8976 Wellington Road
Manassas, VA 20109

January 25, 2019

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

Re: 2018 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 Department of Environmental Conservation (NYSDEC). The remedy performance monitoring work and the preparation of this report were completed on behalf of IBM 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 25, 2019
File No. 63526.05

Re: 2018 Periodic Review Report
IBM Gun Club – Former Burn Pit Area
Union, New York
BCP Agreement #C704044

Dear Ms. Daubert:

This letter and attachments comprise the 2018 Periodic Review Report (PRR) of the remedy status 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 PRR includes the following:

Attachment A – Institutional and Engineering Controls Certification Form
Attachment B – Remedy Performance Testing Reports of April, June, and September 2018
Attachment C – Site-Wide Inspection Report for September 2018
Attachment D – Maintenance Reports for 2018

For the PRR Certification (Attachment A), 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 inspection conducted in 2018. 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 of the certification responsibilities of the Country Club, as site owner, and SHPC, as representative of the remedial party, IBM, is provided below:

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

The remaining components of this PRR have been previously submitted to the Agencies and include remedy performance testing summary memoranda (Attachment B) based on field sampling and laboratory analyses conducted in accordance with the SMP and the annual site-wide inspection report (Attachment C) to assess the integrity of the remedy Engineering Controls (ECs) and compliance with Institutional Controls (ICs) outlined in the SMP. A report of routine maintenance is also included in Attachment D.

As discussed with the NYSDEC, IBM will prepare a comprehensive remedy evaluation every two years as part of the PRR, with the next such evaluation to cover 2018 and 2019, which will be included in the PRR submitted in January 2020.

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, P.E.
President
SANBORN HEAD ENGINEERING, P.C.
20 Foundry Street
Concord, NH 03301

Erica M. Bosse, P.G.
Project Manager
SANBORN HEAD & ASSOCIATES, INC.
1 Technology Park Drive
Westford, MA 01886

Encl. Attachment A – Executed Certification Form
Attachment B – Performance Testing Memorandum Reports
Attachment C – Site Inspection Memorandum Reports
Attachment D – Maintenance Report

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ATTACHMENT A

CERTIFICATION FORM

Attachment A

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 to December 31, 2018

	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 Rd. 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.

K/OA
Signature of Owner, Remedial Party, or Designated Representative Rendering Certification

1/22/19
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 — 1/25/19

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

Stamp (Required for PE)

Date

ATTACHMENT B

PERFORMANCE TESTING MEMORANDUM REPORTS

APRIL 2018 PERFORMANCE TESTING

SANBORN HEAD ENGINEERING

SUMMARY OF APRIL 2018 WATER QUALITY MONITORING

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

INTRODUCTION

This report summarizes the scope and results of remedy performance monitoring conducted in April 2018. 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 16, 2018 in general accordance with the scope and procedures described in Appendix J of the Site Management Plan (SMP)[1].

This report will be included as a component of the annual Periodic Review Report, due in January 2019, and has been prepared consistent with the Monitoring Reporting Requirements described in Section 3.6 of the SMP. Sanborn Head field staff for this event were Jill Getchell and Matthew Stein.

SCOPE OF WORK

The scope of work included:

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

Groundwater Elevation Survey

From April 17 to 19, 2018, the depths to water in select monitoring wells and injection boreholes were gauged in accordance with procedures described in Appendix G of the SMP. 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:

[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.

- Samples were collected for laboratory geochemical analysis instead of in-situ field geochemical testing to improve efficiency;

- Surface water point 112 was dry during April 2018 and could not be sampled. No new on-site seeps/springs were observed. The potential seep (119) noted adjacent to BP-9A during the October 2017 sampling round was also not present.

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 3.

Exhibit 1 Summary of Sampling Methods

Sample Method	Number of Locations Sampled
Modified Low-Flow	14
Purge Water (Tote) Grab Sample	1
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	2
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
Geochemical Analyses	Eurofins	14
Volatile Fatty Acids	Pace	21
Light Gases (Ethane, Ethene, and Methane)	Pace	21

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

SUMMARY OF RESULTS

A summary of the groundwater quality data and inferences is presented on Figure 1. Figure 2 is an interactive PDF figure presenting the geochemical data used to infer the geochemical conditions shown on Figure 1. Field sampling records and analytical laboratory reports are kept on file and available upon request.

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.

The field and laboratory data for April 2018 indicate remedy performance generally consistent with project performance goals established in the SMP. Geochemical conditions generally remain within ranges that are favorable for reductive dehalogenation over most of the source area. An injection of edible oil amendment was conducted in August 2017; thus, the April 2018 data reflects conditions about 8 months later. 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 October 2017. The area under methanogenic conditions that is most conducive to reductive dehalogenation is inferred to be slightly larger than that observed at the end of 2017, encompassing BP-34A and BP-9A, downgradient of the A-line and B-line of injection boreholes, respectively. Figure 2 (an interactive PDF) presents the geochemical data used to infer the geochemical conditions shown on Figure 1.

Exhibit 5 below presents the April 2018 monitoring results for select key parameters in comparison to the previous monitoring results of October 2017. TCE concentrations have decreased or remained stable since the last monitoring round at 12 of the 19 wells (63%), while terminal breakdown product (ethene and ethane) concentrations have increased or remained stable at 11 of the 19 wells (58%), indicating continued reductive dehalogenation.

The geochemical data for oxidation-reduction potential (ORP) and dissolved oxygen (DO) are mixed; only 3 wells show a favorable ORP trend for reductive dechlorination, while 10 wells show a favorable DO trend. Total organic carbon (TOC) concentrations greater than the 100 milligrams per liter (mg/l) threshold for biological degradation were measured at all 5 sampled injection boreholes. However, TOC levels at monitoring wells within the injection displacement zone and further downgradient were much lower.

Exhibit 5: April 2018 Results Compared to October 2017

Analyte	TCE	Ethene+Ethane	TOC	ORP	DO
	ug/L	ug/L	mg/L	mV	mg/L
Injection Boreholes					
IB-7	0.60	28	350		
A-13	<250	2,600	550		
B-4	11	29	780		
B-7	69	440	2,700		
B-9	24	170	4,000		
Injection Displacement Zone					
BP-2A	49	160	3.7	39	0.49
BP-4A	240	71	4.5	-4.5	0.28
BP-13A	12	0.64	1.5		
BP-36A	2,600	490	7.1	-150	0.20
Downgradient - on site					
B-1A	120	6.8	14	130	0.63
BP-5A	20	0.048	21	200	4.4
BP-6A	45,000	120	170	-21	0.21
BP-9A	610	250	2.2	140	0.57
BP-34A	21,000	15	5.0	130	1.0
BP-35A	3,100	0.30	2.4	9.3	7.2
BP-37A	8.7	0.029	2.7	97	1.2
Downgradient - off site					
BP-31A	38	0.070	1.1	240	6.8
BP-38A	150	0.054	1.8	120	1.8
BP-39A	22	0.055	2.2	140	2.2
Favorable Change	≥ 10% decline	≥ 10% increase	≥ 10% increase	≥ 10% decline	≥ 10% decline
Number of Wells	8	8	6	3	10
Stable	0 to ± 10%	0 to ± 10%	0 to ± 10%	0 to ± 10%	0 to ± 10%
Number of Wells	4	3	5	0	1
Unfavorable Change	≥ 10% increase	≥ 10% decline	≥ 10% decline	≥ 10% increase	≥ 10% increase
Number of Wells	7	8	8	10	2

Concentrations shown from April 2018 sampling event, rounded to 2 sig. figures.

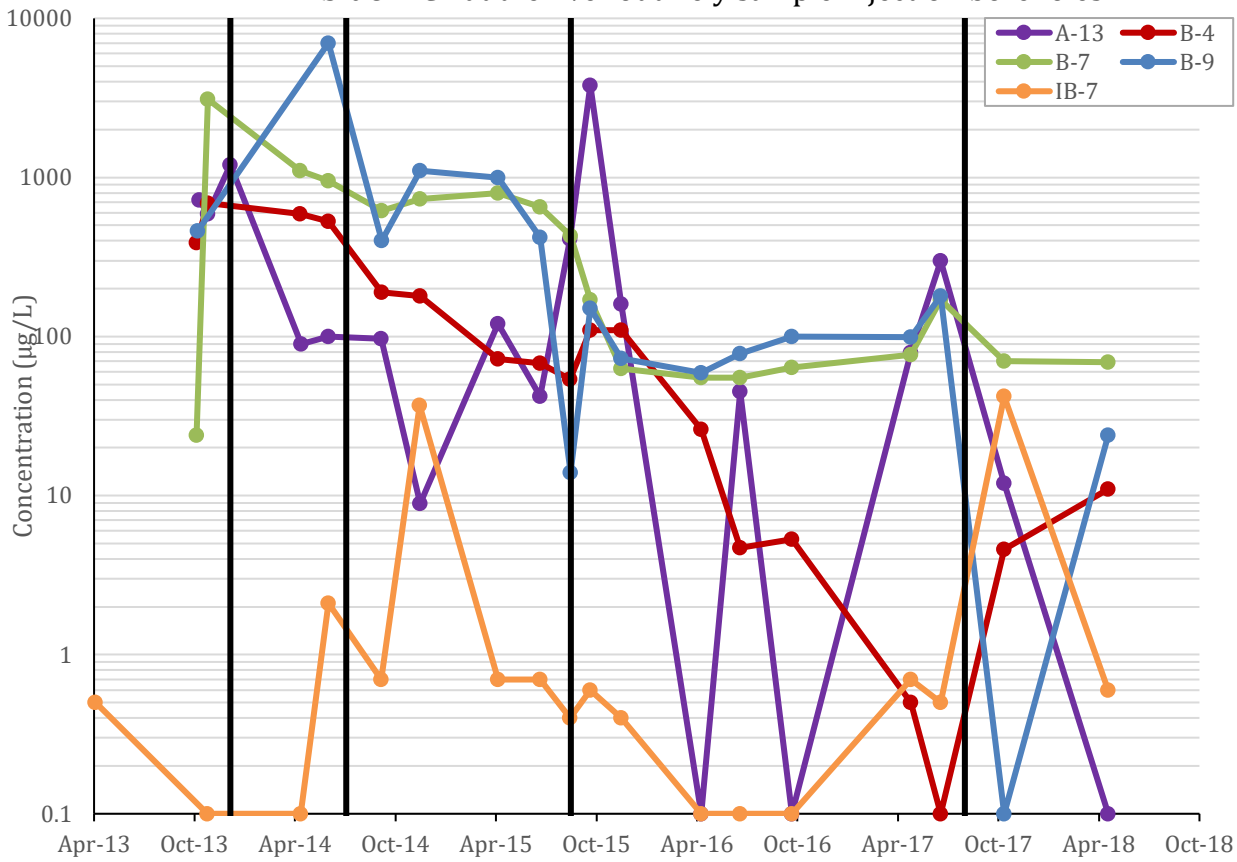
Blank cell indicates lack of data in one or both events.

Overall, the VOC and geochemical data have not indicated a significant response to the injection of edible oil amendment in August 2017. As noted in previous reports, emplacement of the oil emulsion into the fractures has possibly reduced the effective water permeability and contact with VOC-containing groundwater. In addition, groundwater temperatures measured in April 2018, reported on Table 3, are relatively cold (mean of

5.5°C) reflecting post-winter conditions. These temperatures are not favorable to microbial activity and may account for rebound of VOC concentrations in certain wells compared to October 2017 when the mean groundwater temperature was 14.4°C. Rebound of VOC concentrations in April in certain wells has been observed in previous years, followed by a decline in concentrations once groundwater temperatures rise during warmer months.

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. Since the August 2017 injection, no apparent trend has been observed in the five routinely sampled injection boreholes.

Exhibit 6: TCE at the five routinely sample injection boreholes



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

The next performance monitoring event will be conducted in June 2018. Review of the June 2018 monitoring data will consider the value of injection well redevelopment to potentially improve amendment distribution. The June 2018 event will also include an initial review of tree growth associated with the phytoremediation component of the remedy, while the annual comprehensive review of tree growth will be conducted in September 2018.

Attachments:

Table 1	Summary of Water Level Data
Table 2	Scope of Performance Monitoring
Table 3	Summary of April 2018 Performance Monitoring
Figure 1	Summary of April 2018 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	16.77	1377.48
B-4	1385.03	4.11	1380.92
B-7	1385.33	5.24	1380.09
B-9	1385.21	10.69	1374.52
BP-1A	1395.67	11.97	1383.70
BP-2A	1396.89	10.53	1386.36
BP-4A	1391.96	11.09	1380.87
BP-5A	1391.09	13.86	1377.23
BP-6A	1393.95	15.07	1378.88
BP-9A	1379.17	10.36	1368.81
BP-13A	1398.89	10.61	1388.28
BP-31A	1369.63	10.20	1359.43
BP-34A	1392.55	10.36	1382.19
BP-35A	1391.75	12.58	1379.17
BP-36A	1383.68	10.68	1373.00
BP-37A	1389.92	8.33	1381.59
BP-38A	1375.10	9.22	1365.88
BP-39A	1370.17	6.55	1363.62
IB-7	1393.23	6.97	1386.26

Notes:

1. This table summarizes depth to water measurements and calculated water table elevations recorded during the April 2018 performance monitoring round on April 17-19, 2018. 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	Total Iron	Ferrous Iron	Nitrate	Sufate	Sulfide	Water Quality Parameters
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	x	x	x	x
	BP-2A	Monitoring Well	x				x	x	x	x	x	x	x	x	x	x
	BP-4A	Monitoring Well	x				x	x	x	x	x	x	x	x	x	x
	BP-5A	Monitoring Well	x				x	x	x	x	x	x	x	x	x	x
	BP-6A	Monitoring Well	x				x	x	x	x	x	x	x	x	x	x
	BP-9A	Monitoring Well	x				x	x	x	x	x	x	x	x	x	x
	BP-13A	Monitoring Well	x				x	x	x	x	x	x	x	x	x	x
	BP-31A	Monitoring Well	x				x	x	x	x	x	x	x	x	x	x
	BP-34A	Monitoring Well	x				x	x	x	x	x	x	x	x	x	x
	BP-35A	Monitoring Well	x				x	x	x	x	x	x	x	x	x	x
	BP-36A	Monitoring Well	x				x	x	x	x	x	x	x	x	x	x
	BP-37A	Monitoring Well	x				x	x	x	x	x	x	x	x	x	x
	BP-38A	Monitoring Well	x				x	x	x	x	x	x	x	x	x	x
	BP-39A	Monitoring Well	x				x	x	x	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**	**14**	**14**	**14**	**14**	**14**	**48**

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).

