NATIONAL HEATSET PRINTING CO. STATE SUPERFUND SITE
SUFFOLK COUNTY, BABYLON, NEW YORK

FINAL ENGINEERING REPORT

NYSDEC Site Number: 152140

Prepared for:
New York State Department of Environmental Conservation
Division of Environmental Remediation
Remedial Bureau A
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Prepared by:
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AUGUST 2013

CERTIFICATIONS

I, Christopher Canonica, am currently a registered professional engineer licensed by the State of New York, I had primary direct responsibility for implementation of the in-well stripping system construction activities, and I certify that the remedial design was implemented and that all construction activities were completed in substantial conformance with the Department-approved remedial design.

I certify that the data submitted to the Department with this Final Engineering Report demonstrates that the remediation requirements set forth in the remedial design and in all applicable statutes and regulations have been or will be achieved in accordance with the time frames, if any, established in for the remedy.

I certify that all use restrictions, institutional controls, engineering controls, and/or any operation and maintenance requirements applicable to the site are contained in an environmental notice created and recorded pursuant Environmental Conservation Law 71-3605 and that all affected local governments, as defined in Environmental Conservation Law 71-3603, have been notified that such notice has been recorded.

I certify that a Site Management Plan has been submitted for the continual and proper operation, maintenance, and monitoring of all engineering controls employed at the site, including the proper maintenance of all remaining monitoring wells and that such plan has been approved by Department.

I certify that any financial assurance mechanisms required by the Department pursuant to Environmental Conservation Law have been executed.

I certify that all documents generated in support of this report have been submitted in accordance with the DER's electronic submission protocols and have been accepted by the Department.

I certify that all data generated in support of this report have been submitted in accordance with the Department's electronic data deliverable and have been accepted by the Department.

I certify that all information and statements in this certification form are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law. I, Christopher Canonica, of EA Engineering, P.C., am certifying as Owner's Designated Site Representative for the site.

Christopher J. Canonica, PE
NYS Professional Engineer # 070876

8/6/13
Date

Signature

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LIST OF ACRONYMS

Acronym	Definition
bgs	Below ground surface
CAMP	Community Air Monitoring Program
CO	Change Order
DCE	Dichloroethene
DDC	Density Driven Convection
EA	EA Engineering, P.C. and its affiliate EA Science and Technology
FER	Final Engineering Report
FS	Feasibility Study
GWTT	Groundwater Treatment and Technology
HASP	Health and Safety Plan
HDPE	High density polyethylene
Hp	Horsepower
IWS	In-Well Stripping
NHP	National Heatset Printing
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OBG	O’Brien & Gere
O&M	Operation and maintenance
PCE	Tetrachloroethene
PLC	Programmable logic control
ppb	Parts per billion
ppm	Parts per million
PVC	Polyvinyl chloride
RA	Remedial Action
RAO	Remedial Action Objective
RAWP	Remedial Action Work Plan
RC	Reverse circulation
RD	Remedial design
RI	Remedial investigation
ROD	Record of Decision
RSCO	Recommended Soil Cleanup Objective
SCDHS	Suffolk County Department of Health Services
SCWA	Suffolk County Water Authority
SVE	Soil vapor extraction
TCE	Trichloroethene
VDW	Vor Der Wand (in front of the wall)
VFD	Variable frequency drive
VOC	Volatile organic compound

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FINAL ENGINEERING REPORT

1.0 BACKGROUND AND SITE DESCRIPTION

1.1 INTRODUCTION

The New York State Department of Environmental Conservation (NYSDEC) issued a work assignment for EA Engineering, P.C., and its affiliate, EA Science and Technology (EA) to perform construction oversight at the National Heatset Printing Co. (NHP) state superfund site in the Town of Babylon, Suffolk County, New York (Figure 1). The property is being remediated in accordance with the Record of Decision (ROD) (NYSDEC 1999)[(1)] which is provided in Appendix A.

The NYSDEC Contract Documents (Contract) included options to construct either a groundwater remediation system or implement in-well stripping (IWS) systems. The selected contractor (Earth Tech/AECOM) opted to construct the IWS systems. The Contract Documents did not include detailed design information for the IWS systems. This was presented in AECOM's Contractor Work Plan after successful implementation of an IWS pilot test.

The remedial design (RD) for this site was based on the ROD[(1)] and is a component of the Contract (dated January 13, 2005); the Contract is provided in Appendix B. The Contractor Work Plans prepared by AECOM for the remediation of the NHP site are provided in Appendix C. As-built drawings completed following construction of the on-site and off-site IWS systems by AECOM are included in Appendix D. An electronic copy of this Final Engineering Report (FER) with all supporting documentation is included as Appendix E.

1.2 SITE DESCRIPTION / SITE HISTORY

The NHP site is currently a Class 2 Site listed on the NYSDEC Registry of Inactive Hazardous Waste Sites (No. 152140). The site is located at 1 Adams Boulevard in the Hamlet of Farmingdale, Town of Babylon, Suffolk County, New York and is identified as Block 1.00 and Lot 20.001 on the Town of Babylon Tax Map # 132.20-1-3.2. A site location map is presented in Figure 1. The site is currently owned by One Adams Boulevard Realty Corp., managed by Finklestein Realty, and leased by several tenants. The site contains one multi-tenant industrial building and is 4.5 acres in size. The site is located in an industrial area and is bounded by railroad tracks to the north, Adams Boulevard and an industrial property to the south, an industrial property to the east, and an industrial property to the west (Figure 2). The boundaries of the site are indicated in the Environmental Notice, which includes the metes and bounds description (Appendix F).

NHP occupied a portion of this building from July 1983 to April 1989. Their operations consisted of lithographic tri-color printing of newspaper and periodical advertisements and the

1. NYSDEC. 1999. Record of Decision National Heatset Printing Site Babylon, New York Site Number 152140. June

manufacture of lithographic printing plates. NHP had been using organic solvents at the site since 1983. An inspection by the Suffolk County Department of Health Services (SCDHS) in 1983 revealed that NHP was discharging photo plating waste to the on-site sanitary system. In March 1986, an inspection performed by the SCDHS revealed strong evidence of dumping from staining of inks and oils on the ground. The inspection report indicated that drums were being stored improperly both inside and outside of the building.

NHP filed for bankruptcy in 1987. The SCDHS discovered that after filing for bankruptcy, NHP disposed of its chemical inventory by dumping the materials onto the soils and into a leaching pool located off the rear of the building in the northeast side of the property.

In February 1988, a water sample collected by SCDHS from the leaching pool off the northeast side of the building contained elevated levels of volatile organic compounds (VOCs) (i.e., 24,000 parts per billion [ppb] of 1,2-dichloroethene [DCE] and 1,000 ppb of p-ethyltoluene). At the request of SCDHS, the leaching pool bottom sediments were excavated to a depth of 15 ft and end-point samples were collected in November 1988. The end-point soil samples indicated that the remaining leaching pool sediment still contained elevated levels of VOCs (i.e., 13,000 parts per million [ppm] of tetrachloroethene [PCE]).

1.3 SUMMARY OF REMEDIAL INVESTIGATION FINDINGS

A remedial investigation (RI)/feasibility study (FS) was performed at the site in 1999 to:

- Determine the nature and extent of contamination in soils on-site.
- Determine the on- and off-site groundwater conditions.
- Evaluate potential qualitative risks to human health and the environment of site-related contaminants.
- Determine the best remedial technology to remediate soil and groundwater contamination on- and off-site.

The results of the RI are described in detail in the RI/FS Report (H2M 1999)[2], which is provided in Appendix G.

Generally, the RI determined that, based on the standards, criteria, and guidance (SCGs) for the site, subsurface soil and groundwater contained VOC contamination that was to be addressed in the remedy selection.

Below is a summary of site conditions when the RI was performed in 1999.

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[2] H2M Group. 1999. Remedial Investigation/Feasibility Study Report. National Heatset Printing Site. Town of Babylon, New York. NSYDEC Site No. 1-52-140. February.

Soil

Both surface and subsurface soil samples were collected on-site as part of the RI. Six surface soil samples were obtained from 0 to 6 in. below ground surface (bgs) at the leaching pool area and were tested for VOCs. None of the surface soils exhibited concentrations exceeding NYSDEC recommended soil cleanup objectives (RSCOs) included in the *Technical and Administrative Guidance Memorandum (TAGM) 4046: Determination of Soil Cleanup Objectives and Cleanup Levels* (NYSDEC 1994)[3]. The SCOs in TAGM 4046 have since been replaced by 6 NYCRR Part 375 (Table 1).

Subsurface soil samples were collected at or adjacent to the following drainage structures on-site:

- Leaching pool directly under northeast of building;
- Fourteen stormwater drywells; and
- Four sanitary wastewater disposal systems.

The samples were collected at varying depths ranging from 0 to 85 ft bgs. Soil samples obtained at the stormwater drywells and the sanitary wastewater disposal systems ranged from 0 to 12 ft bgs (unsaturated zone; groundwater at 15 ft bgs). All subsurface samples were analyzed for VOCs and four samples were also analyzed for semivolatile organic compounds (SVOCs), metals, and pesticides/polychlorinated biphenyls (PCBs). None of the unsaturated soil samples taken beneath and downgradient of the on-site drywells and sanitary systems exhibited any contaminants exceeding NYSDEC RSCOs.

Subsurface soil samples were collected from saturated and unsaturated soils to characterize the extent of contamination from the leaching pool. Prior to the RI, contaminated soils in the source area were excavated down to 15 ft bgs and were backfilled with clean sand under the supervision of the SCDHS. Analytical results revealed no soil contaminants in unsaturated soils which are above 15 ft bgs. PCE was detected in the saturated soils located directly below the leaching pool at concentrations exceeding the NYSDEC RSCO. The exceedances ranged from 8.2 to 7,700 ppm. These results indicate that the leaching pool was the primary source area of PCE contamination. The RI soil contamination results are depicted on Figure 3.

Site-Related Groundwater

Twelve groundwater monitoring wells were sampled including one upgradient, seven on-site, and four downgradient wells. Seventy-four Geoprobe™ groundwater samples were also obtained, including 8 upgradient, 39 on-site, and 27 downgradient.

Groundwater flows south-southeast from the site (Figures 4 and 5). Groundwater depth for the site is approximately 15 ft bgs in the vicinity of the source area; the depth to groundwater along the downgradient edge of the dissolved plume is approximately 9 ft bgs.

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[3] NYSDEC. 1994. TAGM 4046: Determination of Soil Cleanup Objectives and Cleanup Levels.

Elevated concentrations of PCE, trichloroethene (TCE), and 1,2- DCE were detected in the Geoprobe™ groundwater samples obtained below the on-site leaching pool. Concentrations of PCE (496–7,690 ppb), TCE (162–9,620 ppb), and 1,2-DCE (124–12,200 ppb) exceeded the NYSDEC groundwater standard of 5 ppb. Samples from shallow and deep monitoring wells below the leaching pool exhibited concentrations ranging from 210 to 330 ppb.

Based upon the on-site groundwater quality data collected during the RI from below the leaching pool, sanitary disposal systems, and stormwater drywells, the only identified continuing source of VOC contamination at the time of the RI was in the saturated zone beneath the leaching pool northeast of the building. There was no evidence that any of the other on-site drainage structures were contributing to the VOC contaminant plume in the groundwater. In 2001, the VOC contamination was addressed by the implementation of permanganate injections. Section 3.3 describes the implementation of the permanganate injections and associated conclusions.

To evaluate the extent of groundwater contamination downgradient of the site, several Geoprobe™ groundwater samples were collected at varying depths from 50 to 85 ft bgs. Concentrations of total VOCs (maximum 12,021 ppb) greater than 1,000 ppb were present in the 75–85 ft sampling intervals for a distance of about 4,100 ft downgradient of the site. Concentrations exceeding 100 ppb extend to approximately 5,700 ft downgradient. These levels attenuated to non-detect levels approximately 7,100 ft downgradient of the site. The RI groundwater contamination results are depicted in Figures 6a, 6b, and 6c.

Based on the RI groundwater analytical data, VOC-contaminated groundwater was observed to be migrating off-site in a southeast direction. The level of site-related contamination was observed to be greatest just above the Gardiners Clay unit (80–85 ft bgs).

2.0 SUMMARY OF SITE REMEDY

2.1 REMEDIAL ACTION OBJECTIVES

Based on the results of the RI, the following RA objectives (RAOs) were identified for this site. The remediation goals for this site, as presented in the ROD, were established to eliminate or reduce to the extent possible:

- Eliminate, to the extent practicable, the source area contamination by remediating the groundwater directly below the leaching pool;
- Eliminate, to the extent practicable, ingestion of groundwater affected by the site that does not attain NYSDOH drinking water standards; and
- Eliminate, to the extent practicable, further off-site migration of groundwater that does not attain NYSDEC Class GA Ambient Water Quality Standard.

2.1.1 Groundwater RAOs

RAOs for Public Health Protection

- Monitor groundwater containing contaminant levels exceeding drinking water standards, and evaluate any potential public health issues.
- Prevent contact with, or inhalation of, volatiles emanating from contaminated groundwater.

RAOs for Environmental Protection

- Maintain, to the extent possible, ambient groundwater quality standards by eliminating potential groundwater contamination source(s).

2.1.2 Soil RAOs

RAOs for Public Health Protection

- Prevent ingestion/direct contact with contaminated soil.
- Prevent inhalation of, or exposure to, contaminants volatilizing from contaminated soil.

RAOs for Environmental Protection

- Prevent migration of contaminants that would result in groundwater contamination.

- Prevent impacts to biota due to ingestion/direct contact with contaminated soil that would cause toxicity or bioaccumulation through the terrestrial food chain.

2.1.3 Surface Water RAOs

There is no surface water concern at the site.

2.1.4 Sediment RAOs

There is no sediment concern at the site.

2.2 DESCRIPTION OF SELECTED REMEDY

Potential remedial alternatives for the site were identified, screened and evaluated in the FS. Based on the RI and FS, the Department issued the ROD document which identified the selected remedy for the site. The remedy included groundwater treatment using pump and treat or an alternate technology (i.e., IWS) for three locations: the source area, the downgradient edge of the site, and the downgradient edge of the off-site plume (Figures 7a, 7b, and 7c).

Source Area

The remedy in the ROD was refined during the remedial design (RD). Additional investigation performed during the RD concluded that injection of sodium and potassium permanganate would be the most effective source area remedy (Figure 7a). Therefore, a RD and construction contract (Contract No. D005272) was prepared for implementation of this technology.

Sampling during the RD (obtained in 2001) revealed the presence of contaminated soil beneath the on-site building's slab. In addition, four indoor air samples (AS-1, AS-2, AS-3, and AS-4) were collected from the on-site commercial building in July 2001 and analyzed for VOCs. New York State Department of Health (NYSDOH) indoor air guidance values are provided in Table 1 and a summary of indoor air sampling results obtained during July 2001 is provided in Table 2. The concentration of PCE in sample AS-1, collected near the identified source area, exceeded the corresponding NYSDOH guidance value; no other samples reported a PCE concentration above the NYSDOH guidance value. As this VOC contamination was affecting the indoor air, the NYSDEC installed a soil vapor extraction (SVE) system to remediate the contaminated soil beneath the building slab and address potential vapor intrusion. The SVE system has been running since September 2002 (Figure 7a).

Non-Source Area

For the two non-source area treatment systems, the NYSDEC awarded Contract D005539 to Earth Tech to construct in-well vapor stripping systems (Figures 7b and 7c). The Contract is discussed further in Section 3.3 of this document and the two non-source area treatment systems are described in detail in Section 4.

The site is being remediated in accordance with the RD which included the two construction contracts described above and the SVE work plan.

2.2.1 Site Management Plan

As required under the 1999 ROD[1], EA has developed a site management plan (SMP) that includes the following activities:

- Continued groundwater and treatment system monitoring.
- Identification of any use restrictions on the site.
- Provisions for the continued proper O&M of the components of the remedy.

The SMP was approved by the NYSDEC on July 9, 2013.

2.2.2 Environmental Notice

The NYSDEC prepared an Environmental Notice for the site, which was issued in lieu of an Environmental Easement/Deed Restriction as referenced in DER 33. The document includes a map of the property subject to the Environmental Notice, and identifies certain limitations which apply to the cleanup of contamination disposed at the property. The Environmental Notice was prepared on March, 28 2013 and recorded at the Suffolk County Clerk's Office on April 16, 2013. The Environmental Notice is included in Appendix F .

3.0 INTERIM REMEDIAL MEASURES, OPERABLE UNITS, AND REMEDIAL CONTRACTS

The remedy for this site included performance of an interim remedial measure, installation of an SVE system, and two construction contracts. The construction contracts were associated with implementation of a chemical oxidation pilot test in the source area, and construction of two non-source area in-well vapor stripping systems.

Two additional contracts were issued to provide for construction oversight during construction of the in-well vapor stripping systems, O&M of the SVE system, and preparation of the SMP and FER documents.

3.1 INTERIM REMEDIAL MEASURE

As discussed in the June 1999 ROD(1), interim remedial measures are conducted at sites when a source of contamination or exposure pathway can be effectively addressed before completion of the RI/FS.

While conducting the RI/FS, it became apparent that groundwater contaminated with elevated levels of VOCs was migrating toward the residential area south of the site. Several homes and businesses served by private wells that were impacted by the site were identified downgradient from the site. The levels of contamination detected in some of the private wells exceeded public drinking water standards. To date, six residences and three contiguous stores have been connected to public water. Based on an area private well survey conducted during the investigation of the Fairchild Republic Aircraft site, and information provided by the Suffolk County Water Authority (SCWA) and the SCDHS, all homes and businesses downgradient from the site are currently connected to public water.

3.2 OPERABLE UNITS

No operable units were performed for this site.

3.3 REMEDIAL CONTRACTS

3.3.1 Contract No. D005272 (EnviroTrac, Limited)

Chemical Oxidation Pilot Study (Source Area)

In 2001, Shaw Environmental & Infrastructure Engineering P.C. (Shaw) completed a chemical oxidation pilot at the source area, along with a pump test at the downgradient edge of the site. Sampling during the pilot test revealed the presence of contaminated soil beneath the on-site building slab. This VOC contamination was affecting the indoor air; therefore, NYSDEC installed a SVE system to remediate the contaminated soil beneath the building slab. The SVE system has been operating since September 2002.

Following the pilot test, Shaw completed a RD and associated construction documents for the permanganate injection system. In late-2004, Obrien & Gere (OBG) assumed responsibility for the RA implementation, which included construction inspection and contract administration. The RD for permanganate injection was completed in August 2004 and bids for the permanganate injection system were received in December 2004. EnviroTrac Limited (EnviroTrac) from Ronkonkoma, New York was selected to perform the RA.

Site preparation for the permanganate injection included injection/monitoring well installation, well development, and baseline groundwater sampling. EnviroTrac subcontracted Associated Environmental Services for well drilling and installation. A total of 24 wells were installed at locations presented in OBG's Permanganate Injection System RA Report dated July 2007[4]. Copies of the boring logs are also presented in the Permanganate Injection System RA Report, which is provided in Appendix G. Drill cuttings were disposed of off-site at Triumvirate Environmental, LLC of Astoria, NY by Fenely & Nicol Environmental, Inc. of Deer Park, NY; waste manifests are included in the RA Report.

