Operable Unit-2 Investigation Summary Report – Final

Volume I (Text, Figures, Tables, and Appendix A)

Site:
Stanton Cleaners Area Groundwater Contamination Site
110 Cutter Mill Road
Great Neck, New York 11021

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April 2004

Earth Tech Project No. 71437

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Volume II (Appendix B - E)

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Table of Contents

EXECUTIVE SUMMARY 1

1.0 INTRODUCTION 1
  1.1 Site Background 1
  1.2 Project Objectives 1
  1.3 Site History 2
  1.4 Previous and Current Investigation Activities 3
  1.5 Water Authority of Great Neck North 4
  1.6 Report Organization 7

2.0 INVESTIGATION 9
  2.1 Field Investigation 10
  2.2 Hydrogeologic Characterization 10
    2.2.1 Monitoring Well Installation 10
    2.2.2 Well Development 12
    2.2.3 Well Sampling 12
  2.3 Soil Characterization 12
  2.4 Groundwater Characterization 13
  2.5 Investigation-Derived Waste Management 13
  2.6 Site Surveying 13
  2.7 Analytical Testing 14
    2.7.1 Soil 14
    2.7.2 Groundwater 14
  2.8 Data Validation 16
  2.9 Data Management 16

3.0 REGIONAL GEOLOGY AND HYDROGEOLOGY 17
  3.1 Regional Geology 17
  3.2 Regional Hydrogeology 17

4.0 SPILL INVESTIGATION ACTIVITIES AT OFF-SITE SOURCES 19
  4.1 Fenley Amoco Gas Station Site (Spill #82-00157) 19
    4.1.1 History of Groundwater Analytical Results 20
      4.1.1.1 Groundwater Chemistry: 1997 20
      4.1.1.2 Groundwater Chemistry: 1998 21
      4.1.1.3 Groundwater Chemistry: 1999 22
      4.1.1.4 Groundwater Chemistry: 2000 22
      4.1.1.5 Groundwater Chemistry: 2001 24
      4.1.1.6 Groundwater Chemistry: 2002 25
    4.1.2 History of Soil Analytical Results 26
    4.1.3 Fenley Amoco Projected Remedial Approach 27
  4.2 Mayflower Cleaners Site (Site ID # 1-30-068) 27
    4.2.1 Chronology of Events: 1992 – 1993 28
    4.2.2 Chronology of Events: 1995 - 1996 28
    4.2.3 Chronology of Events: 1997 - 1999 29
    4.2.4 Investigation Data: 2000 – 2003 30
  4.3 Citizen's Development Company Site (Site ID # 1-30-070) 30
    4.3.1 Site History 31

4.3.2 Operating Unit - 1; Impact of PCE on the Shallow Aquifer 31
4.3.2.1 Remediation History 31
4.3.2.2 Interim Remedial Measures 34
4.3.2.3 Remedial Investigation/Feasibility Study 35
4.3.2.4 Feasibility Study 36
4.3.3 Operating Unit - 2; Impact of PCE on the Deeper Aquifer 37
4.3.4 Summary of Data 38
4.4 Active Amoco Gas Station Site – (Spill # 92-08119) 38
4.4.1 Summary of Investigation Data 42
4.5 Jonathan's Auto Repair Shop 43

5.0 NATURE AND EXTENT OF CONTAMINATION 44

5.1 Soil Sampling 45
5.2 Groundwater Sampling 45
5.2.1 Shallow Upper Glacial Aquifer 46
5.2.1.1 Volatile Organic Compounds 46
5.2.1.2 Semi-Volatile Organic Compounds 47
5.2.1.3 Inorganic Compounds 48
5.2.1.4 Pesticides 49
5.2.2 Intermediate Upper Glacial Aquifer 49
5.2.2.1 Volatile Organic Compounds 49
5.2.2.2 Semi-Volatile Organic Compounds 51
5.2.2.3 Inorganic Compounds 51
5.2.2.4 Pesticides 52
5.2.3 Deep Upper Glacial Aquifer 52
5.2.3.1 Volatile Organic Compounds 52
5.2.3.2 Semi-Volatile Organic Compounds 54
5.2.3.3 Inorganic Compounds 54
5.2.3.4 Pesticides 56
5.2.4 Discussion 56

6.0 SUMMARY AND RECOMMENDATIONS 58

6.1 Fenley Amoco Gas Station Site 58
6.2 Mayflower Cleaners Site 59
6.3 Citizen's Development Company (Flower Fashion Cleaners) Site 59
6.4 Active Amoco Gas Station Site 60
6.5 Jonathan's Auto Repair Site 60

7.0 CONCLUSIONS 61

Figures

Figure 1 OU-2 Site Location Map
Figure 2 EPA Monitoring Well Location Map
Figure 3 Regional Geologic Map
Figure 4A Cross-Section Orientation from Stumm 2000
Figure 4B OU-1/OU-2 Area Cross-Section Orientations from Stumm 2000
Figure 5 Fenley Amoco Gas Station, Citizen's Development Company and Mayflowers Cleaners Site Map
Figure 6 Active Amoco Gas Station and Jonathan's Auto Repair Shop Site Map
Figure 7 Groundwater Flow Direction Map: Fenley Amoco Gas Station, Citizen's Development Company and Mayflowers Cleaners Sites
Figure 8 Groundwater Flow Direction Map: Active Amoco Gas Station and Jonathan's Auto Repair Shop Sites

Tables

Table 1 EPA OU-2 Well Construction Data Summary
Table 2 EPA OU-2 Summary of Soil Analytical Results - Volatile Organic Compounds
Table 3 EPA OU-2 Summary of Groundwater Analytical Data - Volatile Organic Compounds
Table 4 EPA OU-2 Summary of Groundwater Analytical Results - Semi-Volatile Organic Compounds
Table 5 EPA OU-2 Summary of Groundwater Analytical Results - Inorganic Compounds
Table 6 EPA OU-2 Summary of Groundwater Analytical Results - Pesticides
Table 4-1 Groundwater Analytical Data - Fenley Amoco Site, January 18 - 24, 2000
Table 4-2 Groundwater Analytical Data - Fenley Amoco Site, April 21 - 27, 2000
Table 4-3 Groundwater Analytical Data - Fenley Amoco Site, July 12 - 17, 2000
Table 4-4 Groundwater Analytical Data - Fenley Amoco Site, October 19 - 25, 2000
Table 4-5 Groundwater Analytical Data - Fenley Amoco Site, January 18 - 24, 2001
Table 4-6 Groundwater Analytical Data - Fenley Amoco Site, March 30 - April 3, 2001
Table 4-7 Groundwater Analytical Data - Fenley Amoco Site, May 1 - 8, 2001
Table 4-8 Groundwater Analytical Data - Fenley Amoco Site, February 27 - March 1, 2002
Table 4-9 Groundwater Analytical Data - Fenley Amoco Site, March 19 - 20, 2002
Table 4-10 Groundwater Analytical Data - Fenley Amoco Site, June 20 - 26, 2002
Table 4-11 Groundwater Analytical Data - Fenley Amoco Site, September 9 - 11, 2002

Appendices

Appendix A

April 2000 Quarterly Monitoring Report (JNM Environmental Inc.)
Summary Report – January 2001-June 2002 (JNM Environmental Inc.)
Historical Groundwater Analytical Results for Year 1997
Historical Groundwater Analytical Results for Year 1998

Historical Groundwater/Soil Analytical Results for Year 1999
Analytical Data Tables Summary for Year 2000 - BTEX

Appendix B

P.W. Grosser Consulting, Closure Plan - August 21, 1995
December 1992 Analytical Data, West Drain/Southeast Drain, Site ID # 1-30-068, Great Neck Rd., Great Neck, NY.
Analytical Results, Site ID # 1-30-068, Great Neck Rd., Great Neck, NY; from James Rhodes of P.W. Grosser Consulting to Frank C. Brock, Chief, USEPA; dated October 6, 1995.
Memorandum, Site ID # 1-30-068, Great Neck Rd., Great Neck, NY; from Frank C. Brock of USEPA to Lawrence Weinberger, dated October 18, 1995.
Memorandum, Site ID # 1-30-068, Great Neck Rd., Great Neck, NY; from Salvatore Ervolina, P.E., NYSDEC to Frank C. Brock, Chief, USEPA, dated January 3, 1996.
Memorandum from James P. Rhodes of P.W. Grosser Consulting to Ed Khadaran of the USEPA, dated March 6, 1996, Site ID # 1-30-068.
Memorandum, Site ID # 1-30-068, Great Neck Rd., Great Neck, NY; from Lawrence Weinberger to NYSDEC Commissioner, dated May 30, 1997.
Memorandum, Site ID # 1-30-068, Great Neck Rd., Great Neck, NY; from Ray E. Cowan, P.E. of NYSDEC to Mr. Lawrence Weinberger, dated July 21, 1997.
Memorandum, , Site ID # 1-30-068, Great Neck Rd., Great Neck, NY; from Walter J. Parrish, P.E. of NYSDEC to Mr. David Gordon Koch, Esq., dated September 16, 1999.

Appendix C

Record of Decision, Citizens Development Company Operable Unit 1 Inactive Hazardous Waste Site, University Gardens, Nassau County, Site Number 1-30-070; March 1998; by the New York State Department of Environmental Conservation, Division of Environmental Remediation.
Final RI/FS Report Submitted by J.R. Kolmer + Associated, Inc.
Remedial Investigation Workplan Flower Fashion Site, Site ID # 1-30-070; prepared by JR Kolmer + Associates, Inc.; prepared for Citizens Development Company; March 26, 1996.
Remedial Investigation Workplan, Operable Unit 2, Citizen Development Company, Site ID # 1-30-070; prepared by JR Kolmer + Associates, Inc.; prepared for Citizens Development Company; May 7, 1999.
Letter from J.R. Kolmer Associates to Jamie Asher, NYSDEC, dated November 24, 1999, Site ID # 1-30-070.
Annual Groundwater Monitoring Report 2003 – Citizens Development Company / Flower Fashion Site prepared by CA Rich Consultants, Inc for the NYSDEC, dated March 31, 2003, Site ID # 1-30-070

Appendix D

Tyree Brothers Environmental Services, Inc. letter, dated 11/13/92, to NYSDEC
Miller Environmental Group Site Summary Report dated October 1994
Miller Environmental Group Progress Report dated September 1996

Miller Environmental Group Quarterly report dated February 1999

An undated memorandum from Nick Acampora of NYSDEC to Mr. Mike Cohen of Baron Lincoln Mercury, Spill # 92-08119.

Memorandum from Dawn Medaglia of Tyree Brothers Environmental Services, Inc. to Nick Acampora of NYSDCEC, dated December 9, 1993, Spill # 92-08119.

Memorandum from Luce, Forward, Hamilton, & Scripps Attorneys at Law (Luce, et.al.) to Richard Hofflich, Esq.; dated February 21, 1995., Spill # 92-08119.

Memorandum from Nick Acampora of NYSDEC to Mr. Gould of the Bellgrave Water Pollution Control District, dated January 18, 1995, Spill # 92-08119.

Miller Environmental Group 1997 Figures

Memorandum from John M. Waltz of County of Nassau Department of Public Works to Nick Acampora of NYSDEDC, dated May 3, 1995, Spill # 92-08119.

Appendix E

Memorandum from Jed A. Myers of Unico Environmental, Inc. to Joanne S. Rogers of Amoco Oil Corporation, dated August 4, 1995, Spill # 00-09365.

Closure Plan by Unico Environmental, Inc., Spill # 00-09365.

Memorandum from Joseph DeFranco of the Nassau County Department of Health to Frank C. Brock of the USEPA Region II, UIC Section, dated November 19, 1990, Spill # 00-09365.

Memorandum from Nick Acampora of the NYSDEC to Bruce Mckay of the Nassau County Department of Health, dated February 2, 2001, Spill # 00-09365.

Memorandum from John Kushwara ot the USEPA Groundwater Compliance Section to Richard Blackburn of Amoco Oil Company, dated March 30, 2001, Spill # 00-09365.

Memorandum from John Lovejoy of the Nassau County Department of Health to Margaret Halley of the USEPA Groundwater Compliance Section, dated October 31, 2001, Spill # 00-09365.

Memorandum from Robert Ferri of the USEPA Groundwater Compliance Section to Jonathan Mori Property and Business owner of Jonathan's Auto Repair Shop, dated November 7, 2001, Spill # 00-09365.

Delta Environmental Consultants, Inc. Site Status Letter No.1, dated January 26, 2001, Spill # 00-09365.

Delta Environmental Consultants, Inc. Drywell Closure Report, dated August 2, 2001, Spill # 00-09365.

LIST OF ACRONYMS

AESIC	Agricultural Excess and Surplus Insurance Company
ARARs	Applicable or Relevant and Appropriate Requirements
AS	Air Sparging
ASTM	American Society for Testing and Materials
bgs	below ground surface
BTEX	Benzene Toluene Ethylbenzene Xylene
CDC	Citizens Development Company
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLP	Contract Laboratory Program
DCA	Dichloroethane
DCE	Dichloroethene
DESA	Division of Environmental Science and Assessment
DO	Dissolved Oxygen
DQO	Data Quality Objective
DW	Dry Well
EPA	Environmental Protection Agency
ERT	Environmental Response Team
F & N	Fenley and Nicol Environmental
ft	feet
GAC	Granular Activated Carbon
gal/min	gallons per minute
HASP	Health and Safety Plan
HI	Hydrogeologic Investigation
HiVac	High Vacuum
HP	Hydropunch
ID	Inner Diameter
IDW	Investigation-Derived Waste
IRM	Interim Remedial Measure
JNM	J.N.M. Environmental, Inc.
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
µg/L	microgram per liter
MEG	Miller Environmental Group
mg/Kg	milligrams per kilogram
msl	mean sea level
MTBE	Methyl Tertiary Butyl Ether
MW	Monitoring Well
NAPL	Non Aqueous Phase Liquid
NCDOH	Nassau County Department of Health
ND	Non-Detect
NPL	National Priority List
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health

LIST OF ACRONYMS (cont.)

ORP	Oxidation-Reduction Potential
OSC	On-Sceene Coordinator
OU-1	Operable Unit 1
OU-2	Operable Init 2
ORC	Oxygen Release Compound
OW	Observation Well
P&T	Pump and Treatment
PCE	Tetrachloroethene
ppb	parts per billion
ppm	parts per million
PRP	Principal Responsible Party
PVC	Poly Vinyl Chloride
QAPP	Quality Assurance Project Plan
REAC	Response Engineering Analytical Contract
RI/FS	Remedial Investigation/Feasability Study
ROD	Record of Decision
RPM	Remedial Project Manager
RSCC	Regional Sampling Control Center
RST	Removal Support Team
RW	Recovery Well
SCA	Stanton Cleaners Area
SCP	Stanton Cleaners Property
SDWA	Safe Drinking Water Act
SOP	Standard Operating Procedure
SOW	Scope of Work
SPC	Spartan Petroleum Corporation
START	Superfund Technical Assessment and Response Team
SVE	Soil Vapor Extraction
SVOCs	Semi-Volatile Organic Compounds
TAGM	Technical Administrative Guidance Memorandum
TAL	Target Analyte List
TBES	Tyree Brothers Environmental Services
TBC	To-Be-Considered
TCE	Trichloroethene
TCL	Target Compound List
UIC	Underground Injection Control
U.S. EPA	United States Environmental Protection Agency
USCS	Unified Soils Classification System
UST	Underground Storage Tank
VOC	Volatile Organic Compounds
WAGNN	Water Authority of Great Neck North

EXECUTIVE SUMMARY

Earth Tech, Inc., under contract from the United States Environmental Protection Agency (U.S. EPA), has conducted an investigation of additional potential sources of groundwater contamination, as identified as Operable Unit 2 (OU-2) in EPA's March 1999 Record of Decision (ROD). The OU-2 investigation covers the area outside the Stanton Cleaners Area Groundwater Contamination Superfund Site, located near the Village of Great Neck in Nassau County, Long Island, New York (Figure 1). The groundwater, soil, and indoor air contamination impact from the Stanton Cleaners Site is addressed as Operable Unit 1 (OU-1). The OU-2 report summarizes the results of previous and ongoing investigations to determine if there are additional potential sources of PCE contamination impacting the public water supply wells located in the Water Authority of Great Neck North (WAGNN) Watermill Lane property.

The OU-2 Investigation Summary Report includes the environmental investigative history of five properties (Figure 1) with petroleum hydrocarbons and/or hazardous materials spills within the vicinity of the Stanton Cleaners Area Groundwater Contamination Site (Stanton Cleaners Site) and the WAGNN facility in Great Neck, Nassau County, New York. The five properties are:

1. Fenley Amoco Gas Station – 500 Great Neck Road - (Spill # 82-00157);
2. Mayflower Cleaners – 489 Great Neck Road - (Site ID # 1-30-068);
3. Citizen's Development Company (CDC) – 47 Northern Boulevard - (Site ID # 1-30-070);
4. Active Amoco Gas Station – 133 Cutter Mill Road - (Spill #92-08119); and
5. Jonathan's Auto Repair Shop – 294 Great Neck Road – (Spill #90-02024 and Spill # 00-09365).

WAGNN has been operating a groundwater pump and treatment system to address volatile organic compound contamination since 1984. The WAGNN Watermill Lane facility provides potable water from eight supply wells (wells 2A and 9 are designated as the primary supply wells) to an area of approximately 10 square miles with more than 34,000 residents and businesses.

The aforementioned spill sites are within a ½ mile radius of the WAGNN facility. Three Sites are approximately 2,500 feet south to southeast of the WAGNN facility; these are the former Fenley Amoco Gas Station Site located at 500 Great Neck Road, the Citizen's Development Company (CDC) Site located at 47 Northern Boulevard, and the Mayflowers Cleaners Site located at 489 Great Neck Road. Two other sites are located approximately 500 feet directly north of WAGNN, include the active Amoco Gas Station Site located at 133 Cutter Mill Road and the former Jonathan's Auto Repair Shop located at 294 Great Neck Road (Figure 1).

Hydrogeologic and chemical data collected during this OU-2 Investigation Summary Report indicate that the local groundwater flow pattern across the Fenley Amoco, Mayflower, and CDC sites is generally in the north-northwest direction in the upper glacial aquifer. In the area of active Amoco Gas Station and Jonathan's Auto Repair, groundwater flow is in the westerly direction.

Data used to support these observations include measurements of groundwater levels from the New York State Department of Environmental Conservation (NYSDEC) Quarterly monitoring and progress reports, EPA data, and the presence of several volatile organic compounds (VOCs), in particular benzene, ethylbenzene, toluene, and xylenes (BTEX), which act as tracers for actual groundwater flow.

While BTEX, Methyl tertiary butyl ether [(MTBE) gasoline additive] and tetrachloroethene (PCE) [and its degradation products, trichloroethene (TCE), dichloroethene (DCE), dichloroethane (DCA), and vinyl chloride] continue to be detected in a limited number of wells above federal maximum contaminant levels

(MCLs) in the area of Fenley, Mayflower, and CDC, these exceedances are confined to a relatively small radius (<200 feet) and restricted to the boundaries of each site.

For the Active Amoco Gas Station and Jonathan's Auto Repair sites, NYSDEC has determined that the BTEX and MTBE plumes are confined to a shallow perched water zone and flowing in a westerly direction, away from the WAGNN Watermill Lane well field. On-site remediation [soil vapor extraction(SVE) and pump and treatment (P&T)] have steadily decreased concentrations of BTEX and MTBE from thousands of parts per billion (ppb) to less than 184 ppb.

Of special significance, based upon data collected during several EPA groundwater sampling events from September 1999 thru April 2003, PCE was detected only one time during the April 2000 sampling event at concentrations of 54.0 and 93 ppb, at EPA monitoring/sentinel wells CL-4S and CL-3, respectively. This sampling event was performed prior to the initiation of the EPA OU-1 remediation efforts of soil vapor extraction and groundwater extraction and treatment. Since this April 2000 sampling event, no VOCs have been detected above the federal MCL for the EPA monitoring/sentinel wells (CL-3, CL-4S, CL-4D, EPA-MW-29 and EPA-MW-30) located between these OU-2 sites and the WAGNN Watermill Lane well field.

For the Fenley, Mayflower, and CDC sites, data support a definitive trend of steady-state to diminishing VOC concentration levels. This is supported by the identification of PCE breakdown products, TCE, DCE, DCA, and vinyl chloride at rising levels within and restricted to the sites' boundaries (<50 feet). It is suggested that the co-mingled BTEX plume may be providing an anthropogenic source of carbon to initiate reductive dechlorination of the residual PCE, thus allowing for the natural attenuation of chlorinated VOCs.

The general pattern of VOC concentrations in groundwater at the OU-2 sites is in a steady-state or equilibrium condition in the magnitude and extent of VOCs present. The chemical data suggests that the mass of VOCs (with BTEX being the most prevalent contaminant) in the shallow upper glacial has been reduced by a factor of two or more between early and recent NYSDEC sampling events. The reduction in contaminant concentrations most likely is attributable to a combination of successful remediation efforts of soil removal, SVE, groundwater extraction and treatment, and natural attenuation.

Under the OU-1 Long-Term Response Action (LTRA), EPA will be sampling an array of monitoring wells, both up-gradient and down-gradient of the Stanton Cleaners Property. The down-gradient wells will be selected in order to provide an assessment of the condition of the groundwater in the vicinity of the Stanton Cleaners Site (*i.e.*, near those sites identified in this OU-2 Investigation Summary Report). These monitoring/sentinel wells will act to provide early identification of potential contamination that could impact the nearby WAGNN Watermill Lane supply wells.

When available, EPA will also include the results from NYSDEC's groundwater monitoring program for the Fenley Amoco, the CDC, and the active Amoco sites in the LTRA monitoring reports for the Stanton Cleaners Site.

EPA has reviewed the ongoing response actions at nearby sites which have been identified as having contributed to groundwater contamination in the vicinity of the Stanton Cleaners Site. EPA has determined that the above-referenced sites have been addressed or are in the process of being addressed by NYSDEC and/or private parties, outside of the Federal Superfund program. Accordingly, based on its review, EPA has concluded that, other than the continued implementation of the March 1999 remedy and the periodic review of that remedy pursuant to CERCLA '121(c), 42 U.S.C. ' 9621(c), no further

Federal response actions, under CERCLA, need to be taken as part of the remediation of the Stanton Cleaners Site.

EPA may revisit this determination in the future if it obtains new information which indicates that it would be appropriate for EPA to do so.

1.0 INTRODUCTION

1.1 Site Background

The Stanton Cleaners Area (SCA) Groundwater Contamination Site includes an active dry-cleaning facility, located at 110 Cutter Mill Road in the Town of North Hempstead, Nassau County (Figure 1). The Stanton Cleaners Property (SCP) is approximately ¼-acre and includes a one-story building in which the dry-cleaning business operates and an adjacent one-story boiler/storage building. Most of the SCP is paved with asphalt except for a narrow strip at the rear of the property. Adjoining properties include an indoor tennis facility (Plaza Tennis), a synagogue and school facility, a condominium (the Century Complex), and a service station. Three public water supply wells are located approximately 1,000 feet south of the SCP. Two of these wells are approximately 145 feet deep and the third well is 434 feet deep. The surrounding community is zoned commercial/residential and is serviced by public sewer and water, which is supplied by the Water Authority of Great Neck North (WAGNN).

1.2 Project Objectives

The objective of the Operable Unit (OU) -2 Investigation Summary Report is to determine if there are additional potential sources of tetrachloroethene (PCE) contamination impacting the public water supply wells located at the WAGNN Watermill Lane well field.

