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NEW YORK STATE SUPERFUND CONTRACT REMEDIAL INVESTIGATION/ FEASIBILITY STUDY (RI/FS)

Volume I • Report

Frost Street Sites

Former Autoline Automotive (Site No. 1-30-043 I)

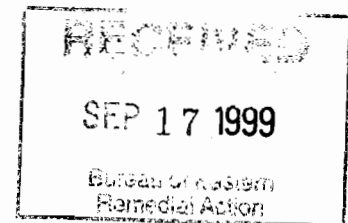
89 Frost Street (Site No. 1-30-043 L)

Former Applied Fluidics (Site No. 1-30-043 M)

Off-Site Investigation (Site No. 1-30-043)

Work Assignment No. D002676-32

DATE: August 1999



Prepared for:

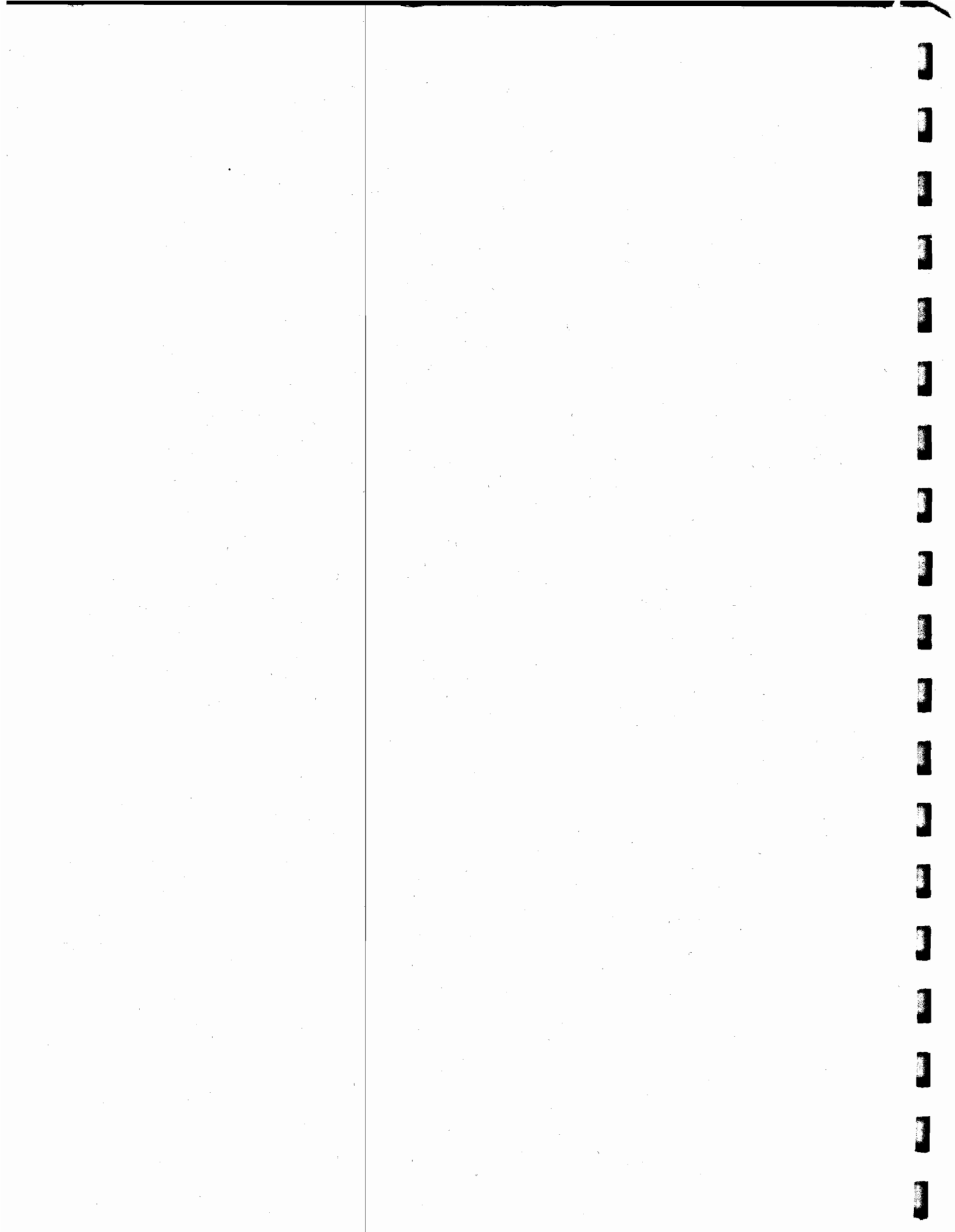
New York State Department of Environmental Conservation

50 Wolf Road, Albany, New York 12233
John Cahill, *Commissioner*

Division of Environmental Remediation
Michael J. O'Toole, Jr., *Director*

By:

Lawler, Matusky & Skelly Engineers LLP



**ENGINEERING AND OPERATIONS SERVICES
NEW YORK STATE SUPERFUND STANDBY CONTRACT**

**FROST STREET SITES
TOWN OF NORTH HEMPSTEAD, NASSAU COUNTY
Former Autoline Automotive - Site I.D. No. 1-30-043I
89 Frost Street - Site I.D. No. 1-30-043L
Former Applied Fluidics - Site I.D. No. 1-30-043M
Off-Site Investigation - Site I.D. No. 1-30-043**

Work Assignment No. D002676-32

**REMEDIAL INVESTIGATION
FEASIBILITY STUDY (RI/FS)
REPORT**

Prepared for:

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



August 1999



**LAWLER, MATUSKY & SKELLY ENGINEERS LLP
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Project No. 650-322, 650-327, 650-612, 650-616

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CHAPTER 1

EXECUTIVE SUMMARY

The Frost Street sites are located in the New Cassel Industrial Area (NCIA), Town of North Hempstead, Nassau County, New York (Figure 1-1). This heavily industrialized area in Nassau County contains numerous New York State Registry of Inactive Hazardous Waste Sites Registry sites as a result of past waste disposal practices. Prior to the area being connected to the county sewer systems, sanitary and process wastes were discharged to the subsurface. It is also likely intentional discharges of hazardous wastes to leachpools and dry wells have occurred in this highly industrialized area. The three properties that make up the Frost Street sites were added to the New York State Registry of Inactive Hazardous Waste Sites in 1996 based on a New York State Department of Environmental Conservation (NYSDEC) Preliminary Site Assessment (PSA) at the NCIA. The potentially responsible parties (PRPs) for the three properties declined to enter into a consent order to investigate and remediate the sites and the NYSDEC is currently conducting the necessary investigations. NYSDEC assigned Lawler, Matusky & Skelly Engineers LLP (LMS) the task of conducting the remedial investigation/feasibility study (RI/FS) and this report presents the results from the RI at the three Frost Street sites conducted in 1998.