Carus Chemical Company provided the permanganate injection equipment. The injection system consisted of a potassium permanganate ($KMnO_4$) feeder mix unit, a 17,000-gal batch mix tank, three injection pumps, and a series of pipes with valves and indicators to deliver the mixed permanganate solution to the injection wells. The site layout is provided in the RA Report (Appendix G).

From September 26 through October 4, 2005, sodium permanganate ($NaMnO_4$) solution was injected into the wells. The $KMnO_4$ injection began on October 6, 2005 and was completed on November 22, 2005. On December 2, 2005, the permanganate injection equipment and associated piping were disconnected and demobilized, and the containment area was cleaned and removed from the site.

As part of the post-injection monitoring plan, a total of four quarterly monitoring and sampling events were conducted. All purge water was contained in 55-gal drums and disposed of off-site as non-hazardous waste at EQ Detroit, Inc. of Detroit, MI by American Hazardous Material Management, Inc. of Middle Island, NY. Waste manifests are included in the RA Report (Appendix G). As shown in the RA Report, the most frequently detected VOCs were PCE, TCE, 2-butanone, and *cis*-1,2-DCE. The injection of permanganate in the source area significantly reduced the VOC concentrations in the groundwater at the site as shown in the RA Report. Specifically, significant reductions were observed in the treatment area behind the on-site building. However, six wells sampled in January 2007 still exhibited VOC concentrations greater than the Technical and Operation Guidance Series values. Three of the wells were located inside and three outside of the treatment area. Five of the six wells showed less than 18 µg/L total VOCs while one well, MW-2A, which is located outside the treatment area, exhibited significant concentrations of PCE, TCE, *cis*-1,2-DCE, and *trans*-1,2-DCE. The information and certifications made in the Permanganate Injection System RA Report (Appendix G) were relied upon to prepare this FER and certify that the remediation requirements for the site are being met.

[4] OBG. 2007. Permanaganate Injection System Remedial Action Report. July.

Soil Vapor Extraction System (Source Area)

As mentioned above, sampling during the chemical oxidation pilot test revealed the presence of contaminated soil beneath the on-site building slab. This VOC contamination was affecting the indoor air; therefore, in 2003, Shaw designed and installed a SVE system to remediate the contaminated soil beneath the building slab. The system includes one vapor extraction well, MW-F, which was an existing monitoring well, constructed of 2-in. schedule-40 polyvinyl chloride (PVC) with 0.02 slotted screens and screened from 10 to 30 ft bgs. The well was modified on April 20, 2002 to facilitate vapor extraction and groundwater monitoring. A 2 ft × 2 ft Department of Transportation-rated roadbox was installed at grade to protect the well. Well modifications included installation of a T-fitting into 2-in. diameter PVC schedule-80 piping that conveys extracted vapor into the treatment equipment enclosure.

The equipment associated with SVE is housed in an enclosure (20-ft long × 8-ft wide × 8-ft high) located adjacent to the north wall of the site building. Inside the enclosure, the 2-in. diameter SVE piping contains a ball valve to control the air flow and vacuum, as well as a sampling port for drawing air samples and conducting flow measurements. The 2-in. piping is connected to a vacuum blower designed to extract a maximum of 400 ft^3/minute of air flow from MW-F. Vapors from the source area are extracted by applying vacuum via a blower system. A 10 Horsepower (Hp) regenerative blower develops a maximum vacuum of approximately 98 in. of water. System details (i.e., piping and instrumentation, electrical supply, well construction) and a plan view of the treatment enclosure are provided in the SVE system O&M Manual[5], a copy of which is provided in the SMP.

Off-gas treatment is comprised of two 1,000-lbs vapor-phase granular activated carbon units. The two vessels are arranged in series to provide assurance that the discharge air will comply with the air permit discharge criteria. Effluent air samples are collected periodically to ensure permit compliance. The discharge stack, constructed of 4-in. Schedule-40 PVC pipe, is mounted along the exterior of the site building and is elevated to a height of approximately 30 ft above the ground surface.

Currently, the carbon vessels are not in use, as contaminant levels in the effluent vapor stream are below regulatory limits. The SVE system has been operating since September 2002.

Based on quarterly field monitoring results from the influent air stream, VOC concentrations have declined during the SVE operations. During startup in 2002, the influent vapor stream was recorded at 1,000–2,000 ppm. Within the first year of operation influent contaminants dropped below 100 ppm. From 2002 to 2013, the vapor stream concentrations have generally decreased. Within the last year of operation, values have ranged from 0 to 62 ppm.

[5] Shaw Environmental & Infrastructure, Inc.. 2003. Soil Vapor Extraction Operation and Maintenance Manual. National Heatset Printing, Farmingdale, New York. Site No. 1-52-140. October.

3.3.2 Contract No. D005539 (Earth Tech/AECOM)

In-Well Vapor Stripping Systems (Non-Source Area)

As documented in the ROD (NYSDEC 1999)[1], the remedy selected was *in Situ* DDC type IWS for on-site and off-site locations. The DDC IWS technology was developed by Wasatch Environmental Inc. (Wasatch), the U.S. Patent Holder. Using the DDC system, groundwater is lifted from a screen at the bottom of the well by injecting air from an aboveground blower through an airline to a desired depth below the water table. As the injected air rises through the water column in the well, contaminants are stripped out of the groundwater. By action of the same air, the groundwater is lifted above the upper screen, through which it is then released back into the aquifer. VOCs are transferred (stripped) into the co-current air stream as the air passes through the water. At the water table surface, the air stream containing the volatile contaminants is extracted for subsequent treatment in an aboveground treatment system. Groundwater reentering the aquifer through the top screen flows both horizontally away from the well and vertically to the lower screen, where it reenters the well. The water can thus be recirculated through the well, where additional air stripping occurs.

For the two non-source area treatment systems, the NYSDEC awarded Contract D005539 to Earth Tech to construct in-well vapor stripping systems. The previous engineer, OBG, managed the in-well stripping pilot test performed in 2006, which was accepted by NYSDEC. Based on the pilot test data, the effectiveness of the DDC system was determined and full scale (on-site and off-site) DDC construction was implemented. In 2010, an additional DDC well was added to the pilot study system and a second on-site system (Treatment System #2) was constructed (Figure 7b). Treatment System #2 consists of two DDC wells. In 2012, the off-site DDC system was constructed at the SCWA – Albany Avenue Well Field (Figure 7c). The system consists of six DDC wells and two treatment trailers. Section 4.3 of this document provides detailed descriptions of the above remedial systems.

3.3.3 Contract Nos. D004441 and D007624 (EA Engineering, P.C. and its Affiliate EA Science and Technology)

Construction Oversight (In-Well Vapor Stripping Systems), O&M (SVE System), and Preparation of SMP/FER

Under Contract Nos. D004441 and D007624, EA performed construction oversight during installation of the on-site and off-site DDC systems by AECOM. In addition, EA performed routine O&M of the SVE system from 2010 to present. EA also prepared the SMP and FER documents on behalf of the NYSDEC for the National Heatset Printing site.

4.0 DESCRIPTION OF REMEDIAL ACTIONS PERFORMED

The remedial actions discussed in this section include the design and construction of both the on-site and off-site DDC systems (under Contract No. D005539), which were installed to provide *in-situ* treatment of the groundwater contaminant plume using a series of groundwater circulation wells to capture and circulate groundwater within the aquifer.

The Contract Documents included options to construct either a groundwater remediation system or implement IWS systems. The selected contractor (Earth Tech/AECOM) opted to construct the IWS systems. The Contract Documents did not include detailed design information for the IWS systems. This was presented in AECOM's Contractor Work Plan after successful implementation of an IWS pilot test.

Remedial activities completed at the site were conducted in accordance with the remedy selected by the NYSDEC in the ROD(1) issued in June 1999 (Appendix A) and the Contractor Work Plans included in Appendix C. A pre-bid meeting was held at the site on March 2, 2005 for all prospective bidders. The Contract was awarded to the low bidder AECOM, by NYSDEC on February 9, 2006. AECOM's bid breakdown is provided in Appendix H. Pre-construction meetings were held on April 21, 2006 and November 9, 2011 for the on-site and off-site DDC systems, respectively.

Substantial completion for construction of the on-site and off-site DDC systems was reached on May 22, 2012. The major components of the selected remedy are described herein. All deviations from the Contract are noted in Section 4.10.

4.1 GOVERNING DOCUMENTS

The Contract provided in Appendix B served as the governing document for the remedial construction of the IWS systems at the NHP site. The RD was included as part of this Contract in the form of Contractor Work Plans. The Contractor Work Plans prepared by AECOM for the remediation of the NHP site are included in Appendix C. As-built drawings completed following construction of the on-site and off-site IWS remediation systems by AECOM are included in Appendix D.

The Contractor was required to submit site documents, including plans, material information, analytical results, and all other items as defined by the Contract Documents. The full list of submittals is provided in the Submittal Log in Appendix I. All Contractor submittals are provided in Appendix I and Engineer approvals of submittals are provided in Appendix J. The following section details the documents that were required under the Contract to be submitted by AECOM.

4.1.1 Contractor Work Plans

Site-specific Contractor Work Plans (referred to hereafter as "Remedial Action Work Plans" or RAWPs) were submitted by AECOM for the on-site and off-site systems, and approved by the

Engineer (EA) on July 10, 2009 and August 22, 2011, respectively. The RAWPs for the on-site and off-site systems are provided in Appendix C. The RAWPs included descriptions of the major tasks involved in the work including mobilization, site work (i.e., DDC well installations, DDC manhole construction, treatment system installation, utility and pipe trench excavation, and monitoring well installation), water management, and decontamination. In addition, the following plans were developed for the RAWP and included as complimentary components:

- Health and Safety Plan (HASP)
- Sampling and Analysis Plan
- Quality Control/Quality Assurance Plan
- Waste Management Plan
- Stormwater Management Plan
- Excavation Plan
- Soil Erosion and Sediment Control Plan
- Dust Control Plan.

An existing fence was used to prevent the public from entering the off-site location and temporary fencing was used at the on-site location. Temporary fencing was also used at both locations around open excavations and drilling operations; all underground utilities were identified and marked out in order to prevent an interruption of service.

4.1.1.1 Health and Safety Plan

The HASP included a discussion of the specific roles, responsibilities, authority, and requirements as they pertain to safety of employees and the scope of services. The document was intended to identify known potential hazards, and facilitate communication and control measures to prevent injury or harm. Additionally, provisions to control the potential for environmental impact from these activities were included. All remedial work performed under this RA was in full compliance with governmental requirements, including site and worker safety requirements mandated by Federal Occupational Safety and Health Administration.

The HASPs were complied with for all remedial and invasive work performed at the site.

4.1.1.2 Sampling and Analysis Plan

The Sampling and Analysis Plan consisted of the Field Sampling Plan and Quality Assurance Project Plan. The Field Sampling Plan provided detailed procedures for the collection of environmental samples. The Quality Assurance Project Plan prescribed requirements for assuring that the remediation was planned and executed in a manner consistent with the project's quality assurance objectives.

4.1.1.3 Soil Erosion and Sediment Control Plan

This plan provided an overview of stormwater runoff and staging of earthmoving activities, and also identified soil erosion and sedimentation control measures (temporary and permanent) to be implemented during the construction activities discussed as part of the proposed alteration to the project area. The erosion and sediment controls for all remedial construction was performed in conformance with the requirements presented in the Soil Erosion and Sediment Control Plan.

4.1.1.4 Community Air Monitoring Plan

Community air monitoring was required during all intrusive activities and activities that risked generating dust. Requirements included real time air monitoring for VOCs and particulates in the work zone, and at the perimeter of the work area using two MiniRAE 2000 (VOCs) and two DataRam 4000 particulate monitors. The Community Air Monitoring Plan (CAMP) required that particulate monitors record data at 15 minute intervals.

4.2 REMEDIAL ELEMENTS

4.2.1 Contractors and Consultants

AECOM was the main Contractor hired by NYSDEC based on the NYS competitive bidding process for the remediation of the site. AECOM performed all remedial excavation and backfill activities during construction of the on-site DDC system; these activities were subcontracted out by AECOM during construction of the off-site DDC system.

As required by the Contract Documents, AECOM made good-faith efforts to subcontract work out to NYS Certified Minority Business Enterprises and Women Business Enterprises. Minority/Women Business Enterprises Quarterly Reports documenting this effort are provided in Appendix K.

Subcontractors hired by AECOM to assist in both the on-site and off-site DDC system activities included the following:

On-site DDC System Subcontractors

- ***YEC Surveying—***Performed all on-site DDC system surveying required for Contractor payment and as-built plans. This included surveying and marking out excavation limits prior to intrusive activities, surveying bottom of trench lines and excavation limits, surveying piping locations/elevations, surveying top of fill elevation and final grades following backfill and site restoration, and surveying newly installed monitoring wells, recirculation wells, and treatment system locations.

- ***Wasatch Environmental, Inc.—***Provided engineering and design of DDC wells. Provided oversight of DDC well and treatment system installation. Wasatch is the U.S. Patent holder of the DDC in-well stripping technology.

- ***Groundwater Treatment and Technology (GWTT), Inc.—***Prefabricated and delivered one of the on-site DDC treatment systems (referred to as "Treatment System #2").

- ***Adler Tank Rentals*—**Provided dewatering and water storage equipment rentals.

- ***Layne Christensen Drilling*—**Provided DDC well installation services.

- ***Town of Brookhaven Landfill and Recycling Center (Brookhaven Landfill)*—** Accepted non-hazardous soil from drilling operations.

- ***H2M Labs, Inc.,*—**Performed laboratory analysis of samples collections for waste characterization sampling.

- ***Chemical Pollution Control*—**Accepted non-hazardous waste water from frac tank cleaning activities for disposal and/or treatment.

- ***Philip Services Corp*—**Provided non-hazardous waste water transport services.

- ***Land, Air, Water Environmental Services, Inc. (LAWES)*—**Provided monitoring well installation services.

- ***Delta Well & Pump Company (Delta), Co. Inc.*—**Provided monitoring well installation services.

Off-site DDC System Subcontractors

- ***Posillico, Inc.,*—**Performed trenching activities, high density polyethylene (HDPE) piping installation, and traffic controls for off-site treatment system installation. In addition, Posillico hired the following subcontractors to assist in activities described below:
    - *YEC Surveying*—Performed all off-site surveying required for Contractor payment and as-built plans. This included surveying and marking out excavation limits prior to intrusive activities, surveying bottom of excavation and excavation limits following excavation, surveying piping locations/elevations, surveying top of fill elevation and final grades following backfill and site restoration, and surveying newly installed monitoring wells, recirculation wells, and treatment systems.
    - *Underground Surveying*—Performed underground utility markouts using geophysical equipment.

- ***Aarco Environmental Services Corp.*—**Provided non-hazardous soil transport services from drilling operations.

- ***Wasatch Environmental, Inc.*—**Provided engineering and design of DDC wells. Provided oversight of DDC well and treatment system installation. Wasatch is the U.S. Patent holder of the DDC in-well stripping technology.

- ***National Environmental Systems (NES), Inc.—***Prefabricated and delivered off-site treatment system.

- ***Clear-Flo Technologies, Inc.—***Accepted non-hazardous waste water from frac tank cleaning activities for disposal and/or treatment.

- ***110 Sand Landfill—***Accepted non-hazardous soil from drilling operations.

- ***Con-Strux LLC –*** Supplied asphalt sub-base material.

- ***AdlerTank Rentals—***Provided dewatering and water storage equipment rentals.

- ***Layne Christensen Drilling—***Provided DDC well installation services.

- ***Zebra Environmental—***Provided monitoring well installation services.

- ***H2M Labs, Inc.,—***Laboratory analysis of samples collections for waste characterization sampling was performed.

The Engineer responsible for certifying remedial construction activities for both the on-site and off-site DDC systems is EA. Construction inspection for both the on-site and off-site DDC systems was also performed by EA. All Contractors' Applications for Payments with associated Certified Payrolls are provided in Appendix L.

4.2.2 Site Preparation

The Notice to Proceed date for the site work was April 21, 2006. A pre-construction meeting was held with NYSDEC and AECOM on November 9, 2011. Meeting minutes are included in Appendix M.

Agency approvals required by the RAWP include letters of approval from the U.S. Environmental Protection Agency and NYSDEC which approved the disposal of materials from the site at each proposed location. There were no non-agency permits required. A NYSDEC-approved project sign was developed but not displayed for the duration of the on-site remedial construction period at the request of the property owner. The sign was eventually disposed of following completion of the construction activities.

Several general site preparation activities were performed by AECOM in accordance with the contract specifications prior to any intrusive soil excavation or grading activities, including utility clearances and identification, survey of pre-excavation cut-lines, installation of erosion controls, clearing and removal of vegetation, preparation of "clean" access area, and implementation of traffic controls.

Underground and above ground utilities were identified prior to the initiation of intrusive activities by an independent company. AECOM reviewed the locations and determined if any utilities conflict with the proposed construction plans. No conflicting utilities were identified on-site. However, two telephone lines and a stormwater line were identified as conflicts during the off-site DDC well installation program. AECOM contacted the appropriate utility company, who relocated the overhead lines. Once all utilities were identified, the proposed treatment system piping layout was adjusted to avoid conflicts and ensure proper drainage of condensate to a collection point(s).

4.2.3 General Site Controls

Measures were continuously taken to minimize business and residential disruption and to work with nearby residents. General site controls implemented daily are summarized herein.

Site Security

Site entry and exit logs were maintained on-site at all times and are provided as Appendix N. The Contractor determined that no additional site security measures were necessary for the on-site and off-site DDC system locations. Caution tape and security cones were placed around the limits of work areas including open excavations, drilling operations, construction equipment, etc., prior to construction personnel leaving the site.

Job Site Record Keeping

Daily construction inspection was performed by EA personnel during remedial activities. The on-site inspector submitted daily field reports to the EA project manager and NYSDEC, which consisted of descriptions of site activities, photos, site sketches, project issues, concerns, comments, etc. These reports are provided in Appendix O.

Erosion and Sedimentation Controls

At the end of each site work day polyethylene sheets were used to cover stockpiles and open excavations to prevent sediment loss.

Stockpiles

Stockpiles of excavated soils were placed on polyethylene sheets until the stockpiles were reused as backfill (i.e., trench locations). Soils from drilling operations were staged in polyethylene lined roll-offs and disposed of off-site. In addition, topsoil within the vicinity of the off-site DDC system was temporarily staged in the southwest corner of the SCWA property until site restoration was performed.

Decontamination

Equipment decontamination prior to site demobilization was performed using a pressure washer and potable water obtained from nearby hydrants.

4.2.4 Nuisance Controls

Nuisance controls were implemented during construction activities and are outlined below.

Truck Wash and Egress Housekeeping

Construction equipment and the site were cleaned prior to equipment (mainly drilling equipment) and personnel leaving at the end of the work day. This included hosing down equipment, sweeping debris, and other standard end-of-day housekeeping activities.

Dust Control

During the work day, excavation/work areas were sprayed with hose water supplied by nearby fire hydrants, as needed, to prevent dust particles from migrating off-site.

Odor Control

No odors were generated during construction.

Truck Routing

A smooth truck route and exit/entrance flow to both the on-site and off-site construction areas was maintained daily, presenting no issues to the general public or site Owner's personnel.