TABLE 3
SUMMARY OF APRIL 2018 PERFORMANCE MONITORING
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-37A	BP-38A	BP-39A
		BP-1A	BP-2A	BP-4A	BP-4A_FD	BP-5A	BP-6A	BP-9A	BP-13A	BP-31A	BP-31A_FD	BP-34A	BP-35A	BP-36A	BP-37A	BP-38A	BP-39A
		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	Low Flow	Low Flow	Low Flow
		S	S	S	FD	S	S	S	S	S	FD	S	S	S	S	S	S
		4/18/2018	4/18/2018	4/17/2018	4/17/2018	4/18/2018	4/18/2018	4/18/2018	4/18/2018	4/17/2018	4/17/2018	4/17/2018	4/17/2018	4/17/2018	4/18/2018	4/17/2018	4/17/2018
VOLATILE ORGANIC COMPOUNDS (VOCs)																	
Trichloroethene (TCE)	µg/l	**120**	**49**	**240**	**220**	**20**	**45,000**	**610**	**12**	**38**	**38**	**21,000**	**3,100**	**2,600**	**8.7**	**150**	**22**
Dichloroethene (cis-1,2-)	µg/l	**130**	**2,300**	**73**	**59**	**23**	**18,000**	**1,200**	**0.20 J**	**9.2**	**9.6**	**35,000**	**4,500**	**5,500**	**1.1**	**30**	**37**
Dichloroethene (trans-1,2-)	µg/l	**2.0**	**5.8 J**	**1.8 J**	**1.3 J**	**0.70 J**	**58 J**	**10.0**	<0.5	<0.5	<0.5	<250	<50	**10 J**	<0.5	<1	**0.10 J**
Dichloroethene (1,1-)	µg/l	**0.60 J**	<25	**0.70 J**	**0.70 J**	<2.5	<250	**4.5 J**	<0.5	<0.5	<0.5	**78 J**	<50	**13 J**	<0.5	<1	<0.5
Tetrachloroethene (PCE)	µg/l	<1	<25	<2.5	<2.5	<2.5	<250	<10	<0.5	**2.0**	**2.1**	<250	<50	<50	<0.5	<1	<0.5
Vinyl chloride	µg/l	**24**	**530**	**24**	**20**	<2.5	**220 J**	**210**	<0.5	**0.20 J**	**0.20 J**	<250	<50	**670**	<0.5	<1	**0.10 J**
LIGHT GASSES																	
Ethane	µg/l	**1.8**	**0.55**	**29**	**30**	**0.028 J**	**1.2**	**52**	**0.63**	**0.025 J**	**0.059 J**	**3.4**	**0.21**	**34**	**0.0088 J**	**0.020 J**	**0.026 J**
Ethene	µg/l	**5.0**	**160**	**39**	**41**	**0.020 J**	**120**	**200**	**0.013 J**	**0.011 J**	**0.0092 J**	**12**	**0.088 J**	**460**	**0.020 J**	**0.034 J**	**0.029 J**
Methane	µg/l	**120**	**1,100**	**3,600**	**3,800**	**1.0**	**120**	**14,000**	**6.8**	**0.49 J**	**0.52**	**980**	**1.0**	**7,500**	**36**	**0.20 J**	**0.14 J**
MOLAR CONCENTRATION																	
Trichloroethene (TCE)	µmol/l	0.91	0.37	1.8	1.7	0.20	340	4.6	0.091	0.29	0.29	160	24	20	0.066	1.1	0.17
Dichloroethene (cis-1,2-)	µmol/l	1.3	24	0.75	0.61	0.24	190	12	0.0020	0.095	0.10	360	46	57	0.011	0.30	0.38
Dichloroethene (trans-1,2-)	µmol/l	0.020	0.060	0.019	0.013	0.0070	0.60	0.10	ND	ND	ND	ND	ND	0.10	ND	ND	0.0010
Dichloroethene (1,1-)	µmol/l	0.0060	ND	0.0070	0.0070	ND	ND	0.046	ND	ND	ND	0.80	ND	0.13	ND	ND	ND
Tetrachloroethene (PCE)	µmol/l	ND	ND	ND	ND	ND	ND	ND	ND	0.010	0.013	ND	ND	ND	ND	ND	ND
Vinyl chloride	µmol/l	0.38	8.5	0.38	0.30	ND	3.5	3.4	ND	0.0030	0.0030	ND	ND	11	ND	ND	0.0020
Ethane	µmol/l	0.060	0.018	0.96	1.0	0.00093	0.040	1.7	0.021	0.00083	0.0020	0.11	0.0070	1.1	0.00029	0.00070	0.00086
Ethene	µmol/l	0.20	5.7	1.4	1.5	0.00070	4.3	7.0	0.00046	0.00039	0.00033	0.43	0.0031	16	0.00070	0.0012	0.0010
Total	µmol/l	2.9	39	5.3	5.1	0.45	540	29	0.11	0.40	0.41	530	70	110	0.078	1.4	0.55
MOLAR PERCENTAGE																	
TCE	%	32	0.96	34	33	45	63	16	80	73	71	30	34	18	85	78	31
DCEs	%	46	62	15	12	55	35	42	1.7	24	24	68	66	52	14	21	69
VC	%	13	22	7.1	5.8	ND	0.65	12	ND	0.75	0.74	ND	ND	10	ND	ND	0.36
Ethane+Ethene	%	9.0	15	44	49	0.36	0.80	30	19	0.31	0.57	0.10	0.014	16	1.3	0.14	0.34
VOLATILE FATTY ACIDS																	
Acetic Acid	mg/l	**0.077 J**	**0.036 J**	**0.049 J**	**0.045 J**	**0.033 J**	**0.45 J**	**0.34**	**0.040 J**	**0.033 J**	**0.048 J**	**0.060 J**	**0.035 J**	**6.9**	**0.034 J**	**0.042 J**	**0.056 J**
Butyric Acid	mg/l	**0.036 J**	<0.1	<0.1	<0.1	<0.1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**0.50**	<0.1	<0.1	<0.1
Hexanoic Acid	mg/l	<0.2	<0.2	<0.2	<0.2	<0.2	<2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	**0.069 J**	<0.2	<0.2	<0.2
i-Hexanoic Acid	mg/l	<0.2	<0.2	<0.2	<0.2	<0.2	<2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
i-Pentanoic Acid	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**0.012 J**	<0.1	<0.1	<0.1
Lactic Acid	mg/l	<0.2	<0.2	<0.2	<0.2	<0.2	<2	<0.2	<0.2	**0.022 J**	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Pentanoic Acid	mg/l	**0.35**	**0.018 J**	**0.025 J**	**0.025 J**	**0.016 J**	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Propionic Acid	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**0.034 J**	<0.1	<0.1	<0.1
Pyruvic Acid	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	**0.40 J**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**0.016 J**	<0.1	<0.1	<0.1
OTHER LABORATORY DATA																	
Total Organic Carbon	mg/l	**13.5**	**3.7**	**4.5**	**4.5**	**21.2**	**166**	**2.2**	**1.5**	**1.1**	**1.1**	**5.0**	**2.4**	**7.1**	**2.7**	**1.8**	**2.2**
WATER QUALITY PROBE DATA																	
Temperature	°C	**5.5**	**4.8**	**4.9**	–	**5.3**	**6.5**	**4.4**	**5.3**	**5.6**	–	**4.9**	**5.8**	**6.0**	**6.3**	**5.7**	**5.9**
Specific Conductance	uS/cm	**2,300**	**880**	**690**	–	**1,600**	**6,600**	**460**	**110**	**240**	–	**1,200**	**800**	**630**	**690**	**150**	**110**
pH	s.u.	**7.4**	**6.7**	**6.9**	–	**7.2**	**7.5**	**7.9**	**6.5**	**6.3**	–	**7.2**	**7.1**	**6.4**	**7.2**	**6.0**	**5.9**
Oxidation/Reduction Potential	mV	**130**	**40**	**-4.5**	–	**200**	**-21**	**140**	**100**	**240**	–	**130**	**9.3**	**-150**	**97**	**120**	**140**
Dissolved Oxygen	mg/l	**0.63**	**0.49**	**0.28**	–	**4.4**	**0.21**	**0.57**	**4.0**	**6.8**	–	**1.0**	**7.2**	**0.20**	**1.2**	**1.8**	**2.2**
Turbidity	NTU	**3.2**	**1.7**	**0.70**	–	**3.4**	**4.0**	**1.9**	**4.1**	**2.7**	–	**3.6**	**2.8**	**9.0**	**10**	**16**	**2.0**
GEOCHEMISTRY																	
Iron	mg/l	**0.31 J**	**15**	<0.4	–	**0.14 J**	**0.74**	**0.10 J**	**0.21 J**	**0.11 J**	–	<0.4	<0.4	**3.1**	**0.13 J**	**0.81**	**0.66**
Iron - Ferrous	mg/l	**0.075**	**13**	**0.020 J**	–	**0.065**	**0.68**	**0.10**	**0.10**	**0.020 J**	–	**0.018 J**	**0.026 J**	**2.8**	**0.061**	<0.05	**0.56**
Nitrate	mg/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	<0.5
Sulfate	mg/l	**180**	**30**	**40**	–	**380**	**1,400**	**25**	**12**	**19**	–	**58**	**22**	**4.4 J**	**8.5**	**10**	**12**
Sulfide	mg/l	**0.16 J**	<0.3	<0.3	–	<0.3	<0.3	<0.3	<0.3	<0.3	–	<0.3	<0.3	**1.1**	<0.3	<0.3	<0.3

TABLE 3
SUMMARY OF APRIL 2018 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	111	113	118	TOTE
		A-13	B-4	B-7	B-9	IB-7	111	113	118	TOTE
		PDB	PDB	PDB	PDB	PDB	Surface Water	Surface Water	Surface Water	Purge Water
		S	S	S	S	S	S	S	S	S
		4/18/2018	4/18/2018	4/18/2018	4/18/2018	4/18/2018	4/18/2018	4/18/2018	4/18/2018	4/18/2018
VOLATILE ORGANIC COMPOUNDS (VOCs)										
Trichloroethene (TCE)	µg/l	<250	**11**	**69**	**24**	**0.60**	**0.50 J**	**0.20 J**	**2.3**	**110**
Dichloroethene (cis-1,2-)	µg/l	**32,000**	**33**	**460**	**630**	**26**	<0.5	<0.5	**4.2**	**230**
Dichloroethene (trans-1,2-)	µg/l	<250	**1.1 J**	**2.7 J**	<10	**0.50 J**	<0.5	<0.5	<0.5	**0.30 J**
Dichloroethene (1,1-)	µg/l	<250	<5	**1.1 J**	<10	<0.5	<0.5	<0.5	<0.5	**0.40 J**
Tetrachloroethene (PCE)	µg/l	<250	<5	<5	**4.3 J**	<0.5	<0.5	<0.5	<0.5	<0.5
Vinyl chloride	µg/l	**4,200**	**3.2 J**	**76**	**74**	**15**	<0.5	<0.5	<0.5	**3.7**
LIGHT GASSES										
Ethane	µg/l	**86**	**14**	**64**	**6.7**	**6.1**	–	–	–	–
Ethene	µg/l	**2,500**	**15**	**380**	**160**	**22**	–	–	–	–
Methane	µg/l	**8,400**	**20,000**	**16,000**	**4,600**	**23,000**	–	–	–	–
MOLAR CONCENTRATION										
Trichloroethene (TCE)	µmol/l	ND	0.084	0.53	0.18	0.0050	0.0040	0.0020	0.018	0.84
Dichloroethene (cis-1,2-)	µmol/l	330	0.34	4.7	6.5	0.27	ND	ND	0.043	2.4
Dichloroethene (trans-1,2-)	µmol/l	ND	0.011	0.028	ND	0.0050	ND	ND	ND	0.0030
Dichloroethene (1,1-)	µmol/l	ND	ND	0.011	ND	0.0050	ND	ND	ND	0.0040
Tetrachloroethene (PCE)	µmol/l	ND	ND	ND	0.026	0.0030	ND	ND	ND	ND
Vinyl chloride	µmol/l	67	0.051	1.2	1.2	0.24	ND	ND	ND	0.059
Ethane	µmol/l	2.9	0.47	2.1	0.22	0.20	–	–	–	–
Ethene	µmol/l	89	0.53	14	5.7	0.78	–	–	–	–
Total	µmol/l	500	1.5	23	14	1.5	0.0040	0.0020	0.061	3.3
MOLAR PERCENTAGE										
TCE	%	ND	5.7	2.3	1.3	0.33	100	100.0	30	25
DCEs	%	66	24	21	47	19	ND	ND	70	73
VC	%	13	3.4	5.3	8.7	16	ND	ND	ND	1.8
Ethane+Ethene	%	18	67	71	43	65	–	–	–	–
VOLATILE FATTY ACIDS										
Acetic Acid	mg/l	**140**	**340**	**540**	**1,200**	**70**	–	–	–	–
Butyric Acid	mg/l	**11**	**17**	**300**	**470**	**1.8**	–	–	–	–
Hexanoic Acid	mg/l	**2.2**	**30**	**150**	**44**	<2	–	–	–	–
i-Hexanoic Acid	mg/l	**0.17 J**	<2	**1.8 J**	<2	<2	–	–	–	–
i-Pentanoic Acid	mg/l	**0.59 J**	**8.2**	**9.3**	**19**	**3.9**	–	–	–	–
Lactic Acid	mg/l	<2	<20	<20	<20	<2	–	–	–	–
Pentanoic Acid	mg/l	**2.9**	**45**	**240**	**710**	**2.9**	–	–	–	–
Propionic Acid	mg/l	**15**	**520**	**470**	**2,600**	**280**	–	–	–	–
Pyruvic Acid	mg/l	**6.9**	**110**	**46**	**34**	**28**	–	–	–	–
OTHER LABORATORY DATA										
Total Organic Carbon	mg/l	**93**	**780**	**2,700 J**	**4,000**	**350**	–	–	–	–
WATER QUALITY PROBE DATA										
Temperature	°C	–	–	–	–	–	**5.4**	**5.2**	**5.6**	–
Specific Conductance	uS/cm	–	–	–	–	–	**230**	**150**	**220**	–
pH	s.u.	–	–	–	–	–	**7.9**	**7.8**	**7.3**	–
Oxidation/Reduction Potential	mV	–	–	–	–	–	**100**	**120**	**130**	–
Dissolved Oxygen	mg/l	–	–	–	–	–	**8.9**	**8.8**	**8.2**	–
Turbidity	NTU	–	–	–	–	–	**47**	**130**	**20**	–
GEOCHEMISTRY										
Iron	mg/l	–	–	–	–	–	–	–	–	–
Iron - Ferrous	mg/l	–	–	–	–	–	–	–	–	–
Nitrate	mg/l	–	–	–	–	–	–	–	–	–
Sulfate	mg/l	–	–	–	–	–	–	–	–	–
Sulfide	mg/l	–	–	–	–	–	–	–	–	–

Notes:

1. The table summarizes samples collected during the week of April 16, 2018 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.
"<" 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 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 April 2018 Groundwater Quality Conditions

IBM Gun Club - Former Burn Pit Area

Union, New York

Drawn By:	D. Saltmarsh
Designed By:	E. Bosse
Reviewed By:	D. Shea
Project No:	3526.05
Date:	June 2018

Figure Narrative

The figure is intended to depict groundwater quality data and inference recorded during the week of April 16, 2018.

The groundwater data for site key VOCs including TCE, cDCE, vinyl chloride, and ethane/ethene 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 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, 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 33,000 — Well Name and April 2018 TCE Concentrations in Groundwater (µg/L).

- Inferred Groundwater Contour 4/19/2018
- Inferred Methanogenic Conditions
- Inferred Sulfate-Reducing Conditions
- 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: dsaltmarsh

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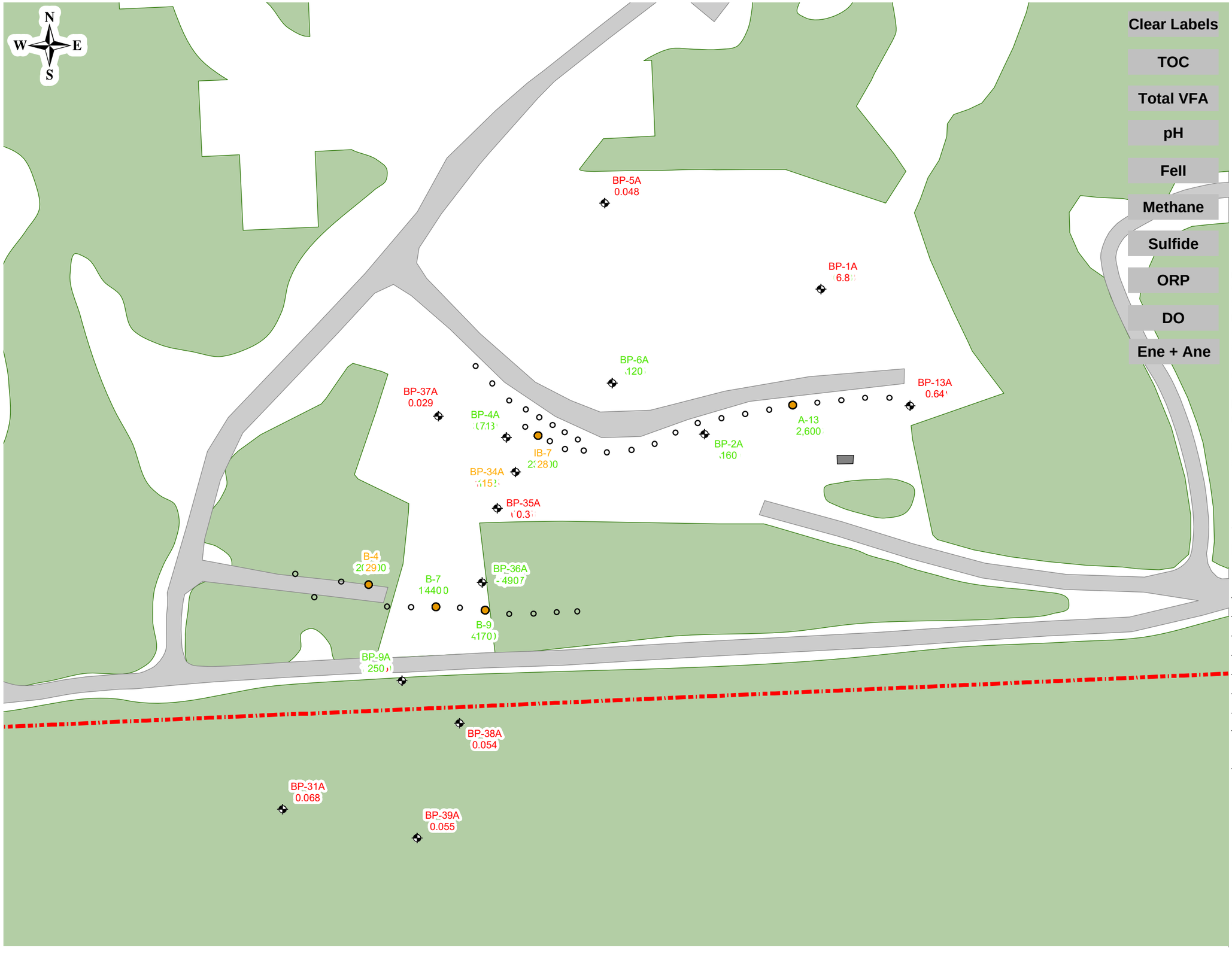


Clear Labels

TOC

Total VFA

pH

Fell

Methane

Sulfide

ORP

DO

Ene + Ane

Figure 2

April 2018 Assessment of Reducing Conditions

IBM Gun Club - Former Burn Pit Area

Union, New York

Drawn By:	D. Saltmarsh
Designed By:	E. Bosse
Reviewed By:	D. Shea
Project No:	3526.05
Date:	May 2018

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 2018 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

JUNE 2017 PERFORMANCE TESTING

SANBORN HEAD ENGINEERING

SUMMARY OF JUNE 2018 WATER QUALITY MONITORING

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

INTRODUCTION

This report summarizes the scope and results of remedy performance monitoring conducted in June 2018. 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 June 11, 2018 in general accordance with the scope and procedures described in Appendix J of the Site Management Plan (SMP)[1].

This report will be included as a component of the annual Periodic Review Report, due in January 2019, and has been prepared consistent with the Monitoring Reporting Requirements described in Section 3.6 of the SMP. Sanborn Head field staff for this event were Connor Murphy, Jill Getchell and Matthew Stein.

SCOPE OF WORK

The scope of work included:

- Comprehensive groundwater elevation survey. The monitoring network is shown on Figure 1;
- Annual well inspection including depth-to-bottom measurements;
- Water quality sampling and laboratory analysis associated with the performance monitoring program; and
- Water quality parameter field screening.

Groundwater Elevation Survey

From June 11 to 13, 2018, the depths to water in monitoring wells and injection boreholes were gauged in accordance with procedures described in Appendix G of the SMP. 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 2.

Water Quality Sampling

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

[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.

- Samples were collected for laboratory geochemical analysis instead of in-situ field geochemical testing to improve efficiency;
- Due to lack of water, the sample from BP-14A was collected with a dedicated bailer following measuring depth to water;
- Multi-level Flute sampler port BP-15D, P1 (18-25 feet below ground surface [ft bgs]) was found to be dry and could not be sampled; and
- Surface water point 118 was dry during June 2018 and could not be sampled. No new on-site seeps/springs were observed. The seep sampling location 119 noted adjacent to BP-9A during the October 2017 sampling round was sampled this round.

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 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	26
FLUTE® Purge	5
Bailer	1
Purge Water Tote Sample	1

Exhibit 2 Summary of QA/QC Samples for VOC analysis

Total Sample Locations	52
Duplicate Samples	5
Matrix Spikes	2
Matrix Spike Duplicates	2
Field Blanks	3
Equipment Blanks	1
Trip Blanks	3

Exhibit 3 Summary of Analytical Type

Sample Type – Off-Site Laboratory	Laboratory	Number of Samples
VOCs	Eurofins	57
Total Organic Carbon	Eurofins	22
Geochemical Analyses	Eurofins	14
Volatile Fatty Acids	Pace	22
Light Gases (Ethane, Ethene, and Methane)	Pace	22

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

SUMMARY OF RESULTS

Geochemical and VOC Results

A summary of the groundwater quality data and inferences is presented on Figure 2. A figure depicting the entire monitoring area, including the area south into the golf course, and summarizing key site VOCs plus carbon tetrachloride, is provided as Figure 3. Figure 4 is an interactive PDF presenting the geochemical data used to infer the geochemical conditions shown on Figure 2. Field sampling records and analytical laboratory reports are kept on file and available upon request.

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.

The field and laboratory data for June 2018 indicate remedy performance generally consistent with project performance goals established in the SMP, with some indications of potential changes noted below. Geochemical conditions generally remain within ranges that are favorable for reductive dehalogenation over most of the source area. The June 2018 monitoring results reflect conditions approximately 10 months after the August 2017 injection. As shown on Figure 2, the overall area of sulfate-reducing conditions, which are marginally conducive to reductive dehalogenation, is slightly increased compared to previous monitoring in April 2018. Figure 4 (the interactive PDF) presents the geochemical data used to infer the limits of sulfate-reduction and methanogenesis shown on Figure 2.