The objectives of the RI were to:

- Determine the nature and extent of soil contamination at each of the sites.
- Determine the nature and extent of contamination in the groundwater on-site.
- Conduct an off-site groundwater investigation to supplement the existing off-site groundwater data in the Frost Street area.
- Provide the necessary data to scope interim remedial measures (IRMs) on-site.

The former Autoline Automotive site, (NYSDEC Site No. 1-30-043I on the New York State Registry of Inactive Hazardous Waste Sites) is located at 101 Frost Street (Figure 1-2). The property is approximately 3 acres and has one large single story warehouse

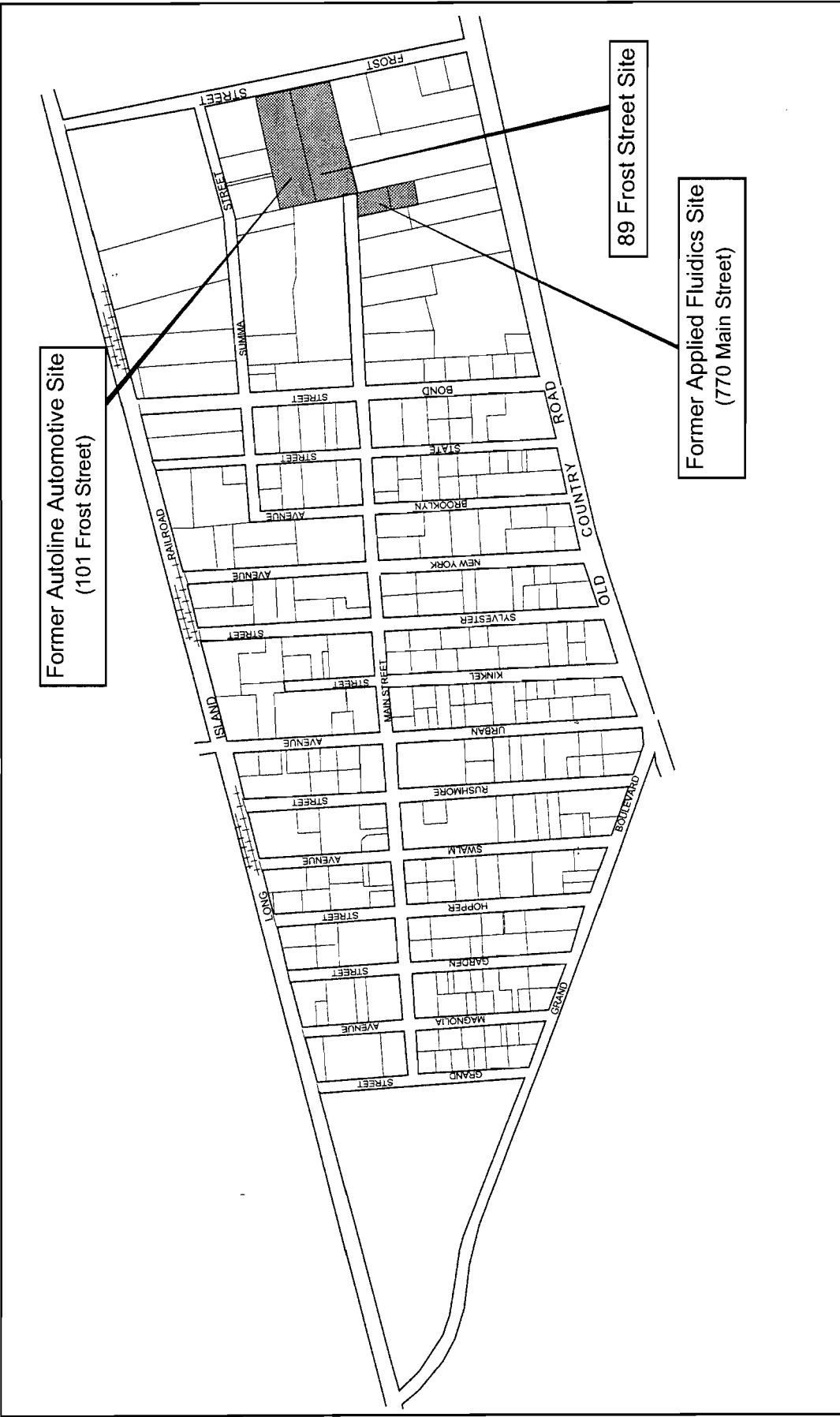


Figure 1-2
Site Plan
 FROST STREET SITES
 NEW CASSEL INDUSTRIAL AREA
 NYSDEC I.D. No. 130043 I, L, and M
 LAWLER, MATUSKY & SKELLY ENGINEERS LLP
 Pearl River, New York

0 ~500 ft
 APPROXIMATE SCALE
 1 in. = 500 ft

Map source: Nassau County tax maps.

building, which is now vacant. The site is entirely paved or covered with the footprint of the building. The 89 Frost Street site (Figure 1-2), (NYSDEC Site No. 1-30-043L on the New York State Registry of Inactive Hazardous Waste Sites) is comprised of approximately 3.5 acres of land. The on-site building was removed prior to 8 July 1998, and the site is now entirely paved for parking for an adjoining store. The former Applied Fluidics site, (NYSDEC Site No. 1-30-043M on the New York State Registry of Inactive Hazardous Waste Sites) is located at 770 Main Street (Figure 1-2). The site is comprised of approximately one acre of land. A multi-story department store built in late 1998, currently occupies the former Applied Fluidics site. The former Applied Fluidics building was a single story industrial building that fronted on Main Street. The building and its associated drainage structures were removed and the site excavated to a depth of approximately 20 ft in early 1998 when the site was redeveloped for its current use.

