RECORD OF DECISION

Former Kenco Chemical Company, Inc.
Operable Unit Number 01: Off-Site Contamination
State Superfund Project
Glenville, Schenectady County
Site No. 447039
September 2017

Prepared by
Division of Environmental Remediation
New York State Department of Environmental Conservation

DECLARATION STATEMENT - RECORD OF DECISION

Former Kenco Chemical Company, Inc.
Operable Unit Number: 01
State Superfund Project
Glenville, Schenectady County
Site No. 447039
September 2017

Statement of Purpose and Basis

This document presents the remedy for Operable Unit Number: 01: Off-Site Contamination of the Former Kenco Chemical Company, Inc. site, a Class 2 inactive hazardous waste disposal site. The remedial program was chosen in accordance with the New York State Environmental Conservation Law and Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York (6 NYCRR) Part 375, and is not inconsistent with the National Oil and Hazardous Substances Pollution Contingency Plan of March 8, 1990 (40CFR300), as amended.

This decision is based on the Administrative Record of the New York State Department of Environmental Conservation (the Department) for Operable Unit Number: 01 of the Former Kenco Chemical Company, Inc. site and the public's input to the proposed remedy presented by the Department. A listing of the documents included as a part of the Administrative Record is included in Appendix B of the ROD.

Description of Selected Remedy

The elements of the selected remedy are as follows:

The potential for public exposure to off-site contamination is currently being managed in OU 01, through several interim remedial measures and will remain in place until no longer needed.

1. Remedial Design
A remedial design program will be implemented to provide the details necessary for the construction, operation, optimization, maintenance, and monitoring of the remedial program. Green remediation principles and techniques will be implemented to the extent feasible in the design, implementation, and site management of the remedy as per DER-31. The major green remediation components are as follows:

- Considering the environmental impacts of treatment technologies and remedy stewardship over the long term;
- Reducing direct and indirect greenhouse gases and other emissions;
- Increasing energy efficiency and minimizing use of non-renewable energy;
- Conserving and efficiently managing resources and materials;

- Reducing waste, increasing recycling and increasing reuse of materials which would otherwise be considered a waste;
- Maximizing habitat value and creating habitat when possible;
- Fostering green and healthy communities and working landscapes which balance ecological, economic and social goals; and
- Integrating the remedy with the end use where possible and encouraging green and sustainable re-development.

2. *In-Situ* Chemical Oxidation or Reduction and/or Biological Treatment
In-situ chemical and/or biological treatment will be implemented to treat contaminants in groundwater and saturated soils off-site, from the source property boundary south-southeasterly for approximately 0.5 miles. A chemical oxidant or a chemical reducing agent, and/or a biological enhancement agent, will be injected into the subsurface to destroy the contaminants *via* injection wells. The method and depth of injection will be determined during the remedial design.

3. Permeable Reactive Barriers
A permeable reactive barrier (PRB) consisting of zero valent iron (ZVI) or another reduced metal will be placed below the water table between Warner Creek and the residential area along Sunnyside Road. A second PRB of similar construction will be placed below the water table upgradient of the self-storage property pond. The exact location of the second PRB will be determined during the remedial design.

4. Institutional Control
The imposition of an institutional control in the form of an environmental easement for the controlled property (Former Kenco Property): and the off-site remedy area that:

- requires the remedial party or site owner to complete and submit to the Department a periodic certification of institutional and engineering controls in accordance with Part 375-1.8 (h)(3); and
- requires compliance with the Department-approved Site Management Plan. The Site Management Plan will address the necessary work required to implement and maintain the off-site operable unit chosen remedy's effectiveness.

5. Site Management Plan
A Site Management Plan is required to address both the on-site (OU 02) and off-site (OU 01) remaining contamination. The Site Management Plan will include the following:

a. an Institutional and Engineering Control Plan that identifies all use restrictions and engineering controls for the site and details the steps and media-specific requirements necessary to ensure the following institutional and/or engineering controls remain in place and effective:

Institutional Controls: The environmental easement discussed in item #4 above.

Engineering Controls: The *In-Situ* Chemical Oxidation or Reduction and the Permeable Reactive Barriers, discussed in above paragraphs two and three, respectively, and the interim remedial measures Surface Water Treatment and Sub-Slab Depressurization

Systems are the engineering controls selected for implementation.

This plan includes, but may not be limited to:

- an Excavation Plan which details the provisions for management of future excavations in areas of residual contamination;
- a provision for evaluation of the potential for soil vapor intrusion for any future buildings constructed in areas of known contamination, including provision for implementing actions recommended to address exposures related to soil vapor intrusion;
- provisions for the management and inspection of the identified engineering controls;
- maintaining site access controls and Department notification; and
- the steps necessary for the periodic reviews and certification of the institutional and/or engineering controls.

b. A Monitoring Plan to assess the performance and effectiveness of the remedy. This plan includes, but may not be limited to:

- monitoring of soil, soil vapor, sub-slab vapor, ambient air, indoor air, surface water and groundwater to assess the performance and effectiveness of the remedy;
- a schedule of monitoring and frequency of submittals to the Department; and
- monitoring for vapor intrusion for any future buildings constructed in areas of known contamination, as may be required by the Institutional and Engineering Control Plan discussed above.

c. An Operation and Maintenance (O&M) Plan to ensure continued operation, maintenance, optimization, monitoring, inspection, and reporting of any mechanical or physical components of the remedy. The plan includes, but is not limited to:

- procedures for operating and maintaining the remedy;
- compliance monitoring of treatment systems to ensure proper O&M as well as providing the data for any necessary permit or permit equivalent reporting;
- maintaining site access controls and Department notification; and
- providing the Department access to the site and O&M records.

New York State Department of Health Acceptance

The New York State Department of Health (NYSDOH) concurs that the remedy for this site is protective of human health.

Declaration

The selected remedy is protective of human health and the environment, complies with State and Federal requirements that are legally applicable or relevant and appropriate to the remedial action to the extent practicable, and is cost effective. This remedy utilizes permanent solutions and alternative treatment or resource recovery technologies, to the maximum extent practicable, and satisfies the preference for remedies that reduce toxicity, mobility, or volume as a principal element.

September 29, 2017
Date

Robert W. Schick, P.E., Director
Division of Environmental Remediation

RECORD OF DECISION

Former Kenco Chemical Company, Inc.
Glenville, Schenectady County
Site No. 447039
September 2017

SECTION 1: SUMMARY AND PURPOSE

The New York State Department of Environmental Conservation (the Department), in consultation with the New York State Department of Health (NYSDOH), has selected a remedy for the above referenced site. The disposal of hazardous wastes at the site has resulted in threats to public health and the environment that will be addressed by the remedy. The disposal or release of hazardous wastes at this site, as more fully described in this document, has contaminated various environmental media. The remedy is intended to attain the remedial action objectives identified for this site for the protection of public health and the environment. This Record of Decision (ROD) identifies the selected remedy, summarizes the other alternatives considered, and discusses the reasons for selecting the remedy.

The New York State Inactive Hazardous Waste Disposal Site Remedial Program (also known as the State Superfund Program) is an enforcement program, the mission of which is to identify and characterize suspected inactive hazardous waste disposal sites and to investigate and remediate those sites found to pose a significant threat to public health and environment.

The Department has issued this document in accordance with the requirements of New York State Environmental Conservation Law and 6 NYCRR Part 375. This document is a summary of the information that can be found in the site-related reports and documents.

SECTION 2: CITIZEN PARTICIPATION

The Department seeks input from the community on all remedies. A public comment period was held, during which the public was encouraged to submit comment on the proposed remedy. All comments on the remedy received during the comment period were considered by the Department in selecting a remedy for the site. Site-related reports and documents were made available for review by the public at the following document repository:

Glenville Public Library
Attn: Reference Librarian
20 Glenridge Rd
Glenville, NY 12302
Phone: 518-386-2243

A public meeting was also conducted. At the meeting, the findings of the remedial investigation

(RI) and the feasibility study (FS) were presented along with a summary of the proposed remedy. After the presentation, a question-and-answer period was held, during which verbal or written comments were accepted on the proposed remedy.

Comments on the remedy received during the comment period are summarized and addressed in the responsiveness summary section of the ROD.

Receive Site Citizen Participation Information By Email

Please note that the Department's Division of Environmental Remediation (DER) is "going paperless" relative to citizen participation information. The ultimate goal is to distribute citizen participation information about contaminated sites electronically by way of county email listservs. Information will be distributed for all sites that are being investigated and cleaned up in a particular county under the State Superfund Program, Environmental Restoration Program, Brownfield Cleanup Program, Voluntary Cleanup Program, and Resource Conservation and Recovery Act Program. We encourage the public to sign up for one or more county listservs at http://www.dec.ny.gov/chemical/61092.html

SECTION 3: SITE DESCRIPTION AND HISTORY

LOCATION: The Former Kenco Chemical Company Site is located at 107 Freemans Bridge Road, in a primarily commercial area, with adjacent farmland and some residential properties nearby. The Site is approximately 0.86 acres in size.

SITE FEATURES: The main site features include several concrete foundations for former buildings and a former aboveground storage tank and an unnamed creek with associated wetlands, between the site and railroad tracks.

CURRENT ZONING AND LAND USE: The site is a commercially zoned property, with mixed commercial and residential use in the area. The on-site storage/warehouse buildings were removed in 2015 and 2016, leaving the foundation slabs. The site is locally zoned “General Business” and the surrounding area is locally zoned “General Business and Research/Development/Technology.”

PAST USE OF THE SITE: The site was used for chemical distribution and warehousing by Kenco Chemical Company Inc. and Voelker Sales Inc. until approximately 1999. The chemicals handled on-site included swimming pool chemicals and dry cleaner chemicals (tetrachloroethene, a.k.a. perc or PCE). The site was purchased by Ultimate, LLC in 1999, and the property was used for general storage and warehousing until the on-site buildings were demolished in 2015 and 2016. A pre-sale site assessment for a nearby parcel identified contamination adjacent to the Former Kenco parcel, resulting in further investigation of the site.

OPERABLE UNITS: The site was divided into two operable units (OUs), namely OU 01 Off-site Contamination and OU 02 Source Area. An operable unit represents a portion of a remedial program for a site that for technical or administrative reasons can be addressed separately to investigate, eliminate or mitigate a release, threat of release or exposure pathway resulting from the site contamination.

SITE GEOLOGY AND HYDROGEOLOGY: Soils consist primarily of silt, sands and clayey layers, with two or more sandy zones divided by clays in many areas across the surrounding area. Depth to bedrock is generally 27-40 feet below ground surface. Depth to groundwater ranges from 3-15 feet below ground surface. The groundwater flows generally south and southeast from the site, and contamination is further transported by impacted unnamed creeks which connect to Warner Creek.

Operable Unit (OU) Number 01 is the subject of this document.

A Record of Decision was issued previously for OU 02.

A site location map is attached as Figure 1 and a site plan map is attached as Figure 2.

SECTION 4: LAND USE AND PHYSICAL SETTING

The Department may consider the current, intended, and reasonably anticipated future land use of the site and its surroundings when evaluating a remedy for soil remediation. For this site, an alternative which allows for unrestricted use of the site was evaluated.

A comparison of the results of the RI against unrestricted use standards, criteria and guidance values (SCGs) for the site contaminants is included in the Tables for the media being evaluated in Exhibit A.

SECTION 5: ENFORCEMENT STATUS

Potentially Responsible Parties (PRPs) are those who may be legally liable for contamination at a site. This may include past or present owners and operators, waste generators, and haulers.

The PRPs for the site, documented to date, include:

Ultimate, LLC

Shaun Cole

Estate of Kenneth K. Cochrane

Kenco Chemical Company Inc.

Voelker Sales Inc.

The PRPs for the site declined to implement a remedial program when requested by the Department. After the remedy is selected, the PRPs will again be contacted to assume responsibility for the remedial program. If an agreement cannot be reached with the PRPs, the Department will evaluate the site for further action under the State Superfund. The PRPs are subject to legal actions by the state for recovery of all response costs the state has incurred.

SECTION 6: SITE CONTAMINATION

6.1: Summary of the Remedial Investigation

A Remedial Investigation (RI) has been conducted. The purpose of the RI was to define the nature and extent of any contamination resulting from previous activities at the site. The field activities and findings of the investigation are described in the RI Report.

The following general activities are conducted during an RI:

- Research of historical information,
- Geophysical survey to determine the lateral extent of wastes,
- Test pits, soil borings, and monitoring well installations,
- Sampling of waste, surface and subsurface soils, groundwater, and soil vapor,
- Sampling of surface water and sediment,
- Ecological and Human Health Exposure Assessments.

The analytical data collected on this site includes data for:

- air
- groundwater
- surface water
- drinking water
- soil
- sediment
- soil vapor
- indoor air
- sub-slab vapor

6.1.1: Standards, Criteria, and Guidance (SCGs)

The remedy must conform to promulgated standards and criteria that are directly applicable or that are relevant and appropriate. The selection of a remedy must also take into consideration guidance, as appropriate. Standards, Criteria and Guidance are hereafter called SCGs.

To determine whether the contaminants identified in various media are present at levels of concern, the data from the RI were compared to media-specific SCGs. The Department has developed SCGs for groundwater, surface water, sediments, and soil. The NYSDOH has developed SCGs for drinking water and soil vapor intrusion. The tables found in Exhibit A list the applicable SCGs in the footnotes. For a full listing of all SCGs see: http://www.dec.ny.gov/regulations/61794.html

6.1.2: RI Results

The data have identified contaminants of concern. A "contaminant of concern" is a hazardous waste that is sufficiently present in frequency and concentration in the environment to require evaluation for remedial action. Not all contaminants identified on the property are contaminants of concern. The nature and extent of contamination and environmental media requiring action are summarized in Exhibit A. Additionally, the RI Report contains a full discussion of the data. The contaminants of concern identified for this Operable Unit at this site are:

tetrachloroethene (PCE)	trichloroethene (TCE)
vinyl chloride	dichloroethene (cis-1,2-DCE)

As illustrated in Exhibit A, the contaminants of concern exceed the applicable SCGs for:

- groundwater
- surface water
- soil
- soil vapor intrusion
- indoor air

6.2: Interim Remedial Measures

An interim remedial measure (IRM) is conducted at a site when a source of contamination or exposure pathway can be effectively addressed before issuance of the Record of Decision.

