D&B Engineers and Architects, P.C.

ACTIVE INDUSTRIAL UNIFORM SITE GROUNDWATER EXTRACTION AND TREATMENT SYSTEM

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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.

Since system start-up on April 26, 2017, routine monitoring indicates an increasing trend in contaminant concentrations in the influent of the GWE&TS. This increase may be due to GWE&TS intercepting deeper on-site contamination. As such, D&B recommended that an evaluation be completed regarding continued operation of the GWE&TS in addition to implementation of a source area investigation to evaluate possible areas of remaining contamination at the Site. To facilitate these RSO activities D&B recommends the GWE&TS remain off to allow for the subsurface environment to come to equilibrium prior to completing the work.

Treatment System Operational Status

Since the system start-up on April 26, 2017, the GWE&TS has been operating for the majority of the time; however, routine groundwater monitoring indicates that the GWE&TS may be causing degradation of shallow groundwater quality. Based on this information, in October of this reporting period D&B recommended that an evaluation be completed regarding continued operation of the GWE&TS and implementation of a source area investigation to evaluate possible areas of remaining contamination at the Site. To facilitate these RSO activities D&B recommended shutting down the GWE&TS to allow for the subsurface environment to come to equilibrium prior to completing the work. The NYSDEC approved shutdown of the system on November 16, 2018 and on November 30, 2018, the NYSDEC Remedial Services Contractor completed a round of O&M activities and subsequently shutdown the system.

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]	1,449 hours	66%
Approximate Downtime - Current Reporting Period [2]	759 hours	34%
Approximate Total Runtime to Date [3]	74,369 hours	62%
Approximate Total Downtime to Date [3]	45,962 hours	38%

Notes:

1. Total elapsed time for current reporting period is 2,208 hours (October 1, 2018 through December 31, 2018).
2. The downtime associated with this reporting period is due to non-routine system shutdowns, on-going maintenance activities and the system shutdown on November 30, 2018.
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. On November 30, 2018 the NYSDEC Remedial Services Contractor shutdown the GWE&TS to allow for the subsurface environment to come to equilibrium prior to completing the RSO activities described above.

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 56 (October 1, 2018 through December 31, 2018)	Quarter 55 (July 1, 2018 through September 30, 2018)	Totals to Date (February 2005 through current Quarter)
Influent			
RW-1 Average Pumping Rate (gal per min)[1]	58.74	80.30	--
RW-1 Total Flow Volume (gal)	5,106,610	10,324,880	432,058,725
RW-1 Maximum Influent PCE Concentration (ug/l)[2]	150	130	--
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)[3]	0.35	0.69	--
Influent Total Flow Volume (gal)	5,106,610	10,324,880	561,959,454
Effluent [4]			
Effluent Total Flow Volume (gal)	5,225,372	10,632,199	562,580,046
Maximum Effluent PCE Concentration (ug/l)[5]	1.9	2.4	--
VOC Removal Summary			
Total VOC Removal (lbs)	9.62	21.01	1,686
Average VOC Removal Rate (lbs/hr)	6.64E-3	9.80E-3	--
VOC Removal Efficiency Range (%)	98.14 - 99.47%	97.06 - 97.65%	--

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

Notes:

1. RW-1 average pumping rates for the last reporting period was higher than the previous periods because the NYSDEC Remedial Services Contractor did not adjust the flow rate following the effluent pipe repair; however, flow rate was adjusted from 78 gpm to 50 gpm on October 17, 2018.
2. RW-1 influent samples are scheduled to be collected on a monthly basis. Due to the GWE&TS shutdown on November 30, 2018, the system was operating for only a portion of this reporting period, as such, only two RW-1 influent samples were collected on October 2, and November 14, 2018, while the system was operating.
3. 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.
4. 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.
5. Effluent samples are scheduled to be collected on a monthly basis. Due to the GWE&TS shutdown on November 30, 2018, the system was operating for only a portion of this reporting period, as such, only two effluent samples were collected on October 2, and November 14, 2018. Concentrations are reflected in the table above.

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		
				Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
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	10/2/18 10/17/18	11/14/18				
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	10/17/18					

Facility Maintenance:

- On October 17, 2018 the NYSDEC Remedial Services Contractor completed grounds keeping activities on-site.

