8976 Wellington Road
Manassas, VA 20109

January 30, 2018

Gary Priscott
New York State Department of Environmental Remediation
1679 Route 11
Kirkwood, NY 13795

Re: Periodic Review Report and IC/EC Certification Submittal
IBM Gun Club, Former Burn Pit Area
Robinson Hill Road, Union, NY 13760
NYSDEC Site # C704044

Dear Mr. Priscott:

This letter serves to transmit copies of the Periodic Review Report and required IC/EC Certifications to the New York State Departments of Conservation (NYSDEC). The remedy performance monitoring work and the preparation of this report were completed by Sanborn, Head Engineering, P.C. (SHPC) in accordance with NYSDEC-approved Site Management Plan (SMP) for this project.

If you have any questions regarding the enclosed report, please contact me at 703-257-2585.

Very truly yours,

Linda Daubert
IBM Program Manager

Enclosures: Periodic Review Report and Certification Form

cc: Kevin O'Hara (Binghamton Country Club)
Eamonn O'Neil (NYSDOH)
Maureen Schuck (NYSDOH)
Harry Warner (NYSDEC)

SANBORN HEAD ENGINEERING
Building Trust. Engineering Success.

20 Foundry Street
Concord, NH 03301

Linda Daubert, P.E.
IBM Corporate Environmental Affairs
8976 Wellington Road
Manassas, Virginia 20109

January 30, 2018
File No. 63526.05

Re: 2017 Periodic Review Report
IBM Gun Club – Former Burn Pit Area
Union, New York
BCP Agreement #C704044

Dear Ms. Daubert:

The attached document comprises the Periodic Review Report (PRR) for 2017 for the above-referenced site. The PRR has been prepared on behalf of IBM by Sanborn, Head Engineering P.C. (SHPC) for submittal to the New York State Department of Environmental Conservation (NYSDEC) and Department of Health (NYSDOH), collectively the Agencies, in accordance with the requirements of the Site Management Plan of April 2016 (SMP). We understand that a copy of this PRR will be provided to the Binghamton Country Club (Country Club), who took ownership of the site at the end of 2015.

This report includes a comprehensive remedy evaluation, currently being conducted every two years, as well as the required annual Institutional and Engineering Controls Certification Form for the period from January 1 to December 31, 2017, which precedes the body of the PRR. For the PRR Certification, the items in boxes 1, 2, and 3 list the questions/statements that the Country Club as the site owner has certified by adding a signature in Box 6. The items in Box 2A are technical matters pertaining to past Remedial Investigation reporting that SHPC certifies as IBM's Designated Representative based on our site inspections conducted in 2017. Additionally, SHPC, as representative of the remedial party (IBM), has endorsed Box 7, certifying that the information provided in Box 4 (pertaining to ECs), and Box 5 (overall certification) is true.

For clarity, a tabular summary is provided below of the certification responsibilities of the Country Club, as site owner, and SHPC, as representative of the remedial party, IBM:

Binghamton Country Club	SHPC for IBM
▪ Box 1 and 2, Questions 1 through 6 – Institutional Controls ▪ Box 3 – Institutional Controls	▪ Box 2, Question 7 – Engineering Controls ▪ Box 2A, Questions 8 and 9 ▪ Box 4 ▪ Box 5 – Based on Country Club Certification of Boxes 1 through 3

If you have any questions or comments, please contact us. We appreciate the opportunity to provide service to you on this important project.

Very truly yours,
SANBORN, HEAD ENGINEERING, P.C.

David Shea

David Shea, P.E.
President

Erica M. Bosse

Erica M. Bosse, P.G.
Project Manager
SANBORN HEAD & ASSOCIATES, INC.

Encl. Executed Certification Form
2017 Periodic Review Report

P:\3500s\3526.02\Source Files\2017 PRR\2017 SHPC PRR cover letter.docx

Enclosure 2
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
Site Management Periodic Review Report Notice
Institutional and Engineering Controls Certification Form

Site Details **Box 1**

Site No. C704044

Site Name IBM Gun Club, Burn Pit

Site Address: Robinson Hill Road Zip Code: 13760
City/Town: Union
County: Broome
Site Acreage: 15.6

Reporting Period: January 1, 2017 to December 31, 2017

	YES	NO
1. Is the information above correct?	☑	☐
If NO, include handwritten above or on a separate sheet.		
2. Has some or all of the site property been sold, subdivided, merged, or undergone a tax map amendment during this Reporting Period?	☐	☑
3. Has there been any change of use at the site during this Reporting Period (see 6NYCRR 375-1.11(d))?	☐	☑
4. Have any federal, state, and/or local permits (e.g., building, discharge) been issued for or at the property during this Reporting Period?	☐	☑
If you answered YES to questions 2 thru 4, include documentation or evidence that documentation has been previously submitted with this certification form.		
5. Is the site currently undergoing development?	☐	☑

Box 2

	YES	NO
6. Is the current site use consistent with the use(s) listed below?	☑	☐
7. Are all ICs/ECs in place and functioning as designed?	☑	☐

IF THE ANSWER TO EITHER QUESTION 6 OR 7 IS NO, sign and date below and DO NOT COMPLETE THE REST OF THIS FORM. Otherwise continue.

A Corrective Measures Work Plan must be submitted along with this form to address these issues.

Not applicable

Signature of Owner, Remedial Party or Designated Representative Date

Box 2A

	YES	NO
8. Has any new information revealed that assumptions made in the Qualitative Exposure Assessment regarding offsite contamination are no longer valid?	☐	☑

If you answered YES to question 8, include documentation or evidence that documentation has been previously submitted with this certification form.

9. Are the assumptions in the Qualitative Exposure Assessment still valid? (The Qualitative Exposure Assessment must be certified every five years)	☑	☐

If you answered NO to question 9, the Periodic Review Report must include an updated Qualitative Exposure Assessment based on the new assumptions.

SITE NO. C704044 **Box 3**

Description of Institutional Controls

Parcel	Owner	Institutional Control
126.18-1-20	Binghamton Country Club	Ground Water Use Restriction Soil Management Plan Landuse Restriction Monitoring Plan Site Management Plan O&M Plan

The site is covered by an Environmental Easement which calls for the adhearence to a Site Management Plan (SMP). The property is restricted from use as a farm and/or a livestock breeding facility via local odinance/zoning. Residential use is allowed throughout the property, except for within the capped area, where restricted residential use is allowed. Groundwater use restrictions apply throughout the site, and a requirement to assess and abate impacts, if any, for soil vapor contamination applies throughout the site as well. Off site property within the contaminated plume area is also controlled institutionally via agreement between IBM and the owners of the Broome County Country Club. This agreement restricts groundwater use in a manner consistent with the above, and similarly requires assessment and abatement, as needed, for soil vapor contamination.

Box 4

Description of Engineering Controls

Parcel	Engineering Control
126.18-1-20	Groundwater Treatment System Cover System Fencing/Access Control

The site contains a capped area that is covered via Environmental Easement and is managed through the SMP. Groundwater is being treated in-situ via an enhanced biological degradation system.

Box 5

Periodic Review Report (PRR) Certification Statements

1. I certify by checking "YES" below that:

   a) the Periodic Review report and all attachments were prepared under the direction of, and reviewed by, the party making the certification;

   b) to the best of my knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the site remedial program, and generally accepted engineering practices; and the information presented is accurate and compete.

YES	NO
☑	☐

2. If this site has an IC/EC Plan (or equivalent as required in the Decision Document), for each Institutional or Engineering control listed in Boxes 3 and/or 4, I certify by checking "YES" below that all of the following statements are true:

   (a) the Institutional Control and/or Engineering Control(s) employed at this site is unchanged since the date that the Control was put in-place, or was last approved by the Department;

   (b) nothing has occurred that would impair the ability of such Control, to protect public health and the environment;

   (c) access to the site will continue to be provided to the Department, to evaluate the remedy, including access to evaluate the continued maintenance of this Control;

   (d) nothing has occurred that would constitute a violation or failure to comply with the Site Management Plan for this Control; and

   (e) if a financial assurance mechanism is required by the oversight document for the site, the mechanism remains valid and sufficient for its intended purpose established in the document.

YES	NO
☑	☐

IF THE ANSWER TO QUESTION 2 IS NO, sign and date below and DO NOT COMPLETE THE REST OF THIS FORM. Otherwise continue.

A Corrective Measures Work Plan must be submitted along with this form to address these issues.

Not applicable

Signature of Owner, Remedial Party or Designated Representative

Date

IC CERTIFICATIONS
SITE NO. C704044

Box 6

SITE OWNER OR DESIGNATED REPRESENTATIVE SIGNATURE

I certify that all information and statements in Boxes 1,2, and 3 are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law.

I Kevin P. O'Hara (print name) at 1401 Robinson Hill Road, Endwell, NY 13760 (print business address),

am certifying as Representative of Binghamton Country Club as Property Owner (Owner or Remedial Party)

for the Site named in the Site Details Section of this form.

KPOH

Signature of Owner, Remedial Party, or Designated Representative Rendering Certification

1/19/18

Date

IC/EC CERTIFICATIONS

Box 7

Professional Engineer Signature

I certify that all information in Boxes 4 and 5 are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law.

I David Shea, P.E. at Sanborn, Head Engineering P.C., 20 Foundry Street, Concord, NH 03301
print name — print business address

am certifying as a Professional Engineer for the IBM Corporation, Remedial Party
(Owner or Remedial Party)

David Shea — 1-30-18

Signature of Professional Engineer, for the Owner or Remedial Party, Rendering Certification — Date

(Required for PE)

SANBORN HEAD ENGINEERING

Building Trust. Engineering Success.

2017 PERIODIC REVIEW REPORT

FORMER BURN PIT AREA

IBM Gun Club
Union, New York
NYSDEC Site # C704044
BCA Index # B7-0661004-05
Prepared for IBM Corporate Environmental Affairs
File No. 3526.05
January 2018

SANBORN, HEAD ENGINEERING, P.C.

TABLES

FIGURES

EXHIBITS

APPENDICES

EXECUTIVE SUMMARY

This annual Periodic Review Report (PRR) for 2017 for the Former Burn Pit Area at the IBM Gun Club in the Town of Union, New York includes a comprehensive remedy evaluation and the required annual Institutional Controls/Engineering Controls (ICs/ECs) certification for the period from January 1 to December 31, 2017. The PRR is intended to review the status of the remedy at the Site, which is addressing the presence of volatile organic compounds (VOCs), principally trichloroethene (TCE) and its biochemical breakdown products. The remedy was constructed, initiated, and is being operated consistent with the Site-specific Decision Document and the Site Management Plan, and meets or exceeds the NYSDEC guidance for Green Remediation. Use of the Site and surrounding area are in accordance with the Environmental Easement.

The overall goals of the site remedy are to:

1. Reduce VOC contaminant source mass;
2. Substantially limit the transport of VOCs from the source area; and
3. Enhance biochemical processes outside of the primary source area (downgradient) without accumulation of toxic breakdown products.

To achieve these goals, various in-situ measures, including a soil cap and soil fill, phytoremediation, and enhanced biochemical degradation were implemented beginning in 2013, with construction completed in 2014. The available performance monitoring data continue to indicate that the engineering controls are operating effectively and are making substantial progress toward the short-term measures of success, defined as less than 5 years since initiation, as well as the overall long-term remedy performance goals, in that:

- The data indicate that biochemical degradation is proceeding throughout the primary source rock as evidenced by geochemical conditions favorable to VOC breakdown and the decreased proportion of the principal contaminant, trichloroethene (TCE);
- The data also indicate that the contaminant mass discharge from the rock mass serving as the primary source of VOCs in groundwater is largely controlled; and
- The data support in-situ destruction by biochemical degradation to non-toxic end products, with no clear evidence of adverse effects such as accumulation or downgradient transport of degradation products.

While the remedy continues to meet its short-term goals and is making progress on its long-term goals, the remedy is expected to operate for decades.

Ownership of the Site was transferred from IBM to Binghamton Country Club (BCC) on December 30, 2015. IBM continues to manage the ECs and reporting, while BCC is responsible for compliance with the ICs. Since the ownership change, the site use has not changed, and all the ICs have been adhered to.

1.0 SITE OVERVIEW AND SUMMARY

This annual Periodic Review Report (PRR) for 2017 summarizes the operations, maintenance, and monitoring of the engineered remedy for the IBM Gun Club-Former Burn Pit Area (BPA), located in Broome County and the Town of Union, New York (the Site), as shown on the Site Location Plan included as Figure 1. This report includes a comprehensive remedy evaluation, currently being conducted every two years, as well as the required annual certification of the Institutional Controls and Engineering Controls (ICs/ECs) for the period from January 1 to December 31, 2017. The executed IC/EC Certification Form is provided at the beginning of this document.

To address the presence of volatile organic compounds (VOCs), principally trichloroethene (TCE) and its biochemical breakdown products, in Site groundwater, the engineered remedy is a combination of enhanced biochemical degradation, an engineered soil cap, and phytoremediation. Following remedy construction and implementation during 2013 and 2014, a Certificate of Completion (COC) for the Site was issued on November 12, 2014 by the New York State Department of Environmental Conservation (NYSDEC). Thus, the remedy has been in place for about 4 years.

This report and the work it summarizes were completed in accordance with the amended Site Management Plan (SMP) of April 2016[1]. The SMP describes the approved program of routine and non-routine maintenance and performance monitoring, and the associated reporting. Table 1 lists the work events at the Site during 2017.

This work and report were completed on behalf of the International Business Machines Corporation (IBM) by Sanborn Head Engineering, P.C. (SHPC), with assistance from Sanborn, Head & Associates, Inc. (Sanborn Head). We understand that IBM will submit this report to NYSDEC and the New York State Department of Health (NYSDOH), referred to as the Agencies. The report will also be provided to the Binghamton Country Club, the present Site owner.

1.1 Summary of Site Remedy

Figure 2 provides a summary of the remedy, which includes the following engineering control components (ECs) that, in addition to the institutional controls (ICs), are part of the overall remedy:

1. **An engineered soil cap** constructed of low-permeability, clean soil fill that provides a minimum of 2 feet of cover over near-surface soils that contain certain metals at concentrations above New York State (NYS) soil cleanup objectives (SCOs) established for residential property use (Residential SCOs).

[1] Sanborn, Head & Associates, Inc., December 13, 2013, amended April 2016, Site Management Plan, Brownfield Cleanup Program, IBM Gun Club – Former Burn Pit Area, Union, New York, NYSDEC Site #C704044, BCA Index # B7-0661004-05.

2. **Placement and compaction of engineered soil fill within a topographic depression south of the BPA,** where VOC-containing groundwater has historically been observed to breakout to the ground surface seasonally as seeps and springs.

3. **Phytoremediation -** Establishment and maintenance of grass and tree cover to limit infiltration recharge to groundwater and enhance direct uptake of VOC-containing shallow groundwater, a process known as phytoremediation; and

4. **Enhanced biochemical degradation (EBD) –** The injection into the subsurface of engineered amendments (edible soybean oil) shown to enhance biochemical destruction of VOCs in site-specific pilot testing.

EBD and phytoremediation are intended to address the apparent on-going presence of VOCs in groundwater and bedrock beneath the Site. Initiation of the EBD component of the remedy on a site-scale began in early December 2013 with the first introduction of edible oil as an electron donor amendment into the A-series boreholes. Cap construction and planting of trees and grass that constitute the phytoremediation component of the remedy was completed by June 2014.

The ICs established as a part of the remedy and adhered to during the certification period include:

- The property may only be used for restricted residential, commercial, and industrial uses within the deed restricted cap area. Residential, restricted residential, commercial, and industrial uses throughout the remainder of the Site are not precluded, although land use is subject to local zoning laws provided that the long-term ECs/ICs included in this SMP are employed;

- The property may not be used for a higher level of use, such as unrestricted use, without additional remediation and amendment of the Environmental Easement, as approved by NYSDEC;

- All future activities on the property that will disturb remaining contaminated material must be conducted in accordance with the SMP;

- The use of the groundwater within and adjacent to the mapped plume as depicted on Figure 2, or as updated based on groundwater monitoring, is prohibited as a source of potable or process water, without treatment rendering it safe for intended use as determined by the NYSDOH or County DOH;

- A provision for evaluation of the potential for soil vapor intrusion for any buildings constructed on-site, as well as for those constructed off-site within the plume area, including provisions for implementing actions recommended to address exposures related to soil vapor intrusion; and

- Vegetable gardens and farming are prohibited on the deed restricted cap area. The remainder of the Site meets Residential Soil Cleanup Objectives and is therefore not subject to any restrictions on gardening.

1.2 Remedial Action Performance Objectives and Measures of Success

The performance goals of the remedy established in the Remedial Work Plan (RWP), and carried through the SMP, include short- and longer-term measures of success that are expected to require decades to complete. The performance goals and measures of success to be assessed in the short term, defined as 5 years or less, are shown in Exhibit 1.1. Given the remedy site-scale startup in July 2014, performance monitoring will be evaluated against Exhibit 1.1's short-term measures until mid-2019. In addition, within the first five years, the intent was to further refine EBD amendment dosing quantity and frequency based on observational performance monitoring.

Remedy Goals	***Short Term Measures of Success (Less than 5 years)***
1. Sustained enhanced biochemical degradation (EBD) throughout Primary Source Rock	*2 orders of magnitude sustained reduction in TCE concentrations in injection displacement zone*
2. Limit Mass Flux Out of Primary Source Rock	*Downgradient response without accumulation of toxic breakdown products*
3. Enhance biochemical processes outside primary source rock	

Exhibit 1.1 - Goals and Short-Term Measures of Success Outlined in the Site Management Plan

1.3 Organization of the Report

Section 2.0 reviews operations and maintenance compliance during the past year and provides the results of Site inspections. Section 3.0 describes compliance with the monitoring plan, and provides observations and an analysis of the data, as contained in Appendix C. This section also provides the comprehensive two-year performance evaluation of the engineering controls. Section 4.0 demonstrates the compliance of the remedy with the site-specific decision document and the assessment of the remedy outlined in Exhibit 1.1. It also presents and discusses the recommendations for future monitoring and possible modifications to the remedy. Finally, Section 5.0 presents the conclusions.

2.0 SITE INSPECTIONS AND MAINTENANCE

Table 1 provides a chronological summary of Site inspection, maintenance, and monitoring work conducted in 2017. Inspection and maintenance forms are provided in chronological order in Appendix B for completeness.

2.1 Site Inspections

In accordance with the SMP, the frequency of routine site-wide inspections was reduced to once per year starting in 2017. The annual inspection was conducted in September 2017. During the site-wide inspection, the condition of the Site was found to be consistent with the design intent of the ECs, and use of the Site and surrounding area consistent with the ICs and the human exposure assessment on which the remedy is based. Inspection findings were documented on the inspection check list and summarized in a letter to IBM dated October 31, 2017, which is included in Appendix B.1. Summary observations were as follows:

- The capped area remains intact with no evidence of settlement, cracking, animal burrows, or other breaches;

- The capped area is vegetated with well-established grass and tree cover. According to the National Weather Service, the region exhibited approximately average to above average precipitation through late summer, with drier conditions during September 2017;

- Based on an assessment of tree growth and mortality conducted in September 2017, poplar poles appear to have grown several feet since May 2016 to an average height of 12 to 20 feet, while cuttings have grown 1 to 2 feet to an average of 4 to 6 feet. Tree mortality since initial planting is shown on the figure included in Appendix B.1.2 and ranged from 22% to 41% across nine areas, with Area 4 exhibiting the highest mortality and Area 7 the lowest. Further discussion is provided below.

- The grass in the capped area was cut in July with minor damage occurring just outside the capped former seep area. The mower left a wheel rut at the base of the capped area along the southern gravel access road as shown on the attached figure of Appendix B.1 and in Photo 8. The rut was made just outside the capped area, and the cap and underlying material were not disturbed. A small amount of standing water was present during the inspection, but was not evident during sampling approximately 2 weeks later. The rut has since been repaired with commercially available topsoil;

- There is still evidence of trespassing and that the bonfire gathering spot on the southwest side of the remedial area near monitoring well BP-10A is being utilized, but remains outside of the capped and fenced area, and there was less debris present than during previous inspections.

- Upon arrival for the inspection, the office trailer portion of the on-site storage container was found have been vandalized. Upon arrival for sampling approximately two weeks later, it was found vandalized again. It is unclear how entry was gained through the perimeter fence as no damage was observed, but trailer repairs have been completed and enhancements to security are underway.

Under the SMP, IBM had proposed to replant as needed to bring the tree cover up to 75% of the initial planting density, allowing for 25% mortality. We note that 25% mortality or lower was an arbitrary threshold for success. Greater than 25% mortality does not necessarily mean the phytoremediation component is not effective. In fact, tree growth has been substantial at many locations, including within the former topographic depression downgradient and south of the capped area where VOC-containing groundwater historically broke out as seasonal seeps and springs. The seeps and springs in this area have largely been eliminated due to the engineered fill and tree planting. Furthermore, less than 25% overall mortality may not be realistic or achievable in areas that exhibit conditions that are not conducive to tree growth (e.g. shallow bedrock, encroachment of woody brush, poor infiltration in the capped area), and re-planting may lead to the same result. IBM elected not to conduct re-planting in 2017 for the reasons stated above, and because replanting would require tracking of mechanized equipment across the cap area, which might damage the cap and live trees. Possible alternate measures of phytoremediation effectiveness other than the 25% mortality threshold are discussed in Section 4.3.

2.2 Routine Maintenance

Routine maintenance conducted during the reporting period included topsoil nutrient analysis, grass cutting, and an edible soybean oil amendment injection, as documented in Appendix B.2. Topsoil sampling consisted of collection and compositing of four soil samples, both on and off the cap, as shown in the figure included in Appendix B.2.1. Analytical results for nutrients, pH, and organic matter did not indicate the need for fertilization. Analytical laboratory reports are included in Appendix B.2.1.

The grass was cut throughout the tree planting areas in August and October 2017 by Groundwater Sciences Corporation (GSC) under contract directly with IBM. Sanborn Head coordinated with GSC personnel to define approximate mowing boundaries, which are shown on a figure included in the routine maintenance report as Appendix B.2.2.

The injection of edible oil amendment into a selection of A- and B-series boreholes was performed in August 2017, as documented in the routine maintenance report included as Appendix B.2.3, which includes a table summarizing previous injections. Similar to the 2015 injection, the 2017 injection focused on greater dosing into those boreholes situated in more transmissive rock, where monitoring has shown more rapid dissipation of total organic carbon, presumably due to greater downgradient transport and greater demand driven by groundwater flow through the more transmissive zone.

2.3 Non-Routine Maintenance

Two occurrences of vandalism to the field office were observed upon arrival for the September 26, 2017 Site inspection and the October 2017 sampling event. Interior damage was observed to windows and equipment, with a few materials stolen, including the wireless internet router. The east gate entrance lock on Robinson Hill road was also observed to have been broken, but no damage was observed to the perimeter fence. GSC completed repairs to the trailer, including installation of a ¼" aluminum plate with tamper-proof screws over the windows and door handle on the field office.

3.0 REMEDY PERFORMANCE MONITORING

The principal contaminants driving the need for remediation at this Site are chlorinated ethenes, primarily trichloroethene (TCE) and its biochemical breakdown products, cis-1,2 dichloroethene (cDCE) and vinyl chloride (VC). Other VOCs were found in soil, rock, and groundwater during remedial investigation work at the Site, but less frequently and at lower concentrations relative to applicable standards. They included chlorinated methanes, chlorinated ethanes, ketones, and petroleum hydrocarbons. VOCs were the only contaminants identified as contaminants of concern (COCs) for groundwater, soil, and rock media, and are the subject of remedy performance monitoring[2]. Figure 3 provides a plan view of the monitoring network.

[2] Sanborn Head & Associates, Inc., August 5, 2009, Report of Findings, Brownfield Cleanup Program Remedial Investigation, IBM Gun Club – Former Burn Pit Area, Union New York. Tables 2 and 3.

Tabular and graphic summaries of the field and laboratory data obtained from three performance monitoring events conducted in 2017, in April, June, and October, are included in Appendix C. The scope of each sampling event and any deviations from the intended scope are documented in memoranda reports included in this appendix.

Table 2 provides a summary of VOCs detected above the reporting limit in 2016 and 2017 monitoring, since the last comprehensive evaluation presented in the 2015 PRR. This table summarizes all VOCs included in laboratory analysis, along with statistics on the number of locations, detections, and exceedances of applicable standards. The data continue to support chlorinated ethenes as the principal contaminant. The presence of chlorinated methanes, aromatics, and ketones were generally detected at a lower frequency and largely found in injection boreholes and monitoring wells central to the primary source rock.

The presence of carbon tetrachloride, also identified during the remedial investigation (RI) as one of the key Site contaminants, was detected at 13 locations, with one sample above the applicable standard. In comparison, during the last comprehensive review representing the period November 2014 through December 2015, carbon tetrachloride was detected at 43 locations, with two locations above the applicable standard. Carbon tetrachloride was detected at 23 locations exceeding the standard during the RI. 2-hexanone was detected for the first time in groundwater collected from injection borehole B-4 in September 2016. It was detected again in B-4 in April 2017. Both times, the levels were well below the applicable standard.

Tables 3 and 4 provide summaries of the concentrations in groundwater and surface water, respectively, of the principal Site contaminants--chlorinated ethenes, including TCE, cDCE, and VC. The water quality data are tabulated for the last two years since the last comprehensive review, along with basic descriptive statistics for the period prior to 2010, including minimum, maximum, median, and mean concentrations for comparison. The pre-2010 statistics are based on data recorded during the RI and pre-remedy monitoring, which provide a baseline prior to startup of the site-scale remedy.

Time-series graphs of principal chlorinated ethenes at current monitoring locations are provided in Appendix D.

The monitoring was conducted under a variety of climatic conditions and groundwater levels. Climatic conditions and groundwater level measurements recorded during the monitoring period were reviewed against historical averages to provide context for the findings discussed in the sections to follow.

3.1 Climatic and Water Level Conditions during the Monitoring Period

Exhibit 3.1, shown below, depicts the deviation from monthly average precipitation as a context for the monitoring over the last two years. As shown by the plot, generally below-average precipitation was recorded in calendar year 2016 and the latter part of 2017. Above average precipitation was recorded in the first half of 2017. Monitoring events were conducted in April, June, September/October in both 2016 and 2017.

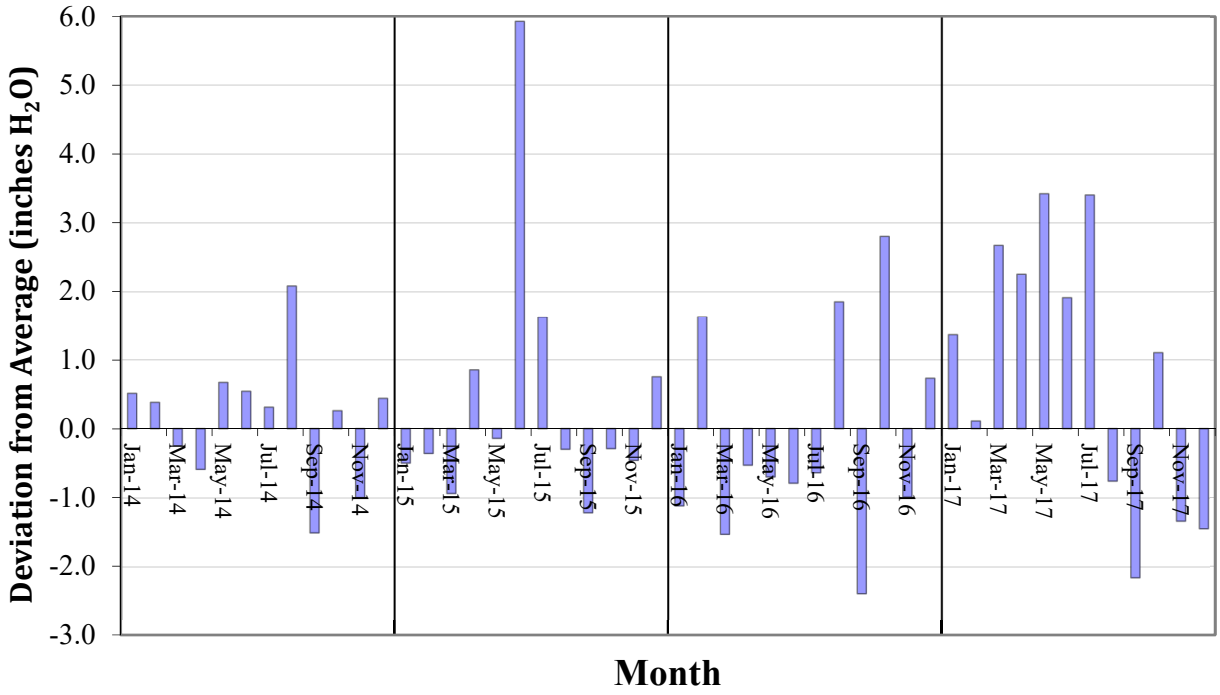

Exhibit 3.1 – Precipitation Records 2016-2017 - The data recorded in monitoring through 2017 were compared with monthly averages calculated from historical records from 1951 to 2004 at the Greater Binghamton Airport, located approximately 7 miles to the north of the Site.

Water level data is provided in the water quality reports in Appendix C. Seasonal fluctuations in water levels, driven by precipitation, infiltration, and uptake by trees, are apparent in most monitoring and injection locations. Seasonally high and low water levels are observed during the spring and fall sampling events, respectively. As a generality, under higher water level conditions, a shift to more oxidizing geochemistry is expected due to infiltration of oxygen containing water, while more reducing geochemistry is expected under lower water conditions.

During the two-year reporting period, water levels from monitoring wells continue to reflect this seasonal pattern. While water levels continue to vary considerably, the pattern of overall declining water levels in monitoring wells between the A- and B-series injection wells attributed to capping activities was not observed during recent monitoring, perhaps due to generally wetter conditions since mid-2016 compared to the previous reporting period. However, the trend for increasing saturated thickness observed in the B-series injection boreholes noted in the last comprehensive PRR was observed during this two-year reporting period. This observation may indicate continued reduced permeability due to displacement of fracture pore space with oil droplets and biological mass. For example, two months after the August 2017 injection event, when the entire borehole intervals were filled with amendment, fluid levels in both B-7 and B-8 had fallen to about 1 foot below ground (ft bgs) and 1 foot above ground, respectively. Typical water levels in both locations are on average 6 ft bgs. The resulting saturated thicknesses in both boreholes was about 5 feet above median saturated thickness recorded since their installation in 2013.

3.2 Quality Assurance and Assessment of Data Usability against Measurement Performance Criteria

Quality control/quality assurance (QA/QC) samples included 10% field duplicates, 5% matrix spike/matrix spike duplicates (MS/MSD) for VOC samples, daily field blanks, and 10% equipment blanks when using non-dedicated equipment. Each cooler shipped with VOC samples included one trip blank and one temperature blank. Additional laboratory QA/QC program components included method blanks, laboratory control samples, and surrogates.

QA/QC results and observations were reviewed against the data quality objectives (DQOs) and measurement performance criteria outlined in Appendix J of the SMP. The review found that the data are considered usable for project objectives/decisions. Specific findings are summarized below:

- ***Blank Detections*** – 42 blanks were submitted during the 2-year reporting period. Among those, 20 had detections. Acetone, dibromochloromethane, methylene chloride, toluene, chloroform, xylenes, ethylbenzene, and bromodichloromethane were detected in one or more blanks, generally below the practical quantitation limit (PQL) and flagged as an estimate. None of the principal chlorinated ethenes were detected in blanks.

- ***Field Duplicate Precision*** – Results for field duplicate samples were reviewed as a measure of precision by calculating the relative percent difference (%RPD) between the primary and duplicate sample. The DQO of +/-30% for field duplicates and matrix spike duplicate (MSD) was generally met. Twenty duplicates were collected during the 2-year reporting period, and about 99% of the analytes met the DQO. Several key VOCs were outside acceptable duplicate precision limits in one or two sample pairs, including 1,1-dichloroethene (DCE), cDCE, VC, and TCE. However, percent recoveries outside the acceptable range were not persistent across analytes or sample groups and likely do not represent a systematic error associated with the sampling process.

- ***Accuracy and Bias via Matrix Spike Duplicates/Laboratory Control Samples*/Surrogate Spikes** – Laboratory accuracy/bias, the extent of agreement between the sample result and the true value of the analyte, is measured by several field and laboratory procedures, including the collection of matrix spike/matrix spike duplicate samples, and analysis of laboratory control samples (LCS) and surrogate spikes in the lab. They entail spiking the sample with a known quantity of the target analytes or "surrogate" analytes that act similarly to the target analytes. The known spiked concentration is compared to the analytical results and a %Recovery is calculated. Recoveries for MS/MSD and LCS samples were generally within the acceptable range, and all surrogate spikes, except for one, were within acceptable range. Among the 13 sample groups submitted since the last comprehensive review two years ago, one group had recoveries of key VOCs below the acceptable range (potential low bias) and 6 had recoveries above the acceptable range (potential high bias). Percent recoveries outside the acceptable range were not persistent across analytes or sample groups and likely do not represent a systematic error associated with the measurement process.

- ***Quantitation Limits and Sensitivity*** – Reporting limits were assessed by reviewing the compound quantitation limit against the compound-specific DQO target. Quantitation limits generally met DQOs for all compounds, except for samples that required dilution due to elevated concentrations of one or more key compounds or matrix interference/foaming. Sampled injection boreholes were most frequently diluted due to the presence of oil amendment that caused matrix interference. Sensitivity was also assessed by analysis of method blanks and continuing calibration verification (CCV). No analytes were detected in method blanks for the 13 sample groups. Continuing calibration drift exceeded acceptable levels for a key VOC (VC) in samples collected from BP-4A and BP-36A in April 2016; the results were considered estimated. CCV was below acceptable limits for several other sample groups; however, the analytes were not detected (ND) in the sample. Sensitivity in this case is confirmed by analyzing a method detection limit standard, which confirmed the ND results for the effected sample batches.

In summary, laboratory data associated with monitoring from April 2016 through October 2017 were found to be usable for their intended purpose. Subject to data qualifying flags, all results were considered acceptable compared to the data quality objectives outlined in Appendix J of the SMP.

3.3 Geochemical Conditions

Consistent with prior reports, geochemical conditions were examined that are relevant to biochemical breakdown of the principal chlorinated VOCs (CVOCs) by reductive dehalogenation. These conditions, including electron donor levels, oxidation/reduction state, and general water quality parameters, are discussed below.

3.3.1 Total Organic Carbon (TOC) and Volatile Fatty Acids (VFAs)

TOC and VFAs must be present to drive biochemical breakdown of CVOCs by the process of reductive dechlorination. VFAs are produced from fermentation of the TOC in the oil amendment. The VFAs are then in turn broken down to free hydrogen that is used in reductive dechlorination. The purpose of periodic injection of oil amendment is to supply the TOC and VFAs needed to enhance the breakdown process.

Overall, the available data indicate that TOC and VFAs are present at sufficient concentrations to enhance biochemical degradation of CVOCs across both injection borehole lines. Sufficient TOC is present over much of the primary source rock; however, certain locations, especially between the two rows of injection boreholes exhibited lower TOC concentrations, which may limit biochemical degradation in this area.

Exhibits 3.2 and 3.3 below show the response of TOC and VFA concentrations, respectively, in monitoring wells to the last two injection events, denoted by the vertical black lines. TOC concentrations clearly increased at nearby monitoring locations BP-6A and BP-36A following the injection events, while the response at other locations further downgradient of the injection lines was more muted, with TOC concentrations consistently less than 10 mg/L.

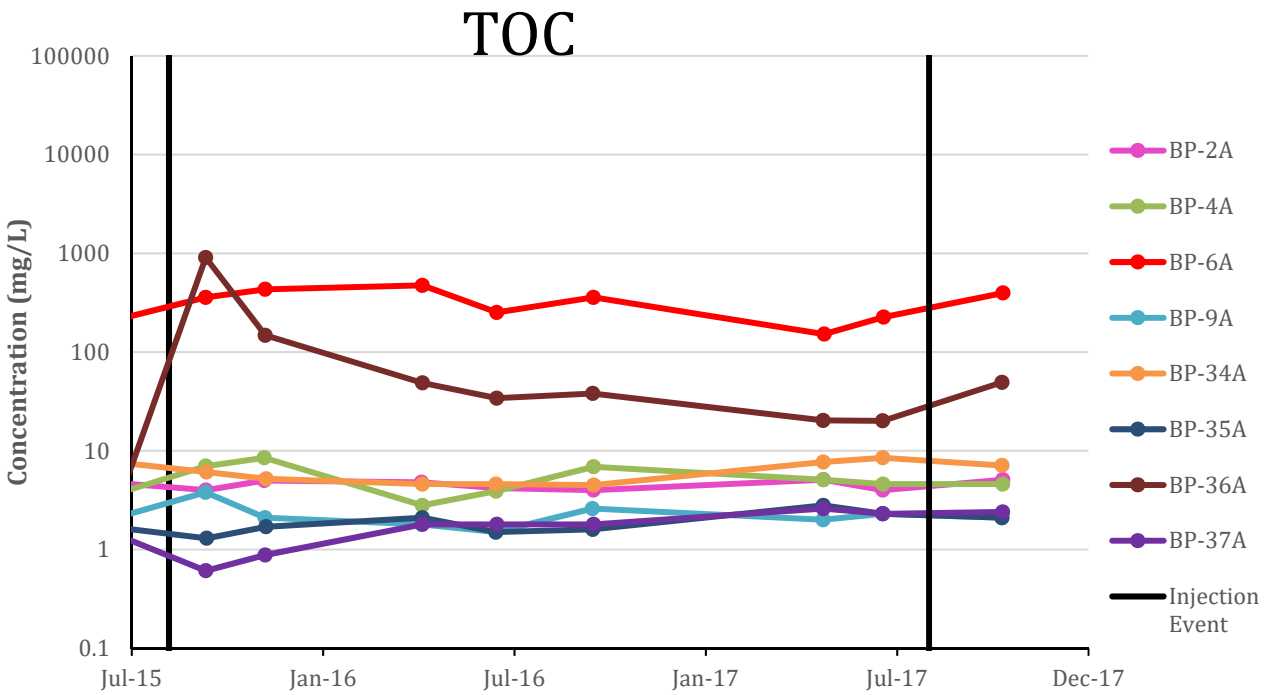

Exhibit 3.2 – Total Organic Carbon (TOC) Data Recorded for Samples from Select Monitoring Wells.

Variability in downgradient transport of TOC is likely due to a combination of matrix diffusion, matrix sorption, variations in transmissivity, and biochemical consumption. TOC concentrations in injection and monitoring wells will continue to be monitored for their response following the most recent injection.

In Exhibit 3.3 below, VFA concentrations are shown to be generally steady or declining before the most recent injection in August 2017. Following the August 2017 injection, VFA concentrations increased at the same locations where TOC increased (BP-6A and BP-36A, plus BP-2A), while no apparent response was observed in BP-4A, BP-9A, BP-34A, BP-35A, and BP-37A during October 2017 monitoring, approximately 2 months after the injection.

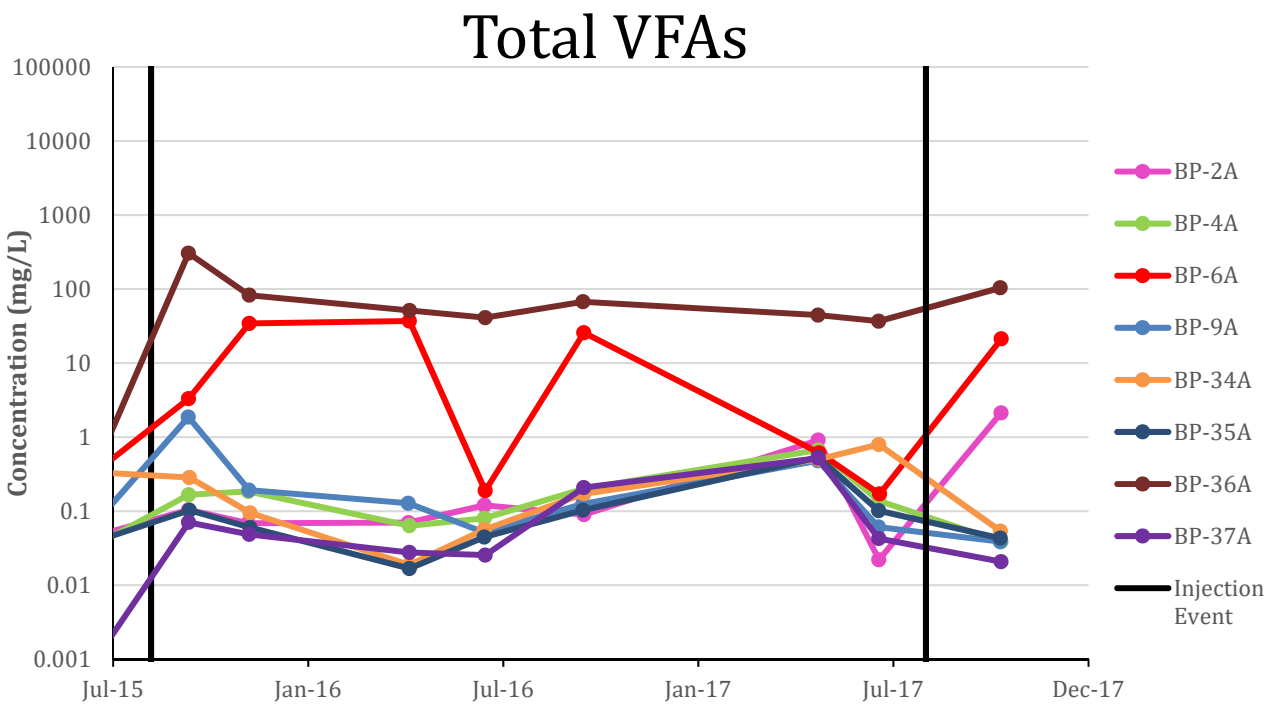

Exhibit 3.3 – Total Volatile Fatty Acids (VFA) Data Recorded for Samples from Select Monitoring Wells.

The TOC and VFA data indicate a somewhat limited response to the August 2017 injection event, suggesting slow migration/transport of the amendment to these locations. This could potentially be attributed to reduced permeability resulting from clogging or plugging of fractures. VFA concentrations, along with CVOC levels, in injection and monitoring wells will continue to be monitored for their response following the most recent injection.

3.3.2 Inferred Geochemical Conditions

In field and lab testing, water quality was monitored for parameters such as dissolved oxygen (DO), oxidation/reduction potential (ORP), and concentrations of certain metals and cations to assess the oxidation/reduction state, or "redox" conditions, of the subsurface. Methanogenic and sulfate-reducing conditions are inferred by the presence of particularly elevated concentrations of methane and sulfide, respectively, in the water samples, and data for other geochemical indicators. Areas under sulfate-reducing and methanogenic conditions are inferred to be areas of enhanced reductive dechlorination.

Figure 4 depicts the maximum and minimum limits of sulfate-reducing conditions inferred from data from sampling events conducted during the two-year reporting period. During the last two years, the smallest area under reducing conditions was observed in April 2017 and the largest area was observed in October 2017, two months after an injection. Typically, seasonally high and low groundwater levels are observed during the spring and fall sampling events, respectively. Therefore, Figure 4 shows geochemical conditions conducive to reductive dehalogenation are observed within much of the primary source rock over a range of water level conditions.

Similarly, Figure 5 depicts the maximum and minimum limits of methanogenic conditions inferred from geochemical results during the two-year reporting limit. Areas under methanogenic conditions are inferred to be most conducive to reductive dechlorination. Methanogenic conditions are inferred to be smaller in 2017 than that observed in 2016, especially in the zone between the two lines of injection boreholes. The smaller limits inferred in 2017 may be indicative of more oxygenated conditions associated with increased infiltration due to the observed above average precipitation in 2017, or perhaps diminishing effects from the 2015 injection, before the effects of the 2017 injection have had a chance to become apparent.

Field screening data for pH, and field and lab analyses for sulfate in groundwater samples from certain locations continue to indicate low pH and higher sulfate concentrations, both conditions that may somewhat limit microbial breakdown of chlorinated VOCs. Since the last comprehensive review two years ago, low pH conditions have been observed at certain monitoring locations in and outside the primary source rock, including BP-2A and BP-13A (locations near or within the injection zone) and locations along the periphery of the primary source rock (BP-5A, BP-31A, BP-38A, and BP-39A). The possible addition of a pH buffer is discussed in Section 4.3 below.

The presence of particularly elevated sulfate concentrations recorded in analysis or field screening of groundwater samples from BP-1A, BP-6A, and BP-34A indicates the potential for conditions that limit reductive dehalogenation. Sulfate concentrations in the thousands of mg/L may partially account for the continued elevated VOC concentrations in BP-6A, but VOC concentrations in monitoring wells further downgradient to the north, including BP-1A, BP-5A, BP-7A, and BP-16A are not increasing.

3.4 VOCs in Water Samples

As shown by the October 2017 pie charts on Figure 4, TCE is no longer the most prevalent chlorinated ethene found in groundwater samples collected from most locations within the primary source rock, with TCE molar fractions generally less than 50%. As previously reported, prior to the initiation of the remedy, TCE made up most of the chlorinated ethane mass, representing 85% to over 90% of the mass within the plume, with small amounts of cDCE and only traces of the terminal breakdown products.

As reflected in selected time-series line plots to follow (Exhibits 3.4-3.7), concentrations of the principal parent compound, TCE, continue to decline consistent with the objectives of the long-term remedy. The plots below represent a selection of representative monitoring locations and show molar concentrations of TCE, primary, and terminal breakdown products over the period spanning the last two injection events through October 2017.

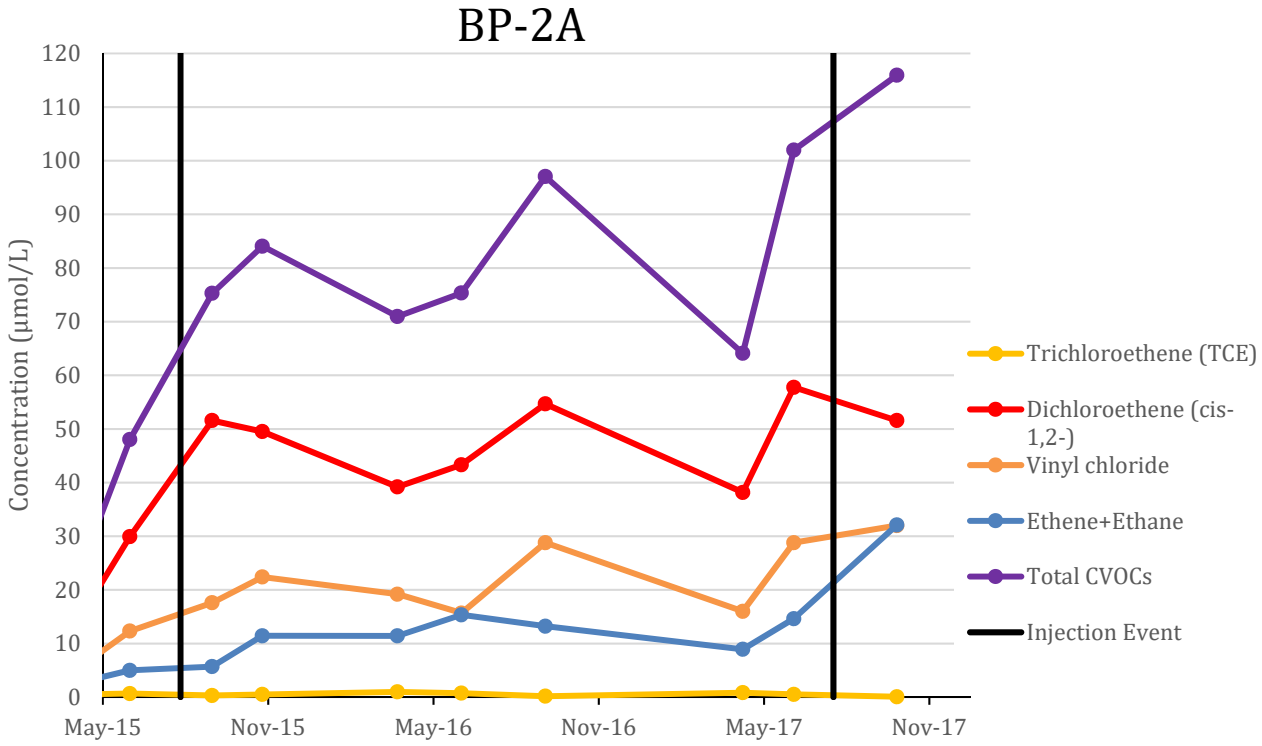

Exhibit 3.4 - Molar Concentrations of TCE and Breakdown Products for BP-2A

BP-2A is a location immediately adjacent to the A-series injection wells. The most recent data for BP-2A indicate that TCE concentrations represent less than 1% of the VOC mass at this location. The non-toxic terminal breakdown products ethene and ethane now represent about 30% of the molar mass, and have been increasing over the last several monitoring rounds. While the overall CVOC concentration has increased, this is likely due to the increased prevalence of breakdown products rather than TCE. Increasing concentrations of breakdown products may reflect increased back diffusion and enhanced dissolution of the VOC mass due to the enhanced biochemical activity, which is expected to be temporary.

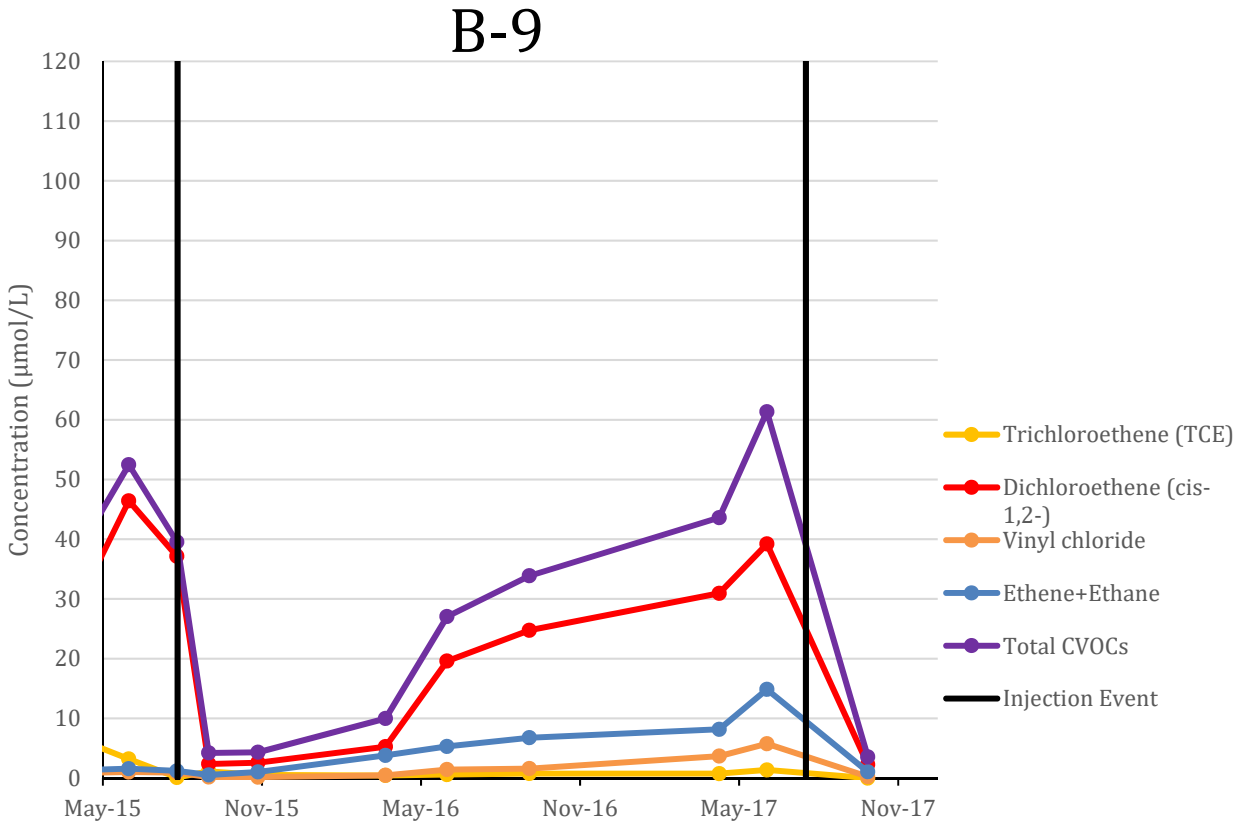

Exhibit 3.5 – Molar Concentrations of TCE and Breakdown Products for Injection Borehole B-9- a location in the B-line IDZ exhibiting about the median transmissivity for the B-series boreholes.

Injection borehole B-9 exhibits high transmissivity in comparison to what is observed in the B-series boreholes. TCE has represented less than 30% of the molar mass at this location since the first B-series injection in July 2014, down from 90%. This well responds quickly to injection events with steeply declining VOC concentrations, while the effects are transported downgradient relatively quickly compared to other, less transmissive injection boreholes.

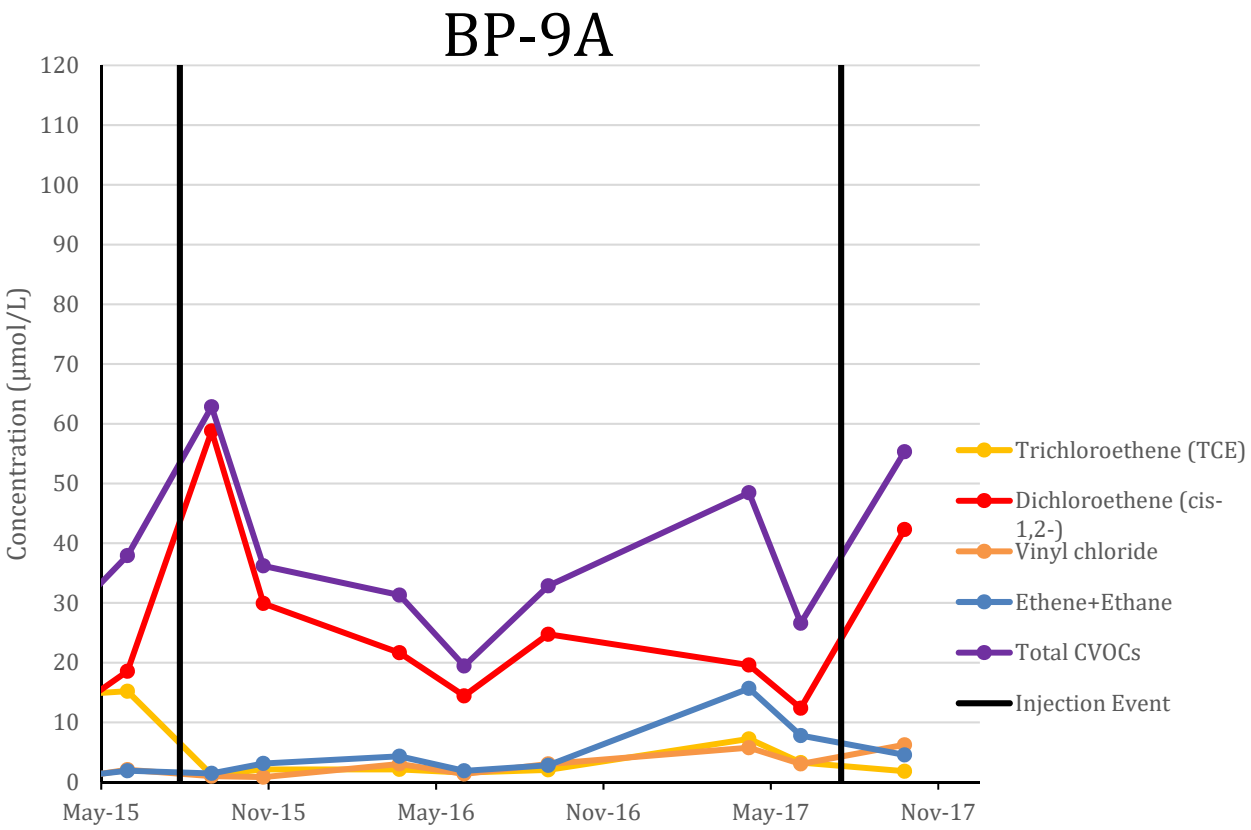

Exhibit 3.6 – Molar Concentrations of TCE and Breakdown Products for BP-9A

BP-9A is located about 60 feet downgradient of the B-series injection boreholes near the property boundary. Since the first B-series injection, cDCE is the most prevalent compound. Recent TCE concentrations are 1 to 1.5 orders of magnitude below the historical high. In the last two years, this pattern has continued. cDCE increased significantly since the August 2017 injection, suggesting transport of TCE breakdown products from the injection zone. A similar increase in cDCE was observed at this location immediately after the 2015 injection, followed by a gradual decline in cDCE.

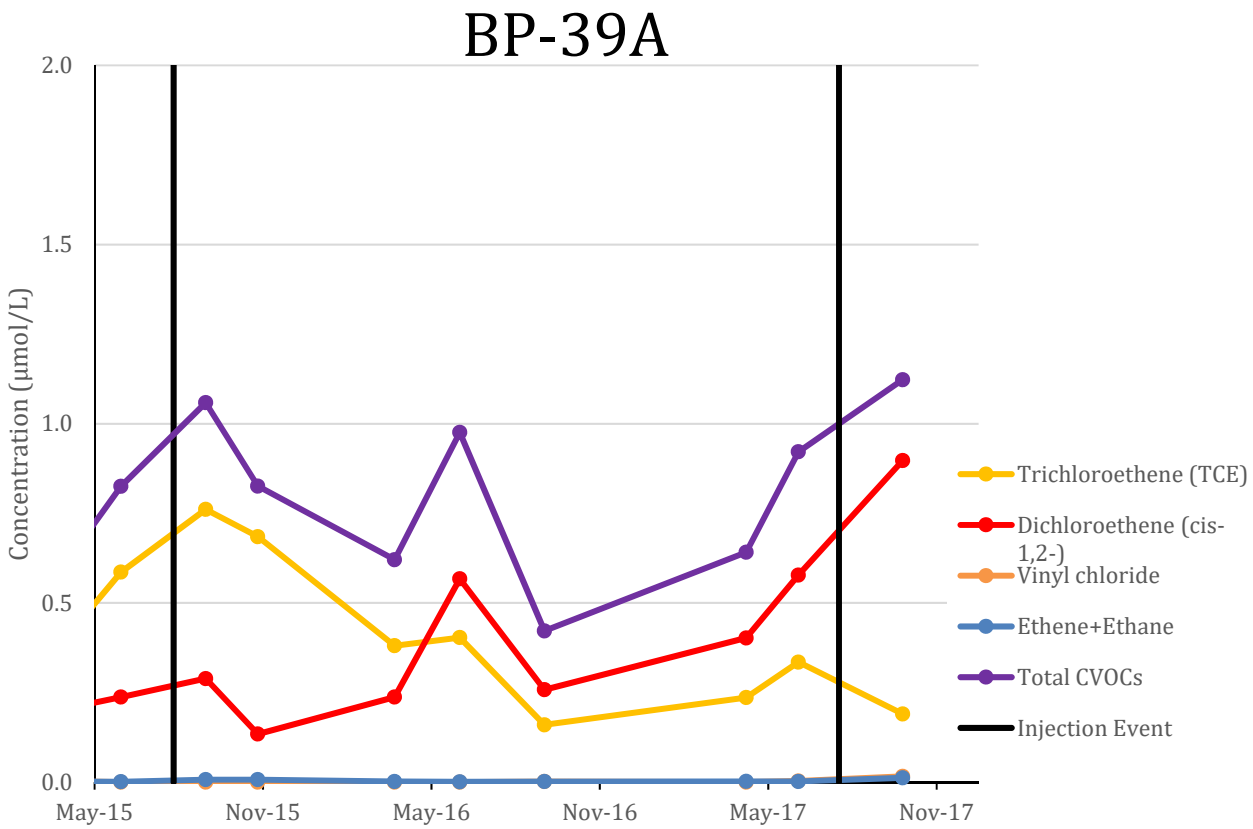

Exhibit 3.7 – Molar Concentrations of TCE and Breakdown Products for BP-39A

BP-39A is located about 80 feet south of the property boundary, or 150 feet downgradient of the B-series injection boreholes. The total CVOC concentration at BP-39A is about 1.5 orders of magnitude lower than BP-9A. cDCE became more prevalent than TCE on a molar basis in June 2016, for the first time since site-wide injections began. The recent increase in cDCE may reflect transport of this breakdown product from updgradient locations closer to the injection zone, such as BP-9A (see above). TCE represented about 80-90% of molar mass prior to the first B-series injection; the proportion of TCE has been generally declining since 2015. In October 2017, the data indicate breakdown products make up over 80% and TCE represents less than 20% of the molar mass.

The data for monitoring locations further downgradient to the south on the Binghamton Country Club property are depicted for key VOCs on Figure 6. The data continue to indicate water quality generally consistent with, or improved over, data from the previous two-year reporting period.

The overall findings of this review of data continue to suggest remediation progress is being made across the primary source rock at differing rates. Differences in transmissivity, groundwater flow conditions, and geochemical conditions likely account for the variability, but the net effect is that the proportion of TCE has decreased from 80-90% down to 50% to less than 1% of molar mass in groundwater samples collected across the Site. The resulting

decreases in mass discharge of TCE across the property boundary are discussed in Section 4.2.3, below.

4.0 SITE EVALUATION

4.1 Compliance with the Site Decision Document

The remedy was constructed and is being operated consistent with the site-specific Decision Document (SDD) issued by the NYSDEC Division of Remediation after the public comment period in December 2012[3].

The remedy was designed, constructed, and is being operated consistent with the description of the selected remedy, and it is meeting or exceeding the requirements of the NYSDEC Green Remediation Guidance DER-31 referenced in the SDD. The daily operation of the remedy requires only solar-powered monitoring instrumentation and no non-renewable energy. The daily operations do not involve mechanical equipment that produce greenhouse gas emissions, but rather relies on native in-situ microorganisms and plants, and the use of edible soybean oil as an electron donor amendment. The project has improved wildlife habitat and enhanced the natural landscape through planting and maintenance of trees.

The remedy ECs and ICs outlined in the SDD have been in place for about four years and have been maintained in accordance with the approved SMP. The soil cap cover has been established and maintained as an engineering control, limiting human and biotic exposure to a small area of metals-containing soils. The condition of the cap and phytoremediation components has been systematically reviewed during site-wide inspections and found to be consistent with their design.

As outlined in Section 4.2, the remedy components of EBD and phytoremediation, which along with the cap serve as an engineered remedy for migration control and source reduction, have shown to be effective at addressing TCE and related compounds.

Monitoring since the last PRR does not indicate any condition that would materially increase potential for human exposure. We have observed a reduced occurrence of seep and spring activity that historically brought VOC-containing water to the ground surface where direct human contact would have been possible. Access to the Site area where most of the source mass resides has largely been controlled by fencing and soil capping.

4.2 Operation and Effectiveness of the Remedy

The performance monitoring data indicate favorable remedy performance about 4 years into the implementation of the site-scale biochemical degradation component of the remedy. The data indicate progress consistent with expectations for a long-term remedy operation, as outlined in the Remedial Design and SMP. Spring and seep activity appears to have been substantially controlled on the former Burn Pit Site given that seepage has largely not been observed since completion of construction. It is acknowledged that seep and spring activity is

[3] New York State Department of Environmental Conservation, Division of Environmental Remediation, December 18, 2012, Decision Document, IBM Gun Club, Burn Pit, Brownfield Cleanup Program, Union, Broom County Site No C704044.

influenced by wet and dry weather cycles. As outlined below, after about 4 years, substantial progress has been made and maintained against the stated remedy goals as established for the short-term (less than 5 years). Sections 4.2.1 through 4.2.3 elaborate on each of the three short term remedy goals.

4.2.1 Establishment and Maintenance of Geochemical Conditions

As shown on Figure 4, and discussed in Section 3, geochemical conditions conducive to biochemical degradation by reductive dehalogenation have been established and maintained over the primary source rock under seasonal high and seasonal low groundwater level conditions. The more strongly reducing geochemical conditions have been observed to be contained largely within the primary source rock and have not propagated further downgradient.

Electron donor injection activities were conducted during the week of July 31, 2017. The effects of the 2017 injection were not yet apparent in the extent of the sulfate-reducing and methanogenic conditions observed during October sampling, conducted approximately 8 weeks after the injections. However, emplacement of oil emulsion into fractures is expected to reduce the effective water permeability, by physical displacement of water by oil droplets, limiting the volume available to transmit groundwater flow. Filling of the fracture pore space with biological mass could also be expected to lower the effective permeability, retarding the downgradient geochemical response. Therefore, more time may be needed for the effects of the recent injection to become more apparent.

4.2.2 Reduction in TCE Prevalence and Concentration

As shown in Figures 4 and 5, and discussed in Section 3, TCE continues to represent less than 50% of the chlorinated ethene mass found in most of groundwater samples within the primary source rock. The progress made toward reduction of TCE concentrations discussed in the last comprehensive evaluation (2015 PRR) have been largely maintained.

As shown in Exhibit 4.1, progress has been made toward a 2 order-of-magnitude reduction in TCE concentrations within the injection displacement zones since beginning the site-scale remedy, one of the measures of short-term (5-years) success identified in the SMP. This assessment is based on average 2017 TCE concentrations from performance monitoring within and near (<50 feet) the injection displacement zone in comparison to data recorded in March 2012 if available, or another reasonable pre-injection monitoring result as a baseline. While the overall number of wells exhibiting reductions in TCE is similar to what was reported in the last comprehensive evaluation, individual wells may be categorized somewhat differently. This is consistent with the variable transport and changing geochemical conditions expected for a decades-long remedy.

Order of Magnitude Reduction				
<½	½ to 1	1 to 1.5	1.5 to 2	>2
BP-4A BP-6A BP-34A BP-37A A-13	BP-9A	BP-2A BP-36A B-7	B-9 IB-7	B-4

Exhibit 4.1 Tabular Summary of Order of Magnitude (Oom) TCE Reductions in Monitoring Locations within or Near the Injection Displacement Zone

4.2.3 Reduction in Apparent Downgradient VOC Mass Discharge

Downgradient mass discharge estimates are derived from ongoing monitoring of three of the B-series injection boreholes. VOC concentrations from Boreholes B-4, B-7, and B-9 represent a range of transmissivity and make up about 75% of the mass discharge across the B-line to the south. A record of VOC mass discharge estimated from sampling of these three boreholes is shown in Exhibit 4.2 below.

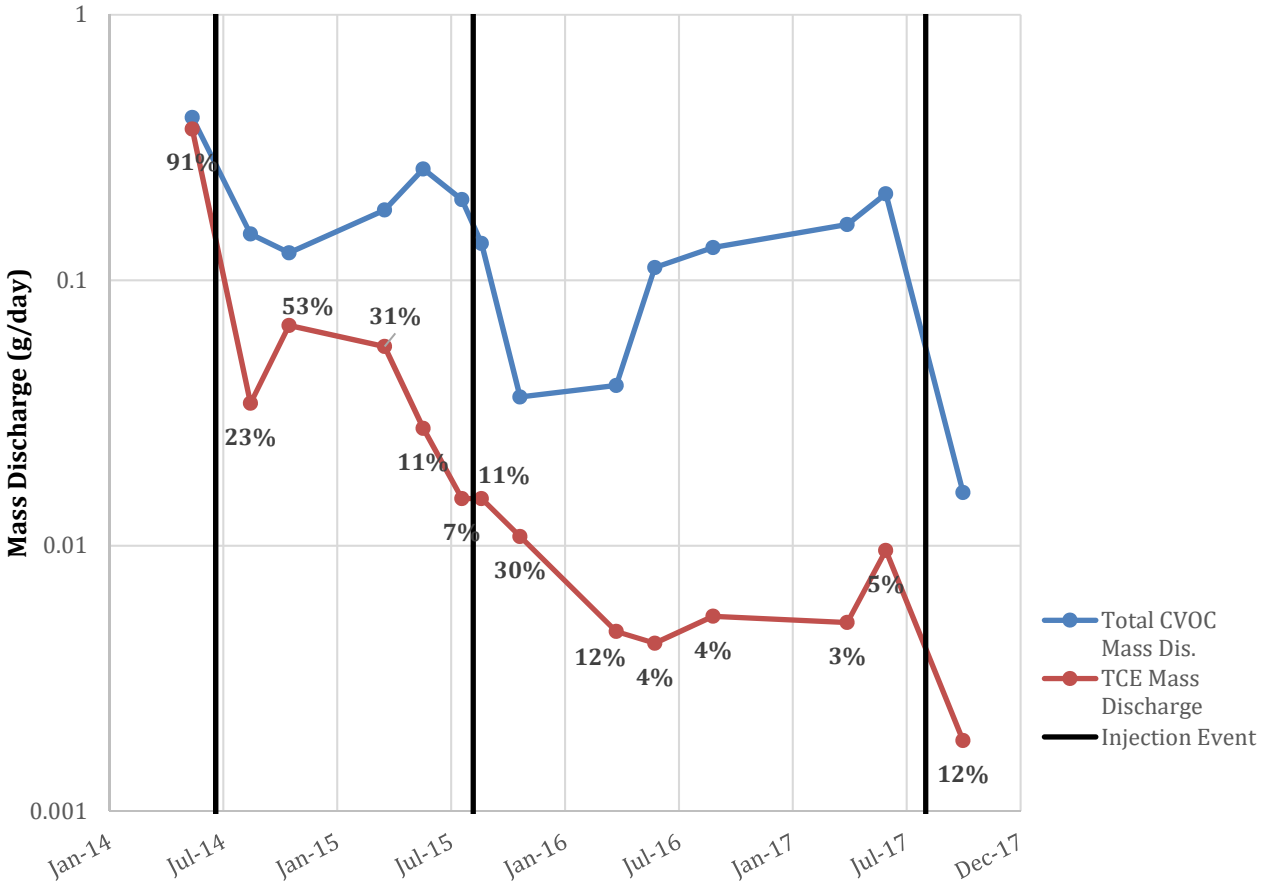

Exhibit 4.2 – Estimated VOC mass discharge in units of grams per day (g/day) based on monitoring data recorded for injection boreholes B-4, B-7, and B-9.

Data derived from sampling in the two years since the last comprehensive review indicate continued progressive reductions in both total CVOC and TCE mass discharge. Reductions from tenths of grams to hundredths of grams per day continue to be realized. The percent of CVOC mass discharge attributed to TCE is labeled in the graph. The percent of mass discharge attributed to TCE has ranged consistently below 30% since the 2015 injection, and 10% on average.

The VOC mass discharge estimates continue to support the presence of a biologically active zone perpendicular to groundwater flow at the B-line, which has largely cut off downgradient transport of VOC mass from the primary source rock. Gradual progressive reductions in TCE concentrations in wells further downgradient are starting to become apparent, as shown in Exhibit 4.3 below. Other wells further downgradient also exhibit decreasing TCE concentrations.

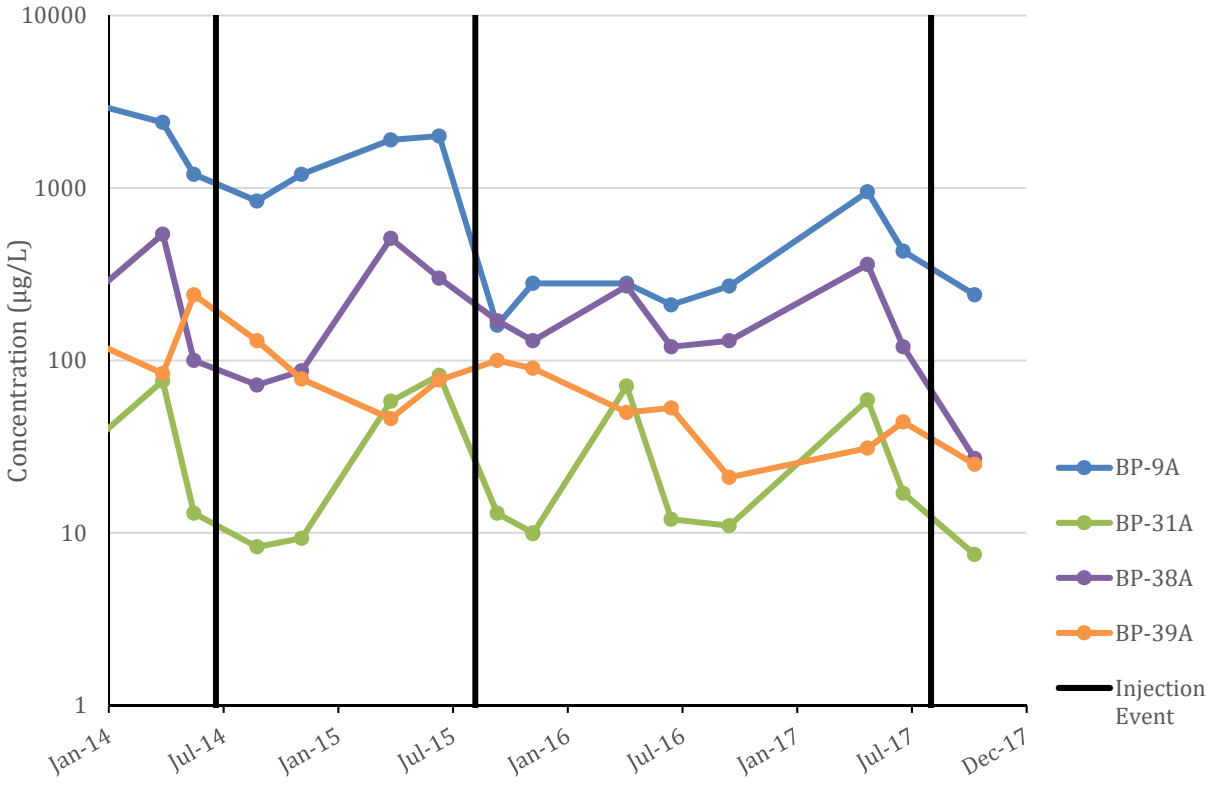

Exhibit 4.3 – TCE Concentrations Over Time in Four Downgradient Wells Located Proximate and South of the Property Boundary.