The following IRMs have been completed at this site based on conditions observed during the RI.

On-Site Surface Water and Groundwater Collection and Treatment

An unnamed tributary to Warner Creek flows along the northern property boundary of the site, then crosses the site and becomes contaminated. The Department is collecting the contaminated surface water from a sump adjacent to the property boundary, along the piped section of the creek, to reduce off-site transport of contamination. The Department is extracting contaminated groundwater from a recovery well immediately downgradient from the site. Since 2009, a Department-installed and operated remedial system treats the collected groundwater and surface water near the site, and treated water is discharged, approximately 1000 feet away, to another unnamed tributary to Warner Creek.

Sub-Slab Depressurization Systems

Residential and commercial buildings within OU 01 are being mitigated for soil vapor intrusion *via* sub-slab depressurization systems (SSDS). Two residential SSDS were installed by the Department in 2007, while one residential and one commercial SSDS were installed by USEPA in 2010. All of the SSDS have been managed by the Department since 2011.

IRM - Private Water Supply Treatment *via* Point-of-Entry Treatment Systems

Three impacted private water supply wells within OU 01 were equipped with point-of-entry treatment (POET) systems by USEPA in 2010. The Department installed additional POET systems on impacted private wells within OU 01 since that time. As of June 2016, the Department has installed municipal waterlines in the Sunnyside Road/Sunnyside Gardens neighborhood, connected the impacted residences to municipal water and disconnected all of the private well POET systems. (See IRM - Public Water Supply Line.)

IRM - Public Water Supply Line

In 2016, the Department installed a new waterline to supply municipal drinking water to all properties located in the Sunnyside Road/Sunnyside Gardens neighborhood 0.5 miles south of the site. All private potable water supply wells were connected to the extended municipal water supply water by August 2016.

IRM - EPA Emergency Removal Action

From 2010-2011, USEPA removed and properly disposed of chlorinated solvent and other chemical containers from the on-site buildings. In conjunction with this removal work, USEPA performed a substantial environmental sampling program for the on-site soil and downgradient soil vapor. USEPA's removal actions included: sampling over 100 private supply wells approximately 0.50 miles downgradient of the site; installing three POET systems on impacted private wells (discussed above); and installing sub-slab depressurization systems on two buildings impacted by soil vapor intrusion (discussed above).

IRM - Creek and Pond Near Sarnowski Drive

An unnamed pond and creek near Sarnowski Drive intercept contaminated groundwater and transport the contaminants downstream to Warner Creek and the Sunnyside Road area. In 2017, the Department installed, and continues to operate, an aeration/bubbler system to treat (i.e., volatilize) this intercepted contaminated groundwater.

6.3: Summary of Environmental Assessment

This section summarizes the assessment of existing and potential future environmental impacts presented by the site. Environmental impacts may include existing and potential future exposure pathways to fish and wildlife receptors, wetlands, groundwater resources, and surface water.

The Fish and Wildlife Resources Impact Analysis (FWRIA) for OU 01, which is included in the RI report, presents a detailed discussion of the existing and potential impacts from the site to fish and wildlife receptors.

Nature and Extent of Contamination:

Soil samples were analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, polychlorinated biphenyls (PCBs) and pesticides. Groundwater, surface water, sediment and soil vapor samples were analyzed only for VOCs. The Remedial Investigation (RI) for the on-site OU 02 area and the RI data for the off-site OU 01 area established the contaminants of concern to be the chlorinated volatile organic compounds tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (DCE), and vinyl chloride (VC).

The media-specific chemical concentration details for the OU 01 portion of the total site area are provided below.

The maximum soil concentrations for PCE, TCE and DCE are 56 parts per million (ppm), 1.4 ppm and 0.26 ppm. (VC was not detected in any of the soil samples for the OU 01 area.) The unrestricted use soil cleanup objective (SCO) for PCE is 1.3 ppm, and was exceeded at only two sampling locations. The unrestricted use SCO for TCE is 0.47 ppm, and was exceeded only at the same two locations as the PCE exceedances. The unrestricted use SCO for DCE is 0.25 ppm, and it was exceeded at only one location, one of the two locations where PCE and TCE exceeded their respective SCOs.

The groundwater contamination plume extends for approximately 0.50 miles southerly from the Former Kenco parcel. The PCE, TCE and DCE contaminants of concern have a groundwater quality standard of 5 parts per billion (ppb), and VC has a groundwater quality standard of 2 ppb. The maximum groundwater concentrations for PCE, TCE, DCE and VC are 58,000 ppb, 760 ppb, 1,200 ppb and 310 ppb, respectively.

Warner creek and an unnamed tributary contain site-related chlorinated VOCs, with the maximum PCE, TCE, DCE and VC concentrations of 2,300 ppb, 51 ppb, 250 ppb and 24 ppb, respectively. An off-site soil vapor intrusion assessment has been conducted for buildings in the OU 01 area. Sub-slab soil vapor and indoor air samples were collected at 51 buildings since 2007. The maximum concentrations in sub-slab vapor for PCE, TCE and DCE are 54,249 micrograms per cubic meter (µg/m3), 2,525 µg/m3 and 1,784 µg/m3, respectively. The maximum concentrations in indoor air for PCE, TCE and DCE are 535 micrograms per cubic meter (µg/m3), 4.51 µg/m3 and 0.91 µg/m3, respectively. VC was not detected in either the sub-slab or indoor air samples. Based on the results of soil vapor intrusion sampling, sub-slab depressurization systems have been installed in four buildings and have been recommended for one additional building. Monitoring has been recommended for ten building locations.

Special Resources Impacted/Threatened: Warner Creek and an unnamed tributary have shown detectable levels of site-related chlorinated VOCs.

6.4: Summary of Human Exposure Pathways

This human exposure assessment identifies ways in which people may be exposed to site-related contaminants. Chemicals can enter the body through three major pathways (breathing, touching or swallowing). This is referred to as *exposure.*

Access to the site is unrestricted. Contact with contaminated soil or groundwater is unlikely unless persons dig beneath the surface near the OU2 on-site portion of this site. People are not drinking the contaminated groundwater because the area is served by a public water supply that is not contaminated by the site. Volatile organic compounds in the groundwater may move into the soil vapor (air spaces within the soil), which in turn may move into overlying buildings and affect the indoor air quality. This process, which is similar to the movement of radon gas from the subsurface into the indoor air of buildings, is referred to as soil vapor intrusion. The inhalation of site-related contaminants due to soil vapor intrusion does not represent a current concern because the site is vacant. However, the potential exists for the inhalation of site contaminants due to soil vapor intrusion for any future on-site development. Sub-slab depressurization systems (systems that ventilate/remove the air beneath the building) have been installed in off-site buildings to prevent the indoor air quality from being affected by the contamination in soil vapor beneath the buildings and air monitoring is recommended for other locations.

6.5: Summary of the Remediation Objectives

The objectives for the remedial program have been established through the remedy selection process stated in 6 NYCRR Part 375. The goal for the remedial program is to restore the site to pre-disposal conditions to the extent feasible. At a minimum, the remedy shall eliminate or mitigate all significant threats to public health and the environment presented by the contamination identified at the site through the proper application of scientific and engineering principles.

The remedial action objectives for this site are:

Groundwater

RAOs for Public Health Protection

- Prevent ingestion of groundwater with contaminant levels exceeding drinking water standards.
- Prevent contact with, or inhalation of volatiles, from contaminated groundwater.

RAOs for Environmental Protection

- Restore ground water aquifer to pre-disposal/pre-release conditions, to the extent practicable.
- Prevent the discharge of contaminants to surface water.
- Remove the source of ground or surface water contamination.

Soil

RAOs for Public Health Protection

- Prevent ingestion/direct contact with contaminated soil.
- Prevent inhalation of or exposure from contaminants volatilizing from contaminants in soil.

RAOs for Environmental Protection

- Prevent migration of contaminants that would result in groundwater or surface water contamination.

Surface Water

RAOs for Public Health Protection

- Prevent ingestion of water impacted by contaminants.
- Prevent contact or inhalation of contaminants from impacted water bodies.

RAOs for Environmental Protection

- Restore surface water to ambient water quality criteria for the contaminant of concern.

Soil Vapor

RAOs for Public Health Protection

- Mitigate impacts to public health resulting from existing, or the potential for, soil vapor intrusion into buildings at a site.

SECTION 7: SUMMARY OF THE SELECTED REMEDY

To be selected, the remedy must be protective of human health and the environment, be cost-effective, comply with other statutory requirements, and utilize permanent solutions, alternative technologies or resource recovery technologies to the maximum extent practicable. The remedy must also attain the remedial action objectives identified for the site, which are presented in Section 6.5. Potential remedial alternatives for the site were identified, screened and evaluated in the feasibility study (FS) report.

A summary of the remedial alternatives that were considered for this site is presented in Exhibit B. Cost information is presented in the form of present worth, which represents the amount of money invested in the current year that would be sufficient to cover all present and future costs associated with the alternative. This enables the costs of remedial alternatives to be compared on a common basis. As a convention, a time frame of 30 years is used to evaluate present worth costs for alternatives with an indefinite duration. This does not imply that operation, maintenance, or monitoring would cease after 30 years if remediation goals are not achieved. A summary of the Remedial Alternatives Costs is included as Exhibit C.

The basis for the Department's remedy is set forth at Exhibit D.

The selected remedy is referred to as the *In-Situ* Chemical Oxidation/Biological Treatment (ISCO/BIO) (Plume Concentrations >1,000 ppb) and Permeable Reactive Barrier Walls remedy, including Common Element for deep groundwater ISCO/BIO (Plume Concentrations >100 ppb).

The estimated present worth cost to implement the remedy is $16,000,000. The cost to construct the remedy is estimated to be $13,300,000 and the estimated average annual cost is $216,000.

The elements of the selected remedy are as follows:

The potential for public exposure to off-site contamination is currently being managed in OU 01, through several interim remedial measures and will remain in place until no longer needed.

1. Remedial Design

A remedial design program will be implemented to provide the details necessary for the construction, operation, optimization, maintenance, and monitoring of the remedial program.

Green remediation principles and techniques will be implemented to the extent feasible in the design, implementation, and site management of the remedy as per DER-31. The major green remediation components are as follows:

- Considering the environmental impacts of treatment technologies and remedy stewardship over the long term;
- Reducing direct and indirect greenhouse gases and other emissions;
- Increasing energy efficiency and minimizing use of non-renewable energy;
- Conserving and efficiently managing resources and materials;
- Reducing waste, increasing recycling and increasing reuse of materials which would otherwise be considered a waste;
- Maximizing habitat value and creating habitat when possible;
- Fostering green and healthy communities and working landscapes which balance ecological, economic and social goals; and
- Integrating the remedy with the end use where possible and encouraging green and sustainable re-development.

2. *In-Situ* Chemical Oxidation or Reduction and/or Biological Treatment

In-situ chemical and/or biological treatment will be implemented to treat contaminants in groundwater and saturated soils off-site, from the source property boundary south-southeasterly for approximately 0.5 miles. A chemical oxidant or a chemical reducing agent, and/or a biological enhancement agent, will be injected into the subsurface to destroy the contaminants *via* injection wells. The method and depth of injection will be determined during the remedial design.

3. Permeable Reactive Barriers

A permeable reactive barrier (PRB) consisting of zero valent iron (ZVI) or another reduced metal will be placed below the water table between Warner Creek and the residential area along Sunnyside Road. A second PRB of similar construction will be placed below the water table upgradient of the self-storage property pond. The exact location of the second PRB will be determined during the remedial design.

4. Institutional Control

The imposition of an institutional control in the form of an environmental easement for the controlled property (Former Kenco Property): and the off-site remedy area that:

- requires the remedial party or site owner to complete and submit to the Department a periodic certification of institutional and engineering controls in accordance with Part 375-1.8 (h)(3); and
- requires compliance with the Department-approved Site Management Plan. The Site Management Plan will address the necessary work required to implement and maintain the off-site operable unit chosen remedy's effectiveness.

5. Site Management Plan

A Site Management Plan is required to address both the on-site (OU 02) and off-site (OU 01) remaining contamination. The Site Management Plan will include the following:

a. an Institutional and Engineering Control Plan that identifies all use restrictions and engineering controls for the site and details the steps and media-specific requirements necessary

to ensure the following institutional and/or engineering controls remain in place and effective:

Institutional Controls: The environmental easement discussed in item #4 above.

Engineering Controls: The *In-Situ* Chemical Oxidation or Reduction and the Permeable Reactive Barriers, discussed in above paragraphs two and three, respectively, and the interim remedial measures Surface Water Treatment and Sub-Slab Depressurization Systems are the engineering controls selected for implementation.

This plan includes, but may not be limited to:

- an Excavation Plan which details the provisions for management of future excavations in areas of residual contamination;
- a provision for evaluation of the potential for soil vapor intrusion for any future buildings constructed in areas of known contamination, including provision for implementing actions recommended to address exposures related to soil vapor intrusion;
- provisions for the management and inspection of the identified engineering controls;
- maintaining site access controls and Department notification; and
- the steps necessary for the periodic reviews and certification of the institutional and/or engineering controls.

b. A Monitoring Plan to assess the performance and effectiveness of the remedy. This plan includes, but may not be limited to:

- monitoring of soil, soil vapor, sub-slab vapor, ambient air, indoor air, surface water and groundwater to assess the performance and effectiveness of the remedy;
- a schedule of monitoring and frequency of submittals to the Department; and
- monitoring for vapor intrusion for any future buildings constructed in areas of known contamination, as may be required by the Institutional and Engineering Control Plan discussed above.

c. An Operation and Maintenance (O&M) Plan to ensure continued operation, maintenance, optimization, monitoring, inspection, and reporting of any mechanical or physical components of the remedy. The plan includes, but is not limited to:

- procedures for operating and maintaining the remedy;
- compliance monitoring of treatment systems to ensure proper O&M as well as providing the data for any necessary permit or permit equivalent reporting;
- maintaining site access controls and Department notification; and
- providing the Department access to the site and O&M records.

