D&B Engineers and Architects, P.C.

ACTIVE INDUSTRIAL UNIFORM SITE GROUNDWATER EXTRACTION AND TREATMENT SYSTEM

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REPORT TITLE

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NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
Division of Environmental Remediation
625 Broadway, 12th Floor, Albany, New York 12233

Site

NYSDEC Site No. 152125, Active Industrial Uniform Site Groundwater Extraction and Treatment System, Village of Lindenhurst, Town of Babylon, Suffolk County, New York.

Project Background and Site Description

The Active Industrial Uniform site (the Site) groundwater extraction and treatment system (GWE&TS) was designed to recover and treat a chlorinated solvent-contaminated groundwater plume emanating from the Site; a former dry cleaning and laundry facility. Dry cleaning activities were conducted at the Site from 1970 to 1987. The GWE&TS has been in operation since December 2001; however, D&B assumed site management duties for the Site in February 2005. Refer to *Figure 1* for a Site location map depicting the GWE&TS location.

Groundwater Extraction and Treatment System Overview

The GWE&TS consists of two, 8-inch diameter extraction wells; one located on-site in the southwest portion of the Site (RW-1), and one located off-site, approximately 1,500 feet southwest of the Site (RW-2). As per NYSDEC direction, extraction well RW-2 was shutdown in April 2010 due to historically low VOC concentrations, and is now being monitored on a quarterly basis. Extracted groundwater is conveyed to the GWE&TS building via underground piping to two packed-tower air strippers. Based on influent concentrations and flow rate, the operation of each tower is currently switched on a quarterly basis where only one tower is operated at any given time. Treated groundwater is pumped via underground piping to a storm water basin located approximately 1,000 feet west of the Site, which subsequently discharges into Little Neck Creek, in accordance with all applicable discharge standards. Exhaust gas from the air stripping towers was treated utilizing two granular activated carbon (GAC) vessels in series. Based on historically low contaminant concentrations detected in the air stripper exhaust gas, the air stripper exhaust piping was reconfigured to bypass the GAC vessels and discharge directly to the atmosphere in June 2011, per the direction of the NYSDEC. The GWE&TS is equipped with instrumentation and controls which allow for automated start-up and operation, and an autodial alarm notification system. Refer to *Figure 2* for an "as-built" system layout diagram.

Regulatory Requirements/Cleanup Goals

Site-specific remedial goals have been established through the remedy selection process and are documented in the Record of Decision (ROD), dated March 1997. The site-specific goals outlined in the March 1997 ROD are provided in *Attachment A*. The overall goal is to meet all appropriate Standards, Criteria, and Guidance (SCGs) and to be protective of human health and the environment. Implementation of the GWE&TS is specifically focused on the following goals:

- Reduce, control, or eliminate contaminated media to the extent practicable.
- Eliminate the threat to surface waters by remediating groundwater to the extent practicable.

- Mitigate the impacts of contaminated groundwater to the environment.
- Prevent, to the extent possible, migration of contaminants.
- Provide for attainment of SCGs for groundwater, soil and indoor air within the limits of the affected area, to the extent practicable.
- Reduce the threat of inhalation of site-related vapor-phase contaminants to residents within homes downgradient of the Site.

Remedial System Optimization (RSO)

As part of an ongoing Remedial System Optimization (RSO) effort to improve the efficiency, effectiveness and net environmental benefit of the GWE&TS, an on-site source area assessment and temporary well plume re-delineation program was completed at the Site in February and March 2013. As per a recommendation of the subsequent July 2013 RSO Data Summary Report, a remedial alternatives study was performed for the Site in October 2013. Following review of the remedial alternatives study and several follow-up discussions with the NYSDEC, it was determined that further plume delineation would be required prior to implementing any alternative remedial approach for the Site.

To this end, and based on D&B's recommendations, a membrane interface probe (MIP) investigation, including targeted groundwater sample collection, was completed at the Site on July 7 through 11 and July 14, 2014. It should be noted that the GWE&TS was manually shutdown during the MIP Investigation in an effort to achieve static aquifer conditions. The results of the completed MIP investigation and groundwater sampling activities were summarized in a February 2015 MIP Investigation Summary Report. Based on the recommendations presented in the February 2015 MIP Investigation Summary Report, D&B prepared a draft chemical injection Pilot Study Scope of Work to address the identified remaining contamination at and downgradient of the Site.

As further detailed below, the GWE&TS was restarted in August 2016; however, the system was only operational for a few days until Transfer Pump P-2 failed. Following troubleshooting activities and system updates the GWE&TS was put back on-line on March 8, 2017, with only Transfer Pump P-1 operating; however, on March 13, 2017, D&B returned to Site for a system inspection and found the system off due to a freeze up at AST-1. As a result, D&B and the NYSDEC Remedial Services Contractor continued efforts to complete system troubleshooting activities successfully restarting the system on April 26, 2017.

Treatment System Operational Status

The GWE&TS was operating for the majority of this reporting period with the exception of maintenance activities and operational issues as detailed below.

System Wiring and Controls

On February 6, 2018, the NYSDEC Remedial Services Contractor was on-site to install a system runtime meter.

GWE&TS Influent Manifold

On December 11, 2017, the NYSDEC Remedial Services Contractor responded to a system alarm due to a high water condition in AST-1. At this time it was identified that a leaking ball valve on the influent manifold was allowing water to enter the tower. On December 21, 2017, the NYSDEC Remedial Services Contractor returned to the Site to replace the ball valve; however, at that time it was identified that a full rebuild of the influent manifold was necessary to complete the repair.

On January 31, 2018, the NYSDEC Remedial Services Contractor was on-site to remove and reconstruct the influent manifold.

Transfer Pump P-1

On March 4, 2018, the GWE&TS shutdown due to a high water level alarm and a high sump alarm at AST-1. The NYSDEC Remedial Services Contractor responded to the alarms on March 5, 2018. While on-site the technician pumped out the sump and restarted the system; however, upon restart of the system a leak was identified at Transfer Pump P-1. The system was left off pending inspection of the piping and troubleshooting activities. On March 7, 2018, the NYSDEC Remedial Services Contractor and D&B returned to Site and while on-site it was identified that the pump failure was caused by a check valve failure on the discharge piping of Transfer Pump P-1. The failed check valve obstructed the discharge line causing the rear casing of Transfer Pump P-1 to fail due to the build up of pressure. It was also identified that the pressure switch on the discharge line did not activate as it was installed after the check valve on the discharge piping.

