Town and Country Cleaners
2308 and 2310 Monroe Avenue
Brighton, New York
Site #C828149

Brownfield Cleanup Program

Remedial Investigation Work Plan

September **2011**
Final NYSDEC Approved Version: January 2012

New York State Department of Environmental Conservation
Division of Environmental Remediation, Region 8
6274 East Avon-Lima Road, Avon, New York 14414-9519
Phone: (585) 226-5353) • **Fax:** (585) 226-8139
Website: www.dec.ny.gov

Joe Martens
Commissioner

December 23, 2011

Mr. Michael Micciche
Town and Country Redevelopment, LLC
259 LaSalle Drive
Webster, New York 14580

Re: Town and Country Cleaners
Site No. C828149
Draft Remedial Investigation Work Plan
Brighton (T), Monroe (C)

Dear Mr. Micchiche:

The New York State Department of Environmental Conservation (Department), in conjunction with the New York State Department of Health (NYSDOH), has completed its review of the September 2011 Remedial Investigation Work Plan (Work Plan) for Town and Country Cleaners (Site) located at 2308 and 2310 Monroe Avenue, Town of Brighton. Based upon the information and representations given in the Work Plan and in accordance with 6 NYCRR Part 375-1.6, the Department approves the Work Plan for the Site with the following modification(s):

1. Section 4.1, Records Search: As part of this task a drawing showing the interior layout of the building and equipment as well as a schedule of equipment with age, last inspection, flow data, etc. will be included. In addition, the Records Search task will include a detailed history (e.g., make, install date, location and removal date) of the equipment (past and present) used in the building.

2. Section 4.2, Utility Evaluation: The Utility Evaluation will also include past and present building infrastructure (e.g., air emission points, exhaust fans, floor drains and trenches, process piping) which has/had the potential to transport solids or liquids to the environment outside or under the building. As part of this task the direction of surface water flows at the Site will be confirmed and a drawing showing the surface water flow patterns will be included in the Remedial Investigation Report. This task will also include section drawing of the manhole(s), surface elevations, pipe inverts, etc. which will be included in the Remedial Investigation Report.

3. Section 4.3.2, Soil Gas Survey: There are two (2) soil vapor locations identified as SV-4 on Sheet 1. As shown on the modified Sheet 1 (attached to the electronic version of this letter), one of these points is moved proximate to MW-4S. The other SV-4 is re-labeled as SV-5 and moved proximate to MW-8S. Placing the soil vapor points near groundwater monitoring wells allows for further evaluation of the potential for VOCs to migrate from the soil and/or groundwater into the soil vapor.

4. Section 4.3.2.2, Sub-slab Vapor Survey: A tracer gas will also be used when collecting sub-slab vapor samples to verify that adequate sampling techniques are being implemented.

5. Section 4.3.2.3, Indoor Air Sampling: A product inventory will also be recorded to document all chemical products stored in the building during the time of the sampling event.

6. Data usability summary reports will be developed for all analytical data generated as part of the remedial investigation activities.

7. Section 4.3.3, Page 33 and 34: The off-site groundwater monitoring wells located at the 2298 Monroe Avenue parcel will only be analyzed for TCL VOCS plus TICs and SVOCS plus TICs not for the full suite of analytical parameters as presented in this section. Additionally, the nomenclature identifying these wells (MW-1 and MW-2) will clearly indicate that they are the off-site groundwater monitoring wells to minimize confusion with on-site groundwater monitoring wells known as MW-1 and MW-2.

8. Section 4.3.3, Page 34 and 35: There is contradicting information presented on Page 34 and 35 regarding the placement of the shallow groundwater monitoring well screens. The information on Page 34 is correct, that is the shallow groundwater monitoring wells will be placed within the silty clay layer with the screen interval being placed within the silty clay layer and water table interface.

9. Section 4.3.3, Page 37 through 39: The groundwater sampling protocol presented in the Work Plan is contradicting. It is stated that low flow sampling procedures as described in ASTM Method D6771-02 will be used to collect groundwater samples, but later in paragraph 2 on page 38, it is stated that all sampling will be conducted with disposable bailers. Both methods of groundwater sampling are acceptable to the Department but only one method should be employed during a sampling event.

10. Section 4.3.3, Page 37: All fluids generated as part of the groundwater development and purging activities will be collected, containerized, and characterized for disposal. The treatment of development or purge water through activated carbon and discharge to unpaved surfaces at the Site will not occur without water samples being collected for laboratory analysis and the data being submitted to the Department for approval for discharge. The Department expects Section 3.3(e)5 of DER-10 to be implemented accordingly. Any discharges to the ground surface, sanitary sewers, or storm sewers must be approved by the Department and all appropriate permitting authorities.

11. Section 4.3.3, Page 39 and 40: Groundwater elevations will be collected from all on-site groundwater monitoring wells (shallow and deep) as well as the off-site groundwater monitoring wells (MW-1 and MW-2). Groundwater contour maps will be generated for each water level measurement event.

12. Section 4.4, Surface Soil Samples: The surface soil samples will be collected from areas where there is sufficient soil to obtain a representative sample. Some of the surface soil sample locations appear to be located in paved areas. Surface soil samples will be located in unpaved areas in the site's interior and along the property boundary to determine if there are any impacts to off-site parcels. The evaluation of the historic fill material at the site will be in accordance with DER-10 Section 3.11. Sufficient surface soil samples will be added to the sampling event to evaluate any historical fill material in the interior portion of grassy area located in the back of the parcel. Final number and locations will be determined based on discussions with Department project manager and field conditions.

13. Section 4.5, Survey & Electronic Data Deliverables: All sample location data must be submitted to the Department in the appropriate Electronic Data Deliverable (EDD) format. Either a survey or a handheld GPS unit will be used to provide the required location data. The NYSDEC Electronic Deliverables Manual provides details regarding EDDs and can be found at the following web address: http://www.dec.ny.gov/chemical/62440.html

    All data collected or submitted to the Department after April 1, 2011 will be submitted in the appropriate EDD format. The Environmental Information Management System (EIMS) being implemented by the Department is intended to automate generation of the majority of tables and figures used in decision documents for the project. Therefore it is necessary that the supporting data be available in the EIMS. This includes all boring location and associated boring data, well location and construction data, soil vapor and soil vapor intrusion installation, location, and analytical data, soil and sediment sampling location and sampling data, field parameters, etc.

14. Section 9.0, Citizen Participation: The citizen participation activities as presented in the Department's DER-23 Citizen Participation Handbook for Remedial Programs will be implemented accordingly. The DER-23 Citizen Participation Handbook can be found at the following web address: http://www.dec.ny.gov/docs/remediation_hudson_pdf/der23.pdf. The attached table from the handbook replaces the table presented in Section 9 of the Work Plan.

The Department shall be notified at least seven (7) days in advance of any field activities so that appropriate field oversight can be arranged.

Within twenty (20) days after receiving this letter and prior to the start of any fieldwork activities, the Applicant shall elect one of the three (3) options presented below in writing (electronic notification is acceptable) to either:

Option A: Accept the Department modified Work Plan; or
Option B: Terminate the Brownfield Cleanup Agreement; or
Option C: Invoke dispute resolution.

If the Remedial Party chooses to accept Option A then this letter becomes part of the approved Remedial Investigation Work Plan. Also, if Option A is chosen then a copy of the approved Remedial Investigation Work Plan with this letter attached must be placed in the document repository within 1 week of accepting Option A and prior to the start of any field work. An electronic version (a single, searchable pdf file also with this letter attached) and one complete hard copy must be submitted to NYSDEC before the start of field work or by January 23, 2012.

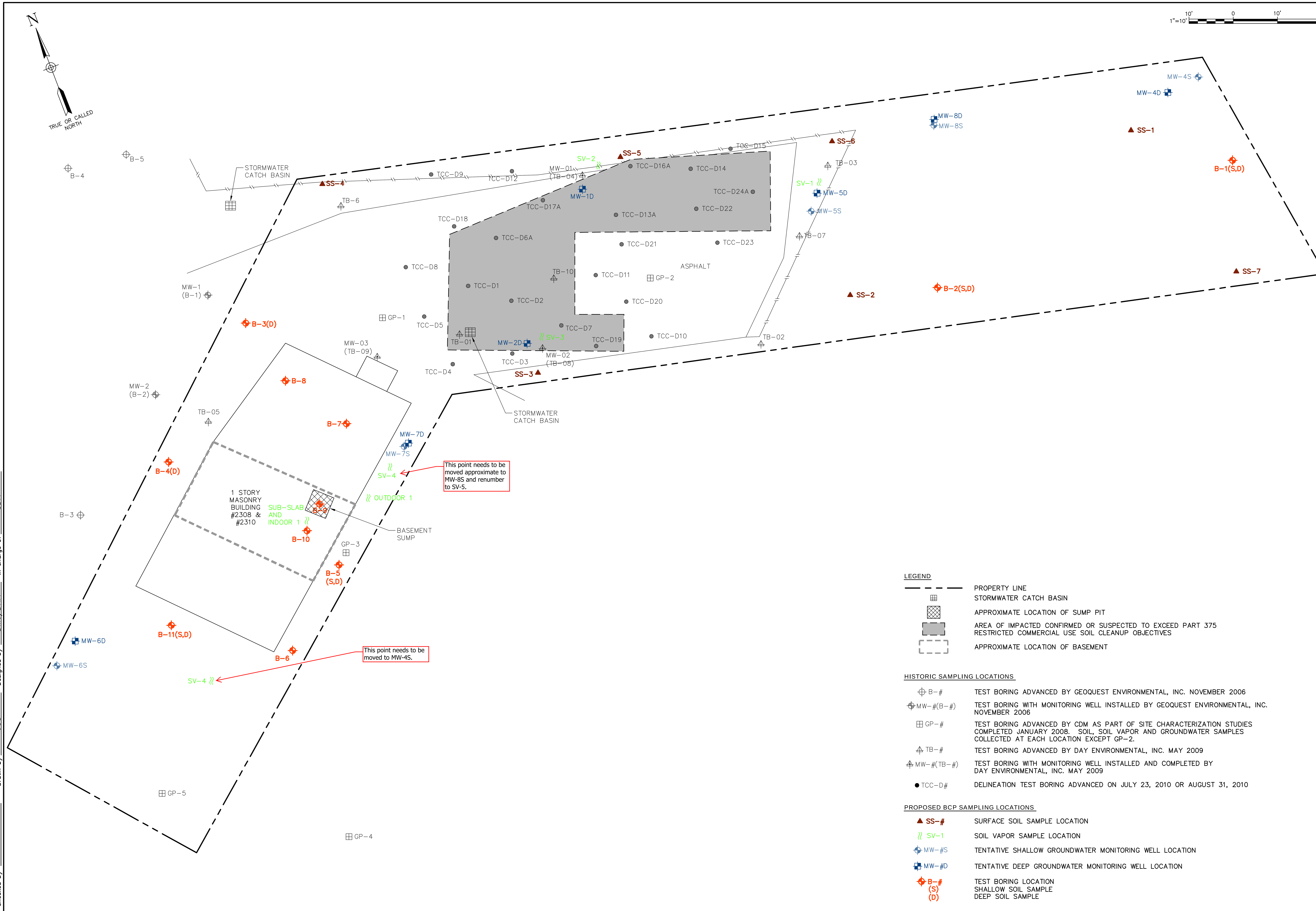
If you have any questions or concerns regarding this letter or the Town and Country Cleaners project, please feel free to call me at (585) 226-5354 or email me at cbtheoba@gw.dec.state.ny.us.

Sincerely,

Charlotte B. Theobald
Environmental Engineer 1

e-attach:
Sheet 1 (modified)
Citizen Participation table

ec:
David Hanny (Barton & Loguidice, P.C.)
David Hastings, Esq. (Merzbach Law Office, P.C.)
Melissa Doroski (NYS Dept. of Health – Troy)
Jeff Kosmala (Monroe County Health Department)
Maura Desmond (NYSDEC)
Bart Putzig (NYSDEC)
Frank Sowers (NYSDEC)



NO ALTERATION PERMITTED HEREON EXCEPT AS PROVIDED UNDER SECTION 7209 SUBDIVISION 2 OF THE NEW YORK STATE EDUCATION LAW.

COMPLETED CONSTRUCTION

Significant Construction Changes Are Shown

By ______ Date ______
Ck'd ______ Date ______

REVISIONS

TOWN AND COUNTRY
2308 AND 2310 MONROE AVENUE – BCP NO. C828149
BROWNFIELD CLEANUP PROGRAM REMEDIAL INVESTIGATION WORK PLAN

PROPOSED SUBSURFACE, SURFACE AND VAPOR TEST LOCATIONS

TOWN OF BRIGHTON MONROE COUNTY, NEW YORK

Barton & Loguidice, P.C.

Date: SEPTEMBER, 2011
Scale: 1" = 10'
Sheet Number: SHEET 1
File Number: 1437.001

In charge of SDN
Designed by DMJ/DRH
Drawn by JGS
Checked by

Plotted: Sep 19, 2011 - 8:04AM SYR By: mj
I:\Shared\1400\1437001\1437001_SHEET 1.dwg

Brownfield Cleanup Program (BCP) Citizen Participation Requirements

BCP Citizen Participation Requirements	Timing of CP Requirement(s)
Application Process:	
• Prepare site contact list • Establish document repository	When Requestor prepares Application to participate in BCP.
• Place complete Application in document repository • Publish notice in Environmental Notice Bulletin (ENB) announcing receipt of Application and 30-day comment period • Publish notice in local newspaper • Mail notice to site contact list (all mailings require certification of mailing sent to DER within 5 days) • Conduct 30-day public comment period on the complete Application	When DER determines that Application is complete. Comment period begins on publication date of ENB notice. End date is as stated in ENB notice. ENB, newspaper, and site contact list notices should be provided at the same time. Notice should request comments on all appropriate documents included in Application package (RI Work Plan, RI Report and/or RWP).
After Execution of Brownfield Cleanup Agreement (BCA):	
• Prepare Citizen Participation (CP) Plan	Draft CP Plan must be submitted to DER within 20 days of execution of BCA. CP Plan must be approved by DER before distribution.
Before DER Approves Proposed Remedial Investigation (RI) Work Plan:	
• Place proposed RI Work Plan in document repository • Mail fact sheet to site contact list about proposed RI Work Plan and 30-day public comment period • Conduct 30-day public comment period on the proposed RI Work Plan	Before DER approves RI Work Plan. If RI Work Plan is submitted with application, comment periods will be combined and public notice will include fact sheet. Comment period begins/ends as per dates identified in fact sheet.
• Place approved RI Work Plan in document repository	When DER approves RI Work Plan.
Before DER Approves Remedial Investigation Report:	
• Mail fact sheet to site contact list that describes RI results	Before DER approves RI Report.
• Place approved RI Report in document repository	When DER approves RI Report.
Significant Threat Determination:	
• Mail fact sheet to site contact list that discusses significant threat determination. Combine notice with another fact sheet where appropriate	Determination may be made any time during remedial process but no later than 20 days after DER approves RI Report. A significant threat site is eligible for a Technical Assistance Grant.
Before DER Approves Remedial Work Plan (RWP):	
• Place draft RWP in document repository • Mail fact sheet to site contact list that describes draft RWP and announces 45-day comment period • Conduct 45-day public comment period about draft RWP • Hold public meeting about draft RWP if site a significant threat and requested by community.	Before DER approves RWP. Comment period begins/ends as per dates identified in fact sheet. Public meeting would be held during the comment period.
• Place approved RWP and final Decision Document in document repository	When DER approves RWP and finalizes Decision Document.
Before Applicant Starts Remedial Action (RA):	
• Mail fact sheet to site contact list that describes upcoming RA	Before the start of RA at the site.
Before DER Approves Final Engineering Report:	
• Mail fact sheet to site contact list that describes report, and any proposed institutional/ engineering controls	Before DER approves Final Engineering Report.
• Place final Engineering Report in document repository	When DER approves Final Engineering Report.

(continued)

BCP Citizen Participation Requirements	Timing of CP Requirement(s)
When DER Issues Certificate of Completion (COC):	
• Place Notice of COC in document repository • Mail fact sheet to site contact list that announces issuance of COC	Within 10 days after DER issues COC.

3.2 Important Information About the BCP Citizen Participation Requirements

1. Fact Sheet Preparation and Distribution. Many of the CP requirements discussed in this section involve preparing and distributing fact sheets to the site contact list. All required fact sheets share the following protocols.

Preparation: The Applicant should use electronic fact sheet templates available from DER to prepare the draft fact sheets. The templates and instructions for preparing the fact sheets are available on the DER web site.

The templates should be customized using plain, understandable language so that issues are explained in clear terms to readers who do not have specialized environmental and technical training (knowledge).

The Applicant should submit each draft fact sheet, in electronic format, to the DER Project Manager for review and approval. The DER Project Manager should provide the appropriate DEC Citizen Participation Specialist (CPS), and others as appropriate, an opportunity to review a draft fact sheet and provide comments within the required time frame. DER may elect to prepare fact sheets in place of having the Applicant do so.

Distribution: A fact sheet will be distributed to the site contact list when DER approves the document and determines that it should be released. DER will determine who will distribute the fact sheet. The Applicant must also place the fact sheet in the document repository. Fact sheets that announce public comment periods must be sent so that they would be received by the site contact list before the comment periods begin. Other fact sheets that describe upcoming field work should be sent so that they would be received before significant site activities take place.

- *Email and paper mail distribution:* To improve efficiency and help reduce waste, DER is transitioning to the electronic distribution of fact sheets and other site information. DER encourages the distribution of fact sheets, meeting notices, and other project information by email. For purposes of this Handbook, “distribution” and “mail” can consist of some combination of distribution of paper versions of facts sheets through the postal service and other means, as well as electronic distribution through email. **Note:** DEC and New York State Department of Health (DOH) staff always will only receive electronic copies of fact sheets. In all cases, everyone on a site contact list must receive project information in a timely way.

If the Applicant distributes a fact sheet to the site contact list, it must provide a certification of mailing to the DER Project Manager within five days of mailing each fact sheet. The Applicant

Town and Country Cleaners
2308 and 2310 Monroe Avenue
Brighton, New York
Site #C828149

Brownfield Cleanup Program

Remedial Investigation Work Plan

September 2011
Final NYSDEC Approved Version: January 2012

Prepared For:

Town and County Redevelopment LLC
259 LaSalle Drive
Webster, New York

Prepared By:

Barton & Loguidice, P.C.
Engineers • Environmental Scientists • Planners • Landscape Architects
1 South Washington Street
Suite 520
Rochester, New York 14614

Prepared From:

Remedial Investigation Work Plan (February 2011)
Day Environmental, Inc.
40 Commercial Street
Rochester, New York 14614

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Sheets

Appendices

1.0 Introduction

DAY Environmental, Inc. (DAY) and Barton and Loguidice, P.C. (B&L) have prepared this Remedial Investigation Work Plan (Work Plan) on behalf of Town and Country Redevelopment LLC, to evaluate the nature and extent of contamination at 2308 and 2310 Monroe Avenue, Town of Brighton, New York (Site). *This version of the Work Plan serves as the fourth submittal to the New York State Department of Environmental Conservation (NYSDEC). DAY submitted previous submittals 1-3 of the Work Plan. B&L has been procured by Town & Country for future assistance with the Brownfield Cleanup Project and is responsible for edits contained in this fourth Work Plan submittal. All edits made to the previous DAY February 2011 version have been completed using Microsoft Word track changes (CD provided separately) to allow efficient review of all necessary changes per the June 20, 2011 NYSDEC comment letter. Text in italics and/or Times New Roman font has been updated by B&L for this current version (September 2011- Final Revision January 2012). All remaining text is the work product of DAY and is referenced from their February 2011 Remedial Investigation Work Plan. Comment responses to the June 20, 2011 letter were provided by B&L on September 19, 2011.*

Town and Country Redevelopment LLC entered the Brownfield Cleanup Program (BCP) as a Volunteer (Site No.C828149). *The Site was accepted into the BCP with signature of a Brownfield Cleanup Agreement in December 2009.* A Project Locus Map is included as Figure 1 and a Site Plan is included as Figure 2.

This Work Plan presents a preliminary Conceptual Site Model based upon currently available information and includes a scope of work, and quality control procedures to update this model and complete a Remedial Investigation (RI) at the Site. This Work Plan also includes a Health and Safety Plan (HASP) to be used during field activities associated with the RI. Implementation of this Work Plan will allow for further evaluation of the environmental impacts to surface soil, subsurface soil, soil vapor, and groundwater associated with the historic use of the Site and the findings of the RI will assist in the determination of appropriate remedial measures that may be warranted.

1.1 Site Background

The Site (Tax I.D. No. 137.14-2-71.1) is located in the Town of Brighton, Monroe County, New York. The Site is zoned for commercial use and it currently operates as a dry cleaning and laundry business. The Site is comprised of approximately 0.39 acres, of which approximately 0.28 acres is improved with a single story, 2,200 square-foot concrete block structure with a partial basement, and associated asphalt paved parking lot. The remaining 0.11 acres is undeveloped and covered by vegetation. The ground surface at the Site ranges in elevation from about 475 feet to 480 feet above mean sea level. Generally, the ground surface slopes from west to east across the Site.

The Site is serviced by public utilities including water and sewer systems, which run along Monroe Avenue. According to available records, the Site has never been serviced by a private septic system. A storm water catch basin is located in the parking lot northeast of the building at the Site, and water entering this catch basin reportedly flows to the northwest into the storm water drainage system along the Monroe Parkway corridor.

The Site is bound to the northwest by commercial properties, to the southeast by commercial and residential properties, to the northeast by residential properties, and to the southwest by Monroe Avenue. Commercial properties are located on the opposite side of Monroe Avenue to the southwest. A map showing land use of the parcels within ½-mile of the Site is included as Figure 3. Two other parcels in the vicinity of the Site have been operated as dry cleaners (i.e., Former Speedy's Cleaners, 2150 Monroe Avenue; and Carriage

Cleaners, 2101 Monroe Avenue) and the New York State Department of Environmental Conservation (NYSDEC) lists these sites as Inactive Hazardous Waste Disposal Sites (IHWDS). The Former Speedy's Cleaner Site (IHWDS Site No. 828128) is located approximately 0.23 miles northwest of the Site and the Carriage Cleaners Site (IHWDS Site No. 828120) is located approximately 0.28 miles northwest of the Site (Refer to Figure 3).

Since approximately 1969 to the present, the Site operated commercially as a dry cleaning plant and laundry, and during this time period tetrachloroethene (PCE) was used as a dry cleaning solvent. *The dry cleaning operations currently utilized by Town and Country Cleaners do not include the use of PCE, which was discontinued from use on May 1, 2011. Cleaning is now conducted with GreenEarth, which is an exclusive dry cleaning process that replaces the solvents that were traditionally used in dry cleaning with liquid silicone. GreenEarth solution does not contain volatile organic compounds (VOCs) and it is non-toxic and non-hazardous. Liquid silicone degrades back into three natural components: sand (SiO_2), water and carbon dioxide.*

1.2 Previous Studies

To date, various studies have been conducted on the Site and/or adjoining properties and these studies include or are summarized in the following:

- *Phase II Environmental Site Assessment 2290, 2294, 2298 Monroe Avenue, Town of Brighton, New York* dated December 2006 prepared by GeoQuest Environmental Inc (GeoQuest)
- *Site Characterization of the Town and Country Cleaners Site (Site No.: 8-28-149)* dated April 2009 prepared by Camp Dresser, and McKee (CDM) on behalf of the NYSDEC

- Limited studies conducted by DAY on behalf of Town and Country Redevelopment LLC in April 2009 and May 2009
- *Data Package, Delineation Study: Storm Water Catch Basin Area*, dated December 2010 prepared by DAY (the Delineation Study Data Package)

The above are collectively referred to as previous studies in this Work Plan and summaries of the relative findings for each of these studies are presented in the following sections.

1.2.1 GeoQuest Phase II Environmental Site Assessment

On November 16, 2006, GeoQuest advanced five direct-push test borings (designated B-1 through B-5) to an approximate depth of 16 feet (ft.) below ground surface (bgs) on the adjacent property, which is located to the northwest of the Town and Country Cleaners building. Three of the test borings (B-1 through B-3) were located along the property line between the Site and the adjacent property. Two of these test borings were converted into monitoring wells (i.e., B-1 designated as MW-1 and B-2 designated as MW-2) with screened intervals from 5 ft. bgs to 15 ft. bgs. The remaining two test borings, designated B-4 and B-5, were located on the north side of the building on the adjacent property. The approximate locations of the test borings/monitoring wells completed by GeoQuest are depicted on Figure 4. [Note: Soil samples collected during previous studies, the soil sample depths and the PCE and total VOC concentrations measured in these samples are presented on Figure 4. Groundwater test results (i.e., PCE and total VOC concentrations) for samples collected during previous studies are presented on Figure 5.]

Conclusions relevant to the Site presented in the GeoQuest Phase II ESA are summarized below:

- A fill deposit ranging in thickness from approximately 4.0 ft. to 7.0 ft. bgs was encountered beginning at the ground surface in the test borings. This fill was reported to consist primarily of re-graded natural and imported soil described as a course to fine sand intermixed with cinders and ash. A lacustrine deposit described as clay with little silt to sand with little gravel, little silt and trace clay was reported below the fill extending to the bottom of the test borings.
- Photoionization detector (PID) measurements made in the headspace of soil samples collected from the test borings were reported as "Not Detected".
- During this study, soil samples were collected and tested for volatile organic compounds (VOCs) from test borings B-2 (5.0-5.5 ft.) and B-3 (6.0-6.5 ft.) and monitoring wells MW-1 and MW-2.
- PCE was detected in soil sample B-2 (5.0-5.5 ft.) at a concentration of 170.0 parts per billion (ppb), which is below the Unrestricted Soil Cleanup Objectives (SCO) presented in 6NYCRR Part 375-6.8(a). VOCs were not detected in soil sample B-3 (6.0-6.5 ft.).
- The groundwater sample collected from MW-1 contained reported concentrations of the following:

Parameter (Concentration)	***TOGs 1.1.1 Groundwater Standard***
Trichloroethene (5.8 ug/l)	*5 ug/l*
Cis-1,2 - Dichloroethene (80.0 ug/l)	*5 ug/l*
1,2 - Dichloroethane (1.0 ug/l)	*0.6 ug/l*
Vinyl Chloride (44 ug/l)	*2.0 ug/l*

- The groundwater sample collected from MW-2 contained reported concentrations of the following:

Parameter (Concentration)	***TOGs 1.1.1 Groundwater Standard***
PCE (110.0 ppb)	*5 ug/l*

- In response to the detection of PCE and breakdown products in the samples tested, the NYSDEC opened spill number 0651703.

1.2.2 NYSDEC/CDM Site Characterization

The fieldwork for this Site Characterization was conducted between January 28 and January 30, 2008, and it consisted of collecting samples of subsurface soil, subsurface vapors and groundwater in locations at the Site and from off-site locations. *The site characterization was completed by NYSDEC with CDM serving as the contractor*. This work included installing and collecting samples from the following locations at the Site including: five temporary groundwater monitoring points (i.e., GP-1 through GP-5), subsurface soil samples from five locations at the Site (i.e., GP-1 through GP-5), groundwater samples collected from two existing monitoring wells (i.e., MW-1 and MW-2, which were installed as part of the GeoQuest

Phase II ESA), and four subsurface soil vapor samples (i.e., collected from locations GP-1, GP-3, GP-4 and GP-5). The samples collected during the Site Characterization were submitted for analytical laboratory testing. [Note: No indoor air, sub-slab or outdoor ambient air samples were collected as part of the Site Characterization.] The locations of explorations completed as part of the Site Characterization that are in proximity of the Site are presented on Figure 4. [Note: Soil samples collected during previous studies, the soil sample depths and the PCE and total VOC concentrations measured in these samples are presented on Figure 4. Groundwater test results (i.e., PCE and total VOC concentrations) for samples collected during previous studies are presented on Figure 5.]

Relevant findings with regard to conditions at the Site and in the immediate proximity are summarized below:

- The depth to groundwater at the Site was reported to range between 3.41 ft. and 8.1 ft. bgs. Groundwater flow within the shallow aquifer in proximity of the Site was identified to be in a southeasterly direction. Groundwater flow patterns at the Site were not specifically evaluated by CDM.
- VOCs were detected in each of the soil samples tested, but only the concentrations of trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2 DCE), vinyl chloride (VC) and/or acetone measured in the samples collected from GP-1 and GP-5 were detected at concentrations above their NYSDEC Unrestricted Use SCO.

- VOCs were detected in each of the groundwater samples tested and the concentrations of PCE, TCE, 1,1-dichlorethene (1,1-DCE), trans-1,2-dichlorethene (trans-1,2-DCE), cis-1,2 DCE, VC, 1,1-dichloroehthane (1,1-DCA), and 1,1,1-trichlorethane (1,1,1-TCA), were detected at concentrations above the NYSDEC groundwater standards in one or more of the groundwater samples collected at the Site.
- The soil vapor samples collected from locations GP-1, GP-3, GP-4 and GP-5 contained various VOCs including PCE measured at concentrations ranging between 1.59 ug/m3 (GP-4) to 10.3 ug/m3 (GP-3) and TCE measured at concentrations ranging between 0.218 ug/m3 (GP-4) and 395 ug/m3 (GP-1). Currently, there are no soil vapor standards for such samples.
- The presence of PCE breakdown products in the soil and groundwater indicates that biodegradation of PCE in the subsurface soil and groundwater is occurring.

1.2.3 DAY Studies: April 2009 and May 2009

In April 2009, DAY conducted a limited evaluation of the sump pit located in the basement of the Town and Country Dry Cleaners facility, and the storm water catch basin located in the parking lot to the northeast of the facility. The water sample collected from the sump pit contained concentrations of PCE (222 ppb), TCE (10.4 ppb) and cis 1,2-DCE (16.5 ppb) *which all exceeded the applicable TOGs 1.1.1 groundwater standards.* Water within the sump pit reportedly discharges into the sanitary sewer system. The sediment sample from the catch basin contained a detectable concentration of PCE (334 parts per million, ppm), *which is greater than the NYSDEC Restricted Commercial Use SCO of 150 ppm.* Piping exiting the catch basin appeared to flow towards the northwest, but the specific discharge location of this piping was not evaluated.

DAY advanced ten test borings at the Site on May 14, 2009 designated TB-01 through TB-10 and converted three of these test borings into 1-inch diameter groundwater monitoring wells [MW-1 (TB-04), MW-2 (TB-08) and MW-3 (TB-09)]. The soil samples tested contained PCE concentrations ranging between approximately 0.008 ppm [TB-06 (4'-8')] and 224 ppm [TB-01 (4'-8')] *(NYSDEC Restricted Commercial Use SCO is 150 ppm),* TCE concentrations between approximately 0.08 ppm [TB-10 (6'-8')] and 0.13 ppm [TB-07 (4'-8')] cis-1, 2-DCE concentrations ranging between 0.125 ppm [TB-02 (4'-8')] and 0.3 ppm [TB-10 (6'-8')] *(NYSDEC Restricted Commercial Use SCO is 500 ppm).* The groundwater samples tested contained concentrations of PCE ranging between about 1.4 ppm (MW-3) and 106 ppm (MW-2) *(TOGs 1.1.1 Groundwater Standard is 1.3 ppm).*

The locations of the test borings and monitoring wells completed during the above studies are presented on Figure 4. [Note: Soil samples collected during previous studies, the soil sample depths and the PCE and total VOC concentrations measured in these samples are presented on Figure 4. Groundwater test results (i.e., PCE and total VOC concentrations) for samples collected during previous studies are presented on Figure 5.]

The supplemental studies completed by DAY identified contamination present within both the building basement sump pit and the on-site storm water catch basin. Further investigations including the installation of ten test borings further supported a potential plume of PCE and VOC's requiring further delineation and investigation.

1.2.4 Delineation Study: Storm Water Catch Basin Area

In order to assess the extent of VOC impact within the soil in proximity of the storm sewer catch basin located in the parking lot to the northeast of the facility, DAY prepared a document titled *Soil Removal IRM Delineation: Storm Water Catch Basin, Work Plan*, dated April 2010 (Revised July 12, 2010). The NYSDEC issued a letter dated July 13, 2010 approving this document. DAY also prepared a report titled *Data Package Delineation Study: Storm Water Catch Basin Area*, *Brownfield Cleanup Program, Town and Country Cleaners, 2308 and 2310 Monroe Avenue, Brighton, New York, BCP Site #C828149* dated December 2010 that summarizes the work completed and the findings of these delineation studies.

The delineation test borings were advanced on July 19, 2010, July 23, 2010 and August 31, 2010. The NYSEC was on-site to provide input and oversight during each day of test borings. The site specific Health and Safety Plan (HASP) and community air-monitoring program (CAMP) presented in Appendix A of this Work Plan were implemented during these field activities.

Twenty-nine test borings were advanced at twenty-four locations at the Site (designated TCC-D1 through TCC-D24). At five locations (i.e., TCC-D6, TCC-D13, TCC-D16, TCC-D17, and TCCD24), an adjacent test boring (designated TCC-D6A, TCC-D13A, TCC-D16A, TCC-D17A, and TCC-D24A) was advanced due to poor or no soil sample recovery from the original boring. The test borings were advanced from the ground surface into the top of the silty clay layer (i.e., approximately 12 ft. bgs), and select test borings (i.e., TCC-D3, TCC-D5, TCC-D6A, TCC-D9, TCC-D10, TCCD11, and TCC-D13A) were advanced to equipment refusal, which occurred at depths ranging from 14.9 ft. to 17.9 ft. bgs.

For each test boring advanced, the sample containing the greatest field evidence of VOC impact (i.e., highest PID reading, staining, odor) collected above the silty clay layer was submitted to the analytical laboratory for testing. In select test borings, a sample collected from the silty clay layer was also submitted for testing. If the test boring was advanced through the silty clay layer an additional sample was collected from below the silty clay layer and submitted for testing. Additionally, in three of the test borings containing evidence of VOC-impact, samples from the soil above the VOC-impacted soil that did not exhibit evidence of field impact were also submitted to the analytical laboratory for the purpose of delineating ‘clean’ soil.

PID readings exceeding background levels (i.e., 0.0 ppm) were recorded above samples collected from each test boring. Peak PID readings of over 150 ppm were recorded in twelve samples at depths ranging from 6.0 ft. bgs (TCC-D1) to 8.0 ft. bgs (TCC-D14, TCC-D21, TCC-D22). Solvent-type odors were observed in twelve of the test borings at depths ranging from 5.8 ft. bgs (TCC-D2) to 9.0 ft. bgs (TCC-D16A). Generally, peak PID readings of over 150 ppm and solvent-type odors were present concurrently, if encountered. Staining was not observed on the samples collected and none of the samples collected contained evidence of dense non-aqueous phase liquid (DNAPL).

Figure 6 depicts the location of test borings advanced in proximity of the storm sewer catch basin located in the parking lot to the northeast of the facility during previous studies and the delineation studies. In addition, the maximum PID measurements and the concentrations of PCE and total VOCs for the samples collected and analyzed are also shown on this figure. The area of impact confirmed or suspected to exceed Part 375 Restricted Commercial Use SCO is also presented on Figure 6. Typically, this VOC-impacted zone was encountered at depths ranging from approximately 6.5 ft. to 8.5 ft. bgs.

To summarize, the delineation study identified a plume of contamination surrounding the storm water catch basin located within the parking lot to the northeast of the facility. The plume contamination contains elevated concentrations of PCE. Total VOC results included in Figure 6 also indicate the presence of other VOC constituents. Based on the results of field soil screening and analytical results, DAY delineated an area included on Figure 6 which includes the suspected area in which contaminated soils exist at the site expected to exceed Part 375 Restricted Commercial Use SCO's.

2.0 Project Objectives

The objectives of this RI are to:

- Confirm the complete list of Contaminants of Concern (COC) at the Site;
- Delineate the areal and vertical extent of COC impact within environmental media at the Site;
- Evaluate surface and subsurface characteristics at the Site, including topography, geology, and groundwater conditions;
- Collect the data necessary to evaluate releases to environmental medium and develop remedial alternative(s) to address each release;
- Collect and evaluate data necessary for a fish and wildlife resource impact analysis (FWRIA), pursuant to section 3.10 in the NYSDEC May 3, 2010 document *DER-10 Technical Guidance for Site Investigation and Remediation;*
- Generate sufficient data from the on-site media to complete a Qualitative Human Health Exposure Assessment, including evaluating current and future potential public health exposure pathways, in accordance with Appendix 3B in the NYSDEC May 3, 2010 document *DER-10 Technical Guidance for Site Investigation and Remediation;* and
- Provide sufficient information to allow the identification of potentially feasible remedial alternatives.

This RI will be completed in general accordance with provisions and guidance outlined in the NYSDEC May 3, 2010 document *DER-10 Technical Guidance for Site Investigation and Remediation*.

3.0 Preliminary Conceptual Site Model

Data collected during the previous studies described herein were used to develop this preliminary Conceptual Site Model describing subsurface conditions, contaminant types and distribution patterns. This preliminary model will be revised as additional data is collected with the intent of using the Conceptual Site Model as the basis for identifying remedial options for the Site.

3.1 Geology

Overburden

The ground surface of the Site is predominately covered by the building footprint (2,200 square feet) and asphalt pavement that surrounds the building. The northeastern portion of the Site (i.e., comprising about 0.11 acres) is undeveloped land covered with vegetation (e.g., grass, weeds and small trees). Based on the studies conducted to date, heterogeneous fill materials consisting primarily of re-worked sand and gravel extend from the ground surface (i.e., below the asphalt pavement) to depths of approximately 0.5 ft. to 4 ft. bgs. In the area of the storm water catch basin on the Site, fill materials extended to a depth of about 7 ft. bgs. Fragments of cinders and ash were noted in the fill on the adjacent property. A silty sand deposit ranging in thickness from about 1 ft. to 5 ft. underlies the fill materials and overlies a continuous silty clay deposit that was more than 4 ft. thick in the test borings advanced at the Site. *The silty clay layer thickness likely varies throughout the 0.39 acre parcel and has not been clearly defined and mapped for the entire site.* A sandy gravel or fractured/broken bedrock deposit underlies this silty clay. Based upon work completed as part of the previous studies, this deposit ranges in thickness from between 2.6 ft. and 5.7 ft.

Bedrock

Seven test borings *(TCC-D3, TCC-D5, TCC-D6A, TCC-D9, TCC-D10, TCC-D11 and D-13A)* advanced during the *previous DAY Storm Water Catch Basin Area Delineation Study* encountered equipment refusal at depths between 14.9 ft. bgs and 17.9 ft. bgs. Apparent fractured rock was observed *within all* of the *samples seven* test borings that were advanced to equipment refusal, suggesting that *a confining layer* underlies the Site at elevations between about 463 ft. and 459 ft. above mean sea level. The thickness of the *confining layer* was not determined during the previous studies. The depth to equipment refusal was greater in test borings advanced in the eastern portion of the Site, indicating a possible slope in the *confining layer* from generally west to east. The bedrock in the vicinity of the Site is identified as Lockport Dolomite. *The previous soil boring descriptions is likely more representative of a glacial till than bedrock. Select borings proposed as part of the BCP investigation will be installed with a auger unit to further characterize the confining layer and to verify the presence of a till and/or bedrock unit.*

Hydrogeology

The Site and surrounding area slope gently down to the east. There are no surface water bodies on or adjoining the Site. The west branch of Allens Creek is located approximately 1,000 feet to the south-southeast of the Site. Buckland Creek is located approximately 2,300 feet to the north of the subject property. No state- or federally-listed wetlands are located within a ½ mile radius of the Site.

In June 2009, groundwater was measured at depths of about 3.8 ft. and 5.4 ft. bgs (i.e., at elevations 471.12 ft. to 473.28 ft.) in the monitoring wells currently installed at the Site. Based on the June 2009 elevations, groundwater flow appears to be predominately to the north and northeast. [Note: The monitoring wells currently installed at the Site terminate at the top of the silty clay layer.]

3.2 Contaminants of Concern

Between approximately 1969 and the present, PCE has been used as a solvent in the dry cleaning process operated at the Site. It appears that an unknown quantity of PCE was released into the environment at the Site via an unknown mechanism(s) and this release resulted in impact to the subsurface. The currently identified COC include PCE and its breakdown products. Specifically, the identified COC at the Site include:

- tetrachloroethene (PCE);
- trichloroethene (TCE);
- 1,1-dichlorethene (1,1-DCE);
- trans-1,2-dichlorethene (trans-1,2-DCE);
- cis-1,2-dichloroethene (cis-1,2 DCE); and
- vinyl chloride (VC)

3.3 COC Distribution and Migration

To-date, the highest concentrations of COC were measured in samples collected within and in proximity to a storm water catch basin located in the parking lot northeast of the building at the Site. It is speculated that waste solvent may have been discharged into this catch basin by some unknown mechanism, and that this catch basin is a source area of the COC detected at the Site.

As evidenced by the detection of COC in locations away from the suspected source area following a release, the potential routes of migration for the COC may include one, or more, of the following:

- Volatilization directly from the ground surface into the air;
- Migration horizontally along preferential subsurface pathways such as utility corridors;
- Migration horizontally and vertically through the overburden soil;
- Migration vertically into the overburden groundwater;
- Migration horizontally and vertically through the overburden groundwater; and/or
- Migration horizontally along an impermeable subsurface layer.

In addition to the apparent release(s) of COC into the storm water catch basin located northeast of the building at the Site, COC releases could have occurred at other locations at the Site.

During the previous studies, the highest concentrations of COC-impact were typically detected in soil samples encountered at depths ranging from approximately 6.5 ft. to 8.5 ft. bgs. The silty clay layer encountered approximately 8 ft. to 11 ft. bgs appears to be acting as a confining layer that restricts vertical groundwater flow and COC migration. Support of the effectiveness of the confining layer is based on test data derived from the previous studies. It appears that the primary route of COC migration is via release into the shallow groundwater within the fill/silty sand above the silty clay layer and migration away from the source area(s) via groundwater flow. Based on the density of the COC, downward vertical migration away from the source area is suspected and higher concentrations of COC are anticipated at the base of the silty sand layer (i.e., above the silty clay). Some preferential flow could also occur along buried utilities and this flow could alter the distribution of COC.

4.0 Scope of Work

The specific work proposed to evaluate the environmental conditions at the Site and implement field sampling and analysis requirements are described in this section. The methods and procedures for field sampling activities, analytical laboratory methods, and data evaluation procedures are presented below. These methods and procedures will be implemented to provide the data necessary to meet the overall objectives of this RI.

4.1 Records Research

This task will include research to assess historic operations and waste management practices at the Site including interviews with previous and current employees. Historic Sanborn Maps (if available) and other documentation will be obtained and reviewed in an attempt to assess past operations at the Site and the surrounding area. In addition, this task will include a review of public records to identify and map the location, elevation and discharge points of buried utilities at the Site. *Presence of the potential trolley bed will be evaluated as part of this task.*

4.2 Utility Evaluation

A utility evaluation will be completed for all utilities and utility pathways at the Site. An investigation of all sanitary sewer lines, storm water lines, floor drains, sumps, catch basins, and trenches currently used or previously used and/or abandoned at the Site will be completed as well as the discharge point of each possible present utility. Dye testing will be conducted within select sanitary and storm sewer lines identified at the Site in an attempt to verify/confirm discharge locations. If necessary, videotaping of select utility lines may be completed to evaluate the condition/location of utilities. The elevation of select utilities (e.g., storm water catch basins) will also be measured to supplement the public records, as needed.

If an underground storage tank is encountered, investigations regarding the tank will be conducted in compliance with Section 3.9 of DER-10

At the present time, it is anticipated that a sediment and/or water sample will be collected from the sump in the basement and from a floor drain located in the northern portion (dry cleaning area) of the building. Depending on accessibility, a water sample will also be collected from the sanitary sewer discharge location for the building. The findings of the records research described in Section 4.1 and the utility evaluation described above will be used to determine the specific sample locations and whether additional sample locations are warranted. The samples collected from the utilities will be submitted for analytical laboratory testing (refer to Table 1) to assess if contaminants have been discharged into the above locations and, if so, whether remediation may be warranted.

4.3 Subsurface Studies

To meet the project objectives, the sampling program outlined herein will include the collection of samples from various media at the Site for in-situ and analytical laboratory testing. *Prior to the start of any subsurface intrusive activities, Dig Safe (1-888-DIGSAFE) will be contacted to allow adequate time for utilities on the site to be properly demarcated.*

4.3.1 Test Borings

*Twenty-three (23) proposed t*est borings will be installed using a Geoprobe Systems (or similar) direct-push drill rig to collect continuous samples using a 2-¼ inch macrocore sampler with acetate liners in general conformance with American Society for Testing and Materials (ASTM) D6282-98. *The locations are depicted on Sheet 1. Eleven (11) borings will consist solely as soil borings (B series). Twelve (12) borings will be completed as shallow or deep groundwater monitoring wells (MW series).* A copy of ASTM D6282-98 is included as Appendix B. The samples collected from the test borings will be observed to assess soil types and physical evidence of contamination (e.g., staining, odors, presence of non-aqueous phase liquid, etc.) and field-screened using a PID in accordance with the SOPs provided in Appendix B. *Laboratory and headspace samples will be collected concurrently. The boring core will be screened with a P1D immediately after opening the core. The laboratory and headspace samples will be collected from the interval with physical evidence of contamination or highest PID reading. If there is no physical evidence of contamination or elevated PID readings then the interval above the water table will be sampled and submitted for laboratory analysis for full suite of analytical parameters, identified in Table 1. The PID lamp will be of sufficient strength to detect the known contaminants at the Site.* Portions of the soil samples collected will be transferred to laboratory containers for possible analysis. Re-useable drilling and sampling equipment (e.g., macrocore sampler, cutting shoe, and drilling rods) will be decontaminated in accordance with the Equipment Decontamination Procedures presented in Section 5.7.

The subsurface conditions at each test boring will be documented in the field and recorded on test boring logs, which will include:

- Date, boring/well identification, and project identification;
- Name of individual preparing the log;
- Name of drilling contractor;
- Drill make and model;
- Identification of alternative drilling methods used and justification thereof;
- Depths recorded in feet and fractions thereof referenced to ground surface;
- The length of the sample interval and the percentage of the sample recovered;
- The depth of the first encountered water table referenced to ground surface;
- Drilling and borehole characteristics;
- Sequential stratigraphic boundaries; and
- Field screening results.

Spoil material generated during the advancement of the test borings will be placed on polyethylene sheeting adjacent to each test boring as it is generated. If no evidence of potential impacts is observed during the field screening, the test boring will be backfilled with the cuttings generated during the completion of that test boring. *Drill cuttings that show no physical evidence of contamination or do not have elevated PID readings will be placed back in the boring in the reverse order they were removed (i.e., last boring out first boring placed back).*Test borings will not be backfilled with cuttings generated from other test borings. If evidence of potential impacts is observed during field screening, the drill cuttings will be transferred from the polyethylene sheeting and stored on-site in secured labeled 55-gallon drums. Drummed materials will subsequently be characterized and disposed in accordance with applicable regulations. Boreholes that appear impacted, based on field screening will be grouted to the ground surface.

The purpose and proposed depths of the test borings to be completed are described below:

- Building Interior Test Borings: To evaluate potential source areas within the building, up to four test borings will be advanced within the building at the Site in the approximate locations depicted on *Sheet 1* (i.e., designated test borings B-7, B-8, B-9 and B-10). The location of these test borings will be dependant, in part, based upon the findings of the work completed during Records Research and Utility Evaluation described above, but it is anticipated that at least one of the test borings will be advanced in proximity of the sump located in the boiler room of the building (B-9) and one of the test borings will be advanced in proximity of a drain located in the former dry cleaning portion of the building (B-10). It is anticipated that test borings B-7 *and B-8* will be advanced using vehicle-mounted Geoprobe sampling equipment; however, due to access restrictions, test borings located in the basement of the building (*B-9 and B-10*) will be advanced with hand-operated equipment. The intent is to advance the interior test borings to equipment refusal, which is anticipated to occur at the bedrock or confining layer surface.

However, equipment limitations may limit the depth that these test borings can be advanced.

- Exterior Test Borings: *Nineteen (19) t*est borings *(B-1 through 6, B-11, MW-1D, 2D, 4S/D, 5S/D, 6S/D, 7S/D, 8S/D)* will be advanced in select exterior locations of the Site (refer to *Sheet 1* for tentative locations to supplement the existing test borings and to allow the collection of groundwater samples. At each of the exterior test boring locations, at least one test boring will be advanced to equipment refusal.

- Groundwater Samples: Shallow groundwater samples (i.e., above the silty clay confining layer) will be collected for subsequent analytical laboratory testing from *temporary monitoring wells MW-4S, 5S, 6S, 7S and 8S* and from existing monitoring wells *MW-01, MW-02 and MW-03* using dedicated bailers. Deep groundwater sample*s* (i.e., below the silty clay confining layer) will be collected *from MW-1D, 2D, 4D, 5D, 6D, 7D and 8D*. The intent of this groundwater sampling is to assess groundwater quality above and below the silty clay layer at adjacent locations and to assist in the determination of subsequent monitoring well locations and depths.

A soil sample exhibiting the greatest field evidence of potential impact (i.e., the highest PID reading, staining, discoloration, chemical-type odors, etc.) will be collected from each test boring. All samples described above will be submitted to a NYSDOH ELAP-certified analytical laboratory for testing (refer to Table 1). Upon completion, the test borings will be grouted using a Portland cement and bentonite clay mixture.

Additional test borings may be completed subsequent to the test borings described above to supplement the data and fill possible data gaps. The need for, depth and location of such test borings will be determined in the future. The NYSDEC will be advised of proposed locations, depths, test parameters, etc. if additional test borings are deemed necessary.

4.3.2 Soil Vapor Investigation

A soil vapor sampling program will be conducted in accordance with the NYSDOH's Guidance for Evaluating Soil Vapor Intrusion in the State of New York. The sampling program will consist of on-site soil gas, sub-slab, indoor and outdoor air sampling. All samples will be submitted for the laboratory analysis of VOCs using EPA Method TO-15. The sample analysis will meet the minimum reporting limits of 1 microgram per cubic meter or less for most analytes. One (1) duplicate sample will also be collected during the vapor investigation. The locations of the proposed vapor samples are depicted on Sheet 1. A pre-sampling product inventory will be conducted at the Town and Country facility in accordance with NYSDOH Guidance. Soil gas samples may be collected at any time during the year. Building vapor intrusion samples will be collected between November 15th and March 31st. The following additional detail summarizes the vapor sampling program:

4.3.2.1 Soil Gas Survey

A total of four (4) on-site soil gas survey points will be installed. Two (2) locations (SV-1, 2) will be in areas of suspected chlorinated solvents adjacent to existing groundwater monitoring well locations MW-01 and 02. A third soil gas location will be installed east of the area of know impacts (SV-1) and a fourth will be installed east of the Town and Country facility (SV-4) to evaluate potential soil gas migration to the adjacent structure to the east. It should be noted that the facility west of the Town and Country property is already equipped with a vapor mitigation system.

Soil vapor probe installations will be semi-permanent. Soil vapor implants or probes will be constructed in the same manner at all sampling locations to minimize possible discrepancies. The following procedures will be included in the installation protocol:

a. *Implants will be installed with a direct push geoprobe or equivalent;*

b. *Porous, inert backfill material (e.g., glass beads, washed #1 crushed stone, etc.) will be used to create a sampling zone 1 to 2 feet in length;*

c. *Implants will be fitted with inert tubing (e.g., polyethylene, stainless steel, nylon, teflon ® , etc.) of the appropriate size* *(typically 1/8 inch to 1/4 inch diameter) and of laboratory or food grade quality to the surface;*

d. *Soil vapor probes will be sealed above the sampling zone with a bentonite slurry for a minimum distance of 3 feet to prevent outdoor air infiltration and the remainder of the borehole backfilled with clean material;*

e. *A protective casing will be installed around the top of the probe tubing and grouting in place to the top of bentonite, sloping the ground surface to direct water away from the borehole like a groundwater monitoring well, etc.).*

Soil vapor samples will be collected in the following manner at all locations:

a. *At least 24 hours after the installation of permanent probes one to three implant volumes (i.e., the volume of the sample probe and tube) will be purged prior to collecting the samples;*

b. *Flow rates for both purging and collecting will not exceed 0.2 liters per minute*

c. *Samples will be collected using Summa ® canisters that are certified clean by the laboratory;*

d. *A helium tracer gas will be used when collecting soil vapor samples to verify that adequate sampling techniques are being implemented (i.e., to verify infiltration of outdoor air is not occurring) in accordance with Section 2.7.5 of the NYSDOH Guidance.*

When soil vapor samples are collected, the following actions will be taken to document local conditions during sampling:

a. *Uses of volatile chemicals during normal operations of the facility will be identified;*

b. *outdoor plot sketches will be drawn that include the site, area streets, neighboring commercial or industrial facilities (with estimated distance to the site),outdoor air sampling locations (if applicable), and compass orientation (north);*

c. *weather conditions (e.g., precipitation and outdoor temperature) will be noted for the past 24 to 48 hours; and*

d. *any pertinent observations will be recorded, such as odors and readings from field instrumentation.*

Additional information that will be gathered to assist in the interpretation of the results includes barometric pressure, wind speed and wind direction. The field sampling team will maintain a sample log sheet summarizing the following:

a. *Sample identification,*

b. *Date and time of sample collection,*

c. *Sampling depth,*

d. *Identity of samplers,*

e. *Sampling methods and devices,*

f. *Purge volumes,*

g. *Volume of soil vapor extracted,*

h. *The canister vacuum before and after samples were collected,*

i. *Apparent moisture content (dry, moist, saturated, etc.) of the sampling zone, and*

j. *Chain of custody protocols and records used to track samples from sampling point to analysis.*

4.3.2.2 Sub-Slab Vapor Survey

One (1) on-site sub-slab vapor survey points will be installed in the Town and Country facility's basement (see Sheet 1). The following sub-slab vapor protocol will be followed. The heating systems will be operating to maintain normal indoor air temperatures (i.e., 65 – 75°F) for at least 24 hours prior to and during the scheduled sampling time. Prior to installation of the sub-slab vapor probe, the building floor will be inspected and any penetrations (cracks, floor drains, utility perforations, sumps, etc.) will be noted and recorded. The following procedures should be included in the sub-slab construction protocol:

a. *Permanent recessed probes will be constructed with brass or stainless steel tubing and fittings;*

b. *Tubing will not extend further than 2 inches into the sub-slab material;*

c. *Porous, inert backfill material (e.g., glass beads, washed #1 crushed stone, etc.) will be added to cover about 1 inch of the probe tip for permanent installations; and*

d *The implant will be sealed to the surface with cement.*

Sub-slab vapor samples will be collected in the following manner:

a. *After installation of the probes, one to three volumes (i.e., the volume of the sample probe and tube) will be purged prior to collecting the samples;*

b. *Flow rates for both purging and collecting will not exceed 0.2 liters per minute;*

c. *Samples will be collected in Summa ® canisters that are certified clean by the laboratory;*

d. *Samples will be collected over the same period of time as concurrent indoor and outdoor air samples.*

The following actions will be taken to document conditions during sampling:

a. *Historic and current storage and uses of volatile chemicals will be identified,*

b. *The use of heating or air conditioning systems during sampling will be noted;*

c. *Floor plan sketches will be drawn that include the floor layout with sampling locations, chemical storage areas, garages, doorways, stairways, location of basement sumps or subsurface drains and utility perforations through building foundations, HVAC system air supply and return registers, compass orientation (north), footings that create separate foundation sections, and any other pertinent information will be completed;*

d. Outdoor plot sketches will be drawn that include the building site, area streets, outdoor air sampling locations (if applicable), compass orientation (north), and paved areas;

e. Weather conditions (e.g., precipitation and indoor and outdoor temperature) and ventilation conditions (e.g., heating system active and windows closed) will be reported; and

f. Any pertinent observations, such as spills, floor stains, smoke tube results, odors and readings from field instrumentation (e.g., vapors via PID) will be recorded.

The field sampling team will maintain a sample log sheet summarizing the following:

a. Sample identification,

b. Date and time of sample collection,

c. Sampling depth,

d. Identity of samplers,

e. Sampling methods and devices,

f. Soil vapor purge volumes,

g. Volume of soil vapor extracted,

h. Vacuum of canisters before and after samples collected,

i. Apparent moisture content (dry, moist, saturated, etc.) of the sampling zone,

j. *Chain of custody protocols and records used to track samples from sampling point to analysis.*

4.3.2.3 Indoor Air Sampling

One (1) on-site indoor air sample will be collected in the Town and Country facility's basement (see Sheet 1). The following protocol will be followed.

The heating systems will be operating to maintain normal indoor air temperatures (i.e., 65 – 75 °F) for at least 24 hours prior to and during the scheduled sampling time. Prior to collecting indoor samples, a pre-sampling inspection will be performed to evaluate the physical layout and conditions of the building to identify conditions that may affect or interfere with the proposed sampling, and to prepare the building for sampling.

Indoor air samples will be collected in the following manner:

a. *Samples will be collected over a 24 hour time period;*
b. *Personnel will be directed to avoid lingering in the immediate area of the sampling device while samples are being collected;*
c. *Sample flow rates will be consistent with the flow rates for concurrent outdoor air and sub-slab samples;*
d. *Samples will be collected in Summa ® canisters that are certified clean by the laboratory.*

The actions outlined in 4.3.2.2 will be taken to document conditions during indoor air sampling.

4.3.2.4 Outdoor Air Sampling

One (1) on-site out air sample will be collected (see Sheet 1). The following protocol will be followed. Outdoor air samples will be collected simultaneously with indoor air samples in a manner consistent with that for indoor air samples (see previous section). The following actions will be taken to document conditions during outdoor air sampling:

a. Outdoor plot sketches will be drawn that include the building site, area streets, outdoor air sampling locations, the location of potential interferences (e.g., gasoline stations, factories, lawn movers, etc.), compass orientation (north), and paved areas;

b. Weather conditions (e.g., precipitation and outdoor temperature) will be reported; and

c. Any pertinent observations, such as odors, readings from field instrumentation, and significant activities in the vicinity (e.g., operation of heavy equipment or dry cleaners) will be recorded.

4.3.3 Groundwater Monitoring Wells

Groundwater monitoring wells will be installed at locations and to depths to be determined subsequent to the work described above and the evaluation of surface samples (Section 4.4) and sump, drain and sewer samples (Section 4.2). In addition to existing monitoring wells MW-01, MW-02 and MW-03, which will be used to evaluate groundwater conditions, it is currently anticipated that twelve (12) additional monitoring wells will be tentatively installed in the locations depicted on Sheet 1. Shallow temporary monitoring wells will be identified with an “S” suffix and deep temporary monitoring wells will be identified with a “D” suffix. The offsite monitoring wells installed as part of the 2006 Geoquest Phase II investigation located at the parcel at 2298 Monroe Avenue (MW-1 and MW-2) will have groundwater elevations taken and groundwater samples collected for both rounds of groundwater sampling for the remedial investigation. The groundwater samples will be analyzed for the full suite of parameters identified on Table 1.

The shallow overburden groundwater monitoring wells will be placed within the silty clay layer with the screen interval being placed within the silty clay layer and water table interface. The deep monitoring wells (bedrock wells) will be set such that the screen will cross the fractured bedrock or confining layer. The deep monitoring wells will characterize the deep groundwater and will provide groundwater elevations to determine deep groundwater flow direction. The presence of DNAPL will be closely examined during the installation of all on-site monitoring wells.

The purpose of the groundwater monitoring wells is to evaluate groundwater conditions (i.e., depth to groundwater, groundwater flow patterns and rates, etc.) and the type and distribution of contaminants within the groundwater. The data collected will be used to assess the need for and, if appropriate, type of remediation required to address groundwater impacts.

Monitoring Well Installation Methods: The monitoring wells will be installed in test borings advanced using rotary drilling techniques or a Geoprobe *with* capability of spinning hollow stem augers to create a boring of sufficient diameter to install a 2-inch diameter monitoring well. The drilling and sampling procedures to be utilized will be in general accordance with the various ASTM methods presented in Appendix B.

The new "shallow" monitoring wells will be constructed of 2-inch inside diameter, Schedule-40 PVC with five-foot long, 0.010-inch slot well screens extending from the top of the silty clay layer into the overlying sandy silt deposit. [Note: If DNAPL is encountered in the test borings, alternative construction materials, and installation options (e.g., placement of a collection "sump" below the well screen, etc.) will be considered.] The wells will be completed with a sand pack surrounding the well screen and extending approximately six inches above the screen. The sand packs will be capped with a minimum two-foot thick bentonite seal, and then grouted to the surface. The wells will be completed with either a protective casing or a flush mounted road box depending on location.

The "deep" monitoring wells will be installed similar to the "shallow" monitoring wells but a 5-foot long bentonite seal will be installed by tremie-type methods through the interface between the silty clay and the underlying sand and gravel (i.e., such that approximately 2.5 ft. of seal is below the interface and 2.5 ft. is above the interface).

A monitoring well construction diagram (i.e., well completion report) will be developed for each new well. Typical construction diagrams for the "shallow" and "deep" monitoring wells are included in Appendix B.

Monitoring Well Development: Following a *minimum of 48 hours after well installation* the monitoring wells will be developed by utilizing either a new dedicated disposable bailer with dedicated cord and/or a pump and dedicated disposable tubing. No fluids will be added to the wells during development, and non-dedicated well development equipment will be decontaminated prior to development of each well. *All generated* *groundwater accumulated from the well development efforts will be managed in accordance with DER-10.* The development procedure will be as follows:

- Obtain pre-development static water level readings;
- Calculate water/sediment volume in the well;
- Obtain initial field water quality measurements (e.g., ph, conductance, turbidity, temperature);
- Select development method and set up equipment depending on method used;
- Alternate water agitation methods (e.g., moving a bailer or pump tubing up and down inside the screened interval) and water removal methods (e.g., pumping or bailing) in order to suspend and remove solids from the well;
- Obtain field water quality measurements for every two to five gallons of water removed;
- Record water quantities and rates removed;
- Stop development when water quality criteria listed below have been met;
- Obtain post-development water level readings; and
- Document development procedures, measurements, quantities, etc.

To the extent feasible, development will continue until the following criteria are achieved:

- Water is clear and free of sediment and turbidity is less than 50 Nephelometric Turbidity Unit (NTU);
- Monitoring parameters have stabilized (i.e., parameters are +10%); and/or
- A minimum of five well volumes has been removed.

The field measurement data will be presented on Monitoring Well Development Logs (refer to Appendix B).

Unless evidence of DNAPL is detected, groundwater produced during monitoring well development will be treated by filtration through activated carbon and discharged on to the unpaved ground surface in the eastern portion of the Site. The discharge water from the treatment system will be observed for evidence of potential impact (e.g., staining and/or unusual odors, etc.) and screened with a PID. If evidence of suspected impact is identified (e.g., visual and/or olfactory and/or PID readings in excess of 25 ppm above background) is observed/detected in the discharge water, treatment will be halted and the discharge water will be placed in labeled 55-gallom drums and stored in a secure location at the Site for subsequent disposal. If evidence of DNAPL is observed in the development water, the water will be containerized handled/disposed similarly.

Groundwater Sampling Program*: A total of two (2) groundwater monitoring events are scheduled to occur as part on this RI. Efforts will be taken ensuring to the best of our ability, groundwater sampling events will be conducted* *during seasonal high and low groundwater elevations.* The initial groundwater sampling event will be conducted *a minimum of two weeks* following development of all of the monitoring wells installed. During this event, it is expected that groundwater samples will be collected from the new *and existing* wells *in* accordance with the low-flow groundwater sampling procedure described in ASTM Method D6771-02 (refer to Appendix B). A second groundwater monitoring event will be collected approximately three months after the initial sampling event. *Groundwater samples will be collected from all groundwater monitoring wells on the site (i.e. new and existing).*

The procedures and equipment used during the groundwater sampling will be documented in the field and recorded on a Monitoring Well Sampling Log (refer to Appendix B).*During all groundwater sampling activities, groundwater will be examined and recorded for the presence of DNAPL and LNAPL by measurement with an interface meter. All groundwater monitoring activities will be conducted in accordance with ASTM D6771-02. All sampling will be conducted with disposable bailers.*

The primary objective of field personnel in obtaining groundwater samples is to collect and preserve representative samples, and adhere to proper chain-of-custody procedures in their prompt shipment to the certified laboratory for analysis within the specified holding times. Upgradient monitoring wells will be sampled before downgradient wells in the following manner:

1. *Monitoring wells will be purged prior to sampling using disposable bailers or properly decontaminated pumping equipment. A minimum of three well volumes will be purged where*

possible. For wells that bail dry, purging will consist of complete evacuation.

2. *Following adequate recovery (within 80% of static levels), obtain sample with a disposable bailer suspended on new, solid-braid nylon rope. Transfer sample directly from the bailer to the parameter-specific sample container labeled appropriately (sample ID Number and preservative), and place in coolers with ice or ice packs. Fill sample bottles in the following order: VOCs then SVOCs, then remaining parameters*

3. *Calibrate all field chemistry equipment every day.*

4. *Follow record keeping and chain-of-custody procedures.*

5. *Replace all well caps, and lock protective well cover.*

6. *At the end of the sampling day, the coolers will be taped shut with the custodian's initials placed on the tape at the points of entry. Samples will be delivered to the laboratory by field personnel upon departure from the site. Alternatively, an express carrier may be used to deliver the samples to the laboratory.*

In order to determine the horizontal hydraulic gradient(s) exhibited by the surface of the water table and potential routes of contaminant migration, water level measurements will be made at each newly installed well using the following procedures:

1. *After noting the general conditions of the well (surface seal, lock, etc.) the bottom of the well will be sounded by lowering a decontaminated, weighted probe into the well.*

2. *Well bottom conditions will be noted (silty, blockages, etc.). The distance from the base of the screen to the top of the casing will be recorded to the nearest 1/100th of a foot.*

3. *The static water level, DNAPL (if present) and LNAPL (if present) will be measured with an interface probe to the nearest 1/100th of a foot.*

4. *The readings will always be taken from a marked point on the well casing.*

5. *Other measurements to be taken are:*

    - *Stickup of well casing from ground surface or surface seal.*
    - *Depth to bottom of well from the top of the riser.*

6. *The date and time will be recorded for these measurements. Also, any pertinent weather conditions will be noted (i.e., significant recent precipitation or drought conditions).*

7. *Upon completion, the wells will be secured, and all downhole equipment will be decontaminated with methanol and deionized water.*

8. *As practicable, all water levels should be collected on the same day.*

Prior to use and between wells, reusable equipment (e.g., static water level meter) that comes in contact with groundwater will be decontaminated using the following procedures:

- Wash in a mixture of potable water and Alconox®-type soap;
- Rinse until soap is no longer visible;

- Rinse with distilled water, allow to air dry or dry with a paper towel.

Groundwater samples will be submitted to the analytical laboratory for testing. Refer to Table 1 for test parameters and QA/QC samples (initial sampling event only).

Hydraulic Conductivity Testing: Subsequent to development and a return to steady-state static water level conditions, in-situ *variable* hydraulic conductivity testing will be completed at monitoring wells *1D, 2D, 5S, 5D, 7S, and 7D* in accordance with ASTM Method D4044-02 (refer to Appendix B). *These locations were selected due to their proximity adjacent to the known area of impact. Also known as the slug or bail test, this method involves either the removal of a bail of water or the displacement of water within the well by the insertion of a slug. Upon creating an elevated or depressed head, the water level in the well is measured and recorded periodically over the recovery time.*

The underlying assumption in the analysis of these tests is that the rate of inflow to the well, after inducing a hydraulic head difference, is a function of the hydraulic conductivity (k) and the unrecovered head distance. The analytical method, typically relying on graphical solution techniques (time vs. head or head ratio), rearranges the flow equation to solve for parameter k. For unconfined groundwater conditions, the Hvorslev and Bouwer-Rice methods will be used. Details of these methods are given in the publications by Hvorslev (1951), Cedergren (1977), and by Bouwer & Rice (1976) and Bouwer (1989), respectively. For confined groundwater conditions, if any are encountered, the Cooper-Bredehoeft-Papadopulos method will be used (Cooper et al. 1967; Papadopulos et al. 1973).

It is important to observe whether the static water level recorded prior to starting the variable head test occurs within the screened interval of the well. If so, the use of the slug test (falling head) is inappropriate due to drainage into the vadose zone above the water table. A bail test (rising head) is preferred in such circumstances. The water levels are recorded with an immersed pressure transducer connected to an automatic data logger.

4.4 Surface Soil Samples

With the exception of the eastern-most portion of the Site and isolated locations along a fence that surrounds the parking lot in the northeastern portion of the Site, the property is covered with the building footprint or asphalt pavement. *S*urface soil samples will be collected from the *seven* locations depicted on *Sheet 1* (i.e., designated SS-1 through SS-*7*). These sample points are located in areas that are not covered by asphalt pavement and/or the building footprint. The sample locations may be adjusted in the field with NYSDEC concurrence to nearby areas if those areas appear stained, devoid of vegetation, or exhibit other characteristics that indicate the presence of contamination. *Supplemental samples may be needed if stained soils or stressed vegetation is encountered.*

The surface soil samples will be collected from a depth of 0 to *2* inches *below* ***exposed*** *soil or below the vegetative cover/sod material*. . Initially, vegetation will be removed with a dedicated disposable trowel and placed to the side of the test location. The trowel will then be used to collect the surface soil sample from the 0 to *2* inch depth interval. Portions of the samples will be placed directly into laboratory-supplied glassware for laboratory analysis. To the extent practicable based on visual and olfactory observations, the portions placed in laboratory-supplied glassware will consist of the most contaminated section of the sample.

Other portions of the samples will be placed in Ziploc®-type plastic baggies that will subsequently be field screened with a PID in accordance with the Soil Sample Field Screening Standard Operating Procedure (SOP) located in Appendix B**.** The laboratory containers and baggies for each sample location will be labeled and placed in a cooler maintained at or below 4ºC. Upon collection, surface soil samples will be submitted to the laboratory for testing as outlined in Table 1.