This OU-2 Investigation Summary Report summarizes all of the information presently available to Environmental Protection Agency (EPA) concerning the groundwater contamination in and around the five properties within the vicinity of the SCA Groundwater Contamination Site and the Water Authority of Great Neck North (WAGNN) Watermill Lane well field, located in Great Neck, Nassau County, NY. There are five properties (Figure 1) in the vicinity of this area where petroleum hydrocarbons and/or hazardous materials spills have occurred. The five properties within the OU-2 area are:

1. Fenley Amoco Gas Station - 500 Great Neck Road - (NYSDEC Spill # 82-00157);
2. Mayflower Cleaners – 489 Great Neck Road – (NYSDEC Site ID# 1-30-068);
3. Citizen's Development Company (CDC) - 47 Northern Boulevard - (NYSDEC Site ID# 1-30-070);
4. Active Amoco Gas Station - 133 Cutter Mill Road - (NYSDEC Spill #92-08119); and
5. Jonathon's Auto Repair Shop - 294 Great Neck Road - (NYSDEC Spill # 90-02024).

It should be noted that under the Superfund law, the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) specifically excludes petroleum from its statuatory provisions including the Superfund reporting requirements. In particular, the law does not address releases of petroleum, including crude oil or any fraction thereof that is not otherwise specifically listed or designated as a hazardous substance under the Superfund law, as well as natural gas, natural gas liquids, liquefied natural gas, or synthetic gas usable for fuel mixtures of natural gas and such synthetic gas. A separate set of oil spill reporting requirements applies under the Clean Water Act.

1.3 Site History

The Remedial Investigation/Feasibility Study (RI/FS) (1998) prepared by Dvirka and Bartilucci for the NYSDEC documents a detailed history of the SCA Groundwater Contamination Site, Great Neck, NY. Additional information is provided in the Draft Final OU-1 Hydrogeological Investigation (HI) Report issued June 2003. A brief summary of site history is presented below.

Since 1958, a dry cleaning operation has existed on the Stanton Cleaners property (SCP). The SCP changed ownership several times during its history; the current owner acquired the property in November 1967. During the late 1970s and early 1980s, Nassau County Department of Health (NCDOH) identified low levels of the volatile organic compound (VOC) PCE, a solvent commonly used by dry cleaners, in the public water supply wells located about 1,000 ft down-gradient of the SCP. In 1983, the WAGNN solicited help from NCDOH to assist them in identifying potential sources of the PCE contamination. As a result, in 1983, the SCP was inspected by the NCDOH. At that time, it was noted that a discharge pipe led from the dry cleaning fluid separator to the grassy, sloped area at the rear of the building. Shortly thereafter, the discharge was stopped.

In 1996, the NYSDEC initiated a RI/FS to determine the nature and extent of contamination and to develop a long-term and permanent remedy to mitigate threats to human health and the environment. During the RI/FS, NYSDEC, in conjunction with the New York State Department of Health (NYSDOH), performed indoor air sampling in some of the buildings adjacent to the SCP in order to determine the contaminant levels in the indoor air. Sampling was performed in the Tennis Club, the Synagogue, and the Century Complex, which are all adjacent to the SCP. Samples collected in spring of 1998 showed the presence of high levels of PCE in the air within the section of the Tennis Club nearest to the SCP. Within the basement of the Synagogue, PCE concentrations also exceeded NYSDOH indoor air quality guidelines. In addition, low levels of PCE were found in the garage level of the Century Complex to the north of the SCP.

Based upon the air, soil, and groundwater data collected, it was evident that PCE was migrating from the subsurface soils into the indoor environments of the above-referenced affected buildings adjacent to the SCP and into the groundwater beneath the Site. Some interim remedial measures have been conducted at the Site. In 1983, following the discovery by NCDOH of elevated levels of PCE contamination in soils [up to 8,000 parts per million (ppm)] at the rear of the SCP, approximately 20 cubic yards of soil were removed by the principal responsible party (PRP) to an off-site disposal facility.

In May 1998, NYSDEC requested that the PRPs repair the groundwater extraction and treatment system on the SCP, which had worked only intermittently since it began operations in 1989. In July 1998, the system was repaired and put back on-line; however, follow-up sampling showed that effluent water samples exceeded discharge standards. In 1998, the PRP repaired and added two 55-gallon drums of aqueous phase granular activated carbon (GAC) to the PRP system, so that it was temporarily operational and complied with the surface water discharge requirements.

Additionally, three WAGNN public water supply wells are located approximately 1,000 ft south of the SCP. Two of these wells are approximately 145 ft deep and the third well is 434 ft deep. In 1998, due to increasing levels of PCE contamination, the NYSDEC funded the construction of a new air stripper treatment system for two of the affected WAGNN water supply wells (PW-2A and PW-9). This new treatment system on the WAGNN supply wells is currently in operation and VOC contamination has been reduced to below federal and state drinking water standards.

In September 1998, at the request of NYSDEC and under it's removal authority, EPA installed a temporary soil vapor interceptor system adjacent to the Plaza Tennis facility in order to mitigate immediate impacts from PCE vapors to this facility.

Also in September 1998, EPA funded a soil remediation response action in order to reduce further the concentrations of VOCs in soils on the SCP. After further study of the area, a soil vapor extraction (SVE) system was designed and constructed on the SCP. A series of SVE wells were installed where significant concentrations of PCE were detected. Soil vapors were extracted using an aboveground vacuum system and treated by a GAC system. In order to enhance the SVE system's efficiency, a low permeability cover was placed over the affected soil area to control any potential short-circuiting with the atmosphere. The SVE system is currently still in operation.

The Site was listed final on the Federal National Priorities List (NPL) of hazardous waste. In March 1999, EPA issued a Record of Decision (ROD) identifying a selected remedy that included: 1) an upgrade of the existing groundwater air stripper on the SCP; 2) a groundwater extraction and treatment (P&T) system for the Site; 3) continued operation of the SVE system; 4) indoor air monitoring of the affected buildings adjacent to the SCP; 5) long-term groundwater monitoring; and 6) groundwater use restrictions.

By June 2003, the SVE soil remedy, which was initiated through the removal program in early 1999 and continues to be operated through the remedial program, has resulted in the recovery of approximately 16,000 pounds of PCE.

To further the objective of source control and removal, in January 2002, field operations for the buried tank removal action were completed with the removal of two 250-gallon PCE underground storage tanks (UST) and one 500-gallon oil UST. A SVE manifold extraction system was connected to the existing on-site SVE system to target areas with elevated PCE vapors.

EPA has completed additional groundwater studies to satisfy the requirements of the ROD by completing the Remedial Design (November 2000), Flow & Transport Model (August 2002), and Remedial Action (September 2001) for the OU-1 P&T System.

The SCA P&T system has been operational since September 2001, running at an average flow rate of 50 gpm, with recent upgrades to 65 gpm, and has treated approximately 42 million gallons of PCE contaminated groundwater by the completion of this report. After approximately 22 months of groundwater remediation, PCE source concentrations have dropped significantly.

To insure continued long-term operation of the P&T and SVE System, EPA has funded and implemented the Long Term Remedial Action for OU-1.

1.4 Previous and Current Investigation Activities

Initial response activities to the release of PCE contamination at the SCP were performed by the NCDOH, NYSDEC, and NYSDOH (see Section 1.2). As stated in Section 1.2, the NYSDEC initiated a RI/FS in 1996. The RI was conducted between September 1997 and October 1998. The FS was issued in January 1999.

The field work for the RI included the following: an inspection of Site facilities; private water well survey; public water supply well survey; soil gas survey of the SCP; soil probe borings and soil sampling; groundwater monitoring system installation and sampling; groundwater elevation and flow data collection; indoor and outdoor air sampling; drainage system sediment sampling; steam/vacuum system sampling; subsurface soil sampling; and an aquifer test. Detailed findings of the RI/FS can be found in the 1998 report by Dvirka and Bartilucci.

In March 1999, EPA issued a ROD identifying the selected remedy for the Site, which included: 1) upgrade of the existing air stripper on the SCP, 2) installation of a groundwater P&T system for the Site, 3) continued operation of the SVE system, 4) indoor air monitoring of the affected adjacent buildings, 5) long term groundwater monitoring, and 6) groundwater use restrictions.

In September 1999, EPA initiated remedial design activities for the groundwater P&T system OU-1. These activities included: extraction well and treatment unit installation, treatability studies, pretreatment studies, installation/sampling of monitoring wells, pump tests, evaluation of the on-site air stripper, performance of a re-injection study, groundwater modeling, and design of the staging area and on-site treatment building.

Historical data were utilized along with data acquired during the OU-1 HI to further characterize the Site and resolve any uncertainties identified during the NYSDEC RI/FS (Dvirka and Bartilucci, 1998). Additional hydrogeologic data were collected through an exploratory program of soil borings and monitoring wells advanced in the shallow, intermediate, and deep Upper Glacial Aquifers both up-gradient and down-gradient of the Site. Furthermore, existing and newly installed monitoring and extraction wells were sampled to provide additional groundwater flow and quality data, and in-situ hydraulic conductivity tests and aquifer tests were conducted to evaluate hydraulic characteristics of the aquifers underlying the Site.

The hydrogeologic data collected during the HI OU-1 were used to develop a groundwater flow and transport model for the SCA. The objectives of the flow and transport model were to: 1) develop a calibrated flow model that could be used to evaluate potential remedial options including groundwater extraction rates and injection; 2)develop a transport model that could be used to evaluate cleanup times and compare remedial strategies; and 3)simulate the groundwater extraction necessary to remediate contamination at the SCA. A report detailing the specifics of the groundwater model construction, calibration, and results was previously provided under separate cover (Earth Tech, May 2001).

The HI OU-1 was conducted between September 1999 and October 2002. The Draft Final OU-1 HI Report was issued June 2003.

1.5 Water Authority of Great Neck North

As mentioned previously, a public water supply well field located at Water Mill Lane (Figure 4A) and operated by WAGNN exists approximately 1000 feet south of the SCP; 2,500 feet north of the OU-2 Fenley Amoco, Mayflower Cleaners, and CDC sites; and 500 feet south of the OU-2 Active Amoco and former Jonathan's Auto Repair Shop sites. Two of the WAGNN wells, PW-2A (N-12796) and PW-9 (N-4388), are screened in the deep portions of the Upper Glacial Aquifer with a total depth of approximately 145 ft below ground surface (bgs) (WAGNN well construction information, influent concentrations, and pumping rates are presented in Appendix H, OU-1 HI Report, June 3002). The presence of discontinuous clays allows for potential hydrogeologic inter-connection between the deep and shallow/intermediate portions of the Upper Glacial Aquifer. This makes the deep Upper Glacial Aquifer susceptible to surface contamination migrating from the impacted shallow/intermediate Upper Glacial Aquifer.

Available analytical data obtained from the NCDOH, indicated that as early as September 1979, the privately owned Citizen's Water Supply Company noted low levels of VOCs (i.e., PCE, BTEX) in supply wells PW-2A (N-12796) and PW-9 (N-4388).

In 1998, due to increasing levels of PCE contamination, the NYSDEC funded the construction of a new air stripper treatment system for two of the affected WAGNN water supply wells (PW-2A and PW-9). This new treatment system on the WAGNN supply wells is currently in operation and VOC contamination has been reduced to below federal and state drinking water standards.

In early 1992, in the process of investigating the Active Amoco Gas Station (133 Cutter Mill Road) and Jonathan's Auto Repair Shop (294 Great Neck Road), the NYSDEC identified three distinct BTEX and MTBE plumes in the area. One plume was identified on the Amoco station property with a MTBE value of 24,800 ppb at MW-2; a second plume on Jonathan's Auto Repair property was identified with a MTBE value of 688 ppb at W-1; and a third plume was located on the southwest portion of the WAGNN Watermill Lane property with a MTBE value of 340 ppb at MW-15 (see Section 4.4 and 4.5).

Further investigations by J.N.M. Environmental, Inc. (JNM) identified the existence of a leaking 1,000 gallon gasoline UST located near PW-9. In 1996, after negotiations with the original privately owned Citizen's Water Supply Company, the UST was removed. After additional prolonged negotiations, through the period 1999 – 2002, active soil vapor extraction remediation was applied to address residual BTEX and MTBE contamination. Five monitoring wells (MW-13, MW-14, MW-15, MW-16, and MW-20) installed by the NYSDEC on the WAGNN property as part of this investigation were abandoned due to remedial construction activities.

Investigations by the NYSDEC at the Active Amoco Gas Station and Jonathan's Auto Repair indicated that contamination from these sites was traveling to the west toward the Long Island Railroad. The location of the WAGNN public supply wells at Watermill is in a southerly direction. In addition, the NYSDEC and Amoco installed a multi-point extraction and treatment system to capture and contain groundwater contamination and SVE system to address soils from these sites. NYSDEC continues to monitor these activities (see Section 4.5).

As previously mentioned, PCE has been detected in groundwater samples collected from public water supply wells PW-9 and PW-2A. As detailed in the HI OU-1 (June 2003), due to the location of the Stanton Cleaners property (up-gradient and within the capture zone of the WAGNN well field), historic and present elevated concentrations of PCE contamination found at the Site, and PCE plume delineation defined by the OU-1 report, the SCP was found to be a likely source for a major portion of the PCE contamination. Readers are directed to the HI OU-1 Report, June 2003 (released for public comment), for additional information.

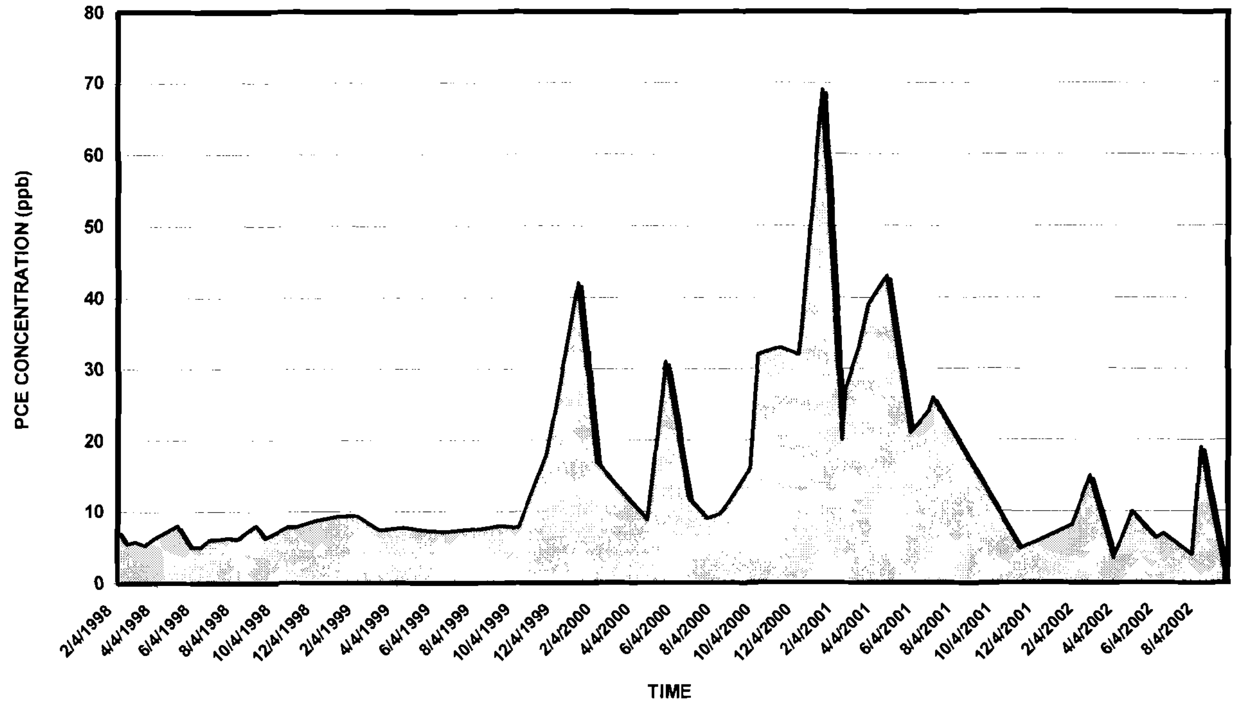
To reduce the susceptibility of the public water supply to contaminants and to mitigate groundwater contamination caused by past activities on the SCP, the ROD issued for the Stanton Cleaners Site March 31, 1999, called for an upgrade of the existing extraction system. The resulting EPA P&T system was put on-line in September 2001 and is currently operational.

As previously mentioned in the HI OU-1 (June 2003), trend plots show that PCE concentrations in WAGNN wells PW-2A and PW-9 have declined since the extraction system was put on-line in September 2001. Some of the decline can conceivably be attributed to capture of contaminant mass by the Site extraction systems (SVE and P&T systems). However, a major portion of this contaminant reduction can probably be attributed to WAGNN, which opened the Community Drive well field in the summer of 2000, thereby reducing their dependence on the Water Mill Lane well field in recent years. The subsequent decrease in pumping rates at the Water Mill Lane well field probably resulted in decreased transport of PCE contamination.

With the limited pumping of the Water Mill Lane well field, the EPA P&T system, which averages an extraction rate of 65 gallons per minute (gpm), was allowed to capture a substantial portion of the contaminant plume (at concentrations of 1 ppm PCE and above).

WAGNN has made available to Earth Tech analytical data from pumping wells # 2A and # 9. These two wells historically show consistent PCE contamination. PCE concentrations have ranged from 1.4 ppb to 69 ppb at pumping well # 2A and from 0.7 ppb to 340 ppb at pumping well # 9 (Table 1 through Table 5 of the HI OU-1 report).

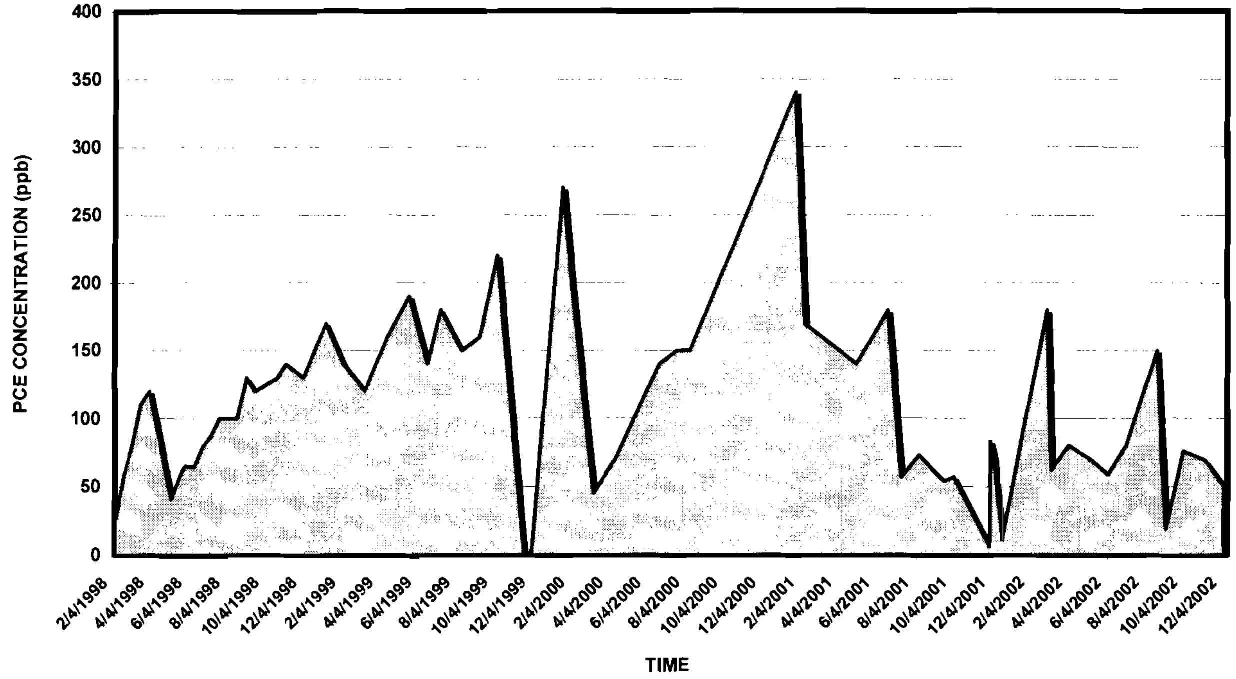
The following is a graphic showing the PCE concentration trend over time at pumping well # 2A.



PCE CONCENTRATION TREND
FROM 1998 TO 2002
AT PUMPING WELL # 2A LOCATED IN THE WAGNN PROPERTY

The following is a graphic showing the PCE concentration trend over time at pumping well # 9.

PCE CONCENTRATION TREND
FROM 1998 TO 2002
AT PUMPING WELL # 9 LOCATED IN THE WAGNN PROPERTY



Both graphs shows an upward PCE concentration trend in early 2001 and a steady decrease thereafter. Portable pump and treat systems were intermittently operational at Stanton Cleaners Site prior to 2001 and in September 2001 the permanent extraction and treatment system (P&T System) began operations. The P&T System has treated approximately 45 million gallons to date.

1.6 Report Organization

This OU-2 Summary Investigation Report is organized such that the step-by-step approach to meeting the project goals may be reviewed in an orderly manner, as follows:

- Section 1.0 (Introduction) presents the relevant background information concerning past and present status of the SCA Site, a summary of Previous and Current Investigation Activities, as well as the focus of the OU-2 Investigation Summary Report;
- Section 2.0 presents a summary of the investigation activities performed to meet the project objectives, which are documented in Sections 3.0 and 4.0;
- Section 3.0 presents information on the Regional Geology and Hydrogeology;
- Section 4.0 presents a summary of Spill Investigation Activities at Off-Site Sources;
- Section 5.0 presents a Summary of the Nature and Extent of Contamination;
- Section 6.0 presents a Summary of Findings and Recommendations; and

- Section 7.0 presents the conclusions derived from all aspects of the OU-2 Investigation.

2.0 INVESTIGATION

The objective of the OU-2 Investigation Summary Report was to determine if there are additional potential sources of PCE contamination impacting the public water supply wells located at the WAGNN Watermill Lane well field.

Information for the OU-2 Investigation Summary Report was generated as an integral part of the field work for the OU-1 HI. The OU-2 Investigation was conducted in accordance with the scope of work (SOW) presented in the work plan and delivery order(s) to Earth Tech, Inc. The data generated for this OU-2 Investigation Summary Report was from field investigation activities conducted between September 1999 and October 2002. These activities included installing and sampling of soil borings, monitoring and extraction wells; collecting groundwater elevation and flow data; and performing a detailed background search of potential sites where petroleum hydrocarbons and/or hazardous materials spills have occurred. Investigation areas and field activities were approved and observed by the U.S. EPA On-Site Coordinator (OSC) and Remedial Project Manager (RPM).

Quality Assurance/Quality Control (QA/QC) measures were performed in accordance with the approved *Sampling Quality Assurance Project Plan* (QAPP) (Earth Tech, January 2001) including the Work Plan (and Addendums) and Sampling and Analysis Management Plan (SAMP). Health and safety procedures were conducted in accordance with the approved *Site Specific Health & Safety Plan* (HASP) (Earth Tech, July 23, 2001).

EPA wells were installed for the OU-2 Investigation Summary Report as part of this Scope of Work (SOW) and included two shallow, four intermediate, and two deep Upper Glacial Aquifer monitoring wells. Details regarding these wells are presented in Section 3.3.1 and in Table 1 of the HI OU1 (June 2003).