Extraction Well Redevelopment

On August 9, 2016, well redevelopment activities were attempted at extraction well RW-2. Approximately 13 feet of accumulated material was identified in the well. After several attempts, approximately 6 feet of the accumulated material was removed; however, NYSDEC Remedial Services Contractor was unable to successfully complete the slated well redevelopment. On August 16, 2016, the NYSDEC Remedial Services Contractor was on-site to complete boroscoping activities at extraction well RW-2 to identify any structural issues within the well. The inspection did not identify any structural issues with RW-2.

A summary of GWE&TS runtime/downtime for this reporting period is summarized below.

Treatment System Runtime/Downtime Summary		
Approximate Runtime - Current Reporting Period [1]	1,988 hours	92%
Approximate Downtime - Current Reporting Period [2]	172 hours	8%
Approximate Total Runtime to Date [3]	69,233 hours	61%
Approximate Total Downtime to Date [3]	44,498 hours	39%

Notes:
1. Total elapsed time for current reporting period is 2,160 hours (January 1, 2018 through March 31, 2018).
2. The downtime associated with this reporting period is due to system shutdowns and on-going maintenance activities.
3. Total downtime is based on when D&B assumed O&M duties in February 2005. The GWE&TS was shutdown from December 2012 to May 2013 due to elevated VOC concentrations detected in system aqueous-phase effluent samples and to allow for the completion of the field investigation portion of the RSO evaluation at the Site. Additionally, GWE&TS was manually shutdown on April 30, 2014, and remained off until November 3, 2014, when it was restarted. The GWE&TS remained off during this time due to anomalous elevated contaminant concentrations in aqueous-phase effluent samples, for inspection of a partially blocked discharge pipe and in an effort to achieve static aquifer conditions for the MIP Investigation program. The GWE&TS had not operated from December of 2014 through April of 2017, except for brief periods in August of 2016 and March of 2017. The GWE&TS was restarted on April 26, 2017, after repairs were completed to bring the system back online.

Treatment System Performance Summary

The GWE&TS performance during the current reporting period and since D&B assumed O&M duties in February 2005 is summarized below. The GWE&TS was operational for the majority of this reporting period, as detailed above.

Parameter	Quarter 53 (January 1, 2018 through March 31, 2018)	Quarter 52 (October 1, 2017 through December 31, 2017)	Totals to Date (February 2005 through current Quarter)
Influent			
RW-1 Average Pumping Rate (gal per min)	49.42	48.09	--
RW-1 Total Flow Volume (gal)	5,894,687	6,231,083	410,109,248
RW-1 Maximum Influent PCE Concentration (ug/l)[1]	29	24	--
RW-2 Average Pumping Rate (gal per min)	NA	NA	--
RW-2 Total Flow Volume (gal)	NA	NA	129,900,729
RW-2 Maximum Influent PCE Concentration (ug/l)[2]	0.76	0.99	--
Influent Total Flow Volume (gal)	5,894,687	6,231,083	540,009,977
Effluent [3]			
Effluent Total Flow Volume (gal)	6,630,305	6,889,120	540,047,251
Maximum Effluent PCE Concentration (ug/l)[4]	ND	0.42	--
VOC Removal Summary			
Total VOC Removal (lbs)	2.57	4.55	1,652
Average VOC Removal Rate (lbs/hr)	1.29E-03	2.11E-03	--
VOC Removal Efficiency Range (%)	97.72- 100%	98.87 - 99.34%	--

NA: Not applicable. ND: Constituents concentrations below the analytical detection limit.

Notes:

1. As the GWE&TS was operating for the majority of this and the previous reporting periods, RW-1 influent samples are collected on a monthly basis from the system.
2. As described above, extraction well RW-2 was shutdown in April 2010, and has generally remained off since this time, based on low historic VOC concentrations, as per NYSDEC direction. As RW-2 is not currently operating, monthly samples are not collected from this extraction well. RW-2 is currently being sampled on a quarterly basis, as part of the quarterly groundwater sampling effort. Concentrations are reflected in the table above.
3. The effluent flow meter was noted by the NYSDEC Remedial Services Contractor to be malfunctioning on January 1, 2014. The GWE&TS was shutdown from this date until January 10, 2014. Per NYSDEC request, the GWE&TS was then operated without the effluent flow meter from January 10, 2014 to March 19, 2014, when a new meter was installed. The GWE&TS flow values were estimated based on recent effluent flow volume data from this approximate time period.
4. As the GWE&TS was operating throughout the majority of this reporting period, three aqueous-phase effluent samples were collected on January 11, 2018, February 7, 2018 and March 8, 2018. Concentrations are reflected in the table above.

Treatment System Cost Summary[1]		
COST ITEM	**CURRENT REPORTING PERIOD BUDGET EXPENDED (January 1, 2018 through March 31, 2018)**	**PREVIOUS REPORTING PERIOD BUDGET EXPENDED (October 1, 2017 through December 31, 2017)**
ENGINEERING SUPPORT		
D&B Engineers and Architects, P.C.	$17,594	$8,613
SUBCONTRACTORS		
NYSDEC Remedial Services Contractor[2] (Routine/Non-Routine Maintenance Activities)	$23,424	$9,431
Test America (Analytical Laboratory)	$1,796	$1,727
SUB-TOTAL	$25,220	$11,158
UTILITIES		
Electric	$3,139	$3,259
Telephone	$215	$196
Natural Gas	$1,063	$129
Water	$60	$61
SUB-TOTAL	$4,477	$3,645
TOTAL COSTS	$47,291	$23,416
AVERAGE COST/MONTH	$15,764	$7,805
COST/POUND OF VOC REMOVED	$18,401[3]	$5,146[4]

NA: Not applicable.

Notes:

1. The treatment system costs include monthly utility charges, maintenance costs and engineering costs. Capital construction costs and NYSDEC project management efforts are not included in this evaluation.
2. Remedial Services Contractor costs do not include utility costs.
3. Based on a total of approximately 2.57 lbs of total VOCs removed during this reporting period.
4. Based on a total of approximately 4.55 lbs of total VOCs removed during the previous reporting period.