Topography at the Frost Street sites is essentially level with an elevation of approximately 120-ft above mean sea level. There are no significant sources of surface water directly surrounding, or in the immediate vicinity of, the Frost Street sites. Land use in the area is a mixture of industrial, commercial, and residential. Commercial property dominates along Old Country Road while land use north and south of the industrial area consists primarily of residential property. Based on an ecological communities classification system outlined by the New York State Department of Environmental Conservation, the NCIA is entirely comprised of a terrestrial cultural community. The climate of Long Island is moderated by its proximity to the ocean with an average annual temperature of 52.7°F and annual precipitation averaging about 44 in. per year (USGS, 1963).

Long Island regional hydrogeology consists of a significant thickness of unconsolidated sediments (Cretaceous and Pleistocene age) overlying Precambrian and Paleozoic basement bedrock. The bedrock surface is found at an average depth of approximately 1000-ft below sea level (USGS, 1989). Of primary concern for this investigation are the upper Pleistocene deposits and the underlying Magothy Formation. The upper Pleistocene deposits of poorly sorted sands and gravel that make up the upper glacial aquifer (UGA) are found from the surface to a depth of approximately 70-ft below the surface. The Magothy Formation consists of interbedded lenses and layers of fine to medium sand, clayey sand and solid clay with a basal, water-bearing, gravel zone. The Magothy is the major aquifer for public supply to nearly all of Long Island. The depth of the upper surface

of the Magothy is found at about 70-ft below ground surface. The UGA and Magothy are in direct hydraulic connection in the study area. Depth to water is about 50 to 55 ft below the ground surface in the study area and groundwater flows to the southwest. Hydraulic conductivity values for the UGA in the study area were lower than typically found, ranging from 2.4 to 217 ft/day. Hydraulic conductivity values based on slug tests conducted in deeper wells (Magothy Formation) ranged from 0.15 to 84 ft/day.

The RI field investigation included the collection of surface soils, subsurface soils, and groundwater samples. Two surface soil samples were taken for use in the modified health risk (exposure) assessment. A total of fourteen probe soil and groundwater sample locations were completed during this RI. The probes were located on 89 Frost Street, the former Autoline Automotive, and the former Applied Fluidics properties. A total of seven hydropunch sampling locations were also part of the investigation at 89 Frost Street, the former Autoline Automotive, and at off-site locations, to supplement the information collected during the probe investigation. A total of ten monitoring well couplets (20 wells) were installed as part of the RI. All twenty newly installed wells and five existing off-site wells were then sampled. Samples were collected from seventeen dry wells at 89 Frost Street, and fifteen dry wells at the former Autoline Automotive. The samples were collected from within the dry well if possible. At each dry well an additional sampling point was placed adjacent to the dry-well location.

A summary of the results of the RI and an interpretation of the data for each of the three sites (former Autoline Automotive, 89 Frost Street, and the former Applied Fluidics) and the off-site investigation are found below:

Former Autoline (101 Frost Street)

Site History

Several facilities occupied the building at this site including, a toy warehouse (1968), a home laboratory supply company (1972), textile companies (1974-1983), and an automotive ignition parts manufacturer (1984-1992). A newspaper insert distributor has most recently occupied the building; currently the building is vacant. The most recent occupant did not reportedly use any chemicals as part of the operation. From 1984 to

1992 Autoline Automotive Corporation, a manufacturer of ignition wires and wire harness sets, occupied the building. Autoline Automotive also occupied the building at 115 Frost Street from 1982 to 1990. Nassau County Department of Health (NCDOH) records indicate that Autoline Automotive used degreasers at their facility at 115 Frost Street. NCDOH records also indicate that a textile company, National Bassen Textiles, which occupied 101 Frost Street from 1974 to 1982, had documented use of degreasers and used 300 gallons of unknown chemicals annually.

On-site Surface Soils Results

The two surface soil samples collected at this site indicate elevated concentrations of semi-volatile organic compounds (SVOCs) and metals. The presence of SVOCs and metals in excess of the recommended soil cleanup objective in the surface soil samples are the result of the past industrial activities in the area. It is likely that similar concentrations of SVOCs would be found throughout the industrial area and the measured concentrations at this site are typical of the area.

On-site Subsurface Soils and Sediments

Two dry well locations at this site appear to have been used to discharge hazardous waste to the subsurface. Samples from 101-DWA-4 and 101-DWA-N/S both exhibited tetrachloroethylene (PCE) concentrations in excess of the recommended soil cleanup objective. Each of the on-site drainage structures contained varying amounts of bottom sediments. Several of these structures exhibited elevated concentrations of metals (copper, mercury, and zinc) and one exhibited an elevated concentration of 4,4'-DDT. The noted contamination in the bottom sediments of the drainage structures at this site appear to be limited to the areas immediately adjacent to and below each of the drainage structures. The contamination is likely bound to the fine-grained organic sediments in each structure. These bottom sediments, however, represent a potential source of contamination to the groundwater through continued leaching as stormwater passes through these materials.

Groundwater

The six on-site wells indicate that volatile organic compounds (VOCs) in excess of the Class GA standards are found in three of the six monitoring wells. The highest on-site groundwater concentration of PCE (18,000 µg/l) was found in the shallow well, FSMW-2A, located near the suspected source area. The groundwater flow direction at this site is to the southwest and it is apparent that the groundwater contamination extends to off-site locations. The vertical groundwater flow gradient at this site is downward; however, a general fining of the subsurface material with depth may be limiting downward migration of the groundwater contamination.

89 Frost Street

Site History

The 89 Frost Street site is currently used as a paved parking area for the department store located southwest of the site. Records dating back to 1971 indicate that several facilities occupied this building including a music amplifier manufacturer, a manufacturer of double-coated adhesive tape and a processing and finishing company. The building was connected to the Nassau County municipal sewer system in February 1983. To create a paved parking area in 1998 the existing building was demolished and many of the drainage structures were abandoned or altered.

Surface Soil Sampling Results

This site was entirely paved during the surface soil sampling and no surface soils were collected as part of this RI.

Subsurface Soils and Sediments

Analytical data from the subsurface soil samples indicate that VOCs in excess of the recommended soil cleanup objective are found below three dry well locations (89-DW-10, 89-DW-11, and 89-DWA-14). Both PCE and trichloroethene (TCE) were found

above the recommend soil cleanup objective in the subsurface soils. The presence of PCE and TCE in the subsurface soils at several depths and locations in this area suggest that hazardous wastes were discharged to the subsurface through one or more of the dry wells located to the rear of the site. The disposal activities associated with the noted contamination likely occurred before the facility was connected to the county sewer system.

