LCL
MW33-103119	SW8260C	Chloroform	ug/l	0.7	UJ	CCV<LCL
MW33-103119	SW8260C	Dichlorodifluoromethane	ug/l	1	UJ	CCV<LCL
MW33-103119	SW8260C	Methylene chloride	ug/l	0.7	UJ	CCV<LCL
MW-35-082119	E350.1	Nitrogen, Ammonia	mg/l	0.284	J	MS<LCL
MW-35-082119	E351.3	Nitrogen, Total Kjeldahl	mg/l	0.669	U	LB<RL
MW-35-082119	SM4500-P E	Phosphorus, Orthophosphate	mg/l	0.003	U	LB<RL
MW-35-082119	SW6020B	Manganese, Total	mg/l	0.02968	J	D_MET>T_MET
MW-35-082119	SW6020B	Manganese, Dissolved	mg/l	0.06808	J	D_MET>T_MET
MW-36-082119	E351.3	Nitrogen, Total Kjeldahl	mg/l	0.387	U	LB<RL
MW-36-082119	SM4500-P E	Phosphorus, Orthophosphate	mg/l	0.002	U	LB<RL
MW-36-082119	SM4500-S2 D	Sulfide	mg/l	0.1	UJ	MS<LCL
PZ03-103119	SM4500-P E	Phosphorus, Orthophosphate	mg/l	0.002	U	LB<RL
PZ03-103119	SM4500-S2 D	Sulfide	mg/l	0.18	J	MS<LCL
PZ03-103119	SW6020B	Iron, Dissolved	mg/l	2.26	U	ICB<RL, CCB<RL
PZ03-103119	SW8260C	1,2-Dichloroethane	ug/l	2.4	J	CCV<LCL, LCS<LCL, LCSD<LCL
PZ03-103119	SW8260C	Acetone	ug/l	3.1	U	TB>RL
PZ03-103119	SW8260C	Benzene	ug/l	0.16	UJ	CCV<LCL, LCSD<LCL
PZ03-103119	SW8260C	Bromochloromethane	ug/l	0.7	UJ	CCV<LCL
PZ03-103119	SW8260C	Bromodichloromethane	ug/l	0.19	UJ	ICVS<LCL
PZ03-103119	SW8260C	Carbon disulfide	ug/l	1	UJ	CCV<LCL
PZ03-103119	SW8260C	Chloroform	ug/l	0.7	UJ	CCV<LCL
PZ03-103119	SW8260C	Dichlorodifluoromethane	ug/l	1	UJ	CCV<LCL
PZ03-103119	SW8260C	Methylene chloride	ug/l	0.7	UJ	CCV<LCL

TABLE 3. Data Qualification Summary

2019 Groundwater Monitoring, Dow Waterloo

Field ID	Method	Analyte	Units	Final Result	Validation Flag	Validation Reason
PZ04-081519	E300	Chloride	mg/l	496	J	MS<LCL, SD<LCL
PZ04-081519	SM4500-P E	Phosphorus, Orthophosphate	mg/l	0.425	J	MS<LCL
PZ04-081519	SW6020B	Aluminum, Total	mg/l	0.0656	J	SD>UCL
PZ04-081519	SW6020B	Calcium, Total	mg/l	142	J	MS>UCL
PZ04-081519	SW6020B	Iron, Total	mg/l	0.105	U	ICB<RL, CCB<RL
PZ04-081519	SW6020B	Magnesium, Total	mg/l	27.6	J	MS>UCL, SD>UCL
PZ04-081519	SW6020B	Potassium, Total	mg/l	14	J	MS>UCL
PZ04-081519	SW6020B	Iron, Dissolved	mg/l	0.0428	U	ICB<RL, MS>UCL (J)
PZ04-081519	SW8260C	Acetone	ug/l	23	U	TB>RL, CCV>UCL (J), MS>UCL (J). SD>UCL (J)
PZ04-081519	SW8260C	Carbon disulfide	ug/l	11	J	MS>UCL, SD>UCL
PZ04-081519	SW8260C	Chloromethane	ug/l	0.75	U	TB<RL, MS>UCL (J), SD>UCL (J)
PZ06-082019	SW8260C	2-Butanone	ug/l	2.3	J	CCV>UCL
PZ06-082019	SW8260C	Acetone	ug/l	25	U	TB>RL, CCV>UCL (J)
TW01-082019	SW8260C	Acetone	ug/l	16	U	TB>RL, CCV>UCL (J)
TW01-082019	SW8260C	Chloromethane	ug/l	0.82	U	TB<RL

Validation Reasons:

CCB<RL	The analyte was detected in the continuing calibration blank at a concentration less than the reporting limit
CCV<LCL	The continuing calibration verification standard recovery was less than criteria
CCV>UCL	The continuing calibration verification standard recovery was greater than criteria
CCVRRF	The continuing calibration verification relative response factor was less than criteria
D_M>T_M	The dissolved concentration was greater than the total concentration
FD>RPD	The relative percent difference exceeded criteria in the FD pair
ICB<RL	The analyte was detected in the initial calibration blank at a concentration less than the reporting limit

TABLE 3. Data Qualification Summary

2019 Groundwater Monitoring, Dow Waterloo

Field ID	Method	Analyte	Units	Final Result	Validation Flag	Validation Reason
ICVS<LCL	The initial calibration verification standard recovery was less than criteria					
LB<RL	The analyte was detected in the method blank at a concentration less than the reporting limit					
LCS<LCL	The laboratory control sample recovery was less than the lower control limit					
LCSD<LCL	The laboratory control sample duplicate recovery was less than the lower control limit					
MS<LCL	The matrix spike sample recovery was less than the lower control limit					
MS>UCL	The matrix spike sample recovery was greater than the upper control limit					
pH	The pH of the analyte was greater than criteria					
SD<LCL	The matrix spike duplicate sample recovery was less than the lower control limit					
SD>UCL	The matrix spike duplicate sample recovery was greater than the upper control limit					
TB<RL	The analyte was detected in the trip blank at a concentration less than the reporting limit					
TB>RL	The analyte was detected in the trip blank at a concentration greater than the reporting limit					

Note:

µg/L = micrograms per liter
mg/L = milligrams per liter