4.3 Evaluation of Possible Modifications to the Remedy and Performance Monitoring Program

The remedy operations, maintenance, monitoring, and reporting was conducted in accordance with the SMP of April 2016. The tracking and analysis of the performance monitoring results will be continued following the current scope of monitoring. The SMP also discussed possible modifications to the remedy that were considered as potential non-routine maintenance to address certain operational conditions that could be encountered (SMP Section 4.2.1.5). In

accordance with SMP Section 5.3 and the PRR General Guidance provided by NYSDEC, possible modifications to the remedy or remedy monitoring are summarized below.

As usual, injection frequency, volumes, and techniques will continue to be reviewed and adapted with the goal of continually enhancing performance. Major remedy modifications and monitoring actions that were detailed in the 2015 PRR do not appear necessary at this time, but are listed below for future consideration:

- Redevelopment and perhaps pressurized hydraulic fracturing of lower transmissivity boreholes to remove biological solids and enhance injection capacity to create a more permeable zone near these boreholes;
- Addition of injection points to further disperse amendment or specifically address higher concentration locations;
- Addition of another monitoring point north of the eastern leg of the A-line between BP-1A and BP-6A to provide additional water quality resolution north of the capped area;
- A small-scale injection near BP-2A of amendment with pH buffer solution could be conducted where low pH may be limiting reductive dehalogenation;
- Insulation of the injection borehole casing risers could be considered to limit winter heat loss by conduction up the metal casing and installing plastic mulches along the injection borehole array to raise subsurface temperatures; and
- Performance of longer term pumped sampling of the B-line of injection boreholes could provide a more robust estimate of downgradient VOC mass discharge potential.

Both borehole redevelopment and pumped mass discharge monitoring have significant downsides that would require containment of relatively large volumes of amendment- and VOC-laden fluid, removing amendment from the subsurface, and requiring off-site treatment and disposal. The above measures will be considered only if clearly needed, or at the time of a transition of the project to monitored natural attenuation in the case of pumped mass transfer sampling.

In addition to the above, alternate measures to evaluate phytoremediation effectiveness are planned. As discussed in Section 2.1, under the SMP, IBM had proposed to replant trees as needed to bring the tree cover up to 75% of the initial planting density, allowing for 25% mortality. However, the 25% threshold was arbitrary and may not be sustainable given the existence of conditions in certain planting areas that are not conducive to tree growth (e.g. shallow bedrock, encroachment of woody brush, poor infiltration in the capped area), and re-planting may lead to the same result. Potential alternatives to the 25% threshold as a measure of phytoremediation effectiveness are:

- Conduct coring and sampling of select trees to evaluate for TCE uptake from groundwater. The presence of TCE in tree core samples would be direct evidence of phytoremediation effectiveness. The drawback of this approach is that it may harm healthy trees. A feasibility assessment of tree core sampling will be conducted in 2018.

- Use the presence or absence of seeps and springs south of the capped area, particularly along the access road inside the southern fence line, as a measure of the effectiveness of the upgradient tree, brush, and grass cover to intercept/uptake VOC-containing groundwater that might otherwise break out at the ground surface. By this measure, the existing phytoremediation components have been effective in largely eliminating seeps and springs previously observed in this area.

- Modify the overall area subject to the 25% mortality threshold to focus on the sub-area that encompasses the former topographic depression that was subject to engineered filling as part of the remedy (Area 7 on the tree mortality inspection figure provided in Appendix B.1.2). This area also encompasses the primary VOC-containing groundwater transport pathway from the Burn Pit Area toward the south. As such, it is a significant area to achieve groundwater and VOC uptake by phytoremediation, thereby supporting the remedy goals of preventing off-site migration of VOCs and limiting formation of seeps and springs. This area has consistently been less than the tree mortality threshold of 25%, most recently 22% in September 2017.

- Modify the overall 25% mortality threshold to a level that is sustainable for actual Site conditions, recognizing that the 25% threshold was selected arbitrarily prior to remedy implementation and site experience. The most recent monitoring suggests that overall mortality may be leveling off at around 30%, but a sustainable threshold may not be apparent for several more growing seasons.

All the above alternatives will be considered, with progress reports provided as part of routine monitoring in 2018.

5.0 CONCLUSIONS

The operation of the former Burn Pit Site remedy in 2017 was conducted in compliance with the management requirements defined in the site-specific SMP. The remedy performance to date indicates notable progress toward the short-term goals and measures of success established in the SMP, including reduction in TCE concentrations in the injection zone, and no adverse accumulation or downgradient transport of toxic breakdown products. These observations support the overall goals of the remedy, including sustaining enhanced biochemical degradation of contaminants in the primary source rock, limiting contaminant mass transport (flux) out of the primary source rock, and enhancing biochemical degradation processes beyond and downgradient of the primary source rock.

The timing of amendment injections for enhanced biochemical degradation will continue to be driven by analysis of the monitoring data. In addition, alternate measures of phytoremediation effectiveness will be assessed. At this time, no additional modifications to the remedy are planned, but data and operations will continue to be analyzed for possible future improvements.

TABLES

Table 1
Summary of Events during the Certification Period
2017 Periodic Review Report
IBM Gun Club - Former Burn Pit Area
Union, New York

Event	Date	Type	Documentation Location
Spring 2017 Sampling	April 24-26, 2017	Performance Monitoring	Appendix C.1
Topsoil Sampling	April 26, 2017	Routine Maintenenace	Appendix B.2.1
Summer 2017 Sampling	June 19-21, 2017	Performance Monitoring	Appendix C.2
Grass Mowing	July 28, 2017	Routine Maintenenace	Appendix B.2.2
Injection	August 1-3, 2017	Routine Maintenenace	Appendix B.2.3
Site Wide Inspection	September 26, 2017	Site Inspection	Appendix B.1
Grass Mowing	October 5, 2017	Routine Maintenenace	Appendix B.2.2
Fall 2017 Sampling	October 10-12, 2017	Performance Monitoring	Appendix C.3
Vandalism/ Site Security Improvements	October 31, 2017	Non-Routine Maintenance	Appendix B.3

Notes:
1. This table outlines the work events that at the Site in 2017. Refer to the report text for further discussion.

Table 2
Location and Frequency of Detections of VOCs for the Reporting Period
2017 Periodic Review Report
IBM Gun Club - Former Burn Pit Area
Union, New York

Analyte	NY State Part 703 Standard (µg/L)	RI Site Contaminant?	Detected April 2016 - October 2017?	No. Locations Detected	No. Locations Exceeding Standard	No. Samples Exceeding Standard	Locations Exceeding Standard	Notes
Chlorinated Ethenes								
Trichloroethene (TCE)	5	Y	Y	43	26	115	A-13, B-4, B-7, B-9, BP-1A, BP-2A, BP-4A, BP-5A, BP-6A, BP-8A, BP-9A, BP-13A, BP-13D Port 1, BP-18A, BP-20A, BP-30A, BP-31A, BP-34A, BP-35A, BP-36A, BP-37A, BP-38A, BP-39A, GC-1 Port 1, GC-2A, IB-7	The principal compound at the site that has been historically detected in groundwater, surface water, soil, and rock core samples.
Dichloroethene (cis-1,2-)	5	Y	Y	36	21	97	A-13, B-4, B-7, B-9, BP-1A, BP-2A, BP-4A, BP-5A, BP-6A, BP-9A, BP-13D Port 1, BP-30A, BP-31A, BP-34A, BP-35A, BP-36A, BP-38A, BP-39A, GC-1 Port 1, GC-1 Port 8, IB-7	The primary breakdown product of TCE. It has frequently been historically detected in groundwater, surface water, soil, and rock core samples on site.
Vinyl chloride	2	Y	Y	21	17	68	A-13, B-4, B-7. B-9, BP-1A, BP-2A, BP-4A, BP-5A, BP-6A, BP-9A, BP-13D Port 1, BP-31A, BP-34A, BP-36A, GC-1 Port 1, GC-1 Port 8, IB-7	The primary breakdown product of cDCE and TCE. It has been historically detected in groundwater and rock core samples on site.
Dichloroethene (trans-1,2-)	5	Y	Y	19	9	40	A-13, B-9, BP-2A, B-4A, BP-6A, BP-9A, BP-34A, BP-35A, BP-36A	Breakdown product of TCA, TCE and may be an impurity in TCE. Detected at one surface water seep and in the groundwater at several locations on site, typically at trace concentrations, during the RI.
Dichloroethene (1,1-)	5	Y	Y	15	8	34	A-13, B-9, BP-2A, BP-6A, BP-9A, BP-34A, BP-35A, BP-36A	Breakdown product of TCE. Has been detected in groundwater samples collected in the vicinity of the former BPA.
Tetrachloroethene (PCE)	5	Y	Y	8	3	3	B-7. B-9, BP-34A	Analyzed for routinely, but was infrequently detected in groundwater, soil, and rock core samples during the RI.
Chlorinated Methanes								
Chloroform (Trichloromethane)	7	Y	Y	22	5	27	A-13, B-9, BP-6A, BP-34A, BP-36A	Historically detected in groundwater, surface water, and soil, and rock core samples collected at the site.
Carbon tetrachloride	5	Y	Y	13	1	1	GC-2A	Historically been detected in GC-1 and GC-2.
Methylene Chloride (Dichloromethane)	5	Y	Y	3	0	0	-	Detected in rock core samples from the uppermost 20 ft of bedrock, but has been infrequently detected in groundwater and surface water samples at the site. Common laboratory contaminant and known abiotic and biotic breakdown product of chloroform.
Chloromethane	5	Y	Y	1	0	0	-	Chloromethane has been infrequently been detected in groundwater samples. Chloromethane is a breakdown product of carbon tetrachloride, chloroform, and methylene chloride.
Chlorinated Ethanes								
Dichloroethane (1,2-)	0.6	Y	Y	21	14	57	B-4, BP-1A, BP-2A, BP-4A, BP-5A, BP-6A, BP-9A, BP-31A, BP-34A, BP-35A, BP-36A, BP-38A, GC-Port 1, GC-1 Port 8	Breakdown product of TCE. Has frequently been detected in groundwater samples collected in the vicinity of the former BPA.
Chloroethane	5	N	Y	9	0	0	-	Not a compound with a known historical presence at the site, but can be produced as a breakdown product of TCA. Infrequently detected at generally trace concentrations in groundwater
Trichloroethane (1,1,2-)	1	Y	Y	6	2	2	B-7, BP-6A	Detected in soils in the vicinity of the former burn pit area at levels below SCO guidelines during the RI. Historically infrequently detected in groundwater samples near the former BPA and sporadically detected in GC-1 and GC-2.
Trichloroethane (1,1,1-)	5	Y	Y	0	-	-	-	Detected infrequently at the site, in soil vapor within the vicinity of the former burn pit area and in one groundwater monitoring well during the RI.
Tetrachloroethane (1,1,2,2-)	5	N	N	0	-	-	-	It is not a compound with a known historical presence at the site. Analyzed for routinely, but not detected in groundwater samples collected at the site.
Dichloroethane (1,1-)	5	N	N	0	-	-	-	Breakdown product of TCA. Analyzed for routinely, but infrequently detected in two samples at concentrations below the groundwater standard.

Table 2
Location and Frequency of Detections of VOCs for the Reporting Period
2017 Periodic Review Report
IBM Gun Club - Former Burn Pit Area
Union, New York

Analyte	NY State Part 703 Standard (µg/L)	RI Site Contaminant?	Detected April 2016 - October 2017?	No. Locations Detected	No. Locations Exceeding Standard	No. Samples Exceeding Standard	Locations Exceeding Standard	Notes
Ketones								
Acetone	50	Y	Y	19	1	3	B-4	Historically detected in groundwater, surface water, rock matrix and soil samples. The compound is a frequent laboratory contaminant.
Butanone (2-) (MEK)	50	Y	Y	4	3	7	B-3, B-7, B-9	Detected at the site during the RI, but generally below the applicable groundwater standards and was detected in rock core samples from the uppermost 20 ft of bedrock.
Methyl-2-pentanone (4-) (MIBK)	N/A	Y	Y	1	-	-	-	Detected in rock core samples from the uppermost 15 ft of bedrock, and has also been detected in groundwater samples and multilevel system ports on the site during the RI.
Aromatic/Aliphatic Petroleum Hydrocarbons								
Toluene	5	Y	Y	23	5	20	A-13, BP-2A, BP-13D Port 5, BP-34A, IB-7	Detected in groundwater and rock core samples during the RI. Elevated toluene concentrations in groundwater associated with FLUTe™ liners has been reported at concentrations similar to what has been observed multilevel systems at the Gun Club.
Cyclohexane	N/A	N	Y	17	-	-	-	No known historical presence at the site. Infrequently detected at trace concentrations during the RI.
Benzene	1	Y	Y	13	5	22	BP-2A, BP-4A, BP-6A, BP-9A, BP-36A	Historically frequently detected in groundwater in the vicinity of the former BPA at concentrations exceeding the groundwater standard. Detected in rock core samples from the uppermost 15 ft of bedrock during the RI. Trace benzene concentrations (few tenths of a microgram per liter) frequently detected south to the property boundary.
Xylene (m,p-)	5	Y	Y	12	3	16	A-13, BP-2A, IB-7	Xylenes have been historically detected in groundwater and rock matrix samples.
Xylene (o-)	5	Y	Y	11	3	14	A-13, BP-2A, IB-7	Xylenes have been historically detected in groundwater and rock matrix samples.
Ethylbenzene	5	Y	Y	7	2	11	A-13, BP-2A	Ethylbenzene was detected in groundwater in the vicinity of the former burn pit and in rock core samples from the uppermost 10 ft of bedrock during the RI.
Methylcyclohexane	N/A	N	Y	8	-	-	-	Infrequently detected at trace levels in the direct vicinity of the former burn pit during the RI.
Isopropylbenzene (Cumene)	5	Y	Y	3	0	0	-	No known historical presence at the site. Infrequently detected at trace concentrations during the RI.
Chlorobenzene (Monochlorobenzene)	5	N	N	0	-	-	-	No known historical presence at the site. Infrequently detected at trace concentrations during the RI.
Styrene	5	N	N	0	-	-	-	It is not a compound with a known historical presence at the site. Analyzed for routinely, has never been detected at the site.
Chlorofluorocarbons								
Dichlorodifluoromethane (CFC12)	5	N	N	0	-	-	-	It is not a compound with a known historical presence at the site. Analyzed for routinely, has never been detected in groundwater at the site.
Ethane, 1,1,2-trichloro-1,2,2-trifluoro- (CFC113)	5	N	N	0	-	-	-	It is not a compound with a known historical presence at the site. Analyzed for routinely, has never been detected in groundwater at the site.
Ethane, 1,2-dichloro-1,1,2-trifluoro- (CFC123a)	N/A	N	N	0	-	-	-	It is not a compound with a known historical presence at the site. Analyzed for routinely, has never been detected in groundwater at the site.
Trichlorofluoromethane	5	N	N	0	-	-	-	It is not a compound with a known historical presence at the site. Analyzed for routinely, has never been detected in groundwater at the site.

Table 2
Location and Frequency of Detections of VOCs for the Reporting Period
2017 Periodic Review Report
IBM Gun Club - Former Burn Pit Area
Union, New York

Analyte	NY State Part 703 Standard (µg/L)	RI Site Contaminant?	Detected April 2016 - October 2017?	No. Locations Detected	No. Locations Exceeding Standard	No. Samples Exceeding Standard	Locations Exceeding Standard	Notes
Other VOCs								
Hexanone (2-)	50	N	Y	1	0	0	-	It is not a compound with a known historical presence at the site. Analyzed for routinely, had never been detected in groundwater at the site previously.
Bromodichloromethane	50	N	N	0	-	-	-	It is not a contaminant with a known historical presence at the site. It is a disinfection by-product commonly produced during the chlorination of municipal water supplies, detected infrequently during the RI.
Bromoform	50	N	N	0	-	-	-	It is not a contaminant with a known historical presence at the site. It is a disinfection by-product commonly produced during the chlorination of municipal water supplies, detected infrequently during the RI.
Bromomethane	5	N	N	0	-	-	-	It is not a compound with a known historical presence at the site. Analyzed for routinely, has never been detected in groundwater at the site.
Carbon disulfide	60	N	N	0	-	-	-	Not a compound with a known historical presence at the site. It was detected at trace concentrations in groundwater and rock core samples near the former BPA during the RI.
Dibromo-3-chloropropane (1,2-)	0.04	N	N	0	-	-	-	It is not a compound with a known historical presence at the site. Analyzed for routinely, has never been detected in groundwater at the site.
Dibromochloromethane	50	N	N	0	-	-	-	It is not a contaminant with a known historical presence at the site. It is a disinfection by-product commonly produced during the chlorination of municipal water supplies, detected infrequently during the RI.
Dibromoethane (1,2-)	0.0006	N	N	0	-	-	-	It is not a compound with a known historical presence at the site. Analyzed for routinely, has never been detected in groundwater at the site.
Dichlorobenzene (1,2-)	3	N	N	0	-	-	-	SVOC infrequently detected and below standard during the RI.
Dichlorobenzene (1,3-)	3	N	N	0	-	-	-	SVOC infrequently detected and below standard during the RI.
Dichlorobenzene (1,4-)	3	N	N	0	-	-	-	SVOC infrequently detected and below standard during the RI.
Dichloropropane (1,2-)	1	N	N	0	-	-	-	No known historical presence at the site. Infrequently detected at trace concentrations during the RI.
Dichloropropene (cis-1,3-)	0.4	N	N	0	-	-	-	It is not a compound with a known historical presence at the site. Analyzed for routinely, has never been detected in groundwater at the site.
Dichloropropene (trans-1,3-)	0.4	N	N	0	-	-	-	It is not a compound with a known historical presence at the site. Analyzed for routinely, has never been detected in groundwater at the site.
Methyl Acetate	N/A	N	N	0	-	-	-	Detected in rock core samples from the uppermost 30 ft of bedrock, but has only been infrequently detected at trace levels in groundwater samples collected in the vicinity of the former BPA during the RI.
Methyl-tert Butyl Ether (MTBE)	N/A	N	N	0	-	-	-	It is not a compound with a known historical presence at the site. Analyzed for routinely, has never been detected in groundwater at the site.
Trichlorobenzene (1,2,4-)	10	N	N	0	-	-	-	SVOC infrequently detected and below standard during the RI.

Notes:

1. The table summarizes frequency and location of detections in groundwater of a comprehensive list of volatile organic compounds (VOCs) during the reporting period, from April 2016 through October 2017. The detected compounds are compared to the New York State Part 703 Water Quality Standards and the relative presence of the compound during the remedial investigation (RI). Summary does not include non-detects with reporting limits that exceed the standards.

2. NY State Standards are established by 6 NYCRR, Part 703 - Surface Water and Groundwater Quality Standards. N/A indicates no MCL has been established for this compound.

3. RI Site Contaminant was determined during the RI based on a reivew of pre-2008 data. A "Yes" indicates that the RI inevetigation found evidence of elevated concentrations. Refer to Table 2 of the Remedial Investigation Report for more details.

4. Refer to the Periodic Review Report for further discussion.

Table 3
Summary of Water Quality Data - Chlorinated Ethenes in Groundwater
2017 Periodic Review Report
IBM Gun Club -Former Burn Pit Area
Union, New York

Analyte		Tetrachloroethene										
NY State Groundwater Standards (µg/L)		**5**										
Well Name	Number of Samples Collected Pre-2010	Baseline (Pre-2010)					Apr '16	Jun '16	Sep '16	Apr '17	Jun '17	Oct '17
		Detects	Min.	Median	Max.	Mean	Conc. (S/FD)	Conc. (S/FD)	Conc. (S/FD)	Conc. (S/FD)	Conc. (S/FD)	Conc. (S/FD)
A-13	NA	Not Installed					<100	<100	<100	<50	<100	<50
B-4	NA	Not Installed					<5.0	<5.0	<5.0	<0.5	<5.0	<5.0
B-7	NA	Not Installed					<25	14 J	<25	<25	<25	<100
B-9	NA	Not Installed					<25	19 J	<25	<25	<25	<50
BP-1A	9	0	<0.5	--	<1	--	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BP-2A	12	1	<5	<38	50	<34	<25	<25	<25	<10	<25	<25
BP-4A	9	2	<0.1	<2.5	2.5	<1.6	<2.5/0.1 J	1.3 J	<2.5/<2.5	0.1 J/0.1 J	0.1 J	<1.0/<1.0
BP-5A	7	0	<0.5	--	<0.5	--	<0.5	<0.5	<0.5	<2.5	<0.5	<2.5
BP-6A	0	<25					<25	<100	<100	<250	<250	<250
BP-7A	10	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-8A	7	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-9A	9	0	<5	--	<50	--	<25	<25	<25	<5.0	<5.0	<50
BP-10A	10	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-11A	15	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-12A	10	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-12D-P1	12	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-12D-P7	10	0	<0.5	--	<1	--		<0.5			<0.5	
BP-13A	8	0	<0.5	--	<2.5	--	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BP-13D-P1	5	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-13D-P5	10	0	<0.5	--	<1	--		<0.5			<0.5	
BP-14A	4	0	<0.5	--	<0.5	--					<0.5	
BP-14D-P1	9	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-14D-P5	11	0	<0.5	--	<1	--		<0.5			<0.5	
BP-15D-P5	10	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-16A	7	0	<0.5	--	<0.5	--					<0.5	
BP-17A	12	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-18A	8	0	<0.5	--	<0.5	--		<0.5/<0.5			<0.5/<0.5	
BP-19A	6	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-20A	6	2	<0.1	<0.5	0.5	<0.4		0.2 J			<0.5	
BP-21A	6	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-22A	4	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-23A	6	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-24A	6	0	<0.5	--	<0.5	--		<0.5/<0.5			<0.5/<0.5	
BP-25A	6	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-26A	6	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-27A	5	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-30A	6	6	0.5	5.1	6.4	4		2.2			1.1	
BP-31A	8	3	<0.1	<0.5	2.2	<0.9	3.6/3.4	0.8/0.8	0.6	3.3/3.0	0.9/0.8	0.6
BP-32A	0	Not Installed						<0.5			<0.5	
BP-34A	0	<250					<250	50 J	<250	<250	<250	<250
BP-35A	0	<25					<25	<25/32 J	<25	<25	<25/<25	<25
BP-36A	0	<25					<50	<50/82	<50/<50	<10	<25/<25	<25/<10
BP-37A	0	<0.5					<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BP-38A	0	<0.5					0.2 J	0.1 J	<0.5/<1.0	0.3 J	0.1 J	<0.5
BP-39A	0	<0.5					<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
GC-1-P1	NA	--	--	--	--	--		<0.5			<0.5	
GC-1-P8	11	0	<0.5	--	<1	--		<0.5			<0.5	
IB7	0	<2.5/<2.5					<5.0	<5.0	<5.0	<0.5	<0.5	<50

Table 3
Summary of Water Quality Data - Chlorinated Ethenes in Groundwater
2017 Periodic Review Report
IBM Gun Club -Former Burn Pit Area
Union, New York

Analyte		Trichloroethene									
NY State Groundwater Standards (µg/L)		**5**									
Well Name	Number of Samples Collected Pre-2010	Baseline (Pre-2010)					Apr '16	Jun '16	Sep '16	Apr '17	Jun '17	Oct '17
		Detects	Min.	Median	Max.	Mean	Conc. (S/FD)	Conc. (S/FD)	Conc. (S/FD)	Conc. (S/FD)	Conc. (S/FD)	Conc. (S/FD)
A-13	NA	Not Installed					<100	45 J	<100	79	300	12 J
B-4	NA	Not Installed					26	4.7 J	5.3	0.5	<5.0	4.6 J
B-7	NA	Not Installed					55	55	64	77	170	70 J
B-9	NA	Not Installed					59	78	100	99	180	<50
BP-1A	9	9	7.9	83	210	98	140	170	65	150	150	140
BP-2A	12	12	330	1,000	2,400	1,100	130	98	24 J	110	70	11 J
BP-4A	9	9	100	210	330	230	210/190	200	290/300	280/270	250	320/270
BP-5A	7	7	2	5.3	23	7.2	30	22	32	25	25	19
BP-6A	0	4,900					4,800	15,000	4,600	44,000	21,000	1,800
BP-7A	10	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-8A	7	7	1.1	10	18	9.7		16			19	
BP-9A	9	9	890	2,800	7,000	2,800	280	210	270	950	430	240
BP-10A	10	10	0.1	1.8	4	1.9		2.3			1.5	
BP-11A	15	11	<0.5	<1.4	3.6	<1.6		2.6			2.7	
BP-12A	10	10	1.9	3.7	8.6	4.6		2.4			2.4	
BP-12D-P1	12	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-12D-P7	10	0	<0.5	--	<1	--		<0.5			<0.5	
BP-13A	8	8	46	120	140	110	31	95	54	16	48	55
BP-13D-P1	5	5	17	89	130	89		54			57	
BP-13D-P5	10	9	0.5	<1.8	7.6	<1.9		0.3 J			0.4 J	
BP-14A	4	4	0.3	0.3	0.3	0.3					0.4 J	
BP-14D-P1	9	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-14D-P5	11	0	<0.5	--	<1	--		<0.5			<0.5	
BP-15D-P5	10	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-16A	7	0	<0.5	--	<0.5	--					<0.5	
BP-17A	12	12	0.4	1	6.9	1.6		1.0			1.4	
BP-18A	8	8	9.3	13	19	13		10/11			11/11	
BP-19A	6	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-20A	6	6	2.3	9.2	14	8.8		10			1.7	
BP-21A	6	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-22A	4	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-23A	6	0	<0.5	--	<0.5	--		2.5			1.2	
BP-24A	6	6	0.2	1.6	1.9	1.2		1.6/1.7			1.5/1.4	
BP-25A	6	6	1.1	2.7	3.9	2.6		0.8			0.7	
BP-26A	6	6	0.2	0.6	0.8	0.6		0.7			0.7	
BP-27A	5	5	12	14	20	15		3.3			3.6	
BP-30A	6	6	8.6	48	64	41		42			14	
BP-31A	8	8	0.3	2.4	38	11	71/70	12/11	11	58/59	17/17	7.5
BP-32A	0	Not Installed						0.6			0.5 J	
BP-34A	0	32,000					30,000	33,000	23,000	43,000	41,000	40,000
BP-35A	0	2,400					3,900	3,600/4,000	3,900	3,700	4,400/4,300	4,900
BP-36A	0	9,600					180	180/170	170/210	1,100	53/44	170/710
BP-37A	0	23					11	10	14	11	13	24
BP-38A	0	67					270	120	130/110	360	120	27
BP-39A	0	150					50	53	21	31	44	25
GC-1-P1	NA	--	--	--	--	--		8.5			12	
GC-1-P8	11	11	0.2	0.4	6.7	0.4		0.2 J			0.2 J	
IB7	0	750/760					<5.0	<5.0	<5.0	0.7	0.5	42 J

Table 3
Summary of Water Quality Data - Chlorinated Ethenes in Groundwater
2017 Periodic Review Report
IBM Gun Club -Former Burn Pit Area
Union, New York

Analyte		Dichloroethene (cis-1,2-)										
NY State Groundwater Standards (µg/L)		**5**										
Well Name	Number of Samples Collected Pre-2010	Baseline (Pre-2010)					Apr '16	Jun '16	Sep '16	Apr '17	Jun '17	Oct '17
		Detects	Min.	Median	Max.	Mean	Conc. (S/FD)	Conc. (S/FD)	Conc. (S/FD)	Conc. (S/FD)	Conc. (S/FD)	Conc. (S/FD)
A-13	NA	Not Installed					9400	8,800	8,700	22,000	34,000	13,000
B-4	NA	Not Installed					100	140	100	2.2	2.1 J	17
B-7	NA	Not Installed					230	240	310	490	560	450
B-9	NA	Not Installed					510	1900	2400	3,000	3800	220
BP-1A	9	9	6.4	30	91	42	130	130	100	130	150	140
BP-2A	12	12	1,800	5,500	13,000	6,000	3,800	4200	5,300	3,700	5,600	5,000
BP-4A	9	9	4.9	6.1	42	11	26/26	47	87/78	77/71	62	130/110
BP-5A	7	7	1.5	2.2	8.4	2.9	41	21	22	34	40	19
BP-6A	0	180					8,500	6,100	18,000	16,000	30,000	37,000
BP-7A	10	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-8A	7	5	<0.1	<0.3	0.6	<0.3		1.3			3.6	
BP-9A	9	9	64	170	390	190	2,100	1,400	2,400	1,900	1200	4,100
BP-10A	10	4	<0.1	<0.5	0.5	<0.4		0.3 J			0.5 J	
BP-11A	15	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-12A	10	9	<0.1	<0.25	0.5	<0.3		0.2 J			0.3 J	
BP-12D-P1	12	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-12D-P7	10	0	<0.5	--	<1	--		<0.5			<0.5	
BP-13A	8	8	2	5.5	14	6.2	1.1	3.7	2	0.4 J	1.6	2.2
BP-13D-P1	5	5	5.2	23	26	23		21			36	
BP-13D-P5	10	9	0.6	<1.1	2.8	<1.1		1.5			1.5	
BP-14A	4	0	<0.5	--	<0.5	--					<0.5	
BP-14D-P1	9	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-14D-P5	11	0	<0.5	--	<1	--		<0.5			<0.5	
BP-15D-P5	10	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-16A	7	0	<0.5	--	<0.5	--					<0.5	
BP-17A	12	7	<0.1	<0.4	0.5	<0.3		<0.5			0.2 J	
BP-18A	8	7	<0.1	<0.2	0.5	<0.2		0.3 J / 0.4 J			0.3 J / 0.3 J	
BP-19A	6	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-20A	6	0	<0.5	--	<0.5	--		0.2 J			<0.5	
BP-21A	6	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-22A	4	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-23A	6	0	<0.5	--	<0.5	--		0.2 J			0.1 J	
BP-24A	6	6	0.1	0.4	0.4	0.3		0.5/0.6			0.5/0.5 J	
BP-25A	6	4	<0.1	<0.3	0.5	<0.3		<0.5			<0.5	
BP-26A	6	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-27A	5	5	2.4	3.3	3.9	3.2		1.1			1.9	
BP-30A	6	6	0.2	1.7	2.5	1.5		17			4.5	
BP-31A	8	2	<0.5	<0.5	1.4	<0.7	23/22	1.4/1.3	1.3	8.8/9.1	4.9/4.6	1.1
BP-32A	0	Not Installed						<0.5			<0.5	
BP-34A	0	19,000					28,000	36,000	16,000	54,000	48,000	49,000
BP-35A	0	830					5,400	5,000/5,700	5,100	5,900	6,300/6,000	6,200
BP-36A	0	230					10,000	9,100/9,100	7,100/7,500	7,000	7,700/7,200	1,400/2,000
BP-37A	0	1.2					0.9	1.1	0.7	1.0	1.0	1.2
BP-38A	0	9.4					43	23	16/15	66	31	14
BP-39A	0	20					23	55	25	39	56	87
GC-1-P1	NA	--	--	--	--	--		23			29	
GC-1-P8	11	11	1.5	16	23	17		22			1.6	
IB7	0	250/250					1.6 J	1.2 J	2.4 J	1.8	1.6	530

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Analyte		Dichloroethene (trans-1,2-)									
NY State Groundwater Standards (µg/L)		**5**									
Well Name	Number of Samples Collected Pre-2010	Baseline (Pre-2010)					Apr '16	Jun '16	Sep '16	Apr '17	Jun '17	Oct '17
		Detects	Min.	Median	Max.	Mean	Conc. (S/FD)	Conc. (S/FD)	Conc. (S/FD)	Conc. (S/FD)	Conc. (S/FD)	Conc. (S/FD)
A-13	NA	Not Installed					<100	24 J	22 J	41 J	75 J	30 J
B-4	NA	Not Installed					<5.0	1.0 J	<5.0	1.6	1.1 J	<5.0
B-7	NA	Not Installed					<25	<25	<25	<25	<25	<100
B-9	NA	Not Installed					<25	<25	<25	5.4 J	9.0 J	<50
BP-1A	9	8	<0.5	<0.7	3.7	<1.5	1.9	1.5	1.0	1.6	2.2	1.3
BP-2A	12	10	<2.6	<17	66	<27	8.0 J	17 J	9.8 J	9.6 J	15 J	15 J
BP-4A	9	2	<0.1	<2.5	2.5	<1.6	0.7 J/1.0	1.5 J	3.7/2.1 J	2.7/3.2	2	6.3/6.4
BP-5A	7	1	<0.2	<0.5	0.5	<0.5	0.9	0.5	0.5	0.6 J	0.6	<2.5
BP-6A	0	<25					30	<100	29 J	57 J	<250	66 J
BP-7A	10	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-8A	7	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-9A	9	1	<3.1	<25	50	<21*	8.5 J	10 J	11 J	10	7	27 J
BP-10A	10	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-11A	15	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-12A	10	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-12D-P1	12	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-12D-P7	10	0	<0.5	--	<1	--		<0.5			<0.5	
BP-13A	8	5	<0.1	<0.2	2.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BP-13D-P1	5	4	<0.1	0.2	0.5	0.2		0.2 J			0.3 J	
BP-13D-P5	10	0	<0.5	--	<1	--		<0.5			<0.5	
BP-14A	4	0	<0.5	--	<0.5	--					<0.5	
BP-14D-P1	9	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-14D-P5	11	0	<0.5	--	<1	--		<0.5			<0.5	
BP-15D-P5	10	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-16A	7	0	<0.5	--	<0.5	--					<0.5	
BP-17A	12	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-18A	8	0	<0.5	--	<0.5	--		<0.5/<0.5			<0.5/<0.5	
BP-19A	6	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-20A	6	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-21A	6	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-22A	4	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-23A	6	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-24A	6	0	<0.5	--	<0.5	--		<0.5/<0.5			<0.5/<0.5	
BP-25A	6	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-26A	6	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-27A	5	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-30A	6	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-31A	8	0	<0.5	--	<0.5	--	0.1 J/0.1 J	<0.5/<0.5	<0.5	<0.5/<0.5	<0.5/<0.5	<0.5
BP-32A	0	Not Installed						<0.5			<0.5	
BP-34A	0	120 J					<250	52 J	<250	77 J	72 J	110 J
BP-35A	0	<25					7.1 J	13 J/<50	38	6.5 J	8.3 J/7.9 J	17 J
BP-36A	0	<25					31 J	14 J / 12J	15 J/19 J	24	15 J/22 J	9.6 J/12
BP-37A	0	<0.5					<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BP-38A	0	0.1 J					0.3 J	0.1 J	<0.5/<1.0	0.3 J	0.1 J	<0.5
BP-39A	0	0.1 J					0.1 J	0.3 J	0.1 J	0.1 J	0.2 J	0.5 J
GC-1-P1	NA	--	--	--	--	--		<0.5			0.1 J	
GC-1-P8	11	9	<0.1	0.2	0.5	0.3		0.2 J			0.2 J	
IB7	0	9.7/9.6					<5.0	<5.0	<5.0	0.1 J	0.2 J	<50

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Analyte		Dichloroethene (1,1-)									
NY State Groundwater Standards (µg/L)		**5**									
Well Name	Number of Samples Collected Pre-2010	Baseline (Pre-2010)					Apr '16	Jun '16	Sep '16	Apr '17	Jun '17	Oct '17
		Detects	Min.	Median	Max.	Mean	Conc. (S/FD)	Conc. (S/FD)	Conc. (S/FD)	Conc. (S/FD)	Conc. (S/FD)	Conc. (S/FD)
A-13	NA	Not Installed					<100	<100	<100	47 J	65 J	16 J
B-4	NA	Not Installed					<5.0	<5.0	<5.0	<0.5	<5.0	<5.0
B-7	NA	Not Installed					<25	<25	<25	<25	<25	<100
B-9	NA	Not Installed					<25	<25	<25	<25	6.2 J	<50
BP-1A	9	8	<0.2	<0.2	0.7	<0.4	0.8	0.7	0.4 J	0.9	0.9	0.5
BP-2A	12	11	<2.7	<14	32	<16	6.0 J	7.9 J	7.3 J	6.2 J	9.4 J	<25
BP-4A	9	7	<0.4	<0.7	2.5	<1.2	<2.5/0.5	0.5 J	0.8 J/0.9 J	0.8/0.9	0.8	1.1/0.9J
BP-5A	7	0	<0.5	--	<0.5	--	<0.5	<0.5	<0.5	<2.5	<0.5	<2.5
BP-6A	0	<25					22 J	<100	45 J	<250	75 J	57 J
BP-7A	10	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-8A	7	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-9A	9	4	<2.4	<10	50	<17	7.0 J	5.1 J	7.1 J	6.5	4.7 J	11 J
BP-10A	10	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-11A	15	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-12A	10	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-12D-P1	12	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-12D-P7	10	0	<0.5	--	<1	--		<0.5			<0.5	
BP-13A	8	7	<0.1	<0.3	2.5	<0.5	<0.5	0.2 J	<0.5	<0.5	<0.5	<0.5
BP-13D-P1	5	5	0.2	0.5	0.6	0.5		0.4 J			0.5	
BP-13D-P5	10	0	<0.5	--	<1	--		<0.5			<0.5	
BP-14A	4	0	<0.5	--	<0.5	--					<0.5	
BP-14D-P1	9	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-14D-P5	11	0	<0.5	--	<1	--		<0.5			<0.5	
BP-15D-P5	10	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-16A	7	0	<0.5	--	<0.5	--					<0.5	
BP-17A	12	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-18A	8	0	<0.5	--	<0.5	--		<0.5/<0.5			<0.5/<0.5	
BP-19A	6	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-20A	6	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-21A	6	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-22A	4	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-23A	6	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-24A	6	0	<0.5	--	<0.5	--		<0.5/<0.5			<0.5/<0.5	
BP-25A	6	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-26A	6	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-27A	5	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-30A	6	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-31A	8	0	<0.5	--	<0.5	--	0.1 J/0.1 J	<0.5/<0.5	<0.5	<0.5/<0.5	<0.5/<0.5	<0.5
BP-32A	0	Not Installed						<0.5			<0.5	
BP-34A	0	<250					81 J	51 J	<250	130 J	130 J	120 J
BP-35A	0	<25					6.4 J	6.2 J/<50	5.2 J	7.7 J	6.4 J/6.6 J	7.8 J
BP-36A	0	9.0 J					15 J	19 J/19 J	10 J/ 14 J	16	14 J/ 13 J	<25/4.1 J
BP-37A	0	<0.5					<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BP-38A	0	<0.5					0.4 J	0.2 J	0.1 J/<1.0	0.6	0.2 J	<0.5
BP-39A	0	0.2 J					<0.5	0.1 J	<0.5	<0.5	0.2 J	0.2 J
GC-1-P1	NA	--	--	--	--	--		<0.5			<0.5	
GC-1-P8	11	0	<0.5	--	<1	--		<0.5			<0.5	
IB7	0	0.6 J/0.6 J					<5.0	<5.0	<5.0	<0.5	<0.5	<50

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Analyte		Vinyl Chloride										
NY State Groundwater Standards (µg/L)		**2**										
Well Name	Number of Samples Collected Pre-2010	Baseline (Pre-2010)					Apr '16	Jun '16	Sep '16	Apr '17	Jun '17	Oct '17
		Detects	Min.	Median	Max.	Mean	Conc. (S/FD)	Conc. (S/FD)	Conc. (S/FD)	Conc. (S/FD)	Conc. (S/FD)	Conc. (S/FD)
A-13	NA	Not Installed					2,500	2,700	2,900	2,700	2,300	1,800
B-4	NA	Not Installed					27	19	4.8 J	2.1	1.2 J	3.3 J
B-7	NA	Not Installed					88	71	67	89	96	76 J
B-9	NA	Not Installed					29	90	100	230	360	15 J
BP-1A	9	9	0.3	6.2	41	14	31	4.3	0.2 J	28	21	0.5 J
BP-2A	12	11	<25	<910	1,700	<920	1,200	980	1,800	1,000	1,800	2,000
BP-4A	9	8	<0.8	<2.5	17	<5.3	8/10	13	34/29	27/24	21	37/25
BP-5A	7	3	<0.3	<0.5	2.3	<0.7	4.9	0.2 J	0.3 J	11	0.6	<2.5
BP-6A	0	47					190	<100	64 J	<250	260	2,000
BP-7A	10	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-8A	7	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-9A	9	5	<5	<10	30	<14	190	85	190	360	190	390
BP-10A	10	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-11A	15	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-12A	10	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-12D-P1	12	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-12D-P7	10	0	<0.5	--	<1	--		<0.5			<0.5	
BP-13A	8	1	<0.2	<0.5	2.5	<0.7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BP-13D-P1	5	4	<0.5	<2	3	<2		1.0			4.7	
BP-13D-P5	10	6	<0.1	<0.2	1	<0.3		0.2 J			0.3 J	
BP-14A	4	0	<0.5	--	<0.5	--					<0.5	
BP-14D-P1	9	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-14D-P5	11	0	<0.5	--	<1	--		<0.5			<0.5	
BP-15D-P5	10	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-16A	7	0	<0.5	--	<0.5	--					<0.5	
BP-17A	12	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-18A	8	0	<0.5	--	<0.5	--		<0.5/<0.5			<0.5/<0.5	
BP-19A	6	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-20A	6	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-21A	6	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-22A	4	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-23A	6	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-24A	6	0	<0.5	--	<0.5	--		<0.5/<0.5			<0.5/<0.5	
BP-25A	6	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-26A	6	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-27A	5	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-30A	6	0	<0.5	--	<0.5	--		<0.5			<0.5	
BP-31A	8	0	<0.5	--	<0.5	--	4.0/4.0	<0.5/<0.5	<0.5	0.2 J/0.1 J	0.2 J/0.2 J	<0.5
BP-32A	0	Not Installed						<0.5			<0.5	
BP-34A	0	400					210 J	100 J	<250	1,400	1,400	1,300
BP-35A	0	19 J					<25	<25/<50	<25	<25	<25/<25	<25
BP-36A	0	21 J					170	390/400	870/900	790	1,600/1,500	630/730
BP-37A	0	0.1 J					<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BP-38A	0	0.9					0.3 J	<0.5	<0.5/<1.0	0.1 J	<0.5	<0.5
BP-39A	0	<0.5					<0.5	<0.5	0.1 J	<0.5	0.2 J	1.0
GC-1-P1	NA	--	--	--	--	--		3.1			6.1	
GC-1-P8	11	1	<0.1	<0.5	1	<0.4		5.6			1.0	
IB7	0	23/23					<5.0	<5.0	<5.0	<0.5	0.2 J	51

Table 3
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Notes:
1. The table summarizes groundwater chlorinated ethene concentrations in micrograms per liter (µg/L) for the principal site contaminants prior to 2010 (baseline period) and during the last two years of monitoring. Pre-2010 data were collected during the remedial investigation. Locations BP-6A, BP-34A through BP-40A, and IB-4 and IB-7 were all installed shortly before injections; therefore, baseline (Pre-2010) data reflect grab samples collected in May 2010, prior to the June 15 injection. All other data are from sampling conducted on the dates noted in the table.

2. For monitoring locations where an analyte was detected during one sample event or more during the baseline (pre-2010) period, the number of detects, minimum, median, maximum, and arithmetic mean concentrations were calculated using the detection limit as a value during sample events where the compound was not detected. If no detections are listed, the minimum and maximum concentrations represent the minimum and maximum detection limits observed for the compound at that particular monitoring location.

3. Gray shaded cells indicate concentrations above NY State Groundwater Standard Maximum Contaminant Levels (MCLs), as established in Part 703, Surface Water and Groundwater Quality Standards. Based on past sampling and position relative to nearby monitoring locations and the primary source rock, analytes exhibiting elevated reporting limits were also shaded gray if the concentrations likely exceeded MCLs. Blank cells indicate that location was not sampled during the sampling event indicated.

'--' Indicates the median and mean values were not calculated because all samples were reported as below analytical detection limits.
"<" indicates that the laboratory data or calculated value includes one or more samples where analyte was below analytical detection limits.
"J" indicates that the laboratory data was below the lowest quantifiable limit and therefore estimated.
"E" indicates that the result is outside the laboratory calibration range and estimated.
"Not Installed" indicate that the monitoring well was not installed at the time of sampling.

4. For the pre-2010 data, the median and mean values for wells BP-13D (all multi-level intervals) and GC-1 (all multi-level intervals) were calculated only using data that were collected between November 2007 and December 2008, whereas the number of detects, minimum, and maximum at reflect all available data.

5. Refer to the report text for further discussion.

Table 4

Summary of Water Quality Data - Chlorinated Ethenes in Surface Water

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Analyte		Tetrachloroethene										
NY State Groundwater Standards (µg/L)		**5**										
Well Name	Number of Samples Collected Pre-2010	Baseline (Pre-2010)					Apr '16	Jun '16	Sep '16	Apr '17	Jun '17	Oct '17
		Detects	Min.	Median	Max.	Mean	Conc. (Sample/ Duplicate)	Conc. (Sample/ Duplicate)	Conc. (Sample/ Duplicate)	Conc. (Sample/ Duplicate)	Conc. (Sample/ Duplicate)	Conc. (Sample/ Duplicate)
111	7	0	<0.5	--	<0.5	--	<0.5	<0.5		<0.5	<0.5	
112	6	0	<0.5	--	<0.5	--	<0.5				<0.5	
113	6	0	<0.5	--	<5	--	<0.5/<0.5	<0.5		<0.5	<0.5	<0.5
118	4	0	<0.5	--	<0.5	--	<0.5			<0.5	<0.5	
119	1	0	<0.5	--	<0.5	--						<0.5

Table 4

Summary of Water Quality Data - Chlorinated Ethenes in Surface Water

2017 Periodic Review Report

IBM Gun Club - Former Burn Pit Area

Union, New York

Analyte		Trichloroethene										
NY State Groundwater Standards (µg/L)		**5**										
Well Name	Number of Samples Collected Pre-2010	Baseline (Pre-2010)					Apr '16	Jun '16	Sep '16	Apr '17	Jun '17	Oct '17
		Detects	Min.	Median	Max.	Mean	Conc. (Sample/ Duplicate)	Conc. (Sample/ Duplicate)	Conc. (Sample/ Duplicate)	Conc. (Sample/ Duplicate)	Conc. (Sample/ Duplicate)	Conc. (Sample/ Duplicate)
111	7	4	0.1	0.5	1.2	0.6	0.2 J	<0.5		0.4 J	<0.5	
112	6	6	0.2	2.2	4.1	2	1.0				0.7	
113	6	5	<0.5	2.7	4.7	2.7	1.3/1.3	2.2		<0.5	1.0	0.2 J
118	4	4	0.7	1.6	2.1	1.5	0.4 J			0.2 J	0.7	
119	1	1	0.3	0.3	0.3	0.3						<0.5

Table 4

Summary of Water Quality Data - Chlorinated Ethenes in Surface Water

2017 Periodic Review Report

IBM Gun Club - Former Burn Pit Area

Union, New York

Analyte		Dichloroethene (cis-1,2-)										
NY State Groundwater Standards (µg/L)		**5**										
Well Name	Number of Samples Collected Pre-2010	Baseline (Pre-2010)					Apr '16	Jun '16	Sep '16	Apr '17	Jun '17	Oct '17
		Detects	Min.	Median	Max.	Mean	Conc. (Sample/ Duplicate)	Conc. (Sample/ Duplicate)	Conc. (Sample/ Duplicate)	Conc. (Sample/ Duplicate)	Conc. (Sample/ Duplicate)	Conc. (Sample/ Duplicate)
111	7	0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	
112	6	0	<0.5	<0.5	<0.5	<0.5	<0.5				<0.5	
113	6	0	<0.5	<0.5	<0.5	<0.5	<0.5/<0.5	<0.5		<0.5	<0.5	<0.5
118	4	3	0.4	0.55	0.7	0.55	<0.5			<0.5	0.8	
119	1	0	<0.5	<0.5	<0.5	<0.5						0.9

Notes:

1. The table summarizes surface water chlorinated ethene concentrations in micrograms per liter (µg/L) for the principal site contaminants prior to 2010 (baseline period) and during the last two years of monitoring.. Pre-2010 data was collected during the remedial investigation. All other data are from sampling conducted on the dates noted in the table. Some seeps with historical analytical results are not included in the table because they are no longer present. Water was not present at any surface water monitoring location in September 2016. As stated in the SMP, the presence of historical or new surface water sampling locations is assessed each sampling round.

2. For surface water locations where an analyte was detected during one sample event or more in the baseline (pre-2010) period, the number of detects, minimum, median, maximum, and arithmetic mean concentrations were calculated including the detection limit as a value during sample events where the compound was not detected. If no detections are listed, the minimum and maximum concentrations represent the minimum and maximum detection limits observed for the compound at that particular monitoring location.

3. Gray shaded cells indicate mean values above NY State Groundwater Standard Maximum Contaminant Levels (MCLs), as established in Part 703, Surface Water and Groundwater Quality Standards. Blank cells indicate that location was not sampled during the sampling event indicated.

"<" indicates that calculated value includes at least sample where analyte was below analytical detection limits or that the result was below the analytical detection limit.
"J" indicates that the result is below the laboratory lowest quantifiable limit and estimated.

4. Refer the report text for further discussion.

FIGURES

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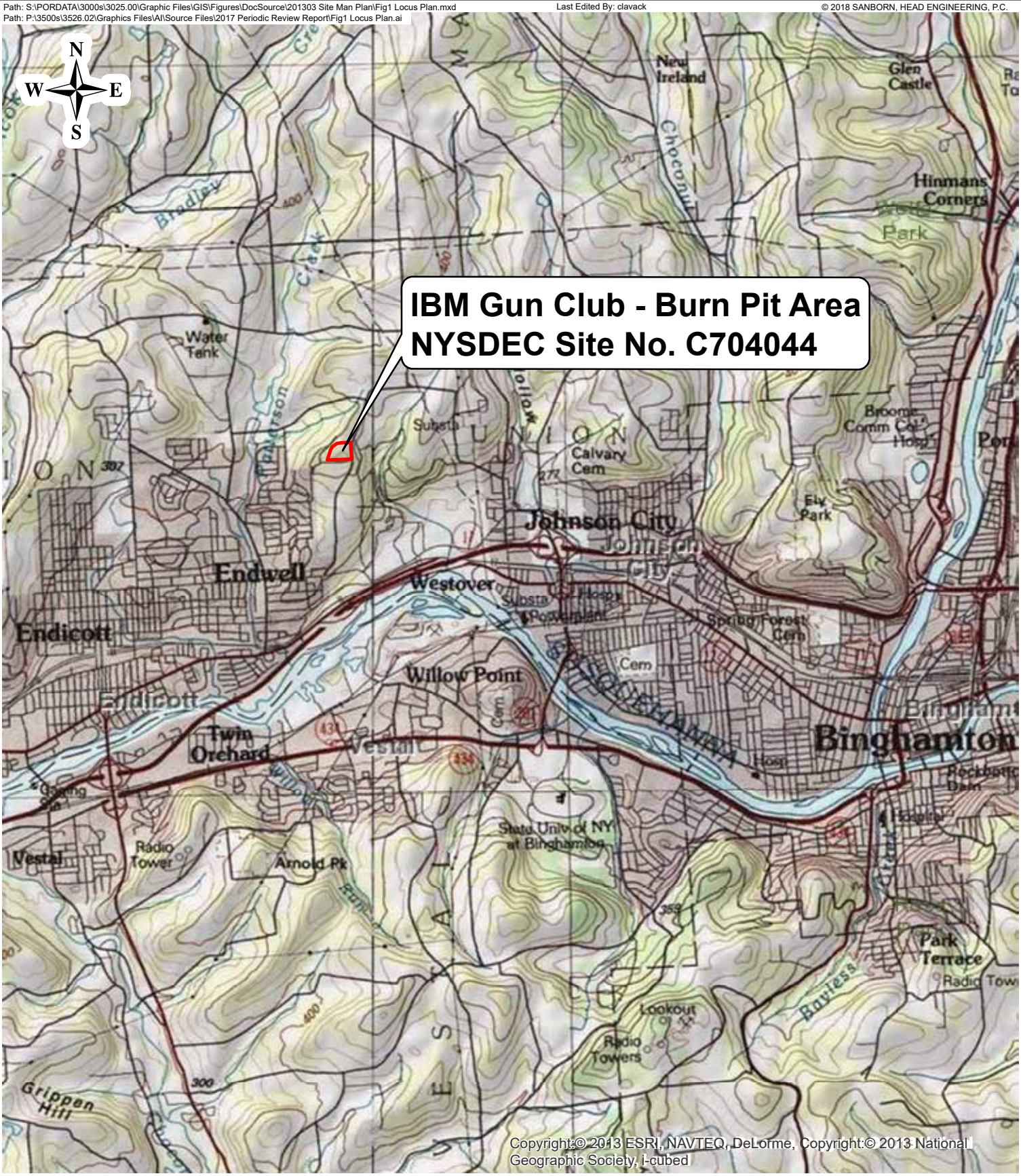
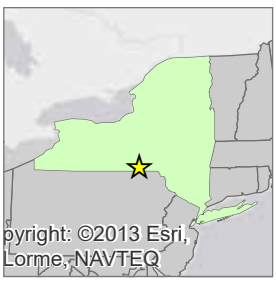
Last Edited By: clavack





Drawn By: C. LaVack
Designed By: E. Bosse
Reviewed By: D. Shea
Project No: 3526.05
Date: January 2018

0.75 0.375 0 0.75 1.5 Miles

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Figure 1

Site Location Plan

2017 Periodic Review Report

IBM Gun Club - Former Burn Pit Area
Union , New York

Last Edited By: clavack

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PORDATA\3000s\3025.00\Graphic Files\Adobe Illustrator\Source Files\2018 Periodic Review Report\Summary of Site Remedy.ai

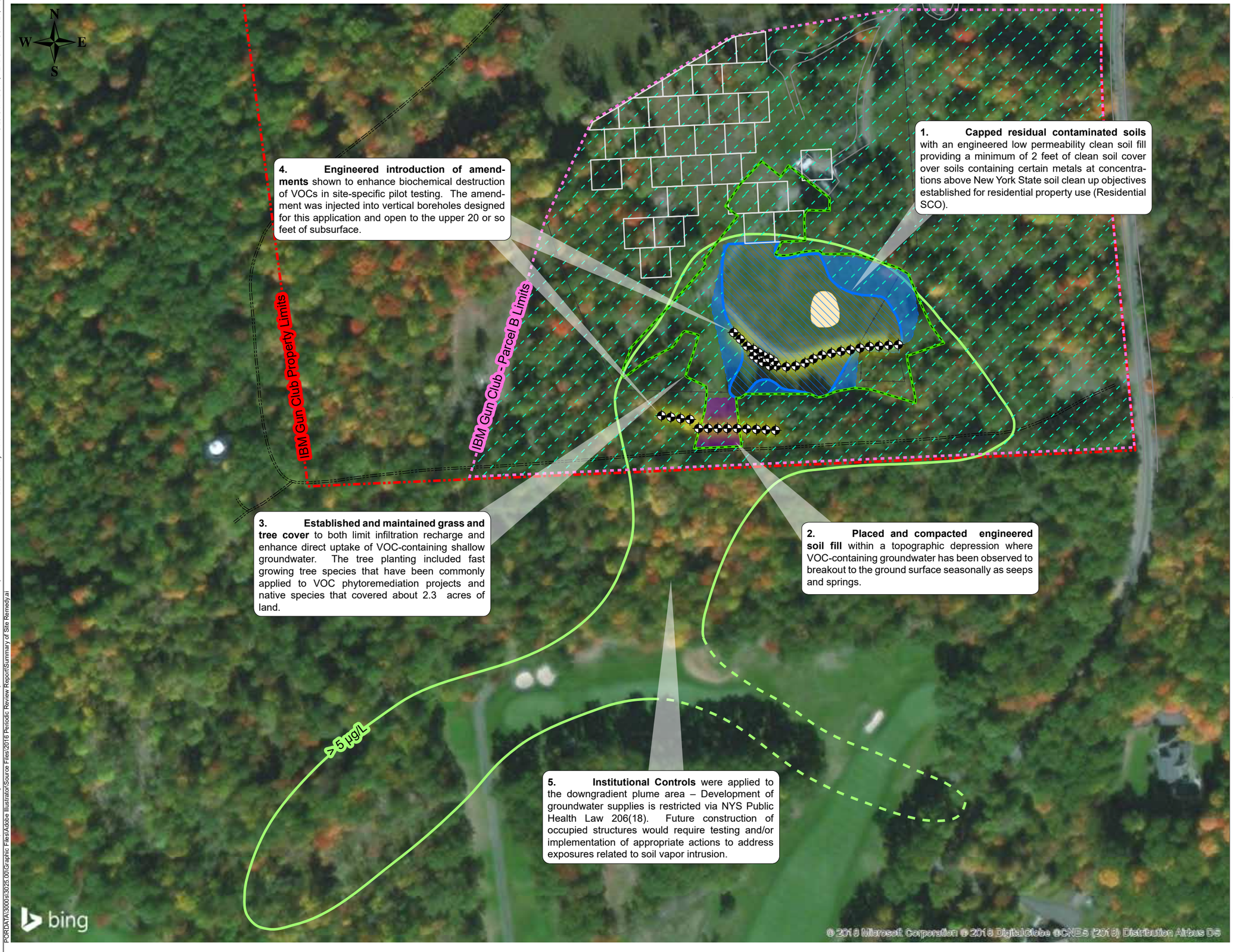

Figure 2

Summary of Site Remedy

2017 Periodic Review Report

IBM Gun Club - Former Burn Pit Area

Union, New York

Drawn By:	C. LaVack
Designed By:	E. Bosse
Reviewed By:	D. Shea
Project No:	3526.05
Date:	January 2018

Figure Narrative

This figure summarizes the components of the site remedy at the IBM Former Burn Pit under the New York State Brownfield Cleanup Program. The remedy involved excavation and capping of surficial soils, enhancing in situ biochemical processes already active at the site, and the planting and maintenance of trees to enhance uptake of VOC-containing groundwater.

Please refer to the Periodic Review Report text for further discussion.

Legend

- Injection Boring Location
- Former Burn Pit Disposal Area
- Surveyed boundaries of Burn Pit Property (Parcel B). Entire parcel is subject to deed restrictions associated with groundwater development/use, and construction of human occupied structures.
- Area of property that meets Track 2 residential SCOs
- Historical (pre-remedy) inferred extent of TCE in groundwater exceeding NY Standard of 5 ug/L - dashed where less certain
- Limits of Tree Planting
- Track 4 Surficial Soil Remedy Area - 1.28 Acre area requiring two feet of Soil Fill Cap meeting soils standards for residential use (Residential Soil Cleanup Objectives or SCO). The area subject to the deed restriction is larger and more regular
- Approximate Limit of Soil Cap Extension - resulting from final grading of imported soils.
- Approximate limit of additional fill that caps a topographic depression where groundwater historically reached the ground surface as seeps and springs
- Surveyed limits of soil removal conducted under Interim Remedial Measure (IRM) in May 2012 to meet residential SCO

75 37.5 0 75 150 Feet

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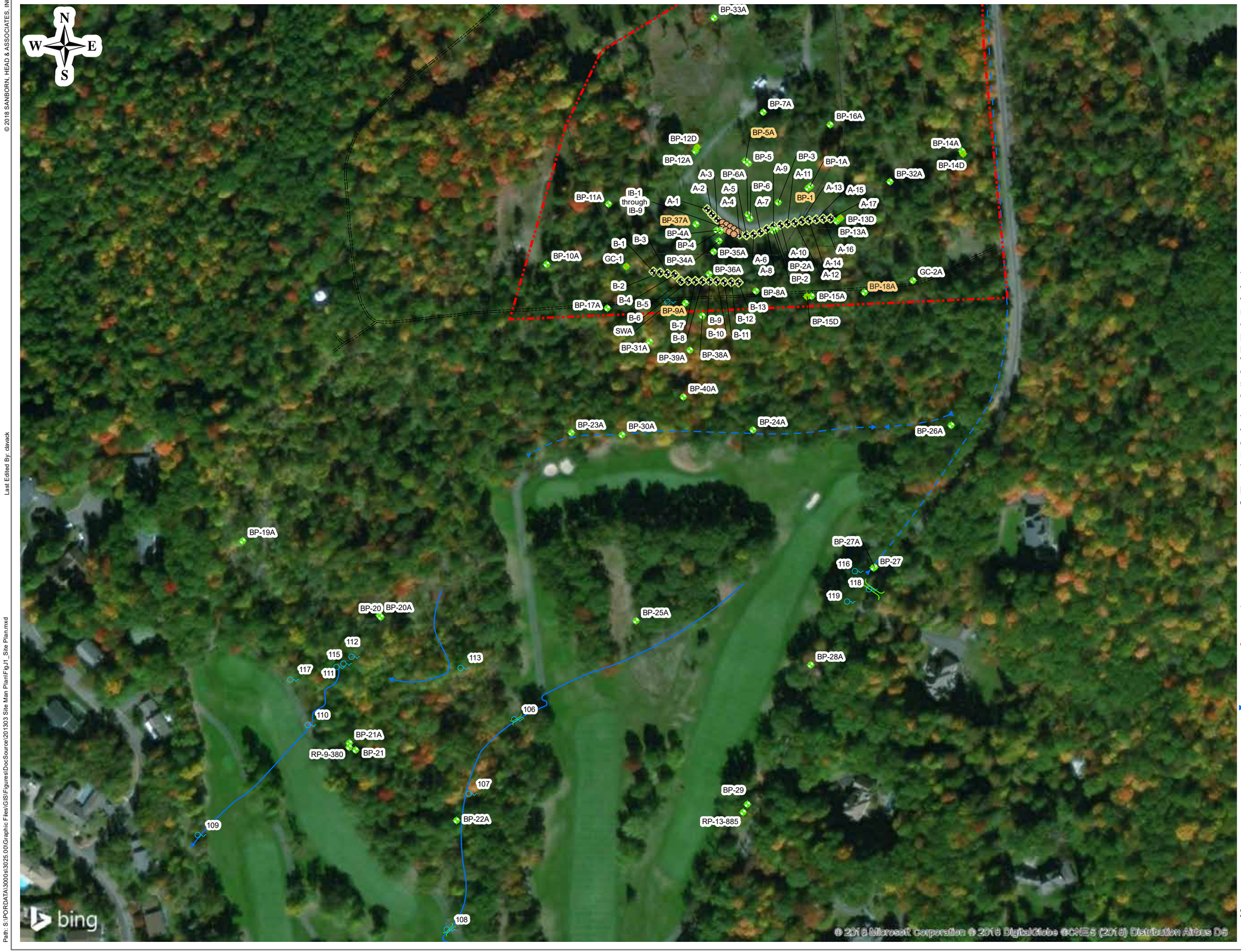

Figure 3

Monitoring Location Plan

2017 Periodic Review Report

IBM Gun Club - Former Burn Pit Area
Union, New York

Drawn By:	C. LaVack
Designed By:	E. Bosse
Reviewed By:	D. Shea
Project No:	3526.05
Date:	January 2018

Figure Narrative

This figure summarizes the locations of monitoring wells, multi-level monitoring systems, and surface water sampling points where depth to water will be measured and water quality samples may be collected for field and analytical laboratory testing as part of routine and performance monitoring programs. The figure also depicts monitoring wells where dedicated water quality probes have been deployed to continuously monitor for temperature, specific conductance, oxidation-reduction potential, dissolved oxygen and pH.

The locations of site features, including monitoring wells, seeps and springs, and culverts are based on field survey by Butler Land Surveying, LLC. of Little Meadows Pennsylvania in the period 2006 through 2012.

Refer to Periodic Review Report for further discussion.

Legend

- Parcel B Site Boundary
- Pilot Test Injection Borehole
- Injection Borehole
- Observed Drainage Features (arrows indicate flow direction)
- BP-5A — Dedicated Water Quality Parameter Probe
- Monitoring Well
- Multi-Level Monitoring Installation
- Surface Water Sampling Point
- Culvert

100 50 0 100 200 Feet

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Figure 4

Summary of Geochemical Conditions - Sulfate-Reducing

2017 Periodic Review Report

IBM Gun Club - Former Burn Pit Area
Union, New York

Drawn By:	C. LaVack
Designed By:	E. Bosse
Reviewed By:	D. Shea
Project No:	3526.05
Date:	January 2018

Figure Narrative

This figure summarizes the extent of inferred geochemical conditions as a measure of remedy performance over the two-year reporting period. Maintenance of geochemical conditions is one of the engineering controls established to address migration in groundwater and VOC source mass over time.

The inferred geochemical conditions are based on observations of oxidation-reduction potential (ORP), methane, sulfide, ferrous and total iron, and nitrate. The assessment is based on data recorded in performance monitoring conducted in 2016 and 2017. Please refer to the report text sections 3.3 and 4.2 for additional details.

Legend

BP-34A Performance Monitoring Location and ID

Inferred Groundwater Contour 10/09/2017

Inferred extent of sulfate-reducing conditions under seasonal high (April 2017- magenta) and low (October 2017- purple) groundwater elevations

- Parent VOC (Trichloroethene)
- Primary Daughter Product (*cis*-1,2DCE)
- Secondary Daughter Product (Vinyl Chloride)
- Terminal Breakdown Products (Ethane, Ethene)

October 2017 Total Chlorinated Ethanes & Ethenes in Groundwater (µmol/L)

< 0.1
>0.1 to 1
>1 to 10
>10 to 100
>100

40 20 0 40 80
Feet

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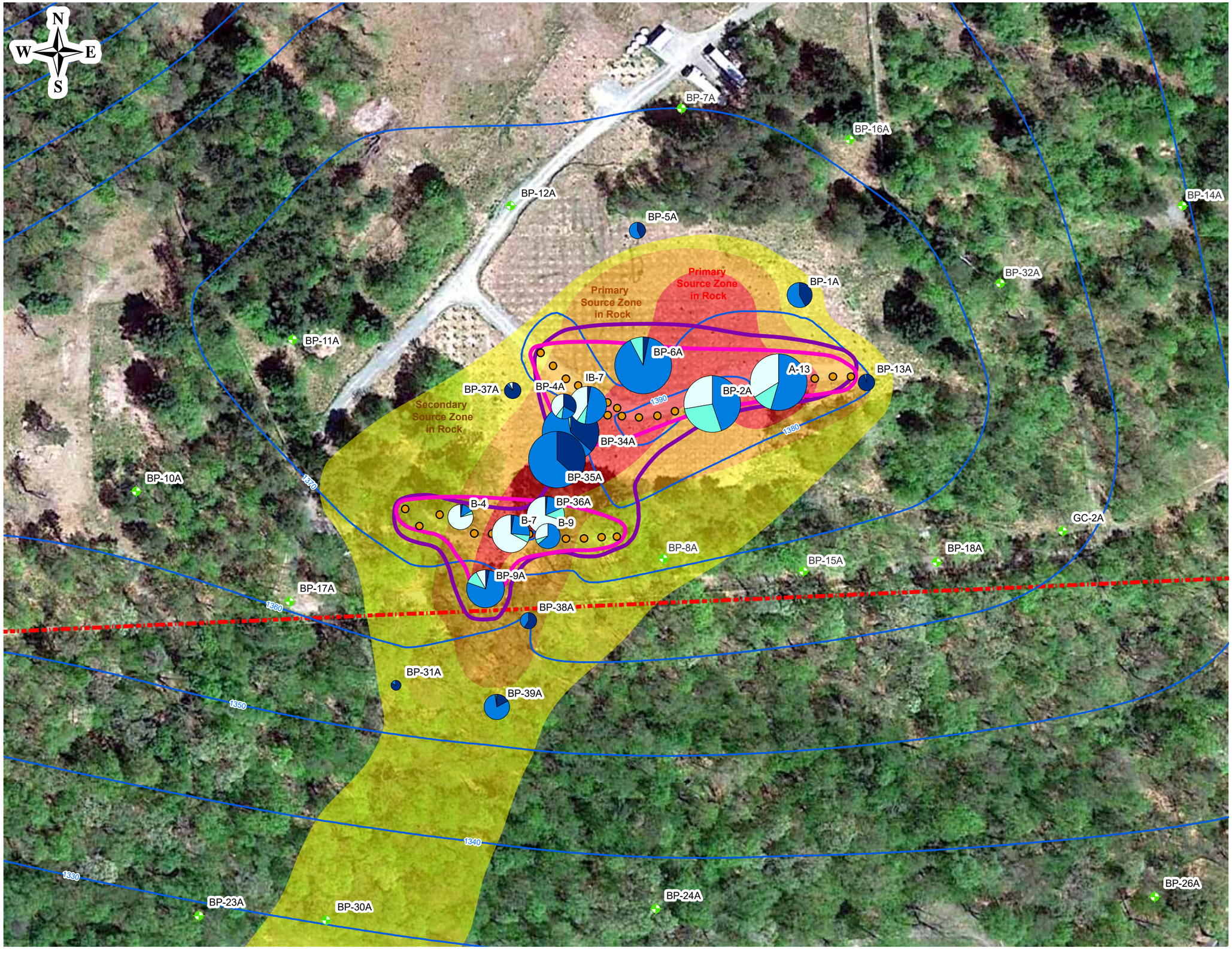

Figure 5

Summary of Geochemical Conditions - Methanogenic Conditions

2017 Periodic Review Report

IBM Gun Club - Former Burn Pit Area
Union, New York

Drawn By:	C. LaVack
Designed By:	E. Bosse
Reviewed By:	D. Shea
Project No:	3526.05
Date:	January 2018

Figure Narrative

This figure summarizes the extent of inferred geochemical conditions as a measure of remedy performance over the two-year reporting period. Maintenance of geochemical conditions is one of the engineering controls established to address migration in groundwater and VOC source mass over time.

The inferred geochemical conditions are based on observations of oxidation-reduction potential (ORP), methane, sulfide, ferrous and total iron, and nitrate. The assessment is based on data recorded in performance monitoring conducted in 2016 and 2017. Please refer to the report text sections 3.3 and 4.2 for additional details.

Legend

BP-34A Performance Monitoring Location and ID

Inferred Groundwater Contour 10/09/2017

Inferred extent of methanogenic conditions under seasonal high (April 2017 - magenta) and low (September 2016 - purple) groundwater elevations

Parent VOC (Trichloroethene)
Primary Daughter Product (*cis*-1,2DCE)
Secondary Daughter Product (Vinyl Chloride)
Terminal Breakdown Products (Ethane, Ethene)

October 2017 Total Chlorinated Ethanes & Ethenes in Groundwater (µmol/L)

< 0.1
>0.1 to 1
>1 to 10
>10 to 100
>100

40 20 0 40 80
Feet

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Figure 6

Key VOC Concentrations in Groundwater and Seeps - June 2017

2017 Periodic Review Report

IBM Gun Club - Former Burn Pit Area

Union, New York

Drawn By:	C. LaVack
Designed By:	E. Bosse
Reviewed By:	D. Shea
Project No:	3526.05
Date:	January 2018

Figure Narrative

This figure depicts groundwater data for key site VOCs from monitoring of water table wells in June 2017.

The data for TCE, selected breakdown products, and carbon tetrachloride are presented as pie diagrams. The wedges of each pie diagram represent concentrations expressed in micrograms per liter (ug/L). The relative diameter of each pie diagram varies based on the sum of the VOCs at each location.

Refer to report text for further discussion.

Legend

Injection Boring

BP-34A 41,000 — Well Name and June 2017 TCE Concentrations in Groundwater (µg/L).