Note: Based upon available information, the eastern portion of the Site, and along the fence line in the northeastern portion of the Site, was formerly occupied by a railroad line that was part of a trolley system. Therefore fill associated with this former railroad line may be present in these areas and it is anticipated that the surface soil samples will assist in the evaluation of the chemical impact of this fill (if any). The location of the trolley system will be evaluated as part of the Records Research task (Section 4.1).

4.5 Survey

A New York State Licensed Surveyor will be retained to measure to within 0.01 feet the top of riser and ground surface elevations at monitoring wells and to establish a benchmark location and elevation using the North American Vertical Datum (NAVD) ’88 coordinate system. The horizontal data will be surveyed using the North American Datum (NAD) ’83 UTM Zone 18 coordinate system. B&L will also use a laser level to measure elevations at select sample locations referenced to the benchmark elevation.

During groundwater monitoring events, static groundwater level measurements will be obtained using an electronic static water level meter or an oil/water interface meter. Groundwater elevations will be calculated by referencing the top of casing elevation established for the monitoring wells to allow the determination of groundwater elevations and the preparation of a potentiometric groundwater map.

B&L will determine the location of test borings/groundwater monitoring wells and site features (e.g., catch basins, the sump within the basement of the building, etc.) using GPS technology or via tape measurement from existing site features. In addition, *B&L* will measure the elevation of the ground surface at select test boring locations, existing groundwater monitoring wells, and site features (e.g., catch basin inverts, the building and basement floors, the sump pit invert, etc.) using a laser level.

4.6 Analytical Laboratory Testing

The samples proposed for analytical laboratory testing, broken down by the environmental media, are specified in Table 1. *The parameters and minimum detection limits include:*

Volatile Target Compound List and Corresponding Minimum Detection Limits			
		Contract Required Minimum Detection Limits	
Compound	***CAS No.***	***Water (ug/L)***	***Soil (ug/kg)***
Dichlorodifluoromethane	75-71-8	*5.0*	*5.0*
Chloromethane	*74-87-3*	*5.0*	*5.0*
Vinyl chloride	*75-01-4*	*5.0*	*5.0*
Bromomethane	*74-83-9*	*5.0*	*5.0*
Chloroethane	*75-00-3*	*5.0*	*5.0*
Trichlorofluoromethane	*75-69-4*	*5.0*	*5.0*
1,1-Dichloroethene	*75-35-4*	*5.0*	*5.0*
1,1,2-Trichloro-1,2,2-trifluoroethane	*76-13-1*	*5.0*	*5.0*

Volatile Target Compound List and Corresponding Minimum Detection Limits			
		Contract Required Minimum Detection Limits	
Compound	***CAS No.***	***Water (ug/L)***	***Soil (ug/kg)***
Acetone	*67-64-1*	*10*	*10*
Carbon disulfide	*75-15-0*	*5.0*	*5.0*
Methyl acetate	*79-20-9*	*5.0*	*5.0*
Methylene chloride	*75-09-2*	*5.0*	*5.0*
trans-1,2-Dichloroethene	*156-60-5*	*5.0*	*5.0*
Methyl tert-butyl ether	*1634-04-4*	*5.0*	*5.0*
1,1-Dichloroethane	*75-34-3*	*5.0*	*5.0*
cis-1,2-Dichloroethene	*156-59-2*	*5.0*	*5.0*
2-Butanone	*78-93-3*	*10*	*10*
Bromochloromethane	*74-97-5*	*5.0*	*5.0*
Chloroform	*67-66-3*	*5.0*	*5.0*
1,1,1-Trichloroethane	*71-55-6*	*5.0*	*5.0*
Cyclohexane	*110-82-7*	*5.0*	*5.0*
Carbon tetrachloride	*56-23-5*	*5.0*	*5.0*
Benzene	*71-43-2*	*5.0*	*5.0*
1,2-Dichloroethane	*107-06-2*	*5.0*	*5.0*
1,4-Dioxane	*123-91-1*	*100*	*100*
Trichloroethene	*79-01-6*	*5.0*	*5.0*
Methylcyclohexane	*108-87-2*	*5.0*	*5.0*
1,2-Dichloropropane	*78-87-5*	*5.0*	*5.0*
Bromodichloromethane	*75-27-4*	*5.0*	*5.0*
cis-1,3-Dichloropropene	*10061-01-5*	*5.0*	*5.0*
4-Methyl-2-pentanone	*108-10-1*	*10*	*10*
Toluene	*108-88-3*	*5.0*	*5.0*
trans-1,3-Dichloropropene	*10061-02-6*	*5.0*	*5.0*
1,1,2-Trichloroethane	*79-00-5*	*5.0*	*5.0*
Tetrachloroethene	*127-18-4*	*5.0*	*5.0*
2-Hexanone	*591-78-6*	*10*	*10*
Dibromochloromethane	*124-48-1*	*5.0*	*5.0*
1,2-Dibromoethane	*106-93-4*	*5.0*	*5.0*

Volatile Target Compound List and Corresponding Minimum Detection Limits			
		Contract Required Minimum Detection Limits	
Compound	***CAS No.***	***Water (ug/L)***	***Soil (ug/kg)***
Chlorobenzene	*108-90-7*	*5.0*	*5.0*
Ethylbenzene	*100-41-4*	*5.0*	*5.0*
o-Xylene	*95-47-6*	*5.0*	*5.0*
m,p-Xylene	*179601-23-1*	*5.0*	*5.0*
Styrene	*100-42-5*	*5.0*	*5.0*
Bromoform	*75-25-2*	*5.0*	*5.0*
Isopropylbenzene	*98-82-8*	*5.0*	*5.0*
1,1,2,2-Tetrachloroethane	*79-34-5*	*5.0*	*5.0*
1,3-Dichlorobenzene	*541-73-1*	*5.0*	*5.0*
1,4-Dichlorobenzene	*106-46-7*	*5.0*	*5.0*
1,2-Dichlorobenzene	*95-50-1*	*5.0*	*5.0*
1,2-Dibromo-3-chloropropane	*96-12-8*	*5.0*	*5.0*
1,2,4-Trichlorobenzene	*120-82-1*	*5.0*	*5.0*
1,2,3-Trichlorobenzene	*87-61-6*	*5.0*	*5.0*

Semi-volatile Target Compound List and Corresponding Minimum Detection Limits			
		Contract Required Minimum Detection Limits	
Compound	***CAS No.***	***Water (ug/L)***	***Soil (ug/kg)***
Benzaldehyde	*100-52-7*	*5.0*	*170*
Phenol	*108-95-2*	*5.0*	*170*
Bis(2-chloroethyl) ether	*111-44-4*	*5.0*	*170*
2-Chlorophenol	*95-57-8*	*5.0*	*170*
2-Methylphenol	*95-48-7*	*5.0*	*170*
2,2'-Oxybis(1-choloropropane)	*108-60-1*	*5.0*	*170*
Acetophenone	*98-86-2*	*5.0*	*170*
4-Methylphenol	*106-44-5*	*5.0*	*170*
N-Nitroso-di-n propylamine	*621-64-7*	*5.0*	*170*

Semi-volatile Target Compound List and Corresponding Minimum Detection Limits			
		Contract Required Minimum Detection Limits	
Compound	***CAS No.***	***Water (ug/L)***	***Soil (ug/kg)***
Hexachloroethane	*67-72-1*	*5.0*	*170*
Nitrobenzene	*98-95-3*	*5.0*	*170*
Isophorone	*78-59-1*	*5.0*	*170*
2-Nitrophenol	*88-75-5*	*5.0*	*170*
2,4-Dimethylphenol	*105-67-9*	*5.0*	*170*
Bis(2-chloroethoxy) methane	*111-91-1*	*5.0*	*170*
2,4-Dichlorophenol	*120-83-2*	*5.0*	*170*
Naphthalene	*91-20-3*	*5.0*	*170*
4-Chloroaniline	*106-47-8*	*5.0*	*170*
Hexachlorobutadiene	*87-68-3*	*5.0*	*170*
Caprolactam	*105-60-2*	*5.0*	*170*
4-Chloro-3-methylphenol	*59-50-7*	*5.0*	*170*
2-Methylnaphthalene	*91-57-6*	*5.0*	*170*
Hexachlorocyclopentadiene	*77-47-4*	*5.0*	*170*
2,4,6-Trichlorophenol	*88-06-2*	*5.0*	*170*
2,4,5-Trichlorophenol	*95-95-4*	*5.0*	*170*
1,1'-Biphenyl	*92-52-4*	*5.0*	*170*
2-Chloronaphthalene	*91-58-7*	*5.0*	*170*
2-Nitroaniline	*88-74-4*	*10*	*330*
Dimethylphthalate	*131-11-3*	*5.0*	*170*
2,6-Dinitrotoluene	*606-20-2*	*5.0*	*170*
Acenaphthylene	*208-96-8*	*5.0*	*170*
3-Nitroaniline	*99-09-2*	*10*	*330*
Acenaphthene	*83-32-9*	*5.0*	*170*
2,4-Dinitrophenol	*51-28-5*	*10*	*330*
4-Nitrophenol	*100-02-7*	*10*	*330*
Dibenzofuran	*132-64-9*	*5.0*	*170*
2,4-Dinitrotoluene	*121-14-2*	*5.0*	*170*
Diethylphthalate	*84-66-2*	*5.0*	*170*
Fluorene	*86-73-7*	*5.0*	*170*
4-Chlorophenyl-phenyl ether	*7005-72-3*	*5.0*	*170*

Semi-volatile Target Compound List and Corresponding Minimum Detection Limits			
		Contract Required Minimum Detection Limits	
Compound	***CAS No.***	***Water (ug/L)***	***Soil (ug/kg)***
4-Nitroaniline	*100-01-6*	*10*	*330*
4,6-Dinitro-2-methylphenol	*534-52-1*	*10*	*330*
N-Nitrosodiphenylamine	*86-30-6*	*5.0*	*170*
1,2,4,5-Tetrachlorobenzene	*95-94-3*	*5.0*	*170*
4-Bromophenyl-phenylether	*101-55-3*	*5.0*	*170*
Hexachlorobenzene	*118-74-1*	*5.0*	*170*
Atrazine	*1912-24-9*	*5.0*	*170*
Pentachlorophenol	*87-86-5*	*10*	*330*
Phenanthrene	*85-01-8*	*5.0*	*170*
Anthracene	*120-12-7*	*5.0*	*170*
Carbazole	*86-74-8*	*5.0*	*170*
Di-n-butylphthalate	*84-74-2*	*5.0*	*170*
Fluoranthene	*206-44-0*	*5.0*	*170*
Pyrene	*129-00-0*	*5.0*	*170*
Butylbenzylphthalate	*85-68-7*	*5.0*	*170*
3,3'-dicholorobenzidine	*91-94-1*	*5.0*	*170*
Benzo(a)anthracene	*56-55-3*	*5.0*	*170*
Chrysene	*218-01-9*	*5.0*	*170*
Bis(2-ethylhexyl) phthalate	*117-81-7*	*5.0*	*170*
Di-n-octylphthalate	*117-84-0*	*5.0*	*170*
Benzo(b) fluoranthene	*205-99-2*	*5.0*	*170*
Benzo(k) fluoranthene	*207-08-9*	*5.0*	*170*
Benzo(a) pyrene	*50-32-8*	*5.0*	*170*
Indeno(1,2,3,-cd) pyrene	*193-39-5*	*5.0*	*170*
Dibenzo(a,h) anthracene	*53-70-3*	*5.0*	*170*
Benzo(g,h,i) perylene	*191-24-2*	*5.0*	*170*
2,3,4,6-Tetrachlorophenol	*58-90-2*	*5.0*	*170*

Pesticides/Aroclors Target Compound List Minimum Detection Limits			
		Contract Required Minimum Detection Limits	
Compound	CAS No.	Water (ug/L)	Soil (ug/Kg)
alpha-BHC	319-84-6	0.050	1.7
beta-BHC	319-85-7	0.050	1.7
delta-BHC	319-86-8	0.050	1.7
gamma-BHC (Lindane)	58-89-9	0.050	1.7
Heptachlor	76-44-8	0.050	1.7
Aldrin	309-00-2	0.050	1.7
Heptachlor epoxide	1024-57-3	0.050	1.7
Endosulfan I	959-98-8	0.050	1.7
Dieldrin	60-57-1	0.10	3.3
4,4'-DDE	72-55-9	0.10	3.3
Endrin	72-20-8	0.10	3.3
Endosulfan II	33213-65-9	0.10	3.3
4,4'-DDD	72-54-8	0.10	3.3
Endosulfan sulfate	1031-07-8	0.10	3.3
4,4'-DDT	50-29-3	0.10	3.3
Methoxychlor	72-43-5	0.50	17.0
Endrin ketone	53494-70-5	0.10	3.3
Endrin aldehyde	7421-93-4	0.10	3.3
alpha-Chlordane	5103-71-9	0.050	1.7
gamma-Chlordane	5103-74-2	0.050	1.7
Toxaphene	8001-35-2	5.0	170.0
Aroclor-1016	12674-11-2	1.0	33.0
Aroclor-1221	11104-28-2	1.0	33.0
Aroclor-1232	11141-16-5	1.0	33.0
Aroclor-1242	53469-21-9	1.0	33.0
Aroclor-1248	12672-29-6	1.0	33.0
Aroclor-1254	11097-69-1	1.0	33.0

Pesticides/Aroclors Target Compound List Minimum Detection Limits			
		Contract Required Minimum Detection Limits	
Compound	***CAS No.***	***Water (ug/L)***	***Soil (ug/Kg)***
Aroclor-1260	*11096-82-5*	*1.0*	*33.0*
Aroclor-1262	*37324-23-5*	*1.0*	*33.0*
Aroclor-1268	*11100-14-4*	*1.0*	*33.0*

Metals and Cyanide Target Analyte List and Corresponding CRQLs			
		Contract Required Minimum Detection Limits	
Analyte	***CAS No.***	***ICP-MS Water (ug/L)***	***ICP-MS Soil (mg/kg)***
Aluminum	*7429-90-5*	*20*	*--*
Antimony	*7440-36-0*	*2*	*1*
Arsenic	*7440-38-2*	*1*	*0.5*
Barium	*7440-39-3*	*10*	*5*
Beryllium	*7440-41-7*	*1*	*0.5*
Cadmium	*7440-43-9*	*1*	*0.5*
Calcium	*7440-70-2*	*500*	*--*
Chromium	*7440-47-3*	*2*	*1*
Cobalt	*7440-48-4*	*1*	*0.5*
Copper	*7440-50-8*	*2*	*1*
Iron	*7439-89-6*	*200*	*--*
Lead	*7439-92-1*	*1*	*0.5*
Magnesium	*7439-95-4*	*500*	*--*
Manganese	*7439-96-5*	*1*	*0.5*
Nickel	*7440-02-0*	*1*	*0.5*
Potassium	*7440-09-7*	*500*	*--*
Selenium	*7782-49-2*	*5*	*2.5*
Silver	*7440-22-4*	*1*	*0.5*
Sodium	*7440-23-5*	*500*	*--*
Thallium	*7440-28-0*	*1*	*0.5*
Vanadium	*7440-62-2*	*5*	*2.5*

Metals and Cyanide Target Analyte List and Corresponding CRQLs			
		Contract Required Minimum Detection Limits	
Analyte	CAS No.	ICP-MS Water (ug/L)	ICP-MS Soil (mg/kg)
Zinc	7440-66-6	2	1
Cyanide by Spectrophotometry	57-12-5	10	0.5

The laboratory data deliverables will be Category B ASP deliverables and will have data usability summary reports (DUSRs) completed. All data that is generated during the remedial investigation will be submitted in the electronic data deliverable format for EQuIS.

Laboratory samples collected for closure verification will be sent for data validation. It is not the intent of this task to submit all Site-generated data for validation, but only those samples which are located in areas at the edges of contaminant plumes, and used for site closure or remedial decisions. The following laboratory and data validator selection criteria will be utilized:

A laboratory will be selected that is qualified to perform the work required for the site. Examples of selection criteria are as follows:

1. *QA/QC Programs – All laboratories must have a detailed written QA/QC program meeting the minimum requirements of the NYSDEC and the NYSDOH, and must be NYSDOH ELAP CLP certified for all analyses being performed.*
2. *Approvals –The selected analytical laboratory will be committed to providing analytical services for vapor, groundwater, soil, sediment and surface water that are commensurate with the required protocols and current state-of-the-art analytical procedures, laboratory practices and instrumentation.*

3. *Data validation will be performed by a validator who meets the following requirements.*

Data Validation Scope of Work – NYSDEC RI/FS Program

Data validation is the systematic process by which the data quality is determined with respect to data quality criteria that are defined in project and laboratory quality control programs and in the referenced analytical methods. The data validation process consists of an assessment of the acceptability or validity of project data with respect to stated project goals and requirements for data usability. Ideally, data validation establishes the data quality in terms of project data quality objectives. Data validation consists of data editing, screening, checking, auditing, certification, review and interpretation. The purpose of data validation is to define and document analytical data quality and determine if the data quality is sufficient for the intended use(s) of the data. In accordance with DEC requirements, all project data must be of known and acceptable quality. Data validation is performed to establish the data quality for all data which are to be considered when making project decisions. Laboratories will be required to submit results which are supported by sufficient back-up data and QA/QC results to enable the reviewer to conclusively determine the quality of the data.

Qualifications of a Data Validator

In order to ensure an acceptable level of performance, the following qualifications and requirements are established for all consultants/contractors functioning as data validators. These qualifications and requirements shall apply whether the consultant/contractor is: a) retained directly through contracts executed by the State: b) retained as a subcontractor to a consultant functioning under contracts executed by the State; or c) retained by a responsible party functioning under the guidance and direction of an order on consent. Consultant/Contractor functioning as a data validator shall be independent of the laboratory generating the data.

The Consultant/Contractor functioning as a data validator shall provide evidence that all staff members involved in the data validation process have: a) a bachelor's degree in chemistry or natural sciences with a minimum of 20 hours in chemistry; and b) one (1) year experience in the implementation and application of the protocols used in generating the data for which they are responsible. The successful completion of the EPA Data Validation Training course may be substituted for the analytical experience requirement. In addition, these same staff members must have a minimum of one (1) year experience evaluating CLP data packages for contract protocol compliance.

Specific Tasks To Be Completed By The Data Validator

Evaluated Completeness of Laboratory Data Package

The data validator shall review the data package to determine completeness. A complete data package will consist of the following components:

- *All sample chain-of-custody forms;*
- *The case narrative(s) including all sample analysis summary forms*;*
- *Quality Assurance/Quality Control summaries including all supporting documentation;*
- *All relevant calibration data including all supporting documentation;*
- *Instrument and method performance data;*
- *Documentation showing the laboratory's ability to attain the contract specified method detection limits for all target analytes in all required matrices;*
- *All data report forms including examples of the calculations used in determining final concentrations; and*

- *All raw data used in the identification and quantification of the contract specified target compounds.*

**These forms appear as an addendum to the NYSDEC CLP forms package and will be required for all data submissions regardless of the protocol requested.*

All deficiencies in the requirement for completeness shall be reported to the consultant immediately. The laboratory shall be contacted by the consultants Quality Assurance Officer and shall be given ten calendar days to produce the documentation necessary to remove the deficiencies.

Compliance of Data Packages with Work Plan

The validator shall review the submitted data package to determine compliance with those portions of the Work Plan that pertain to the generation of laboratory data. Compliance is defined by the following criteria:

- *The data package is complete as defined above;*
- *The data has been generated and reported in a manner consistent with the requirements of the Quality Assurance Program Plan and the laboratory subcontract;*
- *All protocol required AQ/AC criteria have been met;*
- *All instrument tune and calibration requirements have been met for the time frame during which the analyses were completed;*
- *All protocol required initial and continuing calibration data is present and documented;*

- *All data reporting forms are complete for all samples submitted. This will include all requisite flags, all sample dilution/concentration factors and all pre-measurement sample cleanup procedures; and*
- *All problems encountered during the analytical process have been reported in the case narrative along with any and all actions taken by the laboratory to correct these problems.*

The data validation task requires that the validator conduct a detailed comparison of the reported data with raw data submitted as part of the supporting documentation package. It is the responsibility of the validator to determine that the reported data can be completely substantiated by applying protocol defined procedures for the identification and quantification of the individual analytes. To assist the validator in this determination, the following documents are recommended; however, the EPA Functional Guidelines will be used for format only. The specific requirements noted in the project Work Plan are prerequisite, for example holding times or special analytical project needs, to those noted in the Functional Guidelines.

- *The particular protocol(s) under which the data was generated (e.g., NYSDEC Contract Laboratory Protocol; EPA SW-846; EPA Series 500 Protocols).*
- *Data validation guidance documents such as;*
  - *"Functional Guidelines for Evaluation of Inorganic Data" (published by EPA Region 2);*
  - *"Functional Guidelines for Evaluation of Organic Analyses", Technical Directive Document No. HQ-8410-01 (published by EPA); and*
  - *"Functional Guidelines for Evaluating Pesticides/PCB's Analyses" Technical Directive Document No. HQ-8410-01 (published by EPA).*

NOTE: These documents undergo periodic revision. It is assumed that the selected data validator will have access to the most current applicable documents and guidelines.

Reporting

The validator shall submit a final report covering the results of the data review process. This report shall be submitted to the Project Manager or his designee and shall include the following:

- *A general assessment of the data package as determined by the degree to which the package is complete and complies with the protocols set forth in the Work Plan;*
- *A detailed descriptions of any and all deviations from the required protocols. These descriptions must include references to the portions of the protocols involved in the alleged deviations;*
- *Any and all failures in the validator's attempt to reconcile the reported data with the raw data from which it was derived. Specific references must be included. Telephone logs should be included in the validation report.*
- *Detailed assessment by the validator of the degree to which the data has been compromised by any deviations from protocol, QA/QC breakdowns, lack of analytical control, etc., that occurred during the analytical process'*
- *The report shall include, as an attachment, a copy of the laboratory's case narrative, including the DEC required sample and analysis summary sheets;*
- *The report shall include an overall appraisal of the data package; and*

The validation report shall include a chart presented in a spreadsheet format, consisting of site name, sample numbers, data submitted to laboratory, year of CLP or analytical protocol *used, matrix, fractions analyzed (e.g., volatiles, semi-volatiles, Pest/PCB, metals, CN). Space should be provided for a reference to the NYSDEC CLP when non-compliancy is involved and a column for an explanation of such violation.*

Currently, we propose utilizing Michael Fifield, Pace Analytical Services, 2190 Technology Drive, Schenectady, NY 12308 for validation services. We will notify the Department if a change in validator is proposed.

4.7 Qualitative Human Health Exposure Assessment

The data collected during the preceding tasks will be used to prepare a qualitative exposure assessment that will characterize the exposure setting, identify exposure pathways, and evaluate contaminant fate and transport. The qualitative human health exposure assessment will be conducted in accordance with the provisions outlined in Appendix 3B of the May 3, 2010 DER-10 *Technical Guidance for Site Investigation and Remediation*. The completed qualitative human health exposure assessment will be incorporated into the RI report.

4.8 Fish and Wildlife Assessment

Due to the nature of the Site and surrounding areas, a Fish and Wildlife assessment does not appear warranted. To confirm this assumption, a Fish and Wildlife Analysis (i.e., as outlined in Step I through Step II B) will be conducted in *accordance with DER-10 Section 3.10.*. The completed analysis document will be incorporated into the RI Report.

4.9 Remedial Investigation Report

The RI Report will document the research completed as part of the studies outlined herein (including data generated during previous investigations, as appropriate), fieldwork conducted as part of this RI, an evaluation of analytical laboratory results for the samples collected during this study (and previous investigations, as appropriate), and recommendations for additional studies or assessments, if required. The RI report *will be prepared in accordance with DER-10 Section 3.14 and* will include/address the following items:

- Documentation of the observations, investigation, and remedial activities performed;
- Evaluation of the distribution of contaminants detected;
- Tabulated summaries of soil and groundwater sample analytical laboratory data. The analytical laboratory results for soil samples tested will be compared to Soil Cleanup Objectives (SCOs) referenced in NYSDEC 6 NYCRR §375.6 dated December 14, 2006, and/or other appropriate and relevant criteria. Analytical laboratory results for groundwater samples tested during this study will be compared to groundwater standards and guidance values referenced in NYSDEC TOGS 1.1.1 data source 1998 and amended by NYSDEC Table 1, dated August 1, 2001. *All data collected to date will be reported on data summary tables in accordance with DER-10 Section 3.14(c)4.;*
- Figures that includes presentations of the horizontal and vertical distribution of constituents in the environmental media at the Site;
- Results of the Qualitative Human Health Exposure Assessment and the Qualitative Human Health Exposure Assessment; and

- Recommendations for further studies that may be necessary to complete characterization of the Site and/or to provide a preliminary selection of remedial alternatives.

Supporting documentation will be provided as appendices to this report. The supporting documentation will include, but will not necessarily be limited to, photographs, site maps/figures, well development and sampling logs, test boring logs, and a DUSR.

5.0 Quality Assurance *Project Plan*

This section describes the policies, organizations, project activities, and quality assurance and quality control (QA/QC) protocols necessary to meet the project objectives and to provide a mechanism for control and evaluation of the quality of data to be acquired throughout the course of the RI. *In Section 5.8 of the RIWP*

5.1 Sample Designations

The environmental media samples collected during the implementation of the RI will be given unique sample identification. The sample name will include an identifier for the Town and Country Cleaners (TCC) Site, sample location, and sample depth for soil samples. For example, a soil sample collected from a depth of 1.5 feet in test boring B-1 would be given the designation TCC-B-1 (1.5’). Groundwater samples collected will be labeled similarly with the addition of the date, so monitoring well MW-01 sampled in March 10, 2007 would be given the designation TCC-MW01-3/10/07. A surface soil samples collected from location SS-1 at a depth of 0.5 feet will be designated as TCC-SS-1 (0.5’).

5.2 Sample Handling and Analysis

Samples collected for possible analysis will be placed directly into laboratory-provided sample containers and immediately after collection placed in a cooler to be held at a temperature of approximately 4°C until delivery to the laboratory. Samples will be labeled with the sample designation described above and the initials of the person collecting the sample. Each sample will be tracked by means of a Chain-of-Custody form that will be initiated at the time of sample collection and will be maintained with the sample until delivery to the laboratory.

5.3 Analytical Laboratory Methods

The samples submitted for analytical laboratory testing during this study will be analyzed using approved USEPA approved protocol and methods that follow the most recent edition of the USEPA's *Test Methods for Evaluating Solid Waste (SW-846), Methods for Chemical Analysis of Water and Wastes (USEPA Methods 600/4-79-20),* and *Standard Methods for Examination of Water and Wastewater (*American Public Health Association, American Waterworks Association and Water Pollution Federation).

5.4 Analytical Laboratory

The analytical laboratory retained to complete the testing of samples collected during this study will be a New York State Department of Health (NYSDOH) ELAP-certified laboratory. The laboratory will perform the sample analysis in accordance with the most recent NYSDEC Analytical Services Protocol (ASP). *All laboratory data packages will be ASP Category B deliverables.*

5.5 Quality Assurance/Quality Control

Procedures for chain-of-custody, laboratory instrumentation calibration, laboratory analyses, reporting of data, internal quality control and corrective actions will be performed as required by SW-846 and the analytical laboratory's Quality Assurance Plan. As outlined in Table 1, trip blanks, field blanks, *equipment blanks,* matrix spike and matrix spike duplicate samples will be prepared/tested to assess the quality of the data generated. The trip blanks*, equipment blanks and* field blank samples will be prepared/tested at a rate of one sample for every twenty samples submitted for testing during specific sampling events. *Matrix spike/matrix spike duplicate (MS/MSD) samples will be collected at a frequency of one* *for every twenty samples for each sample matrix. If less than twenty samples are collected from any matrix, then at least one MS/MSD will be collected from that matrix. The purpose of these samples is to evaluate the effect of the sample matrix on the analytical results.* The MS/MSD will include the same parameters as that of the field samples.

A field blank will be prepared on-site each day that surface water, sediment and soil samples are collected with non-dedicated or non-disposable sampling equipment. If more than one matrix is being sampled in a given day, field blanks will be prepared for each matrix. A trip blank for water samples and/or soil samples to be analyzed for VOCs will accompany sample containers through all phases of the sampling event to ensure proper bottle preparation and laboratory integrity. Trip blank and field blank samples will receive identical handling procedures as on-site samples. An equipment blank consisting of a sample of analyte free water poured over or through decontaminated field sampling equipment prior to the collection of environmental samples.

Field and trip blanks are used as control or external QA/QC samples to detect contamination that may be introduced in the field (either atmospheric or from sampling equipment), in transit to or from the sampling site, or in the bottle preparation, sample login, or sample storage stages within the laboratory. The blanks will also show any contamination that may occur during the analytical process. The equipment blank is utilized to assess the adequacy of the decontamination process.

Trip blanks are samples of analyte-free water, prepared at the same location and time as the preparation of bottles that are to be used for sampling. They remain with the sample bottles while in transit to the site, during sampling, and during the return trip to the laboratory. At no time during these procedures are they to be opened. Upon return to the laboratory, they are analyzed as if they were another sample, receiving the same

QA/QC procedures as ordinary field samples. If these samples are accidentally opened, it will be noted on the chain-of-custody.

Field blanks are prepared in the field (at the sampling site) using empty bottles and analyte-free water supplied separately (prepared at the same time and place as the bottles used in the sampling). The preferred procedure for collection of field blanks for non-dedicated sampling equipment is to first decontaminate the sampling device (e.g., scoop, beaker), and then pour the analyte-free water over the device and collect the runoff into the empty bottles supplied with the sample bottles.

Field and trip blanks are not part of the laboratory QA/QC procedures. The latter, used to detect contamination during analytical steps, are only included as part of the laboratory service and assess the validity of the laboratory analytical procedures. Field and trip blanks are required as part of QA/QC procedures for the overall sampling and analytical program.

5.5.1 Laboratory Duplicates

Collection of an aqueous or soil duplicate sample provides for the evaluation of the laboratory's performance by comparing analytical results of two samples from the same location. Collection of a duplicate of water sample will be performed by alternately filling sample containers from the same sampling device for each parameter. Collection of duplicate soil samples will be accomplished by splitting soil samples in half and filling sample containers. Groundwater samples for volatile organics analysis from monitoring wells will be the first set of containers filled for the sample set. The duplicate sample may also be designated for the matrix spike/matrix spike duplicate sample for laboratory ASP protocol.

One (1) groundwater and one (1) soil duplicate sample will be collected.

5.6 Field Equipment Procedures and Preventative Maintenance

Prior to the initiation of the RI, preventive maintenance and calibration of equipment will be implemented to assure proper operation of field instruments. Members of the field team will be familiar with the maintenance, calibration, and operation of field equipment. The field equipment will be used according to manufacturer instructions. *The field equipment will be calibrated daily and in accordance with the manufacturer's specifications*

5.7 Equipment Decontamination Procedures

It is anticipated that many of the materials used to assist in obtaining samples will be disposable onetime use materials (e.g., sampling containers, plastic trowels, , rope, latex gloves). However, decontamination of re-useable field equipment will be conducted to ensure that the data collected (i.e., analytical laboratory data and field screening data) is acceptable. When equipment must be re-used (e.g., static water level indicator, macrocore samplers, drilling rods, shovel, etc.), it will be decontaminated by at least one of the following methods:

- Steam clean the equipment; or
- Rough wash in tap water; wash in mixture of tap water and Alconox®-type soap; double rinse with de-ionized or distilled water; and air dry and/or dry with clean paper towel.
- *Large equipment will be decontaminated by steam cleaning portions of the equipment (i.e. tires, tracks, rods, etc.) that come into contact with soil or groundwater. Large equipment will be decontaminated in a decontamination pad constructed of an impermeable barrier capable of holding and collecting all washwater. Decontamination pads constructed*

for field cleaning of sampling and large equipment should meet the following minimum specifications:

- *The pad should be constructed in an area believed to be free of surface contamination.*
- *If possible, the pad should be constructed on a level, paved surface..*
- *Washing should be conducted so splashing does not occur outside of the pad.*
- *Water should be removed from the decontamination pad daily.*
- *The pad should be lined with a water impermeable material with no seams.*
- *At the completion of site activities, the decontamination pad will be deactivated and all washwater shall be handled in accordance with Section 3.3(e) of DER-10*

In order to reduce the potential for cross-contamination of samples collected during this project, reusable field instrumentation, sampling equipment, heavy equipment, drilling equipment, etc. must arrive on-site in clean condition and must also leave the Site in clean condition. Equipment that arrives on-site and is not clean will not be allowed on-site.

Decontamination liquids and disposable equipment and Personal Protective Equipment (PPE) will be containerized, temporarily staged on-site (preferably inside a building). These materials will subsequently be characterized and disposed in accordance with applicable regulations. *All investigation derived waste will also be managed in accordance with Section 3.3(e) of DER-10.*

5.8 Data Usability Summary Report

The DUSR will be in accordance with *Appendix 2B of DER-10*.

6.0 Health and Safety

A site-specific Health and Safety Plan (HASP) for this project is located in Appendix A. This HASP will be maintained on-site and implemented during the field investigation and remedial activities. *All individuals involved in the investigational activities will be OSHA HAZWOPER trained and training certifications will be made available upon request.* A *B&L* representative will act as the on-site health and safety coordinator. The health and safety coordinator will monitor the site conditions in accordance with the provisions of the HASP.

6.1 Community Air Monitoring

During intrusive work that is performed outdoors during the RI, air monitoring will be performed to protect the downwind community. The *outdoor* air monitoring will be conducted in accordance with the generic Community Air Monitoring Plan (CAMP) in Appendix 1A of the NYSDEC May 3, 2010 document *DER-10 Technical Guidance for Site Investigation and Remediation*. A copy of the CAMP is included in the HASP, located in Appendix A. *The following air monitoring will be conducted during indoor intrusive activities:*

- *All individuals not directly involved with the planned work must be absent from the room in which the intrusive activities will occur.*
- *When work areas are within 20 feet of potentially exposed populations, the continuous monitoring locations for VOCs and particulates must reflect the nearest potentially exposed individuals and the location of the ventilation system intake for adjacent occupied rooms.*
- *If total VOC concentrations next to the intake vents exceed 1 ppm, work activities should be suspended until controls are implemented and are*

successful in reducing the total VOC concentrations to 1 ppm or less at the monitoring point.

- *Background readings in the occupied spaces must be taken prior to commencement of the planned work. Any unusual background readings will be discussed with NYSDOH prior to commencement of the work.*

7.0 Project Organization and Responsibility

The organization of the project team and general responsibilities of each of the team members are described below. *B&L is the prime engineering contractor for the Town and Country Brownfield Cleanup Project. B&L will report directly to Town and Country for all services required on the project. With approval from the Town and Country, B&L will serve as direct liaison with the NYSDEC throughout the duration of the project.*

The B&L Project Officer and Program Manager will be Scott D. Nostrand, P.E. Mr. Nostrand has the authority to commit resources and resolve potential project scheduling conflicts. Mr. Nostrand will have primary responsibility for oversight planning and implementation of the Brownfield Cleanup Program.

The Project Manager will be David R. Hanny. The Project Manager will be in charge of all field activities related to the Remedial Investigation program and will be responsible for scheduling and implementing the field activities. Mr. Hanny will have primary contact with project subcontractors designated to perform drilling, surveying, and laboratory analysis as needed and will serve as the primary contact for all project-related communications with Town and Country and NYSDEC. He will also serve as the Quality Assurance Officer for this project, whose responsibilities include: performing periodic field audits during the investigation (particularly sampling activities), interfacing with the analytical laboratory to make requests, or resolve problems, in order to assure that the predetermined project objectives for data quality have been met, and evaluating the data packages and interface with the laboratory and the data validator.

Assisting Mr., Hanny, will be Darik M. Jordan who will oversee site investigation tasks and will provide additional coordination with the client and subcontractors. Mr. Jordan will serve as the Site Investigation Team Leader. Field sampling, monitoring and construction oversight is scheduled to be overseen by Brian J. McGrath.

Subcontractors

Several subcontractors will be retained to implement this RI. The specific subcontractors for this project have not yet been identified, but the types of subcontractors anticipated and their roles are described below:

- Drillers – A drilling subcontractor will be retained to advance test borings and collect soil and groundwater samples for observation, field screening and subsequent analytical laboratory testing using direct-push sampling equipment. A second drilling subcontractor may be retained to install groundwater monitoring wells and/or collect “deeper” soil or rock samples using rotary drilling techniques.
- Analytical Laboratory – A New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP) accredited laboratory will perform the chemical analysis of selected samples collected during the RI. Analyses will be completed in accordance with applicable United States Environmental Protection Agency (USEPA) and NYSDEC protocols.
- Data Validation – A firm approved by the NYSDEC Division of Environmental Remediation will independently validate selected analytical laboratory data generated during this study. This firm will prepare a DUSR in accordance with the requirements described in the NYSDEC May 3, 2010 document *DER-10 Technical Guidance for Site Investigation and Remediation*.
- Survey – A Licensed Surveyor will be retained to measure the elevation and locate (as necessary) selected sample locations.

Individual contractor qualifications will be provided to the NYSDEC upon request and prior to commencing their applicable site activity.

8.0 Schedule

The anticipated schedule to implement the tasks outlined in this Remedial Investigation Work Plan is provided below. The schedule shown is based on the time required following the approval of the Work Plan.

Project Coordination and Subcontractor Selection .... 0-4 weeks
Remedial Investigation Fieldwork (including two groundwater monitoring events) .... 4-28 weeks*
Analytical Laboratory Testing .... 4-32 weeks
Third Party Data Validation.. 32-36 weeks**
Qualitative Human Health Exposure Assessment .... 36-40 weeks
Fish and Wildlife Assessment .... 36-40 weeks
Remedial Investigation Report .... 40-48 weeks

*Schedule does not include additional test borings/monitoring wells that may be required to delineate the extent of impact. A modification to the project schedule may be required if such work is deemed necessary.

**Schedule includes the data validation of the second groundwater monitoring event data. Data validation will be completed on other test samples as the data is received by the analytical laboratory.

9.0 Citizen Participation

A Citizen Participation Plan (CPP) for this project was developed and submitted under separate cover. The CPP describes the public information and involvement program that will be carried out during implementation of the BCP required work at the Site. The primary objective of citizen participation is aimed at increasing public understanding of the investigation (and subsequent remediation) project work process through periodic activities such as public meetings and fact sheet mailings. *The following is a summary of the required citizen participation activities by project phase.*

Project Phase	***Document to Repository***	***Notice***	***Fact Sheet***	***Comment Period***	***Other***
Application Deemed Complete	*Yes*	*Yes*	*Not required*	*30 day*	*Create BSCL ENB Notice and Newspaper Notice*
If Application Includes RI Work Plan or RI Report	*Yes*	*Yes*	*Not required*	*30 day*	*Same as above – incorporate RI*
Before Approval of RI Work Plan	*Yes*	*Yes*	*Not required*	*30 day*	*Need Approved CP Plan*
Before Approval of RI Report	*Yes*	*Yes*	*Not required*	*Not required*	*FS describes findings of RI*
Before Approval of RI Report, if RI calls for No Action or No Further Action	*Yes*	*Yes*	*Not required*	*45 day*	*FS must describe basis for No Action*
Before Approval of Remedial Work Plan	*Yes*	*Yes*	*Not required*	*45 day*	*Public meeting if requested*
Before Construction Starts	*Not required*	*Yes*	*Not required*	*Not required*	
Before Approval of Remedial Action Report	*Yes*	*Yes*	*Not required*	*Not required*	
Issuance of Certificate of Completion if IC/EC part of remedy	*Not required*	*Yes*	*Not required*	*Not required*	*Within 10 days of issuance*

10.0 References

New York State Department of Environmental Conservation (NYSDEC) Draft *Brownfield Cleanup Program Guide*, May 2004.

NYSDEC *DER-10 Technical Guidance for Site Investigation and Remediation* May 3, 2010.

NYSDEC Division of Water Technical and Operational Guidance Series 1.1.1 document titled *Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations* (TOGS 1.1.1) dated June 1998.

NYSDEC 6 NYCRR Subpart 375 Environmental Remediation Program, December 2006.

NYSDEC Draft *Brownfield Cleanup Program Citizen Participation Plan for Town and Country Cleaners, 2308 and 2310 Monroe Avenue, Town of Brighton, Monroe County, New York* dated December 2009.

EDR NEPA Check 2308 Monroe Avenue, Rochester, NY 14618 dated August 19, 2009.

Final Site Characterization Report

Town and Country Cleaners Site

Site No.: 8-28-149

Town of Brighton, Monroe County, NY

April 2009

Prepared for: New York State Department of Environmental Conservation
625 Broadway
Albany, NY

Prepared by: Camp Dresser, and McKee
15 Cornell Road
Latham, New York

Phase II Environmental Site Assessment

2290, 2294, 2298 Monroe Avenue
Town of Brighton, New York

December 2006

Prepared for: The Lois Gibbons Trust – c/o Mr. Roger Hilfiker
80 West Bloomfield Road
Pittsford, New York 14534

Prepared by: GeoQuest Environmental, Inc.
1134 Titus Avenue
Rochester, New York 14623

Soil Removal IRM Delineation:

Storm Water Catch Basin
Work Plan
Brownfield Cleanup Program

Town and Country Cleaners

2308 and 2310 Monroe Avenue
Brighton, New York

BCP Site #C828149

April 2010 (Revised July 2, 2010)

Prepared by: Day Environmental, Inc.

Data Package

Delineation Study: Storm Water Catch Basin Area
Brownfield Cleanup Program

Town and Country Cleaners
2308 and 2310 Monroe Avenue
Brighton, New York

BCP Site #C828149

December 2010

Prepared by: Day Environmental, Inc.

11.0 Acronyms

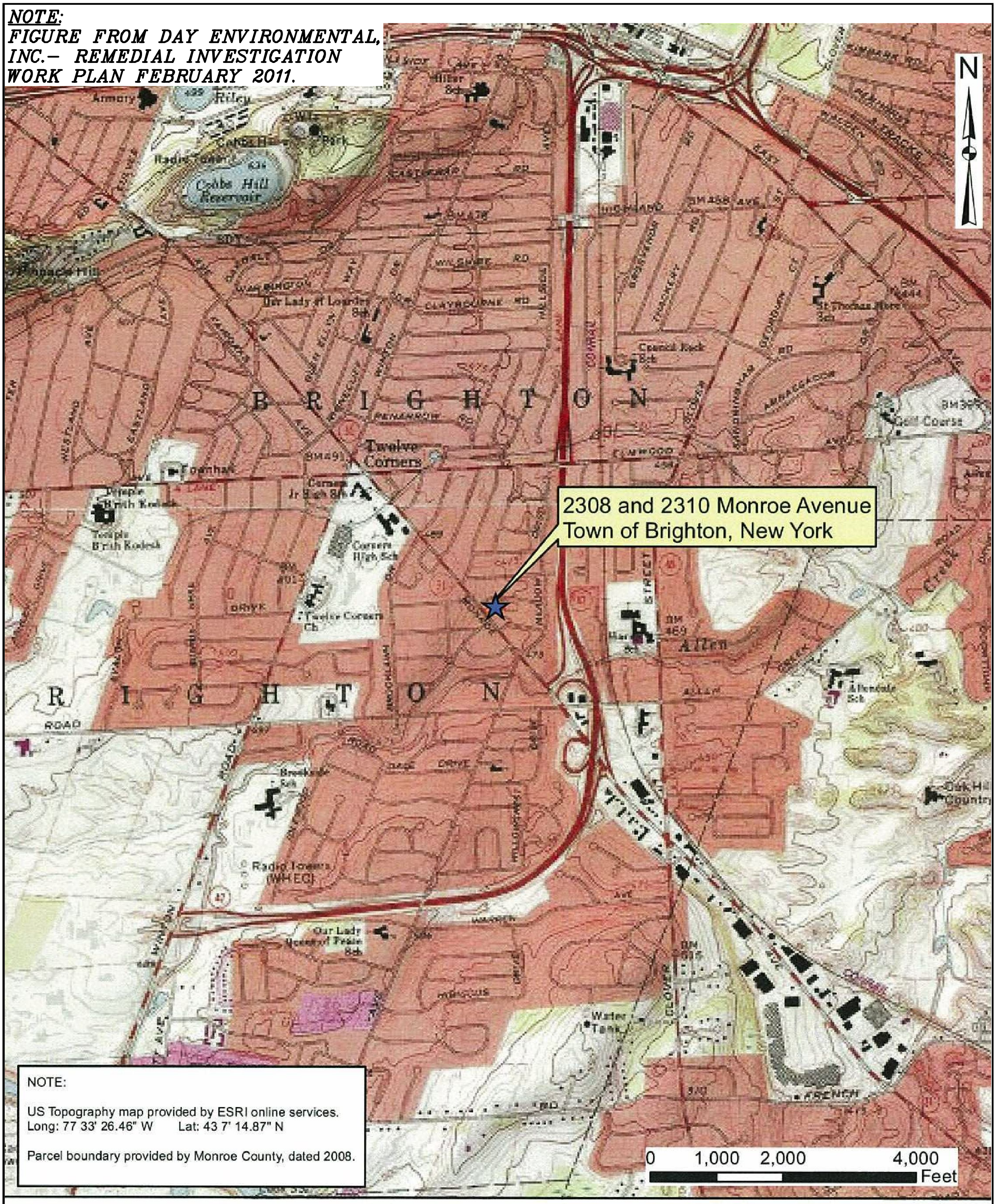
ASP	Analytical Services Protocol
ASTM	American Society for Testing and Materials
B&L	*Barton & Loguidice, P.C.*
BCP	Brownfield Cleanup Program
bgs	below ground surface
CAMP	Community Air Monitoring Program
CDM	Camp, Dresser, and McKee
COCs	Contaminants of Concern
CPP	Citizen Participation Plan
DAY	Day Environmental, Inc.
DNAPL	Dense Non-Aqueous Phase Liquid
DUSR	Data Usability Summary Report
ELAP	Environmental Laboratory Approval Program
GeoQuest	GeoQuest Environmental Inc.
HASP	Health And Safety Plan
IRM	Interim Remedial Measure
LLC	Limited Liability Corporation
MCDOH	Monroe County Department of Health
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NAD	North American Datum
NAVD	North American Vertical Datum
NTU	Nephelometric Turbidity Unit
NYCRR	New York Code of Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PCB	Polychlorinated Bi-phenol
PCE	Tetrachloroethene
ESA	Environmental Site Assessment
PID	Photoionization Detector
PPE	Personal Protective Equipment
ppb	parts per billion
PVC	Polyvinyl Chloride
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RI	Remedial Investigation
SCO	Soil Cleanup Objective
SCG	Standard, Criteria and Guidance
SOP	Standard Operating Procedure
STARS	Spill technology and remediation Series
SVOC	Semi-Volatile Organic Compound
TAL	Target Analyte List

TCE	Trichloroethene
TCL	Target Compound List
TIC	Tentatively Identified Compound
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

Figure 1

Project Locus Map

NOTE:
FIGURE FROM DAY ENVIRONMENTAL, INC.– REMEDIAL INVESTIGATION WORK PLAN FEBRUARY 2011.



NOTE:

US Topography map provided by ESRI online services.
Long: 77 33' 26.46" W Lat: 43 7' 14.87" N

Parcel boundary provided by Monroe County, dated 2008.

Barton & Loguidice, P.C.

Date	Scale
SEPTEMBER, 2011	AS SHOWN

TOWN AND COUNTRY
2308 AND 2310 MONROE AVENUE – BCP NO. C828149
BROWNFIELD CLEANUP PROGRAM REMEDIAL INVESTIGATION WORK PLAN

PROJECT LOCUS MAP

TOWN OF BRIGHTON MONROE COUNTY, NEW YORK

Figure Number
1

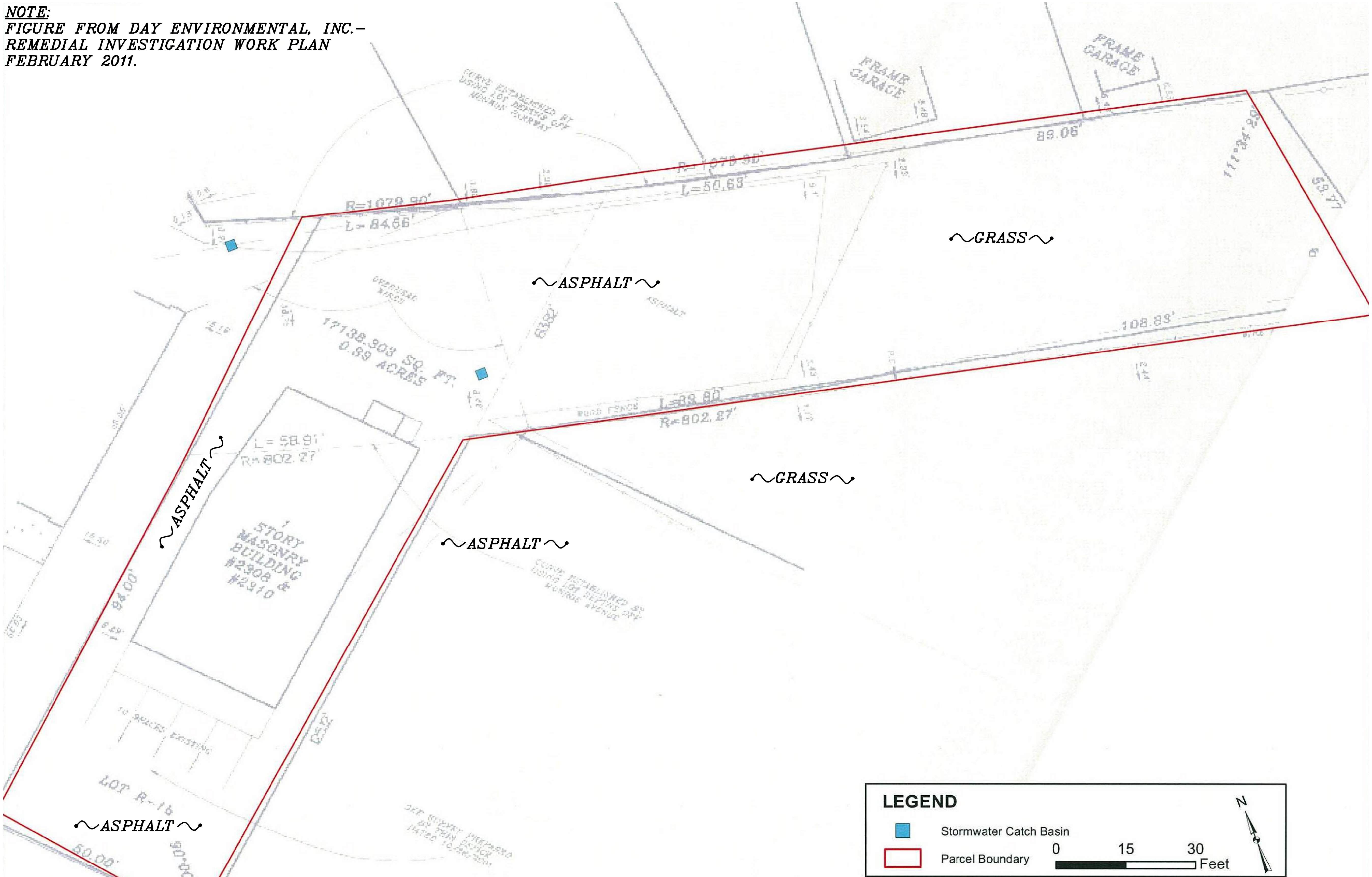
Project Number
1437.001

Plotted: Sep 15, 2011 – 1:40PM SYR By: jgs
I:\Shared\1400\1437001\1437001_FIG01.dwg

Figure 2

Site Plan

NOTE:
FIGURE FROM DAY ENVIRONMENTAL, INC.–
REMEDIAL INVESTIGATION WORK PLAN
FEBRUARY 2011.



NOTE:

Site plan overlay obtained from a figure prepared by O'neill - Rodak Land Surveying Associates, P.C., dated January 2, 2002.

Parcel boundary provided by Monroe County, dated 2008.

TOWN AND COUNTRY
2308 AND 2310 MONROE AVENUE– BCP NO. C828149
BROWNFIELD CLEANUP PROGRAM REMEDIAL INVESTIGATION WORK PLAN

SITE PLAN

TOWN OF BRIGHTON
MONROE COUNTY, NEW YORK

Barton & Loguidice, P.C.

Date	SEPTEMBER, 2011
Scale	AS SHOWN
Figure Number	2
Project Number	1437.001

Plotted: Sep 15, 2011 – 1:41PM SYR By: jgs
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Figure 3

Land Use within ½-mile of 2308 and 2310 Monroe Avenue

Legend

Half Mile Radius from Site

Land Use Description by Parcel

- Residential
- Commercial
- Religious; School
- Vacant Land

0 250 500 1,000 Feet

NOTE:

Site Parcel boundary provided by Monroe County, dated 2008.

Parcel boundaries and Land Use Descripton provided by Monroe County, dated 2008.

NOTE:
FIGURE FROM DAY ENVIRONMENTAL, INC.– REMEDIAL INVESTIGATION WORK PLAN FEBRUARY 2011.

TOWN AND COUNTRY
2308 AND 2310 MONROE AVENUE – BCP NO. C828149
BROWNFIELD CLEANUP PROGRAM REMEDIAL INVESTIGATION WORK PLAN

LAND USE WITHIN 1/2 MILE OF 2308 AND 2310 MONROE AVENUE

TOWN OF BRIGHTON MONROE COUNTY, NEW YORK

Barton & Loguidice, P.C.

Date	SEPTEMBER, 2011
Scale	AS SHOWN
Figure Number	3
Project Number	1437.001

Plotted: Sep 15, 2011 – 1:42PM SYR By: jgs
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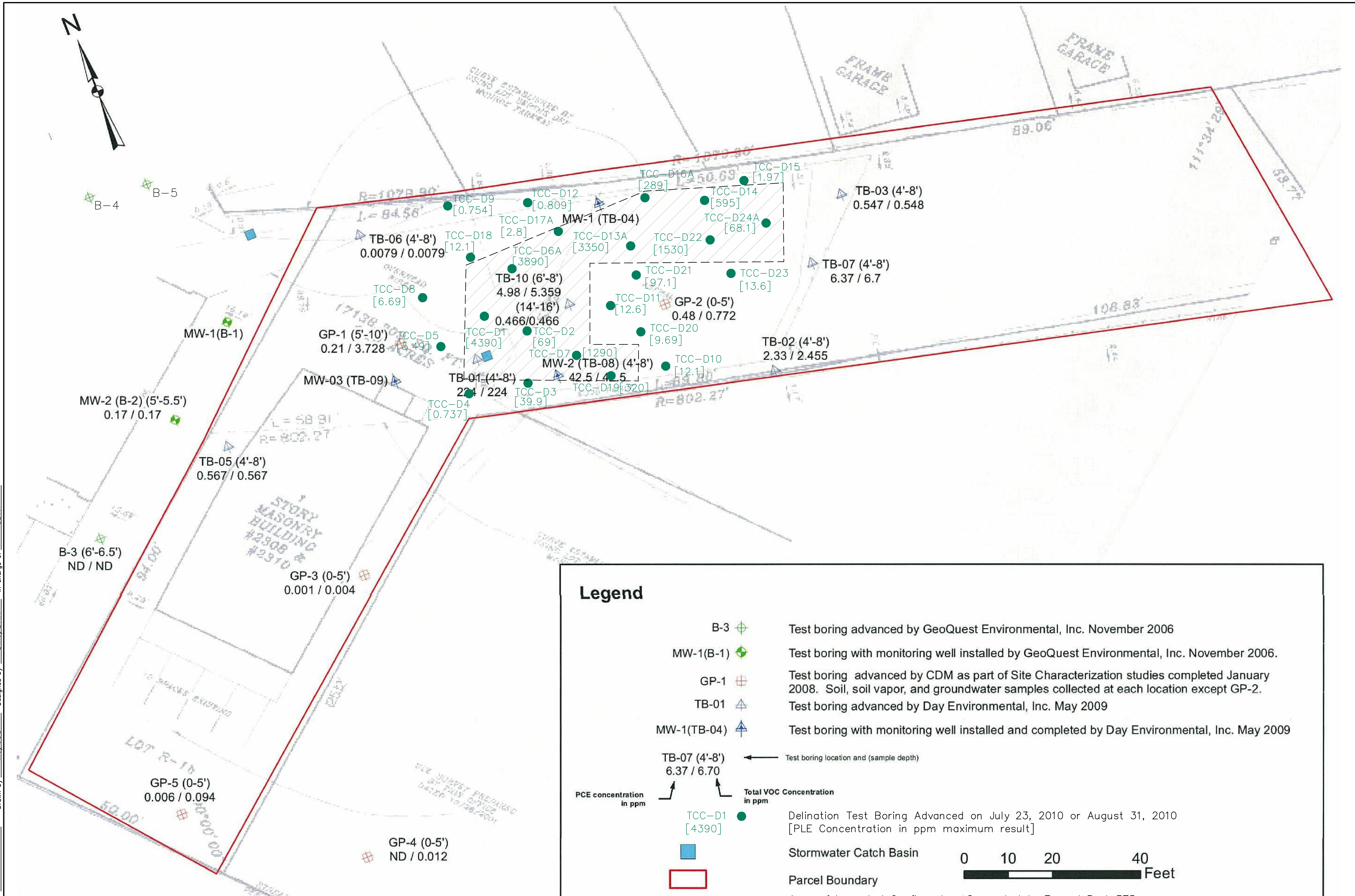
Figure 4

PCE and Total VOC Concentration Detected in Soil Samples



NOTE:
FIGURE FROM DAY ENVIRONMENTAL, INC.– REMEDIAL INVESTIGATION WORK PLAN FEBRUARY 2011.

NO ALTERATION PERMITTED HEREON EXCEPT AS PROVIDED UNDER SECTION 7209 SUBDIVISION 2 OF THE NEW YORK STATE EDUCATION LAW.

COMPLETED CONSTRUCTION

Significant Construction Changes Are Shown

By ______ Date ______
Ck'd ______ Date ______

REVISIONS

TOWN AND COUNTRY
2308 AND 2310 MONROE AVENUE – BCP NO. C828149
BROWNFIELD CLEANUP PROGRAM REMEDIAL INVESTIGATION WORK PLAN

PCE AND TOTAL VOC CONCENTRATIONS DETECTED IN SOIL SAMPLES

TOWN OF BRIGHTON MONROE COUNTY, NEW YORK

Barton & Loguidice, P.C.

Date: SEPTEMBER, 2011
Scale: AS SHOWN
Sheet Number: 4
File Number: 1437.001

Plotted: Sep 16, 2011 – 2:12PM SYR By: mj
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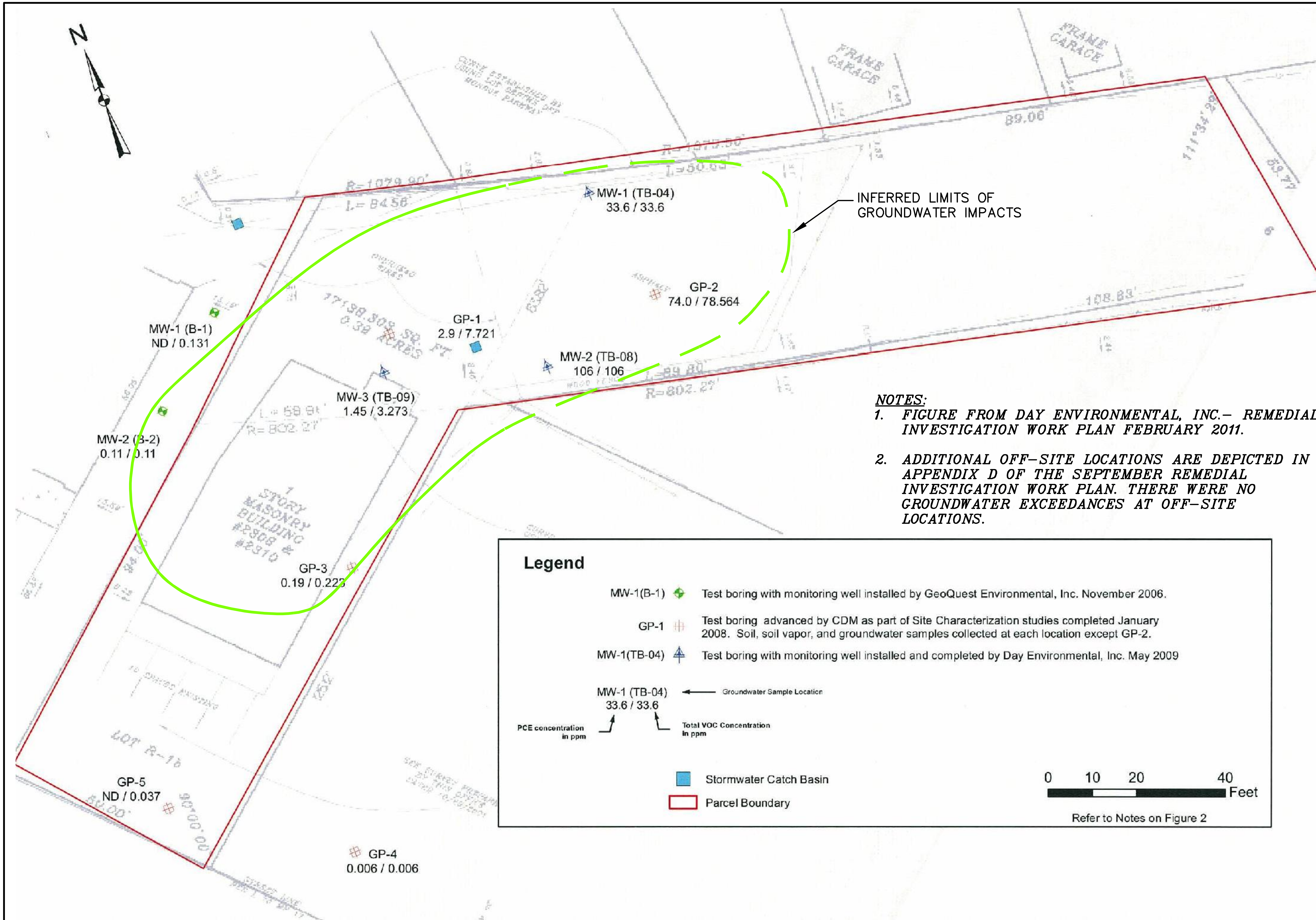
Checked by ______ Drawn by ______ MJ/JGS Designed by ______ DMJ/DRH In charge of ______ SDN

Figure 5

PCE and Total VOC Concentration Detected in Groundwater Samples



NOTES:

1. *FIGURE FROM DAY ENVIRONMENTAL, INC.– REMEDIAL INVESTIGATION WORK PLAN FEBRUARY 2011.*
2. *ADDITIONAL OFF–SITE LOCATIONS ARE DEPICTED IN APPENDIX D OF THE SEPTEMBER REMEDIAL INVESTIGATION WORK PLAN. THERE WERE NO GROUNDWATER EXCEEDANCES AT OFF–SITE LOCATIONS.*

TOWN AND COUNTRY
2308 AND 2310 MONROE AVENUE – BCP NO. C828149
BROWNFIELD CLEANUP PROGRAM REMEDIAL INVESTIGATION WORK PLAN

PCE AND TOTAL VOC CONCENTRATIONS DETECTED IN GROUNDWATER SAMPLES

TOWN OF BRIGHTON MONROE COUNTY, NEW YORK

Barton & Loguidice, P.C.

Date: SEPTEMBER, 2011

Scale: AS SHOWN

Figure Number: 5

Project Number: 1437.001

Plotted: Sep 16, 2011 – 2:29PM SYR By: mj
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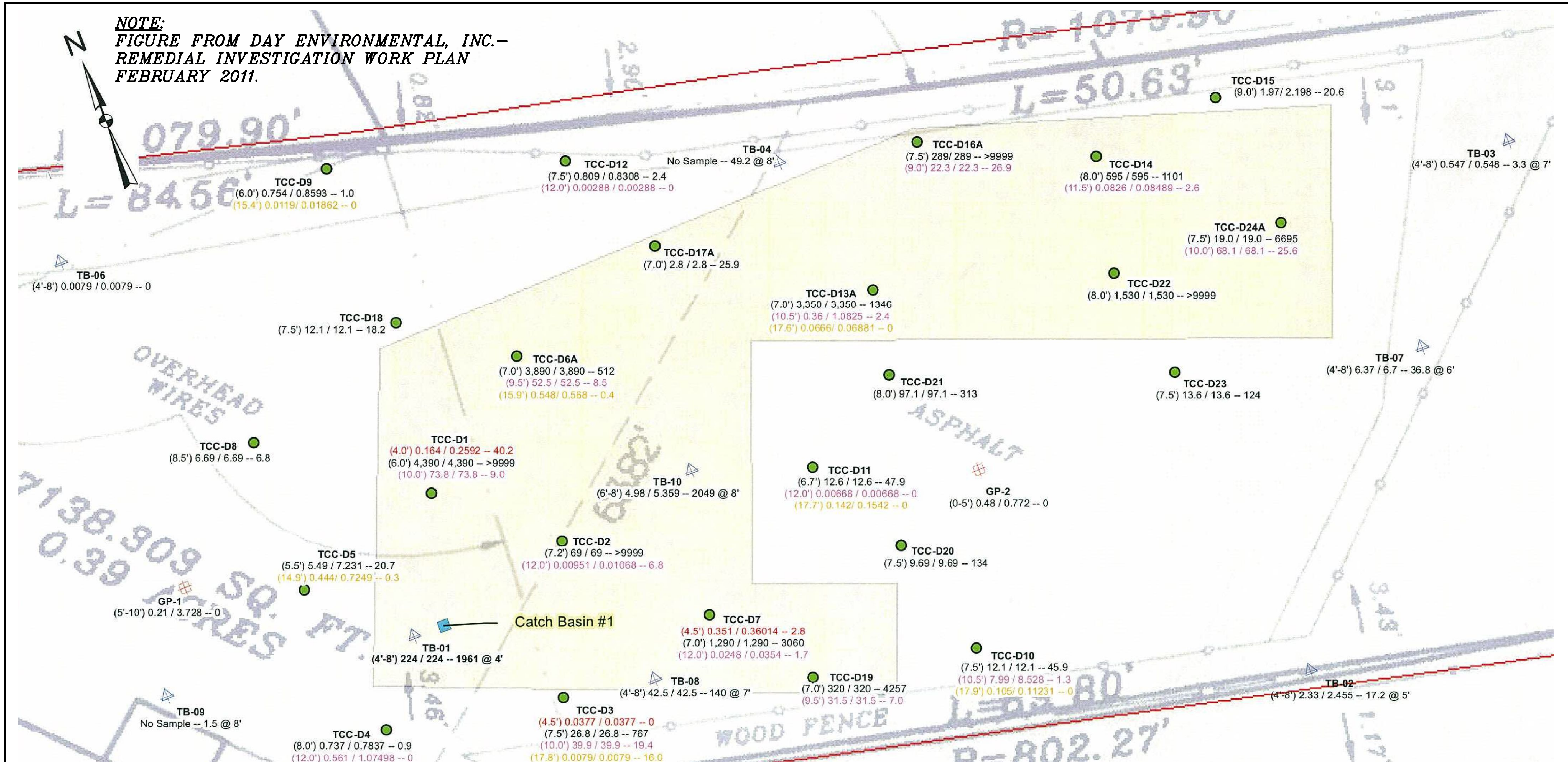
Figure 6

Delineation Study Results



Legend

TCC-D1 ● Delineation test boring advanced on July 19th, 2010, July 23, 2010, or August 31, 2010

GP-1 ⊕ Test boring advanced by CDM as part of Site Characterization studies completed January 2008

TB-01 △ Test boring advanced by Day Environmental, Inc. May 2009

Test boring location (sample depth) → TCC-D3
(4.5') 0.0377 / 0.0377 -- 2.8 ← Sample collected from above the impacted zone (in red)
(7.5') 26.8 / 26.8 -- 767 ← Sample collected from the impacted zone (in black)
(10.0') 39.9 / 39.9 -- 19.4 ← Sample collected from the confining layer (in purple)
(17.8') 0.0079/ 0.0079 -- 16.0 ← Sample collected from below the confining layer (in gold)

Maximum PID reading measured in air space above test sample

PCE concentration in ppm

Total VOC Concentration in ppm

Area of impact confirmed or suspected to exceed Part 375 Restricted Commercial Use Soil Cleanup Objectives

Parcel Boundary

0 4 8 16 Feet

NOTE:

Test borings and Monitoring Wells were located using a Trimble XH GPS Unit with sub-foot accuracy or by reference to existing Site features. In addition the data was differentially corrected to increase accuracy. Locations are to be considered approximate.

Site plan overlay obtained from a figure prepared by O'neill - Rodak Land Surveying Associates, P.C., dated January 2, 2002.

Parcel boundary provided by Monroe County, dated 2008.

TOWN AND COUNTRY
2308 AND 2310 MONROE AVENUE – BCP NO. C828149
BROWNFIELD CLEANUP PROGRAM REMEDIAL INVESTIGATION WORK PLAN
DELINEATION STUDY RESULTS

TOWN OF BRIGHTON MONROE COUNTY, NEW YORK

Barton & Loguidice, P.C.