Complaints

On April 04, 2012, EA received a complaint from Mr. Ravenell (11 Benjoe Drive resident) during construction of the off-site DDC system. Mr. Ravenell's property is approximately 30 ft west of well DDC-10 on the south side of Benjoe Drive. Mr. Ravenell voiced concern that he did not receive proper notification of construction activities along Benjoe Drive and requested that no equipment be staged in front of his property. EA informed him that well DDC-10 represented the western extent of construction activities and, therefore, no drilling operations and/or equipment would impact his property. EA outlined the construction schedule and reviewed the NYSDEC Fact Sheet with Mr. Ravenell, and notified the NYSDEC accordingly.

4.2.5 CAMP Results

Community air monitoring took place in accordance with the approved CAMP. The MiniRAE 2000 used at the site logged minimum, maximum, and average ppm every 10 minutes during excavation activities. The DataRAM 4 particulate meter used at the site logged the real-time concentration by mass (µg/m^3), ambient temperature and humidity, and the particle size (µm) every 10 minutes during earthwork operations. The site was sprayed with hose water to reduce dust generated. Copies of all field data sheets relating to the CAMP are provided in electronic format in Appendix P.

4.2.6 Reporting

Daily activity reports summarizing construction activities at the site were prepared by EA. Daily activity reports contained the following information:

- Summary of the day's construction activities.
- Summary of on-site equipment, personnel, and visitors on-site.
- Summary of any material (stone, asphalt, fabric, etc.) delivered to the site during the day.
- Summary of samples collected, if any, during the day (i.e., waste characterization).
- Summary of any health and safety issues, project schedule issues, budget issues, storm water/erosion/sediment control issues, community air monitoring issues, and any other items of concern noted.
- Any miscellaneous comments on the day's activities.
- Photo log depicting construction photos taken during the day, with captions below each photograph.

All daily reports are included in electronic format in Appendix O. The daily reports also include photo logs in electronic format.

4.3 ON-SITE DDC TREATMENT SYSTEM INSTALLATION

This section summarizes the performance of a DDC pilot study in 2006 (which became on-site Treatment System #1), followed by installation of an additional on-site DDC treatment system in 2010 (referred to Treatment System #2). The equipment trailer and single DDC well (DDC-1) used during the 2006 pilot study were augmented with a second DDC well (DDC-2) in 2010, in conjunction with the installation of the second on-site DDC system and two additional DDC wells (DDC-3 and DDC-4). A figure showing trench lines, monitoring wells, recirculation wells, and equipment enclosures for both on-site DDC systems is provided in Appendix D.

4.3.1 DDC Pilot Study (On-site Treatment System #1)

In 2006, Wasatch Environmental, Inc. (Wasatch) in collaboration with Earth Tech, Inc. (Earth Tech, who later became AECOM) assumed responsibility for the installation and maintenance of the DDC in-well stripping groundwater treatment system pilot study. The DDC in-well stripping technology utilized in the pilot study was developed by Wasatch, the U.S. Patent holder. The purpose of the DDC pilot study was to demonstrate the effectiveness of in-well stripping as a viable remedial technology at the site. For the pilot study, one DDC well (DDC-1), a network of monitoring wells, and a treatment system were installed and tested. The performance requirements for the system were:

- **Horizontal Radius of Influence:** Demonstrate that the DDC wells' horizontal influence in the aquifer is capable of treating the observed plume within the designated treatment area through the use of groundwater tracer compounds;

- **Vertical Recirculation:** Demonstrate the vertical influence of the entre depth of the groundwater aquifer through the use of monitoring wells at various depths;

- **In-Well Stripping:** Demonstrate the effective treatment of water entering and exiting the DDC well through the collection and analysis of groundwater samples;

- **Vapor Treatment:** Demonstrate the effective collection and treatment of any gas generated from the stripping well through the collection and analysis of air samples;

- **Groundwater Treatment:** Demonstrate the treatment of the groundwater influenced by the in-well stripping system by the collection and analysis of groundwater samples;

- **Aquifer Impacts:** Demonstrate that the in-well stripping technology did not artificially change the geologic or hydrogeologic properties of the aquifer.

Earth Tech subcontracted LAWES to drill a test boring at the proposed location of DDC-1. The purpose of the test boring was to determine the depth of the surface of the Gardiners Clay unit and to characterize the stratigraphy and grain size distribution of the Upper Glacial Aquifer unit where DDC-1 was to be screened. These data were used to finalize the well construction design for DDC-1.

A total of 11 monitoring wells were installed for the pilot study at the locations presented in Earth Tech's Final DDC Pilot Study Report (May 2007)[6] (Appendix G). Ten of the wells were installed as well pairs, which consisted of one deep and one shallow. The shallow monitoring wells were installed by LAWES. Earth Tech subcontracted Delta Well & Pump Company (Delta) to install the deep monitoring wells. Monitoring well construction logs are included in the Pilot Study Report (Appendix G). The monitoring wells were used during the pilot test to track the migration of the bromide tracer, to collect groundwater samples, and to measure pressures in the treatment zone of the DDC well using pressure transducers.

Earth Tech subcontracted Layne Christensen, Inc., to drill, install, and develop DDC-1. Layne Christensen utilized the reverse-circulation (RC) drilling method. RC involves advancing an open borehole with a vacuum lift method that returns drill cuttings and recirculation water to the

[6] Earth Tech. 2007. Pilot Study Report DDC In-Well Stripping System National Heatset Printing Site NYSDEC #152140 East Farmindale, New York. May.

surface via the inside of the drill string/bit. DDC-1 borehole was drilled on July 10, 2006. The installation of the DDC-1 well assembly, and shallow and deep piezometers was completed between July 11 and 13, 2006. A schematic diagram of DDC-1 installation is provided in the Pilot Study Report (Appendix G). The DDC well screens and piezometers were developed on July 13 and 14, 2006. The DDC well screens were developed independently using a surge block/submersible pump assembly unit fabricated by Layne Christensen. A temporary packer was installed in the well casing between the upper and lower well screens to hydraulically isolate the two screened intervals. Development was accomplished by alternating the surging and pumping actions. Development water was discharged to a 21,000-gal frac tank located adjacent to DDC-1. At the completion of development, both well screens were relatively clear with a turbidity of 50 nephelometric turbidity units or less. The development purge water stored in the frac tank was left undisturbed for 2 days following development to allow for suspended sediments in the water to settle. Then, in accordance with the Earth Tech's RAWP, the cleared purge water was pumped back down the DDC well. Approximately 400-gal of sludge remained on the bottom of the frac tank, which was pumped into eight 55-gal drums and disposed of off-site at Chemical Pollution Control of Bayshore, NY as non-hazardous waste.

In order to conduct the pilot study, Earth Tech and Wasatch installed a treatment blower system. In compliance with the Contract specifications, a portable cargo container with dimensions of 40-ft long × 8-ft wide × 8.5-ft high was used for the treatment system enclosure. A diagram of the container, treatment system layout, and components are provided in the Pilot Study Report.

The treatment enclosure houses a 60 Hp, 3-phase, 460 volt, Kaeser® Blower package, a 1 Hp, 3-phase, 460 volt air cooler heat exchanger; two knock out drums for condensation removal; two TIGG Model EVPGC-1000 carbon vessels; a CO_2 cylinder to control calcium carbonate fouling; and an acid drip system to control scaling in the well. The system is equipped with a variable frequency drive (VFD) to control the air flow to the well. The entire system is controlled by a programmable logic control (PLC) system. The trailer is also equipped with lighting, an intake louver, and an exhaust fan to control temperature inside the enclosure.

Prior to startup of the DDC well, baseline groundwater samples were collected from the network of monitoring wells. Groundwater circulation was started by energizing the blower and adjusting the airflow rate to the well.

The results of the pilot test demonstrated achievement of the testing performance requirements as follows:

- **Horizontal Radius of Influence:** The pilot test demonstrated that DDC-1 has a cross gradient horizontal radius of capture of at least 65-feet based on the tracer study;

- **Vertical Recirculation:** DDC-1 recirculates groundwater from the top to the bottom of the aquifer, based on bromide tracer results;

- **In-Well Stripping:** Stripping of VOCs entering the DDC well was achieved based on calculations.

- **Vapor Treatment:** GAC treatment of off-gas from DDC-1 met emission criteria.

- **Groundwater Treatment:** The ability to remove VOCs through the combination of the capture radius, vertical recirculation, and in-well stripping criteria, demonstrated that the DDC system effectively reduced chlorinated VOC concentrations in the recirculation cell.

- **Aquifer Impacts:** The DDC system did not cause impacts to surrounding facilities, structures, or hydrogeologic units nor cause transmission of vapors through the vadose zone.

Based on the conclusions and results of the pilot test, the NYSDEC decided to move forward with full-scale implementation of the DDC technology at the on-site and off-site treatment areas. The information and certifications made in the Final DDC Pilot Study Report (May 2007)[5] were relied upon to prepare this report and certify that the remediation requirements for the site have been met.

4.3.2 Full-Scale On-site DDC System Installation

DDC Well and On-site Treatment System #2 Installation

The overall on-site DDC system consists of four DDC treatment wells (DDC-1 through DDC-4) and two treatment systems (referred to as Treatment System #1 and Treatment System #2). The layout of the on-site DDC system is shown in Appendix D. As stated in Section 4.3.1, one of the on-site wells (DDC-1) was installed in 2006 and used to conduct the pilot study. The locations of the three additional DDC wells (DDC-2, DDC-3, and DDC-4) were selected based on the results of the pilot study and project requirements. The wells were arranged in two lines with wells DDC-1 and DDC-2 in the first line, and wells DDC-3 and DDC-4 in the second line. The wells in each set are spaced 100-ft apart in an orientation perpendicular to the direction of groundwater flow. The second line of wells (DDC-3 and DDC-4) are located approximately 140-ft downgradient of the first line of wells (DDC-1 and DDC-2). Wells DDC-1 and DDC-2 are connected to the pilot test treatment enclosure (Treatment System #1), and wells DDC-3 and DDC-4 are connected to Treatment System #2.

AECOM subcontracted Layne Christensen to drill / install the on-site DDC wells. General details of DDC well design are presented in Appendix D. Each well consists of a 10-in. diameter well with a 1-ft sump (blank casing) set into the clay aquitard. The lower screens are 12-ft long, with the bottom slot set as near as possible at the surface of the aquitard. The upper screens are 15-ft long, extending from the approximate seasonal high water table (between 12.5 and 15 ft bgs depending upon the location of the well). The DDC wells were constructed of 10-in. diameter PVC well casing with Johnson HQ 0.020 slot wire-wrapped stainless steel screens for both the upper and lower screen intervals. Centralizers were used to position the wells in the boreholes.

The DDC pilot study well (DDC-1) was constructed with three piezometers installed within the borehole annulus of the DDC well. Two of the piezometers (DDC1-PDa and DDC1-PDb) were screened over the same interval as the lower DDC well screen while the third piezometer (DDC1-PS) was screened over the same interval as the shallow DDC well screen. These piezometers were used during the pilot study to monitor groundwater flow through the well and detect possible fouling of the well (indicated by decreasing draw downs in the lower piezometers over periods of days to weeks), and to collect groundwater samples for analysis of bromide tracer and contaminant concentrations. Two piezometers were installed at each of the additional DDC wells. The deep ("D") piezometers were screened over the same interval as the lower DDC well screens and the shallow ("S") piezometers were screened over the same interval as the upper DDC well screens.

The well bore annulus outside the screens was filled with sand appropriate to the aquifer and 20-slot screen. Between the screens, the annulus was filled with finer sand, and 3–4-ft long bentonite seals placed at approximately 30, 45, and 60 ft bgs. The bentonite seals were installed to prevent water from short-circuiting within the sand pack.

The well screen sections were developed using surge block and pump. The screened intervals were individually surged and pumped until the turbidity stabilized. The wells were packed off using an inflatable packer to isolate the two screen sections during development of the upper screens. Well development water was pumped into frac tanks for settling. Once settlement had occurred (approximately 2 days), the development water was returned to the well in accordance with the RAWP.

The DDC well internal components include a 6-in. and 8-in. diameter eductor pipe (connected by a reducer coupling), with two packers and a 125-slot screened section at the top (Appendix D), and a 4-in. air supply pipe (blower tube) that is centered in the well and the eductor. The eductor sits on the bottom of the well (sump) and extends to the surface with the top of the eductor screen set at approximately 8-ft above the water table. The two packers were installed below the upper screen in between the well casing and the 6-in. section of eductor. The blower tube was placed inside the eductor pipe, extending to approximately 12-ft below the water table.

AECOM subcontracted Layne Christensen, Inc. to drill, install, and develop the DDC wells. Layne Christensen utilized the RC drilling method to drill the DDC wells. RC involves advancing an open borehole with a vacuum lift method that returns drill cuttings and recirculation water to the surface via the inside of the drill string/bit. The method requires that positive hydraulic head be maintained on the borehole through the use of steel surface conductor casing and potable water supply. The water supply used for drilling was obtained from the East Farmingdale Water Authority 10-in. main that supplies the facility's fire sprinkler system.

Installation of the DDC well assemblies and shallow and deep piezometers were completed between 2006 and 2010. Schematic drawings of DDC-1, DDC-2, DDC-3, and DDC-4 are provided in Appendix D.

The well heads of the DDC wells and piezometers were enclosed below grade inside standard 48-in. diameter pre-cast concrete manholes, with H-40 load rated top rings and metal covers.

Soil was excavated around each DDC well to a depth of approximately 8.5 ft bgs and the manholes were placed over the DDC wells.

Utility and Pipe Trench Excavation

The utility trenches were excavated from the DDC wells to the treatment sheds. The trenches included a 4-in. HDPE pipe for air to be introduced to the well and a 4-in. HDPE return air line for gas treatment in the treatment systems. Trench and piping cross sections are provided in Appendix D.

Each trench was located so as to not interfere with existing site structures and/or utilities. AECOM installed all the piping from the treatment systems to the DDC wells. All HDPE was butt-fused together in the field. Grades were determined in the field to promote gravity flow of condensate back to the wells from the air discharge lines. The trenches were backfilled with soil taken from the excavations. Native soil was placed and compacted in 12-in. lifts. All native backfill material met the contract specifications.

The on-site HDPE piping systems were not pressure tested before being put into service. No leaks or pressure decreases have been documented since installation in 2010.

On-site Treatment System #2 Installation

As stated previously, Treatment System #1 was installed in conjunction with the pilot study in 2006. AECOM subcontracted GWTT, Inc. to install Treatment System #2. GWTT installed Treatment System #2 in 2010, which is connected to wells DDC-3 and DDC-4 via underground piping. Treatment System #2 was delivered as a pre-fabricated enclosure (shipping container) that measures 40-ft long × 8-ft wide. Treatment System #2 consists of a 60-Hp blower that both extracts and injects pressurized air into the wells, heat exchangers that reduce the blower discharge temperature, and carbon absorbers for VOC treatment before re-injection back into the wells. The system is equipped with a VFD for adjusting the blower speed and a control panel using an EOS Research PLC for the automation of the system. Additional details and specifications for the system can be found in Appendix D.

4.4 OFF-SITE DDC TREATMENT SYSTEM INSTALLATION

In a letter dated April 8, 2011, AECOM presented various alternatives to the NYSDEC to address the downgradient plume. The alternative selected by the NYSDEC comprised of six DDC wells. The wells extend in a line from the SCWA Albany Avenue well field west across Albany Avenue and along the southern edge of Benjoe Drive, as depicted in Appendix D. Drawing C-01.

In compliance with the Bid Specifications, two project trailers were delivered to the SCWA well field property in preparation for commencement of off-site construction activities, one each for NYSDEC/Engineer and one for AECOM/Wasatch. A utility markout was completed during the week of December 6, 2011.

Monitoring Well Installation

AECOM subcontracted Zebra Environmental to install six monitoring wells (MW-1S/MW-1D, MW-2S/MW-2D, and MW-3S/MW-3D). The wells were installed as shallow/deep well pairs at three locations (Appendix D) for use in sampling groundwater quality upgradient and downgradient of the DDC treatment zone. During drilling of the deep soil borings, continuous direct-push soil samples were collected for waste characterization. Samples were collected from the water table to a depth of approximately 30 ft bgs and again from a depth of 70 to 85 ft bgs. Monitoring well construction and boring logs can be found in Appendix D.

DDC Well Installation

AECOM subcontracted Layne Christensen, Inc. to drill, install and develop the off-site DDC wells. A total of six DDC wells (DDC-05 through DDC-10) were installed at locations depicted in Appendix D. These locations are based on a 105-ft well spacing spanning the 100 parts per billion isopleths, as derived from the 2007 sampling data.

The DDC wells were installed using dual air-rotary drilling techniques. This method utilizes a cased hole and a 24-in. diameter drill head. The method of installation was selected due to the reduction in drill cuttings, as well as the minimization of drilling fluid. The approach also minimized the amount of ancillary equipment, which was critical because the off-site DDC wells are located within active city streets.

An ABI Mobilram with an “in front of the wall – Vor Der Wand” (VDW) drill was utilized to advance the boreholes for the DDC wells. The VDW drill is a dual-rotary drill capable of turning both the outer casing as well as the inner auger to create large diameter well holes to the depths required. The dual-rotary VDW drill consists of two vertically arranged auger drives. The upper auger drive propels the inner auger (approximately 16-in. outside diameter), while the lower auger drive rotates the casing in the opposite direction (approximately18-in. outer diameter / 17-in. inner diameter). The casing and auger drives can be adjusted in relationship to each other depending on ground conditions experienced while drilling with either the casing or the auger being the leading tool. Drill cuttings and spoils were ejected through the top of the outer casing and piped to a polyethylene lined roll-off container. Drilling water was recirculated through a secondary storage tank and the well bore. Upon completion of each well installation, the water was pumped back to the DDC well. All drill cuttings were transported off-site by Aarco Environmental and disposed of at 110 Sand Landfill. Waste manifests and weight tickets are included in Appendix Q.

General details of DDC well design are presented in Appendix D. Each well consists of a 10-in. diameter well with a 1-ft sump (blank casing) set into the clay aquitard (approximately 85-90 ft bgs). The lower screens are 12-ft long, with the bottom slot set as near as possible at the surface of the aquitard. The upper screens are 15-ft long, extending from the approximate seasonal high water table (between 12.5 and 15 ft bgs depending upon the location of the well). The DDC wells were constructed of 10-in. diameter PVC well casing with Johnson HQ 0.020 slot wire-wrapped stainless steel screens for both the upper and lower screen intervals. Centralizers were used to position the wells in the boreholes. Well boring and construction logs are included in Appendix D.

Five of the off-site DDC wells (DDC-05, and DDC-7 through DDC-10) were constructed with two piezometers installed within the borehole annulus of the DDC wells. Two piezometers originally installed within the borehole annulus at DDC-6 were damaged during installation of the DDC well and were replaced with two nearby piezometers in the vicinity of DDC-06. The deep ("D") piezometers were screened over the same interval as the lower DDC well screens and the shallow ("S") piezometers were screened over the same interval as the upper DDC well screens.

The well bore annulus outside of the screens was filled with sand appropriate to the aquifer and 20-slot screen. Between the screens, the annulus was filled with finer sand, and 3–4-ft long bentonite seals placed at approximately 30, 45, and 60 ft bgs. The bentonite seals were installed to prevent water from short-circuiting within the sand pack.