- Trichloroethene (TCE)
- *cis*-1,2 Dichloroethene (*cis*-1,2 DCE)
- Vinyl Chloride (VC)
- Carbon Tetrachloride (CCl4)

Total Chlorinated Ethenes and Carbon Tetrachloride in Groundwater (µg/L)

<10

ND - Not detected above lab reporting limits

>10 to 100

>100 to 1,000

>1,000 to 10,000

>10,000

100 50 0 100 200

Feet

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APPENDIX A

LIMITATIONS

APPENDIX A
LIMITATIONS

1. The conclusions described in this report are based in part on the data obtained from a finite number of groundwater and surface water samples from widely spaced locations. The figures are intended to depict inferred conditions during a given period of time, consistent with available information. The actual conditions will vary from that shown, both spatially and temporally. Other interpretations are possible. If variations or other latent conditions then appear evident, it may be necessary to re-evaluate the conclusions of this report.

2. Water level measurements have been recorded at times and under conditions stated in the report. Note that fluctuations in the level of the groundwater may occur due to variations in rainfall and other factors not evident at the time measurements were made.

3. The conclusions contained in this report are based in part upon various types of chemical data as well as historical and hydrogeologic information developed by previous investigators. While Sanborn Head has reviewed that data available to us at the time the report was prepared and information as stated in this report, any of Sanborn Head's interpretations and conclusions that have relied on that information will be contingent on its validity. Sanborn Head has not performed an independent assessment of the reliability of the data; should additional chemical data, historical information, or hydrogeologic information become available in the future, such information should be reviewed by Sanborn Head and the interpretations and conclusions presented herein may be modified accordingly.

4. Sampling and quantitative laboratory testing was performed by others as part of the investigation as noted within the report. Where such analyses have been conducted by an outside laboratory, unless otherwise stated in the report, Sanborn Head has relied upon the data provided, and has not conducted an independent evaluation of the reliability of these data. Moreover, it should be noted that variations in the types and concentrations of contaminants and variations in their distribution within groundwater and surface water may occur due to the passage of time, seasonal water table fluctuations, recharge events, and other factors.

5. This report has been prepared for the exclusive use of the IBM Corporation for specific application to the former IBM Gun Club in accordance with generally accepted hydrogeologic practices. No warranty, expressed or implied, is made. The contents of this report should not be relied on by any other party without the express written consent of Sanborn Head.

6. In preparing this report, Sanborn Head has endeavored to conform to generally accepted practices of other consultants undertaking similar studies at the same time and in the same geographical area. Sanborn Head has attempted to observe a degree of care and skill generally exercised by the technical community under similar circumstances and conditions.

7. The analyses and recommendations contained in this report are based on the data obtained from the referenced explorations. The explorations indicate subsurface conditions only at the specific locations and times, and only to the depths penetrated. They do not necessarily reflect strata variations that may exist between such locations. The validity of the recommendations is based in part on assumptions and inference Sanborn Head has made about conditions at the site. Such assumptions may be confirmed only during further investigation or remediation. If subsurface conditions different from those described become evident, the recommendations in this report must be re-evaluated.

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APPENDIX B

INSPECTION AND MAINTENANCE REPORTS

APPENDIX B.1

SITE-WIDE INSPECTION REPORT –

SEPTEMBER 2017

SANBORN HEAD ENGINEERING
Building Trust. Engineering Success.

20 Foundry Street
Concord, NH 03301

Linda Daubert, P.E.
International Business Machines Corporation
Corporate Environmental Affairs
8976 Wellington Road
Manassas, VA 20109

October 31, 2017
File No. 3526.05

Re: Site-Wide Inspection – September 2017
IBM Gun Club – Former Burn Pit Area
Union, New York
NYSDEC Site # C704044, BCA Index #B7-0661004

Dear Ms. Daubert:

This letter is intended to transmit the findings of a Site-Wide Inspection completed for the IBM Gun Club, Burn Pit Area (Site). Under the project Site Management Plan (SMP), Site-Wide inspections were conducted semi-annually through May 2016, and are being conducted annually thereafter.

This letter serves to transmit the inspection record and communicate the findings. This inspection report will be included with the next Periodic Review Report required under the SMP, due in March 2018.

BACKGROUND AND SCOPE

The Site-Wide inspection was conducted in accordance with Monitoring Plan included as Section 3.0 of the SMP using the Site Wide Inspection Checklist included as Appendix K.1 of that document. The inspection included visual review of the condition of the soil cap that covers contaminated soils and soil fill placed within the area of historical seeps. The site visit was conducted on September 26, 2017 and included:

- A review of the Site, and conditions on lands downgradient of the Site, related to compliance with the Institutional Controls (ICs) outlined in SMP Section 2.3 and the Environmental Easement;

- A visual review of the cover system associated with the deed restricted area as outlined in SMP Section 3.2, and seep fill area, to observe for settlement, erosion, or other conditions that could be considered detrimental to the effectiveness of these components of the remedy, which is considered an Engineering Control (EC);

- A review of the conditions of tree plantings and grass cover that constitute the phytoremediation component of the EC remedy as described under SMP Section 4.2.1. During this visit, we conducted a general reconnaissance and a comprehensive tree mortality survey.

In addition, we reviewed general Site conditions related to site fencing, security, and the list of notifications required under the SMP. The findings and observations from this visit are noted in the inspection checklist included as Attachment A. An annotated inspection figure is included as Attachment B, and photos are included in Attachment C.

SUMMARY OF FINDINGS

In general, as outlined in the attached checklist, the inspection found the condition of the Site to be consistent with the design intent of the ECs, and the use of the Site and surrounding area is consistent with the ICs and the human exposure assessment on which the remedy is based. Summary observations are as follows:

- The capped area remains intact with no evidence of settlement, cracking, animal burrows, or other breaches;

- The capped area is vegetated with well-established grass and tree cover. According to the National Weather Service, the region exhibited approximately average to above average precipitation through late summer, with drier conditions during September 2017;

- Poplar poles appear to have grown several feet since May 2016 to an average height of 12 to 20 feet, while cuttings have grown 1 to 2 feet to an average of 4 to 6 feet. Tree mortality is shown on the attached figure and ranged from 22% to 41%, with Area 4 exhibiting the highest mortality and Area 7 the lowest. Further discussions is provided in the Closing below.

- The grass in the area of tree planting was cut in August with minor damage just outside the capped seep area. The mower left a wheel rut at the base of the capped area along the southern gravel access road as shown on the attached figure and in Photo 8. The rut was made just outside the capped area, and the cap or underlying material were not disturbed. A small amount of standing water was present during the inspection, but was not evident during sampling approximately 2 weeks later. The rut has since been repaired with commercially available topsoil;

- There is still evidence that the bonfire gathering spot near monitoring well BP-10A is being utilized, but there was less debris present than during previous inspections.

- Upon arrival for the inspection, the office trailer portion of the on-site storage container was found have been vandalized. It was additionally vandalized upon arrival for sampling approximately two weeks later. It is unclear how entry was gained through the perimeter fence as no damage was observed, but repairs and enhancements to security are underway.

CLOSING

Under the SMP, IBM had proposed to replant as needed to bring the tree cover up to 75% of the initial planting density, allowing for 25% mortality. We do not think that replanting of trees is warranted at this time given: 1) the apparent progress of growth of live trees, 2) the possible stabilization of overall mortality around 30%, which is unchanged from a May

2017 review, 3) a good portion of the mortality was observed in areas outside of the primary and secondary source rock (Areas 1,4, and 9), and 4) replanting would require tracking of mechanized equipment across the cap area, which might damage the cap and live trees.

Mortality will be re-surveyed in the fall of 2018. We note that less than 25% mortality may not be achievable in areas that exhibit conditions that are not conducive to tree growth (e.g. shallow bedrock, encroachment of woody brush, poor infiltration in the capped area), and re-planting may lead to the same result. Alternate measures of phytoremediation effectiveness will be assessed as part of the PRR.

If you have any questions, please contact us. We appreciate the opportunity to provide service to IBM on this important project.

Very truly yours,
SANBORN, HEAD ENGINEERING, P.C.

David Shea

David Shea, P.E.
Principal

EMB/DS: ds

Encl. Attachment A - Site Wide Inspection Checklist
Attachment B - Annotated Site Inspection Map
Attachment C - Photographs

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Attachment A
Site Wide Inspection Checklist - September 2017
IBM Gun Club - Former Burn Pit Area
BCP Site No. C704044

Part 1: General Information

Site Name: IBM Gun Club, Former Burn Pit Area Date of Inspection: September 26, 2017

Summary of Remedy:

-Capping the primary VOC source area and residual surficial soils with an engineered low permeability clean soil fill;

-Placement and compaction of engineered soil fill within a topographic depression south of the Burn Pit Area;

-Phytoremediation - establishing and maintaining grass and tree cover to limit infiltration recharge and enhance direct uptake of VOC-containing shallow groundwater; and

-Enhanced biochemical degradation - engineered introduction of amendments shown to enhance biochemical destruction of VOCs.

Part 2: Inspection Specifics

Inspector: Erica Bosse Title: Project Manager

Inspector Contact Information: Sanborn Head Engineering, P.C./Sanborn, Head & Associates, Inc.

Type of Inspection:

Site-wide inspection	☑
Soil cover system monitoring	☑
Routine well inventory and review	☑
Routine phytoremediation monitoring	☑
Non-routine storm event or other emergency	☐
Non-routine EC failure/ performance modifications	☐

Remarks

Weather/ Temperature: Sunny, upper 70s, humid

Part 3: On-site Documents & Records Verification

	Readily Available	Up-to-date	Location/ remarks
Daily access/security logs	☑	☑	Red binder in site trailer
Site Management Plan	☑	☑	Filing cabinet
Health & Safety Plan	☑	☑	Appendix of Site Management Plan
Current underground injection control permit	☐	☐	N/A
Monitoring records	☑	☐	Fall 2017 sampling in progress
Routine maintenance reports	☑	☑	Filing cabinet, in PRR appendix
Non-routine maintenance reports	☑	☑	Filing cabinet, in PRR appendix
Site-wide inspection reports	☑	☐	Through May 2016, will add last two reports next time at the site

Attachment A
Site Wide Inspection Checklist - September 2017
IBM Gun Club - Former Burn Pit Area
BCP Site No. C704044

Part 4: Review of Institutional Controls (SMP Section 2.3)

	True	False	Not Applicable
The property is only used for restricted residential, commercial, and industrial uses within the Track 4 Cleanup area;	☑	☐	☐
The property is only used for residential, restricted residential, commercial, and industrial uses throughout the remainder of the site;	☑	☐	☐
The property is not used for a higher level use, such as unrestricted use without additional remediation and amendment of the Easement with approval by NYSDEC;	☑	☐	☐
Activities on the property that will disturb remaining contaminated material conducted in accordance with the SMP;	☑	☐	☐
The use of groundwater within and adjacent to the currently established plume or updated plume based on groundwater monitoring is prohibited as a source of potable or process water, without necessary water quality treatment	☑	☐	☐
Any buildings developed within the Track 4 Cleanup area evaluated for vapor intrusion, and any potential impacts that are identified are monitored or mitigated	☑	☐	☐
No vegetable gardens or farming within the Track 4 Cleanup area	☑	☐	☐

Narrative/ Other Notes:

The site remains undeveloped with no buildings and is not used for agriculture.

Attachment A
Site Wide Inspection Checklist - September 2017
IBM Gun Club - Former Burn Pit Area
BCP Site No. C704044

Part 5: Review of Engineering Controls

5a: Soil Cover System Monitoring - Deed Restricted Area (SMP Section 3.2)

Monuments and Signage

- ☐ Damaged/missing signage
- ☐ Damaged monuments
- ☐ Location(s) shown on map
- ☑ Photo-documented

Remarks: Signage is as constructed, bollards could use a coat of paint.

Settlement (Low spots)

- ☐ Location(s) shown on map
- ☐ Photo-documented
- ☑ Settlement not evident

Approx. ft^2 _____
Depth _____
Remarks None observed

Cracks

- ☐ Location(s) shown on map
- ☐ Photo-documented
- ☑ Cracking not evident

Length _____
Width _____
Depth _____

Remarks None observed

Erosion

- ☐ Location(s) shown on map
- ☐ Photo-documented
- ☑ Erosion not evident

Approx. ft^2 _____
Depth _____
Remarks _____

Holes

- ☐ Location(s) shown on map
- ☐ Photo-documented
- ☑ Holes not evident

Approx. ft^2 _____
Depth _____
Remarks None observed

Vegetative Cover

- ☑ Photo-documented
- ☑ Grass properly established
- ☐ No signs of stress

Remarks No major bare areas observed. Grass is generally well established after a wet summer.

Attachment A
Site Wide Inspection Checklist - September 2017
IBM Gun Club - Former Burn Pit Area
BCP Site No. C704044

Wet Areas/Water Damage **None apparent**

- ☐ Wet areas — Approx. ft^2 _____ ☐ Shown on site map
- ☐ Ponding — Approx. ft^2 _____ ☐ Photo-documented
- ☐ Seeps — Approx. ft^2 _____ ☑ Wet areas not evident
- ☐ Soft subgrade — Approx. ft^2 _____ Remarks No evidence of water damage

The base of the cap slope in the NE portion of the cap is vegetated with phreatophyte plants but is presently dry.

Slope Instability **None apparent**

- ☐ Location(s) shown on map
- ☐ Photo-documented
- ☑ Slope instability not evident

Approx. ft^2 _____

Remarks None observed

Narrative/ other notes: The trees are showing minor signs of stress - some yellowing/leaf loss.

The grass is generally well established. Growth is such that mowing will be conducted twice per year going forward.

A review of rainfall records for Binghamton NY (National Climatic Data Center) indicate that precipitation over much of 2017 rainfall was above average. Rainfall in August and September was 0.8" and 2.2" below average, respectively.

5b: Soil Fill - Seep Area

Settlement (Low spots)

- ☐ Location(s) shown on map
- ☐ Photo-documented
- ☑ Settlement not evident

Approx. ft^2 _____
Depth _____
Remarks None observed

Cracks

- ☐ Location(s) shown on map
- ☐ Photo-documented
- ☑ Cracking not evident

Length _____
Width _____
Depth _____

Remarks None observed

Erosion

- ☐ Location(s) shown on map
- ☐ Photo-documented
- ☑ Erosion not evident

Approx. ft^2 _____
Depth _____
Remarks None observed

Holes

- ☑ Location(s) shown on map
- ☑ Photo-documented
- ☐ Holes not evident

Approx. ft^2 6 ft2
Depth 8"
Remarks Wheel rut damage just off the capped area to the south; subsequently repaired with commercially available topsoil.

Vegetative Cover

- ☑ Photo-documented
- ☑ Grass properly established
- ☐ No signs of stress

Remarks Less signs of stress in the seep area compared to the cap area, the former of which is generally more shaded and historically wet.

Wet Areas/Water Damage **None apparent**

- ☐ Wet areas — Approx. ft^2 _____
- ☑ Ponding — Approx. ft^2 _____
- ☑ Seeps — Approx. ft^2 _____
- ☐ Soft subgrade — Approx. ft^2 _____

- ☑ Shown on site map
- ☑ Photo-documented
- ☐ Wet areas not evident

Remarks Water is breaking out along the length of the capped seep area after a wet summer. Was not present during the fall sampling round approximately two weeks later so did not sample. Phreatophyte plants present along E and W borders, but are presently dry.

Attachment A
Site Wide Inspection Checklist - September 2017
IBM Gun Club - Former Burn Pit Area
BCP Site No. C704044

Slope Instability

- ☐ Location shown on map
- ☐ Photo-documented
- ☑ Slope instability not evident

Approx. ft^2 _____

Remarks None observed

Narrative / other notes:

Attachment A
Site Wide Inspection Checklist - September 2017
IBM Gun Club - Former Burn Pit Area
BCP Site No. C704044

5c: Phytoremediation\Tree Condition (SMP Section 4.2.1)

Area #1 ☑ Photo Mark Map ☑	Poles	Representative height 6-12' Representative canopy width	% Mortality	35%
	Cuttings	Representative height 4-6' Representative canopy width		
Area #2 ☑ Photo Mark Map ☑	Poles	Representative height 6-12' Representative canopy width	% Mortality	32%
	Cuttings	Representative height 4-6' Representative canopy width		
Area #3 ☑ Photo Mark Map ☑	Poles	Representative height 6-15' Representative canopy width	% Mortality	26%
	Cuttings	Representative height 4-6' Representative canopy width		
Area #4 ☑ Photo Mark Map ☑	Poles	Representative height 5-8' Representative canopy width	% Mortality	41%
	Cuttings	Representative height 4-6' Representative canopy width		
Area #5 ☑ Photo Mark Map ☑	Poles	Representative height 6-15' Representative canopy width	% Mortality	23%
	Cuttings	Representative height 4-6' Representative canopy width		

Attachment A
Site Wide Inspection Checklist - September 2017
IBM Gun Club - Former Burn Pit Area
BCP Site No. C704044

Area #6 ☑ Photo Mark Map ☑	Poles	Representative height 8-18' Representative canopy width	% Mortality	27%
	Cuttings	Representative height 3.5-6' Representative canopy width		
Area #7 ☑ Photo Mark Map ☑	Poles	Representative height 6-15' Representative canopy width	% Mortality	22%
	Cuttings	Representative height N/A Representative canopy width		
Area #8 ☑ Photo Mark Map ☑	Poles	Representative height 10-20' Representative canopy width	% Mortality	30%
	Cuttings	Representative height N/A Representative canopy width		
Area #9 ☑ Photo Mark Map ☑	Poles	Representative height 10-15' Representative canopy width	% Mortality	30%
	Cuttings	Representative height N/A Representative canopy width		

Narrative / other notes:

On average, both poles and cuttings were observed to have grown 2-4 ft since the May 2016 inspection. Poplar tree mortality by area ranged from 22% to 41% with a median of about 30%. Estimated tree mortalities exceeded the 25% threshold specified in the SMP in most areas, but seems to have stabilized after a wet summer with more conducive growing conditions. In Areas 1 and 2, the mortality may be explained by sun exposure, depth to rock/planting depth, and possible gas generation downgradient of pilot test injection boreholes. Poplar poles in Area 4 are crowded by newer woody bushes and are generally more shaded which may contribute to mortality.

Attachment A
Site Wide Inspection Checklist - September 2017
IBM Gun Club - Former Burn Pit Area
BCP Site No. C704044

Part 6: Review of Monitoring and Injection Well Network Inspection

Conditions consistent with Monitoring and Injection Well Inspection Checklist ☑

List deviations, if any The comprehensive well inspection was completed in June 2017, conditions were observed to be similar in September 2017.

Seep Area Monitoring

Seep area dry ☐ New seeps/ springs/ wet areas observed? ☑

Remarks See Section 5B. New seeps along the base of the capped seep area following a wet summer. Were dry approximately two weeks later during the sampling round.

Narrative / other notes:

Attachment A
Site Wide Inspection Checklist - September 2017
IBM Gun Club - Former Burn Pit Area
BCP Site No. C704044

Part 7 - Review of Access/General Site Conditions

Condition of fencing Fence panels intact around entire perimeter. Barbed wire brackets had fallen in two spots

Remarks One small tree is resting on the fence in the NW corner of the larger parcel, no fence damage was observed. Barbed wire repair is underway and tree will be removed.

Condition of monuments and signage Intact as constructed

Remarks

Obvious signs of vandalism/trespassing? Site trailer had window broken and door handle tampered with in an attempt to enter. Bonfire area still present outside the perimeter fence.

Remarks

Condition of access roads and lanes Intact as constructed. Starting to get overgrown. Gravel access roads in capped area mostly grassed over.

Remarks

Investigation derived waste

Frac Tank/ Water Tank

- ☐ N/A
- ☑ Good condition
- ☐ Needs maintenance

Remarks About 150 gallons of sampling purge water in Tote #1.

Approximate volume generated since last inspection 50

	Yes	No
Documentation of IDW analytical results readily available	☐	☑

Location/ Remarks June 2017 purge water sample indicated levels of VOCs below the detection limits and could be discharged to the ground. Purge water was not discharged during the fall sampling round, but will be in the spring 2018 pending acceptable sample analytical results after the Fall 2017 sampling round.

Narrative / other notes:

Attachment A
Site Wide Inspection Checklist - September 2017
IBM Gun Club - Former Burn Pit Area
BCP Site No. C704044

Part #8 Notifications

We are not aware of any planned change in use by the Binghamton Countr:	Not Applicable	Yes	No
A. 60-day advance notice of any proposed changes in site use	☑	☐	☐
B. 7-day advance notice of proposed ground-intrusive activities	☑	☐	☐
C. 48-hour notice of any damage or defect to the engineering controls	☑	☐	☐
D. Verbal notice by noon the following day of any emergency (fire, flood, etc.) that reduces the effectiveness of engineering controls	☑	☐	☐
E. Follow-up status report on emergency actions within 45 days	☑	☐	☐
F. 60-day advance notice of any change in site ownership	☑	☐	☐
G. New owner's contact information confirmed in writing within 15 days of ownership change	☑	☐	☐

Part #9 Action Items

	Action Item	Proposed time frame
Routine maintenance	GSC to mow grass	Spring 2018
	Paint bollards	Spring 2018
Non-routine maintenance	Repair BP-15A PVC riser	Next time drill rig is on site
	Repair GC-2A bollard	Next time drill rig is on site
	Repair field trailer and fence/ enhance security	Underway
Other	Update documentation	Next time on site

Attachment B

NOTES:

1. THIS FIGURE IS INTENDED TO ACCOMPANY THE SITE-WIDE INSPECTION CHECKLIST AND WILL BE USED TO MARK CONDITIONS OF NOTE RECORDED ON THE INSPECTION CHECKLIST FORM. THE SITE WIDE INSPECTION IS REQUIRED AS AN ELEMENT OF THE REMEDIAL PROGRAM AT THE IBM GUN CLUB, BURN PIT UNDER THE NEW YORK STATE BROWNFIELD CLEANUP PROGRAM ADMINISTERED BY NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION. THE SITE IS IN THE PROCESS OF BEING REMEDIATED IN ACCORDANCE WITH BROWNFIELD CLEANUP AGREEMENT #C7044, WHICH WAS EXECUTED ON AUGUST 26, 2005 AND LAST AMENDED ON APRIL 26, 2012.
2. REFER TO THE SITE MANAGEMENT PLAN AND FINAL ENGINEERING REPORT FOR ADDITIONAL NOTES AND LEGEND INFORMATION.

Annual Site-Wide Inspection, Conducted September 26, 2017

Conducted by Erica Bosse

Approximate location of fallen barbed wire

Approximate location of downed tree on fence (no fence damage)

Approximate location of wheel rut damage

LEGEND

- 1350 — EXISTING 10-FOOT CONTOUR
- EXISTING 2-FOOT CONTOUR
- 1380 — AS-BUILT 10-FOOT CONTOUR
- AS-BUILT 2-FOOT CONTOUR
- X — EXISTING CHAIN-LINK FENCE
- X — AS-BUILT CHAIN-LINK FENCE
- EXISTING TREE LINE
- EXISTING UTILITY LINE
- EXISTING EDGE OF PAVED ROAD
- EXISTING EDGE OF GRAVEL PATH
- AS-BUILT EDGE OF GRAVEL PATH
- SURVEYED EXTENT OF MARKER LAYER
- BP-6 — EXISTING MONITORING WELL LOCATION AND DESIGNATION
- IB-4 — EXISTING INJECTION WELL LOCATION AND DESIGNATION
- A-1 — AS-BUILT INJECTION WELL LOCATION AND DESIGNATION
- DEED RESTRICTION BOUNDARY
- MONUMENT TO DOCUMENT DEED RESTRICTED AREA
- MONUMENT TO DOCUMENT DEED RESTRICTED AREA WITH SIGNAGE INSTALLED
- SURVEYED TREE PLANTING LIMITS
- ③ — PHYTOREMEDIATION AREA BOUNDARY AND DESIGNATION
- PRIMARY SOURCE ROCK
- SECONDARY SOURCE ROCK
- LOCATION OF DEAD POPLAR CUTTING (INSIDE CAP AREA) AND POPLAR POLE (OUTSIDE CAP AREA)
- 30% — Tree mortality

SANBORN HEAD ENGINEERING

GRAPHICAL SCALE
60' 30' 0 60' 120'

NO.	DATE	DESCRIPTION	BY

DRAWN BY: E. WRIGHT
DESIGNED BY: J. SANBORN
REVIEWED BY: D. SHEA
PROJECT MGR: E. BOSSE
PIC: D. SHEA
DATE: OCTOBER 2017

SITE WIDE INSPECTION MEMO
IBM GUN CLUB - FORMER BURN PIT AREA
UNION, NEW YORK

PROJECT NUMBER: 3526.05

SITE MANAGEMENT PLAN

FIGURE NUMBER: 1

ATTACHMENT C
INSPECTION PHOTOGRAPHS

Photo 1: Tree and grass cover looking NW across Phytoremediation Area1 1. Well BP-5A instrumentation is visible in the center right.

Photo 2: Tree and grass cover looking north from the gravel access road to Phytoremediation Area 2.

Photo 3: Phytoremediation Area 3, looking NE from Area 2 and the gravel access road.

Photo 4: Looking SE from the gravel access road across Phytoremediation Area 4 towards Areas 2 and 3. A-line injection boreholes are visible in the foreground.

Photo 5: Looking SW from Phytoremediation Area 4 across Area 5 and the A-line of injection boreholes.

Photo 6: Looking west across Phytoremediation Area 6, the instrumentation enclosure for BP-37A is visible in the middle right.

Photo 7: Phytoremediation Area 7 looking north from the southern gravel access road.

Photo 8: Phytoremediation Area 7 – Seep Fill Area looking northeast from the southern gravel access road. The wet wheel rut is visible in the bottom center of the photograph.

Photo 9: Phytoremediation Area 8 – Seep Fill Area looking west towards the tallest poplar at approximately 30 feet high.

Photo 10: Phytoremediation Area 9 looking west.

Photo 11: ATV/vehicle track outside the perimeter fence in the northwest portion of the perimeter fence heading towards the bonfire area.

Photo 12: Looking northwest at the bonfire area outside the perimeter fence.

Photo 13: Fallen barbed wire in the northeastern area of the perimeter fence.

Photo 14: Small tree resting on fence in the northwest corner of the perimeter fence.

Photo 15: Window broken through steel bars at the site trailer.

APPENDIX B.2

ROUTINE MAINTENANCE REPORTS

Appendix B.2.1
Routine Maintenance Report Form
IBM Gun Club - Former Burn Pit Area
BCP Site No. C704044

Field Representative:	Chris Norton	Position: Project Engineer
Company:	Sanborn Head	Date: 5/22/2017

System Type (circle one)	Monitoring Well	Soil Cap
	Injection Well	Phytoremediation
	Soil Fill in Seep Area	

Maintenance activities:

Collection and compositing of four topsoil samples from within the 4 areas marked on the field sketch. Samples were submitted for analysis of nutrients, pH, and organic matter. Sample results did indicate the need for fertilization.

Modifications to the system:

None

Field Representative	Date
Chris Norton	5/22/2017
Erica Bosse	5/22/2017

Attachments:

- ☐ None
- ☐ Photographs
- ☒ Field Sketch
- ☐ Invoices/ Receipts
- ☒ Other – Lab Report

SANBORN HEAD

NOTES:

1. THIS FIGURE IS INTENDED TO ACCOMPANY THE SITE-WIDE INSPECTION CHECKLIST AND WILL BE USED TO MARK CONDITIONS OF NOTE RECORDED ON THE INSPECTION CHECKLIST FORM. THE SITE WIDE INSPECTION IS REQUIRED AS AN ELEMENT OF THE REMEDIAL PROGRAM AT THE IBM GUN CLUB, BURN PIT UNDER THE NEW YORK STATE BROWNFIELD CLEANUP PROGRAM ADMINISTERED BY NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION. THE SITE IS IN THE PROCESS OF BEING REMEDIATED IN ACCORDANCE WITH BROWNFIELD CLEANUP AGREEMENT #C7044, WHICH WAS EXECUTED ON AUGUST 26, 2005 AND LAST AMENDED ON APRIL 26, 2012.
2. REFER TO THE SITE MANAGEMENT PLAN AND FINAL ENGINEERING REPORT FOR ADDITIONAL NOTES AND LEGEND INFORMATION.

LEGEND

- 1350 — EXISTING 10-FOOT CONTOUR
- EXISTING 2-FOOT CONTOUR
- 1380 — AS-BUILT 10-FOOT CONTOUR
- AS-BUILT 2-FOOT CONTOUR
- X — EXISTING CHAIN-LINK FENCE
- X — AS-BUILT CHAIN-LINK FENCE
- EXISTING TREE LINE
- EXISTING UTILITY LINE
- EXISTING EDGE OF PAVED ROAD
- EXISTING EDGE OF GRAVEL PATH
- AS-BUILT EDGE OF GRAVEL PATH
- SURVEYED EXTENT OF MARKER LAYER
- BP-6 — EXISTING MONITORING WELL LOCATION AND DESIGNATION
- IB-4 — EXISTING INJECTION WELL LOCATION AND DESIGNATION
- A-1 — AS-BUILT INJECTION WELL LOCATION AND DESIGNATION
- DEED RESTRICTION BOUNDARY
- MONUMENT TO DOCUMENT DEED RESTRICTED AREA
- MONUMENT TO DOCUMENT DEED RESTRICTED AREA WITH SIGNAGE INSTALLED
- SURVEYED TREE PLANTING LIMITS
- ③ — PHYTOREMEDIATION AREA BOUNDARY AND DESIGNATION

SANBORN HEAD ENGINEERING

GRAPHICAL SCALE
60' 30' 0 60' 120'

NO.	DATE	DESCRIPTION	BY

DRAWN BY: M. HILDENBRAND
DESIGNED BY: J. SANBORN
REVIEWED BY: D. CARR
PROJECT MGR: E. BRADSTREET
PIC: D. SHEA
DATE: AUGUST 2014

SITE MANAGEMENT PLAN
IBM GUN CLUB - FORMER BURN PIT AREA
UNION, NEW YORK

PROJECT NUMBER: 3526.02

SITE INSPECTION PLAN

FIGURE NUMBER: 1

05/15/2017	2555	ONCAP	----	
PRINT DATE	LAB NO.	SAMPLE IDENTIFICATION	COUNTY	ACRES OR SQ. FT.

SOIL TEST REPORT FOR:

ERICA BOSSE

1 TECHNOLOGY PARK DRIVE

WESTFORD MA 01888

MAINE SOIL TESTING SERVICE

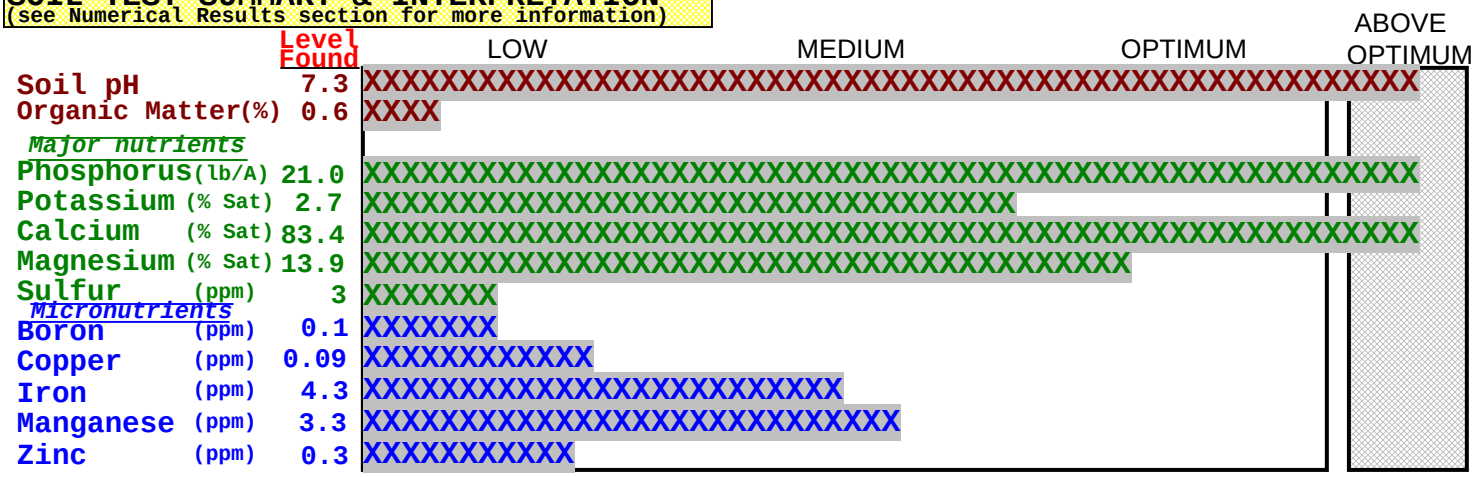
UNIVERSITY OF MAINE 1865

5722 DEERING HALL

ORONO,MAINE 04469-5722

SOIL TEST SUMMARY & INTERPRETATION

(see Numerical Results section for more information)



RECOMMENDED ADDITIONS FOR EXISTING LAWN - Crop Code # 201

No lime recommended. Soil pH is at or above the optimum level for this crop.

Magnesium level is sufficient to meet crop requirement.
Calculated major nutrient requirements as follows:
2.0 pounds nitrogen per 1000 sq. ft.
0.0 pounds phosphate per 1000 sq. ft.
1.5 pounds potash per 1000 sq. ft.

To meet major nutrient requirements:
Apply 8 lb 24-0-11 or 6-7 lb 30-0-15 (or similar ratio) fertilizer/1000 sq ft.
Apply 1/2 in early spring and 1/2 in late August.
If clippings are left on, apply only 1/2 rate in late August.
Apply fertilizer when grass is dry and water in immediately to prevent burn.
For organic fertilizers: adjust the rate to provide 1 lb nitrogen/1000 sq. ft.
To supply sulfur, alternate the recommended fertilizer with 5 lb 21-0-0/1000 sq ft, once every other year. Organic fertilizers will also supply sulfur.
Set mower high and leave clippings when mowing. Rake 1/2 inch fine compost through grass each year, if possible, to improve soil nutrient and water holding capacity over time.

For information on micronutrient management and recommendations, see enclosed form.

NUMERICAL RESULTS

(Test methodology: pH in water and Mehlich buffer, available nutrients by modified Morgan extract)
(Organic matter measured by LOI, P determined colorimetrically, all others measured by ICP-OES)

CEC and nutrient balance calculations are based on present pH of 7.3

	Soil pH	Lime Index 2	Phosphorus (lb/A)	Potassium (lb/A)	Magnesium (lb/A)	Calcium (lb/A)	CEC (me/100 g)	K	Mg (% Saturation)	Ca	Acidity
Level Found	7.3	0.00	21.0	114	184	1829	5.4	2.7	13.9	83.4	0.0
Optimum Range	5.5-6.5	N/A	7-10	see % Saturation levels			> 5	2.8-4.0	10-20	60-80	< 10

	Organic Matter(%)	Sulfur (ppm)	Copper (ppm)	Iron (ppm)	Manganese (ppm)	Zinc (ppm)
Level Found	0.6	3	0.09	4.3	3.3	0.3
Normal Range	5 - 8	> 15	.25-.60	6 - 10	4 - 8	1 - 2

(Extras)	Boron (ppm)	Sodium (ppm)	Soluble Salts (mmhos/cm)	Nitrate-N (ppm)	Ammonium-N (ppm)
Level Found	0.1	N/A	N/A	N/A	N/A
Normal Range	0.5-1.2				

Additional Results or Comments:

Lead scan: NORMAL BACKGROUND LEVEL - no health risk.

Full payment received for this sample. Thank you.

05/15/2017	2555	ONCAP	----	
PRINT DATE	LAB NO.	SAMPLE IDENTIFICATION	COUNTY	ACRES OR SQ. FT.

▪**SOIL TEST REPORT FOR:**

ERICA BOSSE

1 TECHNOLOGY PARK DRIVE

WESTFORD MA 01888

MAINE SOIL TESTING SERVICE

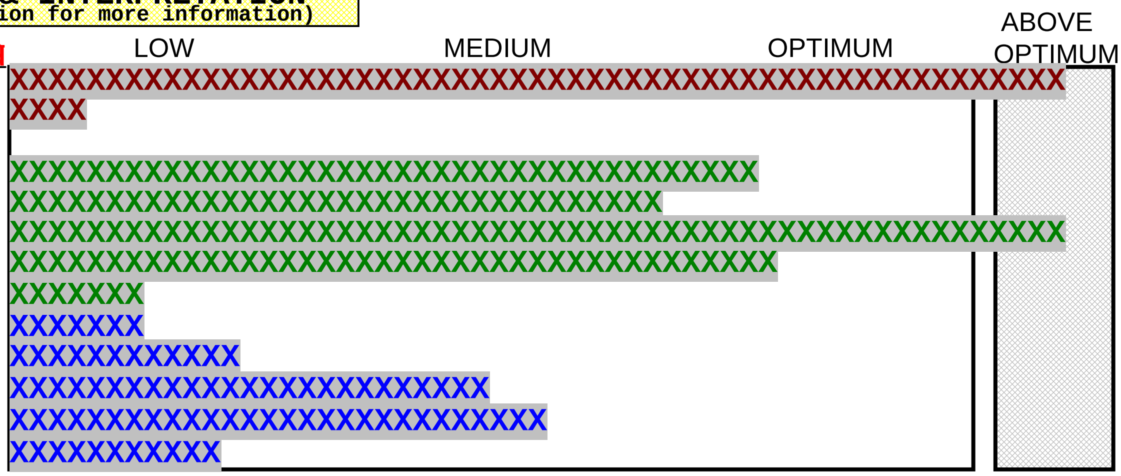
UNIVERSITY OF MAINE

5722 DEERING HALL

ORONO,MAINE 04469-5722

▪SOIL TEST SUMMARY & INTERPRETATION
(see Numerical Results section for more information)

		Level Found
Soil pH		7.3
Organic Matter(%)		0.6
Major nutrients		
Phosphorus	(lb/A)	21.0
Potassium	(% Sat)	2.7
Calcium	(% Sat)	83.4
Magnesium	(% Sat)	13.9
Sulfur	(ppm)	3
Micronutrients		
Boron	(ppm)	0.1
Copper	(ppm)	0.09
Iron	(ppm)	4.3
Manganese	(ppm)	3.3
Zinc	(ppm)	0.3



▪RECOMMENDED ADDITIONS FOR GRASS HAY-ONE CROP - Crop Code # 104

No lime recommended. Soil pH is at or above the optimum level for this crop.

Magnesium level is sufficient to meet crop requirement.
Recommended major nutrient application rates as follows:

80 pounds nitrogen per acre
40 pounds phosphate per acre
120 pounds potash per acre

Apply fertilizer as soon as possible in early spring.

Notes on dairy forage potassium: Any potash fertilizer recommended is for forage grown for lactating cows. Ideally, 8 - 10 % of your hay ground should be kept at a low-medium K test level to maintain forage level at or below 2 % K. Hay grown on this ground should be stored separately and fed to dry cows starting at least one month prepartum.

For information on micronutrient management and recommendations, see enclosed form.

▪NUMERICAL RESULTS

(Test methodology: pH in water and Mehlich buffer, available nutrients by modified Morgan extract)
(Organic matter measured by LOI, P determined colorimetrically, all others measured by ICP-OES)

CEC and nutrient balance calculations are based on present pH of 7.3

	Soil pH	Lime Index 2	Phosphorus (lb/A)	Potassium (lb/A)	Magnesium (lb/A)	Calcium (lb/A)	CEC (me/100 g)	K (% Saturation)	Mg (% Saturation)	Ca (% Saturation)	Acidity
Level Found	7.3	0.00	21.0	114	184	1829	5.4	2.7	13.9	83.4	0.0
Optimum Range	5.5-6.5	N/A	10-40	see % Saturation levels			> 5	2.8-4.0	10-20	60-80	< 10

	Organic Matter(%)	Sulfur (ppm)	Copper (ppm)	Iron (ppm)	Manganese (ppm)	Zinc (ppm)
Level Found	0.6	3	0.09	4.3	3.3	0.3
Normal Range	5 - 8	> 15	.25-.60	6 - 10	4 - 8	1 - 2

Additional Results or Comments:

(Extras)	Boron (ppm)	Sodium (ppm)	Soluble Salts (mmhos/cm)	Nitrate-N (ppm)	Ammonium-N (ppm)
Level Found	0.1	N/A	N/A	N/A	N/A
Normal Range	0.5-1.2				

05/15/2017	2556	OFFCAPPEAST	----	
PRINT DATE	LAB NO.	SAMPLE IDENTIFICATION	COUNTY	ACRES OR SQ. FT.

SOIL TEST REPORT FOR:

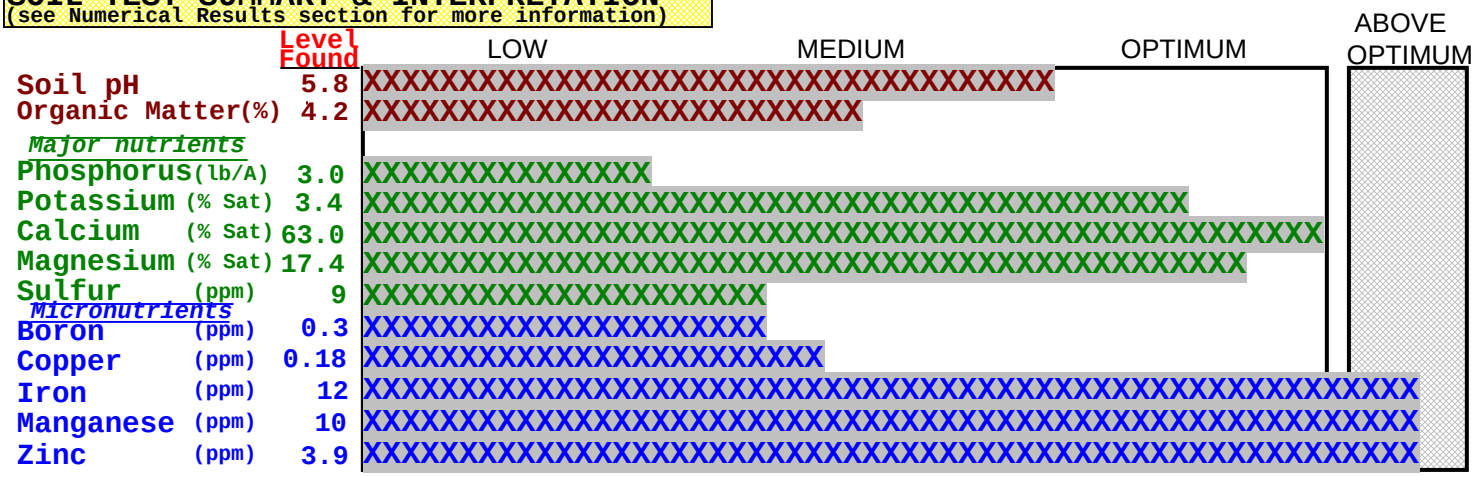
ERICA BOSSE

1 TECHNOLOGY PARK DRIVE

WESTFORD MA 01888

MAINE SOIL TESTING SERVICE
UNIVERSITY OF MAINE 1865
5722 DEERING HALL
ORONO,MAINE 04469-5722

SOIL TEST SUMMARY & INTERPRETATION
(see Numerical Results section for more information)



RECOMMENDED ADDITIONS FOR EXISTING LAWN - Crop Code # 201

To raise soil pH to 6.0, apply 30 pounds of lime per 1000 sq. ft.

Magnesium level is sufficient. Use a calcitic (low magnesium) lime.
Calculated major nutrient requirements as follows:
2.0 pounds nitrogen per 1000 sq. ft.
0.8 pounds phosphate per 1000 sq. ft.
1.0 pounds potash per 1000 sq. ft.

To meet major nutrient requirements:
Apply 10 lb 20-4-8 or 22-6-8 (or similar ratio) fertilizer/1000 sq ft.
Apply 1/2 in early spring and 1/2 in late August.
If clippings are left on, apply only 1/2 rate in late August.
Apply fertilizer when grass is dry and water in immediately to prevent burn.
For organic fertilizers: adjust the rate to provide 1 lb nitrogen/1000 sq. ft.
To supply sulfur, alternate the recommended fertilizer with 5 lb 21-0-0/1000 sq ft, once every other year. Organic fertilizers will also supply sulfur.

For information on micronutrient management and recommendations, see enclosed form.

NUMERICAL RESULTS

(Test methodology: pH in water and Mehlich buffer, available nutrients by modified Morgan extract)
(Organic matter measured by LOI, P determined colorimetrically, all others measured by ICP-OES)

CEC and nutrient balance calculations assume the pH will be raised to 6.0

	Soil pH	Lime Index 2	Phosphorus (lb/A)	Potassium (lb/A)	Magnesium (lb/A)	Calcium (lb/A)	CEC (me/100 g)	K	Mg (% Saturation)	Ca (% Saturation)	Acidity
Level Found	5.8	5.88	3.0	206	327	2558	7.7(A)	3.4	17.4	63.0	16.2
Optimum Range	5.5-6.5	N/A	7-10	see % Saturation levels			> 5	2.8-4.0	10-20	60-80	< 10

	Organic Matter(%)	Sulfur (ppm)	Copper (ppm)	Iron (ppm)	Manganese (ppm)	Zinc (ppm)
Level Found	4.2	9	0.18	12.1	10.3	3.9
Normal Range	5 - 8	> 15	.25-.60	6 - 10	4 - 8	1 - 2

	Boron (ppm)	Sodium (ppm)	Soluble Salts (mmhos/cm)	Nitrate-N (ppm)	Ammonium-N (ppm)
Level Found	0.3	N/A	N/A	N/A	N/A
(Extras) Normal Range	0.5-1.2				

Additional Results or Comments:

Lead scan: NORMAL BACKGROUND LEVEL - no health risk.

Full payment received for this sample. Thank you.

PRINT DATE	LAB NO.	SAMPLE IDENTIFICATION	COUNTY	ACRES OR SQ. FT.
05/15/2017	2556	OFFCAPPEAST	----	

▪**SOIL TEST REPORT FOR:**

ERICA BOSSE

1 TECHNOLOGY PARK DRIVE

WESTFORD MA 01888

MAINE SOIL TESTING SERVICE

UNIVERSITY OF MAINE

5722 DEERING HALL

ORONO,MAINE 04469-5722

▪SOIL TEST SUMMARY & INTERPRETATION

(see Numerical Results section for more information)

	Level Found	LOW / MEDIUM / OPTIMUM / ABOVE OPTIMUM
Soil pH	5.8	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Organic Matter(%)	4.2	XXXXXXXXXXXXXXXXXXXXXXXXXXX
Major nutrients		
Phosphorus (lb/A)	3.0	XXXXXXXXXXXXXXXX
Potassium (% Sat)	3.4	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Calcium (% Sat)	63.0	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Magnesium (% Sat)	17.4	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Sulfur (ppm)	9	XXXXXXXXXXXXXXXXXXXXXX
Micronutrients		
Boron (ppm)	0.3	XXXXXXXXXXXXXXXXXXXXXX
Copper (ppm)	0.18	XXXXXXXXXXXXXXXXXXXXXXXXX
Iron (ppm)	12	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Manganese (ppm)	10	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Zinc (ppm)	3.9	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

▪RECOMMENDED ADDITIONS FOR GRASS HAY-ONE CROP - Crop Code # 104

To raise soil pH to 6.0, apply 1500 pounds of lime per acre.

Lime recommendation assumes a calcium carbonate equivalence (neutralizing value) of 100 %.
Magnesium level is sufficient. Use a calcitic (low magnesium) lime.

Recommended major nutrient application rates as follows:

- 80 pounds nitrogen per acre
- 50 pounds phosphate per acre
- 70 pounds potash per acre

Apply fertilizer as soon as possible in early spring.

Notes on dairy forage potassium: Any potash fertilizer recommended is for forage grown for lactating cows. Ideally, 8 - 10 % of your hay ground should be kept at a low-medium K test level to maintain forage level at or below 2 % K. Hay grown on this ground should be stored separately and fed to dry cows starting at least one month prepartum.

For information on micronutrient management and recommendations, see enclosed form.

▪NUMERICAL RESULTS

(Test methodology: pH in water and Mehlich buffer, available nutrients by modified Morgan extract)
(Organic matter measured by LOI, P determined colorimetrically, all others measured by ICP-OES)

CEC and nutrient balance calculations assume the pH will be raised to 6.0

	Soil pH	Lime Index 2	Phosphorus (lb/A)	Potassium (lb/A)	Magnesium (lb/A)	Calcium (lb/A)	CEC (me/100 g)	K (% Saturation)	Mg (% Saturation)	Ca (% Saturation)	Acidity
Level Found	5.8	5.88	3.0	206	327	2558	7.7(A)	3.4	17.4	63.0	16.2
Optimum Range	5.5-6.5	N/A	10-40	see % Saturation levels			> 5	2.8-4.0	10-20	60-80	< 10

	Organic Matter(%)	Sulfur (ppm)	Copper (ppm)	Iron (ppm)	Manganese (ppm)	Zinc (ppm)
Level Found	4.2	9	0.18	12.1	10.3	3.9
Normal Range	5 - 8	> 15	.25-.60	6 - 10	4 - 8	1 - 2

Additional Results or Comments:

(Extras)	Boron (ppm)	Sodium (ppm)	Soluble Salts (mmhos/cm)	Nitrate-N (ppm)	Ammonium-N (ppm)
Level Found	0.3	N/A	N/A	N/A	N/A
Normal Range	0.5-1.2				

PRINT DATE	LAB NO.	SAMPLE IDENTIFICATION	COUNTY	ACRES OR SQ. FT.
05/15/2017	2557	SEEP	----	

SOIL TEST REPORT FOR:

ERICA BOSSE

1 TECHNOLOGY PARK DRIVE

WESTFORD MA 01888

MAINE SOIL TESTING SERVICE

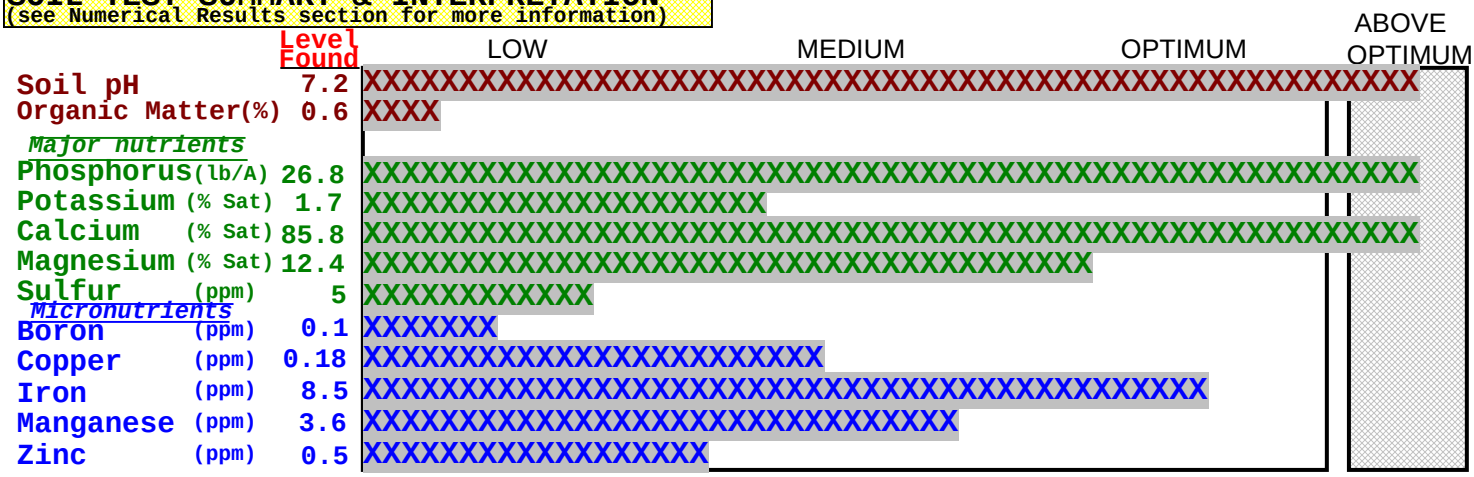
UNIVERSITY OF MAINE 1865

5722 DEERING HALL

ORONO,MAINE 04469-5722

SOIL TEST SUMMARY & INTERPRETATION

(see Numerical Results section for more information)



RECOMMENDED ADDITIONS FOR EXISTING LAWN - Crop Code # 201

No lime recommended. Soil pH is at or above the optimum level for this crop.

To meet crop magnesium requirement, use a fertilizer containing magnesium if possible.
Calculated major nutrient requirements as follows:
2.0 pounds nitrogen per 1000 sq. ft.
0.0 pounds phosphate per 1000 sq. ft.
2.3 pounds potash per 1000 sq. ft.

To meet major nutrient requirements:
Apply 10 lb 20-0-20 or 30 lb 6-0-6 (or similar ratio) fertilizer/1000 sq ft.
Apply 1/2 in early spring and 1/2 in late August.
If clippings are left on, apply only 1/2 rate in late August.
Apply fertilizer when grass is dry and water in immediately to prevent burn.
For organic fertilizers: adjust the rate to provide 1 lb nitrogen/1000 sq. ft.
To supply sulfur, alternate the recommended fertilizer with 5 lb 21-0-0/1000 sq ft, once every other year. Organic fertilizers will also supply sulfur.
Set mower high and leave clippings when mowing. Rake 1/2 inch fine compost through grass each year, if possible, to improve soil nutrient and water holding capacity over time.

For information on micronutrient management and recommendations, see enclosed form.

NUMERICAL RESULTS

(Test methodology: pH in water and Mehlich buffer, available nutrients by modified Morgan extract)
(Organic matter measured by LOI, P determined colorimetrically, all others measured by ICP-OES)

CEC and nutrient balance calculations are based on present pH of 7.2

	Soil pH	Lime Index 2	Phosphorus (lb/A)	Potassium (lb/A)	Magnesium (lb/A)	Calcium (lb/A)	CEC (me/100 g)	K	Mg (% Saturation)	Ca (% Saturation)	Acidity
Level Found	7.2	0.00	26.8	79	175	1991	5.7	1.7	12.4	85.8	0.0
Optimum Range	5.5-6.5	N/A	7-10	see % Saturation levels			> 5	2.8-4.0	10-20	60-80	< 10

	Organic Matter(%)	Sulfur (ppm)	Copper (ppm)	Iron (ppm)	Manganese (ppm)	Zinc (ppm)
Level Found	0.6	5	0.18	8.5	3.6	0.5
Normal Range	5 - 8	> 15	.25-.60	6 - 10	4 - 8	1 - 2

(Extras)	Boron (ppm)	Sodium (ppm)	Soluble Salts (mmhos/cm)	Nitrate-N (ppm)	Ammonium-N (ppm)
Level Found	0.1	N/A	N/A	N/A	N/A
Normal Range	0.5-1.2				

Additional Results or Comments:

Lead scan: NORMAL BACKGROUND LEVEL - no health risk.

Full payment received for this sample. Thank you.

05/15/2017	2557	SEEP	----	
PRINT DATE	LAB NO.	SAMPLE IDENTIFICATION	COUNTY	ACRES OR SQ. FT.

▪**SOIL TEST REPORT FOR:**

ERICA BOSSE
1 TECHNOLOGY PARK DRIVE
WESTFORD MA 01888

MAINE SOIL TESTING SERVICE
UNIVERSITY OF MAINE
5722 DEERING HALL
ORONO,MAINE 04469-5722

▪SOIL TEST SUMMARY & INTERPRETATION
(see Numerical Results section for more information)

	Level Found	LOW	MEDIUM	OPTIMUM	ABOVE OPTIMUM
Soil pH	7.2	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX			
Organic Matter(%)	0.6	XXXX			
Major nutrients					
Phosphorus (lb/A)	26.8	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX			
Potassium (% Sat)	1.7	XXXXXXXXXXXXXXXXXXXX			
Calcium (% Sat)	85.8	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX			
Magnesium (% Sat)	12.4	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX			
Sulfur (ppm)	5	XXXXXXXXXXX			
Micronutrients					
Boron (ppm)	0.1	XXXXXXX			
Copper (ppm)	0.18	XXXXXXXXXXXXXXXXXXXXXX			
Iron (ppm)	8.5	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX			
Manganese (ppm)	3.6	XXXXXXXXXXXXXXXXXXXXXXXXXXXXX			
Zinc (ppm)	0.5	XXXXXXXXXXXXXXXXX			

▪RECOMMENDED ADDITIONS FOR GRASS HAY-ONE CROP - Crop Code # 104

No lime recommended. Soil pH is at or above the optimum level for this crop.

To improve the magnesium level, use a magnesium lime when lime is needed again.
Recommended major nutrient application rates as follows:
80 pounds nitrogen per acre
40 pounds phosphate per acre
150 pounds potash per acre

Apply fertilizer as soon as possible in early spring.

Notes on dairy forage potassium: Any potash fertilizer recommended is for forage grown for lactating cows. Ideally, 8 - 10 % of your hay ground should be kept at a low-medium K test level to maintain forage level at or below 2 % K. Hay grown on this ground should be stored separately and fed to dry cows starting at least one month prepartum.

For information on micronutrient management and recommendations, see enclosed form.

▪NUMERICAL RESULTS

(Test methodology: pH in water and Mehlich buffer, available nutrients by modified Morgan extract)
(Organic matter measured by LOI, P determined colorimetrically, all others measured by ICP-OES)

CEC and nutrient balance calculations are based on present pH of 7.2

	Soil pH	Lime Index 2	Phosphorus (lb/A)	Potassium (lb/A)	Magnesium (lb/A)	Calcium (lb/A)	CEC (me/100 g)	K (% Saturation)	Mg (% Saturation)	Ca (% Saturation)	Acidity
Level Found	7.2	0.00	26.8	79	175	1991	5.7	1.7	12.4	85.8	0.0
Optimum Range	5.5-6.5	N/A	10-40	see % Saturation levels			> 5	2.8-4.0	10-20	60-80	< 10

	Organic Matter(%)	Sulfur (ppm)	Copper (ppm)	Iron (ppm)	Manganese (ppm)	Zinc (ppm)
Level Found	0.6	5	0.18	8.5	3.6	0.5
Normal Range	5 - 8	> 15	.25-.60	6 - 10	4 - 8	1 - 2

Additional Results or Comments:

(Extras)	Boron (ppm)	Sodium (ppm)	Soluble Salts (mmhos/cm)	Nitrate-N (ppm)	Ammonium-N (ppm)
Level Found	0.1	N/A	N/A	N/A	N/A
Normal Range	0.5-1.2				

05/15/2017	2558	OFFCAP	----	
PRINT DATE	LAB NO.	SAMPLE IDENTIFICATION	COUNTY	ACRES OR SQ. FT.

SOIL TEST REPORT FOR:

ERICA BOSSE

1 TECHNOLOGY PARK DRIVE

WESTFORD MA 01888

MAINE SOIL TESTING SERVICE

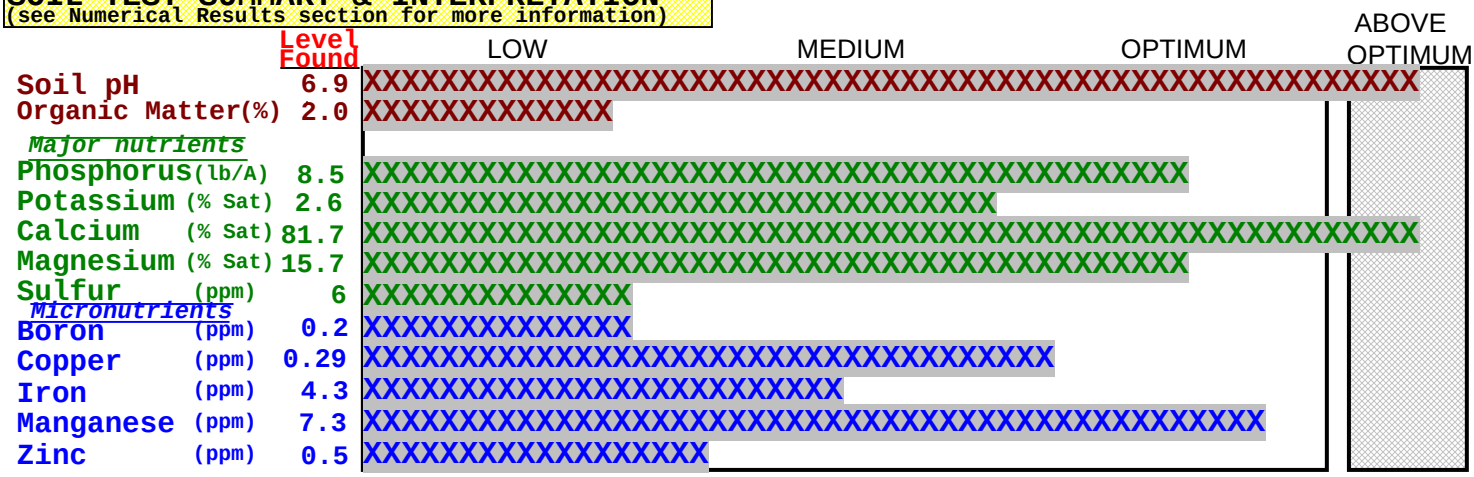
UNIVERSITY OF MAINE 1865

5722 DEERING HALL

ORONO,MAINE 04469-5722

SOIL TEST SUMMARY & INTERPRETATION

(see Numerical Results section for more information)



RECOMMENDED ADDITIONS FOR EXISTING LAWN - Crop Code # 201

No lime recommended. Soil pH is at or above the optimum level for this crop.

Magnesium level is sufficient to meet crop requirement.
Calculated major nutrient requirements as follows:
2.0 pounds nitrogen per 1000 sq. ft.
0.7 pounds phosphate per 1000 sq. ft.
2.2 pounds potash per 1000 sq. ft.

To meet major nutrient requirements:
Apply 17 lb 12-4-8 (or similar ratio) fertilizer/1000 sq ft.
Apply 1/2 in early spring and 1/2 in late August.
If clippings are left on, apply only 1/2 rate in late August.
Apply fertilizer when grass is dry and water in immediately to prevent burn.
For organic fertilizers: adjust the rate to provide 1 lb nitrogen/1000 sq. ft.
To supply sulfur, alternate the recommended fertilizer with 5 lb 21-0-0/1000 sq ft, once every other year. Organic fertilizers will also supply sulfur.
Set mower high and leave clippings when mowing. Rake 1/2 inch fine compost through grass each year, if possible, to improve soil nutrient and water holding capacity over time.

For information on micronutrient management and recommendations, see enclosed form.

NUMERICAL RESULTS

(Test methodology: pH in water and Mehlich buffer, available nutrients by modified Morgan extract)
(Organic matter measured by LOI, P determined colorimetrically, all others measured by ICP-OES)

CEC and nutrient balance calculations are based on present pH of 6.9

	Soil pH	Lime Index 2	Phosphorus (lb/A)	Potassium (lb/A)	Magnesium (lb/A)	Calcium (lb/A)	CEC (me/100 g)	K	Mg (% Saturation)	Ca (% Saturation)	Acidity
Level Found	6.9	6.40	8.5	145	280	3246	7.3(A)	2.6	15.7	81.7	0.0
Optimum Range	5.5-6.5	N/A	7-10	see % Saturation levels			> 5	2.8-4.0	10-20	60-80	< 10

	Organic Matter(%)	Sulfur (ppm)	Copper (ppm)	Iron (ppm)	Manganese (ppm)	Zinc (ppm)
Level Found	2.0	6	0.29	4.3	7.3	0.5
Normal Range	5 - 8	> 15	.25-.60	6 - 10	4 - 8	1 - 2

(Extras)	Boron (ppm)	Sodium (ppm)	Soluble Salts (mmhos/cm)	Nitrate-N (ppm)	Ammonium-N (ppm)
Level Found	0.2	N/A	N/A	N/A	N/A
Normal Range	0.5-1.2				

Additional Results or Comments:

Lead scan: NORMAL BACKGROUND LEVEL - no health risk.

Full payment received for this sample. Thank you.

PRINT DATE	LAB NO.	SAMPLE IDENTIFICATION	COUNTY	ACRES OR SQ. FT.
05/15/2017	2558	OFFCAP	----	

▪**SOIL TEST REPORT FOR:**

ERICA BOSSE

1 TECHNOLOGY PARK DRIVE

WESTFORD MA 01888

MAINE SOIL TESTING SERVICE

UNIVERSITY OF MAINE

5722 DEERING HALL

ORONO,MAINE 04469-5722

▪SOIL TEST SUMMARY & INTERPRETATION
(see Numerical Results section for more information)

	Level Found	LOW / MEDIUM / OPTIMUM / ABOVE OPTIMUM
Soil pH	6.9	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Organic Matter(%)	2.0	XXXXXXXXXXXX
Major nutrients		
Phosphorus(lb/A)	8.5	XXXXXXXXXXXXXXXXXXXXXXXXXXXX
Potassium (% Sat)	2.6	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Calcium (% Sat)	81.7	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Magnesium (% Sat)	15.7	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Sulfur (ppm)	6	XXXXXXXXXXXXX
Micronutrients		
Boron (ppm)	0.2	XXXXXXXXXXXXX
Copper (ppm)	0.29	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Iron (ppm)	4.3	XXXXXXXXXXXXXXXXXXXXXXX
Manganese (ppm)	7.3	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Zinc (ppm)	0.5	XXXXXXXXXXXXXXXXX

▪RECOMMENDED ADDITIONS FOR GRASS HAY-ONE CROP - Crop Code # 104

No lime recommended. Soil pH is at or above the optimum level for this crop.

Magnesium level is sufficient to meet crop requirement.
Recommended major nutrient application rates as follows:

80 pounds nitrogen per acre
50 pounds phosphate per acre
130 pounds potash per acre

Apply fertilizer as soon as possible in early spring.

Notes on dairy forage potassium: Any potash fertilizer recommended is for forage grown for lactating cows. Ideally, 8 - 10 % of your hay ground should be kept at a low-medium K test level to maintain forage level at or below 2 % K. Hay grown on this ground should be stored separately and fed to dry cows starting at least one month prepartum.

For information on micronutrient management and recommendations, see enclosed form.

▪NUMERICAL RESULTS

(Test methodology: pH in water and Mehlich buffer, available nutrients by modified Morgan extract)
(Organic matter measured by LOI, P determined colorimetrically, all others measured by ICP-OES)

CEC and nutrient balance calculations are based on present pH of 6.9

	Soil pH	Lime Index 2	Phosphorus (lb/A)	Potassium (lb/A)	Magnesium (lb/A)	Calcium (lb/A)	CEC (me/100 g)	K (% Saturation)	Mg (% Saturation)	Ca (% Saturation)	Acidity
Level Found	6.9	6.40	8.5	145	280	3246	7.3(A)	2.6	15.7	81.7	0.0
Optimum Range	5.5-6.5	N/A	10-40	see % Saturation levels			> 5	2.8-4.0	10-20	60-80	< 10

	Organic Matter(%)	Sulfur (ppm)	Copper (ppm)	Iron (ppm)	Manganese (ppm)	Zinc (ppm)
Level Found	2.0	6	0.29	4.3	7.3	0.5
Normal Range	5 - 8	> 15	.25-.60	6 - 10	4 - 8	1 - 2

Additional Results or Comments:

(Extras)	Boron (ppm)	Sodium (ppm)	Soluble Salts (mmhos/cm)	Nitrate-N (ppm)	Ammonium-N (ppm)
Level Found	0.2	N/A	N/A	N/A	N/A
Normal Range	0.5-1.2				

Appendix B.2.2
Routine Maintenance Report Form
IBM Gun Club - Former Burn Pit Area
BCP Site No. C704044

Field Representative: Chris Nortom (Sanborn Head)	Position: PM/Field Rep
Company: Bruce Spence (Groundwater Sciences)	Date: 7/28/2017 10/5/2017

System Type (circle one): Monitoring Well; Injection Well; Soil Fill in Seep Area; Soil Cap; Phytoremediation

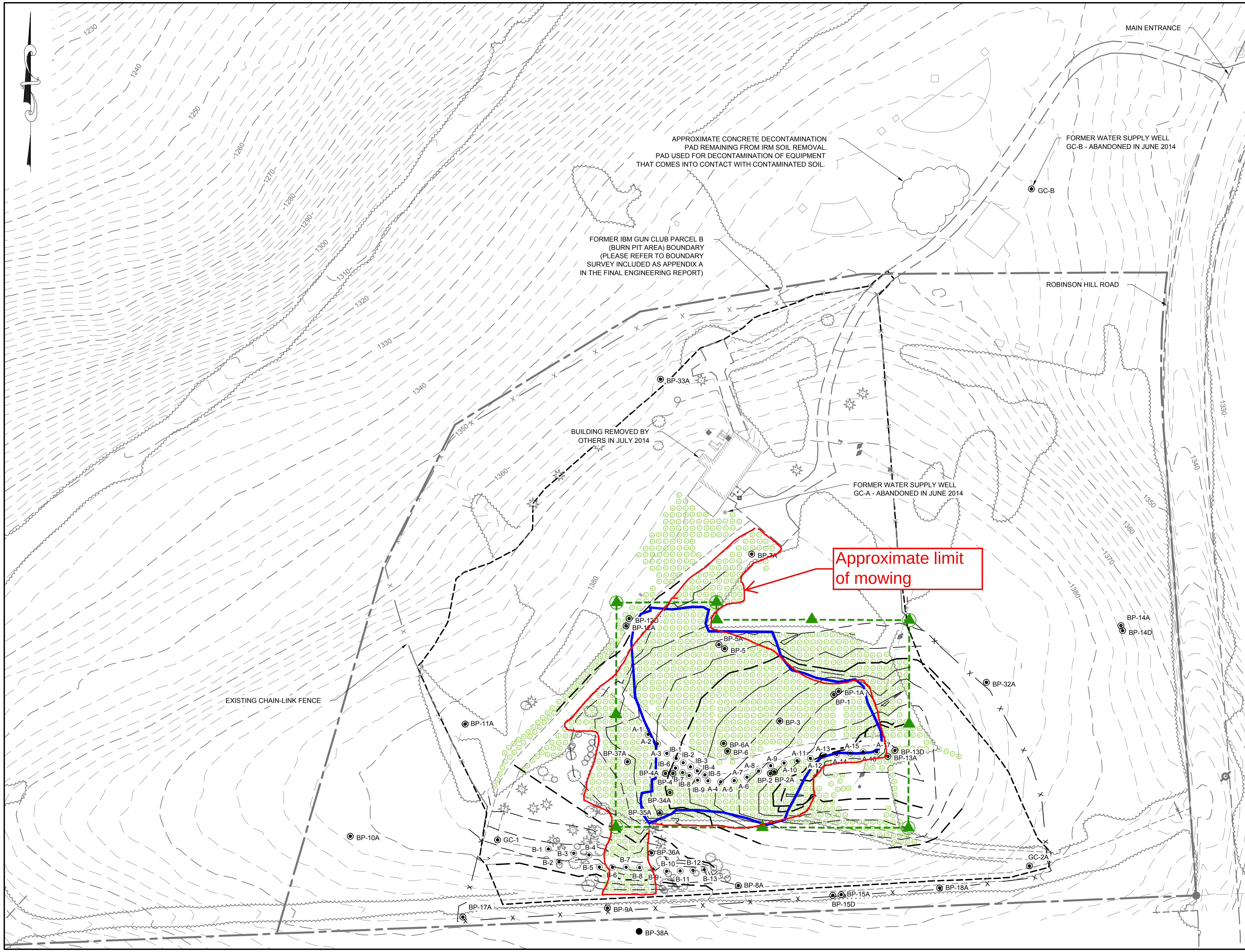
Maintenance activities:

Sanborn Head coordinated with Groundwater Sciences personnel to mow the grass within the area of tree planting. We provided a marked-up field sketch of the areas to mow, but were not present at the time of mowing, which was performed on July 28 and October 5, 2017.

During the July mowing, the mower left a wheel rut at the base of the capped area along the southern gravel access road. The rut was made just outside the capped area, and the vapor or underlying material were not disturbed. A small amount of standing water was present during the site -wide inspection, but was not evident during sampling approximately 2 weeks later. The rut was subsequently repaired with commercially available topsoil.

Modifications to the system: None

Field Representative Date Chris Nortom 10/5/2017	Attachments: ☐ None ☐ Photographs ☒ Field Sketch ☐ Invoices/ Receipts ☐ Other	SANBORN HEAD
Reviewed By Date Erica Bosse 10/5/2017		



NOTES:

1. WITH THE EXCEPTION OF THE FEATURES IDENTIFIED UNDER NOTE 3, THE BASE MAP WAS DEVELOPED FROM THE FOLLOWING SURVEY DATA MERGED BY SANBORN, HEAD & ASSOCIATES, INC. (SANBORN HEAD):

   A. WITHIN THE LIMITS SHOWN ON THE PLAN VIEW FIGURE AS DENOTED IN THE LEGEND THE TOPOGRAPHY AND SITE FEATURES REFLECT FIELD GROUND SURVEY DOCUMENTED ON A PLAN ENTITLED "TOPOGRAPHIC SURVEY OF FORMER IBM GUN CLUB", PREPARED BY BUTLER LAND SURVEYING, LLC (BUTLER) OF LITTLE MEADOWS, PENNSYLVANIA AND PROVIDED TO SANBORN HEAD IN DIGITAL FORMAT. TOPOGRAPHY REPRESENTS SITE CONDITIONS ON MARCH 28, 2012. ORIGINAL SCALE: 1" = 50'. THE MARCH 2012 SURVEY WAS CONDUCTED TO OBTAIN REFINED TOPOGRAPHIC DATA FOR THE AREA THAT WILL BE AFFECTED BY SOIL EXCAVATION AND CAPPING AND TO ESTABLISH PROJECT BENCHMARKS.