Date	SEPTEMBER, 2011
Scale	AS SHOWN
Figure Number	6
Project Number	1437.001

Plotted: Sep 15, 2011 – 2:38PM SYR By: jgs
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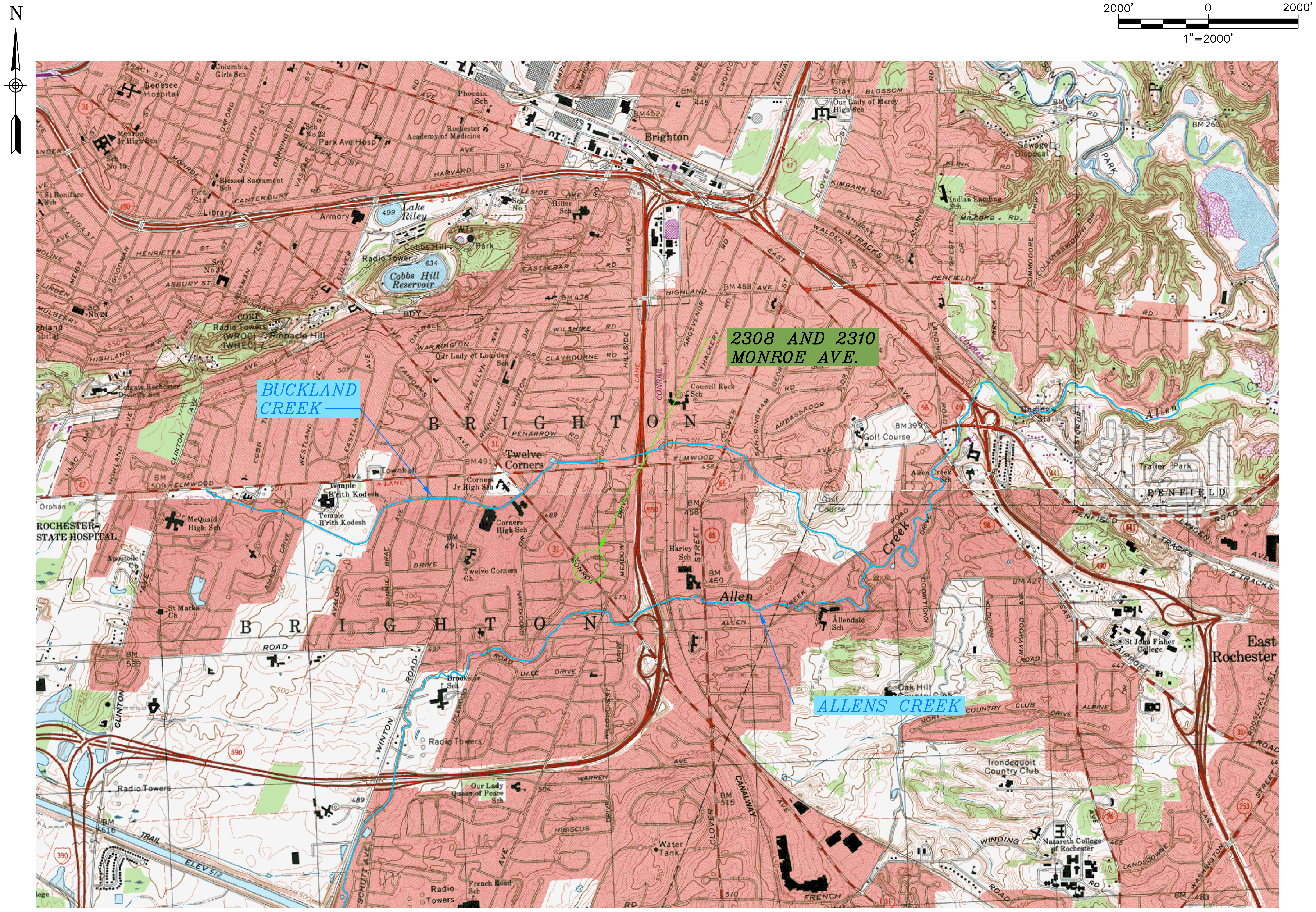
Figure 7

Creek Locations



TOWN AND COUNTRY
2308 AND 2310 MONROE AVENUE– BCP NO. C828149
BROWNFIELD CLEANUP PROGRAM REMEDIAL INVESTIGATION WORK PLAN

CREEK LOCATIONS

TOWN OF BRIGHTON
MONROE COUNTY, NEW YORK

Barton & Loguidice, P.C.

Date	SEPTEMBER, 2011
Scale	AS SHOWN
Figure Number	7
Project Number	1437.001

Plotted: Sep 19, 2011 – 8:07AM SYR By: mj
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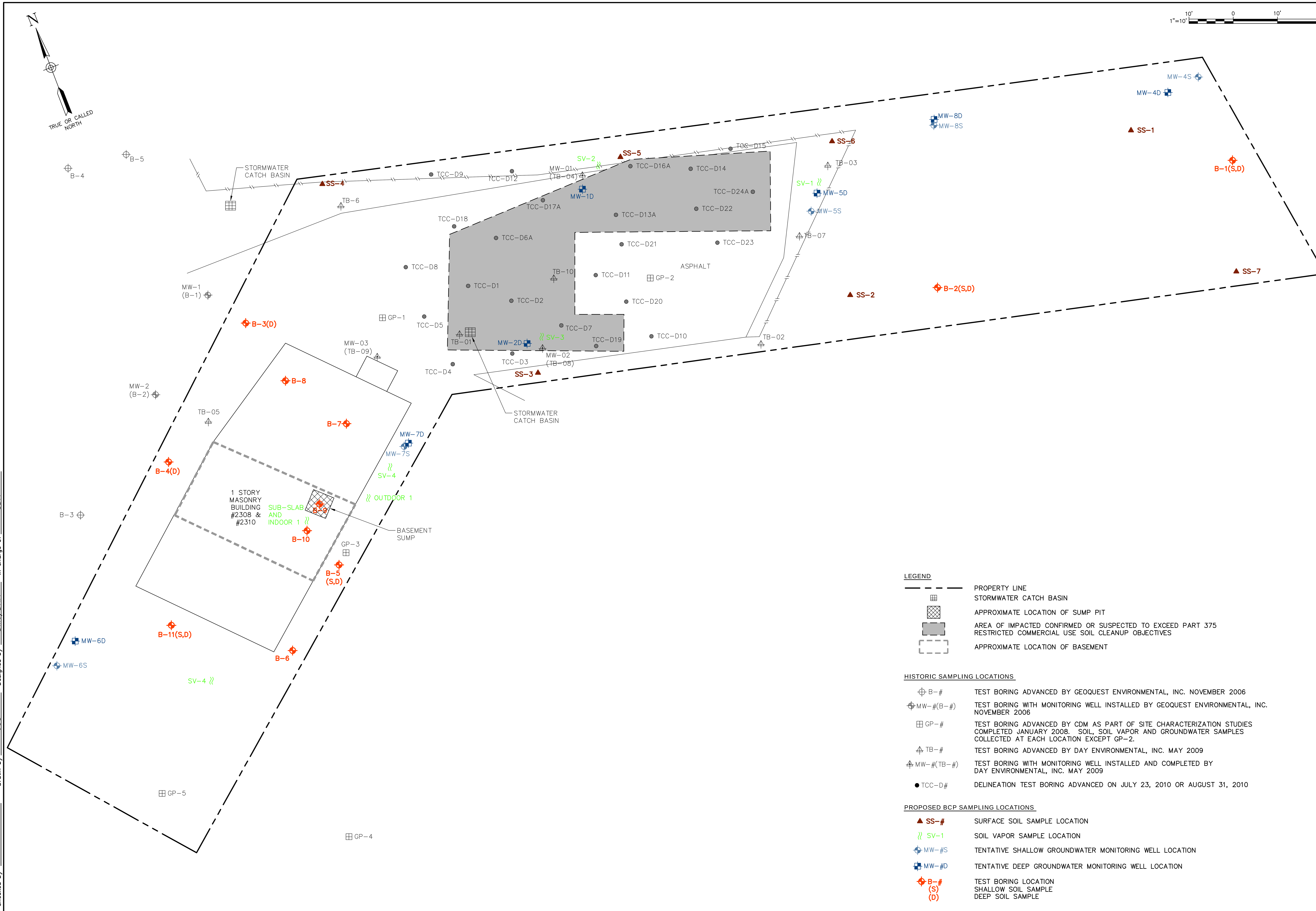
Sheet 1

Proposed Subsurface, Surface, and Vapor Test Locations



LEGEND

(dashed line)	PROPERTY LINE
(symbol)	STORMWATER CATCH BASIN
(symbol)	APPROXIMATE LOCATION OF SUMP PIT
(shaded area)	AREA OF IMPACTED CONFIRMED OR SUSPECTED TO EXCEED PART 375 RESTRICTED COMMERCIAL USE SOIL CLEANUP OBJECTIVES
(dashed box)	APPROXIMATE LOCATION OF BASEMENT

HISTORIC SAMPLING LOCATIONS

B-#	TEST BORING ADVANCED BY GEOQUEST ENVIRONMENTAL, INC. NOVEMBER 2006
MW-#(B-#)	TEST BORING WITH MONITORING WELL INSTALLED BY GEOQUEST ENVIRONMENTAL, INC. NOVEMBER 2006
GP-#	TEST BORING ADVANCED BY CDM AS PART OF SITE CHARACTERIZATION STUDIES COMPLETED JANUARY 2008. SOIL, SOIL VAPOR AND GROUNDWATER SAMPLES COLLECTED AT EACH LOCATION EXCEPT GP-2.
TB-#	TEST BORING ADVANCED BY DAY ENVIRONMENTAL, INC. MAY 2009
MW-#(TB-#)	TEST BORING WITH MONITORING WELL INSTALLED AND COMPLETED BY DAY ENVIRONMENTAL, INC. MAY 2009
TCC-D#	DELINEATION TEST BORING ADVANCED ON JULY 23, 2010 OR AUGUST 31, 2010

PROPOSED BCP SAMPLING LOCATIONS

SS-#	SURFACE SOIL SAMPLE LOCATION
SV-1	SOIL VAPOR SAMPLE LOCATION
MW-#S	TENTATIVE SHALLOW GROUNDWATER MONITORING WELL LOCATION
MW-#D	TENTATIVE DEEP GROUNDWATER MONITORING WELL LOCATION
B-# (S) (D)	TEST BORING LOCATION SHALLOW SOIL SAMPLE DEEP SOIL SAMPLE

COMPLETED CONSTRUCTION

Significant Construction Changes Are Shown

By ______ Date ______
Ck'd ______ Date ______

REVISIONS

TOWN AND COUNTRY
2308 AND 2310 MONROE AVENUE – BCP NO. C828149
BROWNFIELD CLEANUP PROGRAM REMEDIAL INVESTIGATION WORK PLAN

PROPOSED SUBSURFACE, SURFACE AND VAPOR TEST LOCATIONS

TOWN OF BRIGHTON MONROE COUNTY, NEW YORK

Barton & Loguidice, P.C.

Date SEPTEMBER, 2011
Scale 1" = 10'
Sheet Number SHEET 1
File Number 1437.001

Plotted: Sep 19, 2011 - 8:04AM SYR By: mj
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Checked by ______ Drawn by JGS Designed by DMJ/DRH In charge of SDN

Appendix A

Site Specific Health and Safety Plan

Town and Country Cleaners
2308 and 2310 Monroe Avenue
Brighton, New York
Site #C828149

Brownfield Cleanup Program

Remedial Investigation Work Plan

Appendix A

Site Specific Health & Safety Plan

***September* 2011**

Town and Country Cleaners
2308 and 2310 Monroe Avenue
Brighton, New York
Site #C828149

Brownfield Cleanup Program

Site Specific Health & Safety Plan

September 2011

Prepared For:

Town and County Redevelopment LLC
259 LaSalle Drive
Webster, New York

Prepared By:

Barton & Loguidice, P.C.
Engineers • Environmental Scientists • Planners • Landscape Architects
290 Elwood Davis Road
Box 3107
Syracuse, New York 13220

Prepared From:

Remedial Investigation Work Plan (February 2011)
Day Environmental, Inc.
40 Commercial Street
Rochester, New York 14614

Table of Contents

Table of Contents – Continued

1.0 Introduction

Barton & Loguidice, P.C. (B&L) has prepared this Site Specific Health and Safety Plan (HASP) from documents previously prepared by Day Environmental, Inc. (DAY) for work tasks associated with the Brownfield Cleanup Program (BCP) investigation being conducted at the Town and Country facility located at 2308 Monroe Avenue, Rochester, NY (Site).. Text in a different font (Times New Roman) and italics has been updated by B&L for this current version (September 2011). All remaining text is the work product of DAY and is referenced from their February 2011 Remedial Investigation Work Plan. The laboratory analytical results from previous soil and groundwater samples indicate the presence of VOCs, at values greater than NYSDEC standards; these are the *known* contaminants of concern (COCs) on the Site.

This plan outlines the health and safety procedures, personal protective equipment (PPE), and field monitoring equipment required for monitoring the performance of health and safety requirements during proposed RI activities. Adherence to the details outlined in the HASP is intended to minimize the potential for injury or exposure to contaminants of concern to *B&L* employees conducting work on this Site.

1.1 Health and Safety Plan Overview

This HASP has been prepared for *B&L* personnel for activities conducted during the proposed RI project work. The procedures and personal protective equipment described in this plan were developed after reviewing the Site environmental data from previous investigations conducted by DAY *and others*. DAY *and B&L have* evaluated the potential hazards that may be encountered during the tasks and project work detailed in the RI Work Plan. The purpose of this HASP is to:

- Establish personnel safety/protection standards that meet or exceed the Occupational Safety and Health Administration (OSHA) Regulations;
- Define responsibilities of different organizations and personnel;
- Establish safe operating procedures relative to the conditions encountered at the project work area;
- Define the project work area;
- Provide for anticipated contingencies that may arise during the course of investigation work; and
- Modify the HASP in response to new environmental data or conditions encountered during implementation of the investigation.

2.0 Site Access & Personnel

B&L personnel working at the Site must follow this HASP and other appropriate written safe access procedures maintained by *B&L*.

2.1 Site Access

Site access will be given to *B&L* personnel, *B&L's* sub-contractors, and appropriate regulatory agencies involved with the project. *B&L* and *B&L's* sub-contractors are responsible for providing a safe work area and securing the project work area during work hours and during nonwork hours.

Site Specific Health & Safety Personnel

B&L is responsible for the health and safety of *B&L* personnel. This responsibility includes:

- Provide overall health and safety oversight for the project;
- Prepare and/or review potential changes to this HASP and edit a task-specific addendum to the HASP, if required; and
- Monitor health and safety performance.

One person may be designated as having the responsibilities of the key personnel listed below for this project. A description of the responsibilities of the key personnel involved in the HASP program is presented below.

Project Manager

The Project Manager (PM) will assist with management of on-Site work tasks. The PM is responsible for:

- Managing the planned work requirements so that work performed adheres to the outlined health and safety procedures;
- Providing guidance so that personnel follow health and safety procedures;
- Reviewing daily work activities and field conditions encountered that may result in potential injury or exposure to contaminants of concerns (COCs) as identified during project work; and
- Providing notification of unsafe conditions noted during fieldwork to Site owner and subcontractors.

Site Health and Safety Officer

The Site Health and Safety Officer's (SHSO) responsibilities will be implemented by the on-Site representative who will be present during the majority of the field phase of the project. The SHSO will be responsible for the following tasks:

- Implementing the HASP;
- Maintaining a daily record (if relevant to health and safety at the project Site) of personnel activities, monitoring activities and results, exposure incidents, and personnel protection equipment usage;

- Monitoring anticipated hazards and propose modifications (if necessary) for the level of personnel protection and/or work procedures;
- Advising the PM on work activities completed and proposed work tasks or conditions which may impact health and safety requirements;
- Having copies of this HASP available on-Site for review; and
- Recording daily weather conditions (e.g., temperature, wind speed/direction, etc.) if these conditions are relevant to health and safety at the project Site.

The SHSO has the authority to suspend work activities if it is felt that the Site or weather conditions may adversely affect personnel health and safety. The SHSO will notify the PM, subcontractors, and Site owner of such actions.

On-Site Workers

B&L project personnel involved in the proposed investigation activities are responsible for:

- Reading, understanding, and complying with the requirements of the HASP;
- Taking reasonable precautions to prevent incidents and to report accidents;
- Implementing procedures specified in this HASP, and report deviations to the SHSO; and
- Performing the tasks for which they are trained.

For this project, hard hats, work boots, safety glass, and gloves (Level D) are required for field tasks.

Copies of 40-hour HAZWOPER/8-hour refresher certificates are provided in Appendix A.

Visitors

Non-Site workers and Site visitors are responsible for:

- Reading, understanding, and complying with the requirements of the HASP;
- Having the required personnel protecting equipment (e.g., hard hats, safety glass, and work boots); and
- Taking reasonable precautions to prevent incidents that may result in injury.

3.0 Health & Safety Risk Analyses

3.1 Site Overview

The Site is located at:

2308 and 2310 Monroe Avenue
Brighton, New York 14618

A sub-contractor will install the test borings, groundwater monitoring wells, and *soil vapor points* proposed in the RI Work Plan. *B&L* will supervise these subsurface explorations and select soil and groundwater samples for laboratory testing.

3.2 Hazard Analyses

Physical Hazards

Possible physical hazards associated with the proposed work include, but are not limited to the following:

- Hazards associated with injury from vehicles or drilling equipment;
- Hazards associated with excavation activities (i.e., slip or trip into the excavation);
- Underground utilities injury from damage to these utilities (i.e., electric shock, fire, and explosion); and Heat and/or cold stress
- *Slip, trip, and fall hazards (Uneven Terrain)*
- *Noise from heavy equipment - Engineering controls and personal protective equipment will be used to protect employees' hearing.*

- *Electrical Hazards - overhead power lines, electrical wires and cables, site electrical equipment, and lightning also pose a potential hazard to site workers. Site personnel should constantly look out for potential safety hazards and should immediately inform the SHSO of any new hazards*
- *Biological Hazards (insects, poison ivy, etc.) - PPE can reduce the potential for exposure. The SHSO can assist in determining the correct PPE for the hazard present.*
- *Traffic – Portions of the site work will be conducted during normal business hours with pedestrian and customer traffic. The SHSO will be responsible for establishing work zones associated with each activity.*

Chemical Hazards

The chemicals listed below in Table 3.2A are VOCs that were detected at the Site in environmental samples at concentrations above NYSDEC Subpart 375-6 Unrestricted Remedial Soil Clean-up Objectives and NYSDEC TOGS 1.1.1 groundwater standards or guidance values. This list also presents the permissible exposure limits (PELs) and levels that are considered an immediate danger to life or health (IDLH), if such values are available. A summary of the United States Center for Disease Control (CDC) chemical descriptions and hazards associated with overexposure to these VOCs are also presented below. A National Institute for Occupational Safety and Health (NIOSH) Chemical Hazard Data Sheet for each compound is included in Appendix B.

Table 3.2A - Assessment of Chemicals of Potential Concern

Chemical Name	PEL/TLV	Other Pertinent Limits (Specify)	Warning Properties – Odor Threshold	Potential Exposure Pathways	Acute Health Effects	Chronic Health Effects
Decontamination Materials:						
Isopropyl Alcohol (for decontamination, if necessary)	*400 ppm/400 ppm*	*STEL = 500 ppm IDLH = 2000 ppm*	*Colorless liquid with the odor of rubbing alcohol*	*Inhalation. Absorption, Ingestion, Contact*	*Eye, skin & respiratory irritation; headache, drowsiness, dizziness, dry cracking skin*	*Dermatitis*
Methanol (for decontamination, if necessary)	*200 ppm/200 ppm*	*IDLH = 6000*	*Colorless liquid with a pungent odor – 141 ppm*	*Inhalation. Absorption, Ingestion, Contact*	*Irritation of eyes, skin, respiratory system, headache, drowsiness, dizziness, vertigo, light-headedness, nausea, vomiting, visual disturbances*	*Optic nerve damage, dermatitis, damage to respiratory system and GI tract*
VOCs:						
Acetone	*1000 ppm/500ppm*	*REL = 250 ppm IDLH = 2500 ppm*	*Colorless, volatile, extremely flammable liquid. Nail polish odor*	*Inhalation. Absorption, Ingestion, Contact*	*Ingestion can cause unconsciousness and damage to the mouth. Skin irritant.*	*Kidney, liver and nerve damage.*
Benzene	*1 ppm/ 0.5 ppm*	*STEL=5 ppm IDLH=500 ppm*	*Colorless to light yellow liquid with an aromatic odor – 8.65 ppm*	*Inhalation. Absorption, Ingestion, Contact*	*Eye, skin, nose & respiratory irritation; nausea, headache, staggered gait, fatigue, anorexia, weakness, exhaustion*	*Carcinogen, dermatitis, bone marrow depression, damage to the eyes, respiratory system. CNS*
1,1-dichloroethene	*None listed/5 ppm*	*--*	*Colorless liquid with a sweet smell.*	*Inhalation. Absorption, Ingestion, Contact*	*Dizziness, headache, trouble breathing, fainting.*	*Central nervous system, liver, lungs*
Cis 1,2-dichloroethene	*200 ppm/200 ppm*	*REL = 200 ppm IDLH = 1000 ppm*	*Colorless liquid with a sharp, harsh odor*	*Inhalation. Absorption, Ingestion, Contact*	*Nausea, drowsiness, unconsciousness*	*Central nervous system, liver, lungs*
Ethylbenzene	*100 ppm/100 ppm*	*STEL = 125 ppm IDLH = 800 ppm*	*Colorless liquid with an aromatic odor*	*Inhalation. Absorption, Ingestion, Contact*	*Eye, skin & respiratory irritation; CNS effects; headache*	*Dermatitis; CNS effects;*

Table 3.2A - Assessment of Chemicals of Potential Concern

Chemical Name	PEL/TLV	Other Pertinent Limits (Specify)	Warning Properties – Odor Threshold	Potential Exposure Pathways	Acute Health Effects	Chronic Health Effects
Methyl ethyl ketone (MEK, 2-butanone)	200 ppm/200 ppm	IDLH = 3000 ppm	Colorless liquid with a moderately sharp, fragrant, mint-or acetone-like odor	Inhalation. Absorption, Ingestion, Contact	Eye, skin & respiratory irritation; depression; CNS effects	Eyes; respiratory system; dermatitis; CNS; liver and kidneys
Trichloroethene	25 ppm/25 ppm	IDLH=1000 ppm	Colorless liquid with a sweet odor	Inhalation. Absorption, Ingestion, Contact	Irritation of eyes, nose, throat; nausea; headache, lung irritation, dizziness, poor coordination, difficulty concentrating	Liver and kidneydamage. Target organs: eyes, skin, respiratory system, liver, kidneys, CNS.
Tetrachloroethene	100 ppm/25 ppm	C=200 ppm STEL (5 min)=300 ppm IDLH=100 ppm	Colorless to pale yellow liquid with a pungent, chloroform-like odor	Inhalation. Absorption, Ingestion, Contact	Irritation of eyes, nose, throat; nausea; flushing of face and neck; vertigo, dizziness, inchohence; headache, somnolence; skin erythema	Liver damage. Target organs: eyes, skin, respiratory system, liver, kidneys, CNS.
Toluene	200 ppm/ 50 ppm	C=300 ppm STEL=150 ppm IDLH=500 ppm	Colorless liquid with a sweet, pungent, benzene-like odor	Inhalation. Absorption, Ingestion, Contact	Eye, skin & respiratory irritation; confusion, dizziness, headache	CNS effects; liver, kidney damage; dermatitis
Vinyl Chloride	1 ppm/1 ppm	--	Colorless gas with a mild, sweet odor	Inhalation.	Nausea, drowsiness, unconsciousness	Central nervous system, immune system, liver, circulatory system
Total Xylenes	100 ppm/100 ppm	STEL = 150 ppm IDLH = 900 ppm	Colorless liquid with an aromatic odor	Inhalation. Absorption, Ingestion, Contact	Eye, skin & respiratory irritation; dizziness, drowsiness, nausea, vomiting, headache, abdominal pain	Dermatitis; CNS effects; liver/kidney damage; blood
SVOCs						
Dibenzofuran	Not available	Not available	White crystalline solid	Inhalation Absorption Ingestion Contact	No information is available on the acute effects of dibenzofuran in humans or animals.	No information is available on the chronic effects of dibenzofuran in humans or animals.
4-Methyl phenol (p-cresol)	5 ppm/5 ppm	IDLH=250 ppm	Crystalline solid with a sweet, tarry odor (Note: liquid above 95 degree F	Inhalation Absorption Ingestion Contact	Eye, skin, mucous membrane irritation.; CNS effects: confusion, depression, respiratory failure; dyspnea, irregular rapid respiration, weak pulse; eye and skin burns; dermatitis.	Lung, liver, kidney, pancreas damage,

Table 3.2A - Assessment of Chemicals of Potential Concern

Chemical Name	PEL/TLV	Other Pertinent Limits (Specify)	Warning Properties – Odor Threshold	Potential Exposure Pathways	Acute Health Effects	Chronic Health Effects
Naphthalene (and 2-methyl naphthalene)	10 ppm/10 ppm	IDLH=250 ppm	Colorless to brown solid with an odor of mothballs.	Inhalation Absorption Ingestion Contact	Eye irritation; headache, confusion, excitement, malaise; nausea, vomiting, abdominal pain; irritated bladder; profuse sweating; jaundice, hematuria, hemoglobinuria, renal shutdown; dermatitis; optical neuritis, corneal damage.	Target organs: eyes, skin, blood, liver, kidneys, CNS.
Polyaromatic Hydrocarbons (PAHs): **Benzo(a)anthracene** **Benzo(b)Fluoranthene** **Benzo(k)Fluoranthene** **Benzo(a)pyrene** **Chrysene** **Dibenzo(ah)anthracene** **Floranthene** **Indeno(1,2,3-cd)pyrene** **Phenanthrene** **Pyrene**	PAHs TLV = 0.2 mg/m^3	PAHs IDLH = 80 mg/m^3	NA	Inhalation Absorption Ingestion Contact	Skin, respiratory irritants	Bladder and kidney are target organs

PEL = OSHA Permissible Exposure Limit; represents the maximum allowable 8-hour time-weighted average (TWA) exposure concentration.
TLV = ACGIH Threshold Limit Value; represents the maximum recommended 8-hour TWA exposure concentration.
STEL = OSHA Short-term Exposure Limit; represents the maximum allowable 15-minute TWA exposure concentration.
C = OSHA Ceiling Limit; represents the maximum exposure concentration above which an employee shall not be exposed during any period without respiratory protection.
IDLH = Immediately Dangerous to Life and Health; represents the exposure likely to cause death or immediate delayed permanent adverse health effects or prevent escape from such an environment

Acetone

General Description: A colorless, volatile, extremely flammable liquid, which is widely used as an organic solvent. It is readily soluble in water, ethanol, ether, etc., and itself serves as an important solvent. The most familiar household use of acetone is as the active ingredient in nail polish remover. Acetone is also used to make plastic, fibers, drugs, and other chemicals.

Safety and Health: Swallowing very high levels of acetone can result in unconsciousness and damage to the skin in the mouth. Skin contact can result in irritation and damage to the skin. Kidney, liver, and nerve damage, increased birth defects, and lowered reproduction ability of males (only) occurred in animals exposed long-term. It is not known if these same effects would be exhibited in humans.

1,1-Dichloroethene

General Description: 1, 1-Dichloroethene is an industrial chemical that is not found naturally in the environment. It is a colorless liquid with a mild, sweet smell. It is also called vinylidene chloride. 1, 1-Dichloroethene is used to make certain plastics, such as flexible films like food wrap, and in packaging materials. It is also used to make flame retardant coatings for fiber and carpet backings, and in piping, coating for steel pipes, and in adhesive applications.

Safety and Health: The main effect from breathing high levels of 1,1-dichloroethene is on the central nervous system. Some people lost their breath and fainted after breathing high levels of the chemical. Breathing lower levels of 1,1-dichloroethene in air for a long time may damage your nervous system, liver, and lungs. Workers exposed to 1,1-dichloroethene have reported a loss in liver function, but other chemicals were present.

Cis 1,2-dichloroethene

General Description: 1, 2-Dichloroethene, also called 1, 2-dichloroethylene, is a highly flammable, colorless liquid with a sharp, harsh odor. It is used to produce solvents and in chemical mixtures. You can smell very small amounts of 1, 2-dichloroethene in air (about 17 parts of 1, 2-dichloroethene per million parts of air [17 ppm]). There are two forms of 1, 2-dichloroethene; one is called cis-1, 2-dichloroethene and the other is called trans-1,2-dichloroethene. Sometimes both forms are present as a mixture.

Safety and Health: Breathing high levels of 1,2-dichloroethene can make you feel nauseous, drowsy, and tired; breathing very high levels can kill you.

Tetrachloroethene

General Description: Tetrachloroethene is a manufactured chemical that is widely used for dry cleaning of fabrics and for metal-degreasing. It is also used to make other chemicals and is used in some consumer products. Other names for Tetrachloroethene include perchloroethylene, PCE, and tetrachloroethene. It is a nonflammable liquid at room temperature. It evaporates easily into the air and has a sharp, sweet odor. Most people can smell Tetrachloroethene when it is present in the air at a level of 1 part Tetrachloroethene per million parts of air (1Â ppm) or more, although some can smell it at even lower levels.

Safety and Health: High concentrations of Tetrachloroethene(particularly in closed, poorly ventilated areas) can cause dizziness, headache, sleepiness, confusion, nausea, difficulty in speaking and walking, unconsciousness, and death. Irritation may result from repeated or extended skin contact with it. These symptoms occur almost entirely in work (or hobby) environments when people have been accidentally exposed to high concentrations or have intentionally used Tetrachloroethene to get a "high." The health effects of breathing in air or drinking water with low levels of Tetrachloroethene are not known.

Trichloroethene

General Description: Trichloroethene (TCE) is a nonflammable, colorless liquid with a somewhat sweet odor and a sweet, burning taste. It is used mainly as a solvent to remove grease from metal parts, but it is also an ingredient in adhesives, paint removers, typewriter correction fluids, and spot removers. Trichloroethene is not thought to occur naturally in the environment. However, it has been found in underground water sources and many surface waters as a result of the manufacture, use, and disposal of the chemical.

Safety and Health: Breathing small amounts of Trichloroethene may cause headaches, lung irritation, dizziness, poor coordination, and difficulty concentrating. Breathing large amounts of Trichloroethene may cause impaired heart function, unconsciousness, and death. Breathing it for long periods may cause nerve, kidney, and liver damage. Drinking large amounts of Trichloroethene may cause nausea, liver damage, unconsciousness, impaired heart function, or death. Drinking small amounts of Trichloroethene for long periods may cause liver and kidney damage, impaired immune system function, and impaired fetal development in pregnant women, although the extent of some of these effects is not yet clear.

Vinyl Chloride

General Description: Vinyl chloride is a colorless gas. It burns easily and it is not stable at high temperatures. It has a mild, sweet odor. It is a manufactured substance that does not occur naturally. It can be formed when other substances such as trichloroethane, Trichloroethene, and Tetrachloroethene are broken down. Vinyl chloride is used to make polyvinyl chloride (PVC). PVC is used to make a variety of plastic products, including pipes, wire and cable coatings, and packaging materials. Vinyl chloride is also known as chloroethene, chloroethylene, and ethylene monochloride.

Safety and Health: Breathing high levels of vinyl chloride can cause you to feel dizzy or sleepy. Breathing very high levels can cause you to pass out, and breathing extremely high levels can cause death. Some people who have breathed vinyl chloride for several years have changes in the structure of their livers. People are more likely to develop these changes if they breathe high levels of vinyl chloride. Some people who work with vinyl chloride have nerve damage and develop immune reactions. The lowest levels that produce liver changes, nerve damage, and immune reaction in people are not known. The effects of drinking high levels of vinyl chloride are unknown. Some workers exposed to very high levels of vinyl chloride have problems with the blood flow in their hands. Their fingers turn white and hurt when they go into the cold. If you spill vinyl chloride on your skin, it will cause numbness, redness, and blisters.

4.0 Site Control Measures

4.1 Site Control

Site control will minimize potential injury and exposure of COCs to workers and observers. Site control measures also enhance response in emergency situations.

It is anticipated that project work under this program will be generally conducted following Level D health and safety protocol. In the event that an upgrade to Level C health and safety protocol is necessary, a meeting will be held to prepare for Level C health and safety issues and revisions to the HASP. Project work areas and locations to support level C field operations will be defined and divided into distinct areas. The actual extent of each area is considered task and location specific and will be determined in the field.

The following are the daily operating procedures that are to be followed by all on-site personnel:

- *Hold Tailgate Safety Meetings prior to work start and as needed thereafter (suggest daily; however, minimum of weekly).*
- *Use monitoring instruments and follow designated protocol and contaminant action levels.*
- *Use PPE as specified.*
- *Use hearing protection if noise levels exceed 85 dBA and around heavy equipment.*
- *Remain upwind of operations and airborne contaminants, if possible.*

- *Establish a work/rest regimen when ambient temperatures and protective clothing create potential thermal hazards.*
- *Eating, drinking, applying cosmetics and smoking is prohibited in work areas.*
- *Refer to the SHSO for specific safety concerns for each individual site task.*
- *On-site personnel are encouraged to be alert of their own physical condition, as well as their co-workers.*
- ***All accidents, no matter how minor,** must be immediately reported to the SHSO.*

The degree of site control necessary depends on site characteristics and the surrounding community. At this time, there are no access restrictions to the site. During the field activities, B&L and Town and Country are requesting that personnel, subcontractors, and visitors report to the on-site B&L supervisor prior to entering the work area.

Since there are no access restrictions to the Site, particular attention will be placed on the condition of the site regarding four main work zone areas:

4.1.1 Activity Zone

This zone applies to the immediate work area and includes all materials, equipment, vehicles and personnel involved in the site activity. For example, during the installation of a monitoring well, the activity zone will encompass the borehole, drilling rig, monitoring well construction materials and equipment, sampling equipment, decontamination supplies, and drilling/well inspection personnel. Site control measures will include flagging the perimeter of the activity zone to clearly mark the limits of work and to warn passers-by and *visitors of the site activity. In addition, the Site Supervisor will maintain communication with Town and Country personnel as the location of this zone (and the type of work being performed) changes throughout the project.*

This area will be limited to authorized personnel from B&L, regulatory agencies, and contractors/subcontractors to Town and Country. Personnel entering this area will be required to comply with their own HASP that is at least as stringent as this HASP.

Workers entering this zone will be required to be protected as defined in Section 7.0 of this HASP. The work zone is intended for OSHA-trained workers. Within this zone, the levels of protection may be changed in accordance with Section 7.3 of this HASP. The work zone will be considered a 20-foot radius around the investigation locations, the excavation area, and the impacted soil staging area.

4.1.2 Material and Equipment Storage Zone

This zone exhibits the least amount of activity, and as a result, will require the least security. An appropriate area will be designated on-site for the storage of all equipment and supplies to be used throughout the site investigation. The area is to be kept clean and orderly at all times and free from loose equipment, tools, materials or supplies which may compromise the safety of site workers, Town and Country personnel or the public. Construction materials and equipment will be covered with plastic at the end of each workday. Any spills or breakages occurring in this area will be immediately attended to before the Site work continues. This zone is anticipated to be located on the northeastern portion of the site.

4.1.3 Decontamination Zone

In order to prevent incidental contact with contaminants on investigation equipment or in the wash water, all activities within the decontamination area will be completed before subsequent site work or any other activity begins. This includes:

- *Complete removal of contaminants on all equipment used during the preceding phase of the investigation;*
- *Placement of the waste wash water and sediment in sealed drums;*
- *Storage of the drums in a secure and out-of-the-way place for future disposal;*
- *Proper labeling of drum contents;*
- *Cleanup (if necessary) of area outside of decontamination area; and*
- *Storage of all decontamination equipment, site investigation equipment and materials in the Materials and Equipment Storage Zone.*

This zone is anticipated to be located on the northeastern portion of the site.

4.1.4 Support Zone

The support zone is the location of the administrative and other support functions needed to keep the operations in the activity and decontamination zone running smoothly. Any function that need not or cannot be performed in a hazardous atmosphere is performed here. Personnel may wear normal work *clothes within this zone. Any potentially contaminated clothing, equipment and samples must remain in the decontamination zone until decontaminated. All emergency telephone numbers, change for the telephone (if necessary), evacuation route maps, and vehicle keys should be kept in the support zone.*

The SHSO will establish decontamination system and decontamination procedures appropriate to the site and the work that will prevent potentially hazardous materials from leaving the site. All personnel exiting the activity zone will be decontaminated prior to entering the support zone. The decontamination procedures will be reviewed at each daily safety briefing.

Personal hygiene facilities meeting at least the minimum requirements of 29 CFR Part 1910.120 will be provided nearby.

Upon completion of the day's activities, heavy machinery and equipment will be stored securely within the site, or at a location selected by the SHSO.

4.2 Site Security

The SHSO or designated alternate is responsible for controlling access to the active work zone during daytime hours. The sub-contractor is responsible for securing the excavations, *test pits and trenches* during working hours and non-working hours. When necessary to establish a work zone as defined above, the same will be identified by barricades or a barrier fence or tape which will be placed a minimum of 10 feet from the edge of the excavation area. Excavations left open overnight or during non-working hours will be barricaded with orange snow fence or equivalent*. Any excavation, test pit or trench will be treated as an activity zone as defined above with at least a 20-foot protective radius. This radius will* *be cordoned from the public by cones or other protective barriers during working hours, and barricaded by orange snow fence or equivalent during non-working hours.*

4.3 Buddy System

Field activities in contaminated or otherwise potential hazardous work areas should be conducted, whenever possible, with a buddy who is able to:

- Provide partner with assistance;
- Observe partner for signs of chemical or heat/cold exposure;
- Periodically check the integrity of partner’s protective clothing; and
- Notify the SHSO or others if emergency help is needed.

4.4 Site Communications

Communications will be conducted through verbal communications. When out of audible range, verbal communications will be communicated using portable telephones or a 2-way radio.

Communications between workers in various zones shall consist of standard hand signals, voice, or radios. A portable telephone will be used to contact appropriate agencies in the event of an emergency.

4.5 Safe Work Practices

Operating procedures consistent with general safety rules should be followed by all workers. Workers will be conscientious of others working around them and check that they are safe, and working in a safe manner.

General safety rules that will be enforced at the project work areas include the following:

- Monitoring excavations from an upwind location and periodically from a downwind location;
- Smoking will be prohibited in the work zone;
- Eating and chewing gum will be prohibited at work zones;
- Field work will be conducted during daylight hours unless adequate light is provided;
- Anyone authorized to enter the Site will sign the daily field log and will also be required to follow all procedures in this HASP;
- Workers must thoroughly wash their hands prior to leaving the work area and decontamination zones and before eating or drinking; and
- Excessive facial hair should be minimized in the event that respiratory equipment is required for Level C project work.

4.6 Visitors

Visitors may be permitted in the immediate area of active operations with the approval from the SHSO. Visitors will not be allowed to enter into the work zone and decontamination zones. Site visitors will be briefed on appropriate sections of the HASP. The presence of visitors will be documented on the daily log maintained by the SHSO or designated alternate during all Site activities. Visitor vehicles will be restricted to Support Zones. Visitors will not be allowed in work areas during Level C project work.

4.7 Nearest Medical Assistance

First Aid supplies will be located near the area of the work zone, support zone, or in a field vehicle. Additional medical assistance can be summoned by dialing “911”.

The nearest hospital is Strong Memorial Hospital. The emergency route from the Site to this facility is shown on Figure 1 – Hospital Emergency Route.

Additional information regarding driving directions to medical assistance, evacuation routes, and emergency procedures is contained in Section 9.0 of this HASP.

4.8 Safety Equipment

In addition to the PPE necessary to conduct work activities, the following inventory of safety equipment will be available:

- First aid kit;
- Scissors or knife for emergency equipment removal;
- Emergency eye wash;
- Rope for securing objects and use as a lifeline;
- Electrolyte replacement drink – stored in clean area; and
- Fire extinguisher for Class ABC fires.

4.9 Community Air Monitoring Plan

During *intrusive subsurface site activities*, real-time air monitoring for volatile organic compounds (VOCs) and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. A Community Air Monitoring Plan

(CAMP) will be implemented in accordance with Appendix 1A *and IB* of the DER-10 guidance document. A copy of DER-10 Appendix 1A *and IB are* included as Appendix C.

5.0 Employee Training

5.1 Pre-Assigned & Annual Refresher Training

B&L employees and contractor personnel working on this site will be trained in accordance with OSHA 29 CFR Part 1910.120. *All OSHA HAZWOPER certifications for all individuals working on the Site will be made available upon request.*

6.0 Medical Surveillance

B&L employees and contractors will follow their respective individual in-house medical surveillance procedures.

7.0 Personal Protective Equipment

The SHSO has reviewed the environmental and historical sampling data that is relevant to the proposed work to determine potential exposure to COCs and physical hazards. This review resulted in designating the work area as a construction zone. Level D PPE has been designated as the primary level of personnel protection that should be used during project work where contact with soil and groundwater is possible. Upgrading to Level C will be executed as required in the monitoring guidelines outlined.

7.1 Personal Protective Equipment Selection Criteria

PPE requirements selected for each project work task are specified in Section 7.3 of this HASP. Equipment selection was based upon the mechanics of the task and the nature of the hazards that are anticipated. The following criteria were used in the selection of PPE equipment:

- Chemical hazards known or suspected to be present;
- Routes of entry trough which the chemicals could enter the body, e.g., inhalation, ingestion, skin contact; and
- Potential for contaminant/worker contact while performing the specific task or activity.

Based on available data, *B&L* anticipates that most on-Site or near-site work activities will be performed at Level D protection. However, Level C protection will be available in the event an upgrade is required.

7.2 Selected Personal Protective Equipment Ensembles

The following components of Level D PPE will be available and used as appropriate in accordance with the specifications of this HASP:

- Safety glasses
- Hard hat when working with heavy equipment
- Steel-toed or composite-toed work boots
- Protective gloves (e.g., nitrite) during sampling or handling of potentially contaminated media
- Work clothing as prescribed by weather

It is possible that an upgrade to Level C may be required during the tasks identified during the project work. If an inhalation hazard is present or per the guidelines presented in the PPE reassessment program, Level C will consist of the following:

- Air-purifying respirator with appropriate cartridges
- Outer protective wear, such as Tyvek coverall [Tyveks (Sarans) and PVC acid gear will be required when workers have a potential to be exposed to impacted liquids or particulates].
- Hard hat
- Steel-toed or composite-toed work boots
- Nitrile, neoprene, or PVC overboots, if appropriate
- Nitrile, neoprene, or PVC gloves, if appropriate
- Safety glasses

- Face shield (when projectiles or splashes pose a hazard and when using a half-face respirator)

7.2.1 Levels of Protection

The following anticipated levels of protection will be used for specific work activities. Adjustments to these levels may be required given the Site conditions encountered.

- Soil borings and collection of soil samples –Level D
- Groundwater monitoring well installation and collection of water samples – Level D
- *Collection soil vapor samples – Level D*
- *Utility investigation – Level D*
- *Sump water and sediment collection – Level D*

7.3 Personal Protective Equipment Reassessment Program

Air monitoring will be conducted during the project work when *subsurface site investigation of* impacted soils is performed. Such monitoring will be conducted within the work zone utilizing photoionization detection (PID) with a 10.6 eV lamp, or equivalent. Monitoring will consist of determining breathing zone concentrations of total volatile organic vapors. The air monitoring equipment utilized will be calibrated and maintained, in accordance with the manufacturer's instructions. The calibrations and checks will be recorded in the field book. This will be performed by field staff at the beginning each day and more frequently, as the conditions warrant.

Background readings will be obtained in the work zone, upwind, downwind, and support zone prior to excavation of COC impacted soil. Following the establishment of background PID measurement, air monitoring will be conducted in the work zone during the soil excavation activities. Periodic PID measurements will be obtained at downwind locations. The PID measurements will be utilized for evaluating potential upgrade to Level C, if necessary. This may be accomplished by comparing PID measurements to health and safety action levels. The action levels for the PID air-monitoring measurements in the worker's breathing zone are provided below:

- Upgrade from Level D to Level C the following conditions exist:
    - ♦ Total Organic Vapor (TOV) is greater or equal to 5 ppm and less than 50 ppm with compensation made for background readings sustained for a period of at least 10 minutes.
- Downgrade from Level C to Level D if both of the following conditions exist: Total Organic Vapor (TOV) is less than 5 ppm, above background sustained for a period of at least 10 minutes, with subsequent approval to downgrade provided by the Project Manager.

Immediate Evacuation of Area:

- Total Organic Vapor (TOV) – sustained readings greater or equal to 50 ppm in the workers' breathing zone.
- Excavation of unknown soil type or containers.

If evacuation of the area becomes necessary, a meeting will be held to address the air monitoring results and air monitoring may be continued until levels are below evacuation criteria so the area can be reentered. *If evacuation is necessary the Emergency Response Procedures outlined in Section 9.0 should be followed.*

8.0 Decontamination Procedures

Field decontamination of PPE (e.g., Boots) will consist of washing contaminated PPE with a mixture of Alconox soap and water. Modification to the decontamination protocol for PPE will be made on-Site as needed.

9.0 Emergency Response Procedures

9.1 Pre-Emergency Planning

Planning for emergencies is a crucial part of emergency response. The SHSO is responsible for training all employees in potential site hazards and the emergency response procedures.

9.2 Personnel Roles

The SHSO is responsible for responding to, or coordinating the response of, off-site personnel to emergencies. In the event of an emergency, the SHSO will direct all notification, response and follow-up actions. Contacts with outside response personnel (hospital, fire department, etc.) will be done at the direction of the SHSO.

Prior to the start of work on the site, the SHSO will:

1. Confirm that the following safety equipment is available: personal protective equipment, first aid supplies, cellular phone, and fire extinguishers;
2. Have a working knowledge of the safety equipment available; and

The SHSO will be responsible for directing notification, response and follow-up actions and for contacting outside response personnel (ambulance, fire department or others) prior to and during an emergency. Upon notification of an exposure incident, the SHSO will call the Hospital and fire and police emergency response personnel for recommended medical diagnosis, treatment, if necessary, and transportation to the hospital.

The SHSO must conduct an investigation of the incident as soon as possible. The SHSO will determine whether and at what levels exposure actually occurred, the cause of such exposure, and the means to prevent similar incidents from occurring. The resulting report must be accurate, objective, complete and signed and dated.

9.3 Emergency Procedures

9.3.1 Incident Procedures

If an emergency incident occurs, the following actions will be taken:

1. Size-up the situation based upon available information.
2. Notify the SHSO.
3. Only respond to an emergency if personnel are sufficiently trained and properly equipped.
4. As appropriate, evacuate site personnel and notify emergency response agencies, e.g., police, fire, etc.
5. As necessary, request assistance from outside sources and/or allocate personnel and equipment resources for the response.
6. Consult the posted emergency telephone list and contact key project personnel.
7. Prepare an incident report.

All site personnel should be aware of the location of fire fighting equipment. Personnel shall only extinguish minor fires. Large fires will require contacting the local fire department and allowing them to handle the fire.

9.3.2 Medical Emergencies

In the event of an accident or injury, workers will immediately implement emergency decontamination and isolation measures to assist those who have been injured or exposed and to protect others from the hazards. Upon notification of an exposure incident, the SHSO will contact the emergency response personnel who can provide medical diagnosis and treatment. If necessary, immediate medical care will be provided by trained personnel competent in first aid procedures. Trained personnel competent in such matters will only provide other on-site medical and/or first aid response to an injury or illness.

If an individual is transported to a hospital or doctor, a copy of this HASP will accompany the individual.

The SHSO will be notified when an accident or incident occurs and will respond according to the seriousness of the incident. The SHSO will investigate facility/site conditions to determine whether and at what levels exposure actually occurred, the cause of such exposure and the means to be taken to prevent the incident from recurring.

The SHSO and the exposed individual will complete an exposure-incident investigation. The SHSO will prepare a signed and dated report documenting the investigation. The SHSO and the exposed individual will also complete an exposure-incident reporting form. The form will be filed with the employee's medical and safety records to serve as documentation of the incident and the actions taken.

Emergency first aid may include taking care of minor scrapes to performing CPR. All site personnel should be familiar with the location of the site first aid kits. Contacting hospital and/or emergency agencies shall be made on a case by case basis depending on the severity of the injury. If an off-site emergency agency is contacted, all the details relating to the injury should be relayed to that agency. All site injuries should be documented. The following actions should be taken if someone requires first aid:

1. Survey the scene to determine if it is safe to reach the injured person.
2. Ask the injured person what happened. If the person is unconscious, look for signs as to what may have occurred.
3. See if there are others injured.
4. Reassure the victim. Contact others for help; tell them to call the appropriate emergency agency.
5. If it is safe to move the victim, return them back to the field office.

Only trained personnel should perform CPR or rescue breathing on an unconscious victim.

9.3.3 Response Critique

Should an incident on-site occur, the SHSO will analyze the response efforts in order to continually improve on-site conditions and procedures. The SHSO must complete follow-up activities before on-site work is resumed following an emergency. Used emergency equipment must be recharged, refilled or replaced. Government agencies must be notified as required in their regulations.

9.3.4 Available Equipment and Emergency Authorities

B&L and/or B&L's sub-contractor will have a cellular telephone. If additional emergency equipment is required, the following local agencies can be called upon for advice, supplies, or additional support:

Agency	Telephone Number
Town of Brighton Fire Department	911
Town of Brighton Police Department	911
Monroe County Sheriffs Department	911
Medical Emergency	911
NYSDEC Project Manager, Charlotte Theobald	585-226-5354
NYSDOH Project Manager, Melissa Doroski	518-406-7860

9.3.5 Driving Directions to Strong Memorial Hospital

See Figure 1 of the HASP

1. Head **northwest** on **Monroe Ave** toward **Monroe Pkwy** 0.5 mi
2. Turn **left** at **Co Rd 87/Elmwood Ave**
   Continue to follow Elmwood Ave 3.0 mi
3. Turn **left** into Hospital access road
   Strong Memorial Hospital will be on the right

Signature Page

By signing below, I acknowledge that I have been informed of the items covered by this plan.

Printed Name	Signature

Figure 1

Hospital Emergency Route

Appendix A

40-Hour HAZWHOPPER Training Certificates

Appendix B

NIOSH Chemical Hazard Data Sheets

Appendix C

DER-10 Technical Guidance for Site Investigation and Remediation, December 2002- Appendix 1A *and 1B* - New York State Department of Health Generic Community Air Monitoring Plan

Appendix B

Standard Operating Procedures, ASTM Procedures, and Field/Sampling Forms

Appendix C

Project Organizational Chart
with Resumes of Key Personnel

groundwater associated with the historic use of the Site and the findings of the RI will assist in the determination of appropriate remedial measures that may be warranted.

1.1 Site Background

The Site (Tax I.D. No. 137.14-2-71.1) is located in the Town of Brighton, Monroe County, New York. The Site is zoned for commercial use and it currently operates as a dry cleaning and laundry business. The Site is comprised of approximately 0.39 acres, of which approximately 0.28 acres is improved with a single story, 2,200 square-foot concrete block structure with a partial basement, and associated asphalt paved parking lot. The remaining 0.11 acres is undeveloped and covered by vegetation. The ground surface at the Site ranges in elevation from about 475 feet to 480 feet above mean sea level. Generally, the ground surface slopes from west to east across the Site.

The Site is serviced by public utilities including water and sewer systems, which run along Monroe Avenue. According to available records, the Site has never been serviced by a private septic system. A storm water catch basin is located in the parking lot northeast of the building at the Site, and water entering this catch basin reportedly flows to the northwest into the storm water drainage system along the Monroe Parkway corridor.

The Site is bound to the northwest by commercial properties, to the southeast by commercial and residential properties, to the northeast by residential properties, and to the southwest by Monroe Avenue. Commercial properties are located on the opposite side of Monroe Avenue to the southwest. A map showing land use of the parcels within ½-mile of the Site is included as Figure 3. Two other parcels in the vicinity of the Site have been operated as dry cleaners (i.e., Former Speedy’s Cleaners, 2150 Monroe Avenue; and Carriage

Cleaners, 2101 Monroe Avenue) and the New York State Department of Environmental Conservation (NYSDEC) lists these sites as Inactive Hazardous Waste Disposal Sites (IHWDS). The Former Speedy's Cleaner Site (IHWDS Site No. 828128) is located approximately 0.23 miles northwest of the Site and the Carriage Cleaners Site (IHWDS Site No. 828120) is located approximately 0.28 miles northwest of the Site (Refer to Figure 3).

Since approximately 1969 to the present, the Site operated commercially as a dry cleaning plant and laundry, and during this time period tetrachloroethene (PCE) was used as a dry cleaning solvent. *The dry cleaning operations currently utilized by Town and Country Cleaners do not include the use of PCE, which was discontinued from use on May 1, 2011. Cleaning is now conducted with GreenEarth, which is an exclusive dry cleaning process that replaces the solvents that were traditionally used in dry cleaning with liquid silicone. GreenEarth solution does not contain volatile organic compounds (VOCs) and it is non-toxic and non-hazardous. Liquid silicone degrades back into three natural components: sand (SiO2), water and carbon dioxide.*

1.2 Previous Studies

To date, various studies have been conducted on the Site and/or adjoining properties and these studies include or are summarized in the following:

- *Phase II Environmental Site Assessment 2290, 2294, 2298 Monroe Avenue, Town of Brighton, New York* dated December 2006 prepared by GeoQuest Environmental Inc (GeoQuest)
- *Site Characterization of the Town and Country Cleaners Site (Site No.: 8-28-149)* dated April 2009 prepared by Camp Dresser, and McKee (CDM) on behalf of the NYSDEC

- Limited studies conducted by DAY on behalf of Town and Country Redevelopment LLC in April 2009 and May 2009
- *Data Package, Delineation Study: Storm Water Catch Basin Area*, dated December 2010 prepared by DAY (the Delineation Study Data Package)

The above are collectively referred to as previous studies in this Work Plan and summaries of the relative findings for each of these studies are presented in the following sections.

1.2.1 GeoQuest Phase II Environmental Site Assessment

On November 16, 2006, GeoQuest advanced five direct-push test borings (designated B-1 through B-5) to an approximate depth of 16 feet (ft.) below ground surface (bgs) on the adjacent property, which is located to the northwest of the Town and Country Cleaners building. Three of the test borings (B-1 through B-3) were located along the property line between the Site and the adjacent property. Two of these test borings were converted into monitoring wells (i.e., B-1 designated as MW-1 and B-2 designated as MW-2) with screened intervals from 5 ft. bgs to 15 ft. bgs. The remaining two test borings, designated B-4 and B-5, were located on the north side of the building on the adjacent property. The approximate locations of the test borings/monitoring wells completed by GeoQuest are depicted on Figure 4. [Note: Soil samples collected during previous studies, the soil sample depths and the PCE and total VOC concentrations measured in these samples are presented on Figure 4. Groundwater test results (i.e., PCE and total VOC concentrations) for samples collected during previous studies are presented on Figure 5.]

Conclusions relevant to the Site presented in the GeoQuest Phase II ESA are summarized below:

- A fill deposit ranging in thickness from approximately 4.0 ft. to 7.0 ft. bgs was encountered beginning at the ground surface in the test borings. This fill was reported to consist primarily of re-graded natural and imported soil described as a course to fine sand intermixed with cinders and ash. A lacustrine deposit described as clay with little silt to sand with little gravel, little silt and trace clay was reported below the fill extending to the bottom of the test borings.
- Photoionization detector (PID) measurements made in the headspace of soil samples collected from the test borings were reported as "Not Detected".
- During this study, soil samples were collected and tested for volatile organic compounds (VOCs) from test borings B-2 (5.0-5.5 ft.) and B-3 (6.0-6.5 ft.) and monitoring wells MW-1 and MW-2.
- PCE was detected in soil sample B-2 (5.0-5.5 ft.) at a concentration of 170.0 parts per billion (ppb), which is below the Unrestricted Soil Cleanup Objectives (SCO) presented in 6NYCRR Part 375-6.8(a). VOCs were not detected in soil sample B-3 (6.0-6.5 ft.).
- The groundwater sample collected from MW-1 contained reported concentrations of the following:

Parameter (Concentration)	*TOGs 1.1.1 Groundwater Standard*
Trichloroethene (5.8 ug/l)	*5 ug/l*
Cis-1,2 - Dichloroethene (80.0 ug/l)	*5 ug/l*
1,2 - Dichloroethane (1.0 ug/l)	*0.6 ug/l*
Vinyl Chloride (44 ug/l)	*2.0 ug/l*

- The groundwater sample collected from MW-2 contained reported concentrations of the following:

Parameter (Concentration)	*TOGs 1.1.1 Groundwater Standard*
PCE (110.0 ppb)	*5 ug/l*

- In response to the detection of PCE and breakdown products in the samples tested, the NYSDEC opened spill number 0651703.

1.2.2 NYSDEC/CDM Site Characterization

The fieldwork for this Site Characterization was conducted between January 28 and January 30, 2008, and it consisted of collecting samples of subsurface soil, subsurface vapors and groundwater in locations at the Site and from off-site locations. *The site characterization was completed by NYSDEC with CDM serving as the contractor*. This work included installing and collecting samples from the following locations at the Site including: five temporary groundwater monitoring points (i.e., GP-1 through GP-5), subsurface soil samples from five locations at the Site (i.e., GP-1 through GP-5), groundwater samples collected from two existing monitoring wells (i.e., MW-1 and MW-2, which were installed as part of the GeoQuest

Phase II ESA), and four subsurface soil vapor samples (i.e., collected from locations GP-1, GP-3, GP-4 and GP-5). The samples collected during the Site Characterization were submitted for analytical laboratory testing. [Note: No indoor air, sub-slab or outdoor ambient air samples were collected as part of the Site Characterization.] The locations of explorations completed as part of the Site Characterization that are in proximity of the Site are presented on Figure 4. [Note: Soil samples collected during previous studies, the soil sample depths and the PCE and total VOC concentrations measured in these samples are presented on Figure 4. Groundwater test results (i.e., PCE and total VOC concentrations) for samples collected during previous studies are presented on Figure 5.]

Relevant findings with regard to conditions at the Site and in the immediate proximity are summarized below:

- The depth to groundwater at the Site was reported to range between 3.41 ft. and 8.1 ft. bgs. Groundwater flow within the shallow aquifer in proximity of the Site was identified to be in a southeasterly direction. Groundwater flow patterns at the Site were not specifically evaluated by CDM.
- VOCs were detected in each of the soil samples tested, but only the concentrations of trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2 DCE), vinyl chloride (VC) and/or acetone measured in the samples collected from GP-1 and GP-5 were detected at concentrations above their NYSDEC Unrestricted Use SCO.

- VOCs were detected in each of the groundwater samples tested and the concentrations of PCE, TCE, 1,1-dichlorethene (1,1-DCE), trans-1,2-dichlorethene (trans-1,2-DCE), cis-1,2 DCE, VC, 1,1-dichloroehthane (1,1-DCA), and 1,1,1-trichlorethane (1,1,1-TCA), were detected at concentrations above the NYSDEC groundwater standards in one or more of the groundwater samples collected at the Site.
- The soil vapor samples collected from locations GP-1, GP-3, GP-4 and GP-5 contained various VOCs including PCE measured at concentrations ranging between 1.59 ug/m3 (GP-4) to 10.3 ug/m3 (GP-3) and TCE measured at concentrations ranging between 0.218 ug/m3 (GP-4) and 395 ug/m3 (GP-1). Currently, there are no soil vapor standards for such samples.
- The presence of PCE breakdown products in the soil and groundwater indicates that biodegradation of PCE in the subsurface soil and groundwater is occurring.

1.2.3 DAY Studies: April 2009 and May 2009

In April 2009, DAY conducted a limited evaluation of the sump pit located in the basement of the Town and Country Dry Cleaners facility, and the storm water catch basin located in the parking lot to the northeast of the facility. The water sample collected from the sump pit contained concentrations of PCE (222 ppb), TCE (10.4 ppb) and cis 1,2-DCE (16.5 ppb) *which all exceeded the applicable TOGs 1.1.1 groundwater standards.* Water within the sump pit reportedly discharges into the sanitary sewer system. The sediment sample from the catch basin contained a detectable concentration of PCE (334 parts per million, ppm), *which is greater than the NYSDEC Restricted Commercial Use SCO of 150 ppm.* Piping exiting the catch basin appeared to flow towards the northwest, but the specific discharge location of this piping was not evaluated.

DAY advanced ten test borings at the Site on May 14, 2009 designated TB-01 through TB-10 and converted three of these test borings into 1-inch diameter groundwater monitoring wells [MW-1 (TB-04), MW-2 (TB-08) and MW-3 (TB-09)]. The soil samples tested contained PCE concentrations ranging between approximately 0.008 ppm [TB-06 (4'-8')] and 224 ppm [TB-01 (4'-8')] *(NYSDEC Restricted Commercial Use SCO is 150 ppm),* TCE concentrations between approximately 0.08 ppm [TB-10 (6'-8')] and 0.13 ppm [TB-07 (4'-8')] cis-1, 2-DCE concentrations ranging between 0.125 ppm [TB-02 (4'-8')] and 0.3 ppm [TB-10 (6'-8')] *(NYSDEC Restricted Commercial Use SCO is 500 ppm).* The groundwater samples tested contained concentrations of PCE ranging between about 1.4 ppm (MW-3) and 106 ppm (MW-2) *(TOGs 1.1.1 Groundwater Standard is 1.3 ppm).*

The locations of the test borings and monitoring wells completed during the above studies are presented on Figure 4. [Note: Soil samples collected during previous studies, the soil sample depths and the PCE and total VOC concentrations measured in these samples are presented on Figure 4. Groundwater test results (i.e., PCE and total VOC concentrations) for samples collected during previous studies are presented on Figure 5.]

The supplemental studies completed by DAY identified contamination present within both the building basement sump pit and the on-site storm water catch basin. Further investigations including the installation of ten test borings further supported a potential plume of PCE and VOC's requiring further delineation and investigation.

1.2.4 Delineation Study: Storm Water Catch Basin Area

In order to assess the extent of VOC impact within the soil in proximity of the storm sewer catch basin located in the parking lot to the northeast of the facility, DAY prepared a document titled *Soil Removal IRM Delineation: Storm Water Catch Basin, Work Plan*, dated April 2010 (Revised July 12, 2010). The NYSDEC issued a letter dated July 13, 2010 approving this document. DAY also prepared a report titled *Data Package Delineation Study: Storm Water Catch Basin Area*, *Brownfield Cleanup Program, Town and Country Cleaners, 2308 and 2310 Monroe Avenue, Brighton, New York, BCP Site #C828149* dated December 2010 that summarizes the work completed and the findings of these delineation studies.

The delineation test borings were advanced on July 19, 2010, July 23, 2010 and August 31, 2010. The NYSEC was on-site to provide input and oversight during each day of test borings. The site specific Health and Safety Plan (HASP) and community air-monitoring program (CAMP) presented in Appendix A of this Work Plan were implemented during these field activities.

Twenty-nine test borings were advanced at twenty-four locations at the Site (designated TCC-D1 through TCC-D24). At five locations (i.e., TCC-D6, TCC-D13, TCC-D16, TCC-D17, and TCCD24), an adjacent test boring (designated TCC-D6A, TCC-D13A, TCC-D16A, TCC-D17A, and TCC-D24A) was advanced due to poor or no soil sample recovery from the original boring. The test borings were advanced from the ground surface into the top of the silty clay layer (i.e., approximately 12 ft. bgs), and select test borings (i.e., TCC-D3, TCC-D5, TCC-D6A, TCC-D9, TCC-D10, TCCD11, and TCC-D13A) were advanced to equipment refusal, which occurred at depths ranging from 14.9 ft. to 17.9 ft. bgs.

For each test boring advanced, the sample containing the greatest field evidence of VOC impact (i.e., highest PID reading, staining, odor) collected above the silty clay layer was submitted to the analytical laboratory for testing. In select test borings, a sample collected from the silty clay layer was also submitted for testing. If the test boring was advanced through the silty clay layer an additional sample was collected from below the silty clay layer and submitted for testing. Additionally, in three of the test borings containing evidence of VOC-impact, samples from the soil above the VOC-impacted soil that did not exhibit evidence of field impact were also submitted to the analytical laboratory for the purpose of delineating ‘clean’ soil.

PID readings exceeding background levels (i.e., 0.0 ppm) were recorded above samples collected from each test boring. Peak PID readings of over 150 ppm were recorded in twelve samples at depths ranging from 6.0 ft. bgs (TCC-D1) to 8.0 ft. bgs (TCC-D14, TCC-D21, TCC-D22). Solvent-type odors were observed in twelve of the test borings at depths ranging from 5.8 ft. bgs (TCC-D2) to 9.0 ft. bgs (TCC-D16A). Generally, peak PID readings of over 150 ppm and solvent-type odors were present concurrently, if encountered. Staining was not observed on the samples collected and none of the samples collected contained evidence of dense non-aqueous phase liquid (DNAPL).

Figure 6 depicts the location of test borings advanced in proximity of the storm sewer catch basin located in the parking lot to the northeast of the facility during previous studies and the delineation studies. In addition, the maximum PID measurements and the concentrations of PCE and total VOCs for the samples collected and analyzed are also shown on this figure. The area of impact confirmed or suspected to exceed Part 375 Restricted Commercial Use SCO is also presented on Figure 6. Typically, this VOC-impacted zone was encountered at depths ranging from approximately 6.5 ft. to 8.5 ft. bgs.

To summarize, the delineation study identified a plume of contamination surrounding the storm water catch basin located within the parking lot to the northeast of the facility. The plume contamination contains elevated concentrations of PCE. Total VOC results included in Figure 6 also indicate the presence of other VOC constituents. Based on the results of field soil screening and analytical results, DAY delineated an area included on Figure 6 which includes the suspected area in which contaminated soils exist at the site expected to exceed Part 375 Restricted Commercial Use SCO's.

2.0 Project Objectives

The objectives of this RI are to:

- Confirm the complete list of Contaminants of Concern (COC) at the Site;
- Delineate the areal and vertical extent of COC impact within environmental media at the Site;
- Evaluate surface and subsurface characteristics at the Site, including topography, geology, and groundwater conditions;
- Collect the data necessary to evaluate releases to environmental medium and develop remedial alternative(s) to address each release;
- Collect and evaluate data necessary for a fish and wildlife resource impact analysis (FWRIA), pursuant to section 3.10 in the NYSDEC May 3, 2010 document *DER-10 Technical Guidance for Site Investigation and Remediation;*
- Generate sufficient data from the on-site media to complete a Qualitative Human Health Exposure Assessment, including evaluating current and future potential public health exposure pathways, in accordance with Appendix 3B in the NYSDEC May 3, 2010 document *DER-10 Technical Guidance for Site Investigation and Remediation;* and
- Provide sufficient information to allow the identification of potentially feasible remedial alternatives.

This RI will be completed in general accordance with provisions and guidance outlined in the NYSDEC May 3, 2010 document *DER-10 Technical Guidance for Site Investigation and Remediation*.

3.0 Preliminary Conceptual Site Model

Data collected during the previous studies described herein were used to develop this preliminary Conceptual Site Model describing subsurface conditions, contaminant types and distribution patterns. This preliminary model will be revised as additional data is collected with the intent of using the Conceptual Site Model as the basis for identifying remedial options for the Site.

3.1 Geology

Overburden

The ground surface of the Site is predominately covered by the building footprint (2,200 square feet) and asphalt pavement that surrounds the building. The northeastern portion of the Site (i.e., comprising about 0.11 acres) is undeveloped land covered with vegetation (e.g., grass, weeds and small trees). Based on the studies conducted to date, heterogeneous fill materials consisting primarily of re-worked sand and gravel extend from the ground surface (i.e., below the asphalt pavement) to depths of approximately 0.5 ft. to 4 ft. bgs. In the area of the storm water catch basin on the Site, fill materials extended to a depth of about 7 ft. bgs. Fragments of cinders and ash were noted in the fill on the adjacent property. A silty sand deposit ranging in thickness from about 1 ft. to 5 ft. underlies the fill materials and overlies a continuous silty clay deposit that was more than 4 ft. thick in the test borings advanced at the Site. *The silty clay layer thickness likely varies throughout the 0.39 acre parcel and has not been clearly defined and mapped for the entire site.* A sandy gravel or fractured/broken bedrock deposit underlies this silty clay. Based upon work completed as part of the previous studies, this deposit ranges in thickness from between 2.6 ft. and 5.7 ft.

Bedrock

Seven test borings *(TCC-D3, TCC-D5, TCC-D6A, TCC-D9, TCC-D10, TCC-D11 and D-13A)* advanced during the *previous DAY Storm Water Catch Basin Area Delineation Study* encountered equipment refusal at depths between 14.9 ft. bgs and 17.9 ft. bgs. Apparent fractured rock was observed *within all* of the *samples seven* test borings that were advanced to equipment refusal, suggesting that *a confining layer* underlies the Site at elevations between about 463 ft. and 459 ft. above mean sea level. The thickness of the *confining layer* was not determined during the previous studies. The depth to equipment refusal was greater in test borings advanced in the eastern portion of the Site, indicating a possible slope in the *confining layer* from generally west to east. The bedrock in the vicinity of the Site is identified as Lockport Dolomite. *The previous soil boring descriptions is likely more representative of a glacial till than bedrock. Select borings proposed as part of the BCP investigation will be installed with a auger unit to further characterize the confining layer and to verify the presence of a till and/or bedrock unit.*

Hydrogeology

The Site and surrounding area slope gently down to the east. There are no surface water bodies on or adjoining the Site. The west branch of Allens Creek is located approximately 1,000 feet to the south-southeast of the Site. Buckland Creek is located approximately 2,300 feet to the north of the subject property. No state- or federally-listed wetlands are located within a ½ mile radius of the Site.

In June 2009, groundwater was measured at depths of about 3.8 ft. and 5.4 ft. bgs (i.e., at elevations 471.12 ft. to 473.28 ft.) in the monitoring wells currently installed at the Site. Based on the June 2009 elevations, groundwater flow appears to be predominately to the north and northeast. [Note: The monitoring wells currently installed at the Site terminate at the top of the silty clay layer.]

3.2 Contaminants of Concern

Between approximately 1969 and the present, PCE has been used as a solvent in the dry cleaning process operated at the Site. It appears that an unknown quantity of PCE was released into the environment at the Site via an unknown mechanism(s) and this release resulted in impact to the subsurface. The currently identified COC include PCE and its breakdown products. Specifically, the identified COC at the Site include:

- tetrachloroethene (PCE);
- trichloroethene (TCE);
- 1,1-dichlorethene (1,1-DCE);
- trans-1,2-dichlorethene (trans-1,2-DCE);
- cis-1,2-dichloroethene (cis-1,2 DCE); and
- vinyl chloride (VC)

3.3 COC Distribution and Migration

To-date, the highest concentrations of COC were measured in samples collected within and in proximity to a storm water catch basin located in the parking lot northeast of the building at the Site. It is speculated that waste solvent may have been discharged into this catch basin by some unknown mechanism, and that this catch basin is a source area of the COC detected at the Site.