Exhibit 5 below presents the June 2018 monitoring results for select key parameters in comparison to the previous monitoring results of April 2018. TCE and terminal breakdown product (ethene and ethane) concentrations have exhibited a favorable change or remained stable in 47% of sampled wells, compared to about 60% of wells exhibiting favorable changes or stability in April 2018.

The geochemical data for oxidation-reduction potential (ORP) and dissolved oxygen (DO) indicate that 7 wells show a favorable or stable ORP change, compared to 3 wells in April. Ten wells show a favorable or stable DO change, similar to the 11 wells with an observed favorable/stable change in April. Total organic carbon (TOC) concentrations greater than

the 100 milligrams per liter (mg/l) threshold for biological degradation were measured at 4 of the 5 sampled injection boreholes. However, TOC levels at monitoring wells within the injection displacement zone and further downgradient were much lower, except for BP-6A.

Exhibit 5: July 2018 Results Compared to April 2018

Analyte	TCE	Ethene+Ethane	TOC	ORP	DO
	ug/L	ug/L	mg/L	mV	mg/L
Injection Boreholes					
IB-7	0.50	20	320		
A-13	<250	2,900	74		
B-4	10	20	730		
B-7	180	480	8,200		
B-9	25	290	4,000		
Injection Displacement Zone					
BP-2A	120	450	3.5	-110	0.11
BP-4A	220	60	4.2	22	0.63
BP-13A	81	0.13	1.1	160	0.60
BP-36A	1,600	440	10	-160	0.64
Downgradient - on site					
B-1A	17	4.3	19	170	0.13
BP-5A	29	0.68	21	180	4.5
BP-6A	52,000	26	160	-77	0.59
BP-9A	810	200	2.0	130	1.6
BP-34A	30,000	580	4.4	43	0.030
BP-35A	3,600	0.14	2.1	140	0.76
BP-37A	11	0.081	2.0	120	0.18
Downgradient - off site					
BP-31A	7.5	0.0060	0.64	140	7.1
BP-38A	46	2.1	1.4	150	0.45
BP-39A	31	1.3	2.0	150	0.33

Favorable Change	≥ 10% decline	≥ 10% increase	≥ 10% increase	≥ 10% decline	≥ 10% decline
Number of Wells	6	8	3	5	8
Stable	0 to ± 10%	0 to ± 10%	0 to ± 10%	0 to ± 10%	0 to ± 10%
Number of Wells	3	1	6	2	2
Unfavorable Change	≥ 10% increase	≥ 10% decline	≥ 10% decline	≥ 10% increase	≥ 10% increase
Number of Wells	10	10	10	7	4

Concentrations shown from June 2018 sampling event, rounded to 2 sig. figures.

Blank cell indicates lack of data in one or both events.

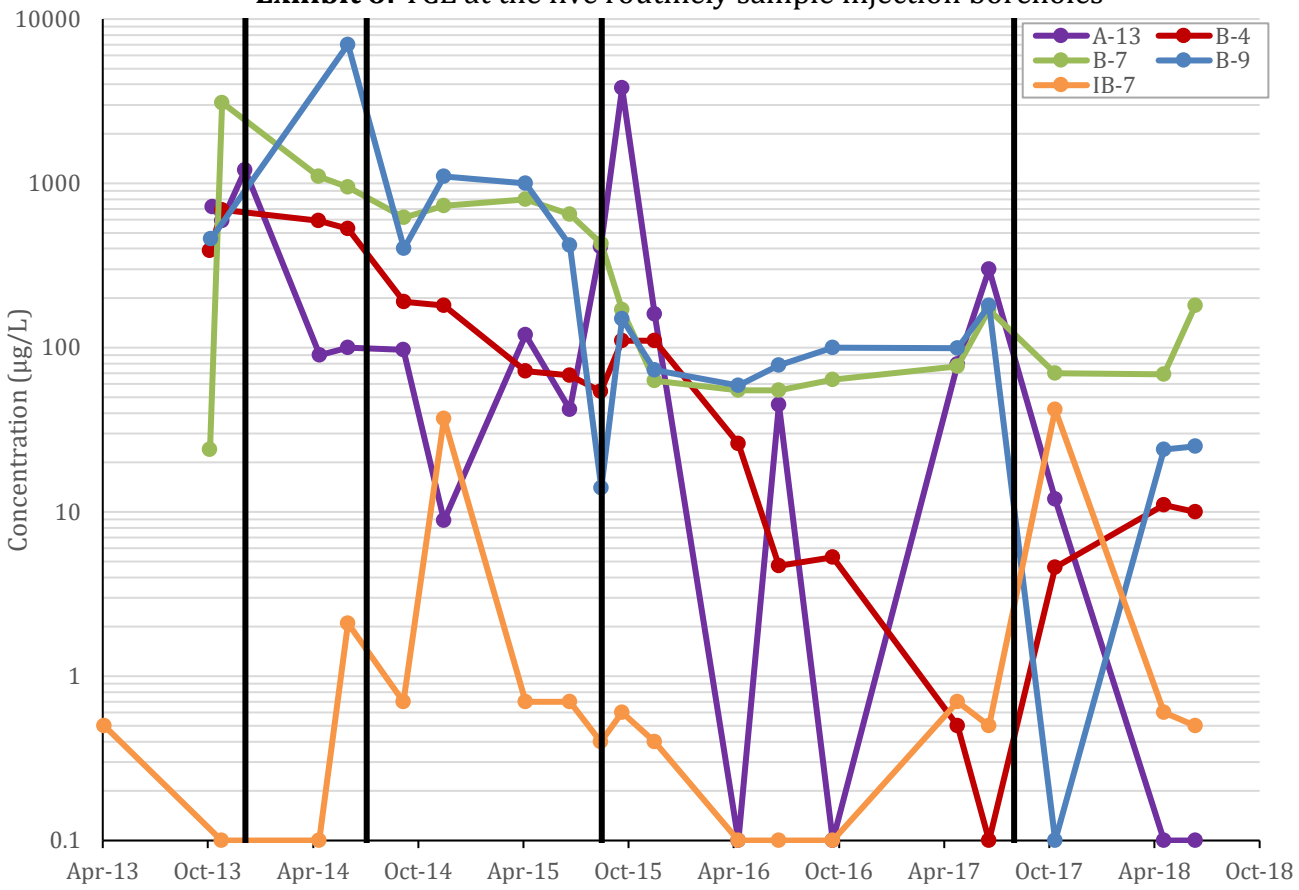
Overall, the VOC and geochemical data continue to indicate a muted response to the injection of edible oil amendment in August 2017. As noted in previous reports, emplacement of the

oil emulsion into the fractures has possibly reduced the effective water permeability and contact with VOC-containing groundwater. However, we do not see compelling evidence to justify redevelopment of injection wells at this time.

The average groundwater temperature increased from 5.5°C in April 2018 to 11°C in June. Groundwater temperature in June was more favorable to microbial activity, but still below the mean groundwater temperature recorded in October 2017 of 14.4°C.

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. Since the August 2017 injection, no apparent trend has been observed in the routinely sampled injection boreholes.

Exhibit 6: TCE at the five routinely sample injection boreholes



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

We note there is an indication of an increasing trend of vinyl chloride at BP-39A located across the former Gun Club property line. Vinyl chloride was detected at 7.2 µg/L in the June 2018 sample, which is an historical high for this VOC and exceeds the New York State Department of Environmental Conservation Class GA Groundwater quality standard of 2 µg/L. Terminal breakdown products ethene and ethane were also detected at a historical

high combined concentration of 1.3 µg/L. This suggests that biodegradation has not stalled at vinyl chloride, but that vinyl chloride may be travelling farther downgradient than previously, before being reduced or oxidized. Vinyl chloride was also present in on-site wells located between the A-line and B-line injection boreholes at an historical high concentration of 820 µg/L in BP-34A, and at 680 µg/L (620 µg/L in the field duplicate) at BP-36A. More production of vinyl chloride associated with TCE breakdown near the injection boreholes may be driving greater vinyl chloride mass flux across the property line. Additional monitoring events are needed to evaluate this possibility.

The data depicted for key VOCs on Figure 3 for most of monitoring locations farther 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 2017, and vinyl chloride was not detected in any of these farther downgradient wells. Carbon tetrachloride continues to be monitored and is included on Figure 3 and Table 3 as a key site VOC identified during the remedial investigation. It continues to be detected in several locations (BP-13A, BP-38A, GC-2A) at stable or decreasing concentrations compared to past monitoring.

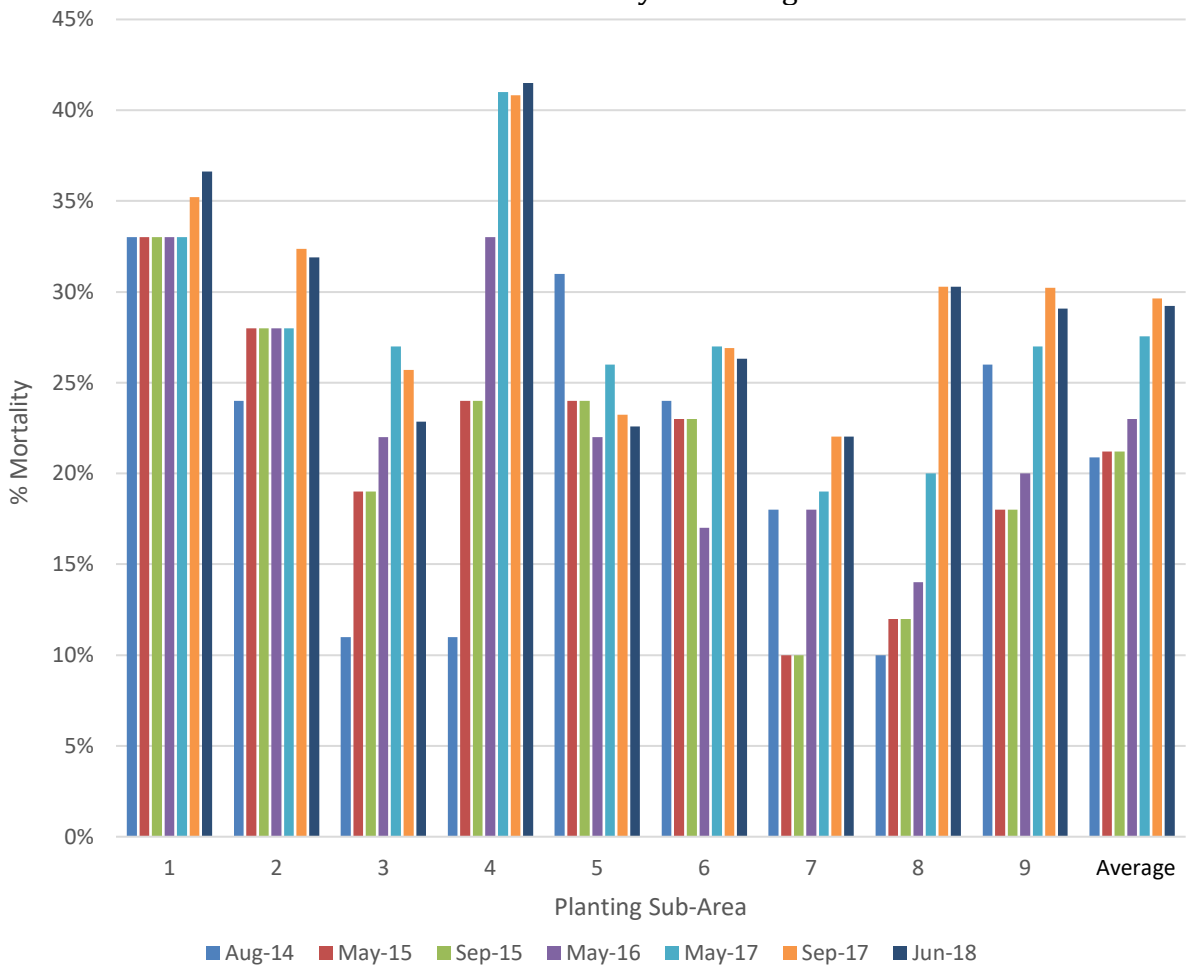
Sampling results from the multilevel monitoring installations (e.g., GC-1, P8 [90 to 97 ft bgs] and BP-15D, P5 [119 to 126 ft bgs]), which screen productive fracture zones between the primary source rock and residential water supplies, continue to not indicate any adverse change in water quality.

Tree Reconnaissance

Concurrent with June 2018 sampling, a count of tree mortality was conducted as part of ongoing monitoring of the phytoremediation component of the remedy. As reported after the annual site-wide inspection in October 2017, replanting of trees was not recommended because: 1) observed year-to-year growth progress 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.

Exhibit 7 below shows the tree mortality percentages for each tree planting sub-area since inspections began in August 2014. Mortality rates ranged from 41% (Area 1) to 22% (Area 7), with an overall mortality of 30%. In general, mortality in each area is stable or improved since the October 2017 inspection.

Exhibit 7: Tree Mortality Percentage



The next performance monitoring event will be conducted in October 2018 along with the annual site-wide inspection, including another count of tree mortality.

Attachments:

Table 1	Summary of Water Level Data
Table 2	Scope of Performance Monitoring
Table 3	Summary of June 2018 Performance Monitoring
Figure 1	Monitoring Location Plan
Figure 2	Summary of June 2018 Groundwater Quality Conditions
Figure 3	Summary of Key Site VOCs – June 2018
Figure 4	Summary of Geochemical Conditions

Table 1
Summary of June 2018 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	5.67	1385.44
A-2	1390.68	4.73	1385.95
A-3	1392.74	7.49	1385.25
A-4	1397.56	5.85	1391.71
A-5	1397.40	4.05	1393.35
A-6	1397.86	3.80	1394.06
A-7	1397.28	5.37	1391.91
A-8	1396.81	2.65	1394.16
A-9	1396.47	3.40	1393.07
A-10	1396.06	1.39	1394.67
A-11	1395.73	7.95	1387.78
A-12	1395.59	11.31	1384.28
A-13	1394.25	17.25	1377.00
A-14	1394.61	6.81	1387.80
A-15	1393.47	10.37	1383.10
A-16	1398.14	11.66	1386.48
A-17	1395.48	10.21	1385.27
B-1	1385.26	8.52	1376.74
B-2	1384.71	7.18	1377.53
B-3	1385.48	4.83	1380.65
B-4	1385.03	4.97	1380.06
B-5	1383.99	7.39	1376.60
B-6	1384.48	6.88	1377.60
B-7	1385.33	5.50	1379.83
B-8	1384.90	2.72	1382.18
B-9	1385.21	10.71	1374.50
B-10	1384.69	4.70	1379.99
B-11	1384.40	6.50	1377.90
B-12	1383.87	5.39	1378.48
B-13	1384.50	6.11	1378.39
BP-1A	1395.67	13.80	1381.87
BP-2A	1396.89	11.51	1385.38
BP-4A	1391.96	12.51	1379.45
BP-5A	1391.09	15.21	1375.88
BP-6A	1393.95	15.31	1378.64
BP-7A	1388.89	14.61	1374.28
BP-8A	1384.53	15.82	1368.71
BP-9A	1379.17	12.70	1366.47
BP-10A	1381.74	14.13	1367.61
BP-11A	1384.80	12.97	1371.83
BP-12A	1386.64	15.15	1371.49

Table 1
Summary of June 2018 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-13A	1398.89	12.92	1385.97
BP-14A	1379.46	29.58	1349.88
BP-15A	1388.32	>16.91	<1371.41
BP-16A	1389.69	13.93	1375.76
BP-17A	1376.30	13.08	1363.22
BP-18A	1386.54	16.15	1370.39
BP-19A	1309.40	21.27	1288.13
BP-20A	1274.60	7.81	1266.79
BP-21A	1244.29	6.05	1238.24
BP-22A	1242.90	5.70	1237.20
BP-23A	1333.39	13.67	1319.72
BP-24A	1338.73	15.77	1322.96
BP-25A	1301.92	4.57	1297.35
BP-26A	1336.96	15.18	1321.78
BP-27A	1299.96	1.81	1298.15
BP-30A	1336.20	13.79	1322.41
BP-31A	1369.63	13.08	1356.55
BP-32A	1389.58	12.13	1377.45
BP-34A	1392.55	12.36	1380.19
BP-35A	1391.75	13.80	1377.95
BP-36A	1383.68	12.79	1370.89
BP-37A	1389.92	9.98	1379.94
BP-38A	1375.10	13.05	1362.05
BP-39A	1370.17	10.20	1359.97
BP-12D Port 1	1388.19	NM	
BP-12D Port 2	1388.19	33.71	1354.48
BP-12D Port 3	1388.19	63.75	1324.44
BP-12D Port 4	1388.19	65.63	1322.56
BP-12D Port 5	1388.19	65.47	1322.72
BP-12D Port 6	1388.19	65.53	1322.66
BP-12D Port 7	1388.19	65.50	1322.69
BP-13D Port 1	1400.09	30.03	1370.06
BP-13D Port 2	1400.09	33.83	1366.26
BP-13D Port 3	1400.09	73.46	1326.63
BP-13D Port 4	1400.09	86.84	1313.25
BP-13D Port 5	1400.09	86.90	1313.19
BP-13D Port 6	1400.09	86.85	1313.24
BP-13D Port 7	1400.09	86.88	1313.21
BP-14D Port 1	1378.07	56.45	1321.62
BP-14D Port 2	1378.07	62.47	1315.60
BP-14D Port 3	1378.07	69.09	1308.98

Table 1
Summary of June 2018 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-14D Port 4	1378.07	69.01	1309.06
BP-14D Port 5	1378.07	69.11	1308.96
BP-14D Port 6	1378.07	69.11	1308.96
BP-15D Port 1	1388.36	Dry	
BP-15D Port 2	1388.36	50.55	1337.81
BP-15D Port 3	1388.36	36.97	1351.39
BP-15D Port 4	1388.36	37.70	1350.66
BP-15D Port 5	1388.36	72.73	1315.63
BP-15D Port 6	1388.36	75.15	1313.21
BP-15D Port 7	1388.36	76.32	1312.04
GC-1 Port 1	1385.22	14.98	1370.24
GC-1 Port 2	1385.22	14.97	1370.25
GC-1 Port 3	1385.22	14.98	1370.24
GC-1 Port 4	1385.22	29.03	1356.19
GC-1 Port 5	1385.22	53.41	1331.81
GC-1 Port 6	1385.22	53.38	1331.84
GC-1 Port 7	1385.22	63.67	1321.55
GC-1 Port 8	1385.22	63.16	1322.06
GC-2A	1383.32	15.33	1367.99
IB-1	1392.20	6.48	1385.72
IB-2	1393.47	7.67	1385.80
IB-3	1393.07	11.60	1381.47
IB-4	1393.78	7.99	1385.79
IB-5	1393.88	10.64	1383.24
IB-6	1393.05	7.30	1385.75
IB-7	1393.23	7.49	1385.74
IB-8	1393.43	11.16	1382.27
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 2018 performance monitoring round on June 11-13, 2018. 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

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	Total Iron	Ferrous Iron	Nitrate	Sufate	Sulfide	Water Quality Parameters
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	x	x	x	x
	BP-2A	Monitoring Well	x				x	x	x	x	x	x	x	x	x	x
	BP-4A	Monitoring Well	x				x	x	x	x	x	x	x	x	x	x
	BP-5A	Monitoring Well	x				x	x	x	x	x	x	x	x	x	x
	BP-6A	Monitoring Well	x				x	x	x	x	x	x	x	x	x	x
	BP-9A	Monitoring Well	x				x	x	x	x	x	x	x	x	x	x
	BP-13A	Monitoring Well	x				x	x	x	x	x	x	x	x	x	x
	BP-31A	Monitoring Well	x				x	x	x	x	x	x	x	x	x	x
	BP-34A	Monitoring Well	x				x	x	x	x	x	x	x	x	x	x
	BP-35A	Monitoring Well	x				x	x	x	x	x	x	x	x	x	x
	BP-36A	Monitoring Well	x				x	x	x	x	x	x	x	x	x	x
	BP-37A	Monitoring Well	x				x	x	x	x	x	x	x	x	x	x
	BP-38A	Monitoring Well	x				x	x	x	x	x	x	x	x	x	x
	BP-39A	Monitoring Well	x				x	x	x	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**	**14**	**14**	**14**	**14**	**14**	**48**

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).