Exhibit A

Nature and Extent of Contamination

This section describes the findings of the Remedial Investigation (RI) for all environmental media that were evaluated. As described in Section 6.1, samples were collected from various environmental media to characterize the nature and extent of contamination, including subsurface soil, groundwater, surface water, sediment, sub-slab soil vapor and indoor air.

For each medium for which contamination was identified, a table summarizes the findings of the investigation. The tables present the range of contamination found at the site in the media and compares the data with the applicable SCGs for the site. The primary contaminants that exceed SCGs are volatile organic compounds (VOCs). For comparison purposes, the SCGs are provided for each medium that allows for unrestricted use.

Groundwater

Between 2009 and 2015, multiple groundwater samples were collected on numerous properties to assess off-site groundwater conditions, downgradient of Operable Unit 2 (Source Area) of the Former Kenco Chemical Company. The samples were collected from a network of overburden monitoring wells installed as part of the RI. Grab groundwater samples were collected using direct push technology at select locations to fill data gaps. As shown on Table 1, the results indicate that contamination in shallow and deep water-bearing zones within OU1 exceeds the SCGs for chlorinated VOCs. Refer to Figure 3 for chlorinated VOC contaminant concentrations in shallow groundwater (5 to 15 feet below grade) and Figure 4 for chlorinated VOC contaminant concentrations in deep groundwater (25 to 40 feet below grade).

Table 1a - Groundwater

Detected Constituents	Concentration Range Detected (µg/l)[a]	SCG[b] (µg/l)	Frequency Exceeding SCG
VOCs			
Cis-1,2-dichloroethene (DCE)	ND – 1,200	5	84 out of 228
Tetrachloroethene (PCE)	ND – 58,000	5	93 out of 228
Trichloroethene (TCE)	ND – 760	5	59 out of 228
Vinyl Chloride (VC)	ND – 310	2	23 out of 228

a - micrograms per liter; a.k.a. parts per billion (ppb).
b- SCG: Standard Criteria or Guidance - Ambient Water Quality Standards and Guidance Values (TOGs 1.1.1), 6 NYCRR Part 703, Surface water and Groundwater Quality Standards, and Part 5 of the New York State Sanitary Code (10 NYCRR Part 5).
ND = Not Detected

Based on the findings of the RI, the past disposal of hazardous waste at the Former Kenco Chemical Company has resulted in the contamination of shallow and deep groundwater on the source property, which has migrated to downgradient properties. The site contaminants that are considered to be the primary contaminants of concern which will drive the remediation of groundwater to be addressed by the remedy selection process are: PCE, TCE, DCE, and VC.

A residential neighborhood located south of Warner Creek, near the leading edge of the groundwater contaminant plume, used the shallow groundwater for domestic water service *via* private water supply wells until August 2016. Water quality was monitored periodically during the RI. Sample VOC results were non-detect or below relevant SCGs for all but 14 locations sampled. These locations were equipped with individual point-of-entry treatment (POET) systems as an interim remedial measure (IRM). As of August 2016, all of the residences with POET systems and additional 86 residences were connected to a municipal potable water supply as an IRM project to eliminate exposures from private drinking water wells.

Soil

Subsurface soil samples were collected at the site during the RI. The subsurface soil samples were collected from a depth of 4 - 34 feet to assess soil contamination. The results indicate that subsurface soils at the site exceed the unrestricted SCGs for VOCs. These results are summarized in Table 2. Refer to Figure 5 for the VOC concentrations in soil.

Table 2 – Subsurface Soil

Detected Constituents	Concentration Range Detected (ppm)[a]	Unrestricted SCG[b] (ppm)	Frequency Exceeding Unrestricted SCG
VOCs			
Cis-1,2-dichloroethene (DCE)	ND – 0.26	0.25	1 of 42
Tetrachloroethene (PCE)	ND – 56	1.3	3 of 42
Trichloroethene (TCE)	ND – 1.4	0.47	2 of 42

a - ppm: parts per million, which is equivalent to milligrams per kilogram, mg/kg, in soil;
b - SCG: Part 375-6.8(a), Unrestricted Soil Cleanup Objectives.

The subsurface soil sample results that exceeded SCGs were collected in a relatively localized off-site area near Freemans Bridge Road. These samples were collected beneath the water table and are likely associated with high contaminant concentrations migrating in groundwater rather than nearby source material. Based on the findings of the RI, site contaminants identified in subsurface soil at concentrations exceeding SCGs will be addressed by the remedy selection process for groundwater.

Surface Water

Surface water samples were collected during the RI to assess the surface water conditions off-site. As shown in Table 3, the results indicate that four site-related chlorinated VOC contaminants in surface water exceed the Department's SCGs. The sample locations and results are shown on Figure 6.

Table 3 - Surface Water

Detected Constituents	Concentration Range Detected (µg/l)[a]	SCG[b] (µg/l)	Frequency Exceeding SCG
VOCs			
Cis-1,2-dichloroethene (DCE)	ND – 250	5	14 of 50
Tetrachloroethene (PCE)	ND – 2,300	0.7	36 of 50
Trichloroethene (TCE)	ND – 51	5	9 of 50
Vinyl Chloride (VC)	ND - 24	0.3	18 of 50

a - micrograms per liter.
b - SCG: Ambient Water Quality Standards and Guidance Values (TOGs 1.1.1) and 6 NYCRR Part 703: Surface Water and Groundwater Quality Standards.

Based on the findings of the RI, groundwater impacted by site-related contaminants discharges to surface water and has resulted in the contamination of surface water within OU1. As noted on Figure 6, surface water contamination exists in the stormwater detention basin located in the self-storage facility property at 65 Freemans Bridge Road, in the tributary creek that flows from the basin to Warner Creek, and in Warner Creek. The site contaminants that are considered to be the primary contaminants of concern which will drive the remediation of surface water are PCE, TCE, DCE, and VC. An aeration system has been installed within the stormwater detention pond as an IRM to mitigate exposure to surface water contamination. The long-term mitigation of surface water impacts will be addressed by the remedy selection process for groundwater.

Sediments

Sediment samples were collected during the RI from the OU1 wetlands, stormwater management ponds, tributary creek and Warner Creek to assess the potential for site-related impacts. The sample locations and results are shown on Figure 7. Site-related contaminants in sediment were reported to exceed the Department's SCGs in 1 of 53 samples. DCE was detected in that sample above the Freshwater Sediment Guidance Value (Screening and Assessment of Contaminated Sediment, June 2014). The exceedance was found to be negligible and not of concern since it was not duplicated with a second co-located sample. Therefore, no media-specific remedial alternatives were evaluated for sediment.

Soil Vapor

The potential for soil vapor intrusion resulting from the presence of site-related groundwater contamination was evaluated by the sampling of sub-slab soil vapor and indoor air under/inside several structures in OU1. Air sampling results from the soil vapor intrusion investigation were evaluated in accordance with New York State's Guidance for Evaluating Soil Vapor Intrusion in the State of New York (NYSDOH 2006).

Sub-slab vapor and indoor air samples were collected at 51 off-site buildings since 2007. PCE, TCE and DCE concentrations were detected in sub-slab samples as much as 54,249 micrograms per cubic meter (µg/m^3), 2,525 µg/m^3 and 1,784 µg/m^3, respectively. PCE, TCE and DCE concentrations were detected in indoor air samples as much as 535 µg/m^3, 4.51 µg/m^3 and 0.91 µg/m^3, respectively. No media-specific remedial alternatives were evaluated; however, the source of the soil vapor impacts will be addressed *via* the groundwater remedy selection process. Off-site soil vapor contamination and soil vapor intrusion identified during the RI was addressed as an IRM, as discussed in Section 6.2. IRMs consist of sub-slab depressurization systems. Four buildings received

sub-slab depressurization systems to address soil vapor intrusion and ten additional buildings will be monitored. Figure 8 illustrates the scope of sampling conducted for sub-slab soil vapor and indoor air (as applicable).

Exhibit B

Description of Remedial Alternatives

The following alternatives were considered based on the remedial action objectives (see Section 6.5) to address the contaminated media identified at the site as described in Exhibit A. Through the Feasibility Study process, *in-situ* chemical oxidation/bioremediation (ISCO/BIO) was deemed the most implementable technology for the off-site plume due to its size. All alternatives have ISCO/BIO as the primary technology and vary slightly in scale or whether supplementary technologies are used.

The common description of the alternatives is that ISCO/BIO will be implemented to destroy volatile organic compounds (VOCs) in groundwater *via* direct subsurface injection of a remedial amendment throughout the groundwater plume where total VOC concentrations are above a prescribed concentration. Costs were calculated assuming that ISCO is the primary technology as it is effective for high contaminant concentrations; however, enhanced bioremediation or a combination of bioremediation and ISCO may be suitable and more cost-effective for treatment of the lower-concentration areas of the plume instead of ISCO. Enhanced bioremediation may also be appropriate as a polishing tool as the remedial program progresses. Byproducts of the ISCO/BIO process are non-toxic. Groundwater quality will be evaluated through a network of monitoring wells.

Alternative 1: No Action

The No Action Alternative is evaluated as a procedural requirement and as a basis for comparison. This alternative leaves the site in its present condition and does not provide any additional protection to public health and the environment.

Present Worth: *$0*
Capital Cost: *$0*
Annual Costs: *$0*

Alternative 2: ISCO/BIO Treatment (Plume Concentrations > 5ppb)

ISCO/BIO will be implemented where total VOC concentrations in groundwater were reported at 5 part per billion (ppb) or greater. This treatment area is approximately 3,325,000 ft^2, and would target approximately 1,570 lbs (or 100%) of the dissolved-phase contaminant mass in the shallow water-bearing zone. Temporary injection points are expected to deliver chemical over a 10-foot thick zone in the shallow water-bearing aquifer. Four rounds of injections are estimated for the area with current contaminant concentrations above 10,000 ppb and two injection rounds are estimated in the remaining treatment area. Remedial goals would likely be achieved in 10 years for Alternative 2. This alternative achieves all of the SCGs discussed in Section 6.1.1 and Exhibit A.

Present Worth: *$28,500,000*
Capital Cost: *$27,200,000*
Annual Costs for Years 1-2: *$220,000*
Annual Costs for Years 3-10: *$139,000*

Alternative 3: ISCO/BIO Treatment (Plume Concentrations > 100ppb)

ISCO/BIO will be implemented where total VOC concentrations in groundwater were reported at 100 ppb or greater. This treatment area is approximately 1,952,000 ft^2, and would target approximately 1,560 lbs (or 99.4%) of the dissolved-phase contaminant mass in the shallow water-bearing zone. Temporary injection points are expected to deliver chemical over a 10-foot thick zone in the shallow water-bearing aquifer. Four rounds of injections are estimated for the area with current contaminant concentrations above 10,000 ppb and two injection rounds are estimated in the remaining treatment area. Remedial goals would likely be achieved in 20 years for Alternative 3. Groundwater monitoring will be performed to verify the progress of the remedy and the remaining contamination. This alternative achieves all of the SCGs discussed in Section 6.1.1 and Exhibit A.

Present Worth: *$18,000,000*
Capital Cost: *$16,400,000*
Annual Costs for Years 1-2: *$220,000*
Annual Costs for Years 3-10: *$139,000*
Annual Costs for Years 11-20: *$98,500*

Alternative 4: ISCO/BIO Treatment (Plume Concentrations > 1,000ppb)

ISCO/BIO will be implemented where total VOC concentrations in groundwater were reported at 1,000 ppb or greater. This treatment area is approximately 941,000 ft^2, and would target approximately 1,460 lbs (or 92.8%) of the dissolved-phase contaminant mass in the shallow water-bearing zone. Temporary injection points are expected to deliver chemical over a 10-foot thick zone in the shallow water-bearing aquifer. Four rounds of injections are estimated for the area with current contaminant concentrations above 10,000 ppb and two injection rounds are estimated in the remaining treatment area. Groundwater monitoring will be performed to verify the progress of the remedy and the remaining contamination. Remedial goals would likely not be achieved within 30 years for Alternative 4.

Present Worth: *$10,900,000*
Capital Cost: *$8,880,000*
Annual Costs for Years 1-2: *$220,000*
Annual Costs for Years 3-10: *$139,000*
Annual Costs for Years 11-30: *$98,500*

Alternative 5: ISCO/BIO Treatment (Plume Concentrations > 1,000ppb) and PRB

ISCO/BIO will be implemented where total VOC concentrations in groundwater were reported at 1,000 ppb or greater. This treatment area is approximately 941,000 ft^2, and would target approximately 1,460 lbs (or 92.8%) of the dissolved-phase contaminant mass in the shallow water-bearing zone. Temporary injection points are expected to deliver chemical over a 10-foot thick zone in the shallow water-bearing aquifer. Four rounds of injections are estimated for the area with current contaminant concentrations above 10,000 ppb and two injection rounds are estimated in the remaining treatment area.

In addition to the ISCO/BIO treatment, Alternative 5 includes the installation of a permeable reactive barrier (PRB) wall near the leading edge of the plume, along Warner Creek. A PRB wall is installed by placing reactive material such as zero-valent iron in a subsurface trench, or through injection of reactive materials into the subsurface. As groundwater passes through the barrier, contaminants are reduced to non-toxic substances. In this

application, a PRB wall would control migration of more significant impacts and aid in reducing VOC concentrations where injection did not occur. The PRB wall offers further protection of the residential neighborhood in the downgradient area of the plume. Long-term monitoring would be conducted to evaluate VOC concentrations and patterns over time. Remedial goals will take more than 30 years to be met for Alternative 5; however, groundwater cleanup standards may be achieved in 10 years for the portion of the plume downgradient of the PRB wall. Groundwater monitoring will be performed to verify the progress of the remedy and the remaining contamination.