Alarm Conditions:

- On October 18, 2018, the NYSDEC Remedial Services Contractor responded to a general systems alarm. The system was reset and restarted on the same day.
- On November 21, 2018, the NYSDEC Remedial Services Contractor responded to a general systems alarm. The system was reset and restarted on the same day.

Non-Routine Treatment System Maintenance:

- On October 31, 2018, the NYSDEC Remedial Services Contractor inspected and snaked the eye wash station drain. It should be noted that the NYSDEC Remedial Services Contractor observed that the eye wash station drain is not plumbed to a discharge outlet. Additionally, a loose fernco coupling was observed at the floor basin plumbing. The NYSDEC Remedial Services contractor attempted to repair the fernco coupling. The contractor was unable to repair the coupling and suggested that it be replaced.
- On November 21, 2018, the NYSDEC Remedial Services Contractor cleaned the sight tube for Transfer Pump P-1.
- On November 30, 2018, the NYSDEC Remedial Services Contractor repaired the heater vent and drained both air stripper towers to complete activities for the system shutdown. Additionally, the Contractor replaced missing bolts for the monitoring well manhole covers.

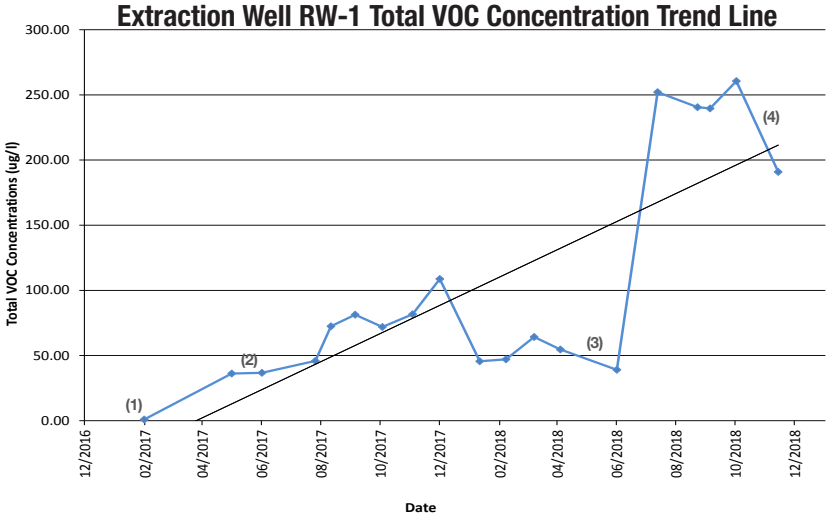
Treatment System Monitoring and Sampling Results

A summary of the routine treatment system monitoring and sampling collection and associated results are provided below. Refer to *Attachment C* for analytical data results.

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	10/2/18 11/14/18	10/2/18 11/14/18					
Extraction Well RW-2 Influent[1]							
Air Stripper Aqueous-Phase Effluent [2]	10/2/18 11/14/18	10/2/18 11/14/18	10/2/18 11/14/18				
Air Stripper Vapor-Phase Effluent [3][4]							
Groundwater Monitoring Wells MW-103 through MW-107, MW-2S, MW-4D, MW-5S and RW-2[5]					10/18/18 10/31/18		
Groundwater Monitoring Wells MW-101, MW-102, MW-108, MW-109 and MW-111							

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. System sampling events are scheduled to be collected on a monthly basis. Due to the GWE&TS shutdown on November 30, 2018 the system was operating for only a portion of this reporting period, as such, only two system sampling events occurred on October 2, and November 14, 2018. Concentrations are reflected in the table above.
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 in the previous reporting period on July 12, 2018.
5. The NYSDEC Remedial Service Contractor inadvertently collected a groundwater sample from monitoring well MW-4S on October 18, 2018, as part of the routine semi-annual groundwater sampling event. Sampling results and analytical lab results are detailed below.



1. 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.
2. 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.
3. A system sample was not collected in May 2018 due to an effluent piping failure and repair activities.
4. Aqueous-phase influent samples are scheduled to be collected on a monthly basis. Due to the GWE&TS shutdown on November 30, 2018 the system was operating for only a portion of this reporting period, as such, only two aqueous-phase influent samples were collected on October 2, and November 14, 2018.