The well screen sections were developed using a surge block and pump. The screened intervals were individually surged and pumped until the turbidity stabilized. The wells were packed off using an inflatable packer to isolate the two screen sections during development of the upper screens. Well development water was pumped into fractionation tanks for settling. Once settlement had occurred (approximately 2 days), the development water was returned to the well in accordance with the RAWP.

The DDC well internal components include a 6-in. and 8-in. diameter eductor pipe (connected by a reducer coupling), with two packers and a 125-slot screened section at the top (Appendix D, and a 4-in. air supply pipe (blower tube) that is centered in the well and the eductor. The eductor sits on the bottom of the well (sump) and extends to the surface with the top of the eductor screen set at approximately 8 ft above the water table. The two packers were installed below the upper screen in between the well casing and the 6-in. section of eductor. The blower tube was placed inside the eductor pipe, extending to approximately 12 ft below the water table.

Utility and Pipe Trench Excavation

AECOM subcontracted Posillico, Inc. (Posillico) to excavate utility trench lines, install HDPE piping, and restore disturbed areas. Prior to DDC well installation, Posillico installed standard 48-in. diameter pre-cast concrete manholes, with H-40 load-rated top rings and metal covers, at DDC-07 through DDC-10. Locations were excavated to a depth of approximately 10 ft bgs and the concrete manholes were installed using a backhoe. Asphalt was placed around the top rings and metal covers. The DDC-05 and DDC-06 well heads were installed above ground and, therefore, did not require manholes; metal sheds were installed over the wells heads by AECOM instead.

The utility trenches for the DDC airlines were excavated from the DDC-10 location to the treatment system pad located on the SCWA well field property (Appendix D). Asphalt and concrete top layers within excavation limits were saw cut using walk behind saw equipment, broken up by an excavator, and loaded into dump trucks for disposal at Posillico's construction yard. Each trench was located so as to not interfere with existing site structures and/or utilities. The trench width varied with depth and piping configuration. The bed width allowed for adequate compaction around piping. The bottom of the trench was excavated to allow for the return lines from the treatment wells to be installed on a grade to promote drainage of condensate moisture to the sump collection point. The sump collection point details and location are provided in Appendix D.

The trenches included a 4-in. HDPE pipe for fresh air to be introduced to the well and a 6-in. HDPE return air line for vapor conveyance to the treatment systems. All HDPE was fused together using heat fusion techniques in the field and pressure tested. The pressure tests were performed after the piping was backfilled. Air was used as the test medium. The test pressure was at a minimum of 1.5 times the maximum blower pressure of 15 lbs per square inch (psi). Initially, air pressure was raised to the test pressure and allowed to stand without makeup pressure for 30 minutes to allow for expansion of the piping. After equilibrium was established, the piping was again pressurized to 1.5 times the blower's maximum pressure, the air pump was turned off, and the final test pressure was held for one hour. All piping sections passed the pressure tests. Pressure test results are provided in Appendix I. Trench and piping cross sections are provided in Appendix D.

The trenches were backfilled with soil taken from the excavations. Native soil was placed and compacted in 12-in. lifts using a plate compactor. All native backfill material met the Contract specifications. Asphalt pavement sub-base and asphalt pavement were installed along the trench line from Albany Ave. to DDC-10 on Benjoe Drive. Asphalt installation details are outlined in Section 4.6 (Imported Backfill) of this report.

Off-site Treatment System Installation

The treatment system was prefabricated by National Environmental Systems, Inc. (NES) and delivered to the SCWA well field property. Prior to delivery, Posillico constructed a 75 ft × 72 ft crushed stone pad within the SCWA well field property for the treatment system pad. The crushed stone extends to an access gate on 45th Street (Appendix D) for site access. In addition, electrical service was extended to and connected to the system. AECOM subcontracted Gray Electric to install a transformer and utility panel on the western side of the treatment system pad.

The treatment system consists of two shipping containers measuring 40-ft long and 8-ft wide. The containers were placed on the crushed stone pad using a crane. The first enclosure houses two Kaeser® Model FB-350P rotary-lobe positive displacement blower units, condensate knock-out tanks, and heat exchangers that reduce the blower discharge temperature. The blowers are capable of supplying up to 500 actual ft^3 per minute of air at a continuous pressure of up to 9 lbs per square inch-gauge (psig) to each well. The blowers are driven by a 60 Hp motor. Due to the proximity of nearby residents, the enclosure is outfitted with sound proofing in order to minimize noise emanating from the equipment enclosure. The system is equipped with a VFD for the blower speed and a control panel using a PLC for the automation of the system. Each blower is intended to operate three DDC wells.

The second enclosure houses six 1,000 lb vapor phase carbon vessels. A 20 kilowatt (kW) duct heater is located in the duct stream of the carbon vessels to reduce relative humidity below 50 percent. Further details and specifications on the system can be found in the system O&M Manual (2012)[7]. As-built drawings of both enclosures are included in Appendix D.

4.5 REMEDIAL PERFORMANCE/DOCUMENTATION SAMPLING

O&M of the on-site and off-site DDC systems was initiated following startup/prove-out of the equipment. Baseline groundwater quality was established prior to system startup at the on-site and off-site systems, and periodic groundwater monitoring (monthly/quarterly) was performed following startup at site monitoring wells. The network of on-site and off-site wells were designed and installed throughout multiple phases of the RD. All groundwater samples were analyzed for VOCs (U.S. Environmental Protection Agency Method 8260B) at an off-site laboratory. During the quarterly groundwater monitoring events performed by AECOM, quality assurance sampling was performed by EA which included the collection of split samples from select monitoring wells. In addition, quality control sampling was performed by AECOM, which included the collection of duplicate samples from select monitoring wells. The results associated with the split and duplicate samples generally correlated with the corresponding groundwater samples. There were no data usability summary reports (DUSR) prepared during the RA activities.

Prior to sampling, all monitoring wells were inspected and gauged to obtain the static water levels for the site. Monitoring well purging was performed and groundwater samples were collected from the monitoring wells using a submersible pump and dedicated section of polyethylene tubing. A water quality meter (Horiba U-52 or similar) with flow-through cell (flushed with distilled water before use at each well) was used during well purging for field measurement of pH, specific conductance, temperature, reduction-oxidation potential (Eh), turbidity, and dissolved oxygen. Each well was purged three well volumes or until field parameters stabilize, whichever occurred first. Purge water was discharged to the ground surface near the well.

Based on gauging data from site monitoring wells, the groundwater flow direction in the vicinity of the DDC systems is generally to the south, as depicted in Figures 4 and 5. Baseline concentrations of VOCs in groundwater (using June 2010 laboratory analytical data) in the vicinity of the on-site DDC systems are illustrated in Figure 8. The preliminary results for groundwater data obtained during subsequent monitoring events (March 2012 and April 2013) suggest that VOC concentrations are being reduced in the vicinity of the on-site DDC systems (Figure 9).

Similarly, baseline concentrations of VOCs in groundwater (using May 2012 laboratory analytical data) in the vicinity of the off-site DDC system are illustrated in Figure 10. The preliminary results for groundwater data obtained during subsequent monitoring (April 2013

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[7] AECOM. 2012. O&M Manual Off-Site In-Well Stripping System National Heatset Printing Site East Farmingdale, Suffolk County, New York. November.

event) suggest that VOC concentrations are being reduced in the vicinity of the off-site DDC system (Figure 11).

Groundwater data obtained from monitoring wells in the vicinity of the on-site and off-site DDC system (between June 2010 and April 2013) are provided in Appendix R.

4.6 IMPORTED BACKFILL

Following trenching and survey activities at each location, disturbed areas were backfilled using the soil obtained from the excavation and restored to original grades. Asphalt pavement sub-base from Con-Strux LLC was imported to the off-site location and placed prior to the installation of the 6-in. thick asphalt pavement supplied and installed by Posillico Materials. Job mix formulas, Marshall gradation analysis worksheets, and laboratory proctor reports are included in Appendix I, Submittal No. 02513-001A.

4.7 CONTAMINATION REMAINING AT THE SITE

Soil/Soil Vapor

As previously mentioned, the SVE system was installed to remediate the remaining contaminated soil beneath the building slab and address potential vapor intrusion. The system has been remediating the soil and vadose zone since 2002. Figure 12 depicts the area of influence for the SVE system.

Groundwater

Groundwater contamination is present on-site and off-site (Tables 3a and 3b, and Figures 9 and 11). The groundwater plume extends approximately 7,100 ft downgradient of the site. The highest concentrations of PCE in groundwater were detected at approximately 80 ft bgs. Concentrations of VOCs greater than 1,000 ppb (maximum 12,021 ppb) in the groundwater were present in the 75–85 ft sampling interval approximately 4,100 ft downgradient (south-southeast) of the site. The intent of the two on-site DDC systems is to mitigate further migration of contaminants downgradient. The intent of the off-site DDC system is to capture contamination at the end of the plume and mitigate further migration of contaminants to the south-southeast.

Since contaminated soil, soil vapor, and groundwater remain at the on-site and off-site locations after completion of the RA, institutional and engineering controls are required to protect human health and the environment. Long-term management of these engineering and institutional controls and residual contamination will be performed under the SMP approved by the NYSDEC.

4.8 OTHER ENGINEERING CONTROLS

Procedures for monitoring, operating and maintaining the SVE and DDC systems are provided in the Operation and Maintenance Plan in Section 4 of the SMP. The Monitoring Plan also addresses inspection procedures that must occur after any severe weather condition has taken place that may affect engineering controls.

4.9 INSTITUTIONAL CONTROLS

An Environmental Notice was prepared by the NYSDEC and filed with the Suffolk County Clerk's Office on April 16, 2013 (Suffolk County Recording Identifier No. D00012726). The Environmental Notice was issued for the property in order to (1) implement, maintain, and monitor the engineering controls; (2) prevent future exposure to remaining contamination by controlling disturbances of the subsurface contamination; and, (3) limit the use and development of the site to industrial use only. The Environmental Notice is included in Appendix F.

4.10 DEVIATIONS FROM THE CONTRACT DOCUMENTS

Deviations from the Contract Documents for the NHP site and their associated Change Orders (CO) (included in Appendix S) are included in the following sections. Remediation costs associated with the National Heatset Printing site are provided in Appendix T.

Extension of Contract Time (CO 1)

An increase in time to the contract was necessary to account for delays associated with new analytical data collected in 2007 and the data impact to the downgradient (off-site) system. There was an increase of 461 days to the Contract time and no change to the Contract amount. CO #1 was executed on June 17, 2008.

Extension of Contract Time (CO 2)

An increase in time to the Contract was necessary to perform additional sampling at the NHP site. The objective of the sampling was to confirm the presence of groundwater contamination both on-site and off-site near the SCWA well field, and to determine the effects of the permanganate that was injected into the source area. This CO covered sampling of six monitoring wells in the vicinity of the on-site system and the installation of three geoprobe points on the SCWA Albany Ave. property. There was an increase of 365 days to the Contract time and no change to the Contract amount. CO #2 was executed on July 24, 2009.

Increase Bid Items LS-3 and LS-5 (CO 3)

This CO was associated with the installation of four additional monitoring wells in the vicinity of the on-site system (Bid Item LS-3). In addition, the CO included sampling and analysis of 12 additional monitoring wells over five events (Bid Item LS-5). This resulted in an additional Contract cost of $45,074.58 and an increase of 150 days to the Contract time. CO #3 was executed on November 3, 2010.

Increase Contract Time and Bid Items UP-6, UP-7, and LS-4 (CO 4)

Construction of the off-site system was postponed to allow for operation of the on-site system and collection of operational data.

This CO included an increase in time associated with postponement of the off-site system construction, an increase in cost and time associated with 3 additional months of system O&M, an increase in cost associated with 3 additional months of groundwater monitoring, and an increase in cost and time associated with the installation of spare underground air lines and telemetry systems. This resulted in an overall additional Contract cost of $160,982.68 and an increase of 758 days to the Contract time. CO #4 was executed on November 3, 2011.

Liquidated Damages

The project schedule associated with the off-site system included a Substantial Completion date of April 4, 2012 as specified in Section IV of CO #4. Startup and prove-out was not completed until May 22, 2012. Therefore, the Department applied liquidated damages in accordance with Section VI of the Contract in the amount of $28,800.

4.11 DEVIATIONS FROM THE REMEDIAL ACTION WORK PLANS

On-site DDC System

- *DDC Well Drilling Methodology*—Dual-rotary was originally proposed for the installation of DDC-2, DDC-3, and DDC-4. The RC method was used instead, which was the same method used for the installation of DDC-1.

Off-site DDC System

- *DDC Well Drilling Methodology*—RC was originally proposed for the installation of DDC-5 through DDC-10. The dual-rotary air rotary technique was used instead. In addition, with the exception of wells DDC-6 and DDC-8, AECOM installed standard well screen sandpack materials (i.e., Ricci #1 or equivalent) instead of "choker" sand due to problems encountered during construction of DDC-6 and DDC-8.

- *Relocation of DDC-6 Recirculation Well*—Well DDC-06 was relocated approximately 100 ft south of the proposed location due to the presence of utilities. DDC-06 was installed at the southwest corner of the SCWA well field property.

- *Configuration of DDC-5 and DDC-6 Recirculation Wells*—Both wells were completed aboveground due to the shallow depth to water in the vicinity of the well locations, in order to allow for proper installation of the necessary plumbing/piping at the top of the wellhead.

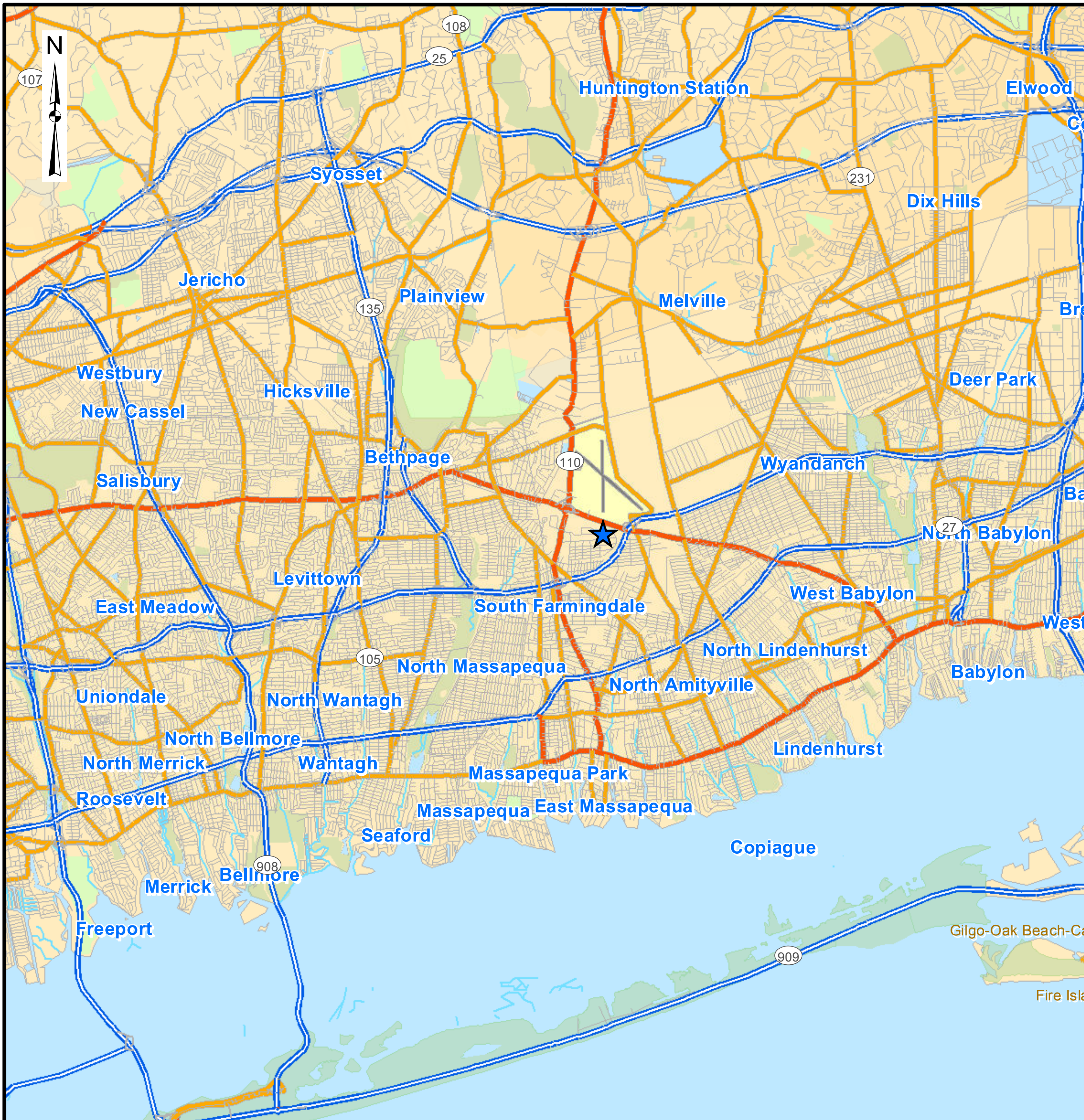
- *Number of Treatment Enclosures*—Originally, the off-site system was to consist of three treatment enclosures, each constructed to operate two DDC recirculation wells. However, AECOM designed the system to operate using two enclosures. One enclosure houses two blowers, knock-out tanks, heat exchangers, VFDs, PLC, and operates all six DDC wells. The second enclosure houses the vapor-phase carbon vessels.

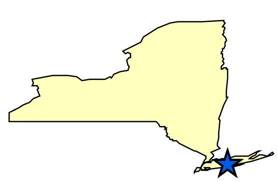
- *Addition of Chiller Unit*—AECOM installed a 10-ton chiller unit within the primary treatment equipment enclosure in order to address elevated temperatures in the process air stream encountered following completion of startup/prove-out.

4.12 PROJECT COMPLETION

Substantial completion was reached on May 22, 2012, based on an inspection conducted by EA on May 22, 2012. A punch list of remaining work tasks was included with the substantial completion certificate included in Appendix U. All punch list work tasks were completed by AECOM as of December 2012. Final completion will be established at a later date, and the final completion certificate will be included as an addendum to the Final Engineering Report.

All analytical data generated as part of this contract (through the date of DDC system substantial completion) was processed through the EQuIS data processor and submitted to NYSDEC.





