



# New York State Department of Environmental Conservation Division of Environmental Remediation

## Franklin Cleaners Site Site No. 130050

### Plume Redelineation Summary Report





## 1.0 Introduction

The Franklin Cleaners Site (the Site) is located at 206-208B South Franklin Street in the Incorporated Village of Hempstead, Nassau County, New York. The Site is a New York State Department of Environmental Conservation (NYSDEC) Class 4 Inactive Hazardous Waste Site listed on the New York State Registry of Inactive Hazardous Waste Sites (Site No. 130050).



The groundwater extraction & treatment system (GWE&TS) associated with the Site is located approximately one mile downgradient of the Site at 1000 Hempstead Avenue in the Village of Rockville Centre, New York. It should be noted that the GWE&TS and associated monitoring wells are located approximately 1,300 feet upgradient of a Village of Rockville Centre water supply well cluster.



The GWE&TS was designed to recover and treat a chlorinated solvent groundwater contamination plume emanating from the Site and discharge the treated groundwater to a Nassau County Department of Public Works storm sewer manhole in accordance with all applicable discharge standards. Refer to [Figure 1-1](#) for a Site Location Map depicting the Site and associated GWE&TS location.

A Remedial System Optimization (RSO) was previously completed at the Site in 2011 and 2012 by D&B Engineers and Architects (D&B) in an effort to improve the efficiency, effectiveness and net environmental benefit of the GWE&TS. As part of these ongoing RSO activities, D&B completed a Plume Redelineation Program at the Site in June and July 2014.



The objective of the Plume Redelineation Program was to identify the current horizontal and vertical extents of the remaining groundwater plume and identify prominent clay layers existing within the limits of the historical plume which may affect the movement and persistence of the plume. This report presents relevant background information, a summary of the field activities and associated findings and recommendations of the Plume Redelineation Program.

## 2.0 Project Background

The below narrative provides a brief Site description and remedial history, and includes a brief description of the GWE&TS.

### 2.1 Remedial History and GWE&TS Description

As described above, the Site is a NYSDEC Class 4 Inactive Hazardous Waste Site and was listed on the New York State Registry of Inactive Hazardous Waste Sites (Site No. 130050), following the identification of chlorinated solvent contamination at the Site due to its historical use as a commercial dry cleaner. It should be noted that groundwater beneath the Site is located at approximately 18 feet below grade. Regional and local groundwater generally flows to the south/southwest toward several small lakes, which generally then discharge to the various bays along Nassau County's southern shore.

The estimated historical horizontal extents of the plume are depicted on [Figure 2-1](#). The estimated historical extent of the plume is based on a limit of 5 micrograms per liter (ug/l) of tetrachloroethene (PCE), a chlorinated solvent, as presented in the November 1998 Remedial Investigation/Feasibility Study (RI/FS). Concentrations of PCE of over 1,500 ug/l were detected in groundwater on-site and PCE concentrations over 1,000 ug/l were detected in off-site areas during the initial plume delineation effort completed as part of the November 1998 RI/FS.



In accordance with the requirements of the NYSDEC Record of Decision (ROD), dated March 1998, on-site and off-site remedial actions have been implemented at and downgradient of the former Franklin Cleaners dry cleaner site in order to remediate chlorinated-solvent contamination associated with the historical use of this property as a commercial dry cleaner.

The “source area” chlorinated solvent contamination at the on-site property was remediated via a soil vapor extraction and air sparging (SVE/AS) system, which operated from November 2003 to August 2004. The SVE/AS system was shut down in August 2004 based on contaminant concentrations below NYSDEC guidelines in soil and groundwater.



In addition, to achieve the Site Standards, Criteria and Guidance (SCGs) identified for the Site, the off-site remedial action included the installation of a GWE&TS designed to capture the leading edge of the groundwater plume which extended from the on-site “source area” property. The groundwater plume associated with the Site is primarily composed of PCE, as well as lesser concentrations of other chlorinated volatile organic compound (VOC) “breakdown” products of PCE, including trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE) and vinyl chloride (VC).