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)	110 - 150 ug/l	120 - 130 ug/l	5.0 ug/l
Trichloroethene (TCE)	23 - 30 ug/l	20 - 28 ug/l	5.0 ug/l
Cis-1,2-Dichloroethene (Cis-1,2-DCE)	57 - 79 ug/l	81 - 110 ug/l	5.0 ug/l
Vinyl Chloride (VC)	0.91 - 1.1 ug/l	0.97 - 1.1 ug/l	2.0 ug/l
Iron	ND	ND	300 ug/l
Manganese	831 - 852 ug/l	836 - 890 ug/l	300 ug/l
Sodium	34,000 - 37,300 ug/l	36,300 - 41,400 ug/l	20,000 ug/l

ND: Constituent concentration below the analytical detection limit. --: Not analyzed
Red font denotes an exceedance 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. RW-1 influent samples are scheduled to be collected on a monthly basis. Due to the GWE&TS shutdown on November 30, 2018 the system was operating for only a portion of this reporting period, as such, only two RW-1 influent samples were collected on October 2, and November 14, 2018.

Aqueous-Phase Air Stripper Effluent Concentration Ranges [1]			
Discharge Permit Parameters	**Current Reporting Period [2]**	**Previous Reporting Period**	**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	0.53 - 1.9	2.1 - 2.4	10.0 ug/l
TCE	ND - 0.55	0.58 - 0.67	10.0 ug/l
Trans-1,2-DCE	ND	ND	10.0 ug/l
Cis-1,2-DCE	0.49 - 2.5	2.9 - 4.6	NL
VC	ND	ND	10.0 ug/l
Bromomethane	ND	ND	Monitor
Chloromethane	ND	ND	Monitor
Copper	ND	ND - 12.3	4.0 ug/l
Iron	ND	ND	1,000 ug/l
Lead	ND	ND	8.0 ug/l
Potassium	2,510 - 2,600	2,700 - 2,750	Monitor
Manganese	650 - 743	812 - 937	Monitor
Vanadium	ND	ND	Monitor
Zinc	ND	ND - 5.5	66.0 ug/l
Total Dissolved Solids (TDS)	162 - 284	229 - 250	Monitor
pH[3]	5.73 - 5.85	5.68	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. Effluent samples are scheduled to be collected on a monthly basis. Due to the GWE&TS shutdown on November 30, 2018 the system was operating for only a portion of this reporting period, as such, only two effluent samples were collected on October 2, and November 14, 2018. Concentrations are reflected in the table above.
3. It should be noted that the NYSDEC Remedial Services Contractor collected two pH samples on October 2, and November 14, 2018. Concentrations are reflected in the table above.

Site-specific contaminants of concern for aqueous-phase air stripper effluent samples exhibited concentrations lower than the limits under the SPDES permit. Copper was previously detected at concentrations of 12.3 ug/l in the effluent sample, which was higher than previous reporting periods and the Site Specific Effluent Limits of 4.0 ug/l; however, during this reporting period, copper was not detected. Two pH readings were collected this reporting period on October 2 and November 14, 2018. pH readings exhibited levels lower than the Site Specific Effluent Limits Standard range of 6.5-8.5 at a concentration of 5.73 and 5.85. 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	-	0.005671	0.007 lbs/hr
TCE	--	0.001215	0.006 lbs/hr
Total Xylenes	--	ND	0.001 lbs/hr
1,2-DCE (total)	--	0.00648	0.003 lbs/hr
VC	--	0.000057	0.014 lbs/hr
1,1,1-TCA	--	ND	0.001 lbs/hr
Total VOC Concentrations (field screening with PID) [2]	0.0 - 8.9	0.0	NA
Maximum Total VOC Emissions[3]	--	0.01342	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 typically collected on a semi-annual basis. A vapor-phase effluent sample was collected during the previous reporting period on July 12, 2018.
2. The total VOC concentrations observed in this 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.

The vapor-phase effluent sample collected in the previous reporting period exhibited concentrations lower than the site specific limits, with the exception of total-1,2-dichloroethene, detected at a concentration of 0.00648 lbs/hr in the effluent sample. The detection is higher than the site-specific limit of 0.003 lbs/hr; however, the total VOC emissions were below the limit for the Site.