Present Worth: *$14,400,000*
Capital Cost: *$12,400,000*
Annual Costs for Years 1-2: *$220,000*
Annual Costs for Years 3-10: *$139,000*
Annual Costs for Years 11-30: *$98,500*

Alternative 5A: ISCO/BIO Treatment (Plume Concentrations > 1,000ppb) and Two PRB

Alternative 5A includes the same remedial aspects as Alternative 5 above, with the addition of a second PRB upgradient of the impacted stormwater retention pond and creek at the self-storage facility, as shown on Figure 9. The second PRB will protect the pond and creek from the potential impact of injected chemicals entering the surface water features. Long-term monitoring would be conducted to evaluate VOC concentrations and patterns over time. Remedial goals will take more than 30 years to be met for Alternative 5A; however, groundwater cleanup standards may be achieved in 10 years for the portion of the plume downgradient of the PRB walls. Groundwater monitoring will be performed to verify the progress of the remedy and the remaining contamination.

Present Worth: *$14,300,000*
Capital Cost: *$12,300,000*
Annual Costs for Years 1-2: *$220,000*
Annual Costs for Years 3-10: *$139,000*
Annual Costs for Years 11-30: *$98,500*

Alternative 6: ISCO/BIO Treatment (Plume Concentrations > 100ppb) and PRB

ISCO/BIO will be implemented where total VOC concentrations in groundwater were reported at 100 ppb or greater. This treatment area is approximately 1,952,000 ft^2, and would target approximately 1,560 lbs (or 99.4%) of the dissolved-phase contaminant mass in the shallow water-bearing zone. Temporary injection points are expected to deliver chemical over a 10-foot thick zone in the shallow water-bearing aquifer. Four rounds of injections are estimated for the area with current contaminant concentrations above 10,000 ppb and two injection rounds are estimated in the remaining treatment area.

In addition to the ISCO/BIO treatment, Alternative 6 includes the installation of a PRB wall near the leading edge of the plume, along Warner Creek. A PRB wall is installed by placing reactive material such as zero-valent iron in a subsurface trench, or through injection of reactive materials into the subsurface. As groundwater passes through the barrier, contaminants are reduced to non-toxic substances. In this application, a PRB wall would control migration of more significant impacts and aid in reducing VOC concentrations where injection did not occur. The PRB wall offers further protection of the residential neighborhood in the downgradient area of the

plume. Long-term monitoring would be conducted to evaluate VOC concentrations and patterns over time. Remedial goals would be met within 20 years for Alternative 6; however, groundwater cleanup standards may be achieved in 10 years for the portion of the plume downgradient of the PRB wall. Groundwater monitoring would be performed to verify the progress of the remedy and the remaining contamination.

Present Worth: *$21,600,000*
Capital Cost: *$19,900,000*
Annual Costs for Years 1-2: *$220,000*
Annual Costs for Years 3-10: *$139,000*
Annual Costs for Years 11-20: *$98,500*

Additional Remedial Action

In addition to the remedial alternative selected for the off-site shallow groundwater plume, a presumptive remedy of ISCO/BIO, as described below, will be implemented to address the most significantly contaminated off-site deep groundwater plume. The common element of the alternatives is depicted on Figure 10.

Common Element Alternative A

ISCO/BIO will be implemented to destroy VOCs in deep groundwater *via* direct subsurface injection of a remedial amendment throughout the groundwater plume where total VOC concentrations were reported at 5 ppb or greater. ISCO/BIO will be implemented in a treatment area of approximately 220,000 ft^2, and would target approximately 43 lbs (or 100%) of the of the dissolved-phase contaminant mass in the deep water-bearing zone.

Byproducts of the ISCO/BIO process are non-toxic. Temporary injection points are expected to deliver chemicals, and/or biological enhancement agents, over a 15-foot thick zone in the deep water-bearing aquifer. Two rounds of injections are estimated for the treatment area. Remedial goals will likely be met within 5 years for Common Element Alternative A. Groundwater quality will be evaluated through a network of monitoring wells. This alternative achieves all of the SCGs discussed in Section 6.1.1 and Exhibit A.

Present Worth: *$4,180,000*
Capital Cost: *$3,430,000*
Annual Costs for Years 1-2: *$186,000*
Annual Costs for Years 3-5: *$105,000*

Common Element Alternative B

ISCO/BIO will be implemented to destroy VOCs in deep groundwater via direct subsurface injection of a remedial amendment throughout the groundwater plume where total VOC concentrations were reported at 100 ppb or greater. ISCO/BIO will be implemented in a treatment area of approximately 48,000 ft^2, as shown in Figure 10, and would target approximately 41.7 lbs (97%) of the dissolved-phase contaminant mass in the deep water-bearing zone.

Byproducts of the ISCO/BIO process are non-toxic. Temporary injection points are expected to deliver chemicals, and/or biological enhancement agents, over a 15-foot thick zone in the deep water-bearing aquifer. Two rounds of injections are estimated for the treatment area. Remedial goals will likely be met within 10 years for Common Element Alternative B. Groundwater quality will be evaluated through a network of monitoring wells. This alternative achieves all of the SCGs discussed in Section 6.1.1 and Exhibit A.

Present Worth: *$1,760,000*
Capital Cost: *$1,000,000*
Annual Costs for Years 1-2: *$186,000*
Annual Costs for Years 3-5: *$105,000*

Exhibit C

Remedial Alternative Costs

Remedial Alternative	Capital Cost ($)	Annual Costs ($)	Total Present Worth ($)
Alternative 1- No Action	0	0	0
Deep Groundwater Alternatives			
Deep Groundwater Common Element Alternative A (Plume Concentrations >5 ppb)	3,430,000	Years 1-2: 186,000 Years 3-5: 105,000	4,180,000
Deep Groundwater Common Element Alternative B (Plume Concentrations >100 ppb)	1,000,000	Years 1-2: 186,000 Years 3-5: 105,000	1,760,000
Shallow Groundwater Alternatives			
Alternative 2 – ISCO/BIO (Plume Concentrations > 5 ppb)	27,200,000	Years 1-2: 220,000 Years 3-10: 139,000	28,500,000
Alternative 3 – ISCO/BIO (Plume Concentrations > 100 ppb)	16,400,000	Years 1-2: 220,000 Years 3-10: 139,000 Years 11-20: 98,500	18,000,000
Alternative 4 – ISCO/BIO (Plume Concentrations > 1,000 ppb)	8,880,000	Years 1-2: 220,000 Years 3-10: 139,000 Years 11-30: 98,500	10,900,000
Alternative 5 – ISCO/BIO (Plume Concentrations > 1,000 ppb) and Permeable Reactive Barrier	12,400,000	Years 1-2: 220,000 Years 3-10: 139,000 Years 11-30: 98,500	14,400,000
Alternative 5A – ISCO/BIO (Plume Concentrations > 1,000 ppb) and Two Permeable Reactive Barriers	12,300,00	Years 1-2: 220,000 Years 3-10: 139,000 Years 11-30: 98,500	14,300,000
Alternative 6 – ISCO/BIO (Plume Concentrations > 100 ppb) and Permeable Reactive Barrier	19,900,000	Years 1-2: 220,000 Years 3-10: 139,000 Years 11-20: 98,500	21,600,000

Exhibit D

SUMMARY OF THE SELECTED REMEDY

The Department has selected Alternative 5A *In-Situ* Chemical/Biological Treatment (ISCO/BIO) and Two Permeable Reactive Barrier Walls (PRBs), for the shallow groundwater contamination, along with Common Element Alternative B *In-Situ* Chemical/Biological (ISCO/BIO) Treatment for Deep Groundwater as the remedy for Operable Unit (OU) 01 Off-Site Contamination. Alternative 5A will achieve the remediation goals for OU 01 by chemically and/or biologically treating the subsurface groundwater down to 25 feet below grade in the shallow groundwater zone and down to 40 feet below grade in the deep groundwater zone, degrading the volatile organic chemicals (VOCs) to benign compounds over a 30-year period or longer. The elements of this remedy are described in Section 7. The selected remedy is depicted in Figures 9 and 10. In conjunction with the selected remedy for the source area OU 02, which is upgradient of OU 01, the selected remedy for OU 01 likely will be installed and operated in a phased approach, with the PRB operations implemented before the ISCO/BIO operations. Groundwater monitoring will be performed to verify the progress of the remedy and the remaining contamination.

Basis for Selection

The selected remedy is based on the results of the RI and the evaluation of alternatives. The criteria to which potential remedial alternatives are compared are defined in 6 NYCRR Part 375. A detailed discussion of the evaluation criteria and comparative analysis is included in the Feasibility Study (FS) report.

The first two evaluation criteria are termed "threshold criteria" and must be satisfied in order for an alternative to be considered for selection.

1. Protection of Human Health and the Environment. This criterion is an overall evaluation of each alternative's ability to protect public health and the environment.

The selected remedy Alternative 5A will satisfy this criterion by treating in-place approximately 93% of the contamination in the groundwater, which is the most significant threat to public health and the environment, plus the residual contamination will be monitored for its further natural breakdown. Alternative 1 (No Action) does not provide any protection to public health and the environment and will not be evaluated further. Alternative 2, by treating all groundwater contaminated above the cleanup objectives, meets the threshold criteria. Alternatives 3 through 6 also comply with this criterion but to varying degrees, relying more or less on natural processes to treat residual contamination over time. Alternatives 3 and 6 treat the targeted area where plume concentrations are 100 parts per billion (ppb) or greater, whereas Alternatives 4 and 5 treat the targeted area where plume concentrations are 1,000 ppb or greater. Alternative 2 offers the best protection of human and environmental health, while Alternative 4 offers the lowest degree of protection to public health and the environment of the remedial alternatives evaluated.

2. Compliance with New York State Standards, Criteria, and Guidance (SCGs). Compliance with SCGs addresses whether a remedy will meet environmental laws, regulations, and other standards and criteria. In addition, this criterion includes the consideration of guidance which the Department has determined to be applicable on a case-specific basis.

Alternative 5A complies with SCGs to the extent practicable. It addresses the most significant area of

groundwater contamination and complies with residential use soil cleanup objectives. Alternative 5A also creates the conditions necessary to restore groundwater quality to the extent practicable. Alternative 2 has the greatest likelihood of achieving chemical-specific SCGs, since the entirety of the contamination is either removed or treated. Alternatives 3 and 4 will meet the SCGs in the area treated by ISCO/BIO; however; the residual plume would need to be degraded by natural processes for many years following source area treatment in order to reach SCGs. The same is true for Alternatives 5, 5A and 6, although the addition of one or two PRB walls will offer more protection to the area downgradient of the PRB. Alternatives 3 through 6 would leave some contamination within OU 01; therefore, would not likely meet the chemical-specific SCG for the site for an extended period of time. Alternatives 3 and 6 treat more of the contaminant mass than Alternatives 4, 5 and 5A, with an estimated timeframe to reach SCGs of 20 years. Alternatives 4, 5 and 5A are estimated to require more than 30 years to reach SCGs. Alternatives 5, 5A and 6 offer a reduced timeframe to achieve SCGs for the residential neighborhood downgradient of Warner Creek. Alternative 1 offers no additional protection against future impacts.

The next six "primary balancing criteria" are used to compare the positive and negative aspects of each of the remedial strategies.

3. Long-term Effectiveness and Permanence. This criterion evaluates the long-term effectiveness of the remedial alternatives after implementation. If wastes or treated residuals remain within OU 01 after the selected remedy has been implemented, the following items are evaluated: 1) the magnitude of the remaining risks, 2) the adequacy of the engineering and/or institutional controls intended to limit the risk, and 3) the reliability of these controls.

Alternatives 2 through 6 would all be an effective long-term solution for the majority of the groundwater contamination. Alternatives 2 through 6 treat the bulk of the contamination from the site, thus reducing the mass volume, mobility and toxicity at the site. Alternatives 2, 3, and 6 would destroy most of the contamination through chemical oxidation, though the effectiveness would be directly linked to the ability to get the chemical oxidant in contact with the contamination and the persistence of the chemical in the subsurface environment. Alternatives 3 through 6 treat the main source area of contamination and rely on MNA and/or PRB walls to treat the remainder of the contamination on-site. Alternatives 4, 5 and 5A may require extended time frames (>30 years) to meet SCGs, with Alternatives 3 and 6 meeting SCGs within 20 years since more of the mass is treated with ISCO/BIO initially. Alternative 1 will not provide any long-term treatment effectiveness.

4. Reduction of Toxicity, Mobility or Volume. Preference is given to alternatives that permanently and significantly reduce the toxicity, mobility or volume of the wastes for OU 01.

Alternatives 2 through 6 would all be an effective means at reducing the toxicity, mobility, and volume of the contaminant mass in the groundwater, although the extent of the effectiveness would vary. Alternatives 2, 3 and 6 would result in the most reduction in contamination in the shortest amount of time and Alternatives 4, 5 and 5A would require longer periods of time before all of the contamination is treated. Alternative 2 offers the greatest reduction in contaminated mass in the plume (greater than 99.9%). Alternatives 3 and 6 would destroy most of the contaminant mass in the source area (99.6%), and the peripheral edge of the plume would be treated through natural processes. Alternatives 4, 5 and 5A treat the majority of the contaminated groundwater (92.8%) and rely on passive treatment of the remaining groundwater through one or two PRB walls and MNA. Alternatives 2 through 6 would chemically oxidize/biologically break down the contamination in the area where the treatment occurred, though the effectiveness would be directly linked to the ability to get the treatment solution in contact with the contamination and its persistence within the subsurface. Alternative 5A directly addresses the potential for contaminant and ISCO/BIO treatment materials into the surface water bodies near

Sarnowski Drive, with the second PRB as compared to Alternative 5. Alternative 1 offers no additional protection against future impacts.

5. Short-term Impacts and Effectiveness. The potential short-term adverse impacts of the remedial action upon the community, the workers, and the environment during the construction and/or implementation are evaluated. The length of time needed to achieve the remedial objectives is also estimated and compared against the other alternatives.

Each alternative would be implemented to minimize human health exposure to contamination, remediation chemicals, and prevent nuisance conditions from remedial activities. Alternatives 2 through 6 would require numerous access agreements to work on private properties and possible disruption in traffic patterns for the injection of the ISCO/BIO materials into the subsurface. The extent of the short-term impacts would be directly related to the footprint of the targeted treatment area and whether there is a PRB installation component. Alternative 2 would have the most short-term impacts, while Alternative 4 would have the least. No short-term impacts are associated with Alternative 1.