The GWE&TS, which has been in operation since September 2004, consists of two 6-inch diameter extraction wells (EW-1 and EW-2) screened approximately 70 to 90 and 75 to 90 feet below grade, respectively. Extracted groundwater is conveyed via underground piping to a low-profile stacked-tray air stripper located in the GWE&TS building. The treated groundwater is discharged from the air stripper to a wet well equipped with two series-configured submersible pumps, which convey the treated water via underground piping to a Nassau County Department of Public Works storm sewer manhole in accordance with all applicable discharge standards. Exhaust gas from the air stripper was treated utilizing two series-configured granular activated carbon (GAC) vessels; however, based on historic low contaminant concentrations detected in the air stripper exhaust gas, the air stripper exhaust piping was reconfigured to bypass the GAC vessels and discharge exhaust gas 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 startup and operation, and an autodial alarm notification system. Refer to [Figure 2-2](#) for an “as-built” treatment system layout diagram.

Based on the results of the current and historic groundwater sampling completed in the vicinity of the GWE&TS, contaminant concentrations within extraction well EW-1 (screened at 70 to 90 feet below grade) and monitoring well ASMW-1 (screened at 80 to 90 feet below grade) have remained elevated. In addition, PCE concentrations have exhibited slightly increasing trends in these wells since August 2009, which it was believed may indicate that the groundwater plume has possibly shifted to the west.

In addition, a RSO evaluation was completed at the Site in 2011 and 2012 in an effort to improve the efficiency, effectiveness and net environmental benefit of the GWE&TS. The RSO evaluation focused on identifying potential system modifications/alternatives for reducing overall project costs and expediting Site closure. The findings of the RSO evaluation were presented in the Franklin Cleaners Remedial System Optimization Report, dated March 2012.

Based on the results of the March 2012 Remedial System Optimization Report, D&B recommended a plume redelineation program be completed at the Site in order to delineate the current vertical and horizontal extents of the plume. The plume redelineation field activities and results are detailed below.

### 3.0 Completed Field Activities

The Plume Redelineation Program field activities were generally completed in accordance with the NYSDEC-approved Plume Redelineation Technical Scope of Work Letter, dated January 24, 2014, as prepared by D&B.

The field program was implemented by the NYSDEC Remedial Services Contractor in June and July 2014. In addition, Aquifer Drilling and Testing, Inc. (ADT) conducted all drilling services, under contract with the NYSDEC Remedial Services Contractor.





Laboratory analyses were performed by Test America Laboratories, Inc. (TAL) of Edison, New Jersey. D&B provided periodic oversight and inspection services during the field program.

Sample intervals referred to below as “shallow, intermediate and deep” generally correspond to depths of approximately up to 50, 50 to 65 and 65 feet below grade and deeper, respectively. Any modifications from the drilling sampling procedures outlined in the January 2014 Scope of Work Letter, are described below, where applicable.

It should be noted that the GWE&TS remained in operation throughout the duration of the Plume Redelineation Program. A detailed description of the completed field activities is provided below:

### 3.1 Existing Groundwater Monitoring Well Sampling

A total of nine groundwater samples were collected from existing monitoring well “clusters” that were previously installed along the historical center-line of the groundwater plume during the RI/FS field work in 1997. The locations of these monitoring well “clusters” are depicted on [Figure 3-1](#). These well “clusters” (MW-1 through MW-4) generally include shallow (“S”), intermediate (“I”), and deep (“D”) monitoring wells. It should be noted that this historical well installation program did not include the installation of shallow monitoring wells at clusters MW-3 and MW-4 or a deep monitoring well at well cluster MW-2.



On June 2 through 5, 2014, and prior to sample collection, each of the monitoring wells was inspected for damage and measured for depth to groundwater and total depth. Field inspection logs for the existing monitoring wells are provided as [Appendix A](#). Based on field measurements collected by the NYSDEC Remedial Services Contractor, the total approximate depth of the shallow wells are approximately 29 feet below grade, the total approximate depths of the intermediate wells are approximately 53 to 58 feet below grade and the total approximate depths of the deep wells are approximately 75 to 85 feet below grade. Groundwater was located at a depth of approximately 17 to 20 feet below grade in the wells.

In order to minimize the generation and handling of purge water, as well as to obtain high-quality samples, the monitoring wells were purged and sampled utilizing low-flow sampling techniques. Purge water was monitored in the field utilizing a calibrated multiple parameter water quality instrument for the following parameters: conductivity, dissolved oxygen, pH, temperature and turbidity. Groundwater samples were collected from each well after field parameters stabilized within 10% for three consecutive readings and the turbidity of the purge water remained at or below 50 nephelometric turbidity units (NTUs). All observations, including any evidence of odors and sheens, were logged by a geologist in a dedicated field notebook throughout the groundwater sampling activities.