LEGEND

★ Site Location

0 1 2 4 Miles

1 inch = 2 miles

Source: StreetMap USA

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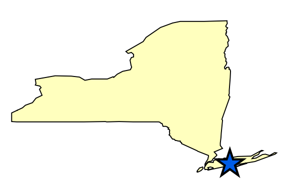
FIGURE 1
Site Location Map

PROJECT MGR:	DESIGNED BY:	CREATED BY:	CHECKED BY:	SCALE:	DATE:	PROJECT NO:	FILE NO:
JCH	CJS	CJS	JCH	AS SHOWN	AUG 2013	14907.08	GIS/PROJECTS/ FIGURE1.MXD



LEGEND

★ Site Location

— Tax Parcel Boundary

Feet

0 250 500 1,000

Source: Town of Babylon, Dept. of GIS

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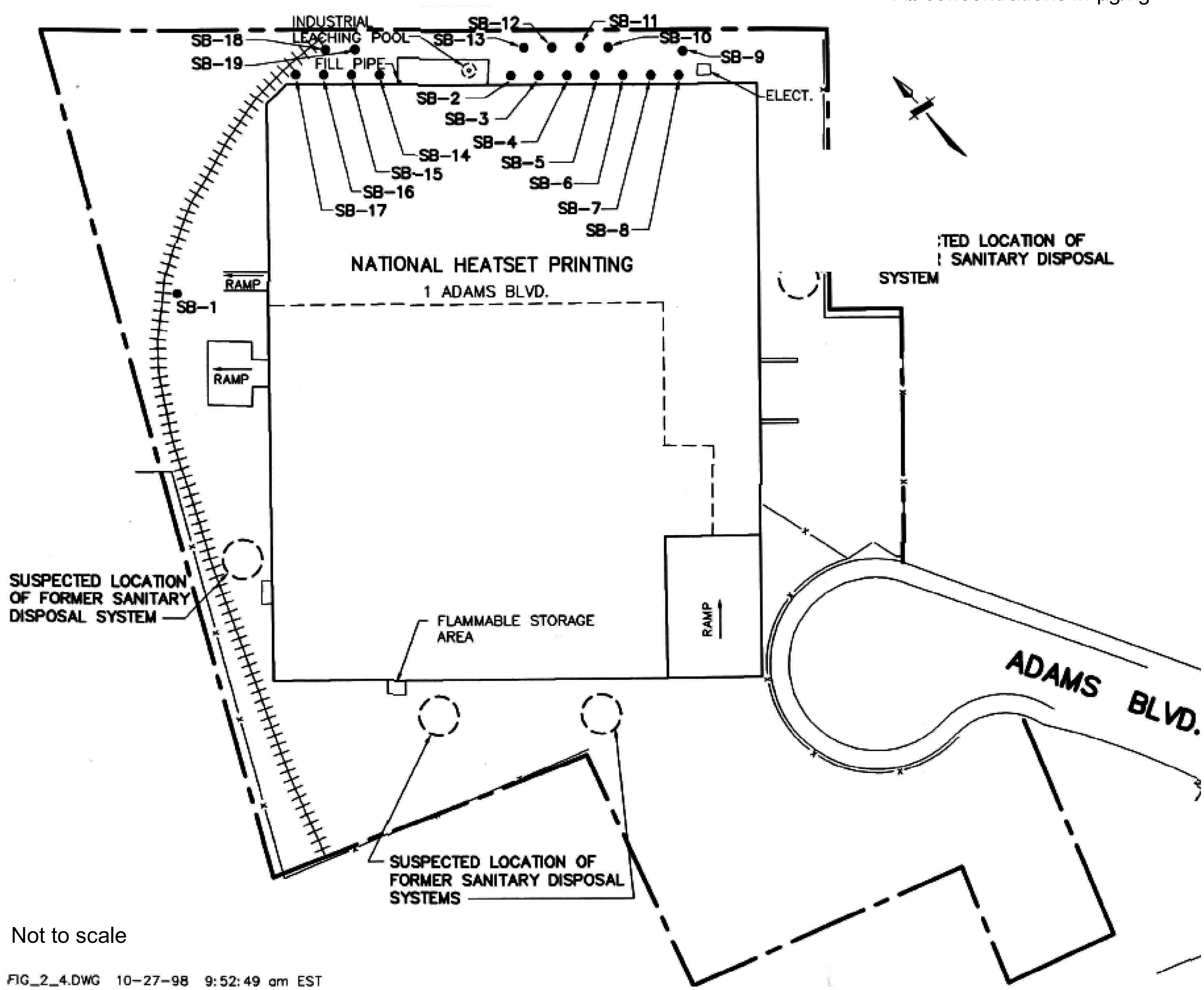
FIGURE 2
SITE BOUNDARY AND PROPERTY PARCEL

PROJECT MGR:	DESIGNED BY:	CREATED BY:	CHECKED BY:	SCALE:	DATE:	PROJECT NO:	FILE NO:
JCH	CJS	CJS	JCH	AS SHOWN	AUG 2013	14907.08	GIS/PROJECTS/ FIGURE2.MXD

	SB-07		SB-09		SB-11		SB-12		SB-13		SB-14		SB-15		SB-16		SB-17		SB-18		SB-19		NYSDEC RSCO[1]
	0-2	5-7	0-2	5-7	0-2	5-7	0-2	5-7	0-2	5-7	0-2	5-7	0-2	5-7	0-2	5-7	0-2	5-7	0-2	5-7	0-2	5-7	
PCE	**150**	ND	ND	ND	**69**	ND	**14.5**	ND	**221**	ND	**88**	**62.8**	**88**	**464**	ND	**331**	**78.9**	**33.9**	**254**	ND	**40.8**	ND	**1400**
TCE	ND	ND	ND	ND	ND	ND	ND	ND	**422**	ND	ND	ND	ND	**18.7**	ND	ND	ND	ND	ND	ND	ND	ND	700
DCE	ND	ND	ND	ND	ND	ND	**16.7**	ND	**133**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	300

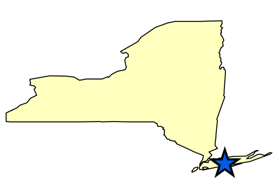
1: Note that Remedial Investigation soil data were evaluated using NYSDEC TAGM #4046 Guidance. These RSCOs have since been superceded by 6 NYCRR Part 375.

All concentrations in μg/kg



Not to scale

FIG_2_4.DWG 10-27-98 9:52:49 am EST



Reprinted from: Figure 2.4 *Remedial invesitgation/ Feasibility Study: National Heatset Printing*. H2M Group. February 1999.

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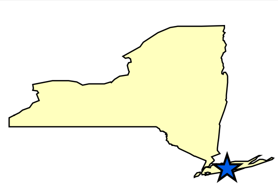
FIGURE 3
REMEDIAL INVESTIGATION
ON-SITE SUBSURFACE
SOIL SUMMARY

PROJECT MGR:	DESIGNED BY:	CREATED BY:	CHECKED BY:	SCALE:	DATE:	PROJECT NO:	FILE NO:
JCH	CJS	CJS	JCH	AS SHOWN	AUG 2013	14907.08	GIS/PROJECTS/ FIGURE3.MXD



Legend

Groundwater Monitoring Well
Assumed Flow Direction
Estimated Groundwater Contour
Known Groundwater Contour

Feet
0 30 60 120

1 inch = 60 feet

Source: NYSDEC OrthoPhotography - 2011,
Groundwater Elevations recorded April 2013

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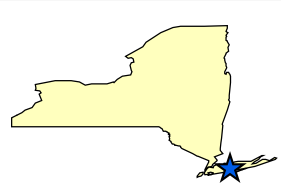
FIGURE 4
ONSITE GROUNDWATER
FLOW DIRECTION
(APRIL 2013)

PROJECT MGR:	DESIGNED BY:	CREATED BY:	CHECKED BY:	SCALE:	DATE:	PROJECT NO:	FILE NO:
JCH	CJS	CJS	JCH	AS SHOWN	AUG 2013	14907.08	GIS/PROJECTS/ FIGURE4.MXD



Legend

- DDC Well Cluster
- Groundwater Monitoring Well
- Interpreted Groundwater Flow Direction
- Interpreted Groundwater Elevation Contour

Feet

0 50 100 200

1 inch = 100 feet

Source: NYSDEC OrthoPhotography - 2011, Groundwater Elevations recorded April 2013

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DEPARTMENT OF ENVIRONMENTAL CONSERVATION • NEW YORK STATE

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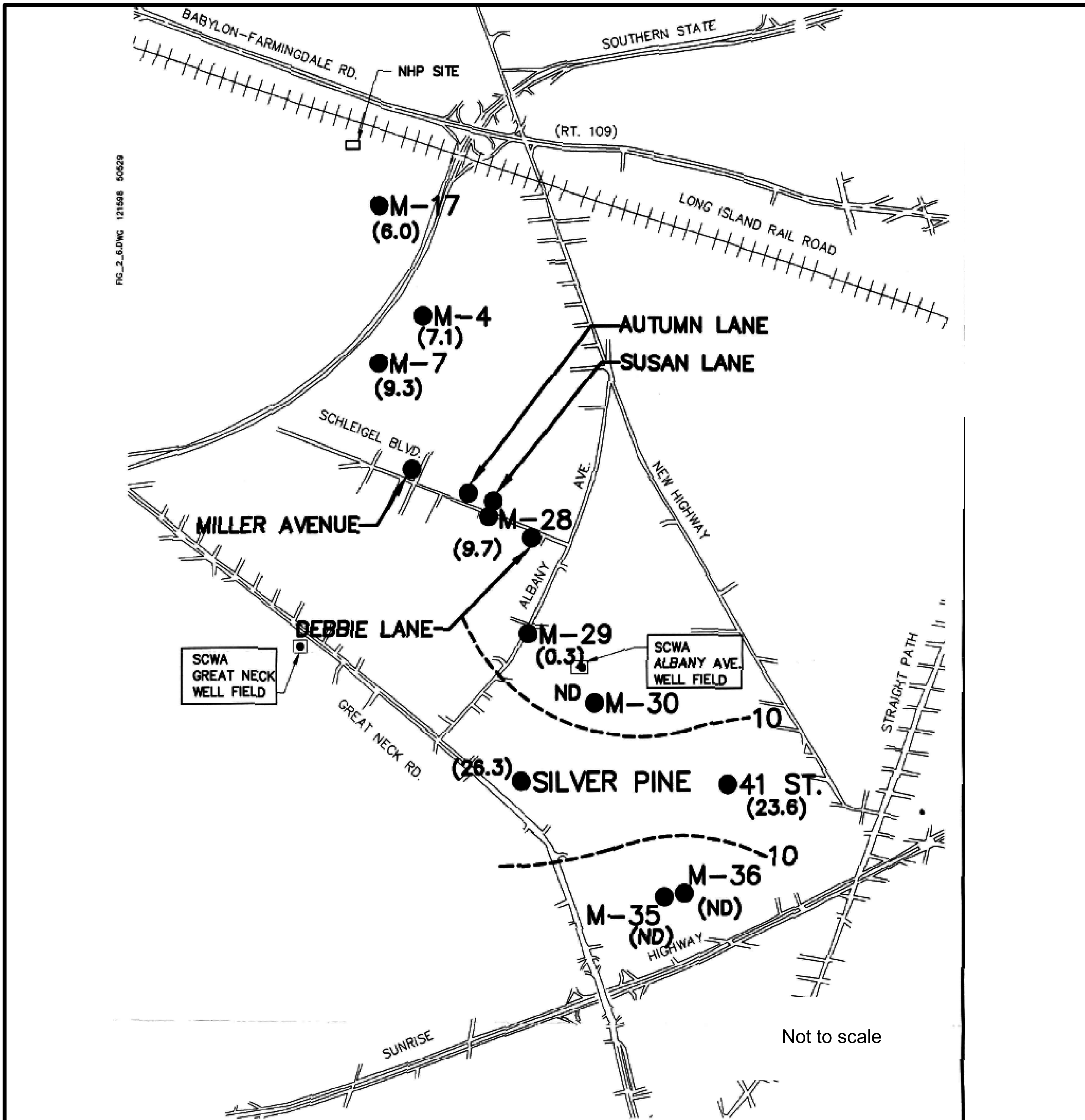
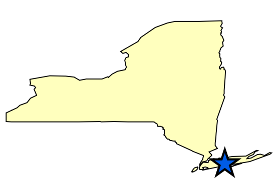
FIGURE 5
OFF-SITE GROUNDWATER FLOW DIRECTION
(APRIL 2013)

PROJECT MGR:	DESIGNED BY:	CREATED BY:	CHECKED BY:	SCALE:	DATE:	PROJECT NO:	FILE NO:
JCH	CJS	CJS	JCH	AS SHOWN	AUG 2013	14907.08	GIS/PROJECTS/ FIGURE5.MXD





LEGEND:

● GEOPROBE GROUND WATER SAMPLING POINT
ALL UNITS ARE IN UG/L
(ND) - NONDETECT

Reprinted from: Figure 4.1 *Remedial invesitgation/ Feasibility Study: National Heatset Printing*. H2M Group. February 1999.

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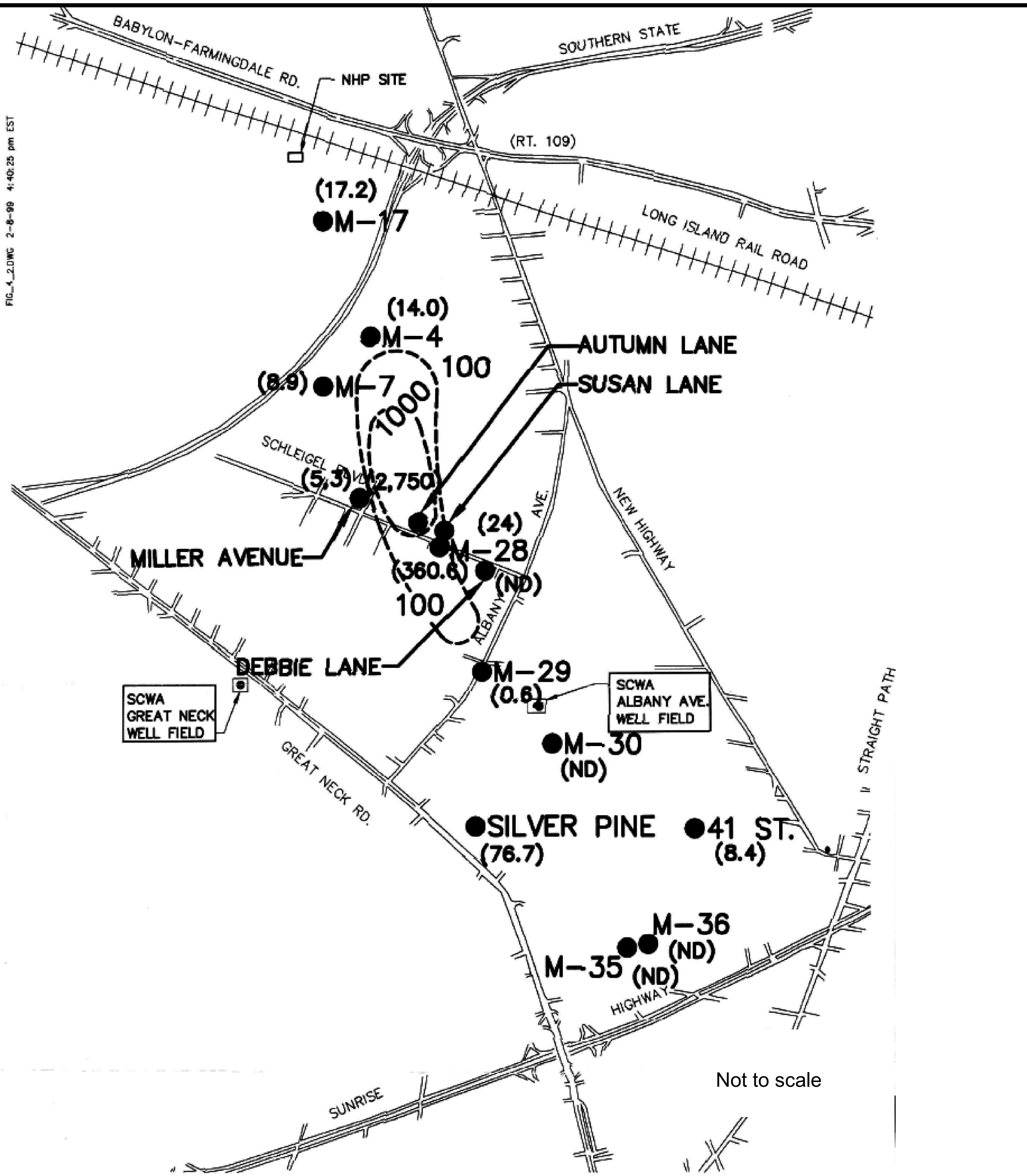
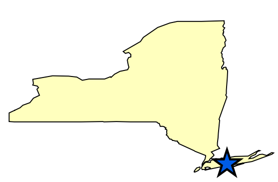
FIGURE 6a
REMEDIAL INVESTIGATION
OFF-SITE GROUNDWATER SUMMARY
(VOCs at 50 ft BGS)

PROJECT MGR:	DESIGNED BY:	CREATED BY:	CHECKED BY:	SCALE:	DATE:	PROJECT NO:	FILE NO:
JCH	CJS	CJS	JCH	AS SHOWN	AUG 2013	14907.08	GIS/PROJECTS/ FIGURE6a.MXD





LEGEND:

● GEOPROBE GROUND WATER SAMPLING POINT
ALL UNITS ARE IN UG/L
(ND) – NONDETECT

Reprinted from: Figure 4.2 *Remedial invesitgation/ Feasibility Study: National Heatset Printing*. H2M Group. February 1999.

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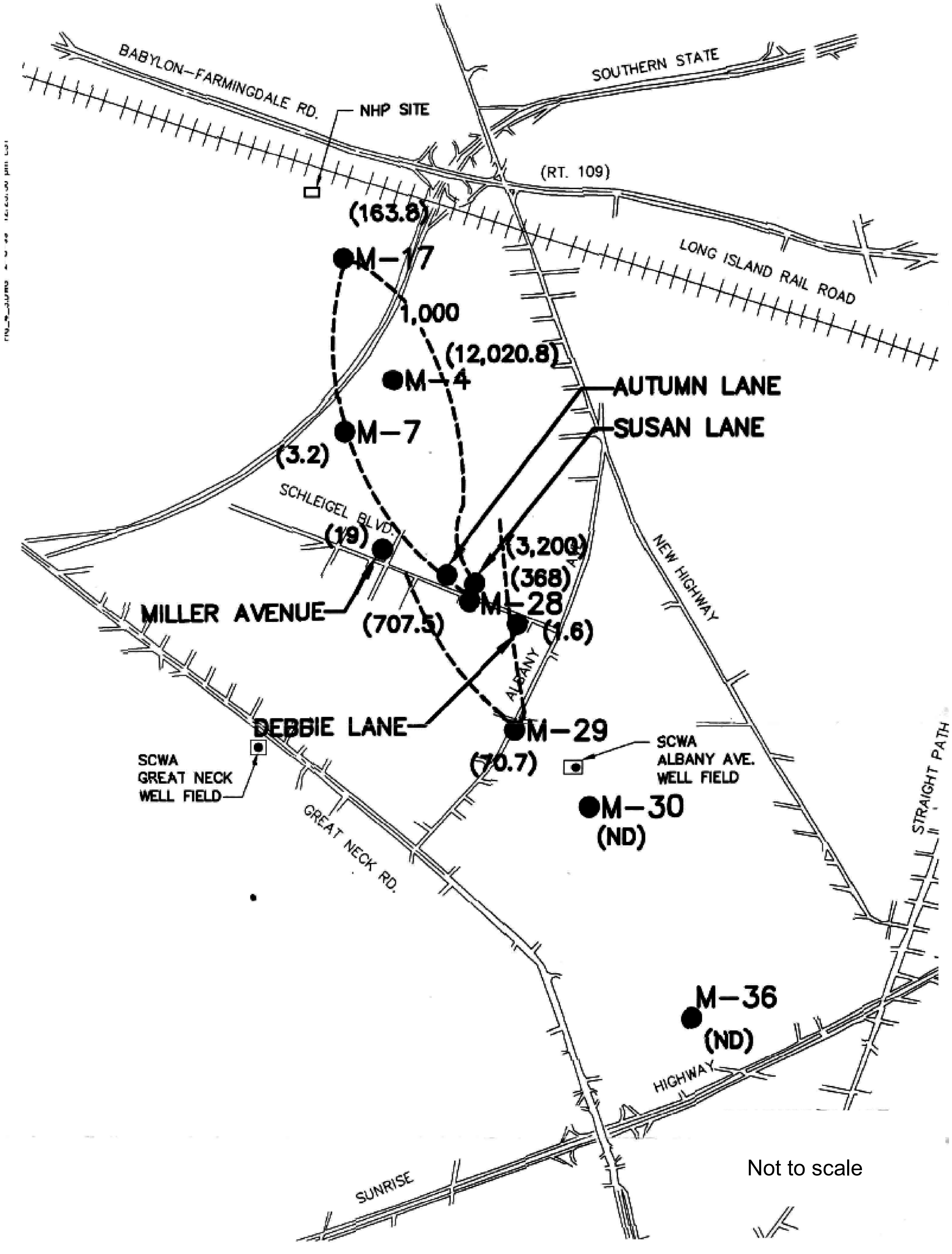
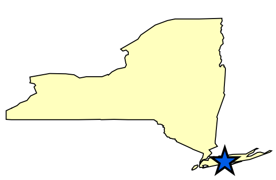
FIGURE 6b
REMEDIAL INVESTIGATION
OFF-SITE GROUNDWATER SUMMARY
(TOTAL VOCs AT 65-70 FT BGS)

PROJECT MGR:	DESIGNED BY:	CREATED BY:	CHECKED BY:	SCALE:	DATE:	PROJECT NO:	FILE NO:
JCH	CJS	CJS	JCH	AS SHOWN	AUG 2013	14907.08	GIS/PROJECTS/ FIGURE6b.MXD





LEGEND:

● GEOPROBE GROUND WATER SAMPLING POINT
ALL UNITS ARE IN UG/L
(ND) – NONDETECT

Reprinted from: Figure 4.2 *Remedial invesitgation/ Feasibility Study: National Heatset Printing*. H2M Group. February 1999.