This investigation procured and utilized the services of the U.S. EPA Region II Removal Action Branch (RAB); U.S. EPA Region II New York Remediation Branch; U.S. EPA Environmental Response Team (ERT), U.S. EPA ERT/REAC; U.S. EPA Region II Division of Environmental Science and Assessment (DESA); Emergency and Rapid Response Services (ERRS) contractor Earth Tech, Inc.; U.S. EPA Region II Superfund Technical Assessment and response Team (START)/Removal Support Team (RST) contractor, Weston Solutions (formerly Roy F. Weston); U.S. EPA Contract laboratory Program (CLP); U.S. EPA Region II, DESA-Edison Laboratory; and private laboratories.

All field work was performed in accordance with provisions of the EPA approved, Earth Tech Drilling Work Plan (January 10, 2001), QAPP (January 2001), and Site-specific HASP (January 23, 2001); as well as Site-specific plans developed by U.S. EPA-ERT/REAC; U.S. EPA Region II DESA; and U.S. EPA Region II START and RST.

The following areas of OU-2 were targeted and evaluated:

1 Fenley Amoco Gas Station (Amoco A), an inactive site located at 500 Great Neck Road.
2 Mayflower Cleaners (Mayflower), an active site located at 489 Great Neck Road .
3 Citizen's Development Company (CDC) a.k.a. Flower Fashion, a.k.a. Cleanland Drive-in Cleaners, an inactive site located at 47 Northern Boulevard.
4 Active Amoco Gas Station (Amoco B), an active site located at 133 Cutter Mill Road.
5. Jonathan's Auto Repair Shop (Auto Repair), an inactive site located at 294 Great Neck Road.

The boundary defined for the OU-2 investigation was from Northern Boulevard to the south, the Water Authority of Great Neck North (WAGNN) wells to the north, Great Neck Road to the east, and Little Neck Bay to the west.

A full description of field activities and technical approach is included in the Draft Final HI OU-1 Report, issued June 2003.

2.1 Field Investigation

To augment the existing monitoring well network, EPA installed a total of 11 additional monitoring wells, 6 intermediate upper glacial (CL-1, CL-2, CL-3, CL-4S, EPA-MW-30, and EPA-MW-32); 2 shallow upper glacial (EPA-MW-31 and EPA-MW-33); and 3 deep upper glacial (CL-1D, CL-4D and EPA-MW-29). The location of each monitoring well is shown on Figure 2.

The EPA-MW designated wells were drilled utilizing Rotosonic™ drilling techniques which utilizes ultrasonic vibrations to advance a core pipe to the target depth. In general, the Rotosonic™ drilling rig first advances a four-inch-diameter core barrel for soil sampling. Upon reaching the desired depth or the end of the stroke, an outer six-inch-diameter casing is advanced to the same depth. Then the core barrel and rods are removed. The four-inch core is displaced from the core barrel by using a low vibration and is contained in a clear plastic tube. The core tube is then placed in a trough for examination, logging, and sampling. Once the core is removed, the core barrel and rods are lowered back to the bottom of the hole. Another rod is added and the system is ready to advance again. The outer casing prevents cross contamination and formation mixing and allows for controlled placement of well installation materials.

The EPA - CL designated monitoring wells were drilled using conventional mud-rotary drilling methods employing a nominal 8-inch drilling bit. Monitoring wells were constructed using ten foot section of 4-inch inner diameter (ID) Schedule 40, 0.020-inch slot polyvinyl chloride (PVC) well screen (set at the base of the well) attached to an appropriate length of 4-inch ID Schedule 40 PVC casing (extending from above the top of the well screen to the ground surface).

All soil samples were classified in the field by the project hydrogeologist in accordance with the Unified Soils Classification System (USCS) and applicable American Society for Testing and Materials (ASTM) D 2488 procedures. Lithologic data were recorded on Test Boring Reports which are provided in Appendix A, Draft Final HI OU-1 Report, issued June 2003.

Soil descriptions included, in order of description: moisture content; color; grain size (most abundant to least abundant); angularity; and other pertinent textural or mineralogical properties. Soil descriptions were used to assess Site-specific geologic and hydrogeologic properties. A USCS field classification name was applied to all soil samples collected [e.g., Poorly-Graded Sand (SP)].

2.2 Hydrogeologic Characterization

2.2.1 Monitoring Well Installation

Wells installed as part of this OU-2 investigation included the following:

Well ID	Aquifer	Installation	Installed By
CL-1S	IUG	5/3/99	U.S. EPA ERTC
CL-1D	DUG	5/3/99	U.S. EPA ERTC
CL-2	IUG	5/11/99	U.S. EPA ERTC
CL - 3	IUG	5/11/99	U.S. EPA ERTC
CL - 4S	IUG	5/11/99	U.S. EPA ERTC
CL - 4D	DUG	5/11/99	U.S. EPA ERTC
EPA-MW - 29	DUG	11/29/00	Earth Tech/Miller Drilling
EPA-MW - 30	IUG	12/1/00	Earth Tech/Miller Drilling
EPA-MW - 31	SUG	11/14/00	Earth Tech/Miller Drilling
EPA-MW - 32	IUG	11/28/00	Earth Tech/Miller Drilling
EPA-MW - 33	SUG	12/4/00	Earth Tech/Miller Drilling

NOTES: SUG – Shallow Upper Glacial; IUG – Intermediate Upper Glacial; DUP – Deep Upper Glacial; Please see Table 1 of the HI OU-1 for a complete summary of monitoring wells installed at the site during this investigation, as well as during previous investigations.

Additional monitoring wells were installed in the SCA to define the extent of impacted groundwater and soils. Figure 2 show the location of the EPA OU-2 wells. Two monitoring wells down-gradient of the SCP (EPA-MW-31, and –33) were installed to provide lithological data and to further define the extent of contamination in the shallow Upper Glacial Aquifer. To provide additional lithologic, water quality, and water level data from the intermediate Upper Glacial Aquifer, three down-gradient monitoring wells (CL-3, and –4S and EPA-MW-32) were installed. Finally, three down-gradient monitoring wells (CL-1D and –4D and EPA-MW-29) were installed to provide lithology and analytical data for the deep Upper Glacial Aquifer. The lithologic/analytical information from previous investigations along with the recent work was utilized in the OU-1 Hydrogeologic Investigation Report to generate cross-sections and provided the necessary data for the groundwater flow and transport model (please refer to OU-1 HI Report).

Each 2-inch diameter monitoring well was constructed inside a nominal six-inch-diameter outer drill rod. Monitoring well construction information is listed in Table 1 of the HI OU-1. The monitoring wells consisted of two-inch PVC materials. The screen length was 10 ft and consisted of two-inch diameter schedule 40 PVC wire wrapped screen with 0.010-inch slot size. The riser sections were two-inch diameter schedule 40 flush threaded PVC. Following drilling, the well casing/screen assembly was inserted to the appropriate depth. PVC centralizers were placed one foot above the screen and at 20-foot intervals where possible along the riser casing.

A filter pack (#1 FilterSil) was placed around the screen by free pouring through the open casing. The filter pack consisted of clean, inert, sorted silica sand that is appropriate for the formation and slot size of the screen. The filter pack extended two to three feet above the top of the well screen. The filter pack level was verified by tag-line measurement during emplacement. The volume of filter pack versus the theoretical annular volume was compared to verify proper placement of the filter pack.

A two to four feet thick bentonite pellet seal was placed immediately above the sand filter pack by free pour through the open casing. The level of the top of the bentonite seal was verified by tag-line measurement. Hydration of the bentonite pellets was allowed for one hour before installation of grout in the remaining annulus.

The grout was emplaced from the bottom of the borehole upward by pumping through a tremie pipe until the undiluted grout mixture returned at the ground surface. The grout mixture typically consisted of a 13.5- to 14-pound-per-gallon cement slurry with two-percent sodium-bentonite powder. The grout was allowed to cure for at least 24 hours prior to development. The wellheads were completed as flush mounts with locking protective covers.

2.2.2 Well Development

Upon completion of all monitoring wells, the wells were developed to ensure that they produced relatively clear, sediment-free, representative groundwater samples. A minimum 24-hour period was observed between well completion (grouting) and development to ensure the stability of the well.

Each well was developed by surging and pumping. Development continued until groundwater was reasonably sand free, turbidity was reduced, and pH and specific conductance were stabilized to within 0.2 standard units and 10%, respectively. Well development logs are included in Appendix B of the OU-1 HI Report.

2.2.3 Well Sampling

Collection of groundwater samples from monitoring wells was necessary to characterize the nature and extent of contamination. Low-Stress (Low-Flow) purging and sampling was performed for all groundwater sampling events, as per the U.S. EPA Region II March 1998 Low-Stress (Low-Flow) approved groundwater Standard Operating Procedure (SOP). The purpose of this SOP is to define the requirements for the collection of groundwater samples using the low-flow purge and sample method. Because of concerns about turbidity in the wells, and the effects of turbidity on metals sampling results, the low-flow purge and sample method was used. The low-flow purge and sample method creates less disturbance and agitation in the well, and therefore excess turbidity is not generated during the purging and sampling process. The result is a more rapid stabilization of turbidity and other parameters (pH, temperature, specific conductivity, dissolved oxygen (DO), and Eh), and a sample more representative of conditions in the formation from which the sample is collected.

2.3 Soil Characterization

During this investigation, 35 subsurface soil samples (not including QA/QC samples) were collected from borings installed as part of the monitoring well installation program. The purpose of these installations was to further define potential sources areas of PCE and to characterize the subsurface lithology.

Soil samples were collected from all EPA-MW designated wells installed as part of this investigation. Soil samples were not collected at EPA-CL designated wells. Subsurface soil samples were collected through the core barrel of the Rotosonic™ drilling rig. The four-inch core was displaced from the core barrel by using low vibration and the core was then contained in a clear plastic tube. The core tube was subsequently placed in a trough for examination, logging, and sampling.

Subsurface soil boring location and depth were designated by the following nomenclature: designated agency (e.g., EPA); type of well installed (e.g., -MW for a monitoring well); location number (e.g. -23 or -02) and sample depth (e.g., -20 for 20 ft).

Subsurface soil boring samples were collected by the U.S. EPA Region II Superfund Technical Assessment and Response Team (START) and Removal Support Team (RST) contractor, Weston Solutions (formerly Roy F. Weston), for each of the soil borings drilled during this Site investigation. Sample locations were selected based upon headspace readings and observed changes in lithology, (i.e., fine grain units). The subsurface soil samples were collected utilizing the EnCore® sampling method to minimize the loss of volatiles in accordance with the Sampling Quality Assurance Project Plan (QAPP) (Earth Tech, January 2001). Each EnCore® sampler cartridge was manually driven into the soil at the sampling depth. The EnCore® samplers were labeled, sealed in a zip-lock bag, and stored on ice in a cooler. Analysis of the Encore® samplers was through the U.S. EPA Contract Laboratory Program (CLP).

2.4 Groundwater Characterization

Water quality sampling was performed in accordance with provisions of the EPA approved, Earth Tech Drilling Work Plan (January 10, 2001), QAPP (January 2001), and Site-specific Health and Safety Plan (HASP) (July 23, 2001), as well as Site-specific plans developed by U.S. EPA Environmental Response Team/ Response Engineering Analytical Contract (ERT/REAC); U.S. EPA Region II Division of Environmental Science and Assessment (DESA); and U.S. EPA Region II START and RST. All rounds of groundwater samples were analyzed for TCL VOCs, with selected wells during the April 2000 and January 2001 events analyzed for full analysis (see OU-1 HI Report, Section 3.8.2).

Established EPA sampling protocols, analytical methods, and QA/QC procedures were followed. Field measurements of DO and oxidation-reduction potential (ORP) were collected at each well during sampling. This information was used to determine where degradation should be included in the groundwater flow and transport model. The QAPPs for all sampling under this study were prepared by the START and/or RST contractor under separate cover.

2.5 Investigation-Derived Waste Management

All Investigation-Derived Waste (IDW) was managed in accordance with applicable state and federal regulations. During all field operations, solid IDW (i.e., drilling spoils) was contained in a lined 20-yard roll-off container. Aqueous IDW was initially contained in two, portable, 500 gallon polytanks and subsequently transferred to the EPA Mobile Groundwater Treatment Trailer, where it was treated through mechanical filtration, air stripping (with vapor phase GAC for off-gas treatment). and final polishing through aqueous phase GAC prior to discharge through the storm sewer system. Analytical testing was performed on representative discharge samples as part of the monitoring for the U.S. EPA P&T System, NYSDEC discharge equivalency permit.

2.6 Site Surveying

Upon completion of the monitoring well construction work, all new and existing wells were surveyed for horizontal location, land surface elevation, and top of casing elevation. Horizontal control was performed to within 1 ft and vertical within 0.01 ft. The work was completed in state plane coordinates with the elevations in mean sea level (msl). Bench Mark 02E16N was utilized as the control point.

2.7 Analytical Testing

This investigation utilized the analytical services of the U.S. EPA ERT/REAC laboratory; U.S. EPA Region II DESA-Edison Laboratory; U.S. EPA CLP; and/or private laboratories procured through ERRS and U.S. EPA Region II START and RST contractors.

The following table summarizes the laboratories used during this investigation. Analytical Laboratory Certificates of Analysis are provided in Appendices C and D of the HI OU-1 for groundwater samples and soil samples, respectively.

Laboratory	Sampling Events
STL – Buffalo	September 1999 Groundwater Sampling
GPL Laboratories, LLLP	February 2000, March 2000, and April 2000 Groundwater Sampling
Mitkem Corp.	January 2001 Groundwater Sampling (VOCs, SVOCs, and Pesticides Only)
Compuchem (Liberty)	January 2001 Groundwater Sampling (Metals Only)
Shealy Environmental	October 2001 Groundwater Sampling
U.S. EPA Region II DESA Lab	September 2002 Groundwater Sampling
Compuchem (Liberty)	November 2000 Soil Sampling
American Analytical & Technical Services (SWL – Tulsa)	December 2000 Soil Sampling
Mitkem Corp.	April 2003 Groundwater Sampling

QA/QC samples were prepared for all sampling events and included deionized water blanks, daily field blanks, and trip blanks. Field and deionized water blanks were submitted for full TCL analyses. Trip blanks were submitted for volatile organic analyses only.

2.7.1 Soil

Soil samples were analyzed for Target Compound List (TCL) VOCs (EnCore® SW846 Method 8260 and 5035) for both the February 2000 and November/December 2000 monitoring/extraction well installation and soil boring programs. Soil samples were also collected from the two up-gradient wells (EPA-MW-26 and -28) for TOC Analysis (SW846 Method 9060).

2.7.2 Groundwater

All rounds of groundwater samples were analyzed for TCL VOCs (EPA Method 524.2, or OLM0 4.2), with selected wells during the April 2000 and January 2001 groundwater events analyzed for full analysis in accordance with the *U.S. EPA CLP SOW for Organic Analysis, Multi-media, Multi-concentration OLM0 4.2* and *U.S. EPA CLP SOW for Inorganic Analysis, Multi-media, Multi-concentration ILM0 4.0*

The following table summarizes information regarding all the groundwater sampling events conducted during this investigation.

Sampling Event	Contractor	Parameters Sampled	Wells Sampled	
September 1999	START /Weston	VOCs	EPA-EXT-01 EPA-MW-9A EPA-MW -11D, EPA -SPARGE-02 ST-MW-09 ST-MW –11 ST-MW –19	CL-1D CL -1S, CL-2 CL-3 CL-4D CL-4S
February 2000	Earth Tech	VOCs	ST-AM-03, ST-MW-01 ST-MW-02 ST-MW-06 ST-MW-09 ST-MW–12 ST-MW-13 ST-MW-14	ST-MW-15 ST-MW-16 ST-MW-17 ST-MW-18 ST-MW-19 ST-MW-20, ST-IW-01
April 2000	Earth Tech	VOCs SVOCs TAL Metals Pesticides	CL-1S CL-1D CL-3 CL-4S CL-4D EPA-MW-21 EPA-MW-22	EPA-MW-23 EPA-MW-24 EPA-MW-25 EPA-MW-26 EPA-MW-27 EPA-MW-28
January 2001	U.S. EPA/ DESA	VOCs SVOCs TAL Metals Pesticides	EPA-MW-9A EPA-MW-22 EPA-MW-23 EPA-MW-24 EPA-MW-25 EPA-MW-26 EPA-MW-27 EPA-MW-29 EPA-MW-30 EPA-MW-31 EPA-MW-32 EPA-MW-33	ST-AM-3 ST-AM-4 ST-MW-02 ST-MW-11 ST-MW-12 ST-MW-14 ST-MW-15 ST-MW-16 ST-MW-18 ST-MW-19 ST-MW-19
October 2001	U.S. EPA/ DESA	VOCs	CL-1S CL-1D CL-3 CL-4S CL-4D CW-1 CW-2 FN-3	EPA-EXT-03 EPA-MW-29 EPA-MW-31 EPA-MW-33 ST-AM-3 ST-AM-4 ST-MW-19
September 2002	U.S. EPA/ DESA	VOCs	EPA-MW-21 EPA-MW-22 EPA-MW-23 EPA-MW-25 EPA-MW-26 EPA-MW-27 EPA-MW-28	EPA-MW-29 EPA-MW-30 EPA-MW-31 EPA-MW-32 EPA-MW-33 ST-MW-19

Sampling Event	Contractor	Parameters Sampled	Wells Sampled	
April 2003	U.S. EPA/ RST	VOCs	EPA-EXT-01 EPA-EXT-03 EPA-MW-9A EPA-MW -11D, CL-1D CL -1S, CL-3 CL-4D CL-4S FN-3 CW-01 CW-02 ST-MW-02 ST-MW-06 ST-MW-09 ST-MW-11 ST-MW-12 ST-MW-13 ST-MW-14	ST-MW-15 ST-MW-16 ST-MW-17 ST-MW-18 ST-MW-19 ST-MW-20 ST-MW-21 ST-MW-22 EPA-MW-23 EPA-MW-25 EPA-MW-26 EPA-MW-27 EPA-MW-28 EPA-MW-29 EPA-MW-30 EPA-MW-31 EPA-MW-32 EPA-MW-33

2.8 Data Validation

Earth Tech, START/RST, and U.S.EPA DESA performed independent QC checks of both field and laboratory procedures that were used for all groundwater sampling events. Analytical data collected during the January 2001, October 2001, and September 2002 groundwater sampling events was validated by the U.S. EPA DESA/Regional Sampling Control Center (RSCC). The QC checks verify that the data collected are of appropriate quality for the intended data use and that the Data Quality Objectives (DQOs) were met. The analytical procedures, where appropriate, were validated with respect to the EPA CLP *Laboratory Data Validation Functional Guidelines for Evaluating Organics Analysis* (EPA-540/R94-082) and *Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analysis* (EPA-540/R94-083).

Data validation and data assessment corrective action was performed in accordance with the *U.S. EPA Region II SOP No. HW-6: CLP Organics Data Review and Preliminary Review* and *HW-2 R11* for Inorganics (CLP/SOW OLM0 4.2 and CLP/SOW ILM0 4.0); and the *U.S. EPA Region II CERCLA Quality Assurance Manual.*

2.9 Data Management

Data generated under this document was evaluated according to the appropriate criteria contained in the Removal Program Data Validation Procedures which accompany OSWER Directive #9360.4-1 and in accordance with U.S. EPA Region II guidelines.

3.0 REGIONAL GEOLOGY AND HYDROGEOLOGY

This section summarizes regional geology and hydrogeology in the vicinity of the Stanton Cleaners Site. Please refer to OU-1 HI Report for additional information.

3.1 Regional Geology

Long Island's geology is composed of a sequence of unconsolidated glacial, lacustrine, deltaic, and marine deposits of clay, silt, and gravel that range in age from Upper Cretaceous to Pleistocene (Figures 3, 4A, and 4B). These deposits overlay a Precambrian to Paleozoic crystalline bedrock. In the region of Nassau County where the SCA is located, the thickness of the unconsolidated deposits is approximately 500 feet.

The Raritan formation overlies the crystalline bedrock surface and includes the Lloyd Sand Member and the Unnamed clay member. The Lloyd sand member has a maximum thickness of 500 feet and consists of fine to coarse sand and gravel, commonly with a clayey matrix. Some lenses and layers of solid and silty clay are included. The Lloyd locally has a gradational contact with the overlying Unnamed clay unit (Raritan clay). The Unnamed clay member known as the Raritan confining unit has a maximum thickness of 200 ft and consists of clay, solid and silty, with few lenses or layers of sand and gravel. An Unconformity separates the Unnamed clay unit from the Magothy Formation above.

The Magothy Formation has a maximum thickness of 1100 feet and consists of fine to medium sand, clayey in parts inter-bedded with lenses and layers of coarse sand and sandy clay. Gravel is common in the basal zone. An Unconformity separates the Magothy from the Pleistocene glacial deposits (Upper Glacial Formation).

The Upper Glacial Formation has a maximum thickness of 340 feet and consists of glacial till, unsorted clay, sand, gravel and boulders. Outwash deposits of stratified brown sand and gravel are also present in the Upper Glacial Formation.

3.2 Regional Hydrogeology

The aquifers underlying the OU-2 area are comprised of coastal-plain deposits of continental and marine origin of Late Cretaceous age overlain by unconsolidated glacial deposits of Pleistocene age. These deposits are underlain by bedrock of Lower Paleozoic and/or Precambrian age. The elevation of the top of bedrock is at –419 ft msl, which is approximately 500 feet below the Site, is virtually impermeable, and forms the base of the groundwater reservoir.

The Lloyd Aquifer overlays the crystalline bedrock and is poorly to moderately permeable. The Lloyd is located at about –273 ft msl approximately 350 ft below the Site and is the major regional drinking water aquifer with well yields of 1,600 gallons per minute (gal/min) and specific capacities of 10 to 20 gal/min per foot of drawdown. The Lloyd has been intruded by salty groundwater from over pumping, locally in necks near the north shore, where the aquifer is shallow and overlying clays are discontinuous.

The Raritan clay located at –223 ft msl (approximately 300 feet beneath the Site), and constitutes a confining unit for the Lloyd Aquifer preventing the impact by contaminants from the overlying deep Upper Glacial formation. The average vertical hydraulic gradient of the Raritan is approximately 0.0001 feet per day (ft/day).

The deep Upper Glacial Aquifer constitutes the principal aquifer for public-supply in eastern Queens, most of Nassau, and western/central Suffolk counties. Wells screened in the basal zone of the aquifer yield as much as 1,400 gal/min. Specific capacities commonly range from 15 to 30 gal/min per foot of drawdown. The deep Upper Glacial has also been invaded by salt water from over pumping locally in southwestern Nassau and southern Queens county and in small areas along the north shore. Hydraulic continuity may exist between the deep Upper Glacial Aquifer and the shallow/intermediate Upper Glacial Aquifer across the North Shore confining unit. The North Shore confining unit is approximately 20 to 30 ft thick and is encountered at 120 to 145 ft (-65 ft msl).

The Upper Glacial Aquifer constitutes the surface aquifer and is composed of glacial till and outwash deposits. The till is relatively impermeable and may cause local perched aquifers and impede downward movement of precipitation. However the outwash deposits of sand and gravel are highly permeable and wells screened in these deposits can yield as much as 1,400 gal/min. The Upper Glacial Aquifer has been impacted by industrial and municipal activities and is vulnerable to impacts by contaminants.