   B. OUTSIDE THE AREA OF MARCH 2012 FIELD SURVEY THE TOPOGRAPHY AND SITE FEATURES ARE FROM A PHOTOGRAMMETRIC SURVEY PLAN PREPARED BY BUTLER AND PROVIDED TO SANBORN HEAD IN DIGITAL FORMAT. THE PHOTOGRAMMETRIC MANUSCRIPT DATED AUGUST 11, 2008 WAS BASED ON AERIAL PHOTOGRAPHY FLOWN IN AUGUST, 2007.

   C. AS-BUILT CONTOURS WERE DEVELOPED BY KEYSTONE ASSOCIATES OF BINGHAMTON, NEW YORK AND WERE BASED ON FIELD SURVEYS CONDUCTED BY KEYSTONE ON OCTOBER 29 AND 30 AND NOVEMBER 7, 2013, AND JUNE 24, 2014.

2. THE VERTICAL DATUM IS BASED ON THE NAVD OF 1988 AND THE HORIZONTAL DATUM IS BASED ON THE NEW YORK STATE PLANE COORDINATE SYSTEM, CENTRAL ZONE. THE APPROXIMATE GLOBAL COORDINATES FOR THE SITE ARE: LONGITUDE - W76° 0' 20", LATITUDE - N42° 7' 57.6".

3. THE EXTENT OF THE MARKER LAYER WAS SURVEYED BY KEYSTONE ASSOCIATES OF BINGHAMTON, NY ON SEPTEMBER 18, 2013. THE REMAINING AS-BUILT FEATURES WERE SURVEYED BY KEYSTONE ON OCTOBER 29 AND 30, 2013 AND NOVEMBER 7, 2013.

LEGEND

Symbol	Description
1350	EXISTING 10-FOOT CONTOUR
	EXISTING 2-FOOT CONTOUR
1380	AS-BUILT 10-FOOT CONTOUR
	AS-BUILT 2-FOOT CONTOUR
X	EXISTING CHAIN-LINK FENCE
X	AS-BUILT CHAIN-LINK FENCE
	EXISTING TREE LINE
	EXISTING UTILITY LINE
	APPROXIMATE LIMIT OF MARCH 2012 FIELD SURVEY (SEE NOTE 1A)
	EXISTING EDGE OF PAVED ROAD
	EXISTING EDGE OF GRAVEL PATH
	AS-BUILT EDGE OF GRAVEL PATH
	SURVEYED EXTENT OF MARKER LAYER
BP-6	EXISTING MONITORING WELL LOCATION AND DESIGNATION
IB-4	EXISTING INJECTION WELL LOCATION AND DESIGNATION
A-1	AS-BUILT INJECTION WELL LOCATION AND DESIGNATION
	DEED RESTRICTION BOUNDARY
	MONUMENT TO DOCUMENT DEED RESTRICTED AREA
	MONUMENT TO DOCUMENT DEED RESTRICTED AREA WITH SIGNAGE INSTALLED
	SURVEYED TREE PLANTING LIMITS

SANBORN | HEAD ENGINEERING

GRAPHICAL SCALE

60' 30' 0 60' 120'

NO.	DATE	DESCRIPTION	BY

DRAWN BY: M. HILDENBRAND
DESIGNED BY: J. SANBORN
REVIEWED BY: D. CARR
PROJECT MGR: E. BRADSTREET
PIC: D. SHEA
DATE: OCTOBER 2014

FINAL ENGINEERING REPORT
IBM GUN CLUB - FORMER BURN PIT AREA
UNION, NEW YORK

LOCATION PLAN

PROJECT NUMBER: 63526.00

FIGURE NUMBER: 4

Appendix B.2.3
Routine Maintenance Report Form
IBM Gun Club - Former Burn Pit Area
BCP Site No. C704044

Field Representative:	Paula Pryor	Position: Field Representative
Company:	Sanborn Head	Date: 8/1 to 8/3/2017
System Type (circle one)	Monitoring Well	Soil Cap
	Injection Well	Phytoremediation
	Soil Fill in Seep Area	Enhanced Biochemical Degradation

Maintenance activities:

- Injected a mixture of water and commercially-available emulsified oil substrate into the subsurface to enhance in-situ biochemical degradation
- Injected about 1,812 gallons of diluted amendment into 27 of the 39 injection boreholes in the A- and B- lines. Injected fluid consisted of 14 gallons of EOS Pro amendment mixed with about 261 gallons of water at about a 19:1 ratio.
- Injected fluid was bubbled with nitrogen gas and kept under a nitrogen head space to limit the introduction of oxygen into the solution
- Pressure injection was completed with the packer system inflated at depths either fully within or outside the casing to aid in distributing amendment across the borehole interval and to induce hydraulic fracturing at two depths.
- At locations where the rate of injection under pressurized conditions diminished before the design injection volume was emplaced, the remaining amendment was added by pumping into the borehole column and steel casing volume, and in these cases, chase water was not added.
- Observations of amendment seepage above the ground were documented when injecting along the B-line which may be due to a steady rainfall that occurred the night of Wednesday, August 2nd, 2017.

Appendix B.2.3
Routine Maintenance Report Form
IBM Gun Club - Former Burn Pit Area
BCP Site No. C704044

The table below summarizes the recent past injection history providing perspective for the design of the August 2017 injection:

Event Date	Scope	Approximate Gallons Dilute Amendment	Comments
June 2010	Pilot Test Boreholes	21	About 2.3 gallons of amendment diluted 11:1 were injected per borehole.
November 2010	Pilot Test Boreholes	54	About 6 gallons of amendment diluted 11:1 were injected per borehole.
May 2013	Pilot Test Boreholes	327	About 8 to 70 gallons of amendment diluted 10:1 were injected per borehole.
December 2013	A-Series Boreholes	640	Between 29 and 44 gallons of amendment diluted 19:1 were injected per borehole.
July 2014	B-Series Boreholes	811	Between 46 and 67 gallons of amendment diluted 19:1 were injected per borehole.
August 2015	Select A- and B-Series Boreholes	1,180	Approximately 11 to 280 gallons of amendment diluted 19:1 were injected per borehole. Injection was completed in 26 of 39 boreholes within the A- and B-Series line of boreholes targeted within the primary source rock and higher transmissivity zones.
August 2017	Select A- and B-Series Boreholes	1,812	Approximately 13 to 200 gallons of amendment diluted 19:1 were injected per borehole. Injection was completed in 27 of 39 boreholes within the A- and B-Series line of boreholes targeted within the primary source rock and higher transmissivity zones.

Detailed notes collected during injection activities and field sheets are attached.

Modifications to the system:

Addition of edible soybean oil to the subsurface.

Field Representative Date
8/4/2017

Reviewed By Date
8/4/2017

Attachments:

☐ None
☐ Photographs
☐ Field Sketch
☐ Invoices/ Receipts
☒ Other
Field Records

SANBORN HEAD

Table 1
2017 Injection Record
IBM Gun Club - Former Burn Pit Area
Union, New York

Location I.D.	General Exploration Information						Day-of Measurements												
	Depth to Bottom (ft bgs)	Top of Casing (ft ags)	Depth to Bottom (ft bTOC)	Casing Depth (ft bgs)	Length of Open Borehole (ft)	Depth to Bottom of Casing (ft bTOC)	Depth to Water (ft bTOC)	Above or Below Casing (A or B)	Unsaturated Interval (ft)	Saturated Thickness (ft)	Saturated Borehole Volume (gal)	Proposed 2017 Dose (gal)	Actual Amendment Injected (gal)	Difference between target and actual dose	Proposed Chase Water (gal)	Actual Chase Water Injected (gal)	Nominal Radius of Influence (ft)	Approximate Injection Pressure	Approximate Injection Rate gpm	Comments
A-1	12.3	2.6	14.9	6.6	5.7	9.2	6.87	Above	0	5.7	8.4	40	40	0	8	10	27	35	16	Took injection dose readily. Bottom of packer set at 8.5' btoc
A-2	12.8	1.9	14.7	6	6.8	7.9	4.99	Above	0	6.8	10.0	30	30	0	8	10	22	50	4.3	Bottom of packer set at 7' btoc. Came up to high pressure (95 psi) at first and steadily dropped throughout injecting. Injected full dose plus chase water readily.
A-3	14.4	3.4	17.8	8	6.4	11.4	11.57	Below	0.17	6.23	9.2	30	24	6	8	0	18	90	1.9	Bottom of packer set at 10.5' bgs. Injected 24 gal under pressure until level rose to top of casing. No chase water due to lack of room.
IB-6	19.8	2.95	22.75	7.3	12.5	10.25	6.87	Above	0	12.5	8.1	150	174	-24	8	10	35	20	18.9	Injected full dose, plus extra and chase water readily. After approximately 80 gallons, stopped to mix small batch of amendment to finish out the day. Bottom of packer set at 8.5' btoc.
IB-2	19.4	3.07	22.47	7.4	12	10.47	7.28	Above	0	12	7.8	90	100	-10	8	10	28	20	10.8	Injected full dose, plus 10 extra gallons of mixed amendment and 10 gallons chase water readily. Bottom packer set at 9.5' btoc
IB-7	19.9	2.83	22.73	7.6	12.3	10.43	7.02	Above	0	12.3	8.0	100	116	-16	8	10	30	20	11.4	Botom of packer set at 9.5' btoc. Took dose, plus extra and chase water readily.
IB-4	20.3	2.78	23.08	8.3	12	11.08	7.53	Above	0	12	7.8	40	56	-16	8	10	22	25	12	Bottom of packer set at 10' btoc. Took dose, plus extra and chase water readily.
IB-9	20.2	2.42	22.62	8.9	11.3	11.32	7.43	Above	0	11.3	7.3	30	46	-16	8	10	21	30	14.7	Bottom of packer set at 10.5' btoc. Took dose, plus extra and chase water readily.
A-4	19.7	2.4	22.1	9	10.7	11.4	9.24	Above	0	10.7	15.7	40	25	15	8	0	14	100	N/A	Bottom of packer at 10.5' btoc. Would not take amendment under pressure, removed packer and topped off with 25 gallons. No chase water due to lack of room.
A-5	19.9	3.2	23.1	10	9.9	13.2	8.37	Above	0	9.9	14.6	30	26	4	8	0	15	90	0.9	Bottom of packer set at 12' btoc. Took only about 4 gal under pressure, topped off until full with 22 gal. No chase water due to lack of room.
A-6	20.1	2.4	22.45	10	10.05	12.4	9.12	Above	0	10.05	14.8	20	22	-2	8	0	14	N/A	N/A	Bottom of packer set at 11.5' btoc. Unable to inject any of the dose under pressure. Topped off with 22 gallons. No chase water due to lack of room.

Table 1
2017 Injection Record
IBM Gun Club - Former Burn Pit Area
Union, New York

Location I.D.	General Exploration Information						Day-of Measurements												
	Depth to Bottom (ft bgs)	Top of Casing (ft ags)	Depth to Bottom (ft bTOC)	Casing Depth (ft bgs)	Length of Open Borehole (ft)	Depth to Bottom of Casing (ft bTOC)	Depth to Water (ft bTOC)	Above or Below Casing (A or B)	Unsaturated Interval (ft)	Saturated Thickness (ft)	Saturated Borehole Volume (gal)	Proposed 2017 Dose (gal)	Actual Amendment Injected (gal)	Difference between target and actual dose	Proposed Chase Water (gal)	Actual Chase Water Injected (gal)	Nominal Radius of Influence (ft)	Approximate Injection Pressure	Approximate Injection Rate gpm	Comments
A-7	18.6	3.1	21.7	10	8.6	13.1	10.91	Above	0	8.6	12.6	40	22	18	8	0	15	N/A	N/A	Bottom of packer set at 12.5' btoc. Unable to inject any of the dose under pressure. Topped off with 22 gallons. No chase water due to lack of room.
A-8	17.7	3.5	21.2	11	6.7	14.5	9.49	Above	0	6.7	9.8	80	24.5	55.5	8	0	18	90	0.6	Bottom of packer set at 12.5' btoc. Able to inject 3 gallons under pressure, topped off with additional 21.5 gal. No chase water due to lack of room.
A-9	17.0		17	11	6	11	4.32	Above	0	6	8.8	20	13	7	8	0	14	80	11.8	Bottom of packer set to 10.5' btoc. Able to inject 2 gallons under pressure before progress stopped, topped off witih additoinal 11 gal. No chase water due to lack of room.
A-10	16.9	2.7	19.6	11	5.9	13.7	4.6	Above	0	5.9	8.7	40	18	22	8	0	16	80	3.7	Bottom of packer set at 12.5' btoc. Able to inject 11 under pressure before progress stopped. Removed packer and topped off with 11 additional gallons.
A-12	17.8	2.7	20.5	10	7.8	12.7	13.12	Below	0.42	7.38	10.8	40	100	-60	8	10	36	30	13.5	Bottom of backer set at 11.5' btoc. Able to inject dose readily. Added 60 additional gallons to cover deficit from nearby wells that did not accept enough amendment.
A-13	17.2	2.7	19.9	10	7.2	12.7	17.16	Below	4.46	2.74	4.0	120	190	-70	8	10	79	25	11.6	Bottom of packer set at 11.5' btoc. Able to inject dose readily. Added 70 additional gallons to cover deficit from nearby wells that did not accept enough amendment.
A-14	16.5	2.0	18.5	8	8.5	10	11.15	Below	1.15	7.35	10.8	40	16	24	8	0	14	60	4	Bottom of packer initially set in rock 10.5 to 13.9' btoc. Injected approximately 8 gal then overflowed. Moved packer up to 6.1 to 9.5, still overflowed. Switched packers to bigger one, and installed from 6.7 to 9.5' btoc. Injected about another 8 gal and overflowed again. No chase water due to lack of room.
A-15	16.1	2.0	18.1	8	8.1	10	12.34	Below	2.34	5.76	8.5	100	38	62	8	0	24	40	2.5	Packer set from 10.5-13.9' btoc in rock. Injected 33 gal under pressure before overflow. Topped off with an additional 5 gal after packer was removed
											Totals:	1080	1080.5	-0.5						
B-4	17	2.18	19.18	6	11	8.18	4.87	Above	0	11	16.2	150	160	-10	8	10	36	25	11.5	Packer set from 4.1-7.5' btoc within casing. Amendment accepted easily. After injection stopped, amendment noted seeping out of hillside.

Table 1
2017 Injection Record
IBM Gun Club - Former Burn Pit Area
Union, New York

Location I.D.	General Exploration Information						Day-of Measurements												
	Depth to Bottom (ft bgs)	Top of Casing (ft ags)	Depth to Bottom (ft bTOC)	Casing Depth (ft bgs)	Length of Open Borehole (ft)	Depth to Bottom of Casing (ft bTOC)	Depth to Water (ft bTOC)	Above or Below Casing (A or B)	Unsaturated Interval (ft)	Saturated Thickness (ft)	Saturated Borehole Volume (gal)	Proposed 2017 Dose (gal)	Actual Amendment Injected (gal)	Difference between target and actual dose	Proposed Chase Water (gal)	Actual Chase Water Injected (gal)	Nominal Radius of Influence (ft)	Approximate Injection Pressure	Approximate Injection Rate gpm	Comments
B-5	17.4	2.5	19.9	7	10.4	9.5	6.16	Above	0	10.4	15.3	80	90	-10	8	10	29	35	10.1	Packer set from 5.6 - 9.0' btoc within casing. Test paused then resumed when amendment noted seeping out of hillside.
B-6	18.7	2.3	21	7	11.7	9.3	6.47	Above	0	11.7	17.2	50	170	-120	8	10	36	25	12.1	Packer set from 5.6 - 9.0' btoc within casing. Amendment accepted easily. Injected 70 gal plus 10 chase water on 8/2 to cover deficit on B-7 and B-8. Returned 8/3, injected 100 gal under pressure to cover deficit from B-9 and B-10. Topped off with 6 gal to finish tote
B-7	19.4	2.5	21.9	7	12.4	9.5	8.49	Above	0	12.4	18.2	60	21	39	8	0	12	100	0	Packer set from 5.6 - 9.0' btoc. No amendment injected under pressure due to bending packer pipe and lifting rig. Topped off borehole with 21 gal. No chase water added.
B-8	17.9	1.9	19.8	7	10.9	8.9	9.77	Above	0	10.9	16.0	60	24	36	8	0	14	100	0	Packer set from 4.6 - 8.0' btoc. No amendment injected under pressure due to bending packer pipe and lifting rig. Topped off borehold with 24 gal. No chase water added.
B-9	18.4	2.8	21.2	8	10.4	10.8	11.41	Below	0.61	9.79	14.4	240	66.5	173.5	8	0	24	50	3.2	Packer set from 6.6 - 10' btoc. Amendment accepted easily, but injection stopped due to overflow in B-8. 66.5 gal injected under pressure, topped off with 19.5 gal. B-9 should be completed before topping off B-8.
B-10	17.35	3	20.35	6	11.35	9	5.18	Above	0	11.35	16.7	90	200	-110	8	0	39	30	14.3	Packer set from 5.1 - 8.5' btoc. Amendment accepted easily. Emptied tote, but test not resumed due to amendment observed seeping above ground on gravel road at base of hill. 189 gal injected under pressure. Topped off with 26 gal. Bubbling observed at B-11
											Totals:	730	731.5	-1.5						

APPENDIX B.3

NON-ROUTINE MAINTENANCE REPORTS

Appendix B.3
Non-Routine Maintenance Report Form
IBM Gun Club - Former Burn Pit Area
BCP Site No. C704044

Field Representative:	Chris Norton	Position: Field Representative
Company:	Bruce Spence (Groundwater Sciences)	Date: 10/31/2017
System Type (circle one)	Monitoring Well Injection Well Soil Fill in Seep Area	Soil Cap Phytoremediation (Field Office)
Nature of problem or incident:	Two occurrences of vandalism to the field office were observed upon arrival for the September 26, 2017 site inspection and October 2017 sampling event. Interior damage was observed to windows and equipment with few materials were observed stolen, including the wireless internet router. The east gate entrance lock on Robinson Hill road was also observed to have been broken.	

Maintenance activities:

The repair was performed on October 31,2017 and consisted of:

- Installation of a ¼" aluminum plate with tamper-proof screws over the windows on the field office windows.
- Placement of an AB-7 lock on the east gate entrance on Robinson Hill road.

Modifications to the system:

Field Representative Date Chris Norton 12/19/2017	Attachments: ☒ None ☐ Photographs ☐ Field Sketch ☐ Invoices/ Receipts ☐ Other	SANBORN HEAD
Reviewed By Date Erica Bosse 12/19/2017		

APPENDIX C

FIELD SAMPLING DOCUMENTATION

APPENDIX C.1

SUMMARY OF APRIL 2017
WATER QUALITY MONITORING

8976 Wellington Road
Manassas, VA 20109

June 22, 2017

Gary Priscott
New York State Department of Environmental Conservation
1679 Route 11
Kirkwood, NY 13795

Re: Summary of April 2017 Water Quality Monitoring
IBM Gun Club, Former Burn Pit Area
Robinson Hill Road, Union, NY 13760
NYSDEC Site # C704044

Dear Mr. Priscott:

This letter serves to transmit copies of the Summary of April 2017 Water Quality Monitoring report. The remedy performance monitoring work and the preparation of this report were completed by Sanborn, Head Engineering, P.C. (SHPC) in accordance with NYSDEC-approved Site Management Plan (SMP) for this project.

If you have any questions regarding the enclosed report, please contact me at 703-257-2585.

Very truly yours,

Linda Daubert
IBM Program Manager

Enclosures: Summary of April 2017 Water Quality Monitoring

cc: Kevin O'Hara (Binghamton Country Club)
Bridget Boyd (NYSDOH)
Maureen Schuck (NYSDOH)
Harry Warner (NYSDEC)

SUMMARY OF APRIL 2017 WATER QUALITY MONITORING

IBM Gun Club – Former Burn Pit Area
Union, New York

INTRODUCTION

This memorandum summarizes the scope and results of remedy performance monitoring conducted in April 2017. It describes the sampling event and provides tabular and figure summaries of the field and laboratory data. The field work was conducted during the week of April 24, 2017 in general accordance with the scope and procedures discussed in Appendix J of the amended Site Management Plan (SMP)[1].

This memorandum will be included as a component of the next Periodic Review Report, due in March 2018, and has been prepared consistent with the Monitoring Reporting Requirements discussed in Section 3.6 of the SMP. The Sanborn Head field staff included Chris Norton and Matthew Stein.

SCOPE OF WORK

The scope of work included:

- Limited groundwater elevation survey;
- Water quality sampling associated with the performance monitoring program; and
- Water quality parameter field screening and field geochemical testing.

Groundwater Elevation Survey

On April 24, 2017, prior to starting the water quality sampling program, the depths to water in select monitoring wells and injection boreholes were gauged in accordance with procedures detailed in Appendix G of the SMP. Water levels were also measured and recorded for monitoring points at the time sampling was conducted. Based on the depth to water data and survey information, groundwater elevations were calculated for each location. Depth to water measurements and groundwater elevations are summarized on Table 1. Inferred groundwater elevation contours are shown on Figure 1.

Water Quality Sampling

The scope of sampling as originally planned is included as Table 2. The scope was modified as follows as a result of field conditions:

[1] Site Management Plan – April 2016 Revision, Brownfield Cleanup Program, IBM Gun Club – Former Burn Pit area, Union, New York, NYSDEC Site #C704044, BCA Index #B7-0661004-05, prepared on behalf of IBM by Sanborn, Head & Associates, Inc., April 25, 2016.

- Water from BP-6A was deemed too turbid for geochemical field testing and samples were collected for laboratory analysis; and
- Surface water point 112 was dry during April 2017 and could not be sampled. No new on-site seeps/springs were observed.

Exhibit 1 below summarizes the sampling methods used during the monitoring event. The quality assurance/quality control (QA/QC) samples collected for VOC analysis are summarized in Exhibit 2. Samples (including QA/QC samples) submitted for off-site laboratory analysis or field screening are tabulated in Exhibit 3. Laboratory and field analytical data are summarized in Table 3A for groundwater and 3B for surface water.

Exhibit 1 Summary of Sampling Methods

Sample Method	Number of Locations Sampled
Modified Low-Flow	14
Bladder Pump Grab	0
Purge Water (Tote) Grab Sample	0
Submerged Container (surface water)	3
Passive Diffusion Bag	5
fLUTE® Purge	0

Exhibit 2 Summary of QA/QC Samples for VOC analysis

Total Sample Locations	22
Duplicate Samples	2
Matrix Spikes	1
Matrix Spike Duplicates	1
Field Blanks	3
Equipment Blanks	1
Trip Blanks	2

Exhibit 3 Summary of Analytical Type

Sample Type – Off-Site Laboratory	Laboratory	Number of Samples
VOCs	Eurofins	32
Total Organic Carbon	Eurofins	21
Volatile Fatty Acids	Pace	21
Light Gases (Ethane, Ethene, and Methane)	Pace	21
Geochemical Analyses	Pace	1
Sample Type - Field Screening	**Laboratory**	**Number of Samples**
Field Geochemistry	Sanborn Head	16

Equipment Calibration

Exhibit 4 below summarizes the field instruments utilized during field sampling. The instruments were calibrated each morning and a calibration check was performed at the end of each day.

Exhibit 4 Summary of Field Instrumentation

INSTRUMENT	FIELD PARAMETER
YSI Water Quality Parameter Probe	Temperature, pH, Specific Conductance, Dissolved Oxygen, and Oxidation-reduction Potential
HACH 2100P Turbidimeter	Turbidity
HACH DR900 Spectrophotometer	Total and Ferrous Iron, Nitrate, Sulfate, and Sulfide

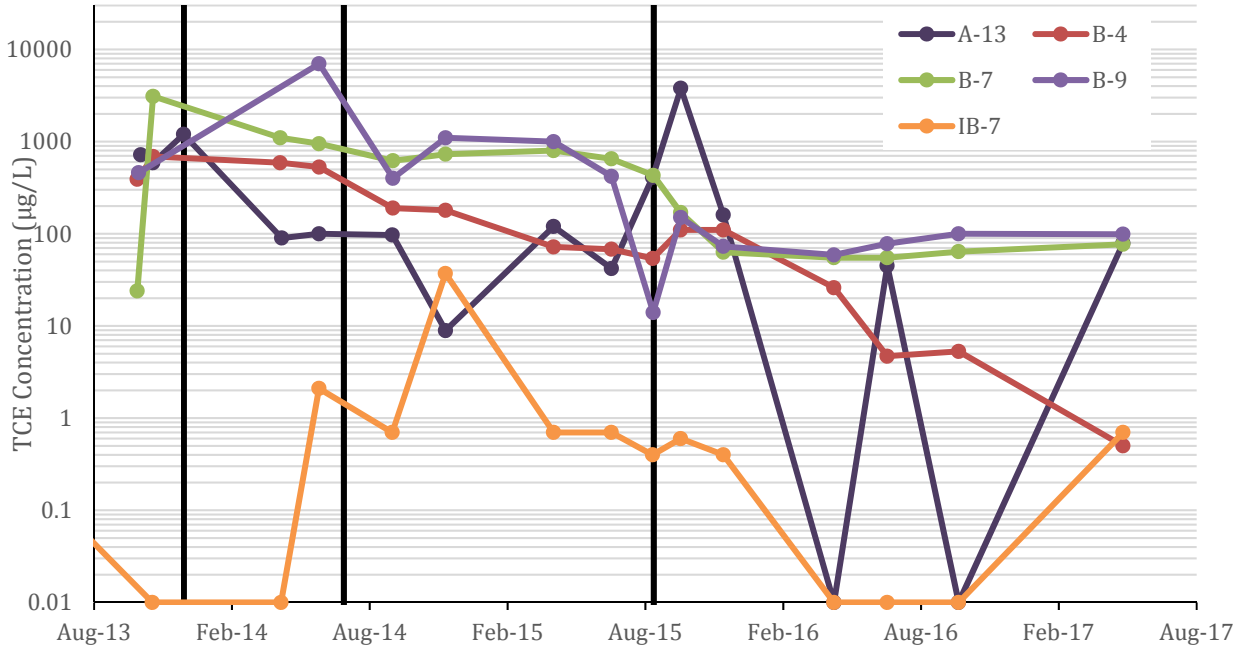
SUMMARY OF RESULTS

The field and laboratory data for April 2017 indicate remedy performance generally consistent with project performance goals established in the SMP. Enhanced biochemical degradation of VOCs in groundwater is being monitored by: 1) tracking changes in concentration of the parent contaminant compound, trichloroethene (TCE), 2) tracking the presence of breakdown products of TCE, including the terminal breakdown products ethene and ethane, and 3) tracking the presence of geochemical conditions favorable to biochemical conditions by reductive dehalogenation.

Geochemical conditions generally remain within ranges that are favorable for reductive dehalogenation over most of the source area. As shown on Figure 1, the overall area of sulfate-reducing conditions, which are marginally conducive to reductive dehalogenation, is consistent with previous monitoring in September 2016. The area under methanogenic conditions that is most conducive to reductive dehalogenation is inferred to be smaller than that observed in 2016, especially in the area near BP-35A located between the two lines of injection boreholes. Figure 2 (PDF with multiple layers) presents the geochemical data used to infer the geochemical conditions shown on Figure 1.

Exhibit 5 below shows the TCE concentrations for the five injection boreholes that are routinely sampled. Most of these injection boreholes continue to exhibit order of magnitude or greater decreases in TCE concentrations compared to historical high concentrations. However, at four of five these boreholes, TCE concentrations since April 2016 have been relatively stable or fluctuating.

Exhibit 5: TCE at the five routinely sampled injection boreholes



Note: Non-detects are plotted as 0.01 µg/L. The vertical black lines indicate site-scale amendment injections conducted in December 2013, July 2014, and August 2015.

Exhibit 6 below presents the April 2017 monitoring results for several select parameters in comparison to the previous monitoring results of September 2016. TCE concentrations have increased since the last monitoring round at 12 of the 19 wells (63%), while terminal breakdown product (ethane and ethane) concentrations have increased or remained stable at 13 of the 19 wells (68%), indicating continued reductive dehalogenation. The geochemical data for total organic carbon, oxidation-reduction potential (ORP), and dissolved oxygen present a mixed picture, with roughly half the measurements having changed in a direction less favorable to reductive dehalogenation.

Total organic carbon (TOC) concentrations in injection boreholes continue to decline consistent with consumption of electron donor. Concentrations exceed 100 milligrams per liter (mg/l) in water from 4 of 5 sampled injection boreholes; however, concentrations of TOC are approaching 100 mg/l at 2 of 5 sampled injection boreholes, which is a threshold below which we have observed evidence of diminishing biochemical degradation.

Since geochemical conditions indicative of reductive dehalogenation may be lessening as discussed above and as evidenced by higher TCE concentrations observed in some wells just downgradient of the lines of injection boreholes (BP-6A, BP-34A), we recommend that IBM plan for the next injection of edible oil amendment in August 2017. This timeframe will be two years since the last amendment injection in August 2015, an interval consistent with the goal of conducting injections at most every two years.

Exhibit 6: April 2017 Results Compared to September 2016

Analyte	TCE	Ethene+Ethane	TOC	ORP	DO
	ug/L	ug/L	mg/L	mV	mg/L
Injection Boreholes					
IB-7	0.70	63	46		
A-13	79	2,300	130		
B-4	0.50	63	270		
B-7	77	480	2,400		
B-9	99	230	1,160		
Injection Displacement Zone					
BP-2A	110	250	5.1	-160	0.26
BP-4A	280	82	5.1	36	0.32
BP-13A	16	0.044	1.5	160	4.0
BP-36A	1,100	750	20	220	0.11
Downgradient - on site					
B-1A	150	8.9	16	130	0.71
BP-5A	25	2.4	24	140	0.90
BP-6A	44,000	2.1	150	-57	0.31
BP-9A	950	440	2.0	-80	0.31
BP-34A	43,000	160	7.7	-16	4.3
BP-35A	3,700	0.53	2.8	7.5	6.6
BP-37A	11	0.16	2.6	140	7.5
Downgradient - off site					
BP-31A	59	0.016	1.3	200	2.5
BP-38A	360	0.018	1.7	210	3.9
BP-39A	31	0.061	2.1	220	4.5
Favorable Change	≥ 10% decline	≥ 10% increase	≥ 10% increase	≥ 10% decline	≥ 10% decline
Number of Wells	4	10	9	3	9
Stable	0 to ± 10%	0 to ± 10%	0 to ± 10%	0 to ± 10%	0 to ± 10%
Number of Wells	3	3	2	1	0
Unfavorable Change	≥ 10% increase	≥ 10% decline	≥ 10% decline	≥ 10% increase	≥ 10% increase
Number of Wells	12	6	8	9	4
Concentrations shown from April 2017 sampling event, rounded to 2 sig. figures.					
Blank cell indicates lack of data in one or both events.					

Field sampling records and analytical laboratory reports are kept on file and are available by request. The next performance monitoring event is to be conducted in June 2017.

Attachments:

Table 1	Summary of Water Level Data
Table 2	Scope of Performance Monitoring
Table 3A	Summary of April 2017 Performance Monitoring – Groundwater
Table 3B	Summary of April 2017 Performance Monitoring – Surface Water
Figure 1	Summary of April 2017 Groundwater Quality Conditions Summary of
Figure 2	Geochemical Conditions

P:\3500s\3526.02\Source Files\201704 Trip Report\20170622 April 2017 WQ Memo.docx

Table 1
Summary of Water Level Data
Summary Trip Report
IBM Gun Club - Former Burn Pit Area
Union, New York

Well Location	Reference Elevation (ft amsl)	Depth to Water (ft bgs)	Equivalent Potentiometric Elevation (ft amsl)
A-13	1394.25	16.15	1376.95
B-4	1385.03	4.08	1377.27
B-7	1385.33	8.32	1375.63
B-9	1385.21	11.15	1371.75
BP-1A	1396.03	11.61	1378.38
BP-2A	1397.15	10.36	1385.24
BP-4A	1392.28	11.23	1377.28
BP-5A	1391.23	11.88	1373.51
BP-6A	1394.10	16.58	1376.08
BP-9A	1379.54	10.25	1366.03
BP-10A	1381.74	10.90	1366.91
BP-11A	1384.80	12.03	1369.78
BP-13A	1399.17	10.70	1380.80
BP-17A	1376.72	9.48	1363.25
BP-31A	1370.63	9.70	1356.65
BP-34A	1392.73	10.17	1376.28
BP-35A	1392.01	13.11	1374.09
BP-36A	1383.88	10.47	1369.03
BP-37A	1390.31	8.41	1377.41
BP-38A	1375.84	9.15	1361.26
BP-39A	1370.47	7.22	1355.72
GC-2A	1384.66	11.02	1363.46
IB-7	1393.23	6.66	1384.30

Notes:

1. This table summarizes depth to water measurements and calculated water table elevations recorded during the April 2017 performance monitoring round on April 24, 2017. Measurements were collected relative to the marked reference point at each location using a QED MP30 water level meter.

2. Abbreviations
ft amsl = feet above mean sea level
ft bgs = feet below ground surface

Table 2
Summary of Routine and Performance Monitoring Program
IBM Gun Club - Former Burn Pit Area
Union, New York

Monitoring Type	Monitoring Location	Monitoring Location Type	Sample Method				Analytical Laboratory				Field Screening	
			Low Flow	PDBs	Nitrogen Purge	Surface Water	VOCs	Light Gasses	TOC	VFAs	Water Quality Parameters	Field Geochemistry
Routine Monitoring (Annually in June)	BP-7A	Monitoring Well		x			x				x	
	BP-8A	Monitoring Well		x			x				x	
	BP-10A	Monitoring Well		x			x				x	
	BP-11A	Monitoring Well		x			x				x	
	BP-12A	Monitoring Well		x			x				x	
	BP-14A	Monitoring Well		x			x				x	
	BP-16A	Monitoring Well		x			x				x	
	BP-17A	Monitoring Well		x			x				x	
	BP-18A	Monitoring Well		x			x				x	
	BP-19A	Monitoring Well		x			x				x	
	BP-20A	Monitoring Well		x			x				x	
	BP-21A	Monitoring Well		x			x				x	
	BP-22A	Monitoring Well		x			x				x	
	BP-23A	Monitoring Well		x			x				x	
	BP-24A	Monitoring Well		x			x				x	
	BP-25A	Monitoring Well		x			x				x	
	BP-26A	Monitoring Well		x			x				x	
	BP-27A	Monitoring Well		x			x				x	
	BP-30A	Monitoring Well		x			x				x	
	BP-32A	Monitoring Well		x			x				x	
	GC-2A	Monitoring Well		x			x				x	
	GC-1, P-1	Multi-Depth			x		x				x	
	GC-1, P-8	Multi-Depth			x		x				x	
	BP-12D, P1	Multi-Depth			x		x				x	
	BP-12D, P7	Multi-Depth			x		x				x	
	BP-13D, P1	Multi-Depth			x		x				x	
	BP-13D, P5	Multi-Depth			x		x				x	
	BP-15D, P1	Multi-Depth			x		x				x	
	BP-15D, P5	Multi-Depth			x		x				x	
Performance Monitoring (3x/year in April, June, and Sept/October)	IB-7	Injection Borehole		x			x	x	x	x		
	A-13	Injection Borehole		x			x	x	x	x		
	B-4	Injection Borehole		x			x	x	x	x		
	B-7	Injection Borehole		x			x	x	x	x		
	B-9	Injection Borehole		x			x	x	x	x		
	BP-1A	Monitoring Well	x				x	x	x	x	x	x
	BP-2A	Monitoring Well	x				x	x	x	x	x	x
	BP-4A	Monitoring Well	x				x	x	x	x	x	x
	BP-5A	Monitoring Well	x				x	x	x	x	x	x
	BP-6A	Monitoring Well	x				x	x	x	x	x	x
	BP-9A	Monitoring Well	x				x	x	x	x	x	x
	BP-13A	Monitoring Well	x				x	x	x	x	x	x
	BP-31A	Monitoring Well	x				x	x	x	x	x	x
	BP-34A	Monitoring Well	x				x	x	x	x	x	x
	BP-35A	Monitoring Well	x				x	x	x	x	x	x
	BP-36A	Monitoring Well	x				x	x	x	x	x	x
	BP-37A	Monitoring Well	x				x	x	x	x	x	x
	BP-38A	Monitoring Well	x				x	x	x	x	x	x
	BP-39A	Monitoring Well	x				x	x	x	x	x	x
	111	Seep/spring				x	x				x	
	112	Seep/spring				x	x				x	
	113	Seep/spring				x	x				x	
	118	Seep/spring				x	x				x	
	SW-Z	Seep/spring				x	x				x	
		Total	**14**	**26**	**8**	**5**	**53**	**19**	**19**	**19**	**48**	**14**

Notes:
1. This table is intended to summarize the programs of routine and performance monitoring for remedy operations at the IBM Gun Club - Former Burn Pit Area starting in 2016. Additional monitoring points may be sampled based on field observations. "SW-Z" serves as a placeholder for sampling any on-site seep or spring that can be reasonably sampled. The table summarizes sample method, analytical laboratory analysis, and field screening.

2. Sample method:
"Low Flow" indicates samples will be collected by bladder pump using low flow techniques.
"PDBs" indicates that the well has sufficient water column to sample with passive diffusion bags - if conditions are observed to be different than anticipated, sampling will proceed using low flow techniques.
"Nitrogen purge" indicates that sample will be collected by purging the multi-level port with nitrogen (multi-level systems only).
"Surface water" samples will be collected using a clean glass vial.

3. Analytical laboratory samples:
"VOCs" indicates volatile organic compounds.
"Light gasses" includes methane, ethene and ethane.
"TOC" indicates total organic carbon.
"VFAs" indicates volatile fatty acids.

4. " Water quality parameters" indicates screening during well purging and water quality sampling by multi-parameter probes, e.g. by YSI® 556 multi-Probe meter or similar and HACH® turbidity meter or similar (low flow, multi-level system, bailer, and surface water sampling) or by water quality parameter sounding (PDB sampling). The water quality parameters may include temperature, specific conductance, oxidation-reduction potential, dissolved oxygen, pH, and turbidity. In addition surface water samples will include water clarity descriptors (transparency, translucence, or opaqueness, and color).

5. "Field Geochemistry" will be performed during performance monitoring by using reagent kits and a spectrophotometer (HACH® DR 900, DR 2800, or similar). The field geochemistry includes analysis for sulfate, sulfide, ferrous iron, total iron, and oxygen. In some cases elevated turbidity (>10 NTU) or color may interfere with the spectrophotometric analysis. In such cases field geochemistry samples will be supplemented with samples submitted to an analytical laboratory as outlined in the Site Management Plan.

TABLE 3A
SUMMARY OF APRIL 2017 PERFORMANCE MONITORING - GROUNDWATER
Summary Trip Report
IBM Gun Club - Former Burn Pit Area
Union, New York

Analyte Name	Unit	BP-1A	BP-2A	BP-4A	BP-4A	BP-5A	BP-6A	BP-9A	BP-13A	BP-31A	BP-31A	BP-34A	BP-35A	BP-36A
		BP-1A	BP-2A	BP-4A	DUP-2	BP-5A	BP-6A	BP-9A	BP-13A	BP-31A	DUP-1	BP-34A	BP-35A	BP-36A
		Low Flow	Low Flow	Low Flow	Low Flow	Low Flow	Low Flow	Low Flow	Low Flow	Low Flow	Low Flow	Low Flow	Low Flow	Low Flow
		S	S	S	FD	S	S	S	S	S	FD	S	S	S
		4/25/2017	4/25/2017	4/25/2017	4/25/2017	4/25/2017	4/26/2017	4/25/2017	4/25/2017	4/25/2017	4/25/2017	4/25/2017	4/25/2017	4/25/2017
VOLATILE ORGANIC COMPOUNDS (VOCs)														
Trichloroethene (TCE)	µg/l	**150**	**110**	**280**	**270**	**25**	**44,000**	**950**	**16**	**58**	**59**	**43,000**	**3,700**	**1100**
Dichloroethene (cis-1,2-)	µg/l	**130**	**3,700**	**77**	**71**	**34**	**16,000**	**1,900**	**0.40 J**	**8.8**	**9.1**	**54,000**	**5,900**	**7,000**
Dichloroethene (trans-1,2-)	µg/l	**1.6**	**9.6 J**	**2.7**	**3.2**	**0.60 J**	**57 J**	**10**	<0.5	<0.5	<0.5	**77 J**	**6.5 J**	**24**
Dichloroethene (1,1-)	µg/l	**0.90**	**6.2 J**	**0.80**	**0.90**	<2.5	<250	**6.5**	<0.5	<0.5	<0.5	**130 J**	**7.7 J**	**16**
Tetrachloroethene (PCE)	µg/l	<0.5	<10	**0.10 J**	**0.1 J**	<2.5	<250	<5.0	<0.5	**3.30**	**3.0**	<250	<25	<10
Vinyl chloride	µg/l	**28**	**1,000**	**27**	**24**	**11**	<250	**360**	<0.5	**0.20 J**	**0.10 J**	**1400**	<25	**790**
LIGHT GASSES														
Ethane	µg/l	**1.8**	**0.46**	**31**	**29**	**0.084 J**	**0.74**	**32**	**0.0087 J**	**0.0052 J**	**0.0080 J**	**3.5**	**0.21**	**32**
Ethene	µg/l	**7.1**	**250**	**51**	**48**	**2.3**	**1.4**	**410**	**0.035 J**	**0.0076 J**	**0.0081 J**	**160**	**0.32**	**720**
Methane	µg/l	**120**	**1,400**	**3,500**	**3,200**	**7.2**	**21**	**12,000**	**0.20 J**	**0.13 J**	**0.13 J**	**990**	**5.6**	**8,500**
MOLAR CONCENTRATION														
Trichloroethene (TCE)	µmol/l	1.1	0.84	2.1	2.1	0.19	335	7.2	0.12	0.44	0.45	327	28	8.4
Dichloroethene (cis-1,2-)	µmol/l	1.3	38	0.79	0.73	0.35	165	20	0.004	0.09	0.09	557	61	72
Dichloroethene (trans-1,2-)	µmol/l	0.02	0.10	0.03	0.03	0.01	0.59	0.10	ND	ND	ND	0.79	0.07	0.25
Dichloroethene (1,1-)	µmol/l	0.01	0.06	0.01	0.01	ND	ND	0.07	ND	ND	ND	1.3	0.08	0.17
Tetrachloroethene (PCE)	µmol/l	ND	ND	0.001	0.001	ND	ND	ND	ND	0.02	0.02	ND	ND	ND
Vinyl chloride	µmol/l	0.45	16	0.43	0.38	0.18	ND	5.8	ND	0.003	0.002	22	ND	13
Ethane	µmol/l	0.06	0.02	1.0	0.96	0.003	0.02	1.1	0.0003	0.0002	0.0003	0.12	0.01	1.1
Ethene	µmol/l	0.25	8.9	1.8	1.7	0.08	0.05	15	0.001	0.0003	0.0003	5.7	0.01	26
Total	µmol/l	3.3	64	6.2	5.9	0.81	501	48	0.13	0.56	0.56	915	89	120
MOLAR PERCENTAGE														
TCE	%	35	1.3	34	35	24	67	15	96	79	80	36	32	7.0
DCEs	%	42	60	13	13	44	33	41	3.2	16	17	61	68	60
VC	%	14	25	6.9	6.5	22	ND	12	ND	0.58	0.28	2.4	ND	11
Ethane+Ethene	%	10	14	46	45	10	0.01	32	1.2	0.08	0.10	0.64	0.02	22
VOLATILE FATTY ACIDS														
Acetic Acid	mg/l	**0.42 J**	**0.37 J**	**0.33 J**	**0.28 J**	**0.51 J**	**0.36 J**	**0.35 J**	**0.18 J**	**0.24 J**	**0.32 J**	**0.37 J**	**0.36 J**	**43**
Butyric Acid	mg/l	**0.073 J**	<1.0	<1.0	<1.0	**0.073 J**	**0.072 J**	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**0.69 J**
Hexanoic Acid	mg/l	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	**0.17 J**
i-Hexanoic Acid	mg/l	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
i-Pentanoic Acid	mg/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**0.083 J**
Lactic Acid	mg/l	**0.26 J**	**0.41 J**	**0.22 J**	**0.14 J**	**0.16 J**	**0.18 J**	**0.13 J**	**0.24 J**	**0.20 J**	**0.28 J**	**0.13 J**	**0.17 J**	**0.42 J**
Pentanoic Acid	mg/l	<1.0	**0.13 J**	<1.0	**0.12 J**	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Propionic Acid	mg/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	**0.11 J**
Pyruvic Acid	mg/l	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
OTHER LABORATORY DATA														
Total Organic Carbon	mg/l	**16**	**5.1**	**5.1**	**4.8**	**24**	**152**	**2.0**	**1.5**	**1.3**	**1.3**	**7.7**	**2.8**	**20**
WATER QUALITY PROBE DATA														
Temperature	°C	**9.79**	**9.5**	**10.3**	-	**9.96**	**11.67**	**7.3**	**9.67**	**7.99**	**7.99**	**9.95**	**9.2**	**8.5**
Specific Conductance	uS/cm	**2,100**	**930**	**730**	-	**1,700**	**6,800**	**450**	**190**	**300**	**300**	**1,100**	**780**	**500**
pH	s.u.	**6.92**	**6.97**	**7.4**	-	**6.6**	**7.1**	**7.6**	**5.94**	**6.4**	**6.4**	**7.5**	**7.72**	**7.4**
Oxidation/Reduction Potential	mV	**130**	**-160**	**36**	-	**140**	**-57**	**-80**	**160**	**200**	**200**	**-16**	**8**	**220**
Dissolved Oxygen	mg/l	**0.71**	**0.26**	**0.32**	-	**0.90**	**0.31**	**0.31**	**3.96**	**2.5**	**2.5**	**4.3**	**6.6**	**0.11**
Turbidity	NTU	**2.02**	**0.69**	**0.25**	-	**2.84**	**1.99**	**3.2**	**3.5**	**1.59**	**1.6**	**2.3**	**2**	**13.4**
FIELD CHEMISTRY														
Iron	mg/l	**0.15**	**>3**	**0.20**	-	**0.33**	**1**	**0.01**	ND	ND	ND	**0.10**	ND	**>3**
Iron - Ferrous	mg/l	**0.05**	**>3**	**0.29**	-	**0.08**	**0.33 J**	ND	ND	**0.01**	**0.01**	**0.01**	**0.06**	**>3**
Nitrate	mg/l	**1**	**0.30**	**0.20**	-	**0.50**	<0.5	**0.20**	**0.40**	**0.30**	**0.30**	**0.60**	**0.60**	**1.00**
Sulfate	mg/l	**>70**	**46**	**17**	-	**>70**	**1,700**	**3.0**	**11**	**5.0**	**5.0**	**64**	**19**	**8.0**
Sulfide	µg/l	**50**	**70**	**70**	-	ND	<1000	**60**	**30**	**20**	**20**	ND	ND	**80**

TABLE 3A
SUMMARY OF APRIL 2017 PERFORMANCE MONITORING - GROUNDWATER
Summary Trip Report
IBM Gun Club - Former Burn Pit Area
Union, New York

Analyte Name	Unit	BP-37A BP-37A Low Flow S 4/25/2017	BP-38A BP-38A Low Flow S 4/25/2017	BP-39A BP-39A Low Flow S 4/25/2017	A-13 A-13 PDB S 4/26/2017	B-4 B-4 PDB S 4/26/2017	B-7 B-7 PDB S 4/26/2017	B-9 B-9 PDB S 4/26/2017	IB-7 IB-7 PDB S 4/26/2017
VOLATILE ORGANIC COMPOUNDS (VOCs)									
Trichloroethene (TCE)	µg/l	**11**	**360**	**31**	**79**	**0.50**	**77**	**99**	**0.70**
Dichloroethene (cis-1,2-)	µg/l	**1.00**	**66**	**39**	**22,000**	**2.2**	**490**	**3,000**	**1.8**
Dichloroethene (trans-1,2-)	µg/l	<0.5	**0.30 J**	**0.10 J**	**41 J**	**1.6**	<25	**5.4 J**	**0.10 J**
Dichloroethene (1,1-)	µg/l	<0.5	**0.60**	<0.5	**47 J**	<0.5	<25	<25	<0.5
Tetrachloroethene (PCE)	µg/l	<0.5	**0.30 J**	<0.5	<50	<0.5	<25	<25	<0.5
Vinyl chloride	µg/l	<0.5	**0.10 J**	<0.5	**2,700**	**2.1**	**89**	**230**	<0.5
LIGHT GASSES									
Ethane	µg/l	**0.066 J**	**0.0053 J**	**0.043 J**	**45**	**60**	**61**	**10**	**63**
Ethene	µg/l	**0.090 J**	**0.013 J**	**0.018 J**	**2,300**	**3.0**	**420**	**220**	**0.041 J**
Methane	µg/l	**160**	**0.22 J**	**0.13 J**	**7,400**	**28,000**	**14,000**	**6,800**	**22,000**
MOLAR CONCENTRATION									
Trichloroethene (TCE)	µmol/l	0.08	2.7	0.24	0.60	0.004	0.59	0.75	0.01
Dichloroethene (cis-1,2-)	µmol/l	0.01	0.68	0.40	227	0.02	5.1	31	0.02
Dichloroethene (trans-1,2-)	µmol/l	ND	0.003	0.001	0.42	0.02	ND	0.06	0.001
Dichloroethene (1,1-)	µmol/l	ND	0.01	ND	0.48	ND	ND	ND	ND
Tetrachloroethene (PCE)	µmol/l	ND	0.002	ND	ND	ND	ND	ND	ND
Vinyl chloride	µmol/l	ND	0.002	ND	43	0.03	1.4	3.7	ND
Ethane	µmol/l	0.002	0.0002	0.001	1.5	2.0	2.0	0.33	2.1
Ethene	µmol/l	0.003	0.0005	0.001	82	0.11	15	7.8	0.001
Total	µmol/l	0.10	3.4	0.64	355	2.2	24	44	2.1
MOLAR PERCENTAGE									
TCE	%	84	80	37	0.17	0.17	2.4	1.7	0.25
DCEs	%	10	20	63	64	1.8	21	71	0.92
VC	%	ND	0.05	ND	12	1.5	5.9	8.4	ND
Ethane+Ethene	%	5.4	0.02	0.32	24	96	71	19	99
VOLATILE FATTY ACIDS									
Acetic Acid	mg/l	**0.22 J**	**0.35 J**	**0.39 J**	**170**	**400**	**630**	**310**	**0.41 J**
Butyric Acid	mg/l	<1.0	<1.0	**0.12 J**	**15**	**25**	**370**	**98**	**0.075 J**
Hexanoic Acid	mg/l	<2.0	<2.0	<2.0	**3.9**	**2.4**	**140**	**43**	<2.0
i-Hexanoic Acid	mg/l	<2.0	<2.0	<2.0	**0.67 J**	**0.48 J**	**4.3**	**3.2**	<2.0
i-Pentanoic Acid	mg/l	<1.0	<1.0	<1.0	**1.4**	**2.1**	**12**	**2.7**	<1.0
Lactic Acid	mg/l	**0.3 J**	**0.19 J**	**0.12 J**	**0.17 J**	**0.17 J**	**1.1 J**	**46**	**0.19 J**
Pentanoic Acid	mg/l	<1.0	<1.0	**0.12 J**	**5.9**	**6.6**	**350**	**140**	<1.0
Propionic Acid	mg/l	<1.0	<1.0	<1.0	**26**	**50**	**500**	**550**	**0.13 J**
Pyruvic Acid	mg/l	<1.0	<1.0	<1.0	**12**	**15**	**69**	**26**	<1.0
OTHER LABORATORY DATA									
Total Organic Carbon	mg/l	**2.6**	**1.7**	**2.1**	**132**	**265**	**2,400**	**1,160**	**46**
WATER QUALITY PROBE DATA									
Temperature	°C	**9.65**	**8.5**	**7.6**	-	-	-	-	-
Specific Conductance	uS/cm	**740**	**250**	**190**	-	-	-	-	-
pH	s.u.	**6.97**	**6.0**	**5.4**	-	-	-	-	-
Oxidation/Reduction Potential	mV	**140**	**210**	**220**	-	-	-	-	-
Dissolved Oxygen	mg/l	**7.5**	**3.9**	**4.5**	-	-	-	-	-
Turbidity	NTU	**10**	**1.2**	**3.1**	-	-	-	-	-
FIELD CHEMISTRY									
Iron	mg/l	**0.11**	**0.28**	ND	-	-	-	-	-
Iron - Ferrous	mg/l	**0.22**	**0.15**	ND	-	-	-	-	-
Nitrate	mg/l	**1.1**	**0.90**	**1.9**	-	-	-	-	-
Sulfate	mg/l	**3.0**	**4.0**	**3.0**	-	-	-	-	-
Sulfide	µg/l	**20**	ND	ND	-	-	-	-	-

Notes:
1. The table summarizes samples collected during the week of April 24, 2017 as part of performance testing at the IBM Gun Club former Burn Pit Area. Samples were analyzed both in the field and at fixed analytical laboratories as indicated on the table.

2. Analytical laboratory analysis was performed by Eurofins Lancaster Laboratories of Lancaster, Pennsylvania (Lancaster) and/or Pace Analytical (formly Microseeps, Inc.) of Pittsburgh, Pennsylvania (Pace). Results of compounds are recorded in units indicated on the table. Detections of compounds are emboldened.

3. Definitions:
"S" indicates primary sample
"FD" indicates field duplicate
"PDB" indicates the sample was collected via a passive diffusion bag
"--" indicates the compounds were not analyzed for that particular sample.
"U" indicates the result was below the analytical detection limit.
"J" indicates that the laboratory data was below the lowest quantifiable limit and therefore estimated.
"*" indicates that the sample exhibited high turbidity and could not be analyzed in the field. Recorded results are from analysis at Lancaster and/or Pace.
"UR" indicates results were under the calibration range and no result was obtained.
"OR" indicates results were over the calibration range and should be considered estimated.
"ND" indicates that results were not detected above the analytical reporting limit or the calibration range of the field screening device.

4. Refer to the report text for further discussion. The sample plan can be referenced in the Site Management Plan.

TABLE 3B
SUMMARY OF APRIL 2017 PERFORMANCE MONITORING - SURFACE WATER
Summary Trip Report
IBM Gun Club - Former Burn Pit Area
Union, New York

Analyte Name	Unit	111	113	118
		111	113	118
		Surface Water	Surface Water	Surface Water
		S	S	S
		4/24/2017	4/24/2017	4/24/2017
VOLATILE ORGANIC COMPOUNDS (VOCs)				
Dichloroethene (1,1-)	ug/l	<0.5	<0.5	<0.5
Dichloroethene (cis-1,2-)	ug/l	<0.5	<0.5	<0.5
Dichloroethene (trans-1,2-)	ug/l	<0.5	<0.5	<0.5
Tetrachloroethene (PCE)	ug/l	<0.5	<0.5	<0.5
Trichloroethene (TCE)	ug/l	**0.4 J**	**<0.5**	**0.2 J**
Vinyl chloride	ug/l	<0.5	<0.5	<0.5
WATER QUALITY PROBE DATA				
Oxidation/Reduction Potential	mv	249	180	183
Specific Conductance	us/cm	158	208	457
Temperature	°C	12.5	15.5	13.6
pH	su	5.3	6.7	6.3

Notes:
1. The table summarizes samples collected during the week of April 24, 2017 as part of performance testing at the IBM Gun Club former Burn Pit Area.

2. Analytical laboratory analysis was performed by Eurofins Lancaster Laboratories of Lancaster, Pennsylvania (Lancaster). Results of compounds are recorded in units indicated on the table. Detections of compounds are emboldened.

3. Definitions:
"<" indicates the result was below the analytical detection limit.
"J" indicates that the laboratory data was below the lowest quantifiable limit and therefore estimated.

4. Refer to the report text for further discussion. The sample plan can be referenced in the Site Management Plan.

Figure 1

Summary of April 2017 Groundwater Quality Conditions

IBM Gun Club - Former Burn Pit Area

Union, New York

Drawn By:	C. LaVack
Designed By:	E. Bosse
Reviewed By:	D. Shea
Project No:	3526.05
Date:	June 2017

Figure Narrative

The figure is intended to depict groundwater quality data and inference recorded during the week of April 24, 2017.

The groundwater data for site key VOCs including TCE, cDCE, vinyl chloride, and ethene/ethane from water table monitoring wells are presented as pie diagrams. The wedges of each pie diagram represent concentrations of the five compounds expressed in micromoles per liter (µmol/L). The relative diameter of each pie diagram varies based on the sum of the five VOCs at each location.

The inferred geochemical (REDOX) conditions are based on observations of oxidation-reduction potential (ORP), methane, sulfide, ferrous and total iron, and nitrate. Methanogenic conditions are characterized by methane concentrations => 20 µg/L and sulfate reducing by sulfide => 50 µg/L. ORP is generally expected to be less than 100 for sulfate reduction, and less than 0 for methanogenic conditions.

Refer to Figure 2 for geochemical monitoring results.

Legend

BP-34A
43,000 Well Name and April 2017 TCE Concentrations in Groundwater (µg/L).

Inferred Groundwater Contour 4/24/2017

Methanogenic, Methane >= 20 µg/L

Sulfate Reducing, Sulfide >= 50 µg/L

Parent VOC (Trichloroethene)

Primary Daughter Product (*cis*-1,2DCE)

Secondary Daughter Product (Vinyl Chloride)

Terminal Breakdown Products (Ethane, Ethene)

Total Chlorinated Ethanes & Ethenes in Groundwater (µmol/L)

< 0.1

>0.1 to 1

>1 to 10

>10 to 100

>100

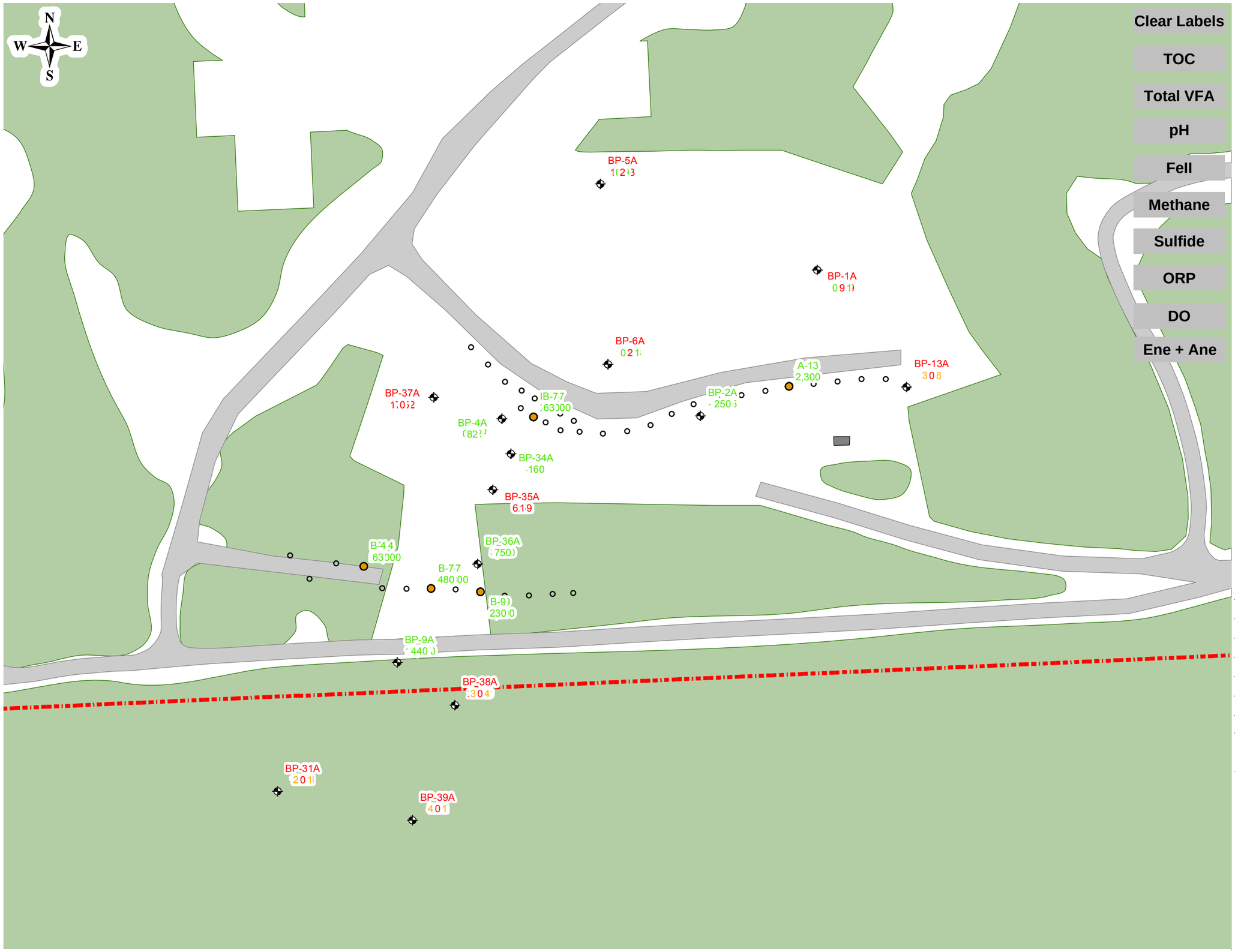
40 20 0 40 80

Feet

SANBORN HEAD

Last Edited By: clavack

Path: P:\3500s\3526.02\Graphics Files\GIS\Figures\April2017 GWQ_extended.mxd



Clear Labels

TOC

Total VFA

pH

FeII

Methane

Sulfide

ORP

DO

Ene + Ane

Figure 2

April 2017 Assessment of Reducing Conditions

IBM Gun Club - Former Burn Pit Area

Union, New York

Drawn By:	C. LaVack
Designed By:	E. Bosse
Reviewed By:	D. Shea
Project No:	3526.05
Date:	June 2017

Figure Narrative

This figure is intended to assess multiple lines of evidence to assess what proportion of the primary and secondary source rock are under sulfate reducing and methanogenic conditions. Green labels indicate conditions conducive to reductive dehalogenation. Orange labels indicate reductive dehalogenation may be possible, but conditions are less conducive. Red labels indicate conditions where reductive dehalogenation is less likely.

Posted data is from the April 2017 sampling round.

Legend

DO mg/L	>5	2-5	<=2
ORP mV	>100	0-100	<=0
Sulfide µg/L	<10	10-50	>=50
Methane µg/L	<0.5	0.5-20	>=20
FeII mg/L	<1		>=1
pH SU	<6.3 or >7.5		6.3-7.5
Total VFA mg/L	<1		>=1
TOC mg/L	<4		>=4
Ethane + Ethene µg/L	<10	10-50	>=50

30 15 0 30 60

Feet

SANBORN HEAD

APPENDIX C.2

SUMMARY OF JUNE 2017

WATER QUALITY MONITORING

SUMMARY OF JUNE 2017 WATER QUALITY MONITORING

IBM Gun Club – Former Burn Pit Area
Union, New York

INTRODUCTION

This memorandum summarizes the scope and result of remedy performance monitoring conducted in June 2017. It describes the sampling event, and provides tabular and figure summaries of the field and laboratory data. The field work was conducted the week of June 20, 2017 in general accordance with the scope and procedures discussed in Appendix J of the amended Site Management Plan (SMP)[1].

This memorandum will be included as a component of the next Periodic Review Report, due in March 2018, and has been prepared consistent with the Monitoring Reporting Requirements discussed in Section 3.6 of the SMP. The Sanborn Head field staff included Chris Norton, Neal Orosz, and Matthew Stein.

SCOPE OF WORK

The scope of work included:

- Comprehensive groundwater elevation survey;
- Annual well inspection including depth-to-bottom measurements;
- Water quality sampling associated with the performance monitoring program; and
- Water quality parameter field screening and field geochemical testing.

Groundwater Elevation Survey

On June 19, 2017, prior to starting the water quality sampling program, the depths to water in monitoring wells and certain injection boreholes were gauged in accordance with procedures detailed in Appendix G of the SMP. Water levels were also measured and recorded at the time sampling was conducted. Based on the depth to water data and survey information, groundwater elevations were calculated for each location. Depth to water measurements and groundwater elevations are summarized on Table 1. Inferred groundwater elevation contours are shown on Figure 1.

Water Quality Sampling

The scope of sampling as originally planned is included as Table 2. The scope was modified as follows as a result of field conditions:

[1] Site Management Plan – April 2016 Revision, Brownfield Cleanup Program, IBM Gun Club – Former Burn Pit area, Union, New York, NYSDEC Site #C704044, BCA Index #B7-0661004-05 prepared on behalf of IBM by Sanborn, Head & Associates, Inc.

- Flute Port BP-15D, P1 (18-25 feet below ground surface [ft bgs]) was found to be dry and could not be sampled. BP-14D is not included in the monitoring program, but we inadvertently sampled Flute ports 14D P1(47 to 54 ft bgs), and P4 (134 to 144 ft bgs) after purging these points to record water levels;

- Due to lack of water, the sample from BP-14A was collected with a dedicated bailer following measuring depth to water; and

- Water from BP-6A were deemed too turbid for geochemical field testing, and samples were collected for laboratory analysis

Exhibit 1 summarizes the sampling methods used during the monitoring event. The quality assurance/quality control (QA/QC) samples collected for VOC analysis are summarized in Exhibit 2. Samples (including QA/QC samples) submitted for off-site laboratory analysis or field screening are tabulated in Exhibit 3. Laboratory and field analytical data are summarized in Table 3.

Exhibit 1 Summary of Sampling Methods

Sample Method	Number of Locations Sampled
Modified Low-Flow	14
Submerged Container (surface water)	4
Passive Diffusion Bag	25
FLUTe™ Purge	9
Bailer	1
Purge Water Tote Sample	1

Exhibit 2 Summary of QA/QC Samples for VOC analysis

Total Primary Samples	19
Duplicate Samples	5
Matrix Spikes	3
Matrix Spike Duplicates	2
Field Blanks	2
Equipment Blanks	1
Trip Blanks	4

Exhibit 3 Summary of Analytical Type including QA/QC

Sample Type - Fixed Laboratory	Laboratory	Number of Samples
VOCs	Eurofins - Lancaster	71
Total Organic Carbon	Eurofins- Lancaster	22
Volatile Fatty Acids	Microseeps	22
Light Gases (Ethane, Ethene, and Methane)	Microseeps	22
Geochemical Analyses	Microseeps	1
Sample Type - Field Screening	**Laboratory**	**Number of Samples**
Field Geochemistry	Sanborn Head	13

Equipment Calibration

Exhibit 4 below summarizes the field instruments utilized during field sampling. The instruments were calibrated each morning, and a calibration check was performed at the end of each day.

Exhibit 4 Summary of Field Instrumentation

INSTRUMENT	FIELD PARAMETER
YSI 556 MPS Water Quality Parameter Probe	Temperature, pH, Specific Conductance, Dissolved Oxygen, and Oxidation-reduction Potential
HACH 2100P Turbidimeter	Turbidity
HACH DR900 Spectrophotometer	Total and Ferrous Iron, Nitrate, Sulfate, and Sulfide

SUMMARY OF RESULTS

A summary of groundwater quality data and inference is presented in Figure 1. A figure depicting the entire monitoring area south into the golf course and summarizing key site VOCs including carbon tetrachloride is included as Figure 2. An interactive layered plan view figure included as Figure 3 can be used to view the geochemical data used in inferring the geochemical conditions shown on Figure 1. Field sampling records and analytical laboratory reports are kept on file and are available by request.

The field and laboratory data for June 2017 are similar to the April 2017 monitoring results and indicate remedy performance generally consistent with the goals established in the SMP. Enhanced biochemical degradation of VOCs in groundwater is being monitored by: 1) tracking changes in concentration of the parent contaminant compound, trichloroethene (TCE), 2) tracking the presence of breakdown products of TCE, including the terminal breakdown products ethene and ethane, and 3) tracking the presence of geochemical conditions favorable to biochemical conditions by reductive dechlorination.

Geochemical conditions generally remain within ranges that are favorable for reductive dechlorination over most of the primary source rock. As shown on Figure 1, the overall area of sulfate-reducing conditions, which are marginally conducive to reductive dechlorination, is consistent with previous monitoring in April 2017. The area under methanogenic conditions that is most conducive to reductive dechlorination is inferred to be similar to that observed in April 2017 monitoring, but smaller than that observed in 2016, especially in the zone between the two lines of injection boreholes. Figure 3 (PDF with multiple layers) presents the geochemical data used to infer the geochemical conditions shown on Figure 1.

Exhibit 5 below presents the June 2017 monitoring results for select parameters in comparison to the previous monitoring results of April 2017. TCE concentrations have decreased or remained stable since the last monitoring round at 12 out of 19 wells (64%), while terminal breakdown product (ethane and ethene) concentrations have increased or remained stable at 12 out of 19 wells (64%), indicating continued reductive dechlorination. Total organic carbon (TOC) concentrations have decreased since the last monitoring round in 16 of the 19 wells (84%), consistent with consumption of electron donor. TOC in two of the five injection boreholes fell below the 100 milligrams per liter (mg/l) threshold, below

with we have observed evidence of diminishing biochemical degradation. The geochemical data for oxidation-reduction potential (ORP) and dissolved oxygen (DO) present a mixed picture, with roughly half the measurements having changed in a direction less favorable to reductive dechlorination.

Exhibit 5: Comparison of June 2017 to April 2017 Performance Monitoring

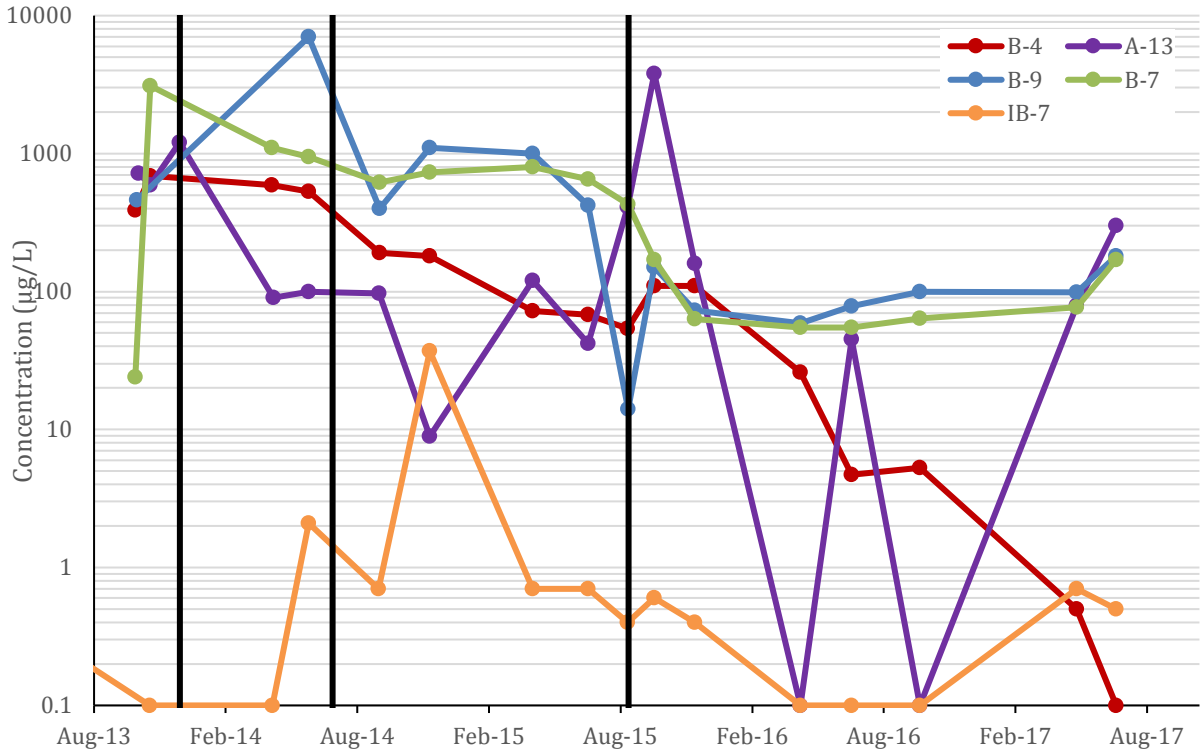
Analyte	TCE	Ethene+Ethane	TOC	ORP	DO
	ug/L	ug/L	mg/L	mV	mg/L
Injection Boreholes					
IB-7	0.50	58	45		
A-13	300	1,700	47		
B-4	<5.0	19	210		
B-7	170	670	1,700		
B-9	180	420	970		
Injection Displacement Zone					
BP-2A	70	410	4.0	-140	0.26
BP-4A	250	77	4.6	-73	1.1
BP-13A	48	0.34	1.1	300	4.9
BP-36A	53	805	20	-160	0.28
Downgradient - on site					
B-1A	150	2.4	19	170	0.63
BP-5A	25	66	23	35	2.8
BP-6A	21,000	7.3	230	-67	0.17
BP-9A	430	220	2.3	100	5.4
BP-34A	41,000	200	8.5	110	5.2
BP-35A	4,400	0.32	2.3	200	4.5
BP-37A	13	0.041	2.3	28	0.41
Downgradient - off site					
BP-31A	17	0.030	1.0	71	8.5
BP-38A	120	0.034	1.8	210	4.8
BP-39A	44	0.052	1.9	130	1.8
Favorable Change	≥ 10% decline	≥ 10% increase	≥ 10% increase	≥ 10% decline	≥ 10% decline
Number of Wells	8	9	3	7	5
Stable	0 to ± 10%	0 to ± 10%	0 to ± 10%	0 to ± 10%	0 to ± 10%
Number of Wells	4	3	5	1	1
Unfavorable Change	≥ 10% increase	≥ 10% decline	≥ 10% decline	≥ 10% increase	≥ 10% increase
Number of Wells	7	7	11	6	8

Concentrations shown from June 2017 sampling event, rounded to 2 sig. figures.
Blank cell indicates lack of data in one or both events.