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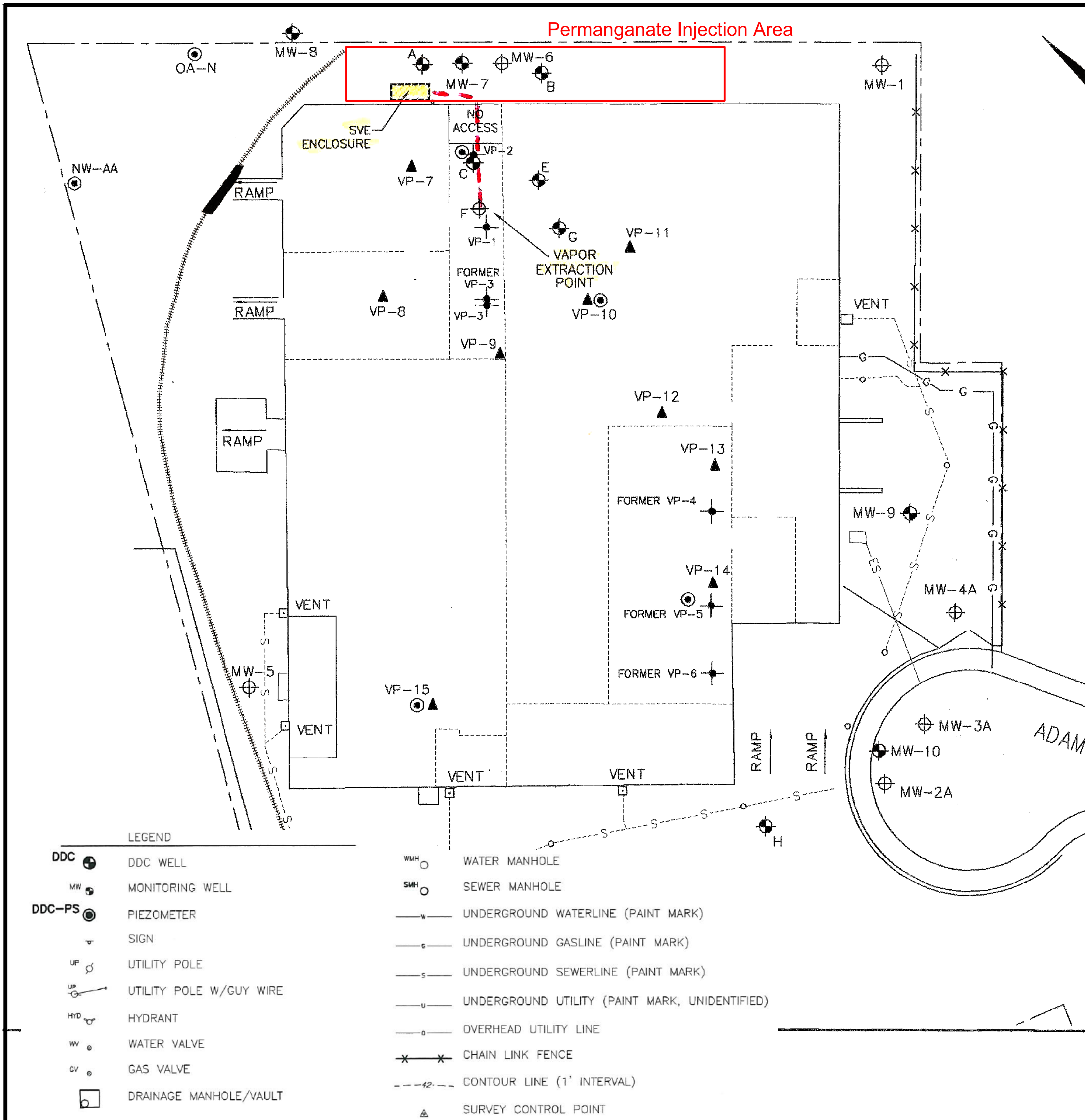
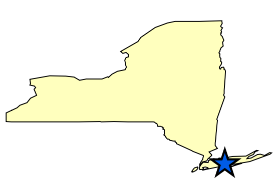
FIGURE 6c
REMEDIAL INVESTIGATION
OFF-SITE GROUNDWATER SUMMARY
(TOTAL VOCs AT 75-85 FT BGS)

PROJECT MGR:	DESIGNED BY:	CREATED BY:	CHECKED BY:	SCALE:	DATE:	PROJECT NO:	FILE NO:
JCH	CJS	CJS	JCH	AS SHOWN	AUG 2013	14907.08	GIS/PROJECTS/ FIGURE6c.MXD





Reprinted from: Figure developed by Shaw Environmental, Inc.
and adpated by O'Brien & Gere Engineers, Inc. & EA Engineering, PC

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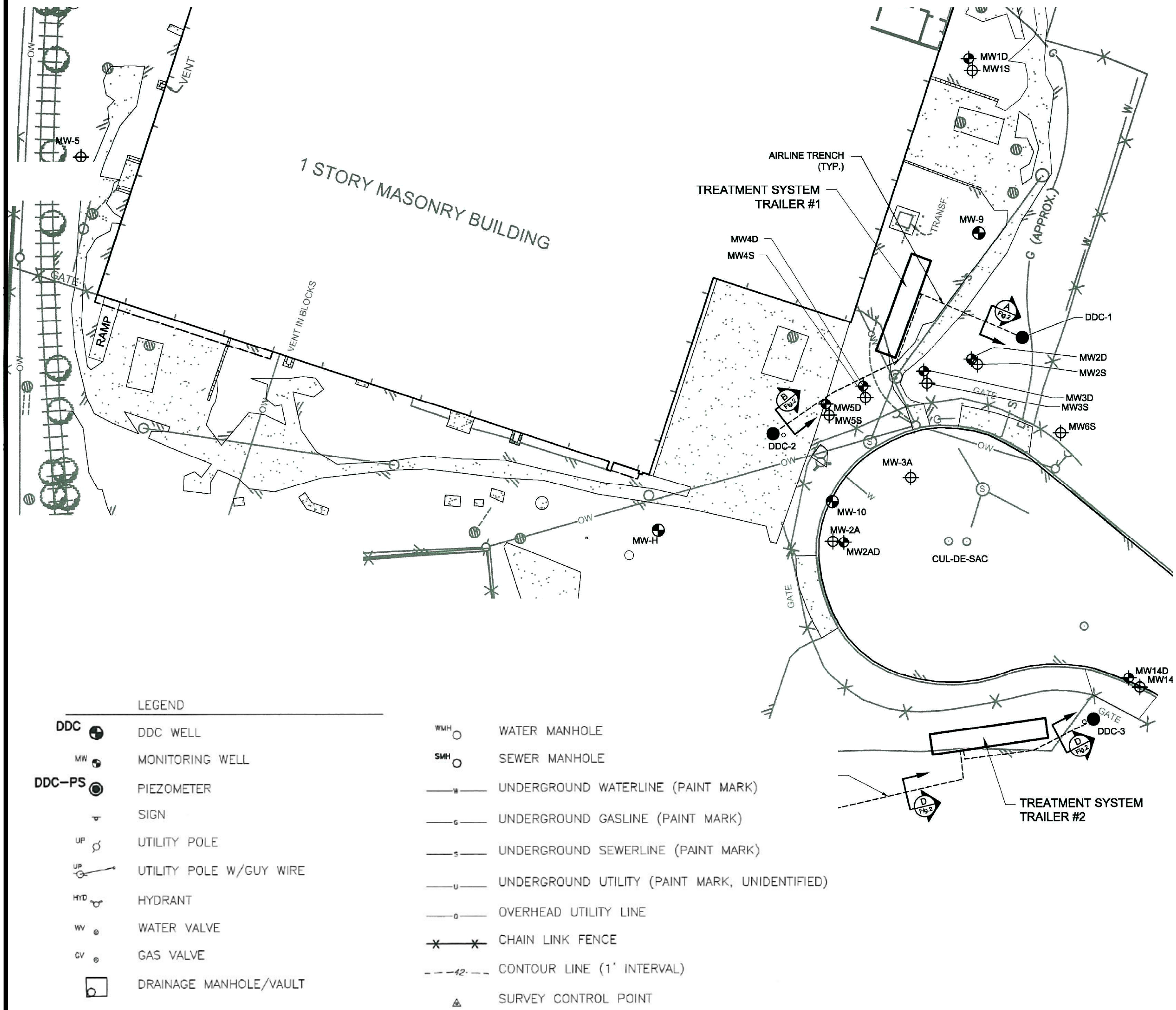
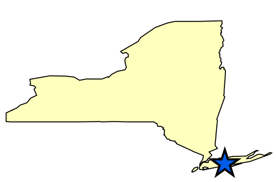
FIGURE 7a
ON-SITE TREATMENT
SYSTEM LOCATION
(SVE SYSTEM)

PROJECT MGR:	DESIGNED BY:	CREATED BY:	CHECKED BY:	SCALE:	DATE:	PROJECT NO:	FILE NO:
JCH	CJS	CJS	JCH	AS SHOWN	AUG 2013	14907.08	GIS/PROJECTS/ FIGURE7a.MXD





Reprinted from: Figure 1 *As-Built Drawings*. AECOM. October 2012. Detailed drawing available as Appendix D: Final Engineering Report. EA Engineering, PC. 2013

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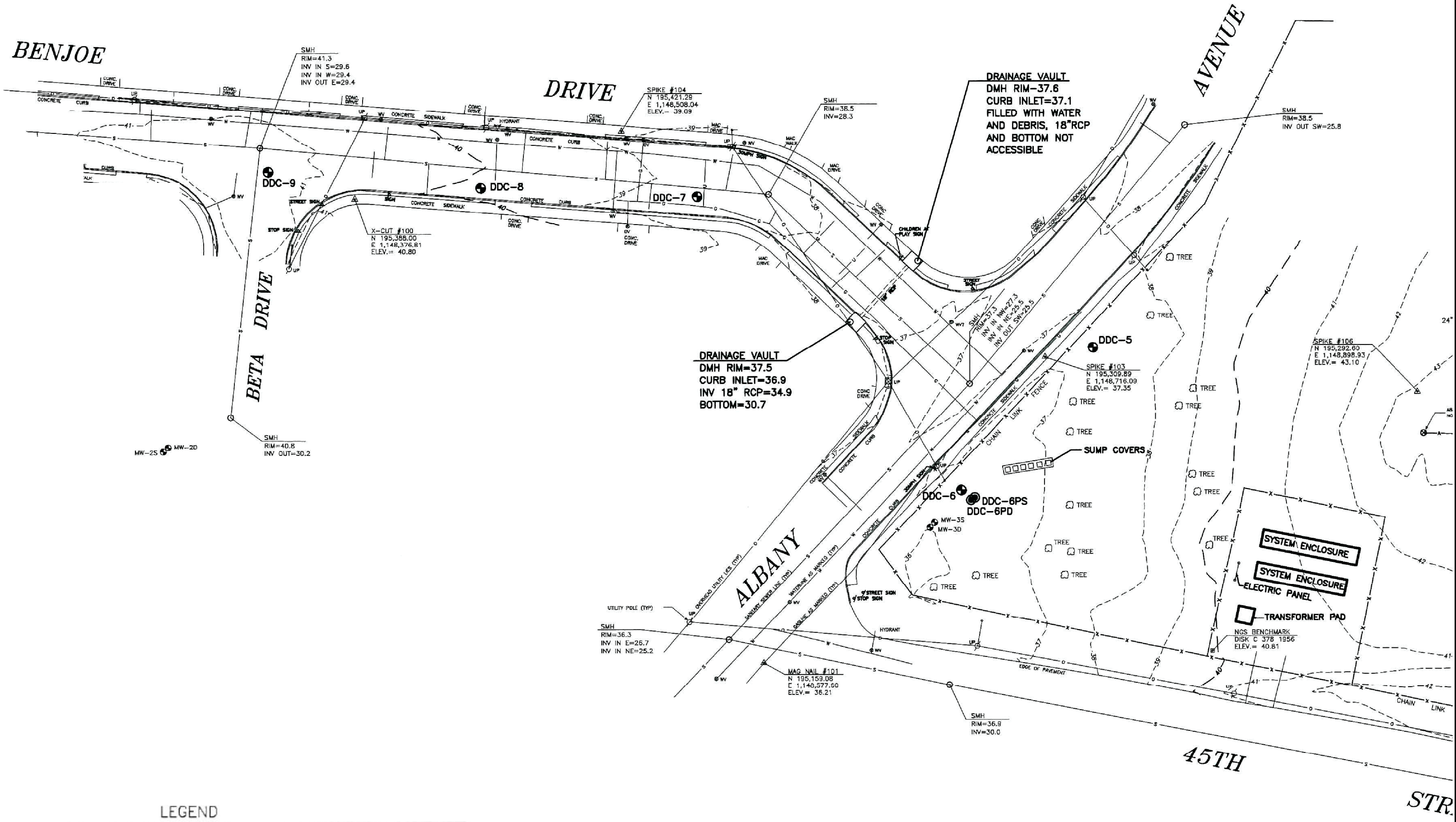
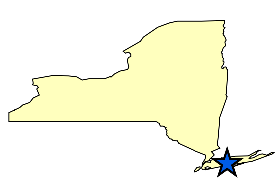
FIGURE 7b
ON-SITE TREATMENT SYSTEM LOCATIONS
(DDC #1 and DDC #2)

PROJECT MGR:	DESIGNED BY:	CREATED BY:	CHECKED BY:	SCALE:	DATE:	PROJECT NO:	FILE NO:
JCH	CJS	CJS	JCH	AS SHOWN	AUG 2013	14907.08	GIS/PROJECTS/ FIGURE7b.MXD



LEGEND

DDC	DDC WELL
MW	MONITORING WELL
DDC-PS	PIEZOMETER
	SIGN
UP	UTILITY POLE
UP	UTILITY POLE W/GUY WIRE
HYD	HYDRANT
WV	WATER VALVE
GV	GAS VALVE
	DRAINAGE MANHOLE/VAULT
WMH	WATER MANHOLE
SMH	SEWER MANHOLE
——W——	UNDERGROUND WATERLINE (PAINT MARK)
——G——	UNDERGROUND GASLINE (PAINT MARK)
——S——	UNDERGROUND SEWERLINE (PAINT MARK)
——U——	UNDERGROUND UTILITY (PAINT MARK, UNIDENTIFIED)
——O——	OVERHEAD UTILITY LINE
—X——X—	CHAIN LINK FENCE
- - -42- - -	CONTOUR LINE (1' INTERVAL)
	SURVEY CONTROL POINT



Reprinted from: Drawing C-01 *As-Built Drawings*. AECOM. October 2012. Detailed drawing available as Appendix D: Final Engineering Report. EA Engineering, PC. 2013

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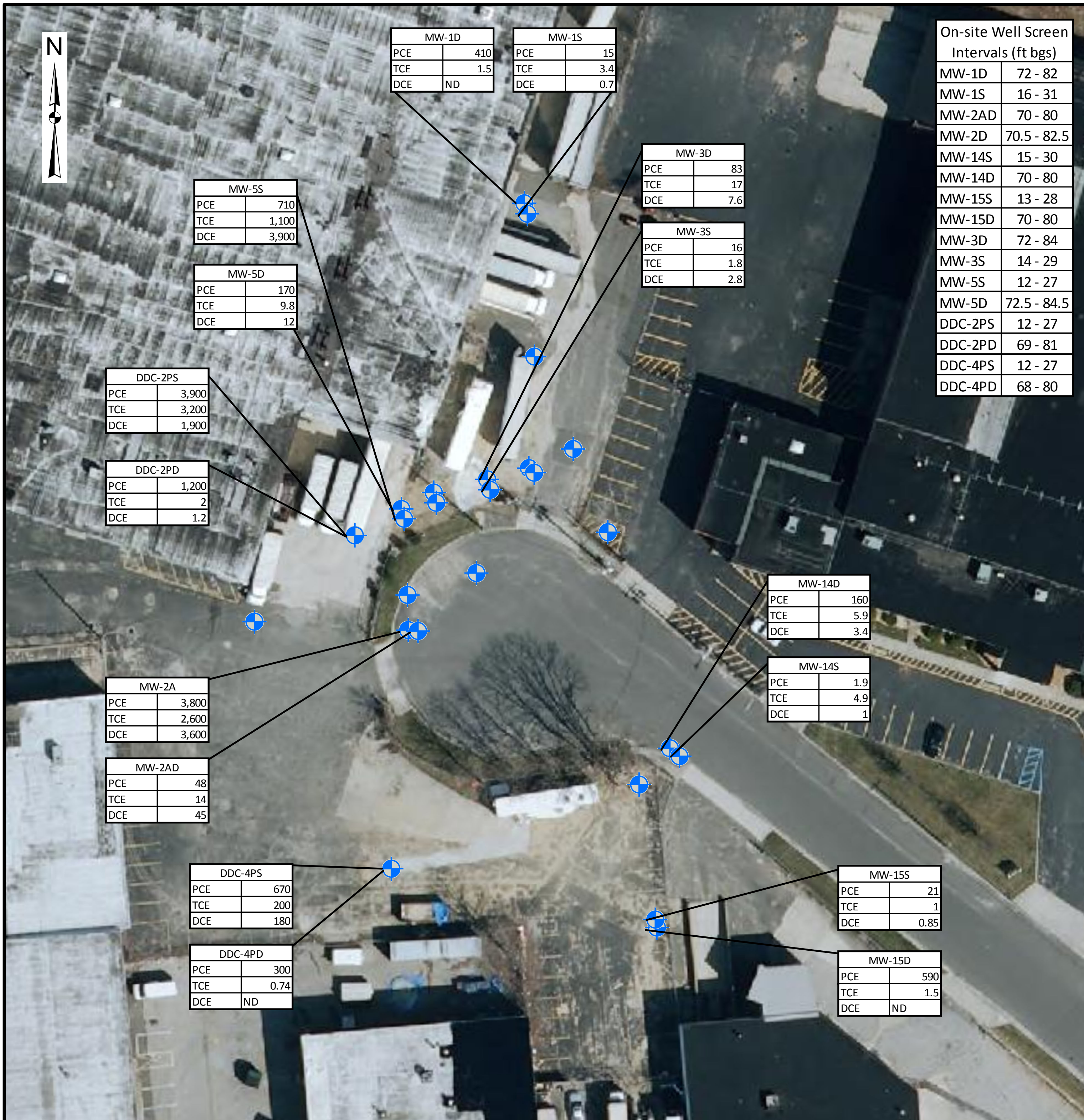
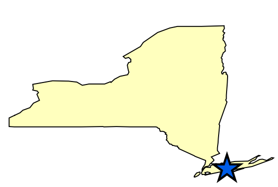
FIGURE 7c
OFF-SITE TREATMENT SYSTEM LOCATION (DDC SYSTEM)