The bottom sediments in the on-site drainage structures contained several contaminants above the recommended soil cleanup objective. The contaminants include SVOCs and metals. A total of eleven dry wells were found to be contaminated. It is believed that the extent of the contamination is likely limited to the bottom sediments in each dry well and the soils immediately adjacent to the dry well.

Groundwater

Analytical data from the four on-site monitoring wells indicate that VOCs in excess of the Class GA standards are found in three of the wells. Extremely high concentrations of PCE were found in the groundwater near the FSMW-4 well pair. In the shallow well at this location (FSMW-4A) total VOCs were 125;860 µg/l, with PCE accounting for a majority of the contamination (120,000 µg/l). The extremely high concentrations indicate that a dense non-aqueous phase liquid (DNAPL) may be present in the vicinity of this location. Groundwater sampling with depth at this location indicates that PCE concentrations are in excess of the Class GA groundwater standards at every depth that was sampled, including 150 ft. The PCE concentrations below 150 ft are unknown; however, it appears that the concentrations are decreasing with depth. The vertical groundwater flow gradients are downward on this site from the UGA to the Magothy. The source of the extremely high concentrations of PCE in the groundwater was not found in the shallow soils at the site. It is believed the high concentrations of PCE in the groundwater are a result of disposal of hazardous wastes into dry wells or former sanitary cesspools on-site or at 770 Main Street.

Former Applied Fluidics (770 Main Street)

Site History

A newly built, large department store currently occupies this site. The former building on the site was used until 1996 as a warehouse for storage of juvenile furniture for the retail operation located at 1111 Old Country Road. Other former occupants of the building include Applied Fluidics (1974 - 1988), a division of Allard Instruments, a Nassau County defense contractor that manufactured research instruments and leak detectors. Applied Fluidics is believed to have used chlorinated solvents at this facility.

Surface Soils

Although surface soils were present during the surface soil sampling, no surface soils were collected since they had been significantly altered during the site redevelopment.

Subsurface Soils and Sediments

Analytical data from the soil probes did not show VOCs in excess of the recommended soil cleanup objective at any of the locations that were sampled. However, a detailed investigation of the on-site soils was not conducted since all of the drainage structures were removed by the PRP prior to the RI sampling activities.

Groundwater

The six on-site monitoring wells indicate that VOCs in excess of the Class GA standards are found in all six of the monitoring wells. Extremely high concentrations of PCE were found in the groundwater near the FSMW-10, FSMW-8, and FSMW-9 well pairs. The PCE concentrations found in FSMW-8A and FSMW-9A indicate that DNAPL is also present at these locations. PCE concentrations in the deeper wells are clearly increasing in the downgradient direction at this site. Previous groundwater sampling conducted during the PSA found seven groundwater probes locations that exhibited PCE concentrations that would suggest the presence of DNAPL. The likely presence of DNAPL in this area

indicates that a large mass of contaminants are present and will continue to act as a significant source of groundwater contamination to off-site locations.

Off-site Groundwater Investigation

The existing data indicates that the off-site groundwater has been impacted by past activities at the three Frost Street sites. The primary contaminants are chlorinated organic compounds with PCE making up the largest percentage of the contamination. The groundwater contamination plume appears to originate in the southwest corner of 101 Frost Street. At this location the highest measured concentrations were found in the shallow groundwater samples. From 101 Frost Street the plume of groundwater contamination is moving in the direction of groundwater flow toward 89 Frost Street and the former Applied Fluidics site. Extremely high concentrations of PCE were found at 89 Frost Street and the former Applied Fluidics site. The PCE concentrations are so high on these two sites that the DNAPL is likely present, which represents a large mass of contamination that is acting as a continuous source of further groundwater contamination. The groundwater plume has migrated south of Old Country Road and is likely responsible for the contamination noted in the early warning wells and the Bowling Green supply wells. The maximum downgradient extent of the off-site plume from the Frost Street sites appears to be as far south as Salisbury Road near Washington Avenue, which is over 2000 ft downgradient of the Frost Street sites.

Feasibility Study for the Frost Street Sites

A health exposure pathway analysis was conducted for the Frost Street sites to evaluate the baseline exposures to human health from environmental contamination at the sites. Results of this health exposure pathway analysis were used to determine the need for remedial action at the sites and to select site remedial action objectives. Prior to the pathway analysis, chemical-, location-, and action-specific standards, criteria, and guidance (SCGs) were identified. Five different on-site environmental matrices were evaluated: surface soil, subsurface soil at depth, shallow subsurface soil, groundwater, and standing water in the dry wells. Contaminants of concern (COCs) were selected by reviewing the analytical data obtained in the RI and determining the frequencies of detection and ranges of detected concentrations of site contaminants. A concentration-

toxicity screening was then performed to identify those contaminants most likely to contribute significantly to the human health risk at the sites. COCs identified primarily included VOCs (PCE, TCE and 1,2-DCE, with PCE accounting for the majority of VOC contamination); however, SVOCs (benzo(a)anthracene, benzo(a) pyrene, and dibenzo(a,h)anthracene), heavy metals (cadmium and zinc), and one pesticide (4,4'-DDT) were also retained as COCs. Current exposure routes identified included short-term inhalation, ingestion, and dermal contact with environmental media. In the current land use scenario, any resulting exposure pathways are expected to be of limited duration to individuals conducting excavation work (i.e., implementation of soil remedies or performing utility work) and can be appropriately addressed by using personal protective equipment and/or engineering control. No exposure pathways were retained for the future land use scenario at the Frost Street sites. No exposure pathways associated with site development or remedial activities (e.g., operation of in-situ groundwater and soil treatment systems) were identified for workers, site occupants, or visitors in the future. There were no current or future direct exposure pathways identified for COCs through groundwater ingestion, inhalation, or dermal contact by site occupants or visitors because institutional treatment controls are implemented by the Bowling Green Water District.

An FS was then conducted to address contamination in site media at levels exceeding the remedial action objectives. The initial step in the FS process was the identification and screening of potential remedial technologies for the site. Potential technologies that address contaminated soil, groundwater, and air emissions were identified and evaluated based on their feasibility, effectiveness in addressing site contaminants, and relative costs.