4.0 SPILL INVESTIGATION ACTIVITIES AT OFF-SITE SOURCES

The Operable Unit 2 (OU-2) Summary Report includes the environmental investigative history of five properties (Figure 1) with petroleum hydrocarbons and/or hazardous materials spills within the vicinity of the Stanton Cleaners Area Groundwater Contamination Site and The Water Authority of Great Neck North (WAGNN) facility in Great Neck, Nassau County, New York. These five properties are:

1. Fenley Amoco Gas Station – 500 Great Neck Road - (Spill # 82-00157);
2. Mayflower Cleaners – 489 Great Neck Road - (Site ID # 1-30-068);
3. Citizen's Development Company (CDC) – 47 Northern Boulevard - (Site ID # 1-30-070);
4. Active Amoco Gas Station – 133 Cutter Mill Road - (Spill #92-08119); and
5. Jonathan's Auto Repair Shop – 294 Great Neck Road – (Spill # 90-02024/ and # 00-09365).

4.1 Fenley Amoco Gas Station Site (Spill #82-00157)

The Fenley Amoco Gas Station was located at 500 Great Neck Road at the intersection of Northern Boulevard and Great Neck Road (see Figure 5). The site is designated by the NYSDEC Spill # 82-00157. Fenley Amoco is positioned approximately 2,500 feet hydraulically up-gradient of the WAGNN Watermill Lane well field, and approximately 100 feet up-gradient of the Mayflower Cleaners Site (see Section 4.3). The primary contaminants of concern are benzene, toluene, ethylbenzene and xylene (BTEX) and methyl –tertiary –butyl ether (MTBE). NYSDEC is the regulatory lead on this inactive site, which operated as a gasoline station until the early 1990's. During its operation, a gasoline spill occurred.

In October 1999, the NYSDEC transferred the site from Fenley and Nicol Environmental (F&N) to J.N.M. Environmental, Inc. (JNM). JNM documented a gasoline spill at the site with BTEX contamination in the soil and groundwater. Analytical data also indicates that PCE) , trichloroethene (TCE), and 1,2-dichloroethane (1,2-DCA) concentrations were in wells that surround the Mayflower Dry Cleaners facility located across the street from the Amoco Station at 489 Great Neck Road (Figure 1).

The present day monitoring well network at the site consists of 5 wells installed by JNM (MW-1 through MW-5), 20 monitoring wells installed by F&N (2, 4A, 5, 14, 15, 17, 22, 23, 26, 34, 37, 42, 50, FN 1, FN 2, FN 3, FN 4, FN 6, FN 7, FN 8); two recovery wells (RW 1, and RW 2); and 3 well clusters (CW 1, CW 2, and CW 3) also installed by F&N (Figure 5).

In December 1988, in response to an NYSDEC directive, Amoco installed a P&T system to address the groundwater contamination including MTBE (an unleaded additive) and various VOCs (BTEX compounds). In order to advance the cleanup, an SVE system was installed in October 1991 and operated until December 1992 to address VOCs in the soils surrounding the site. These two treatment systems were intended to address the soils and groundwater contamination along the western side of Great Neck Road to several hundred feet down-gradient of the source of the spill. In June 1997, however, the P&T system was shut down after an evaluation of its operations showed that the source contamination area was not being effectively remediated (1).

In the 2000 Quarterly Report (Appendix A), JNM Environmental submitted to the U.S. EPA groundwater analytical data for wells downgradient of the Fenley Gas Station and around the Mayflower Cleaners facility which is located across the street. This report included monitoring well data from:

- 1997 (January 21, April 24, and October 20);
- 1998 (February 4, May 20, August 12, and November 30); and
- 1999 (March 25, July 2, and October 5-18).

Also included in this April 2000 Quarterly Report is analytical data from seven borings downgradient of the Fenley Gas Station around the Mayflower Cleaners facility (2).

In the April 2000 Quarterly Monitoring Report (Appendix A), several wells contained PCE (solvent commonly used in dry cleaning facilities) and its degradation products TCE, DCE, and DCA, in addition to predominant BTEX contaminants and MTBE. The sampling dates covered in this report are January 18-24, April 21 – 27, July 12 – 17, and October 19 – 25, 2000.

In the Summary Report – January 2001 – June 2002 (Appendix A), submitted in January 2003 to the U.S. EPA, JNM reports quarterly groundwater sampling results for the following groundwater sampling events:

- 2001 (January 18-24 and March 30-April 3, May 1- 8)and
- 2002 (February 27-March 20, June 20-26, and September 9-11).

The Summary Report – January 2001 – June 2002 includes analytical data for MTBE, BTEX, and Halogenated Organic Compounds (3).

4.1.1 History of Groundwater Analytical Results

The following section summarizes groundwater analytical results from 1997 to 2002. The analytical data reviewed is from the reports listed in section 4.1 and provided by JNM Environmental, Inc.

4.1.1.1 Groundwater Chemistry: 1997

The following is a summary of BTEX and MTBE concentration ranges in groundwater throughout three sampling events that took place in 1997 (January 29, April 24, and October 29). The analytical data reviewed in this section is from an April 2000 Quarterly Report J.N.M. Environmental, Inc. submitted to the U. S. EPA.

Compound	MCL (ppb)	Concentration Range (ppb)
Benzene	5	<0.5 - 29,700
Toluene	1,000	<0.5 - 372,439
Ethylbenzene	700	<0.5 - 14,027
Xylenes	10,000	<0.5 - 199,078
MTBE	-	<0.5 - 311

A total of 14 wells, 17 wells, and 15 wells were sampled in January 29, 1997, April 24, 1997, and October 29, 1997 respectively. Throughout these three groundwater sampling events, 13 monitoring wells exceeded one or more of the federal maximum contaminant limits (MCLs) of 5 ppb, 1,000 ppb, 700 ppb, and 10,000 ppb for Benzene, Toluene, Ethylbenzene, and Xylenes respectively. These monitoring wells were (Figure 5 – Well Location Map):

- January 29, 1997 – wells #14, #26, #37, FN2, FN4, FN6, RW1, and RW2;
- April 24, 1997 – wells #5, #15, #23, #37, FN2, FN3, FN4, and FN6; and
- October 29, 1997 – wells #15, #23, #26, #34, FN3, FN6, and RW2.

The highest concentrations of Benzene (29,700 ppb), Toluene (372,439 ppb), Ethylbenzene (14,027 ppb), Xylene (199,078 ppb), and MTBE (311 ppb) were all detected at monitoring well #23 during the April 24, 1997 sampling event. A table summarizing analytical results from all the monitoring wells is provided in Appendix A.

No halogenated organic compounds data was provided as part of these groundwater analytical sampling events in 1997.

4.1.1.2 Groundwater Chemistry: 1998

The following is a summary of BTEX and MTBE concentration ranges in groundwater throughout four sampling events that took place in 1998 (February 4, May 29, August 12, and November 30). The analytical data reviewed in this section is from an April 2000 Quarterly Report J.N.M. Environmental, Inc. submitted to the U. S. EPA.

Compound	MCL (ppb)	Concentration Range (ppb)
Benzene	5	<0.5 - 5,348
Toluene	1,000	<0.5 - 12,008
Ethylbenzene	700	<0.5 - 3,085
Xylenes	10,000	<0.5 - 13,604
MTBE	-	<0.5 - 544

A total of 14 wells, 21 wells, 17 wells, and 17 wells were sampled in February 4, 1998, May 29, 1998, August 12, 1998, and November 30, 1998 respectively. Throughout these four groundwater sampling events, 17 monitoring wells (two of these wells, W4 and W5, are part of the Citizen's Development Company Site monitoring well network and are located in that property) exceeded one or more of the federal MCLs of 5 ppb, 1,000 ppb, 700 ppb, and 10,000 ppb for Benzene, Toluene, Ethylbenzene, and Xylenes respectively. These monitoring wells were (Figure 5 – Well Location Map):

- February 4, 1998 – wells FN-3, FN4, FN6, and RW2;
- May 29, 1998 – wells #2, #4, #15, #23, #26, FN2, FN4, and FN6;
- August 12, 1998 – wells #5, #15, #23, #26, FN-2, FN4, FN6, RW1, and RW2; and
- November 30, 1998 – wells #5, #15, #17, #23, #26, #34, #50, FN4, FN6, RW1, RW2, W4, and W5

The highest concentrations of Benzene (5,348 μg/L), Xylene (13,604 μg/L), and MTBE (544 μg/L) were detected at monitoring well FN2 during the May 29, 1998 sampling event. The highest concentrations of Toluene (12,008 μg/L) and Ethylbenzene (3,085 μg/L) were detected in well #2, also during the May 29, 1998 sampling event. A table summarizing analytical results is provided in Appendix A.

No halogenated organic compounds data was provided as part of these groundwater analytical sampling events in 1998.

4.1.1.3 Groundwater Chemistry: 1999

The following is a summary of BTEX and MTBE concentration ranges in groundwater throughout three sampling events that took place in 1999 (March 25, July 2, and October 5-18). The analytical data reviewed in this section is from an April 2000 Quarterly Report J.N.M. Environmental, Inc. submitted to the U. S. EPA.

Compound	MCL (ppb)	Concentration Range (ppb)
Benzene	5	<0.5 – 16,000
Toluene	1,000	<0.5 – 23,000
Ethylbenzene	700	<0.5 – 2,500
Xylenes	10,000	<0.5 – 10,800
MTBE	-	<0.5 – 1,300

A total of 18 wells, 16 wells, and 17 wells were sampled in March 25, 1999, July 2, 1999, and October 5-18, 1999 respectively. Throughout these three groundwater sampling events, 14 monitoring wells exceeded one or more of the federal MCLs of 5 ppb, 1,000 ppb, 700 ppb, and 10,000 ppb for Benzene, Toluene, Ethylbenzene, and Xylenes respectively. These monitoring wells were (Figure 5 – Well Location Map):

- March 25, 1999 – wells #14, #15, FN6, and RW-1;
- July 2, 1999 – wells #4A, #5, #14, #15, #17, #23, FN4, FN6, and RW2; and
- October 5-18, 1999 – wells #14, #22, #23, #26, #34, FN3, FN6, and RW1.

The highest concentrations of Benzene (16,000 ppb), Toluene (23,000 ppb), Ethylbenzene (2,500 ppb), Xylene (10,800 ppb), and MTBE (1,300 ppb) were detected in monitoring well #23 during the October 5-18, 1999, sampling event. A table summarizing analytical results is provided in Appendix A.

No halogenated organic compounds data was provided as part of these groundwater analytical sampling events in 1999.

4.1.1.4 Groundwater Chemistry: 2000

The following is a summary of PCE, TCE, DCE, DCA, BTEX, and MTBE concentration ranges in groundwater throughout four sampling events that took place in 2000 (January 18-24, April 21 – 27, July 12 – 17, and October 19 – 25). The analytical data reviewed in this section was provided in the April 2000 Quarterly Report (Appendix A) submitted to the U. S. EPA by JNM Environmental, Inc..

Compound	MCL (ppb)	Concentration Range (ppb)
PCE	5	<1 – 440
TCE	5	<1 – 240
DCE	70	<1 – 300
DCA	5	<1 - 180
Benzene	5	<1 – 19,000
Toluene	1,000	<1 – 44,000
Ethylbenzene	700	<1 – 9,400
Xylenes	10,000	<3 – 71,000
MTBE	-	<1 – 1,100

A total of 21 wells, 24 wells, 24 wells, and 18 wells were sampled January 18-24, 2000, April 21-27, 2000, July 12-17, 2000, and October 19-25, 2000 respectively. Throughout these four groundwater sampling events, 15 monitoring wells (four of these wells, W2, W4, W6, and W7, are part of the Citizen's Development Company Site monitoring well network and are located in that property) exceeded one or more of the federal MCLs of 5 ppb, 5 ppb, 70 ppb, and 5 ppb for PCE, TCE, cis-1,2-DCE, and 1,2-DCA respectively. These monitoring wells were (Figure 5 – Well Location Map):

- January 18-24, 200 – wells #14, MW1, MW3, W4, W7, FN3, FN6, and FN8;
- April 21-27, 2000 – wells #5, #14, #23, MW1, W2, W4, W7, FN4, FN6, and FN8;
- July 12-17, 2000 – wells #5, MW1, MW5, W2, W4, W6, W7, FN4, FN6, and FN8; and
- October 19-25, 2000 – wells #26B, #42, MW1, MW3, W2, W4, W6, W7, FN6, and FN8.

The highest concentration of PCE (440 µg/L) was detected at monitor well #5, and the highest concentration of TCE (240 µg/L) was detected at monitor well FN6, both during the January 18-24, 2000 sampling event. The highest DCE concentration was 300 µg/L at monitor well MW-1 during the July 12–17, 2000 sampling event, while the highest DCA concentration was 180 µg/L at monitor well #23 during the April 21 – 27, 2000 sampling event.

In addition, throughout these four groundwater sampling events, 20 monitoring wells (one of these wells, W2, is part of the Citizen's Development Company Site monitoring well network and is located in that property) exceeded one or more of the federal MCLs of 5 ppb, 1,000 ppb, 700 ppb, and 10,000 ppb for Benzene, Toluene, Ethylbenzene, and Xylenes respectively. These monitoring wells were (Figure 5 – Well Location Map):

- January 18-24, 2000 – wells #14, #15, #22, #34, #50, MW1, MW2, MW3, MW4, MW5, FN3, and FN6;
- April 21-27, 2000 – wells #4A, #5, #14, #15, #22, #23, #26B, #34, MW1, MW2, MW3, MW4, W2, FN4, FN6, and FN7; and
- July 12-17, 2000 – wells #4A, #5, #14, #15, #22, #23, #26B, #50, MW1, MW2, MW3, MW4, MW5, FN2, FN3, FN4, and FN6; and
- October 15-19, 2000 – wells #26B, MW1, MW2, MW3, MW4, MW5, FN3, FN4, and FN6.

The highest concentrations of Benzene (19,000 µg/L at monitoring well FN2) and Toluene (44,000 µg/L at monitoring well MW-3) were detected during the July 12 – 17, 2000, sampling event. The highest concentration of Ethylbenzene (9,400 µg/L) and Xylene (71,000 µg/L) were detected at monitoring well #15 during the January 18-24, 2000, sampling event. The highest MTBE concentration was 1,100 µg/L at monitoring well #23 during the April 27 – 27, 2000, sampling event.

Table 4-1, Table 4-2, Table 4-3, and Table 4-4 summarize the analytical results for the year 2000 groundwater sampling events. A Monitoring Well and Well Nest Location Map is included as Figure 3 in the attached April 2000 Quarterly Report (Appendix A) submitted to the U. S. EPA by JNM Environmental, Inc.

4.1.1.5 Groundwater Chemistry: 2001

The following is a summary of PCE, TCE, DCE, DCA, BTEX, and MTBE concentration ranges in groundwater throughout two sampling events that took place in 2001 [January 18-24 and March 30-April 3 (May 1- 8 was discrete interval sampling)]. The analytical data reviewed in this section was provided in the Summary Report – January 2001-June 2002, submitted to the U. S. EPA by JNM Environmental, Inc, and it is summarized in Table 4-5, Table 4-6, and Table 4-7.

Compound	MCL (ppb)	Concentration Range (ppb)
PCE	5	<1 - 1,100
TCE	5	<1 - 400
DCE	70	<1 - 880
DCA	5	<1 - 74
Benzene	5	<1 - 7,100
Toluene	1,000	<1 - 36,000
Ethylbenzene	700	<1 - 3,500
Xylenes	10,000	<3 - 18,400
MTBE	-	<1 - 160

A total of 19 monitoring wells were sampled January 18-24, 2001 and 19 monitoring wells in March 30-April 3, 2001. Throughout these two groundwater sampling events, 16 monitoring wells exceeded one or more of the federal MCLs of 5 ppb, 5 ppb, 70 ppb, and 5 ppb for PCE, TCE, cis-1,2-DCE, and 1,2-DCA respectively. These wells were (Figure 5 – Well Location Map):

- January 18-24, 2001 – wells #4A, #5, #14, #15, #17, #22, #23, #42, MW1, MW3, MW4, MW5, FN3, FN4, FN6, and FN8; and
- March 30-April 3, 2001 – wells #5, #14, #17, #22, #23, #42, MW1, MW4, FN4, FN6, and FN8.

The highest PCE concentration (1,100 µg/L at monitoring well FN6) and the highest DCE concentration (880 µg/L at monitoring well MW-1) were both detected during the March 30-April 3, 2001 sampling event. On the other hand, the highest TCE concentration (400 µg/L at monitoring well FN6) and the highest DCA concentration (74 µg/L at monitoring well MW-3) were both detected during the January 18-24, 2001 sampling event.

In addition, throughout these two groundwater sampling events, 19 monitoring wells exceeded one or more of the federal MCLs of 5 ppb, 1,000 ppb, 700 ppb, and 10,000 ppb for Benzene, Toluene, Ethylbenzene, and Xylenes respectively. These monitoring wells were (Figure 5 – Well Location Map):

- January 18-24, 2001 - #4A, #5, #14, #15, #22, #23, #26B, #50, MW3, MW4, FN3, FN4, and FN6; and

- March 30-April3, 2001 – wells #4A, #14, #15, #22, #50, MW1, MW2, MW3, MW4, MW5, FN3, and FN4.

The highest concentrations of Benzene (6,200 µg/L), Ethylbenzene (3,500 µg/L), and MTBE (120 µg/L) were detected in monitoring well MW3 during the March 30-April 3, 2001 sampling event. The highest Toluene concentration was 36,000 µg/L at monitoring well MW-2, also during the March 30-April 3, 2001 sampling event. . The highest Xylene concentration was 18,400 µg/L at monitoring well #15 during the January 18-24, 2001 sampling event.

A Source Area Detail Map illustrating monitoring well locations and well nests sampled is included in the attached Summary Report – January 2001-June 2002 (Appendix A) submitted to the U. S. EPA by JNM Environmental, Inc.

4.1.1.6 Groundwater Chemistry: 2002

The following is a summary of PCE, TCE, DCE, DCA, BTEX, and MTBE concentration ranges in groundwater throughout three sampling events that took place in 2002 [March 19-20, June 20- 26, and September 9-11(discrete samples were taken during the February 27-March 1 event)]. The analytical data reviewed in this section was provided in the Summary Report – January 2001-June 2002 submitted to the U. S. EPA by JNM Environmental, Inc, and is summarized in Table 4-8, Table 4-9, Table 4-10, and Table 4-11.

Compound	MCL (ppb)	Concentration Range (ppb)
PCE	5	<1 - 1,500
TCE	5	<1 - 310
DCE	70	<1 - 600
DCA	5	<1 - 70
Benzene	5	<1 - 5,200
Toluene	1,000	<1 - 49,000
Ethylbenzene	700	<1 - 6,400
Xylenes	10,000	<3 - 33,000
MTBE	-	<1 - 220

A total of 20 monitoring wells, 18 monitoring wells, and 18 monitoring wells were sampled in March 19-20, 2002, June 20-26, 2002, and September 9-11, 2002, respectively. Throughout these three groundwater sampling events, 15 monitoring wells exceeded one or more of the federal MCLs of 5 ppb, 5 ppb, 70 ppb, and 5 ppb for PCE, TCE, cis-1,2-DCE, and 1,2-DCA, respectively. These wells were (Figure 5 – Well Location Map):

- March 19-20, 2002 – wells #5, #14, #15, #17, #22, #42, MW1, MW5, FN4, FN6, and FN8;
- June 20-26, 2002 - #5, #14, #17, #22, #42, MW1, MW4, MW5, FN3, FN4, and FN6; and
- September 9-11, 2002 – wells #14, #15, #22, #26, #42, MW1, MW3, MW4, MW5, FN3, FN4, FN6, and FN8.

The highest detected PCE concentration was 1,500 µg/L at monitoring well FN6 during the June 20-26 and September 9-11, 2002 sampling events. The highest concentrations of TCE (310 µg/L at monitoring well FN6) and DCE (600 µg/L at monitoring well MW-1) were each detected during the June 20- 26, 2002 sampling event. On the other hand, the highest detected DCA concentration was 70 µg/L at monitoring well #15 during the March 19-20, 2002 sampling event.

In addition, throughout these three groundwater sampling events, 12 monitoring wells exceeded one or more of the federal MCLs of 5 ppb, 1,000 ppb, 700 ppb, and 10,000 ppb for Benzene, Toluene, Ethylbenzene, and Xylenes, respectively. These monitoring wells were (Figure 5 – Well Location Map):

- March 19-20, 2002 – wells #15, #23, #50, MW1, MW2, MW3, MW4, MW5, FN3, and FN4;
- June 20-26, 2002 – wells #14, #15, #23, #26, #50, MW1, MW2, MW4, MW5, FN3, and FN4; and
- September 9-11, 2002 – wells #14, #15, #23, #50, MW1, MW2, MW3, MW4, MW5, FN3, and FN4.

The highest detected concentrations of Benzene (5,200 μg/L) and MTBE (220 μg/L) were each detected in monitoring well #23 during the March 19-20, 2002 sampling event. The highest detected concentrations of Toluene (49,000 μg/L), Ethylbenzene (6,400 μg/L), and Xylene (33,000 μg/L) were each detected in monitoring well MW-2 during the March 19-20, 2002 sampling event.

A Source Area Detail Map that shows monitoring well locations and well nest sampled is included in the attached Summary Report – January 2001-June 2002 (Appendix A) submitted to the U. S. EPA by JNM Environmental, Inc.

4.1.2 History of Soil Analytical Results

This section summarizes the soil quality in samples collected from seven soil boring drilled by JNM from October 26, 1999 to November 1, 1999.

The following is a summary of petroleum concentration ranges detected in the seven soil borings. The analytical data reviewed in this section is from an April 2000 Quarterly Report submitted to the U. S. EPA by JNM Environmental, Inc.

Compound	TAGM (ppb)	Concentration Range (ppb)
Benzene	60	<5 - 51,000
Toluene	1,500	<5 - 930,000
Ethylbenzene	5,500	<5 - 950,000
Xylene	1,200	<5 - 790,000
MTBE	120	<5 - 34,000

There were a total of 16 Benzene detections, at different depths, that exceeded the Technical Administrative Guidance Memorandum (TAGM) value of 60 ppb. Benzene concentrations ranged from <5 ppb to 51,000 ppb at various locations and various depths. The highest benzene concentration was 51,000 ppb (at a depth of 38 to 40 feet in DB1), while the lowest detected benzene concentration was 350 ppb (at a depth of 34 to 36 feet in SB1). There were a total of 14 toluene detections, at different depths, that exceeded the TAGM value of 1,500 ppb. Toluene concentrations ranged from <5 ppb to 930,000 ppb at different locations and different depths with the highest toluene concentration detected in soil boring DB2 (930,000 ppb at a depth of 46 to 48 feet) and the lowest toluene concentration detected in soil boring DB2 (4.7 ppb at a depth of 42 to 44 feet). There were a total of 13 Ethylbenzene detections, at different depths, that exceeded the TAGM value of 5,500 ppb. Ethylbenzene concentrations ranged from <5 ppb to 950,000 ppb at various locations and various depths. The highest ethylbenzene concentration (950,000 ppb) was detected at soil boring DB1 (38 to 40 feet bgs) and the lowest ethylbenzene concentration (17 ppb) was detected at soil boring DB2 (42 to 44 feet) bgs. There were a total of 16 xylene detections, at different depths, that exceeded the TAGM value of 1,200 ppb. Xylene concentrations ranged from <5 ppb to 790,000 ppb at different locations and different depths. The highest xylene concentration was 790,000 ppb at soil boring DB2 and at a depth of 48 to 50 feet. The lowest detected Xylene concentration was 57 ppb at soil boring DB2 and at a depth of 42 to 44 feet. MTBE concentrations ranged from <5 ppb to 34,000 ppb at different locations and different depths. Soil Boring SB4 (36 to 38 feet bgs) had the highest detected MTBE concentration (34,000 ppb) while the lowest MTBE concentration was detected in soil boring SB2 (630 ppb) at a depth of 37 to 39 feet.