Treatment System Operation and Maintenance

All alarm conditions and routine and non-routine system maintenance activities completed during this reporting period are summarized below. Refer to *Attachment B* for operations and maintenance logs, as prepared by the NYSDEC Remedial Services Contractor for this reporting period.

Routine Equipment Maintenance Schedule Summary

Major System Component	Manufacturer	Model Number	Maintenance Frequency	Maintenance Summary					
				Current Reporting Period			Next Reporting Period		
				Jan-18	Feb-18	Mar-18	Apr-18	May-18	Jun-18
Extraction Well Pump RW-1	Grundfos Pump Corp.	150550-2	As needed based on flow trends						
Extraction Well Pump RW-2	Grundfos Pump Corp.	1505100-5	As needed based on flow trends						
Pressure Blower	Cincinnati Fan	PB-18	Bi-Monthly			3/8/18			
Air Stripper Maintenance	Branch Environmental	48T-25H	As needed based contaminant concentrations						
Air Stripper Transfer Pump Maintenance	Magnatex Pumps, Inc.	MTA-A10-P-F20-2-FE	Quarterly			3/8/18			

: Planned Activity

Facility Maintenance:

- Facility maintenance activities were not completed throughout this reporting period.

Alarm Conditions:

- On January 8, 2018, the GWE&TS shutdown due to a high level alarm at AST-1; . The NYSDEC Remedial Services Contractor responded on the same day to pump out AST-1 and AST-2; however was unable to restart the system. On January 9, 2018, the NYSDEC Remedial Services Contractor returned to Site to reset and restart the system.
- On January 15, 2018, the GWE&TS shutdown due to a high level alarm at AST-1, the NYSDEC Remedial Services Contractor reset and restarted the system on the same day.
- On January 18, 2018, the GWE&TS shutdown due to general alarm caused by low air flow at the blower. The NYSDEC Remedial Services Contractor reset and restarted the system on the same day.
- On March 5, 2018, the GWE&TS shutdown due to high level alarm at AST-1 and a high sump alarm. The NYSDEC Remedial Services Contractor pumped out the floor sump and attempted to restart the system; however, a leak was identified at Transfer Pump P-1. As such the system was restarted on March 7, 2018, following system maintenance activities.
- On March 15, 2018, the GWE&TS shutdown due to a general alarm caused by a loss of power to the Site. The NYSDEC Remedial Services Contractor reset and restarted the system on the same day.

Non-Routine Treatment System Maintenance:

- On January 10, 2018, the NYSDEC Remedial Services Contractor was on-site to transfer operation from AST-2 to AST-1 due to high level alarms occurring at AST-2.
- On January 16, 2018, the NYSDEC Remedial Services Contractor was on-site to disconnect the low level sensor float at AST-2.

- On January 31, 2018, the NYSDEC Remedial Services Contractor was on-site to dismantle and rebuild the influent manifold. The system was left off overnight to allow glue to dry. The NYSDEC Remedial Services Contractor returned to Site on February 1, 2018, to inspect the new influent manifold and restart the system; however, a leak was identified at the union fittings and the system was shutdown. On February 2, 2018, the NYSDEC Remedial Services Contractor was on-site to complete repairs to the leaking union fittings and restart the system.
- On February 6, 2018, the NYSDEC Remedial Services Contractor was on-site to install a system runtime meter.
- On March 7, 2018, the NYSDEC Remedial Services Contractor and D&B were on-site to complete trouble shooting activities at AST-1 and Transfer Pump P-1. Upon inspection it was identified that the Transfer Pump P-1 casing ruptured due to a check valve failure at the discharge piping. The NYSDEC Remedial Services Contractor transferred operation of the system from AST-1 to AST-2 and the system was restarted.

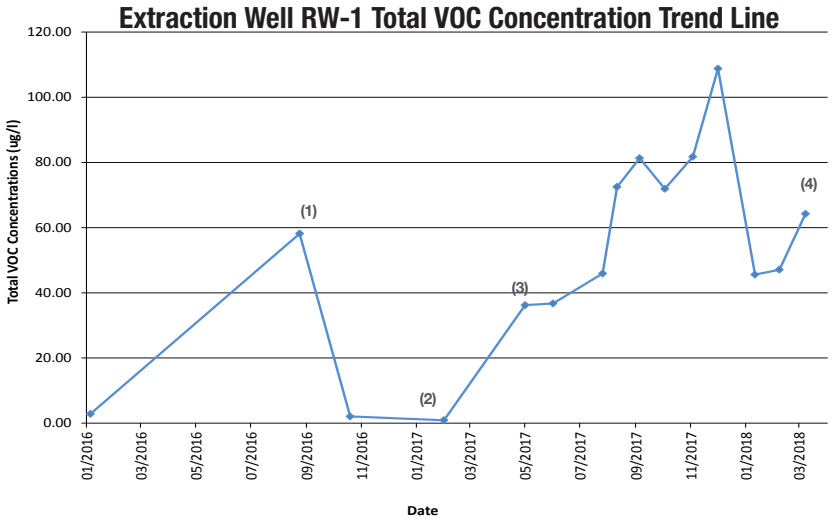
Treatment System Monitoring and Sampling Results

A summary of the routine treatment system monitoring and sampling collection and associated results are provided below.