Quarterly Groundwater Monitoring Summary

Select groundwater monitoring wells and one extraction well were sampled on October 18 and 31, 2018, to determine groundwater quality at and in the vicinity of the Site. Samples were collected from eight on-site groundwater monitoring wells (MW-103 through MW-107, MW-4S, MW-4D and MW-5S) and one off-site groundwater monitoring well (MW-2S). Additionally, off-site extraction well (RW-2) was sampled as part of the quarterly groundwater sampling event, as extraction well RW-2 is not operating. It should be noted that the NYSDEC Remedial Services Contractor inadvertently collected a groundwater sample from monitoring well MW-4S during the quarterly sampling event.

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; however, it should be noted that the NYSDEC Remedial Services Contractor inadvertently did not complete monitoring well logs for MW-4S and RW-2.

Refer to *Attachment D* 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 ranged from non-detect to a maximum of 358.7 ppm in monitoring well MW-4D in headspace readings.

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

Site-Specific Contaminant of Concern Concentrations

Monitoring Well	PCE		TCE		Cis-1,2-DCE		Vinyl Chloride		Site-Specific 2-Year Total VOC Trend Analysis[3]
	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	NS	0.57 ug/l	NS	ND	NS	ND	NS	ND	Stable
MW-102	NS	1.5 ug/l	NS	0.31 ug/l	NS	0.4 ug/l	NS	ND	Stable
MW-103	6.7 ug/l	1.9 ug/l	0.42 ug/l	0.41 ug/l	ND	0.39 ug/l	ND	ND	Decreasing
MW-104	57 ug/l	19 ug/l	5.6 ug/l	1.2 ug/l	0.49 ug/l	ND	ND	ND	Stable
MW-105	1.3 ug/l	0.67 ug/l	ND	ND	ND	ND	ND	ND	Decreasing
MW-106	4.8 ug/l	8 ug/l	5.6 ug/l	6.2 ug/l	24 ug/l	40 ug/l	2.4 ug/l	7.5 ug/l	Increasing
MW-107	3.4 ug/l	0.9 ug/l	1.2 ug/l	0.36 ug/l	1.3 ug/l	ND	0.38 ug/l	ND	Stable
MW-108	NS	0.54 ug/l	NS	ND	NS	ND	NS	ND	Decreasing
MW-4S [1]	0.34 ug/l	--	ND	--	ND	--	ND	--	--
MW-4D	40,000 ug/l	64,000 ug/l	4,300 ug/l	8,600 ug/l	290 ug/l	260 ug/l	25 ug/l	71 ug/l	Increasing
MW-5S	ND	ND	ND	ND	ND	ND	ND	ND	Stable
Off-Site Monitoring Wells									
MW-109	NS	1.1 ug/l	NS	1.9 ug/l	NS	1.7 ug/l	NS	ND	Stable
MW-111	NS	ND	NS	ND	NS	ND	NS	ND	Stable
MW-2S	14 ug/l	11 ug/l	2.2 ug/l	4.9 ug/l	280 ug/l	2,500 ug/l	0.37 ug/l	2.7 ug/l	Increasing
RW-2 [2]	0.35 ug/l	0.69 ug/l	0.54 ug/l	1.4 ug/l	0.67 ug/l	2.7 ug/l	ND	ND	Stable

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: carbon disulfide, 1,1-dichloroethene, ethylbenzene, toluene, trans-1,2-dichloroethene, sec-butylbenzene, and total xylenes.

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

1. The NYSDEC Remedial Services Contractor inadvertently collected a groundwater sample from monitoring well MW-4S during the quarterly groundwater sampling event, as such, analytical data for the contaminants of concern are included here.
2. 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.
3. The Site specific two-year total VOC trend analysis for all thirteen routinely monitored wells is based on the degree of slope exhibited by the best fit line across each Total VOC Concentration Graph.

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): MW-101 was not sampled this reporing period; however, concentrations of site-specific VOCs were detected at concentrations below their respective Class GA Standards throughout the previous reporting periods.
- MW-102 (screened at 5 to 15 feet below grade): MW-102 was not sampled this reporing period; however, concentrations of site-specific VOCs were detected at concentrations below their respective Class GA Standards throughout the previous reporting periods.