6. Implementability. The technical and administrative feasibility of implementing each alternative are evaluated. Technical feasibility includes the difficulties associated with the construction of the remedy and the ability to monitor its effectiveness. For administrative feasibility, the availability of the necessary personnel and materials is evaluated along with potential difficulties in obtaining specific operating approvals, access for construction, institutional controls, and so forth.

Alternatives 2 through 6 are all implementable, though each will have administrative or technical requirements such as obtaining permits, access agreements and design requirements. Impacts to surface water should be considered during the design and implementation phase for ISCO/BIO treatment. Supplementary technologies such as aquifer dewatering, redirection of groundwater flow or strategic placement of ISCO/BIO injection points may be needed in order to successfully implement ISCO/BIO at the site. All alternatives may affect traffic patterns in the area and may require temporary lane closures along Freemans Bridge Road. The degree of difficulty of implementation would be directly related to the footprint of the targeted treatment area and whether there is a PRB installation component. Each subsurface injection will require avoidance of subsurface obstructions such as utilities and may require surface restoration. Alternatives 5, 5A and 6 have higher degrees of difficulty to implement since all of these options require the installation of PRB at one or two portions of the downgradient edge of the plume. Installation of the PRB walls would require additional implementation considerations such as avoiding buildings, and traffic in the area of PRB installation. Alternative 2 is the most difficult to implement, since it targets the largest plume footprint.

7. Cost-Effectiveness. Capital costs and annual operation, maintenance, and monitoring costs are estimated for each alternative and compared on a present worth basis. Although cost-effectiveness is the last balancing criterion evaluated, where two or more alternatives have met the requirements of the other criteria, it can be used as the basis for the final decision.

Alternatives 2 through 6 each permanently remove over 92.8% of the contamination from OU 01 with Alternatives 3, 4, 5, 5A and 6 relying on some natural degradation processes. As discussed above, the estimated costs demonstrate a trade-off between the level of effort in active treatment and the amount of time to achieve groundwater quality standards and criteria. The preliminary costs for these alternatives have the present worth of (ranked least to most costly):

- Alternative 4 ($10.9 million)
- Alternative 5A ($14.3 million)
- Alternative 5 ($14.4 million)
- Alternative 3 ($18.0 million)
- Alternative 6 ($21.6 million)
- Alternative 2 ($28.5 million)

Alternative 2 has the highest cost relative to the amount of contaminant treated. Alternative 3 treats less of the dissolved-phase chemical mass in the plume (99.4%) and offers a cost savings of $10.5 million compared to Alternative 2, while increasing monitoring time from 5 to 20 years. Alternative 4 treats the least amount of dissolved-phase chemical mass in the plume (92.8%), but requires a longer monitoring period for a lower overall cost. Alternatives 5, 5A and 6 have the additional cost of PRB walls, which is a cost-effective solution to prevent further plume migration into the residential neighborhood. (Note: These cost numbers do not include the deep groundwater common element.)

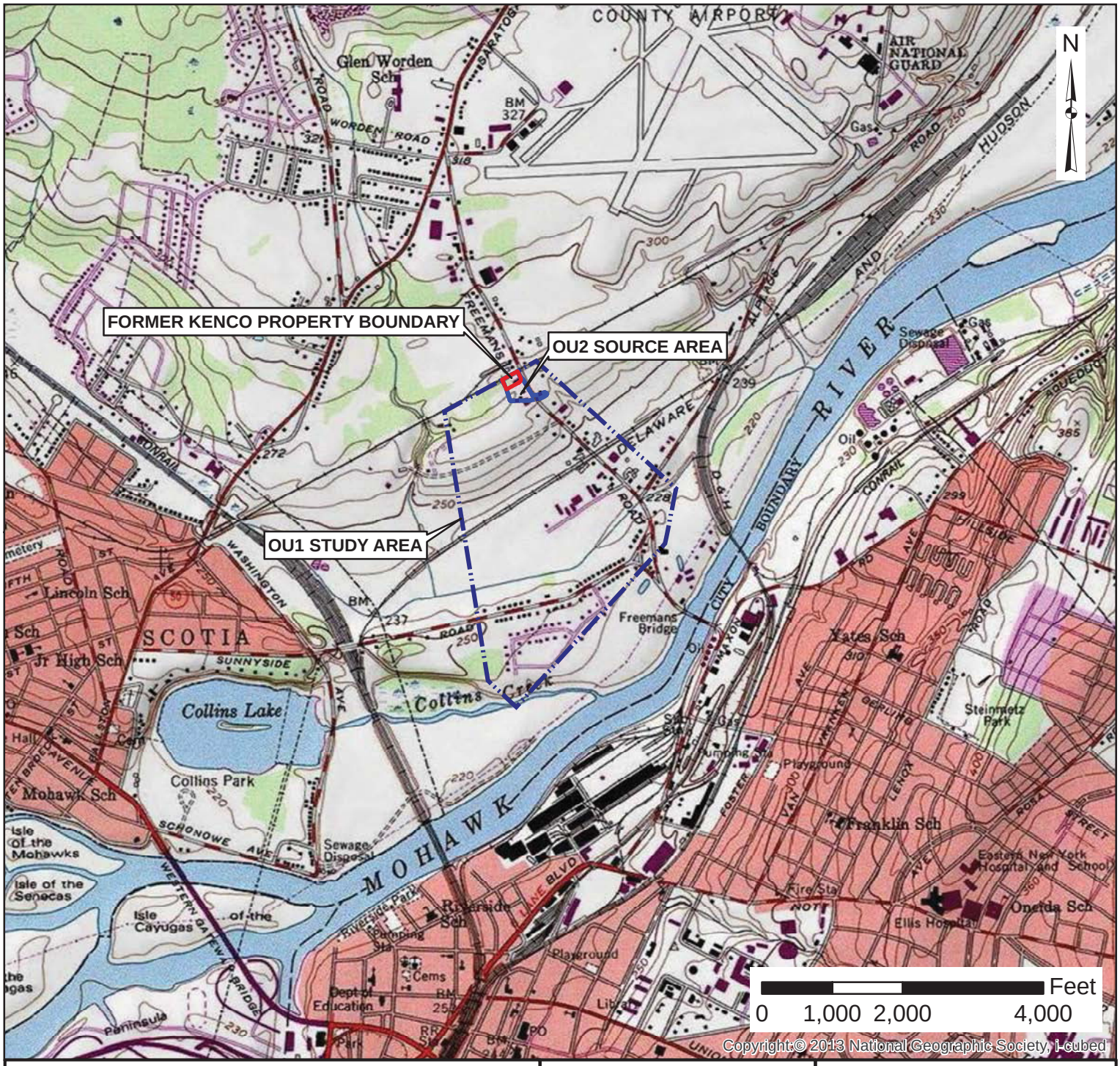
8. Land Use. When cleanup to pre-disposal conditions is determined to be infeasible, the Department may consider the current, intended, and reasonable anticipated future land use of the site and its surroundings in the selection of the soil remedy.

Alternatives 2 through 6 will not likely inhibit current or intended future use of OU 01. Alternatives 2, 3 and 6 provide the most likely chance of meeting the groundwater quality standards and criteria in the shortest amount of time (10 to 20 years), and thereby affecting the land use the least. Alternatives 4, 5 and 5A provide less treatment efficiency and longer treatment time (greater than 30 years); therefore, more restrictions are possible for the impacted properties. Alternative 1 will not meet groundwater quality standards and criteria within 30 years.

The final criterion, Community Acceptance, is considered a "modifying criterion" and is taken into account after evaluating those above. It is evaluated after public comments on the Proposed Remedial Action Plan have been received.

9. Community Acceptance. Concerns of the community regarding the investigation, the evaluation of alternatives, and the PRAP were evaluated. A responsiveness summary was prepared that describes public comments received and the manner in which the Department addressed the concerns raised.

Alternative 5A *In-Situ* Chemical/Biological Treatment and Two Permeable Reactive Barrier Walls along with Common Element Alternative B *In-Situ* Chemical/Biological Treatment for Deep Groundwater was selected because, as described above, it satisfies the threshold criteria and provides the best balance of the balancing criterion.



Source: ArcGIS Topographic Map

AECOM
40 British American Blvd.
Latham, NY 12110
T: (518) 951-2200
F: (518) 951-2300

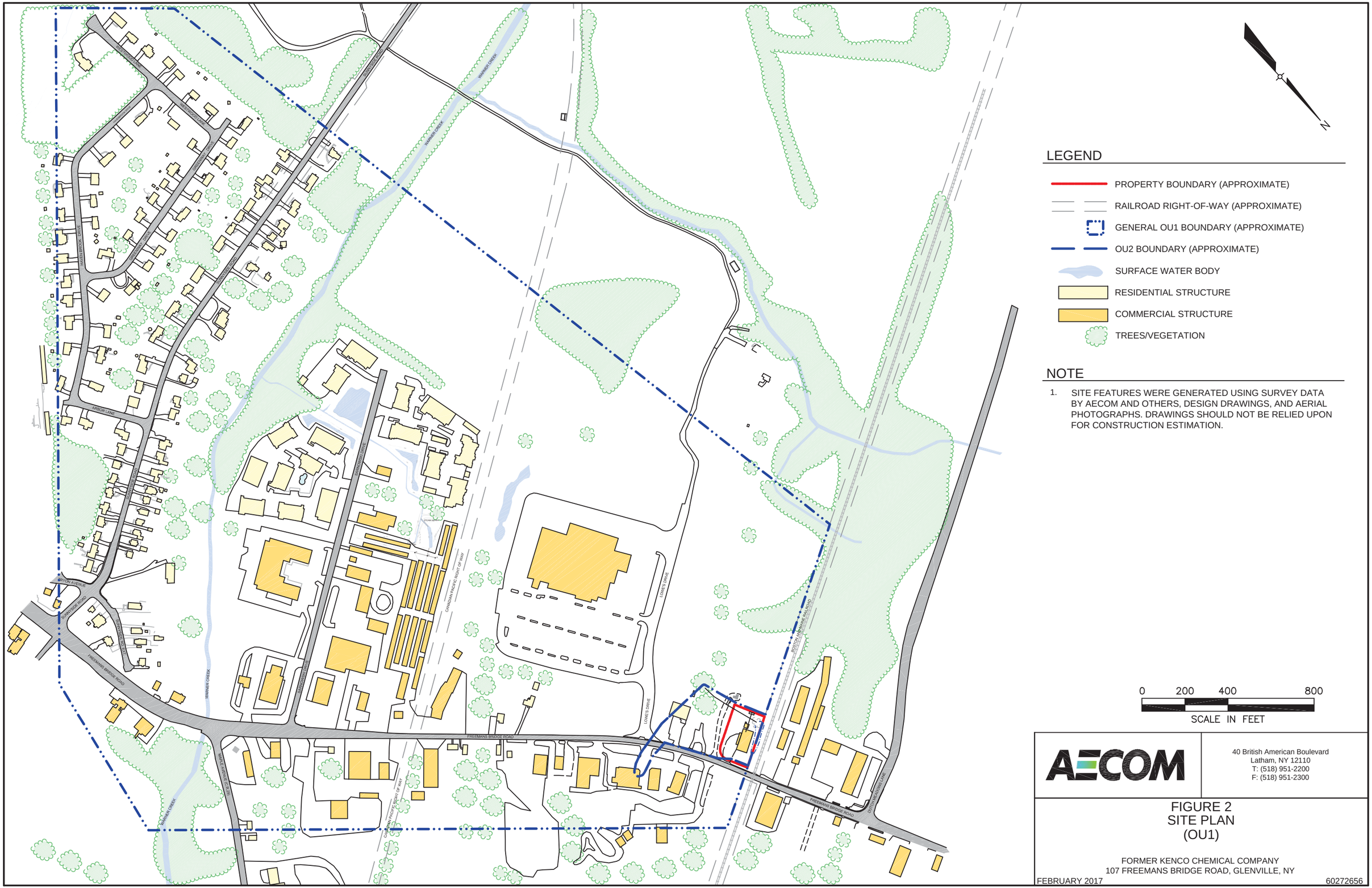
FIGURE 1

SITE LOCATION MAP

FORMER KENCO CHEMICAL COMPANY
107 FREEMANS BRIDGE ROAD, GLENVILLE, NY

FEBRUARY 2017

60272656



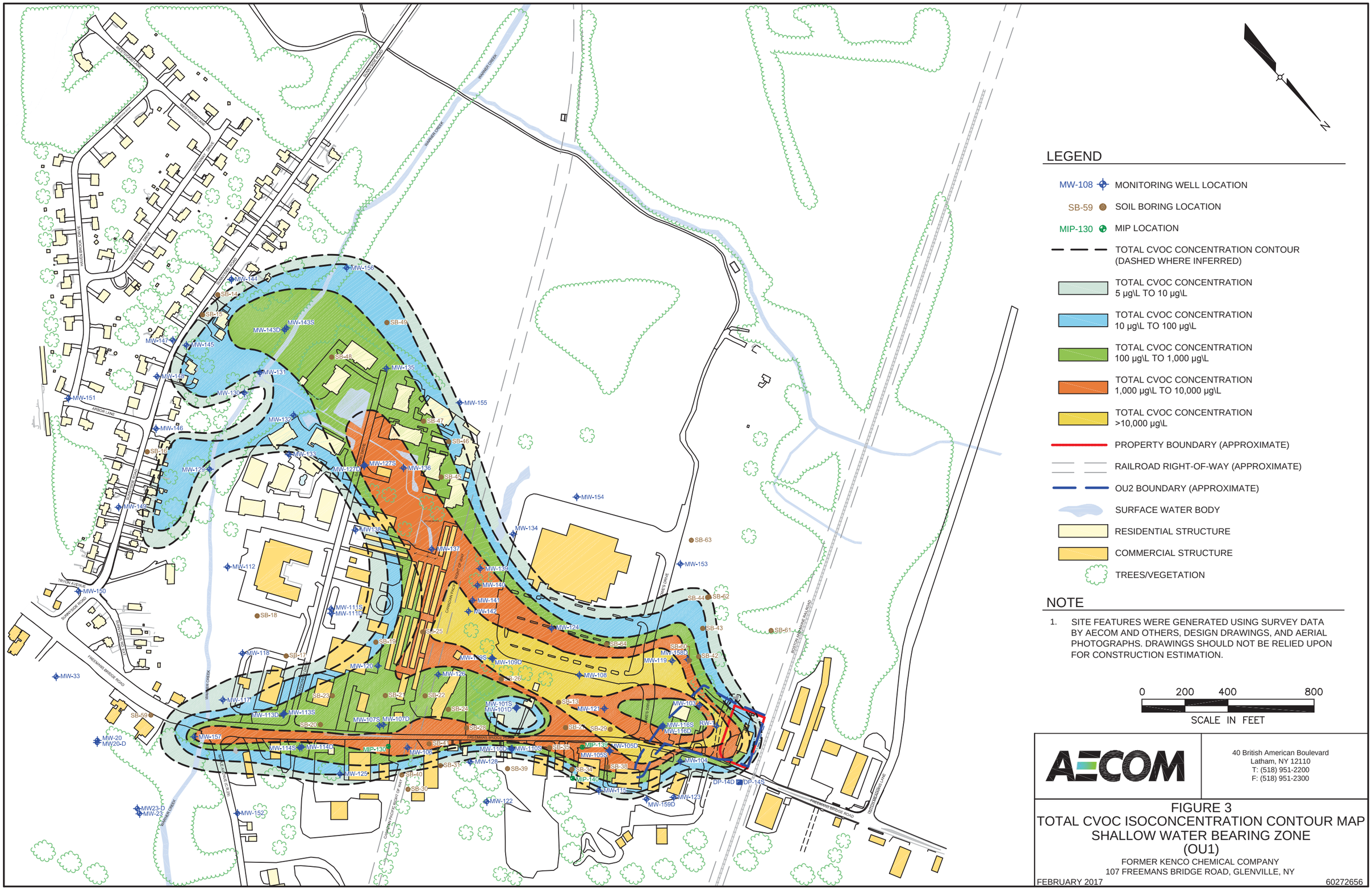
AECOM
40 British American Boulevard
Latham, NY 12110
T: (518) 951-2200
F: (518) 951-2300