The proportion of TCE on a molar basis in groundwater samples in June is similar to conditions observed in April 2017 sampling at many locations within the primary and secondary source rock, where the proportion of cis-1,2 Dichloroethene (cis-1,2 DCE) is greater than TCE. The terminal breakdown product ethene remains the predominant species in water from three of the five injection boreholes sampled regularly (B-4, B-7, and IB-7), with B-7 exhibiting ethene at about 21,000 micrograms per liter (µg/l), or over half of the mass on a molar basis.

Exhibit 6 below shows the TCE concentrations for the five injection boreholes that are routinely sampled. Most of these injection boreholes continue to exhibit order of magnitude or greater decreases in TCE concentrations compared to historical high concentrations. However, observations of stable or incrementally increasing TCE concentrations in four of five sampled injection boreholes noted in the April 2017 sampling report continue to be observed in June 2017 sampling results.

Exhibit 6: TCE at the five routinely sample injection boreholes



Note: Non-detects are plotted as 0.1 µg/L, although reporting limits may vary by sample. The vertical black lines indicate site-scale amendment injections conducted in December 2013, July 2014, and August 2015.

The data depicted for key VOCs on Figure 2 for the majority of monitoring locations further downgradient to the south on the Binghamton Country Club property (e.g. BP-23A, BP-24A, BP-30A) indicate water quality generally consistent, or improved, as compared to the last sampling conducted at these locations in June 2016. Sampling results from the multilevel monitoring installations (e.g., GC-1, P8 [90 to 97 ft bgs] and BP-15D, P5 [119 to 126 ft bgs]), which screen productive fracture zones between the primary source rock and residential water supplies, continue to not indicate any adverse change in water quality.

Carbon tetrachloride continues to be detected in an area around GC-2A at stable or decreasing concentrations compared to past monitoring.

As indicated in the April 2017 sampling report, geochemical conditions indicative of reductive dechlorination may be lessening, especially at locations downgradient of injection boreholes. As such, an injection event has been scheduled for the week of July 31, 2017. The next performance monitoring event is scheduled for October 2017.

Attachments:

Table 1	Scope of Performance Monitoring
Table 2	Summary of Water Level Data
Table 3	Summary of June 2017 Performance Monitoring
Figure 1	Summary of June 2017 Groundwater Quality Conditions
Figure 2	Summary of Key Site VOCs – June 2017
Figure 3	Summary of Geochemical Conditions

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Table 1
Summary of Water Level Data
Summary Trip Report
IBM Gun Club - Former Burn Pit Area
Union, New York

Well Location	Reference Elevation (ft amsl)	Depth to Water (ft bgs)	Equivalent Potentiometric Elevation (ft amsl)
A-1	1391.11	7.16	1383.95
A-2	1390.68	4.99	1385.69
A-3	1392.74	11.78	1380.96
A-4	1397.56	9.65	1387.91
A-5	1397.4	8.92	1388.48
A-6	1397.86	9.30	1388.56
A-7	1397.28	9.06	1388.22
A-8	1396.81	9.06	1387.75
A-9	1396.47	7.28	1389.19
A-10	1396.06	4.87	1391.19
A-11	1395.73	6.51	1389.22
A-12	1395.59	13.44	1382.15
A-13	1394.25	17.67	1376.58
A-14	1394.61	11.48	1383.13
A-15	1393.47	12.43	1381.04
A-16	1398.14	12.04	1386.1
A-17	1395.48	10.84	1384.64
B-1	1385.26	8.30	1376.96
B-2	1384.71	8.19	1376.52
B-3	1385.48	4.75	1380.73
B-4	1385.03	4.78	1380.25
B-5	1383.99	6.86	1377.13
B-6	1384.48	6.46	1378.02
B-7	1385.33	8.31	1377.02
B-8	1384.9	9.64	1375.26
B-9	1385.21	11.00	1374.21
B-10	1384.69	5.34	1379.35
B-11	1384.4	6.32	1378.08
B-12	1383.87	5.63	1378.24
B-13	1384.5	5.53	1378.97
BP-1A	1395.67	13.94	1381.73
BP-2A	1396.89	11.13	1385.76
BP-4A	1391.96	12.51	1379.45
BP-5A	1391.09	13.63	1377.46
BP-6A	1393.95	16.92	1377.03
BP-7A	1388.89	11.75	1377.14
BP-8A	1384.53	14.68	1369.85
BP-9A	1379.17	12.31	1366.86
BP-10A	1381.74	13.88	1367.86
BP-11A	1384.80	12.50	1372.3

Table 1
Summary of Water Level Data
Summary Trip Report
IBM Gun Club - Former Burn Pit Area
Union, New York

Well Location	Reference Elevation (ft amsl)	Depth to Water (ft bgs)	Equivalent Potentiometric Elevation (ft amsl)
BP-12A	1386.64	14.22	1372.42
BP-13A	1398.89	12.90	1385.99
BP-14A	1379.46	29.42	1350.04
BP-15A	1388.32	>16.95	<1371.41
BP-16A	1389.69	10.72	1378.97
BP-17A	1376.3	12.70	1363.6
BP-18A	1386.54	14.94	1371.6
BP-19A	1309.4	11.95	1297.45
BP-20A	1274.6	6.08	1268.52
BP-21A	1244.29	5.66	1238.63
BP-22A	1242.9	5.31	1237.59
BP-23A	1333.39	12.87	1320.52
BP-24A	1338.73	14.55	1324.18
BP-25A	1301.92	2.78	1299.14
BP-26A	1336.96	13.54	1323.42
BP-27A	1299.96	2.27	1297.69
BP-30A	1336.2	12.93	1323.27
BP-31A	1369.63	12.19	1357.44
BP-32A	1389.58	10.31	1379.27
BP-34A	1392.55	12.08	1380.47
BP-35A	1391.75	14.18	1377.57
BP-36A	1383.68	12.56	1371.12
BP-37A	1389.92	9.72	1380.20
BP-38A	1375.1	13.59	1361.51
BP-39A	1370.17	8.69	1361.48
BP-12D Port 1	1388.19	NM	–
BP-12D Port 7	1388.19	64.58	1320.79
BP-13D Port 1	1400.09	25.41	1371.63
BP-13D Port 5	1400.09	85.75	1311.29
BP-14D Port 1	1378.07	53.05	1325.02
BP-14D Port 5	1378.07	67.53	1310.54
BP-15D Port 1	1388.36	Dry	–
BP-15D Port 5	1388.36	72.28	1314.07
GC-1 Port 1	1383.71	12.42	1371.29
GC-1 Port 8	1383.71	60.14	1323.57
GC-2A	1383.32	15.60	1367.72
IB-1	1392.2	6.46	1385.74
IB-2	1393.47	7.74	1385.73
IB-3	1393.07	11.84	1381.23
IB-4	1393.78	8.14	1385.64

Table 1
Summary of Water Level Data
Summary Trip Report
IBM Gun Club - Former Burn Pit Area
Union, New York

Well Location	Reference Elevation (ft amsl)	Depth to Water (ft bgs)	Equivalent Potentiometric Elevation (ft amsl)
IB-5	1393.88	10.90	1382.98
IB-6	1393.05	7.30	1385.75
IB-7	1393.23	7.48	1385.75
IB-8	1393.43	11.44	1381.99
IB-9	1393.62	7.88	1385.74

Notes:

1. This table summarizes depth to water measurements and calculated water table elevations recorded during the June 2017 performance monitoring round on June 20-21, 2017. Measurements were collected relative to the marked reference point at each location using a QED MP30 water level meter.

2. Abbreviations
ft amsl = feet above mean sea level
ft bgs = feet below ground surface

Table 2
Summary of Routine and Performance Monitoring Program
IBM Gun Club - Former Burn Pit Area
Union, New York

Monitoring Type	Monitoring Location	Monitoring Location Type	Sample Method				Analytical Laboratory				Field Screening	
			Low Flow	PDBs	Nitrogen Purge	Surface Water	VOCs	Light Gasses	TOC	VFAs	Water Quality Parameters	Field Geochemistry
Routine Monitoring (Annually in June)	BP-7A	Monitoring Well		x			x				x	
	BP-8A	Monitoring Well		x			x				x	
	BP-10A	Monitoring Well		x			x				x	
	BP-11A	Monitoring Well		x			x				x	
	BP-12A	Monitoring Well		x			x				x	
	BP-14A	Monitoring Well		x			x				x	
	BP-16A	Monitoring Well		x			x				x	
	BP-17A	Monitoring Well		x			x				x	
	BP-18A	Monitoring Well		x			x				x	
	BP-19A	Monitoring Well		x			x				x	
	BP-20A	Monitoring Well		x			x				x	
	BP-21A	Monitoring Well		x			x				x	
	BP-22A	Monitoring Well		x			x				x	
	BP-23A	Monitoring Well		x			x				x	
	BP-24A	Monitoring Well		x			x				x	
	BP-25A	Monitoring Well		x			x				x	
	BP-26A	Monitoring Well		x			x				x	
	BP-27A	Monitoring Well		x			x				x	
	BP-30A	Monitoring Well		x			x				x	
	BP-32A	Monitoring Well		x			x				x	
	GC-2A	Monitoring Well		x			x				x	
	GC-1, P-1	Multi-Depth			x		x				x	
	GC-1, P-8	Multi-Depth			x		x				x	
	BP-12D, P1	Multi-Depth			x		x				x	
	BP-12D, P7	Multi-Depth			x		x				x	
	BP-13D, P1	Multi-Depth			x		x				x	
	BP-13D, P5	Multi-Depth			x		x				x	
	BP-15D, P1	Multi-Depth			x		x				x	
	BP-15D, P5	Multi-Depth			x		x				x	
Performance Monitoring (3x/year in April, June, and Sept/October)	IB-7	Injection Borehole		x			x	x	x	x		
	A-13	Injection Borehole		x			x	x	x	x		
	B-4	Injection Borehole		x			x	x	x	x		
	B-7	Injection Borehole		x			x	x	x	x		
	B-9	Injection Borehole		x			x	x	x	x		
	BP-1A	Monitoring Well	x				x	x	x	x	x	x
	BP-2A	Monitoring Well	x				x	x	x	x	x	x
	BP-4A	Monitoring Well	x				x	x	x	x	x	x
	BP-5A	Monitoring Well	x				x	x	x	x	x	x
	BP-6A	Monitoring Well	x				x	x	x	x	x	x
	BP-9A	Monitoring Well	x				x	x	x	x	x	x
	BP-13A	Monitoring Well	x				x	x	x	x	x	x
	BP-31A	Monitoring Well	x				x	x	x	x	x	x
	BP-34A	Monitoring Well	x				x	x	x	x	x	x
	BP-35A	Monitoring Well	x				x	x	x	x	x	x
	BP-36A	Monitoring Well	x				x	x	x	x	x	x
	BP-37A	Monitoring Well	x				x	x	x	x	x	x
	BP-38A	Monitoring Well	x				x	x	x	x	x	x
	BP-39A	Monitoring Well	x				x	x	x	x	x	x
	111	Seep/spring				x	x				x	
	112	Seep/spring				x	x				x	
	113	Seep/spring				x	x				x	
	118	Seep/spring				x	x				x	
	SW-Z	Seep/spring				x	x				x	
		Total	**14**	**26**	**8**	**5**	**53**	**19**	**19**	**19**	**48**	**14**

Notes:
1. This table is intended to summarize the programs of routine and performance monitoring for remedy operations at the IBM Gun Club - Former Burn Pit Area starting in 2016. Additional monitoring points may be sampled based on field observations. "SW-Z" serves as a placeholder for sampling any on-site seep or spring that can be reasonably sampled. The table summarizes sample method, analytical laboratory analysis, and field screening.

2. Sample method:
"Low Flow" indicates samples will be collected by bladder pump using low flow techniques.
"PDBs" indicates that the well has sufficient water column to sample with passive diffusion bags - if conditions are observed to be different than anticipated, sampling will proceed using low flow techniques.
"Nitrogen purge" indicates that sample will be collected by purging the multi-level port with nitrogen (multi-level systems only).
"Surface water" samples will be collected using a clean glass vial.

3. Analytical laboratory samples:
"VOCs" indicates volatile organic compounds.
"Light gasses" includes methane, ethene and ethane.
"TOC" indicates total organic carbon.
"VFAs" indicates volatile fatty acids.

4. " Water quality parameters" indicates screening during well purging and water quality sampling by multi-parameter probes, e.g. by YSI® 556 multi-Probe meter or similar and HACH® turbidity meter or similar (low flow, multi-level system, bailer, and surface water sampling) or by water quality parameter sounding (PDB sampling). The water quality parameters may include temperature, specific conductance, oxidation-reduction potential, dissolved oxygen, pH, and turbidity. In addition surface water samples will include water clarity descriptors (transparency, translucence, or opaqueness, and color).

5. "Field Geochemistry" will be performed during performance monitoring by using reagent kits and a spectrophotometer (HACH® DR 800, DR 900, DR 2800, or similar). The field geochemistry includes analysis for sulfate, sulfide, ferrous iron, total iron, and oxygen. In some cases elevated turbidity (>10 NTU) or color may interfere with the spectrophotometric analysis. In such cases field geochemistry samples will be supplemented with samples submitted to an analytical laboratory as outlined in the Site Management Plan.

TABLE 3
SUMMARY OF JUNE 2017 PERFORMANCE MONITORING
Summary Trip Report
IBM Gun Club - Former Burn Pit Area
Union, New York

Analyte Name	Unit	BP-1A BP-1A Low Flow S 6/20/2017	BP-2A BP-2A Low Flow S 6/20/2017	BP-4A BP-4A Low Flow S 6/20/2017	BP-5A BP-5A Low Flow S 6/20/2017	BP-6A BP-6A Low Flow S 6/21/2017	BP-7A BP-7A PDB S 6/21/2017	BP-8A BP-8A PDB S 6/21/2017	BP-9A BP-9A Low Flow S 6/20/2017	BP-10A BP-10A PDB S 6/21/2017	BP-11A BP-11A PDB S 6/21/2017	BP-12A BP-12A PDB S 6/21/2017	BP-13A BP-13A Low Flow S 6/20/2017	BP-14A BP-14A PDB S 6/21/2017	BP-16A BP-16A PDB S 6/21/2017	BP-17A BP-17A Low Flow S 6/21/2017	BP-18A BP-18A PDB S 6/21/2017	BP-18A DUP-5 PDB FD 6/21/2017	BP-19A BP-19A PDB S 6/21/2017
VOLATILE ORGANIC COMPOUNDS (VOCs)																			
Trichloroethene (TCE)	µg/l	**150**	**70**	**250**	**25**	**21,000**	<0.5	**19**	**430**	**1.5**	**2.7**	**2.4**	**48**	**0.40 J**	<0.5	**1.4**	**11**	**11**	<0.5
Dichloroethene (cis-1,2-)	µg/l	**150**	**5,600**	**62**	**40**	**30,000**	<0.5	**3.6**	**1,200**	**0.50 J**	<0.5	**0.30 J**	**1.6**	<0.5	<0.5	**0.20 J**	**0.30 J**	**0.30 J**	<0.5
Dichloroethene (trans-1,2-)	µg/l	**2.2**	**15 J**	**2.0**	**0.60**	<250	<0.5	<0.5	**7.0**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dichloroethene (1,1-)	µg/l	**0.90**	**9.4 J**	**0.80**	<0.5	**75 J**	<0.5	<0.5	**4.7 J**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Tetrachloroethene (PCE)	µg/l	<0.5	<25	**0.10 J**	<0.5	<250	<0.5	<0.5	<5.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Vinyl chloride	µg/l	**21**	**1,800**	**21**	**0.60**	**260**	<0.5	<0.5	**190**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
LIGHT GASSES																			
Ethane	µg/l	**0.78**	**0.46**	**36**	**0.031 J**	**0.64**	–	–	**20**	–	–	–	**0.26**	–	–	–	–	–	–
Ethene	µg/l	**1.6**	**410**	**41**	**0.036 J**	**6.7**	–	–	**200**	–	–	–	**0.081 J**	–	–	–	–	–	–
Methane	µg/l	**30**	**1,200**	**3,200**	**0.50**	**12**	–	–	**7,400**	–	–	–	**28**	–	–	–	–	–	–
MOLAR CONCENTRATION																			
Trichloroethene (TCE)	µmol/l	1.1	0.53	1.9	0.19	160	ND	0.14	3.3	0.011	0.021	0.018	0.37	0.0030	ND	0.011	0.084	0.084	ND
Dichloroethene (cis-1,2-)	µmol/l	1.5	58	0.64	0.41	309	ND	0.037	12	0.0052	ND	0.0031	0.017	ND	ND	0.0021	0.0031	0.0031	ND
Dichloroethene (trans-1,2-)	µmol/l	0.023	0.15	0.021	0.0062	ND	ND	ND	0.072	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichloroethene (1,1-)	µmol/l	0.0093	0.097	0.0083	ND	0.77	ND	ND	0.048	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene (PCE)	µmol/l	ND	ND	0.00060	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl chloride	µmol/l	0.34	29	0.34	0.0096	4.2	ND	ND	3.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethane	µmol/l	0.026	0.015	1.2	0.0010	0.021	–	–	0.67	–	–	–	0.0086	–	–	–	–	–	–
Ethene	µmol/l	0.057	15	1.5	0.0013	0.24	–	–	7.1	–	–	–	0.0029	–	–	–	–	–	–
Total	µmol/l	3.1	102	5.6	0.62	474	ND	0.18	27	0.017	0.021	0.021	0.39	0.0030	ND	0.013	0.087	0.087	ND
MOLAR PERCENTAGE																			
TCE	%	36	0.52	34	31	34	ND	80	12	69	100	86	93	100	ND	84	96	96	ND
DCEs	%	50	57	12	67	65	ND	20	47	31	ND	14	4.2	ND	ND	16	3.6	3.6	ND
VC	%	11	28	6.0	1.5	0.88	ND	ND	11	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethane+Ethene	%	2.6	14	48	0.37	0.05	–	–	29	–	–	–	2.9	–	–	–	–	–	–
VOLATILE FATTY ACIDS																			
Acetic Acid	mg/l	**0.032 J**	**0.022 J**	**0.048 J**	**0.037 J**	**0.17 J**	–	–	**0.038 J**	–	–	–	**0.040 J**	–	–	–	–	–	–
Butyric Acid	mg/l	**0.0068 J**	<0.1	**0.0074 J**	<0.1	<1.0	–	–	**0.0065 J**	–	–	–	**0.0088 J**	–	–	–	–	–	–
Hexanoic Acid	mg/l	<0.2	<0.2	<0.2	<0.2	<2.0	–	–	<0.2	–	–	–	<0.2	–	–	–	–	–	–
i-Hexanoic Acid	mg/l	<0.2	<0.2	<0.2	<0.2	<2.0	–	–	<0.2	–	–	–	<0.2	–	–	–	–	–	–
i-Pentanoic Acid	mg/l	<0.1	<0.1	<0.1	<0.1	<1.0	–	–	<0.1	–	–	–	<0.1	–	–	–	–	–	–
Lactic Acid	mg/l	<0.2	<0.2	<0.2	<0.2	<2.0	–	–	**0.016 J**	–	–	–	<0.2	–	–	–	–	–	–
Pentanoic Acid	mg/l	<0.1	<0.1	**0.013 J**	<0.1	<1.0	–	–	<0.1	–	–	–	<0.1	–	–	–	–	–	–
Propionic Acid	mg/l	**0.0056 J**	<0.1	**0.046 J**	<0.1	<1.0	–	–	<0.1	–	–	–	**0.014 J**	–	–	–	–	–	–
Pyruvic Acid	mg/l	<0.1	<0.1	**0.023 J**	**0.020 J**	<1.0	–	–	<0.1	–	–	–	<0.1	–	–	–	–	–	–
OTHER LABORATORY DATA																			
Total Organic Carbon	mg/l	**19.1**	**4.0**	**4.6**	**22.5**	**226**	–	–	**2.3**	–	–	–	**1.1**	–	–	–	–	–	–
WATER QUALITY PROBE DATA																			
Temperature	°C	**14.8**	**15.6**	**13.3**	**14.4**	**12.2**	**9.3**	**9.5**	**13.5**	**9.7**	**9.0**	**9.7**	**13.8**	**10.7**	**9.5**	**10.1**	**9.2**	–	**9.9**
Specific Conductance	uS/cm	**2,700**	**810**	**650**	**1,600**	**11,000**	**140**	**160**	**770**	**96**	**92**	**420**	**460**	**150**	**45**	**280**	**170**	–	**90**
pH	s.u.	**7.1**	**6.7**	**7.5**	**6.8**	**6.9**	**6.0**	**6.1**	**7.2**	**6.1**	**5.6**	**6.5**	**6.0**	**6.7**	**5.4**	**7.2**	**6.4**	–	**6.1**
Oxidation/Reduction Potential	mV	**170**	**-140**	**-73**	**35**	**-67**	**42**	**120**	**100**	**250**	**190**	**220**	**300**	**230**	**250**	**110**	**100**	–	**220**
Dissolved Oxygen	mg/l	**0.63**	**0.26**	**1.1**	**2.8**	**0.17**	**6.1**	**6.6**	**5.4**	**5.5**	**4.0**	**10.2**	**4.9**	**7.7**	**6.8**	**3.8**	**4.3**	–	**9.5**
Turbidity	NTU	**2.3**	**3.3**	**1.2**	**2.9**	**2.9**	–	–	**2.5**	–	–	–	**5.4**	–	–	–	–	–	–
FIELD CHEMISTRY																			
Iron	mg/l	ND	**>3.0**	ND	ND	**5.1** *	–	–	**0.09**	–	–	–	**0.03**	–	–	–	–	–	–
Iron - Ferrous	mg/l	ND	**>3.0**	**0.09**	ND	**4.9** *	–	–	**0.22**	–	–	–	**0.21**	–	–	–	–	–	–
Nitrate	mg/l	**0.70**	**0.60**	**0.40**	**0.70**	<0.5 *	–	–	**1.9**	–	–	–	**0.50**	–	–	–	–	–	–
Sulfate	mg/l	**>70**	**30**	**22**	ND	**2,100** *	–	–	**34**	–	–	–	**5.0**	–	–	–	–	–	–
Sulfide	µg/l	**90**	**90**	**90**	**60**	**1,000** *	–	–	**40**	–	–	–	**150**	–	–	–	–	–	–

TABLE 3
SUMMARY OF JUNE 2017 PERFORMANCE MONITORING
Summary Trip Report
IBM Gun Club - Former Burn Pit Area
Union, New York

Analyte Name	Unit	BP-20A	BP-21A	BP-22A	BP-23A	BP-24A	BP-24A	BP-25A	BP-26A	BP-27A	BP-30A	BP-31A	BP-31A	BP-32A	BP-34A	BP-35A	BP-35A	BP-36A
		BP-20A	BP-21A	BP-22A	BP-23A	BP-24A	DUP-4	BP-25A	BP-26A	BP-27A	BP-30A	BP-31A	DUP-1	BP-32A	BP-34A	BP-35A	DUP-2	BP-36A
		PDB	PDB	PDB	PDB	PDB	PDB	PDB	PDB	PDB	PDB	Low Flow	Low Flow	PDB	Low Flow	Low Flow	Low Flow	Low Flow
		S	S	S	S	S	FD	S	S	S	S	S	FD	S	S	S	FD	S
		6/21/2017	6/21/2017	6/21/2017	6/21/2017	6/21/2017	6/21/2017	6/21/2017	6/21/2017	6/21/2017	6/21/2017	6/20/2017	6/20/2017	6/21/2017	6/20/2017	6/20/2017	6/20/2017	6/20/2017
VOLATILE ORGANIC COMPOUNDS (VOCs)																		
Trichloroethene (TCE)	µg/l	**1.7**	<0.5	<0.5	**1.2**	**1.5**	**1.4**	**0.70**	**0.70**	**3.6**	**14**	**17**	**17**	**0.50 J**	**41,000**	**4,400**	**4,300**	**53**
Dichloroethene (cis-1,2-)	µg/l	<0.5	<0.5	<0.5	**0.10 J**	**0.50**	**0.50 J**	<0.5	<0.5	**1.9**	**4.5**	**4.9**	**4.6**	<0.5	**48,000**	**6,300**	**6,000**	**7,700**
Dichloroethene (trans-1,2-)	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**72 J**	**8.3 J**	**7.9 J**	**15 J**
Dichloroethene (1,1-)	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**130 J**	**6.4 J**	**6.6 J**	**14 J**
Tetrachloroethene (PCE)	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**1.1**	**0.90**	**0.80**	<0.5	<250	<25	<25	<25
Vinyl chloride	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**0.20 J**	**0.20 J**	<0.5	**1,400**	<25	<25	**1,600**
LIGHT GASSES																		
Ethane	µg/l	–	–	–	–	–	–	–	–	–	–	**0.0075 J**	**0.012 J**	–	**3.6**	**0.26**	**0.17**	**25**
Ethene	µg/l	–	–	–	–	–	–	–	–	–	–	**0.018 J**	**0.018 J**	–	**200**	**0.031 J**	**0.061 J**	**700**
Methane	µg/l	–	–	–	–	–	–	–	–	–	–	**0.26 J**	**0.39 J**	–	**990**	**0.74**	**0.86**	**8,200**
MOLAR CONCENTRATION																		
Trichloroethene (TCE)	µmol/l	0.013	ND	ND	0.0091	0.011	0.011	0.0053	0.0053	0.027	0.11	0.13	0.13	0.0038	312	33	33	0.40
Dichloroethene (cis-1,2-)	µmol/l	ND	ND	ND	0.0010	0.0052	0.0052	ND	ND	0.020	0.046	0.051	0.047	ND	495	65	62	79
Dichloroethene (trans-1,2-)	µmol/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.74	0.086	0.081	0.15
Dichloroethene (1,1-)	µmol/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.34	0.066	0.068	0.14
Tetrachloroethene (PCE)	µmol/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0066	0.0054	0.0048	ND	ND	ND	ND	ND
Vinyl chloride	µmol/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0032	0.0032	ND	22	ND	ND	26
Ethane	µmol/l	–	–	–	–	–	–	–	–	–	–	0.00025	0.00040	–	0.12	0.0086	0.0057	0.83
Ethene	µmol/l	–	–	–	–	–	–	–	–	–	–	0.00064	0.00064	–	7.1	0.0011	0.0022	25
Total	µmol/l	0.013	ND	ND	0.010	0.017	0.016	0.0053	0.0053	0.047	0.16	0.19	0.19	0.0038	839	99	95	132
MOLAR PERCENTAGE																		
TCE	%	100	ND	ND	90	69	67	100	100	58	67	68	70	100	37	34	35	0.31
DCEs	%	ND	ND	ND	10	31	33	ND	ND	42	29	27	26	ND	59	66	65	61
VC	%	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.7	1.7	ND	2.7	ND	ND	19
Ethane+Ethene	%	–	–	–	–	–	–	–	–	–	–	0.47	0.56	–	0.86	0.01	0.01	20
VOLATILE FATTY ACIDS																		
Acetic Acid	mg/l	–	–	–	–	–	–	–	–	–	–	**0.032 J**	**0.043 J**	–	**0.31**	**0.048 J**	**0.026 J**	**35**
Butyric Acid	mg/l	–	–	–	–	–	–	–	–	–	–	**0.0074 J**	**0.0076 J**	–	**0.28**	**0.026 J**	<0.1	**1.2**
Hexanoic Acid	mg/l	–	–	–	–	–	–	–	–	–	–	<0.2	<0.2	–	<0.2	<0.2	<0.2	**0.27**
i-Hexanoic Acid	mg/l	–	–	–	–	–	–	–	–	–	–	<0.2	<0.2	–	<0.2	<0.2	<0.2	<0.2
i-Pentanoic Acid	mg/l	–	–	–	–	–	–	–	–	–	–	<0.1	<0.1	–	**0.011 J**	<0.1	<0.1	**0.046 J**
Lactic Acid	mg/l	–	–	–	–	–	–	–	–	–	–	<0.2	<0.2	–	**0.034 J**	**0.015 J**	<0.2	<0.2
Pentanoic Acid	mg/l	–	–	–	–	–	–	–	–	–	–	<0.1	<0.1	–	**0.0095 J**	<0.1	<0.1	**0.020 J**
Propionic Acid	mg/l	–	–	–	–	–	–	–	–	–	–	<0.1	<0.1	–	**0.13**	**0.012 J**	<0.1	**0.19**
Pyruvic Acid	mg/l	–	–	–	–	–	–	–	–	–	–	<0.1	<0.1	–	**0.019 J**	<0.1	<0.1	**0.034 J**
OTHER LABORATORY DATA																		
Total Organic Carbon	mg/l	–	–	–	–	–	–	–	–	–	–	**1.0**	**0.8 J**	–	**8.5**	**2.3**	**2.3**	**20.1**
WATER QUALITY PROBE DATA																		
Temperature	°C	**10.3**	**9.2**	**9.1**	**9.7**	**9.9**	–	**10.0**	**9.3**	**11.2**	**9.6**	**10.5**	–	**10.2**	**14.4**	**14.2**	–	**12.8**
Specific Conductance	uS/cm	**170**	**570**	**800**	**210**	**170**	–	**200**	**230**	**260**	**210**	**290**	–	**96**	**1,600**	**1,100**	–	**550**
pH	s.u.	**5.9**	**7.4**	**7.4**	**6.9**	**6.5**	–	**6.2**	**6.1**	**6.2**	**6.5**	**7.5**	–	**6.0**	**7.3**	**7.5**	–	**7.1**
Oxidation/Reduction Potential	mV	**190**	**210**	**190**	**130**	**89**	–	**140**	**87**	**63**	**120**	**71**	–	**250**	**110**	**200**	–	**-160**
Dissolved Oxygen	mg/l	**0.65**	**1.1**	**0.28**	**1.0**	**1.5**	–	**0.97**	**4.3**	**1.2**	**0.59**	**8.5**	–	**3.4**	**5.2**	**4.5**	–	**0.28**
Turbidity	NTU	–	–	–	–	–	–	–	–	–	–	**7.8**	–	–	**2.4**	**2.5**	–	**5.7**
FIELD CHEMISTRY																		
Iron	mg/l	–	–	–	–	–	–	–	–	–	–	**0.47**	–	–	**0.19**	**0.06**	–	**>3.0**
Iron - Ferrous	mg/l	–	–	–	–	–	–	–	–	–	–	**0.38**	–	–	**0.10**	**0.39**	–	**>3.0**
Nitrate	mg/l	–	–	–	–	–	–	–	–	–	–	**1.8**	–	–	**0.50**	**0.80**	–	**0.50**
Sulfate	mg/l	–	–	–	–	–	–	–	–	–	–	**23**	–	–	**>70**	**21**	–	ND
Sulfide	µg/l	–	–	–	–	–	–	–	–	–	–	**40**	–	–	**70**	**80**	–	**120**

TABLE 3
SUMMARY OF JUNE 2017 PERFORMANCE MONITORING
Summary Trip Report
IBM Gun Club - Former Burn Pit Area
Union, New York

Analyte Name	Unit	BP-36A	BP-37A	BP-38A	BP-39A	GC-2A	A-13	B-4	B-7	B-9	IB-7	GC-1 Port 1	GC-1 Port 8	BP-12D Port 1	BP-12D Port 7	BP-13D Port 1	BP-13D Port 5
		DUP-3	BP-37A	BP-38A	BP-39A	GC-2A	A-13	B-4	B-7	B-9	IB-7	GC-1,P1	GC1,P8	BP-12D,P1	BP-12D,P7	BP-13D,P1	BP-13D,P5
		Low Flow	Low Flow	Low Flow	Low Flow	PDB	PDB	PDB	PDB	PDB	PDB	FLUTe	FLUTe	FLUTe	FLUTe	FLUTe	FLUTe
		FD	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
		6/20/2017	6/20/2017	6/20/2017	6/20/2017	6/21/2017	6/19/2017	6/19/2017	6/19/2017	6/19/2017	6/19/2017	6/21/2017	6/21/2017	6/21/2017	6/21/2017	6/21/2017	6/21/2017
VOLATILE ORGANIC COMPOUNDS (VOCs)																	
Trichloroethene (TCE)	µg/l	**44**	**13**	**120**	**44**	**5.5**	**300**	<5.0	**170**	**180**	**0.50**	**12**	**0.2 J**	<0.5	<0.5	**57**	**0.40 J**
Dichloroethene (cis-1,2-)	µg/l	**7,200**	**1.0**	**31**	**56**	**0.30 J**	**34,000**	**2.1 J**	**560**	**3,800**	**1.6**	**29**	**1.6**	<0.5	<0.5	**36**	**1.5**
Dichloroethene (trans-1,2-)	µg/l	**22 J**	<0.5	**0.10 J**	**0.20 J**	<0.5	**75 J**	**1.1 J**	<25	**9.0 J**	**0.2 J**	**0.1 J**	**0.2 J**	<0.5	<0.5	**0.3 J**	<0.5
Dichloroethene (1,1-)	µg/l	**13 J**	<0.5	**0.20 J**	**0.20 J**	<0.5	**65 J**	<5.0	<25	**6.2 J**	<0.5	<0.5	<0.5	<0.5	<0.5	**0.50**	<0.5
Tetrachloroethene (PCE)	µg/l	<25	<0.5	**0.10 J**	<0.5	<0.5	<100	<5.0	<25	<25	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Vinyl chloride	µg/l	**1,500**	<0.5	<0.5	**0.20 J**	<0.5	**2,300**	**1.2 J**	**96**	**360**	**0.2 J**	**6.1**	**1.0**	<0.5	<0.5	**4.7**	**0.30 J**
LIGHT GASSES																	
Ethane	µg/l	**23**	**0.020 J**	**0.014 J**	**0.034 J**	–	**32**	**18**	**83**	**18**	**58**	–	–	–	–	–	–
Ethene	µg/l	**780**	**0.021 J**	**0.020 J**	**0.018 J**	–	**1,700**	**0.59**	**590**	**400**	**0.035 J**	–	–	–	–	–	–
Methane	µg/l	**7,200**	**17**	**0.25 J**	**0.22 J**	–	**5,500**	**28,000**	**19,000**	**11,000**	**26,000**	–	–	–	–	–	–
MOLAR CONCENTRATION																	
Trichloroethene (TCE)	µmol/l	0.33	0.099	0.91	0.33	0.042	2.3	ND	1.3	1.4	0.0038	0.091	0.0015	ND	ND	0.43	0.0030
Dichloroethene (cis-1,2-)	µmol/l	74	0.010	0.32	0.58	0.0031	351	0.022	5.8	39	0.017	0.30	0.017	ND	ND	0.37	0.015
Dichloroethene (trans-1,2-)	µmol/l	0.23	ND	0.0010	0.0021	ND	0.77	0.011	ND	0.093	0.0021	0.0010	0.0021	ND	ND	0.0031	ND
Dichloroethene (1,1-)	µmol/l	0.13	ND	0.0021	0.0021	ND	0.67	ND	ND	0.064	ND	ND	ND	ND	ND	0.0052	ND
Tetrachloroethene (PCE)	µmol/l	ND	ND	0.00060	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl chloride	µmol/l	24	ND	ND	0.0032	ND	37	0.019	1.5	5.8	0.0032	0.098	0.016	ND	ND	0.075	0.0048
Ethane	µmol/l	0.76	0.00067	0.00047	0.0011	–	1.1	0.60	2.8	0.60	1.9	–	–	–	–	–	–
Ethene	µmol/l	28	0.00075	0.00071	0.00064	–	61	0.021	21	14	0.0012	–	–	–	–	–	–
Total	µmol/l	128	0.11	1.2	0.92	0.045	453	0.67	32	61	2.0	0.49	0.036	ND	ND	0.89	0.023
MOLAR PERCENTAGE																	
TCE	%	0.26	89	74	36	93	0.50	ND	4.0	2.2	0.19	19	4.2	ND	ND	49	13
DCEs	%	59	9.3	26	63	6.9	78	4.9	18	64	0.95	61	51	ND	ND	43	66
VC	%	19	ND	ND	0.35	ND	8.1	2.9	4.7	9.4	0.16	20	44	ND	ND	8.5	21
Ethane+Ethene	%	22	1.3	0.10	0.19	–	14	92	73	24	99	–	–	–	–	–	–
VOLATILE FATTY ACIDS																	
Acetic Acid	mg/l	**33**	**0.036 J**	**0.040 J**	**0.037 J**	–	**74**	**290**	**460**	**280**	**0.72**	–	–	–	–	–	–
Butyric Acid	mg/l	**1.2**	**0.006 J**	**0.0055 J**	<0.1	–	**4.3**	**9.2**	**330**	**74**	**0.0093 J**	–	–	–	–	–	–
Hexanoic Acid	mg/l	**0.30**	<0.2	<0.2	<0.2	–	**0.94**	**0.65**	**150**	**44**	<0.2	–	–	–	–	–	–
i-Hexanoic Acid	mg/l	<0.2	<0.2	<0.2	<0.2	–	**0.21**	**0.14 J**	**5.3**	**3.7**	<0.2	–	–	–	–	–	–
i-Pentanoic Acid	mg/l	**0.045 J**	<0.1	<0.1	<0.1	–	**0.39**	**2.2**	**11**	**2.5**	<0.1	–	–	–	–	–	–
Lactic Acid	mg/l	<2.0	<0.2	<0.2	**0.017 J**	–	<2.0	<2.0	<20	**2.7 J**	<0.2	–	–	–	–	–	–
Pentanoic Acid	mg/l	**0.021 J**	<0.1	<0.1	<0.1	–	**0.58**	**2.6**	**320**	**110**	<0.1	–	–	–	–	–	–
Propionic Acid	mg/l	**0.19**	<0.1	<0.1	<0.1	–	**3.9**	**44**	**460**	**430**	**0.057 J**	–	–	–	–	–	–
Pyruvic Acid	mg/l	**0.033 J**	<0.1	<0.1	<0.1	–	**2.2**	**16**	**74**	**42**	<0.1	–	–	–	–	–	–
OTHER LABORATORY DATA																	
Total Organic Carbon	mg/l	**19.5**	**2.3**	**1.8**	**1.9**	–	**46.9**	**207**	**1,710**	**971**	**44.5**	–	–	–	–	–	–
WATER QUALITY PROBE DATA																	
Temperature	°C	–	**15.1**	**13.1**	**12.1**	**8.8**	–	–	–	–	–	**13.6**	**13.3**	**11.8**	**11.8**	**13.2**	**12.3**
Specific Conductance	uS/cm	–	**660**	**530**	**110**	**120**	–	–	–	–	–	**410**	**480**	**460**	**1,300**	**400**	**570**
pH	s.u.	–	**7.0**	**6.4**	**5.9**	**6.2**	–	–	–	–	–	**7.9**	**8.0**	**8.1**	**8.0**	**8.5**	**8.4**
Oxidation/Reduction Potential	mV	–	**28**	**210**	**130**	**260**	–	–	–	–	–	**110**	**32**	**250**	**170**	**210**	**51**
Dissolved Oxygen	mg/l	–	**0.41**	**4.8**	**1.8**	**3.9**	–	–	–	–	–	**2.1**	**2.3**	**0.66**	**0.86**	**8.4**	**1.1**
Turbidity	NTU	–	**9.5**	**3.1**	**3.9**	–	–	–	–	–	–	–	–	–	–	–	–
FIELD CHEMISTRY																	
Iron	mg/l	–	**0.01**	**0.34**	**0.08**	–	–	–	–	–	–	–	–	–	–	–	–
Iron - Ferrous	mg/l	–	**0.05**	**0.52**	**0.08**	–	–	–	–	–	–	–	–	–	–	–	–
Nitrate	mg/l	–	**0.40**	**1.5**	**0.30**	–	–	–	–	–	–	–	–	–	–	–	–
Sulfate	mg/l	–	**11**	**22**	**11**	–	–	–	–	–	–	–	–	–	–	–	–
Sulfide	µg/l	–	**20**	**30**	**20**	–	–	–	–	–	–	–	–	–	–	–	–

TABLE 3
SUMMARY OF JUNE 2017 PERFORMANCE MONITORING
Summary Trip Report
IBM Gun Club - Former Burn Pit Area
Union, New York

Analyte Name	Unit	BP-14D Port 1 BP-14D,P1 FLUTe S 6/21/2017	BP-14D Port 5 BP-14D,P5 FLUTe S 6/21/2017	BP-15D Port 5 BP-15D,P5 FLUTe S 6/21/2017	111 111 Surface Water S 6/21/2017	112 112 Surface Water S 6/21/2017	113 113 Surface Water S 6/21/2017	118 118 Surface Water S 6/21/2017	POLY3 TOTE 1 Purge Water S 6/21/2017
VOLATILE ORGANIC COMPOUNDS (VOCs)									
Trichloroethene (TCE)	µg/l	<0.5	<0.5	<0.5	<0.5	**0.70**	**1.0**	**0.70**	**0.10 J**
Dichloroethene (cis-1,2-)	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**0.80**	<0.5
Dichloroethene (trans-1,2-)	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dichloroethene (1,1-)	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Tetrachloroethene (PCE)	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Vinyl chloride	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
LIGHT GASSES									
Ethane	µg/l	–	–	–	–	–	–	–	–
Ethene	µg/l	–	–	–	–	–	–	–	–
Methane	µg/l	–	–	–	–	–	–	–	–
MOLAR CONCENTRATION									
Trichloroethene (TCE)	µmol/l	ND	ND	ND	ND	0.0053	0.0076	0.0053	0.00076
Dichloroethene (cis-1,2-)	µmol/l	ND	ND	ND	ND	ND	ND	0.0083	ND
Dichloroethene (trans-1,2-)	µmol/l	ND	ND	ND	ND	ND	ND	ND	ND
Dichloroethene (1,1-)	µmol/l	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene (PCE)	µmol/l	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl chloride	µmol/l	ND	ND	ND	ND	ND	ND	ND	ND
Ethane	µmol/l	–	–	–	–	–	–	–	–
Ethene	µmol/l	–	–	–	–	–	–	–	–
Total	µmol/l	ND	ND	ND	ND	0.0053	0.0076	0.014	0.00076
MOLAR PERCENTAGE									
TCE	%	ND	ND	ND	ND	100	100	39	100
DCEs	%	ND	ND	ND	ND	ND	ND	61	ND
VC	%	ND	ND	ND	ND	ND	ND	ND	ND
Ethane+Ethene	%	–	–	–	–	–	–	–	–
VOLATILE FATTY ACIDS									
Acetic Acid	mg/l	–	–	–	–	–	–	–	–
Butyric Acid	mg/l	–	–	–	–	–	–	–	–
Hexanoic Acid	mg/l	–	–	–	–	–	–	–	–
i-Hexanoic Acid	mg/l	–	–	–	–	–	–	–	–
i-Pentanoic Acid	mg/l	–	–	–	–	–	–	–	–
Lactic Acid	mg/l	–	–	–	–	–	–	–	–
Pentanoic Acid	mg/l	–	–	–	–	–	–	–	–
Propionic Acid	mg/l	–	–	–	–	–	–	–	–
Pyruvic Acid	mg/l	–	–	–	–	–	–	–	–
OTHER LABORATORY DATA									
Total Organic Carbon	mg/l	–	–	–	–	–	–	–	–
WATER QUALITY PROBE DATA									
Temperature	°C	**15.2**	**12.8**	**13.5**	**14.0**	**13.9**	**13.2**	**17.3**	–
Specific Conductance	uS/cm	**320**	**630**	**720**	**110**	**140**	**220**	**380**	–
pH	s.u.	**8.2**	**8.1**	**8.6**	**6.8**	**6.7**	**5.6**	**7.2**	–
Oxidation/Reduction Potential	mV	**150**	**90**	**100**	**170**	**170**	**180**	**66**	–
Dissolved Oxygen	mg/l	**0.79**	**1.2**	**1.1**	**8.3**	**8.4**	**6.1**	**5.5**	–
Turbidity	NTU	–	–	–	–	–	–	–	–
FIELD CHEMISTRY									
Iron	mg/l	–	–	–	–	–	–	–	–
Iron - Ferrous	mg/l	–	–	–	–	–	–	–	–
Nitrate	mg/l	–	–	–	–	–	–	–	–
Sulfate	mg/l	–	–	–	–	–	–	–	–
Sulfide	µg/l	–	–	–	–	–	–	–	–

Notes:

1. The table summarizes samples collected during the week of June 19, 2017 as part of performance testing at the IBM Gun Club former Burn Pit Area. Samples were analyzed both in the field and at fixed analytical laboratories as indicated on the table.

2. Analytical laboratory analysis was performed by Eurofins Lancaster Laboratories of Lancaster, Pennsylvania (Lancaster) and/or Pace Analytical (formly Microseeps, Inc.) of Pittsburgh, Pennsylvania (Pace). Results of compounds are recorded in units indicated on the table. Detections of compounds are emboldened.

3. Definitions:
"S" indicates primary sample
"FD" indicates field duplicate
"PDB" indicates the sample was collected via a passive diffusion bag
"–" indicates the compounds were not analyzed for that particular sample.
"U" indicates the result was below the analytical detection limit.
"J" indicates that the laboratory data was below the lowest quantifiable limit and therefore estimated.
"*" indicates that the sample exhibited high turbidity and could not be analyzed in the field. Recorded results are from analysis at Pace.
">" indicates results were over the calibration range and should be considered estimated.
"ND" indicates that results were not detected above the analytical reporting limit or the calibration range of the field screening device.

4. Refer to the report text for further discussion. The sample plan can be referenced in the Site Management Plan.

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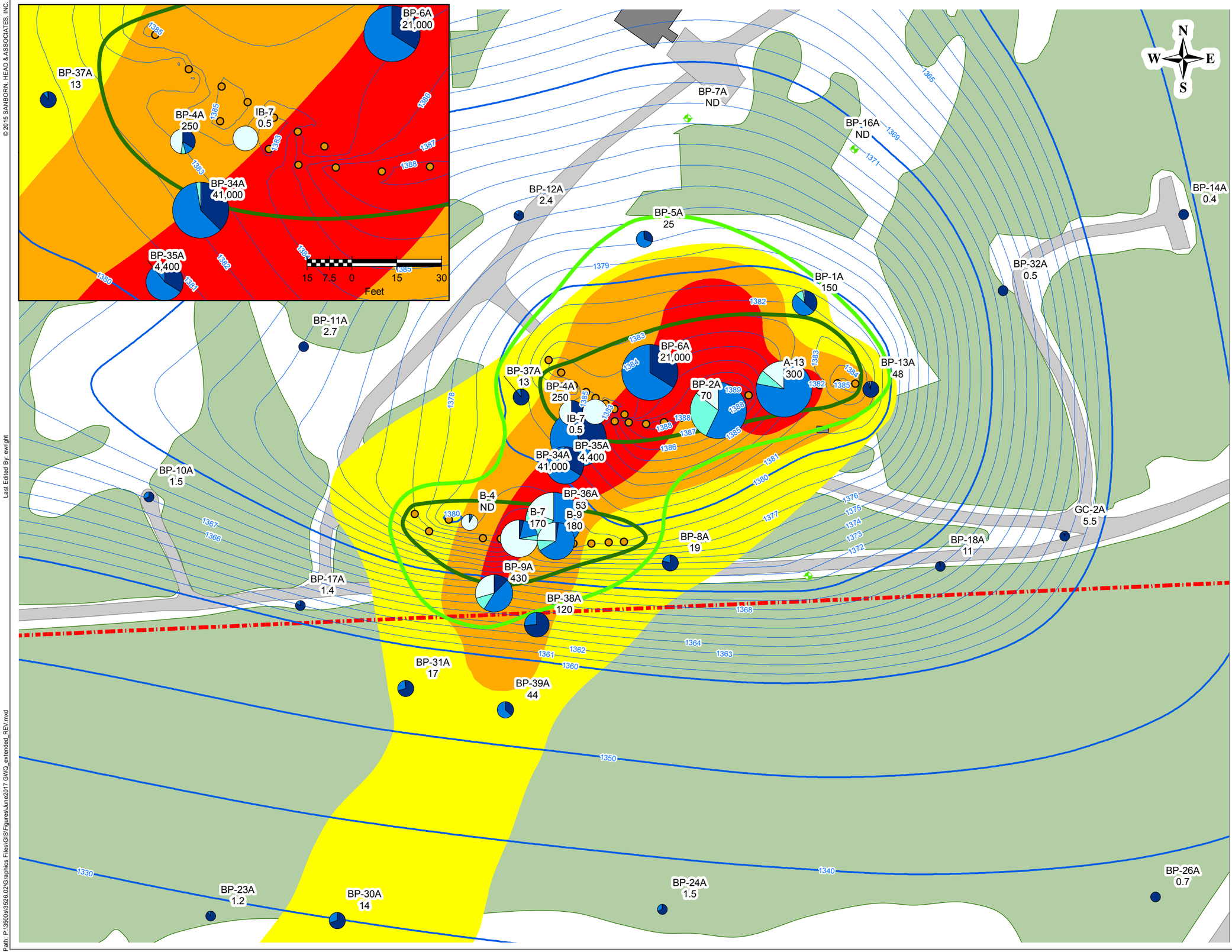

Figure 1

Summary of June 2017 Groundwater Quality Conditions

IBM Gun Club - Former Burn Pit Area
Union, New York

Drawn By:	C. LaVack
Designed By:	E. Bosse
Reviewed By:	D. Shea
Project No:	3526.05
Date:	August 2017

Figure Narrative

The figure is intended to depict groundwater quality data and inference recorded during the week of June 19, 2017.

The groundwater data for site key VOCs including TCE, cDCE, vinyl chloride and ethene/ethane from water table monitoring wells are presented as pie diagrams. The wedges of each pie diagram represent concentrations of the five compounds expressed in micromoles per liter (umol/L). The relative diameter of each pie diagram varies based on the sum of the five VOCs at each location.

The inferred geochemical (REDOX) conditions are based on observations of oxidation-reduction potential (ORP), methane, sulfide, ferrous and total iron, and nitrate. Methanogenic conditions are characterized by methane concentrations >=20 µg/L and sulfate reducing by sulfide >= 50 µg/L. ORP is generally expected to be less than 100 for sulfate reduction, and less than 0 for methanogenic conditions.

Refer to Figure 3 for geochemical monitoring results and the report text for further discussion.

Legend

BP-34A 41,000 — Well Name and June 2017 TCE Concentrations in Groundwater (µg/L).

- Inferred Groundwater Contour 6/19/2016
- Methanogenic, Methane >= 20 µg/L
- Sulfate Reducing, Sulfide >= 50 µg/L
- Parent VOC (Trichloroethene)
- Primary Daughter Product (*cis*-1,2DCE)
- Secondary Daughter Product (Vinyl Chloride)
- Terminal Breakdown Products (Ethane, Ethene)

Total Chlorinated Ethanes & Ethenes in Groundwater (µmol/L)

< 0.1
>0.1 to 1
>1 to 10
>10 to 100
>100

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Figure 2

Groundwater Quality Conditions for Key Site VOCs - June 2017

IBM Gun Club - Former Burn Pit Area

Union, New York

Drawn By:	C. LaVack
Designed By:	E. Bosse
Reviewed By:	D. Shea
Project No:	3526.05
Date:	August 2017

Figure Narrative

This figure depicts groundwater data for key site VOCs from monitoring of water table wells in June 2017.

The data for TCE, selected breakdown products, and carbon tetrachloride are presented as pie diagrams. The wedges of each pie diagram represent concentrations expressed in micrograms per liter (ug/L). The relative diameter of each pie diagram varies based on the sum of the VOCs at each location.

Refer to report text for further discussion.

Legend

- Injection Boring
- BP-34A 41,000 — Well Name and June 2017 TCE Concentrations in Groundwater (µg/L).
- Trichloroethene (TCE)
- *cis*-1,2 Dichloroethene (*cis*-1,2 DCE)
- Vinyl Chloride (VC)
- Carbon Tetrachloride (CCl4)

Total Chlorinated Ethenes and Carbon Tetrachloride in Groundwater (µg/L)

- Not detected above lab reporting limits
- <10
- >10 to 100
- >100 to 1,000
- >1,000 to 10,000
- >10,000

25 12.5 0 25 50

Feet

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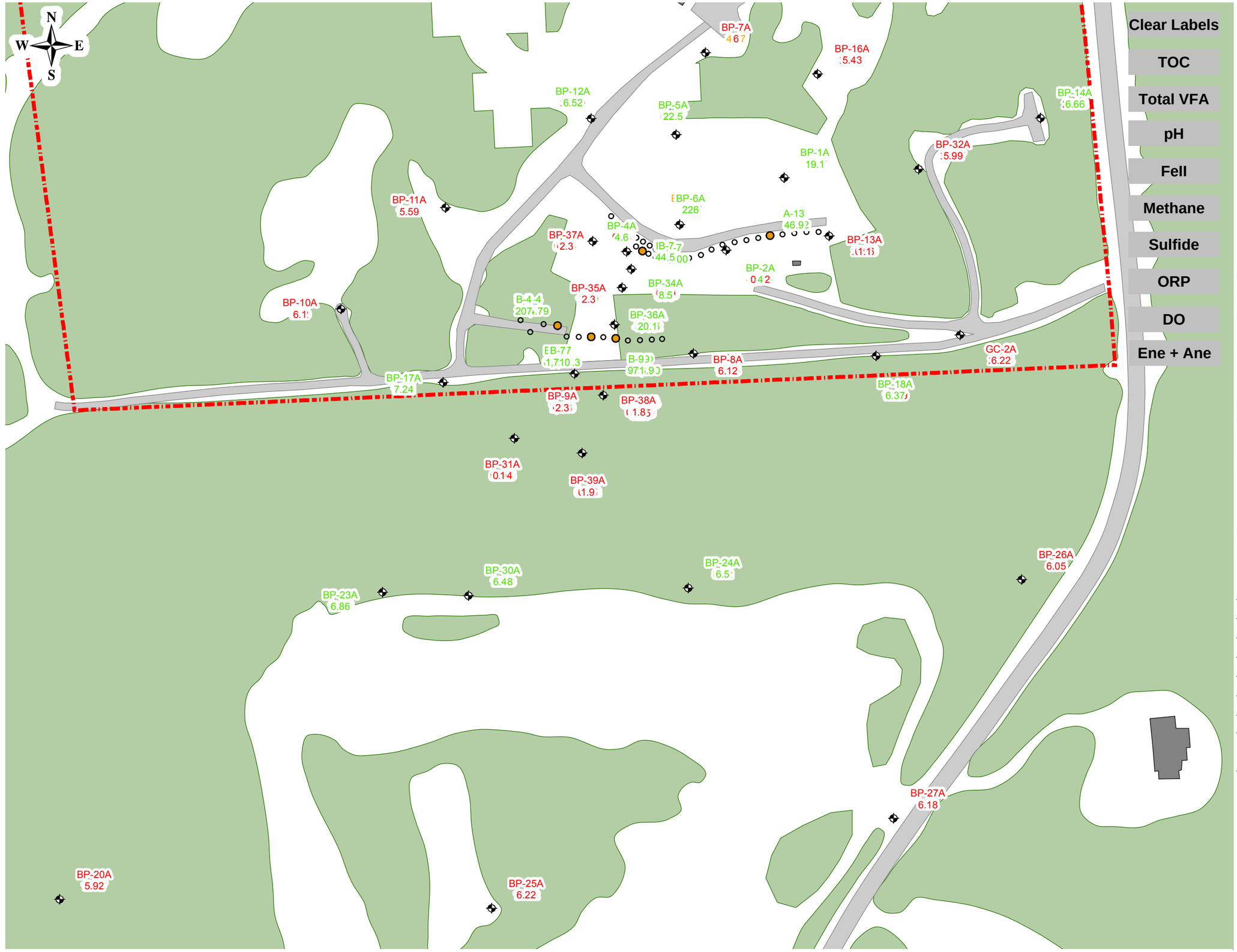

Figure 3

June 2017 Assessment of Reducing Conditions

IBM Gun Club - Former Burn Pit Area
Union, New York

Drawn By:	C. LaVack
Designed By:	E. Bosse
Reviewed By:	D. Shea
Project No:	3526.05
Date:	August 2017

Figure Narrative

This figure is intended to assess multiple lines of evidence to assess what proportion of the primary and secondary source rock are under sulfate reducing and methanogenic conditions. Green labels indicate conditions conducive to reductive dehalogenation. Orange labels indicate reductive dehalogenation may be possible, but conditions are less conducive. Red labels indicate conditions where reductive dehalogenation is less likely.

Posted data is from the June 2017 sampling round.

Legend

DO mg/L	>5	2-5	<=2
ORP mV	>100	0-100	<=0
Sulfide µg/L	<10	10-50	>=50
Methane µg/L	<0.5	0.5-20	>=20
FeII mg/L	<1		>=1
pH SU	<6.3 or >7.5		6.3-7.5
Total VFA mg/L	<1		>=1
TOC mg/L	<4		>=4
Ethane + Ethene µg/L	<10	10-50	>=50

60 30 0 60 120
Feet

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APPENDIX C.3

SUMMARY OF OCTOBER 2017

WATER QUALITY MONITORING

SUMMARY OF OCTOBER 2017 WATER QUALITY MONITORING

IBM Gun Club – Former Burn Pit Area
Union, New York

INTRODUCTION

This memorandum summarizes the scope and result of remedy performance monitoring conducted in October 2017. It describes the sampling event, and provides tabular and figure summaries of the field and laboratory data. The field work was conducted the week of October 9, 2017 in general accordance with the scope and procedures discussed in Appendix J of the amended Site Management Plan (SMP)[1].

This memorandum will be included as a component of the next Periodic Review Report, due in January 2018, and has been prepared consistent with the Monitoring Reporting Requirements discussed in Section 3.6 of the SMP. The Sanborn Head field staff included Chris Norton and Jill Getchell.

SCOPE OF WORK

The scope of work included:

- Limited groundwater elevation survey;
- Water quality sampling associated with the performance monitoring program; and
- Water quality parameter field screening and field geochemical testing.

Groundwater Elevation Survey

On October 9, 2017, prior to starting the water quality sampling program, the depths to water in monitoring wells and certain injection boreholes were gauged in accordance with procedures detailed in Appendix G of the SMP. Water levels were also measured and recorded at the time sampling was conducted. Based on the depth to water data and survey information, groundwater elevations were calculated for each location. Depth to water measurements and groundwater elevations are summarized on Table 1. Inferred groundwater elevation contours are shown on Figure 1. The results are similar to the previous monitoring event and also consistent with the historical pattern.

Water Quality Sampling

The scope of sampling as originally planned is included as Table 2. The scope was modified as follows as a result of field conditions:

[1] Site Management Plan – April 2016 Revision, Brownfield Cleanup Program, IBM Gun Club – Former Burn Pit area, Union, New York, NYSDEC Site #C704044, BCA Index #B7-0661004-05 prepared on behalf of IBM by Sanborn, Head & Associates, Inc.

- Water from BP-6A was deemed too turbid for geochemical field testing, and samples were collected for laboratory analysis; and

- Surface water points 112 and 118 were dry during October 2017 and could not be sampled. A sample was collected from a new potential on-site seep, surface water point designated as 119, which was located south of the B-Injection line and adjacent to monitoring well BP-9A. This location is termed "potential" pending further monitoring of its persistence.

Exhibit 1 summarizes the sampling methods used during the monitoring event. The quality assurance/quality control (QA/QC) samples collected for VOC analysis are summarized in Exhibit 2. Samples (including QA/QC samples) submitted for off-site laboratory analysis or field screening are tabulated in Exhibit 3. Laboratory and field analytical data are summarized in Table 3.

Exhibit 1 Summary of Sampling Methods

Sample Method	Number of Locations Sampled
Modified Low-Flow	14
Submerged Container (surface water)	2
Passive Diffusion Bag	5
FLUTe™ Purge	0
Bailer	0
Purge Water Tote Sample	1

Exhibit 2 Summary of QA/QC Samples for VOC analysis

Total Primary Samples	22
Duplicate Samples	2
Matrix Spikes	1
Matrix Spike Duplicates	1
Field Blanks	3
Equipment Blanks	1
Trip Blanks	2

Exhibit 3 Summary of Analytical Type including QA/QC

Sample Type - Fixed Laboratory	Laboratory	Number of Samples
VOCs	Eurofins - Lancaster	32
Total Organic Carbon	Eurofins- Lancaster	21
Volatile Fatty Acids	Pace Analytical	21
Light Gases (Ethane, Ethene, and Methane)	Pace Analytical	21
Geochemical Analyses	Pace Analytical	1
Sample Type - Field Screening	**Laboratory**	**Number of Samples**
Field Geochemistry	Sanborn Head	13

Equipment Calibration

Exhibit 4 below summarizes the field instruments utilized during field sampling. The instruments were calibrated each morning, and a calibration check was performed at the end of each day.

Exhibit 4 Summary of Field Instrumentation

INSTRUMENT	FIELD PARAMETER
YSI 600XL Water Quality Parameter Probe	Temperature, pH, Specific Conductance, Dissolved Oxygen, and Oxidation-reduction Potential
HACH 2100Q Turbidimeter	Turbidity
HACH DR900 Spectrophotometer	Total and Ferrous Iron, Nitrate, Sulfate, and Sulfide

SUMMARY OF RESULTS

A summary of groundwater quality data and inference is presented in Figure 1. An interactive layered plan view figure included as Figure presents the geochemical data used in inferring the geochemical conditions shown on Figure 1. Field sampling records and analytical laboratory reports are kept on file and are available by request.

The field and laboratory data for October 2017 are similar to previous results in 2017 that indicate remedy performance generally consistent with the goals established in the SMP. Enhanced biochemical degradation of VOCs in groundwater is being monitored by: 1) tracking changes in concentration of the parent contaminant compound, trichloroethene (TCE), 2) tracking the presence of breakdown products of TCE, including the terminal breakdown products ethene and ethane, and 3) tracking the presence of geochemical conditions favorable to biochemical conditions by reductive dechlorination.

Geochemical conditions generally remain within ranges that are favorable for reductive dechlorination over most of the primary source rock. As shown on Figure 1, the overall area of sulfate-reducing conditions, which are marginally conducive to reductive dechlorination, is consistent with previous monitoring in 2017. The area under methanogenic conditions that is most conducive to reductive dechlorination is inferred to be similar to that observed in previous sampling in 2017, but continues to be smaller than that observed in 2016, especially in the zone between the two lines of injection boreholes. Figure 2 (PDF with multiple layers) presents the geochemical data used to infer the geochemical conditions shown on Figure 1.

Electron donor injection activities were conducted during the week beginning July 31, 2017. This amendment injection was conducted as part of the site-scale remedy and involved injection of a mixture of water and commercially-available emulsified oil substrate into the subsurface to enhance in situ biochemical degradation of chlorinated VOCs. The effects of the 2017 injection were not yet apparent in the extent of the sulfate-reducing and methanogenic conditions observed during October sampling, conducted approximately 8 weeks after the injections.

An analysis of the timing of the downgradient geochemical response to amendment injections presented in the 2015 Periodic Review Report suggested that initial arrival velocities to downgradient wells may be on the order of weeks, and peak arrival on the order

of 3 to 6 months. However, it was also noted that emplacement of oil emulsion into fractures is expected to reduce the effective water permeability, by physical displacement of water by oil droplets, limiting the volume available to transmit groundwater flow. Filling of the fracture pore space with biological mass could also be expected to lower the effective permeability, retarding the downgradient geochemical response. Therefore, more time may be needed for the effects of the recent injection to become more apparent.

Exhibit 5 below presents the October 2017 monitoring results for select parameters in comparison to the previous monitoring results of June 2017. Concentration trends for TCE, ethene plus ethane, and total organic carbon (TOC) in the sampled injection boreholes were favorable during October sampling. TOC was detected above the 100 milligrams per liter (mg/l) threshold where we observe evidence of increased biochemical degradation in all five injection boreholes. Results for monitoring wells within the injection displacement zone and further downgradient were more varied.

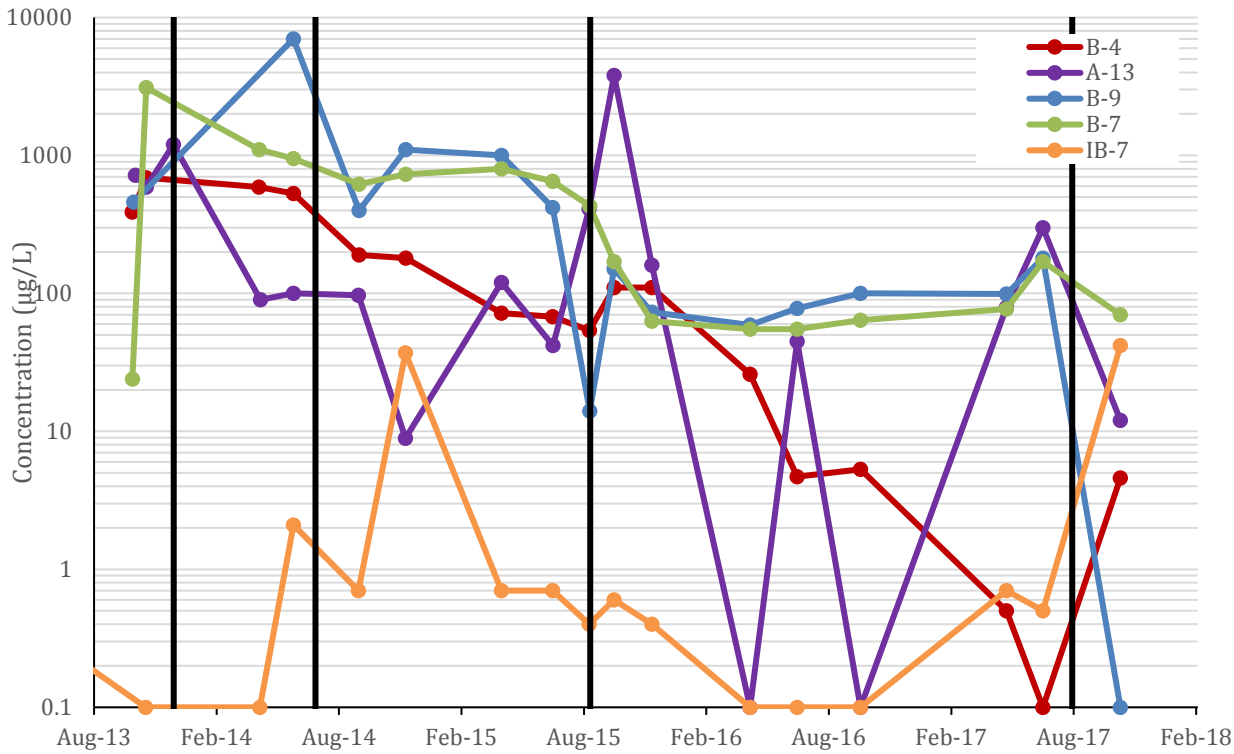
Twelve out of 19 monitoring wells (64%) sampled in October 2017 show decreasing or stable TCE concentrations, since the previous monitoring round. Similarly, terminal breakdown product (ethane and ethene) concentrations have increased or remained stable since June 2017 in 11 out of 19 wells (58%). The geochemical data for oxidation-reduction potential (ORP) and dissolved oxygen (DO) are varied, with roughly half the measurements moving in a direction more favorable to reductive dechlorination and half in a direction less favorable. These concentration trends are not much different than those observed in the June 2017 monitoring results, indicating that the effects of the injection of organic carbon have not yet propagated past the injection boreholes.

Exhibit 5 Comparison of October 2017 to June 2017 Performance Monitoring

Analyte	TCE	Ethene+Ethane	TOC	ORP	DO
	ug/L	ug/L	mg/L	mV	mg/L
Injection Boreholes					
IB-7	42	130	1,200		
A-13	12	2,400	550		
B-4	4.6	28	1,300		
B-7	70	370	3,000		
B-9	<50	30	3,300		
Injection Displacement Zone					
BP-2A	11	900	5.1	-90	2.8
BP-4A	320	83	4.6	19	0.92
BP-13A	55	0.020	1.2		
BP-36A	710	1,800	49	-110	0.43
Downgradient - on site					
B-1A	140	0.075	17	49	11
BP-5A	19	0.082	20	62	7.2
BP-6A	1,800	84	400	-90	1.3
BP-9A	240	130	2.1	45	2.4
BP-34A	40,000	130	7.1	4.2	1.2
BP-35A	4,900	0.16	2.1	34	6.4
BP-37A	24	0.46	2.4	81	3.9
Downgradient - off site					
BP-31A	7.5	0.027	0.58	80	6.9
BP-38A	27	0.049	0.84	100	2.7
BP-39A	25	0.34	2.1	110	1.1
Favorable Change	≥ 10% decline	≥ 10% increase	≥ 10% increase	≥ 10% decline	≥ 10% decline
Number of Wells	10	10	8	7	6
Stable	0 to ± 10%	0 to ± 10%	0 to ± 10%	0 to ± 10%	0 to ± 10%
Number of Wells	2	1	6	0	0
Unfavorable Change	≥ 10% increase	≥ 10% decline	≥ 10% decline	≥ 10% increase	≥ 10% increase
Number of Wells	7	8	5	6	7
Concentrations shown from October 2017 sampling event, rounded to 2 sig. figures.					
Blank cell indicates lack of data in one or both events.					

Exhibit 6 below shows the TCE concentrations for the five injection boreholes that are routinely sampled. In October 2017, TCE was detected in four out of five boreholes (IB-7, A-13, B-4, and B-7) at concentrations up to three orders of magnitude less than at installation in 2013. Concentrations of TCE sharply decreased in three of five boreholes (A-13, B-7, B-9) following the injection, while increasing at B-4 and IB-7.

Exhibit 6: TCE at the five routinely sample injection boreholes



Note: Non-detects are plotted as 0.1 µg/L, although reporting limits may vary by sample. The vertical black lines indicate site-scale amendment injections conducted in December 2013, July 2014, August 2015, and August 2017.

We note that TCE was not detected in the sample collected at the new potential seep location 119, while trace levels of 1,2-DCE and vinyl chloride were reported.

Geochemical and chemical concentrations trends will continue to be monitored for evidence of enhanced biodegradation and to assess the full extent of the July 2017 injection response after more time has passed. The next performance monitoring event is scheduled for April 2018.

Attachments:

Table 1	Summary of Water Level Data
Table 2	Scope of Performance Monitoring
Table 3	Summary of October 2017 Performance Monitoring
Figure 1	Summary of October 2017 Groundwater Quality Conditions
Figure 2	Summary of Geochemical Conditions

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Table 1
Summary of Water Level Data
Summary Trip Report
IBM Gun Club - Former Burn Pit Area
Union, New York

Well Location	Reference Elevation (ft amsl)	Depth to Water (ft bgs)	Equivalent Potentiometric Elevation (ft amsl)
A-13	1394.25	17.34	1376.92
B-4	1385.03	6.75	1378.29
B-7	1385.33	3.78	1381.56
B-9	1385.21	9.37	1375.84
BP-1A	1396.03	16.45	1379.58
BP-2A	1397.15	12.35	1384.80
BP-4A	1392.28	14.60	1377.68
BP-5A	1391.23	17.53	1373.70
BP-6A	1394.10	16.95	1377.15
BP-9A	1379.54	13.23	1366.31
BP-13A	1399.17	18.60	1380.57
BP-31A	1370.63	14.19	1356.44
BP-34A	1392.73	14.79	1377.94
BP-35A	1392.01	16.72	1375.29
BP-36A	1383.88	14.25	1369.63
BP-37A	1390.31	12.14	1378.17
BP-38A	1375.84	14.45	1361.39
BP-39A	1370.47	14.29	1356.18
IB-7	1393.23	8.64	1384.59

Notes:

1. This table summarizes depth to water measurements and calculated water table elevations recorded during the October 2017 performance monitoring round on October 9-11, 2017. Measurements were collected relative to the marked reference point at each location using a QED MP30 water level meter.