As evidenced by the detection of COC in locations away from the suspected source area following a release, the potential routes of migration for the COC may include one, or more, of the following:

- Volatilization directly from the ground surface into the air;
- Migration horizontally along preferential subsurface pathways such as utility corridors;
- Migration horizontally and vertically through the overburden soil;
- Migration vertically into the overburden groundwater;
- Migration horizontally and vertically through the overburden groundwater; and/or
- Migration horizontally along an impermeable subsurface layer.

In addition to the apparent release(s) of COC into the storm water catch basin located northeast of the building at the Site, COC releases could have occurred at other locations at the Site.

During the previous studies, the highest concentrations of COC-impact were typically detected in soil samples encountered at depths ranging from approximately 6.5 ft. to 8.5 ft. bgs. The silty clay layer encountered approximately 8 ft. to 11 ft. bgs appears to be acting as a confining layer that restricts vertical groundwater flow and COC migration. Support of the effectiveness of the confining layer is based on test data derived from the previous studies. It appears that the primary route of COC migration is via release into the shallow groundwater within the fill/silty sand above the silty clay layer and migration away from the source area(s) via groundwater flow. Based on the density of the COC, downward vertical migration away from the source area is suspected and higher concentrations of COC are anticipated at the base of the silty sand layer (i.e., above the silty clay). Some preferential flow could also occur along buried utilities and this flow could alter the distribution of COC.

4.0 Scope of Work

The specific work proposed to evaluate the environmental conditions at the Site and implement field sampling and analysis requirements are described in this section. The methods and procedures for field sampling activities, analytical laboratory methods, and data evaluation procedures are presented below. These methods and procedures will be implemented to provide the data necessary to meet the overall objectives of this RI.

4.1 Records Research

This task will include research to assess historic operations and waste management practices at the Site including interviews with previous and current employees. Historic Sanborn Maps (if available) and other documentation will be obtained and reviewed in an attempt to assess past operations at the Site and the surrounding area. In addition, this task will include a review of public records to identify and map the location, elevation and discharge points of buried utilities at the Site. *Presence of the potential trolley bed will be evaluated as part of this task.*

4.2 Utility Evaluation

A utility evaluation will be completed for all utilities and utility pathways at the Site. An investigation of all sanitary sewer lines, storm water lines, floor drains, sumps, catch basins, and trenches currently used or previously used and/or abandoned at the Site will be completed as well as the discharge point of each possible present utility. Dye testing will be conducted within select sanitary and storm sewer lines identified at the Site in an attempt to verify/confirm discharge locations. If necessary, videotaping of select utility lines may be completed to evaluate the condition/location of utilities. The elevation of select utilities (e.g., storm water catch basins) will also be measured to supplement the public records, as needed.

If an underground storage tank is encountered, investigations regarding the tank will be conducted in compliance with Section 3.9 of DER-10

At the present time, it is anticipated that a sediment and/or water sample will be collected from the sump in the basement and from a floor drain located in the northern portion (dry cleaning area) of the building. Depending on accessibility, a water sample will also be collected from the sanitary sewer discharge location for the building. The findings of the records research described in Section 4.1 and the utility evaluation described above will be used to determine the specific sample locations and whether additional sample locations are warranted. The samples collected from the utilities will be submitted for analytical laboratory testing (refer to Table 1) to assess if contaminants have been discharged into the above locations and, if so, whether remediation may be warranted.

4.3 Subsurface Studies

To meet the project objectives, the sampling program outlined herein will include the collection of samples from various media at the Site for in-situ and analytical laboratory testing. *Prior to the start of any subsurface intrusive activities, Dig Safe (1-888-DIGSAFE) will be contacted to allow adequate time for utilities on the site to be properly demarcated.*

4.3.1 Test Borings

*Twenty-three (23) proposed t*est borings will be installed using a Geoprobe Systems (or similar) direct-push drill rig to collect continuous samples using a 2-¼ inch macrocore sampler with acetate liners in general conformance with American Society for Testing and Materials (ASTM) D6282-98. *The locations are depicted on Sheet 1. Eleven (11) borings will consist solely as soil borings (B series). Twelve (12) borings will be completed as shallow or deep groundwater monitoring wells (MW series).* A copy of ASTM D6282-98 is included as Appendix B. The samples collected from the test borings will be observed to assess soil types and physical evidence of contamination (e.g., staining, odors, presence of non-aqueous phase liquid, etc.) and field-screened using a PID in accordance with the SOPs provided in Appendix B. *Laboratory and headspace samples will be collected concurrently. The boring core will be screened with a P1D immediately after opening the core. The laboratory and headspace samples will be collected from the interval with physical evidence of contamination or highest PID reading. If there is no physical evidence of contamination or elevated PID readings then the interval above the water table will be sampled and submitted for laboratory analysis for full suite of analytical parameters, identified in Table 1. The PID lamp will be of sufficient strength to detect the known contaminants at the Site.* Portions of the soil samples collected will be transferred to laboratory containers for possible analysis. Re-useable drilling and sampling equipment (e.g., macrocore sampler, cutting shoe, and drilling rods) will be decontaminated in accordance with the Equipment Decontamination Procedures presented in Section 5.7.

The subsurface conditions at each test boring will be documented in the field and recorded on test boring logs, which will include:

- Date, boring/well identification, and project identification;
- Name of individual preparing the log;
- Name of drilling contractor;
- Drill make and model;
- Identification of alternative drilling methods used and justification thereof;
- Depths recorded in feet and fractions thereof referenced to ground surface;
- The length of the sample interval and the percentage of the sample recovered;
- The depth of the first encountered water table referenced to ground surface;
- Drilling and borehole characteristics;
- Sequential stratigraphic boundaries; and
- Field screening results.

Spoil material generated during the advancement of the test borings will be placed on polyethylene sheeting adjacent to each test boring as it is generated. If no evidence of potential impacts is observed during the field screening, the test boring will be backfilled with the cuttings generated during the completion of that test boring. *Drill cuttings that show no physical evidence of contamination or do not have elevated PID readings will be placed back in the boring in the reverse order they were removed (i.e., last boring out first boring placed back).*Test borings will not be backfilled with cuttings generated from other test borings. If evidence of potential impacts is observed during field screening, the drill cuttings will be transferred from the polyethylene sheeting and stored on-site in secured labeled 55-gallon drums. Drummed materials will subsequently be characterized and disposed in accordance with applicable regulations. Boreholes that appear impacted, based on field screening will be grouted to the ground surface.

The purpose and proposed depths of the test borings to be completed are described below:

- Building Interior Test Borings: To evaluate potential source areas within the building, up to four test borings will be advanced within the building at the Site in the approximate locations depicted on *Sheet 1* (i.e., designated test borings B-7, B-8, B-9 and B-10). The location of these test borings will be dependant, in part, based upon the findings of the work completed during Records Research and Utility Evaluation described above, but it is anticipated that at least one of the test borings will be advanced in proximity of the sump located in the boiler room of the building (B-9) and one of the test borings will be advanced in proximity of a drain located in the former dry cleaning portion of the building (B-10). It is anticipated that test borings B-7 *and B-8* will be advanced using vehicle-mounted Geoprobe sampling equipment; however, due to access restrictions, test borings located in the basement of the building (*B-9 and B-10*) will be advanced with hand-operated equipment. The intent is to advance the interior test borings to equipment refusal, which is anticipated to occur at the bedrock or confining layer surface.

However, equipment limitations may limit the depth that these test borings can be advanced.

- Exterior Test Borings: *Nineteen (19) t*est borings *(B-1 through 6, B-11, MW-1D, 2D, 4S/D, 5S/D, 6S/D, 7S/D, 8S/D)* will be advanced in select exterior locations of the Site (refer to *Sheet 1* for tentative locations to supplement the existing test borings and to allow the collection of groundwater samples. At each of the exterior test boring locations, at least one test boring will be advanced to equipment refusal.

- Groundwater Samples: Shallow groundwater samples (i.e., above the silty clay confining layer) will be collected for subsequent analytical laboratory testing from *temporary monitoring wells MW-4S, 5S, 6S, 7S and 8S* and from existing monitoring wells *MW-01, MW-02 and MW-03* using dedicated bailers. Deep groundwater sample*s* (i.e., below the silty clay confining layer) will be collected *from MW-1D, 2D, 4D, 5D, 6D, 7D and 8D*. The intent of this groundwater sampling is to assess groundwater quality above and below the silty clay layer at adjacent locations and to assist in the determination of subsequent monitoring well locations and depths.

A soil sample exhibiting the greatest field evidence of potential impact (i.e., the highest PID reading, staining, discoloration, chemical-type odors, etc.) will be collected from each test boring. All samples described above will be submitted to a NYSDOH ELAP-certified analytical laboratory for testing (refer to Table 1). Upon completion, the test borings will be grouted using a Portland cement and bentonite clay mixture.

Additional test borings may be completed subsequent to the test borings described above to supplement the data and fill possible data gaps. The need for, depth and location of such test borings will be determined in the future. The NYSDEC will be advised of proposed locations, depths, test parameters, etc. if additional test borings are deemed necessary.

4.3.2 Soil Vapor Investigation

A soil vapor sampling program will be conducted in accordance with the NYSDOH's Guidance for Evaluating Soil Vapor Intrusion in the State of New York. The sampling program will consist of on-site soil gas, sub-slab, indoor and outdoor air sampling. All samples will be submitted for the laboratory analysis of VOCs using EPA Method TO-15. The sample analysis will meet the minimum reporting limits of 1 microgram per cubic meter or less for most analytes. One (1) duplicate sample will also be collected during the vapor investigation. The locations of the proposed vapor samples are depicted on Sheet 1. A pre-sampling product inventory will be conducted at the Town and Country facility in accordance with NYSDOH Guidance. Soil gas samples may be collected at any time during the year. Building vapor intrusion samples will be collected between November 15th and March 31st. The following additional detail summarizes the vapor sampling program:

4.3.2.1 Soil Gas Survey

A total of four (4) on-site soil gas survey points will be installed. Two (2) locations (SV-1, 2) will be in areas of suspected chlorinated solvents adjacent to existing groundwater monitoring well locations MW-01 and 02. A third soil gas location will be installed east of the area of know impacts (SV-1) and a fourth will be installed east of the Town and Country facility (SV-4) to evaluate potential soil gas migration to the adjacent structure to the east. It should be noted that the facility west of the Town and Country property is already equipped with a vapor mitigation system.

Soil vapor probe installations will be semi-permanent. Soil vapor implants or probes will be constructed in the same manner at all sampling locations to minimize possible discrepancies. The following procedures will be included in the installation protocol:

a. *Implants will be installed with a direct push geoprobe or equivalent;*

b. *Porous, inert backfill material (e.g., glass beads, washed #1 crushed stone, etc.) will be used to create a sampling zone 1 to 2 feet in length;*

c. *Implants will be fitted with inert tubing (e.g., polyethylene, stainless steel, nylon, teflon ® , etc.) of the appropriate size* *(typically 1/8 inch to 1/4 inch diameter) and of laboratory or food grade quality to the surface;*

d. *Soil vapor probes will be sealed above the sampling zone with a bentonite slurry for a minimum distance of 3 feet to prevent outdoor air infiltration and the remainder of the borehole backfilled with clean material;*

e. *A protective casing will be installed around the top of the probe tubing and grouting in place to the top of bentonite, sloping the ground surface to direct water away from the borehole like a groundwater monitoring well, etc.).*

Soil vapor samples will be collected in the following manner at all locations:

a. *At least 24 hours after the installation of permanent probes one to three implant volumes (i.e., the volume of the sample probe and tube) will be purged prior to collecting the samples;*

b. *Flow rates for both purging and collecting will not exceed 0.2 liters per minute*

c. *Samples will be collected using Summa ® canisters that are certified clean by the laboratory;*

d. *A helium tracer gas will be used when collecting soil vapor samples to verify that adequate sampling techniques are being implemented (i.e., to verify infiltration of outdoor air is not occurring) in accordance with Section 2.7.5 of the NYSDOH Guidance.*

When soil vapor samples are collected, the following actions will be taken to document local conditions during sampling:

a. *Uses of volatile chemicals during normal operations of the facility will be identified;*

b. *outdoor plot sketches will be drawn that include the site, area streets, neighboring commercial or industrial facilities (with estimated distance to the site),outdoor air sampling locations (if applicable), and compass orientation (north);*

c. *weather conditions (e.g., precipitation and outdoor temperature) will be noted for the past 24 to 48 hours; and*

d. *any pertinent observations will be recorded, such as odors and readings from field instrumentation.*

Additional information that will be gathered to assist in the interpretation of the results includes barometric pressure, wind speed and wind direction. The field sampling team will maintain a sample log sheet summarizing the following:

a. *Sample identification,*

b. *Date and time of sample collection,*

c. *Sampling depth,*

d. *Identity of samplers,*

e. *Sampling methods and devices,*

f. *Purge volumes,*

g. *Volume of soil vapor extracted,*

h. The canister vacuum before and after samples were collected,

i. Apparent moisture content (dry, moist, saturated, etc.) of the sampling zone, and

j. Chain of custody protocols and records used to track samples from sampling point to analysis.

4.3.2.2 Sub-Slab Vapor Survey

One (1) on-site sub-slab vapor survey points will be installed in the Town and Country facility's basement (see Sheet 1). The following sub-slab vapor protocol will be followed. The heating systems will be operating to maintain normal indoor air temperatures (i.e., 65 – 75°F) for at least 24 hours prior to and during the scheduled sampling time. Prior to installation of the sub-slab vapor probe, the building floor will be inspected and any penetrations (cracks, floor drains, utility perforations, sumps, etc.) will be noted and recorded. The following procedures should be included in the sub-slab construction protocol:

a. Permanent recessed probes will be constructed with brass or stainless steel tubing and fittings;

b. Tubing will not extend further than 2 inches into the sub-slab material;

c. Porous, inert backfill material (e.g., glass beads, washed #1 crushed stone, etc.) will be added to cover about 1 inch of the probe tip for permanent installations; and

d The implant will be sealed to the surface with cement.

Sub-slab vapor samples will be collected in the following manner:

a. After installation of the probes, one to three volumes (i.e., the volume of the sample probe and tube) will be purged prior to collecting the samples;

b. Flow rates for both purging and collecting will not exceed 0.2 liters per minute;

c. Samples will be collected in Summa ® canisters that are certified clean by the laboratory;

d. Samples will be collected over the same period of time as concurrent indoor and outdoor air samples.

The following actions will be taken to document conditions during sampling:

a. Historic and current storage and uses of volatile chemicals will be identified,

b. The use of heating or air conditioning systems during sampling will be noted;

c. Floor plan sketches will be drawn that include the floor layout with sampling locations, chemical storage areas, garages, doorways, stairways, location of basement sumps or subsurface drains and utility perforations through building foundations, HVAC system air supply and return registers, compass orientation (north), footings that create separate foundation sections, and any other pertinent information will be completed;

d. Outdoor plot sketches will be drawn that include the building site, area streets, outdoor air sampling locations (if applicable), compass orientation (north), and paved areas;

e. Weather conditions (e.g., precipitation and indoor and outdoor temperature) and ventilation conditions (e.g., heating system active and windows closed) will be reported; and

f. Any pertinent observations, such as spills, floor stains, smoke tube results, odors and readings from field instrumentation (e.g., vapors via PID) will be recorded.

The field sampling team will maintain a sample log sheet summarizing the following:

a. Sample identification,

b. Date and time of sample collection,

c. Sampling depth,

d. Identity of samplers,

e. Sampling methods and devices,

f. Soil vapor purge volumes,

g. Volume of soil vapor extracted,

h. Vacuum of canisters before and after samples collected,

i. Apparent moisture content (dry, moist, saturated, etc.) of the sampling zone, *j. Chain of custody protocols and records used to track samples from sampling point to analysis.*

4.3.2.3 Indoor Air Sampling

One (1) on-site indoor air sample will be collected in the Town and Country facility's basement (see Sheet 1). The following protocol will be followed.

The heating systems will be operating to maintain normal indoor air temperatures (i.e., 65 – 75 °F) for at least 24 hours prior to and during the scheduled sampling time. Prior to collecting indoor samples, a pre-sampling inspection will be performed to evaluate the physical layout and conditions of the building to identify conditions that may affect or interfere with the proposed sampling, and to prepare the building for sampling.

Indoor air samples will be collected in the following manner:

a. Samples will be collected over a 24 hour time period;

b. Personnel will be directed to avoid lingering in the immediate area of the sampling device while samples are being collected;

c. Sample flow rates will be consistent with the flow rates for concurrent outdoor air and sub-slab samples;

d. Samples will be collected in Summa ® canisters that are certified clean by the laboratory.

The actions outlined in 4.3.2.2 will be taken to document conditions during indoor air sampling.

4.3.2.4 Outdoor Air Sampling

One (1) on-site out air sample will be collected (see Sheet 1). The following protocol will be followed. Outdoor air samples will be collected simultaneously with indoor air samples in a manner consistent with that for indoor air samples (see previous section). The following actions will be taken to document conditions during outdoor air sampling:

a. Outdoor plot sketches will be drawn that include the building site, area streets, outdoor air sampling locations, the location of potential interferences (e.g., gasoline stations, factories, lawn movers, etc.), compass orientation (north), and paved areas;

b. Weather conditions (e.g., precipitation and outdoor temperature) will be reported; and

c. Any pertinent observations, such as odors, readings from field instrumentation, and significant activities in the vicinity (e.g., operation of heavy equipment or dry cleaners) will be recorded.

4.3.3 Groundwater Monitoring Wells

Groundwater monitoring wells will be installed at locations and to depths to be determined subsequent to the work described above and the evaluation of surface samples (Section 4.4) and sump, drain and sewer samples (Section 4.2). In addition to existing monitoring wells MW-01, MW-02 and MW-03, which will be used to evaluate groundwater conditions, it is currently anticipated that twelve (12) additional monitoring wells will be tentatively installed in the locations depicted on Sheet 1. Shallow temporary monitoring wells will be identified with an “S” suffix and deep temporary monitoring wells will be identified with a “D” suffix. The offsite monitoring wells installed as part of the 2006 Geoquest Phase II investigation located at the parcel at 2298 Monroe Avenue (MW-1 and MW-2) will have groundwater elevations taken and groundwater samples collected for both rounds of groundwater sampling for the remedial investigation. The groundwater samples will be analyzed for the full suite of parameters identified on Table 1.

The shallow overburden groundwater monitoring wells will be placed within the silty clay layer with the screen interval being placed within the silty clay layer and water table interface. The deep monitoring wells (bedrock wells) will be set such that the screen will cross the fractured bedrock or confining layer. The deep monitoring wells will characterize the deep groundwater and will provide groundwater elevations to determine deep groundwater flow direction. The presence of DNAPL will be closely examined during the installation of all on-site monitoring wells.

The purpose of the groundwater monitoring wells is to evaluate groundwater conditions (i.e., depth to groundwater, groundwater flow patterns and rates, etc.) and the type and distribution of contaminants within the groundwater. The data collected will be used to assess the need for and, if appropriate, type of remediation required to address groundwater impacts.

Monitoring Well Installation Methods: The monitoring wells will be installed in test borings advanced using rotary drilling techniques or a Geoprobe *with* capability of spinning hollow stem augers to create a boring of sufficient diameter to install a 2-inch diameter monitoring well. The drilling and sampling procedures to be utilized will be in general accordance with the various ASTM methods presented in Appendix B.

The new “shallow” monitoring wells will be constructed of 2-inch inside diameter, Schedule-40 PVC with five-foot long, 0.010-inch slot well screens extending from the top of the silty clay layer into the overlying sandy silt deposit. [Note: If DNAPL is encountered in the test borings, alternative construction materials, and installation options (e.g., placement of a collection “sump” below the well screen, etc.) will be considered.] The wells will be completed with a sand pack surrounding the well screen and extending approximately six inches above the screen. The sand packs will be capped with a minimum two-foot thick bentonite seal, and then grouted to the surface. The wells will be completed with either a protective casing or a flush mounted road box depending on location.

The “deep” monitoring wells will be installed similar to the “shallow” monitoring wells but a 5-foot long bentonite seal will be installed by tremie-type methods through the interface between the silty clay and the underlying sand and gravel (i.e., such that approximately 2.5 ft. of seal is below the interface and 2.5 ft. is above the interface).

A monitoring well construction diagram (i.e., well completion report) will be developed for each new well. Typical construction diagrams for the “shallow” and “deep” monitoring wells are included in Appendix B.

Monitoring Well Development: Following a *minimum of 48 hours after well installation* the monitoring wells will be developed by utilizing either a new dedicated disposable bailer with dedicated cord and/or a pump and dedicated disposable tubing. No fluids will be added to the wells during development, and non-dedicated well development equipment will be decontaminated prior to development of each well. *All generated* *groundwater accumulated from the well development efforts will be managed in accordance with DER-10.* The development procedure will be as follows:

- Obtain pre-development static water level readings;
- Calculate water/sediment volume in the well;
- Obtain initial field water quality measurements (e.g., ph, conductance, turbidity, temperature);
- Select development method and set up equipment depending on method used;
- Alternate water agitation methods (e.g., moving a bailer or pump tubing up and down inside the screened interval) and water removal methods (e.g., pumping or bailing) in order to suspend and remove solids from the well;
- Obtain field water quality measurements for every two to five gallons of water removed;
- Record water quantities and rates removed;
- Stop development when water quality criteria listed below have been met;
- Obtain post-development water level readings; and
- Document development procedures, measurements, quantities, etc.

To the extent feasible, development will continue until the following criteria are achieved:

- Water is clear and free of sediment and turbidity is less than 50 Nephelometric Turbidity Unit (NTU);
- Monitoring parameters have stabilized (i.e., parameters are +10%); and/or
- A minimum of five well volumes has been removed.

The field measurement data will be presented on Monitoring Well Development Logs (refer to Appendix B).

Unless evidence of DNAPL is detected, groundwater produced during monitoring well development will be treated by filtration through activated carbon and discharged on to the unpaved ground surface in the eastern portion of the Site. The discharge water from the treatment system will be observed for evidence of potential impact (e.g., staining and/or unusual odors, etc.) and screened with a PID. If evidence of suspected impact is identified (e.g., visual and/or olfactory and/or PID readings in excess of 25 ppm above background) is observed/detected in the discharge water, treatment will be halted and the discharge water will be placed in labeled 55-gallom drums and stored in a secure location at the Site for subsequent disposal. If evidence of DNAPL is observed in the development water, the water will be containerized handled/disposed similarly.

Groundwater Sampling Program*: A total of two (2) groundwater monitoring events are scheduled to occur as part on this RI. Efforts will be taken ensuring to the best of our ability, groundwater sampling events will be conducted* *during seasonal high and low groundwater elevations.* The initial groundwater sampling event will be conducted *a minimum of two weeks* following development of all of the monitoring wells installed. During this event, it is expected that groundwater samples will be collected from the new *and existing* wells *in* accordance with the low-flow groundwater sampling procedure described in ASTM Method D6771-02 (refer to Appendix B). A second groundwater monitoring event will be collected approximately three months after the initial sampling event. *Groundwater samples will be collected from all groundwater monitoring wells on the site (i.e. new and existing).*

The procedures and equipment used during the groundwater sampling will be documented in the field and recorded on a Monitoring Well Sampling Log (refer to Appendix B).*During all groundwater sampling activities, groundwater will be examined and recorded for the presence of DNAPL and LNAPL by measurement with an interface meter. All groundwater monitoring activities will be conducted in accordance with ASTM D6771-02. All sampling will be conducted with disposable bailers.*

The primary objective of field personnel in obtaining groundwater samples is to collect and preserve representative samples, and adhere to proper chain-of-custody procedures in their prompt shipment to the certified laboratory for analysis within the specified holding times. Upgradient monitoring wells will be sampled before downgradient wells in the following manner:

1. *Monitoring wells will be purged prior to sampling using disposable bailers or properly decontaminated pumping equipment. A minimum of three well volumes will be purged where*

possible. For wells that bail dry, purging will consist of complete evacuation.

2. *Following adequate recovery (within 80% of static levels), obtain sample with a disposable bailer suspended on new, solid-braid nylon rope. Transfer sample directly from the bailer to the parameter-specific sample container labeled appropriately (sample ID Number and preservative), and place in coolers with ice or ice packs. Fill sample bottles in the following order: VOCs then SVOCs, then remaining parameters*

3. *Calibrate all field chemistry equipment every day.*

4. *Follow record keeping and chain-of-custody procedures.*

5. *Replace all well caps, and lock protective well cover.*

6. *At the end of the sampling day, the coolers will be taped shut with the custodian's initials placed on the tape at the points of entry. Samples will be delivered to the laboratory by field personnel upon departure from the site. Alternatively, an express carrier may be used to deliver the samples to the laboratory.*

In order to determine the horizontal hydraulic gradient(s) exhibited by the surface of the water table and potential routes of contaminant migration, water level measurements will be made at each newly installed well using the following procedures:

1. *After noting the general conditions of the well (surface seal, lock, etc.) the bottom of the well will be sounded by lowering a decontaminated, weighted probe into the well.*

2. *Well bottom conditions will be noted (silty, blockages, etc.). The distance from the base of the screen to the top of the casing will be recorded to the nearest 1/100th of a foot.*

3. *The static water level, DNAPL (if present) and LNAPL (if present) will be measured with an interface probe to the nearest 1/100th of a foot.*

4. *The readings will always be taken from a marked point on the well casing.*

5. *Other measurements to be taken are:*

   - *Stickup of well casing from ground surface or surface seal.*
   - *Depth to bottom of well from the top of the riser.*

6. *The date and time will be recorded for these measurements. Also, any pertinent weather conditions will be noted (i.e., significant recent precipitation or drought conditions).*

7. *Upon completion, the wells will be secured, and all downhole equipment will be decontaminated with methanol and deionized water.*

8. *As practicable, all water levels should be collected on the same day.*

Prior to use and between wells, reusable equipment (e.g., static water level meter) that comes in contact with groundwater will be decontaminated using the following procedures:

- Wash in a mixture of potable water and Alconox®-type soap;
- Rinse until soap is no longer visible;

- Rinse with distilled water, allow to air dry or dry with a paper towel.

Groundwater samples will be submitted to the analytical laboratory for testing. Refer to Table 1 for test parameters and QA/QC samples (initial sampling event only).

Hydraulic Conductivity Testing: Subsequent to development and a return to steady-state static water level conditions, in-situ *variable* hydraulic conductivity testing will be completed at monitoring wells *1D, 2D, 5S, 5D, 7S, and 7D* in accordance with ASTM Method D4044-02 (refer to Appendix B). *These locations were selected due to their proximity adjacent to the known area of impact. Also known as the slug or bail test, this method involves either the removal of a bail of water or the displacement of water within the well by the insertion of a slug. Upon creating an elevated or depressed head, the water level in the well is measured and recorded periodically over the recovery time.*

The underlying assumption in the analysis of these tests is that the rate of inflow to the well, after inducing a hydraulic head difference, is a function of the hydraulic conductivity (k) and the unrecovered head distance. The analytical method, typically relying on graphical solution techniques (time vs. head or head ratio), rearranges the flow equation to solve for parameter k. For unconfined groundwater conditions, the Hvorslev and Bouwer-Rice methods will be used. Details of these methods are given in the publications by Hvorslev (1951), Cedergren (1977), and by Bouwer & Rice (1976) and Bouwer (1989), respectively. For confined groundwater conditions, if any are encountered, the Cooper-Bredehoeft-Papadopulos method will be used (Cooper et al. 1967; Papadopulos et al. 1973).

It is important to observe whether the static water level recorded prior to starting the variable head test occurs within the screened interval of the well. If so, the use of the slug test (falling head) is inappropriate due to drainage into the vadose zone above the water table. A bail test (rising head) is preferred in such circumstances. The water levels are recorded with an immersed pressure transducer connected to an automatic data logger.

4.4 Surface Soil Samples

With the exception of the eastern-most portion of the Site and isolated locations along a fence that surrounds the parking lot in the northeastern portion of the Site, the property is covered with the building footprint or asphalt pavement. *S*urface soil samples will be collected from the *seven* locations depicted on *Sheet 1* (i.e., designated SS-1 through SS-*7*). These sample points are located in areas that are not covered by asphalt pavement and/or the building footprint. The sample locations may be adjusted in the field with NYSDEC concurrence to nearby areas if those areas appear stained, devoid of vegetation, or exhibit other characteristics that indicate the presence of contamination. *Supplemental samples may be needed if stained soils or stressed vegetation is encountered.*

The surface soil samples will be collected from a depth of 0 to *2* inches *below* ***exposed*** *soil or below the vegetative cover/sod material*. . Initially, vegetation will be removed with a dedicated disposable trowel and placed to the side of the test location. The trowel will then be used to collect the surface soil sample from the 0 to *2* inch depth interval. Portions of the samples will be placed directly into laboratory-supplied glassware for laboratory analysis. To the extent practicable based on visual and olfactory observations, the portions placed in laboratory-supplied glassware will consist of the most contaminated section of the sample.

Other portions of the samples will be placed in Ziploc®-type plastic baggies that will subsequently be field screened with a PID in accordance with the Soil Sample Field Screening Standard Operating Procedure (SOP) located in Appendix B**.** The laboratory containers and baggies for each sample location will be labeled and placed in a cooler maintained at or below 4ºC. Upon collection, surface soil samples will be submitted to the laboratory for testing as outlined in Table 1.

Note: Based upon available information, the eastern portion of the Site, and along the fence line in the northeastern portion of the Site, was formerly occupied by a railroad line that was part of a trolley system. Therefore fill associated with this former railroad line may be present in these areas and it is anticipated that the surface soil samples will assist in the evaluation of the chemical impact of this fill (if any). The location of the trolley system will be evaluated as part of the Records Research task (Section 4.1).

4.5 Survey

A New York State Licensed Surveyor will be retained to measure to within 0.01 feet the top of riser and ground surface elevations at monitoring wells and to establish a benchmark location and elevation using the North American Vertical Datum (NAVD) ’88 coordinate system. The horizontal data will be surveyed using the North American Datum (NAD) ’83 UTM Zone 18 coordinate system. B&L will also use a laser level to measure elevations at select sample locations referenced to the benchmark elevation.

During groundwater monitoring events, static groundwater level measurements will be obtained using an electronic static water level meter or an oil/water interface meter. Groundwater elevations will be calculated by referencing the top of casing elevation established for the monitoring wells to allow the determination of groundwater elevations and the preparation of a potentiometric groundwater map.

B&L will determine the location of test borings/groundwater monitoring wells and site features (e.g., catch basins, the sump within the basement of the building, etc.) using GPS technology or via tape measurement from existing site features. In addition, *B&L* will measure the elevation of the ground surface at select test boring locations, existing groundwater monitoring wells, and site features (e.g., catch basin inverts, the building and basement floors, the sump pit invert, etc.) using a laser level.

4.6 Analytical Laboratory Testing

The samples proposed for analytical laboratory testing, broken down by the environmental media, are specified in Table 1. *The parameters and minimum detection limits include:*

Volatile Target Compound List and Corresponding Minimum Detection Limits			
		Contract Required Minimum Detection Limits	
Compound	***CAS No.***	***Water (ug/L)***	***Soil (ug/kg)***
Dichlorodifluoromethane	75-71-8	*5.0*	*5.0*
Chloromethane	*74-87-3*	*5.0*	*5.0*
Vinyl chloride	*75-01-4*	*5.0*	*5.0*
Bromomethane	*74-83-9*	*5.0*	*5.0*
Chloroethane	*75-00-3*	*5.0*	*5.0*
Trichlorofluoromethane	*75-69-4*	*5.0*	*5.0*
1,1-Dichloroethene	*75-35-4*	*5.0*	*5.0*
1,1,2-Trichloro-1,2,2-trifluoroethane	*76-13-1*	*5.0*	*5.0*

Volatile Target Compound List and Corresponding Minimum Detection Limits			
		Contract Required Minimum Detection Limits	
Compound	CAS No.	Water (ug/L)	Soil (ug/kg)
Acetone	67-64-1	10	10
Carbon disulfide	75-15-0	5.0	5.0
Methyl acetate	79-20-9	5.0	5.0
Methylene chloride	75-09-2	5.0	5.0
trans-1,2-Dichloroethene	156-60-5	5.0	5.0
Methyl tert-butyl ether	1634-04-4	5.0	5.0
1,1-Dichloroethane	75-34-3	5.0	5.0
cis-1,2-Dichloroethene	156-59-2	5.0	5.0
2-Butanone	78-93-3	10	10
Bromochloromethane	74-97-5	5.0	5.0
Chloroform	67-66-3	5.0	5.0
1,1,1-Trichloroethane	71-55-6	5.0	5.0
Cyclohexane	110-82-7	5.0	5.0
Carbon tetrachloride	56-23-5	5.0	5.0
Benzene	71-43-2	5.0	5.0
1,2-Dichloroethane	107-06-2	5.0	5.0
1,4-Dioxane	123-91-1	100	100
Trichloroethene	79-01-6	5.0	5.0
Methylcyclohexane	108-87-2	5.0	5.0
1,2-Dichloropropane	78-87-5	5.0	5.0
Bromodichloromethane	75-27-4	5.0	5.0
cis-1,3-Dichloropropene	10061-01-5	5.0	5.0
4-Methyl-2-pentanone	108-10-1	10	10
Toluene	108-88-3	5.0	5.0
trans-1,3-Dichloropropene	10061-02-6	5.0	5.0
1,1,2-Trichloroethane	79-00-5	5.0	5.0
Tetrachloroethene	127-18-4	5.0	5.0
2-Hexanone	591-78-6	10	10
Dibromochloromethane	124-48-1	5.0	5.0
1,2-Dibromoethane	106-93-4	5.0	5.0

Volatile Target Compound List and Corresponding Minimum Detection Limits			
		Contract Required Minimum Detection Limits	
Compound	***CAS No.***	***Water (ug/L)***	***Soil (ug/kg)***
Chlorobenzene	*108-90-7*	*5.0*	*5.0*
Ethylbenzene	*100-41-4*	*5.0*	*5.0*
o-Xylene	*95-47-6*	*5.0*	*5.0*
m,p-Xylene	*179601-23-1*	*5.0*	*5.0*
Styrene	*100-42-5*	*5.0*	*5.0*
Bromoform	*75-25-2*	*5.0*	*5.0*
Isopropylbenzene	*98-82-8*	*5.0*	*5.0*
1,1,2,2-Tetrachloroethane	*79-34-5*	*5.0*	*5.0*
1,3-Dichlorobenzene	*541-73-1*	*5.0*	*5.0*
1,4-Dichlorobenzene	*106-46-7*	*5.0*	*5.0*
1,2-Dichlorobenzene	*95-50-1*	*5.0*	*5.0*
1,2-Dibromo-3-chloropropane	*96-12-8*	*5.0*	*5.0*
1,2,4-Trichlorobenzene	*120-82-1*	*5.0*	*5.0*
1,2,3-Trichlorobenzene	*87-61-6*	*5.0*	*5.0*

Semi-volatile Target Compound List and Corresponding Minimum Detection Limits			
		Contract Required Minimum Detection Limits	
Compound	***CAS No.***	***Water (ug/L)***	***Soil (ug/kg)***
Benzaldehyde	*100-52-7*	*5.0*	*170*
Phenol	*108-95-2*	*5.0*	*170*
Bis(2-chloroethyl) ether	*111-44-4*	*5.0*	*170*
2-Chlorophenol	*95-57-8*	*5.0*	*170*
2-Methylphenol	*95-48-7*	*5.0*	*170*
2,2'-Oxybis(1-choloropropane)	*108-60-1*	*5.0*	*170*
Acetophenone	*98-86-2*	*5.0*	*170*
4-Methylphenol	*106-44-5*	*5.0*	*170*
N-Nitroso-di-n propylamine	*621-64-7*	*5.0*	*170*

Semi-volatile Target Compound List and Corresponding Minimum Detection Limits			
		Contract Required Minimum Detection Limits	
Compound	CAS No.	Water (ug/L)	Soil (ug/kg)
Hexachloroethane	67-72-1	5.0	170
Nitrobenzene	98-95-3	5.0	170
Isophorone	78-59-1	5.0	170
2-Nitrophenol	88-75-5	5.0	170
2,4-Dimethylphenol	105-67-9	5.0	170
Bis(2-chloroethoxy) methane	111-91-1	5.0	170
2,4-Dichlorophenol	120-83-2	5.0	170
Naphthalene	91-20-3	5.0	170
4-Chloroaniline	106-47-8	5.0	170
Hexachlorobutadiene	87-68-3	5.0	170
Caprolactam	105-60-2	5.0	170
4-Chloro-3-methylphenol	59-50-7	5.0	170
2-Methylnaphthalene	91-57-6	5.0	170
Hexachlorocyclopentadiene	77-47-4	5.0	170
2,4,6-Trichlorophenol	88-06-2	5.0	170
2,4,5-Trichlorophenol	95-95-4	5.0	170
1,1'-Biphenyl	92-52-4	5.0	170
2-Chloronaphthalene	91-58-7	5.0	170
2-Nitroaniline	88-74-4	10	330
Dimethylphthalate	131-11-3	5.0	170
2,6-Dinitrotoluene	606-20-2	5.0	170
Acenaphthylene	208-96-8	5.0	170
3-Nitroaniline	99-09-2	10	330
Acenaphthene	83-32-9	5.0	170
2,4-Dinitrophenol	51-28-5	10	330
4-Nitrophenol	100-02-7	10	330
Dibenzofuran	132-64-9	5.0	170
2,4-Dinitrotoluene	121-14-2	5.0	170
Diethylphthalate	84-66-2	5.0	170
Fluorene	86-73-7	5.0	170
4-Chlorophenyl-phenyl ether	7005-72-3	5.0	170

Semi-volatile Target Compound List and Corresponding Minimum Detection Limits			
		Contract Required Minimum Detection Limits	
Compound	**CAS No.**	**Water (ug/L)**	**Soil (ug/kg)**
4-Nitroaniline	100-01-6	10	330
4,6-Dinitro-2-methylphenol	534-52-1	10	330
N-Nitrosodiphenylamine	86-30-6	5.0	170
1,2,4,5-Tetrachlorobenzene	95-94-3	5.0	170
4-Bromophenyl-phenylether	101-55-3	5.0	170
Hexachlorobenzene	118-74-1	5.0	170
Atrazine	1912-24-9	5.0	170
Pentachlorophenol	87-86-5	10	330
Phenanthrene	85-01-8	5.0	170
Anthracene	120-12-7	5.0	170
Carbazole	86-74-8	5.0	170
Di-n-butylphthalate	84-74-2	5.0	170
Fluoranthene	206-44-0	5.0	170
Pyrene	129-00-0	5.0	170
Butylbenzylphthalate	85-68-7	5.0	170
3,3'-dicholorobenzidine	91-94-1	5.0	170
Benzo(a)anthracene	56-55-3	5.0	170
Chrysene	218-01-9	5.0	170
Bis(2-ethylhexyl) phthalate	117-81-7	5.0	170
Di-n-octylphthalate	117-84-0	5.0	170
Benzo(b) fluoranthene	205-99-2	5.0	170
Benzo(k) fluoranthene	207-08-9	5.0	170
Benzo(a) pyrene	50-32-8	5.0	170
Indeno(1,2,3,-cd) pyrene	193-39-5	5.0	170
Dibenzo(a,h) anthracene	53-70-3	5.0	170
Benzo(g,h,i) perylene	191-24-2	5.0	170
2,3,4,6-Tetrachlorophenol	58-90-2	5.0	170

Pesticides/Aroclors Target Compound List Minimum Detection Limits			
		Contract Required Minimum Detection Limits	
Compound	***CAS No.***	***Water (ug/L)***	***Soil (ug/Kg)***
alpha-BHC	319-84-6	*0.050*	*1.7*
beta-BHC	*319-85-7*	*0.050*	*1.7*
delta-BHC	*319-86-8*	*0.050*	*1.7*
gamma-BHC (Lindane)	*58-89-9*	*0.050*	*1.7*
Heptachlor	*76-44-8*	*0.050*	*1.7*
Aldrin	*309-00-2*	*0.050*	*1.7*
Heptachlor epoxide	*1024-57-3*	*0.050*	*1.7*
Endosulfan I	*959-98-8*	*0.050*	*1.7*
Dieldrin	*60-57-1*	*0.10*	*3.3*
4,4'-DDE	*72-55-9*	*0.10*	*3.3*
Endrin	*72-20-8*	*0.10*	*3.3*
Endosulfan II	*33213-65-9*	*0.10*	*3.3*
4,4'-DDD	*72-54-8*	*0.10*	*3.3*
Endosulfan sulfate	*1031-07-8*	*0.10*	*3.3*
4,4'-DDT	*50-29-3*	*0.10*	*3.3*
Methoxychlor	*72-43-5*	*0.50*	*17.0*
Endrin ketone	*53494-70-5*	*0.10*	*3.3*
Endrin aldehyde	*7421-93-4*	*0.10*	*3.3*
alpha-Chlordane	*5103-71-9*	*0.050*	*1.7*
gamma-Chlordane	*5103-74-2*	*0.050*	*1.7*
Toxaphene	*8001-35-2*	*5.0*	*170.0*
Aroclor-1016	*12674-11-2*	*1.0*	*33.0*
Aroclor-1221	*11104-28-2*	*1.0*	*33.0*
Aroclor-1232	*11141-16-5*	*1.0*	*33.0*
Aroclor-1242	*53469-21-9*	*1.0*	*33.0*
Aroclor-1248	*12672-29-6*	*1.0*	*33.0*
Aroclor-1254	*11097-69-1*	*1.0*	*33.0*

Pesticides/Aroclors Target Compound List Minimum Detection Limits			
		Contract Required Minimum Detection Limits	
Compound	CAS No.	Water (ug/L)	Soil (ug/Kg)
Aroclor-1260	11096-82-5	1.0	33.0
Aroclor-1262	37324-23-5	1.0	33.0
Aroclor-1268	11100-14-4	1.0	33.0

Metals and Cyanide Target Analyte List and Corresponding CRQLs			
		Contract Required Minimum Detection Limits	
Analyte	CAS No.	ICP-MS Water (ug/L)	ICP-MS Soil (mg/kg)
Aluminum	7429-90-5	20	--
Antimony	7440-36-0	2	1
Arsenic	7440-38-2	1	0.5
Barium	7440-39-3	10	5
Beryllium	7440-41-7	1	0.5
Cadmium	7440-43-9	1	0.5
Calcium	7440-70-2	500	--
Chromium	7440-47-3	2	1
Cobalt	7440-48-4	1	0.5
Copper	7440-50-8	2	1
Iron	7439-89-6	200	--
Lead	7439-92-1	1	0.5
Magnesium	7439-95-4	500	--
Manganese	7439-96-5	1	0.5
Nickel	7440-02-0	1	0.5
Potassium	7440-09-7	500	--
Selenium	7782-49-2	5	2.5
Silver	7440-22-4	1	0.5
Sodium	7440-23-5	500	--
Thallium	7440-28-0	1	0.5
Vanadium	7440-62-2	5	2.5

Metals and Cyanide Target Analyte List and Corresponding CRQLs			
		Contract Required Minimum Detection Limits	
Analyte	***CAS No.***	***ICP-MS Water (ug/L)***	***ICP-MS Soil (mg/kg)***
Zinc	*7440-66-6*	*2*	*1*
Cyanide by Spectrophotometry	*57-12-5*	*10*	*0.5*

The laboratory data deliverables will be Category B ASP deliverables and will have data usability summary reports (DUSRs) completed. All data that is generated during the remedial investigation will be submitted in the electronic data deliverable format for EQuIS.

Laboratory samples collected for closure verification will be sent for data validation. It is not the intent of this task to submit all Site-generated data for validation, but only those samples which are located in areas at the edges of contaminant plumes, and used for site closure or remedial decisions. The following laboratory and data validator selection criteria will be utilized:

A laboratory will be selected that is qualified to perform the work required for the site. Examples of selection criteria are as follows:

1. *QA/QC Programs – All laboratories must have a detailed written QA/QC program meeting the minimum requirements of the NYSDEC and the NYSDOH, and must be NYSDOH ELAP CLP certified for all analyses being performed.*
2. *Approvals –The selected analytical laboratory will be committed to providing analytical services for vapor, groundwater, soil, sediment and surface water that are commensurate with the required protocols and current state-of-the-art analytical procedures, laboratory practices and instrumentation.*

3. *Data validation will be performed by a validator who meets the following requirements.*

Data Validation Scope of Work – NYSDEC RI/FS Program

Data validation is the systematic process by which the data quality is determined with respect to data quality criteria that are defined in project and laboratory quality control programs and in the referenced analytical methods. The data validation process consists of an assessment of the acceptability or validity of project data with respect to stated project goals and requirements for data usability. Ideally, data validation establishes the data quality in terms of project data quality objectives. Data validation consists of data editing, screening, checking, auditing, certification, review and interpretation. The purpose of data validation is to define and document analytical data quality and determine if the data quality is sufficient for the intended use(s) of the data. In accordance with DEC requirements, all project data must be of known and acceptable quality. Data validation is performed to establish the data quality for all data which are to be considered when making project decisions. Laboratories will be required to submit results which are supported by sufficient back-up data and QA/QC results to enable the reviewer to conclusively determine the quality of the data.

Qualifications of a Data Validator

In order to ensure an acceptable level of performance, the following qualifications and requirements are established for all consultants/contractors functioning as data validators. These qualifications and requirements shall apply whether the consultant/contractor is: a) retained directly through contracts executed by the State: b) retained as a subcontractor to a consultant functioning under contracts executed by the State; or c) retained by a responsible party functioning under the guidance and direction of an order on consent. Consultant/Contractor functioning as a data validator shall be independent of the laboratory generating the data.

The Consultant/Contractor functioning as a data validator shall provide evidence that all staff members involved in the data validation process have: a) a bachelor's degree in chemistry or natural sciences with a minimum of 20 hours in chemistry; and b) one (1) year experience in the implementation and application of the protocols used in generating the data for which they are responsible. The successful completion of the EPA Data Validation Training course may be substituted for the analytical experience requirement. In addition, these same staff members must have a minimum of one (1) year experience evaluating CLP data packages for contract protocol compliance.

Specific Tasks To Be Completed By The Data Validator

Evaluated Completeness of Laboratory Data Package

The data validator shall review the data package to determine completeness. A complete data package will consist of the following components:

- *All sample chain-of-custody forms;*
- *The case narrative(s) including all sample analysis summary forms*;*
- *Quality Assurance/Quality Control summaries including all supporting documentation;*
- *All relevant calibration data including all supporting documentation;*
- *Instrument and method performance data;*
- *Documentation showing the laboratory's ability to attain the contract specified method detection limits for all target analytes in all required matrices;*
- *All data report forms including examples of the calculations used in determining final concentrations; and*

- *All raw data used in the identification and quantification of the contract specified target compounds.*

**These forms appear as an addendum to the NYSDEC CLP forms package and will be required for all data submissions regardless of the protocol requested.*

All deficiencies in the requirement for completeness shall be reported to the consultant immediately. The laboratory shall be contacted by the consultants Quality Assurance Officer and shall be given ten calendar days to produce the documentation necessary to remove the deficiencies.

Compliance of Data Packages with Work Plan

The validator shall review the submitted data package to determine compliance with those portions of the Work Plan that pertain to the generation of laboratory data. Compliance is defined by the following criteria:

- *The data package is complete as defined above;*
- *The data has been generated and reported in a manner consistent with the requirements of the Quality Assurance Program Plan and the laboratory subcontract;*
- *All protocol required AQ/AC criteria have been met;*
- *All instrument tune and calibration requirements have been met for the time frame during which the analyses were completed;*
- *All protocol required initial and continuing calibration data is present and documented;*

- *All data reporting forms are complete for all samples submitted. This will include all requisite flags, all sample dilution/concentration factors and all pre-measurement sample cleanup procedures; and*
- *All problems encountered during the analytical process have been reported in the case narrative along with any and all actions taken by the laboratory to correct these problems.*

The data validation task requires that the validator conduct a detailed comparison of the reported data with raw data submitted as part of the supporting documentation package. It is the responsibility of the validator to determine that the reported data can be completely substantiated by applying protocol defined procedures for the identification and quantification of the individual analytes. To assist the validator in this determination, the following documents are recommended; however, the EPA Functional Guidelines will be used for format only. The specific requirements noted in the project Work Plan are prerequisite, for example holding times or special analytical project needs, to those noted in the Functional Guidelines.

- *The particular protocol(s) under which the data was generated (e.g., NYSDEC Contract Laboratory Protocol; EPA SW-846; EPA Series 500 Protocols).*
- *Data validation guidance documents such as;*
  - *"Functional Guidelines for Evaluation of Inorganic Data" (published by EPA Region 2);*
  - *"Functional Guidelines for Evaluation of Organic Analyses", Technical Directive Document No. HQ-8410-01 (published by EPA); and*
  - *"Functional Guidelines for Evaluating Pesticides/PCB's Analyses" Technical Directive Document No. HQ-8410-01 (published by EPA).*

NOTE: These documents undergo periodic revision. It is assumed that the selected data validator will have access to the most current applicable documents and guidelines.

<u>Reporting</u>

The validator shall submit a final report covering the results of the data review process. This report shall be submitted to the Project Manager or his designee and shall include the following:

- *A general assessment of the data package as determined by the degree to which the package is complete and complies with the protocols set forth in the Work Plan;*
- *A detailed descriptions of any and all deviations from the required protocols. These descriptions must include references to the portions of the protocols involved in the alleged deviations;*
- *Any and all failures in the validator's attempt to reconcile the reported data with the raw data from which it was derived. Specific references must be included. Telephone logs should be included in the validation report.*
- *Detailed assessment by the validator of the degree to which the data has been compromised by any deviations from protocol, QA/QC breakdowns, lack of analytical control, etc., that occurred during the analytical process'*
- *The report shall include, as an attachment, a copy of the laboratory's case narrative, including the DEC required sample and analysis summary sheets;*
- *The report shall include an overall appraisal of the data package; and*

The validation report shall include a chart presented in a spreadsheet format, consisting of site name, sample numbers, data submitted to laboratory, year of CLP or analytical protocol *used, matrix, fractions analyzed (e.g., volatiles, semi-volatiles, Pest/PCB, metals, CN). Space should be provided for a reference to the NYSDEC CLP when non-compliancy is involved and a column for an explanation of such violation.*

Currently, we propose utilizing Michael Fifield, Pace Analytical Services, 2190 Technology Drive, Schenectady, NY 12308 for validation services. We will notify the Department if a change in validator is proposed.

4.7 Qualitative Human Health Exposure Assessment

The data collected during the preceding tasks will be used to prepare a qualitative exposure assessment that will characterize the exposure setting, identify exposure pathways, and evaluate contaminant fate and transport. The qualitative human health exposure assessment will be conducted in accordance with the provisions outlined in Appendix 3B of the May 3, 2010 DER-10 *Technical Guidance for Site Investigation and Remediation*. The completed qualitative human health exposure assessment will be incorporated into the RI report.

4.8 Fish and Wildlife Assessment

Due to the nature of the Site and surrounding areas, a Fish and Wildlife assessment does not appear warranted. To confirm this assumption, a Fish and Wildlife Analysis (i.e., as outlined in Step I through Step II B) will be conducted in *accordance with DER-10 Section 3.10.*. The completed analysis document will be incorporated into the RI Report.

4.9 Remedial Investigation Report

The RI Report will document the research completed as part of the studies outlined herein (including data generated during previous investigations, as appropriate), fieldwork conducted as part of this RI, an evaluation of analytical laboratory results for the samples collected during this study (and previous investigations, as appropriate), and recommendations for additional studies or assessments, if required. The RI report *will be prepared in accordance with DER-10 Section 3.14 and* will include/address the following items:

- Documentation of the observations, investigation, and remedial activities performed;
- Evaluation of the distribution of contaminants detected;
- Tabulated summaries of soil and groundwater sample analytical laboratory data. The analytical laboratory results for soil samples tested will be compared to Soil Cleanup Objectives (SCOs) referenced in NYSDEC 6 NYCRR §375.6 dated December 14, 2006, and/or other appropriate and relevant criteria. Analytical laboratory results for groundwater samples tested during this study will be compared to groundwater standards and guidance values referenced in NYSDEC TOGS 1.1.1 data source 1998 and amended by NYSDEC Table 1, dated August 1, 2001. *All data collected to date will be reported on data summary tables in accordance with DER-10 Section 3.14(c)4.;*
- Figures that includes presentations of the horizontal and vertical distribution of constituents in the environmental media at the Site;
- Results of the Qualitative Human Health Exposure Assessment and the Qualitative Human Health Exposure Assessment; and

- Recommendations for further studies that may be necessary to complete characterization of the Site and/or to provide a preliminary selection of remedial alternatives.

Supporting documentation will be provided as appendices to this report. The supporting documentation will include, but will not necessarily be limited to, photographs, site maps/figures, well development and sampling logs, test boring logs, and a DUSR.

5.0 Quality Assurance *Project Plan*

This section describes the policies, organizations, project activities, and quality assurance and quality control (QA/QC) protocols necessary to meet the project objectives and to provide a mechanism for control and evaluation of the quality of data to be acquired throughout the course of the RI. *In Section 5.8 of the RIWP*

5.1 Sample Designations

The environmental media samples collected during the implementation of the RI will be given unique sample identification. The sample name will include an identifier for the Town and Country Cleaners (TCC) Site, sample location, and sample depth for soil samples. For example, a soil sample collected from a depth of 1.5 feet in test boring B-1 would be given the designation TCC-B-1 (1.5’). Groundwater samples collected will be labeled similarly with the addition of the date, so monitoring well MW-01 sampled in March 10, 2007 would be given the designation TCC-MW01-3/10/07. A surface soil samples collected from location SS-1 at a depth of 0.5 feet will be designated as TCC-SS-1 (0.5’).

5.2 Sample Handling and Analysis

Samples collected for possible analysis will be placed directly into laboratory-provided sample containers and immediately after collection placed in a cooler to be held at a temperature of approximately 4°C until delivery to the laboratory. Samples will be labeled with the sample designation described above and the initials of the person collecting the sample. Each sample will be tracked by means of a Chain-of-Custody form that will be initiated at the time of sample collection and will be maintained with the sample until delivery to the laboratory.

5.3 Analytical Laboratory Methods

The samples submitted for analytical laboratory testing during this study will be analyzed using approved USEPA approved protocol and methods that follow the most recent edition of the USEPA's *Test Methods for Evaluating Solid Waste (SW-846), Methods for Chemical Analysis of Water and Wastes (USEPA Methods 600/4-79-20),* and *Standard Methods for Examination of Water and Wastewater (*American Public Health Association, American Waterworks Association and Water Pollution Federation).

5.4 Analytical Laboratory

The analytical laboratory retained to complete the testing of samples collected during this study will be a New York State Department of Health (NYSDOH) ELAP-certified laboratory. The laboratory will perform the sample analysis in accordance with the most recent NYSDEC Analytical Services Protocol (ASP). *All laboratory data packages will be ASP Category B deliverables.*

5.5 Quality Assurance/Quality Control

Procedures for chain-of-custody, laboratory instrumentation calibration, laboratory analyses, reporting of data, internal quality control and corrective actions will be performed as required by SW-846 and the analytical laboratory's Quality Assurance Plan. As outlined in Table 1, trip blanks, field blanks, *equipment blanks,* matrix spike and matrix spike duplicate samples will be prepared/tested to assess the quality of the data generated. The trip blanks*, equipment blanks and* field blank samples will be prepared/tested at a rate of one sample for every twenty samples submitted for testing during specific sampling events. *Matrix spike/matrix spike duplicate (MS/MSD) samples will be collected at a frequency of one* *for every twenty samples for each sample matrix. If less than twenty samples are collected from any matrix, then at least one MS/MSD will be collected from that matrix. The purpose of these samples is to evaluate the effect of the sample matrix on the analytical results.* The MS/MSD will include the same parameters as that of the field samples.

A field blank will be prepared on-site each day that surface water, sediment and soil samples are collected with non-dedicated or non-disposable sampling equipment. If more than one matrix is being sampled in a given day, field blanks will be prepared for each matrix. A trip blank for water samples and/or soil samples to be analyzed for VOCs will accompany sample containers through all phases of the sampling event to ensure proper bottle preparation and laboratory integrity. Trip blank and field blank samples will receive identical handling procedures as on-site samples. An equipment blank consisting of a sample of analyte free water poured over or through decontaminated field sampling equipment prior to the collection of environmental samples.

Field and trip blanks are used as control or external QA/QC samples to detect contamination that may be introduced in the field (either atmospheric or from sampling equipment), in transit to or from the sampling site, or in the bottle preparation, sample login, or sample storage stages within the laboratory. The blanks will also show any contamination that may occur during the analytical process. The equipment blank is utilized to assess the adequacy of the decontamination process.

Trip blanks are samples of analyte-free water, prepared at the same location and time as the preparation of bottles that are to be used for sampling. They remain with the sample bottles while in transit to the site, during sampling, and during the return trip to the laboratory. At no time during these procedures are they to be opened. Upon return to the laboratory, they are analyzed as if they were another sample, receiving the same

QA/QC procedures as ordinary field samples. If these samples are accidentally opened, it will be noted on the chain-of-custody.

Field blanks are prepared in the field (at the sampling site) using empty bottles and analyte-free water supplied separately (prepared at the same time and place as the bottles used in the sampling). The preferred procedure for collection of field blanks for non-dedicated sampling equipment is to first decontaminate the sampling device (e.g., scoop, beaker), and then pour the analyte-free water over the device and collect the runoff into the empty bottles supplied with the sample bottles.

Field and trip blanks are not part of the laboratory QA/QC procedures. The latter, used to detect contamination during analytical steps, are only included as part of the laboratory service and assess the validity of the laboratory analytical procedures. Field and trip blanks are required as part of QA/QC procedures for the overall sampling and analytical program.

5.5.1 Laboratory Duplicates

Collection of an aqueous or soil duplicate sample provides for the evaluation of the laboratory's performance by comparing analytical results of two samples from the same location. Collection of a duplicate of water sample will be performed by alternately filling sample containers from the same sampling device for each parameter. Collection of duplicate soil samples will be accomplished by splitting soil samples in half and filling sample containers. Groundwater samples for volatile organics analysis from monitoring wells will be the first set of containers filled for the sample set. The duplicate sample may also be designated for the matrix spike/matrix spike duplicate sample for laboratory ASP protocol.

One (1) groundwater and one (1) soil duplicate sample will be collected.

5.6 Field Equipment Procedures and Preventative Maintenance

Prior to the initiation of the RI, preventive maintenance and calibration of equipment will be implemented to assure proper operation of field instruments. Members of the field team will be familiar with the maintenance, calibration, and operation of field equipment. The field equipment will be used according to manufacturer instructions. *The field equipment will be calibrated daily and in accordance with the manufacturer's specifications*

5.7 Equipment Decontamination Procedures

It is anticipated that many of the materials used to assist in obtaining samples will be disposable onetime use materials (e.g., sampling containers, plastic trowels, , rope, latex gloves). However, decontamination of re-useable field equipment will be conducted to ensure that the data collected (i.e., analytical laboratory data and field screening data) is acceptable. When equipment must be re-used (e.g., static water level indicator, macrocore samplers, drilling rods, shovel, etc.), it will be decontaminated by at least one of the following methods:

- Steam clean the equipment; or
- Rough wash in tap water; wash in mixture of tap water and Alconox®-type soap; double rinse with de-ionized or distilled water; and air dry and/or dry with clean paper towel.
- *Large equipment will be decontaminated by steam cleaning portions of the equipment (i.e. tires, tracks, rods, etc.) that come into contact with soil or groundwater. Large equipment will be decontaminated in a decontamination pad constructed of an impermeable barrier capable of holding and collecting all washwater. Decontamination pads constructed*

for field cleaning of sampling and large equipment should meet the following minimum specifications:

- *The pad should be constructed in an area believed to be free of surface contamination.*
- *If possible, the pad should be constructed on a level, paved surface..*
- *Washing should be conducted so splashing does not occur outside of the pad.*
- *Water should be removed from the decontamination pad daily.*
- *The pad should be lined with a water impermeable material with no seams.*
- *At the completion of site activities, the decontamination pad will be deactivated and all washwater shall be handled in accordance with Section 3.3(e) of DER-10*

In order to reduce the potential for cross-contamination of samples collected during this project, reusable field instrumentation, sampling equipment, heavy equipment, drilling equipment, etc. must arrive on-site in clean condition and must also leave the Site in clean condition. Equipment that arrives on-site and is not clean will not be allowed on-site.

Decontamination liquids and disposable equipment and Personal Protective Equipment (PPE) will be containerized, temporarily staged on-site (preferably inside a building). These materials will subsequently be characterized and disposed in accordance with applicable regulations. *All investigation derived waste will also be managed in accordance with Section 3.3(e) of DER-10.*

5.8 Data Usability Summary Report

The DUSR will be in accordance with *Appendix 2B of DER-10*.

6.0 Health and Safety

A site-specific Health and Safety Plan (HASP) for this project is located in Appendix A. This HASP will be maintained on-site and implemented during the field investigation and remedial activities. *All individuals involved in the investigational activities will be OSHA HAZWOPER trained and training certifications will be made available upon request.* A *B&L* representative will act as the on-site health and safety coordinator. The health and safety coordinator will monitor the site conditions in accordance with the provisions of the HASP.

6.1 Community Air Monitoring

During intrusive work that is performed outdoors during the RI, air monitoring will be performed to protect the downwind community. The *outdoor* air monitoring will be conducted in accordance with the generic Community Air Monitoring Plan (CAMP) in Appendix 1A of the NYSDEC May 3, 2010 document *DER-10 Technical Guidance for Site Investigation and Remediation*. A copy of the CAMP is included in the HASP, located in Appendix A. *The following air monitoring will be conducted during indoor intrusive activities:*

- *All individuals not directly involved with the planned work must be absent from the room in which the intrusive activities will occur.*
- *When work areas are within 20 feet of potentially exposed populations, the continuous monitoring locations for VOCs and particulates must reflect the nearest potentially exposed individuals and the location of the ventilation system intake for adjacent occupied rooms.*
- *If total VOC concentrations next to the intake vents exceed 1 ppm, work activities should be suspended until controls are implemented and are*

successful in reducing the total VOC concentrations to 1 ppm or less at the monitoring point.

- *Background readings in the occupied spaces must be taken prior to commencement of the planned work. Any unusual background readings will be discussed with NYSDOH prior to commencement of the work.*

7.0 Project Organization and Responsibility

The organization of the project team and general responsibilities of each of the team members are described below. *B&L is the prime engineering contractor for the Town and Country Brownfield Cleanup Project. B&L will report directly to Town and Country for all services required on the project. With approval from the Town and Country, B&L will serve as direct liaison with the NYSDEC throughout the duration of the project.*

The B&L Project Officer and Program Manager will be Scott D. Nostrand, P.E. Mr. Nostrand has the authority to commit resources and resolve potential project scheduling conflicts. Mr. Nostrand will have primary responsibility for oversight planning and implementation of the Brownfield Cleanup Program.

The Project Manager will be David R. Hanny. The Project Manager will be in charge of all field activities related to the Remedial Investigation program and will be responsible for scheduling and implementing the field activities. Mr. Hanny will have primary contact with project subcontractors designated to perform drilling, surveying, and laboratory analysis as needed and will serve as the primary contact for all project-related communications with Town and Country and NYSDEC. He will also serve as the Quality Assurance Officer for this project, whose responsibilities include: performing periodic field audits during the investigation (particularly sampling activities), interfacing with the analytical laboratory to make requests, or resolve problems, in order to assure that the predetermined project objectives for data quality have been met, and evaluating the data packages and interface with the laboratory and the data validator.

Assisting Mr., Hanny, will be Darik M. Jordan who will oversee site investigation tasks and will provide additional coordination with the client and subcontractors. Mr. Jordan will serve as the Site Investigation Team Leader. Field sampling, monitoring and construction oversight is scheduled to be overseen by Brian J. McGrath.

Subcontractors

Several subcontractors will be retained to implement this RI. The specific subcontractors for this project have not yet been identified, but the types of subcontractors anticipated and their roles are described below:

- Drillers – A drilling subcontractor will be retained to advance test borings and collect soil and groundwater samples for observation, field screening and subsequent analytical laboratory testing using direct-push sampling equipment. A second drilling subcontractor may be retained to install groundwater monitoring wells and/or collect "deeper" soil or rock samples using rotary drilling techniques.
- Analytical Laboratory – A New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP) accredited laboratory will perform the chemical analysis of selected samples collected during the RI. Analyses will be completed in accordance with applicable United States Environmental Protection Agency (USEPA) and NYSDEC protocols.
- Data Validation – A firm approved by the NYSDEC Division of Environmental Remediation will independently validate selected analytical laboratory data generated during this study. This firm will prepare a DUSR in accordance with the requirements described in the NYSDEC May 3, 2010 document *DER-10 Technical Guidance for Site Investigation and Remediation*.
- Survey – A Licensed Surveyor will be retained to measure the elevation and locate (as necessary) selected sample locations.

Individual contractor qualifications will be provided to the NYSDEC upon request and prior to commencing their applicable site activity.

8.0 Schedule

The anticipated schedule to implement the tasks outlined in this Remedial Investigation Work Plan is provided below. The schedule shown is based on the time required following the approval of the Work Plan.

Project Coordination and Subcontractor Selection .... 0-4 weeks
Remedial Investigation Fieldwork (including two groundwater monitoring events) .... 4-28 weeks*
Analytical Laboratory Testing .... 4-32 weeks
Third Party Data Validation.. 32-36 weeks**
Qualitative Human Health Exposure Assessment .... 36-40 weeks
Fish and Wildlife Assessment .... 36-40 weeks
Remedial Investigation Report .... 40-48 weeks

*Schedule does not include additional test borings/monitoring wells that may be required to delineate the extent of impact. A modification to the project schedule may be required if such work is deemed necessary.

**Schedule includes the data validation of the second groundwater monitoring event data. Data validation will be completed on other test samples as the data is received by the analytical laboratory.

9.0 Citizen Participation

A Citizen Participation Plan (CPP) for this project was developed and submitted under separate cover. The CPP describes the public information and involvement program that will be carried out during implementation of the BCP required work at the Site. The primary objective of citizen participation is aimed at increasing public understanding of the investigation (and subsequent remediation) project work process through periodic activities such as public meetings and fact sheet mailings. *The following is a summary of the required citizen participation activities by project phase.*

Project Phase	***Document to Repository***	***Notice***	***Fact Sheet***	***Comment Period***	***Other***
Application Deemed Complete	*Yes*	*Yes*	*Not required*	*30 day*	*Create BSCL ENB Notice and Newspaper Notice*
If Application Includes RI Work Plan or RI Report	*Yes*	*Yes*	*Not required*	*30 day*	*Same as above – incorporate RI*
Before Approval of RI Work Plan	*Yes*	*Yes*	*Not required*	*30 day*	*Need Approved CP Plan*
Before Approval of RI Report	*Yes*	*Yes*	*Not required*	*Not required*	*FS describes findings of RI*
Before Approval of RI Report, if RI calls for No Action or No Further Action	*Yes*	*Yes*	*Not required*	*45 day*	*FS must describe basis for No Action*
Before Approval of Remedial Work Plan	*Yes*	*Yes*	*Not required*	*45 day*	*Public meeting if requested*
Before Construction Starts	*Not required*	*Yes*	*Not required*	*Not required*	
Before Approval of Remedial Action Report	*Yes*	*Yes*	*Not required*	*Not required*	
Issuance of Certificate of Completion if IC/EC part of remedy	*Not required*	*Yes*	*Not required*	*Not required*	*Within 10 days of issuance*

10.0 References

New York State Department of Environmental Conservation (NYSDEC) Draft *Brownfield Cleanup Program Guide*, May 2004.

NYSDEC *DER-10 Technical Guidance for Site Investigation and Remediation* May 3, 2010.

NYSDEC Division of Water Technical and Operational Guidance Series 1.1.1 document titled *Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations* (TOGS 1.1.1) dated June 1998.

NYSDEC 6 NYCRR Subpart 375 Environmental Remediation Program, December 2006.

NYSDEC Draft *Brownfield Cleanup Program Citizen Participation Plan for Town and Country Cleaners, 2308 and 2310 Monroe Avenue, Town of Brighton, Monroe County, New York* dated December 2009.

EDR NEPA Check 2308 Monroe Avenue, Rochester, NY 14618 dated August 19, 2009.

Final Site Characterization Report

Town and Country Cleaners Site

Site No.: 8-28-149

Town of Brighton, Monroe County, NY

April 2009

Prepared for: New York State Department of Environmental Conservation
625 Broadway
Albany, NY

Prepared by: Camp Dresser, and McKee
15 Cornell Road
Latham, New York

Phase II Environmental Site Assessment

2290, 2294, 2298 Monroe Avenue
Town of Brighton, New York

December 2006

Prepared for: The Lois Gibbons Trust – c/o Mr. Roger Hilfiker
80 West Bloomfield Road
Pittsford, New York 14534

Prepared by: GeoQuest Environmental, Inc.
1134 Titus Avenue
Rochester, New York 14623

Soil Removal IRM Delineation:

Storm Water Catch Basin
Work Plan
Brownfield Cleanup Program

Town and Country Cleaners

2308 and 2310 Monroe Avenue
Brighton, New York

BCP Site #C828149

April 2010 (Revised July 2, 2010)

Prepared by: Day Environmental, Inc.

Data Package

Delineation Study: Storm Water Catch Basin Area
Brownfield Cleanup Program

Town and Country Cleaners
2308 and 2310 Monroe Avenue
Brighton, New York

BCP Site #C828149

December 2010

Prepared by: Day Environmental, Inc.