All samples were shipped to TAL, under proper Chain of Custody procedures. All groundwater samples were analyzed for volatile organic compounds (VOCs) by United States Environmental Protection Agency (USEPA) method 8260. Sample results are discussed in Section 4.0.

### 3.2 Vertical Profile Temporary Well Installation and Sampling

Seventeen vertical profile temporary wells (FCTW-01 through FCTW-17) were installed and sampled within and to the east and west of the historic extent of the groundwater plume in order to determine the current horizontal and vertical extent of the remaining plume. Completed temporary well locations are provided in [Figure 3-1](#).

The temporary well installations and groundwater sampling were generally completed in accordance with the requirements of the January 2014 Scope of Work Letter; however,





the NYSDEC Remedial Services Contractor's drilling subcontractor (ADT) could not provide the direct-push drill rig specified in the January 2014 Scope of Work Letter. As such, refusal was encountered at several temporary well locations and, after several unsuccessful attempts utilizing two separate direct-push drill rigs, ADT ultimately provided a Sonic XL Max drill rig to complete the installation of the temporary wells.

The temporary wells were consequently installed by driving a steel double-cased drill pipe to the deepest target sample depth. Disposable polyethylene tubing was then inserted into the inner casing assembly and groundwater was purged utilizing an oscillating stainless steel check valve. The purge water was monitored for stabilization of field parameters and the groundwater sample was collected for laboratory analysis. Once sampling was completed at a given interval, the double-cased steel drill pipe was withdrawn to the next sample depth and sampling continued until all sample intervals were completed at each temporary well location. All observations, including any evidence of odors and sheens, were logged by a geologist in a dedicated field notebook throughout the groundwater sampling activities.

The vertical profile temporary wells were generally biased towards deeper sample intervals, and were installed as follows:

- Four temporary wells (FCTW-01 through FCTW-04) were installed in the vicinity and downgradient of the GWE&TS in order to determine whether the entirety of the leading edge of the remaining plume is being captured by the GWE&TS, in its current configuration and at its current extraction rate.
- Thirteen temporary wells (FCTW-05 through FCTW-17) were installed along the historic extent of the groundwater plume and upgradient of the GWE&TS in order to determine the current horizontal and vertical extent of the plume.

Between three to five groundwater samples were collected from each temporary well location, at 20-foot increments ranging generally from 40 to 100 feet below grade. However, as temporary well locations FCTW-09, FCTW-14 and FCTW-16 were installed in close proximity to monitoring well clusters sampled as part of the existing groundwater well sampling outlined above, groundwater samples were not collected from the 60 and 80-foot depth at FCTW-09 and FCTW-14 or the 60-foot depth at FCTW-16 to avoid duplication of sample intervals. In addition, due to poor groundwater flow associated with silt and clay at the screened sample interval, a sample could not be collected from the 100 to 104-foot interval at FCTW-03.

As per the January 2014 Scope of Work Letter, three temporary well locations (FCTW-01, FCTW-09 and FCTW-14) were extended to a depth of approximately 120 feet below grade, where an additional groundwater sample was collected in order to confirm that the plume has not migrated below its historical depth of 90 to 95 feet below grade, as detailed in the 1998 RI/FS and December 2000 GWE&TS Design Report.



All groundwater samples were shipped to TAL, under proper Chain of Custody procedures. All groundwater samples were analyzed for VOCs by USEPA Method 8260.

Temporary well locations penetrating prominent clay layers were grouted with bentonite to prevent creating a conduit for contaminant migration. Upon completion, the remaining portions of each temporary well location were allowed to collapse into themselves. Where feasible, visibly clean soil was backfilled into probe locations from where it was removed. All soil generated during the installation of the temporary wells which was visibly contaminated or otherwise not able to be backfilled was containerized in 55-gallon drums, or equivalent, for proper characterization and

off-site disposal. A waste manifest is provided in [Appendix B](#). Any remaining void space was then backfilled with either clean sand and/or bentonite pellets. Soil boring locations were restored at grade in-kind with asphalt or concrete patch, as needed.

In order to limit waste disposal costs, all purge water generated as part of the temporary well sampling program was contained for transport and treatment at the GWE&TS.