FIGURE 2
SITE PLAN
(OU1)

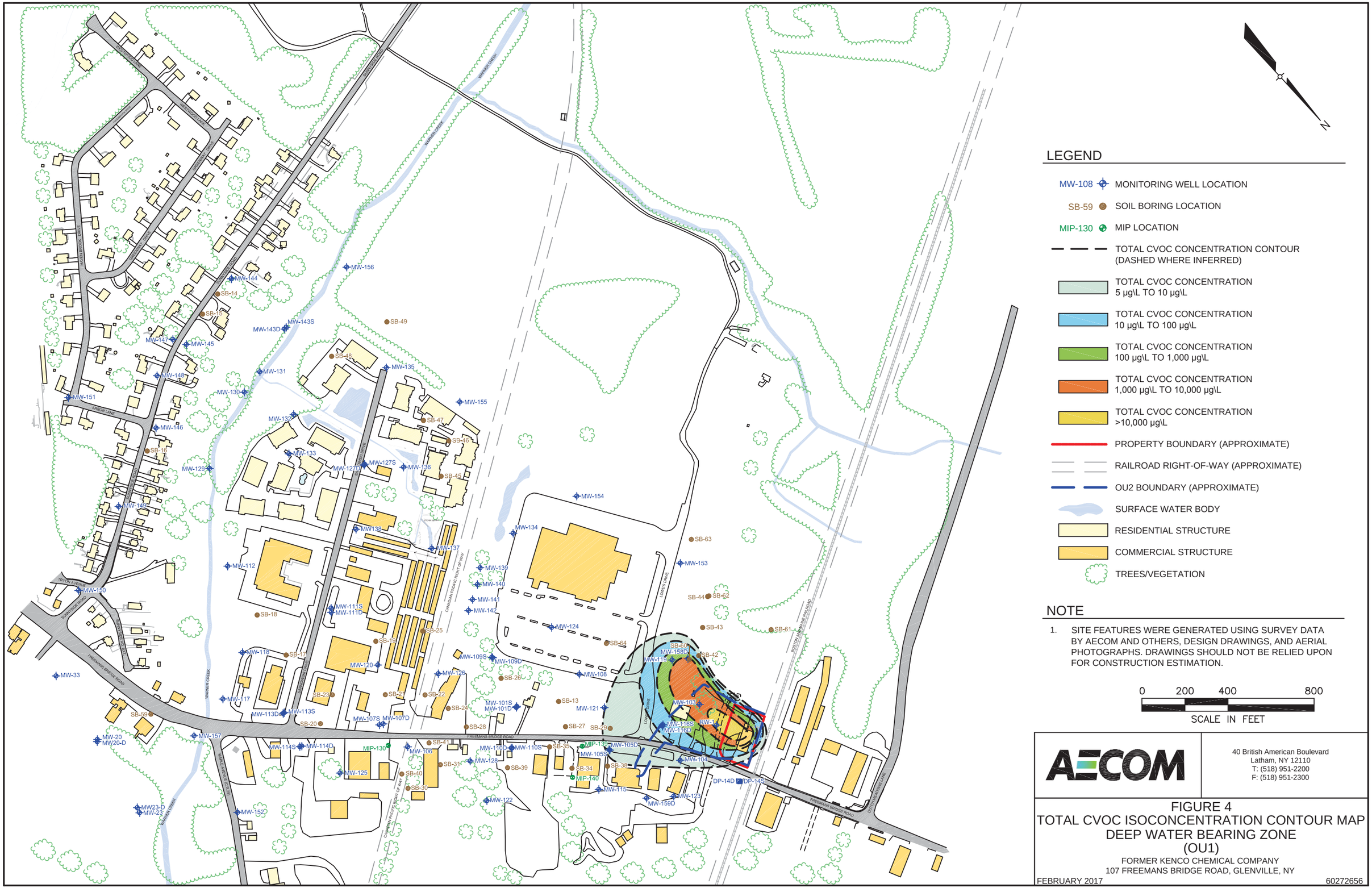
FORMER KENCO CHEMICAL COMPANY
107 FREEMANS BRIDGE ROAD, GLENVILLE, NY

FEBRUARY 2017 60272656

L:\Group\earth\Latham NY Work\Kenco\112730_226 OU1_PRAP_Fig2_Site Plan.dwg, 2/22/2017 11:27:32 AM, Splawnm



L:\Group\earth\Latham NY Work\Kenco\112730_234 OU1_PRAP_Fig3_Total CVOC Iso Contour_Shallow Water Bearing Zone.dwg, 2/22/2017 11:08:05 AM, Splawnm



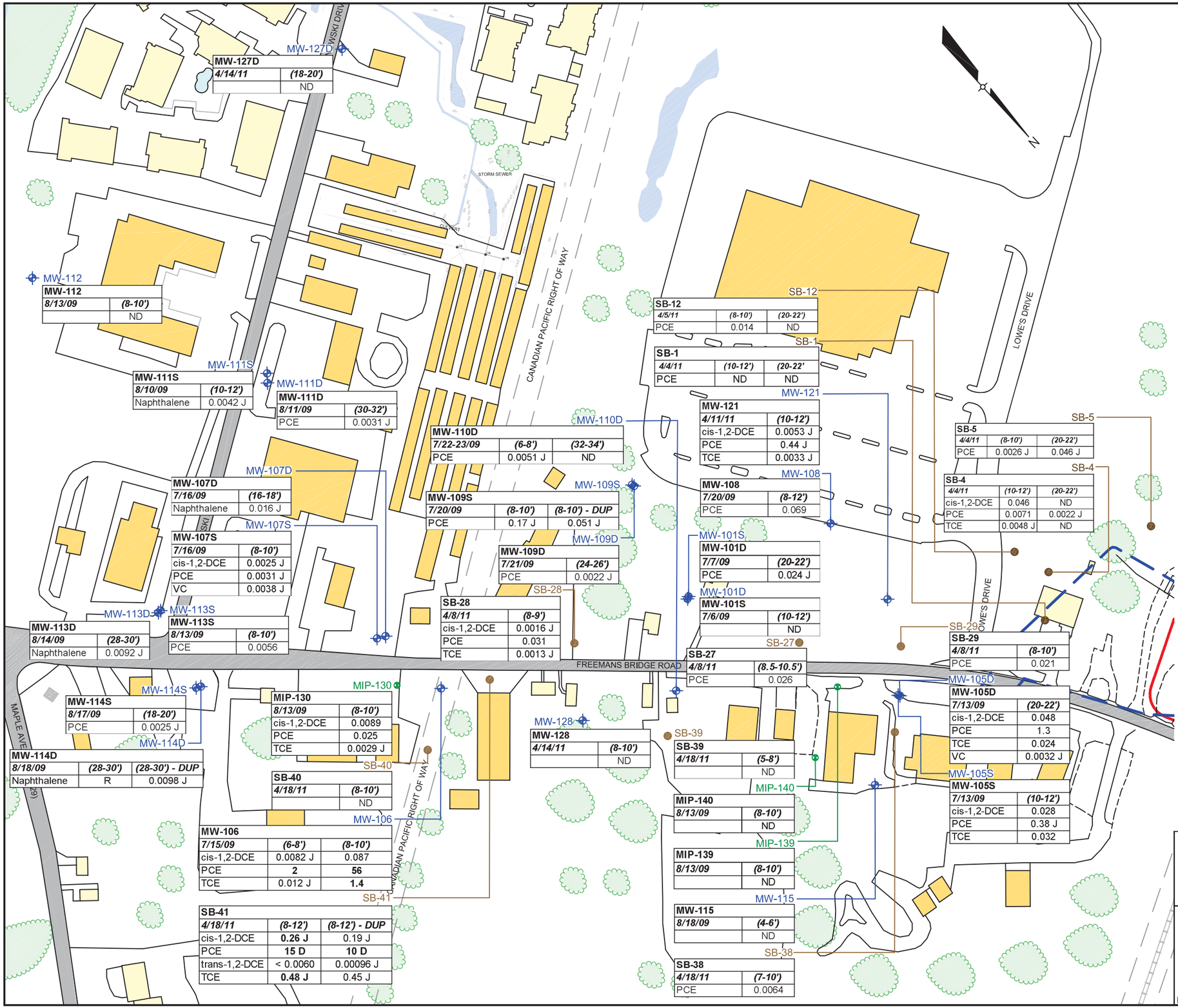
AECOM
40 British American Boulevard
Latham, NY 12110
T: (518) 951-2200
F: (518) 951-2300

FIGURE 4
TOTAL CVOC ISOCONCENTRATION CONTOUR MAP DEEP WATER BEARING ZONE (OU1)

FORMER KENCO CHEMICAL COMPANY
107 FREEMANS BRIDGE ROAD, GLENVILLE, NY

FEBRUARY 2017 60272656

L:\Group\earth\Latham NY Work\Kenco\112730_235 OU1_PRAP_Fig4_Total CVOC Iso Contour_Deep Water Bearing Zone.dwg, 2/22/2017 11:08:39 AM, Splawnm



LEGEND

- MW-108 — MONITORING WELL LOCATION
- SB-59 — SOIL BORING LOCATION
- MIP-130 — MIP LOCATION
- PROPERTY BOUNDARY (APPROXIMATE)
- RAILROAD RIGHT-OF-WAY (APPROXIMATE)
- SURFACE WATER BODY
- RESIDENTIAL STRUCTURE
- COMMERCIAL STRUCTURE
- TREES/VEGETATION

MW-101D	
7/7/09	(20-22')
PCE	0.024 J

VOC RESULTS IN SOIL (mg\kg) WITH SAMPLE DEPTH
ND = NON DETECT
SEE REPORT TABLES FOR DATA QUALIFIERS

NOTES

1. SITE FEATURES WERE GENERATED USING SURVEY DATA BY AECOM AND OTHERS, DESIGN DRAWINGS, AND AERIAL PHOTOGRAPHS. DRAWINGS SHOULD NOT BE RELIED UPON FOR CONSTRUCTION ESTIMATION.
2. EXCEEDANCES SHOWN IN BOLD.