11.0 Acronyms

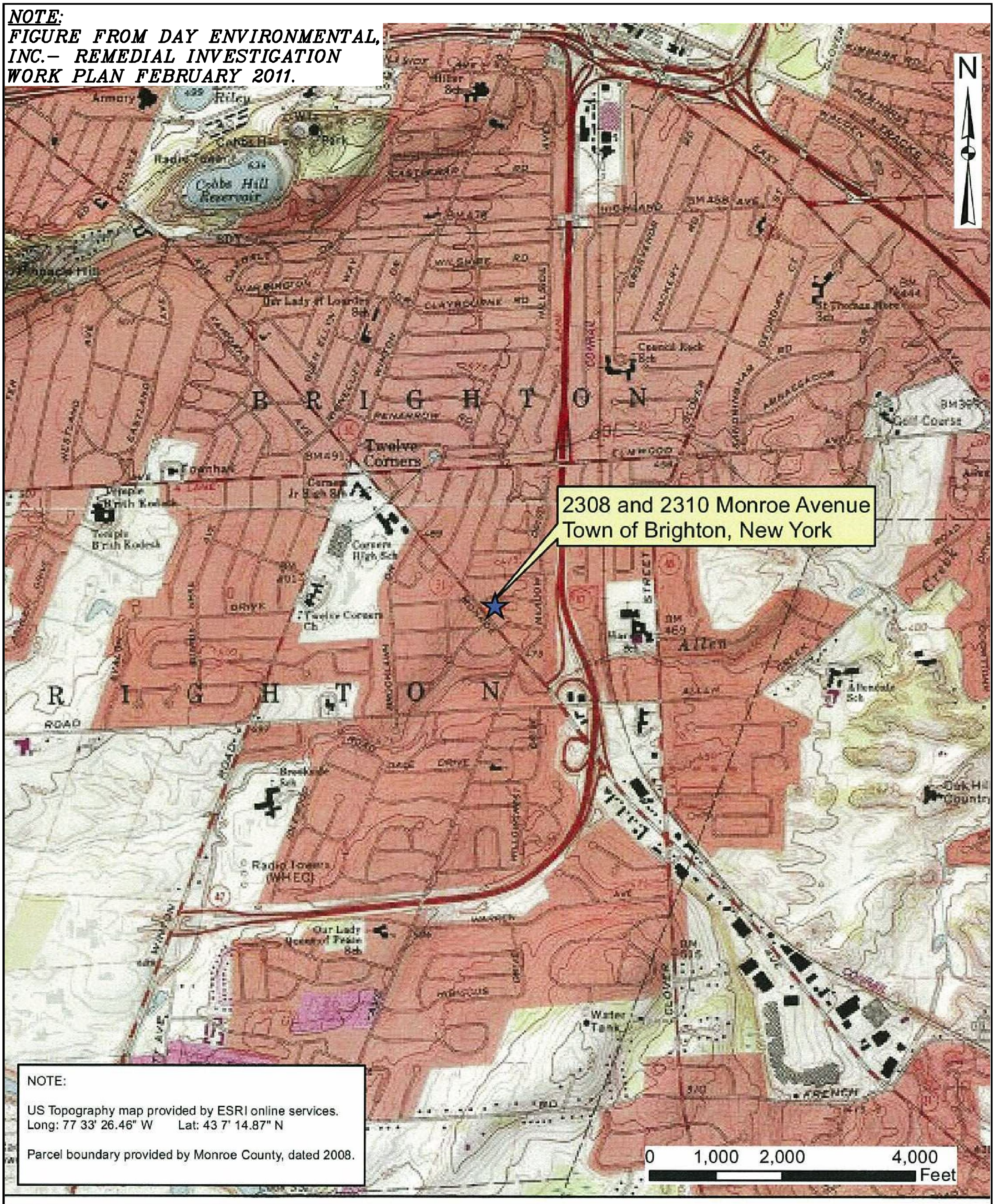
ASP	Analytical Services Protocol
ASTM	American Society for Testing and Materials
B&L	*Barton & Loguidice, P.C.*
BCP	Brownfield Cleanup Program
bgs	below ground surface
CAMP	Community Air Monitoring Program
CDM	Camp, Dresser, and McKee
COCs	Contaminants of Concern
CPP	Citizen Participation Plan
DAY	Day Environmental, Inc.
DNAPL	Dense Non-Aqueous Phase Liquid
DUSR	Data Usability Summary Report
ELAP	Environmental Laboratory Approval Program
GeoQuest	GeoQuest Environmental Inc.
HASP	Health And Safety Plan
IRM	Interim Remedial Measure
LLC	Limited Liability Corporation
MCDOH	Monroe County Department of Health
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NAD	North American Datum
NAVD	North American Vertical Datum
NTU	Nephelometric Turbidity Unit
NYCRR	New York Code of Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PCB	Polychlorinated Bi-phenol
PCE	Tetrachloroethene
ESA	Environmental Site Assessment
PID	Photoionization Detector
PPE	Personal Protective Equipment
ppb	parts per billion
PVC	Polyvinyl Chloride
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RI	Remedial Investigation
SCO	Soil Cleanup Objective
SCG	Standard, Criteria and Guidance
SOP	Standard Operating Procedure
STARS	Spill technology and remediation Series
SVOC	Semi-Volatile Organic Compound
TAL	Target Analyte List

TCE	Trichloroethene
TCL	Target Compound List
TIC	Tentatively Identified Compound
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

Figure 1

Project Locus Map

NOTE:
FIGURE FROM DAY ENVIRONMENTAL, INC.– REMEDIAL INVESTIGATION WORK PLAN FEBRUARY 2011.



NOTE:

US Topography map provided by ESRI online services.
Long: 77 33' 26.46" W Lat: 43 7' 14.87" N

Parcel boundary provided by Monroe County, dated 2008.

Barton & Loguidice, P.C.

Date	Scale
SEPTEMBER, 2011	AS SHOWN

TOWN AND COUNTRY
2308 AND 2310 MONROE AVENUE – BCP NO. C828149
BROWNFIELD CLEANUP PROGRAM REMEDIAL INVESTIGATION WORK PLAN

PROJECT LOCUS MAP

TOWN OF BRIGHTON MONROE COUNTY, NEW YORK

Figure Number
1

Project Number
1437.001

Plotted: Sep 15, 2011 – 1:40PM SYR By: jgs
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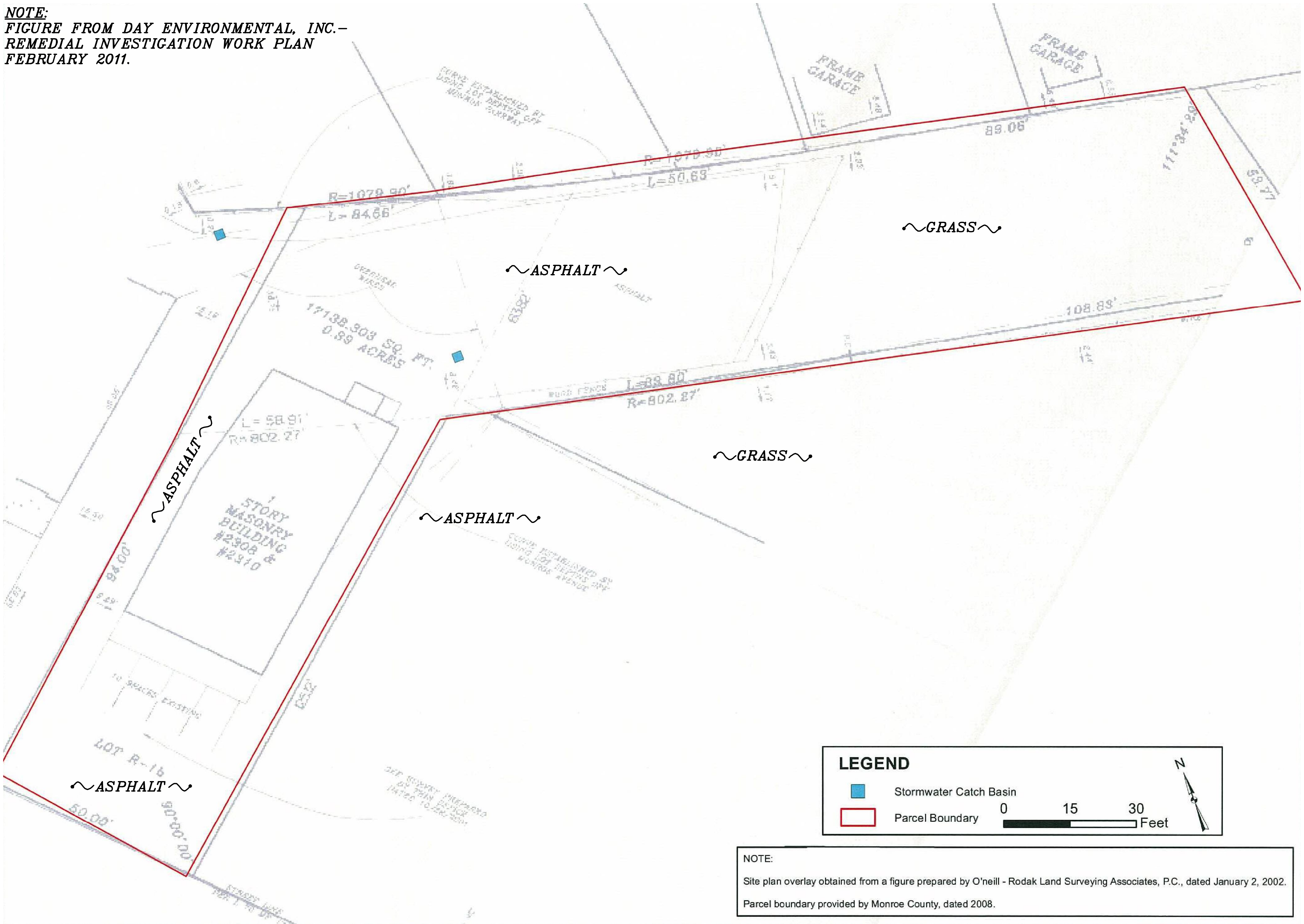
Figure 2

Site Plan

NOTE:
FIGURE FROM DAY ENVIRONMENTAL, INC.– REMEDIAL INVESTIGATION WORK PLAN FEBRUARY 2011.



NOTE:

Site plan overlay obtained from a figure prepared by O'neill - Rodak Land Surveying Associates, P.C., dated January 2, 2002.

Parcel boundary provided by Monroe County, dated 2008.

TOWN AND COUNTRY
2308 AND 2310 MONROE AVENUE– BCP NO. C828149
BROWNFIELD CLEANUP PROGRAM REMEDIAL INVESTIGATION WORK PLAN

SITE PLAN

MONROE COUNTY, NEW YORK

TOWN OF BRIGHTON

Barton & Loguidice, P.C.

Date	SEPTEMBER, 2011
Scale	AS SHOWN
Figure Number	2
Project Number	1437.001

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Figure 3

Land Use within ½-mile of 2308 and 2310 Monroe Avenue

NOTE:

Site Parcel boundary provided by Monroe County, dated 2008.

Parcel boundaries and Land Use Descripton provided by Monroe County, dated 2008.

NOTE:
FIGURE FROM DAY ENVIRONMENTAL, INC.– REMEDIAL INVESTIGATION WORK PLAN FEBRUARY 2011.

TOWN AND COUNTRY
2308 AND 2310 MONROE AVENUE – BCP NO. C828149
BROWNFIELD CLEANUP PROGRAM REMEDIAL INVESTIGATION WORK PLAN

LAND USE WITHIN 1/2 MILE OF 2308 AND 2310 MONROE AVENUE

TOWN OF BRIGHTON MONROE COUNTY, NEW YORK

Barton & Loguidice, P.C.

Date	SEPTEMBER, 2011
Scale	AS SHOWN
Figure Number	3
Project Number	1437.001

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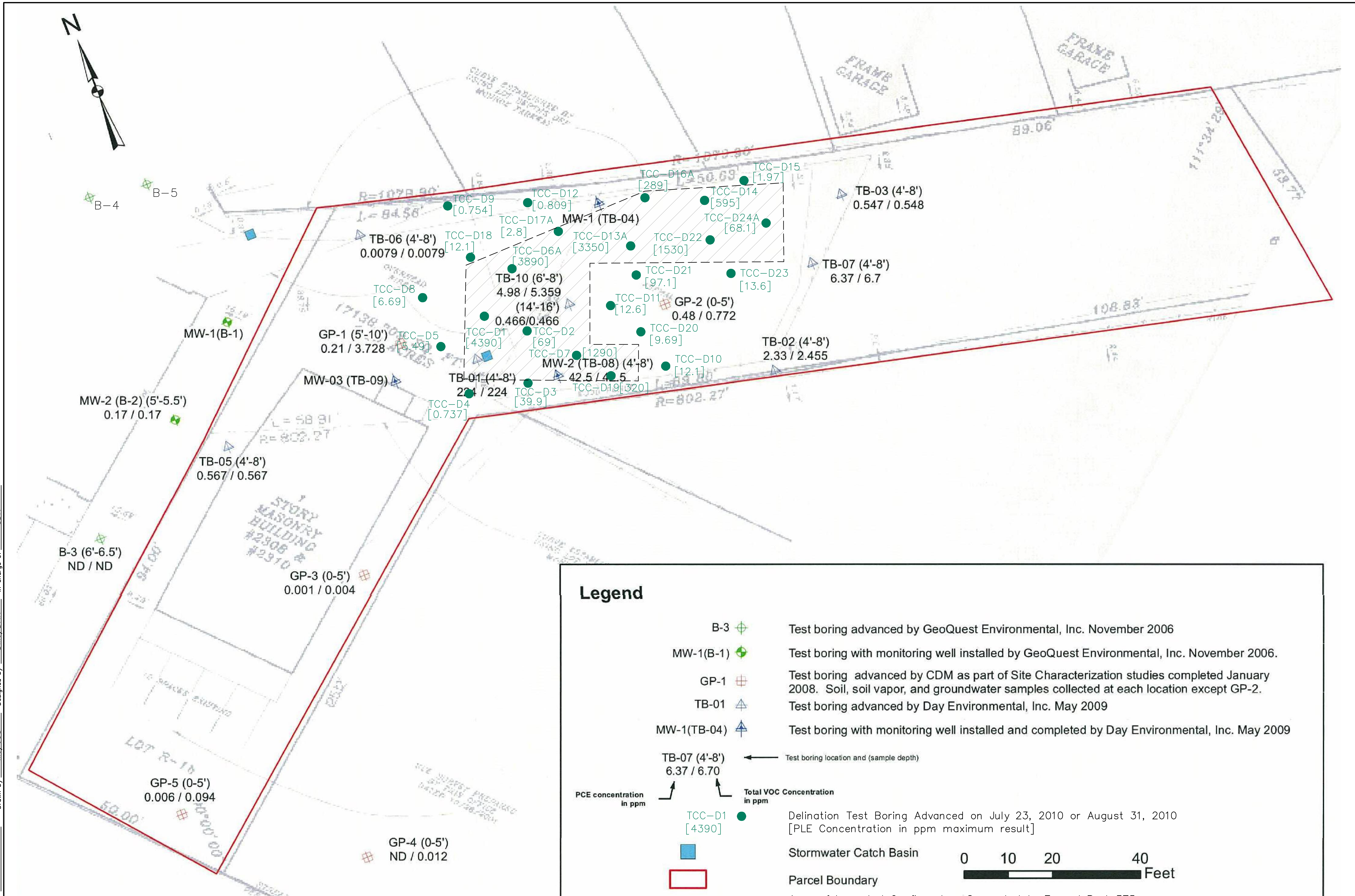
Figure 4

PCE and Total VOC Concentration Detected in Soil Samples



NOTE:
FIGURE FROM DAY ENVIRONMENTAL, INC.– REMEDIAL INVESTIGATION WORK PLAN FEBRUARY 2011.

Plotted: Sep 16, 2011 – 2:12PM SYR By: mj
I:\Shared\1400\1437001\1437001_FIG04.dwg

Checked by ______ Drawn by MJ/JGS Designed by DMJ/DRH In charge of SDN

NO ALTERATION PERMITTED HEREON EXCEPT AS PROVIDED UNDER SECTION 7209 SUBDIVISION 2 OF THE NEW YORK STATE EDUCATION LAW.

COMPLETED CONSTRUCTION

Significant Construction Changes Are Shown

By ______ Date ______
Ck'd ______ Date ______

REVISIONS

TOWN AND COUNTRY
2308 AND 2310 MONROE AVENUE – BCP NO. C828149
BROWNFIELD CLEANUP PROGRAM REMEDIAL INVESTIGATION WORK PLAN

PCE AND TOTAL VOC CONCENTRATIONS DETECTED IN SOIL SAMPLES

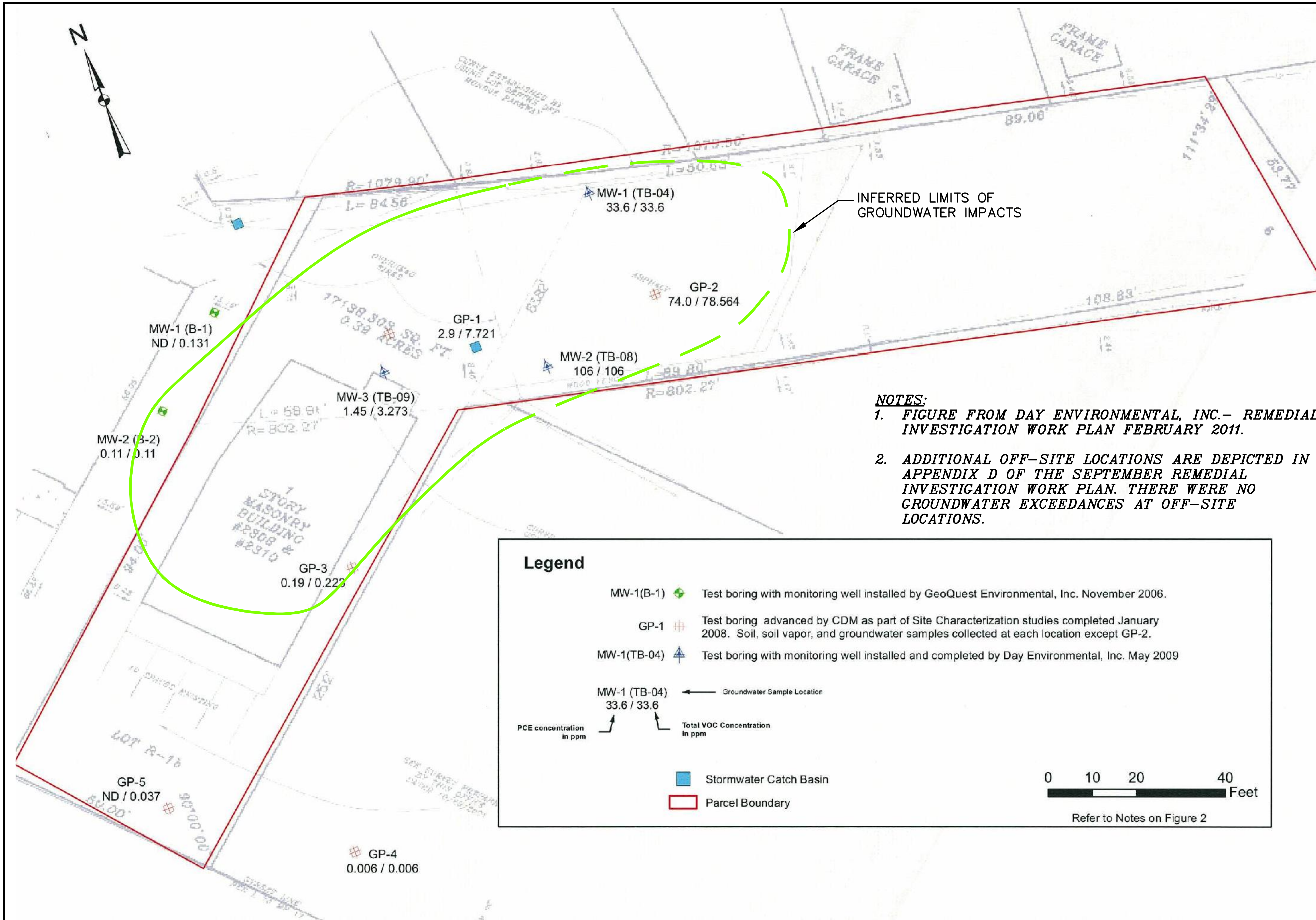
TOWN OF BRIGHTON MONROE COUNTY, NEW YORK

Barton & Loguidice, P.C.

Date SEPTEMBER, 2011
Scale AS SHOWN
Sheet Number 4
File Number 1437.001

Figure 5

PCE and Total VOC Concentration Detected in Groundwater Samples



NOTES:

1. *FIGURE FROM DAY ENVIRONMENTAL, INC.– REMEDIAL INVESTIGATION WORK PLAN FEBRUARY 2011.*
2. *ADDITIONAL OFF–SITE LOCATIONS ARE DEPICTED IN APPENDIX D OF THE SEPTEMBER REMEDIAL INVESTIGATION WORK PLAN. THERE WERE NO GROUNDWATER EXCEEDANCES AT OFF–SITE LOCATIONS.*

TOWN AND COUNTRY
2308 AND 2310 MONROE AVENUE – BCP NO. C828149
BROWNFIELD CLEANUP PROGRAM REMEDIAL INVESTIGATION WORK PLAN

PCE AND TOTAL VOC CONCENTRATIONS DETECTED IN GROUNDWATER SAMPLES

TOWN OF BRIGHTON MONROE COUNTY, NEW YORK

Barton & Loguidice, P.C.

Date: SEPTEMBER, 2011

Scale: AS SHOWN

Figure Number: 5

Project Number: 1437.001

Plotted: Sep 16, 2011 – 2:29PM SYR By: mj
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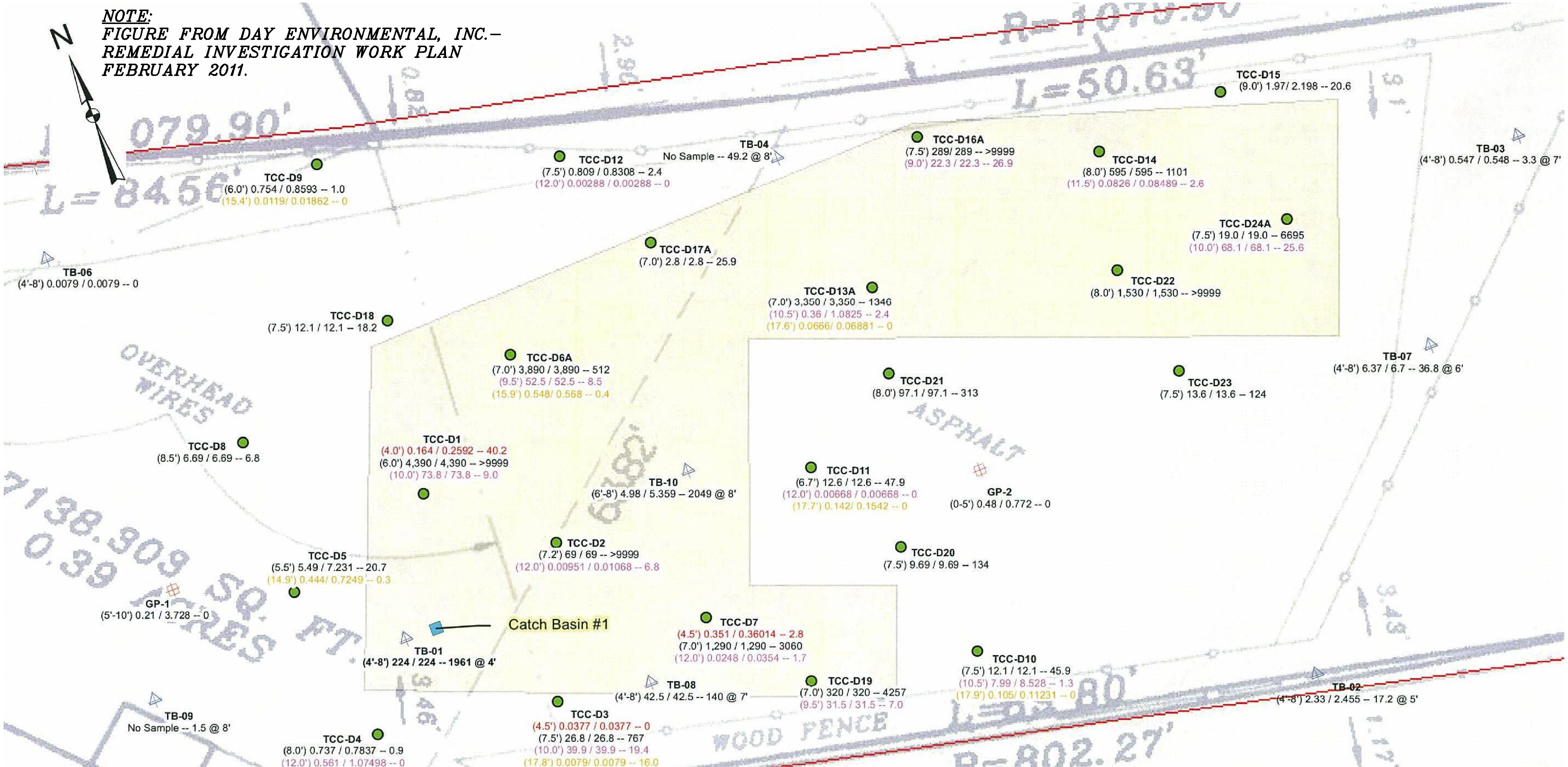
Figure 6

Delineation Study Results



Legend

TCC-D1 ● Delineation test boring advanced on July 19th, 2010, July 23, 2010, or August 31, 2010

GP-1 ⊕ Test boring advanced by CDM as part of Site Characterization studies completed January 2008

TB-01 △ Test boring advanced by Day Environmental, Inc. May 2009

Test boring location (sample depth) → TCC-D3
(4.5') 0.0377 / 0.0377 -- 2.8 ← Sample collected from above the impacted zone (in red)
(7.5') 26.8 / 26.8 -- 767 ← Sample collected from the impacted zone (in black)
(10.0') 39.9 / 39.9 -- 19.4 ← Sample collected from the confining layer (in purple)
(17.8') 0.0079/ 0.0079 -- 16.0 ← Sample collected from below the confining layer (in gold)

Maximum PID reading measured in air space above test sample
PCE concentration in ppm
Total VOC Concentration in ppm

Area of impact confirmed or suspected to exceed Part 375 Restricted Commercial Use Soil Cleanup Objectives

Parcel Boundary

0 4 8 16 Feet

NOTE:

Test borings and Monitoring Wells were located using a Trimble XH GPS Unit with sub-foot accuracy or by reference to existing Site features. In addition the data was differentially corrected to increase accuracy. Locations are to be considered approximate.

Site plan overlay obtained from a figure prepared by O'neill - Rodak Land Surveying Associates, P.C., dated January 2, 2002.

Parcel boundary provided by Monroe County, dated 2008.

TOWN AND COUNTRY
2308 AND 2310 MONROE AVENUE – BCP NO. C828149
BROWNFIELD CLEANUP PROGRAM REMEDIAL INVESTIGATION WORK PLAN

DELINEATION STUDY RESULTS

TOWN OF BRIGHTON MONROE COUNTY, NEW YORK

Barton & Loguidice, P.C.

Date	SEPTEMBER, 2011
Scale	AS SHOWN
Figure Number	6
Project Number	1437.001

Plotted: Sep 15, 2011 – 2:38PM SYR By: jgs
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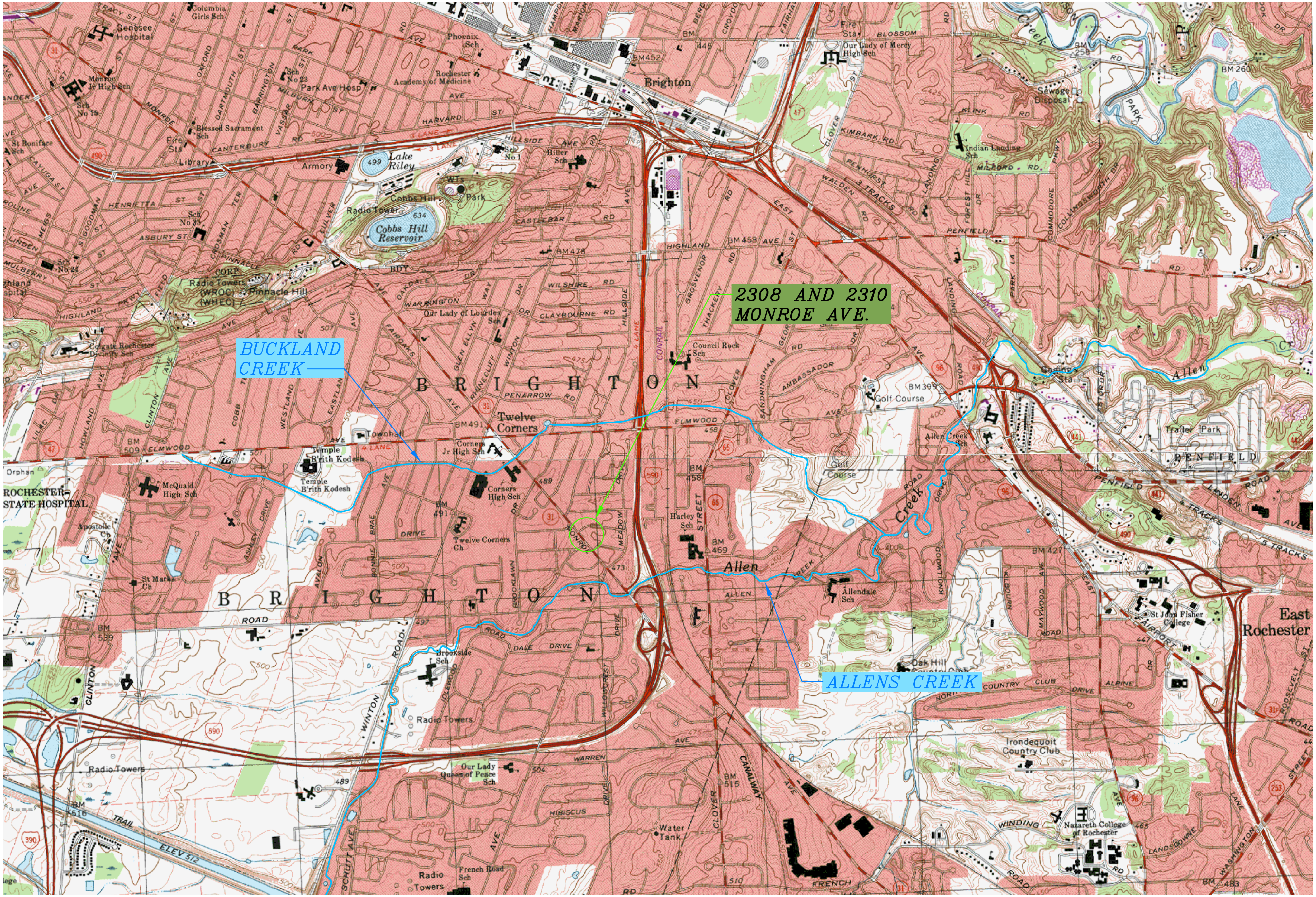
Figure 7

Creek Locations

N

2000' 0 2000'
1"=2000'



TOWN AND COUNTRY
2308 AND 2310 MONROE AVENUE– BCP NO. C828149
BROWNFIELD CLEANUP PROGRAM REMEDIAL INVESTIGATION WORK PLAN

CREEK LOCATIONS

TOWN OF BRIGHTON
MONROE COUNTY, NEW YORK

Barton & Loguidice, P.C.

Date	SEPTEMBER, 2011
Scale	AS SHOWN
Figure Number	7
Project Number	1437.001

Plotted: Sep 19, 2011 – 8:07AM SYR By: mj
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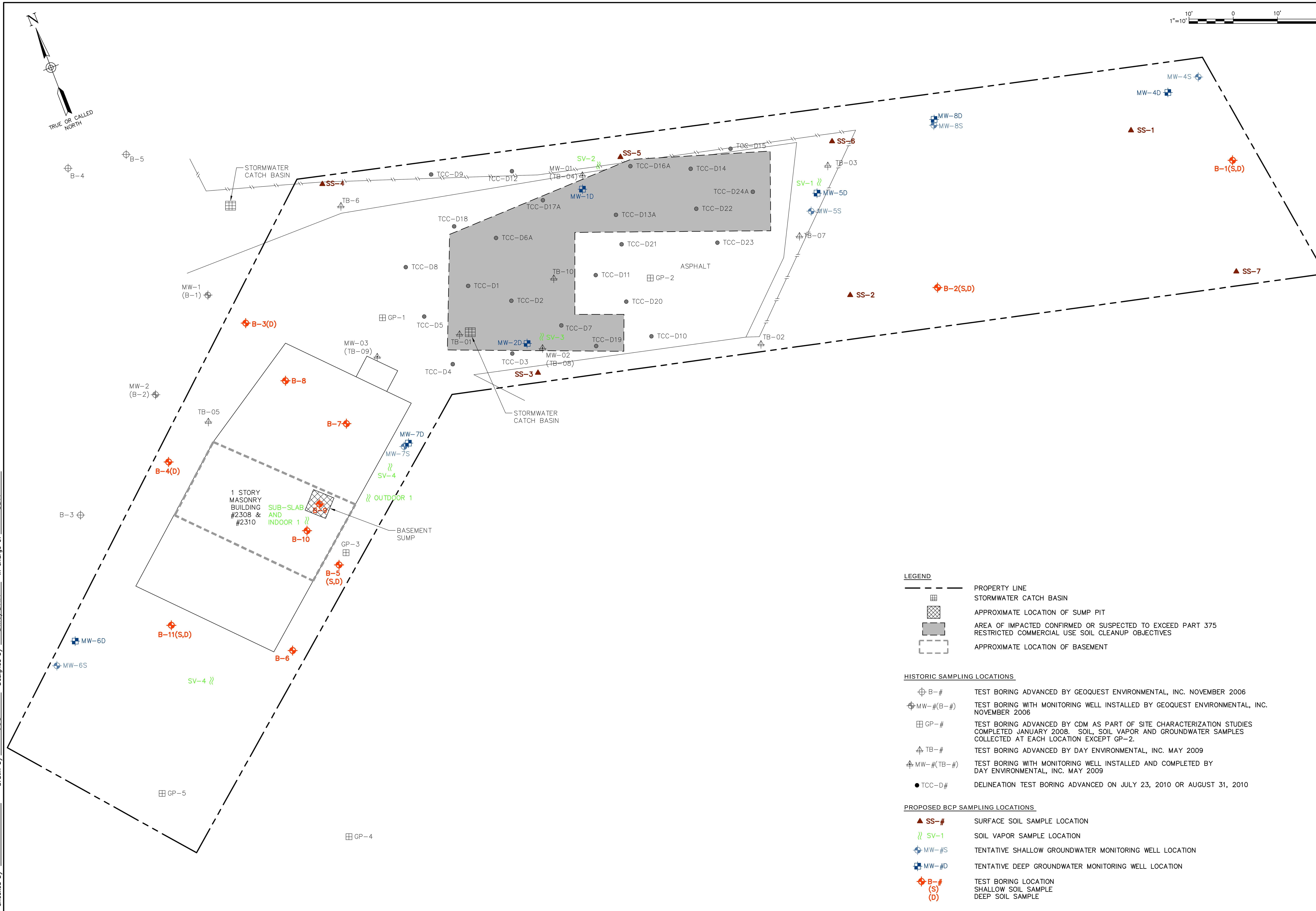
Sheet 1

Proposed Subsurface, Surface, and Vapor Test Locations



LEGEND

———	PROPERTY LINE
⊞	STORMWATER CATCH BASIN
▩	APPROXIMATE LOCATION OF SUMP PIT
▮	AREA OF IMPACTED CONFIRMED OR SUSPECTED TO EXCEED PART 375 RESTRICTED COMMERCIAL USE SOIL CLEANUP OBJECTIVES
⬚	APPROXIMATE LOCATION OF BASEMENT

HISTORIC SAMPLING LOCATIONS

B-#	TEST BORING ADVANCED BY GEOQUEST ENVIRONMENTAL, INC. NOVEMBER 2006
MW-#(B-#)	TEST BORING WITH MONITORING WELL INSTALLED BY GEOQUEST ENVIRONMENTAL, INC. NOVEMBER 2006
GP-#	TEST BORING ADVANCED BY CDM AS PART OF SITE CHARACTERIZATION STUDIES COMPLETED JANUARY 2008. SOIL, SOIL VAPOR AND GROUNDWATER SAMPLES COLLECTED AT EACH LOCATION EXCEPT GP-2.
TB-#	TEST BORING ADVANCED BY DAY ENVIRONMENTAL, INC. MAY 2009
MW-#(TB-#)	TEST BORING WITH MONITORING WELL INSTALLED AND COMPLETED BY DAY ENVIRONMENTAL, INC. MAY 2009
TCC-D#	DELINEATION TEST BORING ADVANCED ON JULY 23, 2010 OR AUGUST 31, 2010

PROPOSED BCP SAMPLING LOCATIONS

SS-#	SURFACE SOIL SAMPLE LOCATION
SV-1	SOIL VAPOR SAMPLE LOCATION
MW-#S	TENTATIVE SHALLOW GROUNDWATER MONITORING WELL LOCATION
MW-#D	TENTATIVE DEEP GROUNDWATER MONITORING WELL LOCATION
B-# (S) (D)	TEST BORING LOCATION SHALLOW SOIL SAMPLE DEEP SOIL SAMPLE

NO ALTERATION PERMITTED HEREON EXCEPT AS PROVIDED UNDER SECTION 7209 SUBDIVISION 2 OF THE NEW YORK STATE EDUCATION LAW.

COMPLETED CONSTRUCTION

Significant Construction Changes Are Shown

By ______ Date ______
Ck'd ______ Date ______

REVISIONS

TOWN AND COUNTRY
2308 AND 2310 MONROE AVENUE – BCP NO. C828149
BROWNFIELD CLEANUP PROGRAM REMEDIAL INVESTIGATION WORK PLAN

PROPOSED SUBSURFACE, SURFACE AND VAPOR TEST LOCATIONS

TOWN OF BRIGHTON MONROE COUNTY, NEW YORK

Barton & Loguidice, P.C.

Date SEPTEMBER, 2011
Scale 1" = 10'
Sheet Number SHEET 1
File Number 1437.001

Plotted: Sep 19, 2011 – 8:04AM SYR By: mj
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Checked by ______ Drawn by JGS Designed by DMJ/DRH In charge of SDN

Appendix A

Site Specific Health and Safety Plan

Town and Country Cleaners
2308 and 2310 Monroe Avenue
Brighton, New York
Site #C828149

Brownfield Cleanup Program

Remedial Investigation Work Plan

Appendix A

Site Specific Health & Safety Plan

***September* 2011**

Town and Country Cleaners
2308 and 2310 Monroe Avenue
Brighton, New York
Site #C828149

Brownfield Cleanup Program

Site Specific Health & Safety Plan

September 2011

Prepared For:

Town and County Redevelopment LLC
259 LaSalle Drive
Webster, New York

Prepared By:

Barton & Loguidice, P.C.
Engineers • Environmental Scientists • Planners • Landscape Architects
290 Elwood Davis Road
Box 3107
Syracuse, New York 13220

Prepared From:

Remedial Investigation Work Plan (February 2011)
Day Environmental, Inc.
40 Commercial Street
Rochester, New York 14614

Table of Contents

Table of Contents – Continued

1.0 Introduction

Barton & Loguidice, P.C. (B&L) has prepared this Site Specific Health and Safety Plan (HASP) from documents previously prepared by Day Environmental, Inc. (DAY) for work tasks associated with the Brownfield Cleanup Program (BCP) investigation being conducted at the Town and Country facility located at 2308 Monroe Avenue, Rochester, NY (Site).. Text in a different font (Times New Roman) and italics has been updated by B&L for this current version (September 2011). All remaining text is the work product of DAY and is referenced from their February 2011 Remedial Investigation Work Plan. The laboratory analytical results from previous soil and groundwater samples indicate the presence of VOCs, at values greater than NYSDEC standards; these are the *known* contaminants of concern (COCs) on the Site.

This plan outlines the health and safety procedures, personal protective equipment (PPE), and field monitoring equipment required for monitoring the performance of health and safety requirements during proposed RI activities. Adherence to the details outlined in the HASP is intended to minimize the potential for injury or exposure to contaminants of concern to *B&L* employees conducting work on this Site.

1.1 Health and Safety Plan Overview

This HASP has been prepared for *B&L* personnel for activities conducted during the proposed RI project work. The procedures and personal protective equipment described in this plan were developed after reviewing the Site environmental data from previous investigations conducted by DAY *and others*. DAY *and B&L have* evaluated the potential hazards that may be encountered during the tasks and project work detailed in the RI Work Plan. The purpose of this HASP is to:

- Establish personnel safety/protection standards that meet or exceed the Occupational Safety and Health Administration (OSHA) Regulations;
- Define responsibilities of different organizations and personnel;
- Establish safe operating procedures relative to the conditions encountered at the project work area;
- Define the project work area;
- Provide for anticipated contingencies that may arise during the course of investigation work; and
- Modify the HASP in response to new environmental data or conditions encountered during implementation of the investigation.

2.0 Site Access & Personnel

B&L personnel working at the Site must follow this HASP and other appropriate written safe access procedures maintained by *B&L*.

2.1 Site Access

Site access will be given to *B&L* personnel, *B&L's* sub-contractors, and appropriate regulatory agencies involved with the project. *B&L* and *B&L's* sub-contractors are responsible for providing a safe work area and securing the project work area during work hours and during nonwork hours.

Site Specific Health & Safety Personnel

B&L is responsible for the health and safety of *B&L* personnel. This responsibility includes:

- Provide overall health and safety oversight for the project;
- Prepare and/or review potential changes to this HASP and edit a task-specific addendum to the HASP, if required; and
- Monitor health and safety performance.

One person may be designated as having the responsibilities of the key personnel listed below for this project. A description of the responsibilities of the key personnel involved in the HASP program is presented below.

Project Manager

The Project Manager (PM) will assist with management of on-Site work tasks. The PM is responsible for:

- Managing the planned work requirements so that work performed adheres to the outlined health and safety procedures;
- Providing guidance so that personnel follow health and safety procedures;
- Reviewing daily work activities and field conditions encountered that may result in potential injury or exposure to contaminants of concerns (COCs) as identified during project work; and
- Providing notification of unsafe conditions noted during fieldwork to Site owner and subcontractors.

Site Health and Safety Officer

The Site Health and Safety Officer's (SHSO) responsibilities will be implemented by the on-Site representative who will be present during the majority of the field phase of the project. The SHSO will be responsible for the following tasks:

- Implementing the HASP;
- Maintaining a daily record (if relevant to health and safety at the project Site) of personnel activities, monitoring activities and results, exposure incidents, and personnel protection equipment usage;

- Monitoring anticipated hazards and propose modifications (if necessary) for the level of personnel protection and/or work procedures;
- Advising the PM on work activities completed and proposed work tasks or conditions which may impact health and safety requirements;
- Having copies of this HASP available on-Site for review; and
- Recording daily weather conditions (e.g., temperature, wind speed/direction, etc.) if these conditions are relevant to health and safety at the project Site.

The SHSO has the authority to suspend work activities if it is felt that the Site or weather conditions may adversely affect personnel health and safety. The SHSO will notify the PM, subcontractors, and Site owner of such actions.

On-Site Workers

B&L project personnel involved in the proposed investigation activities are responsible for:

- Reading, understanding, and complying with the requirements of the HASP;
- Taking reasonable precautions to prevent incidents and to report accidents;
- Implementing procedures specified in this HASP, and report deviations to the SHSO; and
- Performing the tasks for which they are trained.

For this project, hard hats, work boots, safety glass, and gloves (Level D) are required for field tasks.

Copies of 40-hour HAZWOPER/8-hour refresher certificates are provided in Appendix A.

Visitors

Non-Site workers and Site visitors are responsible for:

- Reading, understanding, and complying with the requirements of the HASP;
- Having the required personnel protecting equipment (e.g., hard hats, safety glass, and work boots); and
- Taking reasonable precautions to prevent incidents that may result in injury.

3.0 Health & Safety Risk Analyses

3.1 Site Overview

The Site is located at:

2308 and 2310 Monroe Avenue
Brighton, New York 14618

A sub-contractor will install the test borings, groundwater monitoring wells, and *soil vapor points* proposed in the RI Work Plan. *B&L* will supervise these subsurface explorations and select soil and groundwater samples for laboratory testing.

3.2 Hazard Analyses

Physical Hazards

Possible physical hazards associated with the proposed work include, but are not limited to the following:

- Hazards associated with injury from vehicles or drilling equipment;
- Hazards associated with excavation activities (i.e., slip or trip into the excavation);
- Underground utilities injury from damage to these utilities (i.e., electric shock, fire, and explosion); and Heat and/or cold stress
- *Slip, trip, and fall hazards (Uneven Terrain)*
- *Noise from heavy equipment - Engineering controls and personal protective equipment will be used to protect employees' hearing.*

- *Electrical Hazards - overhead power lines, electrical wires and cables, site electrical equipment, and lightning also pose a potential hazard to site workers. Site personnel should constantly look out for potential safety hazards and should immediately inform the SHSO of any new hazards*
- *Biological Hazards (insects, poison ivy, etc.) - PPE can reduce the potential for exposure. The SHSO can assist in determining the correct PPE for the hazard present.*
- *Traffic – Portions of the site work will be conducted during normal business hours with pedestrian and customer traffic. The SHSO will be responsible for establishing work zones associated with each activity.*

Chemical Hazards

The chemicals listed below in Table 3.2A are VOCs that were detected at the Site in environmental samples at concentrations above NYSDEC Subpart 375-6 Unrestricted Remedial Soil Clean-up Objectives and NYSDEC TOGS 1.1.1 groundwater standards or guidance values. This list also presents the permissible exposure limits (PELs) and levels that are considered an immediate danger to life or health (IDLH), if such values are available. A summary of the United States Center for Disease Control (CDC) chemical descriptions and hazards associated with overexposure to these VOCs are also presented below. A National Institute for Occupational Safety and Health (NIOSH) Chemical Hazard Data Sheet for each compound is included in Appendix B.

Table 3.2A - Assessment of Chemicals of Potential Concern

Chemical Name	PEL/TLV	Other Pertinent Limits (Specify)	Warning Properties – Odor Threshold	Potential Exposure Pathways	Acute Health Effects	Chronic Health Effects
Decontamination Materials:						
Isopropyl Alcohol (for decontamination, if necessary)	*400 ppm/400 ppm*	*STEL = 500 ppm IDLH = 2000 ppm*	*Colorless liquid with the odor of rubbing alcohol*	*Inhalation. Absorption, Ingestion, Contact*	*Eye, skin & respiratory irritation; headache, drowsiness, dizziness, dry cracking skin*	*Dermatitis*
Methanol (for decontamination, if necessary)	*200 ppm/200 ppm*	*IDLH = 6000*	*Colorless liquid with a pungent odor – 141 ppm*	*Inhalation. Absorption, Ingestion, Contact*	*Irritation of eyes, skin, respiratory system, headache, drowsiness, dizziness, vertigo, light-headedness, nausea, vomiting, visual disturbances*	*Optic nerve damage, dermatitis, damage to respiratory system and GI tract*
VOCs:						
Acetone	*1000 ppm/500ppm*	*REL = 250 ppm IDLH = 2500 ppm*	*Colorless, volatile, extremely flammable liquid. Nail polish odor*	*Inhalation. Absorption, Ingestion, Contact*	*Ingestion can cause unconsciousness and damage to the mouth. Skin irritant.*	*Kidney, liver and nerve damage.*
Benzene	*1 ppm/ 0.5 ppm*	*STEL=5 ppm IDLH=500 ppm*	*Colorless to light yellow liquid with an aromatic odor – 8.65 ppm*	*Inhalation. Absorption, Ingestion, Contact*	*Eye, skin, nose & respiratory irritation; nausea, headache, staggered gait, fatigue, anorexia, weakness, exhaustion*	*Carcinogen, dermatitis, bone marrow depression, damage to the eyes, respiratory system. CNS*
1,1-dichloroethene	*None listed/5 ppm*	*--*	*Colorless liquid with a sweet smell.*	*Inhalation. Absorption, Ingestion, Contact*	*Dizziness, headache, trouble breathing, fainting.*	*Central nervous system, liver, lungs*
Cis 1,2-dichloroethene	*200 ppm/200 ppm*	*REL = 200 ppm IDLH = 1000 ppm*	*Colorless liquid with a sharp, harsh odor*	*Inhalation. Absorption, Ingestion, Contact*	*Nausea, drowsiness, unconsciousness*	*Central nervous system, liver, lungs*
Ethylbenzene	*100 ppm/100 ppm*	*STEL = 125 ppm IDLH = 800 ppm*	*Colorless liquid with an aromatic odor*	*Inhalation. Absorption, Ingestion, Contact*	*Eye, skin & respiratory irritation; CNS effects; headache*	*Dermatitis; CNS effects;*

Table 3.2A - Assessment of Chemicals of Potential Concern

Chemical Name	PEL/TLV	Other Pertinent Limits (Specify)	Warning Properties – Odor Threshold	Potential Exposure Pathways	Acute Health Effects	Chronic Health Effects
Methyl ethyl ketone (MEK, 2-butanone)	*200 ppm/200 ppm*	*IDLH = 3000 ppm*	*Colorless liquid with a moderately sharp, fragrant, mint-or acetone-like odor*	*Inhalation. Absorption, Ingestion, Contact*	*Eye, skin & respiratory irritation; depression; CNS effects*	*Eyes; respiratory system; dermatitis; CNS; liver and kidneys*
Trichloroethene	*25 ppm/25 ppm*	*IDLH=1000 ppm*	*Colorless liquid with a sweet odor*	*Inhalation. Absorption, Ingestion, Contact*	*Irritation of eyes, nose, throat; nausea; headache, lung irritation, dizziness, poor coordination, difficulty concentrating*	*Liver and kidneydamage. Target organs: eyes, skin, respiratory system, liver, kidneys, CNS.*
Tetrachloroethene	*100 ppm/25 ppm*	*C=200 ppm STEL (5 min)=300 ppm IDLH=100 ppm*	*Colorless to pale yellow liquid with a pungent, chloroform-like odor*	*Inhalation. Absorption, Ingestion, Contact*	*Irritation of eyes, nose, throat; nausea; flushing of face and neck; vertigo, dizziness, inchohence; headache, somnolence; skin erythema*	*Liver damage. Target organs: eyes, skin, respiratory system, liver, kidneys, CNS.*
Toluene	*200 ppm/ 50 ppm*	*C=300 ppm STEL=150 ppm IDLH=500 ppm*	*Colorless liquid with a sweet, pungent, benzene-like odor*	*Inhalation. Absorption, Ingestion, Contact*	*Eye, skin & respiratory irritation; confusion, dizziness, headache*	*CNS effects; liver, kidney damage; dermatitis*
Vinyl Chloride	*1 ppm/1 ppm*	*--*	*Colorless gas with a mild, sweet odor*	*Inhalation.*	*Nausea, drowsiness, unconsciousness*	*Central nervous system, immune system, liver, circulatory system*
Total Xylenes	*100 ppm/100 ppm*	*STEL = 150 ppm IDLH = 900 ppm*	*Colorless liquid with an aromatic odor*	*Inhalation. Absorption, Ingestion, Contact*	*Eye, skin & respiratory irritation; dizziness, drowsiness, nausea, vomiting, headache, abdominal pain*	*Dermatitis; CNS effects; liver/kidney damage; blood*
SVOCs						
Dibenzofuran	*Not available*	*Not available*	*White crystalline solid*	*Inhalation Absorption Ingestion Contact*	*No information is available on the acute effects of dibenzofuran in humans or animals.*	*No information is available on the chronic effects of dibenzofuran in humans or animals.*
4-Methyl phenol (p-cresol)	*5 ppm/5 ppm*	*IDLH=250 ppm*	*Crystalline solid with a sweet, tarry odor (Note: liquid above 95 degree F*	*Inhalation Absorption Ingestion Contact*	*Eye, skin, mucous membrane irritation.; CNS effects: confusion, depression, respiratory failure; dyspnea, irregular rapid respiration, weak pulse; eye and skin burns; dermatitis.*	*Lung, liver, kidney, pancreas damage,*

Table 3.2A - Assessment of Chemicals of Potential Concern

Chemical Name	PEL/TLV	Other Pertinent Limits (Specify)	Warning Properties – Odor Threshold	Potential Exposure Pathways	Acute Health Effects	Chronic Health Effects
Naphthalene (and 2-methyl naphthalene)	*10 ppm/10 ppm*	*IDLH=250 ppm*	*Colorless to brown solid with an odor of mothballs.*	*Inhalation Absorption Ingestion Contact*	*Eye irritation; headache, confusion, excitement, malaise; nausea, vomiting, abdominal pain; irritated bladder; profuse sweating; jaundice, hematuria, hemoglobinuria, renal shutdown; dermatitis; optical neuritis, corneal damage.*	*Target organs: eyes, skin, blood, liver, kidneys, CNS.*
Polyaromatic Hydrocarbons (PAHs)**:* ***Benzo(a)anthracene ***Benzo(b)Fluoranthene*** ***Benzo(k)Fluoranthene*** ***Benzo(a)pyrene*** ***Chrysene*** ***Dibenzo(ah)anthracene*** ***Floranthene*** ***Indeno(1,2,3-cd)pyrene*** ***Phenanthrene*** ***Pyrene***	*PAHs TLV = 0.2* mg/m^3	*PAHs IDLH = 80* mg/m^3	*NA*	*Inhalation Absorption Ingestion Contact*	*Skin, respiratory irritants*	*Bladder and kidney are target organs*

PEL = OSHA Permissible Exposure Limit; represents the maximum allowable 8-hour time-weighted average (TWA) exposure concentration.
TLV = ACGIH Threshold Limit Value; represents the maximum recommended 8-hour TWA exposure concentration.
STEL = OSHA Short-term Exposure Limit; represents the maximum allowable 15-minute TWA exposure concentration.
C = OSHA Ceiling Limit; represents the maximum exposure concentration above which an employee shall not be exposed during any period without respiratory protection.
IDLH = Immediately Dangerous to Life and Health; represents the exposure likely to cause death or immediate delayed permanent adverse health effects or prevent escape from such an environment

Acetone

General Description: A colorless, volatile, extremely flammable liquid, which is widely used as an organic solvent. It is readily soluble in water, ethanol, ether, etc., and itself serves as an important solvent. The most familiar household use of acetone is as the active ingredient in nail polish remover. Acetone is also used to make plastic, fibers, drugs, and other chemicals.

Safety and Health: Swallowing very high levels of acetone can result in unconsciousness and damage to the skin in the mouth. Skin contact can result in irritation and damage to the skin. Kidney, liver, and nerve damage, increased birth defects, and lowered reproduction ability of males (only) occurred in animals exposed long-term. It is not known if these same effects would be exhibited in humans.

1,1-Dichloroethene

General Description: 1, 1-Dichloroethene is an industrial chemical that is not found naturally in the environment. It is a colorless liquid with a mild, sweet smell. It is also called vinylidene chloride. 1, 1-Dichloroethene is used to make certain plastics, such as flexible films like food wrap, and in packaging materials. It is also used to make flame retardant coatings for fiber and carpet backings, and in piping, coating for steel pipes, and in adhesive applications.

Safety and Health: The main effect from breathing high levels of 1,1-dichloroethene is on the central nervous system. Some people lost their breath and fainted after breathing high levels of the chemical. Breathing lower levels of 1,1-dichloroethene in air for a long time may damage your nervous system, liver, and lungs. Workers exposed to 1,1-dichloroethene have reported a loss in liver function, but other chemicals were present.

Cis 1,2-dichloroethene

General Description: 1, 2-Dichloroethene, also called 1, 2-dichloroethylene, is a highly flammable, colorless liquid with a sharp, harsh odor. It is used to produce solvents and in chemical mixtures. You can smell very small amounts of 1, 2-dichloroethene in air (about 17 parts of 1, 2-dichloroethene per million parts of air [17 ppm]). There are two forms of 1, 2-dichloroethene; one is called cis-1, 2-dichloroethene and the other is called trans-1,2-dichloroethene. Sometimes both forms are present as a mixture.

Safety and Health: Breathing high levels of 1,2-dichloroethene can make you feel nauseous, drowsy, and tired; breathing very high levels can kill you.

Tetrachloroethene

General Description: Tetrachloroethene is a manufactured chemical that is widely used for dry cleaning of fabrics and for metal-degreasing. It is also used to make other chemicals and is used in some consumer products. Other names for Tetrachloroethene include perchloroethylene, PCE, and tetrachloroethene. It is a nonflammable liquid at room temperature. It evaporates easily into the air and has a sharp, sweet odor. Most people can smell Tetrachloroethene when it is present in the air at a level of 1 part Tetrachloroethene per million parts of air (1Â ppm) or more, although some can smell it at even lower levels.

Safety and Health: High concentrations of Tetrachloroethene(particularly in closed, poorly ventilated areas) can cause dizziness, headache, sleepiness, confusion, nausea, difficulty in speaking and walking, unconsciousness, and death. Irritation may result from repeated or extended skin contact with it. These symptoms occur almost entirely in work (or hobby) environments when people have been accidentally exposed to high concentrations or have intentionally used Tetrachloroethene to get a "high." The health effects of breathing in air or drinking water with low levels of Tetrachloroethene are not known.

Trichloroethene

General Description: Trichloroethene (TCE) is a nonflammable, colorless liquid with a somewhat sweet odor and a sweet, burning taste. It is used mainly as a solvent to remove grease from metal parts, but it is also an ingredient in adhesives, paint removers, typewriter correction fluids, and spot removers. Trichloroethene is not thought to occur naturally in the environment. However, it has been found in underground water sources and many surface waters as a result of the manufacture, use, and disposal of the chemical.

Safety and Health: Breathing small amounts of Trichloroethene may cause headaches, lung irritation, dizziness, poor coordination, and difficulty concentrating. Breathing large amounts of Trichloroethene may cause impaired heart function, unconsciousness, and death. Breathing it for long periods may cause nerve, kidney, and liver damage. Drinking large amounts of Trichloroethene may cause nausea, liver damage, unconsciousness, impaired heart function, or death. Drinking small amounts of Trichloroethene for long periods may cause liver and kidney damage, impaired immune system function, and impaired fetal development in pregnant women, although the extent of some of these effects is not yet clear.

Vinyl Chloride

General Description: Vinyl chloride is a colorless gas. It burns easily and it is not stable at high temperatures. It has a mild, sweet odor. It is a manufactured substance that does not occur naturally. It can be formed when other substances such as trichloroethane, Trichloroethene, and Tetrachloroethene are broken down. Vinyl chloride is used to make polyvinyl chloride (PVC). PVC is used to make a variety of plastic products, including pipes, wire and cable coatings, and packaging materials. Vinyl chloride is also known as chloroethene, chloroethylene, and ethylene monochloride.

Safety and Health: Breathing high levels of vinyl chloride can cause you to feel dizzy or sleepy. Breathing very high levels can cause you to pass out, and breathing extremely high levels can cause death. Some people who have breathed vinyl chloride for several years have changes in the structure of their livers. People are more likely to develop these changes if they breathe high levels of vinyl chloride. Some people who work with vinyl chloride have nerve damage and develop immune reactions. The lowest levels that produce liver changes, nerve damage, and immune reaction in people are not known. The effects of drinking high levels of vinyl chloride are unknown. Some workers exposed to very high levels of vinyl chloride have problems with the blood flow in their hands. Their fingers turn white and hurt when they go into the cold. If you spill vinyl chloride on your skin, it will cause numbness, redness, and blisters.

4.0 Site Control Measures

4.1 Site Control

Site control will minimize potential injury and exposure of COCs to workers and observers. Site control measures also enhance response in emergency situations.

It is anticipated that project work under this program will be generally conducted following Level D health and safety protocol. In the event that an upgrade to Level C health and safety protocol is necessary, a meeting will be held to prepare for Level C health and safety issues and revisions to the HASP. Project work areas and locations to support level C field operations will be defined and divided into distinct areas. The actual extent of each area is considered task and location specific and will be determined in the field.

The following are the daily operating procedures that are to be followed by all on-site personnel:

- *Hold Tailgate Safety Meetings prior to work start and as needed thereafter (suggest daily; however, minimum of weekly).*
- *Use monitoring instruments and follow designated protocol and contaminant action levels.*
- *Use PPE as specified.*
- *Use hearing protection if noise levels exceed 85 dBA and around heavy equipment.*
- *Remain upwind of operations and airborne contaminants, if possible.*

- *Establish a work/rest regimen when ambient temperatures and protective clothing create potential thermal hazards.*
- *Eating, drinking, applying cosmetics and smoking is prohibited in work areas.*
- *Refer to the SHSO for specific safety concerns for each individual site task.*
- *On-site personnel are encouraged to be alert of their own physical condition, as well as their co-workers.*
- ***All accidents, no matter how minor,** must be immediately reported to the SHSO.*

The degree of site control necessary depends on site characteristics and the surrounding community. At this time, there are no access restrictions to the site. During the field activities, B&L and Town and Country are requesting that personnel, subcontractors, and visitors report to the on-site B&L supervisor prior to entering the work area.

Since there are no access restrictions to the Site, particular attention will be placed on the condition of the site regarding four main work zone areas:

4.1.1 Activity Zone

This zone applies to the immediate work area and includes all materials, equipment, vehicles and personnel involved in the site activity. For example, during the installation of a monitoring well, the activity zone will encompass the borehole, drilling rig, monitoring well construction materials and equipment, sampling equipment, decontamination supplies, and drilling/well inspection personnel. Site control measures will include flagging the perimeter of the activity zone to clearly mark the limits of work and to warn passers-by and *visitors of the site activity. In addition, the Site Supervisor will maintain communication with Town and Country personnel as the location of this zone (and the type of work being performed) changes throughout the project.*

This area will be limited to authorized personnel from B&L, regulatory agencies, and contractors/subcontractors to Town and Country. Personnel entering this area will be required to comply with their own HASP that is at least as stringent as this HASP.

Workers entering this zone will be required to be protected as defined in Section 7.0 of this HASP. The work zone is intended for OSHA-trained workers. Within this zone, the levels of protection may be changed in accordance with Section 7.3 of this HASP. The work zone will be considered a 20-foot radius around the investigation locations, the excavation area, and the impacted soil staging area.

4.1.2 Material and Equipment Storage Zone

This zone exhibits the least amount of activity, and as a result, will require the least security. An appropriate area will be designated on-site for the storage of all equipment and supplies to be used throughout the site investigation. The area is to be kept clean and orderly at all times and free from loose equipment, tools, materials or supplies which may compromise the safety of site workers, Town and Country personnel or the public. Construction materials and equipment will be covered with plastic at the end of each workday. Any spills or breakages occurring in this area will be immediately attended to before the Site work continues. This zone is anticipated to be located on the northeastern portion of the site.

4.1.3 Decontamination Zone

In order to prevent incidental contact with contaminants on investigation equipment or in the wash water, all activities within the decontamination area will be completed before subsequent site work or any other activity begins. This includes:

- *Complete removal of contaminants on all equipment used during the preceding phase of the investigation;*
- *Placement of the waste wash water and sediment in sealed drums;*
- *Storage of the drums in a secure and out-of-the-way place for future disposal;*
- *Proper labeling of drum contents;*
- *Cleanup (if necessary) of area outside of decontamination area; and*
- *Storage of all decontamination equipment, site investigation equipment and materials in the Materials and Equipment Storage Zone.*

This zone is anticipated to be located on the northeastern portion of the site.

4.1.4 Support Zone

The support zone is the location of the administrative and other support functions needed to keep the operations in the activity and decontamination zone running smoothly. Any function that need not or cannot be performed in a hazardous atmosphere is performed here. Personnel may wear normal work *clothes within this zone. Any potentially contaminated clothing, equipment and samples must remain in the decontamination zone until decontaminated. All emergency telephone numbers, change for the telephone (if necessary), evacuation route maps, and vehicle keys should be kept in the support zone.*

The SHSO will establish decontamination system and decontamination procedures appropriate to the site and the work that will prevent potentially hazardous materials from leaving the site. All personnel exiting the activity zone will be decontaminated prior to entering the support zone. The decontamination procedures will be reviewed at each daily safety briefing.

Personal hygiene facilities meeting at least the minimum requirements of 29 CFR Part 1910.120 will be provided nearby.

Upon completion of the day's activities, heavy machinery and equipment will be stored securely within the site, or at a location selected by the SHSO.

4.2 Site Security

The SHSO or designated alternate is responsible for controlling access to the active work zone during daytime hours. The sub-contractor is responsible for securing the excavations, *test pits and trenches* during working hours and non-working hours. When necessary to establish a work zone as defined above, the same will be identified by barricades or a barrier fence or tape which will be placed a minimum of 10 feet from the edge of the excavation area. Excavations left open overnight or during non-working hours will be barricaded with orange snow fence or equivalent. *Any excavation, test pit or trench will be treated as an activity zone as defined above with at least a 20-foot protective radius. This radius will* *be cordoned from the public by cones or other protective barriers during working hours, and barricaded by orange snow fence or equivalent during non-working hours.*

4.3 Buddy System

Field activities in contaminated or otherwise potential hazardous work areas should be conducted, whenever possible, with a buddy who is able to:

- Provide partner with assistance;
- Observe partner for signs of chemical or heat/cold exposure;
- Periodically check the integrity of partner's protective clothing; and
- Notify the SHSO or others if emergency help is needed.

4.4 Site Communications

Communications will be conducted through verbal communications. When out of audible range, verbal communications will be communicated using portable telephones or a 2-way radio.

Communications between workers in various zones shall consist of standard hand signals, voice, or radios. A portable telephone will be used to contact appropriate agencies in the event of an emergency.

4.5 Safe Work Practices

Operating procedures consistent with general safety rules should be followed by all workers. Workers will be conscientious of others working around them and check that they are safe, and working in a safe manner.

General safety rules that will be enforced at the project work areas include the following:

- Monitoring excavations from an upwind location and periodically from a downwind location;
- Smoking will be prohibited in the work zone;
- Eating and chewing gum will be prohibited at work zones;
- Field work will be conducted during daylight hours unless adequate light is provided;
- Anyone authorized to enter the Site will sign the daily field log and will also be required to follow all procedures in this HASP;
- Workers must thoroughly wash their hands prior to leaving the work area and decontamination zones and before eating or drinking; and
- Excessive facial hair should be minimized in the event that respiratory equipment is required for Level C project work.

4.6 Visitors

Visitors may be permitted in the immediate area of active operations with the approval from the SHSO. Visitors will not be allowed to enter into the work zone and decontamination zones. Site visitors will be briefed on appropriate sections of the HASP. The presence of visitors will be documented on the daily log maintained by the SHSO or designated alternate during all Site activities. Visitor vehicles will be restricted to Support Zones. Visitors will not be allowed in work areas during Level C project work.

4.7 Nearest Medical Assistance

First Aid supplies will be located near the area of the work zone, support zone, or in a field vehicle. Additional medical assistance can be summoned by dialing “911”.

The nearest hospital is Strong Memorial Hospital. The emergency route from the Site to this facility is shown on Figure 1 – Hospital Emergency Route.

Additional information regarding driving directions to medical assistance, evacuation routes, and emergency procedures is contained in Section 9.0 of this HASP.

4.8 Safety Equipment

In addition to the PPE necessary to conduct work activities, the following inventory of safety equipment will be available:

- First aid kit;
- Scissors or knife for emergency equipment removal;
- Emergency eye wash;
- Rope for securing objects and use as a lifeline;
- Electrolyte replacement drink – stored in clean area; and
- Fire extinguisher for Class ABC fires.

4.9 Community Air Monitoring Plan

During *intrusive subsurface site activities*, real-time air monitoring for volatile organic compounds (VOCs) and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. A Community Air Monitoring Plan

(CAMP) will be implemented in accordance with Appendix 1A *and IB* of the DER-10 guidance document. A copy of DER-10 Appendix 1A *and IB are* included as Appendix C.

5.0 Employee Training

5.1 Pre-Assigned & Annual Refresher Training

B&L employees and contractor personnel working on this site will be trained in accordance with OSHA 29 CFR Part 1910.120. *All OSHA HAZWOPER certifications for all individuals working on the Site will be made available upon request.*

6.0 Medical Surveillance

B&L employees and contractors will follow their respective individual in-house medical surveillance procedures.

7.0 Personal Protective Equipment

The SHSO has reviewed the environmental and historical sampling data that is relevant to the proposed work to determine potential exposure to COCs and physical hazards. This review resulted in designating the work area as a construction zone. Level D PPE has been designated as the primary level of personnel protection that should be used during project work where contact with soil and groundwater is possible. Upgrading to Level C will be executed as required in the monitoring guidelines outlined.

7.1 Personal Protective Equipment Selection Criteria

PPE requirements selected for each project work task are specified in Section 7.3 of this HASP. Equipment selection was based upon the mechanics of the task and the nature of the hazards that are anticipated. The following criteria were used in the selection of PPE equipment:

- Chemical hazards known or suspected to be present;
- Routes of entry trough which the chemicals could enter the body, e.g., inhalation, ingestion, skin contact; and
- Potential for contaminant/worker contact while performing the specific task or activity.

Based on available data, *B&L* anticipates that most on-Site or near-site work activities will be performed at Level D protection. However, Level C protection will be available in the event an upgrade is required.

7.2 Selected Personal Protective Equipment Ensembles

The following components of Level D PPE will be available and used as appropriate in accordance with the specifications of this HASP:

- Safety glasses
- Hard hat when working with heavy equipment
- Steel-toed or composite-toed work boots
- Protective gloves (e.g., nitrite) during sampling or handling of potentially contaminated media
- Work clothing as prescribed by weather

It is possible that an upgrade to Level C may be required during the tasks identified during the project work. If an inhalation hazard is present or per the guidelines presented in the PPE reassessment program, Level C will consist of the following:

- Air-purifying respirator with appropriate cartridges
- Outer protective wear, such as Tyvek coverall [Tyveks (Sarans) and PVC acid gear will be required when workers have a potential to be exposed to impacted liquids or particulates].
- Hard hat
- Steel-toed or composite-toed work boots
- Nitrile, neoprene, or PVC overboots, if appropriate
- Nitrile, neoprene, or PVC gloves, if appropriate
- Safety glasses

- Face shield (when projectiles or splashes pose a hazard and when using a half-face respirator)

7.2.1 Levels of Protection

The following anticipated levels of protection will be used for specific work activities. Adjustments to these levels may be required given the Site conditions encountered.