The technologies that were retained as applicable to site conditions and contaminants were then combined into a range of site-wide remedial alternatives. The alternatives were then developed in detail to allow for a detailed evaluation of key tradeoffs among alternatives. The remedial alternatives were evaluated with respect to the EPA- and NYSDEC-specified criteria, which include overall protection of human health and the environment; compliance with SCGs; long-term effectiveness and permanence; reduction of toxicity, mobility, or volume of contamination through treatment; short-term effectiveness; implementability; and cost. State and community acceptance of the remedial alternatives will be considered prior to final selection of a remedial action plan

and will be addressed in the Record of Decision (ROD) for the site. Capital and long-term operations and maintenance (O&M) costs were estimated for each alternative, and the present worth of each alternative was calculated based on a 30-yr life and a 5% interest rate.

To satisfy the remedial action objectives for the site, the sitewide remedial action plan should include remedial alternative to address the shallow subsurface soils and subsurface soils at depth at the 101 and 89 Frost Street sites and a remedial alternative to address the near-field contaminant plume, which spans all three of the Frost Street sites.

Source Control Alternatives for the 101 Frost Street Site

For contaminated shallow subsurface soils (less than 25 ft below grade) and subsurface soils at depth (25 ft below grade and greater), remedial alternatives were developed separately for the 101 and 89 Frost Street sites. Alternatives addressing contaminated soils were termed "source control" alternatives. At the 101 Frost Street site, four source control alternatives were evaluated including no action (Alternative 101-S1), excavation/off-site disposal of shallow subsurface soils and subsurface soils at depth (Alternative 101-S2), excavation/off-site disposal of shallow subsurface soils/SVE for subsurface soils at depth (Alternative 101-S3), and SVE for shallow subsurface soils and subsurface soils at depth (Alternative 101-S4).

Of the four alternatives, Alternatives 101-S2 and 101-S3 offer the greatest protection of human health and the environment by removing the contaminated source areas from the site. Alternative 101-S4 reduces levels of VOC concentrations in shallow subsurface soils and subsurface soils at depth, but concentrations of non-volatile compounds, such as metals and pesticides, would not be reduced in the shallow subsurface soils. Alternatives 101-S2, 101-S3, and 101-S4 comply with SCGs that relate to soil remediation objectives. Alternatives 101-S2, 101-S3, and 101-S4 are expected to result in a decrease in toxicity, mobility, and volume by removing contaminants from subsurface soils. However, applying SVE to shallow subsurface soils (Alternative 101-S4) would not effectively reduce concentrations of non-volatile contaminants present in shallow subsurface soils. Of the active remedies, Alternatives 101-S2 will cause the greatest disruption to normal site operations and the surrounding community due to the remedial activities to be conducted

(i.e., soil excavation, on-site soil staging, traffic and noise associated with soil load-out). Alternative 101-S4 (in-situ soil treatment) is likely to cause the least disruption out of the three active remedies; Alternative 101-S3 (excavation and in-situ soil treatment) is likely to cause site disturbances at a level between the other two active remedies. Alternatives 101-S2 and 101-S3 permanently remove contaminants from the soil media, whereas in Alternative 101-S4, non-volatile contaminants remain in the environment. Alternative 101-S1 does not provide long-term effectiveness or permanence as no active remediation measures are proposed.

All four alternatives are implementable; Alternative 101-S1 is the easiest of the four alternatives to implement, as only establishment of institutional measures is required. Alternatives 101-S3 and 101-S4 are estimated to take the longest to implement (three years). Alternative 101-S2 is estimated to be completed in the shortest amount of time (approximately six months). Improved estimates of remediation time can be calculated in the remedial design stage and/or after conducting necessary pilot tests. Alternative 101-S1, the no action alternative, has no associated costs. Alternative 101-S4, SVE, has the second lowest estimated cost (\$0.4 million). Alternative 101-S3 has the third lowest estimated cost (\$1.4 million). Alternative 101-S2 (excavation and off-site disposal) has the highest estimated cost (\$2.7 million).

Source Control Alternatives for the 89 Frost Street Site

Similarly at the 89 Frost Street site, four source control alternatives were evaluated including no action (Alternative 89-S1), excavation/off-site disposal of shallow subsurface soils and subsurface soils at depth (Alternative 89-S2), excavation/off-site disposal of shallow subsurface soils/SVE for subsurface soils at depth (Alternative 89-S3), and SVE for shallow subsurface soils and subsurface soils at depth (Alternative 89-S4).

Of the four alternatives, Alternatives 89-S2 and 89-S3 offer the greatest protection of human health and the environment by removing the contaminated source areas from the site. Alternative 89-S4 reduces levels of VOC concentrations in shallow subsurface soils and subsurface soils at depth, but concentrations of non-volatile compounds, such as metals and pesticides, would not be reduced in the shallow subsurface soils. Alternatives

89-S2, 89-S3, and 89-S4 comply with SCGs that relate to soil remediation objectives. Alternatives 89-S2, 89-S3, and 89-S4 are expected to result in a decrease in toxicity, mobility, and volume by removing contaminants from subsurface soils. However, applying SVE to shallow subsurface soils (Alternative 89-S4) would not effectively reduce concentrations of non-volatile contaminants present in shallow subsurface soils. Of the active remedies, Alternatives 89-S2 will cause the greatest disruption to normal site operations and the surrounding community due to the remedial activities to be conducted (i.e., soil excavation, on-site soil staging, traffic and noise associated with soil load-out). Alternative 89-S4 (in-situ soil treatment) is likely to cause the least disruption out of the three active remedies; Alternative 89-S3 (excavation and in-situ soil treatment) is likely to cause site disturbances at a level between the other two active remedies. Alternatives 89-S2 and 89-S3 permanently remove contaminants from the soil media, whereas in Alternative 89-S4, non-volatile contaminants remain in the environment. Alternative 89-S1 does not provide long-term effectiveness or permanence as no active remediation measures are proposed.

All four alternatives are implementable; Alternative 89-S1 is the easiest of the four alternatives to implement, as only establishment of institutional measures is required. Alternatives 89-S3 and 89-S4 are estimated to take the longest to implement (three years). Alternative 89-S2 is estimated to be completed in the shortest amount of time (approximately six months). Improved estimates of remediation time can be calculated in the remedial design stage and/or after conducting necessary pilot tests. Alternative 89-S1, the no action alternative, has no associated costs. Alternative 89-S4 (SVE) has the second lowest estimated cost (\$0.6 million). Alternative 89-S3 has the third lowest estimated cost (\$0.9 million). Alternative 89-S2 (excavation and off-site disposal) has the highest estimated cost (\$9.7 million).