TABLE 3
SUMMARY OF JUNE 2018 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 6/13/2018	BP-2A BP-2A Low Flow S 6/13/2018	BP-4A BP-4A Low Flow S 6/12/2018	BP-5A BP-5A Low Flow S 6/13/2018	BP-6A BP-6A Low Flow S 6/13/2018	BP-7A BP-7A PDB S 6/11/2018	BP-8A BP-8A PDB S 6/11/2018	BP-9A BP-9A Low Flow S 6/12/2018	BP-10A BP-10A PDB S 6/11/2018	BP-11A BP-11A PDB S 6/11/2018	BP-12A BP-12A PDB S 6/11/2018	BP-13A BP-13A Low Flow S 6/13/2018	BP-14A BP-14A PDB S 6/11/2018	BP-16A BP-16A PDB S 6/11/2018	BP-17A BP-17A Low Flow S 6/11/2018	BP-18A BP-18A PDB S 6/11/2018	BP-18A BP-18A_FD PDB FD 6/11/2018	BP-19A BP-19A PDB S 6/11/2018
VOLATILE ORGANIC COMPOUNDS (VOCs)																				
Trichloroethene (TCE)	µg/l	**17**	**120**	**220**	**29**	**52,000**	<0.5	**20**	**810**	**1.9**	**3.4**	**0.40 J**	**81**	**0.30 J**	<0.5	**1.3**	**8.0**	**7.7**	<0.5
Dichloroethene (cis-1,2-)	µg/l	**18**	**6,300**	**67**	**32**	**25,000**	<0.5	**2.9**	**1,800**	**0.70**	<0.5	<0.5	**3.7**	<0.5	<0.5	**0.20 J**	**0.20 J**	**0.10 J**	<0.5
Dichloroethene (trans-1,2-)	µg/l	<2.5	**26**	**4.4**	**0.70 J**	**51 J**	<0.5	<0.5	**8.9 J**	<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	<2.5	**12 J**	**1.00**	<2.5	**72 J**	<0.5	<0.5	**5.9 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	<2.5	<25	<0.5	<2.5	<250	<0.5	<0.5	<10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Vinyl chloride	µg/l	**2.4 J**	**1,400**	**16**	<2.5	**480**	<0.5	<0.5	**200**	<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	**0.83**	**0.49**	**24**	**0.17**	**0.83**	–	–	**20**	–	–	–	**0.058 J**	–	–	–	–	–	–
Ethene	µg/l	**3.5**	**450**	**36**	**0.51**	**25**	–	–	**180**	–	–	–	**0.073 J**	–	–	–	–	–	–
Methane	µg/l	**53**	**1,200**	**3,300**	**3.00**	**55**	–	–	**9,200**	–	–	–	**4.0**	–	–	–	–	–	–
MOLAR CONCENTRATION																				
Trichloroethene (TCE)	µmol/l	0.13	0.91	1.7	0.22	400	ND	0.15	6.2	0.014	0.026	0.0030	0.62	0.0023	ND	0.0099	0.061	0.059	ND
Dichloroethene (cis-1,2-)	µmol/l	0.19	65	0.69	0.33	260	ND	0.030	19	0.0072	ND	ND	0.038	ND	ND	0.0021	0.0021	0.0010	ND
Dichloroethene (trans-1,2-)	µmol/l	ND	0.27	0.045	0.0072	0.53	ND	ND	0.092	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichloroethene (1,1-)	µmol/l	ND	0.12	0.010	ND	0.74	ND	ND	0.061	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene (PCE)	µmol/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl chloride	µmol/l	0.038	22	0.26	ND	7.7	ND	ND	3.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethane	µmol/l	0.028	0.016	0.80	0.0057	0.028	–	–	0.67	–	–	–	0.0019	–	–	–	–	–	–
Ethene	µmol/l	0.12	16	1.3	0.018	0.89	–	–	6.4	–	–	–	0.0026	–	–	–	–	–	–
Total	µmol/l	0.51	100	4.8	0.58	660	ND	0.18	35	0.022	0.026	0.0030	0.66	0.0023	ND	0.012	0.063	0.060	ND
MOLAR PERCENTAGE																				
TCE	%	26	0.91	35	38	61	ND	84	18	67	100	100	94	100	ND	83	97	98	ND
DCEs	%	37	65	16	58	40	ND	16	53	33	ND	ND	5.8	ND	ND	17	3.3	1.7	ND
VC	%	7.6	22	5.4	ND	1.2	ND	ND	9.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethane+Ethene	%	30	16	44	4.1	0.14	–	–	20	–	–	–	0.69	–	–	–	–	–	–
VOLATILE FATTY ACIDS																				
Acetic Acid	mg/l	**0.34 J**	**0.036 J**	**0.032 J**	**0.020 J**	**0.28 J**	–	–	**0.026 J**	–	–	–	**0.031 J**	–	–	–	–	–	–
Butyric Acid	mg/l	<1	<0.1	<0.1	<0.1	<1	–	–	<0.1	–	–	–	<0.1	–	–	–	–	–	–
Hexanoic Acid	mg/l	<2	<0.2	<0.2	<0.2	<2	–	–	<0.2	–	–	–	<0.2	–	–	–	–	–	–
i-Hexanoic Acid	mg/l	<2	<0.2	<0.2	<0.2	<2	–	–	<0.2	–	–	–	<0.2	–	–	–	–	–	–
i-Pentanoic Acid	mg/l	<1	<0.1	<0.1	<0.1	**0.14 J**	–	–	<0.1	–	–	–	<0.1	–	–	–	–	–	–
Lactic Acid	mg/l	<2	<0.2	<0.2	<0.2	<2	–	–	<0.2	–	–	–	<0.2	–	–	–	–	–	–
Pentanoic Acid	mg/l	**0.52 J**	**0.047 J**	**0.046 J**	**0.029 J**	**0.70 J**	–	–	**0.046 J**	–	–	–	**0.043 J**	–	–	–	–	–	–
Propionic Acid	mg/l	**0.088 J**	**0.0065 J**	<0.1	<0.1	<1	–	–	<0.1	–	–	–	<0.1	–	–	–	–	–	–
Pyruvic Acid	mg/l	<1	<0.1	<0.1	**0.016 J**	**8.1**	–	–	<0.1	–	–	–	<0.1	–	–	–	–	–	–
OTHER LABORATORY DATA																				
Carbon Tetrachloride	µg/l	<2.5	<25	<0.5	<2.5	<250	<0.5	**0.10 J**	<10	<0.5	<0.5	<0.5	**2.1**	<0.5	<0.5	<0.5	**0.20 J**	**0.20 J**	<0.5
Total Organic Carbon	mg/l	**19**	**3.5**	**4.2**	**21**	**160**	–	–	**2.0**	–	–	–	**1.1**	–	–	–	–	–	–
WATER QUALITY PROBE DATA																				
Temperature	°C	**13**	**15**	**14**	**13**	**13**	**8.4**	**9.0**	**12**	**8.9**	**9.0**	**9.1**	**12**	**12**	**9.0**	**8.7**	**8.6**	–	**9.0**
Specific Conductance	uS/cm	**2,400**	**840**	**690**	**1,600**	**6,300**	**240**	**190**	**460**	**120**	**130**	**370**	**110**	**190**	**55**	**280**	**200**	–	**96**
pH	s.u.	**7.0**	**6.8**	**7.5**	**6.8**	**6.9**	**6.8**	**6.4**	**7.5**	**6.5**	**5.9**	**6.6**	**5.9**	**6.9**	**5.9**	**7.2**	**6.7**	–	**6.2**
Oxidation/Reduction Potential	mV	**170**	**-110**	**22**	**180**	**-77**	**160**	**16**	**130**	**90**	**210**	**180**	**160**	**190**	**130**	**100**	**21**	–	**190**
Dissolved Oxygen	mg/l	**0.13**	**0.11**	**0.63**	**4.5**	**0.59**	**9.2**	**4.8**	**1.6**	**2.2**	**2.8**	**4.2**	**0.60**	**6.8**	**8.8**	**1.6**	**2.0**	–	**9.1**
Turbidity	NTU	**2.5**	**1.2**	**0.94**	**4.3**	**3.2**	–	–	**3.1**	–	–	–	**3.0**	–	–	–	–	–	–
FIELD CHEMISTRY																				
Iron	mg/l	**0.30 J**	**6.0**	<0.4	<0.4	**2.0**	–	–	<0.4	–	–	–	<0.4	–	–	–	–	–	–
Iron - Ferrous	mg/l	**0.11**	**6.2**	**0.041 J**	**0.071**	**3.2**	–	–	**0.11**	–	–	–	**0.024 J**	–	–	–	–	–	–
Nitrate	mg/l	<0.5	<0.5	<0.5	**0.33 J**	<0.5	–	–	<0.5	–	–	–	<0.5	–	–	–	–	–	–
Sulfate	mg/l	**200**	**48**	**40**	**380**	**1,490**	–	–	**23**	–	–	–	**13**	–	–	–	–	–	–
Sulfide	µg/l	<0.3	**0.30 J**	<0.3	<0.3	<0.3	–	–	<0.3	–	–	–	<0.3	–	–	–	–	–	–

TABLE 3
SUMMARY OF JUNE 2018 PERFORMANCE MONITORING
Summary Trip Report
IBM Gun Club - Former Burn Pit Area
Union, New York

Analyte Name	Unit	BP-20A BP-20A PDB S 6/11/2018	BP-21A BP-21A PDB S 6/11/2018	BP-22A BP-22A PDB S 6/11/2018	BP-23A BP-23A PDB S 6/11/2018	BP-24A BP-24A PDB S 6/11/2018	BP-24A BP-24A_FD PDB FD 6/11/2018	BP-25A BP-25A PDB S 6/11/2018	BP-26A BP-26A PDB S 6/11/2018	BP-27A BP-27A PDB S 6/11/2018	BP-30A BP-30A PDB S 6/11/2018	BP-31A BP-31A Low Flow S 6/12/2018	BP-31A BP-31A_FD Low Flow FD 6/12/2018	BP-32A BP-32A PDB S 6/11/2018	BP-34A BP-34A Low Flow S 6/12/2018	BP-35A BP-35A Low Flow S 6/12/2018	BP-35A BP-35A_FD Low Flow FD 6/12/2018	BP-36A BP-36A Low Flow S 6/12/2018	BP-36A BP-36A_FD Low Flow FD 6/12/2018
VOLATILE ORGANIC COMPOUNDS (VOCs)																			
Trichloroethene (TCE)	µg/l	**2.5**	<0.5	<0.5	**0.60**	**2.1**	**2.0**	**0.60**	**0.70**	**3.6**	**9.0**	**7.5**	**7.4**	**0.60**	**30,000**	**3,600**	**3,500**	**1,400**	**1,600**
Dichloroethene (cis-1,2-)	µg/l	<0.5	<0.5	<0.5	<0.5	**0.90**	**0.90**	<0.5	<0.5	**1.5**	**3.2**	**1.1**	**1.0**	<0.5	**54,000**	**5,400**	**5,200**	**8,200**	**7,600**
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	**130 J**	**13 J**	**11 J**	**68**	**43 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	**110 J**	**7.2 J**	<50	**17 J**	**16 J**
Tetrachloroethene (PCE)	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**0.90**	**0.50**	**0.50**	<0.5	<250	<25	<50	<50	<50
Vinyl chloride	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**820**	<25	<50	**680**	**620**
LIGHT GASSES																			
Ethane	µg/l	–	–	–	–	–	–	–	–	–	–	<0.1	<0.1	–	**18**	**0.11**	**0.12**	**26**	**23**
Ethene	µg/l	–	–	–	–	–	–	–	–	–	–	**0.0060 J**	<0.1	–	**560**	**0.019 J**	**0.019 J**	**410**	**380**
Methane	µg/l	–	–	–	–	–	–	–	–	–	–	**1.0**	**0.78**	–	**4,300**	**0.36 J**	**0.45 J**	**7,200**	**6,200**
MOLAR CONCENTRATION																			
Trichloroethene (TCE)	µmol/l	0.019	ND	ND	0.0046	0.016	0.015	0.0046	0.0053	0.027	0.068	0.057	0.056	0.0046	230	27	27	11	12
Dichloroethene (cis-1,2-)	µmol/l	ND	ND	ND	ND	0.0093	0.0093	ND	ND	0.015	0.033	0.011	0.010	ND	560	56	54	85	78
Dichloroethene (trans-1,2-)	µmol/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.3	0.13	0.11	0.70	0.44
Dichloroethene (1,1-)	µmol/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.1	0.074	ND	0.18	0.17
Tetrachloroethene (PCE)	µmol/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0054	0.0030	0.0030	ND	ND	ND	ND	ND	ND
Vinyl chloride	µmol/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	13	ND	ND	11	9.9
Ethane	µmol/l	–	–	–	–	–	–	–	–	–	–	ND	ND	–	0.60	0.0037	0.0040	0.86	0.76
Ethene	µmol/l	–	–	–	–	–	–	–	–	–	–	0.00021	ND	–	20	0.00068	0.00068	15	14
Total	µmol/l	0.019	ND	ND	0.0046	0.025	0.025	0.0046	0.0053	0.043	0.11	0.072	0.070	0.0046	820	83	80	120	120
MOLAR PERCENTAGE																			
TCE	%	100	ND	ND	100	63	62	100	100	64	64	80	81	100	28	33	33	8.9	10
DCEs	%	ND	ND	ND	ND	37	38	ND	ND	36	31	16	15	ND	69	67	67	71	66
VC	%	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.6	ND	ND	9.1	8.3
Ethane+Ethene	%	–	–	–	–	–	–	–	–	–	–	0.30	ND	–	2.5	0.0052	0.0058	13	12
VOLATILE FATTY ACIDS																			
Acetic Acid	mg/l	–	–	–	–	–	–	–	–	–	–	**0.023 J**	<0.1	–	**0.039 J**	**0.037 J**	**0.036 J**	**18**	**17**
Butyric Acid	mg/l	–	–	–	–	–	–	–	–	–	–	<0.1	<0.1	–	<0.1	<0.1	<0.1	**0.75**	**0.72**
Hexanoic Acid	mg/l	–	–	–	–	–	–	–	–	–	–	<0.2	<0.2	–	<0.2	<0.2	<0.2	**0.12 J**	**0.11 J**
i-Hexanoic Acid	mg/l	–	–	–	–	–	–	–	–	–	–	<0.2	<0.2	–	<0.2	<0.2	<0.2	<0.2	<0.2
i-Pentanoic Acid	mg/l	–	–	–	–	–	–	–	–	–	–	<0.1	<0.1	–	<0.1	<0.1	<0.1	**0.014 J**	**0.013 J**
Lactic Acid	mg/l	–	–	–	–	–	–	–	–	–	–	<0.2	<0.2	–	<0.2	<0.2	<0.2	<0.2	<0.2
Pentanoic Acid	mg/l	–	–	–	–	–	–	–	–	–	–	**0.051 J**	**0.046 J**	–	**0.013 J**	**0.040 J**	**0.035 J**	**0.042 J**	**0.060 J**
Propionic Acid	mg/l	–	–	–	–	–	–	–	–	–	–	<0.1	<0.1	–	<0.1	<0.1	<0.1	**0.11**	**0.091 J**
Pyruvic Acid	mg/l	–	–	–	–	–	–	–	–	–	–	<0.1	<0.1	–	<0.1	<0.1	<0.1	<0.1	<0.1
OTHER LABORATORY DATA																			
Carbon Tetrachloride	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**0.40 J**	**0.20 J**	<0.5	<0.5	<0.5	<0.5	<250	<25	<50	<50	<50
Total Organic Carbon	mg/l	–	–	–	–	–	–	–	–	–	–	**0.64 J**	**0.60 J**	–	**4.4**	**2.0**	**2.1**	**10**	**10**
WATER QUALITY PROBE DATA																			
Temperature	°C	**8.9**	**9.2**	**9.4**	**9.4**	**9.7**	–	**9.5**	**8.7**	**9.4**	**9.7**	**11**	–	**8.5**	**10**	**11**	–	**14**	–
Specific Conductance	uS/cm	**160**	**540**	**770**	**220**	**160**	–	**250**	**220**	**230**	**370**	**320**	–	**110**	**1,200**	**810**	–	**610**	–
pH	s.u.	**5.8**	**7.5**	**7.5**	**7.1**	**6.5**	–	**6.7**	**6.3**	**6.3**	**6.6**	**7.7**	–	**6.1**	**7.1**	**7.1**	–	**7.1**	–
Oxidation/Reduction Potential	mV	**200**	**140**	**130**	**99**	**150**	–	**200**	**180**	**230**	**100**	**140**	–	**160**	**43**	**140**	–	**-160**	–
Dissolved Oxygen	mg/l	**1.8**	**0.98**	**0.22**	**0.89**	**1.1**	–	**0.79**	**7.3**	**1.2**	**0.08**	**7.1**	–	**5.1**	**0.030**	**0.76**	–	**0.64**	–
Turbidity	NTU	–	–	–	–	–	–	–	–	–	–	**2.6**	–	–	**3.9**	**2.7**	–	**4.7**	–
FIELD CHEMISTRY																			
Iron	mg/l	–	–	–	–	–	–	–	–	–	–	<0.4	–	–	**0.13 J**	**0.12 J**	–	**2.7**	–
Iron - Ferrous	mg/l	–	–	–	–	–	–	–	–	–	–	**0.051**	–	–	**0.046 J**	<0.05	–	**3.0**	–
Nitrate	mg/l	–	–	–	–	–	–	–	–	–	–	<0.5	–	–	<0.5	<0.5	–	<0.5	–
Sulfate	mg/l	–	–	–	–	–	–	–	–	–	–	**32**	–	–	**47**	**22**	–	**4.9 J**	–
Sulfide	µg/l	–	–	–	–	–	–	–	–	–	–	<0.3	–	–	<0.3	<0.3	–	**0.42**	–