- Soil borings and collection of soil samples –Level D
- Groundwater monitoring well installation and collection of water samples – Level D
- *Collection soil vapor samples – Level D*
- *Utility investigation – Level D*
- *Sump water and sediment collection – Level D*

7.3 Personal Protective Equipment Reassessment Program

Air monitoring will be conducted during the project work when *subsurface site investigation of* impacted soils is performed. Such monitoring will be conducted within the work zone utilizing photoionization detection (PID) with a 10.6 eV lamp, or equivalent. Monitoring will consist of determining breathing zone concentrations of total volatile organic vapors. The air monitoring equipment utilized will be calibrated and maintained, in accordance with the manufacturer's instructions. The calibrations and checks will be recorded in the field book. This will be performed by field staff at the beginning each day and more frequently, as the conditions warrant.

Background readings will be obtained in the work zone, upwind, downwind, and support zone prior to excavation of COC impacted soil. Following the establishment of background PID measurement, air monitoring will be conducted in the work zone during the soil excavation activities. Periodic PID measurements will be obtained at downwind locations. The PID measurements will be utilized for evaluating potential upgrade to Level C, if necessary. This may be accomplished by comparing PID measurements to health and safety action levels. The action levels for the PID air-monitoring measurements in the worker's breathing zone are provided below:

- Upgrade from Level D to Level C the following conditions exist:
    - ♦ Total Organic Vapor (TOV) is greater or equal to 5 ppm and less than 50 ppm with compensation made for background readings sustained for a period of at least 10 minutes.
- Downgrade from Level C to Level D if both of the following conditions exist: Total Organic Vapor (TOV) is less than 5 ppm, above background sustained for a period of at least 10 minutes, with subsequent approval to downgrade provided by the Project Manager.

Immediate Evacuation of Area:

- Total Organic Vapor (TOV) – sustained readings greater or equal to 50 ppm in the workers' breathing zone.
- Excavation of unknown soil type or containers.

If evacuation of the area becomes necessary, a meeting will be held to address the air monitoring results and air monitoring may be continued until levels are below evacuation criteria so the area can be reentered. *If evacuation is necessary the Emergency Response Procedures outlined in Section 9.0 should be followed.*

8.0 Decontamination Procedures

Field decontamination of PPE (e.g., Boots) will consist of washing contaminated PPE with a mixture of Alconox soap and water. Modification to the decontamination protocol for PPE will be made on-Site as needed.

9.0 Emergency Response Procedures

9.1 Pre-Emergency Planning

Planning for emergencies is a crucial part of emergency response. The SHSO is responsible for training all employees in potential site hazards and the emergency response procedures.

9.2 Personnel Roles

The SHSO is responsible for responding to, or coordinating the response of, off-site personnel to emergencies. In the event of an emergency, the SHSO will direct all notification, response and follow-up actions. Contacts with outside response personnel (hospital, fire department, etc.) will be done at the direction of the SHSO.

Prior to the start of work on the site, the SHSO will:

1. Confirm that the following safety equipment is available: personal protective equipment, first aid supplies, cellular phone, and fire extinguishers;
2. Have a working knowledge of the safety equipment available; and

The SHSO will be responsible for directing notification, response and follow-up actions and for contacting outside response personnel (ambulance, fire department or others) prior to and during an emergency. Upon notification of an exposure incident, the SHSO will call the Hospital and fire and police emergency response personnel for recommended medical diagnosis, treatment, if necessary, and transportation to the hospital.

The SHSO must conduct an investigation of the incident as soon as possible. The SHSO will determine whether and at what levels exposure actually occurred, the cause of such exposure, and the means to prevent similar incidents from occurring. The resulting report must be accurate, objective, complete and signed and dated.

9.3 Emergency Procedures

9.3.1 Incident Procedures

If an emergency incident occurs, the following actions will be taken:

1. Size-up the situation based upon available information.
2. Notify the SHSO.
3. Only respond to an emergency if personnel are sufficiently trained and properly equipped.
4. As appropriate, evacuate site personnel and notify emergency response agencies, e.g., police, fire, etc.
5. As necessary, request assistance from outside sources and/or allocate personnel and equipment resources for the response.
6. Consult the posted emergency telephone list and contact key project personnel.
7. Prepare an incident report.

All site personnel should be aware of the location of fire fighting equipment. Personnel shall only extinguish minor fires. Large fires will require contacting the local fire department and allowing them to handle the fire.

9.3.2 Medical Emergencies

In the event of an accident or injury, workers will immediately implement emergency decontamination and isolation measures to assist those who have been injured or exposed and to protect others from the hazards. Upon notification of an exposure incident, the SHSO will contact the emergency response personnel who can provide medical diagnosis and treatment. If necessary, immediate medical care will be provided by trained personnel competent in first aid procedures. Trained personnel competent in such matters will only provide other on-site medical and/or first aid response to an injury or illness.

If an individual is transported to a hospital or doctor, a copy of this HASP will accompany the individual.

The SHSO will be notified when an accident or incident occurs and will respond according to the seriousness of the incident. The SHSO will investigate facility/site conditions to determine whether and at what levels exposure actually occurred, the cause of such exposure and the means to be taken to prevent the incident from recurring.

The SHSO and the exposed individual will complete an exposure-incident investigation. The SHSO will prepare a signed and dated report documenting the investigation. The SHSO and the exposed individual will also complete an exposure-incident reporting form. The form will be filed with the employee's medical and safety records to serve as documentation of the incident and the actions taken.

Emergency first aid may include taking care of minor scrapes to performing CPR. All site personnel should be familiar with the location of the site first aid kits. Contacting hospital and/or emergency agencies shall be made on a case by case basis depending on the severity of the injury. If an off-site emergency agency is contacted, all the details relating to the injury should be relayed to that agency. All site injuries should be documented. The following actions should be taken if someone requires first aid:

1. Survey the scene to determine if it is safe to reach the injured person.
2. Ask the injured person what happened. If the person is unconscious, look for signs as to what may have occurred.
3. See if there are others injured.
4. Reassure the victim. Contact others for help; tell them to call the appropriate emergency agency.
5. If it is safe to move the victim, return them back to the field office.

Only trained personnel should perform CPR or rescue breathing on an unconscious victim.

9.3.3 Response Critique

Should an incident on-site occur, the SHSO will analyze the response efforts in order to continually improve on-site conditions and procedures. The SHSO must complete follow-up activities before on-site work is resumed following an emergency. Used emergency equipment must be recharged, refilled or replaced. Government agencies must be notified as required in their regulations.

9.3.4 Available Equipment and Emergency Authorities

B&L and/or B&L's sub-contractor will have a cellular telephone. If additional emergency equipment is required, the following local agencies can be called upon for advice, supplies, or additional support:

Agency	Telephone Number
Town of Brighton Fire Department	911
Town of Brighton Police Department	911
Monroe County Sheriffs Department	911
Medical Emergency	911
NYSDEC Project Manager, Charlotte Theobald	585-226-5354
NYSDOH Project Manager, Melissa Doroski	518-406-7860

9.3.5 Driving Directions to Strong Memorial Hospital

See Figure 1 of the HASP

1. Head **northwest** on **Monroe Ave** toward **Monroe Pkwy** 0.5 mi

2. Turn **left** at **Co Rd 87/Elmwood Ave**
   Continue to follow Elmwood Ave 3.0 mi

3. Turn **left** into Hospital access road
   Strong Memorial Hospital will be on the right

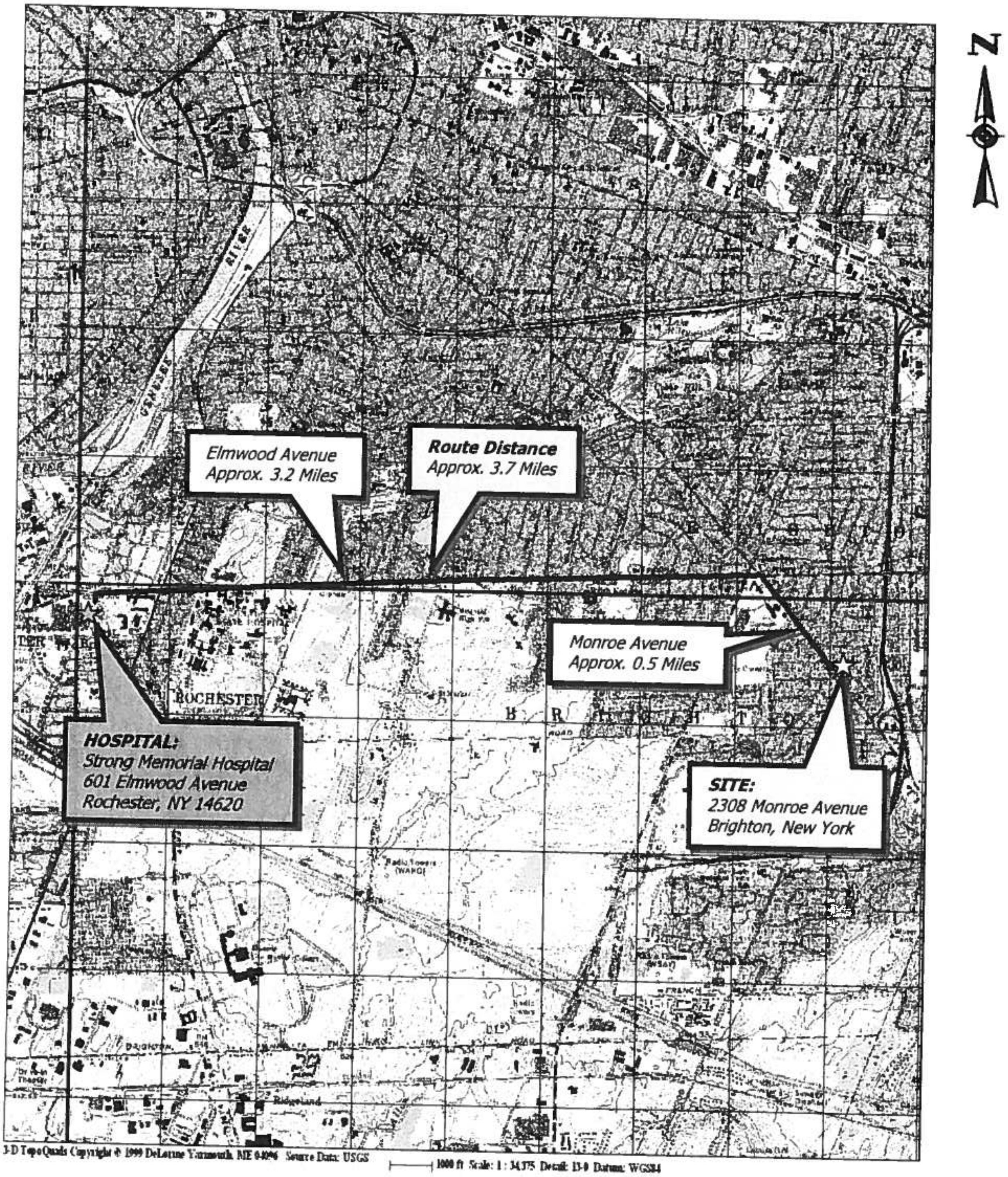
Signature Page

By signing below, I acknowledge that I have been informed of the items covered by this plan.

Printed Name	Signature

Figure 1

Hospital Emergency Route



Drawing Produced From: 3-D TopoQuads, DeLorme Map Co., referencing USGS quad maps Rochester East (NY) 1995 and Pittsford (NY) 1995.

DATE 1-5-2010 DRAWN BY RJM SCALE As Noted	day DAY ENVIRONMENTAL, INC. ENVIRONMENTAL CONSULTANTS ROCHESTER, NEW YORK 14614-1008	PROJECT TITLE 2308 MONROE AVENUE BRIGHTON, NEW YORK HEALTH AND SAFETY PLAN DRAWING TITLE ROUTE FOR EMERGENCY SERVICES	PROJECT NO. 4214S-09 FIGURE 1

Appendix A

40-Hour HAZWHOPPER Training Certificates

Appendix B

NIOSH Chemical Hazard Data Sheets

NIOSH Publication 2005-149 September 2005

NIOSH Pocket Guide to Chemical Hazards

NPG Home | Introduction | Synonyms & Trade Names | Chemical Names | CAS Numbers | RTECS Numbers | Appendices | Search

Vinylidene chloride

CAS 75-35-4

$CH_2=CCl_2$

RTECS KV9275000

Synonyms & Trade Names
1,1-DCE; 1,1-Dichloroethene; 1,1-Dichloroethylene; VDC; Vinylidene chloride monomer; Vinylidene dichloride

DOT ID & Guide
1303 130P (inhibited)

Exposure Limits
NIOSH REL: Ca See Appendix A
OSHA PEL†: none

IDLH Ca [N.D.] See: IDLH INDEX

Conversion

Physical Description
Colorless liquid or gas (above 89°F) with a mild, s weet, chloroform-like odor.

MW: 96.9	BP: 89°F	FRZ: -189°F	Sol: 0.04%
VP: 500 mmHg	IP: 10.00 eV		Sp.Gr: 1.21
Fl.P: -2°F	UEL: 15.5%	LEL: 6.5%	

Class IA Flammable Liquid: Fl.P. below 73°F and BP below 100°F.

Incompatibilities & Reactivities
Aluminum, sunlight, air, copper, heat [Note: Polymerization may occur if exposed to oxidizers, chlorosulfonic acid, nitric acid, or oleum. Inhibitors such as the monomethyl ether of hydroquinone are added to prevent polymerization.]

Measurement Methods
NIOSH 1015; OSHA 19
See: NMAM or OSHA Methods

Personal Protection & Sanitation (See protection codes)
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet (flammable)
Change: No recommendation
Provide: Eyewash, Quick drench

First Aid (See procedures)
Eye: Irrigate immediately
Skin: Soap flush immediately
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations NIOSH
At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus
Important additional information about respirator selection

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, throat; dizziness, headache, nausea, dyspnea (breathing difficulty); liver, kidney disturbance; pneumonitis; [potential occupational carcinogen]

Target Organs Eyes, skin, respiratory system, central nervous system, liver, kidneys

Cancer Site [in animals: liver & kidney tumors]

See also: INTRODUCTION See ICSC CARD: 0083

NIOSH Publication 2005-149 September 2005

NIOSH Pocket Guide to Chemical Hazards

Acetone

CAS 67-64-1

$(CH_3)_2CO$

RTECS AL3150000

Synonyms & Trade Names
Dimethyl ketone, Ketone propane, 2-Propanone

DOT ID & Guide
1090 127

Exposure Limits

NIOSH REL: TWA 250 ppm (590 mg/m^3)

OSHA PEL†: TWA 1000 ppm (2400 mg/m^3)

IDLH 2500 ppm [10%LEL] See: 67641

Conversion 1 ppm = 2.38 mg/m^3

Physical Description
Colorless liquid with a fragrant, mint-like odor.

MW: 58.1	BP: 133°F	FRZ: -140°F	Sol: Miscible
VP: 180 mmHg	IP: 9.69 eV		Sp.Gr: 0.79
Fl.P: 0°F	UEL: 12.8%	LEL: 2.5%	

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

Incompatibilities & Reactivities
Oxidizers, acids

Measurement Methods
NIOSH 1300, 2555, 3800; OSHA 69
See: NMAM or OSHA Methods

Personal Protection & Sanitation (See protection codes)
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet (flammable)
Change: No recommendation

First Aid (See procedures)
Eye: Irrigate immediately
Skin: Soap wash immediately
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations NIOSH
Up to 2500 ppm:
(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
(APF = 10) Any supplied-air respirator*
(APF = 50) Any self-contained breathing apparatus with a full facepiece
Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus
Important additional information about respirator selection

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms irritation eyes, nose, throat; headache, dizziness, central nervous system depression; dermatitis

Target Organs Eyes, skin, respiratory system, central nervous system

See also: INTRODUCTION See ICSC CARD: 0087 See MEDICAL TESTS: 0002

NIOSH Publication 2005-149 September 2005

NIOSH Pocket Guide to Chemical Hazards

1,2-Dichloroethylene

CAS 540-59-0

ClCH=CHCl

RTECS KV9360000

Synonyms & Trade Names
Acetylene dichloride, cis-Acetylene dichloride, trans-Acetylene dichloride, sym-Dichloroethylene

DOT ID & Guide
1150 130P

Exposure Limits
NIOSH REL: TWA 200 ppm (790 mg/m^3)
OSHA PEL: TWA 200 ppm (790 mg/m^3)

IDLH 1000 ppm See: 540590

Conversion 1 ppm = 3.97 mg/m^3

Physical Description
Colorless liquid (usually a mixture of the cis & trans isomers) with a slightly acrid, chloroform-like odor.

MW: 97.0	BP: 118-140°F	FRZ: -57 to -115°F	Sol: 0.4%
VP: 180-265 mmHg	IP: 9.65 eV		Sp.Gr(77°F): 1.27
Fl.P: 36-39°F	UEL: 12.8%	LEL: 5.6%	

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

Incompatibilities & Reactivities
Strong oxidizers, strong alkalis, potassium hydroxide, copper [Note: Usually contains inhibitors to prevent polymerization.]

Measurement Methods
NIOSH 1003; OSHA 7
See: NMAM or OSHA Methods

Personal Protection & Sanitation (See protection codes)
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet (flammable)
Change: No recommendation

First Aid (See procedures)
Eye: Irrigate immediately
Skin: Soap wash promptly
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations NIOSH/OSHA
Up to 1000 ppm:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode£
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)£
(APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece
Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus
Important additional information about respirator selection

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Irritation eyes, respiratory system; central nervous system depression

Target Organs Eyes, respiratory system, central nervous system

See also: INTRODUCTION See ICSC CARD: 0436

NIOSH Publication 2005-149 September 2005

NIOSH Pocket Guide to Chemical Hazards

Tetrachloroethylene

CAS 127-18-4

$Cl_2C=CCl_2$

RTECS KX3850000

Synonyms & Trade Names
Perchlorethylene, Perchloroethylene, Perk, Tetrachlorethylene

DOT ID & Guide
1897 160

Exposure Limits

NIOSH REL: Ca Minimize workplace exposure concentrations. See Appendix A

OSHA PEL†: †: TWA 100 ppm
C 200 ppm (for 5 minutes in any 3-hour period), with a maximum peak of 300 ppm

IDLH Ca [150 ppm] See: 127184

Conversion 1 ppm = 6.78 mg/m^3

Physical Description
Colorless liquid with a mild, chloroform-like odor.

MW: 165.8	BP: 250°F	FRZ: -2°F	Sol: 0.02%
VP: 14 mmHg	IP: 9.32 eV		Sp.Gr: 1.62
Fl.P: NA	UEL: NA	LEL: NA	

Noncombustible Liquid, but decomposes in a fire to hydrogen chloride and phosgene.

Incompatibilities & Reactivities
Strong oxidizers; chemically-active metals such as lithium, beryllium & barium; caustic soda; sodium hydroxide; potash

Measurement Methods
NIOSH 1003; OSHA 1001
See: NMAM or OSHA Methods

Personal Protection & Sanitation (See protection codes)
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: No recommendation
Provide: Eyewash, Quick drench

First Aid (See procedures)
Eye: Irrigate immediately
Skin: Soap wash promptly
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations NIOSH
At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus
Important additional information about respirator selection

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; dizziness, incoordination; headache, drowsiness; skin erythema (skin redness); liver damage; [potential occupational carcinogen]

Target Organs Eyes, skin, respiratory system, liver, kidneys, central nervous system

Cancer Site [in animals: liver tumors]

See also: INTRODUCTION See ICSC CARD: 0076 See MEDICAL TESTS: 0179

NIOSH Publication 2005-149 September 2005

NIOSH Pocket Guide to Chemical Hazards

Trichloroethylene

CAS 79-01-6

$ClCH{=}CCl_2$

RTECS KX4550000

Synonyms & Trade Names
Ethylene trichloride, TCE, Trichloroethene, Trilene

DOT ID & Guide
1710 160

Exposure Limits
NIOSH REL: Ca See Appendix A See Appendix C
OSHA PEL†: TWA 100 ppm C 200 ppm 300 ppm (5-minute maximum peak in any 2 hours)

IDLH Ca [1000 ppm] See: 79016

Conversion 1 ppm = 5.37 mg/m^3

Physical Description
Colorless liquid (unless dyed blue) with a chloroform-like odor.

MW: 131.4	BP: 189°F	FRZ: -99°F	Sol(77°F): 0.1%
VP: 58 mmHg	IP: 9.45 eV		Sp.Gr: 1.46
Fl.P: ?	UEL(77°F): 10.5%	LEL(77°F): 8%	

Combustible Liquid, but burns with difficulty.

Incompatibilities & Reactivities
Strong caustics & alkalis; chemically-active metals (such as barium, lithium, sodium, magnesium, titanium & beryllium)

Measurement Methods
NIOSH 1022, 3800; OSHA 1001
See: NMAM or OSHA Methods

Personal Protection & Sanitation (See protection codes)
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: No recommendation
Provide: Eyewash, Quick drench

First Aid (See procedures)
Eye: Irrigate immediately
Skin: Soap wash promptly
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations NIOSH
At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus
Important additional information about respirator selection

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin; headache, visual disturbance, lassitude (weakness, exhaustion), dizziness, tremor, drowsiness, nausea, vomiting; dermatitis; cardiac arrhythmias, paresthesia; liver injury; [potential occupational carcinogen]

Target Organs Eyes, skin, respiratory system, heart, liver, kidneys, central nervous system

Cancer Site [in animals: liver & kidney cancer]

See also: INTRODUCTION See ICSC CARD: 0081 See MEDICAL TESTS: 0236

NIOSH Publication 2005-149 September 2005

NIOSH Pocket Guide to Chemical Hazards

Vinyl chloride

CAS 75-01-4

CH_2=CHCl

RTECS KU9625000

Synonyms & Trade Names
Chloroethene, Chloroethylene, Ethylene monochloride, Monochloroethene, Monochloroethylene, VC, Vinyl chloride monomer (VCM)

DOT ID & Guide
1086 116P (inhibited)

Exposure Limits
NIOSH REL: Ca See Appendix A
OSHA PEL: [1910.1017] TWA 1 ppm C 5 ppm [15-minute]

IDLH Ca [N.D.] See: IDLH INDEX

Conversion 1 ppm = 2.56 mg/m^3

Physical Description
Colorless gas or liquid (below 7°F) with a pleasant odor at high concentrations. [Note: Shipped as a liquefied compressed gas.]

MW: 62.5	BP: 7°F	FRZ: -256°F	Sol(77°F): 0.1%
VP: 3.3 atm	IP: 9.99 eV	RGasD: 2.21	
Fl.P: NA (Gas)	UEL: 33.0%	LEL: 3.6%	

Flammable Gas

Incompatibilities & Reactivities
Copper, oxidizers, aluminum, peroxides, iron, steel [Note: Polymerizes in air, sunlight, or heat unless stabilized by inhibitors such as phenol. Attacks iron & steel in presence of moisture.]

Measurement Methods
NIOSH 1007; OSHA 4, 75
See: NMAM or OSHA Methods

Personal Protection & Sanitation (See protection codes)
Skin: Frostbite
Eyes: Frostbite
Wash skin: No recommendation
Remove: When wet (flammable)
Change: No recommendation
Provide: Frostbite wash

First Aid (See procedures)
Eye: Frostbite
Skin: Frostbite
Breathing: Respiratory support

Respirator Recommendations (See Appendix E) NIOSH
At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern/Any appropriate escape-type, self-contained breathing apparatus
Important additional information about respirator selection

Exposure Routes inhalation, skin, and/or eye contact (liquid)

Symptoms Lassitude (weakness, exhaustion); abdominal pain, gastrointestinal bleeding; enlarged liver; pallor or cyanosis of extremities; liquid: frostbite; [potential occupational carcinogen]

Target Organs Liver, central nervous system, blood, respiratory system, lymphatic system

Cancer Site [liver cancer]

See also: INTRODUCTION See ICSC CARD: 0082 See MEDICAL TESTS: 0241

Appendix C

DER-10 Technical Guidance for Site Investigation and Remediation, December 2002- Appendix 1A *and 1B* - New York State Department of Health Generic Community Air Monitoring Plan

DER-10 Appendices

Appendix 1A
New York State Department of Health
Generic Community Air Monitoring Plan

Overview

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical- specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for VOCs and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate DEC/NYSDOH staff.

Continuous monitoring will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. “Periodic” monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions, particularly if wind direction changes. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

1. If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

2. If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

3. If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.

4. All 15-minute readings must be recorded and be available for State (DEC and NYSDOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations should be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

1. If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.

2. If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m^3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m^3 of the upwind level and in preventing visible dust migration.

3. All readings must be recorded and be available for State (DEC and NYSDOH) and County Health personnel to review.

December 2009

Appendix 1B
Fugitive Dust and Particulate Monitoring

A program for suppressing fugitive dust and particulate matter monitoring at hazardous waste sites is a responsibility on the remedial party performing the work. These procedures must be incorporated into appropriate intrusive work plans. The following fugitive dust suppression and particulate monitoring program should be employed at sites during construction and other intrusive activities which warrant its use:

1. Reasonable fugitive dust suppression techniques must be employed during all site activities which may generate fugitive dust.

2. Particulate monitoring must be employed during the handling of waste or contaminated soil or when activities on site may generate fugitive dust from exposed waste or contaminated soil. Remedial activities may also include the excavation, grading, or placement of clean fill. These control measures should not be considered necessary for these activities.

3. Particulate monitoring must be performed using real-time particulate monitors and shall monitor particulate matter less than ten microns (PM10) with the following minimum performance standards:

(a) Objects to be measured: Dust, mists or aerosols;
(b) Measurement Ranges: 0.001 to 400 mg/m3 (1 to 400,000 :ug/m3);
(c) Precision (2-sigma) at constant temperature: +/- 10 :g/m3 for one second averaging; and +/- 1.5 g/m3 for sixty second averaging;
(d) Accuracy: +/- 5% of reading +/- precision (Referred to gravimetric calibration with SAE fine test dust (mmd= 2 to 3 :m, g= 2.5, as aerosolized);
(e) Resolution: 0.1% of reading or 1g/m3, whichever is larger;
(f) Particle Size Range of Maximum Response: 0.1-10;
(g) Total Number of Data Points in Memory: 10,000;
(h) Logged Data: Each data point with average concentration, time/date and data point number
(i) Run Summary: overall average, maximum concentrations, time/date of maximum, total number of logged points, start time/date, total elapsed time (run duration), STEL concentration and time/date occurrence, averaging (logging) period, calibration factor, and tag number;
(j) Alarm Averaging Time (user selectable): real-time (1-60 seconds) or STEL (15 minutes), alarms required;
(k) Operating Time: 48 hours (fully charged NiCd battery); continuously with charger;
(l) Operating Temperature: -10 to 50^{o} C (14 to 122^{o} F);
(m) Particulate levels will be monitored upwind and immediately downwind at the working site and integrated over a period not to exceed 15 minutes.

4. In order to ensure the validity of the fugitive dust measurements performed, there must be appropriate Quality Assurance/Quality Control (QA/QC). It is the responsibility of the remedial party to adequately supplement QA/QC Plans to include the following critical features: periodic instrument calibration, operator training, daily instrument performance (span) checks, and a record keeping plan.

5. The action level will be established at 150 ug/m3 (15 minutes average). While conservative,

this short-term interval will provide a real-time assessment of on-site air quality to assure both health and safety. If particulate levels are detected in excess of 150 ug/m3, the upwind background level must be confirmed immediately. If the working site particulate measurement is greater than 100 ug/m3 above the background level, additional dust suppression techniques must be implemented to reduce the generation of fugitive dust and corrective action taken to protect site personnel and reduce the potential for contaminant migration. Corrective measures may include increasing the level of personal protection for on-site personnel and implementing additional dust suppression techniques (see paragraph 7). Should the action level of 150 ug/m3 continue to be exceeded work must stop and DER must be notified as provided in the site design or remedial work plan. The notification shall include a description of the control measures implemented to prevent further exceedances.

6. It must be recognized that the generation of dust from waste or contaminated soil that migrates off-site, has the potential for transporting contaminants off-site. There may be situations when dust is being generated and leaving the site and the monitoring equipment does not measure PM10 at or above the action level. Since this situation has the potential to allow for the migration of contaminants off-site, it is unacceptable. While it is not practical to quantify total suspended particulates on a real-time basis, it is appropriate to rely on visual observation. If dust is observed leaving the working site, additional dust suppression techniques must be employed. Activities that have a high dusting potential--such as solidification and treatment involving materials like kiln dust and lime--will require the need for special measures to be considered.

7. The following techniques have been shown to be effective for the controlling of the generation and migration of dust during construction activities:

(a) Applying water on haul roads;
(b) Wetting equipment and excavation faces;
(c) Spraying water on buckets during excavation and dumping;
(d) Hauling materials in properly tarped or watertight containers;
(e) Restricting vehicle speeds to 10 mph;
(f) Covering excavated areas and material after excavation activity ceases; and
(g) Reducing the excavation size and/or number of excavations.

Experience has shown that the chance of exceeding the 150ug/m3 action level is remote when the above-mentioned techniques are used. When techniques involving water application are used, care must be taken not to use excess water, which can result in unacceptably wet conditions. Using atomizing sprays will prevent overly wet conditions, conserve water, and provide an effective means of suppressing the fugitive dust.

8. The evaluation of weather conditions is necessary for proper fugitive dust control. When extreme wind conditions make dust control ineffective, as a last resort remedial actions may need to be suspended. There may be situations that require fugitive dust suppression and particulate monitoring requirements with action levels more stringent than those provided above. Under some circumstances, the contaminant concentration and/or toxicity may require additional monitoring to protect site personnel and the public. Additional integrated sampling and chemical analysis of the dust may also be in order. This must be evaluated when a health and safety plan is developed and when appropriate suppression and monitoring requirements are established for protection of health and the environment.

ASTM PROCEDURES

Designation: D 6282 – 98 (Reapproved 2005)

Standard Guide for Direct Push Soil Sampling for Environmental Site Characterizations[1]

This standard is issued under the fixed designation D 6282; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This guide addresses direct push soil samplers, which also may be driven into the ground from the surface or through prebored holes. The samplers can be continuous or discrete interval units. Samplers are advanced by a combination of static push, or impacts from hammers, or vibratory methods, or a combination thereof, to the depth of interest. The guide does not cover open chambered samplers operated by hand such as augers, agricultural samplers operated at shallow depths, or side wall samplers. This guide does not address single sampling events in the immediate base of the drill hole using rotary drilling equipment with incremental drill hole excavation. Other sampling standards, such as Test Methods D 1586 and D 1587 and Practice D 3550 apply to rotary drilling activities. This guide does not address advancement of sampler barrel systems with methods that employ cuttings removal as the sampler is advanced. Other drilling and sampling methods may apply for samples needed for engineering and construction applications.

1.2 Guidance on preservation and transport of samples, as given in Guide D 4220, may or may not apply. Samples for chemical analysis often must be subsampled and preserved for chemical analysis using special techniques. Practice D 3694 provides information on some of the special techniques required. Additional information on environmental sample preservation and transportation is available in other references (**1, 2**).[2] Samples for classification may be preserved using procedures similar to Class A. In most cases, a direct push sample is considered as Class B in Practice D 4220 but is protected, representative, and suitable for chemical analysis. The samples taken with this practice do not usually produce Class C and D (with exception of thin wall samples of standard size) samples for testing for engineering properties, such as shear strength and compressibility. Guide D 4700 has some information on mechanical soil sampling devices similar to direct push techniques, however, it does not address most direct push sampling methods. If sampling is for chemical evaluation in the Vadose Zone, consult Guide D 4700 for any special considerations.

1.3 Field methods described in this guide, include the use of discreet and continuous sampling tools, split and solid barrel samplers and thin walled tubes with or without fixed piston style apparatus.

1.4 Insertion methods described include static push, impact, percussion, other vibratory/sonic driving, and combinations of these methods using direct push equipment adapted to drilling rigs, cone penetrometer units, and specially designed percussion/direct push combination machines. Hammers providing the force for insertion include drop style, hydraulically activated, air activated and mechanical lift devices.

1.5 Direct push soil sampling is limited to soils and unconsolidated materials that can be penetrated with the available equipment. The ability to penetrate strata is based on hammer energy, carrying vehicle weight, compactness of soil, and consistency of soil. Penetration may be limited or damage to samplers and conveying devices can occur in certain subsurface conditions, some of which are discussed in 5.5. Successful sample recovery also may be limited by the ability to retrieve tools from the borehole. Sufficient retract force must be available when attempting difficult or deep investigations.

1.6 This guide does not address the installation of any temporary or permanent soil, ground water, vapor monitoring, or remediation devices.

1.7 The practicing of direct push techniques may be controlled by local regulations governing subsurface penetration. Certification, or licensing requirements, or both, may need to be considered in establishing criteria for field activities.

1.8 The values stated in SI units are to be regarded as standard: however, dimensions used in the drilling industry are given in inch-pound units by convention. Inch-pound units are used where necessary in this guide.

1.9 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

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[1] This guide is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.21 on Ground Water and Vadose Zone Investigation.

Current edition approved Jan. 1, 2005. Published February 2005. Originally approved in 1998. Last previous edition approved in 1998 as D 6282–98.

[2] The boldface numbers in parentheses refer to the list of references at the end of this standard.

1.10 *This guide offers an organized collection of information or a series of options and does not recommend a specific course of action. This document cannot replace education or experience and should be used in conjunction with professional judgment. Not all aspects of this guide may be applicable in all circumstances. This ASTM standard is not intended to represent or replace the standard of care by which the adequacy of a given professional service must be judged, nor should this document be applied without consideration of a projects's many unique aspects. The word "Standard" in the title of this document means only that the document has been approved through the ASTM consensus process.*

2. Referenced Documents

2.1 *ASTM Standards:* [3]

D 653 Terminology Relating to Soil, Rock and Contained Fluids
D 1586 Test Method for Penetration Test and Split-Barrel Sampling of Soils
D 1587 Practice for Thin-Wall Tube Sampling of Soils
D 2488 Practice for Description and Identification of Soils (Visual-Manual Method)
D 3550 Practice for Ring-Lined Barrel Sampling of Soils
D 3694 Practices for Preparation of Sample Containers and for Preservation of Organic Constituents
D 4220 Practices for Preserving and Transporting Soil Samples
D 4700 Guide for Soil Sampling from the Vadose Zone
D 5088 Practice for Decontamination of Field Equipment Used at Nonradioactive Waste Sites
D 5092 Practice for Design and Installation of Ground Water Monitoring Wells in Acquifers
D 5299 Guide for Decommisioning of Ground Water Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities
D 5434 Guide for Field Logging of Subsurface Explorations of Soil and Rock
D 6001 Guide for Direct-Push Water Sampling for Geoenvironmental Investigations

3. Terminology

3.1 *Definitions*—General definitions for terminology used in this guide are in accordance with Terminology D 653. Definitions for terms related to direct push water sampling for geoenvironmental investigations are in accordance with Guide D 6001.

3.1.1 *assembly length, n*—length of sampler body and riser pipes.

3.1.2 *borehole, n*—a hole of circular cross-section made in soil or rock.

3.1.3 *casing, n*—pipe furnished in sections with either threaded connections or bevelled edges to be field-welded, which is installed temporarily or permanently to counteract caving, to advance the borehole, or to isolate the interval being monitored, or combination thereof.

3.1.4 *caving/sloughing, n*—the inflow of unconsolidated material into an unsupported borehole that occurs when the borehole walls lose their cohesive strength.

3.1.5 *decontamination, n*—the process of removing undesirable physical or chemical constituents, or both, from equipment to reduce the potential for cross-contamination.

3.1.6 *direct push sampling, n*—sampling devices that are advanced into the soil to be sampled without drilling or borehole excavation.

3.1.7 *extension rod, n*—hollow steel rod, threaded, in various lengths, used to advance and remove samplers and other devices during direct pushing boring. Also known as *drive rod.* In some applications, small diameter solid extension rods are used through hollow drive rods to activate closed samples at depth.

3.1.8 *incremental drilling and sampling, n*—insertion method where rotary drilling and sampling events are alternated for incremental sampling. Incremental drilling often is needed to penetrate harder or deeper formations.

3.1.9 *percussion driving, n*—insertion method where rapid hammer impacts are performed to advance the sampling device. The percussion normally is accompanied with the application of a static down-force.

3.1.10 *push depth, n*—the depth below a ground surface datum to which the lower end, or tip, of the direct-push sampling device is inserted.

3.1.11 *sample interval, n*—defined zone within a subsurface strata from which a sample is gathered.

3.1.12 *sample recovery, n*—the length of material recovered divided by the length of sampler advancement and stated as a percentage.

3.1.13 *soil core, n*—cylindrical shaped specimen of sediments or other unconsolidated accumulations of solid particles produced by the physical and chemical disintegration of rocks and which may or may not contain organic matter recovered from a soil sampler.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *closed barrel sampler, n*—a sampling device with a piston or other secured device that is held to block the movement of material into the barrel until the blocking device is removed or released. Liners are required in closed barrel samplers. Also may be referred to as a *protected type sampler.*

3.2.2 *impact heads/drive heads, n*—pieces or assemblies that fit to top of the above ground portion of the direct push tool assembly to receive the impact of the hammering device and transfer the impact energy to sampler extensions.

3.2.3 *open barrel sampler, n*—sampling barrel with open end allowing material to enter at any time or depth. Also may be referred to as an *unprotected type sampler.*

3.2.4 *piston lock, n*—device to lock the sampler piston in place to prevent any entry of a foreign substance into the sampler chamber prior to sampling.

3.2.5 *single tube system, n*—a system whereby single extension/drive rods with samplers attached are advanced into the subsurface strata to collect a soil sample.

[3] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

3.2.6 *solid barrel sampler*, *n*—a soil sampling device consisting of a continuous or segmented tube with a wall thickness sufficient to withstand the forces necessary to penetrate the strata desired and gather a sample. A cutting shoe and a connecting head are attached to the barrel.

3.2.7 *split barrel sampler*, *n*—a soil sampling device consisting of the two half circle tubes manufactured to matching alignment, held together on one end by a shoe and on the other by a connecting head.

3.2.8 *two tube systems*, *n*—a system whereby inner and outer tubes are advanced simultaneously into the subsurface strata to collect a soil sample. The outer tube is used for borehole stabilization. The inner tube for sampler recovery and insertion.

4. Summary of Guide

4.1 Direct push soil sampling consists of advancing a sampling device into subsurface soils by applying static pressure, by applying impacts, or by applying vibration, or any combination thereof, to the above ground portion of the sampler extensions until the sampler has been advanced to the desired sampling depth. The sampler is recovered from the borehole and the sample removed from the sampler. The sampler is cleaned and the procedure repeated for the next desired sampling interval. Sampling can be continuous for full depth borehole logging or incremental for specific interval sampling. Samplers used can be protected type for controlled specimen gathering or unprotected for general soil specimen collection.

5. Significance and Use

5.1 Direct push methods of soil sampling are used for geologic investigations, soil chemical composition studies, and water quality investigations. Examples of a few types of investigations in which direct push sampling may be used include site assessments, underground storage tank investigations, and hazardous waste site investigations. Continuous sampling is used to provide a lithological detail of the subsurface strata and to gather samples for classification and index or for chemical testing. These investigations frequently are required in the characterization of hazardous waste sites. Samples, gathered by direct push methods, provide specimens necessary to determine the chemical composition of soils, and in most circumstances, contained pore fluids **(3)**.

5.2 Direct push methods can provide accurate information on the characteristics of the soils encountered and of the chemical composition if provisions are made to ensure that discrete samples are collected, that sample recovery is maximized, and that clean decontaminated tools are used in the sample gathering procedure. For purposes of this guide, "soil" shall be defined in accordance with Terminology D 653. Using sealed or protected sampling tools, cased boreholes, and proper advancement techniques can assure good representative samples. Direct push boreholes may be considered as a supplementary part of the overall site investigation or may be used for the full site investigation if site conditions permit. As such, they should be directed by the same procedural review and quality assurance standards that apply to other types of subsurface borings. A general knowledge of subsurface conditions at the site is beneficial.

5.3 Soil strata profiling to shallow depths may be accomplished over large areas in less time than with conventional drilling methods because of the rapid sample gathering potential of the direct push method. More site time is available for actual productive investigation as the time required for ancillary activities, such as decontamination, rig setup, tool handling, borehole backfill, and site clean-up is reduced over conventional drilling techniques. Direct push soil sampling has benefits of smaller size tooling, smaller diameter boreholes, and minimal investigative derived waste.

5.4 The direct push soil sampling method may be used as a site characterization tool for subsurface investigation and for remedial investigation and corrective action. The initial direct push investigation program can provide good soil stratigraphic information depending on the soil density and particle size, determine ground water depth, and provide samples for field screening and for formal laboratory analysis to determine the chemical composition of soil and contained pore fluids. Use of this method, results in minimum site disturbance and no cuttings are generated.

5.5 This guide may not be the correct method for investigations in all cases. As with all drilling methods, subsurface conditions affect the performance of the sample gathering equipment and methods used. Direct push methods are not effective for solid rock and are marginally effective in partially weathered rock or very dense soils. These methods can be utilized to determine the rock surface depth. The presence or absence of ground water can affect the performance of the sampling tools. Compact gravelly tills containing boulders and cobbles, stiff clay, compacted gravel, and cemented soil may cause refusal to penetration. Certain cohesive soils, depending on their water content, can create friction on the sampling tools which can exceed the static delivery force, or the impact energy applied, or both, resulting in penetration refusal. Some or all of these conditions may complicate removal of the sampling tools from the borehole as well. Sufficient retract force should be available to ensure tool recovery. As with all borehole advancement methods, precautions must be taken to prevent cross contamination of aquifers through migration of contaminants up or down the borehole. Regardless of the tool size, the moving of drilling and sampling tools through contaminated strata carries risks. Minimization of this risk should be a controlling factor in selecting sampling methods and drilling procedures. The user should take into account the possible chemical reaction between the sample and the sampling tool itself, sample liners, or other items that may come into contact with the sample **(3, 4)**.

5.6 In some cases this guide may combine water sampling, or vapor sampling, or both, with soil sampling in the same investigation. Guides D 6001 and D 4700 can provide additional information on procedures to be used in such combined efforts.

6. Criteria for Selection

6.1 Important criteria to consider when selecting sampling tools include the following:

6.1.1 Size of sample.

6.1.2 Sample quality (Class A,B,C,D) for physical testing. Refer to Practice D 4220.

6.1.3 Sample handling requirements, such as containers, preservation requirements.

6.1.4 Soil conditions anticipated.

6.1.5 Ground water depth anticipated.

6.1.6 Boring depth required.

6.1.7 Chemical composition of soil and contained pore fluids.

6.1.8 Probability of cross contamination.

6.1.9 Available funds.

6.1.10 Estimated cost.

6.1.11 Time constraints.

6.1.12 History of tool performance under anticipated conditions (consult experienced users and manufacturers).

6.2 Important criteria to consider when selecting direct push equipment include the following:

6.2.1 Site accessibility.

6.2.2 Site visibility.

6.2.3 Soil conditions anticipated.

6.2.4 Boring depth required.

6.2.5 Borehole sealing requirements.

6.2.6 Equipment performance history.

6.2.7 Personnel requirements.

6.2.8 Decontamination requirements.

6.2.9 Equipment grouting capability.

6.2.10 Local regulatory requirements.

7. Apparatus

7.1 *General*—A direct push soil sampling system consists of a sample collection tool, hollow extension rods for advancement, retrieval, and transmission of energy to the sampler, and an energy source to force sampler penetration. Auxiliary tools are required to handle, assemble and disassemble, clean, and repair the sample collection tools and impact surfaces. Necessary expendable supplies are sample containers, sample container caps, sample liners, sample retainers, appropriate lubricants, and personal safety gear.

7.2 *Direct Push Tool Systems*:

7.2.1 *Two Tube System*—An outer casing and an inner extension rod with a sampler attached (see Fig. 1) are advanced simultaneously into the soil for the length capacity of the sampler. The sampler is removed from the borehole and a new sampler barrel or plug bit is inserted for each increment of depth. Two-tube sampling systems also may incorporate sample gathering chambers that are fitted into the outer casing shoe. These sample barrels are designed to create a minimum of sample disturbance while gathering high quality specimens (see Fig. 2). Samplers are held in the proper position by different methods, such as extension rods, pneumatic or mechanical packers, spring activated latches, or other devices (see Figs. 1 and 2). Locking devices must be strong enough to hold the sampler while penetrating the sample strata. The outer casing supports the borehole wall. Sample retrieval is expedited by the cased hole and continuous sampling is simplified. Continuous sampling may be a benefit to lithological logging. A cased borehole can be sealed from the bottom up as the casing is extracted (see Section 10). A cased hole may reduce the risk of contamination migration down the borehole and sample cross contamination. The two-tube system is more susceptible to soil friction because of its larger diameter and may require larger direct push energy than single-tube systems. An oversized drive shoe is sometimes used to reduce friction and buckling but may increase the risk of contamination migration down the borehole.

7.2.2 *Single Tube System*—The single tube system (see Fig. 3), uses a hollow extension/drive rod to advance and retrieve the sampler. The sampler is attached to the bottom of the extension/drive rod. A drive cap is added to the top of the extension/drive rod and the sampler is pushed into the soil. Extension/drive rods generally are smaller in diameter than the sampler. The single tube system minimizes effort for discrete interval sampling under many subsurface conditions. Tool connection time per interval is reduced. Time of removal and reinsertion of samplers into the borehole is affected by soil conditions. Repeated movement of the sampler through contaminated subsurface strata may increase the risk of contamination migration down the borehole. Bottom up borehole sealing may require re-entry in soil formations that collapse (see Section 10).

7.3 *Samplers*:

7.3.1 *Split Barrel Samplers*—Split barrel samplers (see Fig. 4) are available for use with direct push drilling methods and are available in various sizes up to 3.0 in. (76.2-mm) inside diameter. The inside tolerance should allow for use of liners. Split barrel sampler shoes used in two tube systems must be of sufficient diameter to prevent the intrusion of soil between the outer diameter of the shoe and the inside wall of the outer tube. Split barrel shoes should be replaced when the leading edge is damaged. Damaged shoes can negatively affect sample recovery. Samplers can be used with or without ball check value fitted split barrel heads. The ball check prevents uphole fluids from flowing down through the sample. Where soil sampling will be performed below the water table, the split barrel head, equipped with a ball check, should be used. The open split barrel is best used with the two tube system because the outer casing protects the borehole against cave-in or sloughing, or in soils in which the borehole wall will not collapse. Split barrel sealing systems are available. Split barrel sections can be joined to create a sampler with a nominal sample length capacity of 48 in. (1.22 m). It is understood that samplers with usable lengths beyond 24 in. (0.61 m) are used to advantage in certain soil types; however, the added weight of the soil sample in the chamber and the added friction within the sampler may prevent loose soils from entering the sampler, affecting sample recovery and representativeness. Split barrel samplers can be fitted with a basket to improve recovery in cohesionless soils. Retainers are available in many styles and materials. Retainers should allow the passage of softer soils. Stiff retainers can reduce specimen recovery in soft soils.

7.3.2 *Solid Barrel Samplers*:

7.3.2.1 *Open Solid Barrel Samplers*—Open solid barrel (see Fig. 5) samplers are used with all types of direct push sampling systems. Solid barrels can have inside diameters ranging up to 3 in. (76.2 mm). Barrel lengths range from 6 in. (152.4 mm) to 5 ft (1.53 m). Solid barrel samplers may be one piece or segmented. Sample liners should be used to facilitate removal

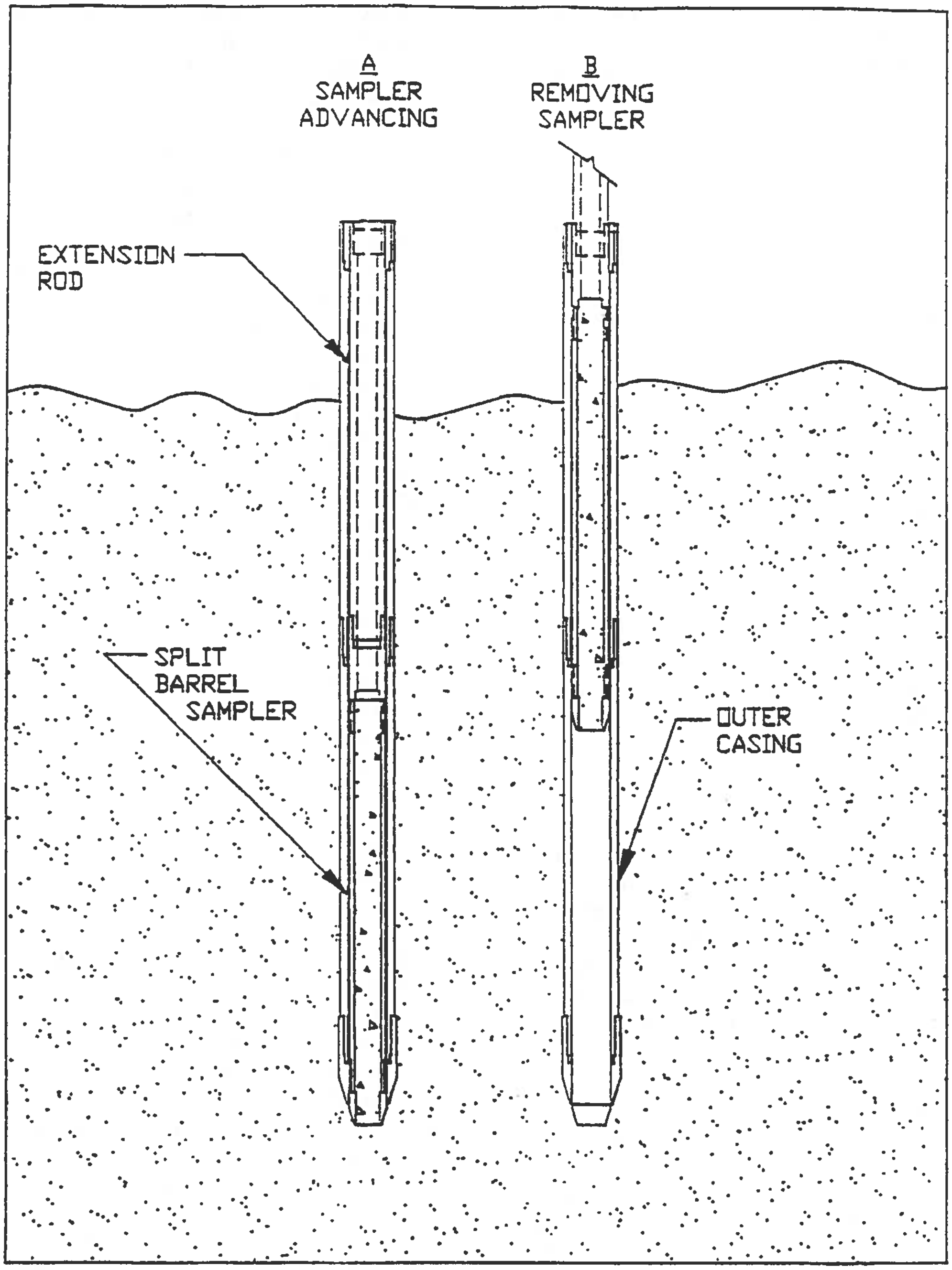

FIG. 1 Split Spoon Sampling, Two Tube System

of the sample from the solid barrel. Without the use of liners, samples are extruded mechanically. Liner lengths should fit sampler barrel lengths. Solid barrel samplers are generally assembled with a removable cutting shoe and a drive head (see Fig. 6). The head provides a backing to hold the liner stationary while the sampler is advanced and serves as a connector to the extension/drive rods. The shoe is manufactured to hold the liner stationary during the soil collection procedure. The liner should be slightly larger than the inner diameter of the cutting shoe. It may be slipped over the cutting shoe (see Fig. 6) or nested inside of the cutting shoe (see Fig. 7). The shoe is manufactured to cut the sample to a slightly undersized diameter allowing it to pass into the sample liner with a minimum of side friction to reduce sample disturbance. The amount of specimen contact with the inside of the shoe should be held to the minimum distance possible to aid in achieving the maximum amount of recovery.

7.3.3 *Closed Barrel Sampler*—Closed barrel samplers (see Figs. 2 and 3, Figs. 5-8) are devices, which remain sealed shut until an action is taken to open the sample receiving chamber. These samplers are used most often for single events (discrete point sampling) where a sealed sampler is required to avoid

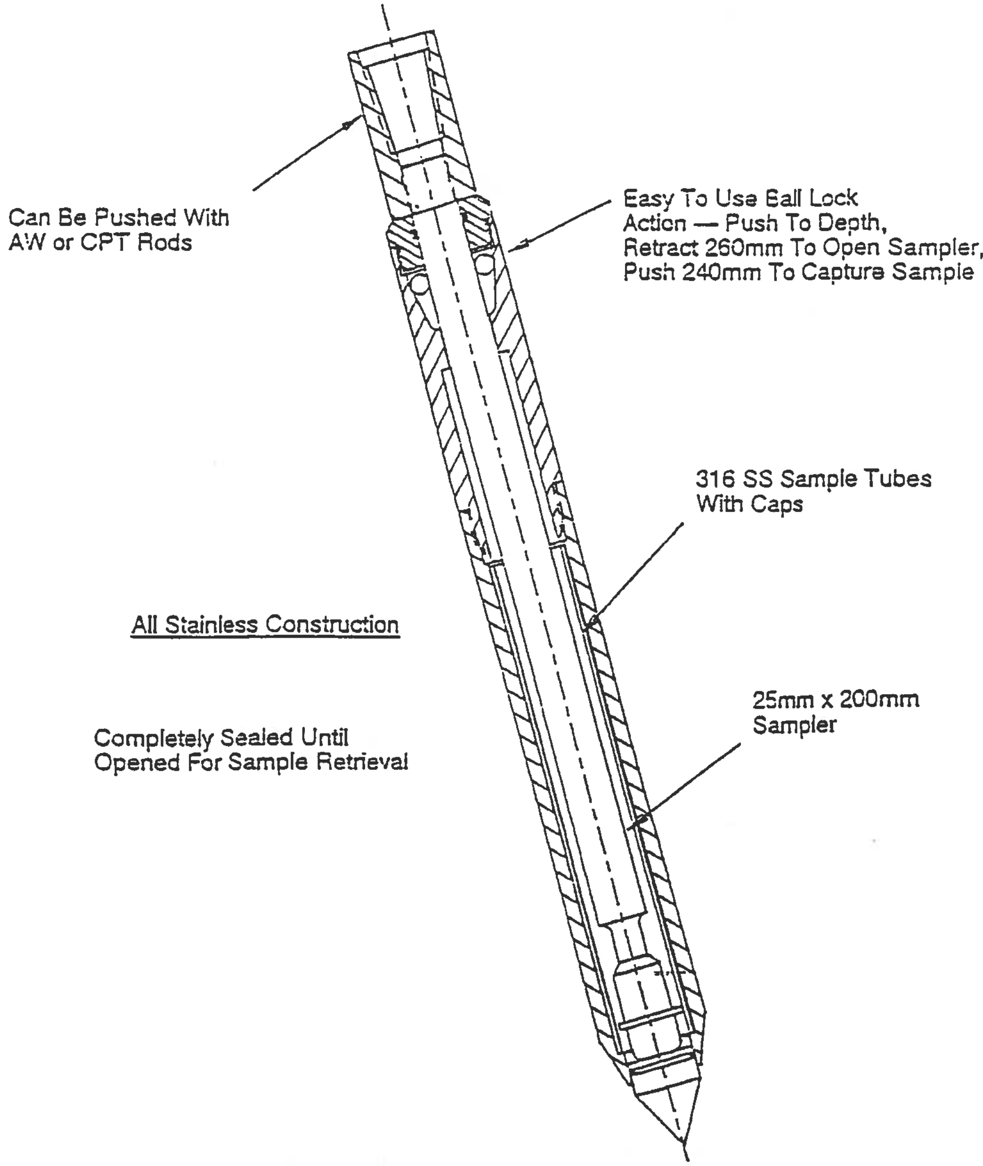

FIG. 2 Sealed Sample Barrel, Single Tube System

cross contamination or in circumstances where borehole wall stability cannot be assured. The shoe sealing device generally is a point designed to allow the continuous flow of soil around and past the sampler until such time as it is removed or released. The piston point can be fitted with seals, such as "O" rings at top and bottom to hold fluid out until sampling the desired interval. The piston rod extends through the sample retaining liner and must be released or removed for the soil to enter (see Fig. 3, Fig. 5, Fig. 7). The piston can be removed manually before sampling or be displaced by the soil entering the sampler chamber. Using the displacement method can result in reduced recovery if sampled soils do not have sufficient strength to displace the piston. Pistons are locked in place by several methods, such as a spring loaded latch. The latch holds several balls (see Fig. 2, Fig. 7, Fig. 8) into a groove in the latch coupling. When the latch is released by lifting up on the latch stem, the balls slip back into the latch chamber allowing the piston to be removed. Another method uses a locking screw. A reverse thread pin (Fig. 3, Fig. 6) is positioned in the sampler head to prevent the piston from being displaced by the soil when advancing the sampler. At the sampling interval, small diameter extension rods are inserted through the sampler extension/drive rods and rotated clockwise to unscrew the locking pin. A third method uses an inflated packer. An inflated packer (see Fig. 9) is attached to the top of the sampler barrel. The sample barrel is lowered into position in the drive casing and the packer inflated. The packer is deflated to release and the sample barrel is recovered after being advanced the sampling interval.

7.3.4 *Thin Wall Tube*—A 1.0-in. (25.4-mm) diameter thin wall tube (see Fig. 10) is available for use with direct push equipment and is manufactured according to Practice D 1587. Thin wall tubes can be effective when used with dual tube direct push systems as the borehole must be kept clear of

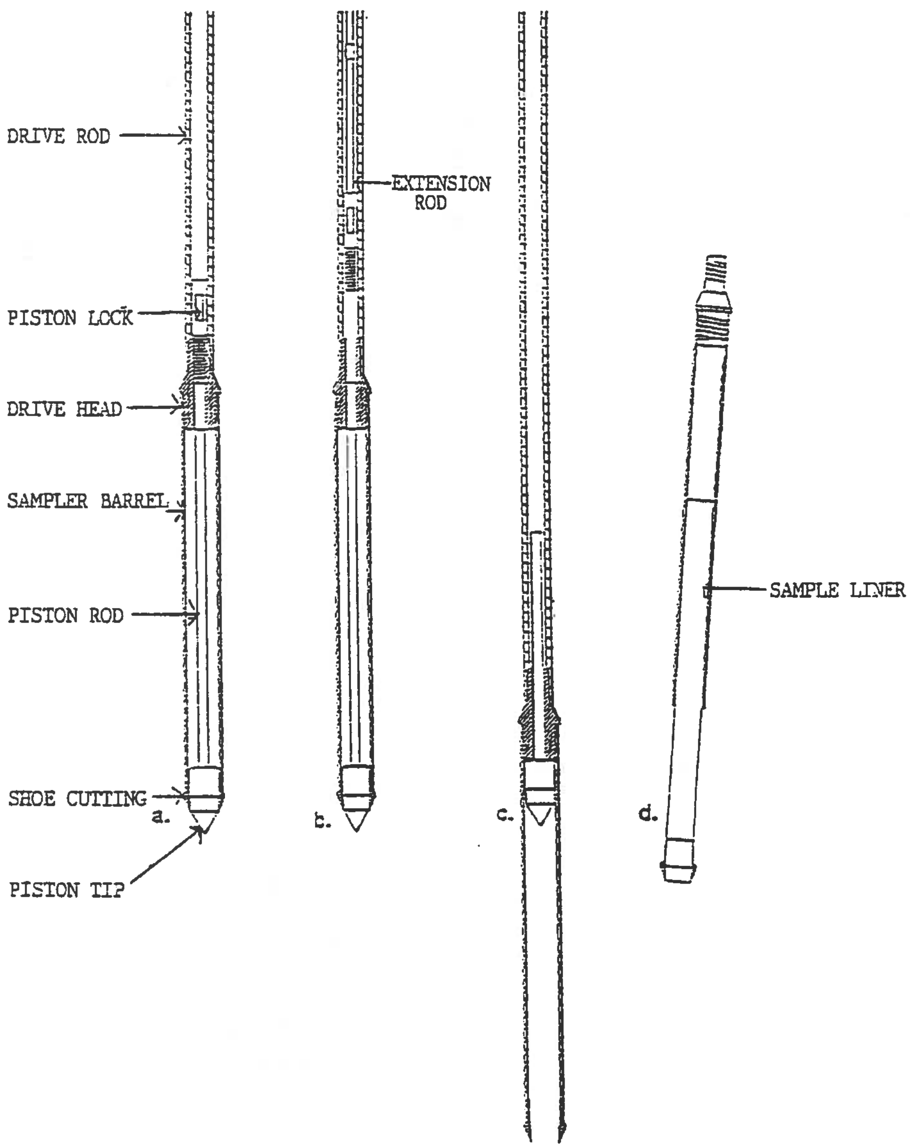

FIG. 3 Driving and Sampling, Single Tube System

(a) Driving the sealed sampler. (b) Removing the stop-pin.
(c) Collecting a sample (d) Recovering sample in liner.

disturbed soil prior to gathering a sample. Thin wall tubes may be effective in cohesive soils with single tube systems when the borehole can be kept clear of disturbed soil. Thin wall tubes must have an outside diameter that will allow passage through the outer casing. The thin wall tube can be operated in accordance with Practice D 1587, or it can be advanced using the percussion hammer of the direct push equipment. The primary use of the thin wall tube is to gather relatively undisturbed samples in cohesive soils. Sealing of thin wall tube ends should be completed in accordance with Practice D 4220. Fixed piston apparatus (see Fig. 10) also is available for use with thin walled tubes. The fixed piston action allows the sampling of very soft formations, which may not be retained in conventional samplers. In certain soil formations, the thin wall tube provides the best method to collect an undisturbed sample.

7.3.5 *Sampler Extension/Drive Rods*—Sampler extension/drive rods are lengths of rod or tube generally constructed of steel to withstand the pushing or percussion forces applied. Extension drive rods are available in various lengths. Rod lengths should be mated with casing and sampling equipment used. Thread types and classes vary between equipment manufacturers. Rod joints can be sealed to prevent fluid intrusion with "O" rings. Teflon™ washers or Teflon™ tape. Because of the percussive effort, joint seals should be checked for each sampling effort. Extension/drive rods should have sufficient inside diameter to accommodate the equipment necessary to perform the desired action.

7.3.6 *Sampler Liners*—Sampler liners are used to collect and store samples for shipment to laboratories, for field index testing of samples and for removing samples from solid barrel

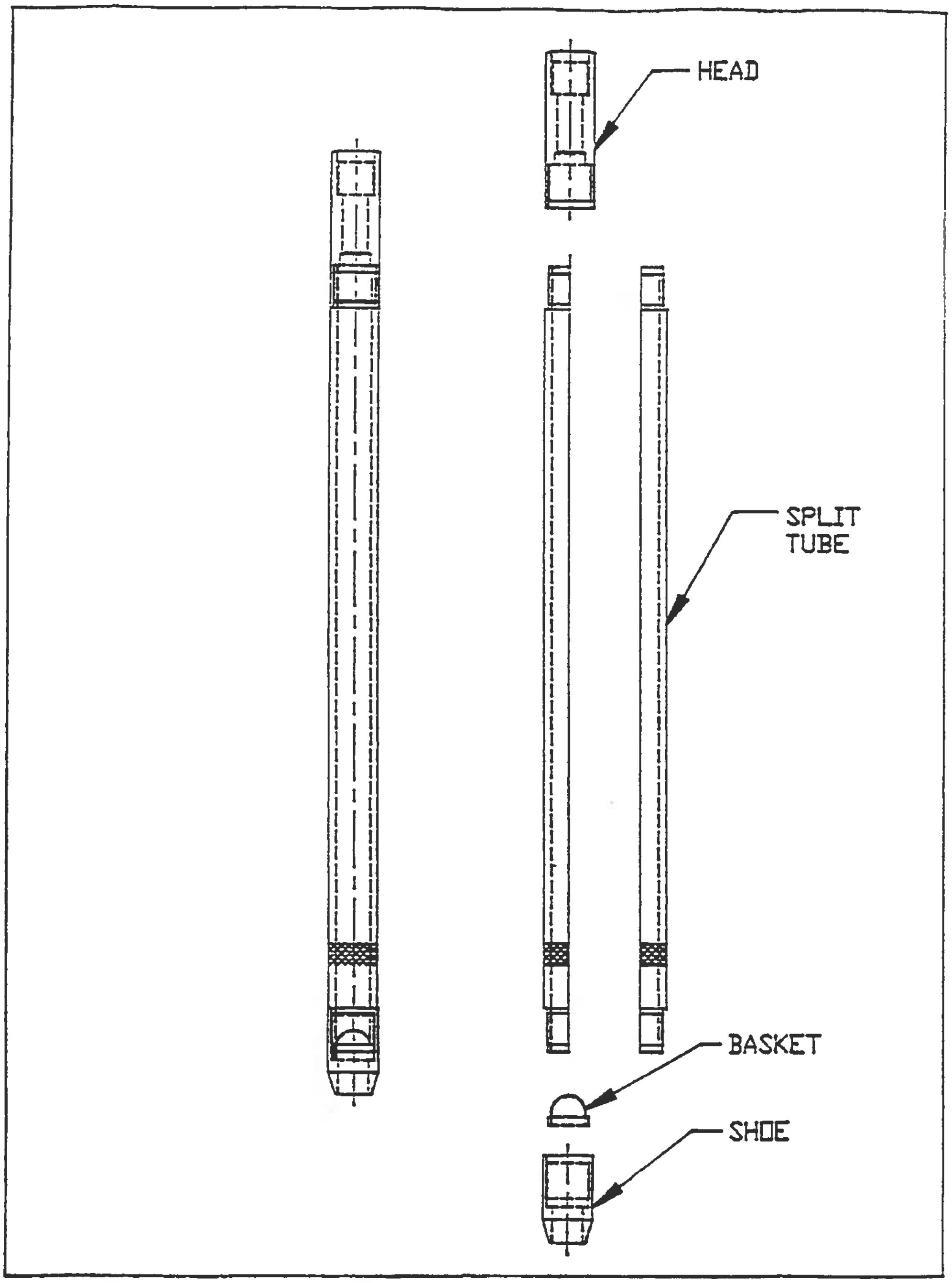

FIG. 4 Split Barrel Sampler, Two Tube System

type samplers. Liners are available in plastics, Teflon®, brass, and stainless steel. Other materials can be used as testing needs dictate. Liners are available in lengths from 6 in. (152.4 mm) to 5.0 ft (1.53 m). Liner material selection often is based on the chemical composition of liner/soil to minimize sample reaction with liner. Most liner use is short term as samples are subsampled and preserved immediately on site. A general rule for liner selection is stainless steel for organic compounds and plastic for metals. Teflon® may be required for mixed wastes and for long time storage. Liners should be sealed in accordance with Practice D 4220 when samples are collected for physical testing. Other appropriate procedures must be used when samples are collected for environmental analysis (see Practices D 3694) **(1, 2)**. Liners generally are split in the field for subsampling. Individually split liners are available in some sizes for field use. The liner should have a slightly larger inside diameter than the soil specimen to reduce soil friction and enhance recovery. When a slightly oversized liner is used, the potential for air space exists around the sample. Certain chemical samples may be affected by the enclosed air. Liners having less tolerance may be required and a shortened sampled interval used to reduce friction in the liner. Metal liners can be

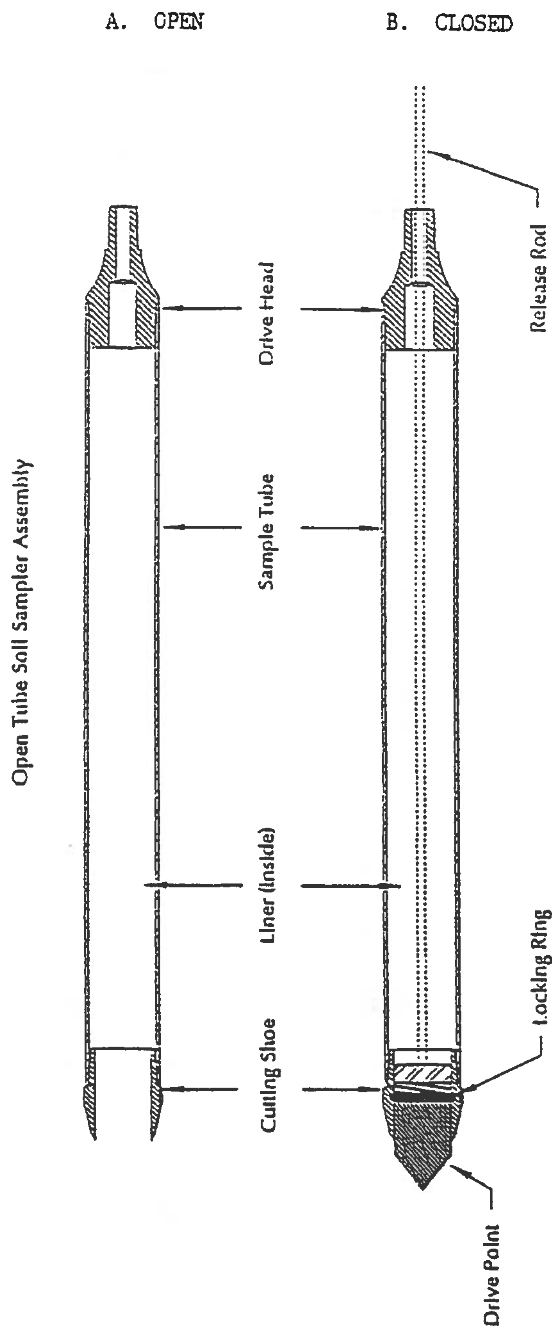

FIG. 5 (A) Open and (B) Closed Piston Sampler Assembly, Single Tube System

reused after proper cleaning and decontamination. Plastic liners should be disposed of properly after use.