A summary of soil boring analytical results is provided in Appendix A. A Soil Boring Location Map is included in the attached April 2000 Quarterly Report (Appendix A) prepared by JNM Environmental, Inc.

4.1.3 Fenley Amoco Projected Remedial Approach

Recent investigation information from the period January 2000 to September 2002, provided by the NYSDEC at the Fenley Amoco Site has indicated elevated concentrations of BTEX (and MTBE) compounds still exist within the soil and groundwater resulting from the gasoline release, but that this contamination has reached an equilibrium and steady–state condition within the site boundaries and environment

Due to the limited success in remediating the spill source area at Fenley with a P&T system (operational December 1992 to June 1997, see Section 4.1), JNM Environmental, under the direction of the NYSDEC, developed a remedial system to address the remaining BTEX and MTBE contamination, as detailed in the January 2001 – June 2002 Summary Report, dated December 6, 2002 (3). This remedial system consists of a combination of air sparging (AS) and SVE/high vacuum (HiVac) extraction wells. At this time, a total of seven AS wells and three SVE/HiVac wells have been installed and are in the process of being tested. It is expected that this system will address the source of contamination for both the soils and the groundwater, thereby reducing the contamination migration pathway through the soil-groundwater interface.

As an integral part of this remediation approach, the NYSDEC has also installed numerous groundwater monitoring wells in this area and will install additional monitoring wells down-gradient of the existing well network to ensure effective plume capture and to prevent further contaminant migration.

Initiation of this remedial action has begun with field installation and testing of the remediation system (i.e., SVE extraction wells, etc.). In the January 2001 – June 2002 Summary Report (3), JNM has included tables on the SVE/HiVac system performance testing results with figures graphing distance versus depth to screen, and wells estimated radius of influence. Figures were also included showing the general layout of the AS and SVE/HiVac system. The NYSDEC has indicated full-scale system operation is expected to begin in late 2003, with the completion of field monitoring and testing.

A copy of the Summary Report January 2001 – June 2002 dated December 6, submitted by JNM is included in Appendix A.

4.2 Mayflower Cleaners Site (Site ID # 1-30-068)

The Mayflower Cleaners Site is located at 489 Great Neck Road. This active dry cleaners site is located across the street from the Fenley Amoco site. This site was added to the NYSDEC registry of inactive hazardous waste sites as a class 2 site, NYSDEC Site No. 1-30-068, on May 25, 1993. The primary contaminant of concern is PCE.

The Mayflower site is located approximately 2,000 feet up-gradient of the WAGNN Watermill Lane well field, and approximately 100 feet down-gradient of the Fenley Amoco Site. NYSDEC requested that EPA investigate this site as part of the OU-2 effort.

4.2.1 Chronology of Events: 1992 – 1993

In response to a complaint from the NYSDEC on December 15, 1992, the NCDOH conducted an inspection at the Mayflowers Cleaners site. Two soil samples were collected from two floor drains located in the basement of the facility. One drain, identified as the "west drain", was in the back corner adjacent to the boiler. The other drain, identified as the "southeast drain" was near the front of the building. The responsible party of the facility admitted to NCDOH officials to dumping boiler water down the west drain on a daily basis. Analytical results showed a PCE concentration of 1,700 ppb in the southeast drain and 3,200 ppb in the west drain (4).

Subsequently, the site was referred to EPA's Underground Injection Control (UIC) Program for response, since drywells are classified as Class V injection wells, which are regulated under EPA's UIC program.

4.2.2 Chronology of Events: 1995 - 1996

On August 21, 1995, P.W. Grosser Consulting, the responsible party consultant, submitted to the U. S. EPA UIC Program a site closure plan to excavate and remove the PCE contaminated soil from the two basement drains at the Mayflower Cleaners facility. The plan included collecting soil samples from the surface of each drain to verify the results obtained by the NCDOH in 1992, and to auger by hand and collect a sample at a depth of 2.5 feet (5).

The closure plan included three scenarios:

1. If the surface and subsurface soil samples are clean – no further action would be required;

2. If the surface sample is contaminated above the NYSDEC TAGM value of 1,400 ppb and the subsurface soil is clean, then the soil would be excavated to a depth of 2.5 feet and disposed of properly. No further sampling would be required. The void would be backfilled with clean inert material, and sealed with at least 6-inches of concrete or asphalt; and

3. If the surface and subsurface soil samples are contaminated above the TAGM value, then further investigations would be completed based on NYSDEC's requirements for Inactive Hazardous Waste Disposal Sites.

On October 6, 1995, P.W. Grosser Consulting submitted the results of the surface and subsurface samples collected from the two basement drains in the cleaners building. The samples were collected in accordance with the August 21, 1995 EPA approved closure plan. The surface samples of each drain verified the results obtained by the NCDOH in 1992. The southeast drain contained PCE at 3,400 ppb compared to NCDOH's value of 1,700 ppb; and the west drain contained PCE at 2,400 ppb compared to NCDOH's value of 3,200 ppb. The subsurface samples contained PCE at 110 ppb and 11 ppb in the southeast and west drains, respectively. In this letter, P.W. Grosser requests to proceed with scenario # 2 of the approved closure plan (6). The following table summarizes the analytical results for soil samples taken at the southeast and west drains on December 12, 1992 and on September 14, 1995.

Sample Location	TAGM (ppb)	PCE Concentration	PCE Concentration

		on 12/15/92 (ppb)	**on 9/14/95 (ppb)**
Southeast drain	1,400	1,700	3,400
West drain	1,400	3,200	2,400

On October 18, 1995, EPA forwarded to the responsible party (Lawrence Weinberger) approval to follow scenario 2 from the closure plan to remove the contaminated soil within each drain. On October 31, 1995, legal counsel for the responsible party submitted a request to NYSDEC for approval to proceed with the closure plan scenario 2 that was approved by the U. S. EPA (7).

On November 9, 1995, Mr. Byrne, NYSDEC legal counsel, forwarded the information submitted to him from Theodore Firetog (legal counsel for the responsible party) to the NYSDEC Chief, for appropriate action.

On January 3, 1996, NYSDEC submitted a memorandum to U. S. EPA stating that the NYSDEC did not object to the closure plan and cleanup as proposed by P.W. Grosser Consulting, but the actions would be conducted without a Department consent order. Without a consent order all necessary permits are required, and the department would not provide oversight during cleanup activities. Additionally, the cleanup would not relieve the PRP from the requirement of completing a full remedial investigation (8).

In a letter dated March 6, 1996 to Mr. Ed Khadaran of the USEPA Region II, James P. Rhodes of P.W. Grosser Consulting notifies that the closure of the two floor drains was performed on January 17, 1996 according to scenario # 2 of the USEPA approved closure plan (35).

In March 14, 1996, EPA transmitted a letter to the property owner approving the satisfactory closure of the UIC Class V wells, as per EPA's UIC closure requirements. EPA believes that the drywell cleanup conducted at the site has addressed the major source of PCE contamination (33).

4.2.3 Chronology of Events: 1997 - 1999

On May 30, 1997, Lawrence Weinberger (Mayflower responsible party) sent a memo to NYSDEC Commissioner asking for an update on status of remedial measures for treating the contaminated groundwater underneath the Mayflower Cleaners facility. Mr. Weinberger asked for a time schedule for the completion of the remediation measures (9). The Mayflowers Cleaners Site is hydraulically downgradient to the Fenley Amoco Gas Station Site (Amoco A Spill # 82-00157). The Fenley Amoco Gas Station Site has a history of BTEX contamination in the soils and groundwater. The BTEX plume has migrated into the vicinity of the Mayflower Cleaners Site (see section 4.1).

On July 21, 1997, NYSDEC responded to Mr. Weinberger's request for a schedule of the cleanup activities. NYSDEC is continued to operate the remediation system to capture the gasoline-contaminated groundwater and the PCE from the Mayflower site. NYSDEC stated that additional investigations would be completed to determine if it is feasible to enhance the remedial efforts to reduce the duration of the cleanup. NYSDEC mentioned to Mr. Weinberger that "... however, as a potential responsible party, you must address the tetrachloroethylene contamination."(10)

On September 16, 1999, NYSDEC submitted a memo to Mr. David Koch, Esq., as a follow up to recent discussions between him and the Department's Bureau of Spill Prevention and Response. The memo also stated, "While the Department has no current plans to conduct an environmental investigation at the site, your client may choose to do so. By entering into an Order of Consent with the Department, your client could conduct an environmental investigation with the Department's approval and under the Department's oversight. Your client would then acquire data, which would aid the Department in determining the nature and extent of contamination at the site and appropriate remedial alternative for removing the contamination. Ultimately, this could lead to the reclassification or delisting of the site from the Registry."(11).

4.2.4 Investigation Data: 2000 – 2003

Due to the reluctance of the responsible party to perform the environmental investigation, the NYSDEC provided characterization information on soil and groundwater at Mayflower Cleaners based on its close proximity to the Fenley Amoco site investigation and remediation efforts.

Based upon information provided by the Fenley investigation, it has been determined that residual PCE (and its breakdown components TCE, DCE, DCA and vinyl chloride) still exist at concentrations which exceed the federal MCL within the following shallow upper glacial wells: 23, MW-1, MW-3, FN-6, CW2, and CW3 (Figure 5 – Well Location Map). All of these wells are located within a 50 foot radius of the Mayflower Cleaners and within 200 feet of the Fenley Amoco site.

It is important to note that monitoring well FN-6, the closest well to the source remediation area at Mayflower, historically contained the highest detected concentrations of PCE (1,500 ppb) and its degradation products. Well 5, located up-gradient from Mayflower Cleaners site and on the former Fenley property, has historically shown the second highest levels of PCE ranging from 320 to 470 ppb. Monitoring wells located up-gradient to well 5 (17, 4A, and EPA-MW-33) have shown only low level PCE detections (< 7 ppb), suggesting that Fenley may have also operated a service department, which could have contributed to the PCE contamination at Mayflower (Figure 5 – Well Location Map). No other information was available in the NYSDEC files on the investigation of the former Fenley Amoco property.

In summary, the identified chlorinated VOC plume contains total concentrations ranging from 1,000 to 2,300 ppb, and is co-mingled with the much higher BTEX and MTBE concentrations at Fenley, ranging from 65,000 to 145,000 ppb (during the monitoring period January 2000 to September 2002 , see Sections 4.1.1.4 – 4.1.1.6).

It is a safe assumption that, as with the Fenley Amoco BTEX and MTBE contamination, the chlorinated VOC (i.e., PCE) contamination at Mayflower has reached an equilibrium and steady–state condition within the site boundaries (<50 feet) and environment. This assumption is supported by the identification of PCE daughter products, TCE, DCE, DCA and vinyl chloride, providing evidence that the co-mingled BTEX plume may be providing an anthropogenic source of carbon to initiate reductive dechlorination of the residual PCE.

With the implementation of the proposed plan at Fenley Amoco site (AS and SVE/ HiVac extraction), the zone of influence of this active remediation extends well within the area of contamination of the Mayflower Cleaners site (i.e., co-mingled BTEX/MTBE/PCE plume). EPA believes that any remaining residual contamination at Mayflower Cleaners will be addressed as part of the overall site cleanup plan at the Fenley Amoco Gas Station site.

4.3 Citizen's Development Company Site (Site ID # 1-30-070)

The CDC site has the NYSDEC Spill Site Number 1-30-070. This site is comprised of two Operable Units. OU-1 addresses the completed remediation of the on-site source area through SVE and groundwater pump and treatment, and documents groundwater quality in the shallow aquifer at the site. OU-2 addresses the investigation and characterization of groundwater quality in the deeper aquifer at the site. J. R. Kolmer + Associates, Inc. was contracted as CDC's environmental consultant. Attached in Appendix C is a copy of the Final RI/FS Report submitted by J. R. Kolmer + Associates, Inc.

4.3.1 Site History

This site was formerly referred to as the Flower Fashion Site, which was leased and managed by the Citizen's Development Company (CDC). This site is located at 47 Northern Boulevard (Figure 1) just east of the intersection of Great Neck Road with Northern Boulevard. The 1-acre site encompasses a one story, 3,000 square foot building. Cleanland Drive-In Cleaners occupied the facility from 1960 through 1976. Based on the site ROD (12), the facility stored PCE saturated filters on unpaved areas along the north side of the site. In 1976, the facility burned down. The structure was rebuilt, and from 1982 through 1984, it was occupied by Flower Fashion, a commercial florist. Since 1984, the facility has been occupied by various other businesses that had no documented association with the use or discharge of hazardous wastes. Currently the facility houses an ATT telephone sales office.

The Property was listed in the New York State Registry of Inactive Hazardous Waste Disposal Sites, NYSDEC Site #1-30-070 on April 12, 1993. Investigations have been ongoing at the site since 1983.

The WAGNN operates a public water supply well field at Watermill Lane approximately ½-mile north of the site.

4.3.2 Operating Unit - 1; Impact of PCE on the Shallow Aquifer

4.3.2.1 Remediation History

The site remediation history began in 1983. In November 1983 and January 1984, the NCDOH collected surface soil samples from the rear yard at the CDC site, with results indicating PCE contamination in soils that ranged from 3.5 parts per million (ppm) to 17 ppm. As a result, in March 1984, NCDOH required CDC to perform additional investigation work at the site (13).

In April 1984, the PRP, under NCDOH oversight, installed an on-site observation well (OW) screened in the shallow aquifer, and four soil borings (SB-1, SB-2, SB-3, and SB-4) up to 27 feet below ground surface (bgs) in the rear yard (3) (see Figure 2 of the attached RI/FS Report in Appendix C). The following table is a summary of PCE concentrations detected in the OW boring and soil borings, and the depths of detection (13).

Sample Location	Depth	PCE Concentration (ppm)
OW Boring	5 to 7 feet	1,300
	10 to 12 feet	550
Boring 1 (B1)	5 to 7 feet	0.13
	10 to 12 feet	0.015
Boring 2 (B2)	5 to 7 feet	0.014
	10 to 12 feet	< 0.01
Boring 3 (B3)	5 to 7 feet	< 0.01
	10 to 12 feet	< 0.01
Boring 4 (B4)	5 to 7 feet	470
	10 to 12 feet	6.5

PCE was the highest within the top 12 feet of soil ranging from < 1 ppm to 1,300 ppm, and the PCE in the groundwater varied from 4.7 ppm to 4.9 ppm (see Table 1 of the attached RI/FS Report in Appendix C).

In December 1984, the PRP excavated approximately 75 cubic yards of contaminated soil from the rear of the site. Three monitoring wells (MW-2, MW-3, and MW-4) were installed behind the facility (Figure 5 – Well Location Map), and in January 1985 sampling and analysis of these three wells and OW (which was converted into a recovery well, RW) indicated PCE contamination from 970 ppb to 3,503 ppb. In January 1985, six additional monitoring wells (MW-5, MW-6, MW-7, MW-8, MW-9, and MW-10) were installed north (down-gradient) of the site. Refer to Figure 3 of the attached RI/FS Report - Appendix C, for monitoring well locations MW-2 through MW-10 (Figure 5 – Well Location Map).

In January 1986, a groundwater pump and treat system was installed by the responsible party to address groundwater contamination.. The OW was replaced with a 12-inch recovery well (RW) that was installed to 75 feet bgs. The depth to GW was estimated to be 43 feet bgs. The groundwater treatment system included a submersible pump that transferred the groundwater from the RW through granular activated carbon prior to discharge to the storm sewer. The system operated until May 1990 when a mechanical failure of the groundwater recovery system caused the system to shut down (13).

Groundwater samples collected in August 1989, from monitoring wells MW-2, MW-3, and MW-4, and the recovery well, RW, found PCE concentrations had dropped to a range of 26 to 860 ppb.

In December 1990, an up-gradient well (MW-1A) was installed. Water levels were collected and the groundwater flow direction was determined to be nearly due north. In addition, groundwater samples were collected from monitor wells MW-1, MW-2, and MW-4. PCE concentrations ranged from 63 ppb to 1033 ppb. The RI/FS (13) indicated that the recent groundwater data indicated that PCE levels had rebounded from the lower values measured in 1989. CDC was required to continue site monitoring.

From February to July 1991, groundwater samples were collected from wells MW-1A, 2, 3, 4, 8, and 10. The following is a summary of PCE, TCF, and BTEX compounds detected in these monitoring wells, and their respective concentration ranges during this period.

Well ID	Benzene (ppb)	Toluene (ppb)	Ethylbenzene (ppb)	Xylene (ppb)	PCE (ppb)	TCE (ppb)
MW-1	ND	ND	ND	ND	20 -38	ND – 3
MW-2	ND	ND – 19	ND - 32	ND – 92	333 – 772	42 – 92
MW-3	ND – 4	ND	ND	ND – 10	37 – 446	12 – 34
MW-4	ND	ND	ND	ND	327 – 1,780	11 – 55
MW-8	ND	ND	ND	ND	57 – 58	5 – 8
MW-10	ND – 135	ND	ND – 1	ND – 2	46 – 104	19 – 21
MW-42	ND – 7	ND – 24	74 – 127	67 – 309	ND – 2	-
MW-44	ND	ND	ND	ND	-	-
MW-47	226 - 548	671 – 3,420	332 – 663	1,271 – 1,685	100 – 109	49 – 65
FN-4	5,045 – 6,099	17,643 – 19,113	2,666 – 2,992	6,745 – 14,327	336 – 399	215 – 239
FN-5	11 – 36	34 – 156	2 – 111	115 – 151	-	-

NOTE: ND - non-detect.

Low VOC levels were detected in the up-gradient wells. BTEX (from another source) and PCE (20 to 1,780 ppb) were also detected in the down-gradient wells. The highest total VOC value was from well MW-4. The direction of groundwater flow was determined to be north-northwest, which is consistent with previous sampling events. Figure 21 of the attached RI/FS Report (Appendix C) shows groundwater contours and flow direction. The RI/FS stated that PCE (ranging from 20 to 38 ppb) is migrating onto the site from an up gradient source area. Monitoring well FN-4, located northeast of the site contained PCE (ranging from 300 to 400 ppb) and BTEX (ranging from 35,000 to 40,000 ppb). BTEX contamination is not attributable to the site. BTEX contamination is also found at MW-2 (up to 139 ppb) again attributable to an off-site source.

The RI/FS stated that review of the analytical data suggests that PCE is migrating onto the site from an up-gradient source area, and that there is a light non-aqueous phase liquid layer of petroleum hydrocarbons floating on top of the water table in the area of FN-4 and MW-2, with PCE and TCE. The RI/FS contributes the BTEX contamination found in on-site wells to have migrated from an offsite, up-gradient source. Figure 5 of the RI/FS Report (Appendix C) shows the locations of the monitoring wells sampled on this event, and Table 2 summarizes groundwater quality data for the sampling period from February to July 1991.

In February 1993, seventeen additional soil borings (B-1 through B-17 inclusive) were installed on site (12 were up-gradient of the site, and 5 were down-gradient within the source area). See Figure 7 of the attached RI/FS (Appendix C) for soil boring locations. The results indicated low levels of VOCs from borings B-14 (PCE at 93 ppb), B-16 (PCE at 13 ppb), and B-17 (near RW) (PCE at 1,700 ppb at 10 feet deep) all down-gradient of the site. Borings B-3 and B-4 were converted to monitoring wells MW-1C, and MW-1D, respectively. Well MW-1B was also installed at this time (near B-9). The following is a summary of BTEX, DCE, TCE, and PCE detected in monitoring well samples and their respective concentration ranges in the February/March 1993 groundwater sampling event.

Well ID	DCE	TCE	PCE	Benzene	Toluene	Total Xylene	Ethylbenzene
MW-1A	ND	1	46 – 48	ND	ND	ND	ND
MW-1B	3 – 9	ND – 2	120 – 150	3 – 9	140 – 1,100	140 - 900	27 - 150
MW-1C	3 – 6	2	45 – 54	ND	ND	ND	ND
MW-1D	ND	ND	9 – 18	ND	ND	ND	ND
MW-2	ND	ND – 50	8 – 860	ND	ND	ND	ND
MW-3	ND	ND – 1	25 – 50	ND	ND	ND	ND
MW-4	ND	17 – 23	850 – 1,800	ND	ND	ND	ND
RW	ND	1	38	ND	ND	ND	ND

NOTE: ND – non-detect.

Analysis of wells MW-1A, -1B, -1C, and -1D, MW-2, MW-3, and MW-4, and the recovery well, RW, completed in February and March 1993 indicated PCE ranging from 8 to 1,800 ppb. The highest value was from well MW-4. After review of the analytical data, J. R. Kolmer + Associates, Inc. concluded that PCE and BTEX are entering the site from an up-gradient source area.

During the same time period, two soil borings were drilled into two dry wells (DW-1 and DW-2) in the parking lot of the site and were sampled. DW-1 contained low levels of VOCs (PCE was 170 ppb), and DW-2 did not contain any VOCs. Based on this data J. R. Kolmer + Associates, Inc. concluded that the dry wells were not a source of chemicals for subsurface migration. See Figure 9, of the attached RI/FS Report (Appendix C) which shows the location of the dry wells on the Property.

In April 1993, the site was listed in the New York State Registry of Inactive Hazardous Waste Sites as a Class II site.

In an inspection of the building interior, performed in early 1994, floor sump was discovered in the basement. This sump (2 feet by 1 foot by 1 foot deep) contained free liquid with a PCE value of 270 ppm. The soil was found contaminated to a depth of 22 inches (in) bgs with PCE concentrations ranging from 1,300 ppm to 39,000 ppm. The following is a summary of BTEX, DCE, TCE, and PCE detected in the floor drain water and soil beneath the drain, and their respective concentrations at different depths (13).

Sample Location	DCE	TCE	PCE	Benzene	Toluene	Total Xylene	Ethylbenzene
Floor Drain Water	0.17	2.8	270	ND	ND	ND	ND
Soil Beneath Drain							
@ 14 in	ND	2.5	1,300	ND	ND	ND	ND
@ 16 in	2.6	150	39,000	ND	ND	ND	ND
@ 20 in	ND	51	13,000	ND	ND	ND	ND
@ 22 in	ND	40	11,500	ND	ND	ND	ND
@ 5 ft	ND	0.008	0.27	ND	ND	ND	ND
@ 10 ft	ND	ND	0.033	ND	ND	ND	ND
@ 13.5 ft	ND	ND	0.1	ND	ND	ND	ND

NOTE: ND – non-detect.

The sump analytical data was found to be consistent with the soil boring analytical data of April 1993 (PCE concentrations decrease at 2 feet bgs.

4.3.2.2 Interim Remedial Measures

In early 1995, an Interim Remedial Measures (IRM) recommending the excavation and removal of elevated PCE soils and the implementation of a soil-vapor extraction (SVE) system were proposed to address the source of PCE contamination in soils. On January 24, 1995, the NYSDEC approved the IRM Work Plan.

In May 1995, under the approved IRM Work Plan, liquid and soil was removed. The concrete was cut exposing an 8 to 10 square foot area. The contaminated soil was removed with a truck mounted vacuum system creating a void five feet in diameter and four feet deep. During this excavation, a 55-gallon drum was found beneath the floor. This drum was apparently used to line the floor sump. The excavated soil was containerized on site into a four cubic yard dumpster (13).