TABLE 3
SUMMARY OF JUNE 2018 PERFORMANCE MONITORING
Summary Trip Report
IBM Gun Club - Former Burn Pit Area
Union, New York

Analyte Name	Unit	BP-37A BP-37A Low Flow S 6/12/2018	BP-38A BP-38A Low Flow S 6/12/2018	BP-39A BP-39A Low Flow S 6/12/2018	GC-2A GC-2A PDB S 6/11/2018	A-13 A-13 PDB S 6/11/2018	B-4 B-4 PDB S 6/11/2018	B-7 B-7 PDB S 6/11/2018	B-9 B-9 PDB S 6/11/2018	IB-7 IB-7 PDB S 6/11/2018	GC-1 Port 1 GC-1,P1 FLUTe S 6/21/2017	GC-1 Port 8 GC1,P8 FLUTe S 6/21/2017	BP-12D Port 1 BP-12D,P1 FLUTe S 6/13/2018	BP-12D Port 7 BP-12D,P7 FLUTe S 6/13/2018	BP-13D Port 1 BP-13D,P1 FLUTe S 6/13/2018	BP-13D Port 5 BP-13D,P5 FLUTe S 6/13/2018	BP-15D Port 5 BP-15D,P5 FLUTe S 6/13/2018
VOLATILE ORGANIC COMPOUNDS (VOCs)																	
Trichloroethene (TCE)	µg/l	**11**	**46**	**31**	**6.2**	<250	**10**	**180**	**25**	**0.50 J**	**5.9**	**0.20 J**	<0.5	<0.5	**53**	**0.40 J**	<0.5
Dichloroethene (cis-1,2-)	µg/l	**1.4**	**22**	**68**	**0.90**	**24,000**	**35**	**570**	**660**	**8.5**	**26**	**0.80**	<0.5	<0.5	**45**	**1.4**	<0.5
Dichloroethene (trans-1,2-)	µg/l	<0.5	<0.5	**0.40 J**	<0.5	**71 J**	<5.0	**3.0 J**	<10	**0.30 J**	**0.20 J**	**0.20 J**	<0.5	<0.5	**0.20 J**	<0.5	<0.5
Dichloroethene (1,1-)	µg/l	<0.5	<0.5	**0.20 J**	<0.5	<250	<5.0	**1.5 J**	<10	<0.5	<0.5	<0.5	<0.5	<0.5	**0.30 J**	<0.5	<0.5
Tetrachloroethene (PCE)	µg/l	<0.5	<0.5	<0.5	<0.5	<250	<5.0	<5.0	<10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Vinyl chloride	µg/l	<0.5	**0.10 J**	**7.2**	<0.5	**2,400**	**2.4 J**	**63**	**72**	**5.5**	**6.1**	**0.20 J**	<0.5	<0.5	**2.4**	**0.40 J**	<0.5
LIGHT GASSES																	
Ethane	µg/l	**0.027 J**	**0.20**	**0.26**	–	**90**	**7.9**	**67**	**12**	**4.2**	–	–	–	–	–	–	–
Ethene	µg/l	**0.054 J**	**1.9**	**1.0**	–	**2,800**	**12**	**410**	**280**	**16**	–	–	–	–	–	–	–
Methane	µg/l	**39**	**51**	**32**	–	**8,400**	**23,000**	**18,000**	**8,200**	**24,000**	–	–	–	–	–	–	–
MOLAR CONCENTRATION																	
Trichloroethene (TCE)	µmol/l	0.084	0.35	0.24	0.047	ND	0.076	1.4	0.19	0.0038	0.045	0.0015	ND	ND	0.40	0.0030	ND
Dichloroethene (cis-1,2-)	µmol/l	0.014	0.23	0.70	0.0093	250	0.36	5.9	6.8	0.088	0.27	0.0083	ND	ND	0.46	0.014	ND
Dichloroethene (trans-1,2-)	µmol/l	ND	ND	0.0041	ND	0.73	ND	0.031	ND	0.0031	0.0021	0.0021	ND	ND	0.0021	ND	ND
Dichloroethene (1,1-)	µmol/l	ND	ND	0.0021	ND	ND	ND	0.015	ND	ND	ND	ND	ND	ND	0.0031	ND	ND
Tetrachloroethene (PCE)	µmol/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl chloride	µmol/l	ND	0.0016	0.12	ND	38	0.038	1.0	1.2	0.088	0.098	0.0032	ND	ND	0.038	0.0064	ND
Ethane	µmol/l	0.00090	0.0067	0.0086	–	3.0	0.26	2.2	0.40	0.14	–	–	–	–	–	–	–
Ethene	µmol/l	0.0019	0.068	0.036	–	100	0.43	15	10.0	0.57	–	–	–	–	–	–	–
Total	µmol/l	0.10	0.65	1.1	0.056	390	1.2	25	19	0.89	0.41	0.015	ND	ND	0.91	0.024	ND
MOLAR PERCENTAGE																	
TCE	%	83	54	21	84	ND	6.5	5.4	1.0	0.43	11	10	ND	ND	44	13	ND
DCEs	%	14	35	64	16	64	31	24	37	10	65	69	ND	ND	52	60	ND
VC	%	ND	0.25	10	ND	9.8	3.3	4.0	6.2	9.9	24	21	ND	ND	4.2	27	ND
Ethane+Ethene	%	2.8	11	4.0	–	26	59	67	56	80	–	–	–	–	–	–	–
VOLATILE FATTY ACIDS																	
Acetic Acid	mg/l	**0.022 J**	**0.023 J**	**0.032 J**	–	**120**	**260**	**540**	**1,200**	**100**	–	–	–	–	–	–	–
Butyric Acid	mg/l	<0.1	<0.1	<0.1	–	**8.2**	**18**	**320**	**480**	**1.9**	–	–	–	–	–	–	–
Hexanoic Acid	mg/l	<0.2	<0.2	<0.2	–	**1.5**	**39**	**140**	**44**	<2	–	–	–	–	–	–	–
i-Hexanoic Acid	mg/l	<0.2	<0.2	<0.2	–	**0.12 J**	<2	**0.88 J**	<2	<2	–	–	–	–	–	–	–
i-Pentanoic Acid	mg/l	<0.1	<0.1	<0.1	–	**0.71**	**8.3**	**5.8**	**10**	**3.1**	–	–	–	–	–	–	–
Lactic Acid	mg/l	<0.2	<0.2	<0.2	–	<2	<2	<20	**0.67 J**	<2	–	–	–	–	–	–	–
Pentanoic Acid	mg/l	**0.040 J**	**0.038 J**	**0.049 J**	–	**2.0**	**53**	**250**	**710**	**4.0**	–	–	–	–	–	–	–
Propionic Acid	mg/l	<0.1	<0.1	<0.1	–	**10**	**520**	**480**	**2,600**	**180**	–	–	–	–	–	–	–
Pyruvic Acid	mg/l	<0.1	<0.1	<0.1	–	**4.3**	**120**	**36**	**24**	**18**	–	–	–	–	–	–	–
OTHER LABORATORY DATA																	
Carbon Tetrachloride	µg/l	**0.20 J**	**1.3**	<0.5	**1.5**	<250	<5	<5	<10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Organic Carbon	mg/l	**2.0**	**1.4**	**2.0**	–	**74**	**730**	**8,200**	**4,000**	**320**	–	–	–	–	–	–	–
WATER QUALITY PROBE DATA																	
Temperature	°C	**15**	**13**	**11**	**8.1**	–	–	–	–	–	**11**	**12**	**11**	**11**	**11**	**11**	**11**
Specific Conductance	uS/cm	**680**	**240**	**130**	**90**	–	–	–	–	–	**430**	**470**	**450**	**1,200**	**400**	**560**	**730**
pH	s.u.	**7.0**	**6.4**	**6.0**	**6.4**	–	–	–	–	–	**7.2**	**7.4**	**7.8**	**7.7**	**7.7**	**7.7**	**8.1**
Oxidation/Reduction Potential	mV	**120**	**150**	**150**	**120**	–	–	–	–	–	**5.0**	**-68**	**55**	**-53**	**150**	**-130**	**-81**
Dissolved Oxygen	mg/l	**0.18**	**0.45**	**0.33**	**6.2**	–	–	–	–	–	**1.3**	**3.1**	**0.64**	**1.1**	**15**	**1.2**	**0.80**
Turbidity	NTU	**9.2**	**18**	**2.3**	–	–	–	–	–	–	–	–	–	–	–	–	–
FIELD CHEMISTRY																	
Iron	mg/l	**0.11 J**	**0.18 J**	**0.90**	–	–	–	–	–	–	–	–	–	–	–	–	–
Iron - Ferrous	mg/l	**0.071**	**0.037 J**	**0.10**	–	–	–	–	–	–	–	–	–	–	–	–	–
Nitrate	mg/l	<0.5	<0.5	<0.5	–	–	–	–	–	–	–	–	–	–	–	–	–
Sulfate	mg/l	**7.2**	**16**	**12**	–	–	–	–	–	–	–	–	–	–	–	–	–
Sulfide	µg/l	<0.3	<0.3	<0.3	–	–	–	–	–	–	–	–	–	–	–	–	–

TABLE 3
SUMMARY OF JUNE 2018 PERFORMANCE MONITORING
Summary Trip Report
IBM Gun Club - Former Burn Pit Area
Union, New York

Analyte Name	Unit	111	112	113	119	TOTE
		111	112	113	119	TOTE
		Surface Water	Surface Water	Surface Water	Surface Water	Purge Water
		S	S	S	S	S
		6/11/2018	6/11/2018	6/11/2018	6/11/2018	6/13/2018
VOLATILE ORGANIC COMPOUNDS (VOCs)						
Trichloroethene (TCE)	µg/l	**0.80**	**1.3**	**0.90**	**0.30 J**	**70**
Dichloroethene (cis-1,2-)	µg/l	<0.5	<0.5	<0.5	**4.6**	**59**
Dichloroethene (trans-1,2-)	µg/l	<0.5	<0.5	<0.5	**0.10 J**	<2.5
Dichloroethene (1,1-)	µg/l	<0.5	<0.5	<0.5	<0.5	<2.5
Tetrachloroethene (PCE)	µg/l	<0.5	<0.5	<0.5	<0.5	<2.5
Vinyl chloride	µg/l	<0.5	<0.5	<0.5	**0.60**	**2.6**
LIGHT GASSES						
Ethane	µg/l	–	–	–	–	–
Ethene	µg/l	–	–	–	–	–
Methane	µg/l	–	–	–	–	–
MOLAR CONCENTRATION						
Trichloroethene (TCE)	µmol/l	0.0061	0.0099	0.0068	0.0023	0.53
Dichloroethene (cis-1,2-)	µmol/l	ND	ND	ND	0.047	0.61
Dichloroethene (trans-1,2-)	µmol/l	ND	ND	ND	0.0010	ND
Dichloroethene (1,1-)	µmol/l	ND	ND	ND	ND	ND
Tetrachloroethene (PCE)	µmol/l	ND	ND	ND	ND	ND
Vinyl chloride	µmol/l	ND	ND	ND	0.0096	0.042
Ethane	µmol/l	–	–	–	–	–
Ethene	µmol/l	–	–	–	–	–
Total	µmol/l	0.0061	0.0099	0.0068	0.060	1.2
MOLAR PERCENTAGE						
TCE	%	100	100	100	3.8	45
DCEs	%	ND	ND	ND	80	51
VC	%	ND	ND	ND	16	3.5
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						
Carbon Tetrachloride	µg/l	<0.5	<0.5	<0.5	<0.5	<2.5
Total Organic Carbon	mg/l	–	–	–	–	–
WATER QUALITY PROBE DATA						
Temperature	°C	**13**	**13**	**13**	**16**	–
Specific Conductance	uS/cm	**100**	**140**	**230**	**820**	–
pH	s.u.	**6.3**	**6.5**	**6.7**	**6.7**	–
Oxidation/Reduction Potential	mV	**150**	**140**	**150**	**-59**	–
Dissolved Oxygen	mg/l	**7.7**	**5.8**	**6.8**	**1.6**	–
Turbidity	NTU	**>1,000**	**>1,000**	**64**	**210**	–
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 11, 2018 as part of performance monitoring 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 (formerly Microseeps, Inc.) of Pittsburgh, Pennsylvania (Pace). Results 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.
"<" 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 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 Table 2 and the Site Management Plan.

Last Edited By: hpothier

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

Figure 1

Monitoring Location Plan

IBM Gun Club - Former Burn Pit Area

Union, New York

Drawn By:	H. Pothier
Designed By:	E. Bosse
Reviewed By:	D. Shea
Project No:	3526.05
Date:	August 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 report text for further discussion.

Legend

- Parcel B Site Boundary
- Injection Borehole
- Observed Drainage Features (arrows indicate flow direction)
- Monitoring Well
- Multi-Level Monitoring Installation
- Surface Water Sampling Point
- Culvert

100 50 0 100 200 Feet

SANBORN HEAD

Figure 2

Summary of June 2018 Groundwater Quality Conditions

IBM Gun Club - Former Burn Pit Area

Union, New York

Drawn By:	H. Pothier
Designed By:	E. Bosse
Reviewed By:	D. Shea
Project No:	3526.05
Date:	August 2018

Figure Narrative

This figure shows groundwater quality data and inference based on monitoring conducted June 11-12, 2018.

The groundwater data for site key VOCs including TCE, cDCE, vinyl chloride, and ethane/ethene 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 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, 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
30,000 Well Name and June 2018 TCE Concentrations in Groundwater (µg/L).

- Inferred Groundwater Contour June 2018
- Inferred Methanogenic Conditions
- Inferred Sulfate-Reducing Conditions
- 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

Figure 3

Groundwater Quality Conditions for Key Site VOCs - June 2018

IBM Gun Club - Former Burn Pit Area

Union, New York

Drawn By:	H. Pothier
Designed By:	E. Bosse
Reviewed By:	D. Shea
Project No:	3526.05
Date:	August 2018

Figure Narrative

This figure depicts groundwater data for key site VOCs from monitoring of water table wells in June 2018.

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 30,000 — Well Name and June 2018 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
- 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

SANBORN HEAD ENGINEERING

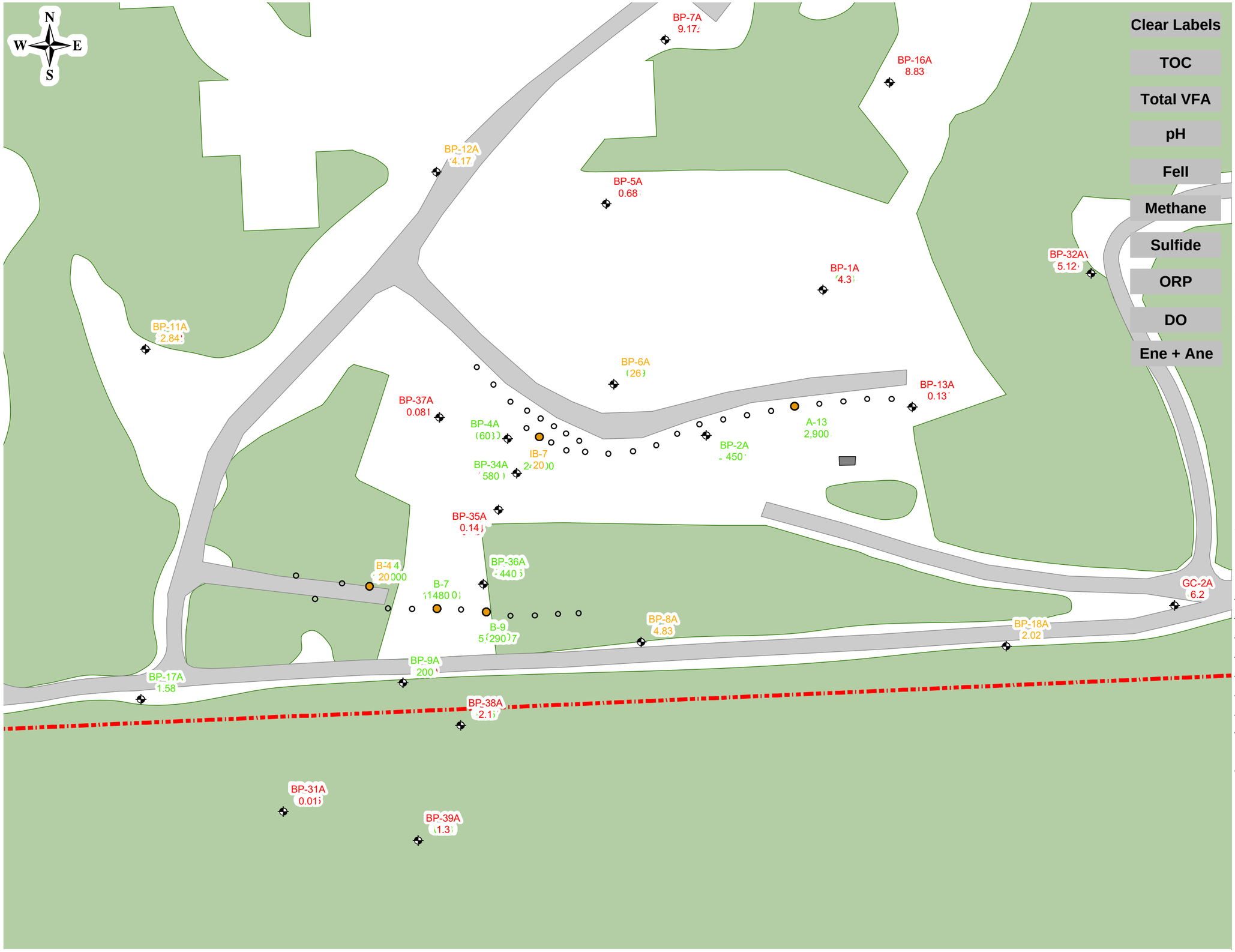


Figure 4

June 2018 Assessment of Reducing Conditions

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

Drawn By:	H. Pothier
Designed By:	E. Bosse
Reviewed By:	D. Shea
Project No:	3526.05
Date:	August 2018

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 2018 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

SEPTEMBER 2018 PERFORMANCE TESTING

SANBORN HEAD ENGINEERING

8976 Wellington Road
Manassas, VA 20109

November 26, 2018

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

Re: Summary of September 2018 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 September 2018 Water Quality Monitoring report. The remedy performance monitoring work and the preparation of this report were completed on behalf of IBM Corporation 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 September 2018 Water Quality Monitoring

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

SUMMARY OF SEPTEMBER 2018 WATER QUALITY MONITORING

IBM Gun Club – Former Burn Pit Area
Union, New York
NYSDEC Site No. C704044

INTRODUCTION

This report summarizes the scope and results of remedy performance monitoring conducted in September 2018. It describes the sampling event and provides tabular and graphical summaries of the field and laboratory data. The field work was conducted during the week of September 24, 2018 in general accordance with the scope and procedures described in Appendix J of the Site Management Plan (SMP)[1].