### 3.3 Clay Layer Investigation

Based on review of the limited boring logs provided in the 1998 RI/FS and December 2000 GWE&TS Design Report, several discontinuous clay layers appear to be located at varying depths along the extent of the historic groundwater plume and in the vicinity of its leading edge, at depths generally ranging from 60 to 85 feet below grade. As these clay layers may affect groundwater flow, and therefore plume movement, soil borings were continuously logged and inspected to record the presence of clay at the vertical profile temporary well locations which were extended to 120 feet below grade (FCTW-01, FCTW-09 and FCTW-14). Boring logs are provided in [Appendix C](#).

Soil samples were collected continuously from 70 feet below grade to the termination depth of (120 feet) for soil borings FCTW-01, FCTW-09 and FCTW-14 in order to retrieve soil samples at these depths for visual inspection. In addition, the recovered soil was screened for the presence of volatile organics with a photoionization detector (PID). All observations, including any evidence of odors and sheens, were logged by a geologist in a dedicated field notebook.

All soil boring locations that penetrated a prominent clay layer were grouted with bentonite to prevent creating a conduit for possible contaminant migration below these clay layers.

### 4.0 Investigation Findings

As the chlorinated solvent plume associated with the Site is primarily composed of PCE, and as is typical of the data collected as part of the routine GWE&TS performance monitoring and quarterly groundwater monitoring programs currently be completed at the Site, PCE was the only contaminant detected in exceedance of its Class GA Groundwater Standard during the Plume Redelineation Program. Analytical data generated during the Plume Redelineation Program is provided in [Appendix D](#).

A figure depicting PCE concentrations generated from the existing well and temporary well analytical data and the current configuration of the PCE plume, is provided as [Figure 4-1](#). Note that this figure also includes the historical plume limits, as presented in the November 1998 RI/FS, for reference. In addition, a cross-sectional representation of the current plume and silty-clay/clay layer thickness observations associated with current and historical soil borings is provided as [Figure 4-2](#).

A summary of the analytical data and other pertinent results from the plume redelineation investigation are provided below:

#### 4.1 Existing Groundwater Monitoring Well Groundwater Sample Results

A total of nine groundwater samples were collected from existing shallow, intermediate and deep monitoring wells at plume center-line well “clusters” MW-1 through MW-4. All groundwater monitoring well sample results were compared to the NYSDEC Class GA Groundwater Standards and Guidance Values (Class GA Standards). Analytical data is provided in [Appendix D](#).

Based on review of the analytical data, several chlorinated VOCs, including PCE, TCE and cis-1,2-DCE were detected in 5 of the 9 collected groundwater samples. However, PCE was the only VOC detected in exceedance of its Class GA Groundwater Standard of 5 ug/l in several intermediate and deep monitoring wells, as indicated below:



**Table 4-1: Existing Groundwater Monitoring Well PCE Exceedances**

<b>Monitoring Well</b>	<b>Screened Interval (in feet)</b>	<b>PCE Concentration</b>
MW-1I	42-57 bgs	51 ug/l
MW-1D	60-75 bgs	240 ug/l
MW-2I	43-58 bgs	11 ug/l
MW-3D	66-86 bgs	61 ug/l
MW-4D	62-77 bgs	23 ug/l

In general, concentrations of chlorinated VOCs in the groundwater monitoring wells were observed to increase with depth and were generally greatest in concentration at intermediate and deep intervals (approximately 42 to 86 feet below grade). The highest concentration of PCE was detected in deep monitoring well MW-1D, located approximately 250 feet upgradient of the on-site “source area” property. The greatest PCE concentration detected downgradient of the on-site “source area” property was detected in deep monitoring well MW-3D, located approximately 1,250 feet south of the on-site “source area” property.

In addition to PCE, chloroform, cis-1,2-DCE, methyl tert-butyl ether (MTBE) and TCE were detected in one or more groundwater sample, well below their respective Class GA Groundwater Standards.

#### 4.2 Vertical Profile Temporary Well Groundwater Sample Results

A total of 65 groundwater samples were collected for laboratory analysis from the 17 temporary well locations (FCTW-01 through FCTW-17). All groundwater sample results were compared to the Class GA Standards. Analytical data is provided in [Appendix D](#).