A SVE system was then installed to address removal of additional PCE from the subsurface soil (see Figure 10, of the attached RI/FS Report (Appendix C) which shows the SVE system layout). The SVE system included a vacuum sump installed within the basement excavation; five vacuum extraction wells installed around borings B-14, B-16, and B-17 that contained elevated PCE and the containerized soil, and two vacuum blower units. A perforated pipe drain bedded in sand was placed within the bottom of the sump excavation, which was connected to a PVC pipe extended above the floor surface. A plastic sheet was installed above the bedding sand, the excavation back-filled, a concrete lined sump installed, and the remaining floor replaced with concrete. Each of the five vacuum extraction wells were installed to a depth of 20 feet. Each SVE extraction well was 2 inches in diameter and consisted of 15 feet of well screen and 5.5 feet of raiser pipe. The opening around the well screen was backfilled with filter pack material, a 2-foot bentonite plug installed, followed by grout to the surface. A perforated PVC pipe was installed along the bottom of the dumpster containing the excavated soils, with a 2-inch PVC riser pipe connecting the perforated PVC pipe to the SVE manifold line.

There were two vacuum blower units. Unit one was connected via a manifold to the basement sump, and SVE wells 1 and 3. The second unit was connected via a manifold to SVE wells 2, 4, and 5 and the dumpster. The two vacuum units were housed within a trailer. The exhaust from the units was passed through a vapor phase granular activated carbon canister prior to discharge to the atmosphere (13).

On May 16, 1995 and before the start up of the SVE system, PCE levels were measured using Draeger Tubes. Measurements were taken at each element of the SVE system (five SVE extraction wells, sump vent, and containerized soil). PCE concentrations ranged from 50 ppm at SVE-2 to >300 ppm at the sump vent.

The SVE system operated for 10 months, until February 1996, when steady-state conditions were observed. During its period of operation, PCE levels were routinely monitored. The following table summarizes PCE concentrations ranges at each extraction points of the SVE system from May 18, 1995 to June 14, 1995.

Sample Location	PCE Concentration Range (ppm)
Sump Vent	ND – 2
SVE-1	<2 – 5
SVE-2	15 – 28
SVE-3	<2 – 6
SVE-4	42 – 190
SVE-5	17 – 40
Soil Dumpster	ND – 3

Based upon review of this data, J. R. Kolmer + Associates, Inc. concluded that the SVE system was effectively working to reduce the PCE concentration in the soil.

Five confirmatory soil samples were collected after the SVE operational period, 3 from additional soil borings installed to a depth of 7 feet (around the five original SVE borings) and 2 from the containerized soil. Analytical results indicated PCE concentrations ranging from 9 to 470 ppb, below the NYSDEC TAGM #4046 value of 1,400 ppb for soil (13).

4.3.2.3 Remedial Investigation/Feasibility Study

On September 29, 1994, CDC entered into an Order of Consent with the NYSDEC to conduct a Remedial Investigation/Feasibility Study (RI/FS) (14).

The objectives of the RI/FS included:

- Determine the direction of flow for the groundwater at the site. Water level measurements will be collected for three months. If significant fluctuations are noted, additional measurements will be made to evaluate the significance of these variations. The period for the measurements will not exceed six months (14).
- Determine the aquifer characteristics including velocity and permeability. To determine the permeability, six slug tests would be conducted at the following monitoring wells: MW-2, MW-4, MW-5, MW-8, MW-9, and MW-10 (Figure 20 of the RI Work Plan shows the slug test well locations). This data along with the flow direction will be used to determine the groundwater flow velocity across the site (14).

- Another round of samples will be collected from the monitoring wells. These samples will be analyzed for VOCs. The tabulated results would be mapped and compared to the groundwater flow data to develop an assessment of the direction and rate of chemical movement. The data analyses would be evaluated to further define the source of PCE, i.e., to determine if the PCE source is emanating from the site (14).

In November 1997, CDC completed the RI/FS pursuant to this Order of Consent. The RI fieldwork was completed during the period June to September 1997 and included water level measurements at 15 monitoring wells to determine the GW flow direction. These measurements confirmed groundwater flow direction to be almost due north, as reported in 1990. These 15 wells were also sampled and analyzed for VOCs with the PCE ranging from 3 to 180 ppb (MW-4 again showing the highest value at 180 ppb)(12).

The data from the July 1997 RI sampling indicated, in addition to PCE (3 ppb to 180 ppb), TCE (non-detect to 30 ppb), DCE (non-detect to 38 ppb), and methylene chloride (f2 ppb to 24 ppb) in the wells. BTEX compounds ranging from non-detect to 3,700 ppb was again identified (3). Table 9 of the attached RI/FS Report (Appendix D) summarizes the groundwater quality data for July 1997.

The September 1997 data again indicated a groundwater flow direction to the north-northwest, which was consistent with the flow determined from previous monitoring events. Monitoring well sampling results indicated that PCE in the site up-gradient wells ranged from 4 ppb to 12 ppb; the PCE just down-gradient of the site ranged from 52 ppb to 180 ppb; and the PCE in wells 200 feet down-gradient of the site ranged from 2 ppb to 25 ppb (13). A summary of these analytical results is included in Table 9 of the RI/FS.

PCE concentrations for wells MW-4 (typically the highest values of PCE), MW-8, and the recovery well steadily declined with time. The PCE concentrations dropped significantly when the groundwater pump and treat system was operational from January 1986 to May 1990. When operation of the pump & treatment system ceased, the PCE values increased again. With the installation and operation of the SVE system from May 1995 through February 1996, the PCE concentrations again dropped significantly.

The following conclusions were obtained after reviewing the data obtained from the RI.

- "The Flower Fashion site has had an impact on the groundwater quality. PCE levels are present both up-gradient and down-gradient of the site, however, the down-gradient concentrations are greater than the up-gradient values." (13)
- "The historical remedial operations have had a positive impact on groundwater quality and have significantly reduced PCE concentrations in the groundwater. The historical groundwater data collected in 1985 and 1990 document this beneficial impact." (13)
- "The concentration of PCE in the groundwater, both up-gradient and down-gradient of the site have significantly dissipated since 1990. The available data show that background levels in the site area are in the range of 3 to 12 ppb. PCE concentrations immediately down-gradient of the site are in the range of 50 to 180 ppb. These concentrations dissipate within 200 feet of the site and approach background levels."(13)

4.3.2.4 Feasibility Study

Three remedial alternatives were investigated during the FS. These include;

1. No action, but to continue annual well sampling for three years;
2. Groundwater pump and treat; and
3. Groundwater air sparging system.

The NYSDEC proposed alternative 1 – no action, but continued annual well sampling for three years was the selected alternative. Yearly water level measurements to determine the direction of groundwater movement were also included (13).

4.3.3 Operating Unit - 2; Impact of PCE on the Deeper Aquifer

On May 7, 1999, Kolmer + Associates submitted to the NYSDEC, the CDC RI Work Plan for Operable Unit - 2. This work plan addresses the proposed actions to determine if PCE found in the shallow groundwater during the initial RI (OU-1) have migrated to deeper portions in the Upper Glacial aquifer (15). The wells installed for OU-1 were screened at the groundwater interface which is approximately 50 feet bgs.

The proposed work plan incorporated the installation of three sets of two hydropunched wells. These hydro-punch wells were to be located at MW-1C, MW-4, and MW-6. One hydropunch well was to be set to 25 feet below groundwater, and the other was to be set at 50 feet below groundwater. Groundwater samples for VOC analysis were then to be collected from these hydro-punch wells and also from monitoring well FN-8, which is north-northeast of the site. A round of samples was also to be collected from the OU-1 monitoring wells. These samples would then provide data for groundwater at the surface, at 25 feet, and at 50 feet (15). Furthermore, an indoor air quality sample was to be collected from the basement of the CDC building (15).

In a November 24, 1999 correspondence from J.R. Kolmer to NYSDEC (16), the results from the monitoring well samples and hydropunch samples are presented. These data indicate that MW-3 and MW-4 contain 140 µg/L of PCE. These data also indicate that MW-4 still has significant contamination in the groundwater. There were three sets of two hydropunches installed. Hydropunch locations HP-1S and HP-1D were up-gradient of the site adjacent to MW-1C. The other two sets were down-gradient of the site, HP-2S and HP-2D (adjacent to MW-4) and HP-3S and HP-3D (adjacent to MW-6).

The hydropunch well samples were designated by an "S" (i.e., HP-1S) for shallow, and "D" (i.e., HP-2D), deep, and collected at 25 feet and 50 feet, respectively, below the water table.

HP-2S indicated PCE concentrations at 100 ppb compared to sample results from MW- 4 (screened at the water table) which had PCE concentrations of 140 ppb. HP-1S and HP-3S contained PCE at non-detect and 4.9 ppb, respectively. HP-1D and HP-3D contain PCE at 6 ppb and 6.3 ppb, respectively. HP-2D indicated PCE at 740 ppb. Kolmer makes the statement, "This increase in PCE appears to be related to the presence of silty clay/clayey silt at the depth of HP-2D. Approximately 15 feet of this material was found at the bottom of the borehole drilled for this hydropunch."(16) Kolmer further states, "The silty clay/clayey silt will retard the movement of chemicals migrating in the groundwater. This retardation is good because it keeps the chemicals from migrating to greater distances in the groundwater, but it also slows the rate at which chemicals will flush out of the groundwater after the site has been remediated."(16)

The following table summarizes PCE concentrations found in the hydropunch samples.

Well Proximity	Hydropunch ID	PCE Concentration (ppb)
MW-1C	HP-1S	ND
	HP-1D	6

MW-4	HP-2S	100
	HP-2D	740
MW-6	HP-3S	4.9
	HP-3D	6.3

4.3.4 Summary of Data

In March 2003, CDC retained CA Rich Consultants, Inc., to prepare the latest Annual Report of groundwater sample results and summarize historic sampling results of the site monitoring network (34). This report satisfied the requirements under the CDC OU-1 ROD no action selected alternative, which requires continued annual well sampling for three years with yearly water levels to determine the direction of groundwater movement (13).

In summary, residual PCE contamination appears to be traveling as a narrow plume restricted to the lower Upper Glacial Aquifer. It is suggested that groundwater moving onto the CDC site has been impacted by PCE, as indicated by PCE levels observed in up-gradient well W-1A.

Compared to historic levels of contamination, the monitoring wells directly down-gradient of the former CDC source area have demonstrated significant decreases in PCE concentrations. For example, W-4 has shown a decrease from a high of 1,800 ppb in February 1993 to a low of 41 ppb in October 2003. Monitoring at more distant off-site wells indicates concentrations ranging from 1.2 ppb at W-8 to 34.5 ppb at W-6.

In conclusion, some elevated concentrations of VOCs above Federal and State standards still remain in the groundwater, but a comparison of historic and recent groundwater sampling results (March 2003 Annual Report) support a downward trend of PCE concentration levels. CDC recommends additional investigations of the PCE suggested to be migrating on the CDC site and continual monitoring as required by the CDC OU-1 ROD.

Currently, NYSDEC continues to monitor groundwater in the area as part of the CDC OU-1 ROD. NYSDEC is also proposing to conduct soil gas sampling to evaluate the potential for contaminant exposure in indoor air. Any future investigations and potential response actions will be addressed under a second operable unit by the NYSDEC.

4.4 Active Amoco Gas Station Site – (Spill # 92-08119)

The Amoco Gas Station Site is located at 133 Cutter Mill Road, in Great Neck, Nassau County, New York (Figure 1). There is an active gas station on the property. The property is leased by Elrod Service Station, Inc. from Amoco, and operates under the name of RB Gas & Services. Elrod Service Station, Inc. Elrod contracted the services of Tyree Brothers Environmental Services, Inc. (TBES) to perform environmental work on the property. A Site Location Map and Well Location Map is included as Figure 6.

On November 13, 1992, TBES submitted documentation (included in Appendix D) to the NYSDEC concerning the source of spill # 92-08119 at the 133 Cutter Mill Road facility (17). In that correspondence, TBES stated that the source of spill # 92-08119 is not the underground storage tank system (4 tanks) of the 133 Cuter Mill Road facility. TBES also stated the four underground storage tanks were installed in 1982, and recent integrity tests performed on the tanks and lines on May 29, 1992 indicated no leakage.

TBES indicated that a spill (# 90-02024 assigned May 17, 1990), which occurred up-gradient of the property at an old gas station located at 294 Great Neck Road (Jonathan's Auto Repair Shop) was the source of contamination at 133 Cutter Mill Road. TBES supported its claim by stating that groundwater has been determined to flow from the 294 Great Neck Road property to the 133 Cutter Mill Road facility.

TBES also provided information regarding the period from September 29, 1992 through November 11, 1992, when four on site wells were monitored and approximately 14-gallons of product and liquid were removed from MW-2, an up-gradient well from the Elrod Station. TBES concluded the correspondence by stating, "... Elrod Service Station, Inc. has not accepted liability for the above-mentioned spill."

The following table summarizes the dates product was removed and the amount of product removed from MW-2 (see TBES November 13, 1992 letter to the NYSDEC).

Well ID	Date	Product Removed (gallons)	Liquid Removed (gallons)
#2	9/29/92	1	-
#2	10/21/92	11	4
#2	11/4/92	0.5	-
#2	11/6/92	0.5	10.5
#2	11/11/92	1	-

On December 9, 1993, TBES sent to NYSDEC investigative information, which included a site cross-section indicating well locations, water level measurements, well screen intervals, and soil types. Boring logs of wells 5, 6, 7, 8, and 9 were also included. The figure and cross-section indicate a VW-8 well along the sidewalk adjacent to Cutter Mill Road. Information suggests this well was converted to one of the SVE extraction wells.(19)

At that time, Miller Environmental Group, Inc. (MEG) was contracted by the NYSDEC to provide technical and associated field services pertaining to the oil spill #92-08119 at the Amoco Gas Station located at 133 Cutter Mill Road.

The owner of Jonathan's Auto Repair (Figure 1), located at 294 Great Neck Road, opposite to and across the street from the Active Amoco Station Site, had also been conducting an environmental investigation. Monitoring wells W-1, W-2, W-3, W-4, W-5, W-6, W-7, W-8, W-9, and W-10 had been installed prior to MEG's investigation. In addition, a soil vapor extraction system had been installed and maintained by the owner on this property (20).

In October 1994, MEG completed a Site Summary Report (20) for NYSDEC (included in Appendix D). TBES was further contracted to conduct soil boring, monitoring well installation and sampling for the owner. A deeper soil boring MW-11A, was installed to a depth of 145 feet between the Amoco station and the WAGNN Watermill Lane well field to characterize the geologic formation and to investigation the potential for groundwater contamination at greater depths to impact the public supply wells.

Well MW-11A, was installed as a monitoring well nest with sampling ports at various depths. American Engineering surveyed the wells and provided MEG with well casing elevations. This information and the depth to groundwater were used to determine groundwater flow direction. Groundwater flow was determined to be west, towards the Long Island railroad tracks (Figure 8 - Groundwater Flow Direction). MEG sampled all the monitoring wells and recorded product only in MW-2. These findings were consistent with TBES's findings.

In their October 1994 Site Summary Report, MEG identifies three distinct MTBE plumes: one on the Amoco station property at 133 Cutter Mill Road with an MTBE value of 24,800 ppb at MW-2; a second plume on Jonathan's Auto Repair property at 294 Great Neck Road with an MTBE value of 688 ppb at

W-1; and a third on the southwest portion of the WAGNN Watermill Lane property with an MTBE value of 340 ppb at MW-15. Each plume was found to be separated by wells without contamination (20).

A letter from Luce, Forward, Hamilton, & Scripps Attorneys at Law (Luce, et.al.) dated February 21, 1995 was submitted to Richard Hofflich, Esq. concerning an insurance claim submitted by Spartan Petroleum Corporation (SPC) (21). Luce et.al. is representing the insurance company Agricultural Excess and Surplus Insurance Company (AESIC). This letter states that AESIC is denying the claim from SPC for various reasons. In summary, the letter stated there was uncertainty as to the source of the spill at the Amoco gas station at 133 Cutter Mill Road. Spartan is under the impression the spill is from an old gas station, across Cutter Mill road from the gas station. AESIC believes with uncertainty that on-site surface spills or overfills may have lead to the contamination. On March 23, 1994, Dawn Medaglia of TBES submitted contaminant information from well boring logs and stated these logs confirmed that surface spills or overfills were the source of site contamination. AESIC is at this time retaining an in-house consultant (unnamed at this time) to review the data.

The NYSDEC retained consultant, MEG, was tasked to review May and June 1994 site data provided by TBES. The information is condensed in the October 1994 Summary report and identifies several potential sources of contamination for investigation, including the 133 Cutter Mill Road site and the former Amoco station at 294 Great Neck Road. This letter stated that, "The actual source of contamination still has not been determined and a number of questions remain open."(21). Based upon Amoco's ownership of both properties, they have implemented remediation efforts to address the groundwater MTBE and BTEX plume for both sites.

On January 18, 1995, NYSDEC submitted a request to the Bellgrave Water Pollution Control District for access to a storm water drain in the vicinity of Great Neck Road and Cutter Mill Road to discharge treated groundwater from the proposed groundwater remediation system (22).

On May 3, 1995, Mr. John M. Waltz of the County of Nassau Department of Public Works submitted to Nick Acampora, NYSDEC Project Manager, correspondence requesting the NYSDEC obtain a road opening permit to install a discharge pipeline to a storm sewer behind the Amoco gas station near wells MW-9 and MW-10 (23).

In October 1995, MEG proposed to evaluate the soil-vapor extraction system (installed by TBES) currently in operation at the Amoco gas station to determine its effectiveness and recommendations on a pump and treat system design with two recovery well locations (one at the source area at the gas station, and one at MW-9) (20).

In the September 1996 Progress Report (24) (included in Appendix D), MEG summarized activities and sampling completed in July 1996. The Amoco contractor, TBES installed monitoring wells MW-1 through MW-10, and an SVE system to address BTEX contamination in the soil. TBES provided to MEG monitoring and sampling data, but failed to provide operational data on the design and effect of their SVE system.

MEG was contracted by NYSDEC to conduct additional investigations hydraulically down-gradient and west of the Amoco Site. MEG installed monitoring wells MW-10 through MW-23 to further delineate the soil and groundwater contamination. The screens of these wells are positioned approximately 10 feet into the water table. It was determined that on-site residual non-aqueous phase liquid (NAPL) still exists and acts as a continual source of dissolved phase contaminants to groundwater. The free product, first detected in March 1995, continues to be detected in MW-2.

The investigation by MEG verified the existence of 2 distinct dissolved BTEX plumes in the area; one in the vicinity of the Amoco gas station at 133 Cutter Mill Road which MEG is investigating, and one to the southwest of the WAGNN Watermill Lane well field that is being investigated by J.N.M. Environmental. There is also a MTBE plume that follows a similar pattern to the BTEX plume, but the aerial extent is greater. MEG has determined that a clay layer has confined the BTEX and MTBE contamination to a shallow perched water zone (24).

In August 1995, under the direction of the NYSEC, MEG installed a multi-point extraction, pump and treatment system that includes eight extraction wells (RW-1 through RW-8) just down-gradient of the BTEX/MTBE plume. Each well was placed 10 feet apart and installed to a depth of 20 feet below grade (corresponds to the depth of the clay confining layer). An air-actuated diaphragm pump transfers the contaminated water from the recovery wells to a 300-gallon recovery tank. A centrifugal pump transfers the water through an air stripper tower for treatment prior to discharge to a nearby storm drain (24).

Soon after operation of the pump and treatment system, groundwater gradient maps were developed for up-gradient wells MW-1 and MW-2 and down-gradient well MW-10, to evaluate it's the system's operation. A distinct capture zone and cone of depression was documented. The up-gradient water levels varied approximately 2 feet between March 1995 and July 1996. In July 1995, the down-gradient well varied approximately 7 feet due to the influenced of the operation of the eight recovery wells. By July 1996, only two recovery wells were in operation (RW-4 and RW-5), and the variance in water level was less at four feet.

In the September 1996 Progress Report submitted by MEG to the NYSDEC (in Appendix D), results from groundwater samples collected quarterly from December 1994 through July 1996 are presented. Graphical representative of well data indicates a steady decline in the MTBE and BTEX contamination. The July 16, 1996 samples indicated MTBE was the only contaminant detected (BTEX compounds were not detected). The highest MTBE concentration recorded was in MW-9, which is on the leading edge of the plume at the recovery wells.

During monthly sampling of the air-stripper influent and effluent, only MTBE was detected in the influent. The results continued to indicate a steady decrease in influent and effluent concentrations between November 30, 1995, and July 26, 1996. These data support the conclusion that the recovery wells were intercepting and preventing the migration of the dissolved phase contamination. Concentrations in the surrounding monitoring wells also showed a steady decrease in contaminant concentrations. Groundwater flow across the site continued to be in the western direction (24).

Various figures generated from quarterly reports were reviewed and information for May 23, 1997, shows groundwater flow at the site to the west direction with elevations varying from 35 feet to 19 feet (25). A figure showing dissolved phase MTBE concentrations (ppb) from samples collected between April 29 and May 6, 1997 indicated concentrations throughout the site ranging from approximately 90 ppb to 170 ppb (26). A bar graph showed "Concentrations of Dissolved MTBE/BTEX vs. Time" for 10 monitoring wells, which indicated the MTBE concentrations dropped from approximately 5,000 ppb in December 1994, to approximately 170 ppb in May 1997(27).

In the February 11, 1999 Quarterly Report (32) (included in Appendix D) to the NYSDEC, MEG provided a summary of activities completed at the Amoco Gas Station between the period August 1998 through January 1999. Groundwater samples were collected on December 22-23, 1998. Five wells (MW-13, MW-14, MW-15, MW-16, and MW-20) installed on the WAGNN property were abandoned due to construction activities. Quarterly groundwater sampling between April 1996 and February 1998 failed to show any BTEX contamination other than benzene at 2.9 ppb from MW-22.

In the February 1998 groundwater sampling event, several wells were found to contain BTEX up to 54 ppb. In the July and December 1998 sampling events, BTEX compounds were found at 1,290 ppb (MW-8), and 943 ppb (MW-2). These rising values can probably be attributed to complications with the groundwater recovery system, with only one recovery well (RW-5) operational.

During this period, MEG continued to monitor the groundwater levels and monthly flow, in-addition to performing biweekly operation and maintenance of the pump and treatment system. The following table is a summary of MTBE and BTEX detected and their respective concentration ranges during the December 22-23, 1998 groundwater sampling event.

Compound	Concentration Range (in ppb)	Number of detections
Benzene	<0.5 – 31	1
Toluene	<0.5 – 60	5
Xylene	<0.5 – 641	10
Ethylbenzene	<0.5 – 2.2	1
Chlorobenzene	<0.5 – 5.5	1
Dichlorobenzene	<0.5 – 205	3
Total BTEX	<0.5 – 942.5	13
MTBE	<0.5 – 184	11

The highest total BTEX concentration was 942.5 ppb at monitoring well MW-2 and the highest MTBE concentration was 184 ppb at monitoring well MW-4. Both wells are located on the property of the Active Amoco site.