This report will be included as a component of the annual Periodic Review Report, due in January 2019, and has been prepared consistent with the Monitoring Reporting Requirements described in Section 3.6 of the SMP. Sanborn Head field staff for this monitoring event were Dallin Jensen and Matthew Stein.

SCOPE OF WORK

The scope of work included:

- Limited groundwater elevation survey. The monitoring network is shown on Figure 1;
- Water quality sampling and laboratory analysis associated with the performance monitoring program; and
- Water quality parameter field screening.

Groundwater Elevation Survey

From September 24 to 26, 2018, the depths to water in monitoring wells and injection boreholes were gauged in accordance with procedures described in Appendix G of the SMP. Based on the depth to water data and survey information, groundwater elevations were calculated for each location. Groundwater levels were several feet higher in September than observed during June 2018 monitoring, likely due to above-average rainfall during the summer months. According to the National Weather Service, the Binghamton area recorded rainfall of 2.5 inches, 5.5 inches, and 5.2 inches above average in July, August, and September 2018, respectively. Depth to water measurements and groundwater elevations are summarized on Table 1. Inferred groundwater elevation contours are shown on Figure 2.

[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 Quality Sampling

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

- Samples were collected for laboratory geochemical analysis instead of in-situ field geochemical testing to improve efficiency;
- The seep sampling location 119 noted adjacent to BP-9A during the October 2017 sampling round was sampled this round;
- The annual site-wide inspection was conducted on September 18, 2018. The results of the inspection will be reported under separate cover.

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 3.

Exhibit 1 Summary of Sampling Methods

Sample Method	Number of Locations Sampled
Modified Low-Flow	14
Submerged Container (surface water)	5
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 Sample Locations	25
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	35
Total Organic Carbon	Eurofins	21
Geochemical Analyses	Eurofins	14
Volatile Fatty Acids	Pace	21
Light Gases (Ethane, Ethene, and Methane)	Pace	21

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

SUMMARY OF RESULTS

Geochemical and VOC Results

A summary of the groundwater quality data and inferences is presented on Figure 2. Figure 3 is an interactive PDF presenting the geochemical data used to infer the geochemical conditions shown on Figure 2. Field sampling records and analytical laboratory reports are kept on file and available upon request.

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.

The field and laboratory data for September 2018 reflect conditions approximately 13 months after the August 2017 injection of edible oil amendment. The results indicate remedy performance generally consistent with project performance goals established in the SMP, with some indications of potential changes noted below. Geochemical conditions generally remain within ranges that are favorable for reductive dehalogenation over most of the primary source area; however, there is some suggestion that the most recent injection did not have as strong or sustained effects as previous injections, as further described below. As shown on Figure 2, the overall area of sulfate-reducing conditions, which are marginally conducive to reductive dehalogenation, and the overall area of methanogenic conditions, which are more conducive to reductive dehalogenation, are slightly decreased compared to previous monitoring in June 2018. Figure 3 (the interactive PDF) presents the geochemical data used to infer the limits of sulfate-reduction and methanogenesis shown on Figure 2.

Depicted below in Exhibit 5 are the September 2018 monitoring results for select key parameters in comparison to the previous monitoring results of June 2018. TCE and terminal breakdown product (ethene and ethane) concentrations have exhibited a favorable change or remained stable in 53% and 63% of sampled wells, respectively. By comparison, 47% of wells exhibited favorable changes or stability for both TCE and terminal breakdown products in June 2018.

Exhibit 5: September 2018 Results Compared to June2018

Analyte	TCE	Ethene+Ethane	TOC	ORP	DO
	ug/L	ug/L	mg/L	mV	mg/L
Injection Boreholes					
IB-7	0.40	3.2	210		
A-13	<100	2,700	62		
B-4	12	24	690		
B-7	110	340	<5,000		
B-9	35	320	3,900		
Injection Displacement Zone					
BP-2A	22	36	4.4	-65	0.94
BP-4A	240	75	4.0	-40	0.46
BP-13A	46	0.056	3.5	170	2.0
BP-36A	2,500	540	7.5	-210	0.47
Downgradient - on site					
B-1A	97	14	16	12	0.89
BP-5A	33	0.082	22	110	4.9
BP-6A	6,000	170	250	-120	0.47
BP-9A	950	310	2.3	12	0.74
BP-34A	25,000	220	4.9	49	0.63
BP-35A	3,900	0.73	2.3	150	7.4
BP-37A	12	0.078	3.0	190	1.4
Downgradient - off site					
BP-31A	40	0.0056	1.5	130	4.3
BP-38A	230	9.7	2.4	200	3.8
BP-39A	41	1.0	2.3	180	1.2

Favorable Change	≥ 10% decline	≥ 10% increase	≥ 10% increase	≥ 10% decline	≥ 10% decline
Number of Wells	6	8	9	7	5
Stable	0 to ± 10%	0 to ± 10%	0 to ± 10%	0 to ± 10%	0 to ± 10%
Number of Wells	4	4	5	2	1
Unfavorable Change	≥ 10% increase	≥ 10% decline	≥ 10% decline	≥ 10% increase	≥ 10% increase
Number of Wells	9	7	5	5	8

Concentrations shown from September 2018 sampling event, rounded to 2 sig. figures.
Blank cell indicates lack of data in one or both events.

Exhibit 5 also lists results for total organic carbon (TOC) and geochemical data for oxidation-reduction potential (ORP) and dissolved oxygen (DO). The data indicate that 9 wells show a favorable or stable ORP change, compared to 7 wells in June. Six wells show a favorable or stable DO change, compared to 10 wells in June. TOC concentrations greater than the 100 milligrams per liter (mg/L) threshold to support biological degradation were measured at 3

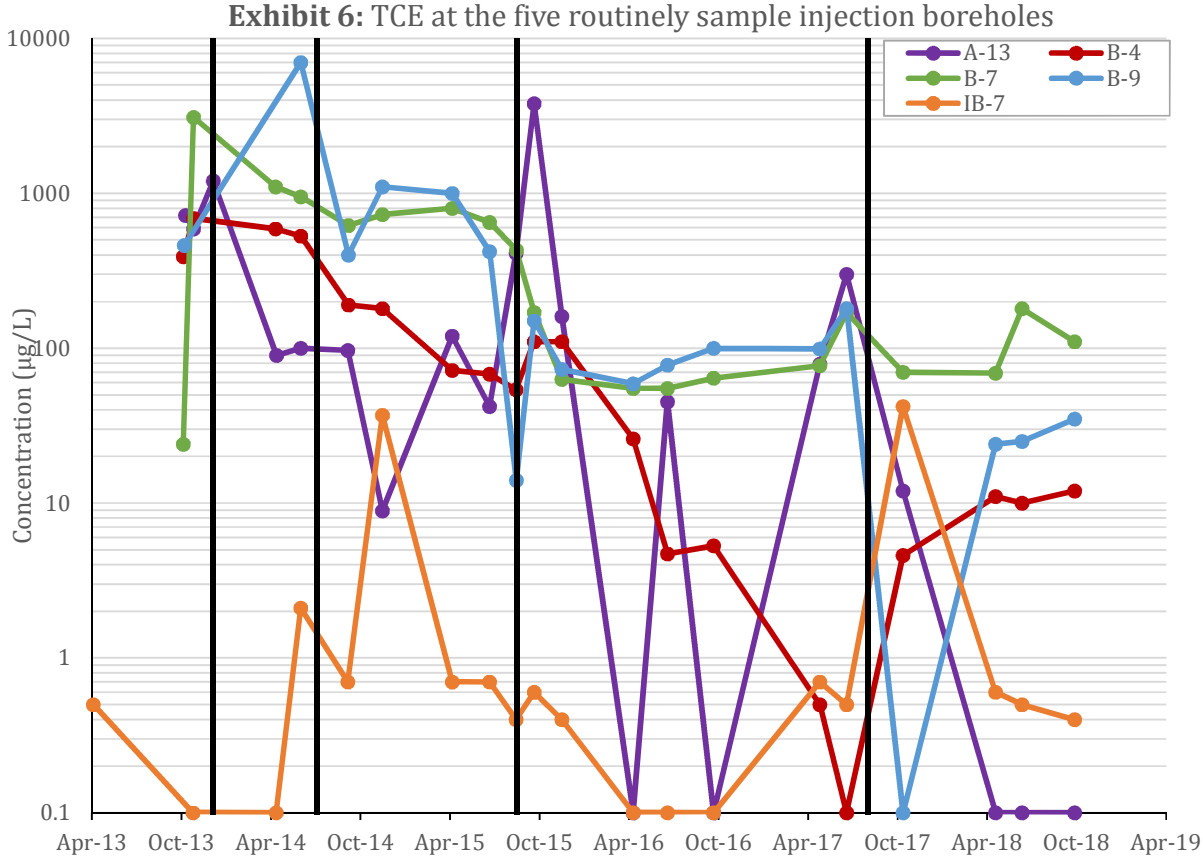
of the 5 sampled injection boreholes, and the elevated reporting limit at well B-7 may be masking TOC presence greater than 100 mg/L. While TOC levels at monitoring wells within the injection displacement zone and further downgradient were much lower than those at the injection boreholes, 9 of the 19 wells showed an increase in TOC level which could indicate further downgradient dispersal of the amendment. Consistent with historical monitoring, the highest TOC concentration observed in wells other than injection wells was at BP-6A, where TOC was reported at 250 mg/L.

The average groundwater temperature increased from 11°C in June 2018 to 15.2°C in September. Groundwater temperature above 10°C is thought to be most conducive to microbial activity.

Overall, the VOC and geochemical data continue to indicate a muted response to the injection of edible oil amendment in August 2017, which has been generally less impactful than previous injection events. As noted in previous reports, emplacement of the oil emulsion into the fractures has possibly reduced the effective water permeability and contact with VOC-containing groundwater. We will assess the possibility of redeveloping the injection wells in 2019.

Exhibit 6 below shows the TCE concentrations for the five injection boreholes that are routinely sampled. Most of these injection boreholes continue to exhibit overall order of magnitude or greater decreases in TCE concentrations compared to historical high concentrations; however, since the August 2017 injection, the TCE concentrations trends have been variable.

Exhibit 6: TCE at the five routinely sample injection boreholes



Note: Non-detects are plotted as 0.1 µg/L. The vertical black lines indicate amendment injections conducted in December 2013, July 2014, August 2015, and August 2017.

The June 2018 report noted a possible indication of an increasing trend of vinyl chloride at BP-39A based on the detection of 7.2 µg/L, which exceeded the New York State Department of Environmental Conservation Class GA Groundwater quality standard of 2 µg/L. In September, vinyl chloride was detected at 0.2 µg/L. Also, at BP-39A, terminal breakdown products ethene and ethane were detected at historically high combined concentrations of 1.3 µg/L in June and 0.98 µg/L in September. This result continues to suggest that biodegradation has not stalled at vinyl chloride.

The June 2018 report also noted historical high concentrations of vinyl chloride at 820 µg/L in BP-34A and 680 µg/L at BP-36A, wells located between the A-line and B-line injection boreholes. In September vinyl chloride detections were 650 µg/L at BP-34A and 1,200 µg/L at BP-36A. An historical high concentration of vinyl chloride was also observed at BP-6A in September at 2,800 µg/L. While there is evidence of more production of vinyl chloride associated with TCE breakdown near the injection boreholes, this does not appear to be driving greater mass flux across the property line based on monitoring results from BP-38A and BP-39A.

The next performance monitoring event will be conducted in April 2019.

Attachments:

Table 1 Summary of Water Level Data
Table 2 Scope of Performance Monitoring
Table 3 Summary of September 2018 Performance Monitoring
Figure 1 Monitoring Location Plan
Figure 2 Summary of September 2018 Groundwater Quality Conditions
Figure 3 Summary of Geochemical Conditions

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Table 1
Summary of September 2018 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	4.41	1386.70
A-2	1390.68	4.06	1386.62
A-3	1392.74	8.58	1384.16
A-4	1397.56	7.03	1390.53
A-5	1397.40	4.88	1392.52
A-6	1397.86	4.74	1393.12
A-7	1397.28	6.98	1390.30
A-8	1396.81	3.18	1393.63
A-9	1396.47	4.08	1392.39
A-10	1396.06	1.66	1394.40
A-11	1395.73	8.38	1387.35
A-12	1395.59	11.55	1384.04
A-13	1394.25	16.99	1377.26
A-14	1394.61	7.55	1387.06
A-15	1393.47	10.99	1382.48
A-16	1398.14	11.48	1386.66
A-17	1395.48	10.57	1384.91
B-1	1385.26	6.48	1378.78
B-2	1384.71	5.96	1378.75
B-3	1385.48	7.05	1378.43
B-4	1385.03	5.59	1379.44
B-5	1383.99	7.87	1376.12
B-6	1384.48	8.13	1376.35
B-7	1385.33	6.33	1379.00
B-8	1384.90	3.73	1381.17
B-9	1385.21	11.40	1373.81
B-10	1384.69	5.33	1379.36
B-11	1384.40	6.84	1377.56
B-12	1383.87	6.51	1377.36
B-13	1384.50	2.97	1381.53
BP-1A	1395.67	11.96	1383.71
BP-2A	1396.89	9.58	1387.31
BP-4A	1391.96	11.50	1380.46
BP-5A	1391.09	13.88	1377.21
BP-6A	1393.95	15.42	1378.53
BP-7A	1388.89	9.47	1379.42
BP-8A	1384.53	8.21	1376.32
BP-9A	1379.17	9.95	1369.22
BP-10A	1381.74	11.15	1370.59
BP-11A	1384.80	12.18	1372.62
BP-12A	1386.64	12.09	1374.55
BP-13A	1398.89	9.06	1389.83
BP-14A	1379.46	26.42	1353.04
BP-15A	1388.32	15.96	1372.36
BP-16A	1389.69	10.09	1379.60
BP-17A	1376.30	9.52	1366.78

Table 1
Summary of September 2018 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-18A	1386.54	13.42	1373.12
BP-19A	1309.40	19.38	1290.02
BP-20A	1274.60	6.05	1268.55
BP-21A	1244.29	7.03	1237.26
BP-22A	1242.90	5.70	1237.20
BP-23A	1333.39	10.56	1322.83
BP-24A	1338.73	10.65	1328.08
BP-25A	1301.92	3.70	1298.22
BP-26A	1336.96	8.53	1328.43
BP-27A	1299.96	2.11	1297.85
BP-30A	1336.20	9.06	1327.14
BP-31A	1369.63	9.82	1359.81
BP-32A	1389.58	7.45	1382.13
BP-34A	1392.55	11.32	1381.23
BP-35A	1391.75	14.47	1377.28
BP-36A	1383.68	10.71	1372.97
BP-37A	1389.92	8.68	1381.24
BP-38A	1375.10	8.23	1366.87
BP-39A	1370.17	5.43	1364.74
GC-2A	1383.32	11.47	1371.85
IB-1	1392.20	5.33	1386.87
IB-2	1393.47	6.51	1386.96
IB-3	1393.07	11.63	1381.44
IB-4	1393.78	6.82	1386.96
IB-5	1393.88	11.28	1382.60
IB-6	1393.05	6.18	1386.87
IB-7	1393.23	6.35	1386.88
IB-8	1393.43	10.46	1382.97
IB-9	1393.62	6.73	1386.89

Notes:

1. This table summarizes depth to water measurements and calculated water table elevations recorded during the September 2018 performance monitoring round on September 24-26, 2018. 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	Total Iron	Ferrous Iron	Nitrate	Sufate	Sulfide	Water Quality Parameters
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	x	x	x	x
	BP-2A	Monitoring Well	x				x	x	x	x	x	x	x	x	x	x
	BP-4A	Monitoring Well	x				x	x	x	x	x	x	x	x	x	x
	BP-5A	Monitoring Well	x				x	x	x	x	x	x	x	x	x	x
	BP-6A	Monitoring Well	x				x	x	x	x	x	x	x	x	x	x
	BP-9A	Monitoring Well	x				x	x	x	x	x	x	x	x	x	x
	BP-13A	Monitoring Well	x				x	x	x	x	x	x	x	x	x	x
	BP-31A	Monitoring Well	x				x	x	x	x	x	x	x	x	x	x
	BP-34A	Monitoring Well	x				x	x	x	x	x	x	x	x	x	x
	BP-35A	Monitoring Well	x				x	x	x	x	x	x	x	x	x	x
	BP-36A	Monitoring Well	x				x	x	x	x	x	x	x	x	x	x
	BP-37A	Monitoring Well	x				x	x	x	x	x	x	x	x	x	x
	BP-38A	Monitoring Well	x				x	x	x	x	x	x	x	x	x	x
	BP-39A	Monitoring Well	x				x	x	x	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**	**14**	**14**	**14**	**14**	**14**	**48**

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).