7.3.7 *Sample Containers*—Sample containers should be prescribed according to the anticipated use of the sample specimen. Samples taken for chemical testing may require decontaminated containers with specific preservatives. Practice D 3694 provides information on some of the special containers and preservation techniques required (**1, 2**). These containers generally will be decontaminated to specific criteria. Samples for geotechnical testing require certain minimum volumes and specific handling techniques. Practice D 4220 offers guidance for sample handling of samples submitted for physical testing.

7.4 *Direct Push Power Sources*—Soil probing percussion driving systems, penetrometer drive systems, and rotary drilling equipment may be used to drive casings and direct push soil sampling devices. The equipment should be capable of applying sufficient static force, or dynamic force, or both, to advance the sampler to the required depth to gather the desired sample. The system must have adequate retraction force to remove the sampler and extension/drive rods once the selected strata has been penetrated. Rotation of the drill string can be added during insertion, as well as during retraction if the drive system can impart rotation.

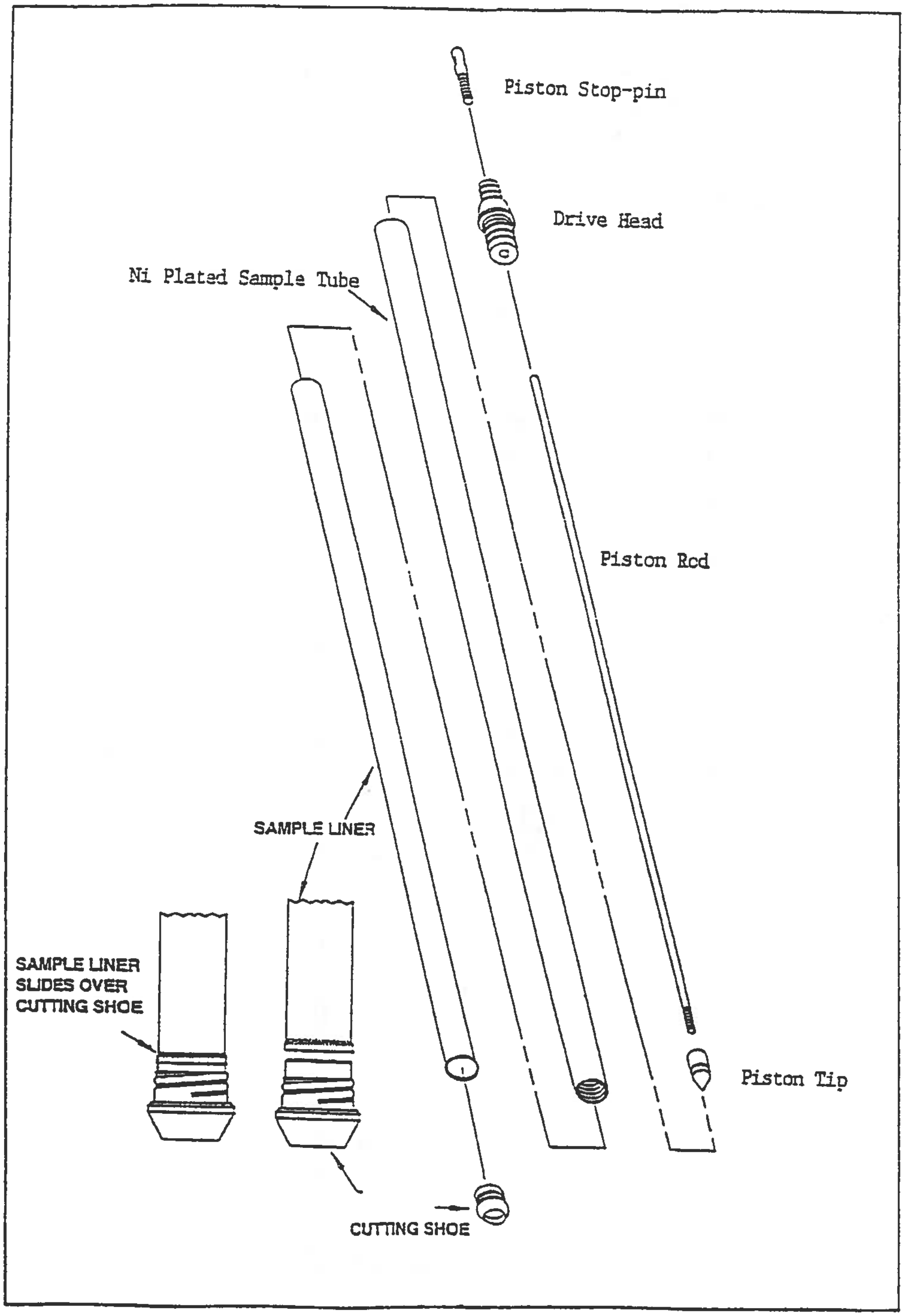

FIG. 6 Sampler Parts, Single Tube System

7.4.1 *Retraction Force*—The retraction force can be applied by direct mechanical pull back using the hydraulic system of the power source; line pull methods using mechanical or hydraulic powered winches, or cathead and rope windlass type devices. Winches used with direct push technology should have a minimum of 2000 lb (907 kg) top layer rating capacity and a line speed of 400 ft (121.96 m)/min to provide effective tool handling. Direct push sampling tools can be retracted by back pounding using weights similar to those of standard penetration testing practices. Backpounding to recover samples can affect recovery and cause disturbances to the sample. Other forms of extraction, such as jacking, that do not cause undue disturbance to the sample, are preferable.

7.4.2 *Percussion Devices*—Percussion devices for use with direct push methods are hydraulically-operated hammers, air-operated hammers, and mechanically-operated hammers. Hydraulically-operated hammers should have sufficient energy to be effective in moving the samplers through the subsurface

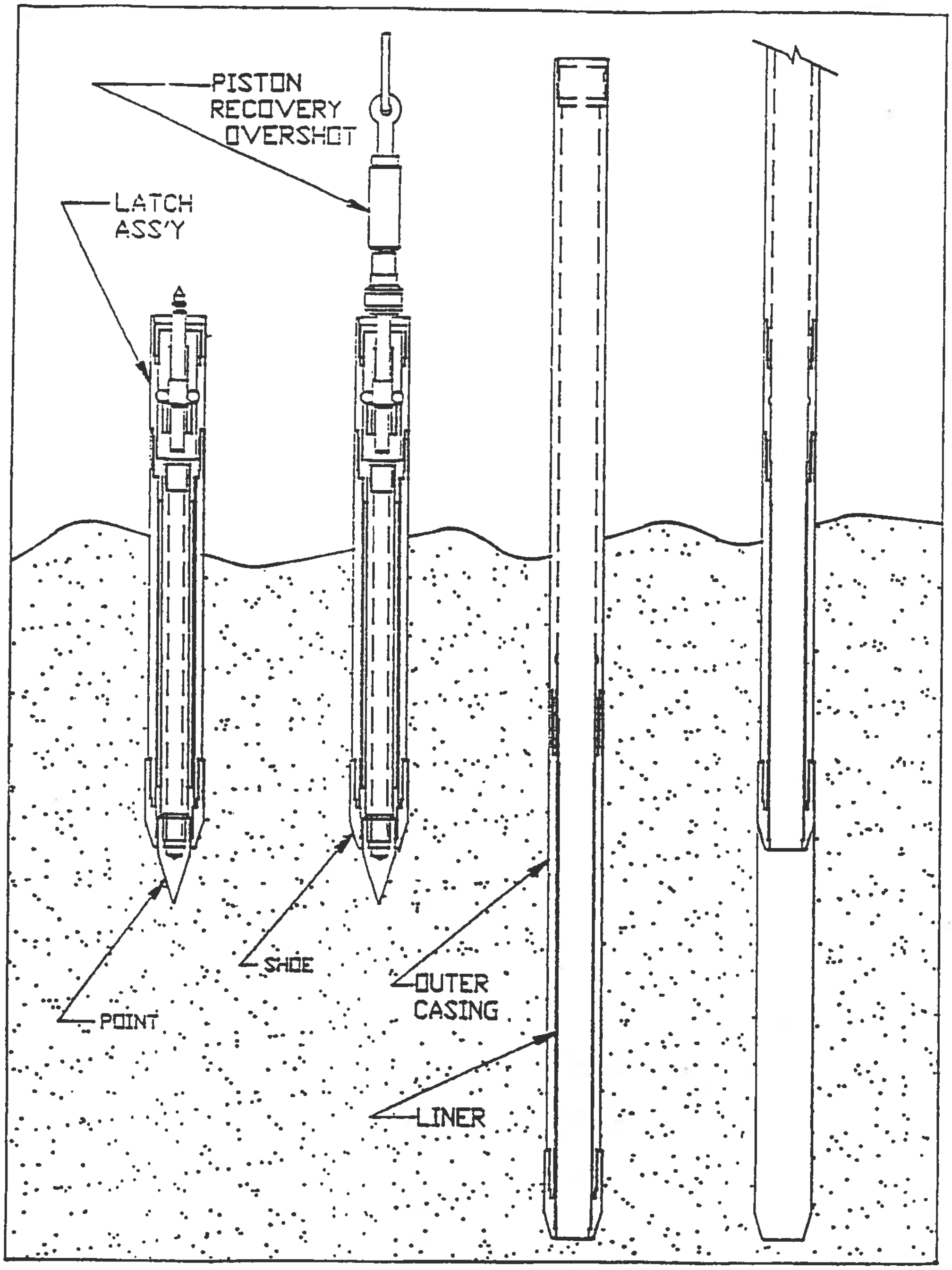

FIG. 7 Closed Solid Barrel Sampler, Single Tube System

strata. The maximum energy application is dependent on the tools used. Hammer energy that exceeds tool tolerance will result in tool damage or loss and will not achieve the goal of collecting high quality samples. Air-operated hammers should be capable of delivering sufficient energy, as well. Hammer systems utilizing hydraulic oil or air should be operated in the range specified by the manufacturer. Manually-operated hammers can be used to advance direct push tools. These hammers can be operated mechanically or manually using cathead and rope. These systems generally involve using 140 lb, standard penetration (see Test Method D 1586) hammers, which can work well for direct push sampling. In operation, these hammers tend to be slower than hydraulic hammers and can cause tool damage if direct push tools are not designed to take the heavy blows associated with these hammers. The hydraulic- and air-operated hammers strike up to 2000 blows/min. In addition to the energy transferred, the rapid hammer action sets up a vibratory effect, which also aids in penetration. This vibratory effect, along with the percussive effort, may disturb some soil samples.

7.4.3 *Static Push Systems*—Cone penetrometer systems are an example of static push systems. They impart energy to the

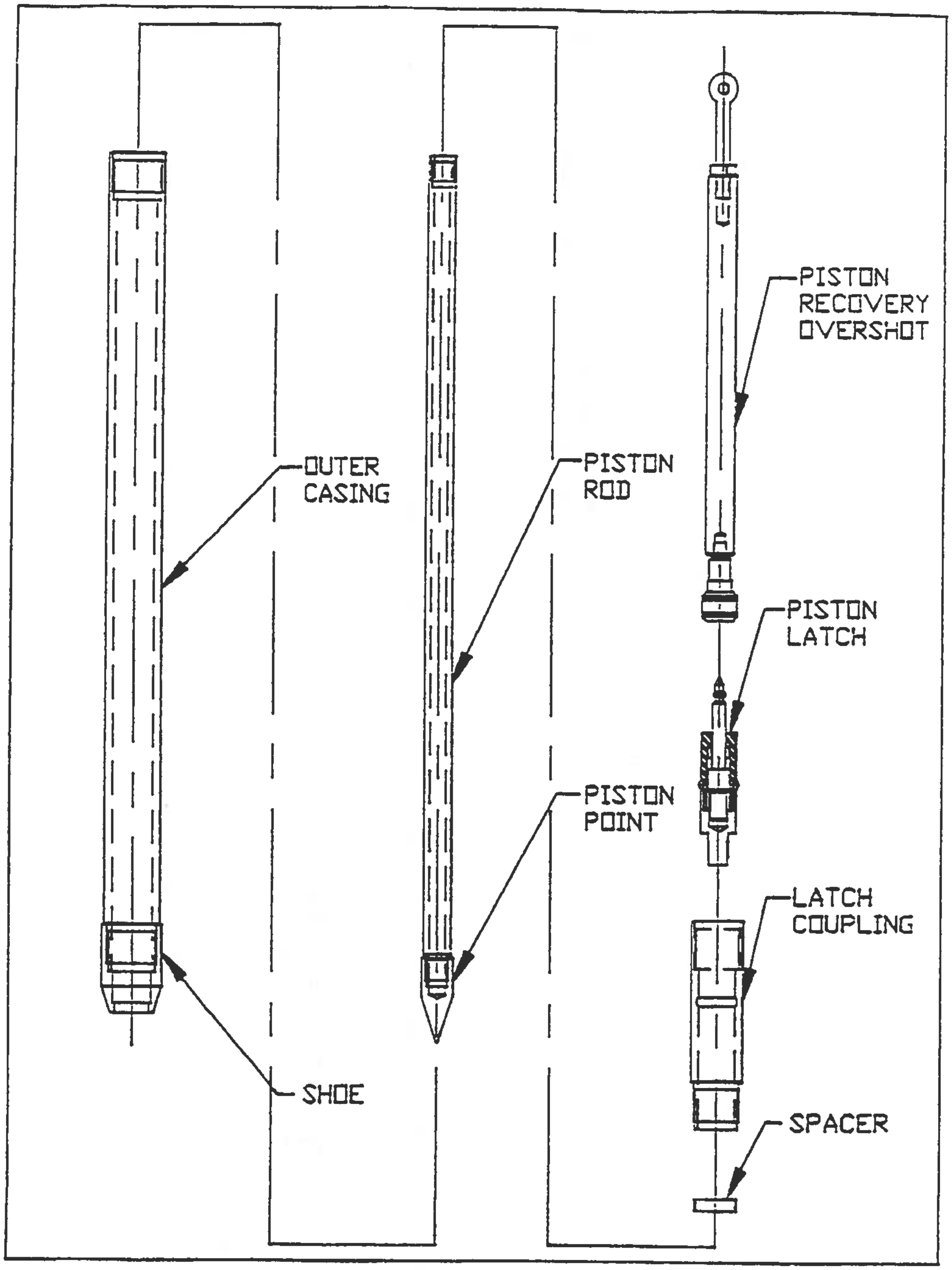

FIG. 8 Closed Solid Barrel Sampler, Single Tube System

sampler and extension rods by using hydraulic rams to apply pressure. The pressure applied is limited to the reactive weight of the drive vehicle. Retraction of the sampler and extension rods is by static pull from the hydraulic rams.

7.4.4 *Vibratory/Sonic Systems*—These systems utilize a vibratory device, which is attached to the top of the sampler extension rods. Reactive pressure and vibratory action are applied to the sampler extensions moving the sampler into the formation. In certain formations, sample recovery and formation penetration is expedited; however, all formations do not react the same to vibratory penetration methods.

7.4.4.1 *Sonic or Resonance Drilling Systems*—These are high powered vibratory systems that can be effective in advancing large diameter single or dual tube systems. They generally have depth capabilities beyond the smaller direct push systems.

7.4.5 *Rotary Drilling Equipment*—Direct push systems are readily adaptable to rotary drill units. The drill units offer a ready hydraulic system to operate percussion hammers, as well as reactive weight for static push. Because most drills are equipped with leveling jacks, better weight application is achieved. Vertical pushing is improved because of the ability to

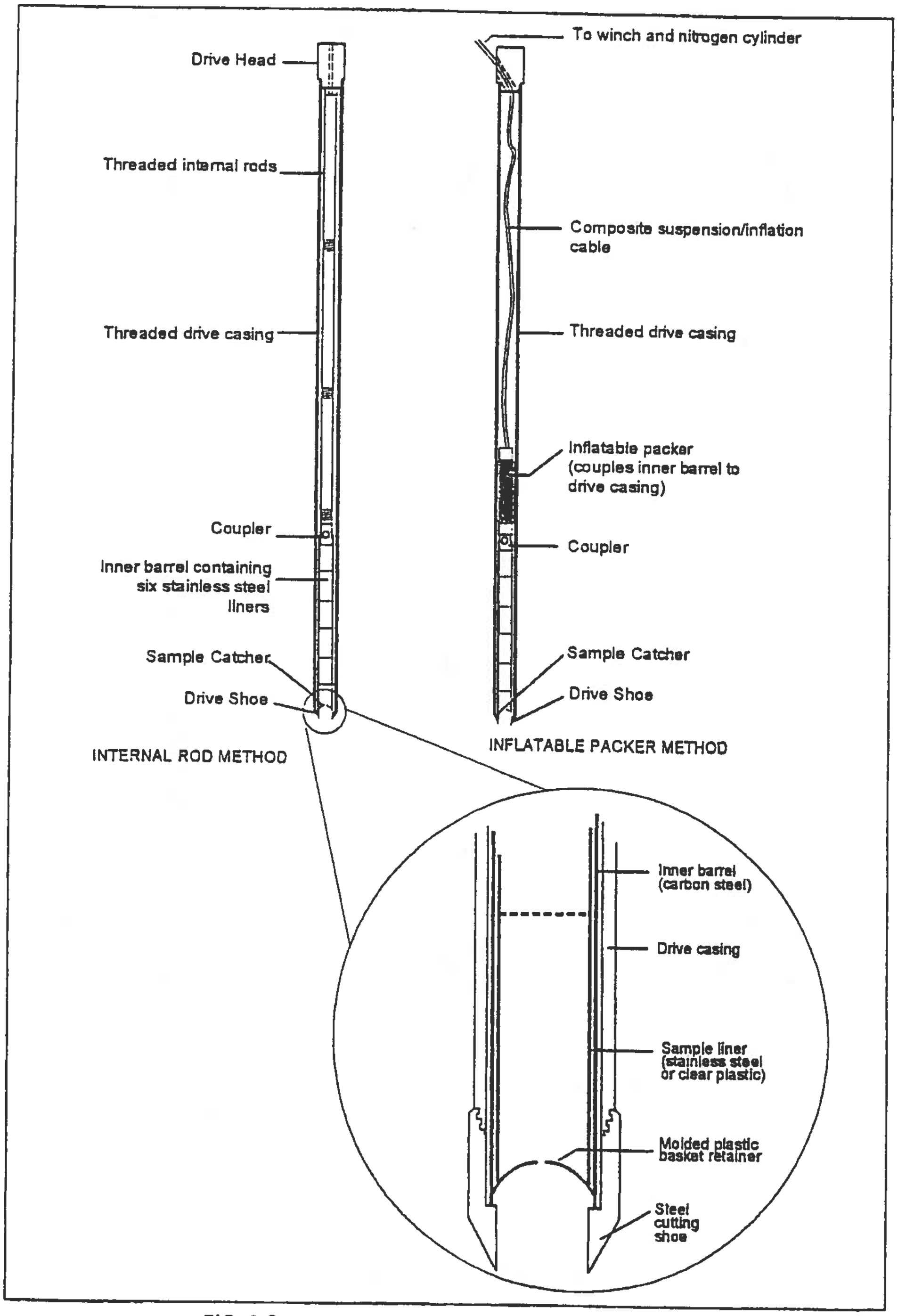

FIG. 9 Sampler Holding Methods, Two Tube System

level the machine. Tool handling is facilitated by high speed winches common to drilling rigs, extended masts for long tool pulls, and longer feed stroke length. Drill units with direct push adaptations also offer drilling techniques should obstacles be encountered while using direct push technology. Large drill units may have reactive weights that can exceed the tool capacity, thereby resulting in damaged tools.

8. Conditioning

8.1 *Decontamination*—Sampling equipment that will contact the soil to be sampled should be cleaned and decontaminated before and after the sampling event. Extension rods should be cleaned prior to each boring to avoid the transfer of contaminants and to ease the connecting of joints. Thread

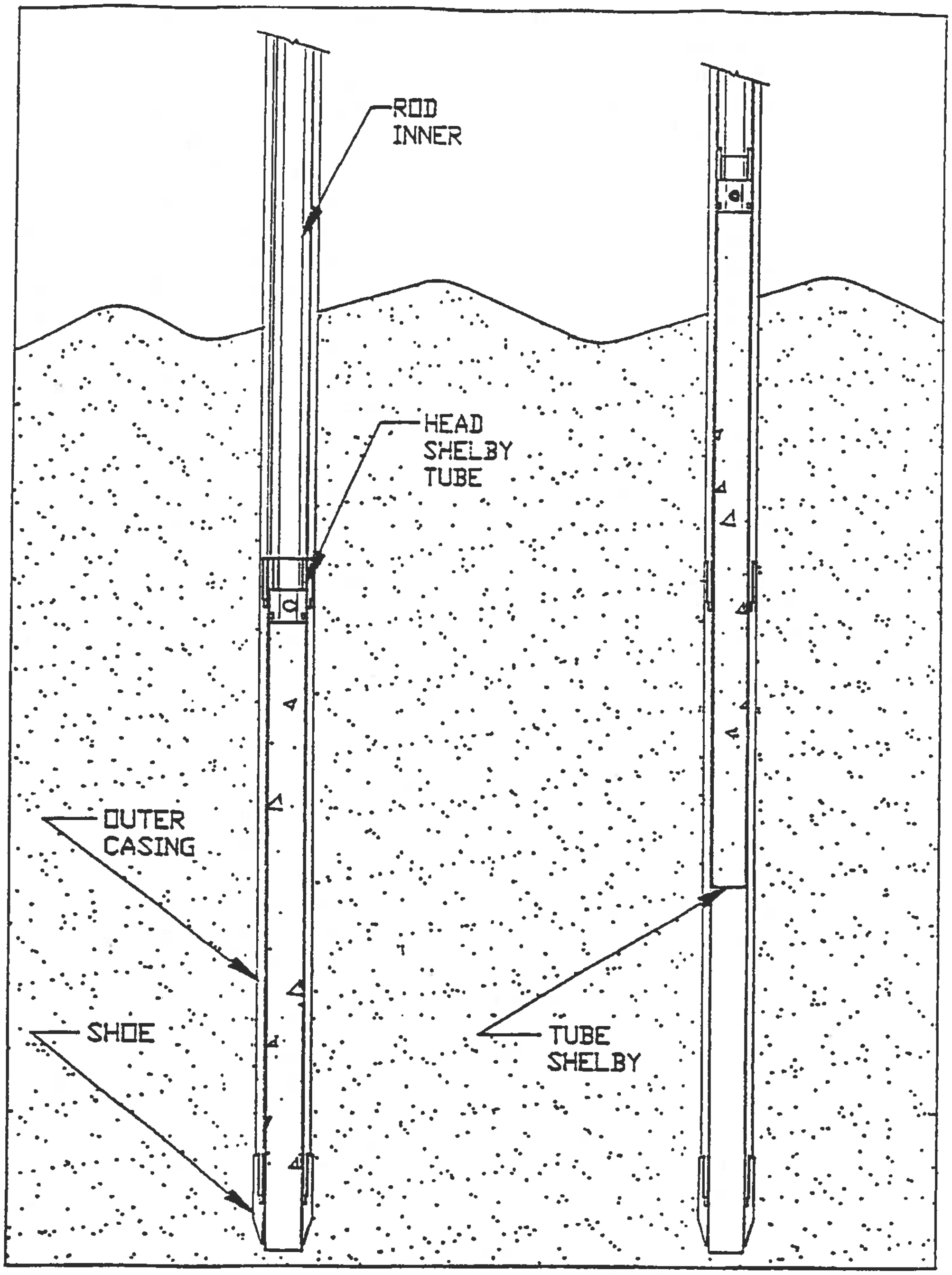

FIG. 10 Thin Wall Tube Sampler, Two Tube System

maintenance is necessary to ensure long service life of the tools. Sample liners should be kept in a sealed or clean environment prior to use. Reusable liners should be decontaminated between each use. All ancillary tools used in the sampling process should be cleaned thoroughly, and if contaminants are encountered, decontaminated before leaving the site. It should not be assumed that new tools are clean. They should be cleaned and decontaminated before use. Decontamination should be performed following procedures outlined in Practice D 5088 along with any site safety plans, sampling protocols, or regulatory requirements.

8.2 *Tool Selection*—Prior to dispatch to the project site an inventory of the necessary sampling tools should be made. Sample liners, containers, sampling tools, and ancillary equipment should be checked to ensure its proper operation for the work program prescribed. Sampling is expedited by having two or more samplers on site. Since samples can be recovered quite fast, a supply of samplers will allow a boring to be completed so other functions can be performed while samples are being processed. A backup tool system adaptable to and within the capabilities of the power source should be available should the original planned method prove unworkable. Materials for proper sealing of boreholes should always be available at the site **(5-7)**.

9. Procedure

9.1 While procedures for direct push soil sampling with two common direct push methods are outlined here, other systems may be available. As long as the basic principles of practice relating to sampler construction and use are followed, other systems may be acceptable.

9.2 *General Set-Up*—Select the boring location and check for underground and overhead utilities and other site obstructions. Establish a reference point on the site for datum measurements, and set the direct push unit over the boring location. Stabilize and level the unit, raise the drill mast or frame into the drilling position, and attach the hammer assembly to the drill head if not permanently attached. Attach the anvil assembly in the prescribed manner, slide the direct push unit into position over the borehole, save a portion of the sliding distance for alignment during tool advancement, and ready the tools for insertion.

9.2.1 *Tool Preparation*—Inspect the direct push tools before using, and clean and decontaminate as necessary. Inspect drive shoes for damaged cutting edges, dents, or thread failures as these conditions can cause loss of sample recovery and slow the advancement rate. Where permissible, lubricate rod joints with appropriate safe products, and check impact surfaces for cracks or other damage that could result in failure during operations. Assemble samples and install where required, install sample retainers where needed, and install and secure sampler pistons to ensure proper operation where needed.

9.2.2 *Sample Processing*—Sample processing should follow a standard procedure to ensure quality control procedures are completed. View sample in the original sampling device, if possible. Open the sampling device with care to keep disturbance to a minimum. When using liners or thin wall tubes, protect ends to prevent samples from falling out or being disturbed by movement within the liner. Measure recovery accurately, containerize as specified in the work plan or applicable ASTM procedures, and label recovered samples with sufficient information for proper identification. When collecting samples for volatile chemical analysis, sample specimens must be contained and preserved as soon as possible to prevent loss of these components. Follow work plan instructions or other appropriate documents (see Practice D 3694) when processing samples collected for chemical analysis.

9.3 *Two Tube System*:

9.3.1 *Split Barrel Sampling (see* Fig. 1*)*—Assemble the outer casing with the drive shoe on the bottom, attach the drive head to the top of the outer casing, and attach the sampler to the extension rods. Connect the drive head to the top of the sampler extension rods, and insert the sampler assembly into the outer casing. The sampler cutting shoe should contact the soil ahead of the outer casing to prevent unnecessary sample disturbance. The split spoon cutting shoe should extend a minimum of 0.25 in. (6.25 mm) ahead of the outer casing. Greater extensions may improve recovery in soft formations. Mark the outer casing to designate the required drive length, position the outer casing and sampler assembly under the drill head, and move the drill head downward to bring pressure on the tool string. If soil conditions allow, advance the sampler/casing assembly into the soil at a steady rate slow enough to allow the soil to be cut by the shoe and move up inside the sample barrel. If advancement is too rapid, it can result in loss of recovery because of soil friction in the shoe. Occasional hammer action during the push may help recovery by agitating the sample surface. If soil conditions prevent smooth static push advancement, activate the hammer to advance the sampler. Apply a continuous pressure while hammering to expedite soil penetration. The pressure required is controlled by subsurface conditions. Applications of excessive down pressure may result in the direct push unit being shifted off the borehole causing misalignment with possible tool damage. Stop the hammer at completion of advancement of the measured sampling barrel length. Release the pressure and move the drill head off the drive head. Attach a pulling device to the extension rods or position the hammer bail and retrieve the sampler from the borehole. At the surface remove the sampler from the extension rods and process. Soil classification is accomplished easily using split barrel samplers as the specimen is available readily for viewing, physical inspection and subsampling when the barrel is opened. Clean, decontaminate, and reassemble the sampler. Reattach the sampler to the extension rod, add the necessary extension rod and outer casing to reach the next sampling interval, and sound the borehole for free water before each sample interval. If water is present, it may be necessary to change sampling tools. Unequal pressure inside the casing may result in blow-in of material disturbing the soil immediately below the casing. Lower the sampler to its proper position, add the drive heads, and repeat the procedure. If it is desired that the pass through certain strata without sampling, install an extension rod point in lieu of the sampler. When the sampling interval is reached, remove the point and install the sampler. Advance the sampler as described. Upon completion of the borehole, remove the outer casing after instrumentation has been set or as the borehole is sealed as described in Section 10 **(6)**.

9.3.2 *Two Tube System—Other Samplers*:

9.3.2.1 *Thin Wall Tubes*—Thin wall tubes (see Fig. 10) can be used with the dual tube system. Attach the tube to the tube head using removable screws. Attach the tube assembly to the extension rods and position at the base of the outer casing shoe protruding a minimum of 0.25 in. (6.25 mm) to contact the soil ahead of the outer casing. Advance the tube, with or without the outer casing, at a steady rate similar to the requirements of Practice D 1587. At completion of the advancement interval, let the tube remain stationary for 1 min. Rotate the tube slowly two revolutions to shear off the sample. Remove the tube from the borehole, measure recovery, and classify soil. The thin wall tube can be field extruded for on-site analysis or sealed in accordance with Practice D 4220 and sent to the laboratory for processing. Samples for environmental testing generally require the subsampling and preservation of samples in controlled containers. Soil samples generally are removed from the sampling device for storage and shipping. Thin wall tubes should be cleaned and decontaminated before and after use.

9.3.2.2 *Thin Wall Tube Piston Sampler (see Fig. 11)*—Check the fixed piston sampling equipment for proper operation of the cone clamping assembly and the condition of the sealing "O" rings. Slide the thin wall tube over the piston, and attach it to the tube head. Position the piston at the sharpened end of the thin wall tube just above the sample relief bend. Attach the sampler assembly to the extension rods, and lower the sampler into position through the outer casing. Install the actuator rods through the extension rod, and attach to the actuator rod in the sampler assembly. Attach a holding ring to the top of the actuator rod string, and hook the winch cable or other hook to the holding ring to hold the actuator rods in a fixed position. Attach the pushing fork to the drill head/probe hammer, and slowly apply downward pressure to the extension rods advancing the thin wall tube over the fixed piston into the

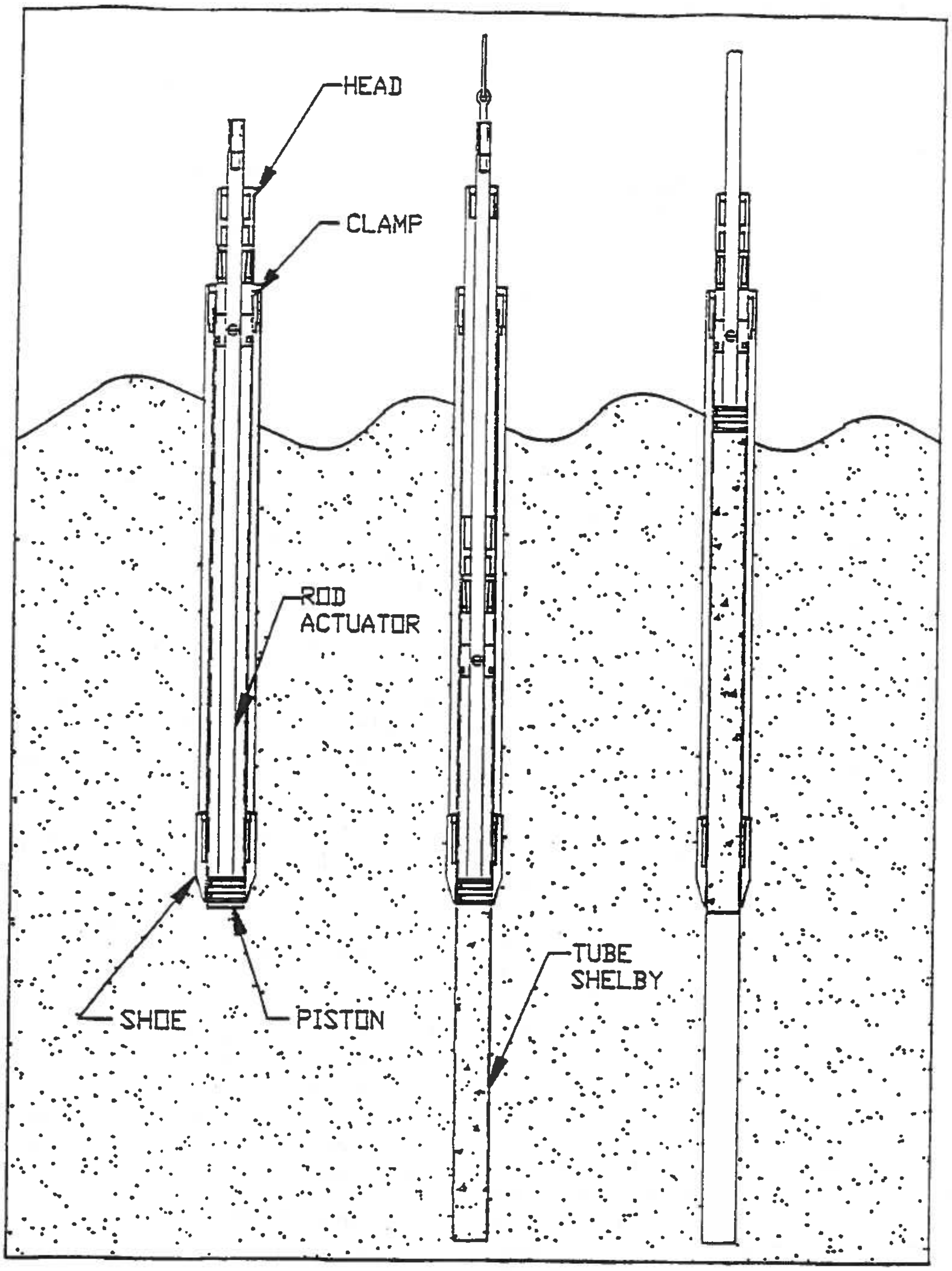

FIG. 11 Fixed Piston Sampler, Two Tube System

soil for the sample increment. Rest sampler 1 min to allow sample to conform to tube. Rotate tube one revolution to shear off sample. Remove sampler assembly from borehole and process sample **(6)**.

9.3.2.3 *Open Solid Barrel Samplers*—Use solid barrel samplers in advance of the outer casing where the soil conditions could cause swelling of split barrel samplers, or where friction against the outer casing precludes its advancement and sampling must still be accomplished. The solid, single, or segmented barrel sampler requires the use of liners for removal of the sample. The sampler must be cleaned and decontaminated before use. Use of the sampler follows the procedure described in 9.3.1.

9.4 *Single Tube System*:

9.4.1 *Open Solid Barrel Sampler (see Figs. 5 and 6)*—Attached the required liner to the cutting shoe by insertion into the machined receptacle area or by sliding over the machined tube. Insert the liner and shoe into the solid barrel, and attach the shoe **(6, 8-11)**. Attach the sampler head to the sampler barrel providing a backing plate for the liner. Attach the sampler assembly to the drive rod and the drive head to the drive rod. Position the assembly under the hammer anvil and advanced as described in 9.3.1. At completion of the sampling increment, remove the sampler from the borehole. Remove the filled sample liner from the barrel by unscrewing the shoe, cap the liner for laboratory testing or spit open for field processing, and advance the borehole by repeating the procedure. Because the solid barrel cannot be opened for cleaning, it may require more effort for cleaning and decontamination. The open solid barrel sampler is used in soil formations that have sufficient wall strength to maintain a borehole wall without sloughing or cave-in. In soil formations not affording such structure, other sampling methods may be required or the opening sealed. To enhance recovery in some soil strata, it may be necessary to vary the length of the sampling increment. Shorter increments generally improve recovery because of lower sample friction and compression inside the sampler chamber. Sample recovery can be enhanced in some formations by intermittent use of the percussion hammer **(6, 8, 10, 11)**.

9.4.2 *Closed Solid Barrel Sampler (see Figs. 5-7,* Fig. 11*)*—Insert or attach the sample liner to the shoe, and insert the assembly into the solid barrel sampler. Install sample retaining basket if desired. Attach the latch coupling or sampler head to the sampler barrel, and attach the piston assembly with point and" O" rings if free water is present, to the latching mechanism or holder. Insert the piston or packer into the liner to its proper position so the point leads the sampler shoe. Set latch, charge packer, or install locking pin, and attach assembled sampler to drive rod. Add drive head and position under the hammer anvil. Apply down pressure, hammer if needed, to penetrate soil strata above the sampling zone. When the sampling zone is reached, insert the piston latch release and recovery tool, removing the piston, or insert the locking pin removal/extension rods through the drive rods, turn counterclockwise, and remove the piston locking pin so the piston can float on top of the sample, or release any other piston holding device. Direct push or activate the hammer to advance the sampler the desired increment. Retrieve the sampler from the borehole by withdrawing the extension/drive rods. Remove the shoe, and withdraw the sample liner with sample for processing. Clean and decontaminate the sampler, reload as described, and repeat the procedure. Extreme stress is applied to the piston when driving through dense soils. If the piston releases prematurely, the sample will not be recovered from the correct interval, and a resample attempt must be made. The piston sampler can be used as a re-entry grouting tool for sealing boreholes on completion if it is equipped with a removable piston **(5, 6, 7, 10, 11)**.

9.4.3 *Standard Split Barrel Sampler*—Attach the split spoon to an extension rod or drill rod. Using a mechanical or hydraulic hammer drive the sampler into the soil the desired increment, as long as that increment does not exceed the sampler chamber length. Remove the sampler from the borehole, disassemble, and process sample. Standard split barrel samplers can be used, as long as borehole wall integrity can be maintained and the additional friction can be overcome. If caving or sloughing occurs, the sampler tip should be sealed or other sampling tools used **(9)**.

9.5 *Quality Control*:

9.5.1 *Quality Control*—Quality control measures are necessary to ensure that sample integrity is maintained and that project data quality objectives are accomplished. By following good engineering principles and applying common sense, reliable site characterizations can be accomplished.

9.5.2 *Water Checks*—Water seeping into the direct push casing or connecting rods from contaminated zones may influence testing results. Periodically check for ground water before inserting samplers into borehole or into outer casings in the two tube system. If water is encountered, it may be necessary to switch to the sealed piston type samplers to protect sample integrity. Sealed piston type samples may not always be water tight. Sealing of rod or casing joints can prevent ground water from entering through the joints.

9.5.3 *Datum Points*—Establishment of a good datum reference is essential to providing reliable sample interval depths and elevators. Select datum reference points that are sufficiently protected from the work effort, and that can be located for future reference. Field measurements should be to 0.1 ft (3.05 mm). Measure extension rods as the bore advances to locate sample depth. Mark rods before driving each sample interval to determine accurate measurement of sample recovery and to accurately log borehole depth.

9.5.4 *Sample Recovery*—Sample recovery should be monitored closely and results documented. Poor recovery could indicate a change in sampling method is needed, that improper sampling practices are being conducted, or that sampling tools are incorrect. Sample recovery involves both volume and condition. Poor sample recovery should cause an immediate review of the sampling program.

9.5.5 *Decontamination*—Follow established decontamination procedures. Taking shortcuts may result in erroneous or suspect data.

10. Completion and Sealing

10.1 *Completion*—For boreholes receiving permanent monitoring devices, completion should be in accordance with Practice D 5092, site work plan, or regulatory requirements.

10.2 *Borehole Sealing*—Seal direct push boreholes to minimize preferential pathways for containment migration. Additional information and guidance on borehole sealing can be found in Guide D 6001 and in Guide D 5299. State or local regulations may control both the method and the materials for borehole sealing. Regulations generally direct bottom up borehole sealing as it is the surest and most permanent method for complete sealing. High pressure grouting is available for use with direct push technology for bottom up borehole sealing.

10.2.1 *Sealing by Slurry, Two Tube System*—Sound the borehole for free water. If water exists in the casing, place the extension rods, open-ended, to the bottom of the outer casing, as a tremie. Mix the slurry to standard specifications prescribed by regulation or work plan. Pump slurry through the extension/drive rod until it appears at the surface of the outer casing. Remove the extension rods. If no free water exists in the borehole, the slurry can be placed by gravity. Top off the outer casing as it is removed from the borehole.

10.2.1.1 *Slurry Mixes*—Slurry mixes used for slurry grouting of direct push boreholes generally are of lower viscosity because of the small diameter tremie pipes required. Usable mixes are 6 to 8 gal (22.7 to 30.28 L) of water/94-lb (42.64-kg) bag of cement with 5 lb (2.27 kg) of bentonite or 24 to 36 gal (90.84 to 136.28 L) of water to 50 lb (22.68 kg) of bentonite.

10.2.2 *Sealing by Gravity—Two Tube System*—Measure the cased hole to ensure it is open to depth. Slowly add bentonite chips or granular bentonite to fill the casing approximately 2 ft. Withdraw the casing 2 ft and recheck depth. Hydrate the bentonite by adding water. Repeat this procedure as the outer casing is withdrawn. The bentonite must be below the bottom of the casing during hydration. Wetness inside the rods may affect the flow of granular bentonite to the bottom of the casing. Fill the top foot of the borehole with material that is the same as exists in that zone.

10.2.3 *Borehole Sealing Single Tube System*:

10.2.3.1 *Gravity Sealing from Surface*—If the soil strata penetrated has sufficient wall strength to maintain an open hole, then it may be possible to add sealing materials from the surface. Dry bentonite chips or granular bentonite can be placed by gravity. The borehole volume should be determined and the borehole sounded every 10 ft (3 m) to ensure bridging has not occurred. The bentonite should be hydrated by adding approximately 1 pt (0.57 L) of water for each 5 ft of filled borehole. Seal the surface with native material.

10.2.3.2 *Wet Grout Mix Tremie Sealing*—Tremie sealing methods can be used with single tube systems when borehole wall strength is sufficient to maintain an open hole or when extension rods with an expendable point are used to reenter the borehole. The grout pipe should be inserted immediately after the direct push tools are withdrawn or through the annulus of the extension rods that have been reinserted down the borehole for grouting. Care must be taken to not plug the end of the grout pipe. Side discharge grout pipes also can be used to prevent plugging.

10.2.4 *Re-Entry Grouting*—If the borehole walls are not stable, the borehole can be re-entered by static pushing grouting tools, such as an expendable point attached to the extension/drive rods to the bottom of the original borehole. Pump a slurry through the rods as they are withdrawn. High pressure grouting equipment may be beneficial in pumping standard slurry mixes through small diameter gravity pipes. Care must be taken to ensure the original borehole is being sealed.

11. Record Keeping

11.1 *Field Report*—The field report may consist of boring log or a report of the sampling event and a description of the sample. Soil samples can be classified in accordance with Practice D 2488 or other methods as required for the investigation **(12)**. Prepare the log in accordance with standards set in Guide D 5434 listing the parameters required for the field investigation program. List all contaminants identified, instrument readings taken, and comments on sampler advancement. Record any special field tests performed and sample processing procedures beyond those normally used in the defined investigation. Record borehole sealing procedures, materials used, and mix formulas on the boring log. Survey or otherwise locate the boring site to provide a permanent record of its replacement.

11.2 *Backfilling Record*—Record the method of sealing, materials used, and volume of materials placed in each borehole. This information can be added to the field boring log or recorded on a separate abandonment form.

12. Keywords

12.1 decontamination; direct push; ground water; sealing; soil sampling

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Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils[1]

This standard is issued under the fixed designation D 1586; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope *

1.1 This test method describes the procedure, generally known as the Standard Penetration Test (SPT), for driving a split-barrel sampler to obtain a representative soil sample and a measure of the resistance of the soil to penetration of the sampler.

1.2 *This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* For a specific precautionary statement, see 5.4.1.

1.3 The values stated in inch-pound units are to be regarded as the standard.

NOTE 1—Practice D 6066 can be used when testing loose sands below the water table for liquefaction studies or when a higher level of care is required when drilling these soils. This practice provides information on drilling methods, equipment variables, energy corrections, and blow-count normalization.

2. Referenced Documents

2.1 *ASTM Standards:*

D 2487 Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)[2]

D 2488 Practice for Description and Identification of Soils (Visual-Manual Procedure)[2]

D 4220 Practices for Preserving and Transporting Soil Samples[2]

D 4633 Test Method for Stress Wave Energy Measurement for Dynamic Penetrometer Testing Systems[2]

D 6066 Practice for Determining the Normalized Penetration Resistance Testing of Sands for Evaluation of Liquefaction Potential[3]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *anvil*—that portion of the drive-weight assembly which the hammer strikes and through which the hammer energy passes into the drill rods.

3.1.2 *cathead*—the rotating drum or windlass in the rope-cathead lift system around which the operator wraps a rope to lift and drop the hammer by successively tightening and loosening the rope turns around the drum.

3.1.3 *drill rods*—rods used to transmit downward force and torque to the drill bit while drilling a borehole.

3.1.4 *drive-weight assembly*—a device consisting of the hammer, hammer fall guide, the anvil, and any hammer drop system.

3.1.5 *hammer*—that portion of the drive-weight assembly consisting of the 140 ± 2 lb (63.5 ± 1 kg) impact weight which is successively lifted and dropped to provide the energy that accomplishes the sampling and penetration.

3.1.6 *hammer drop system*—that portion of the drive-weight assembly by which the operator accomplishes the lifting and dropping of the hammer to produce the blow.

3.1.7 *hammer fall guide*—that part of the drive-weight assembly used to guide the fall of the hammer.

3.1.8 *N-value*—the blowcount representation of the penetration resistance of the soil. The *N*-value, reported in blows per foot, equals the sum of the number of blows required to drive the sampler over the depth interval of 6 to 18 in. (150 to 450 mm) (see 7.3).

3.1.9 ΔN—the number of blows obtained from each of the 6-in. (150-mm) intervals of sampler penetration (see 7.3).

3.1.10 *number of rope turns*—the total contact angle between the rope and the cathead at the beginning of the operator's rope slackening to drop the hammer, divided by 360° (see Fig. 1).

3.1.11 *sampling rods*—rods that connect the drive-weight assembly to the sampler. Drill rods are often used for this purpose.

3.1.12 *SPT*—abbreviation for standard penetration test, a term by which engineers commonly refer to this method.

4. Significance and Use

4.1 This test method provides a soil sample for identification purposes and for laboratory tests appropriate for soil obtained from a sampler that may produce large shear strain disturbance in the sample.

4.2 This test method is used extensively in a great variety of geotechnical exploration projects. Many local correlations and

[1] This method is under the jurisdiction of ASTM Committee D-18 on Soil and Rock and is the direct responsibility of Subcommittee D18.02 on Sampling and Related Field Testing for Soil Investigations.

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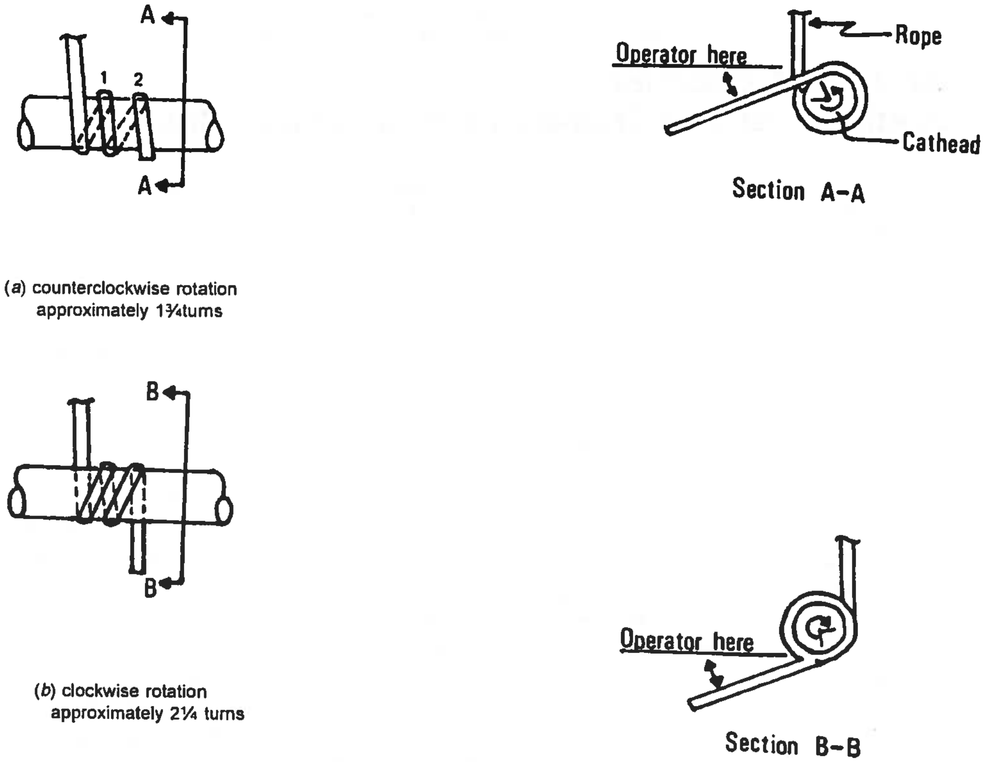
[2] *Annual Book of ASTM Standards*, Vol 04.08.

[3] *Annual Book of ASTM Standards*, Vol 04.09.

***A Summary of Changes section appears at the end of this standard.**



(*a*) counterclockwise rotation approximately 1¾turns

(*b*) clockwise rotation approximately 2¼ turns

FIG. 1 Definitions of the Number of Rope Turns and the Angle for (*a*) Counterclockwise Rotation and (*b*) Clockwise Rotation of the Cathead

widely published correlations which relate SPT blowcount, or *N*-value, and the engineering behavior of earthworks and foundations are available.

5. Apparatus

5.1 *Drilling Equipment*—Any drilling equipment that provides at the time of sampling a suitably clean open hole before insertion of the sampler and ensures that the penetration test is performed on undisturbed soil shall be acceptable. The following pieces of equipment have proven to be suitable for advancing a borehole in some subsurface conditions.

5.1.1 *Drag, Chopping, and Fishtail Bits*, less than 6.5 in. (162 mm) and greater than 2.2 in. (56 mm) in diameter may be used in conjuction with open-hole rotary drilling or casing-advancement drilling methods. To avoid disturbance of the underlying soil, bottom discharge bits are not permitted; only side discharge bits are permitted.

5.1.2 *Roller-Cone Bits*, less than 6.5 in. (162 mm) and greater than 2.2 in. (56 mm) in diameter may be used in conjunction with open-hole rotary drilling or casing-advancement drilling methods if the drilling fluid discharge is deflected.

5.1.3 *Hollow-Stem Continuous Flight Augers*, with or without a center bit assembly, may be used to drill the boring. The inside diameter of the hollow-stem augers shall be less than 6.5 in. (162 mm) and greater than 2.2 in. (56 mm).

5.1.4 *Solid, Continuous Flight, Bucket and Hand Augers*, less than 6.5 in. (162 mm) and greater than 2.2 in. (56 mm) in diameter may be used if the soil on the side of the boring does not cave onto the sampler or sampling rods during sampling.

5.2 *Sampling Rods*—Flush-joint steel drill rods shall be used to connect the split-barrel sampler to the drive-weight assembly. The sampling rod shall have a stiffness (moment of inertia) equal to or greater than that of parallel wall "A" rod (a steel rod which has an outside diameter of 1⅝ in. (41.2 mm) and an inside diameter of 1⅛ in. (28.5 mm).

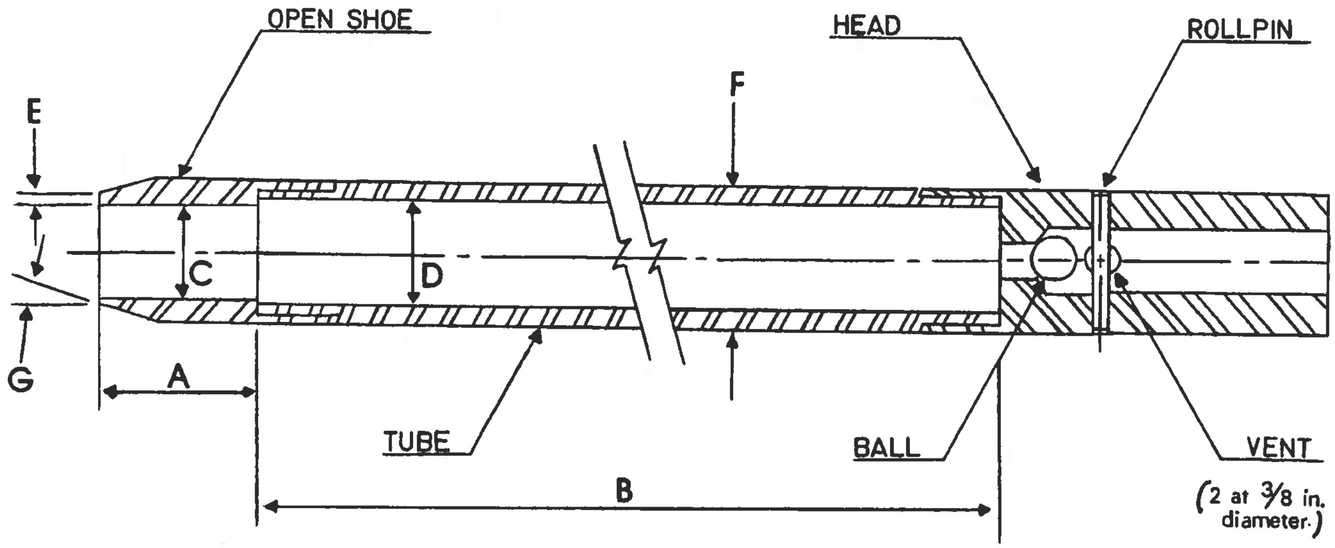
NOTE 2—Recent research and comparative testing indicates the type rod used, with stiffness ranging from "A" size rod to "N" size rod, will usually have a negligible effect on the *N*-values to depths of at least 100 ft (30 m).

5.3 *Split-Barrel Sampler*—The sampler shall be constructed with the dimensions indicated in Fig. 2. The driving shoe shall be of hardened steel and shall be replaced or repaired when it becomes dented or distorted. The use of liners to produce a constant inside diameter of 1⅜ in. (35 mm) is permitted, but shall be noted on the penetration record if used. The use of a sample retainer basket is permitted, and should also be noted on the penetration record if used.

NOTE 3—Both theory and available test data suggest that *N*-values may increase between 10 to 30 % when liners are used.

5.4 *Drive-Weight Assembly*:

5.4.1 *Hammer and Anvil*—The hammer shall weigh 140 ± 2 lb (63.5 ± 1 kg) and shall be a solid rigid metallic mass. The hammer shall strike the anvil and make steel on steel contact when it is dropped. A hammer fall guide permitting a free fall



A = 1.0 to 2.0 in. (25 to 50 mm)
B = 18.0 to 30.0 in. (0.457 to 0.762 m)
C = 1.375± 0.005 in. (34.93 ± 0.13 mm)
D = 1.50 ± 0.05 − 0.00 in. (38.1 ± 1.3 − 0.0 mm)
E = 0.10 ± 0.02 in. (2.54 ± 0.25 mm)
F = 2.00 ± 0.05 − 0.00 in. (50.8 ± 1.3 − 0.0 mm)
G = 16.0° to 23.0°

The 1½ in. (38 mm) inside diameter split barrel may be used with a 16-gage wall thickness split liner. The penetrating end of the drive shoe may be slightly rounded. Metal or plastic retainers may be used to retain soil samples.

FIG. 2 Split-Barrel Sampler

shall be used. Hammers used with the cathead and rope method shall have an unimpeded overlift capacity of at least 4 in. (100 mm). For safety reasons, the use of a hammer assembly with an internal anvil is encouraged.

NOTE 4—It is suggested that the hammer fall guide be permanently marked to enable the operator or inspector to judge the hammer drop height.

5.4.2 *Hammer Drop System*—Rope-cathead, trip, semi-automatic, or automatic hammer drop systems may be used, providing the lifting apparatus will not cause penetration of the sampler while re-engaging and lifting the hammer.

5.5 *Accessory Equipment*—Accessories such as labels, sample containers, data sheets, and groundwater level measuring devices shall be provided in accordance with the requirements of the project and other ASTM standards.

6. Drilling Procedure

6.1 The boring shall be advanced incrementally to permit intermittent or continuous sampling. Test intervals and locations are normally stipulated by the project engineer or geologist. Typically, the intervals selected are 5 ft (1.5 mm) or less in homogeneous strata with test and sampling locations at every change of strata.

6.2 Any drilling procedure that provides a suitably clean and stable hole before insertion of the sampler and assures that the penetration test is performed on essentially undisturbed soil shall be acceptable. Each of the following procedures have proven to be acceptable for some subsurface conditions. The subsurface conditions anticipated should be considered when selecting the drilling method to be used.

6.2.1 Open-hole rotary drilling method.

6.2.2 Continuous flight hollow-stem auger method.

6.2.3 Wash boring method.

6.2.4 Continuous flight solid auger method.

6.3 Several drilling methods produce unacceptable borings. The process of jetting through an open tube sampler and then sampling when the desired depth is reached shall not be permitted. The continuous flight solid auger method shall not be used for advancing the boring below a water table or below the upper confining bed of a confined non-cohesive stratum that is under artesian pressure. Casing may not be advanced below the sampling elevation prior to sampling. Advancing a boring with bottom discharge bits is not permissible. It is not permissible to advance the boring for subsequent insertion of the sampler solely by means of previous sampling with the SPT sampler.

6.4 The drilling fluid level within the boring or hollow-stem augers shall be maintained at or above the in situ groundwater level at all times during drilling, removal of drill rods, and sampling.

7. Sampling and Testing Procedure

7.1 After the boring has been advanced to the desired sampling elevation and excessive cuttings have been removed, prepare for the test with the following sequence of operations.

7.1.1 Attach the split-barrel sampler to the sampling rods and lower into the borehole. Do not allow the sampler to drop onto the soil to be sampled.

7.1.2 Position the hammer above and attach the anvil to the top of the sampling rods. This may be done before the sampling rods and sampler are lowered into the borehole.

7.1.3 Rest the dead weight of the sampler, rods, anvil, and drive weight on the bottom of the boring and apply a seating blow. If excessive cuttings are encountered at the bottom of the boring, remove the sampler and sampling rods from the boring and remove the cuttings.

7.1.4 Mark the drill rods in three successive 6-in. (0.15-m) increments so that the advance of the sampler under the impact of the hammer can be easily observed for each 6-in. (0.15-m) increment.

7.2 Drive the sampler with blows from the 140-lb (63.5-kg) hammer and count the number of blows applied in each 6-in. (0.15-m) increment until one of the following occurs:

7.2.1 A total of 50 blows have been applied during any one of the three 6-in. (0.15-m) increments described in 7.1.4.

7.2.2 A total of 100 blows have been applied.

7.2.3 There is no observed advance of the sampler during the application of 10 successive blows of the hammer.

7.2.4 The sampler is advanced the complete 18 in. (0.45 m) without the limiting blow counts occurring as described in 7.2.1, 7.2.2, or 7.2.3.

7.3 Record the number of blows required to effect each 6 in. (0.15 m) of penetration or fraction thereof. The first 6 in. is considered to be a seating drive. The sum of the number of blows required for the second and third 6 in. of penetration is termed the "standard penetration resistance," or the "*N*-value." If the sampler is driven less than 18 in. (0.45 m), as permitted in 7.2.1, 7.2.2, or 7.2.3, the number of blows per each complete 6-in. (0.15-m) increment and per each partial increment shall be recorded on the boring log. For partial increments, the depth of penetration shall be reported to the nearest 1 in. (25 mm), in addition to the number of blows. If the sampler advances below the bottom of the boring under the static weight of the drill rods or the weight of the drill rods plus the static weight of the hammer, this information should be noted on the boring log.

7.4 The raising and dropping of the 140-lb (63.5-kg) hammer shall be accomplished using either of the following two methods:

7.4.1 By using a trip, automatic, or semi-automatic hammer drop system which lifts the 140-lb (63.5-kg) hammer and allows it to drop 30 ± 1.0 in. (0.76 m ± 25 mm) unimpeded.

7.4.2 By using a cathead to pull a rope attached to the hammer. When the cathead and rope method is used the system and operation shall conform to the following:

7.4.2.1 The cathead shall be essentially free of rust, oil, or grease and have a diameter in the range of 6 to 10 in. (150 to 250 mm).

7.4.2.2 The cathead should be operated at a minimum speed of rotation of 100 RPM, or the approximate speed of rotation shall be reported on the boring log.

7.4.2.3 No more than 2¼ rope turns on the cathead may be used during the performance of the penetration test, as shown in Fig. 1.

NOTE 5—The operator should generally use either 1¾ or 2¼ rope turns, depending upon whether or not the rope comes off the top (1¾ turns) or the bottom (2¼ turns) of the cathead. It is generally known and accepted that 2¾or more rope turns considerably impedes the fall of the hammer and should not be used to perform the test. The cathead rope should be maintained in a relatively dry, clean, and unfrayed condition.

7.4.2.4 For each hammer blow, a 30-in. (0.76-m) lift and drop shall be employed by the operator. The operation of pulling and throwing the rope shall be performed rhythmically without holding the rope at the top of the stroke.

7.5 Bring the sampler to the surface and open. Record the percent recovery or the length of sample recovered. Describe the soil samples recovered as to composition, color, stratification, and condition, then place one or more representative portions of the sample into sealable moisture-proof containers (jars) without ramming or distorting any apparent stratification. Seal each container to prevent evaporation of soil moisture. Affix labels to the containers bearing job designation, boring number, sample depth, and the blow count per 6-in. (0.15-m) increment. Protect the samples against extreme temperature changes. If there is a soil change within the sampler, make a jar for each stratum and note its location in the sampler barrel.

8. Report

8.1 Drilling information shall be recorded in the field and shall include the following:

8.1.1 Name and location of job,

8.1.2 Names of crew,

8.1.3 Type and make of drilling machine,

8.1.4 Weather conditions,

8.1.5 Date and time of start and finish of boring,

8.1.6 Boring number and location (station and coordinates, if available and applicable),

8.1.7 Surface elevation, if available,

8.1.8 Method of advancing and cleaning the boring,

8.1.9 Method of keeping boring open,

8.1.10 Depth of water surface and drilling depth at the time of a noted loss of drilling fluid, and time and date when reading or notation was made,

8.1.11 Location of strata changes,

8.1.12 Size of casing, depth of cased portion of boring,

8.1.13 Equipment and method of driving sampler,

8.1.14 Type sampler and length and inside diameter of barrel (note use of liners),

8.1.15 Size, type, and section length of the sampling rods, and

8.1.16 Remarks.

8.2 Data obtained for each sample shall be recorded in the field and shall include the following:

8.2.1 Sample depth and, if utilized, the sample number,

8.2.2 Description of soil,

8.2.3 Strata changes within sample,

8.2.4 Sampler penetration and recovery lengths, and

8.2.5 Number of blows per 6-in. (0.15-m) or partial increment.

9. Precision and Bias

9.1 *Precision*—A valid estimate of test precision has not been determined because it is too costly to conduct the necessary inter-laboratory (field) tests. Subcommittee D18.02 welcomes proposals to allow development of a valid precision statement.

9.2 *Bias*—Because there is no reference material for this test method, there can be no bias statement.

9.3 Variations in *N*-values of 100 % or more have been observed when using different standard penetration test apparatus and drillers for adjacent borings in the same soil formation. Current opinion, based on field experience, indicates that when using the same apparatus and driller, *N*-values in the same soil can be reproduced with a coefficient of variation of about 10 %.

9.4 The use of faulty equipment, such as an extremely massive or damaged anvil, a rusty cathead, a low speed cathead, an old, oily rope, or massive or poorly lubricated rope sheaves can significantly contribute to differences in *N*-values obtained between operator-drill rig systems.

9.5 The variability in *N*-values produced by different drill rigs and operators may be reduced by measuring that part of the hammer energy delivered into the drill rods from the sampler and adjusting *N* on the basis of comparative energies. A method for energy measurement and *N*-value adjustment is given in Test Method D 4633.

10. Keywords

10.1 blow count; in-situ test; penetration resistance; split-barrel sampling; standard penetration test

SUMMARY OF CHANGES

(1) Added note to Section 1, Scope. The note refers to a related standard, Practice D 6066.

(2) Added Practice D 6066 to Section 2 on Referenced Documents.

Designation: D 6771 – 02

Standard Practice for Low-Flow Purging and Sampling for Wells and Devices Used for Ground-Water Quality Investigations[1]

This standard is issued under the fixed designation D 6771; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice covers the method for purging and sampling wells and devices used for ground-water quality investigations and monitoring programs known as low-flow purging and sampling. This method is also known by the terms minimal drawdown purging or low-stress purging. This method could be used for other types of ground-water sampling programs but these uses are not specifically addressed in this practice.

1.2 This practice applies only to wells sampled at the wellhead.

1.3 This practice does not address sampling of wells containing either light or dense non-aqueous-phase liquids (LNAPLs or DNAPLs).

1.4 This practice offers a set of instructions for performing one or more specific operations. This document cannot replace education or experience and should be used in conjunction with professional judgment. Not all aspects of this practice may be applicable in all circumstances. This ASTM standard is not intended to represent or replace the standard of care by which the adequacy of a given professional service must be judged, nor should this document be applied without consideration of a project's many unique aspects. The word "standard" in the title means that the document has been approved through the ASTM consensus process.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 4750 Test Method for Determining Subsurface Liquid Levels in a Borehole or Monitoring Well (Observation Well)[2]

D 5088 Practice for Decontamination of Field Equipment Used at Non-Radioactive Waste Sites[2]

D 5092 Practice for Design and Installation of Ground-Water Monitoring Wells in Aquifers[2]

D 5521 Guide for Development of Ground-Water Monitoring Wells in Granular Aquifers[2]

D 5903 Guide for Planning and Preparing for a Ground-Water Sampling Event[3]

D 6026 Practice for Using Significant Digits in Geotechnical Data[3]

D 6089 Guide for Documenting a Ground-Water Sampling Event[3]

D 6452 Guide for Purging Methods for Wells Used for Ground-Water Quality Investigations[3]

D 6517 Guide for Field Preservation of Ground-Water Samples[3]

D 6564 Guide for Field Filtration of Ground-Water Samples[3]

D 6634 Guide for the Selection of Purging and Sampling Devices for Ground-Water Monitoring Wells[3]

3. Terminology

3.1 *drawdown (low-flow purging and sampling), n*—lowering of the water level in a well caused by pumping the well.

3.2 *entrance velocity, n*—the velocity with which formation pore water passes through a well screen during pumping of the well. This velocity should be controlled (held to less than 0.10 ft/s or 3.0 cm/s) to avoid turbulent flow through the screen and to minimize or eliminate deleterious effects on water chemistry and on well construction materials.

3.3 *low flow, n*—refers to the velocity that is imparted during pumping to the formation pore water adjacent to the well screen. It does not necessarily refer to the flow rate of water discharged by a pump at the surface.

4. Summary of Practice

4.1 Low-flow purging and sampling is a method of collecting samples from a well that, unlike traditional purging methods, does not require the removal of large volumes of water from the well. Low-flow purging differs from traditional methods of purging (as described in Guide D 6452) in that its use is based on the observations of many researchers that water moving through the formation also moves through the well

[1] This practice is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.21 on Ground-Water and Vadose Zone Investigations.

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[2] *Annual Book of ASTM Standards*, Vol 04.08.

[3] *Annual Book of ASTM Standards*, Vol 04.09.

screen. Thus, the water in the screen is representative of the formation water surrounding the screen. This assumes that the well has been properly designed, constructed, and developed as described in Practice D 5092 and Guide D 5521. In wells in which the flow through the screen or intake zone is limited by hydraulic conductivity contrasts (for example, borehole smearing, residual filter cake, filter pack grain size, or well screen open area), the head difference induced by low-flow pumping provides an exchange of water between the formation and the well. Low-flow purging involves removing water directly from the screened interval without disturbing any stagnant water above the screen. This is done by pumping the well at a low enough flow rate to maintain minimal drawdown of the water column within the well as determined through water-level measurement during pumping. The objective is to pump in a manner that minimizes stress to the ground-water system to the extent practical, taking into account site sampling objectives. Pumping at low rates, in effect, hydraulically isolates the column of stagnant water in the well and negates the need for its removal prior to sample collection. Typically, flow rates on the order of 0.1 to 0.5 L/min are used; however, this is dependent on site-specific and well-specific factors (**1**). Some very coarse textured formations have been successfully purged and sampled in this manner at flow rates up to 1 L/min. Pumping water levels in the well and water-quality indicator parameters (such as pH, temperature, specific conductance, dissolved oxygen and redox potential) should be monitored during pumping, with stabilization indicating that purging is completed and sampling can begin. Because the flow rate used for purging is, in most cases, the same or only slightly higher than the flow rate used for sampling, and because purging and sampling are conducted as one continuous operation in the field, the process is referred to as low-flow purging and sampling.

5. Significance and Use

5.1 The objective of most ground-water sampling programs is to obtain samples that are representative of formation-quality water. Wells used in ground-water quality investigations or monitoring programs are generally purged of some amount of water in an attempt to obtain a representative sample. For traditional methods of purging (for example, well-volume purging), purging is done to minimize bias associated with stagnant water standing in the casing of the well (above the well screen), which generally does not accurately reflect ambient ground-water chemistry. To use low-flow purging and sampling, a pump intake is set within the well screen and the pump is operated at a low flow rate (generally less than or equal to the natural recovery rate of the well), minimizing drawdown in the well and thus hydraulically isolating the water in the screened zone from the water in the casing. Water pumped in this way comes directly from the screened interval of the well. This obviates the need to purge the stagnant water in the well prior to collecting samples. Access to formation-quality water is confirmed by monitoring water quality parameters to the point at which they stabilize as described in Guide D 6452.