- MW-103 (screened at 5 to 15 feet below grade): Concentrations of site-specific VOCs in monitoring well MW-103 have exhibited decreasing trends throughout the last two-year period. PCE was detected at a concentration of 6.7 ug/l exceeding its Class GA Standard of 5 ug/l, on October 18, 2018, of this reporting period. PCE, cis-1,2-DCE and VC, site-specific contaminants, were detected at concentrations exceeding their respective Class GA Standards throughout the previous 2-year period, as follows:
  - PCE was detected at a concentration of 6.7 ug/l on October 17, 2018, 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 a concentration 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 and now exhibit a stable trend. PCE was detected in exceedance of it's respective Class GA Standard throughout the previous 2-year period. Additionally, TCE has typically been detected at concentrations below it's respective Class GA Standard through the previous 2-year period, with the exception of this reporting period:
  - PCE was detected at concentrations ranging from 19 ug/l to 57 ug/l, with the maximum concentration detected on October 18, 2018. PCE has generally exhibited a slightly decreasing trend over the last two year period.
  - TCE was detected at concentrations of 5.6 ug/l on October 18, 2018 exceeding its respective Class GA Standards of 5.0 ug/l
- 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. It should be noted that MW-105 has exhibited a decreasing trend in total contaminants of concern throughout the last two-year period. Site-specific contaminants which were detected at concentrations exceeding their respective Class GA Standards throughout the previous 2-year period are as follows:
  - PCE was detected at a concentration of 14 ug/l on January 17, 2018.
  - Cis-1,2-DCE was detected at a concentration of 260 ug/l on April 24, 2017.
  - VC was detected at a concentration of 27 ug/l 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. Total VOCs have increased 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 throughout the previous 2-year period, as follows:
  - PCE was detected at concentrations ranging from 2.4 ug/l to 17 ug/l, with the maximum concentration detected on April 24, 2017. Overall, PCE concentrations have exhibited decreasing trends throughout the last two-year period.
  - TCE was detected at concentrations ranging from 2.5 ug/l to 9.10 ug/l, with the maximum concentration detected on January 19, 2017. 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 1,200 ug/l, with the maximum concentration detected on May 22, 2018. 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 2.4 ug/l to 58 ug/l, with the maximum concentration detected on May 22, 2018. 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 were 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): MW-108 was not sampled this reporting period; however, site-specific VOCs were detected at concentrations below the Class GA Standards in the previous 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 Standards 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, cis-1,2-DCE and VC have been detected in exceedance of their respective Class GA Standards throughout the previous 2-year period, 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.
  - TCE was detected at concentrations ranging from 54 ug/l to 8,600 ug/l, with the maximum concentration detected on July 2, 2018. Overall, TCE concentrations have exhibited an increasing trend throughout last two-year period.
  - Cis-1,2-DCE was detected at concentrations ranging from 5.3 ug/l to 490 ug/l, with the maximum concentration detected on January 17, 2018. 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 71 ug/l, with the maximum concentration detected on July 2, 2018. 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 were detected at concentrations below their respective Class GA Standards during this reporting period and have exhibited generally stable trends since June 2010.

Additionally, the NYSDEC inadvertently sampled MW-4S this reporting period as part of the on-site monitoring well network. Concentrations in monitoring well MW-4S were detected at concentrations below the Class GA Standards or non-detect. In general, site-specific VOCs have shown increasing trends in two on-site monitoring wells (MW-106 and MW-4D) since the system start-up in April 26, 2017.

It should also 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 also 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. MW-109 was not sampled this reporting period; however, site-specific VOCs have been detected at concentrations below their respective Class GA Groundwater Standards from June 2006 through the end of the previous 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. MW-111 was not sampled this reporting period; however, 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 of the previous 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 have been detected in exceedance of their respective Class GA Standards throughout the previous 2-year period, as follows:
  - PCE was detected at concentrations ranging from 1.7 ug/l to 61 ug/l, with the maximum concentration detected on July 3, 2017. Overall, PCE has exhibited a decreasing trend over the last two-year period.
  - Cis-1,2-DCE was detected at concentrations ranging from 11 ug/l to 2,500 ug/l, with the maximum concentration detected on July 3, 2018. Overall, cis-1,2-DCE concentrations have increased over the last two-year period.
  - 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 decreasing 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. 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.