Based on review of the analytical data, PCE was detected in 21 of the 65 collected groundwater samples, with PCE concentrations detected in exceedance of its Class GA Standard of 5 ug/l in three temporary well groundwater samples, as indicated below:

**Table 4-2: Vertical Profile Temporary Well PCE Exceedances**

<b>Monitoring Well</b>	<b>Sample Interval (in feet)</b>	<b>PCE Concentration</b>
FCTW-06	60 to 64 feet bgs	7.9 ug/l
FCTW-06	80 to 84 feet bgs	5.8 ug/l
FCTW-11	100 to 104 feet bgs	20 ug/l

In general, concentrations of chlorinated VOCs in the completed temporary wells were observed to increase with depth and were generally greatest in concentration at intermediate and deep depths (approximately 60 to 100 feet below grade), at temporary wells located within the historical extent of the groundwater plume.

It should be noted that VOCs were not detected at concentrations exceeding their Class GA Standards in the groundwater samples collected from temporary wells completed to a depth of 120 feet below grade (FCTW-01, FCTW-09 and FCTW-14). However, as a PCE concentration of 20 ug/l was detected at a depth of 100 to 104 feet at temporary well FCTW-11, elevated concentrations of PCE in this area of the groundwater plume have extended slightly below the maximum historical depth of approximately 90 to 95 feet below grade, as detailed in the November 1998 RI/FS and December 2000 GWE&TS Design Report.



### 4.3 Clay Layer Investigation



As indicated above, soil samples were collected continuously from 70 feet to 120 feet below grade for inspection and characterization from temporary well locations FCTW-01, FCTW-09 and FCTW-14. It should be noted that the soil samples collected from these limited number of soil borings will provide limited information as to the presence and thicknesses of the discontinuous clay layers known to exist at the Site and is not intended to provide sufficient data for the preparation of full geologic cross sections. Boring logs are provided in [Appendix C](#).

In general, the soil encountered at depths ranging from 70 to 120 feet below grade during the installation of soil borings at FCTW-01, FCTW-09 and FCTW-14 consisted of tan, brown or gray fine sand with varying amounts of gravel and silt. Based on field observations collected by the NYSDEC Environmental Services Contractor, several discontinuous silty-clay and clay layers were observed at various depths and thicknesses at each of these three soil boring locations. Sample intervals where significant silty-clay and clay were noted are depicted on [Figure 4-2](#). Discontinuous silty-clay and clay layers were generally observed at depths of approximately 70 to 73 feet, 87 to 100 feet, 107 to 110 feet and 115 to 120 feet below grade, at varying thicknesses in one or more of each of the three soil borings. The most prominent thicknesses of silty-clay and clay (11 and 12 feet thick) were identified at depths of approximately 73 to 85 and 87.5 to 95.5 feet below grade, respectively, at soil boring locations FCTW-01, installed in the vicinity of the GWE&TS, and FCTW-09, installed within the vicinity of well “cluster” MW-4.

Evidence of contamination including sheens, chemical odors or elevated PID readings, were not detected in any of these soil borings. PID readings obtained from these soil borings ranged from non-detect to a maximum of only 0.4 parts per million (ppm), detected at a depth of approximately 85 to 90 feet below grade at FCTW-09. As such, the collection of soil samples for chemical analysis from the completed temporary well locations was not completed.

### 4.4 Data Validation

All sample results have been reviewed by D&B and deemed valid and usable for environmental assessment purposes. Data Validation Checklists are presented in [Appendix E](#).

In addition, all analytical data have been submitted to the NYSDEC in the required EQuIS format upon receipt of the data from the NYSDEC Remedial Services contractor.

## 5.0 Conclusions

The following conclusions have been established based on review of the results of the Plume Redelineation Program:

### Contaminant Plume Extents and Concentrations

- *Shallow Groundwater Contamination:* PCE was detected at concentrations well below its respective Class GA Groundwater Standard in 19 existing monitoring well and temporary well groundwater samples collected from the shallow sample zone (generally up to 50 feet below grade).

It should be noted that PCE was historically detected at concentrations of greater than 1,500 ug/l within the shallow sample interval at the on-site “source area” property during the initial plume delineation effort completed as part of the November 1998 RI/FS. It should also be noted that PCE was historically detected at a concentration of 15 ug/l within the shallow sample interval upgradient of the on-site “source area” property during the November 1998 RI/FS.

- *Intermediate Groundwater Contamination:* PCE was detected in exceedance of its Class GA Standard of 5 ug/l in three of the 18 existing monitoring well and temporary well groundwater samples collected from the intermediate sample



zone (generally 50 to 65 feet below grade). PCE exceedances ranged in concentration from 7.9 ug/l to 51 ug/l, with the greatest PCE concentration detected in the groundwater sample collected from existing well MW-11, located approximately 200 feet upgradient of the on-site “source area” property.