On August 5, 1998, MEG and Impact Environmental met on site to collect a round of groundwater samples. Samples were collected from wells MW-3, MW-4, MW-6, MW-7, MW-8A, MW-17, MW-18, MW-19, and MW-23. Figure 2 of the February 1999 Quarterly Summary Report indicates that groundwater flow continues to mimic observed flow direction in May and September 1997 and July 1998, which was in an arc starting in the northwest and continuing to the west, with elevations varying from 34 feet to 12 feet. Figure 6 of this report shows the BTEX plume and its position to the east of the site at MW-2 and MW-8. Figure 7 shows the MTBE plume and its position at MW-4 with concentrations ranging from 50 ppb to 170 ppb.(32). In Figure 5, a graph presents MTBE concentrations vs. time for wells MW-2, MW-4, MW-8, MW-9, and MW-23. The figure further supports information which indicates the MTBE has steadily decreased with remediation efforts from thousands of ppb to less than 184 ppb in December 1998 (32).

4.4.1 Summary of Investigation Data

Multiple groundwater sampling and water level measurement events indicate that groundwater flow from the Active Amoco Gasoline Spill site is to the west, toward the Long Island Railroad. Whereas the WAGNN public supply wells at Watermill are south of the Site.

NYSDEC and Amoco investigations have identified two distinct BTEX and MTBE plumes in the area, one on the Active Amoco station property at 133 Cutter Mill Road and a second on Jonathan's Auto Repair property at 294 Great Neck Road. Each plume is separated by monitoring wells without contamination. NYSDEC had determined that a clay layer has confined the BTEX and MTBE contamination to a shallow perched water zone for each of these plumes.

In August 1995, in response to the identified BTEX and MTBE contamination at the Amoco B site, the NYSDEC installed a multi-point extraction and treatment system that includes eight extraction wells (RW-1 through RW-8) at the leading edge of the BTEX and MTBE plume. Each well was placed 10 feet apart and installed to a depth of 20 feet below grade (corresponding to the depth of the clay confining layer). This system, in conjunction with an earlier SVE system installed by Amoco to address on-site contaminated soils, has successfully contained and steadily decreased concentrations levels within the BTEX and MTBE plume. NYSDEC continues to monitor these activities.

At the time of this report, NYSDEC is evaluating in situ treatment options (e.g. oxygen release compounds) to address residual source areas in an effort to expedite the remediation of the sites (32).

4.5 Jonathan's Auto Repair Shop

Jonathan's Auto Repair (Auto Repair) is located at 294 Great Neck Road and is designated by the NYSDEC Gasoline Spill # 90-02024 and # 00-09365. This active site was a former Amoco gasoline station and is located directly across the street from the Amoco B (Active Amoco) site. Both sites were operated under the ownership of Amoco. During the closure of the gasoline station, the underground storage tanks were excavated. During this operation, there was a gasoline spill from these tanks. At that time, NYSDEC Spills Program became involved. Subsequently, Amoco conducted a groundwater investigation at the site during the same time as the investigation at the Amoco B site (see Section 4.4).

In a letter submitted to Frank C. Brook of the USEPA Region II UIC Section and dated November 19, 1990, Joseph DeFranco of the Nassau County Department of Health states that the drywells Closure Plan submitted by Unico Environmental, Inc. is acceptable for documenting cessation of injection (37 and 38).

In October 1994, MTBE and BTEX was found at elevated levels in groundwater at the Amoco B station property at 133 Cutter Mill Road with an MTBE value of 24,800 ppb (at MW-2) and a second plume on Jonathan's Auto Repair property at 294 Great Neck Road with an MTBE value of 688 ppb (at W-1). Based upon Amoco's ownership of both properties, Amoco has selected to address MTBE and BTEX soil and groundwater remediation for Jonathan's as part of the overall Amoco B remediation.

During 1995-96, groundwater sampling at both the Amoco B site and the Jonathan's site indicated that the two operating Amoco B systems (SVE and P&T) were reducing the MTBE concentrations from both sites.

On November 14, 2000, Delta Environmental Consultants completed an investigation of three leaching pools/drywells on the behalf of Amoco Oil Company and them to be impacted by VOC and SVOC. As a result of these findings, Delta Environmental Consultants proposes to close the pools (39).

On March 30, 2001 the USEPA notifies Amoco Oil Company of its approval (40) of Delta Environmental Consultants Closure Plan dated February 26, 2001. The drywells were excavated in June 14 and 18, 2001 (41) as part of EPA's UIC program under a new assigned site # 00-09365 for this closure, down to NYSDEC TAGM levels. EPA approved the remediation in November 2001 (42).

At this time, the on-going treatment operations at Amoco B have been and continue to be successful in preventing further migration of the MTBE and BTEX plume. This site has now been closed under NYSDEC's Spills and EPA UIC programs.

5.0 NATURE AND EXTENT OF CONTAMINATION

This section provides an overview of analytical test results and a summary of the nature and extent of PCE and BTEX contaminants. Historical data collected during previous investigations are not included in this section and were not used to characterize the nature and extent of contaminants

Analytical data results presented in this Section were compared to Applicable or Relevant and Appropriate Requirements (ARARs) where available. The ARARs were used in the evaluation and derivation of the chemicals of concern at the SCA site. *Applicable* requirements are defined as those promulgated federal or state requirements (e.g., cleanup standards, standards of control) that specifically address a hazardous substance, pollutant, or contaminant found at a CERCLA site. *Relevant and appropriate* requirements are those promulgated federal or state requirements that, while not applicable, address problems sufficiently similar to those encountered at CERCLA sites where their use is appropriate. Chemical-specific ARARs provide guidance on acceptable or permissible concentrations of contaminants in soil, air, and water. The ARARs for this investigation are:

a) *New York State Groundwater Standards* (NYSDEC 1998) have been promulgated by NYSDEC for the protection of human health and/or aquatic life and are legally enforceable; and

b) *The Safe Drinking Water Act* (SDWA) promulgated National Primary Drinking Water Standards (40 CFR Part 141) for the regulation of contaminants in all surface water or groundwater utilized as potable water supplies. The primary standards include both maximum contaminant levels (MCLs) and maximum contaminant level goals (MCLGs). MCLs are enforceable standards for specific contaminants based on human health factors as well as the technical and economic feasibility of removing the contaminant from the water supply. MCLGs are unenforceable standards that do not consider the feasibility of contaminant removal. The SDWA also includes secondary MCLs (40 CFR Part 143) that are unenforceable guidelines for those contaminants that may adversely affect the aesthetic quality of drinking water, such as taste, odor, color, and appearance.

In addition to ARARs, other federal, state, and local criteria, advisories, or guidances may apply to the conditions found at the site. These are referred to as to-be-considered (TBC) items. TBCs are not legally binding but may be useful within the context of assessing site risks and determining site cleanup goals. Chemical-specific ARARs provide guidance on acceptable or permissible concentrations of contaminants in soil, air, and water. The TBCs applicable to this investigation are:

New York State Recommended Soil Cleanup Objectives have been established by NYSDEC in a Technical and Administrative Guidance Memorandum (TAGM) (NYSDEC 1994). This TBC guidance outlines the basis and procedure for determining soil cleanup levels at a state Superfund site. The document includes recommended soil cleanup objectives as well as eastern United States native soil concentration ranges for metals.

In this section, detected concentrations are summarized and compared to ARARs and TBCs where they are available. Complete analytical data from soil and groundwater samples collected during this investigation are presented in Tables 7 through 12 of the HI OU-1. Analytical laboratory certificates of analysis are provided in Appendices C and D of the HI OU-1 and analytical data qualifiers are presented in Table 13 of the HI OU-1.

5.1 Soil Sampling

Soil samples were collected during this investigation to evaluate possible residual soil contamination that may present a continued source to of groundwater. A total of 35 sub-surface soil samples (not including QA/QC samples) were collected during the installation of EPA-MW-29 through –33 on November 8 – December 4, 2000.

The EnCore® sampling method was used to collect soil samples for analysis of VOCs. A summary of PCE and BTEX concentrations detected in the soil samples is presented in this section and the results are compared to NYSDEC TAGM values when available. Complete analytical results for VOCs in soil can be found in Table 2.

Volatile Organic Compounds in Soil	NYSDEC TAGM (ug/kg)	Detected Concentration Range (ug/kg)	Number of Detections	Number of Exceedances
Benzene	60	6.0 – 170.0	3	2
Ethylbenzene	5,500	12 – 41,000	6	1
MTBE	120	20	1	0
Tetrachloroethene	1,400	2.0 – 11.0	2	0
Toluene	1,500	16.0– 86,000	8	1
Xylenes (Total)	1,200	0.3 – 170,000	6	1

The most prevalent VOCs and only exceedances of NYSDEC TAGM values were for benzene, toluene, ethylbenzene, and Xylenes (BTEX compounds). Two Benzene detections (170 µg/L at 55 ft bgs in EPA-MW-31 and 160 µg/L at 52 ft bgs in EPA-MW-33) exceeded the standards, while Toluene, Ethylbenzene and Xylenes had one exceedance each with concentrations of 86,000 µg/L, 41,000 µg/L, and 170,000 µg/L, respectively, at EPA-MW-33 (51 ft bgs).

No detected concentrations for the constituent of concerns (i.e., PCE, TCE, and cis-1,2-DCE) exceeded the NYSDEC TAGM values. The remaining VOCs were detected infrequently and/or at low concentrations that did not exceed ARARs for soils.

5.2 Groundwater Sampling

This section summarizes the groundwater quality in the shallow, intermediate, and deep Upper Glacial Aquifer. As previously stated, to augment the existing monitoring well network, EPA installed a total of 11 additional monitoring wells, 6 intermediate upper glacial (CL-1, CL-2, CL-3, CL-4S, EPA-MW-30, and EPA-MW-32); 2 shallow upper glacial (EPA-MW-31 and EPA-MW-33); and 3 deep upper glacial (CL-1D, CL-4D and EPA-MW-29). The location of each monitoring well is shown on Figure 2.

Results from seven rounds of groundwater sampling (September 1999, February 2000, April 2000, January 2001, October 2001, September 2002, and April 2003) conducted as part of the SCA investigation for OU- 2 are presented. Samples from all rounds were analyzed for TCL VOCs. Samples from April 2000 and January 2001 were also analyzed for full TCL semivolatile organic compounds (SVOCS), TCL pesticides, and Target Analyte List (TAL) inorganics.

Concentrations ranges for detected compounds are summarized below and, where appropriate, are compared to the lower of NYSDEC groundwater (GA) standards or federal MCLs. Analytical results for VOCs, SVOCs, inorganics, pesticides, and groundwater quality parameters are presented in Tables 3 through 6 of the HI OU-1, respectively.

5.2.1 Shallow Upper Glacial Aquifer

This section discusses the groundwater quality in the shallow Upper Glacial Aquifer. Results for each class of compounds are summarized for sampling events conducted between January 2001 and September 2002. No Shallow Upper Glacial Aquifer wells were sampled during the September 1999, February 200, or April 2000 sampling events.

5.2.1.1 Volatile Organic Compounds

Detected VOCs are summarized below for each of the seven groundwater sampling events between September 1999 and September 2002. A complete list of VOC analytical results is presented in Table 3.

January 2001

Volatile Organic Compounds in Groundwater (January 2001)	MCL or NYSDEC GA (µg/L	Detected Concentration Range (µg/L)	Number of Detections	Number of Exceedances
Benzene	1	490	1	1
Ethyl Benzene	5	61	1	1
Xylenes (Total)	5	260	1	1

Three shallow Upper Glacial Aquifer OU-2 wells (ST-AM-04, EPA-MW-31, and EPA-MW-33) were sampled in January 2001. Benzene, ethylbenzene and total Xylenes had one exceedance each at monitoring well EPA-MW-31 (490 µg/L benzene, 61 µg/L ethyl benzene, and 260 µg/L total Xylenes).

October 2001

Volatile Organic Compounds in Groundwater (October 2001)	MCL or NYSDEC GA (µg/L)	Detected Concentration Range (µg/L)	Number of Detections	Number of Exceedances
Benzene	1	430	1	1
Ethyl Benzene	5	63	1	1
MTBE	10	7.1	1	0
Tetrachloroethene	5	0.17	1	0
Toluene	5	44	1	1
Xylenes (Total)	5	200	1	1

Three shallow Upper Glacial Aquifer OU-2 wells were sampled in October 2001. Benzene, Ethylbenzene, Toluene, and total Xylenes had one exceedance each in monitoring well EPA-MW-31 (430 µg/L Benzene, 44 µg/L Toluene, 63 µg/L Ethylbenzene, and 200 µg/L total Xylenes).

September 2002

Volatile Organic Compounds in Groundwater (September 2002)	MCL or NYSDEC GA (µg/L)	Detected Concentration Range (µg/L)	Number of Detections	Number of Exceedances
Benzene	1	360	1	1
Ethyl Benzene	5	66	1	1
M + p –xylene	5	140	1	1
o-xylene	5	46	1	1
Toluene	5	32	1	1

Two shallow Upper Glacial Aquifer OU-2 wells were sampled in September 2002. Benzene, Ethyl benzene, Toluene, and total Xylenes had one exceedance each in monitoring well EPA-MW-31 (360 µg/L Benzene, 32 µg/L Toluene, 66 µg/L Ethylbenzene, 140 µg/L m+p-Xylenes, 46 µg/L o-Xylenes).

April 2003

Volatile Organic Compounds in Groundwater (April 2003)	MCL or NYSDEC GA (µg/L)	Detected Concentration Range (µg/L)	Number of Detections	Number of Exceedances
Benzene	1	430	1	1
Ethyl Benzene	5	81	1	1
Toluene	5	30	1	1
Xylenes (Total)	5	270	1	1

Two shallow Upper Glacial Aquifer OU-2 wells were sampled in April 2003. Benzene, Ethylbenzene and total Xylenes had one exceedance each in monitoring well EPA-MW-31 (430 µg/L Benzene, 30 µg/L Toluene, 81 µg/L Ethylbenzene, and 270 µg/L total Xylenes).

5.2.1.2 Semi-Volatile Organic Compounds

Select samples from January 2001 were analyzed for full TCL SVOCs. Detected SVOCs are summarized below for both groundwater sampling events. A complete list of SVOC analytical results is presented in Table 4.

January 2001

Semi-Volatile Organic Compounds in Groundwater (January 2001)	MCL or NYSDEC GA (µg/L)	Detected Concentration Range (µg/L)	Number of Detections	Number of Exceedances
2,4-Dimethylphenol	50	1.0	1	0
Di-N-Butylphthalate	NA	1.0	1	0

Semi-Volatile Organic Compounds in Groundwater (January 2001)	MCL or NYSDEC GA (µg/L)	Detected Concentration Range (µg/L)	Number of Detections	Number of Exceedances
Di-N-Octylphthalate	50	1.0	1	0
Naphthalene	10	6.0	1	0

Four SVOCs were detected in the two shallow Upper Glacial OU-2 monitoring wells (EPA-MW-31 and EPA-MW-33) sampled in January 2001. All of the detects were infrequent and at low concentrations. None of the detected concentrations exceeded federal MCLs or NYSDEC GA standards.

5.2.1.3 Inorganic Compounds

Select samples from January 2001 were analyzed for TAL inorganics. Detected inorganic compounds are summarized below. A complete list of inorganic analytical results is presented in Table 5.

January 2001

Inorganic Compounds in Groundwater (January 2001)	MCL or NYSDEC GA (µg/L	Detected Concentration Range (µg/L	Number of Detections	Number of Exceedances
Aluminum	NA	59.6	1	0
Arsenic	10	12.2	1	1
Barium	1000	61.6 – 493	2	0
Calcium	NA	39,200 – 42,700	2	0
Chromium	50	9.0 – 12.9	2	0
Cobalt	NA	1.7	1	0
Copper	200	0.86 – 1.5	2	0
Iron	300	446 – 28,700	2	2
Magnesium	35,000	16,900 – 17,800	2	0
Manganese	300	67.3 – 5,530	2	1
Mercury	0.7	0.12	1	0
Nickel	100	8.6 – 10.8	2	0
Potassium	NA	2,270 – 2,350	2	0
Sodium	20,000	31,500 – 51,200	2	2
Vanadium	NA	1.1	1	0
Zinc	2,000	1.9	1	0

In the two shallow Upper Glacial OU-2 monitoring wells sampled for analysis of inorganic contaminants (EPA-MW-31 and EPA-MW–33), sixteen compounds were detected. Iron and sodium were detected in both wells at concentrations greater than the NYSDEC GA standards. Concentrations of manganese were detected in both wells, and the concentration in EPA-MW-31 (5,530 µg/L) exceeded the NYSDEC GA standard. Arsenic was also detected in monitoring well EPA-MW-31 at a concentration (12.2 µg/L) that exceeded the federal MCL. None of these inorganic compounds are believed to be Site related. The remaining twelve inorganic compounds (aluminum, barium, calcium, chromium, cobalt, copper, magnesium, mercury, nickel, potassium, vanadium, and zinc) were detected at low concentrations and did not exceed the ARARs.

5.2.1.4 Pesticides

Select samples from January 2001 were also analyzed for full TCL pesticides. No pesticides were detected in the two shallow Upper Glacial Aquifer groundwater samples (EPA-MW-31 and EPA-MW-33) collected in January 2001. A summary of pesticide analytical results is presented in Table 6.

5.2.2 Intermediate Upper Glacial Aquifer

This section discusses the groundwater quality in the intermediate Upper Glacial Aquifer. Results for each class of compounds are summarized for sampling events conducted between September 1999 and September 2002.

5.2.2.1 Volatile Organic Compounds

A complete list of VOC analytical results is presented in Table 3.

September 1999

Volatile Organic Compounds in Groundwater (September 1999)	MCL or NYSDEC GA (µg/L)	Detected Concentration Range (µg/L)	Number of Detections	Number of Exceedances
Tetrachloroethene	5	0.5 – 2.2	2	0

Four intermediate Upper Glacial OU-2 monitoring wells (CL-1S, -2, -3, -4S) were sampled for VOC analysis in September 1999. PCE was the only detected VOC and was detected in two monitoring wells (CL-1S and CL-4S). All detected concentrations were below the ARARs.

February 2000

No intermediate Upper Glacial OU-2 monitoring wells were sampled during the February 2000 sampling event.

April 2000

Volatile Organic Compounds in Groundwater (April 2000)	MCL or NYSDEC GA (µg/L)	Detected Concentration Range (µg/L)	Number of Detections	Number of Exceedances
Tetrachloroethene	5	4.0 – 93	3	2

Three intermediate Upper Glacial Aquifer OU-2 monitoring wells were sampled in April 2000. PCE concentrations were detected in all three wells, two of which exceeded ARARs. These exceedances were at CL-3 (93 µg/L) and CL-4S (54 µg/L); both wells are located down-gradient of the SCA in the vicinity of the WAGNN well field.

January 2001

Volatile Organic Compounds in Groundwater (January 2001)	MCL or NYSDEC GA (µg/L)	Detected Concentration Range (µg/L)	Number of Detections	Number of Exceedances
Tetrachloroethene	5	4.0	1	0

Two intermediate Upper Glacial Aquifer OU-2 monitoring wells were sampled in January 2001. PCE was detected in only one of the wells (EPA-MW-30) at a concentration below state and federal ARARs.

October 2001

Volatile Organic Compounds in Groundwater (October 2001)	MCL or NYSDEC GA (µg/L)	Detected Concentration Range (µg/L)	Number of Detections	Number of Exceedances
MTBE	10	1.5	1	0
Tetrachloroethene	5	1.9 – 5.0	4	0

Five intermediate Upper Glacial OU-2 monitoring wells were sampled in October 2001. PCE was detected in four of the five wells sampled, at concentrations ranging from 1.9 µg/L (EPA-MW-30) to 5.0 µg/L (CL-3). None of the PCE detections exceeded federal or state guidance values. MTBE was detected in one well (CL-1S) at a concentration below ARARs.

September 2002

Volatile Organic Compounds in Groundwater (September 2002)	MCL or NYSDEC GA (µg/L)	Detected Concentration Range (µg/L)	Number of Detections	Number of Exceedances
Tetrachloroethene	5	2.6	1	0

Two intermediate Upper Glacial monitoring OU-2 monitoring wells were sampled in September 2002. PCE was detected below federal and state guidance values in well EPA-MW-30.

April 2003

Volatile Organic Compounds in Groundwater (April 2003)	MCL or NYSDEC GA (µg/L)	Detected Concentration Range (µg/L)	Number of Detections	Number of Exceedances
MTBE	10	0.73 -1.8	3	0
Tetrachloroethene	5	1.5 – 3.9	4	0

Five intermediate Upper Glacial OU-2 monitoring wells were sampled in April 2003. PCE was detected in four of the five samples, at concentrations ranging from 1.5 µg/L (CL-1S) to 3.9 µg/L (CL-3). None of the PCE detections exceeded federal or state guidance values. MTBE was detected in three of the wells at concentrations below ARARs.

5.2.2.2 Semi-Volatile Organic Compounds

Select samples from January 2001 were analyzed for full TCL SVOCs. Detected SVOCs are summarized below for both groundwater sampling events. A complete list of SVOC analytical results is presented in Table 4.

January 2001

Semi-Volatile Organic Compounds in Groundwater (April 2000)	MCL or NYSDEC GA (µg/L)	Detected Concentration Range (µg/L)	Number of Detections	Number of Exceedances
Di-N-Butylphthalate	NA	1.0	1	0

Di-N-butylphthalate was the only SVOC detected in the two intermediate Upper Glacial OU-2 monitoring wells (EPA-MW-30 and EPA-MW-32) sampled in January 2001. The contaminant was detected at a low concentration (1.0 µg/L) and did not exceed ARARs.

5.2.2.3 Inorganic Compounds

Select samples from January 2001 were analyzed for TAL inorganics. Detected inorganic compounds are summarized below for both groundwater sampling events. A complete list of inorganic analytical results is presented in Table 5.

January 2001

Inorganic Compounds in Groundwater (January 2001)	MCL or NYSDEC GA (µg/L)	Detected Concentration Range (µg/L)	Number of Detections	Number of Exceedances
Aluminum	NA	240 - 944	2	0
Barium	1000	17.3 – 35.9	2	0
Beryllium	3	0.12 – 0.13	2	0
Calcium	NA	27,500 – 30,500	2	0
Chromium	50	14.3 – 25.6	2	0
Cobalt	NA	0.92 – 2.4	2	0
Copper	200	2.4 – 27.4	2	0
Iron	300	619 - 853	2	2

Inorganic Compounds in Groundwater (January 2001)	MCL or NYSDEC GA (µg/L)	Detected Concentration Range (µg/L)	Number of Detections	Number of Exceedances
Magnesium	35,000	10,400 – 10,900	2	0
Manganese	300	33.2 - 179	2	0
Mercury	0.7	0.10 – 0.12	2	0
Nickel	100	10.5 – 19.3	2	0
Potassium	NA	1,550 – 3,080	2	0
Sodium	20,000	8,300 – 19,800	2	0
Vanadium	NA	0.76 – 2.4	2	0
Zinc	2,000	2.5 – 41.8	2	0

Sixteen inorganic compounds were detected in both intermediate Upper Glacial Aquifer samples (EPA-MW-30 and EPA-MW–32) collected in January 2001. Iron was the only compound exceeding the NYSDEC GA standard with detected at concentrations of 619 µg/L (EPA-MW-30) and 853 µg/L (EPA-MW-32). Iron is not believed to be related to past activities conducted in the SCA. The remaining fifteen inorganic compounds were detected at low concentrations that did not exceed ARARs.

5.2.2.4 *Pesticides*

Select samples from January 2001 were also analyzed for full TCL pesticides. No pesticides were detected in the two intermediate Upper Glacial Aquifer groundwater samples (EPA-MW-30 and EPA-MW–32) collected in January 2001. A summary of pesticide analytical results is presented in Table 6.