Groundwater Response Alternatives for the Near-Field Contaminant Plume

For the near-field contaminated groundwater medium, remedial alternatives were considered for the three Frost Street sites collectively and termed "groundwater response" alternatives. Four groundwater response alternatives were developed, including the no action (Alternative G1), air sparging/soil vapor extraction (Alternative G2), in-well air

stripping (Alternative G3), and groundwater extraction/air stripping/vapor extraction (Alternative G4).

Of the four groundwater response alternatives, Alternatives G2, G3 and G4 provide similar levels of protection in that they all control further downgradient migration of VOCs in shallow groundwater. Alternative G1 provides the least protection of human health and the environment as institutional controls will not be effective in preventing the migration of the contaminant plume. Alternatives G2, G3 and G4 comply with SCGs that relate to groundwater cleanup, whereas Alternative G1 does not. Alternatives G2, G3, and G4 would result in a permanent decrease in the toxicity, mobility, and volume of contaminants present in captured soil gas and/or groundwater. Alternative G1 does not comply with any site SCGs with the exception of the Federal and state requirement to include a "no action" alternative in the range of detailed evaluation.

Alternative G1 results in the least amount of short-term impacts to human health and the environment as the only remedial activities included are sampling. Alternatives G2, G3, and G4 will cause similar disruptions to the surrounding community when being implemented. Community disturbance will occur over varying time periods depending on the expected operation time. Alternatives G2, G3, and G4 permanently remove captured VOC contaminants from the groundwater medium. Alternative G2 transfers volatile contaminants from the groundwater to the overlying soil gas. Some clean subsurface soil areas may be temporarily contaminated during the AS/SVE process. Alternative G1 does not provide a high degree of long-term effectiveness or permanence as no active remediation measures are proposed. Implementation of a combination of Alternative G2, G3, or G4 and an active source control alternative is expected to provide the greatest degree of long-term effectiveness and permanence.

Of these alternatives, Alternative G4 is estimated to have the longest operating time, 15 years, while Alternatives G2 and G3 are estimated to be operating for approximately 12 years. If Alternative G2, G3, or G4 is implemented, future use of some of the property space would temporarily be restricted by constructed wells, underground piping, or a treatment system. All four alternatives are readily implementable. Alternative G1 is the easiest of the four alternatives to implement as only establishment of institutional measures and a monitoring program are required. Alternative G2 involves the installation of an

AS/SVE and vapor treatment system, which are commonly applied technologies at inactive hazardous waste sites. Alternative G3 involves the installation of in-well vapor stripping wells and a vapor treatment system; the in-well vapor stripping technology is licensed to a small number of vendors and requires specialized experience to implement. Alternative G4 includes the installation of a groundwater extraction and treatment system, which is a commonly applied technology at inactive hazardous waste site.

Alternative G1, the no action alternative, has the lowest estimated present worth (\$0.3 million) of the remedial alternatives. Alternative G2, the air sparging and soil vapor extraction alternative, has the lowest estimated present worth of the active groundwater response alternatives (\$1.6 million). Alternative G3, the in-well vapor stripping/vapor treatment alternative has the next highest estimated present worth (\$3.2 million). Alternative G4, the groundwater extraction/air stripping/reinjection alternative, has the highest present worth (\$3.7 million).

In deriving a cost estimate for Alternative G3, installation of the UVB in-well vapor stripping system was assumed. Costs for several line items were obtained from a vendor familiar with the technology's installation and operations and maintenance. Because in-well vapor stripping is an innovative technology at hazardous waste sites and is still being optimized, capital costs for the system are high. Like many innovative technologies, costs decrease with successive applications. Capital costs for the in well vapor stripping technology vary widely; therefore, the cost estimate presented in this FS may decrease substantially if quotes are received for in-well vapor stripping technologies other than the UVB system. In Alternative G2, the remediation time was assumed to be 12 years, similar to the Alternative G3, the AS/SVE alternative. If another in-well vapor stripping vendor technology or the results of a pilot study confirm that the remediation time is less than 12 years, then additional cost savings would be realized that may bring the Alternative G3 present worth more in line with Alternative G2.

The cost analysis conducted for Alternatives G3A, G3B, and G3C (see section 15.2.3.8 for description) demonstrated that by implementing a remedial technology at each site rather than providing a sitewide remedy (i.e., remedy which includes all three of the Frost Street sites), the capital and operations and maintenance costs escalate substantially. The total

cost for implementing Alternatives G3A, G3B, and G3C is \$5.0 million, which represents a 56% increase over the cost (present worth) to implement Alternative G3.

CHAPTER 2

INTRODUCTION AND BACKGROUND

2.1 SITE DESCRIPTION

2.1.1 The Former Autoline Automotive Site

The former Autoline Automotive site (NYSDEC Site No. 1-30-043I on the New York State Registry of Inactive Hazardous Waste Disposal Sites) is located at 101 Frost Street in the NCIA, Town of North Hempstead, Nassau County, New York (Figure 1-2). The site consists of approximately 3 acres of land bounded by a parking lot to the west, commercial buildings and parking lots to the north, Frost Street to the east, and 89 Frost Street to the south. The property is currently vacant and has one large single-story warehouse building, most recently used as a distribution facility for newspaper inserts. The site is entirely paved or covered with the footprint of the building.

2.1.2 89 Frost Street

The 89 Frost Street site (NYSDEC Site No. 1-30-043L on the New York State Registry of Inactive Hazardous Waste Disposal Sites) is located in the NCIA, Town of North Hempstead, Nassau County, New York (Figure 1-2). The site comprises approximately 3.5 acres of land bounded by a parking lot and Main Street to the west, the former Autoline Automotive site to the north, Frost Street to the east, and a commercial building and parking lot to the south. At the time of the site reconnaissance the property was vacant, although it was being used for storage for construction currently taking place on to the southwest. The building at 89 Frost Street was removed prior to 8 July 1998, and the dry wells located on the property were filled in, partially excavated, or both, from 8 through 12 July 1998. The site currently is entirely paved and used for parking for an adjoining store.