TABLE 3
SUMMARY OF SEPTEMBER 2018 PERFORMANCE MONITORING
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-34A	BP-35A	BP-36A	BP-36A	BP-37A	BP-38A	BP-39A	A-13	B-4
		BP-1A	BP-2A	BP-4A	BP-4A_FD	BP-5A	BP-6A	BP-9A	BP-13A	BP-31A	BP-34A	BP-35A	BP-36A	BP-36A_FD	BP-37A	BP-38A	BP-39A	A-13	B-4
		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	Low Flow	Low Flow	Low Flow	PDB	PDB
		S	S	S	FD	S	S	S	S	S	S	S	S	FD	S	S	S	S	S
		9/26/2018	9/26/2018	9/26/2018	9/26/2018	9/26/2018	9/26/2018	9/25/2018	9/26/2018	9/25/2018	9/26/2018	9/25/2018	9/25/2018	9/25/2018	9/25/2018	9/25/2018	9/25/2018	9/26/2018	9/26/2018
VOLATILE ORGANIC COMPOUNDS (VOCs)																			
Trichloroethene (TCE)	µg/l	**97**	**22**	**240**	**240**	**33**	**6,000**	**950**	**46**	**40**	**25,000**	**3,900**	**2,500**	**2,400**	**12**	**230**	**41**	<100	**12**
Dichloroethene (cis-1,2-)	µg/l	**180**	**620**	**110**	**110**	**47**	**47,000**	**2,200**	**1.4**	**23**	**36,000**	**6,500**	**9,900**	**9,600**	**1.6**	**59**	**45**	**9,800**	**39**
Dichloroethene (trans-1,2-)	µg/l	**2.1 J**	**4.1**	**1.3**	**1.5**	**0.70 J**	**52 J**	**9.0 J**	<0.5	**0.080 J**	**58 J**	**6.4 J**	**21 J**	**21 J**	<0.5	**0.50 J**	**0.20 J**	**30 J**	**0.90 J**
Dichloroethene (1,1-)	µg/l	**0.80 J**	**0.70 J**	**1.0 J**	**0.90 J**	<2.5	**85 J**	**7.8 J**	**0.070 J**	<0.5	**73 J**	**8.1 J**	**23 J**	**23 J**	<0.5	**0.20 J**	**0.080 J**	**12 J**	<5
Tetrachloroethene (PCE)	µg/l	<2.5	<2.5	**0.10 J**	<1	<2.5	<250	<10	<0.5	**3.6**	<250	<25	<50	<50	<0.5	**0.20 J**	**0.060 J**	<100	<5
Vinyl chloride	µg/l	**25**	**120**	**18**	**17**	<2.5	**2,800**	**310**	<0.5	<0.5	**650**	<25	**1,200**	**1,300**	<0.5	**1.6**	**0.20 J**	**1,500**	**2.6 J**
LIGHT GASSES																			
Ethane	µg/l	**4.1**	**1.1**	**41**	**36**	**0.045 J**	**0.73**	**48**	**0.018 J**	<0.1	**9.9**	**0.17**	**20**	**19**	**0.036 J**	**4.1**	**0.42**	**96**	**13**
Ethene	µg/l	**9.4**	**35**	**34**	**31**	**0.037 J**	**170**	**260**	**0.038 J**	**0.0056 J**	**210**	**0.56**	**520**	**510**	**0.042 J**	**5.6**	**0.56**	**2,600**	**11**
Methane	µg/l	**200**	**3,600**	**4,300**	**3,700**	**0.40 J**	**31**	**14,000**	**1.0**	**0.16 J**	**2,400**	**22**	**5,900**	**5,900**	**11**	**390**	**4.4**	**7,800**	**19,000**
MOLAR CONCENTRATION																			
Trichloroethene (TCE)	µmol/l	0.74	0.17	1.8	1.8	0.25	46	7.2	0.35	0.30	190	30	19	18	0.091	1.8	0.31	ND	0.091
Dichloroethene (cis-1,2-)	µmol/l	1.9	6.4	1.1	1.1	0.48	480	23	0.014	0.24	370	67	100	99	0.017	0.61	0.46	100	0.40
Dichloroethene (trans-1,2-)	µmol/l	0.022	0.042	0.013	0.015	0.0072	0.54	0.093	ND	0.00083	0.60	0.066	0.22	0.22	ND	0.0052	0.0021	0.31	0.0093
Dichloroethene (1,1-)	µmol/l	0.0083	0.0072	0.010	0.0093	ND	0.88	0.080	0.00072	ND	0.75	0.084	0.24	0.24	ND	0.0021	0.00083	0.12	ND
Tetrachloroethene (PCE)	µmol/l	ND	ND	0.00060	ND	ND	ND	ND	ND	0.022	ND	ND	ND	ND	ND	0.0012	0.00036	ND	ND
Vinyl chloride	µmol/l	0.40	1.9	0.29	0.27	ND	45	5.0	ND	ND	10	ND	19	21	ND	0.026	0.0032	24	0.042
Ethane	µmol/l	0.14	0.037	1.4	1.2	0.0015	0.024	1.6	0.00060	ND	0.33	0.0057	0.67	0.63	0.0012	0.14	0.014	3.2	0.43
Ethene	µmol/l	0.34	1.2	1.2	1.1	0.0013	6.1	9.3	0.0014	0.00020	7.5	0.020	19	18	0.0015	0.20	0.020	93	0.39
Total	µmol/l	3.5	9.8	5.8	5.6	0.75	580	46	0.37	0.56	580	97	160	160	0.11	2.7	0.82	220	1.4
MOLAR PERCENTAGE																			
TCE	%	21	1.7	31	33	34	7.9	16	95	54	33	31	12	11	83	64	38	ND	6.7
DCEs	%	54	66	20	21	66	83	50	4.1	42	64	69	63	62	15	23	57	46	30
VC	%	11	20	4.9	4.9	ND	7.7	11	ND	ND	1.8	ND	12	13	ND	0.94	0.39	11	3.0
Ethane+Ethene	%	13	13	44	41	0.38	1.0	24	0.53	0.035	1.3	0.026	12	12	2.4	12	4.2	44	60
VOLATILE FATTY ACIDS																			
Acetic Acid	mg/l	**0.22**	**0.15**	**0.14**	**0.085 J**	<0.1	**0.38 J**	**0.046 J**	**0.10**	**0.046 J**	**0.11**	**0.036 J**	**10**	**10**	**0.040 J**	**0.036 J**	<0.1	**83**	**59**
Butyric Acid	mg/l	**0.054 J**	**0.038 J**	**0.035 J**	**0.017 J**	<0.1	<1	**0.018 J**	<0.1	<0.1	<0.1	<0.1	**0.31**	**0.31**	<0.1	<0.1	<0.1	**5.7**	**21**
Hexanoic Acid	mg/l	<0.2	<0.2	<0.2	<0.2	<0.2	<2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	**1.1 J**	**63**
i-Hexanoic Acid	mg/l	<0.2	<0.2	<0.2	<0.2	<0.2	<2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<2	<2
i-Pentanoic Acid	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<0.1	<0.1	<0.1	<0.1	<0.1	**0.015 J**	**0.014 J**	<0.1	<0.1	<0.1	**0.76 J**	**9.1**
Lactic Acid	mg/l	<0.2	<0.2	<0.2	<0.2	**0.042 J**	**0.40 J**	**0.017 J**	**0.030 J**	**0.029 J**	**0.076 J**	<0.2	**0.017 J**	<0.2	**0.026 J**	**0.030 J**	**0.064 J**	<2	<2
Pentanoic Acid	mg/l	**0.33**	<0.1	**0.036 J**	**0.042 J**	<0.1	**0.56 J**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**1.0 J**	**48**
Propionic Acid	mg/l	**0.11**	**0.091 J**	**0.077 J**	**0.065 J**	<0.1	<1	<0.1	**0.0094 J**	<0.1	<0.1	<0.1	**0.047 J**	**0.069 J**	<0.1	<0.1	<0.1	**7.7**	**280**
Pyruvic Acid	mg/l	<0.1	<0.1	<0.1	<0.1	**0.029 J**	<1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	<1
OTHER LABORATORY DATA																			
Carbon Tetrachloride	µg/l	<2.5	<2.5	<1	<1	<2.5	<250	<10	**1.1**	**0.40 J**	<250	<25	<50	<50	**0.10 J**	**1.7**	**0.10 J**	<100	<5
Total Organic Carbon	mg/l	**16**	**4.4**	**4.0**	**4.0**	**22**	**250**	**2.3**	**3.5**	**1.5**	**4.9**	**2.3**	**7.3**	**7.5**	**3.0**	**2.4**	**2.3**	**62**	**690**
WATER QUALITY PROBE DATA																			
Temperature	°C	**18**	**17**	**17**	**–**	**17**	**17**	**13**	**17**	**13**	**16**	**14**	**14**	**–**	**16**	**13**	**14**	**–**	**–**
Specific Conductance	uS/cm	**2,600**	**1,000**	**790**	**–**	**1,900**	**11,000**	**560**	**56**	**280**	**1,300**	**770**	**740**	**–**	**820**	**240**	**140**	**–**	**–**
pH	s.u.	**7.0**	**6.8**	**7.4**	**–**	**6.8**	**6.8**	**7.4**	**5.4**	**6.6**	**7.1**	**7.2**	**7.2**	**–**	**6.6**	**5.7**	**5.8**	**–**	**–**
Oxidation/Reduction Potential	mV	**12**	**-65**	**-40**	**–**	**110**	**-120**	**12**	**170**	**130**	**49**	**150**	**-210**	**–**	**190**	**200**	**180**	**–**	**–**
Dissolved Oxygen	mg/l	**0.89**	**0.94**	**0.46**	**–**	**4.9**	**0.47**	**0.74**	**2.0**	**4.3**	**0.63**	**7.4**	**0.47**	**–**	**1.4**	**3.8**	**1.2**	**–**	**–**
Turbidity	NTU	**2.0**	**1.5**	**0.30**	**–**	**3.2**	**3.9**	**3.0**	**6.3**	**4.2**	**3.2**	**2.7**	**2.2**	**–**	**3.2**	**33**	**5.8**	**–**	**–**
GEOCHEMISTRY																			
Iron	mg/l	**0.49**	**14**	<0.2	**–**	**0.076 J**	**8.7**	**0.066 J**	**0.29**	**0.086 J**	**0.11 J**	**0.079 J**	**1.0**	**–**	**0.053 J**	**0.84**	**0.32**	**–**	**–**
Iron - Ferrous	mg/l	**0.21**	**13**	**0.095 J**	**–**	**0.045 J**	**8.4**	**0.074 J**	**0.081 J**	<0.1	**0.057 J**	<0.1	**1.2**	**–**	**0.021 J**	**0.19**	**0.087 J**	**–**	**–**
Nitrate	mg/l	<0.5	<0.5	<0.5	**–**	<0.5	**0.42 J**	<0.5	<0.5	<0.5	<0.5	**1.0**	<0.5	**–**	<0.5	<0.5	<0.5	**–**	**–**
Sulfate	mg/l	**190**	**7.8**	**27**	**–**	**1,800**	**300**	**20**	**6.9**	**16**	**37**	**21**	**4.1 J**	**–**	**6.9**	**15**	**8.8**	**–**	**–**
Sulfide	µg/l	<0.3	**0.38**	<0.3	**–**	<0.3	**0.32**	<0.3	<0.3	<0.3	<0.3	<0.3	**1.7**	**–**	<0.3	<0.3	<0.3	**–**	**–**

TABLE 3
SUMMARY OF SEPTEMBER 2018 PERFORMANCE MONITORING
Summary Trip Report
IBM Gun Club - Former Burn Pit Area
Union, New York

Analyte Name	Unit	B-7	B-9	IB-7	111	112	113	118	119	TOTE
		B-7	B-9	IB-7	111	112	113	118	119	TOTE
		PDB	PDB	PDB	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Purge Water
		S	S	S	S	S	S	S	S	S
		9/26/2018	9/26/2018	9/26/2018	9/24/2018	9/24/2018	9/24/2018	9/24/2018	9/24/2018	9/26/2018
VOLATILE ORGANIC COMPOUNDS (VOCs)										
Trichloroethene (TCE)	µg/l	**110**	**35**	**0.40 J**	**0.60**	**0.30 J**	**0.20 J**	**2.6**	**0.20 J**	<0.5
Dichloroethene (cis-1,2-)	µg/l	**520**	**900**	**2.8**	<0.5	<0.5	<0.5	**2.2**	**1.1**	<0.5
Dichloroethene (trans-1,2-)	µg/l	**2.5 J**	**2.4 J**	**0.20 J**	<0.5	<0.5	<0.5	<0.5	**0.10 J**	<0.5
Dichloroethene (1,1-)	µg/l	**1.2 J**	<10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Tetrachloroethene (PCE)	µg/l	<5	<10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Vinyl chloride	µg/l	**62**	**100**	**0.90**	<0.5	<0.5	<0.5	<0.5	**0.40 J**	<0.5
LIGHT GASSES										
Ethane	µg/l	**63**	**11**	**1.7**	–	–	–	–	–	–
Ethene	µg/l	**280**	**310**	**1.5**	–	–	–	–	–	–
Methane	µg/l	**13,000**	**7,700**	**23,000**	–	–	–	–	–	–
MOLAR CONCENTRATION										
Trichloroethene (TCE)	µmol/l	0.84	0.27	0.0030	0.0046	0.0023	0.0015	0.020	0.0015	ND
Dichloroethene (cis-1,2-)	µmol/l	5.4	9.3	0.029	ND	ND	ND	0.023	0.011	ND
Dichloroethene (trans-1,2-)	µmol/l	0.026	0.025	0.0021	ND	ND	ND	ND	0.0010	ND
Dichloroethene (1,1-)	µmol/l	0.012	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene (PCE)	µmol/l	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl chloride	µmol/l	1.0	1.6	0.014	ND	ND	ND	ND	0.0064	ND
Ethane	µmol/l	2.1	0.37	0.057	–	–	–	–	–	–
Ethene	µmol/l	10.0	11	0.053	–	–	–	–	–	–
Total	µmol/l	19	23	0.16	0.0046	0.0023	0.0015	0.042	0.020	ND
MOLAR PERCENTAGE										
TCE	%	4.3	1.2	1.9	100	100	100	47	7.5	ND
DCEs	%	28	41	20	ND	ND	ND	53	61	ND
VC	%	5.1	7.1	9.1	ND	ND	ND	ND	32	ND
Ethane+Ethene	%	63	51	69	–	–	–	–	–	–
VOLATILE FATTY ACIDS										
Acetic Acid	mg/l	**620**	**1,100**	**170**	–	–	–	–	–	–
Butyric Acid	mg/l	**330**	**400**	**5.0**	–	–	–	–	–	–
Hexanoic Acid	mg/l	**160**	**43**	**0.50**	–	–	–	–	–	–
i-Hexanoic Acid	mg/l	**0.38 J**	<20	**0.35**	–	–	–	–	–	–
i-Pentanoic Acid	mg/l	**7.5**	**11**	**2.5**	–	–	–	–	–	–
Lactic Acid	mg/l	**2.0 J**	<20	<2	–	–	–	–	–	–
Pentanoic Acid	mg/l	**270**	**640**	**0.82**	–	–	–	–	–	–
Propionic Acid	mg/l	**370**	**2,300**	**19**	–	–	–	–	–	–
Pyruvic Acid	mg/l	**4.2**	<10	<1	–	–	–	–	–	–
OTHER LABORATORY DATA										
Carbon Tetrachloride	µg/l	<5	<10	<0.5	<0.5	<0.5	<0.5	**0.10 J**	<0.5	<0.5
Total Organic Carbon	mg/l	<5,000	**3,900**	**210**	–	–	–	–	–	–
WATER QUALITY PROBE DATA										
Temperature	°C	–	–	–	**15**	**16**	**16**	**18**	**17**	–
Specific Conductance	uS/cm	–	–	–	**130**	**140**	**220**	**520**	**940**	–
pH	s.u.	–	–	–	**6.6**	**7.2**	**7.5**	**6.3**	**6.6**	–
Oxidation/Reduction Potential	mV	–	–	–	**71**	**33**	**1.1**	**150**	**-69**	–
Dissolved Oxygen	mg/l	–	–	–	**7.9**	**7.4**	**7.5**	**6.4**	**1.5**	–
Turbidity	NTU	–	–	–	**27**	**82**	**43**	**9.1**	**30**	–
GEOCHEMISTRY										
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 September 24, 2018 as part of performance monitoring 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 (formerly Microseeps, Inc.) of Pittsburgh, Pennsylvania (Pace). Results 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.
"<" indicates the result was below the analytical detection limit.
"J" indicates that the laboratory data was below the lowest quantifiable limit and therefore 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 Table 2 and the Site Management Plan.

Last Edited By: hpothier

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Figure 1

Monitoring Location Plan

IBM Gun Club - Former Burn Pit Area

Union, New York

Drawn By:	H. Pothier
Designed By:	E. Bosse
Reviewed By:	D. Shea
Project No:	3526.05
Date:	November 2018

Figure Narrative

This figure summarizes the locations of monitoring wells, multi-level monitoring systems, and surface water sampling points where depth to water is 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 report text for further discussion.

Legend

- Parcel B Site Boundary
- Pilot Test Injection Borehole
- Proposed 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

SANBORN HEAD

Figure 2

Summary of September 2018 Groundwater Quality Conditions

IBM Gun Club - Former Burn Pit Area

Union, New York

Drawn By:	H. Pothier
Designed By:	E. Bosse
Reviewed By:	D. Shea
Project No:	3526.05
Date:	November 2018

Figure Narrative

This figure shows groundwater quality data and inference based on monitoring conducted September 24-26, 2018.

The groundwater data for site key VOCs including TCE, cDCE, vinyl chloride, and ethane/ethene 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 five VOCs at each location.

The inferred sulfate-reducing and methanogenic 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 <200 for iron reduction, <100 for sulfate reduction, and <0 for methanogenic conditions. See Figure 3 for geochemical data.

Not all geochemical conditions are satisfied within the areas shown for sulfate-reducing and methanogenic conditions. The inferred areas assume the presence of a transition zone between sulfate-reducing and methanogenic, and the position and size of these zones are based on judgement of the combined data. Other interpretations are possible.

Refer to the report text for further discussion.

Legend

BP-34A
30,000 Well Name and Sept. 2018 TCE Concentrations in Groundwater (µg/L).

- Inferred Groundwater Contour Sept. 2018
- Inferred Methanogenic Conditions
- Inferred Sulfate-Reducing Conditions
- 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

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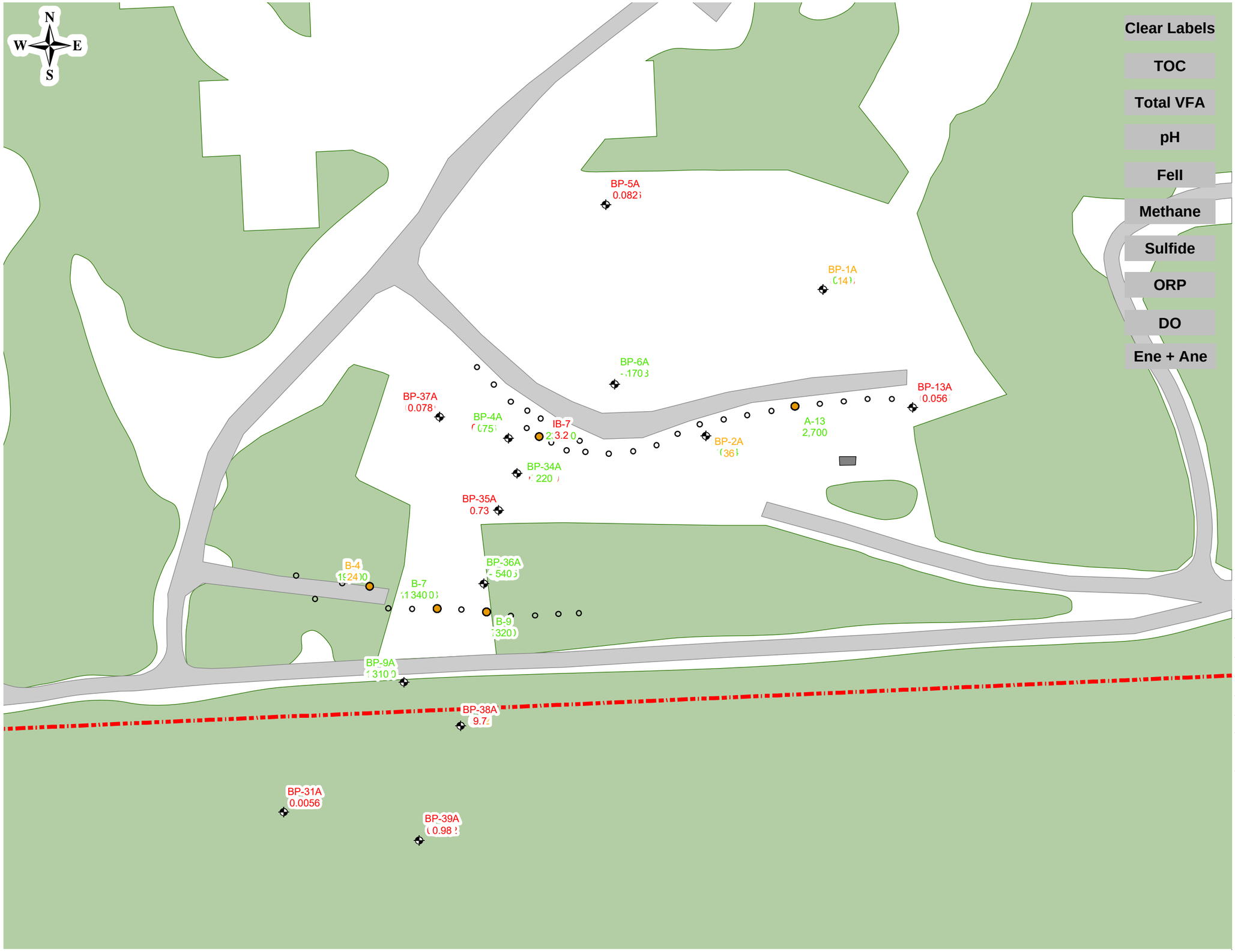


Clear Labels

TOC

Total VFA

pH

FeII

Methane

Sulfide

ORP

DO

Ene + Ane

Figure 3

September 2018 Assessment of Reducing Conditions

IBM Gun Club - Former Burn Pit Area

Union, New York

Drawn By:	H. Pothier
Designed By:	E. Bosse
Reviewed By:	D. Shea
Project No:	3526.05
Date:	November 2018

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 September 2018 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

ATTACHMENT C

SITE INSPECTION MEMORANDUM REPORT

SANBORN HEAD ENGINEERING

SEPTEMBER 2018 SITE WIDE INSPECTION

SANBORN HEAD ENGINEERING

SANBORN HEAD ENGINEERING
Building Trust. Engineering Success.