5.2.3 Deep Upper Glacial Aquifer

This section discusses the groundwater quality in the deep Upper Glacial Aquifer. Results for each class of compounds are summarized for sampling events conducted between September 1999 and September 2002.

5.2.3.1 *Volatile Organic Compounds*

A complete list of VOC analytical results is presented in Table 3.

September 1999

Volatile Organic Compounds in Groundwater (September 1999)	MCL or NYSDEC GA (µg/L)	Detected Concentration Range (µg/L)	Number of Detections	Number of Exceedances
Tetrachloroethene	5	3.4 – 1,300	2	1

Two deep Upper Glacial Aquifer OU-2 monitoring wells (CL-1D and –4D) were sampled for VOC analysis in September 1999. PCE was detected in both wells, and exceeded the ARARs in monitoring well CL-1D with a concentration of 1,300 µg/L.

February 2000

Volatile Organic Compounds in Groundwater (February 2000)	MCL or NYSDEC GA (µg/L)	Detected Concentration Range (µg/L)	Number of Detections	Number of Exceedances
Tetrachloroethene	5	1.0	1	0

Only one deep Upper Glacial Aquifer OU-2 monitoring well (ST-AM-03) was sampled for VOC analysis in February 2000. PCE was detected at a concentration below the ARARs

April 2000

Volatile Organic Compounds in Groundwater (April 2000)	MCL or NYSDEC GA (µg/L)	Detected Concentration Range (µg/L)	Number of Detections	Number of Exceedances
Benzene	1	10	1	1
Tetrachloroethene	5	840	1	1
Trichloroethene	5	5.0	1	0

Two deep Upper Glacial Aquifer OU-2 monitoring wells (CL-1D and –4D) were sampled in April 2000 resulting in the detection of three VOCs. PCE and TCE were each detected in CL-1D south of the SCA. PCE exceeded ARARs with a detected concentration of 840 µg/L and TCE was detected at a concentration equal to the MCL and NYSDEC GA value of 5.0 µg/L. Benzene was detected above federal and state guidance values in monitoring well CL-4D at a concentration of 10 µg/L.

January 2001

Two deep Upper Glacial Aquifer OU-2 monitoring wells (EPA-MW-29 and ST-AM-03) were sampled in January 2001. BTEX or PCE were not detected in either of these two wells.

October 2001

Volatile Organic Compounds in Groundwater (October 2001)	MCL or NYSDEC GA (µg/L)	Detected Concentration Range (µg/L)	Number of Detections	Number of Exceedances
Tetrachloroethene	5	0.26 - 23	4	1
Trichloroethene	5	0.24 – 0.59	2	0

Four deep Upper Glacial OU-2 monitoring wells (CL-1D, -4D, EPA-MW-29, and ST-AM-03) were sampled for in October 2001. PCE was detected in all four wells with one exceedance of ARARs in monitoring well CL-1D (23 µg/L). TCE was detected in wells CL-1D and ST-AM-03 at concentrations of 0.59 µg/L and 0.24 µg/L, respectively.

September 2002

EPA-MW-29, located south of the Site, was the only deep Upper Glacial OU-2 monitoring well sampled in September 2002. BTEX and PCE were not detected in this well during this sampling event.

April 2003

Volatile Organic Compounds in Groundwater (April 2003)	MCL or NYSDEC GA (µg/L)	Detected Concentration Range (µg/L)	Number of Detections	Number of Exceedances
Tetrachloroethene	5	1.1 - 120	4	1
Xylenes (Total)	5	0.8	2	0

Three deep Upper Glacial OU-2 monitoring wells (CL-1D, -4D, and EPA-MW-29) were sampled in April 2003. PCE was detected in two wells with one exceedance of ARARs in monitoring well CL-1D (120 µg/L). A concentration of total Xylenes was also detected in well CL-4D below the ARARs.

5.2.3.2 Semi-Volatile Organic Compounds

In April 2000 and January 2001, select samples were analyzed for full TCL SVOCs. No SVOCs were detected in deep Upper Glacial Aquifer wells during the April 2000 (CL-1D) or January 2001 (EPA-MW-29) event. A complete list of SVOC analytical results is presented in Table 4.

5.2.3.3 Inorganic Compounds

Select samples from April 2000 and January 2001 were analyzed for TAL inorganics. Detected inorganic compounds are summarized below for both groundwater sampling events. A complete list of inorganic analytical results is presented in Table 5.

April 2000

Inorganic Compounds in Groundwater (April 200)	MCL or NYSDEC GA (µg/L)	Detected Concentration Range (µg/L)	Number of Detections	Number of Exceedances
Barium	1000	51.4	1	0
Calcium	NA	40,600	1	0
Chromium	50	4.4	1	0
Copper	200	2.8	1	0

Inorganic Compounds in Groundwater (April 200)	MCL or NYSDEC GA (µg/L)	Detected Concentration Range (µg/L)	Number of Detections	Number of Exceedances
Iron	300	55	1	0
Magnesium	35,000	15,600	1	0
Manganese	300	2.6	1	0
Nickel	100	4.7	1	0
Potassium	NA	2,810	1	0
Selenium	10	3.1	1	0
Sodium	20,000	30,900	1	1
Zinc	2,000	4.3	1	0

One deep Upper Glacial monitoring well, CL-1D was sampled for inorganic compounds in April 2000. Sodium was detected at a concentration of 30,900 µg/L, which exceeded the NYSDEC GA standard of 20,000 µg/L, but is not believed to be related to past Site activities. The remaining eleven inorganic compounds were detected at concentrations below the federal and state guidance values.

January 2001

Inorganic Compounds in Groundwater (January 2001)	MCL or NYSDEC GA (µg/L)	Detected Concentration Range (µg/L)	Number of Detections	Number of Exceedances
Aluminum	NA	23.3	1	0
Barium	1000	31.4	1	0
Calcium	NA	27,800	1	0
Chromium	50	1.3	1	0
Cobalt	NA	0.89	1	0
Copper	200	0.91	1	0
Iron	300	18	1	0
Magnesium	35,000	13,400	1	0
Manganese	300	0.94	1	0
Nickel	100	1.6	1	0
Potassium	NA	1,920	1	0
Sodium	20,000	24,400	1	1

One well screened in the deep Upper Glacial Aquifer, EPA-MW-29, was sampled for inorganic compounds in January 2001. The detected concentration of sodium (24,400 µg/L) exceeded the NYSDEC GA standard (20,000 µg/L), but this compound is not believed to be related to past Site activities. Concentrations were below ARARs for the remaining eleven detected inorganic compounds.

5.2.3.4 Pesticides

Select samples from April 2000 and January 2001 were also analyzed for full TCL pesticides. No pesticides were detected in deep Upper Glacial Aquifer monitoring well CL-1D in April 2000 or in deep Upper Glacial Aquifer monitoring well EPA-MW-29 in January 2001. A summary of pesticide analytical results is presented in Table 6.

5.2.4 Discussion

Based upon the sampling results presented in Section 5.0 for the EPA monitoring/sentinel wells, the only PCE concentration detected in the shallow Upper Glacial Aquifer was in the OU-2 monitoring well EPA-MW-33 at a concentration of 0.17 µg/L in October 2001. This well is up-gradient of the Fenley Amoco and Mayflower sites.

Total BTEX concentrations ranging from 648 µg/L to 811 µg/L have been detected in OU-2 monitoring well EPA-MW-31 since it was first sampled in January 2001, until the most recent sampling event in April 2003. EPA-MW-31 is directly down-gradient of the Fenley Amoco and Mayflower sites. No other EPA OU-2 monitoring/sentinel wells in the shallow Upper Glacial Aquifer have had detections of PCE or BTEX.

Elevated PCE concentrations have been detected in the intermediate and deep Upper Glacial in OU-2 monitoring wells CL-3, CL-4s, and CL-1D. The highest detection of PCE in the intermediate Upper Glacial Aquifer was in monitoring wells CL-3 and CL-4s (93 µg/L and 54 µg/L respectively in April 2000). Both of these wells are located down-gradient of the OU-2 sites (i.e., Fenley, Mayflower, and CDC) in the vicinity of the WAGNN field (Figure 2). The April 2000 sampling event was performed prior to the initiation of the EPA OU-1 remediation efforts of soil vapor extraction and groundwater extraction and treatment. Since this April 2000 sampling event, no VOCs have been detected above the federal MCL for the EPA monitoring/sentinel wells (CL-3, CL-4s, CL-4D, EPA-MW-29 and EPA-MW-30) located between these OU-2 sites and the WAGNN Watermill Lane well field (Figure 2).

In the deep Upper Glacial Aquifer, the highest PCE concentration (1,300 µg/L) was detected in monitoring well CL-1D in September 1999. It has been determined in the HI OU-1 Report (June 2003) that well CL-1D is directly down-gradient of the Stanton Cleaners property and that this PCE contamination is attributable to this site. A Benzene concentration of 10 µg/L was detected in monitoring well CL-4D in April 2000.

During the September 2002 and April 2003 sampling events, concentrations of PCE in the intermediate and deep portions of the Upper Glacial aquifer decreased substantially when compared to earlier sampling events. The PCE concentration in the deep Upper Glacial Aquifer monitoring well CL-1D has decreased from 1,300 µg/L to 120 µg/L as of the last sampling event conducted in April 2003. Additionally, the PCE concentration in the intermediate Upper Glacial Aquifer monitoring well CL-3 has decreased from 93 µg/L in April 2000 to 3.9 µg/L in April 2003.

However, the elevated total BTEX concentrations in the shallow Upper Glacial Aquifer monitoring well EPA-MW-31 have remained relatively constant. As previously stated, this well is down-gradient and within the area of contamination from the Fenley Amoco site.

Based upon the sampling results presented in Section 5, the only PCE concentration detected in the shallow Upper Glacial Aquifer OU-2 monitoring wells is in monitoring well EPA-MW-33 at a concentration of 0.17 µg/L (October 2001). Total BTEX concentrations ranging from 648 µg/L to 811 µg/L have been detected in OU-2 monitoring well EPA-MW-31 since it was first sampled in January 2001 until the most recent sampling event in April 2003. No other OU-2 monitoring wells in the shallow Upper Glacial Aquifer have had detections of PCE or BTEX

Elevated PCE concentrations have been detected in the intermediate and deep Upper Glacial in OU-2 monitoring wells CL-3, CL-4, and CL-1D. The highest detection of PCE in the intermediate Upper Glacial Aquifer was in monitoring wells CL-3 and CL-4 (93 µg/L and 54 µg/L respectively in April 2000). Both of these wells are located down-gradient of the SCA in the vicinity of the WGNN field. In the deep Upper Glacial Aquifer, the highest PCE concentration (1,300 µg/L) was detected in monitoring well CL-1D in September 1999. A Benzene concentration of 10 µg/L was detected in monitoring well CL-4D in April 2000.

6.0 SUMMARY AND RECOMMENDATIONS

Hydrogeologic and chemical data collected during this OU-2 Investigation Summary Report indicate that the local groundwater flow pattern across the Fenley Amoco, Mayflower and CDC sites is generally in the north-northwest direction in the upper glacial aquifer. In the area of the active Amoco Gas Station (Amoco B) and Jonathan's Auto Repair, groundwater flow is in the westerly direction. Data used to support these observations include measurements of groundwater levels from the NYSDEC Quarterly monitoring and progress reports; EPA data; and the presence of several VOCs, particularly BTEX, which act as tracers for actual groundwater flow.

In the area of Fenley, Mayflower and CDC, while BTEX, MTBE and PCE (and its breakdown products, TCE, DCE, DCA, and vinyl chloride) continue to be found in a limited number of wells above federal MCLs, these locations are confined to a relatively small radius (<200 feet) and restricted to each sites' boundaries.

For the Active Amoco Gas Station and Jonathan's Auto Repair Sites, NYSDEC has determined that the BTEX and MTBE plumes are confined to a shallow perched water zone and are flowing in a westerly direction, away from the WAGNN Watermill Lane well field. On-site remediation (SVE and P&T) have steadily decreased concentrations of BTEX and MTBE from thousands of ppb to less than 184 ppb.

Of special significance, based upon data collected during several EPA groundwater sampling events from September 1999 through April 2003, PCE was only detected at concentrations exceeding Federal or State standards one time during the April 2000 sampling event at EPA monitoring/sentinel wells CL-4S (54 ppb) and CL-3 (93 ppb). This sampling event was performed prior to the initiation of the EPA OU-1 remediation efforts of soil vapor extraction and groundwater extraction and treatment. Since this April 2000 sampling event, no VOCs have been detected above the federal MCL for the EPA monitoring/sentinel wells (CL-3, CL-4s, CL-4D, EPA-MW-29 and EPA-MW-30) located between these OU-2 sites and the WAGNN Watermill Lane well field.

For the Fenley, Mayflower, and CDC sites, data support a definitive trend of steady-state to diminishing VOC concentration levels. This is supported by the identification of PCE breakdown products, TCE, DCE, DCA and vinyl chloride, at rising levels within and restricted to the sites' boundaries (<50 feet). It is suggested that the co-mingled BTEX plume may be providing an anthropogenic source of carbon to initiate reductive dechlorinization of the residual PCE, in effect, natural attenuation.

As presented in data Tables 4-1 through 4-11, the general pattern of VOC concentrations in groundwater at the OU-2 sites is in a steady-state or equilibrium condition in the magnitude and extent of VOCs present. The chemical data suggests that the mass of VOCs (with BTEX being the most prevalent contaminant) in the shallow upper glacial has been reduced by a factor of two or more between early and recent NYSDEC sampling events. The reduction in contaminant concentrations most likely is attributable to a combination of successful remediation efforts of soil removal, SVE, groundwater extraction and treatment, and natural attenuation.

6.1 Fenley Amoco Gas Station Site

Previous response actions at this site includes a SVE system and groundwater extraction and treatment system to remedy the BTEX contamination in the soils and groundwater. Elevated concentrations of BTEX compounds above Federal and States standards still remain in the groundwater.

Due to the limited success in remediating the spill source area at Fenley with a P&T system (December 1992 to June 1997, see Section 4.1), in September 2002 the NYSDEC Spills program approved a proposed remedial system which consists of a combination of air sparging (AS) and SVE/high vacuum (HiVac) extraction wells. A total of seven AS wells and three SVE/HiVac wells have been installed and are in the process of being tested. It is expected that this system will address the source of contamination for both the soils and the groundwater, thereby reducing the contaminant migration pathway through the soil-groundwater interface.

NYSDEC has installed numerous groundwater monitoring wells in the area to monitor effective plume capture and to ensure that the contamination does not migrate further from the site. NYSDEC also plans to install additional transects of well nests down-gradient of the existing monitoring well network to verify the steady state nature of the contaminant plume in this area. Any future actions that would be necessary for this site will be addressed by NYSDEC.

6.2 Mayflower Cleaners Site

In March 1996, EPA transmitted a letter to the property owner approving the satisfactory closure of the UIC Class V wells, as per EPA's UIC closure requirements. EPA believes that the drywell cleanup conducted at the site has addressed the major source of PCE contamination. EPA's most recent groundwater sampling at EPA monitoring/sentinel wells down-gradient of the site and between the WAGNN Watermill Lane well field has shown non-detectable levels of PCE in the groundwater.

Groundwater characterization at Mayflower, which included monitoring well installation and soil and groundwater sampling, was performed as part of the NYSDEC Fenley Amoco Site soil and groundwater remediation effort. It has been determined that residual PCE groundwater contamination, which is confined to a 50 foot radius surrounding Mayflower, is co-mingled with the higher concentrations of the BTEX plume identified as part of the Fenley Amoco Site. Evidence suggests that the former Fenley property may be a contributing source to PCE groundwater contamination at Mayflower.

Based upon the close proximity of the Mayflower Cleaners site and Fenley Site, EPA believes any remaining residual contamination at Mayflower Cleaners will be addressed as part of the overall site cleanup plan implemented by the NYSDEC as part of the Fenley Amoco Gas Station Site cleanup. Based on these findings, EPA believes that no further action is required.

6.3 Citizen's Development Company (Flower Fashion Cleaners) Site

Previous response actions at this site included soil removal, SVE treatment of soils, and a groundwater extraction and treatment system to address VOC contamination (primarily PCE) in the soils and groundwater. Some elevated concentrations of VOCs above Federal and States standards still remain in the groundwater, but a comparison of historic and recent groundwater sampling results (March 2003 Annual Report) support a downward trend of PCE concentration levels.

Currently, NYSDEC continues to monitor groundwater in the area as part of the CDC OU-1 ROD. NYSDEC is also proposing to conduct soil gas sampling to evaluate the potential for contaminant exposure in indoor air. Any future investigations and potential response actions will be addressed under a second operable unit by the NYSDEC.

6.4 Active Amoco Gas Station Site

The on-going SVE and extraction and treatment systems have successfully treated and continue to prevent further migration of the MBTE and BTEX plume. NYSDEC continues to monitor these activities. At this time, the NYSDEC is further evaluating potential source area remediation through the use of oxygen release compounds to expedite in situ treatment. Any future actions that would be necessary will be addressed by the NYSDEC.

6.5 Jonathan's Auto Repair Site

Both UIC and NYSDEC spills closure work has been completed at this site. The ongoing treatment operations at the Active Amoco Gas Station (Amoco B) across the street, have successfully prevented further migration of the MTBE and BTEX plume, as it relates to this site. Any future actions that would be necessary will be addressed by NYSDEC as part of the Active Amoco Gas Station Site.

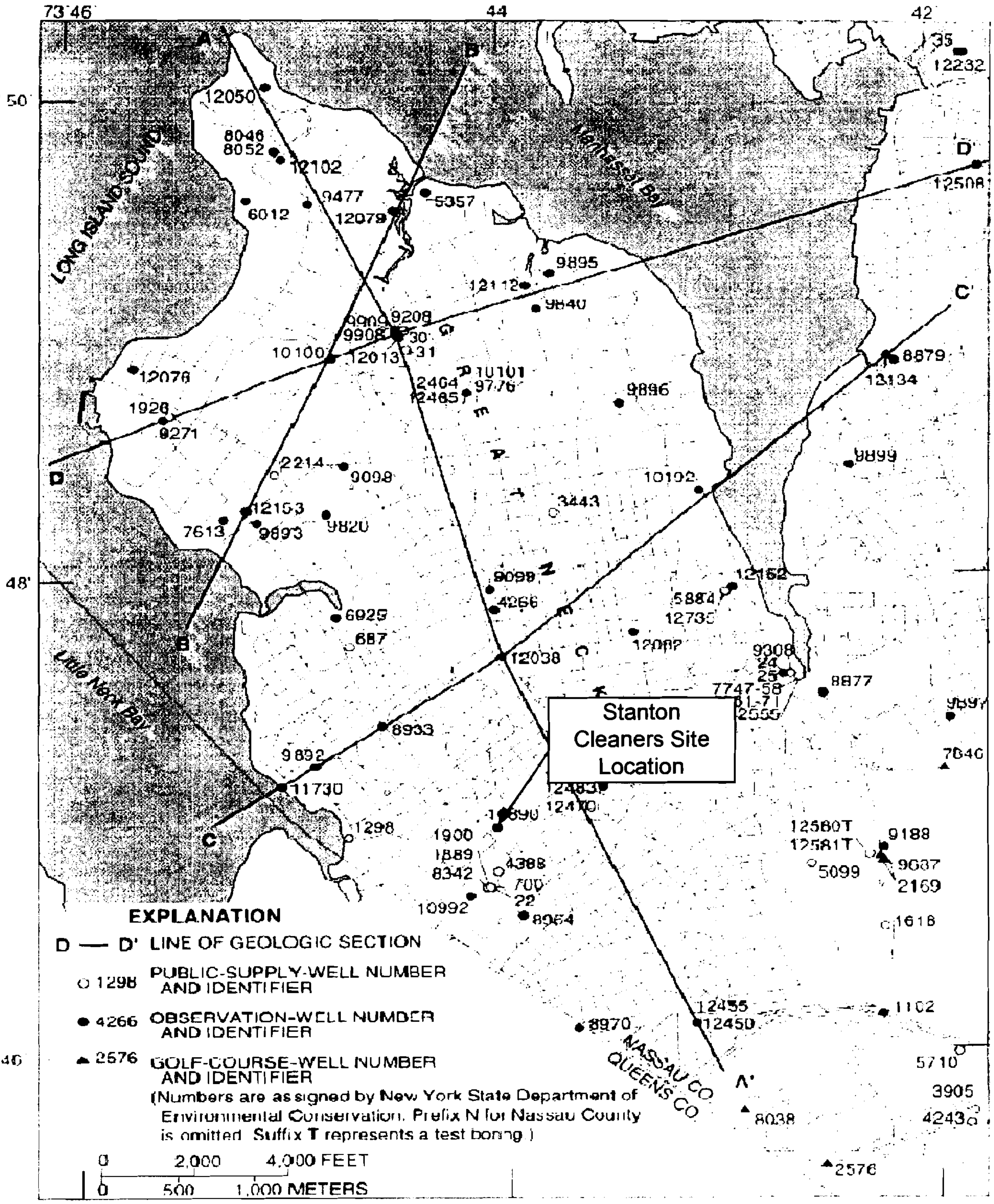
7.0 CONCLUSIONS

Under the Operable Unit One Long-Term Response Action (LTRA), EPA will be sampling an array of monitoring wells, both up-gradient and down-gradient of the Stanton Cleaners Property. The down-gradient wells will be selected in order to provide an assessment of the condition of the groundwater in the vicinity of the Stanton Cleaners site (i.e., near those sites identified in this Operable Unit Two Investigation Summary Report). These monitoring/sentinel wells will act to provide early identification of potential contamination that could impact the nearby WAGNN Watermill Lane supply wells.

When available, EPA will also include the results from NYSDEC's groundwater monitoring program for the Fenley Amoco, the CDC, and the Amoco (B) sites in the LTRA monitoring reports for the Stanton Cleaners site.

EPA has reviewed the ongoing response actions at the nearby sites which have been identified as having contributed to groundwater contamination in the vicinity of the Stanton Cleaners Site. EPA has determined that the above-referenced sites have been addressed or are in the process of being addressed by NYSDEC and/or private parties, outside of the Federal Superfund program. Accordingly, based on its review, EPA has concluded that, other than the continued implementation of the March 1999 remedy and the periodic review of that remedy pursuant to CERCLA '121(c), 42 U.S.C. ' 9621(c), no further Federal response actions, under CERCLA, need to be taken as part of the remediation of the Stanton Cleaners Site.

EPA may revisit this determination in the future if it obtains new information which indicates that it would be appropriate for EPA to do so.



EXPLANATION

D —— D' LINE OF GEOLOGIC SECTION

○ 1298 PUBLIC-SUPPLY-WELL NUMBER AND IDENTIFIER

● 4266 OBSERVATION-WELL NUMBER AND IDENTIFIER

▲ 2576 GOLF-COURSE-WELL NUMBER AND IDENTIFIER

(Numbers are assigned by New York State Department of Environmental Conservation. Prefix N for Nassau County is omitted. Suffix T represents a test boring.)

Base from New York State Department of Transportation 1:24,000, 1981

Locations of public-supply wells, observation wells, and golf-course wells within the Great Neck pennisula, Nassau County, N.Y.

E A R T H T E C H

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Figure 4A

CROSS-SECTIONS ORIENTATIONS FROM STUMM 2000

Great Neck, Nassau County, New York

Ref.: Hydrogeology and Extent of Saltwater Intrusion of the Great Neck Pennisula, Great Neck, Long Island, New York. Stumm, 2000.