2. Abbreviations
ft amsl = feet above mean sea level
ft bgs = feet below ground surface

Table 2
Summary of Routine and Performance Monitoring Program
IBM Gun Club - Former Burn Pit Area
Union, New York

Monitoring Type	Monitoring Location	Monitoring Location Type	Sample Method				Analytical Laboratory				Field Screening	
			Low Flow	PDBs	Nitrogen Purge	Surface Water	VOCs	Light Gasses	TOC	VFAs	Water Quality Parameters	Field Geochemistry
Routine Monitoring (Annually in June)	BP-7A	Monitoring Well		x			x				x	
	BP-8A	Monitoring Well		x			x				x	
	BP-10A	Monitoring Well		x			x				x	
	BP-11A	Monitoring Well		x			x				x	
	BP-12A	Monitoring Well		x			x				x	
	BP-14A	Monitoring Well		x			x				x	
	BP-16A	Monitoring Well		x			x				x	
	BP-17A	Monitoring Well		x			x				x	
	BP-18A	Monitoring Well		x			x				x	
	BP-19A	Monitoring Well		x			x				x	
	BP-20A	Monitoring Well		x			x				x	
	BP-21A	Monitoring Well		x			x				x	
	BP-22A	Monitoring Well		x			x				x	
	BP-23A	Monitoring Well		x			x				x	
	BP-24A	Monitoring Well		x			x				x	
	BP-25A	Monitoring Well		x			x				x	
	BP-26A	Monitoring Well		x			x				x	
	BP-27A	Monitoring Well		x			x				x	
	BP-30A	Monitoring Well		x			x				x	
	BP-32A	Monitoring Well		x			x				x	
	GC-2A	Monitoring Well		x			x				x	
	GC-1, P-1	Multi-Depth			x		x				x	
	GC-1, P-8	Multi-Depth			x		x				x	
	BP-12D, P1	Multi-Depth			x		x				x	
	BP-12D, P7	Multi-Depth			x		x				x	
	BP-13D, P1	Multi-Depth			x		x				x	
	BP-13D, P5	Multi-Depth			x		x				x	
	BP-15D, P1	Multi-Depth			x		x				x	
	BP-15D, P5	Multi-Depth			x		x				x	
Performance Monitoring (3x/year in April, June, and Sept/October)	IB-7	Injection Borehole		x			x	x	x	x		
	A-13	Injection Borehole		x			x	x	x	x		
	B-4	Injection Borehole		x			x	x	x	x		
	B-7	Injection Borehole		x			x	x	x	x		
	B-9	Injection Borehole		x			x	x	x	x		
	BP-1A	Monitoring Well	x				x	x	x	x	x	x
	BP-2A	Monitoring Well	x				x	x	x	x	x	x
	BP-4A	Monitoring Well	x				x	x	x	x	x	x
	BP-5A	Monitoring Well	x				x	x	x	x	x	x
	BP-6A	Monitoring Well	x				x	x	x	x	x	x
	BP-9A	Monitoring Well	x				x	x	x	x	x	x
	BP-13A	Monitoring Well	x				x	x	x	x	x	x
	BP-31A	Monitoring Well	x				x	x	x	x	x	x
	BP-34A	Monitoring Well	x				x	x	x	x	x	x
	BP-35A	Monitoring Well	x				x	x	x	x	x	x
	BP-36A	Monitoring Well	x				x	x	x	x	x	x
	BP-37A	Monitoring Well	x				x	x	x	x	x	x
	BP-38A	Monitoring Well	x				x	x	x	x	x	x
	BP-39A	Monitoring Well	x				x	x	x	x	x	x
	111	Seep/spring				x	x				x	
	112	Seep/spring				x	x				x	
	113	Seep/spring				x	x				x	
	118	Seep/spring				x	x				x	
	SW-Z	Seep/spring				x	x				x	
		Total	**14**	**26**	**8**	**5**	**53**	**19**	**19**	**19**	**48**	**14**

Notes:
1. This table is intended to summarize the programs of routine and performance monitoring for remedy operations at the IBM Gun Club - Former Burn Pit Area starting in 2016. Additional monitoring points may be sampled based on field observations. "SW-Z" serves as a placeholder for sampling any on-site seep or spring that can be reasonably sampled. The table summarizes sample method, analytical laboratory analysis, and field screening.

2. Sample method:
"Low Flow" indicates samples will be collected by bladder pump using low flow techniques.
"PDBs" indicates that the well has sufficient water column to sample with passive diffusion bags - if conditions are observed to be different than anticipated, sampling will proceed using low flow techniques.
"Nitrogen purge" indicates that sample will be collected by purging the multi-level port with nitrogen (multi-level systems only).
"Surface water" samples will be collected using a clean glass vial.

3. Analytical laboratory samples:
"VOCs" indicates volatile organic compounds.
"Light gasses" includes methane, ethene and ethane.
"TOC" indicates total organic carbon.
"VFAs" indicates volatile fatty acids.

4. " Water quality parameters" indicates screening during well purging and water quality sampling by multi-parameter probes, e.g. by YSI® 556 multi-Probe meter or similar and HACH® turbidity meter or similar (low flow, multi-level system, bailer, and surface water sampling) or by water quality parameter sounding (PDB sampling). The water quality parameters may include temperature, specific conductance, oxidation-reduction potential, dissolved oxygen, pH, and turbidity. In addition surface water samples will include water clarity descriptors (transparency, translucence, or opaqueness, and color).

5. "Field Geochemistry" will be performed during performance monitoring by using reagent kits and a spectrophotometer (HACH® DR 800, DR 900, DR 2800, or similar). The field geochemistry includes analysis for sulfate, sulfide, ferrous iron, total iron, and oxygen. In some cases elevated turbidity (>10 NTU) or color may interfere with the spectrophotometric analysis. In such cases field geochemistry samples will be supplemented with samples submitted to an analytical laboratory as outlined in the Site Management Plan.

TABLE 3
SUMMARY OF OCTOBER 2017 PERFORMANCE MONITORING
Summary Trip Report
IBM Gun Club - Former Burn Pit Area
Union, New York

Analyte Name	Unit	BP-1A BP-1A Low Flow S 10/11/2017	BP-2A BP-2A Low Flow S 10/11/2017	BP-4A BP-4A Low Flow S 10/11/2017	BP-4A DUP-1 Low Flow FD 10/11/2017	BP-5A BP-5A Low Flow S 10/11/2017	BP-6A BP-6A Low Flow S 10/11/2017	BP-9A BP-9A Low Flow S 10/10/2017	BP-13A BP-13A Low Flow S 10/11/2017	BP-31A BP-31A Low Flow S 10/10/2017	BP-34A BP-34A Low Flow S 10/10/2017	BP-35A BP-35A Low Flow S 10/10/2017	BP-36A BP-36A Low Flow S 10/10/2017	BP-36A DUP-2 Low Flow FD 10/10/2017	BP-37A BP-37A Low Flow S 10/11/2017	BP-38A BP-38A Low Flow S 10/10/2017	BP-39A BP-39A Low Flow S 10/10/2017
VOLATILE ORGANIC COMPOUNDS (VOCs)																	
Trichloroethene (TCE)	µg/l	**140**	**11 J**	**320**	**270**	**19**	**1,800**	**240**	**55**	**7.5**	**40,000**	**4,900**	**170**	**710**	**24**	**27**	**25**
Dichloroethene (cis-1,2-)	µg/l	**140**	**5,000**	**130**	**110**	**19**	**37,000**	**4,100**	**2.2**	**1.1**	**49,000**	**6,200**	**1,400**	**2,000**	**1.2**	**14**	**87**
Dichloroethene (trans-1,2-)	µg/l	**1.3**	**15 J**	**6.3**	**6.4**	<2.5	**66 J**	**27 J**	<0.5	<0.5	**110 J**	**17 J**	**9.6 J**	**12**	<0.5	<0.5	**0.50 J**
Dichloroethene (1,1-)	µg/l	**0.50**	<25	**1.1**	**0.90 J**	<2.5	**57 J**	**11 J**	<0.5	<0.5	**120 J**	**7.8 J**	<25	**4.1 J**	<0.5	<0.5	**0.20 J**
Tetrachloroethene (PCE)	µg/l	<0.5	<25	<1.0	<1.0	<2.5	<250	<50	<0.5	**0.60**	<250	<25	<25	<10	<0.5	<0.5	<0.5
Vinyl chloride	µg/l	**0.50 J**	**2,000**	**37**	**25**	<2.5	**2,000**	**390**	<0.5	<0.5	**1,300**	<25	**630**	**730**	<0.5	<0.5	**1.0**
LIGHT GASSES																	
Ethane	µg/l	**0.040 J**	**0.88**	**27**	**25**	**0.017 J**	**0.66**	**8.3**	**0.014 J**	**0.018 J**	**3.7**	**0.12**	**5.6**	**5.3**	**0.20**	**0.029 J**	**0.11**
Ethene	µg/l	**0.035 J**	**900**	**56**	**36**	**0.065 J**	**83**	**120**	**0.0059 J**	**0.0088 J**	**130**	**0.038 J**	**1,700**	**1,800**	**0.26**	**0.020 J**	**0.23**
Methane	µg/l	**0.20 J**	**1,600**	**2,900**	**2,700**	**0.31 J**	**7.9**	**8,700**	**0.14 J**	**0.20 J**	**1,300**	**1.1**	**5,800**	**6,000**	**220**	**0.27 J**	**1.9**
MOLAR CONCENTRATION																	
Trichloroethene (TCE)	µmol/l	1.1	0.084	2.4	2.1	0.14	14	1.8	0.42	0.057	300	37	1.3	5.4	0.18	0.21	0.19
Dichloroethene (cis-1,2-)	µmol/l	1.4	52	1.3	1.1	0.20	380	42	0.023	0.011	510	64	14	21	0.012	0.14	0.90
Dichloroethene (trans-1,2-)	µmol/l	0.013	0.15	0.065	0.066	ND	0.68	0.28	ND	ND	1.1	0.18	0.10	0.12	ND	ND	0.0052
Dichloroethene (1,1-)	µmol/l	0.0052	ND	0.011	0.0093	ND	0.59	0.11	ND	ND	1.2	0.080	ND	0.042	ND	ND	0.0021
Tetrachloroethene (PCE)	µmol/l	ND	ND	ND	ND	ND	ND	ND	ND	0.0036	ND	ND	ND	ND	ND	ND	ND
Vinyl chloride	µmol/l	0.0080	32	0.59	0.40	ND	32	6.2	ND	ND	21	ND	10	12	ND	ND	0.016
Ethane	µmol/l	0.0013	0.029	0.90	0.83	0.00057	0.022	0.28	0.00047	0.00060	0.12	0.0040	0.19	0.18	0.0067	0.00096	0.0037
Ethene	µmol/l	0.0012	32	2.0	1.3	0.0023	3.0	4.3	0.00021	0.00031	4.6	0.0014	61	64	0.0093	0.00071	0.0082
Total	µmol/l	2.5	116	7.3	5.8	0.34	430	55	0.44	0.073	838	102	87	102	0.21	0.35	1.1
MOLAR PERCENTAGE																	
TCE	%	42	0.072	33	36	42	3.2	3.3	95	78	36	37	1.5	5.3	87	58	17
DCEs	%	58	45	19	21	57	89	77	5.1	16	61	63	17	20	5.9	41	81
VC	%	0.32	28	8.1	6.9	ND	7.4	11	ND	ND	2.5	ND	12	11	ND	ND	1.4
Ethane+Ethene	%	0.10	28	39	37	0.84	0.69	8.2	0.15	1.2	0.57	0.0053	70	63	7.5	0.47	1.1
VOLATILE FATTY ACIDS																	
Acetic Acid	mg/l	**0.15 J**	**2.1**	**0.024 J**	**0.019 J**	**0.019 J**	**8.1 J**	**0.024 J**	**0.024 J**	**0.023 J**	**0.053 J**	**0.025 J**	**79**	**93**	**0.020 J**	**0.027 J**	**0.021 J**
Butyric Acid	mg/l	<1.0	<0.1	<0.1	<0.1	<0.1	**0.55 J**	<0.1	**0.0066 J**	**0.0055 J**	<0.1	**0.0055 J**	**6.2**	**7.7**	<0.1	<0.1	<0.1
Hexanoic Acid	mg/l	<2.0	<0.2	<0.2	<0.2	<0.2	<20	<0.2	<0.2	<0.2	<0.2	<0.2	**1.2**	**2.0**	<0.2	<0.2	<0.2
i-Hexanoic Acid	mg/l	<2.0	<0.2	<0.2	<0.2	<0.2	<20	<0.2	<0.2	<0.2	<0.2	<0.2	**0.038 J**	**0.038 J**	<0.2	<0.2	<0.2
i-Pentanoic Acid	mg/l	<1.0	<0.1	<0.1	<0.1	<0.1	<10	<0.1	<0.1	<0.1	<0.1	<0.1	**0.083 J**	**0.094 J**	<0.1	<0.1	<0.1
Lactic Acid	mg/l	<2.0	<0.2	<0.2	**0.014 J**	<0.2	**9.8 J**	**0.014 J**	**0.012 J**	**0.015 J**	<0.2	**0.012 J**	<2.0	<2.0	<0.2	**0.032 J**	<0.2
Pentanoic Acid	mg/l	<1.0	<0.1	<0.1	<0.1	<0.1	<10	<0.1	<0.1	<0.1	<0.1	<0.1	**0.12**	**0.13**	<0.1	<0.1	<0.1
Propionic Acid	mg/l	<1.0	**0.023 J**	<0.1	<0.1	<0.1	**1.7 J**	<0.1	<0.1	<0.1	<0.1	<0.1	**0.73 J**	**0.77 J**	<0.1	<0.1	<0.1
Pyruvic Acid	mg/l	<1.0	<0.1	<0.1	<0.1	**0.016 J**	**1.1 J**	<0.1	<0.1	<0.1	<0.1	<0.1	**0.080 J**	**0.095 J**	<0.1	<0.1	<0.1
OTHER LABORATORY DATA																	
Total Organic Carbon	mg/l	**17.2**	**5.1**	**4.6**	**–**	**20.2**	**397**	**2.1**	**1.2**	**0.58 J**	**7.1**	**2.1**	**42.8**	**49.4**	**2.4**	**0.84 J**	**2.1**
WATER QUALITY PROBE DATA																	
Temperature	°C	**14.5**	**14.6**	**14.0**	**–**	**16.0**	**14.3**	**15.3**	**–**	**13.8**	**14.3**	**14.2**	**14.6**	**–**	**13.7**	**14.6**	**14.0**
Specific Conductance	uS/cm	**2,700**	**920**	**710**	**–**	**1,700**	**14,000**	**550**	**–**	**350**	**1,400**	**800**	**660**	**–**	**700**	**390**	**200**
pH	s.u.	**7.2**	**6.4**	**7.3**	**–**	**7.1**	**6.74**	**7.4**	**–**	**7.4**	**6.93**	**7.2**	**6.73**	**–**	**7.0**	**6.76**	**5.88**
Oxidation/Reduction Potential	mV	**49**	**-90**	**19**	**–**	**62**	**-90**	**45**	**–**	**80**	**4.2**	**34**	**-110**	**–**	**81**	**100**	**110**
Dissolved Oxygen	mg/l	**11**	**2.8**	**0.92**	**–**	**7.2**	**1.3**	**2.4**	**–**	**6.9**	**1.2**	**6.4**	**0.43**	**–**	**3.9**	**2.7**	**1.1**
Turbidity	NTU	**1.1**	**1.9**	**0.97**	**–**	**4.1**	**9.3**	**2.0**	**–**	**5.3**	**6.9**	**13**	**5.0**	**–**	**3.0**	**2.1**	**5.0**
FIELD CHEMISTRY																	
Iron	mg/l	ND	**>3.0**	**0.080**	**–**	**0.03**	**11**	**0.010**	**–**	**0.010**	**0.33**	**0.13**	**>3.0**	**–**	ND	**0.020**	**0.070**
Iron - Ferrous	mg/l	ND	**>3.0**	**0.21**	**–**	ND	**10**	**0.050**	**–**	ND	**0.15**	**0.10**	**>3.0**	**–**	ND	**0.040**	**0.010**
Nitrate	mg/l	**2.7**	**4.7**	**1.2**	**–**	**1.6**	<0.5	**1.1**	**–**	**1.1**	**1.8**	**2.8**	**2.9**	**–**	**1.4**	**3.8**	**0.70**
Sulfate	mg/l	**>70**	**2.0**	**16**	**–**	**>70**	**2,900**	**10**	**–**	**13**	**58**	**17**	ND	**–**	ND	ND	**6.0**
Sulfide	µg/l	**160**	**370**	**30**	**–**	**60**	<1,000	ND	**–**	**30**	ND	**70**	**90**	**–**	**40**	ND	**60**

TABLE 3
SUMMARY OF OCTOBER 2017 PERFORMANCE MONITORING
Summary Trip Report
IBM Gun Club - Former Burn Pit Area
Union, New York

Analyte Name	Unit	A-13	B-4	B-7	B-9	IB-7	113	119	POLY3
		A-13	B-4	B-7	B-9	IB-7	113	119	TOTE 1
		PDB	PDB	PDB	PDB	PDB	Surface Water	Surface Water	Purge Water
		S	S	S	S	S	S	S	S
		10/12/2017	10/12/2017	10/12/2017	10/12/2017	10/12/2017	10/12/2017	10/12/2017	10/12/2017
VOLATILE ORGANIC COMPOUNDS (VOCs)									
Trichloroethene (TCE)	µg/l	**12 J**	**4.6 J**	**70 J**	<50	**42 J**	**0.20 J**	<0.5	**180**
Dichloroethene (cis-1,2-)	µg/l	**13,000**	**17**	**450**	**220**	**530**	<0.5	**0.90**	**510**
Dichloroethene (trans-1,2-)	µg/l	**30 J**	<5.0	<100	<50	<50	<0.5	<0.5	**1.2 J**
Dichloroethene (1,1-)	µg/l	**16 J**	<5.0	<100	<50	<50	<0.5	<0.5	<5.0
Tetrachloroethene (PCE)	µg/l	<50	<5.0	<100	<50	<50	<0.5	<0.5	<5.0
Vinyl chloride	µg/l	**1,800**	**3.3 J**	**76 J**	**15 J**	**51**	<0.5	**0.10 J**	**20**
LIGHT GASSES									
Ethane	µg/l	**53**	**8.3**	**53**	**5.0**	**30**	–	–	–
Ethene	µg/l	**2,300**	**20**	**320**	**25**	**98**	–	–	–
Methane	µg/l	**9,700**	**19,000**	**13,000**	**970**	**19,000**	–	–	–
MOLAR CONCENTRATION									
Trichloroethene (TCE)	µmol/l	0.091	0.035	0.53	ND	0.32	0.0015	ND	1.4
Dichloroethene (cis-1,2-)	µmol/l	130	0.18	4.6	2.3	5.5	ND	0.0093	5.3
Dichloroethene (trans-1,2-)	µmol/l	0.31	ND	ND	ND	ND	ND	ND	0.012
Dichloroethene (1,1-)	µmol/l	0.17	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene (PCE)	µmol/l	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl chloride	µmol/l	29	0.053	1.2	0.24	0.82	ND	0.0016	0.32
Ethane	µmol/l	1.8	0.28	1.8	0.17	1.0	–	–	–
Ethene	µmol/l	82	0.71	11	0.89	3.5	–	–	–
Total	µmol/l	243	1.3	20	3.6	11	0.0	0.0	7.0
MOLAR PERCENTAGE									
TCE	%	0.037	2.8	2.7	ND	2.9	100	ND	20
DCEs	%	54	14	24	64	49	ND	85	76
VC	%	12	4.2	6.2	6.7	7.4	ND	15	4.6
Ethane+Ethene	%	34	79	67	30	40	–	–	–
VOLATILE FATTY ACIDS									
Acetic Acid	mg/l	**190**	**430**	**470**	**660**	**740**	–	–	–
Butyric Acid	mg/l	**90**	**74**	**350**	**170**	**130**	–	–	–
Hexanoic Acid	mg/l	**4.5**	**11**	**160**	**16**	**8.2**	–	–	–
i-Hexanoic Acid	mg/l	**0.72 J**	**0.87 J**	**3.2**	**0.86 J**	**2.2**	–	–	–
i-Pentanoic Acid	mg/l	**2.3**	**5.5**	**8.8**	**6.5**	**5.5**	–	–	–
Lactic Acid	mg/l	<2.0	**1.1 J**	<20	**0.26 J**	**0.18 J**	–	–	–
Pentanoic Acid	mg/l	**9.1**	**36**	**340**	**230**	**40**	–	–	–
Propionic Acid	mg/l	**360**	**870**	**530**	**1,800**	**970**	–	–	–
Pyruvic Acid	mg/l	**6.1**	**71**	**89**	**30**	**41**	–	–	–
OTHER LABORATORY DATA									
Total Organic Carbon	mg/l	**554**	**1,330**	**2,960**	**3,270**	**1,170**	–	–	–
WATER QUALITY PROBE DATA									
Temperature	°C	–	–	–	–	–	**13.5**	**13.0**	–
Specific Conductance	uS/cm	–	–	–	–	–	**380**	**600**	–
pH	s.u.	–	–	–	–	–	**7.5**	**7.0**	–
Oxidation/Reduction Potential	mV	–	–	–	–	–	**37**	**-98**	–
Dissolved Oxygen	mg/l	–	–	–	–	–	**2.0**	**5.9**	–
Turbidity	NTU	–	–	–	–	–	–	–	–
FIELD CHEMISTRY									
Iron	mg/l	–	–	–	–	–	–	–	–
Iron - Ferrous	mg/l	–	–	–	–	–	–	–	–
Nitrate	mg/l	–	–	–	–	–	–	–	–
Sulfate	mg/l	–	–	–	–	–	–	–	–
Sulfide	µg/l	–	–	–	–	–	–	–	–

Notes:

1. The table summarizes samples collected during the week of October 9, 2017 as part of performance testing at the IBM Gun Club former Burn Pit Area. Samples were analyzed both in the field and at fixed analytical laboratories as indicated on the table.

2. Analytical laboratory analysis was performed by Eurofins Lancaster Laboratories of Lancaster, Pennsylvania (Lancaster) and/or Pace Analytical (formly Microseeps, Inc.) of Pittsburgh, Pennsylvania (Pace). Results of compounds are recorded in units indicated on the table. Detections of compounds are emboldened.

3. Definitions:
"S" indicates primary sample
"FD" indicates field duplicate
"PDB" indicates the sample was collected via a passive diffusion bag
"–" indicates the compounds were not analyzed for that particular sample.
"U" indicates the result was below the analytical detection limit.
"J" indicates that the laboratory data was below the lowest quantifiable limit and therefore estimated.
"*" indicates that the sample exhibited high turbidity and could not be analyzed in the field. Recorded results are from analysis at Pace.
">" indicates results were over the calibration range and should be considered estimated.
"ND" indicates that results were not detected above the analytical reporting limit or the calibration range of the field screening device.

4. Refer to the report text for further discussion. The sample plan can be referenced in the Site Management Plan.

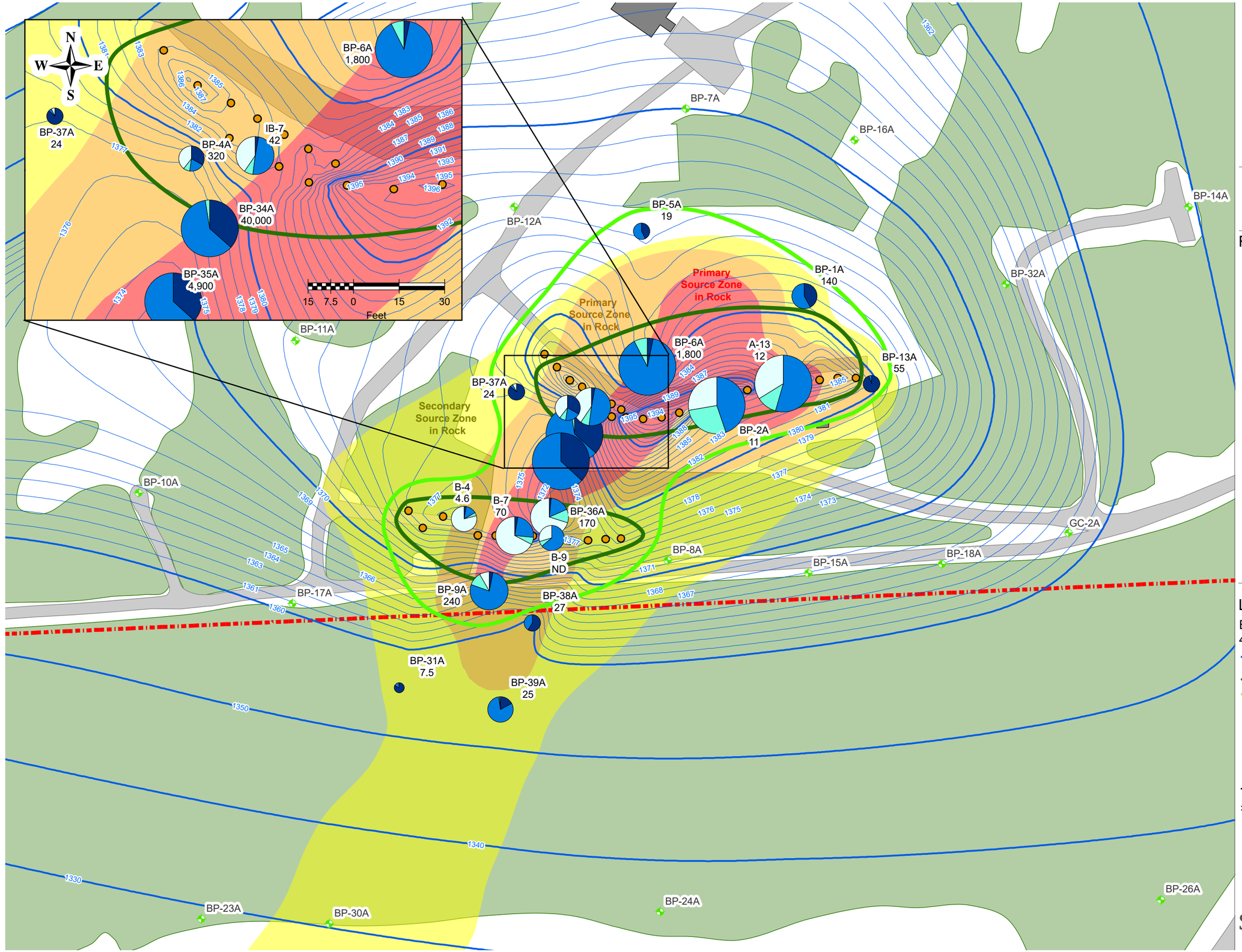

Figure 1

Summary of October 2017 Groundwater Quality Conditions

2017 Annual Performance Testing

IBM Gun Club - Former Burn Pit Area

Union, New York

Drawn By:	C. LaVack
Designed By:	E. Bosse
Reviewed By:	D. Shea
Project No:	3526.05
Date:	November 2017

Figure Narrative

The figure is intended to depict groundwater quality data and inference recorded during the week of October 9, 2017.

The groundwater data for site key VOCs including PCE, TCE, cDCE, vinyl chloride from water table monitoring wells are presented as pie diagrams. The wedges of each pie diagram represent concentrations of the four compounds expressed in micromoles per liter (umol/L). The relative diameter of each pie diagram varies based on the sum of the four VOCs at each location.

The inferred geochemical (REDOX) conditions are based on observations of oxidation-reduction potential (ORP), methane, sulfide, ferrous and total iron, and nitrate. Methanogenic conditions are characterized by methane concentrations = 20 µg/L, sulfate reducing by sulfide = 50 µg/L, iron reducing by Fe(II)/Fe(tot) = 0.7 mg/L, and nitrate reduction by nitrate < 1 mg/L. ORP is generally expected to be less than 200 for iron reduction, less than 100 for sulfate reduction, and less than 0 for methanogenic conditions.

Refer to the report text for further discussion.

Legend

BP-34A
40,000
Well Name and October 2017 TCE Concentrations in Groundwater (µg/L).

Inferred Groundwater Contour 10/9/2017

Methanogenic, Methane >= 20 µg/L

Sulfate Reducing, Sulfide >= 50 µg/L

Parent VOC (Trichloroethene)

Primary Daughter Product (*cis*-1,2DCE)

Secondary Daughter Product (Vinyl Chloride)

Terminal Breakdown Products (Ethane, Ethene)

Total Chlorinated Ethanes & Ethenes in Groundwater (µmol/L)

< 0.1

>0.1 to 1

>1 to 10

>10 to 100

>100

40 20 0 40 80

Feet

SANBORN HEAD

Last Edited By: clavack

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N
W E
S

BP-5A
0.082

BP-1A
0.075

BP-6A
(84)

BP-37A
0.46

BP-4A
(832

IB-777
130 00 8

/A-133
2,400 2

BP-13A
0.02

BP-2A
900)

BP-34A
130

BP-35A
0.16

B- B-4
19,0 28 47

BP-36A
1,700

B B-7-7
13,370 51

B-9 9
2, 30 52

BP-9A
130

BP-38A
0.049

BP-31A
0.027

BP-39A
0.34

Clear Labels
TOC
Total VFA
pH
FeII
Methane
Sulfide
ORP
DO
Ene + Ane

Figure 2

October 2017 Assessment of Reducing Conditions

IBM Gun Club - Former Burn Pit Area
Union, New York

Drawn By:	C. LaVack
Designed By:	E. Bosse
Reviewed By:	D. Shea
Project No:	3526.05
Date:	November 2017

Figure Narrative

This figure is intended to assess multiple lines of evidence to assess what proportion of the primary and secondary source rock are under sulfate reducing and methanogenic conditions. Green labels indicate conditions conducive to reductive dehalogenation. Orange labels indicate reductive dehalogenation may be possible, but conditions are less conducive. Red labels indicate conditions where reductive dehalogenation is less likely.

Posted data is from the October 2017 sampling round.

Legend

DO mg/L	>5	2-5	<=2
ORP mV	>100	0-100	<=0
Sulfide µg/L	<10	10-50	>=50
Methane µg/L	<0.5	0.5-20	>=20
FeII mg/L	<1		>=1
pH SU	<6.3 or >7.5		6.3-7.5
Total VFA mg/L	<1		>=1
TOC mg/L	<4		>=4
Ethane + Ethene µg/L	<10	10-50	>=50

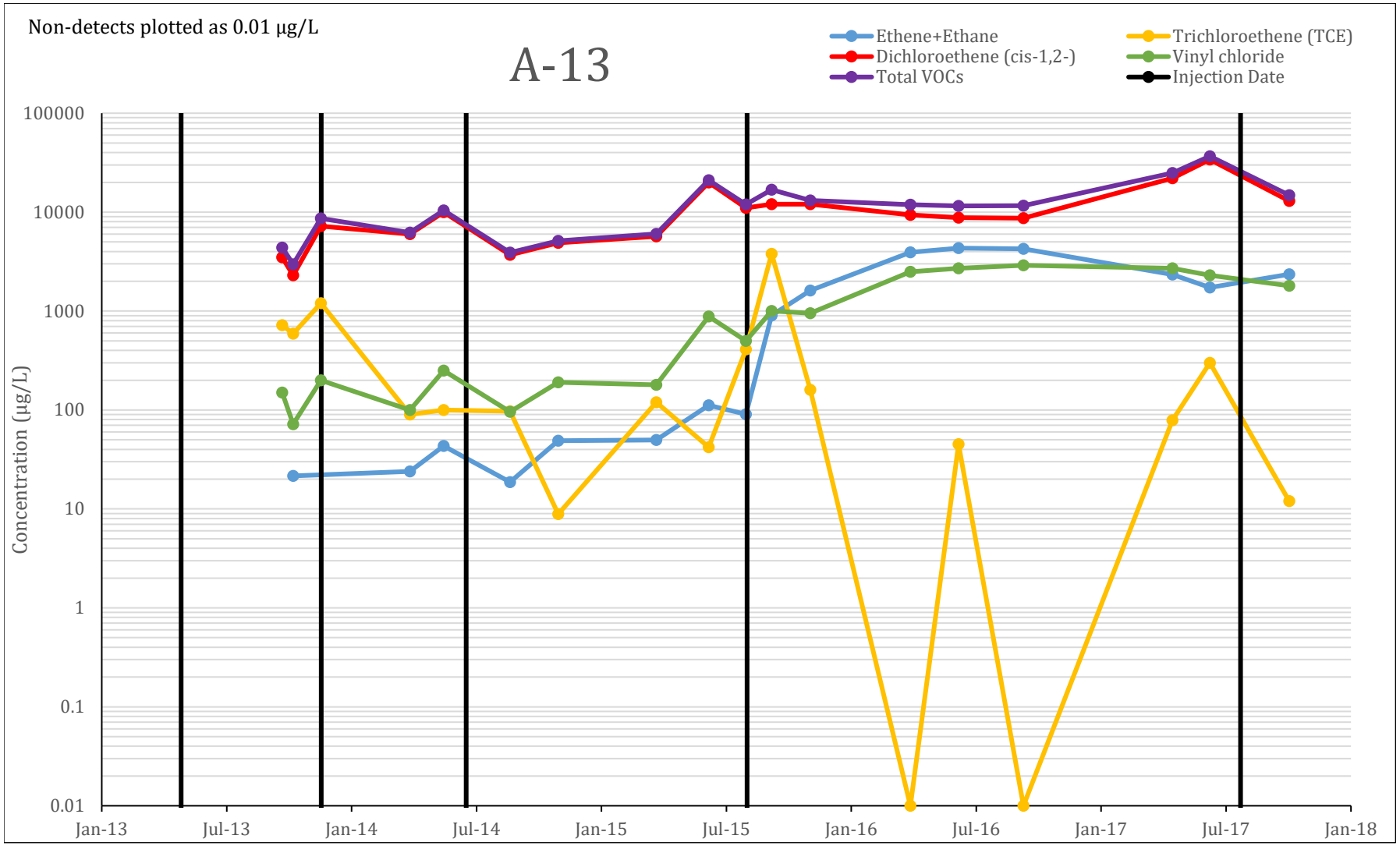
30 15 0 30 60
Feet

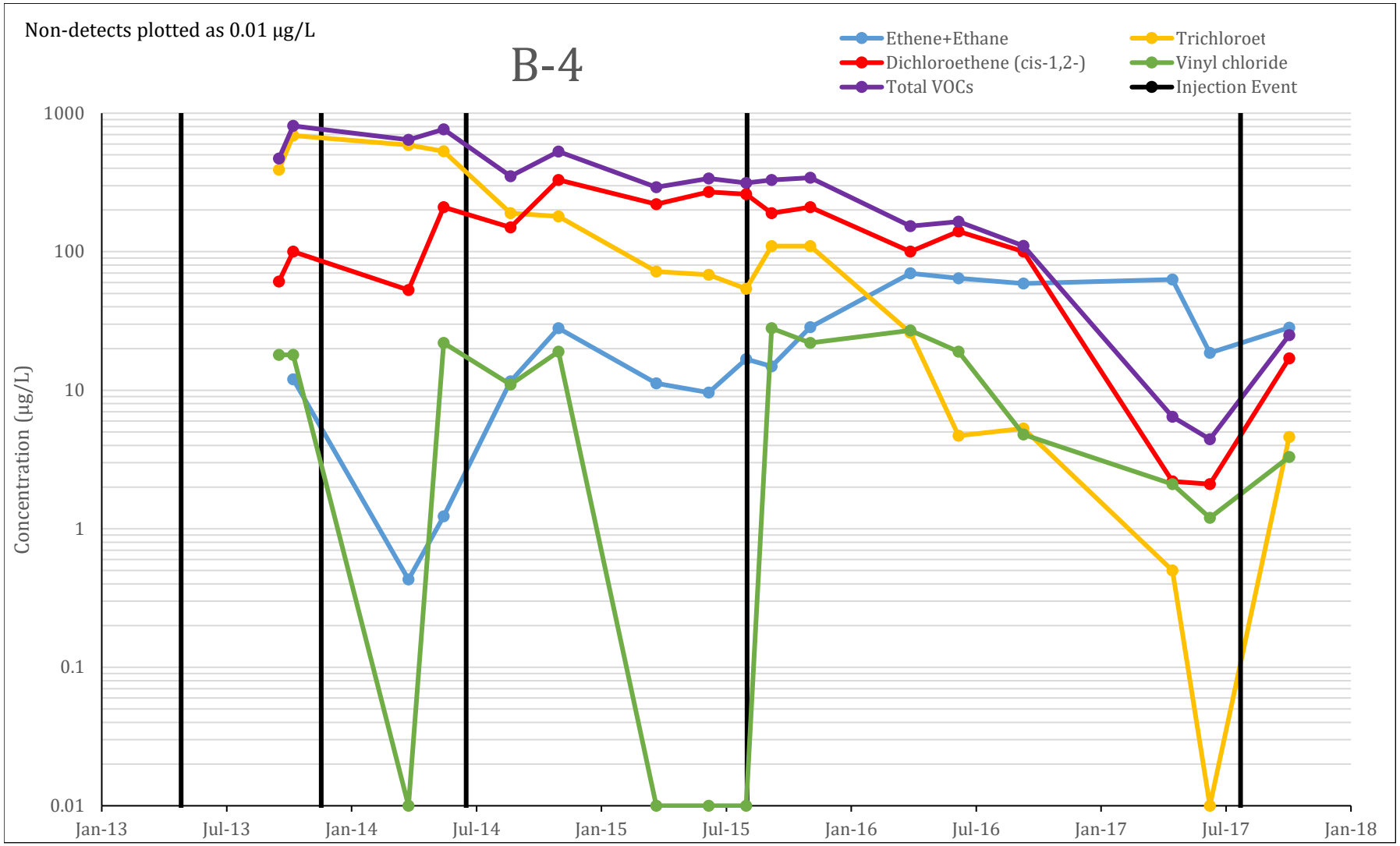
SANBORN HEAD

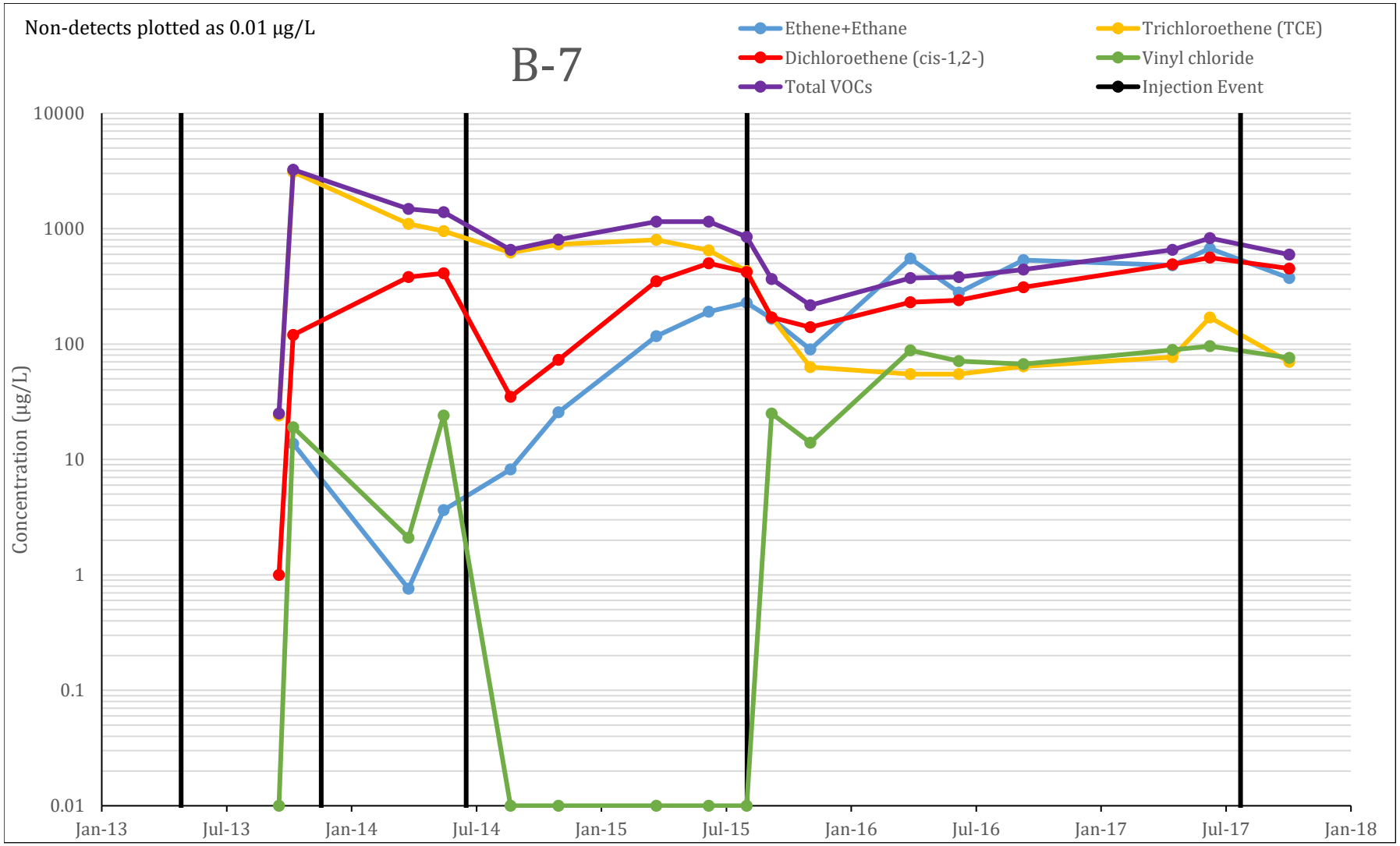
APPENDIX D

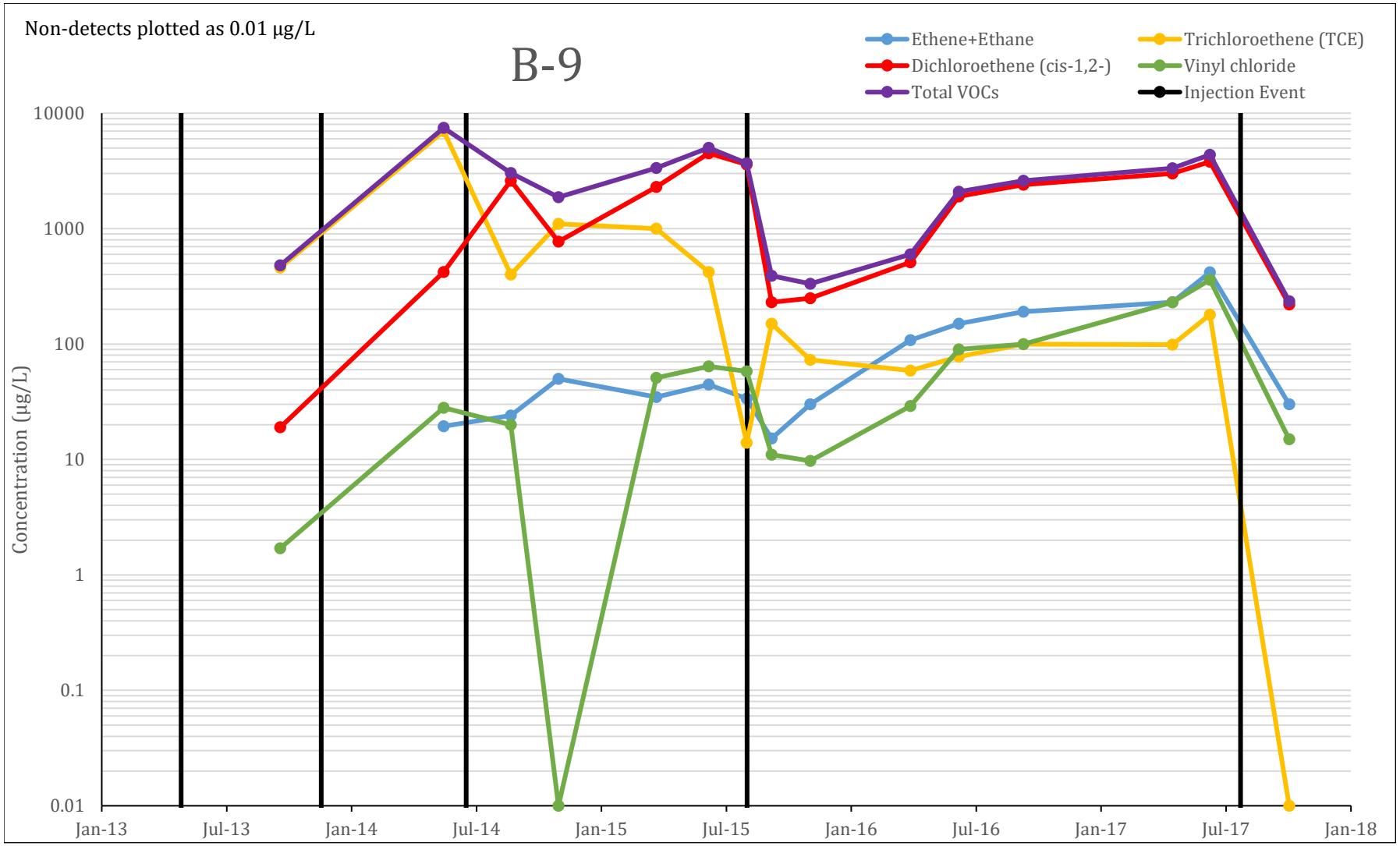
TIME SERIES PLOTS FOR

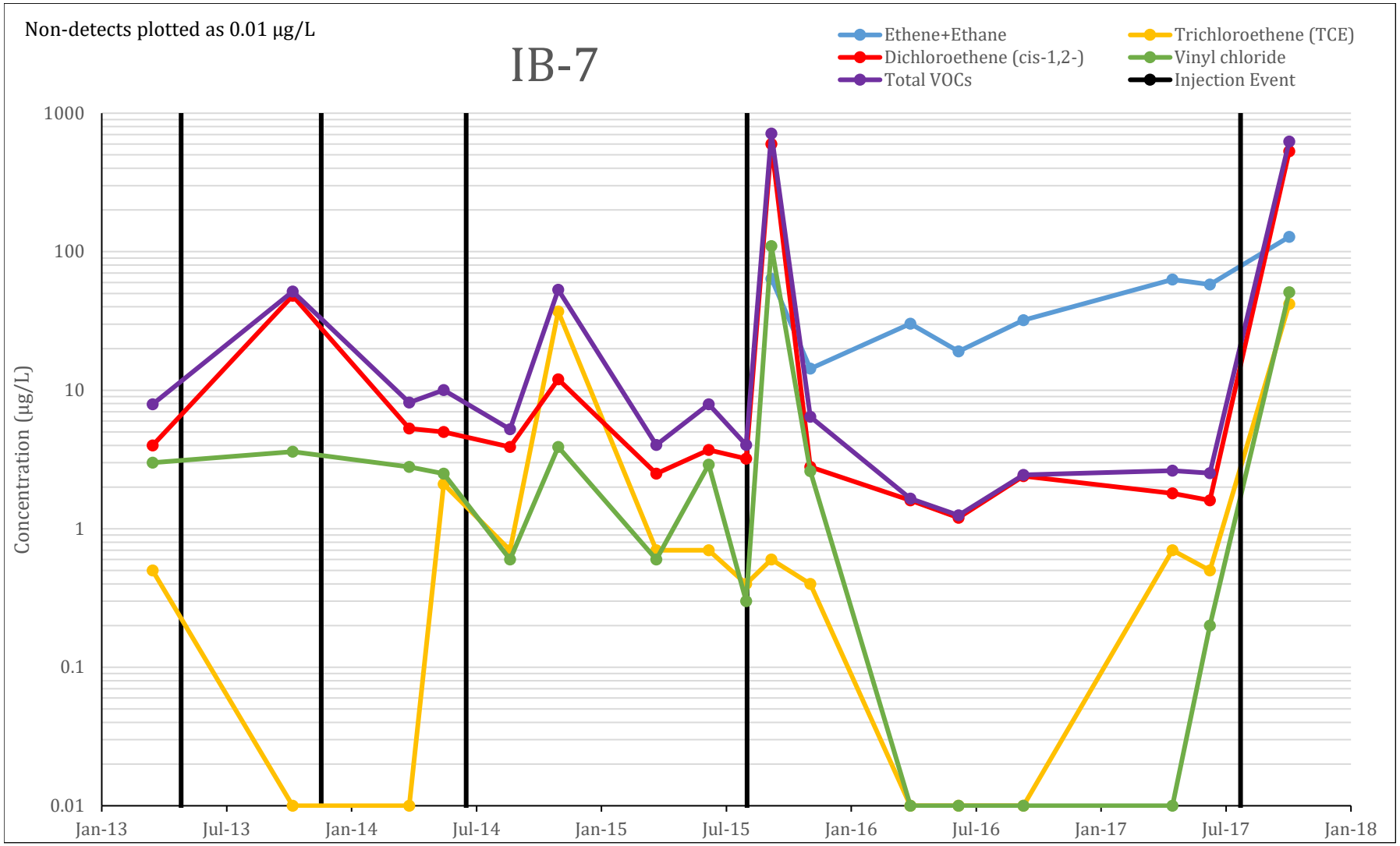
CURRENT MONITORING LOCATIONS

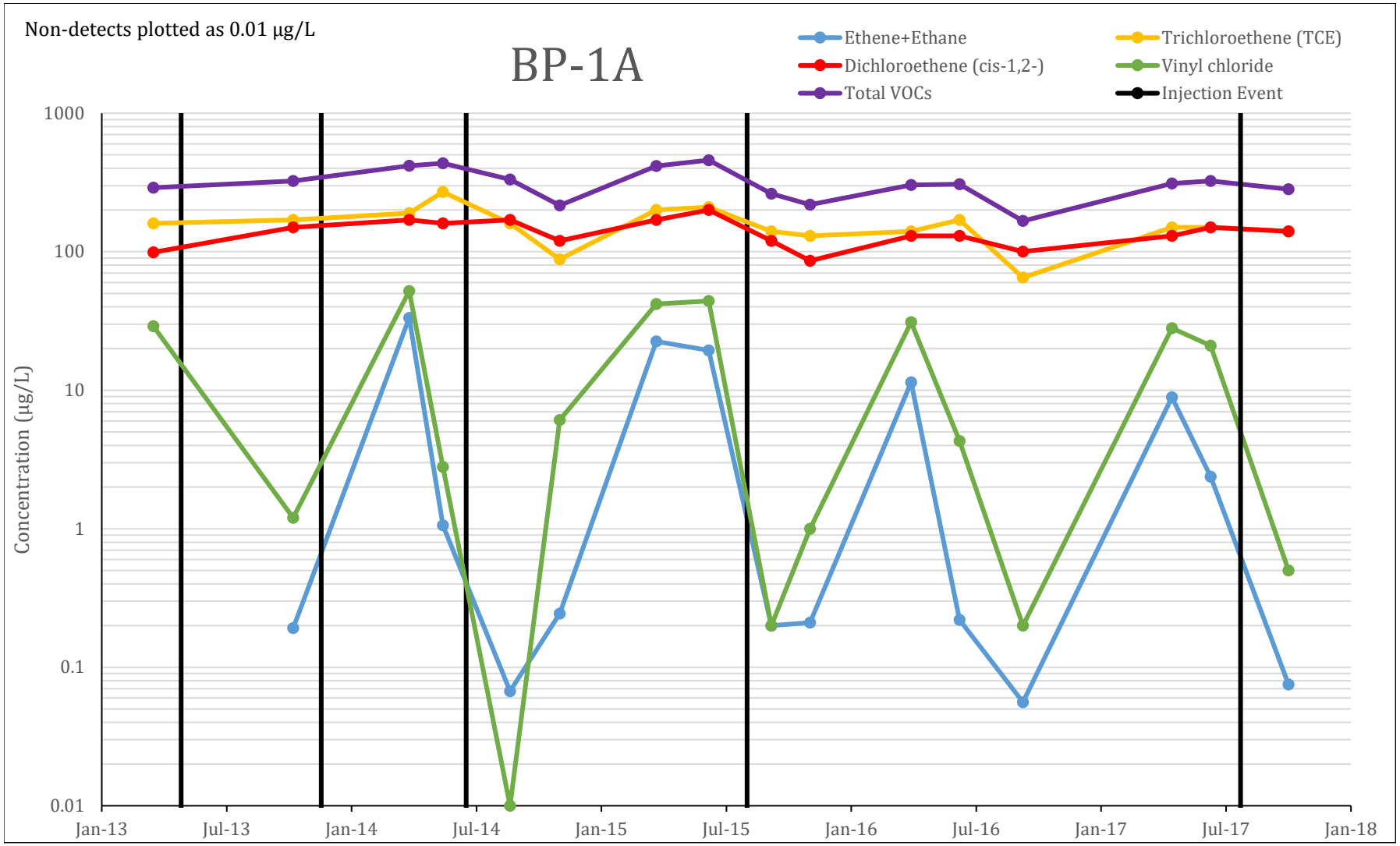

Non-detects plotted as 0.01 µg/L
A-13
Ethene+Ethane
Dichloroethene (cis-1,2-)
Total VOCs
Trichloroethene (TCE)
Vinyl chloride
Injection Date
Concentration (µg/L)
100000
10000
1000
100
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18


Non-detects plotted as 0.01 µg/L
B-4
Ethene+Ethane
Dichloroethene (cis-1,2-)
Total VOCs
Trichloroet
Vinyl chloride
Injection Event
Concentration (µg/L)
1000
100
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18


Non-detects plotted as 0.01 µg/L
B-7
Ethene+Ethane
Trichloroethene (TCE)
Dichloroethene (cis-1,2-)
Vinyl chloride
Total VOCs
Injection Event
Concentration (µg/L)
10000
1000
100
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18


Non-detects plotted as 0.01 µg/L
B-9
Ethene+Ethane
Trichloroethene (TCE)
Dichloroethene (cis-1,2-)
Vinyl chloride
Total VOCs
Injection Event
Concentration (µg/L)
10000
1000
100
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18


Non-detects plotted as 0.01 µg/L
IB-7
Ethene+Ethane
Dichloroethene (cis-1,2-)
Total VOCs
Trichloroethene (TCE)
Vinyl chloride
Injection Event
Concentration (µg/L)
1000
100
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18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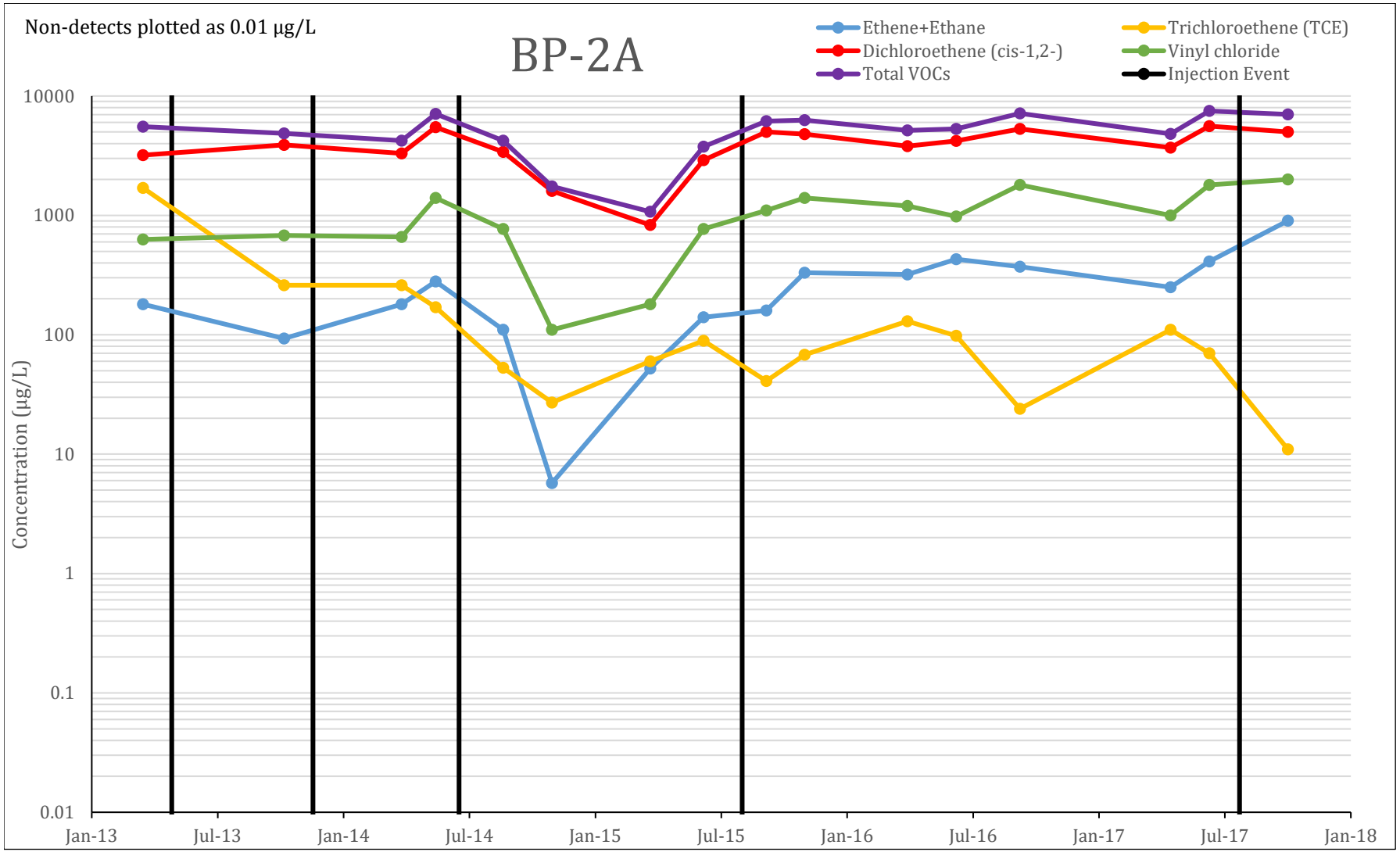
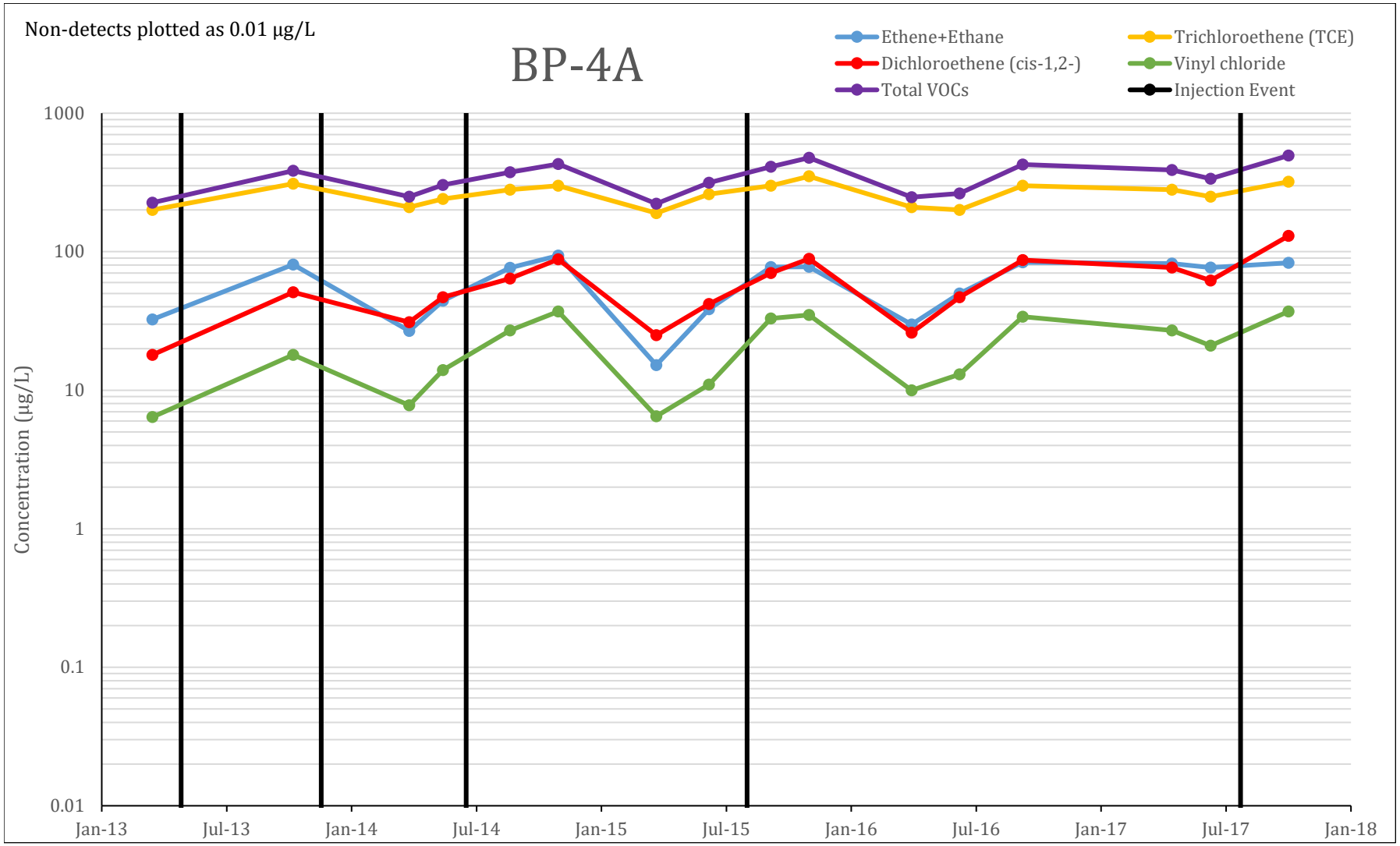
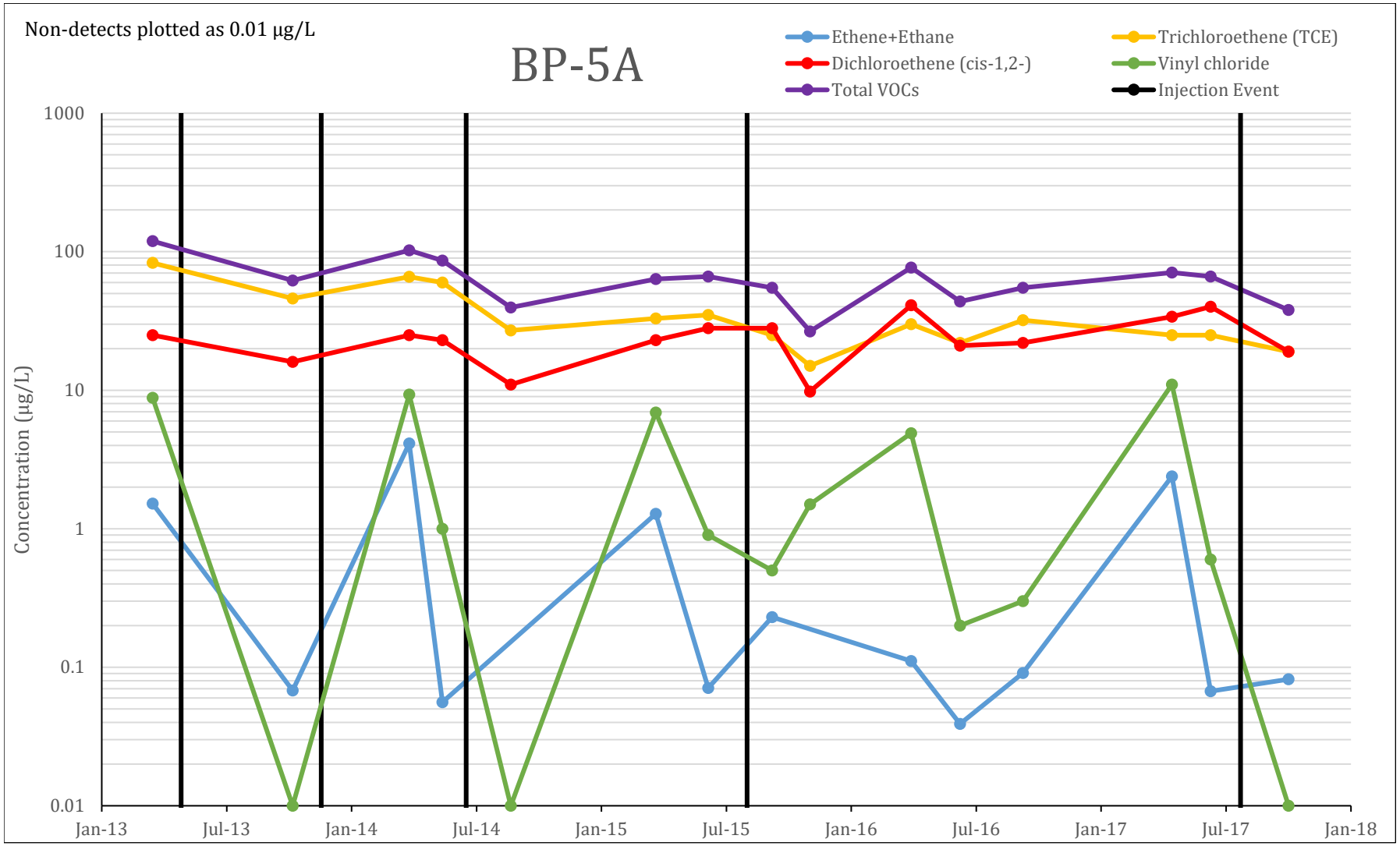
BP-1A
Ethene+Ethane
Trichloroethene (TCE)
Dichloroethene (cis-1,2-)
Vinyl chloride
Total VOCs
Injection Event
Concentration (µg/L)
1000
100
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18


Non-detects plotted as 0.01 µg/L
BP-2A
Ethene+Ethane
Dichloroethene (cis-1,2-)
Total VOCs
Trichloroethene (TCE)
Vinyl chloride
Injection Event
Concentration (µg/L)
10000
1000
100
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18


Non-detects plotted as 0.01 µg/L
BP-4A
Ethene+Ethane
Trichloroethene (TCE)
Dichloroethene (cis-1,2-)
Vinyl chloride
Total VOCs
Injection Event
Concentration (µg/L)
1000
100
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18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Ethene+Ethane
Trichloroethene (TCE)
Dichloroethene (cis-1,2-)
Vinyl chloride
Total VOCs
Injection Event
Concentration (µg/L)
1000
100
10
1
0.1
0.01
Jan-13
Jul-13
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Jan-15
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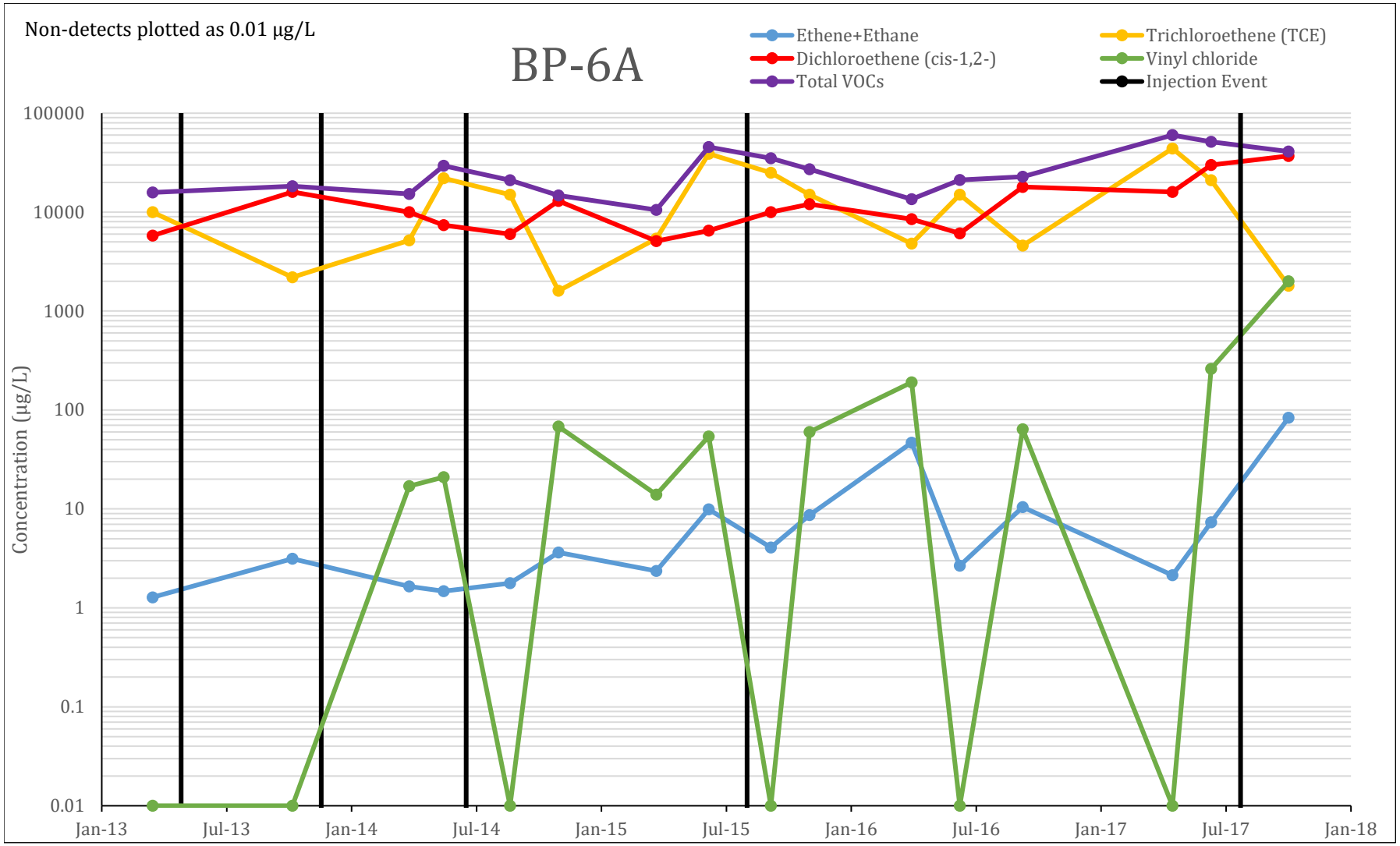
Jul-17
Jan-18