NYSDEC 375-6 UNRESTRICTED USE SOIL CLEANUP OBJECTIVES (mg/kg)	
1,1-Dichloroethene (DCE)	0.33
Naphthalene	12
cis-1,2-Dichloroethene	0.25
Tetrachloroethene (PCE)	1.3
Trichloroethene (TCE)	0.47
trans-1,2-Dichloroethene	0.19
Vinyl Chloride (VC)	0.02

KEY MAP - NOT TO SCALE

0 100 200 400
SCALE IN FEET

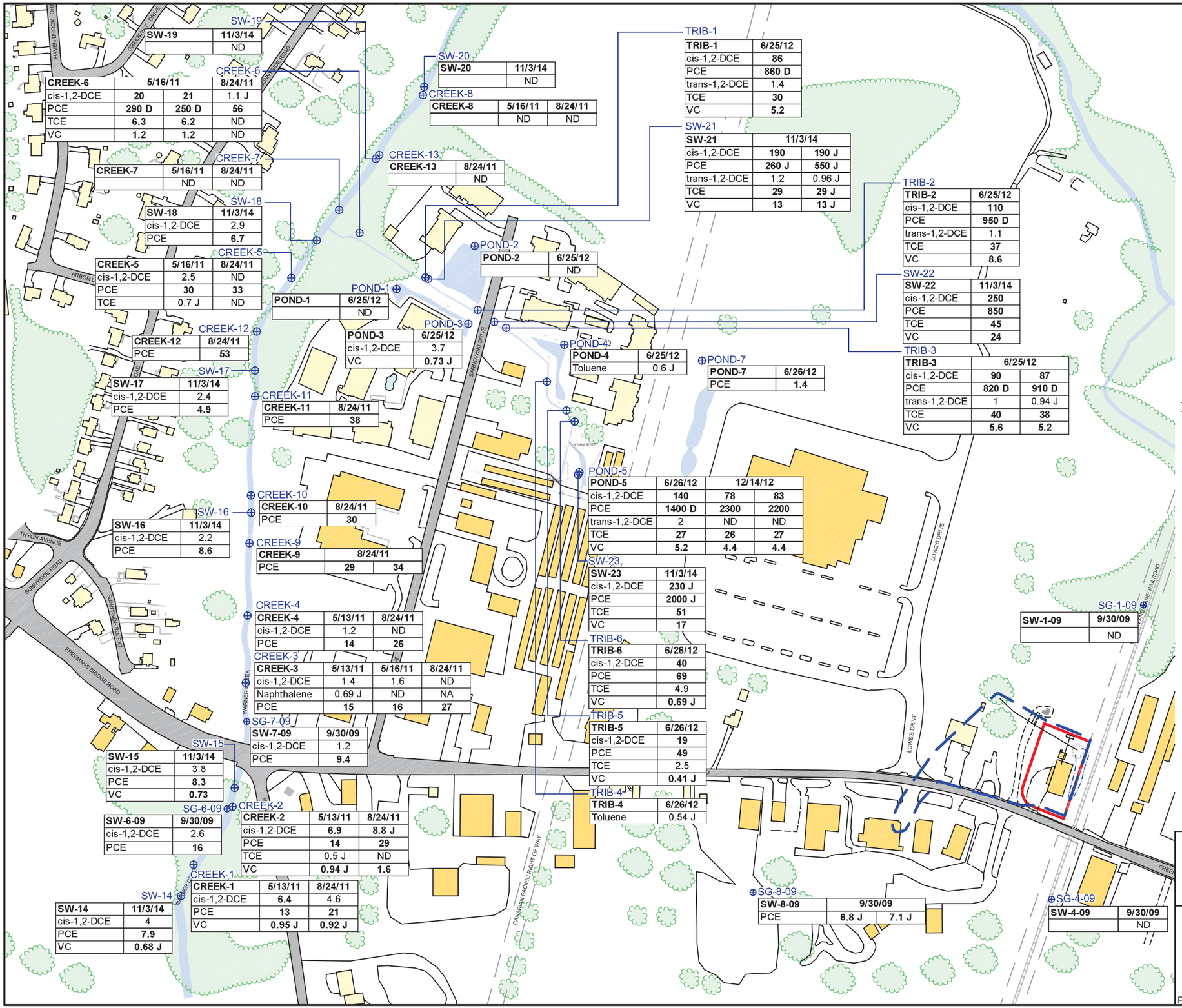
AECOM
40 British American Boulevard
Latham, NY 12110
T: (518) 951-2200
F: (518) 951-2300

FIGURE 5
SUBSURFACE SOIL ANALYTICAL DATA 2009 - 2013 (OU1)

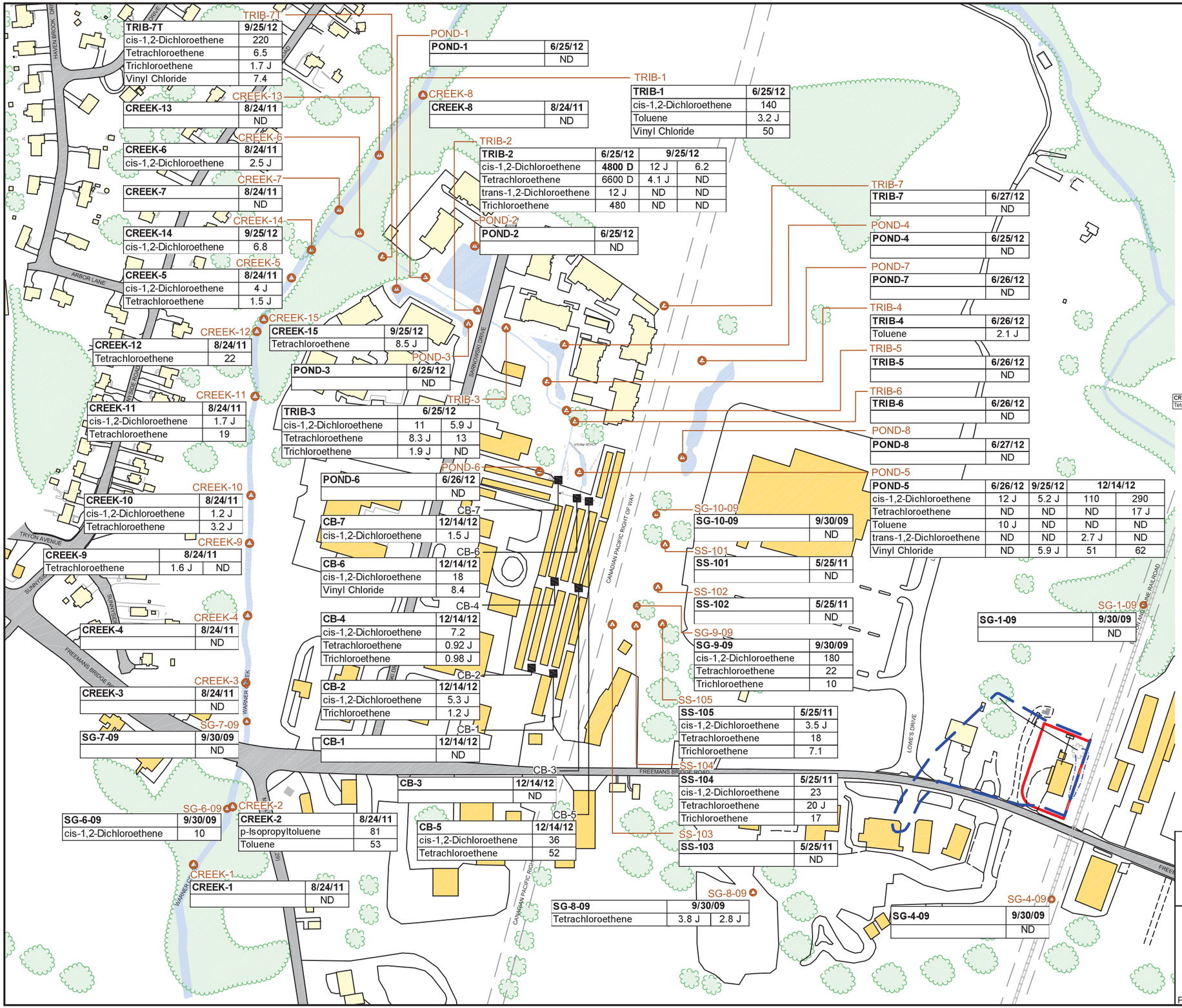
FORMER KENCO CHEMICAL COMPANY
107 FREEMANS BRIDGE ROAD, GLENVILLE, NY

FEBRUARY 2017 60272656

L:\Group\earth\Latham NY Work\Kenco\112730_237 OU1_PRAP_Fig5_Subsurface Soil Analytical Data (2009-2013).dwg, 2/22/2017 11:09:10 AM, Splawnm



L:\Group\earth\Latham NY Work\Kenco\112730_238 OU1_PRAP_Fig6_SW Analytical Data_2009-2014.dwg, 2/22/2017 11:09:38 AM, Splawnm



AECOM

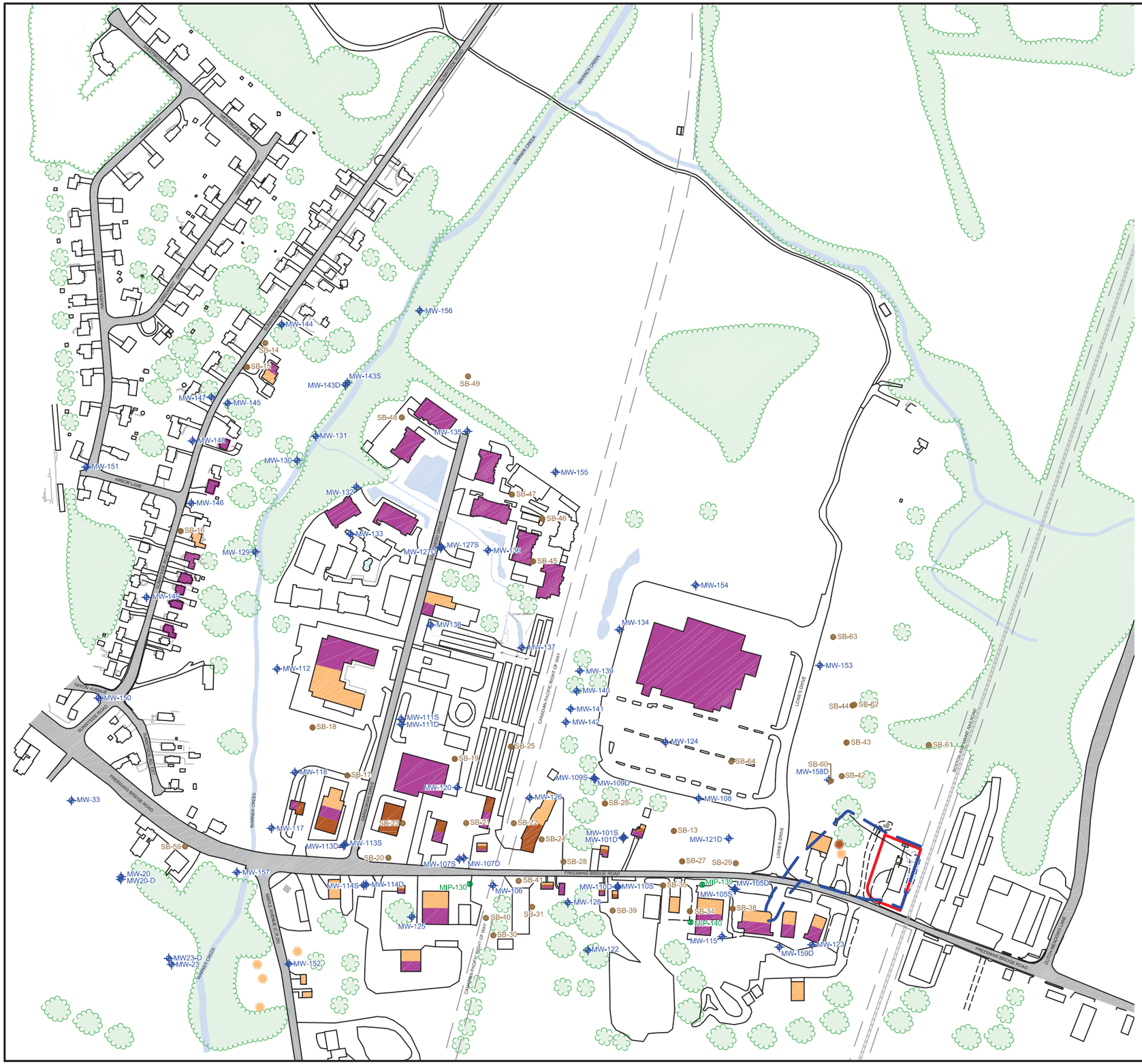
40 British American Boulevard
Latham, NY 12110
T: (518) 951-2200
F: (518) 951-2300

FIGURE 7
SEDIMENT ANALYTICAL DATA (OU1)

FORMER KENCO CHEMICAL COMPANY
107 FREEMANS BRIDGE ROAD, GLENVILLE, NY

FEBRUARY 2017 60272656

L:\Group\earth\Latham NY Work\Kenco\112730_239 OU1_PRAP_Fig7_Sediment Analytical Results.dwg, 2/22/2017 11:10:09 AM, Splawnm



LEGEND

- MW-108 — MONITORING WELL LOCATION
- SB-59 — SOIL BORING LOCATION
- MIP-130 — MIP LOCATION
- PROPERTY BOUNDARY (APPROXIMATE)
- OU2 BOUNDARY (APPROXIMATE)
- RAILROAD RIGHT-OF-WAY (APPROXIMATE)
- SURFACE WATER BODY
- SAMPLED BY NYSDOH (2007)
- SAMPLED BY NYSDEC/AECOM (2010-2016)
- SVI SAMPLING CONDUCTED BY USEPA
- TREES/VEGETATION

NOTE

1. SITE FEATURES WERE GENERATED USING SURVEY DATA BY AECOM AND OTHERS, DESIGN DRAWINGS, AND AERIAL PHOTOGRAPHS. DRAWINGS SHOULD NOT BE RELIED UPON FOR CONSTRUCTION ESTIMATION.