Treatment System and Groundwater Sampling Summary

Sampling Location	Monthly				Quarterly	Semi-Annual	
	Influent/Effluent VOC (EPA Method 8260)	Influent/Effluent TAL Metals (EPA Method 6010)	Effluent pH (Field Screening)	Effluent TDS (EPA Method 160.1 or SM 2540C)	Monitoring Well VOC (EPA Method 8260)	Monitoring Well VOC (EPA Method 8260)	Effluent VOC (EPA Method TO-15)
Extraction Well RW-1 Influent	1/11/18 2/7/18 3/8/18	1/11/18 2/7/18 3/8/18					
Extraction Well RW-2 Influent[1]							
Air Stripper Aqueous-Phase Effluent [2]	1/11/18 2/7/18 3/8/18	1/11/18 2/7/18 3/8/18	2/7/18 3/8/18				
Air Stripper Vapor-Phase Effluent [3][4]							
Groundwater Monitoring Wells MW-103 through MW-107, MW-2S, MW-4D, MW-5S and RW-2						1/17/18	
Groundwater Monitoring Wells MW-101, MW-102, MW-108, MW-109 and MW-111						1/17/18	

1. As RW-2 is not currently being operated, monthly samples are not collected from this extraction well; however, RW-2 is currently being sampled on a quarterly basis, as part of the quarterly groundwater sampling effort.
2. The NYSDEC Remedial Services Contractor completed system sampling on January 11, 2018, February 7, 2018, March 8, 2018; however, inadvertently did not collect an effluent pH sample in January 2018, due to a lack of sampling equipment on-site.
3. Monthly effluent vapor samples are analyzed utilizing tedlar bags and a hand-held photoionization detector (PID).
4. System vapor-phase effluent samples are to be collected on a semi-annual basis. A vapor-phase effluent sample for laboratory analysis was collected on December 1, 2017, of the previous reporting period.



1. The GWE&TS was operating for a brief amount of time throughout the July to September 2016 reporting period. As such only one aqueous-phase influent sample was collected from RW-1 for VOC analysis only, in August 2016.
2. It should be noted that a groundwater sample was collected from extraction well RW-1 for VOC analysis only, as part of the quarterly groundwater sampling conducted on January 31, 2017.
3. The GWE&TS was not operating for the majority of April 2017, as such, aqueous-phase influent samples were not collected in April 2017; however, a groundwater sample was collected from extraction well RW-1 for VOC analysis only, as part of the quarterly groundwater sampling conducted on April 24, 2017. Two aqueous phase influent system samples were collected from RW-1 in May and June 2017, while the system was operating.
4. Three aqueous-phase influent samples were collected throughout this reporting period on January 11, 2018, February 7, 2018, March 8, 2018, while the system was operating.

Extraction Well RW-1 - System Influent Contaminant Concentration Ranges/Averages [1]

Contaminant [2]	*Current Reporting Period* [3]	*Previous Reporting Period*	*Class GA Groundwater Standard*
Tetrachloroethene (PCE)	18 - 29 ug/l	17 - 24 ug/l	5.0 ug/l
Trichloroethene (TCE)	2.8 - 3.2 ug/l	3 - 4.3 ug/l	5.0 ug/l
Cis-1,2-Dichloroethene (Cis-1,2-DCE)	17 - 31 ug/l	50 - 78 ug/l	5.0 ug/l
Vinyl Chloride (VC)	0.51 - 0.98 ug/l	1.10 - 1.50 ug/l	2.0 ug/l
Iron	ND	ND	300 ug/l
Manganese	1,050 - 1,100 ug/l	986 - 1,020 ug/l	300 ug/l
Sodium	29,500 - 39,000 ug/l	30,400 - 34,400 ug/l	20,000 ug/l

ND: Constituent concentration below the analytical detection limit. --: Not analyzed
Red font denotes an exceedances of the applicable standard.

1. Only includes constituents consistently or periodically detected in exceedance of their respective Class GA Groundwater Standard.
2. Click on the blue-colored contaminants for graphs of VOC concentrations over the last 2 years for VOCs detected above the Class GA Groundwater Standards for this and/or the previous reporting periods.
3. As the GWE&TS was operating for the majority of this reporting period three aqueous-phase influent system samples were collected from extraction well RW-1 on January 11, 2018, February 7, 2018, March 8, 2018, while the system was operating.

Aqueous-Phase Air Stripper Effluent Concentration Ranges [1]			
Discharge Permit Parameters	Current Reporting Period [2]	Previous Reporting Period [3]	Site-Specific Effluent Limit
1,2-Dichlorobenzene	ND	ND	10.0 ug/l
1-1-Dichloroethane	ND	ND	10.0 ug/l
1,1,1-Trichloroethane	ND	ND	10.0 ug/l
PCE	ND	ND - 0.42	10.0 ug/l
TCE	ND	ND	10.0 ug/l
Trans-1,2-DCE	ND	ND	10.0 ug/l
Cis-1,2-DCE	ND - 0.45	0.48 - 0.82	NL
VC	ND	ND	10.0 ug/l
Bromomethane	ND	ND	Monitor
Chloromethane	ND	ND	Monitor
Copper	ND	ND	4.0 ug/l
Iron	ND	ND - 209	1,000 ug/l
Lead	ND	ND - 6.4	8.0 ug/l
Potassium	2,510 - 2,950	2,530-2,680	Monitor
Manganese	876 - 1,080	3,540 - 3,750	Monitor
Vanadium	ND	ND	Monitor
Zinc	ND	ND - 11.3	66.0 ug/l
Total Dissolved Solids (TDS)	167 - 215	183 - 194	Monitor
pH[3]	6.49 - 6.52[4]	7.60 - 7.80	6.5 - 8.5

ND: Constituent concentration below the analytical detection limit. NL: No limit. - - : Not analyzed.

1. Includes constituents considered contaminants of concern, as well as requiring monitoring as detailed under the State Pollution Discharge Elimination System (SPDES) permit equivalency.
2. As the GWE&TS was operating for the majority of this reporting period, three aqueous-phase effluent system samples were collected on January 11, 2018, February 7, 2018, March 8, 2018 while the system was operating.
3. It should be noted that, the NYSDEC Remedial Services Contractor collected two pH samples in February 2018 and March 2018 in conjunction with aqueous-phase air stripper effluent sampling; however, pH samples were not collected in January 2018. Additionally, a pH reading collected on March 8, 2018 exhibited a value below the Site Specific Effluent Limits range of 6.5 - 8.5 s.u. at a value of 6.49 s.u.

Site-specific contaminants of concern for aqueous-phase air stripper effluent samples exhibited concentrations lower than the limits under the SPDES permit. It should be noted that the pH readings collected throughout this reporting period exhibited levels lower than the Site Specific Effluent Limits Standard range of 6.5-8.5 on March 8, 2018 at a concentration of 6.49. All aqueous-phase effluent sample results will be monitored on a routine basis to ensure all contaminants of concern are below SPDES limits.