- Carbon disulfide was detected in the method blank associated with sample MW-4S collected on October 18, 2018 as part of the semi-annual groundwater sampling event. Carbon disulfide was qualified as non-detect (UB) in sample MW-4S and MW-X.
- The percent recoveries (%Rs) were above the quality control (QC) limit in the lab control sample (LCS) for 1,2,3-trichlorobenzene and 2-butanone. 1,2,3-trichlorobenzene and 2-butanone were not detected in the aqueous-phase system samples therefore qualification of the data collected on November 14, 2018 was not necessary.
- The %Rs were above the QC limits for 1,1-dichloroethene, chloroform and trans-1,2-dichloroethene in the LCS. They were not detected in the samples therefore qualification of the data collected on November 14, 2018, was not necessary.

Data Validation Checklists are presented in *Attachment E*.

Findings and Recommendations

Findings:

- GWE&TS Operation: The GWE&TS was operating utilizing AST-1 for the majority of the system runtime this reporting period. The GWE&TS was operating for only a portion of this reporting period due to general system alarms throughout the operational period and the scheduled system shutdown on November 30, 2018.

- GWE&TS Maintenance: The NYSDEC Remedial Services Contractor completed several rounds of routine maintenance activities this reporting period. Additionally, as detailed above, non-routine maintenance was completed on several occasions throughout this reporting period to enable the successful system shutdown and potential restart in the future.

- System Aqueous-Phase Influent and Effluent Contaminant Concentrations: The GWE&TS was operating for only a portion of this reporting period, as such, aqueous-phase influent samples from extraction well RW-1 and aqueous-phase effluent samples were collected only on two occasions throughout this reporting period. Influent and effluent

samples were collected on October 2, and November 14, 2018, for VOC and metals analysis. It should be noted that VOC influent concentrations have increased significantly since restarting the GWE&TS. This is possibly due to RW-1 influencing the deep groundwater contamination identified at MW-4D. The NYSDEC Remedial Services Contractor collected a groundwater sample from extraction well RW-2 on October 18, 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 with the exception of pH. The pH readings collected exhibited levels lower than the previous reporting period and outside of the SPDES permit acceptable range. It should be noted that copper, which was previously observed above reporting limits, exhibited no detections this reporting period.

- System Vapor-Phase Effluent Monitoring: System vapor-phase effluent samples are typically collected on a semi-annual basis. A vapor-phase effluent sample for laboratory analysis was collected on July 12, 2018, in the previous reporting period. Total VOC concentrations observed were below the Site Specific Maximum Total VOC emissions limit of 0.5 lbs/hr; however, 1,2-DCE was higher than its limit of 0.003 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.

- Monitoring/Extraction Well Sampling: On-site groundwater monitoring wells (MW-103, MW-104, MW-106, and MW-4D), and one off-site monitoring well (MW-2S) 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 nine of ten groundwater monitoring wells sampled this reporting period at concentrations ranging from 0.34 ug/l to a maximum of 40,000 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 ten groundwater monitoring wells.

Recommendations:

- Remedial System Optimization:
  - Based on the current status of the GWE&TS and the remaining elevated contaminant concentrations in groundwater detected at the Site, the necessary RSO activities to complete the recommended source area investigation include the installation of several on-site test pits, completion of an on-site vapor study, off-site discrete groundwater sampling, and the installation of off-site groundwater monitoring wells.
- General Treatment System:
  - Based on the remaining elevated contaminant concentrations in groundwater detected at the Site, D&B recommends that an evaluation be completed regarding continued operation of the GWE&TS.
- Treatment System Operational Issues:
  - 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: As the GWE&TS was shutdown on November 30, 2018, the NYSDEC Remedial Services Contractor should continue to sample and monitor Extraction Wells EW-1 and EW-2 as part of the routine quarterly groundwater monitoring events.
- Monitoring/Extraction Well Sampling: It is recommended that quarterly monitoring activities continue at the on-site and off-site groundwater monitoring wells.

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: _____ 5.23.19

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

Project Manager: _____ 5.23.19

James Van Horn — *Project Manager* — **Date**