It should be noted that PCE was historically detected at concentrations of greater than 1,000 ug/l in several groundwater samples collected within the intermediate sample interval approximately 1,000 feet downgradient of the on-site “source area” property, including in groundwater samples collected from MW-31, during the initial plume delineation effort completed as part of the November 1998 RI/FS. PCE was also historically detected at concentrations of greater than 100 ug/l within the intermediate sample interval at a distance of approximately 3,500 feet downgradient of the on-site “source area” property during the November 1998 RI/FS.

- *Deep Groundwater Contamination:* PCE was detected in exceedance of its Class GA Standard of 5 ug/l in five of the 37 existing monitoring well and temporary well groundwater samples collected from the deep sample zone (generally from 65 feet below grade and deeper). PCE exceedances ranged in concentration from 5.8 ug/l to 240 ug/l, with the greatest PCE concentration detected in the groundwater sample collected from existing well MW-1D, located approximately 200 feet upgradient of the on-site “source area” property.

In addition, PCE exceedances were not detected within any of the groundwater samples collected from the three temporary wells extended to a depth of 120 feet below grade (FCTW-01, FCTW-09 and FCTW-14). However, as one PCE exceedance (20 ug/l) was detected at a depth of approximately 104 feet below grade at temporary well location FCTW-11, advanced at the approximate middle of the historic extent of the groundwater plume, this area of the groundwater plume has extended slightly below its maximum historical depth of approximately 90 to 95 feet below grade, as detailed in the November 1998 RI/FS and December 2000 GWE&TS Design Report. It should be noted that deep groundwater samples collected from a depth of approximately 78 feet below grade in this area during the November 1998 RI/FS exhibited PCE concentrations of greater than 1,200 ug/l.

It also should be noted that PCE was historically detected at concentrations ranging from approximately 70 ug/l to greater than 1,200 ug/l in several groundwater samples collected within the deep sample interval from the on-site “source area” property to approximately 4,500 feet downgradient of the property during the initial plume delineation effort completed as part of the November 1998 RI/FS. Most notably, PCE was historically detected at concentrations of greater than 900 ug/l within the deep sample interval at a distance of approximately 1,500 feet upgradient of the on-site “source area” property during the November 1998 RI/FS field program.

In comparison to the historical extents and concentrations of the initial plume identified during the November 1998 RI/FS, the current plume occupies the same general horizontal extents, and has a greatly reduced vertical presence in the shallow sampling zone. The plume has migrated slightly below its historical depth of approximately 90 to 95 feet below grade, as identified in the November 1998 RI/FS and December 2000 GWE&TS Design Report, although at significantly reduced concentrations.

As detailed above, over the course of the past several years and following the completion of remedial activities at the on-site “source area” property in August 2004, contaminant concentrations have reduced dramatically throughout the vast majority of the plume’s vertical and horizontal extents. Although a maximum PCE concentration of 240 ug/l was detected during the Plume Redelineation Program, this concentration was detected upgradient of the on-site “source area” property. A maximum PCE concentration of only 61 ug/l was detected downgradient of the Site, which is well below maximum PCE concentrations of greater than 1,000 ug/l and 1,500 ug/l detected at and downgradient of the on-site “source area” property during the initial plume delineation effort completed as part of the November 1998 RI/FS.

## Clay Layer Investigation

- *Clay Layer Locations and Arrangement:* Results of Plume Redelineation Program confirm that several discontinuous silty-clay and clay layers exist at various depths and thicknesses in the vicinity of the groundwater plume associated



with the Site, as indicated in several historical boring logs associated with the GWE&TS extraction wells and network of existing plume centerline and leading edge monitoring wells associated with the Site. Based on the results of the Plume Redelineation Program, several prominent discontinuous silty-clay and clay layers of varying thickness were identified at depths of approximately 70 to 73 feet, 87 to 100 feet, 107 to 110 feet and 115 to 120 feet below grade, with the most prominent silty-clay and clay thicknesses noted from 73 to 85 and 87.5 to 95.5 feet below grade at soil boring locations FCTW-01 and FCTW-09, respectively.

One PCE exceedance was detected slightly below the maximum historical depth of the groundwater plume, indicating that the discontinuous nature of the silty-clay and clay layers existing at the Site have likely limited the downward migration of contamination, but have not fully prevented its downward migration.