Vapor-Phase Air Stripper Effluent Concentrations			
	Current Reporting Period	Previous Reporting Period [1]	Site-Specific Limits
PCE	--	0.000541 lbs/hr	0.007 lbs/hr
TCE	--	0.000087 lbs/hr	0.006 lbs/hr
Total Xylenes	--	0.000324 lbs/hr	0.001 lbs/hr
1,2-DCE (total)	--	0.00195 lbs/hr	0.003 lbs/hr
VC	--	0.000027 lbs/hr	0.014 lbs/hr
1,1,1-TCA	--	ND	0.001 lbs/hr
Total VOC Concentrations (field screening with PID) [2]	0.0 - 0.3	0.1	NA
Maximum Total VOC Emissions[3]	--	0.00346 lbs/hr	0.5 lbs/hr

ND: Constituent concentration below the analytical detection limit. NA: Not applicable. - - : Not analyzed.

PID: Photoionization Detector

Red font denotes an exceedance of the applicable site-specific limit.

1. Vapor-phase effluent samples for laboratory analysis are collected on a semi-annual basis. A sample was collected during the previous reporting period on December 1, 2017.
2. The total VOC concentrations observed in the previous reporting period were well below the Site-Specific Maximum Total VOC Emissions Limit.
3. The Site-Specific Maximum Total VOC Emissions Limit of 0.5 lbs/hr was developed in consultation with the NYSDEC and is utilized as a means to monitor total vapor-phase VOCs emitted by the GWE&TS.

Quarterly Groundwater Monitoring Summary

All groundwater monitoring wells and one extraction well were sampled on January 17, 2018, to determine groundwater quality at and in the vicinity of the Site. Samples were collected from ten on-site groundwater monitoring wells (MW-101 through MW-109, MW-4D and MW-5S) and three off-site groundwater monitoring wells (MW-2S, MW-109 and MW-111) on January 17, 2018. Additionally, off-site extraction well (RW-2) was sampled as part of the quarterly groundwater sampling event on January 17, 2018, as extraction well RW-2 is not operating.

The locations of the on-site groundwater monitoring wells are depicted on *Figure 3* and the locations of off-site groundwater monitoring wells are depicted on *Figure 4*.

Groundwater Monitoring Well Condition Summary

All sampled groundwater monitoring wells were located as indicated on the Site map and the concrete well pads (where applicable), protective casings, surface seals, well IDs, PVC well risers, well plugs and locks were observed to be present and in good condition, with the following exception:

- A lock is not functional at MW-108, MW-109, MW-111, MW-2S, and MW-4D and should be replaced,
- The manhole bolts for MW-108, MW-109, MW-111, MW-2S, and MW-4D need to be replaced; and,
- The manhole pads at MW-108, MW-109, MW-111, MW-2S, and MW-4D need to be replaced.

Refer to *Attachment C* for monitoring well inspection logs.

Groundwater Monitoring Results Summary:

A headspace reading was collected utilizing a PID at each groundwater monitoring well. PID readings were collected from each well immediately after the removal of the well caps and plugs. VOCs were non-detected in headspace readings of the monitoring wells.

Below is a table summarizing the site-specific contaminants of concern in on-site and off-site groundwater. Refer to *Attachment D* for analytical data results.

Site-Specific Contaminant of Concern Concentrations

Monitoring Well [1]	PCE		TCE		Cis-1,2-DCE		Vinyl Chloride		Site-Specific 2-Year Total VOC Trend Analysis
	Current Reporting Period	Previous Reporting Period	Current Reporting Period	Previous Reporting Period	Current Reporting Period	Previous Reporting Period	Current Reporting Period	Previous Reporting Period	
On-Site Monitoring Wells									
MW-101	0.48 ug/l	NS	0.25 ug/l	NS	ND	NS	ND	NS	Stable
MW-102	0.71 ug/l	NS	ND	NS	ND	NS	ND	NS	Stable
MW-103	1.6 ug/l	2.4 ug/l	0.70 ug/l	0.77 ug/l	0.28 ug/l	0.80 ug/l	ND	0.13 ug/l	Decreasing
MW-104	30 ug/l	21 ug/l	3.1 ug/l	2.0 ug/l	ND	ND	ND	ND	Decreasing
MW-105	0.86 ug/l	1.4 ug/l	0.23 ug/l	0.37 ug/l	ND	ND	ND	ND	Decreasing
MW-106	10 ug/l	9.5 ug/l	4.9 ug/l	4.9 ug/l	21 ug/l	140 ug/l	3.7 ug/l	18 ug/l	Increasing
MW-107	1.2 ug/l	1.0 ug/l	0.49 ug/l	0.51 ug/l	0.58 ug/l	0.43 ug/l	0.090 ug/l	ND	Stable
MW-108	0.88 ug/l	NS	ND	NS	1.8 ug/l	NS	ND	NS	Decreasing
MW-4D	67,000 ug/l	4,500 ug/l	5,800 ug/l	580 ug/l	490 ug/l	78 ug/l	67 ug/l	1.50 ug/l	Increasing
MW-5S	0.23 ug/l	ND	ND	ND	ND	ND	ND	ND	Stable
Off-Site Monitoring Wells									
MW-109	0.69 ug/l	NS	1.1 ug/l	NS	1.2 ug/l	NS	ND	NS	Stable
MW-111	ND	NS	ND	NS	ND	NS	ND	NS	Stable
MW-2S	13 ug/l	40 ug/l	1.3 ug/l	2.8 ug/l	1,500 ug/l	82 ug/l	0.63 ug/l	0.86 ug/l	Increasing
RW-2 [1]	0.76 ug/l	0.99 ug/l	2.6 ug/l	ND	2.6	3.9 ug/l	ND	ND	Decreasing

ND: Constituent concentration below the analytical detection limit. NS: Not sampled.
Red font denotes an exceedance of the constituents Class GA Groundwater Standard (5.0 ug/l for PCE, TCE and Cis-1,2-DCE, and 2.0 ug/l for VC).

In addition, the following VOCs were also detected in one or more wells, generally well below their respective Class GA Groundwater Standards: acetone, chloroform, 1,1-dichloroethane, 1,1-dichloroethene, 1,2-dichlorobenzene, isopropylbenzene, MTBE, sec-butylbenzene, 1,2,4-trimethylbenzene and trans-1,2-dichloroethene.