PROJECT MGR:	DESIGNED BY:	CREATED BY:	CHECKED BY:	SCALE:	DATE:	PROJECT NO:	FILE NO:
JCH	CJS	CJS	JCH	AS SHOWN	AUG 2013	14907.08	GIS/PROJECTS/ FIGURE7c.MXD





Legend

Groundwater Monitoring Well

MW-1D	
PCE	410
TCE	1.5
DCE	ND

PCE - Tetrachloroethene
TCE - Trichloroethene
DCE - cis-1,2-Dichloroethene
Results are reported in µg/L

Feet
0 30 60 120
1 inch = 60 feet

Source: NYSDEC OrthoPhotography - 2011

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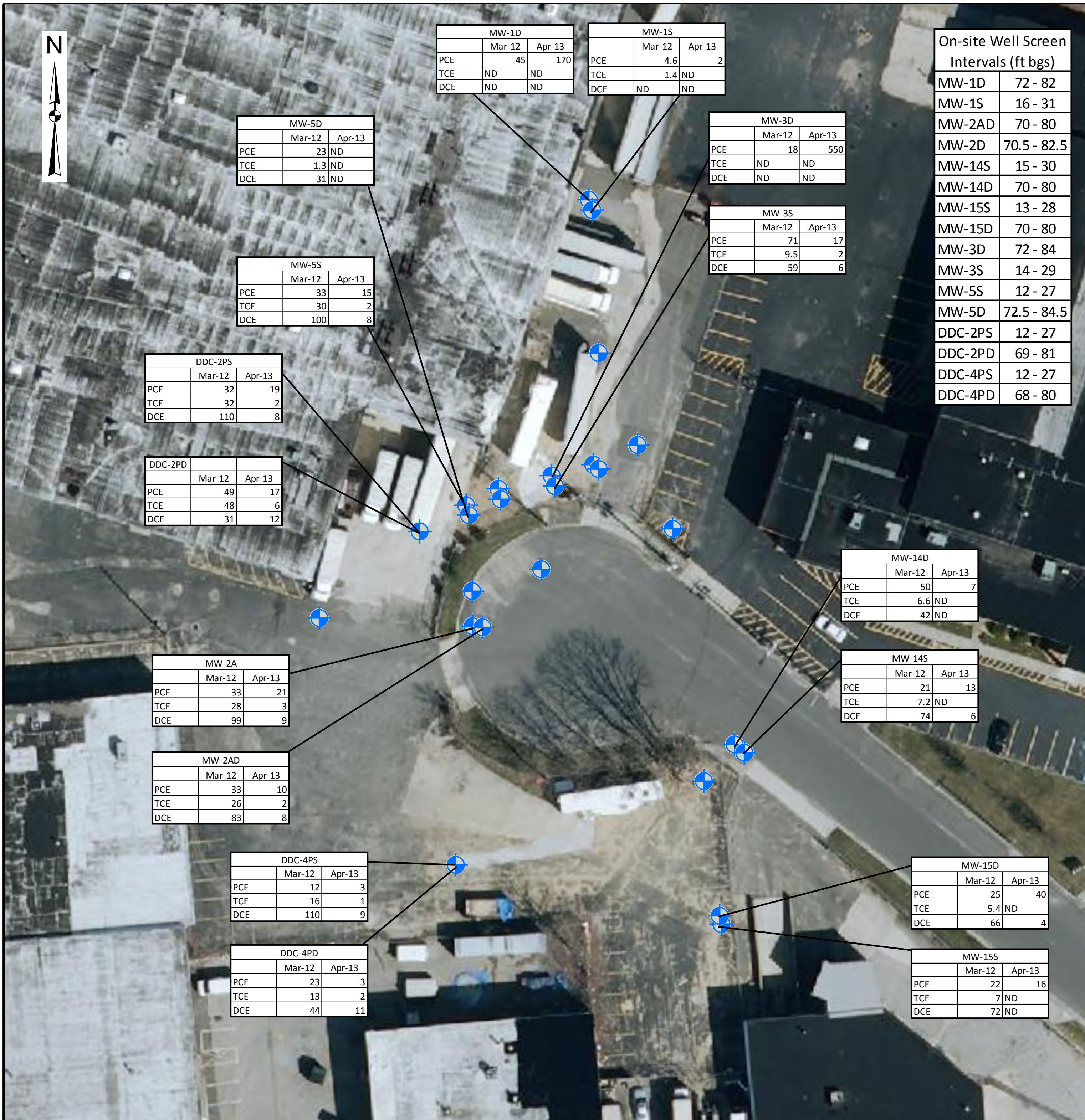
FIGURE 8
BASELINE ONSITE GROUNDWATER QUALITY - 3 JUNE 2010

PROJECT MGR:	DESIGNED BY:	CREATED BY:	CHECKED BY:	SCALE:	DATE:	PROJECT NO:	FILE NO:
JCH	CJS	CJS	JCH	AS SHOWN	AUG 2013	14907.08	GIS/PROJECTS/ FIGURE8.MXD



MW-1D	Mar-12	Apr-13
PCE	45	170
TCE	ND	ND
DCE	ND	ND

MW-1S	Mar-12	Apr-13
PCE	4.6	2
TCE	1.4	ND
DCE	ND	ND

MW-5D	Mar-12	Apr-13
PCE	23	ND
TCE	1.3	ND
DCE	31	ND

MW-3D	Mar-12	Apr-13
PCE	18	550
TCE	ND	ND
DCE	ND	ND

MW-3S	Mar-12	Apr-13
PCE	71	17
TCE	9.5	2
DCE	59	6

MW-5S	Mar-12	Apr-13
PCE	33	15
TCE	30	2
DCE	100	8

DDC-2PS	Mar-12	Apr-13
PCE	32	19
TCE	32	2
DCE	110	8

DDC-2PD	Mar-12	Apr-13
PCE	49	17
TCE	48	6
DCE	31	12

MW-14D	Mar-12	Apr-13
PCE	50	7
TCE	6.6	ND
DCE	42	ND

MW-14S	Mar-12	Apr-13
PCE	21	13
TCE	7.2	ND
DCE	74	6

MW-2A	Mar-12	Apr-13
PCE	33	21
TCE	28	3
DCE	99	9

MW-2AD	Mar-12	Apr-13
PCE	33	10
TCE	26	2
DCE	83	8

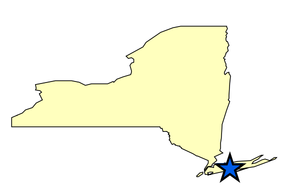
DDC-4PS	Mar-12	Apr-13
PCE	12	3
TCE	16	1
DCE	110	9

DDC-4PD	Mar-12	Apr-13
PCE	23	3
TCE	13	2
DCE	44	11

MW-15D	Mar-12	Apr-13
PCE	25	40
TCE	5.4	ND
DCE	66	4

MW-15S	Mar-12	Apr-13
PCE	22	16
TCE	7	ND
DCE	72	ND

On-site Well Screen Intervals (ft bgs)	
MW-1D	72 - 82
MW-1S	16 - 31
MW-2AD	70 - 80
MW-2D	70.5 - 82.5
MW-14S	15 - 30
MW-14D	70 - 80
MW-15S	13 - 28
MW-15D	70 - 80
MW-3D	72 - 84
MW-3S	14 - 29
MW-5S	12 - 27
MW-5D	72.5 - 84.5
DDC-2PS	12 - 27
DDC-2PD	69 - 81
DDC-4PS	12 - 27
DDC-4PD	68 - 80



Legend

Groundwater Monitoring Well

MW-1D	
PCE	410
TCE	1.5
DCE	ND

PCE - Tetrachloroethene
TCE - Trichloroethene
DCE - cis-1,2-Dichloroethene
Results are reported in µg/L

Feet
0 30 60 120
1 inch = 60 feet

Source: NYSDEC OrthoPhotography - 2011,

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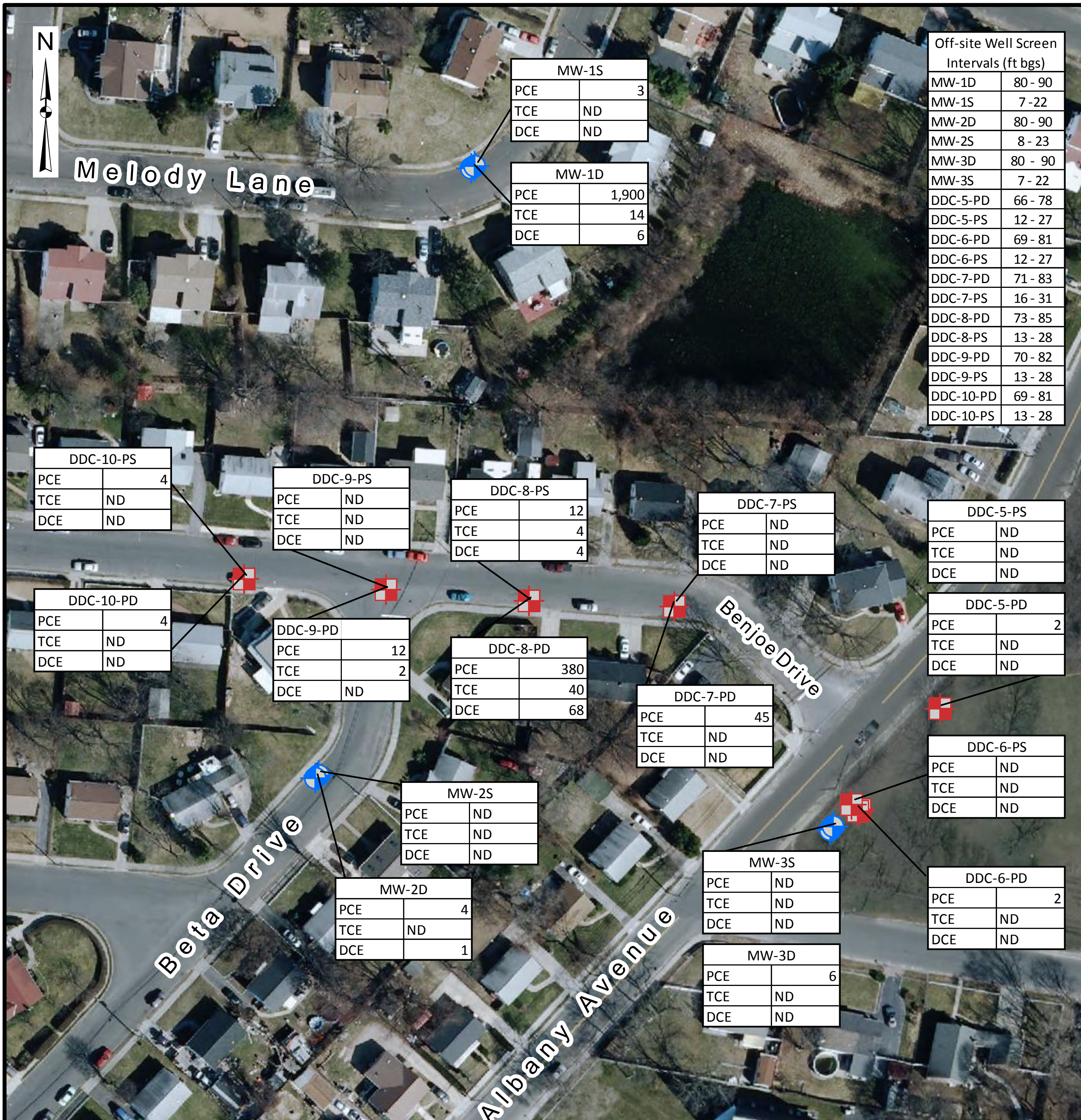
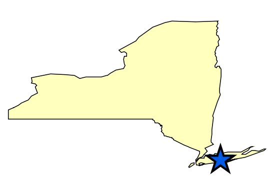
FIGURE 9
ONSITE GROUNDWATER QUALITY (27 MARCH 2012 & 3 APRIL 2013)

PROJECT MGR:	DESIGNED BY:	CREATED BY:	CHECKED BY:	SCALE:	DATE:	PROJECT NO:	FILE NO:
JCH	CJS	CJS	JCH	AS SHOWN	AUG 2013	14907.08	GIS/PROJECTS/ FIGURE9.MXD





Legend

DDC Well Cluster

Groundwater Monitoring Well

MW-1D	
PCE	410
TCE	1.5
DCE	ND

PCE - Tetrachloroethene
TCE - Trichloroethene
DCE - cis-1,2-Dichloroethene
Results are reported in µg/L

Feet
0 50 100 200
1 inch = 102.67 feet

Source: NYSDEC OrthoPhotography - 2011,

EA Engineering, Science, and Technology, Inc.

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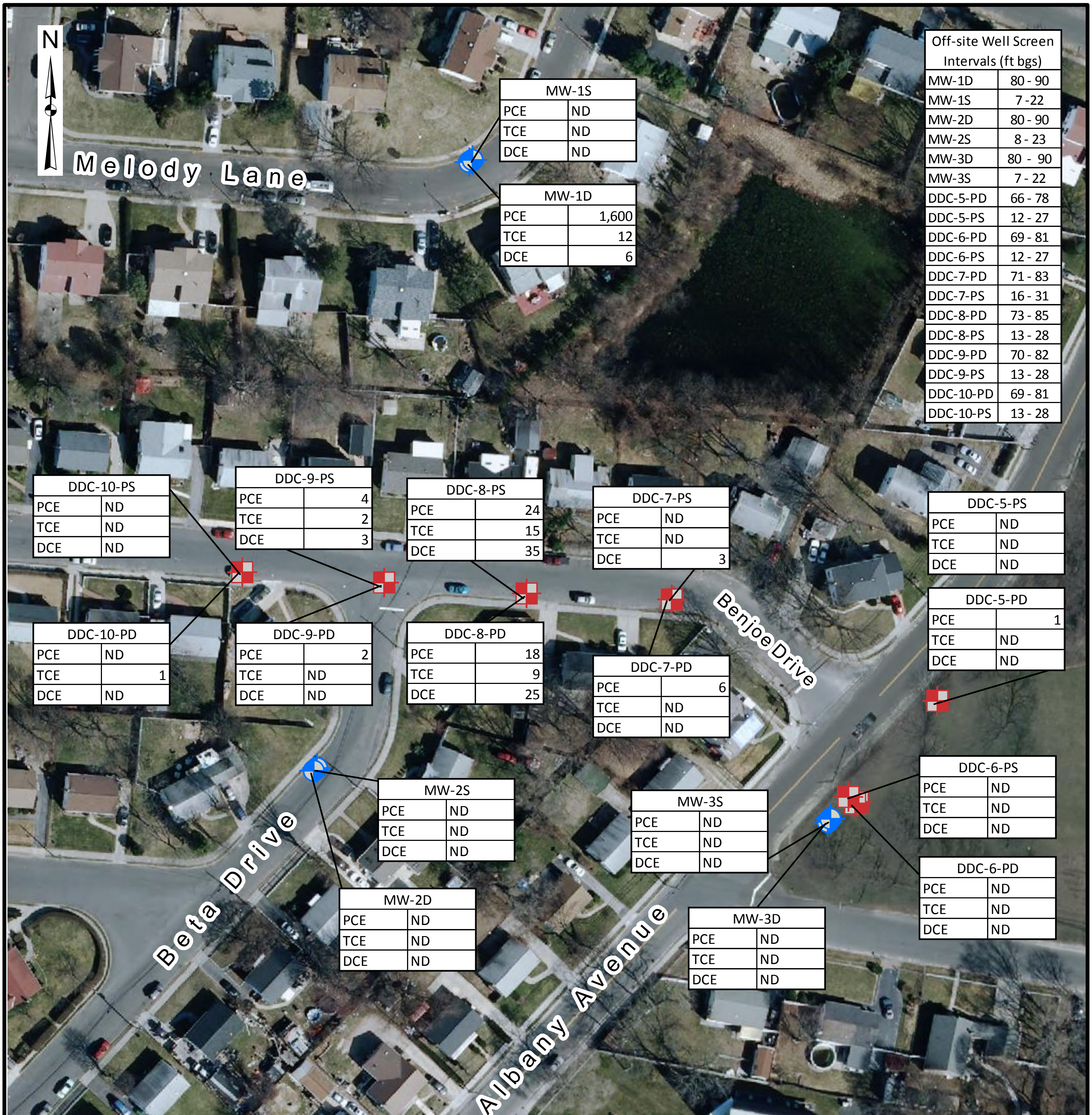
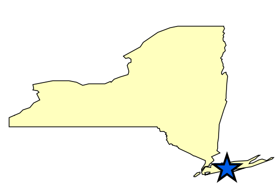
FIGURE 10
BASELINE OFF-SITE GROUNDWATER QUALITY
(MAY 2012)

PROJECT MGR:	DESIGNED BY:	CREATED BY:	CHECKED BY:	SCALE:	DATE:	PROJECT NO:	FILE NO:
JCH	CJS	CJS	JCH	AS SHOWN	AUG 2013	14907.08	GIS/PROJECTS/ FIGURE10.MXD





Legend

DDC Well Cluster

Groundwater Monitoring Well

MW-1D	
PCE	410
TCE	1.5
DCE	ND

PCE - Tetrachloroethene
TCE - Trichloroethene
DCE - cis-1,2-Dichloroethene
Results are reported in µg/L

Feet
0 50 100 200
1 inch = 100 feet

Source: NYSDEC OrthoPhotography - 2011,
Groundwater Elevations recorded December 2011