Non-detects plotted as 0.01 µg/L
BP-6A
Ethene+Ethane
Dichloroethene (cis-1,2-)
Total VOCs
Trichloroethene (TCE)
Vinyl chloride
Injection Event
Concentration (µg/L)
100000
10000
1000
100
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
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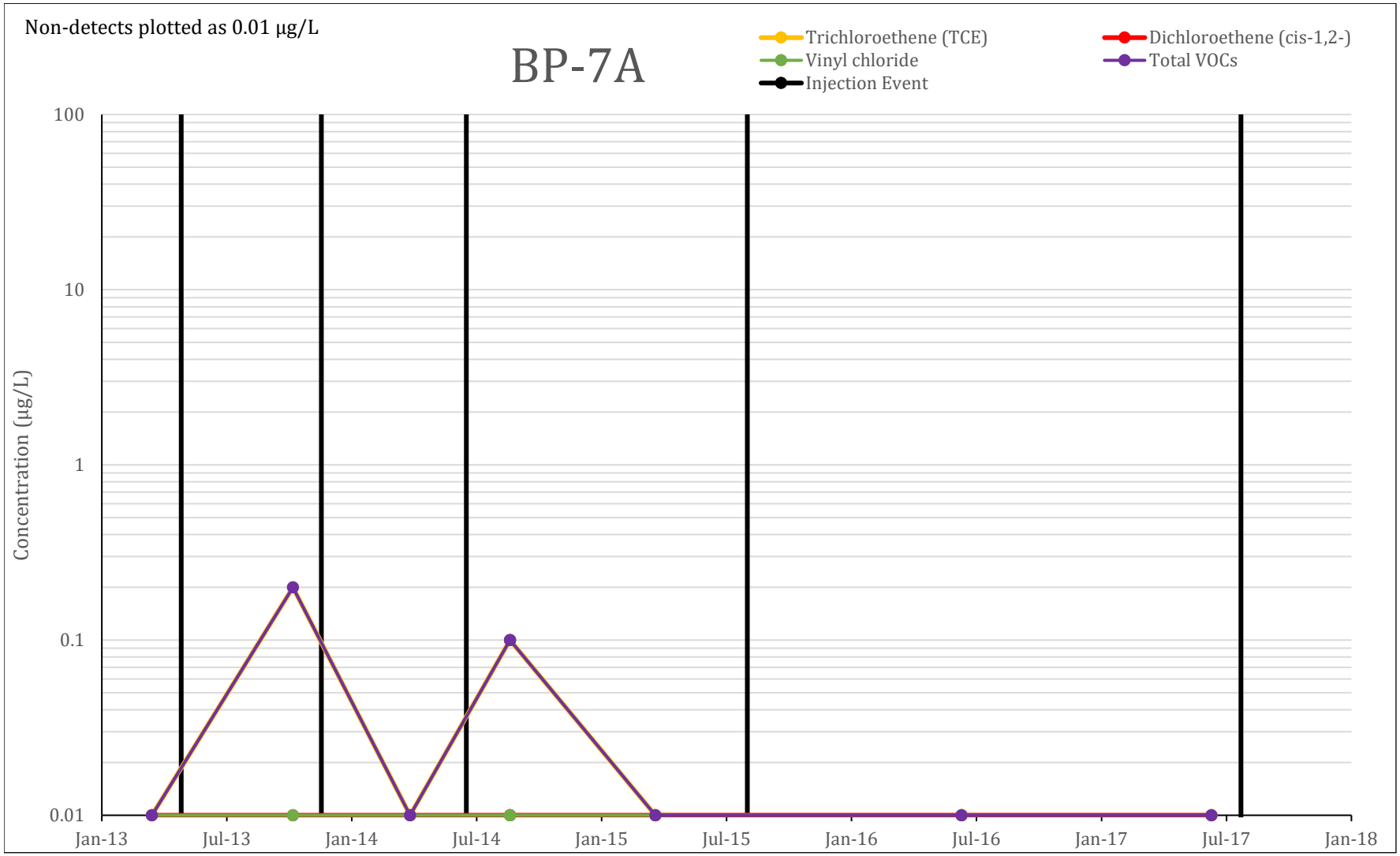
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18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BP-7A
Trichloroethene (TCE)
Dichloroethene (cis-1,2-)
Vinyl chloride
Total VOCs
Injection Event
Concentration (µg/L)
100
10
1
0.1
0.01
Jan-13
Jul-13
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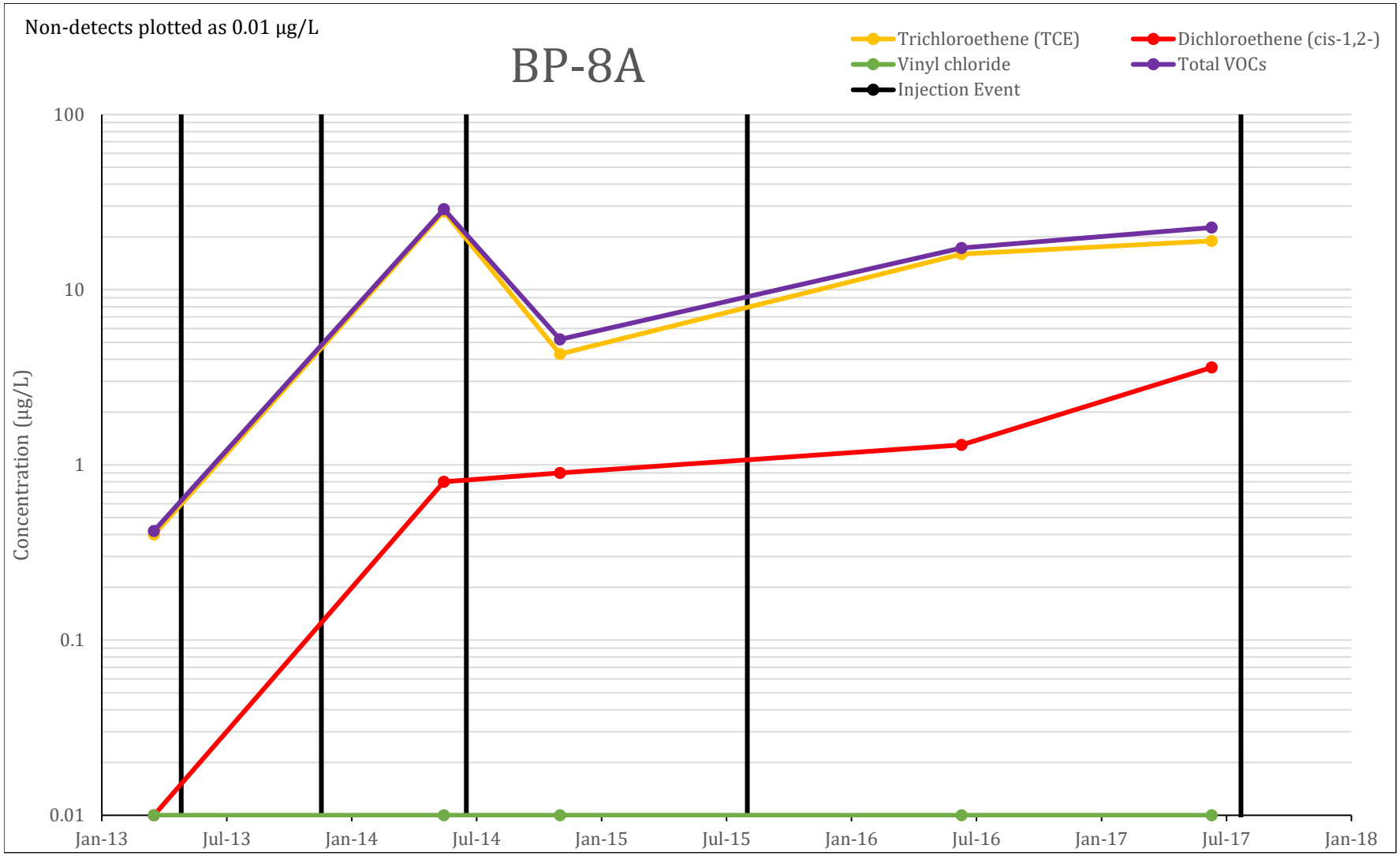
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BP-8A
Trichloroethene (TCE)
Dichloroethene (cis-1,2-)
Vinyl chloride
Total VOCs
Injection Event
Concentration (µg/L)
100
10
1
0.1
0.01
Jan-13
Jul-13
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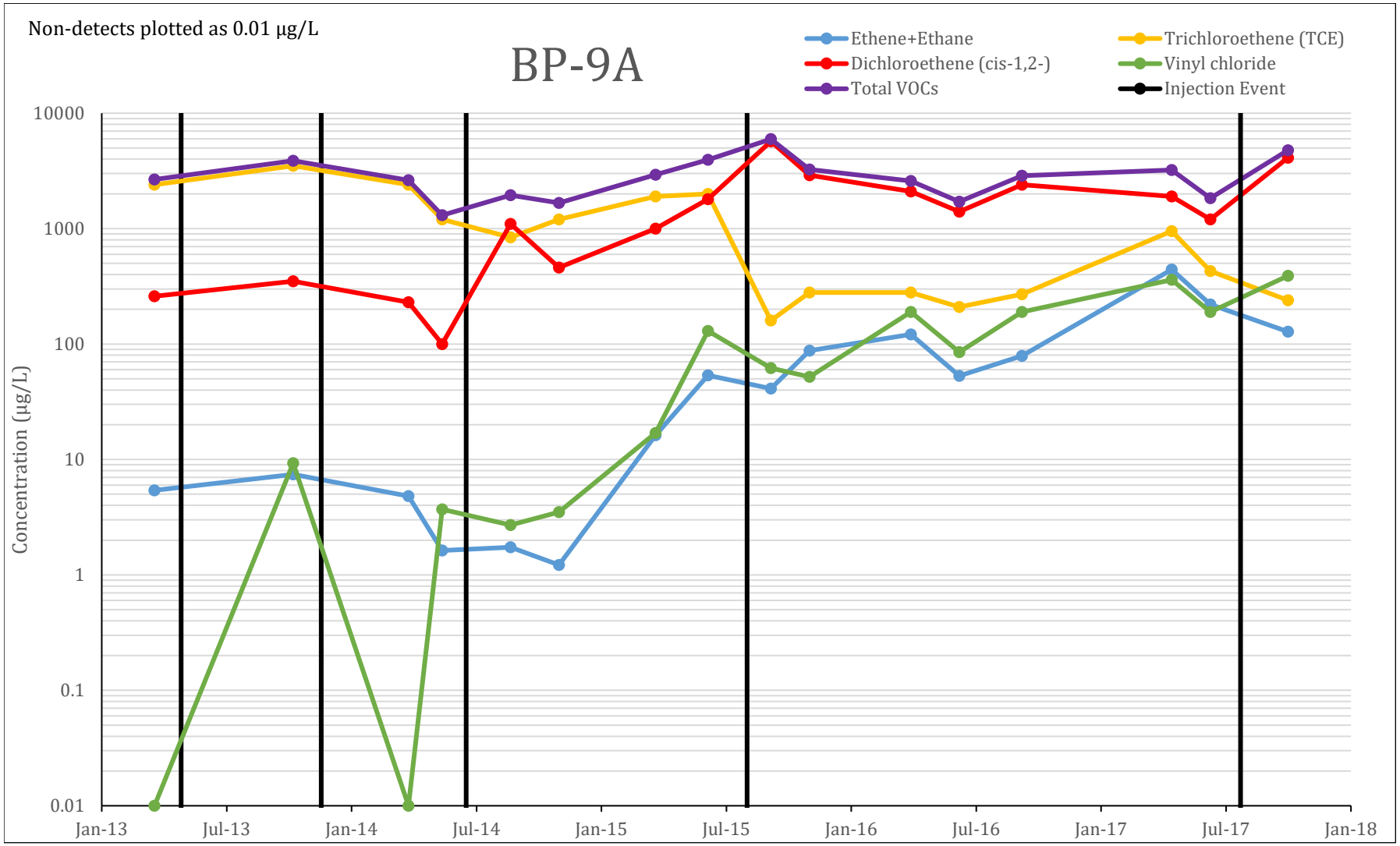
Jan-17
Jul-17
Jan-18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BP-9A
Ethene+Ethane
Dichloroethene (cis-1,2-)
Total VOCs
Trichloroethene (TCE)
Vinyl chloride
Injection Event
Concentration (µg/L)
10000
1000
100
10
1
0.1
0.01
Jan-13
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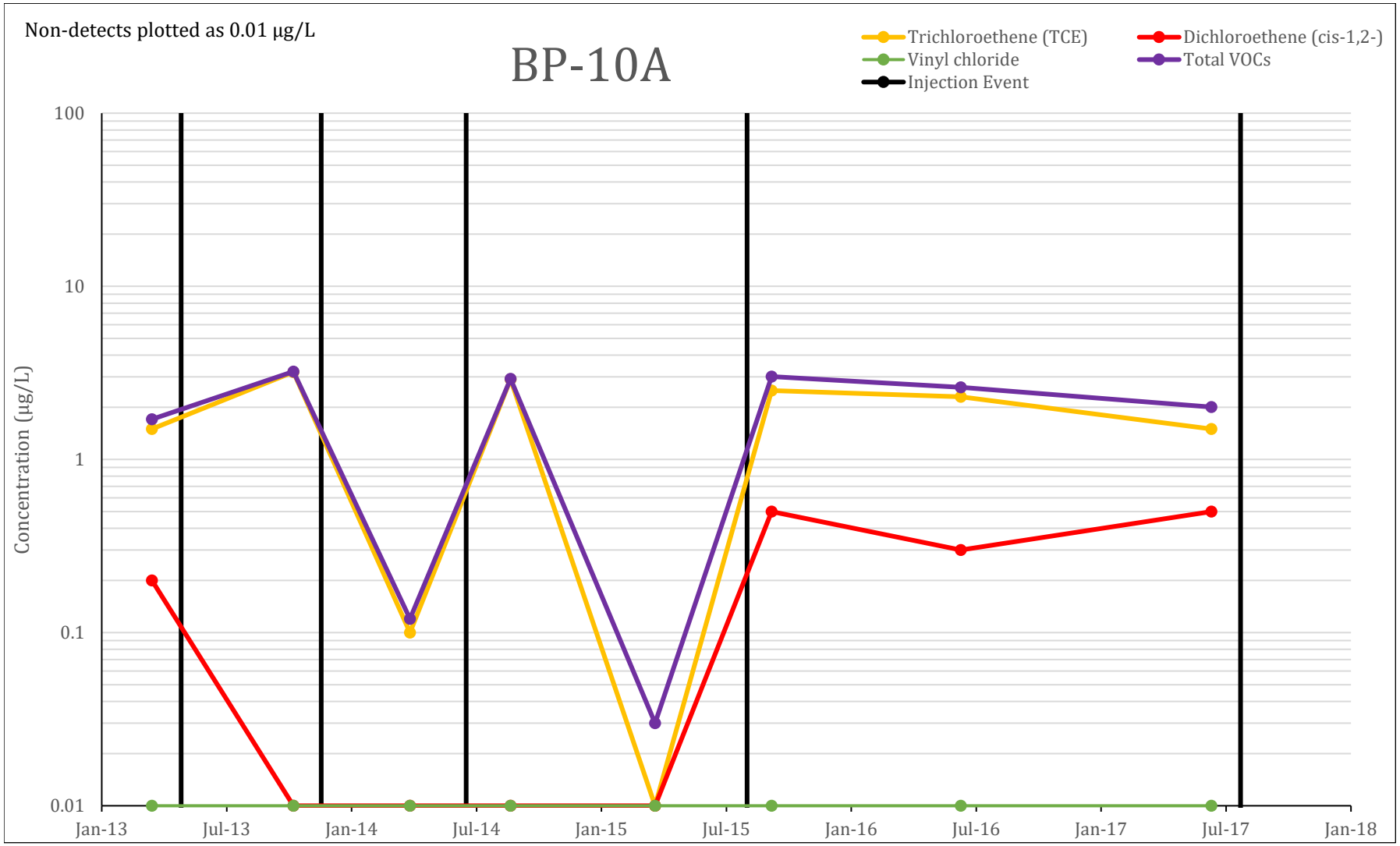
Jul-17
Jan-18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BP-10A
Trichloroethene (TCE)
Dichloroethene (cis-1,2-)
Vinyl chloride
Total VOCs
Injection Event
Concentration (µg/L)
100
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
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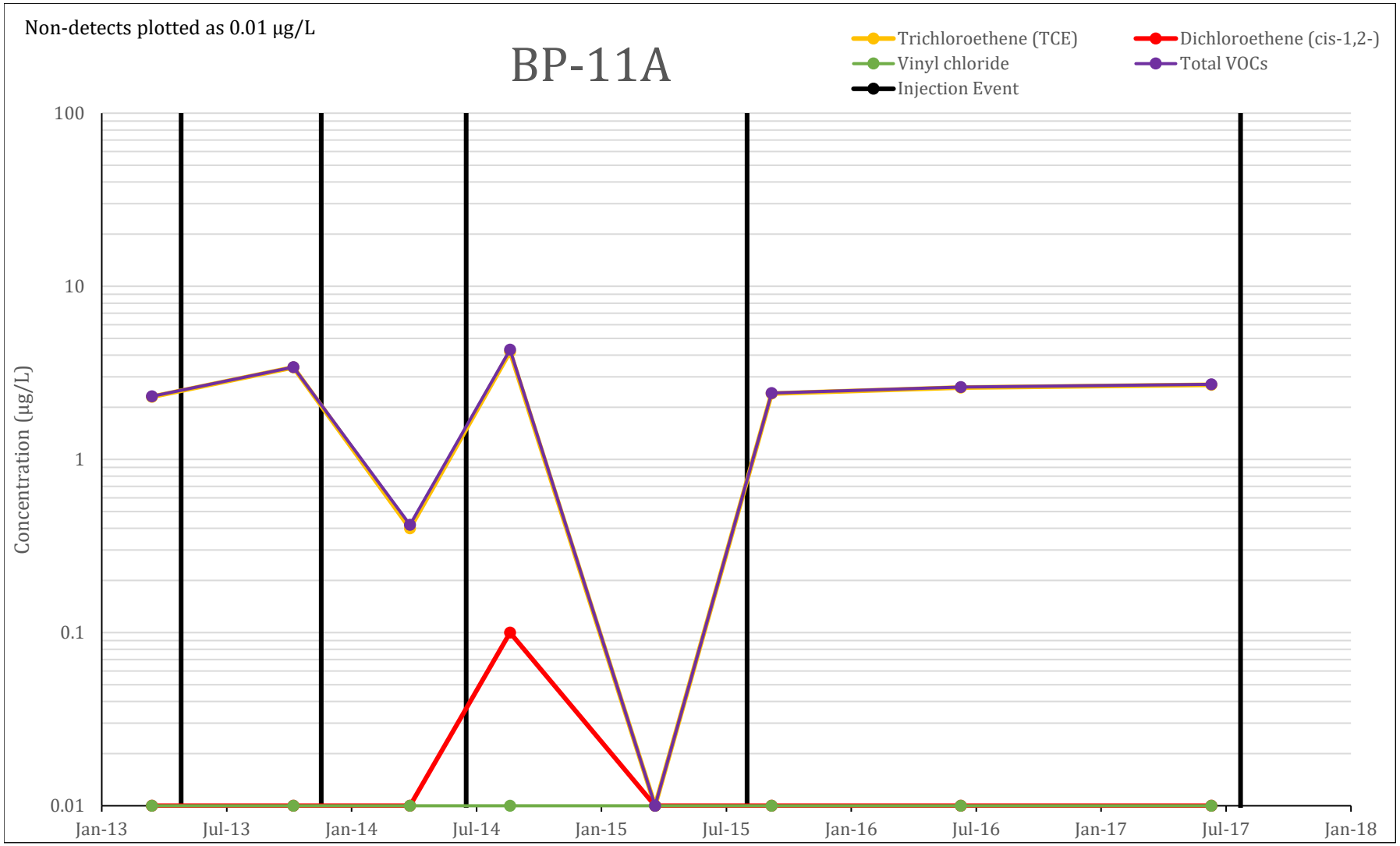
Jul-17
Jan-18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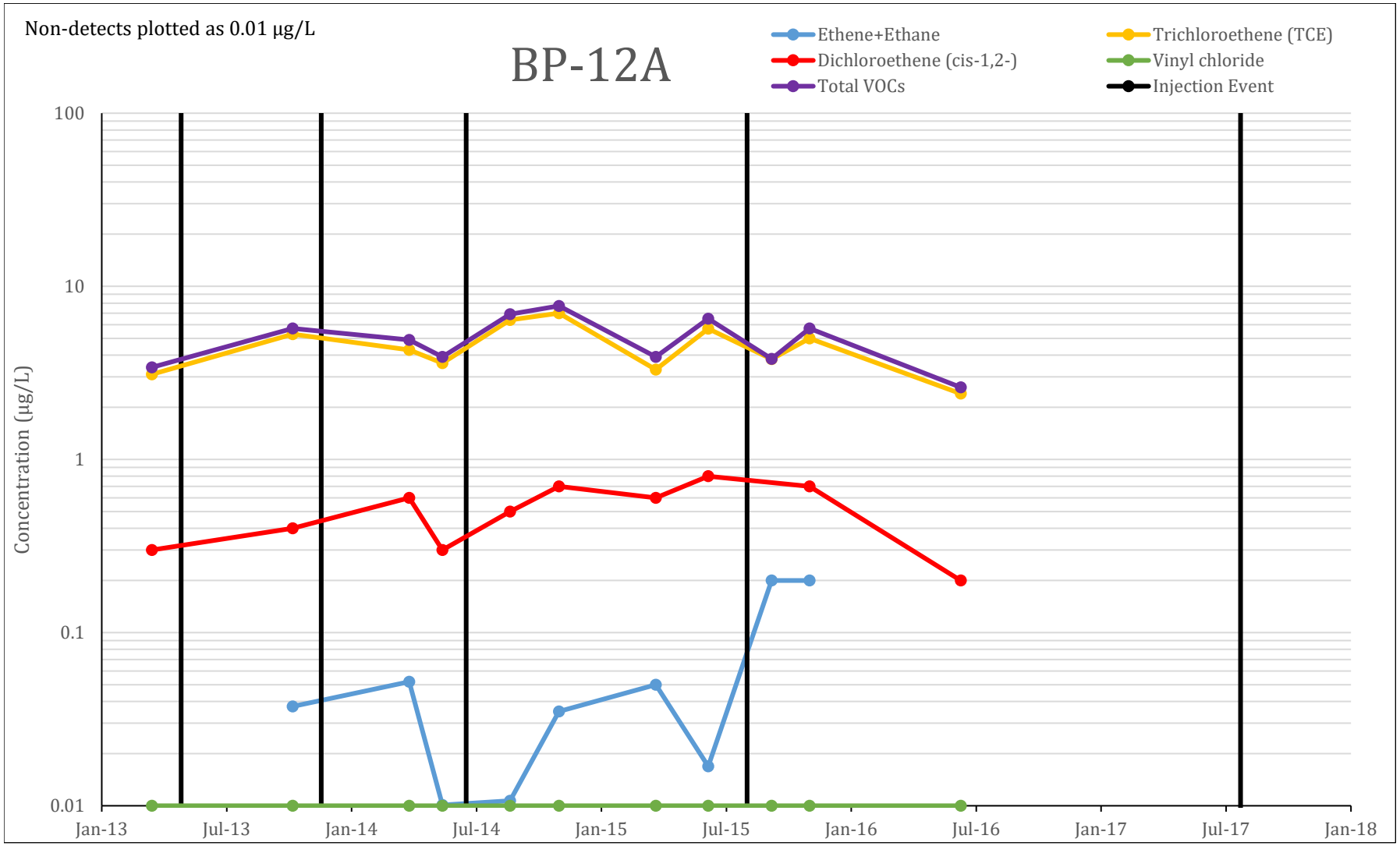
BP-11A
Trichloroethene (TCE)
Dichloroethene (cis-1,2-)
Vinyl chloride
Total VOCs
Injection Event
Concentration (µg/L)
100
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18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BP-12A
Ethene+Ethane
Trichloroethene (TCE)
Dichloroethene (cis-1,2-)
Vinyl chloride
Total VOCs
Injection Event
Concentration (µg/L)
100
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
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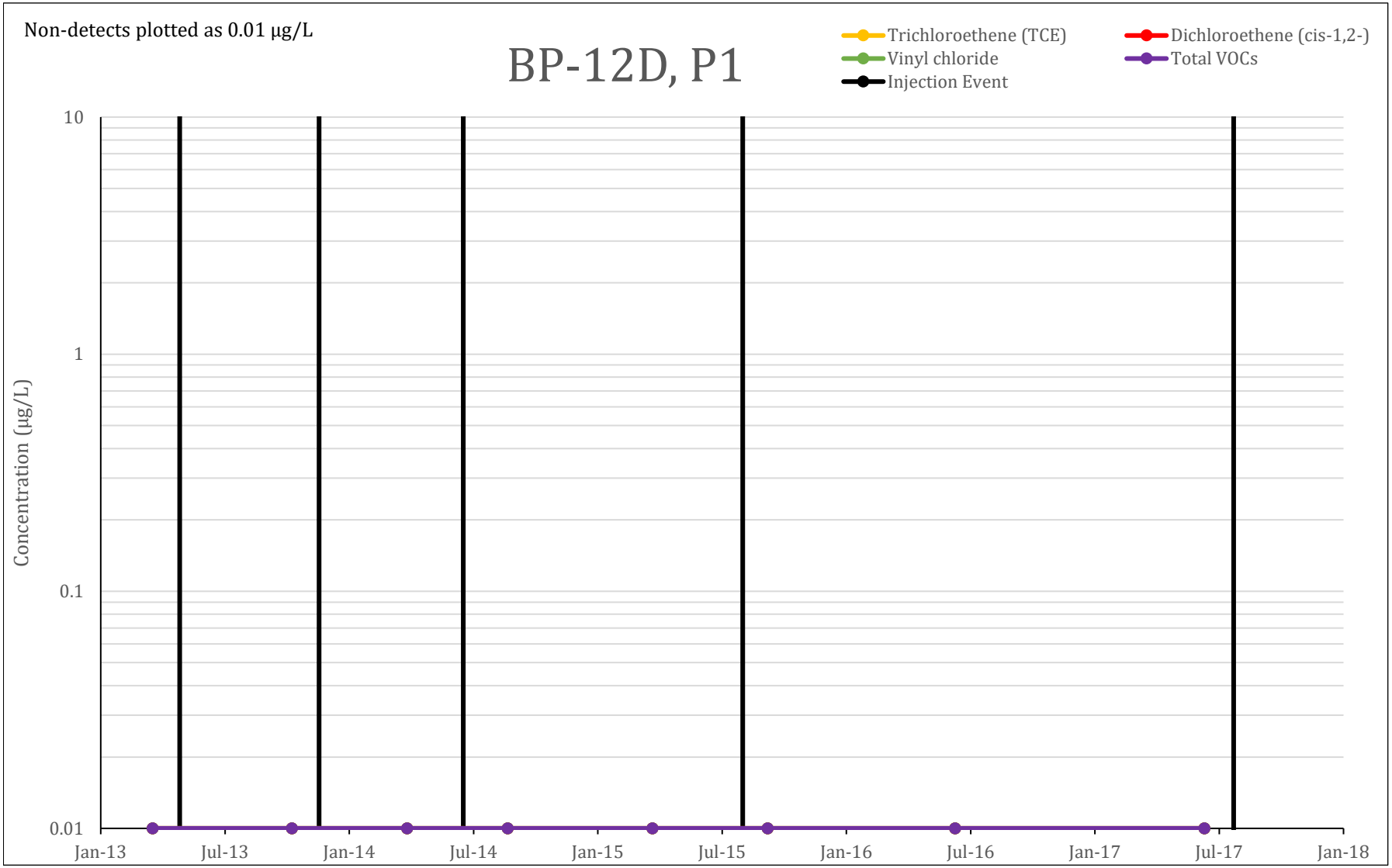
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18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BP-12D, P1
Trichloroethene (TCE)
Dichloroethene (cis-1,2-)
Vinyl chloride
Total VOCs
Injection Event
Concentration (µg/L)
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
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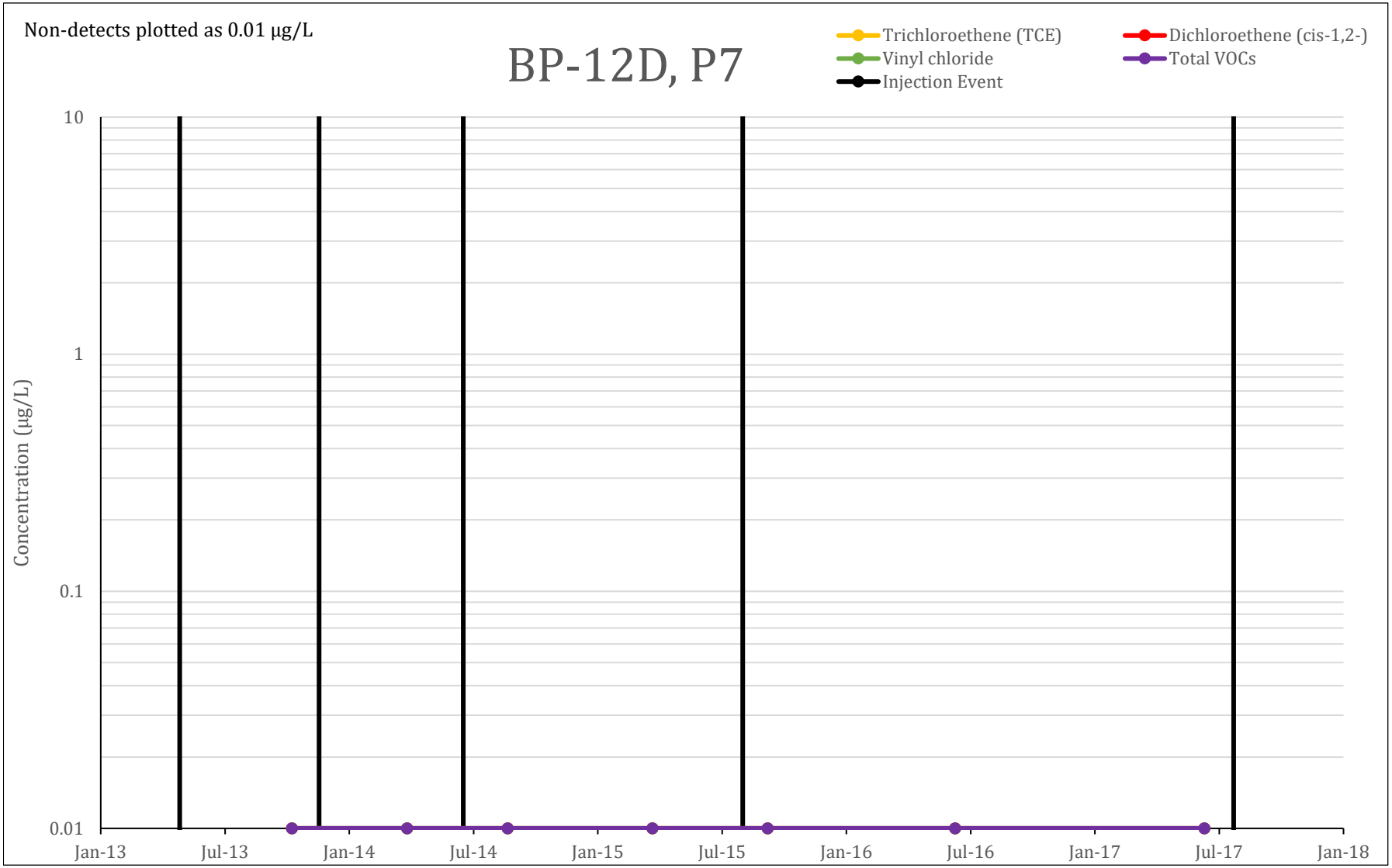
Jul-17
Jan-18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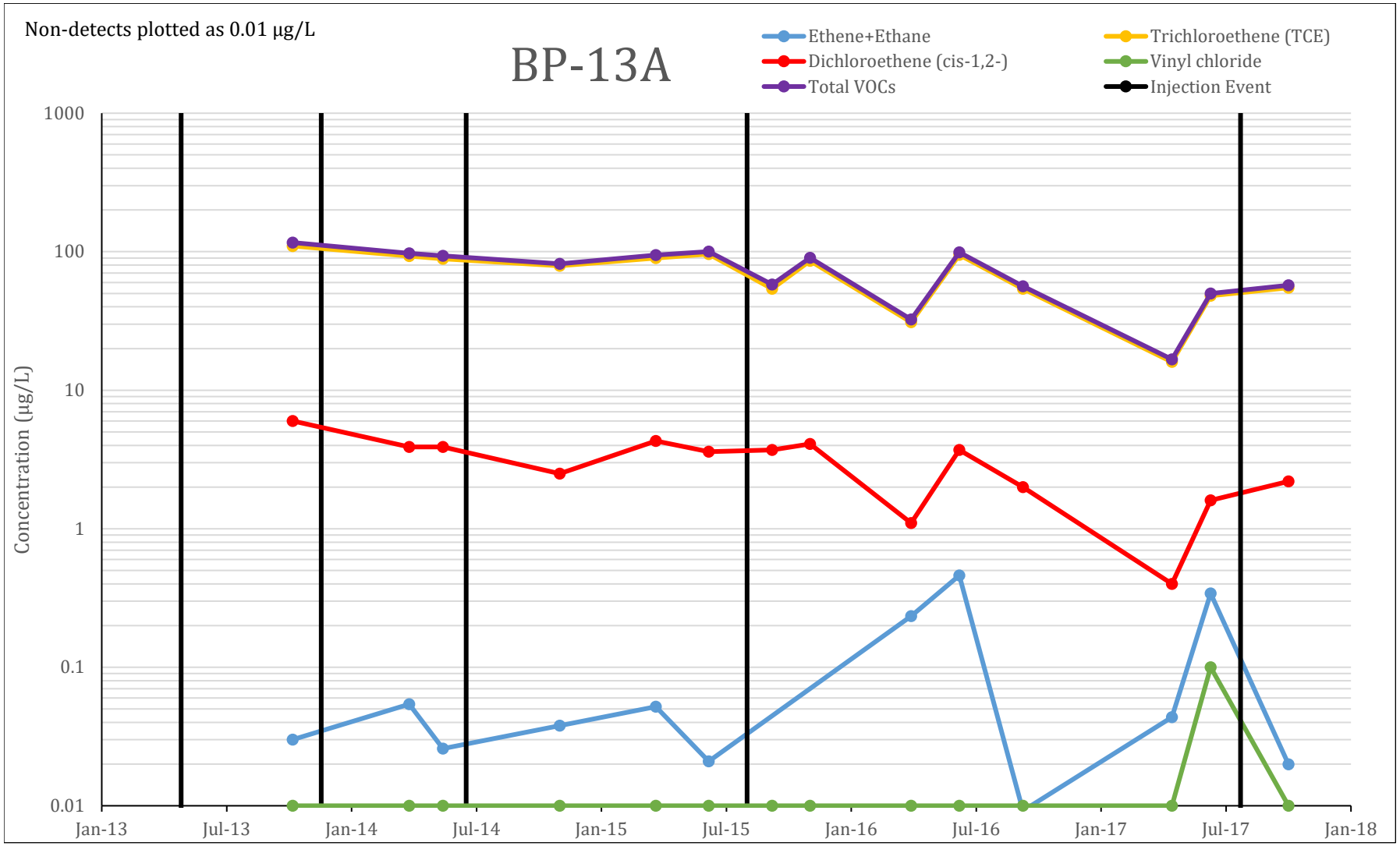
BP-12D, P7
Trichloroethene (TCE)
Dichloroethene (cis-1,2-)
Vinyl chloride
Total VOCs
Injection Event
Concentration (µg/L)
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18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BP-13A
Ethene+Ethane
Dichloroethene (cis-1,2-)
Total VOCs
Trichloroethene (TCE)
Vinyl chloride
Injection Event
Concentration (µg/L)
1000
100
10
1
0.1
0.01
Jan-13
Jul-13
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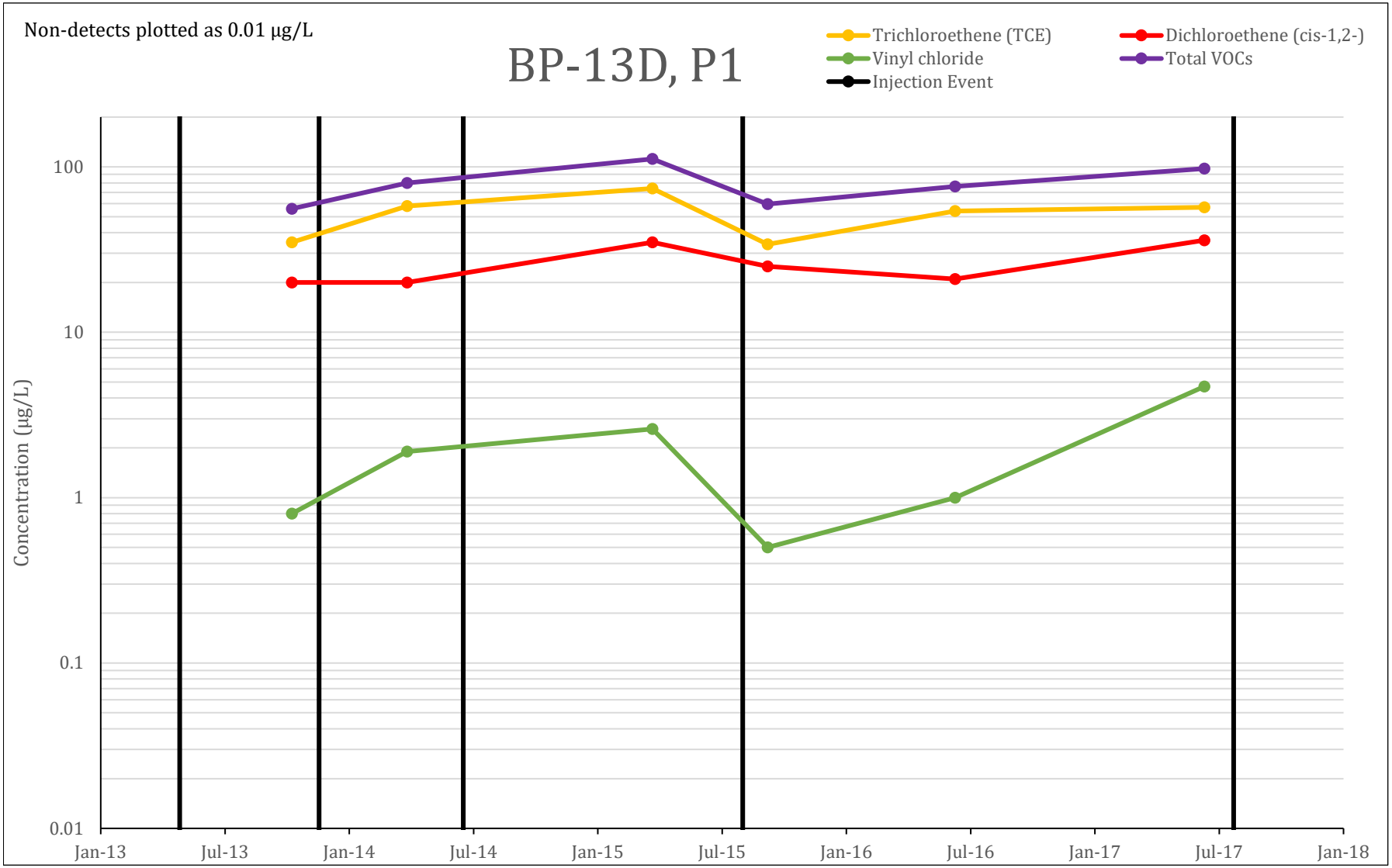
Jan-18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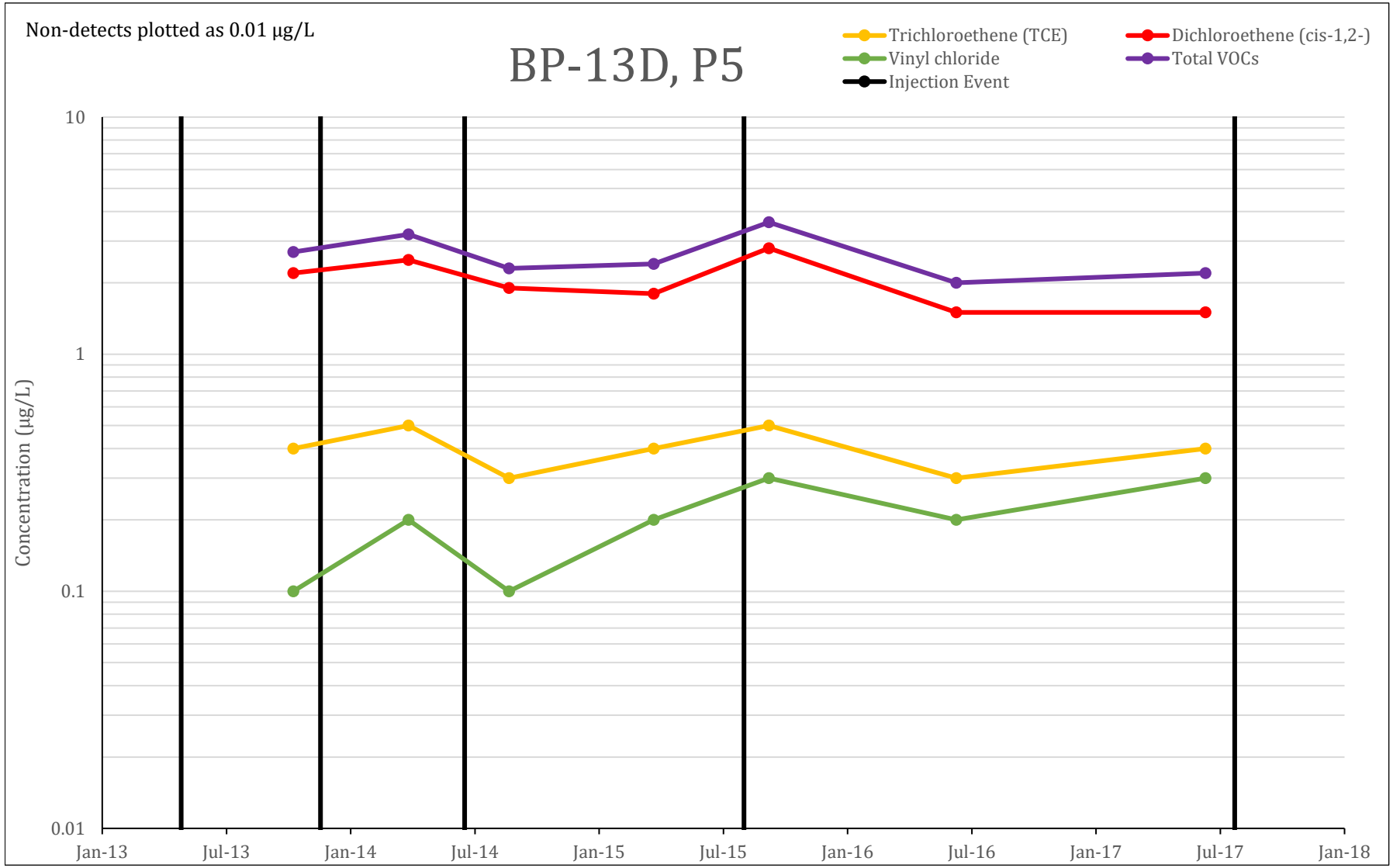
BP-13D, P1
Trichloroethene (TCE)
Dichloroethene (cis-1,2-)
Vinyl chloride
Total VOCs
Injection Event
Concentration (µg/L)
100
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18


Non-detects plotted as 0.01 µg/L
BP-13D, P5
Trichloroethene (TCE)
Dichloroethene (cis-1,2-)
Vinyl chloride
Total VOCs
Injection Event
Concentration (µg/L)
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
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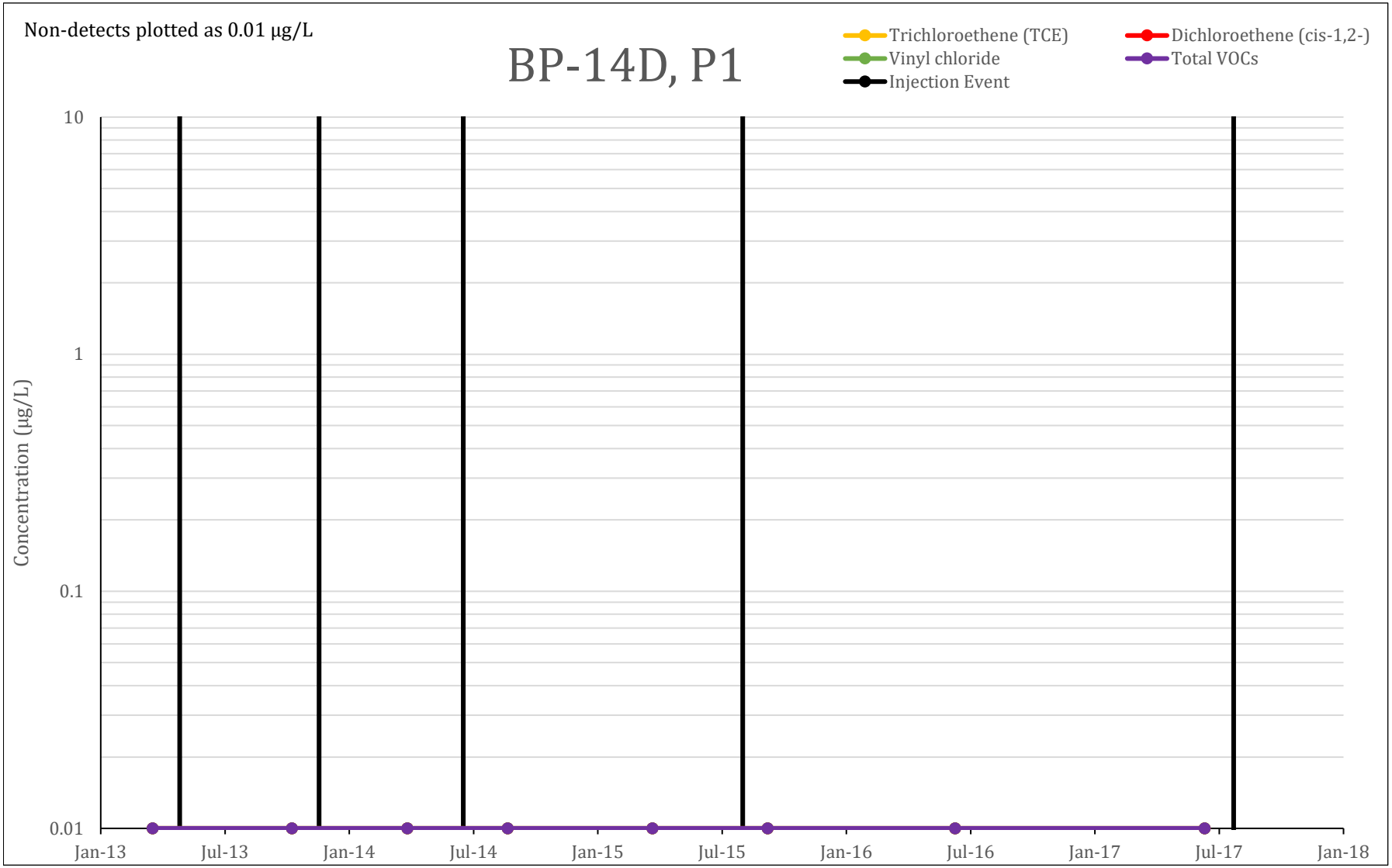
Jul-17
Jan-18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BP-14D, P1
Trichloroethene (TCE)
Dichloroethene (cis-1,2-)
Vinyl chloride
Total VOCs
Injection Event
Concentration (µg/L)
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
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Jul-15
Jan-16
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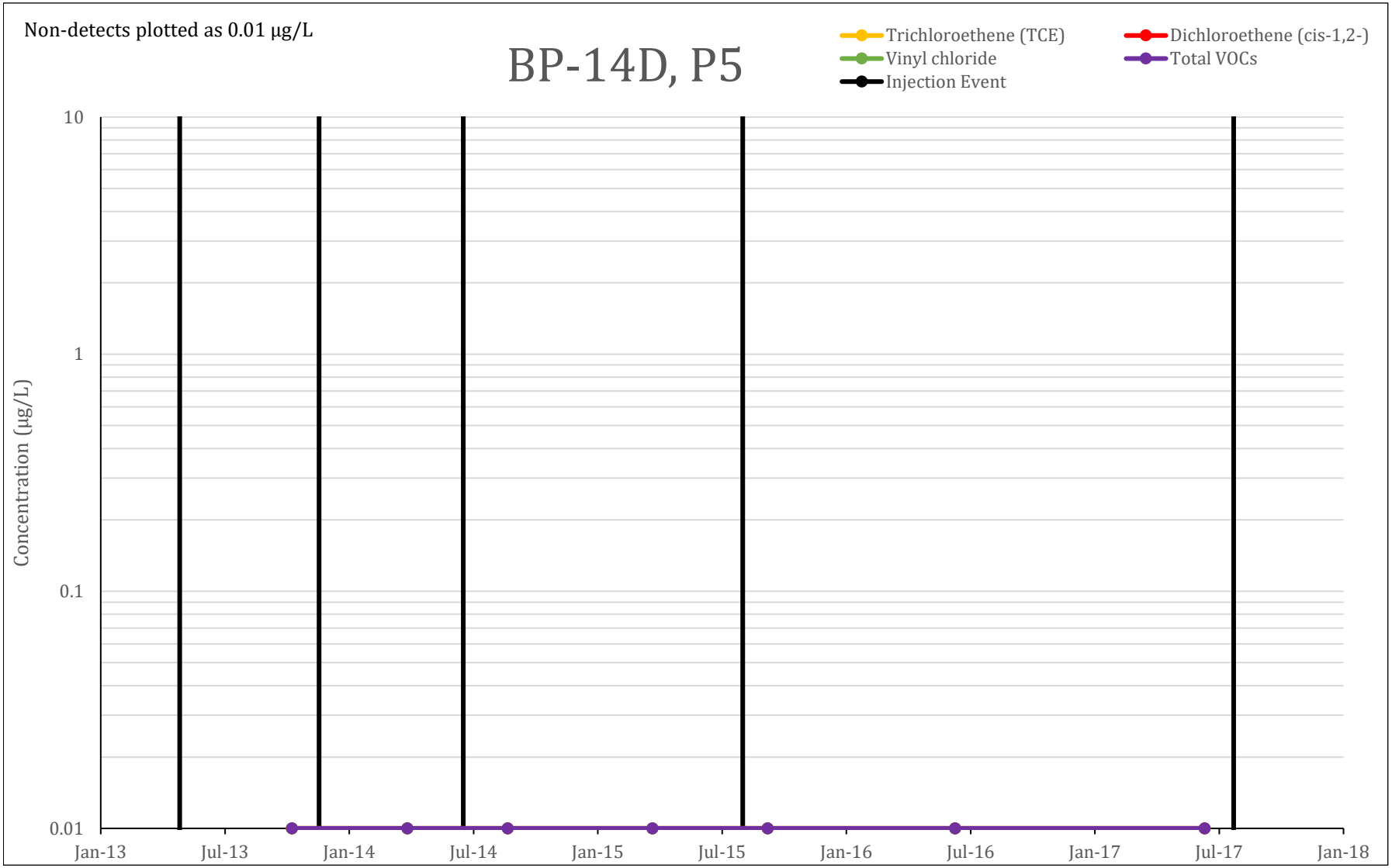
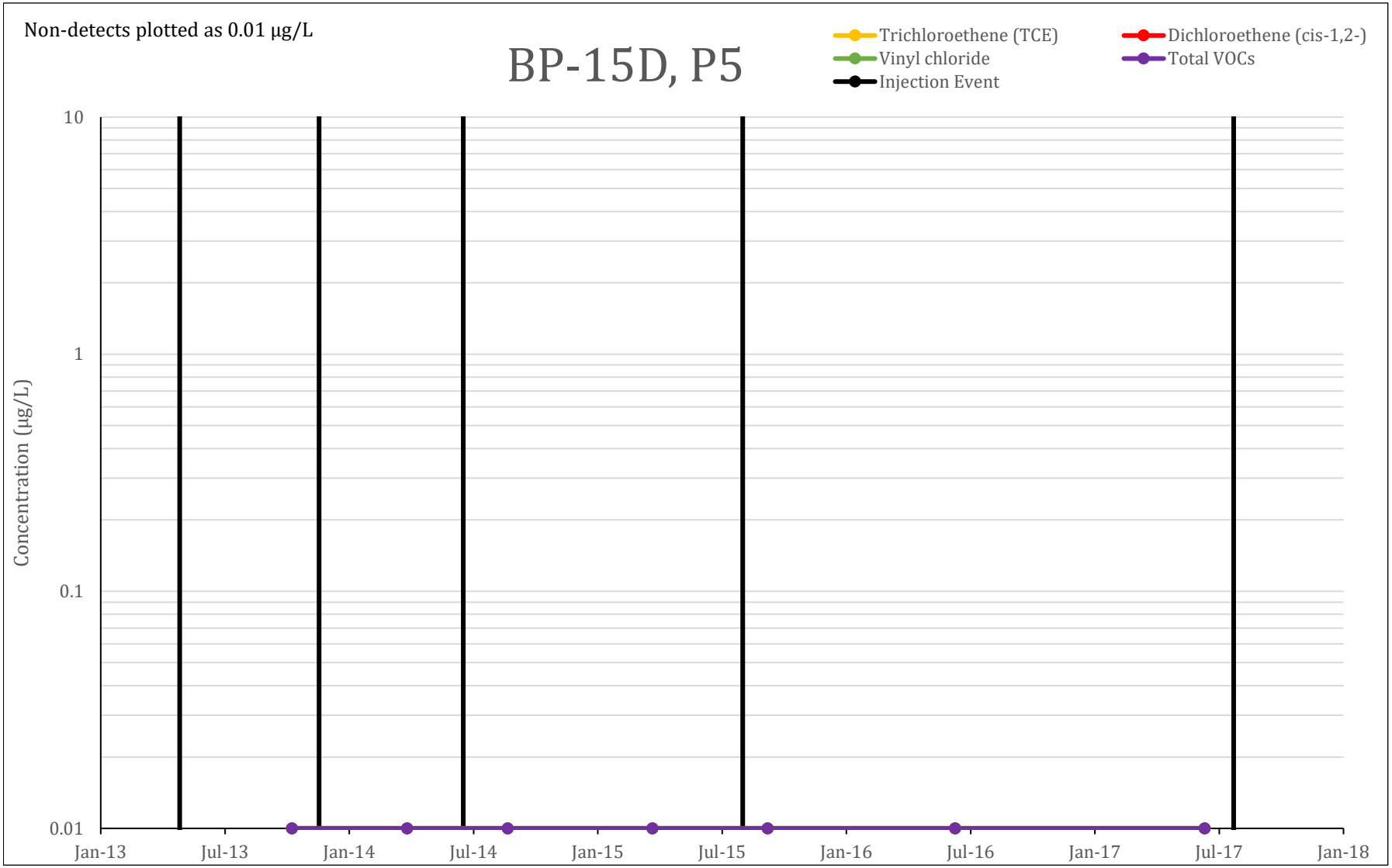
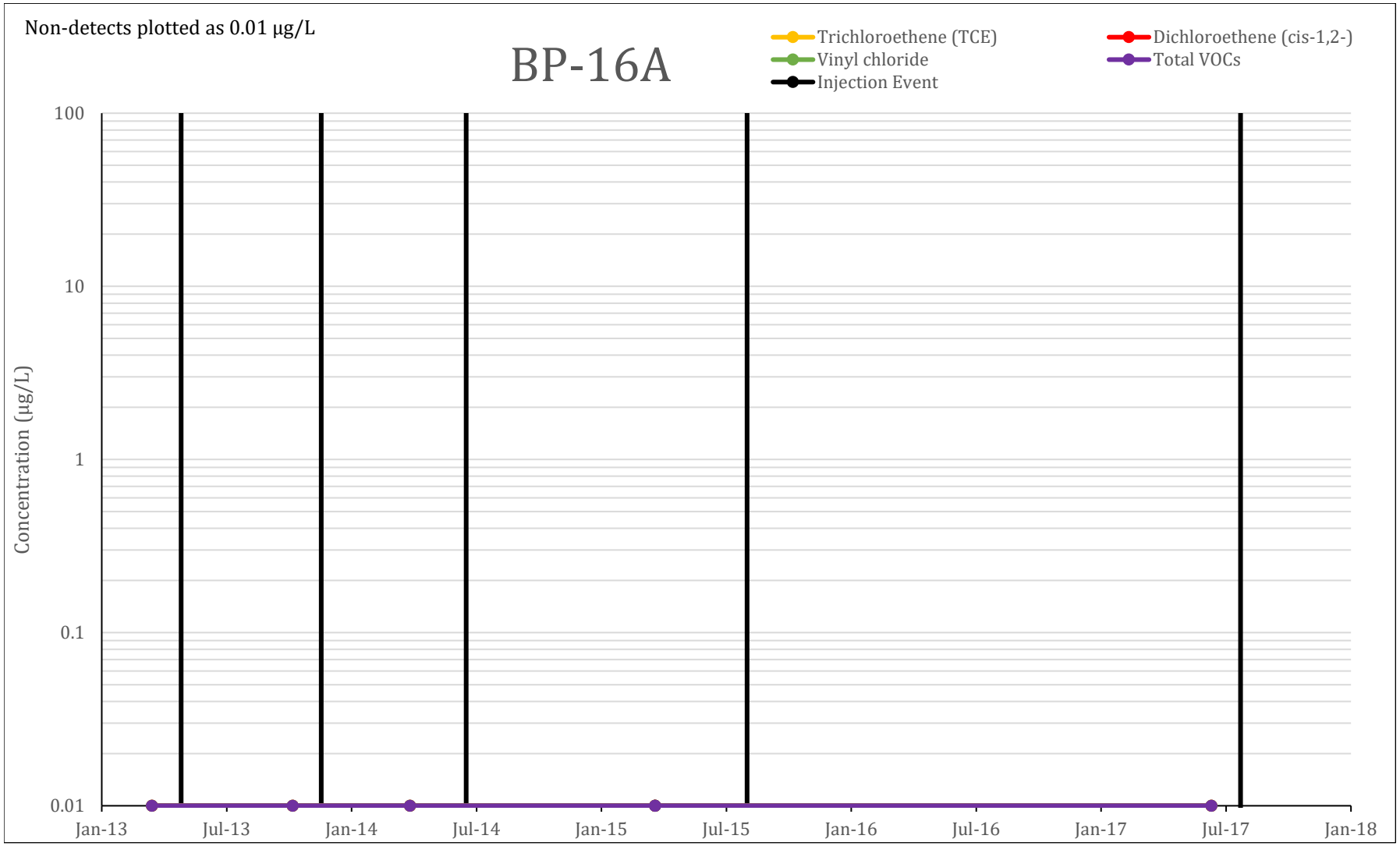
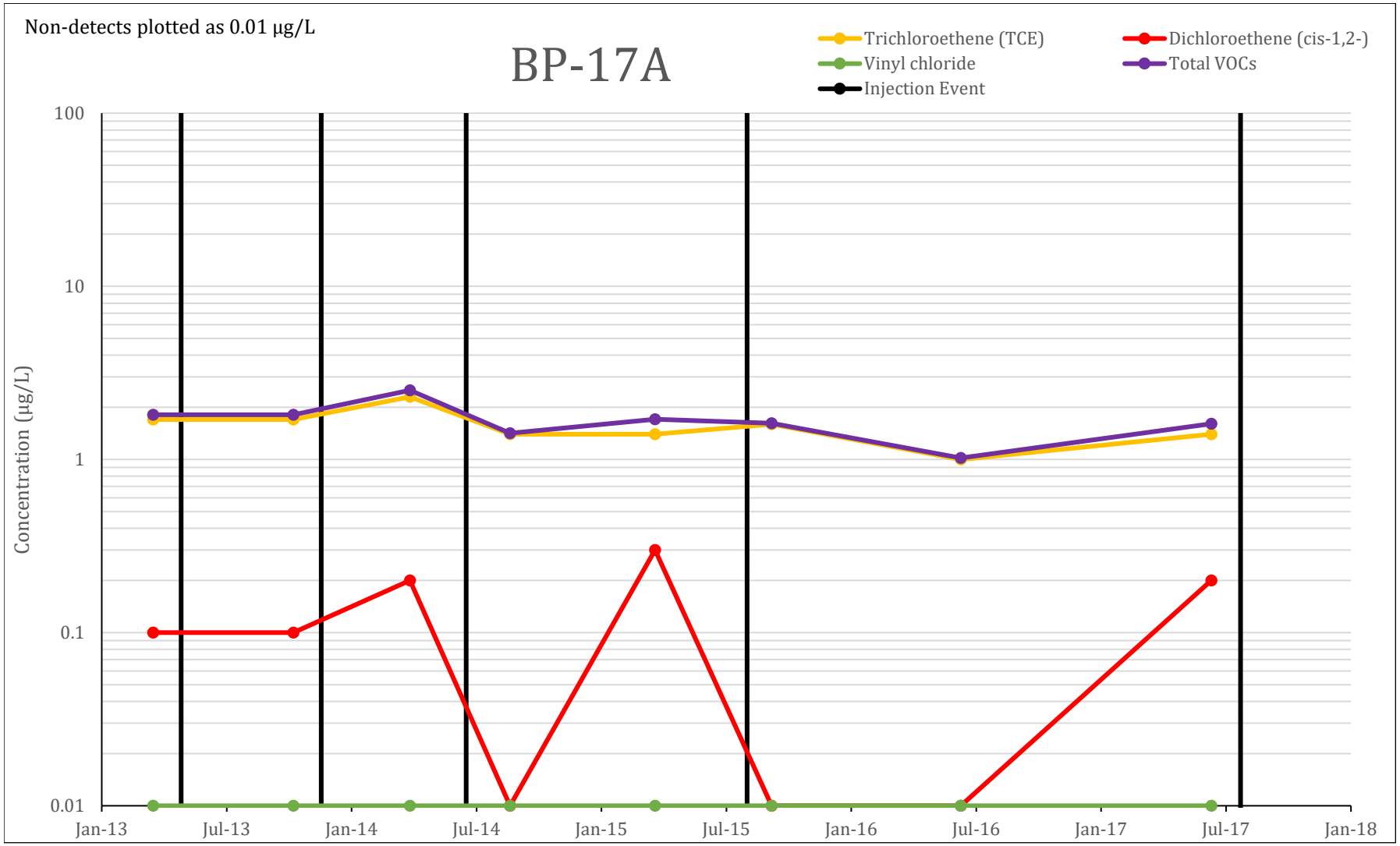
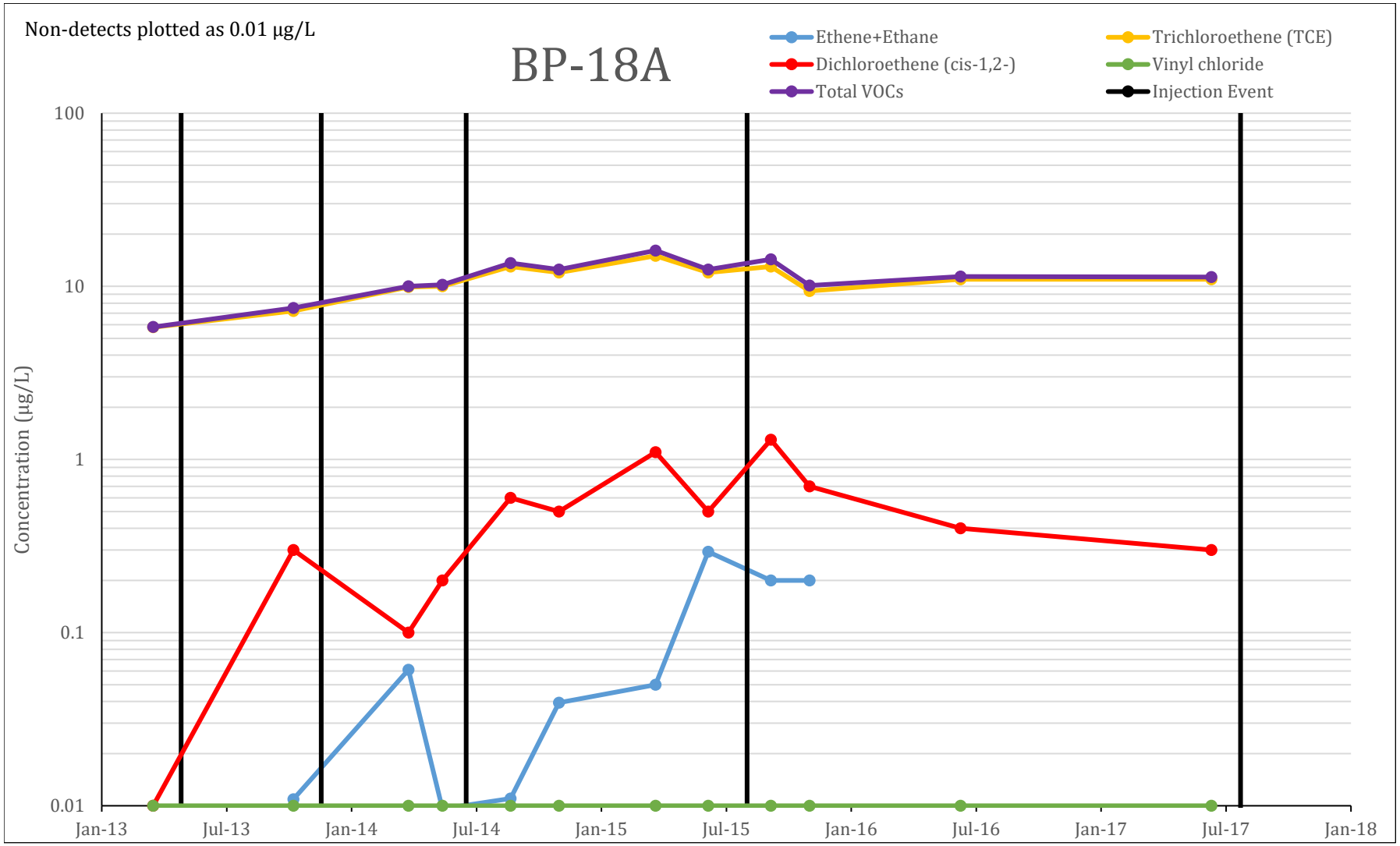
Jan-18

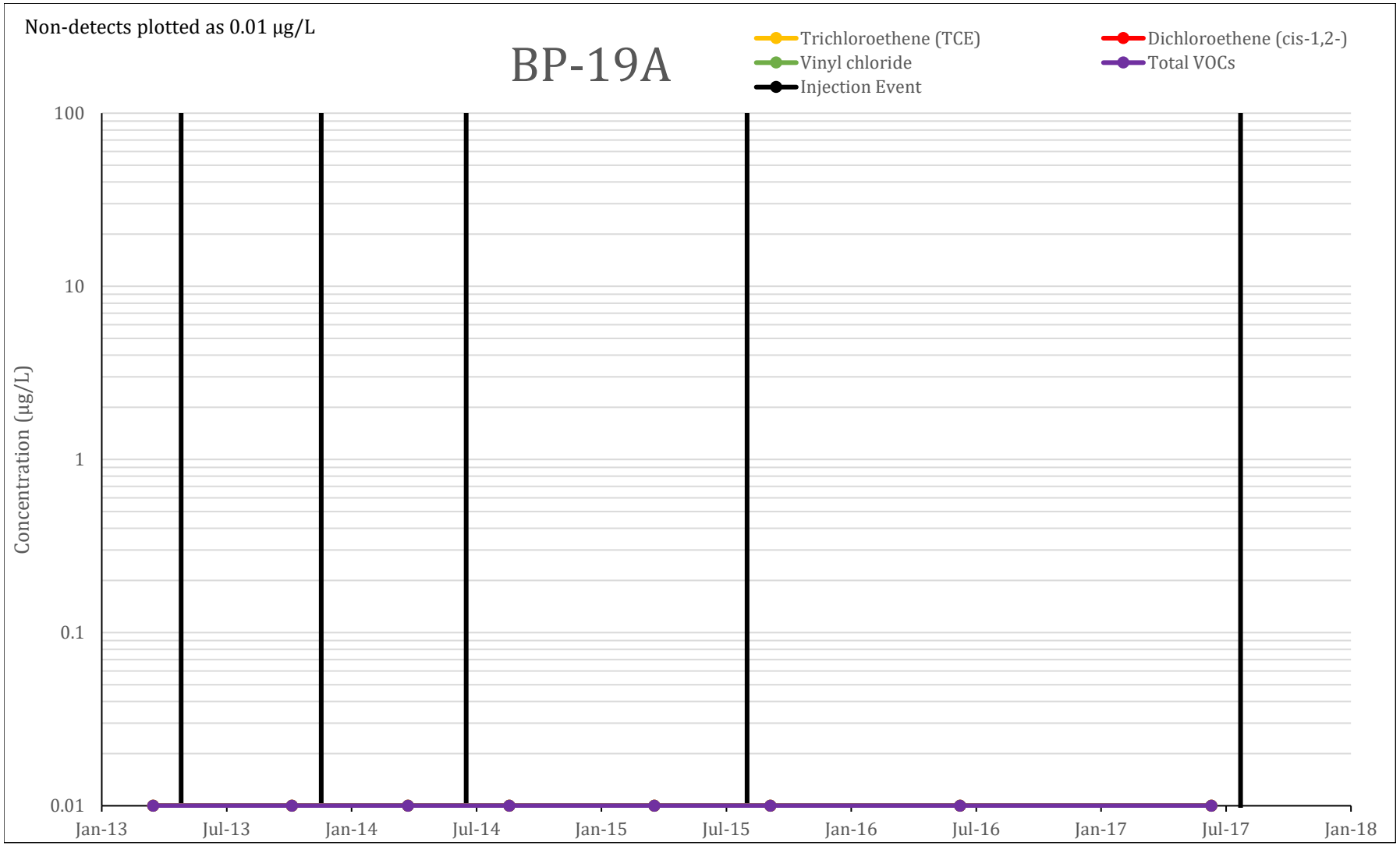

Non-detects plotted as 0.01 µg/L
BP-14D, P5
Trichloroethene (TCE)
Dichloroethene (cis-1,2-)
Vinyl chloride
Total VOCs
Injection Event
Concentration (µg/L)
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18

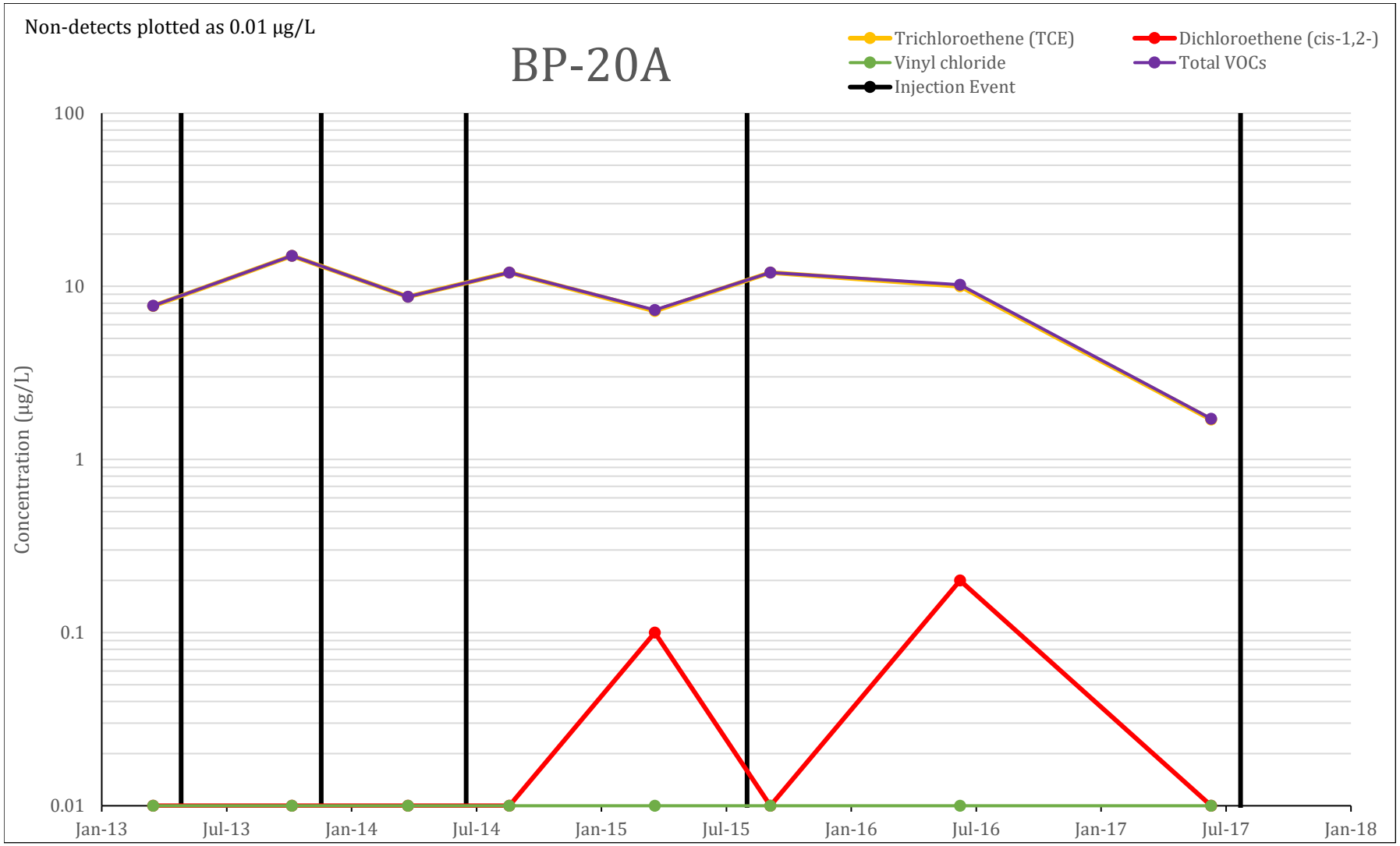

Non-detects plotted as 0.01 µg/L
BP-15D, P5
Trichloroethene (TCE)
Dichloroethene (cis-1,2-)
Vinyl chloride
Total VOCs
Injection Event
Concentration (µg/L)
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18