Click on monitoring well IDs for graphs depicting contaminant concentrations over the last 2 years in wells exhibiting exceedances of the Class GA Groundwater Standards for this and the previous reporting period.

1. Extraction well RW-2 is sampled as part of the groundwater sampling event on a quarterly basis in order to better monitor off-site contaminant concentrations.

On-Site Monitoring Well Network (MW-101 through MW-108, MW-4D and MW-5S)

- MW-101 (screened at 5 to 15 feet below grade): Concentrations of site-specific VOCs have been detected at concentrations well below their respective Class GA Standards throughout this reporting period.
- MW-102 (screened at 5 to 15 feet below grade): Concentrations of site-specific VOCs have been detected at concentrations below their respective Class GA Standards throughout this reporting period.
- MW-103 (screened at 5 to 15 feet below grade): Concentrations of site-specific VOCs in monitoring well MW-103 have exhibited decreasing to stable trends throughout the last two-year period. Site-specific contaminants were not detected at concentrations exceeding the Class GA Standards during this reporting period; however, throughout the last two-year period PCE, cis-1,2-DCE and VC have exhibited as follows:
  - PCE was detected at a concentration of 6.2 ug/l on January 19, 2017, exceeding its respective Class GA Standards of 5.0 ug/l.
  - Cis-1,2-DCE was detected at a concentration of 180 ug/l on January 19, 2017, exceeding its respective Class GA Standards of 5.0 ug/l.

- VC was detected at concentrations of 29 ug/l on January 19, 2017, exceeding its respective Class GA Standards of 2.0 ug/l.

- MW-104 (screened at 5 to 15 feet below grade): Site-specific VOCs have been consistently detected at concentrations in exceedance of the Class GA Standards in MW-104. Note that the site-specific contaminants within monitoring well MW-104 have steadily decreased since D&B assumed O&M duties in February 2005. PCE was detected in exceedance of the respective Class GA Standards, as follows:
  - PCE was detected at concentrations ranging from 20 ug/l to 49 ug/l, with the maximum concentration detected on April 24, 2017. PCE has generally exhibited a slightly decreasing trend over the last two year period.

- MW-105 (screened at 5 to 15 feet below grade): Concentrations of site-specific VOCs were detected at concentrations below their respective Class GA Standards during this reporting period; however, it should be noted that MW-105 has exhibited a decreasing trend in total contaminants of concern throughout the last two-year period. Three site-specific contaminants were detected at concentrations exceeding the Class GA Standards throughout the previous 2-year period: PCE, cis-1,2-DCE and VC, as follows:
  - PCE was detected at concentrations ranging from 0.86 ug/l to 14 ug/l, with the maximum concentration detected on January 17, 2018.
  - Cis-1,2-DCE was detected at concentrations ranging from non-detect to 260 ug/l, with the maximum concentration detected on April 24, 2017.
  - VC was detected at concentrations ranging from non-detect to 27 ug/l, with the maximum concentration detected on April 24, 2017.

- MW-106 (screened at 5 to 15 feet below grade): Site-specific VOCs have generally been detected at concentrations in exceedance of the Class GA Standards throughout this reporting period and since D&B assumed O&M duties in February 2005. MW-106 has exhibited generally increasing trends for contaminants of concern, cis-1,2-DCE and VC; however, total VOCs have decreased throughout the previous two-year period. PCE, TCE, cis-1,2-DCE and VC have been detected in exceedance of their respective Class GA Standards, as follows:
  - PCE was detected at concentrations ranging from 6.7 ug/l to 17 ug/l, with the maximum concentration detected on April 24, 2017. Overall, PCE concentrations have exhibited stable trends throughout the last two-year period.
  - TCE was detected at concentrations ranging from 4.9 ug/l to 11 ug/l, with the maximum concentration detected on January 5, 2016. Overall, TCE concentrations have exhibited a decreasing trend over the last two-year period.
  - Cis-1,2-DCE was detected at concentrations ranging from 21 ug/l to 420 ug/l, with the maximum concentration detected on July 3, 2017. Overall, cis-1,2-DCE concentrations have exhibited an increasing trend throughout the last two-year period reporting period.
  - VC was detected at concentrations ranging from 2.0 ug/l to 49 ug/l, with the maximum concentration detected on July 3, 2017. Overall, VC concentrations have exhibited an increasing trend over the last two-year period.

- MW-107 (screened at 5 to 15 feet below grade): Concentrations of site-specific VOCs have been detected at concentrations below their respective Class GA Standards throughout this reporting period, similar to the previous reporting period.

- MW-108 (screened at 5 to 15 feet below grade): Site-specific VOCs were detected at concentrations below the Class GA Standards throughout this reporting period. Overall, PCE concentrations have exhibited a decreasing trend over the last two year period and total VOC concentrations have also exhibited a decreasing trend throughout the last two-year period.

- MW-4D (screened at 60 to 70 feet below grade): Site-specific VOCs have been detected at concentrations in exceedance of their Class GA Standard since this well was added to the routine groundwater monitoring list in June 2012. It should also be noted that site-specific VOC concentrations in MW-4D have been detected at widely varying concentrations since 2012. Total VOCs exhibited in MW-4D have increased since the system start-up in April 26, 2017. PCE, TCE and cis-1,2-DCE exceedances detected during this reporting period are as follows:

- PCE was detected at concentrations ranging from 170 ug/l to 67,000 ug/l, with the maximum concentration detected on January 17, 2018. Overall, PCE concentrations have exhibited an increasing trend throughout the last two-year period. It should be noted that PCE levels have increased to similar elevated levels as seen in previous reporting periods.
- TCE was detected at concentrations ranging from 54 ug/l to 580 ug/l, with the maximum concentration detected on October 6, 2017. Overall, TCE concentrations have exhibited an increasing trend throughout last two-year period.
- Cis-1,2-DCE was detected at concentrations ranging from 9.1 ug/l to 78 ug/l, with the maximum concentration detected on October 6, 2017. Overall, cis-1,2-DCE concentrations have exhibited an increasing trend throughout last two-year period
- VC was detected at concentrations ranging from non-detect to 67 ug/l, with the maximum concentration detected on January 17, 2018 of this reporting period. Overall, VC concentrations have exhibited an increasing trend throughout last two-year period.