2.1.3 The Former Applied Fluidics

The former Applied Fluidics site (NYSDEC Site No. 1-30-043M on the New York State Registry of Inactive Hazardous Waste Disposal Sites) is located at 770 Main Street in the NCIA, Town of North Hempstead, Nassau County, New York (Figure 1-2). The site consists

of approximately 1 acre of land bounded by Main Street to the north, a parking lot to the east, and a parking lot to the south. A newly built, multistory department store currently occupies the former Applied Fluidics site. Once completed, the site will be entirely paved or covered with the footprint of the building. The former Applied Fluidics building was a single-story industrial building that fronted on Main Street. The building and its associated drainage structures were removed in early 1998, when the site was redeveloped for its current use.

2.2 SITE BACKGROUND

The Frost Street sites are located in the NCIA, which contains numerous Registry sites. In 1986 extensive chlorinated solvent contamination (1000-10,000 µg/l) was discovered in the UGA and Magothy Aquifer, which underlie the site (NCDOH, 1986).

Based on a number of shallow (less than 100 ft) geoprobe groundwater samples collected in the NCIA during the site investigations (SIs) and the preliminary site assessment (PSA), a number of groundwater contaminant plumes have been discovered, including the large PCE plume found in the Frost Street area.

The three sites are currently owned by the same PRPs. Petitions to delist these sites were received by NYSDEC in August 1996, which were rejected in November 1996. NYSDEC notified the PRPs of its intention to negotiate orders on consent for a remedial investigation (RI) and feasibility study (FS). However, in February 1997 the owners' attorney notified NYSDEC of their unwillingness to enter into a consent order for any of these sites. A second set of petitions to delist these sites was filed on behalf of the PRPs on 28 February 1997. These petitions were reviewed and denied in June 1997. The PRPs filed a lawsuit against NYSDEC in October 1997 under an Article 78 proceeding, challenging NYSDEC's denial of the PRPs petitions to delist the sites. The PRPs also notified NYSDEC in October 1997 of their planned change of use at two of these properties (770 Main Street and 89 Frost Street) involving demolition of buildings and the excavation of soils from the site. NYSDEC advised the PRPs to sign a consent order and cooperate with NYSDEC prior to demolishing the buildings. The PRPs informed NYSDEC in January 1998 that they were declining to enter into a consent order. The sites were referred for investigation and remediation using State Superfund (SSF) monies. A work assignment was issued to a state's consultant, LMS, to undertake a RI and the field work began in July 1998.

2.3 REPORT ORGANIZATION

The RI/FS Report is divided into 15 chapters, as outlined below.

Chapter 1	Executive Summary
Chapter 2	Introduction and Background
Chapter 3	Field Investigation Procedures
Chapter 4	Physical Characteristics
Chapter 5	Investigation Analytical Results
Chapter 6	Individual Site Discussion
Chapter 7	Summary and Conclusions of the Remedial Investigation
Chapter 8	Applicable Standards, Criteria, and Guidance
Chapter 9	Health Exposure Pathway Analysis
Chapter 10	Objectives of the Feasibility Study
Chapter 11	Identification and Screening of Alternatives
Chapter 12	Development and Screening of Source Control Alternatives
Chapter 13	Development and Screening of Groundwater Response Alternatives
Chapter 14	Detailed Evaluation of Source Control Alternatives
Chapter 15	Detailed Evaluation of Groundwater Response Alternatives

As the three sites are contiguous, the analytical and physical data for each of the sites are combined in single chapters. A site-specific discussion on the nature and extent of the contamination on each of the individual sites is presented in Chapter 6.

CHAPTER 3

FIELD INVESTIGATION PROCEDURES

3.1 INTRODUCTION

The objectives of the RI were to:

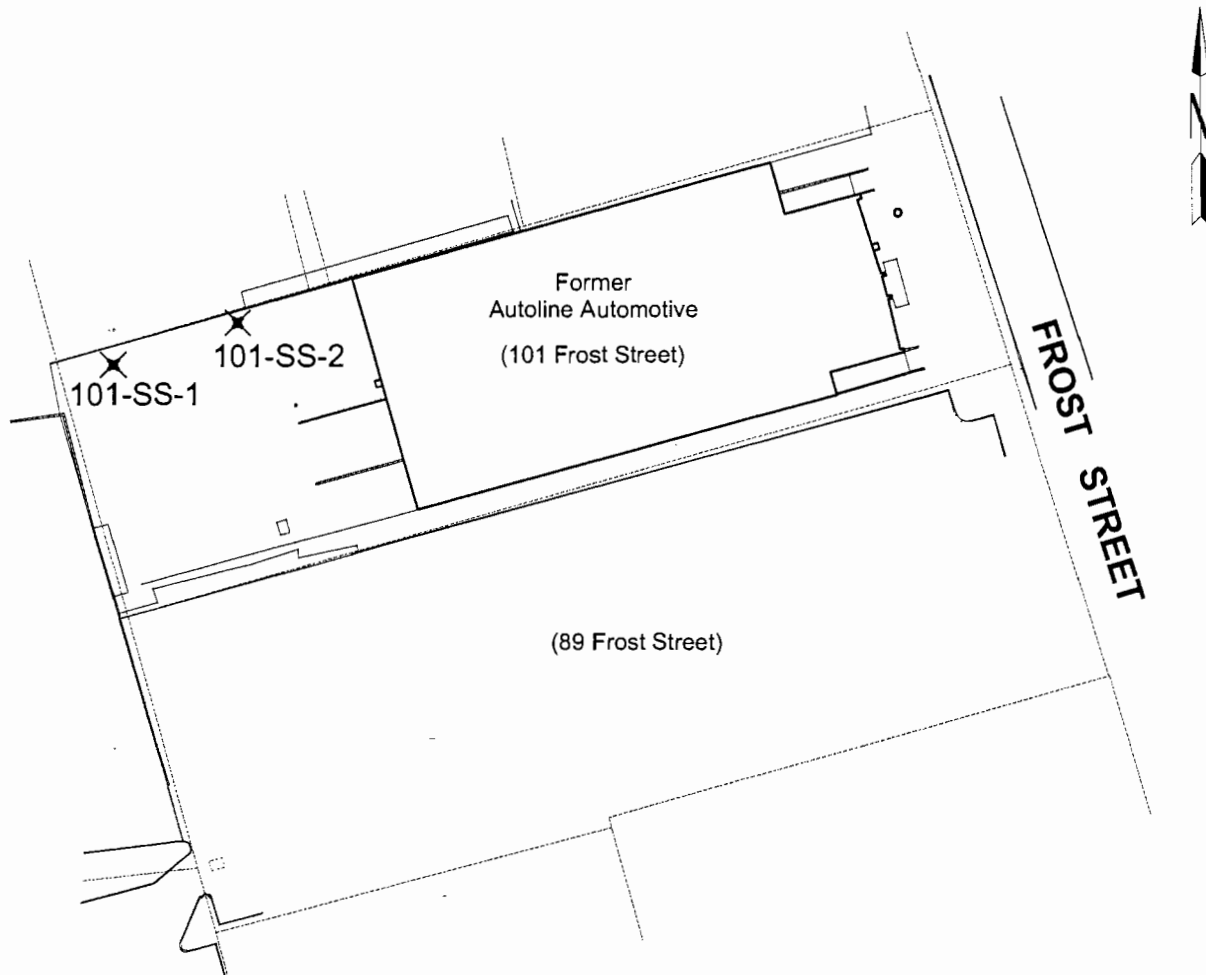
- Determine the nature and extent of soil contamination at each of the sites.
- Determine the nature and extent of contamination in the groundwater on-site.
- Conduct an off-site groundwater investigation to supplement the existing off-site groundwater data in the Frost Street area.
- Provide the necessary data to scope interim remedial measures (IRMs) on-site.