- **Contaminant Adsorption:** Based on soil logging results associated with the Plume Redelineation Program and the November 1998 RI/FS field program, a relatively high percentage of clay was noted at the locations and screened intervals of existing monitoring wells where the most elevated PCE exceedances were identified downgradient of the on-site “source area” property during the Plume Redelineation Program (MW-3D and MW-4D). In addition, although historical records do not include logging of soil in all areas where wells were installed, based on historic and current soil logging data, a relatively high percentage of clay was noted at and in the vicinity of the locations and screened intervals of GWE&TS extraction well EW-2 (screened from 70 to 90 feet below grade) and plume leading edge monitoring well ASMW-1 (screened from 80 to 90 feet below grade), which both continue to exhibit generally elevated concentrations of PCE.

It should be noted that many VOCs, including chlorinated VOC such as PCE and its breakdown components, have the tendency to become adsorbed to clay and then slowly “leach out” low levels of dissolved-phase contamination over time. This process, in addition to what appears to be a contributing source of PCE contamination upgradient of the Site, likely accounts for the elevated concentrations of PCE noted during the Plume Redelineation Program and within routine samples collected from GWE&TS extraction well EW-2 and associated plume leading edge monitoring well ASMW-1.

### System and Extraction Well Placement

As indicated in Section 3.0, the GWE&TS remained in operation throughout the duration of the Plume Redelineation Program.

Based on the current plume extents and generally non-detect concentrations of PCE associated with temporary wells located at the leading edge of the groundwater plume (FCTW-01 through FCTW-03), existing GWE&TS extraction wells EW-1 and EW-2 (screened from 70 to 90 and 75 to 90 feet below grade, respectively) are still adequately positioned to effectively capture the leading edge of the groundwater plume in its current configuration.

In addition, the horizontal extents of the groundwater plume have not substantially shifted to the west of the GWE&TS capture zone, as was identified as a possibility based on a slightly increasing PCE concentration trend observed in routine groundwater samples collected from leading edge monitoring well ASMW-1 over the last 5-year period.

### Upgradient Contaminant Source

As indicated in Section 1.0, regional and local groundwater generally flows to the south/southwest in the vicinity of the Site. The completed Plume Redelineation Program identified concentrations of PCE exceeding its Class GA Standard in intermediate and deep monitoring wells at well “cluster” MW-1, which is located in an upgradient orientation from the Site. As also detailed above, exceedances of PCE ranging from 15 ug/l to greater than 900 ug/l were historically detected upgradient of the on-site “source area” property during the November 1998 RI/FS field program, with the greatest upgradient PCE concentration detected approximately 1,500 feet upgradient of the Site.

Given these historical upgradient PCE concentrations, and based on the fact that the greatest current PCE exceedance



identified during the Plume Redelineation Program were identified upgradient of the Site (following the successful completion of the on-site “source area” remediation in August 2004), it is likely that an off-site “source area” exists upgradient of the Site.

Based on the presence of this upgradient contaminant source, and as PCE is likely slowly “leaching out” of the clay documented to exist in the area of the remaining groundwater plume, estimating a time frame for attainment of the SCGs in groundwater downgradient of the Site is not feasible at this time. Based on these same factors, the continued operation of the GWE&TS to intercept the leading edge of the groundwater plume will likely extend beyond the 20-year time frame provided in the March 1998 Record of Decision (ROD) for the Site due to these conditions.

## 6.0 Recommendations

Based on the conclusions presented above, it is recommended to continue routine operation of the GWE&TS in its current configuration to capture the leading edge of the groundwater plume.

Although operation of the GWE&TS is still recommended at this time, based on the fact that the greatest current PCE exceedance identified during the Plume Redelineation Program were identified upgradient of the Site (following the successful completion of the on-site “source area” remediation in August 2004), the groundwater plume currently being captured by the GWE&TS may be emanating from an off-site “source area” located upgradient of the Site.

Therefore, it is further recommended that the NYSDEC investigate the area to the north, or upgradient, of the Site to locate and address any remaining “source areas” likely to exist in this vicinity. It should be noted that the November 1998 RI/FS identified at least three former dry cleaners known to have existed in an upgradient arrangement with respect to the Site. Once the upgradient “source areas” are identified and addressed, it may be warranted to pursue alternate remedial actions, such as a chemical injection program, to address any residual contamination at that time.