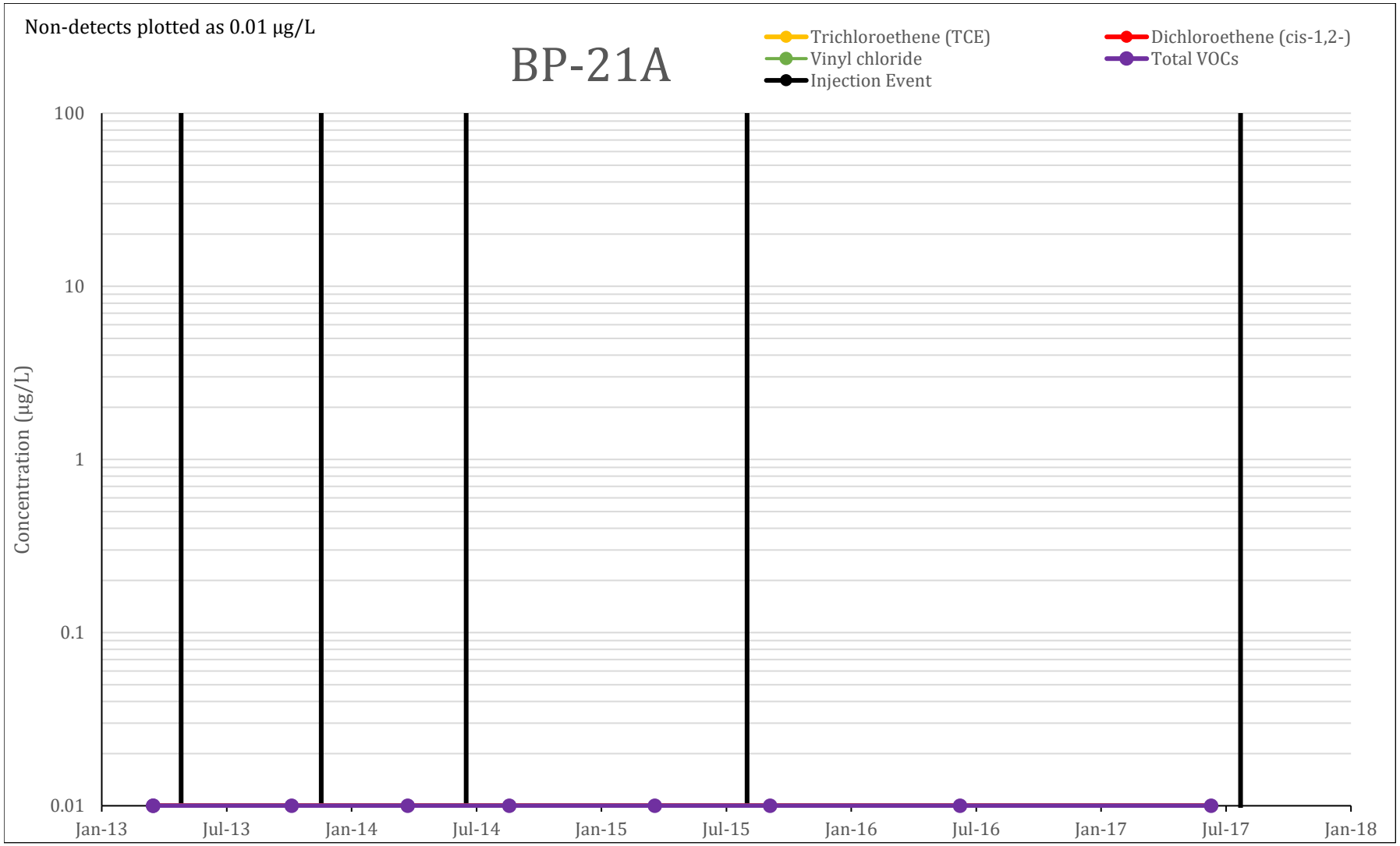

Non-detects plotted as 0.01 µg/L
BP-16A
Trichloroethene (TCE)
Dichloroethene (cis-1,2-)
Vinyl chloride
Total VOCs
Injection Event
Concentration (µg/L)
100
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18

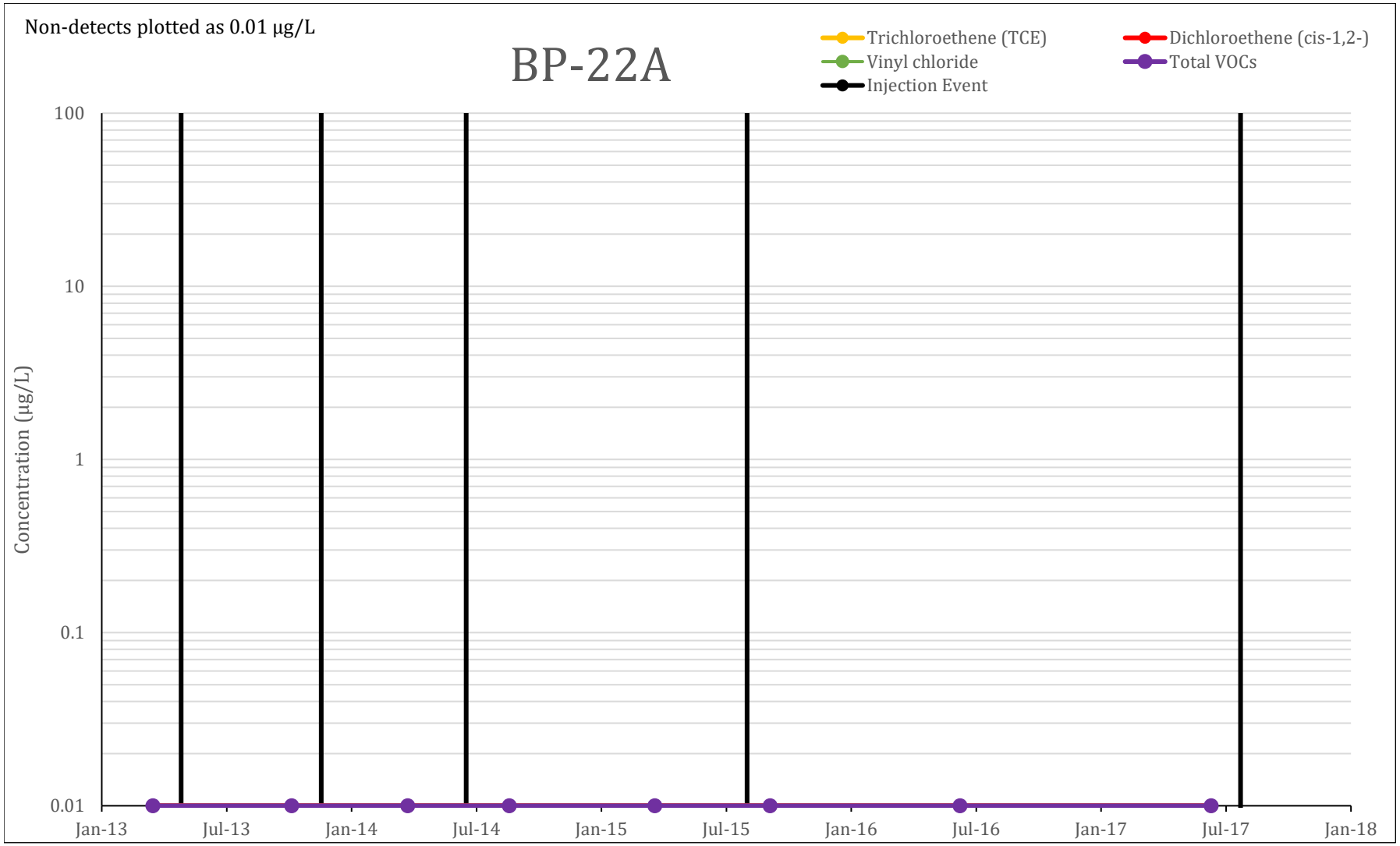

Non-detects plotted as 0.01 µg/L
BP-17A
Trichloroethene (TCE)
Dichloroethene (cis-1,2-)
Vinyl chloride
Total VOCs
Injection Event
Concentration (µg/L)
100
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18

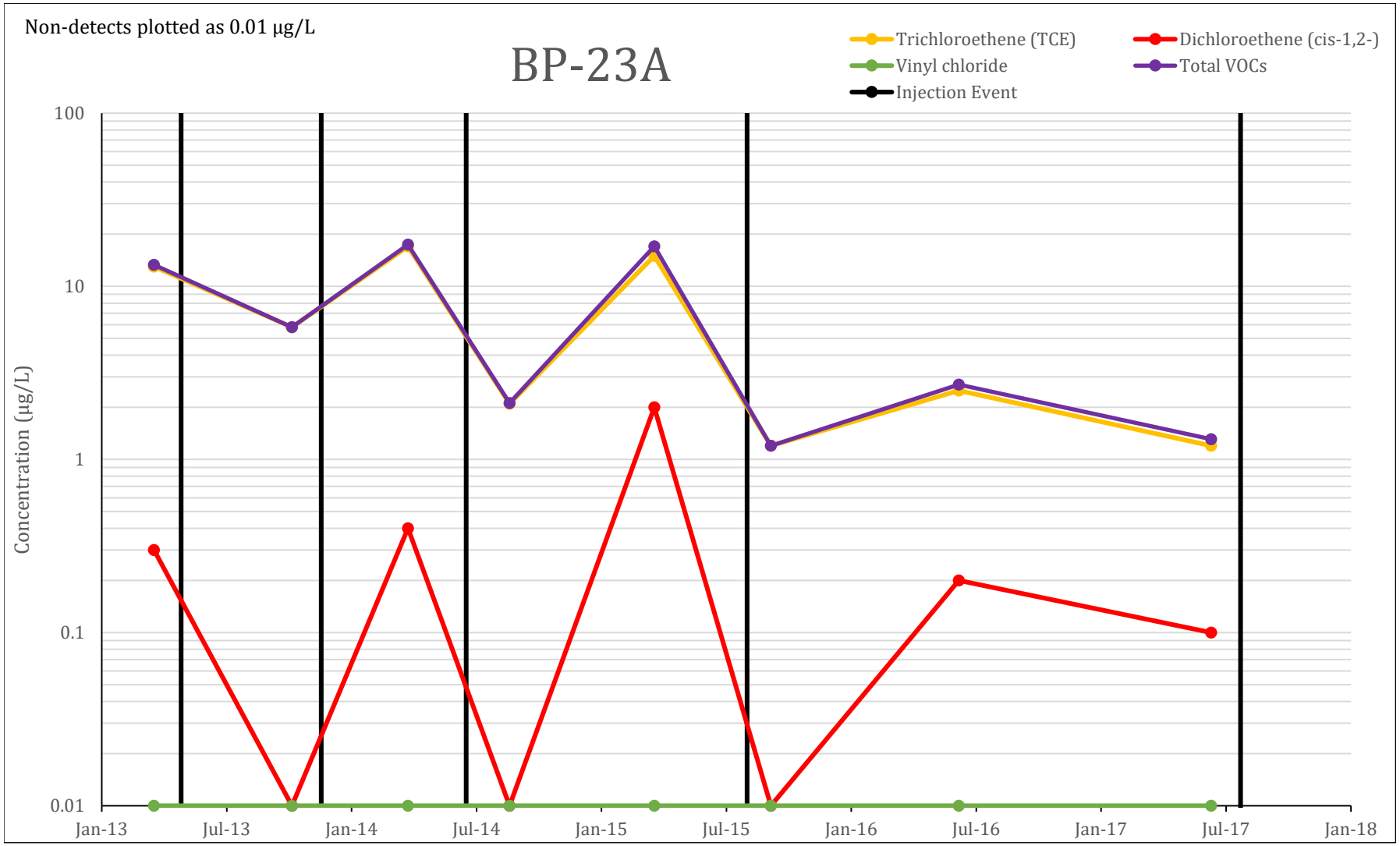

Non-detects plotted as 0.01 µg/L
BP-18A
Ethene+Ethane
Trichloroethene (TCE)
Dichloroethene (cis-1,2-)
Vinyl chloride
Total VOCs
Injection Event
Concentration (µg/L)
100
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18

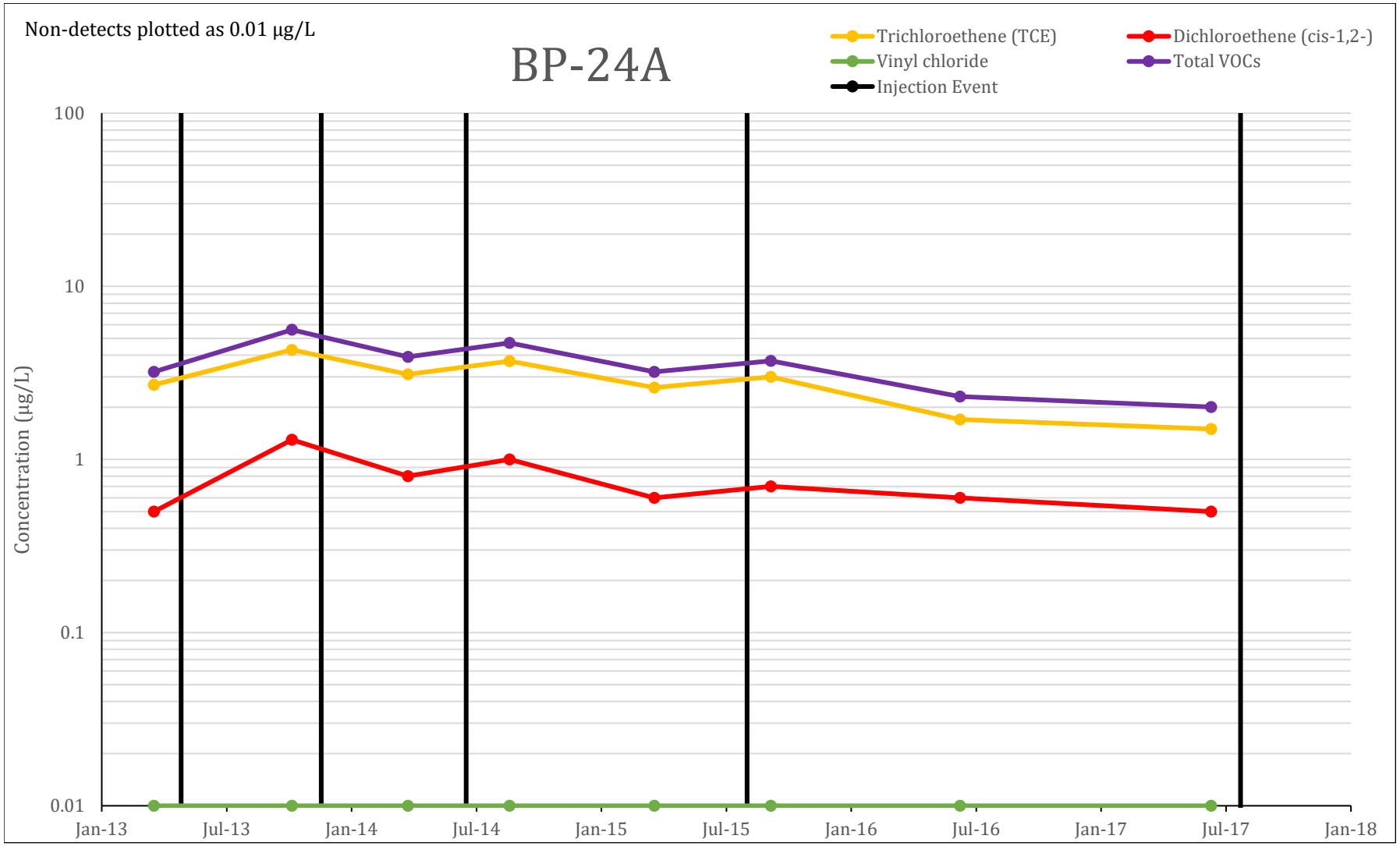

Non-detects plotted as 0.01 µg/L
BP-19A
Trichloroethene (TCE)
Dichloroethene (cis-1,2-)
Vinyl chloride
Total VOCs
Injection Event
Concentration (µg/L)
100
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18

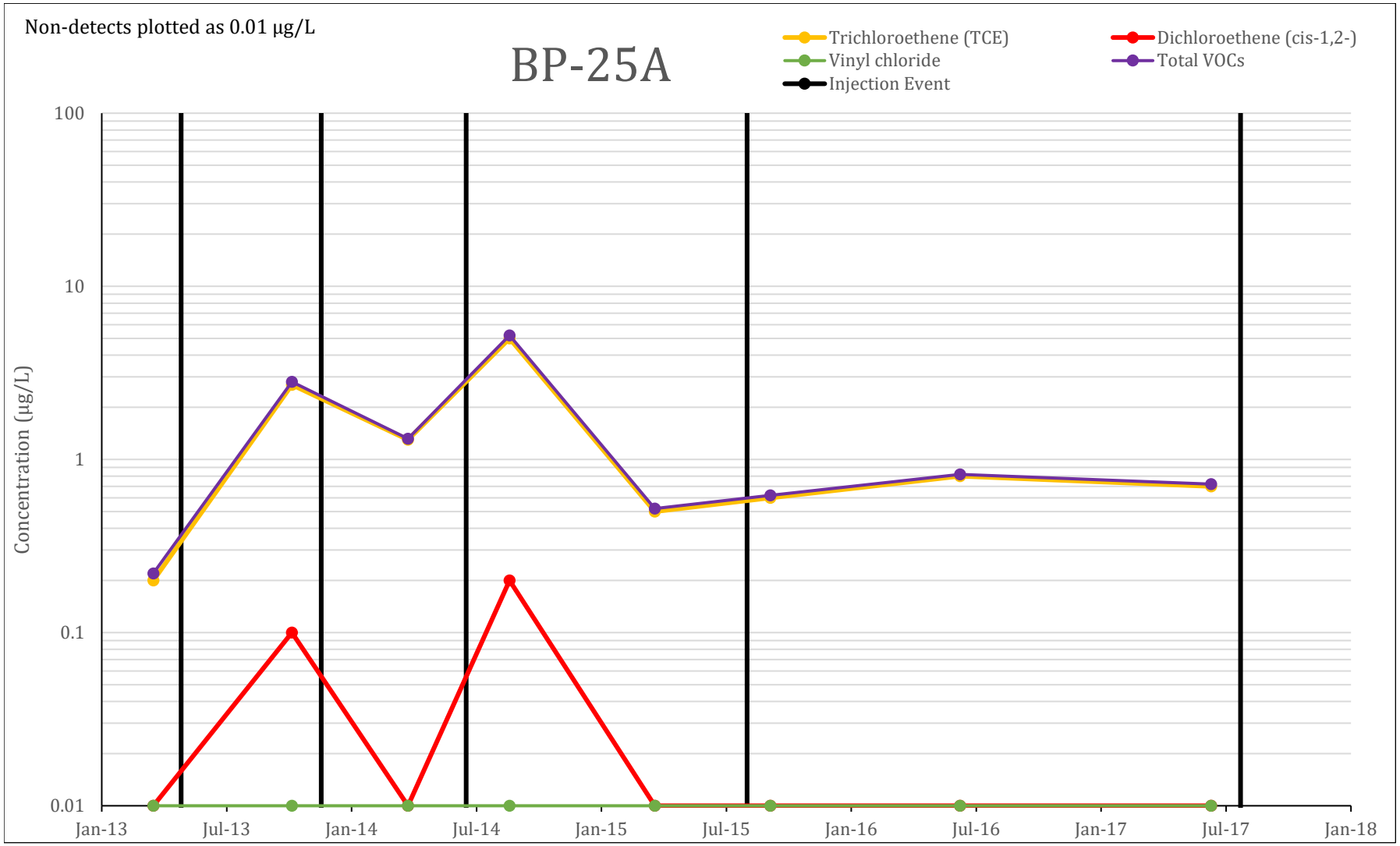

Non-detects plotted as 0.01 µg/L
BP-20A
Trichloroethene (TCE)
Dichloroethene (cis-1,2-)
Vinyl chloride
Total VOCs
Injection Event
Concentration (µg/L)
100
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18

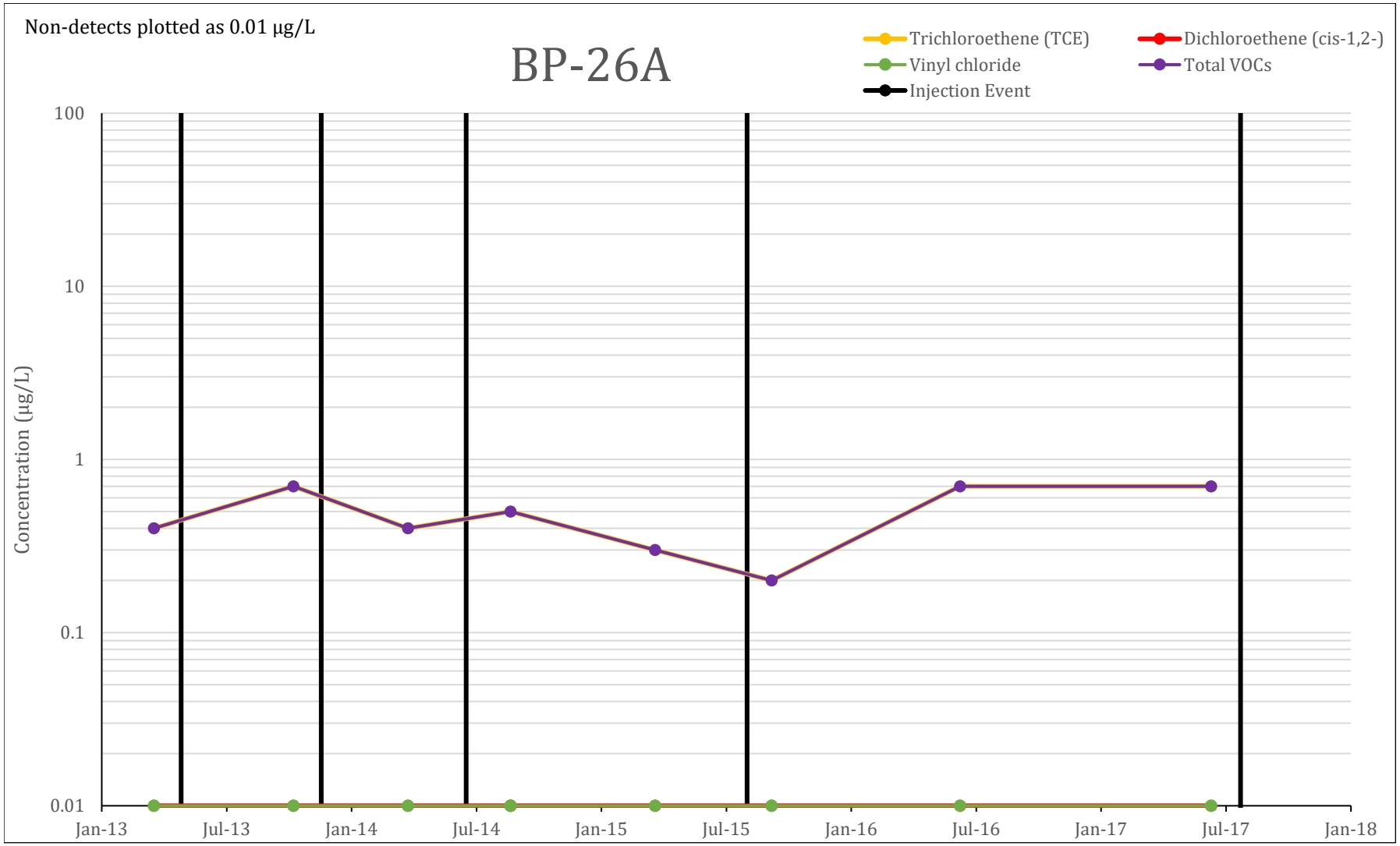

Non-detects plotted as 0.01 µg/L
BP-21A
Trichloroethene (TCE)
Vinyl chloride
Injection Event
Dichloroethene (cis-1,2-)
Total VOCs
Concentration (µg/L)
100
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18

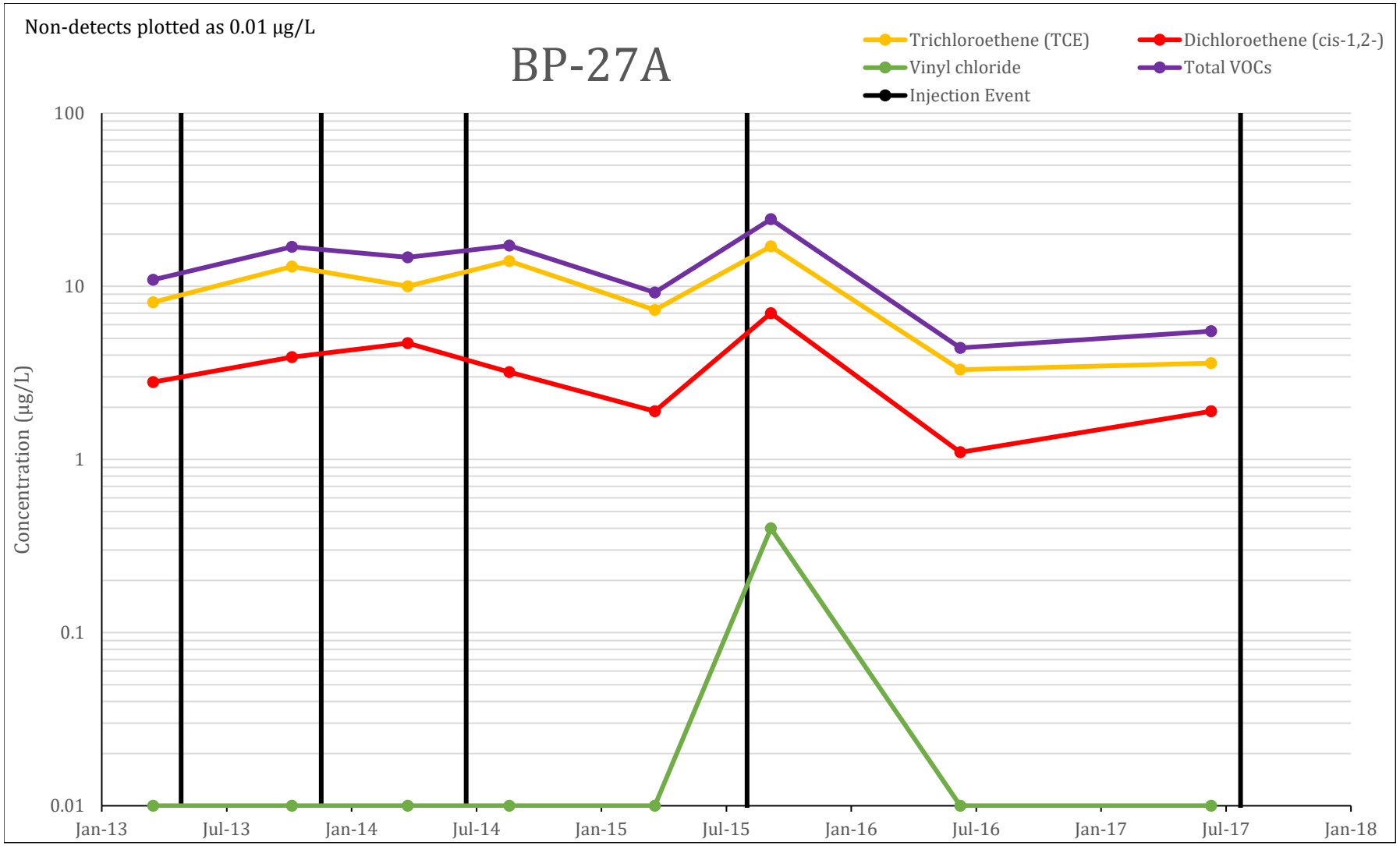

Non-detects plotted as 0.01 µg/L
BP-22A
Trichloroethene (TCE)
Dichloroethene (cis-1,2-)
Vinyl chloride
Total VOCs
Injection Event
Concentration (µg/L)
100
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18

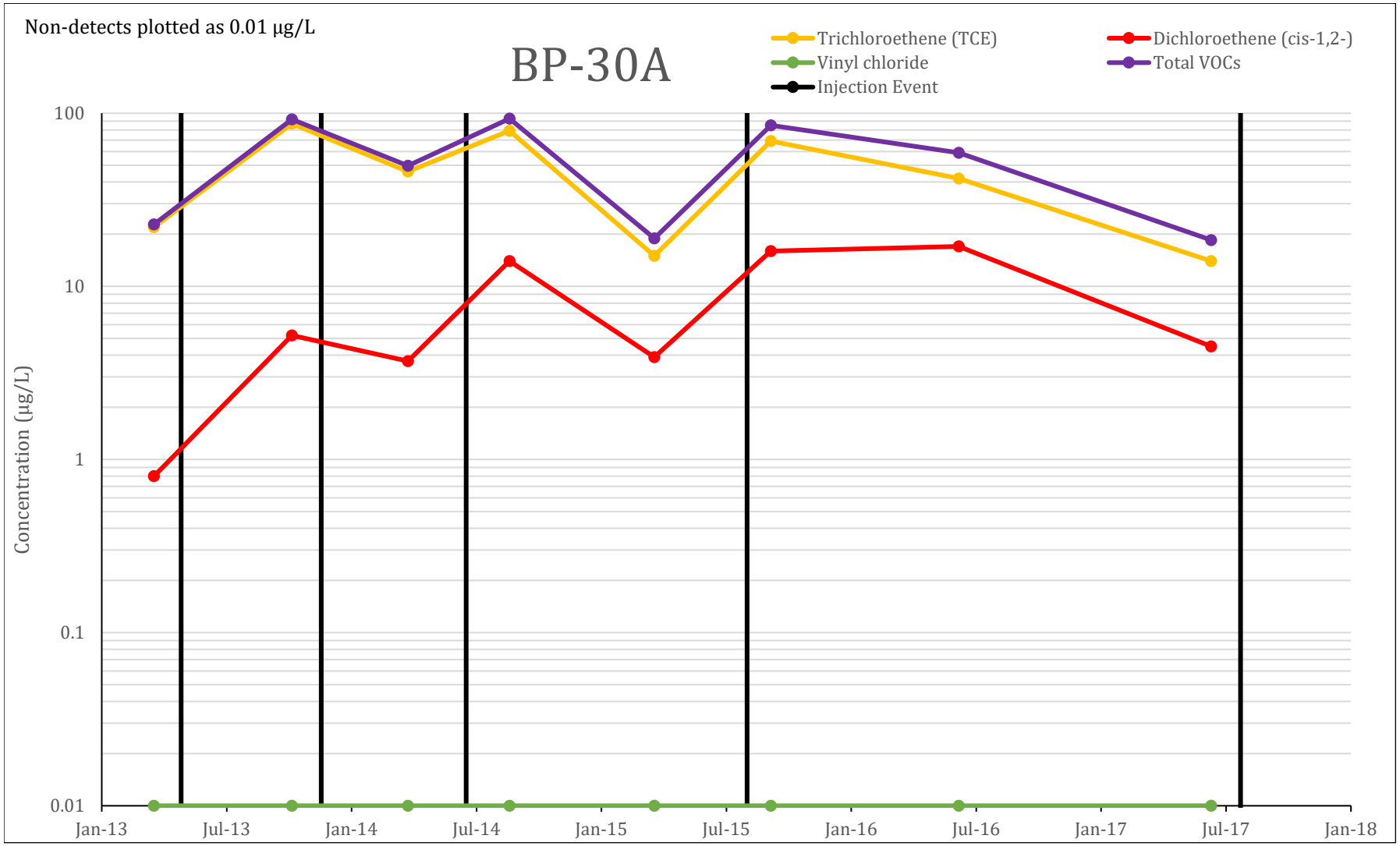

Non-detects plotted as 0.01 µg/L
BP-23A
Trichloroethene (TCE)
Dichloroethene (cis-1,2-)
Vinyl chloride
Total VOCs
Injection Event
Concentration (µg/L)
100
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18

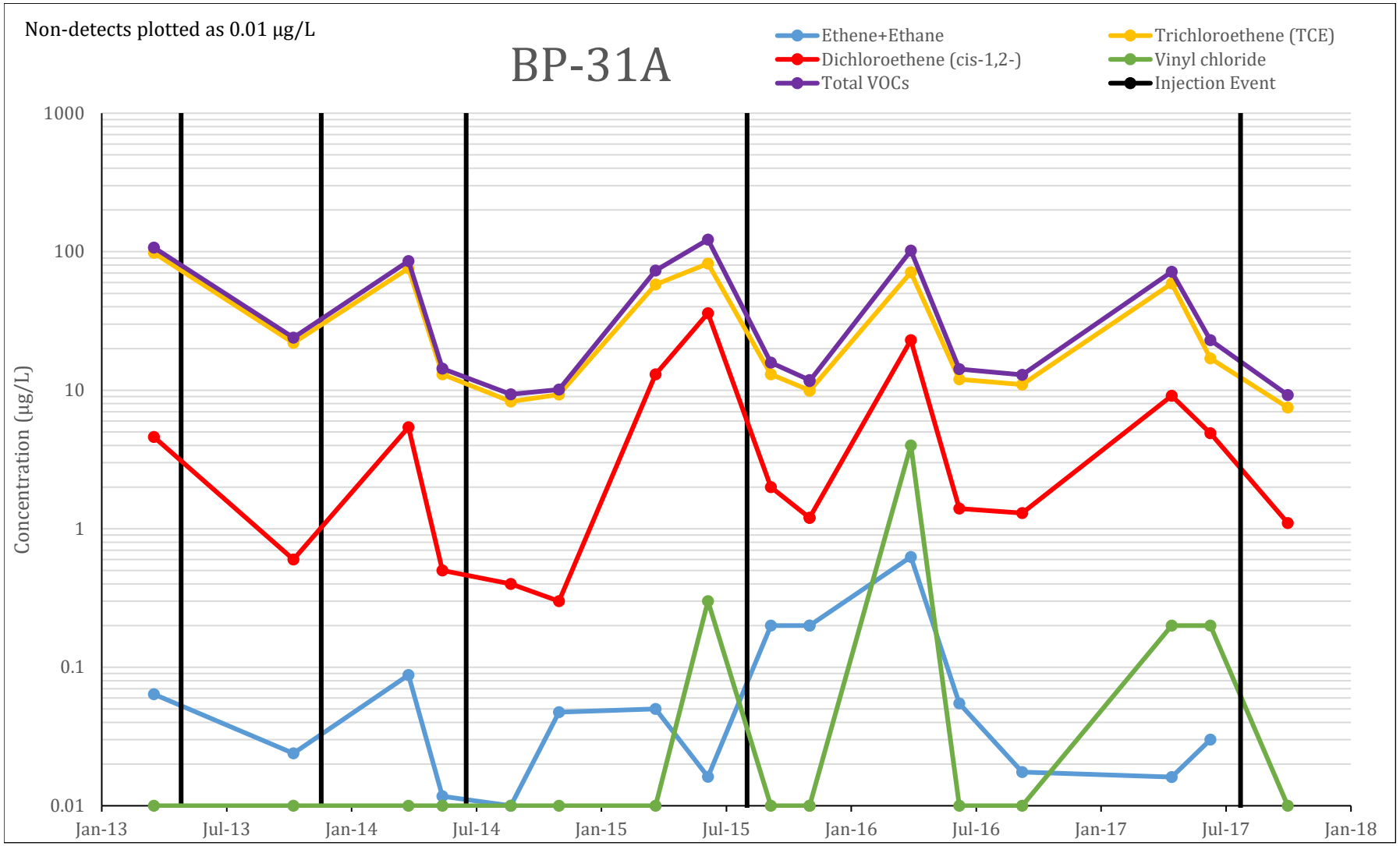

Non-detects plotted as 0.01 µg/L
BP-24A
Trichloroethene (TCE)
Dichloroethene (cis-1,2-)
Vinyl chloride
Total VOCs
Injection Event
Concentration (µg/L)
100
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18

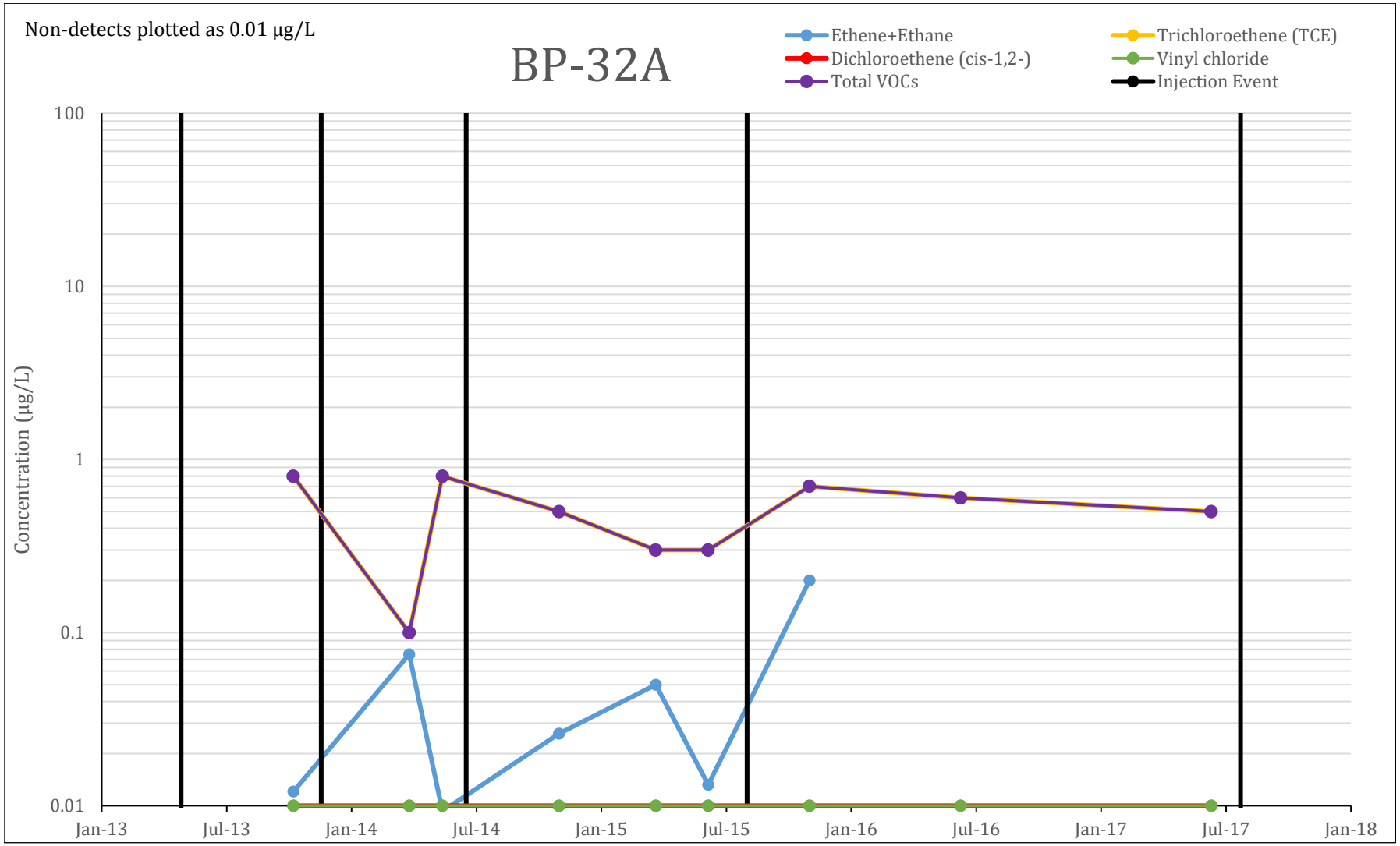

Non-detects plotted as 0.01 µg/L
BP-25A
Trichloroethene (TCE)
Dichloroethene (cis-1,2-)
Vinyl chloride
Total VOCs
Injection Event
Concentration (µg/L)
100
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18

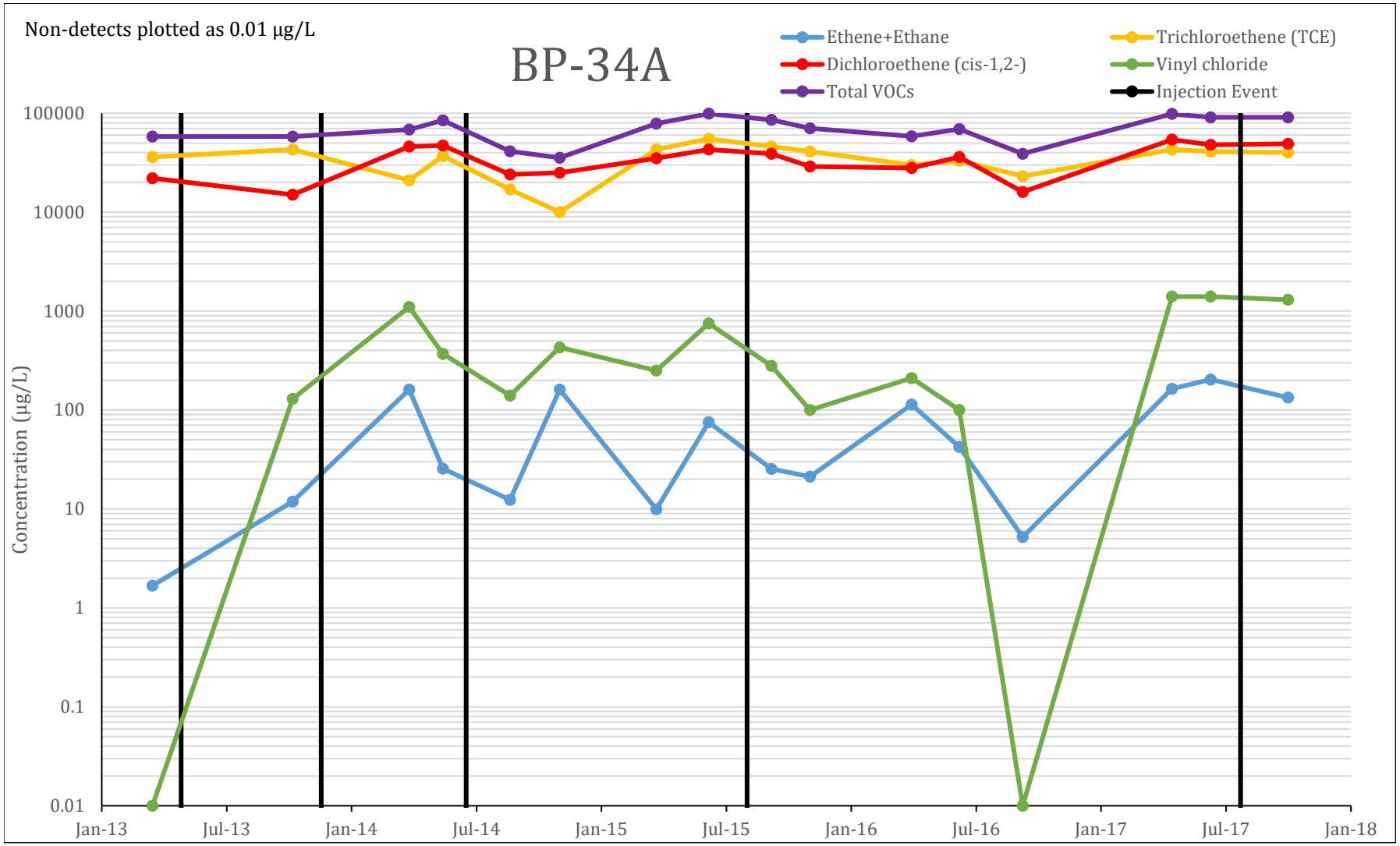

Non-detects plotted as 0.01 µg/L
BP-26A
Trichloroethene (TCE)
Dichloroethene (cis-1,2-)
Vinyl chloride
Total VOCs
Injection Event
Concentration (µg/L)
100
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18

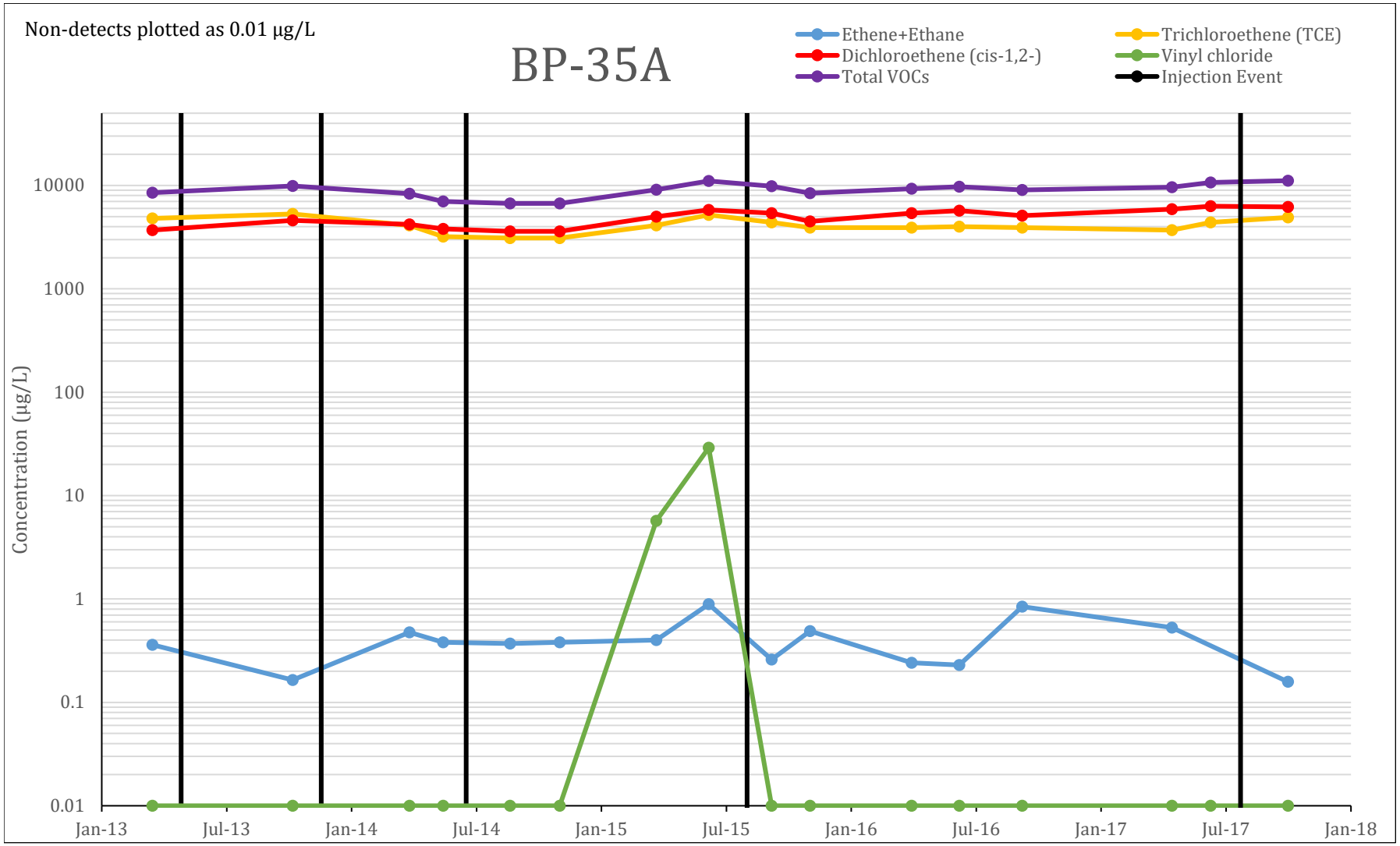

Non-detects plotted as 0.01 µg/L
BP-27A
Trichloroethene (TCE)
Dichloroethene (cis-1,2-)
Vinyl chloride
Total VOCs
Injection Event
Concentration (µg/L)
100
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18

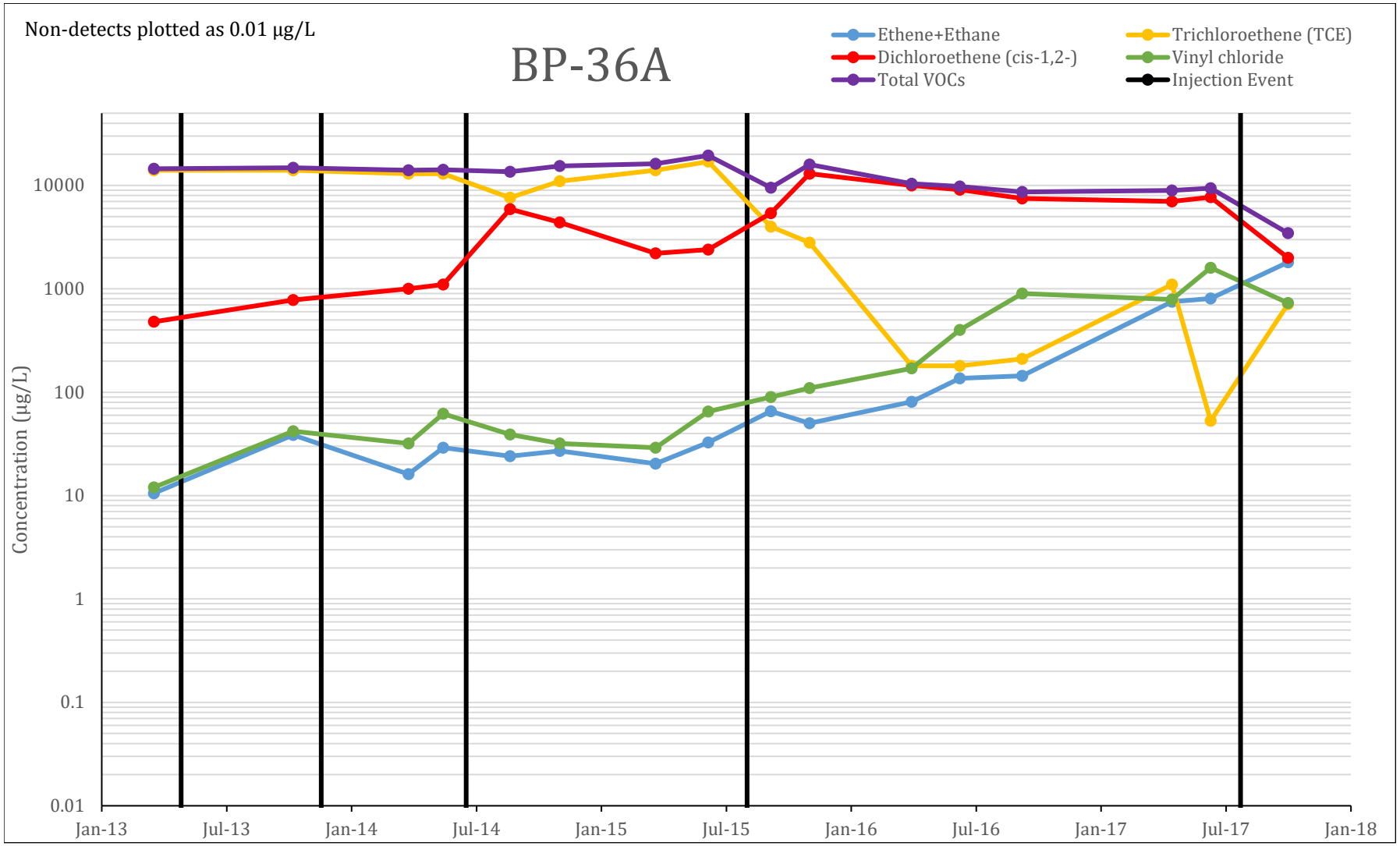

Non-detects plotted as 0.01 µg/L
BP-30A
Trichloroethene (TCE)
Dichloroethene (cis-1,2-)
Vinyl chloride
Total VOCs
Injection Event
Concentration (µg/L)
100
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18

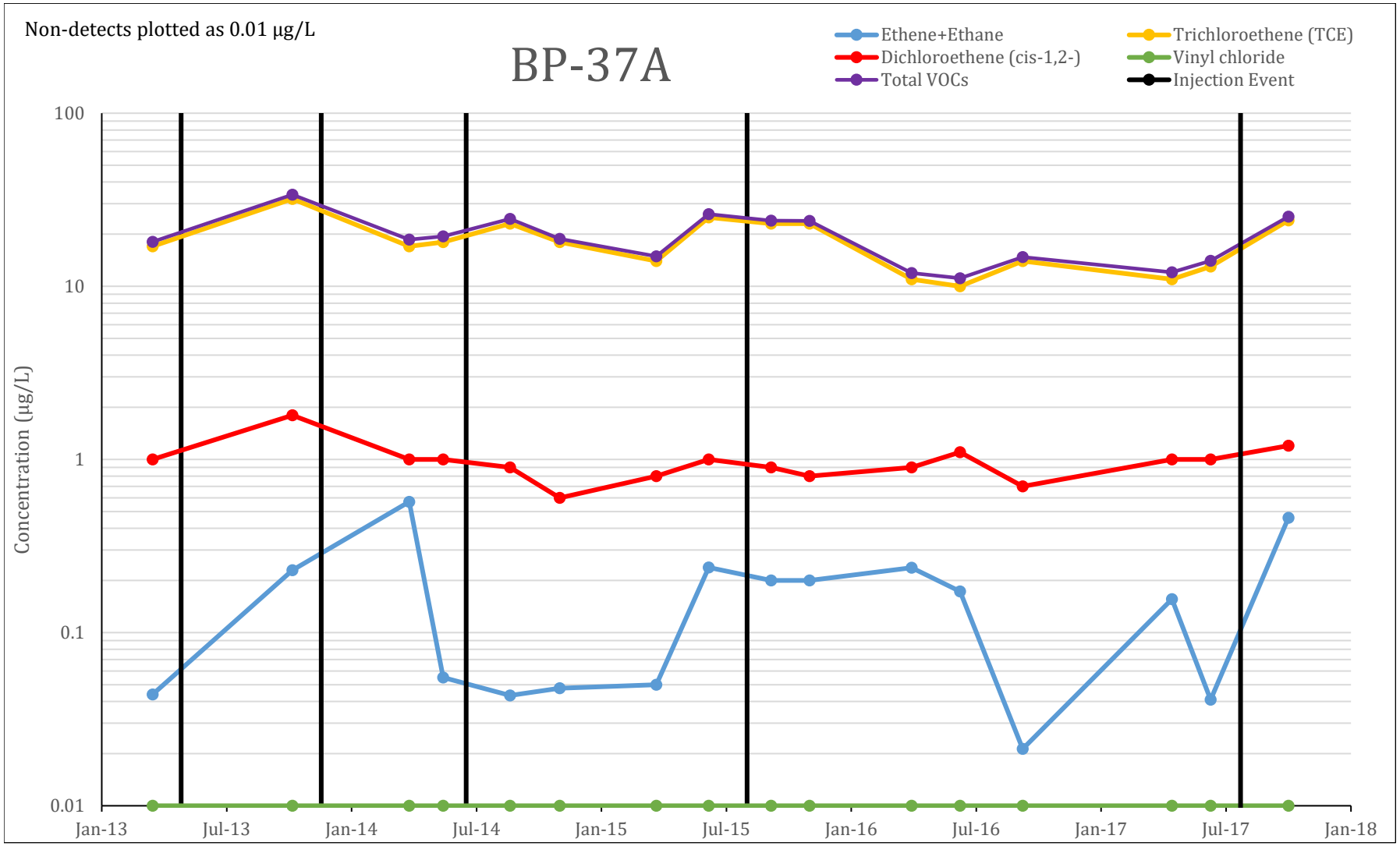

Non-detects plotted as 0.01 µg/L
BP-31A
Ethene+Ethane
Dichloroethene (cis-1,2-)
Total VOCs
Trichloroethene (TCE)
Vinyl chloride
Injection Event
Concentration (µg/L)
1000
100
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18

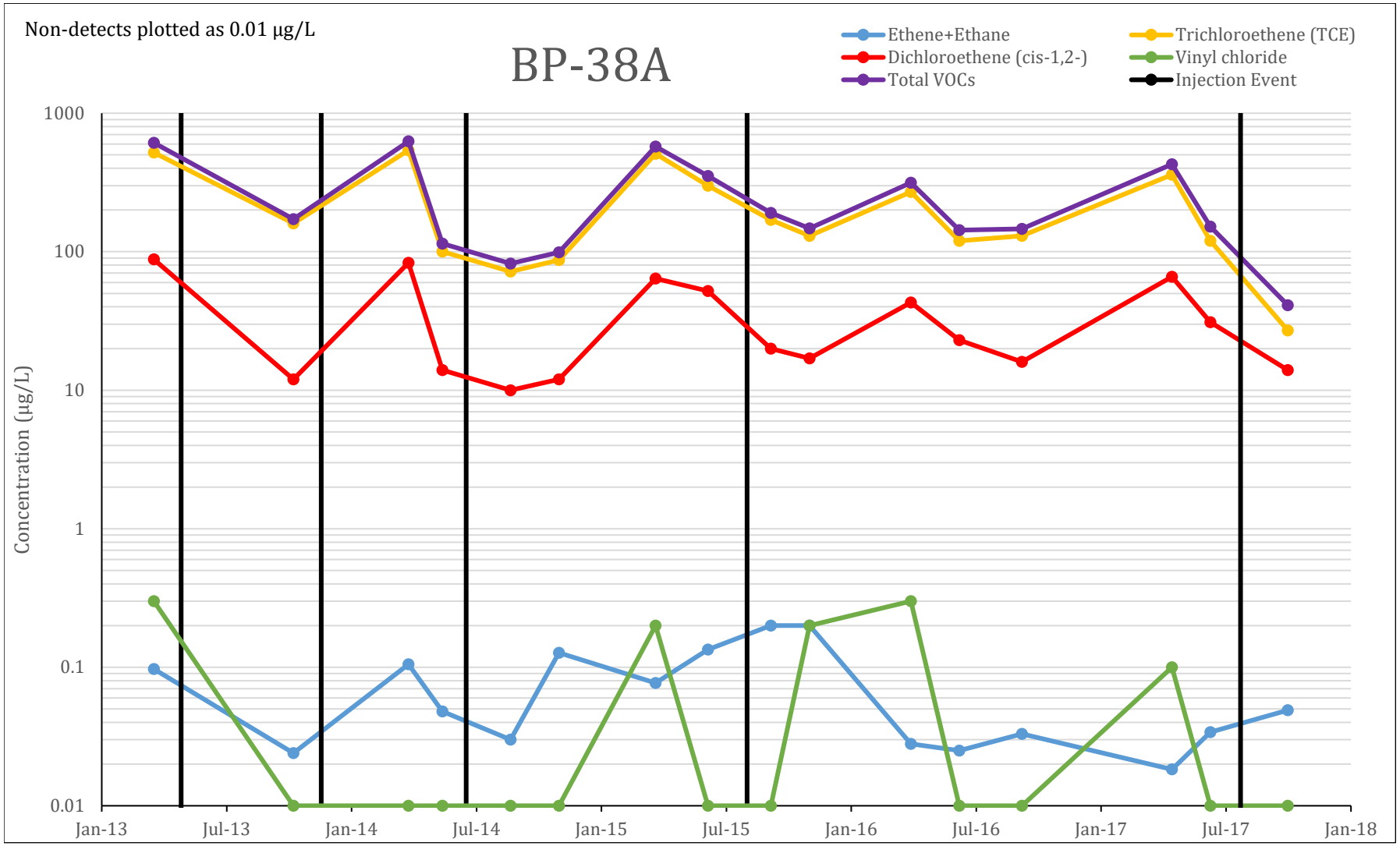

Non-detects plotted as 0.01 µg/L
BP-32A
Ethene+Ethane
Dichloroethene (cis-1,2-)
Total VOCs
Trichloroethene (TCE)
Vinyl chloride
Injection Event
Concentration (µg/L)
100
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18

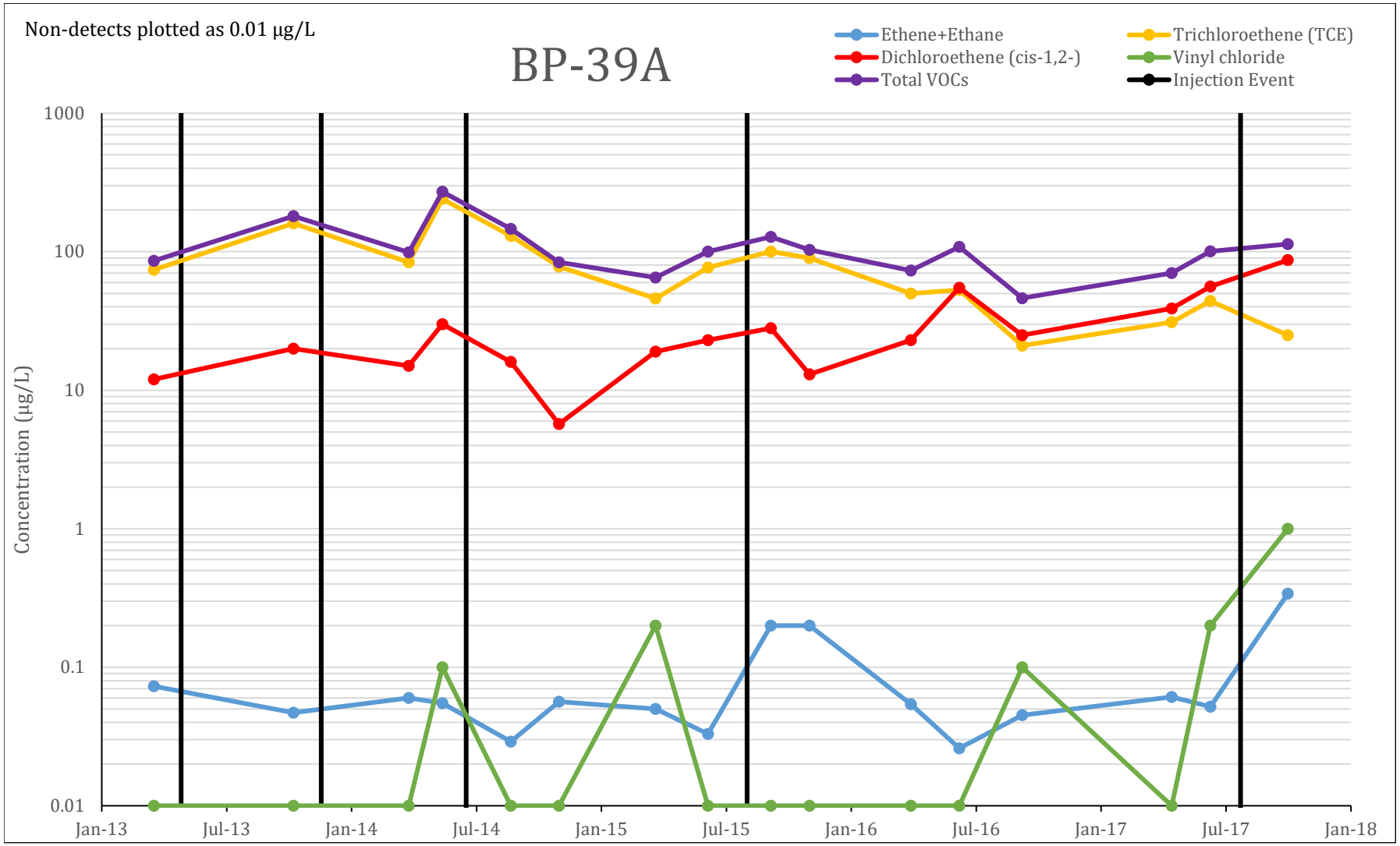

Non-detects plotted as 0.01 µg/L
BP-34A
Ethene+Ethane
Trichloroethene (TCE)
Dichloroethene (cis-1,2-)
Vinyl chloride
Total VOCs
Injection Event
Concentration (µg/L)
100000
10000
1000
100
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18

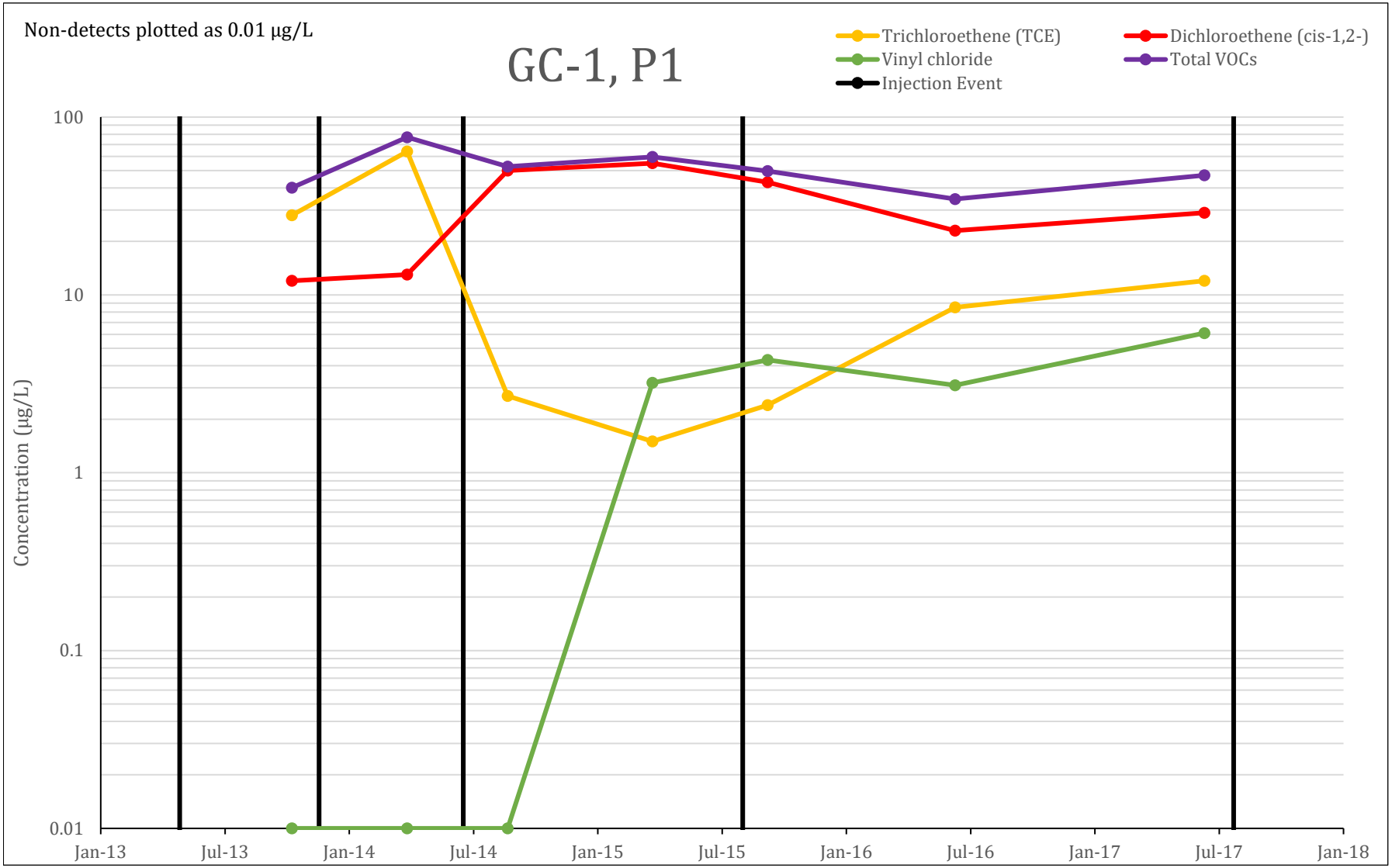

Non-detects plotted as 0.01 µg/L
BP-35A
Ethene+Ethane
Dichloroethene (cis-1,2-)
Total VOCs
Trichloroethene (TCE)
Vinyl chloride
Injection Event
Concentration (µg/L)
10000
1000
100
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18

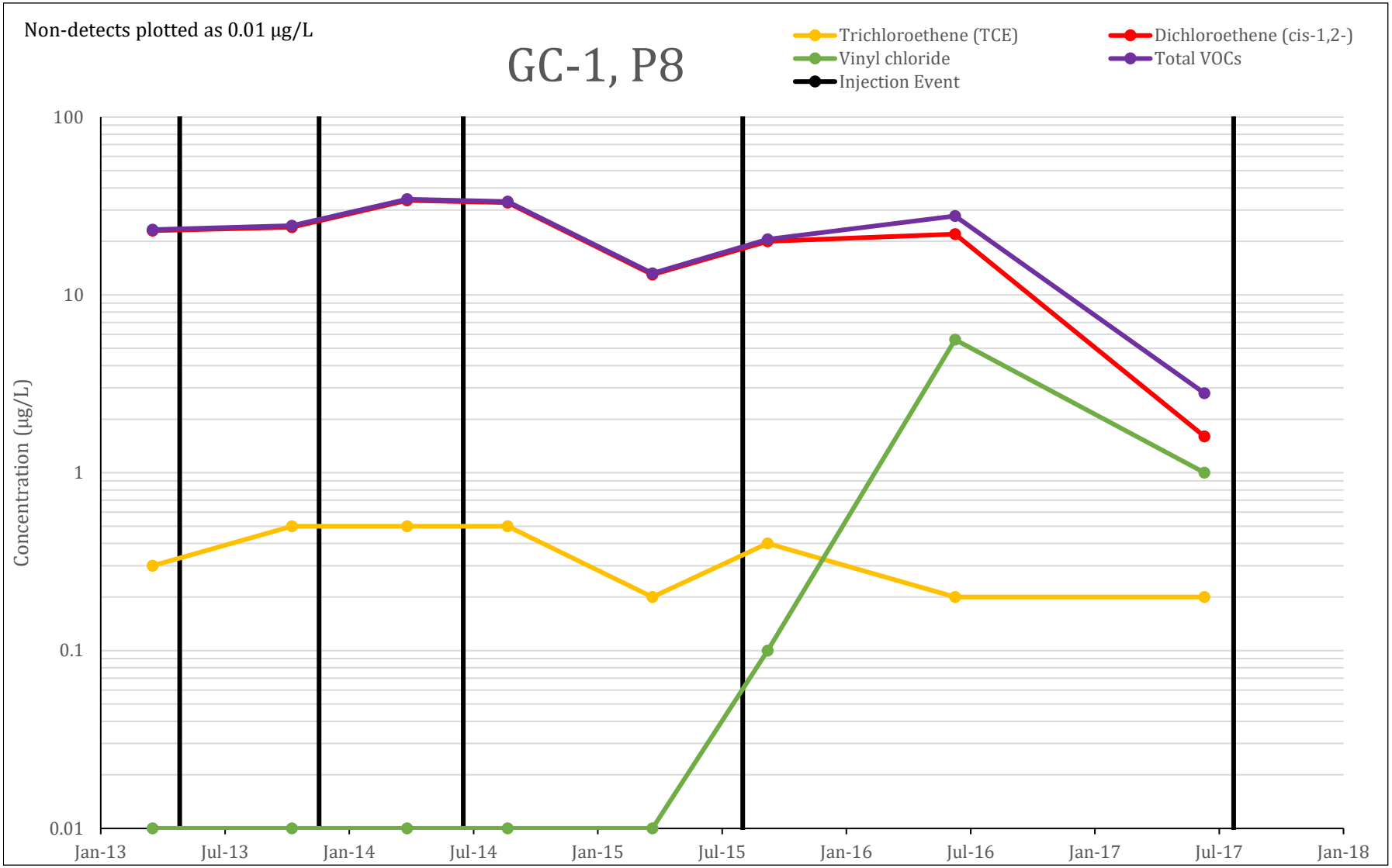

Non-detects plotted as 0.01 µg/L
BP-36A
Ethene+Ethane
Dichloroethene (cis-1,2-)
Total VOCs
Trichloroethene (TCE)
Vinyl chloride
Injection Event
Concentration (µg/L)
10000
1000
100
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18


Non-detects plotted as 0.01 µg/L
BP-37A
Ethene+Ethane
Trichloroethene (TCE)
Dichloroethene (cis-1,2-)
Vinyl chloride
Total VOCs
Injection Event
Concentration (µg/L)
100
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18


Non-detects plotted as 0.01 µg/L
BP-38A
Ethene+Ethane
Trichloroethene (TCE)
Dichloroethene (cis-1,2-)
Vinyl chloride
Total VOCs
Injection Event
Concentration (µg/L)
1000
100
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18


Non-detects plotted as 0.01 µg/L
BP-39A
Ethene+Ethane
Trichloroethene (TCE)
Dichloroethene (cis-1,2-)
Vinyl chloride
Total VOCs
Injection Event
Concentration (µg/L)
1000
100
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18


Non-detects plotted as 0.01 µg/L
GC-1, P1
Trichloroethene (TCE)
Dichloroethene (cis-1,2-)
Vinyl chloride
Total VOCs
Injection Event
Concentration (µg/L)
100
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18


Non-detects plotted as 0.01 µg/L
GC-1, P8
Trichloroethene (TCE)
Dichloroethene (cis-1,2-)
Vinyl chloride
Total VOCs
Injection Event
Concentration (µg/L)
100
10
1
0.1
0.01
Jan-13
Jul-13
Jan-14
Jul-14
Jan-15
Jul-15
Jan-16
Jul-16
Jan-17
Jul-17
Jan-18