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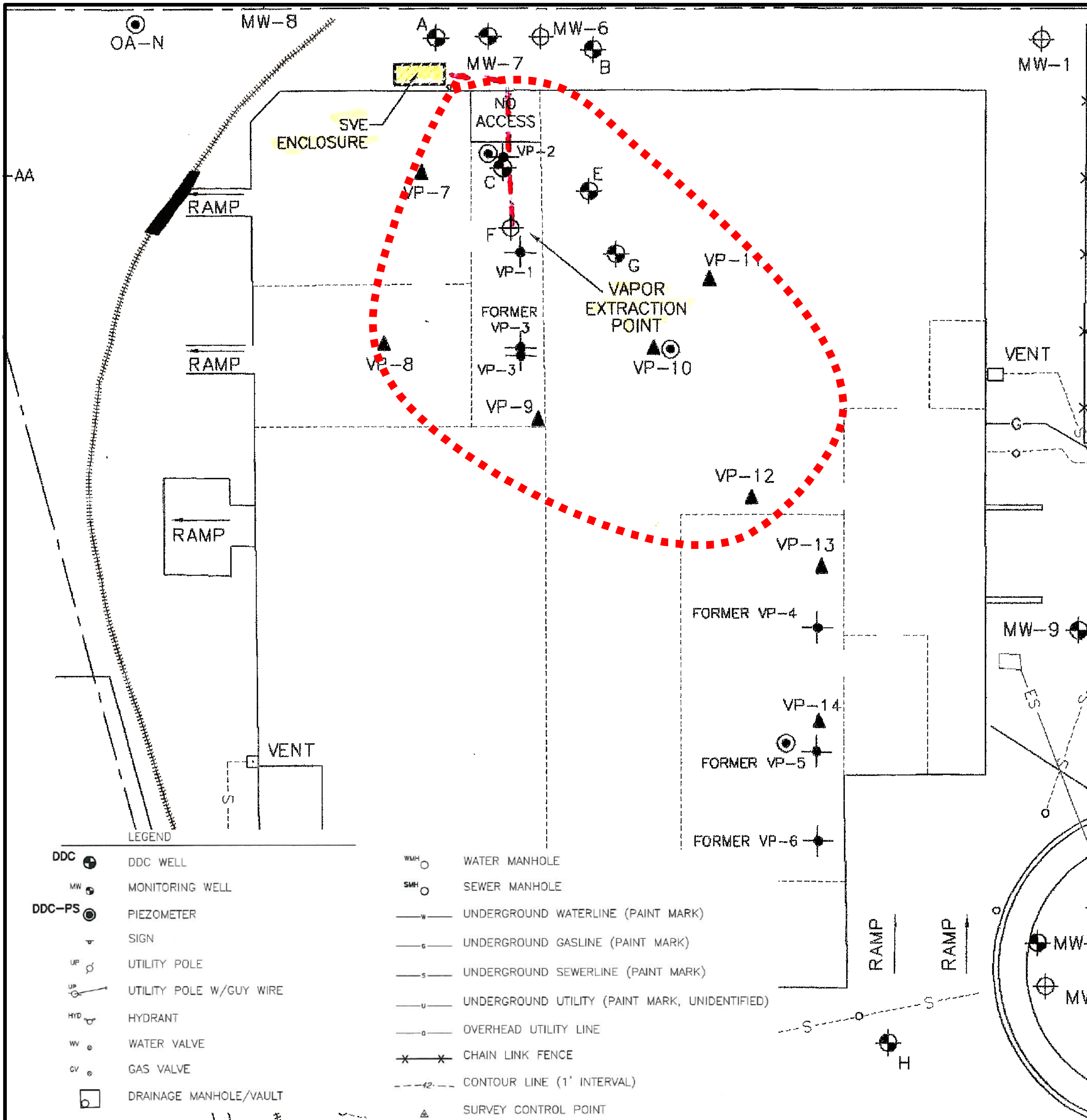
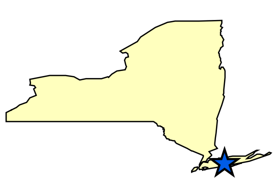
FIGURE 11
OFF-SITE
GROUNDWATER QUALITY
(5 APRIL 2013)

PROJECT MGR:	DESIGNED BY:	CREATED BY:	CHECKED BY:	SCALE:	DATE:	PROJECT NO:	FILE NO:
JCH	CJS	CJS	JCH	AS SHOWN	AUG 2013	14907.08	GIS/PROJECTS/ FIGURE11.MXD





Estimated area of SVE influence (based on on observed vacuum level o f 0.1" H_20 at vapor monitoring points).

Reprinted from: Figure developed by Shaw Environmental, Inc. and adpated by O'Brien & Gere Engineers, Inc. & EA Engineering, PC

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FIGURE 12
ESTIMATED AREA
OF INFLUENCE FOR
SVE SYSTEM

PROJECT MGR:	DESIGNED BY:	CREATED BY:	CHECKED BY:	SCALE:	DATE:	PROJECT NO:	FILE NO:
JCH	CJS	CJS	JCH	AS SHOWN	AUG 2013	14907.08	GIS/PROJECTS/ FIGURE12.MXD

TABLE 1 SITE-SPECIFIC SOIL/GROUNDWATER CLEANUP OBJECTIVES AND INDOOR AIR GUIDANCE VALUES

Constituent	Standards, Criteria, and Guidance	Units
VOLATILE ORGANIC COMPOUNDS - SOIL[(a)]		
Tetrachloroethene (PCE)	1.30	mg/Kg
Trichloroethene (TCE)	0.47	mg/Kg
cis -1,2-Dichloroethene (DCE)	0.25	mg/Kg
VOLATILE ORGANIC COMPOUNDS - GROUNDWATER[(b)]		
1,1-Dichloroethene	5	µg/L
1,4-Dichlorobenzene	30	µg/L
1,2,4-Trichlorobenzene	5	µg/L
Acetone	50	µg/L
Carbon Tetrachloride	5	µg/L
cis -1,2-Dichloroethene (DCE)	5	µg/L
Dichloroethylenes	5	µg/L
Isopropylbenzene	5	µg/L
Tetrachloroethene (PCE)	5	µg/L
Toluene	5	µg/L
trans -1,2-Dichloroethene	5	µg/L
Trichloroethene (TCE)	5	µg/L
Vinyl chloride	2	µg/L
VOLATILE ORGANIC COMPOUNDS - INDOOR AIR[(c)]		
Tetrachloroethene (PCE)	100	µg/m^3
Trichloroethene (TCE)	5	µg/m^3
Polychlorinated Biphenyls	1	µg/m^3
Tetrachlorodibenzo-*p* -dioxin equivalents	0.00001	µg/m^3
Methylene Chloride (dichloromethane)	60	µg/m^3

(a) 6 NYCRR Part 375 - 6.7(d) Unrestricted Use
(b) NYS Ambient Water Quality Standards
(c) Air guidance values derived by the New York State Department of Health.

TABLE 2 SUMMARY OF PRELIMINARY INDOOR AIR SAMPLING RESULTS (JULY 2001)

Analyte	Sample ID / Sample Date	MDL	AS-1 / 19-Jul-01	AS-2 / 19-Jul-01	AS-3 / 19-Jul-01	AS-4 / 19-Jul-01
Dichlorodiflouromethane (Freon 12)	$\mu g/m^3$	2.50	3.40	3.20	2.80	2.80
Chloromethane	$\mu g/m^3$	0.80	1.30	1.10	0.90	0.90
1,2-Dichlorotetraflouroethane (Freon 114)	$\mu g/m^3$	3.50	ND	ND	ND	ND
Vinyl Chloride	$\mu g/m^3$	1.30	ND	ND	ND	ND
Bromomethane	$\mu g/m^3$	1.90	ND	ND	ND	ND
Chloroethane	$\mu g/m^3$	1.30	ND	ND	ND	ND
Trichloroflouromethane (Freon 11)	$\mu g/m^3$	2.80	3.60	ND	ND	ND
1,1-Dichloroethene	$\mu g/m^3$	2.00	ND	ND	ND	ND
Methylene Chloride	$\mu g/m^3$	1.70	ND	ND	ND	ND
1,1,2-Trichlorotriflouroethane (Freon 113)	$\mu g/m^3$	3.80	ND	ND	ND	ND
1,1-Dichloroethane	$\mu g/m^3$	2.00	ND	ND	ND	ND
1,2-Dichloroethene	$\mu g/m^3$	2.00	2.10	ND	ND	ND
Chloroform	$\mu g/m^3$	2.40	ND	ND	ND	ND
1,2-Dichloroethane	$\mu g/m^3$	2.00	ND	ND	ND	ND
1,1,1-Trichloroethane	$\mu g/m^3$	2.70	ND	ND	ND	ND
Benzene	$\mu g/m^3$	1.60	2.20	ND	ND	ND
Carbon Tetrachloride	$\mu g/m^3$	3.10	ND	ND	ND	ND
1,2-Dichloropropane (cis)	$\mu g/m^3$	2.30	ND	ND	ND	ND
Trichloroethene	$\mu g/m^3$	2.70	ND	ND	ND	ND
1,3-Dichloropropene (cis)	$\mu g/m^3$	2.30	2.60	ND	ND	ND
1,3-Dichloropropene (trans)	$\mu g/m^3$	2.30	ND	ND	ND	ND
1,1,2-Trichloroethane	$\mu g/m^3$	2.70	ND	ND	ND	ND
Toluene	$\mu g/m^3$	1.90	52.70	4.90	67.70	3.00
1,2-Dibromoethane	$\mu g/m^3$	3.80	ND	ND	ND	ND
Tetrachloroethene	$\mu g/m^3$	3.40	**189.90**	13.60	30.50	ND
Chlorobenzene	$\mu g/m^3$	2.30	ND	ND	ND	ND
Ethylbenzene	$\mu g/m^3$	2.20	2.80	ND	ND	ND
M/P-Xylene	$\mu g/m^3$	2.20	5.60	ND	2.80	ND
Styrene	$\mu g/m^3$	2.10	4.30	ND	5.50	ND
O-Xylene	$\mu g/m^3$	2.20	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	$\mu g/m^3$	3.40	ND	ND	ND	ND

NOTE: ID = Identification
MDL = Method Detection Limit
$\mu g/m^3$ = Micrograms per cubic meter
ND = Non-detect
Bold values indicate exceedance of guidance value.

Analyte	Sample ID / Sample Date	MDL	AS-1	AS-2	AS-3	AS-4
			19-Jul-01	19-Jul-01	19-Jul-01	19-Jul-01
1,3,5-Trimethylbenzene	$\mu g/m^3$	2.50	ND	ND	ND	ND
1,2,4-Trimethylbenzene	$\mu g/m^3$	2.50	3.40	ND	ND	ND
1,3-Dichlorobenzene	$\mu g/m^3$	3.00	ND	ND	ND	ND
1,4-Dichlorobenzene	$\mu g/m^3$	3.00	ND	ND	13.80	ND
1,2-Dichlorobenzene	$\mu g/m^3$	3.00	ND	ND	ND	ND
1,2,4-Trichlorobenzene	$\mu g/m^3$	3.70	ND	ND	ND	ND
Hexachlorobutadiene	$\mu g/m^3$	5.30	ND	ND	ND	ND

TABLE 3A SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS IN ON-SITE GROUNDWATER SAMPLES QUARTERLY SAMLPING EVENT - APRIL 2013

Parameters List EPA Method 8260B	Sample ID	DDC-2-PD		DDC-2-PS		DDC-4-PD		DDC-4-PS		MW-1D		MW-1S		MW-2A		MW-2AD		MW-3D		NYSDEC AWQS (µg/L)
	Sample Type	Groundwater		Groundwater		Groundwater		Groundwater		Groundwater		Groundwater		Groundwater		Groundwater		Groundwater		
	Sample Date	2–3 Apr 13		2–3 Apr 13		2–3 Apr 13		2–3 Apr 13		2–3 Apr 13		2–3 Apr 13		2–3 Apr 13		2–3 Apr 13		2–3 Apr 13		
1,2-Dichloroethene (total)	(µg/L)	**13**		**9**		**11**		**9**		(<2)	U	(<2)	U	**9**		**8**		(<2)	U	5 (s)
cis -1,2-Dichloroethene	(µg/L)	**12**		**8**		**11**		**9**		(<1)	U	(<1)	U	**9**		**8**		(<1)	U	5 (s)
Chloroform	(µg/L)	(<1)	U	(<1)	U	(<1)	U	(<1)	U	1		(<1)	U	(<1)	U	(<1)	U	2		7 (s)
Carbon Tetrachloride	(µg/L)	(<1)	U	(<1)	U	(<1)	U	(<1)	U	(<1)	U	(<1)	U	(<1)	U	(<1)	U	4		5 (s)
Trichloroethene	(µg/L)	**6**		2		2		1		(<1)	U	(<1)	U	3		2		(<1)	U	5 (s)
Tetrachloroethene	(µg/L)	**17**	**Z**	**19**	**Z**	3	Z	3		**170**	**Z**	2	Z	**21**		**10**	**Z**	**550**	**D**	5 (s)

Parameters List EPA Method 8260B	MW ID	MW-3S		MW-18S		MW-5D		MW-5S		MW-6S		MW-14D		MW-14S		MW-15D		MW-15S		NYSDEC AWQS (µg/L)
	Sample Type	Groundwater		Duplicate		Groundwater		Groundwater		Groundwater		Groundwater		Groundwater		Groundwater		Groundwater		
	Sample Date	2–3 Apr 13		2–3 Apr 13		2–3 Apr 13		2–3 Apr 13		2–3 Apr 13		2–3 Apr 13		2–3 Apr 13		2–3 Apr 13		2–3 Apr 13		
1,2-Dichloroethene (total)	(µg/L)	**6**		**6**		2	U	**8**		(<2)	U	(<2)	U	**7**		**5**		**7**		5 (s)
cis -1,2-Dichloroethene	(µg/L)	**6**		**5**		(<1)	U	**8**		(<1)	U	(<1)	U	**6**		4		**7**		5 (s)
Chloroform	(µg/L)	(<1)	U	(<1)	U	(<1)	U	(<1)	U	(<1)	U	(<1)	U	(<1)	U	(<1)	U	(<1)	U	7 (s)
Carbon Tetrachloride	(µg/L)	(<1)	U	(<1)	U	(<1)	U	(<1)	U	(<1)	U	(<1)	U	(<1)	U	(<1)	U	(<1)	U	5 (s)
Trichloroethene	(µg/L)	2		1		(<1)	U	2		(<1)	U	(<1)	U	(<1)	U	(<1)	U	(<1)	U	5 (s)
Tetrachloroethene	(µg/L)	**17**	**Z**	**16**	**Z**	(<1)	U	**15**	**Z**	**9**	**Z**	**7**	**Z**	**13**	**Z**	**40**	**Z**	**16**	**Z**	5 (s)

NOTE:
EPA = U.S. Environmental Protection Agency
ID = Identification
NYSDEC = New York State Department of Environmental Conservation
AWQS = Ambient Water Quality Standard
µg/L = Micrograms per liter (parts per billion)
U = Analyte not detected at the listed laboratory reproting limit.
Z = Analyte had a percent difference greater than 15% in the daily CCV.
MW = Monitoring well
D = Analysis at secondary dilution factor.

MW-18S was a blind field duplicate quality assurance/quality control sample of site sample MW-3S for this sampling event.
Bold values indicate that the analyte was detected greater than the NYSDEC AWQS.

TABLE 3B SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS IN OFF-SITE GROUNDWATER SAMPLES QUARTERLY SAMLPING EVENT - APRIL 2013

Parameters List EPA Method 8260B	Sample ID	DDC-5-PD		DDC-5-PS		DDC-6-PD		DDC-6-PS		DDC-7-PD		DDC-7-PS		DDC-8-PD		DDC-8PS		DDC-9-PD		DDC-9-PS		NYSDEC AWQS (µg/L)
	Sample Type	Groundwater		Groundwater		Groundwater		Groundwater		Groundwater		Groundwater		Groundwater		Groundwater		Groundwater		Groundwater		
	Sample Date	4–5 Apr 13		4–5 Apr 13		4–5 Apr 13		4–5 Apr 13		4–5 Apr 13		4–5 Apr 13		4–5 Apr 13		4–5 Apr 13		4–5 Apr 13		4–5 Apr 13		
1,1-Dichloroethane	(µg/L)	(<10)	U	(<10)	U	(<10)	U	(<10)	U	(<10)	U	(<10)	U	(<10)	U	(<10)	U	(<10)	U	(<10)	U	5 (s)
1,2-Dichloroethene (total)	(µg/L)	(<2)	U	(<2)	U	(<2)	U	(<2)	U	(<2)	U	3		**27**		**36**		(<2)	U	3		5 (s)
cis -1,2-Dichlorethene	(µg/L)	(<1)	U	(<1)	U	(<1)	U	(<1)	U	(<1)	U	3		**25**		**35**		(<1)	U	3		5 (s)
Chloroform	(µg/L)	1		(<1)	U	1		(<1)	U	(<1)	U	(<1)	U	(<1)	U	(<1)	U	(<1)	U	(<1)	U	7 (s)
Trichloroethene	(µg/L)	(<1)	U	(<1)	U	(<1)	U	(<1)	U	(<1)	U	(<1)	U	**9**		**15**		2		2		5 (s)
Tetrachloroethene	(µg/L)	1		(<1)	U	(<1)	U	(<1)	U	**6**		(<1)	U	**18**		**24**		(<1)	U	4		5 (s)

Parameters List EPA Method 8260B	MW ID	DDC-10-PD		DDC-10-PS		MW-1D		MW-4S		MW-1S		MW-2D		MW-2S		MW-3D		MW-3S				NYSDEC AWQS (µg/L)
	Sample Type	Groundwater		Groundwater		Groundwater		Duplicate		Groundwater		Groundwater		Groundwater		Groundwater		Groundwater				
	Sample Date	4–5 Apr 13		4–5 Apr 13		4–5 Apr 13		4–5 Apr 13		4–5 Apr 13		4–5 Apr 13		4–5 Apr 13		4–5 Apr 13		4–5 Apr 13				
1,1-Dichloroethane	(µg/L)	(<10)	U	(<10)	U	(<10)	U	(<10)	U	(<10)	U	(<10)	U	(<10)	U	(<10)	U	(<10)	U			5 (s)
1,2-Dichloroethene (total)	(µg/L)	(<2)	U	(<2)	U	**6**		**5**		(<2)	U	(<2)	U	(<2)	U	(<2)	U	(<2)	U			5 (s)
cis -1,2-Dichlorethene	(µg/L)	(<1)	U	(<1)	U	**6**		**5**		(<1)	U	(<1)	U	(<1)	U	(<1)	U	(<1)	U			5 (s)
Chloroform	(µg/L)	(<1)	U	(<1)	U	2		2		(<1)	U	(<1)	U	(<1)	U	(<1)	U	(<1)	U			7 (s)
Trichloroethene	(µg/L)	1		(<1)	U	**12**		**12**		(<1)	U	(<1)	U	(<1)	U	(<1)	U	(<1)	U			5 (s)
Tetrachloroethene	(µg/L)	(<1)	U	(<1)	U	**1700**	**DJ**	**1700**	**D**	3		(<1)	U	1	U	3		(<1)	U			5 (s)

NOTE:
EPA = U.S. Environmental Protection Agency
ID = Identification
NYSDEC = New York State Department of Environmental Conservation
AWQS = Ambient Water Quality Standard
µg/L = Micrograms per liter (parts per billion)
U = Analyte not detected at the listed laboratory reproting limit.
MW = Monitoring well
D = Analysis at secondary dilution factor.
J = Estimated value.

MW-4S was a blind field duplicate quality assurance/quality control sample of site sample MW-1D for this sampling event.
Bold values indicate that the analyte was detected greater than the NYSDEC AWQS.