0 200 400 800

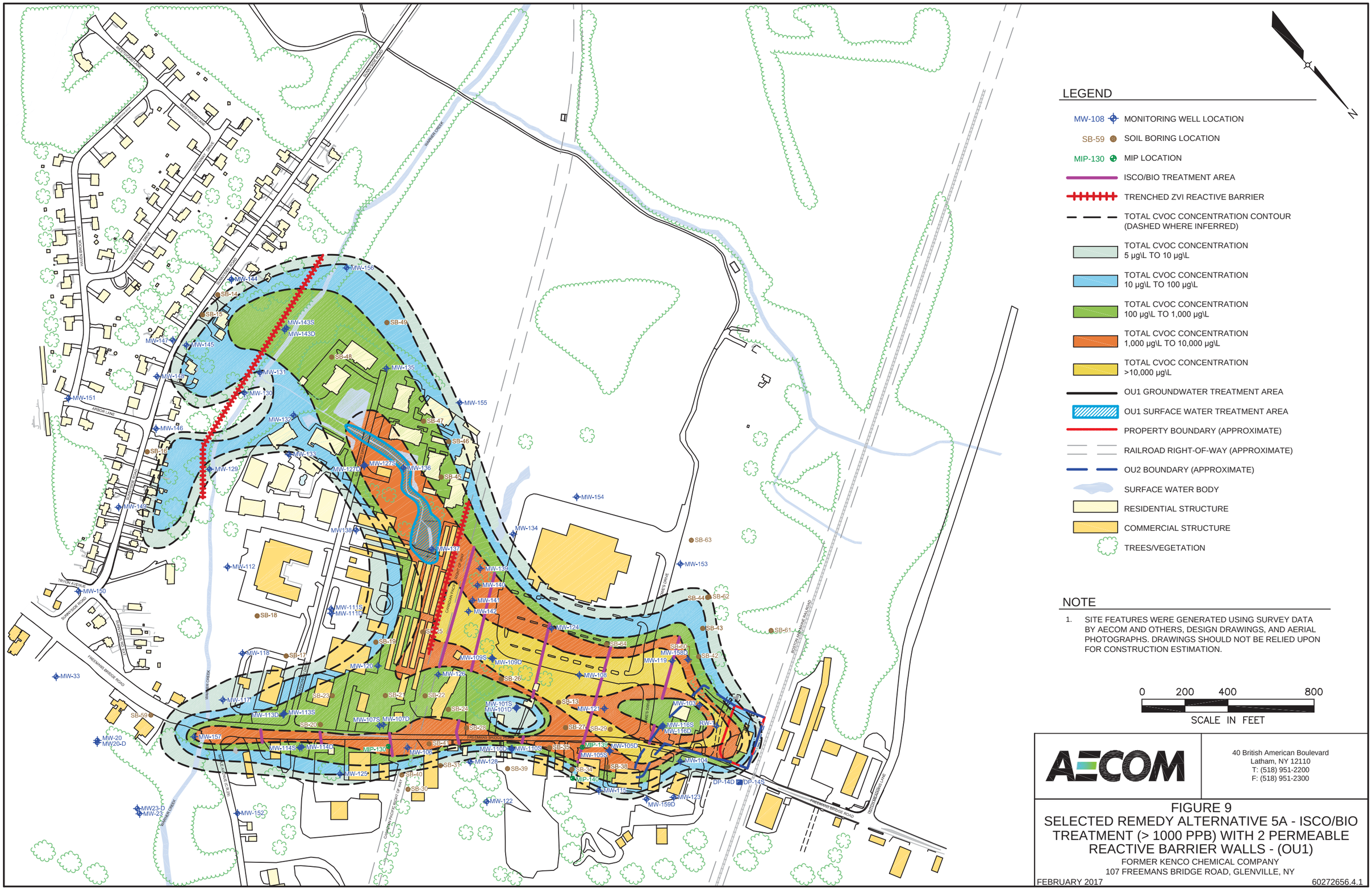
SCALE IN FEET

AECOM
40 British American Boulevard
Latham, NY 12110
T: (518) 951-2200
F: (518) 951-2300

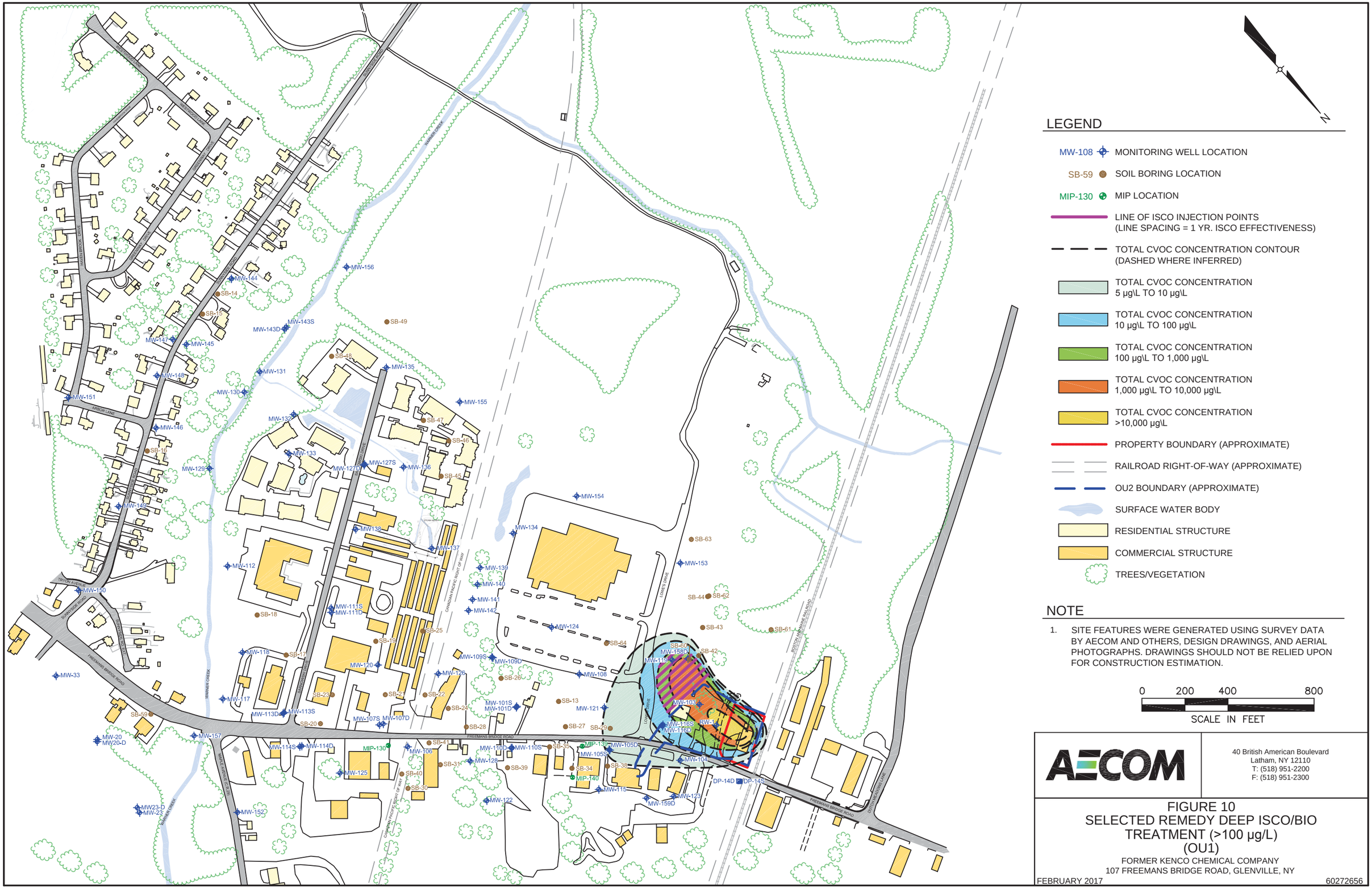
FIGURE 8
SOIL VAPOR INTRUSION SAMPLING AND MITIGATION (OU1)

FORMER KENCO CHEMICAL COMPANY
107 FREEMANS BRIDGE ROAD, GLENVILLE, NY

FEBRUARY 2017 60272656



L:\Group\earth\Latham NY Work\Kenco\112730_248 Fig_9 Alt 5A Proposed Remedy ISCO BioTreat w 2 Permeable Reactive Walls_Rev1.dwg, 6/21/2017 10:21:13 AM, Splawnm



NOTE

1. SITE FEATURES WERE GENERATED USING SURVEY DATA BY AECOM AND OTHERS, DESIGN DRAWINGS, AND AERIAL PHOTOGRAPHS. DRAWINGS SHOULD NOT BE RELIED UPON FOR CONSTRUCTION ESTIMATION.

AECOM
40 British American Boulevard
Latham, NY 12110
T: (518) 951-2200
F: (518) 951-2300

FIGURE 10
SELECTED REMEDY DEEP ISCO/BIO TREATMENT (>100 µg/L) (OU1)

FORMER KENCO CHEMICAL COMPANY
107 FREEMANS BRIDGE ROAD, GLENVILLE, NY

FEBRUARY 2017 60272656

L:\Group\earth\Latham NY Work\Kenco\112730_247 OU1_PRAP_Fig10_Deep ISCO Bio Treatment_GreaterThan100.dwg, 6/21/2017 10:24:31 AM, Splawnm

APPENDIX A

Responsiveness Summary

RESPONSIVENESS SUMMARY

Former Kenco Chemical Company
Operable Unit No. 01: Off-Site Contamination
State Superfund Project
Town of Glenville, Schenectady County, New York
Site No. 447039

The Proposed Remedial Action Plan (PRAP) for the Operable Unit 01 for the Former Kenco Chemical Company site was prepared by the New York State Department of Environmental Conservation (the Department) in consultation with the New York State Department of Health (NYSDOH) and was issued to the document repositories on February 28, 2017. The PRAP outlined the remedial measure proposed for the contaminated soil, groundwater, surface water and soil vapor within OU 01 for the Former Kenco Chemical Company site.

The release of the PRAP was announced by sending a notice to the public contact list *via* the Department's county-based listserv, informing the public of the opportunity to comment on the proposed remedy.

A public meeting was held on April 4, 2017, which included a presentation of the remedial investigation feasibility study (RI/FS) for the Former Kenco Chemical Company as well as a discussion of the proposed remedy. The meeting provided an opportunity for citizens to discuss their concerns, ask questions and comment on the proposed remedy. These comments have become part of the Administrative Record for this site. The public comment period for the PRAP ended on April 14, 2017.

This responsiveness summary responds to all questions and comments raised during the public comment period. The following are the comments received, with the Department's responses:

COMMENT 1: What's the uncertainty and how is it factored into the plan?

RESPONSE 1: The remedial investigation was comprehensive and the nature and extent of site-related contamination have been well documented. While the contaminant concentration diagrams reflect some degree of uncertainty, data gaps will be addressed by the Remedial Design (e.g., further refine contaminant limits, etc.).

COMMENT 2: What is the potential liability for downstream owners?

RESPONSE 2: The impacted off-site properties have no liability for the contamination attributed to this site. As far as disclosure requirements between the owner of an off-site impacted property and a prospective buyer (e.g., New York State's Property Condition Disclosure Act), the owner should direct such matters to the property owner's real estate counsel.

COMMENT 3: Will there be any construction in the Atrium senior housing development?

RESPONSE 3: The groundwater data for the Sunnyside Road area has shown that the contamination has not migrated past Sunnyside Road. This data comes from groundwater monitoring wells on both sides of Sunnyside Road and one well at Arbor Lane and Havenbrook Drive, close to the Atrium property. Therefore, no remedial activities are planned for the Atrium senior housing area.

COMMENT 4: How often do you test the monitoring wells?

RESPONSE 4: Monitoring wells have been tested as often as twice per year, as part of the site's ongoing remedial program. Groundwater will continue to be monitored as part of the Remedial Design, to confirm the current contaminant concentrations and limits before implementing the remedy to ensure the remedy's efficiency and effectiveness.

COMMENT 5: What kind of disruption will property owners face during the cleanup?

RESPONSE 5: The injection approach was specifically proposed to limit the disruptions on the neighborhood properties. For the injection points, a small drill rig, about the size of a pickup truck, and other support vehicles and equipment will be used. These vehicles will access properties seeking to cause as little disruption as possible. Damage, if any, by the vehicles will be repaired. Installation of the passive reactive barriers will be more intrusive though. During the Remedial Design phase, locations will be selected to balance effectiveness and accessibility. All areas will be fully restored as part of the remedial action process.

COMMENT 6: What is the time frame for the cleanup?

RESPONSE 6: The total cleanup time, when all the groundwater will satisfy groundwater standards, will be about 30 years. Within that time frame there will be approximately 5 years of more active remedial work, with the PRBs, injection events and sample collection, followed by a lengthier period of on-going monitoring to confirm the remedy has effectively treated the contaminants in the groundwater.

COMMENT 7: Will injections take place year round?

RESPONSE 7: The plan is to inject the remedial chemicals within a three-month period for each year injections are needed. The most favorable schedule would be to conduct the injections during the normal construction season, so that the injection lines or grids would be readily accessible. Preliminarily, the highest contaminant concentration areas will get four injection events, and the areas with lower contaminant concentrations will get two injection events.

COMMENT 8: How do you know that the contaminants are not coming from an underground creek, or a train derailment many years ago?

RESPONSE 8: There has been no evidence presented to, or discovered by, the Department indicating anything other than release(s) of dry cleaning fluid from the Former Kenco property as the source of the contamination.

COMMENT 9: The current owner of the Former Kenco property asked why his $200,000 bank account has been seized by the Department?

RESPONSE 9: Questions pertaining to the seizure of assets should be directed to the NYS Attorney General's Office.

COMMENT 10: The Town of Glenville Supervisor requested, via conversation and email, that the large concrete slab, the former location of the Kenco warehouse building, on the Former Kenco property be removed as part of the total site remedy, stating that he wanted "to re-state my (his) strong encouragement to include the removal of the building's foundation as part of the cleanup" and the Town believes "that the property should be free of any contamination and debris and this includes all parts of the building."

RESPONSE 10: The on-site Source Area remedy is being finalized for contractor bidding at this time. The on-site concrete slab foundation from the former warehouse building will be removed as part of the on-site remedy.

COMMENT 11: How deep will the permeable reactive barriers need to be installed?

RESPONSE 11: The exact depths, locations and compositions of the proposed permeable reactive barriers will be determined during the Remedial Design phase.

APPENDIX B

Administrative Record

Administrative Record

Former Kenco Chemical Company
Operable Unit No. 01: Off-Site Contamination
State Superfund Project
Town of Glenville, Schenectady County, New York
Site No. 447039

1. "Proposed Remedial Action Plan for the Former Kenco Chemical Company site, Operable Unit No.01: Off-Site Contamination", dated February 2017, prepared by the NYS Department of Environmental Conservation.

2. Referral Memorandum dated December 3, 2008 for Superfund Referral: Former Kenco Chemical Co., Inc., site #447039.

3. "Work Plan, 107 Freeman's Bridge Road, Site Number: 447039", June 2009, prepared by AECOM Technical Services Northeast, Inc.

4. "AECOM MIP Visualization Report", August 2009, prepared by Zebra Environmental.

5. "Citizen Participation Plan for Former Kenco Chemical Company", August 2010, prepared by NYS Department of Environmental Conservation.

6. "Work Plan, Remedial Investigation/Feasibility Study, Former Kenco Chemical Company, 107 Freemans Bridge Road Site, Site Number: 447039", January 2011, prepared by AECOM Technical Services Northeast, Inc.

7. "EPA Removal Assessment and Removal Action Final Summary Report, Kenco Site, (a.k.a. Former Kenco Chemical Company Site)", September 2011, prepared by U.S. Environmental Protection Agency, Region II.

8. "Former Kenco Chemical Company OU 01: Off-site Contamination, Remedial Investigation Report", April 2015, prepared by AECOM Environment.

9. "Former Kenco Chemical Company OU 01: Off-site Contamination, Feasibility Study Report", February 2017, prepared by AECOM Environment.