- MW-5S (screened at 14 to 24 feet below grade): MW-5S has been sampled as part of D&B's work assignment since June 2010. Site-specific VOCs have been detected at concentrations below their respective Class GA Standards during this reporting period and have exhibited generally stable trends since June 2010.

In general, site-specific VOCs have shown increasing trends in two on-site monitoring wells since the system start-up in April 26, 2017. It should be noted that several monitoring wells have exhibited slightly higher levels of contaminants of concern in this reporting period as compared to previous reporting periods.

It should be noted that monitoring well MW-4D is screened at a depth of approximately 60 to 70 feet below grade, approximately 30 feet deeper than on-site extraction well RW-1 and the site-wide monitoring well network. It should be noted that the Gardiners Clay is located below the Site at a depth of approximately 70 feet below grade and is likely acting as a lower "confining unit" for the groundwater plume. Based on the relatively dense nature of chlorinated solvents, the groundwater plume may be "pooling" or migrating along the top of the Gardiners Clay.

Off-Site Monitoring Well Network (MW-109, MW-111, MW-2S and RW-2)

A summary of the site-specific VOCs (PCE, cis-1,2-DCE, TCE and VC) detected during this reporting period in each off- Site groundwater monitoring well located downgradient of the GWE&TS and extraction well RW-2 are provided below.

- MW-109 (screened at 25 to 35 feet below grade): Monitoring well MW-109 is located approximately 1,800 feet south of the Site. Site-specific VOCs have been detected at concentrations below their respective Class GA Groundwater Standards from June 2006 through the end of this reporting period.
- MW-111 (screened at 25 to 35 feet below grade): Monitoring well MW-111 is located approximately 580 feet southwest of the Site. Site-specific VOCs have been detected at concentrations below their respective Class GA Standards since start-up of the GWE&TS and through the end this reporting period.
- MW-2S (screened at 12 to 22 feet below grade): Monitoring well MW-2S is located approximately 220 feet south of the Site. Site-specific VOCs (primarily including PCE and cis-1,2-DCE) have consistently been detected at concentrations in exceedance of their respective Class GA Standards from when this well was added to the routine groundwater monitoring list (September 2008) through the end of this reporting period. PCE, cis-1,2-DCE and VC exceedances over the last two year period are as follows:
  - PCE was detected at concentrations ranging from 1.7 ug/l to 1,500 ug/l, with the maximum concentration detected on July 3, 2017. Overall, PCE has exhibited an increasing trend over the last two-year period.
  - Cis-1,2-DCE was detected at concentrations ranging from 11 ug/l to 82 ug/l, with the maximum concentration detected on October 16, 2017. Overall, cis-1,2-DCE concentrations have increased over the last two-year period and after system start-up on April 26, 2017.
  - VC was detected at concentrations ranging from 0.69 ug/l to 2.9 ug/l, with the maximum concentration detected on July 3, 2017. Overall, VC has exhibited a stable trend over the past several years.

- RW-2 (screened at 12 to 37 feet below grade): Extraction well RW-2 is located approximately 1,500 feet southwest of the Site. As detailed above, RW-2 is now monitored on a quarterly basis with the site-wide monitoring wells due to generally low contaminant concentrations. It should be noted that site-specific VOC concentrations were observed to be erratic over the last two year period; however, concentrations of all site-specific VOCs have decreased in RW-2 and have remained generally stable throughout this reporting period. During this reporting period, site specific contaminants of concern were detected below their Class GA Groundwater Standards.

A figure depicting total VOC concentrations in on-site and off-site wells is provided as *Figure 5*.

Data Validation:

All sample results have been reviewed by D&B and deemed valid and usable for environmental assessment purposes.

- The percent recoveries (%Rs) were below the quality control (QC) limits for 1,1,1,2-tetrachloroethane and dibromochloromethane in the matrix spike (MS) and matrix spike duplicate (MSD) for the system aqueous phase samples collected on January 11, 2018. 1,1,1,2-Tetrachloroethane and dibromochloromethane were qualified as estimated (UJ) in all samples.
- Acetone was detected in the method blank. Acetone was qualified as non-detect (UB) in groundwater monitoring well samples RW-2, MW-109, MW-111, MW-106, MW-107, MW-103, MW-102, MW-101, MW-105, MW-5S, MW-104 and MW-X collected as part of the routine groundwater monitoring event on January 17, 2018.
- The %Rs were below QC limits for cis-1,3-dichloropropene and MTBE in the MS associated with system sample RW-1 and were qualified as estimated (J/UJ) for system samples collected on March 8, 2018.
- The %R was below the QC limit for total xylene in the MSD associated with system sample Effluent and was qualified as an estimated detection limit (UJ) for system samples collected on March 8, 2018.

Data Validation Checklists are presented in *Attachment E*.

Findings and Recommendations

Findings:

- GWE&TS Operation: The GWE&TS was operating for the majority of this reporting period utilizing AST-2. The NYSDEC Remedial Services Contractor identified a leak at Transfer Pump P-1 due to a check valve failure. As such, a new transfer pump, check valve and re-plumbing of the pressure switch are necessary to complete the repairs.
- GWE&TS Maintenance: The NYSDEC Remedial Services Contractor completed one round of routine maintenance activities during this reporting period. Additionally, as detailed above, non-routine maintenance was completed throughout this reporting period in an effort to improve the GWE&TS.
- System Aqueous-Phase Influent and Effluent Contaminant Concentrations: As the GWE&TS was operating throughout the majority of this reporting period, three aqueous-phase influent samples from extraction well RW-1 and three aqueous-phase effluent samples were collected on January 11, February 7, and March 8, 2018, for VOC and metal analysis. The NYSDEC Remedial Services Contractor collected a groundwater sample from extraction well RW-2 on January 17, 2018, for VOC analysis only, as part of the quarterly groundwater sampling event, per NYSDEC direction. Site-specific contaminants of concern for aqueous-phase air stripper effluent samples exhibited concentrations lower than the limits under the SPDES permit. It should be noted that the pH readings collected throughout this reporting period exhibited levels lower than the Site Specific Effluent Limits Standard range of 6.5-8.5 on March 8, 2018 at a concentration of 6.49.
- System Vapor-Phase Effluent Monitoring: System vapor-phase effluent samples are to be collected on a semi-annual basis. A vapor-phase effluent sample for laboratory analysis was collected on December 1, 2017, of the previous reporting period. The system vapor-phase effluent sample exhibited a VOC emission rate of 0.0035 lbs/hr, lower than the Site-Specific Vapor-Phase Effluent Limit of 0.5 lbs/hr.
- Monitoring Well Conditions: All on-site sampled groundwater monitoring wells were located as indicated on the Site map and the concrete well pads (where applicable), protective casings, surface seals, well IDs, PVC well risers, well plugs and locks were observed to be present and in good condition, with the following exceptions:

- A lock is not functional for MW-108, MW-109, MW-111, MW-2S, and MW-4D and should be replaced,
- The manhole bolts for MW-108, MW-109, MW-111, MW-2S, and MW-4D need to be replaced; and,
- The manhole pads for MW-108, MW-109, MW-111, MW-2S, and MW-4D need to be replaced.

- Monitoring/Extraction Well Sampling: On-site groundwater monitoring wells (MW-101 through MW-108, MW-4D, and MW-5S) and four off-site monitoring wells (MW-109, MW-111, MW-2S, RW-2) exhibited one or more of the site-specific VOCs at concentrations exceeding their respective Class GA Groundwater Standards during this reporting period. It should also be noted that PCE was detected in thirteen of fourteen groundwater monitoring wells sampled this reporting period at concentrations ranging from non-detect to a maximum of 67,000 ug/l, as detected in groundwater monitoring well MW-4D. However, PCE only exceeded the Class GA Standard of 5 ug/l in four of the groundwater monitoring wells. Off-site extraction well RW-2 has exhibited widely varying concentrations of total VOCs, with total VOC concentrations ranging from non-detect to a maximum of 103.3 ug/l (detected on February 12, 2014). In addition, concentrations for PCE in MW-2S have exhibited higher levels in the last two reporting periods. It should be noted that monitoring well RW-2 has experienced a decreasing trend over the last two-years; however, monitoring well MW-2S has exhibited an increasing trend over the last two-year period. Off-site groundwater monitoring wells MW-109 and MW-111, have experienced stable trends throughout the last two-years; both wells had VOC concentrations below the Class GA Standard of 5 ug/l.

Recommendations:

- General Treatment System:
  - Based on the remaining elevated contaminant concentrations in groundwater detected at the Site, it is recommended that the GWE&TS continue operating and an additional subsurface investigation be completed beneath and in the immediate vicinity of the treatment system building to evaluate possible remaining areas of contamination below the treatment system building slab.
  - D&B recommends that the NYSDEC Remedial Services Contractor record more clear and detailed descriptions of completed field activities and issues encountered, as well as alarm triggers, downtime dates and times and the steps taken to bring the GWE&TS back online on the Site Activities and System Operation Logs, as appropriate. In addition, logs received over the last several quarters have included multiple copies of logs, including some differing information. As such, D&B further recommends that the NYSDEC Remedial Services Contractor make an effort to provide one set of logs with all descriptions and dates of activities clearly indicated. These steps will help enable D&B to better understand the current status of the GWE&TS and facilitate a more efficient preparation of the Site Management Quarterly Reports. In addition, it is recommended that the NYSDEC Remedial Services Contractor adhere to the routine maintenance schedule.
- Treatment System Operational Issues:
  - System Wiring and Controls: D&B recommends the pressure switch at Transfer Pump P-1 be relocated to before the check valve on the discharge piping.
  - Transfer Pump P-1: Repair or replace the pump and necessary piping at Transfer Pump P-1.
  - Well Redevelopment: D&B recommends that the NYSDEC Remedial Services Contractor complete well redevelopment activities at extraction well RW-2.
- System Aqueous-Phase Influent and Effluent Contaminant Concentrations: All aqueous-phase effluent sample results will be monitored on a routine basis to ensure all contaminants of concern are below SPDES limits. It is also recommended that the NYSDEC Remedial Services Contractor collect pH readings during the system effluent sampling events to ensure pH readings are monitored on a routine basis.
- Monitoring/Extraction Well Sampling: Based on the widely varying VOC concentrations detected in several wells over the course of several monitoring events it is recommended that the NYSDEC ensures that the Remedial Services Contractor is utilizing proper and consistent sampling techniques during each groundwater sampling event. It is recommended that monitoring activities continue at the off-site and on-site groundwater monitoring wells to continue to evaluate the system remediation efficiency.

- Monitoring Wells: Replace nonfunctional locks, man hole covers and manhole pads for monitoring wells, as detailed above.

Reclassification/Delisting Evaluation

The Site was originally listed as a Class 2 Inactive Hazardous Waste Site by the NYSDEC in November 1990. Since this time, completion of the following project phases has occurred, as summarized below:

Project Phases and Completion Dates

Project Phase	Completion Date
Remedial Investigation	04/1994
Phase II Remedial Design Investigation	12/1998
Remedial Design	06/2000
Groundwater Extraction and Treatment System Construction	12/2001 (1)
UST Removal and Phase I Contaminated Soil Removal IRM	06/2010
Phase II Contaminated Soil Removal IRM	07/2011

1. Construction of the GWE&TS was completed in December 2001. The GWE&TS was placed into routine operation in December 2001 and D&B assumed O&M duties in February 2005.

Given the above, the Active Industrial Uniform Site cannot be reclassified at this time, pursuant to the requirements identified in 6 NYCRR §375-2.7, as site-related contamination has not been fully remediated and continues to pose a significant threat to public health and the environment. As such, Site delisting is not recommended at this time, as all remediation and post-remediation activities have not been satisfactorily completed. Work continues to address residual on-site contamination and system optimization to expedite overall remediation and Site closure.

Report Certification:

I have personally examined and am familiar with the information submitted in the referenced report. To the best of my knowledge and belief, and based upon my inquiry of those individuals immediately responsible for obtaining the information reported therein, I certify that the submitted information is true, accurate, and complete.

Project Director: R M. Walka — 10.17.18

Richard M. Walka — **Date**
Senior Vice President

Project Manager: — 10.18.2018

James Van Horn — **Date**
Project Manager