5.2 Low-flow purging and sampling may be used in any well that can be pumped at a constant rate of 1.0 L/min or less without continuous drawdown of the water level in the well (**1**). It is feasible to implement low-flow purging and sampling in wells in which the water level is always above the top of the well screen, and in wells that are constructed so that the water level is always within the well screen.

5.3 Low-flow purging and sampling can be used to collect samples for all categories of aqueous-phase contaminants and naturally occurring analytes, including volatile and semi-volatile organic compounds (VOCs and SVOCs), metals and other inorganics, pesticides, PCBs, other organic compounds, radionuclides and microbiological constituents. It is particularly well suited for use where it is desirable to sample aqueous-phase constituents that may sorb or partition to particulate matter. It is not applicable to sampling either light or dense non-aqueous-phase liquids (LNAPLs or DNAPLs).

6. Benefits and Limitations of Low-Flying Purging and Sampling

6.1 Purging and sampling at a low flow rate offers a number of benefits over traditional methods including:

6.1.1 Improved sample quality and reduced (or eliminated) need for sample filtration, through minimized disturbance of the well and the formation, which results in reduced artifactual sample turbidity and minimization of false positives for analytes associated with particulate matter;

6.1.2 Improved sample accuracy and precision and greatly reduced sample variability as a result of reduced stress on the formation, reduced mixing of the water column in the well and dilution of analytes, and reduced potential for sample agitation, aeration and degassing or volatilization;

6.1.3 Samples represent a smaller section or volume of the formation, representing a significant improvement in the ability to detect and resolve contaminant distributions, which may vary greatly over small distances in three-dimensional space;

6.1.4 Overall, improved sample reproducibility, especially when using dedicated pumps;

6.1.5 Improved ability to directly quantify the total mobile contaminant load (including mobile colloid-sized particulate matter) without the need for sample filtration;

6.1.6 Increased well life through reduced pumping stress on the well and formation, resulting in greatly reduced movement of fine sediment into the filter pack and well screen;

6.1.7 Greatly reduced purge-water volume, (often 90 to 95 %) resulting in significant savings of cost related to purge water handling and disposal or treatment, and reduced exposure of field personnel to potentially contaminated purge water; and

6.1.8 Reduced purging and sampling time (much reduced at sites using dedicated pumps), resulting in savings of labor cost, depending on the time required for water-quality indicator parameters to stabilize.

6.2 Though the application of low-flow purging and sampling will improve sampling results and produce significant technical and cost benefits at most sites, not all sites, and not all individual wells within a site, are well suited to this approach. Limitations of the method include the following:

6.2.1 On a practical basis, low-flow purging and sampling is generally not suitable for use in very low-yield wells (those that will not yield sufficient water without continued drawdown with pumping over time). This limitation is largely a function of the limitations of discharge rates of available pumps and the volume of the flow cell (if used) for indicator parameter measurement;

6.2.2 The need to use a variable flow-rate pump capable of pumping within the desired flow-rate range. Low-flow purging cannot be performed using grab sampling devices, such as bailers, or inertial lift devices, which severely agitate the water column in the well, resulting in significant mixing of the water column and release of considerable sediment, which shows up as increased turbidity in samples.

6.2.3 For some applications, the need to use a flow-through cell, which may increase capital costs, lead to slightly greater set-up time in the field, and add one piece of field equipment.

7. Equipment Requirements for Low-Flow Purging and Sampling

7.1 A variety of pumps capable of pumping at low flow rates may be used for low-flow purging and sampling. Continuous discharge and cyclic discharge pumps work equally well as long as the pump has adjustable flow rate controls and is capable of being run at a low enough flow rate to avoid causing continuous drawdown in the well. Because the purging and sampling processes are joined together into one continuous operation, the pump selected (see Guide D 6634) should be appropriate for use both in purging and sampling the analytes of interest. For example, if VOCs or other pressure-sensitive parameters (for example, dissolved oxygen, carbon dioxide, trace metals) are analytes of interest, peristaltic and other suction-lift pumps should be avoided because they may cause loss of VOCs, degassing and redox and pH changes **(2-5)**.

7.2 Dedicated pumps (those that are permanently installed in the well) are preferred over portable pumps because they eliminate disturbance to the water column in the well resulting in lower turbidity values, shorter purge times and lower purge volumes to achieve stabilized indicator parameter measurements. However, portable pumps can be used if care is taken to minimize disturbance to the water column during pump installation and some time is allowed prior to pump operation for any fines agitated in the water column to settle.

7.3 Grab sampling devices, such as bailers and kemmerer samplers, and inertial-lift devices, cannot be used for low-flow purging and sampling because of the disturbance they cause to the water column in the well and the attendant effects of mixing and increased sample turbidity.

7.4 A volume measuring device (for example, graduated cylinder) and a time piece capable of measuring in seconds will be necessary to calculate the flow rate from the discharge tube from the pump.

7.5 Low-flow purging and sampling requires continuous or periodic water-level measurements (see Test Method D 4750). Any water-level measurement equipment that does not disturb the water column in the well may be used, as long as it provides the accuracy required by the sampling program (generally ±0.01 ft [3 mm]).

7.6 Low-flow purging and sampling requires continuous or periodic measurement of selected water-quality indicator parameters (and, possibly, turbidity) to determine when purging is complete and sampling can commence. Continuous monitoring in a closed flow-through cell of known volume generally provides the most consistent and reliable results, especially for dissolved oxygen and redox potential, and is the preferred method of measuring indicator parameters. However, individual instruments designed to measure the most common water-quality indicator parameters (temperature, pH, and conductivity or specific conductance) may also be used. Dissolved oxygen and redox potential measurements made after the purged water is exposed to atmospheric conditions, however, will not accurately reflect in-situ conditions. All instruments used to measure indicator parameters should be properly calibrated and maintained in accordance with manufacturers' instructions at the well head at the start of each day of sampling and calibration should be checked periodically throughout the sampling event.

7.7 Other equipment and supplies that may be used in low-flow purging and sampling include those items specified by the site-specific sampling and analysis plan (for example, decontamination supplies, sample bottles, filtration media and equipment, preservation supplies, wellhead screening instruments [PID, FID, OVA, combustible gas indicators], sample shipping containers, and field documentation materials [for example, field notebook, field data sheets, chain-of-custody forms, sample bottle labels, shipping documents]).

8. Description of the Procedure

8.1 *General*:

8.1.1 "Low flow" refers to the velocity with which water enters the pump intake and that is imparted during pumping to the formation pore water adjacent to the well screen. This velocity must be minimized to preclude the entrainment of artifactual particulate matter in the water to be collected as a sample. Low-flow does not necessarily refer to the flow rate of water discharged by a pump at the surface, which can be affected by valves, restrictions in the discharge tubing or flow regulators. Some researchers refer to the method as "low-stress" purging, where "low-stress" refers to the impact of pumping the well on the formation. Water-level drawdown provides a measurable indicator of the stress on a given formation imparted by a pumping device operated at a given flow rate. The objective of low-flow purging is to pump in a manner that minimizes stress (drawdown) or disturbance to the ground-water flow system to the extent practical.

8.2 *Preparation for Low-Flow Purging and Sampling*:

8.2.1 Prior to conducting the initial sampling event, the sampling team should prepare themselves and any equipment and materials to be used in the event in accordance with Practice D 5903. Any equipment used in the sampling program that could contact the water in the well, the water collected during field parameter measurement, or the water collected as a sample should be properly cleaned before each use (see Practice D 5088). The clean equipment should not be allowed to contact the ground or other surfaces that could impart contaminants. An effort should be made to closely match the length of the tubing used for portable pumps with the depth at which the pump will be set in the well. Excess tubing can affect the temperature of the water sampled, which could affect sample chemistry (see Guide D 6634). All instrumentation used during low-flow purging and sampling must be properly calibrated. Instructions for calibration are specific to the individual instrument and manufacturers' instructions should be followed. The frequency and timing of calibration should be in accordance with the site-specific sampling and analysis plan.

8.3 *Pump Placement*:

8.3.1 In situations where a well is screened or open across a single zone of interest, and that zone is comprised of nearly homogeneous geologic materials, the pump intake should be positioned at or near the mid-point of the well screen. In this type of situation, the water that is withdrawn will likely represent the water quality of the entire screened zone, even at low-flow pumping rates. In situations in which the geology of the screened zone consists of heterogeneous materials with layers of contrasting hydraulic conductivity, the pump intake should be positioned adjacent to the zone of highest hydraulic conductivity (as defined by geologic samples). This provides the preferred flow pathway for ground water, and samples will be drawn primarily from this zone. In situations in which dissolved-phase contaminants of interest are known to concentrate near the top or bottom of the screened zone, it may be desirable to position the pump intake to target this zone.

8.3.2 Care should be taken not to position the pump intake too near the top of the screen in wells in which the water level is above the top of the screen (to avoid drawing in water from storage in the casing), or too near the bottom of the screen (to avoid mobilization and entrainment of settled solids from the bottom of the well). If screen length allows, the pump intake should be at least two feet from the top and two feet from the bottom of the screen.

8.3.3 Portable pumps can be used for low-flow purging and sampling, but the pump must be installed carefully and lowered slowly into the screened zone to minimize disturbance of the water column. Even if done with the utmost care, the installation of a portable pump will result in some mixing of the water column above the well screen with that within the screened interval, and the release of some suspended material. This usually requires pumping for a longer period of time to achieve stabilization of indicator parameters and turbidity. Ideally the pump should remain in place prior to operation until any turbidity resulting from pump installation has settled out and until horizontal flow through the well screen has been reestablished. Carefully lowering the pump intake to the appropriate position in the well screen, then completing preparation of other equipment and materials to be used in the sampling event often allows sufficient time for reduction of initial turbidity to acceptable levels. If, after the pump is started, initial turbidity readings are high (for example, >100 NTU) and reducing the pumping rate does not result in lower readings after a few minutes, it may be necessary to stop the pump and allow turbidity to settle for an hour or more. The time required for turbidity to settle is well-specific and should be determined on a well-by-well basis.

8.4 *Pumping Rate*:

8.4.1 In general, the pumping rate used during low-flow purging and sampling must be low enough to minimize mobilization and entrainment of particulate matter that is not naturally mobile (for example, artifactual particles) under ambient, non-pumping conditions and to minimize hydraulic stress on the well and the formation (for example, to minimize drawdown and to eliminate inclusion of stagnant water from the casing in the sample).

8.4.2 Because each well screen is installed in a hydraulically unique position, and because of differences in the effects that drilling and well development may have had on the borehole and adjacent formation, the hydraulic performance of each well will be different. This means that the pumping rate used for low-flow purging and sampling should be determined on a well-specific basis. It is not appropriate to assess one well in a network of wells and apply the low-flow purging and sampling techniques and rates from that one well to all of the wells in the network. If possible, the optimum pumping rate for each well should be established in advance of the initial sampling event. For newly installed wells, this can be done immediately following well development by running a short-term single well pilot test ideally using the same pump that will be used for low-flow purging and sampling. Once the optimum pumping rate is established for a given well, the same pumping rate can be used for that well for each sampling event, provided well performance does not vary over the life of the well.

8.4.3 To determine the appropriate pumping rate for any given well, the following procedure is recommended. After the pump intake is properly set in the well, the pump should be started at a low pumping rate, generally 100 mL/min or less. For pumps that cannot achieve a flow rate this low, start the pump at the lowest flow rate possible. From the time the pump is started, the water level in the well should be measured (see 8.5) to determine the amount of drawdown caused by pumping. If drawdown is rapid and continuous, the pumping rate should be lowered until drawdown decreases and stabilizes. If drawdown is very slow or imperceptible, the pumping rate may be raised slowly and adjusted to the point at which drawdown stabilizes. The maximum pumping rate used for sampling should not exceed the rate used for purging. Increases in pumping rates may induce increases in turbidity **(6-9)**.

8.5 *Drawdown and Water-Level Measurement*:

8.5.1 Prior to installing a portable pump in the well or prior to the commencement of pumping in wells in which dedicated pumps are installed, an initial water level measurement should be obtained.

8.5.2 Measurement of the water level in the well during purging, on either a continuous or periodic basis, is critical to establishing the optimum flow rate for purging and to determining the stress placed on the well by pumping. The goal is to achieve a stabilized pumping water level as quickly as possible with minimal drawdown. Continuous water-level measurements may be made using devices such as downhole pressure transducers, bubblers or acoustic tools; periodic measurements may be made with electric tapes, poppers or ploppers or other devices as described in Test Method D 4750. Measurement accuracy of the device used should be in accordance with that specified in the sampling and analysis plan (generally ±0.01 ft [3 mm]). Water-level measurements should be taken every one to two minutes to the point at which the water level in the well has stabilized, or at which drawdown ceases. Pumping rate (see 8.4) may need to be adjusted to allow the water level to stabilize.

8.5.3 After the water level in the well has stabilized, water-level measurements can be discontinued. Once the optimum pumping rate is established for the well, it may be necessary to periodically monitor the water level during subsequent purging and sampling events, more frequently if a significant difference in well performance (generally signified by an increase in drawdown over time) is noted in subsequent sampling events.

8.5.4 Several researchers have proposed limits on the amount of drawdown that should be allowed before water-level stabilization occurs, but none have provided any scientific rationale for the proposed limits. For example, Puls and Barcelona suggest a limit of less than 0.1 m (0.33 ft or about 4 in.) drawdown for all wells, conceding that this goal may be difficult to achieve under some conditions due to geologic heterogeneities within the screened interval, and may require adjustment based on site-specific conditions and personal experience (**1**). In practical terms, allowable drawdown should never exceed the distance between the top of the well screen and the pump intake, which is normally positioned near the mid-point of the screen. To provide a safety factor, drawdown should generally not exceed 25 % of this distance to ensure that no water stored in the casing prior to purging is drawn down into the pump intake and collected as part of the sample.

8.6 *Measurement of Water Quality Indicator Parameters and Turbidity*:

8.6.1 Water-quality indicator parameters should be measured to determine when purging is complete and sampling can commence. In wells in which the pump intake is set in the screen and operated at a rate less than the natural recovery rate of the well, stabilized water chemistry indicates that formation-quality water is being pumped and, therefore, that conditions are suitable for sampling (**1**). The water quality parameters that are most easily measured in the field and that provide evidence that formation-quality water is being provided include: pH, conductivity (or specific conductance), dissolved oxygen and oxidation-reduction potential (redox or ORP, also measured as Eh).

8.6.2 Water-quality indicator parameters can be monitored on either a continuous or periodic basis, though continuous monitoring in a closed flow-through cell provides the most consistent and reliable results, particularly for dissolved oxygen and redox potential. Indicator parameters are considered stable when three consecutive readings made several minutes apart fall within the ranges presented in Table 1.

8.6.3 While the criteria in Table 1 are reasonable criteria for many hydrogeochemical situations, it should be recognized that firm criteria may not be appropriate for other situations because of factors including variability in aquifer properties, monitoring well hydraulics, and natural spatial and temporal variation in ground-water chemistry and contaminant distribution. Therefore, the criteria in Table 1 should be compared to well-specific measurements to determine if the site-specific criteria need to be adjusted. Additionally, these criteria should be evaluated to select those that are most important and relevant to meeting the sampling objectives for the specific site. Not all criteria need to be met for all sites. Stabilization criteria that are too stringent may unnecessarily lead to the generation of large amounts of contaminated purge water without providing the benefit of ensuring that the samples are any more representative.

TABLE 1 Example Criteria for Defining Stabilization of Water-Quality Indicator Parameters

Parameter	Stabilization Criterion
pH	±0.2 pH units[A]
Conductivity	±3 % of reading
Dissolved Oxygen	±10 % of reading or ±0.2 mg/L, whichever is greater[A]
Eh or ORP	±20 mV[A]

[A] Related to the measurement accuracy of commonly available field instruments.

8.6.4 For in-line flow-through cells, the frequency of the measurements should be based on the time required to completely evacuate one volume of the cell, to ensure that independent measurements are made. For example, a 500 mL cell in a system pumped at a rate of 250 mL/min will be evacuated in 2 min so measurements should be made at least 2 min apart. It is important, therefore, that the sampling team establish the following volumes and rates in the field prior to the sampling event: (*1*) Volume of the pump and discharge tubing; (*2*) Optimum pump discharge rate; and (*3*) Volume of the flow-through cell corrected for displacement volume of the field parameter measurement instrumentation installed inside the flow-through cell. It is also important to know the manufacturer's recommendations for the amount of time to allow individual sensors being used to measure field parameters (for example, dissolved oxygen) to stabilize to ensure that representative data are being collected.

8.6.5 For wells in which dedicated pumps are used, chemical indicator parameters tend to stabilize more readily because there is minimal disturbance of the water column in the well. For wells in which portable pumps are used, the effects of pump installation on the water column usually result in the need to remove significantly more water before chemical indicator parameters (and, as noted below, turbidity) reach stabilization.

8.6.6 Though not a chemical parameter, and not indicative of when formation-quality water is being pumped, turbidity may also be a useful parameter to monitor. Turbidity is a physical parameter that provides a measure of the suspended particulate matter in the water being pumped. Turbidity may be most indicative of pumping stress on the formation. Sources of turbidity in monitoring wells can include: (*1*) Naturally occurring colloid-sized or larger solids that may be in transit through the formation; (*2*) Naturally occurring solids or artifactual solids from well drilling and installation (for example, drilling fluids, filter pack, grout) that have not been effectively removed by well development and are mobilized by agitation of the water column (that is, by bailing, by installation of a portable pump, or by overpumping the well); (*3*) Microbial growth that often occurs within monitoring wells in the presence of certain types of contaminants (that is, petroleum hydrocarbons); and (*4*) Precipitation caused by different redox conditions in the well than in the aquifer. Turbidity levels elevated above the natural formation condition can result in biased analytical results for many chemical parameters. Naturally occurring turbidity in some ground water can exceed 10 NTU (**1**) and may be unavoidable. Turbidity in a properly designed, constructed and developed well is most often a result of significant disturbance of the water column or excessive stress placed on the formation by overpumping.

8.6.7 To avoid artifacts in sample analysis, turbidity should be as low as possible when samples are collected.[4] Turbidity measurements should be taken at the same time that chemical parameter measurements are made, or, at a minimum, once when pumping is initiated and again just prior to sample collection, after indicator parameters have stabilized. The stabilization criterion for turbidity is ±10 % of the prior reading or ±1.0 NTU, whichever is greater. If turbidity values are persistently high, the pumping rate should be lowered until turbidity decreases. If high turbidity persists even after lowering the pumping rate, the pump may have to be stopped for a period of time until turbidity settles, and the purging process restarted. If this fails to solve the problem, well maintenance or redevelopment may be necessary. Difficulties with high turbidity should be identified during pilot tests prior to implementing low-flow purging or during the initial low-flow sampling event, and contingencies should be established to minimize the problem of elevated turbidity.

8.7 *Sample Collection Following Purging*:

8.7.1 After drawdown and chemical indicator parameters stabilize, sampling can begin per the site's approved sampling and analysis plan. If an in-line flow-through cell is used to continuously monitor chemical indicator parameters, it should be disconnected or bypassed during sample collection. The pumping rate may remain at the established purging rate or it may be adjusted downward to minimize aeration, bubble formation, or turbulent filling of sample bottles. For most parameters, sampling rates of less than 500 mL/min are appropriate **(1)**. Sampling rates for the most sensitive parameters (for example, VOCs) should be lower (generally less than 250 mL/min). Generally, the most sensitive parameters, or those that are of greatest interest at the site, should be sampled first; analyses that require filtration should be sampled last **(1)**. Sample filtration (see Guide D 6564), preservation (see Guide D 6517), handling, shipping and documentation (see Guide D 6089) should be consistent with procedures documented in the approved site-specific sampling and analysis plan.

9. Reporting

9.1 The procedures and equipment used during low-flow purging and sampling must be documented in the field. Specific guidance on documenting a ground-water sampling event is provided in Guide D 6089. Field data specific to low-flow purging and sampling that should be recorded includes:

9.1.1 Equipment calibration;

9.1.2 Equipment decontamination;

9.1.3 Equipment configuration for purging and sampling;

9.1.4 Pump placement (relative to well screen position and static water level);

9.1.5 Initial static water level;

9.1.6 Initial pumping rate;

9.1.7 Drawdown measurements;

9.1.8 Stabilized pumping water level;

9.1.9 Final pumping rate;

9.1.10 Water quality indicator and turbidity measurements;

9.1.11 Times for all measurements; and

9.1.12 Sampling flow rate.

10. Keywords

10.1 ground water; ground-water monitoring; ground-water quality; ground-water sampling; indicator parameters; low-flow purging; low-stress purging; micropurging; minimal drawdown purging; purging; water quality monitoring

[4] The primary reason for minimizing turbidity during purging and sampling is that turbidity can affect the aqueous phase concentration of the analytes of interest for both organic and inorganic analytes. The accurate analysis of aqueous-phase inorganic analytes can be affected by stripping of cations, particularly metal species, from the surface of suspended inorganic particulate matter (for example, clays) by the sample preservation process (acidification). The accurate analysis of hydrophobic organic compounds can be affected by the presence of both organic and inorganic particulate matter. In addition, analysis of aqueous-phase organic analytes can be hampered by the physical presence of suspended solids (that is, causing clogging of the nebulizer on the analytical equipment).

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Standard Test Method (Field Procedure) for Instantaneous Change in Head (Slug) Tests for Determining Hydraulic Properties of Aquifers[1]

This standard is issued under the fixed designation D 4044; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method covers the field procedure for performing an in situ instantaneous change in head (slug) test.

1.2 This test method is used in conjunction with an analytical procedure such as Test Method D 4104 to determine aquifer properties.

1.3 The values stated in the SI units are to be regarded as standard.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 653 Terminology Relating to Soil, Rock, and Contained Fluids[2]

D 4043 Guide for Selection of Aquifer-Test Method in Determination of Hydraulic Properties by Well Techniques[2]

D 4104 Test Method (Analytical Procedure) for Determining Transmissivity of Confined Nonleaky Aquifers by Overdamped Well Response to Instantaneous Change in Head (Slug Test)[2]

D 4750 Test Method for Determining Subsurface Liquid Levels in a Borehole or Monitoring Well (Observation Well)[2]

D 5785 Test Method for (Analytical Procedure) for Determining Transmissivity of Confined Nonleaky Aquifers by Underdamped Well Response to Instantaneous Change In Head (Slug Test)[3]

D 5881 Test Method (Analytical Procedure) for Determining Transmissivity of Confined Nonleaky Aquifers by Critically Damped Well Response to Instantaneous Change In Head (Slug Test)[3]

D 5912 Test Method (Analytical Procedure) for Determining Hydraulic Conductivity of an Unconfined Aquifer by Overdamped Well Response to Instantaneous Change In Head (Slug Test)[3]

3. Terminology

3.1 *Definitions:* Definitions:

3.1.1 *control well*—well by which the aquifer is stressed, for example, by pumping, injection, or change of head.

3.1.2 *hydraulic conductivity—(field aquifer tests)*, the volume of water at the existing kinematic viscosity that will move in a unit time under a unit hydraulic gradient through a unit area measured at right angles to the direction of flow.

3.1.3 *observation well*—a well open to all or part of an aquifer.

3.1.4 *overdamped-well response*—characterized by the water level returning to the static level in an approximately exponential manner following a sudden change in water level. (See for comparison *underdamped well.*)

3.1.5 *slug*—a volume of water or solid object used to induce a sudden change of head in a well.

3.1.6 *storage coefficient*—the volume of water an aquifer releases from or takes into storage per unit surface area of the aquifer per unit change in head. For a confined aquifer, it is equal to the product of specific storage and aquifer thickness. For an unconfined aquifer, the storage coefficient is approximately equal to the specific yield.

3.1.7 *transmissivity*—the volume of water at the existing kinematic viscosity that will move in a unit time under a unit hydraulic gradient through a unit width of the aquifer.

3.1.8 *underdamped-well response*—characterized by the water level oscillating about the static water level following a sudden change in water level. (See for comparison *overdamped well.*)

3.1.9 For definitions of other terms used in this test method, refer to Terminology D 653.

4. Summary of Test Method

4.1 This test method describes the field procedures involved in conducting an instantaneous head (slug) test. The slug test method involves causing a sudden change in head in a control well and measuring the water level response within that control well. Head change may be induced by suddenly injecting or

[1] This test method is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.21 on Ground Water and Vadose Zone Investigations.

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[2] *Annual Book of ASTM Standards*, Vol 04.08.

[3] *Annual Book of ASTM Standards*, Vol 04.09

removing a known quantity or "slug" of water into the well, rapid removal of a mechanical "slug" from below the water level, increasing or decreasing the air pressure in the well casing, or emplacement of a mechanical slug into the water column.

4.2 The water-level response in the well is a function of the mass of water in the well and the transmissivity and coefficient of storage of the aquifer. One method of analysis of the data from this field practice is described in Test Method D 4104.

5. Significance and Use

5.1 This slug test field procedure is used in conjunction with a slug test analytical procedure, such as Test Method D 4104 to provide quick and relatively inexpensive estimates of transmissivity.

5.2 The slug test provides an advantage over pumping tests in that it does not require the disposal of the large quantities of water that may be produced. This is of special importance when testing a potentially contaminated aquifer. However, slug tests reflect conditions near the well, therefore are influenced by near-well conditions, such as gravel pack, poor well development, and skin effects.

5.3 Slug tests may be made in aquifer materials of lower hydraulic conductivity than generally considered suitable for hydraulic testing with pumping tests.

5.4 The method of data analysis (analytical procedure) should be known prior to the field testing to ensure that all appropriate dimensions and measurements are properly recorded. Selection of the analytical procedure can be aided by using Guide D 4043, Test Method D 5785, Test Method D 5881, and Test Method D 5912.

6. Apparatus

6.1 *Slug-Inducing Equipment*—This test method describes the types of equipment that can be used. Because of the infinite variety of testing conditions and because similar results can be achieved with different apparatus, engineering specifications for apparatus are not appropriate. This test method specifies the results to be achieved by the equipment to satisfy the requirements of this practice.

6.2 *Water-Level Measurement Equipment*—The method of water level measurement may be dependent on the method selected for injection or withdrawal of water, and the nature of the response of the well. For an open-well test, that is, where access to the water level is open to the surface, measure water levels manually as described in Test Method D 4750, by an automatic recording device linked to a float, or with a pressure transducer linked to a data logger or display device. A pressure transducer linked to a data logger will be necessary for a test in a closed well in which water-level changes are induced by vacuum or pressure on the control well and where manual measurements do not provide measurements of adequate frequency (see 9.3).

7. Conditioning

7.1 *Pre-Test Procedure*:

7.1.1 *Measuring Pre-Test Water Levels*—Measure the water level in the control well before beginning the test for a period longer than the duration of the test to determine the pre-test water level fluctuations and to establish pre-pumping water-level trend and to determine a pre-pumping reference water level.

8. Procedure

8.1 Cause a change in water level, either a rise or decline, by one of the following methods:

8.1.1 *Water Slug*—Inject or withdraw water of a known quantity into or from the control well.

8.1.2 *Mechanical Slug*—Inject or withdraw a mechanical slug below or above the water level. The water within the control well will then rise or decline an amount equal to the volume of the mechanical slug.

8.1.3 *Release Vacuum or Pressure*—A method of simulating the injection or withdrawal of a slug of water is by the release of a vacuum or pressure on a tightly capped (shut-in) control well. Before the release, the vacuum or pressure is held constant.

NOTE 1—There is no fixed requirement for the magnitude of the change in water level. Similar results can be achieved with a wide range in induced head change. Some considerations include a magnitude of change that can be readily measured with the apparatus selected, for example the head change should be such that the method of measurement should be accurate to 1 % of the maximum head change. Generally, an induced head change of from one-third to one meter is adequate. Although the induced head change should be sufficient to allow the response curve to be defined, excessive head change should be avoided to reduce the possibility of introducing large frictional losses in well bore.

The mechanical model for the test assumes the head change is induced instantaneously. Practically, a finite time is required to effect a head change. Selection of time zero can be selected experimentally. Refer to the method of analysis (such as Test Method D 4104) to determine time zero and to evaluate the suitability of the change effected in the well.

8.2 Measure water-level response to the change in water level. The frequency of water-level measurement during the test is dependent upon the hydraulic conductivity of the material being tested. During the early portions of the test, measure water levels at closely-spaced intervals. Measurements of water level made manually with a tape should be made as frequently as possible until the water level has recovered about 60 to 80 %. Increase the length of time between measurements with increasing duration of the test. Since most methods of data analysis are curve-fitting techniques, it is essential that water levels are measured frequently enough to define the water-level response curve (see Guide D 4043, Test Methods D 4104 and D 5785).

8.2.1 In aquifer-well systems where water-level changes are rapid, it may be necessary to use a pressure transducer linked to an electronic data logger to measure and record the water levels frequently enough to adequately define the waterlevel response. The use of transducers and data loggers generally provides a greater than adequate frequency of measurements, ranging from several measurements per second in the early part of the test to a specified frequency in the later portions of a test. With such equipment, the test analysis may use a reduced data set of measurements to calculate the hydraulic properties (see Guide D 4043, Test Methods D 4104 and D 5785 for analysis of water level data).

8.3 *Post-Test Procedure*—Make preliminary analysis of data before leaving the field and evaluate the test regarding the criteria given in this test method and the method of analysis, such as Test Method D 4104 to determine if the test should be rerun.

9. Report

9.1 Include the information listed below in the report of the field procedure:

9.2 All test reports should include the following:

9.2.1 Date, time, and well identification,

9.2.2 Method of slug withdrawal or injection, as well as whether the test is a falling head (injection) or a rising head (withdrawal) test,

9.2.3 Inside diameter of well screen and well casing above screen,

9.2.4 Depth of well,

9.2.5 Length and depth setting of screen,

9.2.6 Volume of mechanical slug or pressure change imposed on water level, and

9.2.7 Pre-testing water-level trend.

9.3 Establish and record the measurement point from which all measurements of water level are made. Record date, time, and depth to water level below measurement point of all water levels.

9.4 Water levels measured during the test should be recorded with information on date, clock time, and time since test started. If the water levels are measured with a pressure transducer and recorded with an electronic data logger, record the name of the data file on the data logger.

10. Precision and Bias

10.1 It is not practical to specify the precision of this test method because the response of aquifer systems during aquifer tests is dependent upon ambient system stresses. No statement can be made about bias because no true reference values exist.

11. Keywords

11.1 aquifers; aquifer tests; ground water; hydraulic conductivity; hydraulic properties; instantaneous head test; slug tests; storage coefficient; transmissivity

DAY STANDARD OPERATING PROCEDURES
(SOPs)

STANDARD OPERATING PROCEDURE
HEADSPACE SCREENING: SOIL SAMPLES

This document provides procedures to be used by Day Environmental, Inc. (DAY) to complete field screening of soil samples using a photoionization detector (PID) or a flame ionization detector (FID).

Field Screening Procedure

1. Perform PID or FID instrument calibration in accordance with the manufacturer's requirements. Record calibration results, including the date/time of calibration, in a bound field book. In the event contaminant types/concentrations change during the field day, the PID/FID malfunction or other such occurrences, the equipment should be re-calibrated and the results summarized in the field book.

2. Use a new self-sealing quart-size polyethylene freezer bag (or a sandwich-size bag depending on the size of sample) for each test. Half-fill the bag with a soil sample to be tested (the volume ratio of sample to air within the bag should be approximately equal), then immediately seal the bag. Manually break up the soil sample within the bag. [Note: The test sample should be placed into the bag immediately after opening the split spoon or direct-push sample liner. Soil samples from test pits or stockpiles should be obtained from freshly exposed surfaces.]

3. Allow the headspace to equilibrate for at least 10 minutes at approximate room or ambient air temperature (if above 32° Fahrenheit). Vigorously shake the bag and break up the soil sample for 15 seconds at the beginning and end of the equilibration period. Release of volatile vapors from soil decreases with temperature. When the air temperature is below 32° Fahrenheit, the sample should be allowed to equilibrate within a heated vehicle or building. Record the date/time of headspace screening in the field book. <u>The headspace analysis should be completed within 20 minutes of sample collection.</u>

4. After the headspace sample has been prepared, introduce the PID or FID probe through a small opening in the bag to the approximate mid-point of the headspace. Keep the probe free of water droplets and soil particles.

5. Record the highest PID or FID meter response on the test boring/test pit log (or within a field book if no log is generated). The maximum response typically occurs within about two seconds. Erratic meter response readings may occur if high organic vapor concentrations or moisture is present. Note any erratic headspace data in the field book, as this information could indicate that the headspace readings are questionable. **Do not collect samples for analytical laboratory testing from the polyethylene bag.**

Standard Operating Procedure for Soil Classification

This document presents the soil classification system to be used by Day Environmental, Inc. (DAY) to describe soil samples collected from test borings and test pits or other appropriate sample collection methodologies.

Classification System

Soil samples are to be described based primarily upon their gradation characteristics and plasticity with additional information provided to describe unique characteristics, such as, evidence of suspect contamination (e.g., unusual odor, staining, etc.) and other physical characteristics of the soil (e.g., moisture content, color, soil structure, etc.).

The first step is to estimate the major constituent of the material and the relative percentages of the lesser soil fractions. [Note: In the description for indigenous soils, the major constituent (or constituents when using "and") is written entirely in capitals, while only the first letter of minor constituents are capitalized.] The relative percentages of the lesser sizes are described by "some", "little" and "trace". If the material being classified is a fill, the first letter of each of the individual components is capitalized and at the end of the description the material is denoted as "FILL".

In this system, it is recognized that it is impossible to determine the gradation of fines (i.e., silt and clay). Thus, no attempt is made to express the relative amount of silt and clay sizes present in the fines. Rather the fine material is classified based upon plasticity to describe the material. The description "silty clay" does not mean 70% clay size particles and 30% silt size particles, but that the fines have a plasticity index which is indicative of silty clay. In this soil classification system, the relative amounts of fine grained soil are described similarly to granular soils. For example, if the material is primarily a silty clay with about 20% fine sand the description would be written "Silty CLAY, little fine Sand". Similarly if the material is primarily a fine sand with about 10 % silty clay the description would be written as " fine SAND, trace Silty Clay".

In addition to the gradation and plasticity characteristics, the description should include pertinent adjectives to define the material. In general, adjectives describing consistency, color and grain size range should precede the soil component name, while further details, such as plasticity, mineralogy, structure, moisture content and contaminant characteristics should follow the main body of the identification.

<u>Example</u>

Medium-dense, red-brown, fine to coarse SAND, little fine Gravel, trace Clayey Silt, wet. Slight overall plasticity, sand subangular, slight petroleum odor.

Guide for the Description of Soils

This guide describes the soil description system to be used by DAY personnel in the field. It is based primarily upon visual observations and field measurements and it can be refined to include additional site-specific data or test results. The format described herein should be used as the basis of the soil description system.

Description of Soils

Samples should be described using the following format and order:

1. Density or Consistency (based upon a standard penetration test or observation)

Density descriptions are used for soils in which the major component is a granular soil (i.e., non-cohesive silt, sand and gravel). The table below is based upon blow counts from the Standard Penetration Test (SPT).

SPT Blows/Foot	Density
0-4	Very Loose
4-10	Loose
10-30	Medium Dense
30-50	Dense
50+	Very Dense

Consistency descriptions are used to describe fine grained (cohesive) soils. The table below is based upon SPT and physical tests (provided a SPT is not completed).

SPT Blow/Foot	Consistency	Physical Test
0-2	Very Soft	Extrudes between fingers when squeezed
2-4	Soft	Molded by light finger pressure
4-8	Medium Stiff	Molded by strong finger pressure
8-15	Stiff	Indented by thumb with effort
15-30	Very Stiff	Indented by thumb with difficulty
30+	Hard	Knife required to indent

2. Color

Simple color descriptions should be used such as the primary colors, a combination of them or shades (e.g., light, dark). Avoid the use of exotic colors (e.g., purple, chartreuse, etc.) and extensive color descriptions (e.g., light to dark gray-brown, red etc.). Also distinguish between the soil color and staining, since staining implies a secondary reaction such as the introduction of contamination (e.g., red-brown stained black).

3. Grain Size

A granular soil is further defined by its grain size distribution. Generally, these sizes are based upon standard sieve sizes and the range of particle sizes as follows.

Material	Sieve Size
Boulder	Larger than 12 inches
Cobble	3 inches to 12 inches
Gravel – coarse	¾ inch to 3 inches
Gravel – fine	No. 4 to ¾ inch
Sand – coarse	No. 10 to No. 4
Sand – medium	No. 4 to No. 40
Sand – fine	No. 40 to No. 200
Silt and Clay	Less than No. 200

In test boring samples, the maximum size of the material that can be collected is limited. As such, descriptions of the amount of coarse gravel, cobbles and boulders must be take the sample collection procedure into account. The determination of the size and amount of 'larger" granular deposits is best done via test pit explorations.

A fine grained soil is described by its plasticity as follows:

Material	Degree of Plasticity	Smallest Diameter of Threads
SILT	Non-Plastic	None
Clayey SILT	Slight	¼ inch
SILT & CLAY	Low	1/8 inch
CLAY & SILT	Medium	1/16 inch
Silty CLAY	High	1/32 inch
CLAY	Very High	1/64 inch

An organic soil is classified by its soil structure.

Material	Description
TOPSOIL	Surfical soils (or an original layer potentially buried beneath a layer of fill) that supports plant life and, which contains organic matter (e.g., roots)
PEAT `	Deposits of plant remains in which the original plant fibers may be visible

4. Major Soil Type

For indigenous soils, the major soil component (i.e., greater than 50 % by weight) is written with upper case letters for granular soil (e.g., SAND, GRAVEL) and a combination of upper and lower case letters for fine grained soils (e.g., Silty CLAY, Clayey SILT) or all upper case letters if the amount of silt and clay is judged to be approximately the same (e.g., CLAY and SILT).

Fill material is described by its major component(s) and additional significant components. Only the first letter of each fill component is capitalized, but the word "FILL" (all upper case letters) follows the sample description to denote the material was not placed by natural processes.

5. Minor Constituents

Minor constituents follow the major soil type in order of decreasing percentages. These are described by the following:

0 –10 %	trace
10 – 20 %	little
20 – 35 %	some
35 – 50 %	and

Each minor constituent has the first letter capitalized (e.g., trace Gravel).

6. Moisture Content

The moisture content of the soil/fill sample is described by the following:

Damp	Moisture is not apparent, sample appears dusty
Moist	No visible water
Wet	Visible free water

Groundwater level measurements taken in test boring/test pits should include the date and time of measurement as the readings may have been taken before equilibrium has been reached and the level shown may or may not be representative.

7. Special Components

This will include descriptions of soil structure produced by deposition of sediments as shown below.

Stratified	Random soil deposits of varying components or color
Varved	Alternating soil deposits of varying thickness (i.e., clays and silts)

Stratum	Soil deposit >12 inches thick
Layer	Soil deposit 3 inches to 12 inches thick
Seam	Soil deposit 1/8 inch to 3 inches thick
Parting/Lens	Soil deposit <1/8 inch thick

The special components will also include a description of suspect contamination. This discussion should be presented in the following order.

Evidence of staining (e.g., black staining with stained interval defined)

Unusual odors, which should generally be limited to chemical or petroleum odors unless additional information is known to define the type of odor (e.g., diesel fuel, weathered gasoline, etc.). Limit the use of "organic" odor to the description of decaying vegetation and qualify this description as follows: organic odor (decaying vegetation)

The presence of free product should be carefully described and qualified. For example, describe if the free product was observed on the sample device, within the sample and the apparent depth/interval of the product. Also, describe the physical appearance of the product (e.g., globules, streaks within partings, etc.). Care should be exercised when describing the presence of free product on boring logs.

Color changes attributable to contamination should be identified with depth and interval of occurrence. For example, weathered gasoline contamination can change the soil to an olive green and gray soils may suggest anaerobic conditions due to an abundance of microbes reacting to contaminants.

Passive Diffusion Bag Sampling Standard Operating Procedure

Monitoring wells will be sampled to determine the concentration of VOCs. The groundwater samples will be collected from specific depths within each well utilizing passive diffusion bag (PDB) samplers. The depth intervals selected will be based upon conditions observed during the advancement of the test borings and the collection of previous groundwater samples, to place the PDB samplers to intercept water-bearing zones in the overburden.

During these sample events, the PDB sampler deployment and retrieval procedures will be as follows:

- Measure the well depth and compare the measured depth with the reported depth to the bottom of the well.
- Attach a stainless-steel weight to the end of the line selected to hold the PDB samplers. Sufficient weight will be added to counterbalance the buoyancy of the PDB samplers.
- Calculate the distance from the bottom of the well up to the point were the PDB sampler are to placed and attach the PDB hanger assemblies in the appropriate locations.
- Fill the PDB with deionized water by removing the plug from the sampler bottom, inserting a short funnel into the sampler and pouring deionized water into the sampler. The sampler will be filled until water rises and stands at least halfway into the funnel. Excess bubbles will be removed from the sampler and the PDB sampler will be filled to capacity. The funnel will be removed from the sampler and the plug reattached.
- Attach the PDB samplers to the weighted line utilizing the hanger assembly.
- Lower the weight and weighted line down the well until the weight rests on the bottom of the well and the line is taut. The PDB samplers should now be positioned at the expected depth.
- Secure the assembly by attaching the weighted line to a hook on the inside of the well cap. Reattach the well cap and seal the cap in a way that will prevent surface water intrusion.
- Allow the system to remain undisturbed as the PDB samplers equilibrate for minimum of 10 days.

Recovery of PDB samplers will be accomplished by using the following approach:

- Remove the PDB samplers from the well by using the attached weighted assembly line. During retrieval care will be taken to minimize PDB exposure to heat and agitation.
- Examine the surface of the PDB sampler for evidence of algae, iron or other coatings, and for tears in the membrane. Note the observations on the sampling log or field book. If tears in the membrane are identified, the sample should be rejected. Evidence of a coating on the PDB sampler (if any) noted.

- Detach and remove PDB sampler from the weighted line. Remove excess liquid from the exterior of the bag to reduce the potential for cross contamination.
- Transfer the water from PDB samplers to 40-mL VOC vials.
- Any unused water from the PDB sampler and water used to decontaminate cutting devices will be disposed of in accordance with applicable regulations.

In conjunction with the retrieval of the PDB samplers, field measurements of pH, oxygen reduction potential (ORP), specific conductivity, dissolve oxygen and temperature will be collected.

Appendix B

Standard Operating Procedures, ASTM Procedures, and Field/Sampling Forms

Appendix C

Project Organizational Chart with Resumes of Key Personnel

Town and Country

Brownfield Site Cleanup (Site C828149)

NYSDEC — **Town and Country** — **NYSDOH**

Project Manager	Officer-in-Charge
David R. Hanny, CPESC, CPSWQ, LEED AP *Senior Managing Environmental Scientist*	**Scott D. Nostrand, P.E.** *Senior Vice President*

• Corrective Action Plan • Project Reporting • Community Participation • Regulatory Coordination • Subcontractor Coordination	• Analysis of Brownfield Alternatives • Engineering/Institutional Controls	• Remedial Construction Oversight • Field Sampling and Analysis • Community Air Monitoring	• Hydrogeological Assessment • Annual Groundwater Reports	• Health and Safety • Quality Assurance Project Plan • Data Validation Coordination
David R. Hanny, CPESC, CPSWQ, LEED AP *Senior Managing Environmental Scientist*	**Scott D. Nostrand, P.E.** *Senior Vice President* **David R. Hanny, CPESC, CPSWQ, LEED AP** *Senior Managing Environmental Scientist*	**Darik M. Jordan** *Project Environmental Scientist* **Brian J. McGrath** *Environmental Scientist II*	**Michael R. Brother** *Senior Managing Hydrogeologist* **Joshua G. Haugh** *Hydrogeologist III*	**John A. Benson** *Associate*

Scott D. Nostrand, P.E.

Senior Vice President

Years of Experience

24

Education

B.S. Agricultural Engineering - Cornell University, 1984

M.S. Animal Science - Cornell University, 1989

Professional Registrations

Professional Engineer - New York, 1998

State of New York, Department of Labor, Current Asbestos Handling Certificate - Project Designer

Hazardous Waste Operations Health & Safety (HAZWOPER)

Professional Affiliations

Air and Waste Management Association

Solid Waste Associations of North America (SWANA)

Summary

Mr. Nostrand manages B&L's environmental engineering and consulting group and oversees all the firm's environmental activities including hazard mitigation planning, environmental permitting and compliance, stormwater, site remediation, fuel systems design, industrial environmental compliance, air permitting and modeling, asbestos abatement, industrial wastewater pretreatment systems, and biosolids management.

Relevant Project Experience

Remediation Projects
Mr. Nostrand has been responsible for the management of numerous investigations of petroleum, solvent, PCB and hazardous substance spills at industrial and municipal sites under various regulatory programs such as NYSDEC's Oil Spills Program, Inactive Hazardous Waste Site Program, Voluntary Cleanup Program, and Environmental Restoration Program (municipal brownfields). These projects have included site characterization, remedial investigation, feasibility analysis, remedial design and construction administration. Remedial design projects have involved in-situ bioremediation, groundwater extraction and treatment, soil vapor extraction, source removal, and monitored natural attenuation. Projects have included remediation investigations at hazardous waste landfills, industrial facilities, abandoned industrial and commercial properties, and petroleum bulk storage and retail service stations.

Petroleum and Chemical Bulk Storage
Mr. Nostrand oversees the design and management of petroleum and chemical bulk storage tank and design of replacement systems to meet regulatory mandates has required design of replacement systems. Recent designs have included fleet fueling systems for petroleum products with capacities from 500 to 12,000 gallons. These systems incorporated fuel management systems, fuel leak detection and meet all NFPA codes. Other designs include bulk storage containment, chemical bulk storage tanks, and loading area containment systems

Environmental Compliance
Mr. Nostrand also manages B&L's program for environmental compliance reporting. This area has included the preparation of EPA Spill Prevention Control & Countermeasure Plans, Chemical Bulk Storage Spill Prevention Reports, Hazardous Waste Reduction Plans, and Environmental Compliance Audits.

Due Diligence
Mr. Nostrand has prepared more than 300 Phase I Environmental Site Assessment reports for commercial and industrial clients in the Northeast. Environmental concerns identified during these assessments included leaking

underground storage tanks, deteriorated asbestos materials, polychlorinated biphenyls, air, soil, wastewater pollution, permit compliance, and other environmental concerns.

Asbestos Management
Mr. Nostrand is a certified Asbestos Project Designer, and oversees B&L's Industrial Hygiene group, which provides a broad array of Asbestos Management, Indoor Air Quality, and Environmental Health and Safety services. These services include preparation of pre-demolition surveys, asbestos abatement design, noise assessment, safety training, air quality analysis, and construction inspection for projects company wide.

For all of the project areas identified above, Mr. Nostrand has been involved with contract administration, construction management, and preparation of private and municipal bidding documents.

David R. Hanny, CPESC, CPSWQ, LEED AP

Senior Managing Environmental Scientist

Years of Experience

12

Education

B.S. Environmental Science - SUNY College of Environmental Science and Forestry, Syracuse, New York, 1998

Professional Registrations

Certified Professional in Erosion and Sediment Control (CPESC)

Certified Professional in Stormwater Quality (CPSWQ)

Asbestos Inspector Certificate

Hazardous Waste Operations Health & Safety (Initial 40-hour Course, and Current Annual 8-Hour Refresher Course)

Professional Accreditations

Leadership in Energy and Environmental Design (LEED) Accredited Professional

Professional Affiliations

Soil and Water Conservation Society

National Groundwater Association

Summary

Mr. Hanny has also been responsible for project management on numerous petroleum spill sites remediated under the NYSDEC Voluntary Cleanup Agreement and Brownfield Programs. He has provided oversight and project management for PCB, solvent, and hazardous substance spill cleanups for both private industrial and municipally-based clients. In addition he has also provided project assistance with numerous other environmental remediation and compliance projects including underground storage tank removals, subsurface site investigations, asbestos abatement projects and landfill compliance monitoring. Mr. Hanny also provides technical report writing for clients, database management and evaluation of various analytical project data associated with Phase I Site Assessments, Hazardous Waste/Contaminated Material Reports, Asbestos Assessments and Site Characterization Reports. He has submitted compliance and investigation reports under various regulatory programs such as NYSDEC's Petroleum Spills Program, Voluntary Clean-up Program, and Environmental Restoration Program (i.e., Brownfields).

Mr. Hanny has been the designated project manager for five NYSDEC Environmental Restoration Projects. Following investigation and cleanup of contaminants of concern including petroleum products, metals, solvents, and PCBs, Mr. Hanny has also assisted in site redevelopment planning and design. These sites have been revitalized and include current uses as a fire training facility, retail shop, and a proposed fire station expansion. Mr. Hanny has also been the project manager for two Voluntary Cleanup Projects, an industrial Brownfield Cleanup Project, an EPA Brownfield Cleanup Project, and several NYSDEC spill files. Through this experience, Mr. Hanny has developed numerous site investigation and remedial designs for a host of various environmental issues. Mr. Hanny has developed strong relationships with the regulatory community including NYSDEC, NYSDOH, and EPA. These relationships and understanding of various regulatory programs have assisted private and municipal clients with progressing projects from investigation, through remediation, and ultimately into site reuse.

Mr. Hanny has assisted several clients with grant preparation to secure funding for environmental investigations, remedial design, and site cleanup. Through these grant programs Mr. Hanny has served as the primary community relations contact for several projects. He has developed detailed Citizen Participation Plans, presented project reports at public forums, and has worked with the adjacent community members to assure active public involvement throughout environmental investigations.

Prior to his current project management role, Mr. Hanny provided field services for numerous Phase I and II site investigations. He has collected samples from all environmental media including soil, groundwater, sludge, soil gas, sub-slab vapors, and indoor/outdoor air. Mr. Hanny has extensive field oversight experience with drilling operations, monitoring well construction, and environmental compliance sampling. This background assists Mr. Hanny with managing projects as he is intimately familiar with the fieldwork associated with site investigations. This experience allows him to effectively develop site investigation work plans, sampling and analysis plans, quality assurance/control plans, health and safety plans, and remedial design plans.

Relevant Project Experience

Site Investigation/Remedial Alternatives Report, Village of Vernon, NY
The Village of Vernon's Village Hall/Garage had previously been a trucking company maintenance facility. Three underground storage tanks from that former business were found on the property, and Barton & Loguidice assisted the Village in applying for ERP funding. As part of the investigation of this property, an Interim Remedial Measures (IRM) project was scoped to remove the USTs from the site. During the removal, contaminated soils were identified and also removed from the property. The Site Investigation included a soil and groundwater quality investigation surrounding the former location of the tanks, and a soil vapor survey of the site, including a sub-slab soil gas survey in the building.

210 Sconondoa ERP Brownfield, City of Oneida
The City of Oneida acquired a parcel of property that had several underground storage tanks on the property. The City worked with the NYSDEC and B&L to investigate and close the tanks. Initially conducted under the NYSDEC's spill program, a site investigation revealed a widespread contaminant plume on the site with both petroleum and solvent based contaminants of concern. B&L assisted the City with funding applications for the NYSDEC Environmental Restoration Program (ERP) to allow the City to continue the site investigation and also to obtain funding for a portion of the underground storage tank closures conducted as part of the spill program. B&L also worked with the City to finalize the work plan for the ERP Site Investigation which included a supplemental soil and groundwater investigation, ecological assessment, interim remedial measures consisting of underground storage tank closure and soil excavation, and soil gas surveys. The property is being renovated by the City for use as a fire training center.

Schoeppfel Chevrolet SI/RAR Brownfield, Wayne County
B&L was retained by Wayne County to conduct a Site Investigation and Remedial Alternatives Analysis of a former automobile dealership as part of the NYS Department of Environmental Conservation's (NYSDECs) Environmental Restoration Project (ERP) brownfield program. The project included a characterization of subsurface conditions and an evaluation of potential remedial alternatives. The building was demolished and source materials were removed including drums, underground storage tanks and contaminated soils. B&L conducted asbestos related services and assisted with oversight of the field investigation.

Michael R. Brother

Senior Managing Hydrogeologist

Years of Experience

28

Education

B.A. Earth Sciences, Farleigh Dickinson University, 1978
M.S. Geology, University of Vermont, 1984

Professional Affiliations

Certified Ground Water Professional (CGWP) No. 469
National Ground Water Association

Association of Ground Water Scientists and Engineers

Summary

Mr. Brother has been involved in technical group management, project management, and has served as technical director for hydrogeologic investigations at proposed, active, and inactive solid and hazardous waste disposal facilities throughout the eastern U.S.

Specific technical expertise in aquifer analysis, subsurface mapping, fractured bedrock investigations, surface and borehole geophysics, statistics and geostatistics, computer data management, GIS, remedial alternatives evaluations, and cost-effectiveness analyses.

Specific project management experience includes management of investigations at more than eight existing solid waste disposal facilities, four existing commercial secure hazardous waste landfill facilities, and more than a dozen industrial and/or inactive hazardous waste disposal sites. Training throughout the U.S. on the statistical ramifications of RCRA-mandated sampling programs, interpretation of water quality data, and the use of innovative investigative techniques.

Relevant Project Experience

Technology Accelerator Site, Glens Falls, New York
The Greater Glens Falls Development Corporation retained Barton & Loguidice, P.C. to perform a Site Investigation/Remedial Alternatives Report on a 0.13 acre property in Glens Falls' central business district. The vacant building at the location housed a clothing manufacturing facility from 1920 to 1970 and it was used as an automobile repair shop in the 1930s. The site contained aboveground storage tanks used for fuel oil and a buried storage tanks of unknown size or contents. B&L conducted a Site Investigation and performed Interim Remedial Measures, in cooperation with the City's subcontractors. The Remedial Alternatives Report was submitted at the conclusion of the project.

Diamond International Paper Mill Site - Environmental Restoration Project
The City of Ogdensburg is proceeding with an Environmental Restoration Project of the former Diamond International Paper Mill Site, a vacant 17-acre parcel situated on the eastern bank of the St. Lawrence River. The City has included the site as part of its Waterfront Redevelopment Action Plan, and the site was assessed by the City under an EPA Brownfield Pilot Program. B&L worked with the City to prepare a work plan for investigation of the site to identify the environmental quality of soil and groundwater across the site. Contaminants of concern on this property included petroleum, chlorinated solvents, dioxin, PCBs, and metals. An Interim Remedial Measure (IRM) was performed for the decontamination and demolition of remaining paper mill structures on the site.

Environmental Restoration Program Sites, Rome, NY
The City retained the services of B&L in April 2007 to prepare a Site Investigation and Remedial Alternatives Report (SI/RAR) for the five properties located within the City of Rome in accordance with NYSDEC criteria. The five sites, which range in size from 0.31 acres to 2.85 acres, were formerly used as petroleum bulk storage (PBS) facilities (two sites), a textile mill and machine shop, a sawmill manufacturing facility, and gasoline station/automobile repair facilities (two sites). The SI/RAR at each property will consist of: a subsurface investigation to determine the horizontal and vertical extent of soil and/or groundwater contamination at the site (Site Investigation); the implementation of Interim Remedial Measures (IRMs) including the demolition of building structures; and the identification and evaluation of remedial alternatives for potential additional site cleanup measures (Remedial Alternatives Report). In addition, B&L is also administrating a $200,000 U.S. Environmental Protection Agency (USEPA) Brownfield Assessment grant that the City was awarded in September 2004.

NYSDEC Environmental Restoration Projects – Town of New Bremen, NY
B&L was retained by the Town to conduct a site investigation and remedial alternatives analysis of a former convenience store and gas station located in Croghan, NY as part of the NYSDEC ERP Brownfield program. B&L provided the hydrogeologic investigation including monitoring well installation and sampling, a soil vapor and sub-slab vapor assessment at the site and surrounding residential area, provided a Site Investigation report, and provided field oversight during a pilot test program for the selected in-situ remediation technology.

210 Sconondoa ERP Brownfield, City of Oneida
The City of Oneida acquired a parcel of property that had several underground storage tanks on the property. The City worked with the NYSDEC and B&L to investigate and close the tanks. Initially conducted under the NYSDEC's spill program, a site investigation revealed a widespread contaminant plume on the site with both petroleum and solvent based contaminants of concern. B&L assisted the City with funding applications for the NYSDEC Environmental Restoration Program (ERP) to allow the City to continue the site investigation and also to obtain funding for a portion of the underground storage tank closures conducted as part of the spill program. B&L also worked with the City to finalize the work plan for the ERP Site Investigation which included a supplemental soil and groundwater investigation, ecological assessment, interim remedial measures consisting of underground storage tank closure and soil excavation, and soil gas surveys. The property is being renovated by the City for use as a fire training center.

Joshua G. Haugh

Hydrogeologist III

Years of Experience

5

Education

B.S. Water Resources, Geology Minor, State University of New York at Oneonta, 2005

Professional Registrations

Hazardous Waste Operations and Emergency Response 40-hour Course

Professional Affiliations

Hudson-Mohawk Professional Geologists Association

American Institute of Professional Geologists

Summary

Mr. Haugh has been responsible for the supervision of multiple field projects, including brownfield sites, environmental site assessments, and landfill hydrogeologic investigations.

Mr. Haugh has directed various field investigations, including the delineation of subsurface soil and groundwater contamination, hydrogeologic investigations, and groundwater supply studies. His field and office experience include the following:

- Drilling and environmental construction and remediation oversight.
- Soil classification and borehole logging of bedrock and overburden borings.
- Determine screen placement and construction of monitoring wells and water-supply wells based on soil classification and site hydrogeology.
- Conventional and low-flow groundwater sampling, as well as soil and sediment sampling for site investigations and routine monitoring events.
- Landfill gas, soil vapor intrusion, and sub-slab air sampling.
- Various aquifer testing methods, such as slug tests, packer tests, and pump tests, and use of special software in aquifer test analysis.
- Surveys to contour groundwater flow and plume migration.
- Experience performing landfill hydrogeologic investigations and landfill closure investigations at various landfills in New York State.
- Experience using groundwater modeling software at landfill sites.
- Support in Phase I inspections, wetland delineations, and site inspections.
- Site data management and interpretation.
- Construction of structural contour and isopach maps and geologic cross-sections.
- Preparation of reports, including development of figures and data summary tables

Relevant Project Experience

NYSDEC Environmental Restoration Projects – Town of New Bremen, NY
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John A. Benson

Associate

Years of Experience

24

Education

B.A. Biology Ithaca College, 1988
M.B.A. Le Moyne College, 2001

Professional Registrations

Hazardous Waste Operations Health & Safety Training (HAZWOPER 40CFR 1910.120)

New York State Landfill Operator Certification (6NYCRR Part 360)

Professional Accreditations

Central New York Air and Waste Management Association

National Groundwater Association

Onondaga County Council on Environmental Health

Summary

Mr. Benson is a manager in B&L's environmental engineering services group. He has extensive experience as an environmental consultant including "Brownfield" redevelopment, permitting and compliance, petroleum bulk storage, remediation, solid waste and hazardous materials management, and water/wastewater infrastructure projects.

Mr. Benson has been responsible for the management of numerous environmental site investigations involving petroleum, solvent, PCB and other hazardous substance releases at industrial and municipal owned sites. Regulatory program involvement has included NYSDEC' s Part 360 solid waste regulations, Oil Spills Program, Inactive Hazardous Waste Site Program, Voluntary Cleanup Program, and Environmental Restoration Program (Municipal Brownfields). Project experience has involved Health & Safety Plans, Site Characterization, Remedial Investigation/Feasibility Studies, Remedial Design and General Construction Administration. Site investigations have ranged from hazardous waste landfills, industrial facilities, power authorities, abandoned commercial properties, and petroleum bulk storage facilities.

For the project areas identified above, Mr. Benson has been directly involved with budgeting, various funding programs, consent order actions, contract administration, construction management, subcontractor oversight and assisted in the preparation of numerous private and municipal bidding documents. Mr. Benson has also served as a direct client liaison to the general public and to both state and federal regulatory agencies.

Relevant Project Experience

Diamond International Paper Mill Site - Environmental Restoration Project
The City of Ogdensburg is proceeding with an Environmental Restoration Project of the former Diamond International Paper Mill Site, a vacant 17-acre parcel situated on the eastern bank of the St. Lawrence River. The City has included the site as part of its Waterfront Redevelopment Action Plan, and the site was assessed by the City under an EPA Brownfield Pilot Program. B&L worked with the City to prepare a work plan for investigation of the site to identify the environmental quality of soil and groundwater across the site. Contaminants of concern on this property included petroleum, chlorinated solvents, dioxin, PCBs, and metals. An Interim Remedial Measure (IRM) was performed for the decontamination and demolition of remaining paper mill structures on the site.

NYSDEC Voluntary Clean-up Program Hazardous Waste Site, Private Client
While expanding operations at an existing industrial laundry enterprise, a private industrial company identified concerns with prior releases of petroleum and dry cleaning fluid on the property. B&L scoped a site investigation of the site to include an assessment for soil vapor migration from the property onto adjacent residential lots. In addition to a soil and groundwater investigation, the

soil vapor investigation was expanded to include an assessment of sub-slab vapor at the site. B&L is working with the NYSDEC to prepare a proposed remedial action plan that will require annual monitoring of the plume to confirm the natural attenuation of the solvent area and installation of a sub-slab vapor suppression system.

Site Investigation/Remedial Alternatives Report, Village of Vernon, NY
The Village of Vernon's Village Hall/Garage had previously been a trucking company maintenance facility. Three underground storage tanks from that former business were found on the property, and Barton & Loguidice assisted the Village in applying for ERP funding. As part of the investigation of this property, an Interim Remedial Measures (IRM) project was scoped to remove the USTs from the site. During the removal, contaminated soils were identified and also removed from the property. The Site Investigation included a soil and groundwater quality investigation surrounding the former location of the tanks, and a soil vapor survey of the site, including a sub-slab soil gas survey in the building.

Prepare NYSDEC Brownfield project Work Plan for Thibado Site, Town of Webb, NY
B&L conducted a Site Investigation and Remedial Alternatives Analysis of a former gasoline station as part of the NYSDEC ERP brownfield program for the Town of Webb. A previously completed Phase I Environmental Site Assessment revealed the presence of six underground storage tanks, a mechanics pit, a reported oil spill, and the potential for petroleum contaminated groundwater present on the property. B&L's services included a site investigation work plan and a remedial alternatives report that included a description of historical land uses; a preliminary risk evaluation; site investigation activity objectives; technical approach overview; and a Sampling and Analysis Plan, Health and Safety Plan, and Citizen Participation Plan. Site investigation tasks included a site survey/map; a geophysical survey; a site inspection, pre-demolition asbestos survey, and residential well survey; interim remedial measures that resulted in the demolition of the existing structure and the removal of underground storage tanks; community relations; subsurface soil investigations; groundwater investigations; wetlands, floodplains, and sensitive environment surveys; public health and wildlife risk evaluations; data validation; and various project administration activities.

Darik M. Jordan

Project Environmental Scientist

Years of Experience

10

Education

B.S. Environmental Health & Safety Management, Rochester Institute of Technology, Rochester, NY, 2000

Professional Registrations

CFR 1910.120–Hazardous Waste Operations Health and Safety-Initial 40 hour course and current annual 8 hour refresher course

Summary

Mr. Jordan's primary responsibilities have been associated with the firm's Environmental and Solid Waste Service groups. Work in those areas has included brownfield environmental remediation projects, petroleum spill remediation projects, UST tank closures, EPA UIC closures, air permitting compliance services and preparation of SPCC and SWPP plans.

Mr. Jordan's field work experience gained while working at B&L has included collection of various environmental samples including groundwater, soil, surface water, mold, lead-based paint, and landfill gas sampling. The collection of these environmental samples has occurred on various projects including brownfield sites, underground storage tank removals, subsurface site investigations, remedial projects, and municipal solid waste landfills.

Mr. Jordan's office based duties related to the field activities listed above include technical report writing, database management, and evaluation of various analytical data. He has assisted in writing of landfill groundwater reports, tank closure reports, and a variety of other environmental reports and documents. Mr. Jordan is also experienced in reviewing analytical laboratory data and has created complex databases that help assist and demonstrate environmental compliance for various facilities.

Relevant Project Experience

Prepare NYSDEC Brownfield project Work Plan for Thibado Site, Town of Webb, NY

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Darik M. Jordan

Project Environmental Scientist

Diamond International Paper Mill Site - Environmental Restoration Project
The City of Ogdensburg is proceeding with an Environmental Restoration Project of the former Diamond International Paper Mill Site, a vacant 17-acre parcel situated on the eastern bank of the St. Lawrence River. The City has included the site as part of its Waterfront Redevelopment Action Plan, and the site was assessed by the City under an EPA Brownfield Pilot Program. B&L worked with the City to prepare a work plan for investigation of the site to identify the environmental quality of soil and groundwater across the site. Contaminants of concern on this property included petroleum, chlorinated solvents, dioxin, PCBs, and metals. An Interim Remedial Measure (IRM) was performed for the decontamination and demolition of remaining paper mill structures on the site.

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NYSDEC Environmental Restoration Projects – Town of New Bremen, NY
B&L was retained by the Town to conduct a site investigation and remedial alternatives analysis of a former convenience store and gas station located in Croghan, NY as part of the NYSDEC ERP Brownfield program. B&L provided the hydrogeologic investigation including monitoring well installation and sampling, a soil vapor and sub-slab vapor assessment at the site and surrounding residential area, provided a Site Investigation report, and provided field oversight during a pilot test program for the selected in-situ remediation technology.

Schoepfel Chevrolet-SI/RAR, Wayne County
B&L was retained by Wayne County to conduct a Site Investigation and Remedial Alternatives Analysis of a former automobile dealership as part of the NYS Department of Environmental Conservation's (NYSDECs) Environmental Restoration Project (ERP) brownfield program. The project included a characterization of subsurface conditions and an evaluation of potential remedial alternatives. The building was demolished and source materials were removed including drums, underground storage tanks and contaminated soils. B&L conducted asbestos related services and assisted with oversight of the field investigation.

Brian J. McGrath

Environmental Scientist II

Years of Experience

7

Education

B.S. Degree in Environmental Science from Rochester Institute of Technology - 2004

A.A.S. Degree in Natural Resource Conservation from Finger Lakes Community College - 2000

Professional Certifications

OSHA HAZWOPPER 1910.120 40 Hr. Training Certificate, 8-hour Annual Refresher Training Course, and Field Experience

Stormwater Certifications from the State University of New York College of Environmental Science and Forestry for -Erosion and Sediment Control Site Planning -Design and Implementation of Erosion and Sediment Control Practices

New York State – Department of Labor Asbestos Inspector Certificate with Field Experience

Summary

Mr. McGrath has several years of experience in environmental compliance, hazardous and non-hazardous remediation, biological surveying, landfill compliance, conducting stormwater inspections, and environmental sampling of most every facet.

Mr. McGrath has also provided oversight on several remediation projects that have ranged from former paper mills, machine shops, manufactured gas plant coal tar waste (MGP), petroleum tank farms, underground storage tank closures and removals, and remedial treatment through the use of chemicals and wastewater treatment. He has performed numerous soil investigations utilizing geo-probing techniques and performed soil/vapor intrusion sampling and analysis. He has been responsible for field related activities and compliance reporting for up to 30 landfills across New York, ensuring NYSDEC 6 NYCRR Part 360 Solid Waste Regulations. Field related activities at the landfills include installing, developing, and sampled monitoring wells, along with sampling sediment and surface waters. He has conducted methane gas sampling. He has sampled groundwater with bailers, and numerous low flow pumps.

Relevant Project Experience

EPA Phase II Investigation of the former Augsbury Tank Farm site (Kiwanis property), Ogdensburg, NY
B&L performed Phase I and Phase II Environmental Site Assessments (ESA) on the Augsbury Tank Farm Site in the City of Ogdensburg. The site had previously served as a petroleum bulk storage facility containing a total of 14 tanks. The Phase I ESA identified widespread contamination including subsurface soil and groundwater contamination, and possible lead and asbestos-containing materials. The Phase II ESA included project planning and scoping, site characterization, sample analysis, data management, preliminary risk assessment, data summation, and evaluation of information needs.

Diamond International Paper Mill Site - Environmental Restoration Project
The City of Ogdensburg is proceeding with an Environmental Restoration Project of the former Diamond International Paper Mill Site, a vacant 17-acre parcel situated on the eastern bank of the St. Lawrence River. The City has included the site as part of its Waterfront Redevelopment Action Plan, and the site was assessed by the City under an EPA Brownfield Pilot Program. B&L worked with the City to prepare a work plan for investigation of the site to identify the environmental quality of soil and groundwater across the site. Contaminants of concern on this property included petroleum, chlorinated solvents, dioxin, PCBs, and metals. An Interim Remedial Measure (IRM) was performed for the decontamination and demolition of remaining paper mill structures on the site.

Environmental Restoration Program Sites, Rome, NY
The City retained the services of B&L in April 2007 to prepare a Site Investigation and Remedial Alternatives Report (SI/RAR) for the five properties located within the City of Rome in accordance with NYSDEC criteria. The five sites, which range in size from 0.31 acres to 2.85 acres, were formerly used as petroleum bulk storage (PBS) facilities (two sites), a textile mill and machine shop, a sawmill manufacturing facility, and gasoline station/automobile repair facilities (two sites). The SI/RAR at each property will consist of: a subsurface investigation to determine the horizontal and vertical extent of soil and/or groundwater contamination at the site (Site Investigation); the implementation of Interim Remedial Measures (IRMs) including the demolition of building structures; and the identification and evaluation of remedial alternatives for potential additional site cleanup measures (Remedial Alternatives Report). In addition, B&L is also administrating a $200,000 U.S. Environmental Protection Agency (USEPA) Brownfield Assessment grant that the City was awarded in September 2004.

NYSDEC Environmental Restoration Projects – Town of New Bremen, NY
B&L was retained by the Town to conduct a site investigation and remedial alternatives analysis of a former convenience store and gas station located in Croghan, NY as part of the NYSDEC ERP Brownfield program. B&L provided the hydrogeologic investigation including monitoring well installation and sampling, a soil vapor and sub-slab vapor assessment at the site and surrounding residential area, provided a Site Investigation report, and provided field oversight during a pilot test program for the selected in-situ remediation technology.

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