20 Foundry Street
Concord, NH 03301

Linda Daubert, P.E.
IBM Corporation
8976 Wellington Road
Manassas, VA 20109

November 8, 2018
File No. 3526.05

Re: Site-Wide Inspection – September 2018
IBM Gun Club – Former Burn Pit Area
Union, New York
NYSDEC Site # C704044, BCA Index #B7-0661004

Dear Ms. Daubert:

This letter transmits the findings of the 2018 Site-Wide Inspection completed for the IBM Gun Club, Former Burn Pit Area (Site). Site-wide inspections under the Site Management Plan (SMP) are being conducted annually. This inspection report will also be included with the next Periodic Review Report required by the SMP, due in January 2019.

BACKGROUND AND SCOPE

The Site-Wide Inspection was conducted in accordance with the 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 the soil fill placed within the area of historical seeps. The site inspection was conducted on September 18, 2018 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 Engineering Control (EC) remedy;
- 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.

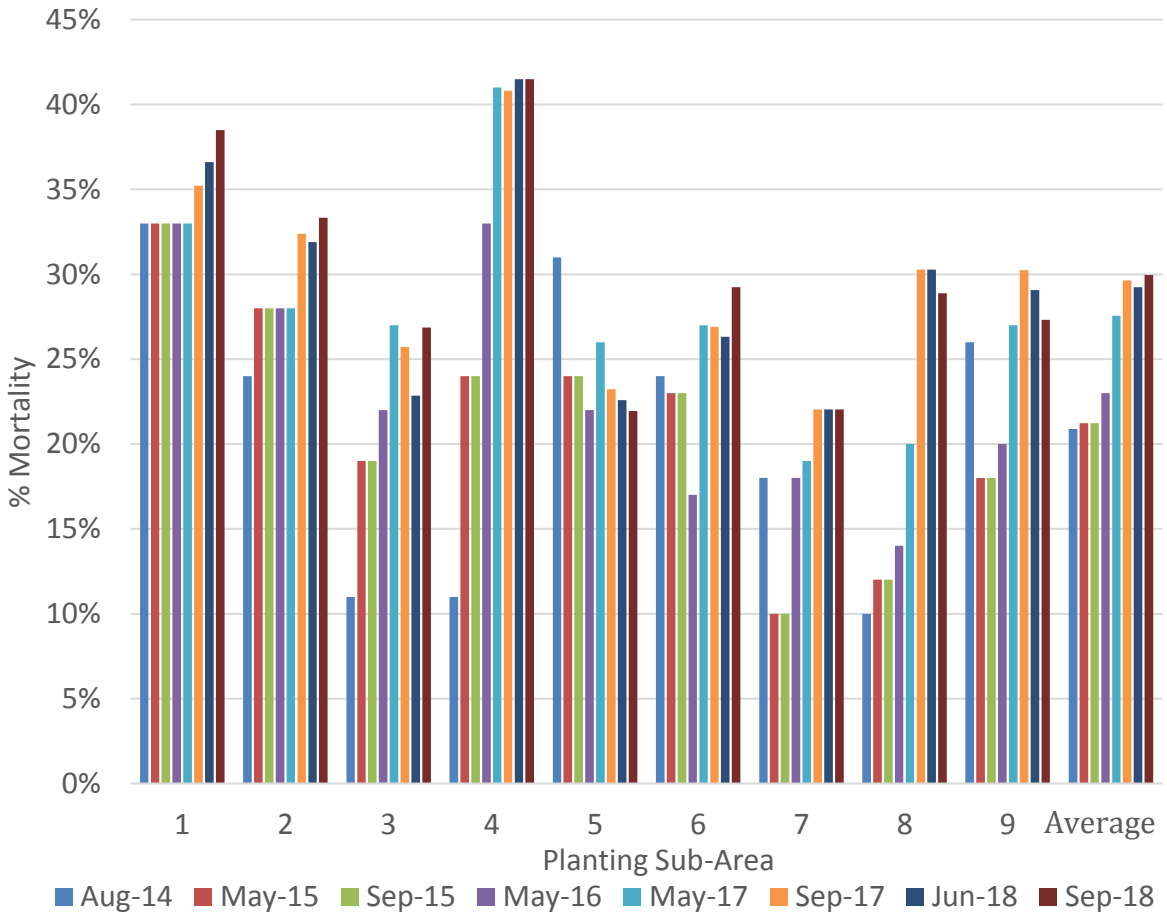
In addition, we reviewed general Site conditions related to site fencing, security, and the list of notifications required under the SMP. The findings and observations from this visit are noted in the inspection checklist included as Attachment A. An annotated inspection figure is included as Attachment 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 was subject to much greater than average precipitation in the three months preceding the September 2018 inspection;
- Poplar trees initially planted as tree poles appear to have grown several feet since September 2017 to an average height of 15 to 20 feet, while poplar trees initially planted as cuttings have grown 1 to 2 feet to an average of 5 to 7 feet. Tree mortality compared to initial planting in 2013 is shown in Exhibit 1 below and on the attached figure (Attachment B) and ranged from 22% to 41%, with Area 4 exhibiting the highest mortality and Areas 5 and 7 the lowest. Further discussion is provided in the Closing below;

Exhibit 1: Summary of tree mortality percentage



- There is some evidence that a portion of the soil fill in the seep area is creeping downhill towards the southern access road at the toe of the fill slope. A silt fence present at the base of the slope has been partially covered by soil material from above. There is no evidence of slope failure, and the tree and grass coverage are still well established. We will continue to monitor the slope;

- Evidence remains that the bonfire gathering spot near outside the site fence and near monitoring well BP-10A is being utilized, but there was less debris present compared to previous inspections.

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. As discussed in the 2017 Site-Wide Inspection report, we still do not think that replanting of trees is warranted at this time given: 1) the continuing growth progress of live trees, 2) the apparent stabilization of overall average mortality around 30% as shown in the above histogram, which is unchanged from the September 2017 inspection and a tree count conducted in June 2018, 3) a good portion of the mortality is located 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.

We note also 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.

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

Erica Bosse
Erica M. Bosse
Project Manager
Sanborn, Head & Associates, Inc.

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 2018
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 18, 2018

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: Partly cloudy, upper 60s, 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	☑	☐	Needs updating
Routine maintenance reports	☑	☐	Needs 2018 PRR
Non-routine maintenance reports	☑	☐	Needs 2018 PRR
Site-wide inspection reports	☑	☐	Needs updating

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.

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.

Attachment A
Site Wide Inspection Checklist - September 2018
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.

Water was ponded (~1-2" deep) at the base of the cap slope in the NE portion of the cap after significant rain the day before the inspection.

Slope Instability **None apparent**

- ☐ Location(s) shown on map — Approx. ft^2 _____
- ☐ Photo-documented — Remarks None observed
- ☑ Slope instability not evident

Narrative/ other notes:

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 was generally average to above average in 2018. Rainfall in July, August, and September 2018 was particularly above average, at 2.5", 5.5", and 5.2" above average, respectively.

5b: Soil Fill - Seep Area

Settlement (Low spots)

- ☐ Location(s) shown on map — Approx. ft^2 _____
- ☐ Photo-documented — Depth _____
- ☑ Settlement not evident — Remarks None observed

Cracks

- ☐ Location(s) shown on map — Length _____
- ☐ Photo-documented — Width _____
- ☑ Cracking not evident — Depth _____

Remarks None observed

Erosion

- ☐ Location(s) shown on map — Approx. ft^2 _____
- ☐ Photo-documented — Depth _____
- ☑ Erosion not evident — Remarks None observed

Holes

- ☐ Location(s) shown on map — Approx. ft^2 _____
- ☐ Photo-documented — Depth _____
- ☑ Holes not evident — Remarks None observed

Vegetative Cover

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

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 bottom length and sides of the capped seep area aftersigificant rainfall in the days before the inspection.

Slope Instability

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

Approx. ft^2 _____

Remarks _____

Narrative / other notes: There is some evidence that soil fill in the seep area is creeping down hill to the southern access road. A silt fence present as the base of the seep area since construction is slowly being covered by soil material from above.

Attachment A
Site Wide Inspection Checklist - September 2018
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 10-15'		
		Representative canopy width		
			% Mortality	38%
	Cuttings	Representative height 5-7'		
		Representative canopy width		
Area #2 ☑ Photo Mark Map ☑	Poles	Representative height 10-15'		
		Representative canopy width		
			% Mortality	33%
	Cuttings	Representative height 5-7'		
		Representative canopy width		
Area #3 ☑ Photo Mark Map ☑	Poles	Representative height 12-16'		
		Representative canopy width		
			% Mortality	27%
	Cuttings	Representative height 5-7'		
		Representative canopy width		
Area #4 ☑ Photo Mark Map ☑	Poles	Representative height 6-8'		
		Representative canopy width		
			% Mortality	41%
	Cuttings	Representative height 5-7'		
		Representative canopy width		
Area #5 ☑ Photo Mark Map ☑	Poles	Representative height 8-10'		
		Representative canopy width		
			% Mortality	22%
	Cuttings	Representative height 5-7'		
		Representative canopy width		

Attachment A
Site Wide Inspection Checklist - September 2018
IBM Gun Club - Former Burn Pit Area
BCP Site No. C704044

Area #6 ☑ Photo Mark Map ☑	Poles	Representative height 15-20' Representative canopy width	% Mortality	29%
	Cuttings	Representative height 5-7' Representative canopy width		
Area #7 ☑ Photo Mark Map ☑	Poles	Representative height 12-16' Representative canopy width	% Mortality	22%
	Cuttings	Representative height N/A Representative canopy width		
Area #8 ☑ Photo Mark Map ☑	Poles	Representative height 15-20' Representative canopy width	% Mortality	29%
	Cuttings	Representative height N/A Representative canopy width		
Area #9 ☑ Photo Mark Map ☑	Poles	Representative height 12-16' Representative canopy width	% Mortality	29%
	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 September 2017 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 seem to have stabilized. Areas 1, 2, 3, and 6 exhibited slightly increased mortality compared to 2017, while mortality was unchanged in Areas 4,7, and 9 and improved in Areas 5 and 8. 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.

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 2018, conditions were observed to be similar in September 2018.

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.

Narrative / other notes:

Attachment A
Site Wide Inspection Checklist - September 2018
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.

Condition of monuments and signage: Intact as constructed

Remarks:

Obvious signs of vandalism/trespassing? Bonfire area still present outside the perimeter fence, does not appear to be as active as in the past. Continued vandalism to the former Gun Club building outside the perimeter fence.

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 200 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: September 2018 purge water sample indicated levels of VOCs below the detection limits and could be discharged to the ground. Purge water will be discharged to the ground in the spring 2019.

Narrative / other notes:

Attachment A
Site Wide Inspection Checklist - September 2018
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 Country	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 2019
	Discharge purge water	Spring 2019
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
	Paint bollards	Spring 2019
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 18, 2018

Conducted by Erica Bosse

Tree resting on fence

Bonfire area

Seep area cap creeping down slope

LEGEND

- EXISTING 10-FOOT CONTOUR
- EXISTING 2-FOOT CONTOUR
- AS-BUILT 10-FOOT CONTOUR
- AS-BUILT 2-FOOT CONTOUR
- EXISTING CHAIN-LINK FENCE
- 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
- EXISTING MONITORING WELL LOCATION AND DESIGNATION
- EXISTING INJECTION WELL LOCATION AND DESIGNATION
- 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
- 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)
- 27% 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: NOVEMBER 2018

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 east across Phytoremediation Areas 1, 2, and 3.

Photo 2: Tree and grass cover looking east from Phytoremediation Area 6 across Areas 5 and 4. A- and IB-series injection boreholes are visible at the center left.

Photo 3: Phytoremediation Area 6, looking NE across to Areas 1 and 2.

Photo 4: Looking north from the B-series injection boreholes in Phytoremediation Area 7.

Photo 5: Looking west along the southern access road. The toe of the seep area with water breaking out along the length is to the right in the photo. Black fabric of the partially covered silt fence is faintly visible in the lower right.

Photo 6: Looking NE from Phytoremediation Area 8 to Area 9. A storage box and water tank located in the vicinity of the site trailer are visible in the background.

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

Photo 8: Southern gravel access road, looking east from approximately BP-17A.

Photo 9: Looking northwest at the bonfire area outside the perimeter fence.

Photo 10: Small tree resting on fence in the northwest corner of the perimeter fence.

ATTACHMENT D

MAINTENANCE REPORTS

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

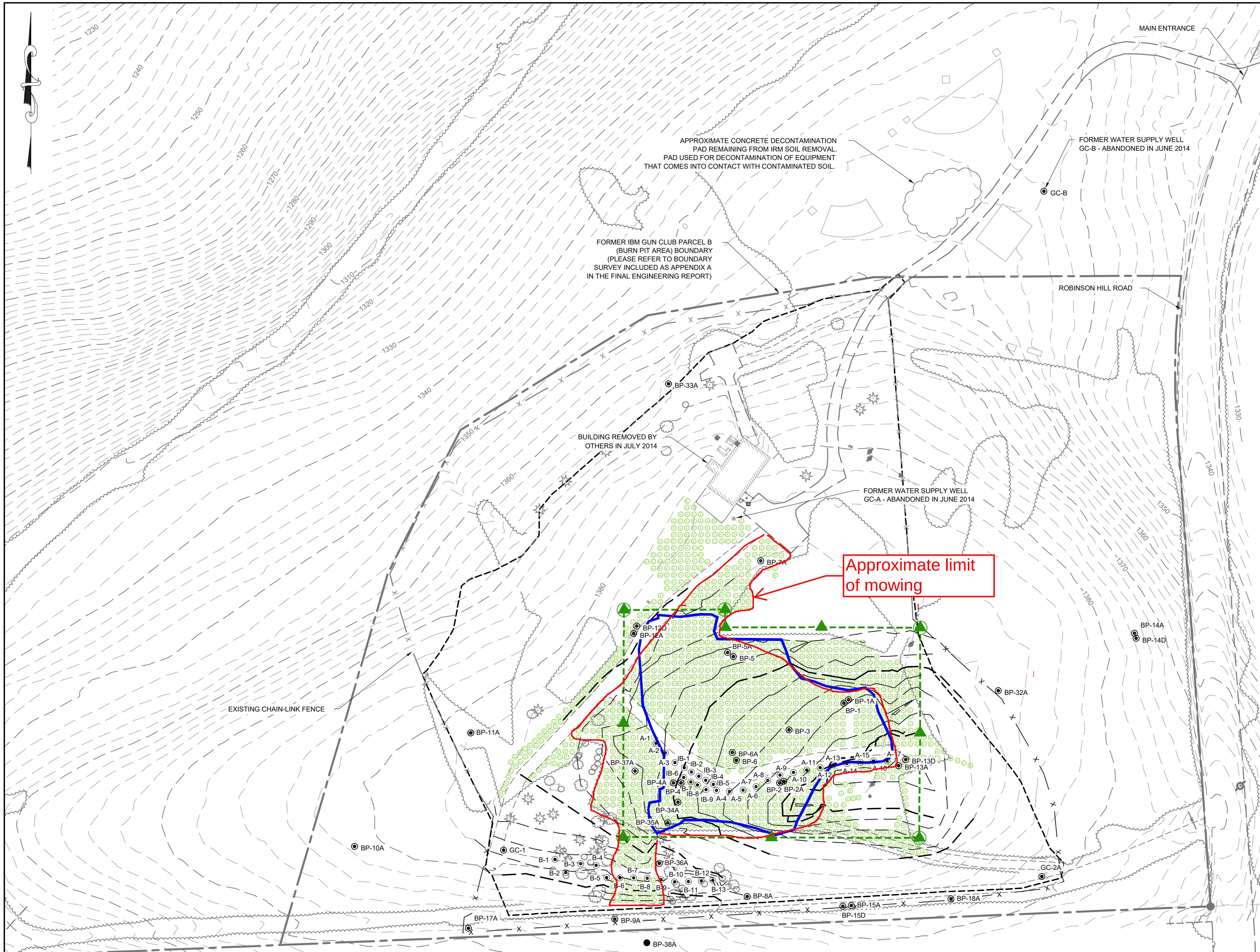
Field Representative:	Erica Bosse (Sanborn Head)	Position: Project Manager
Company:	Glenn Carson (Groundwater Sciences)	
System Type (circle one)	Monitoring Well Injection Well Soil Fill in Seep Area	Soil Cap Phytoremediation

Maintenance activities:

Sanborn Head coordinated with Groundwater Sciences personnel to mow the grass within the area of tree planting in June and October 2018. We provided a marked up field sketch of the areas to mow, but were not present at the time of mowing. In visits to the site after mowing, it was observed that mowing was completed with no damage to the capped area.

Modifications to the system: None

Field Representative Date Erica Bosse 10/15/2018	Attachments: ☐ None ☐ Photographs ☒ Field Sketch ☐ Invoices/ Receipts ☐ Other	SANBORN HEAD
Reviewed By Date David Shea 10/15/2018		



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

- 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