Two surface soil samples (Figure 3-1) were taken for use in the modified health risk (exposure) assessment.

A total of 14 probe soil and groundwater sample locations (Figure 3-2) were investigated during this RI. The probes were located on the 89 Frost Street, the former Autoline Automotive, and the former Fluidics properties. A total of seven hydropunch sampling locations (Figure 3-3) were also included as part of the investigation at 89 Frost Street, the former Autoline Automotive site, and off-site locations to supplement the information collected during the probe investigation.

Ten monitoring well couplets (20 wells) were installed as part of the RI. All 20 newly installed wells (Figure 3-4) and five existing off-site wells (Figure 3-5) were sampled as part of this RI.

Samples were collected from 17 dry wells at 89 Frost Street (Figure 3-6) and 15 dry wells at the former Autoline Automotive site (Figure 3-7). The samples were collected from within, below, and adjacent to each dry well, if possible. At each dry well an additional point was placed adjacent to the dry well location.



Approximate Scale
1 in. = 100 ft

\\survey base map frost only 100'.dsf

Legend

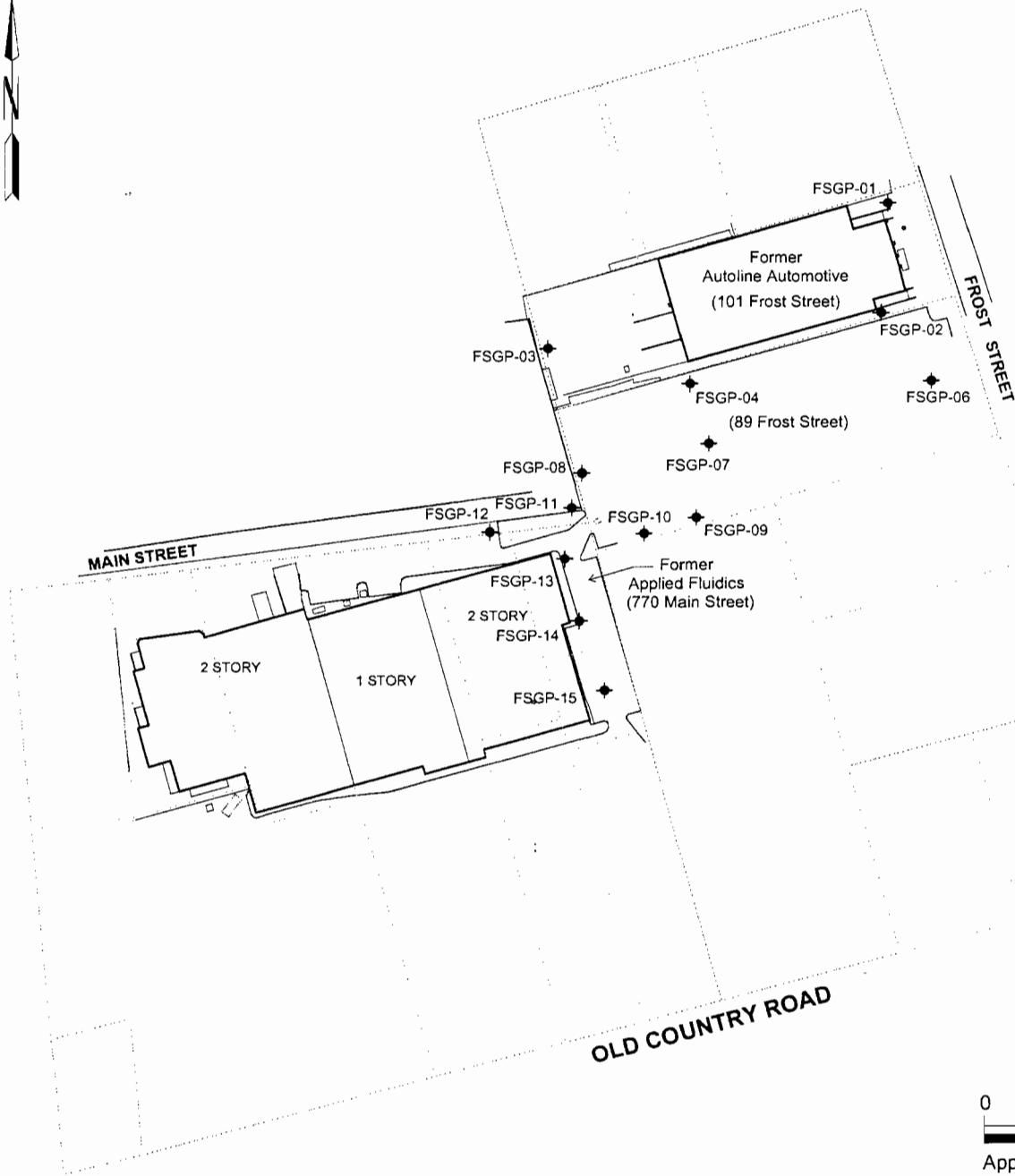
✕ Surface soil sample location

Map source: YEC, 1998.

Figure 3-1
Surface Soil Sample Locations
101 Frost Street
(Former Autoline Automotive)

FROST STREET SITES
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043 I, L, and M

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Pearl River, New York



Approximate Scale
1 in. = 200 ft

\\survey base map frost&main.dsf

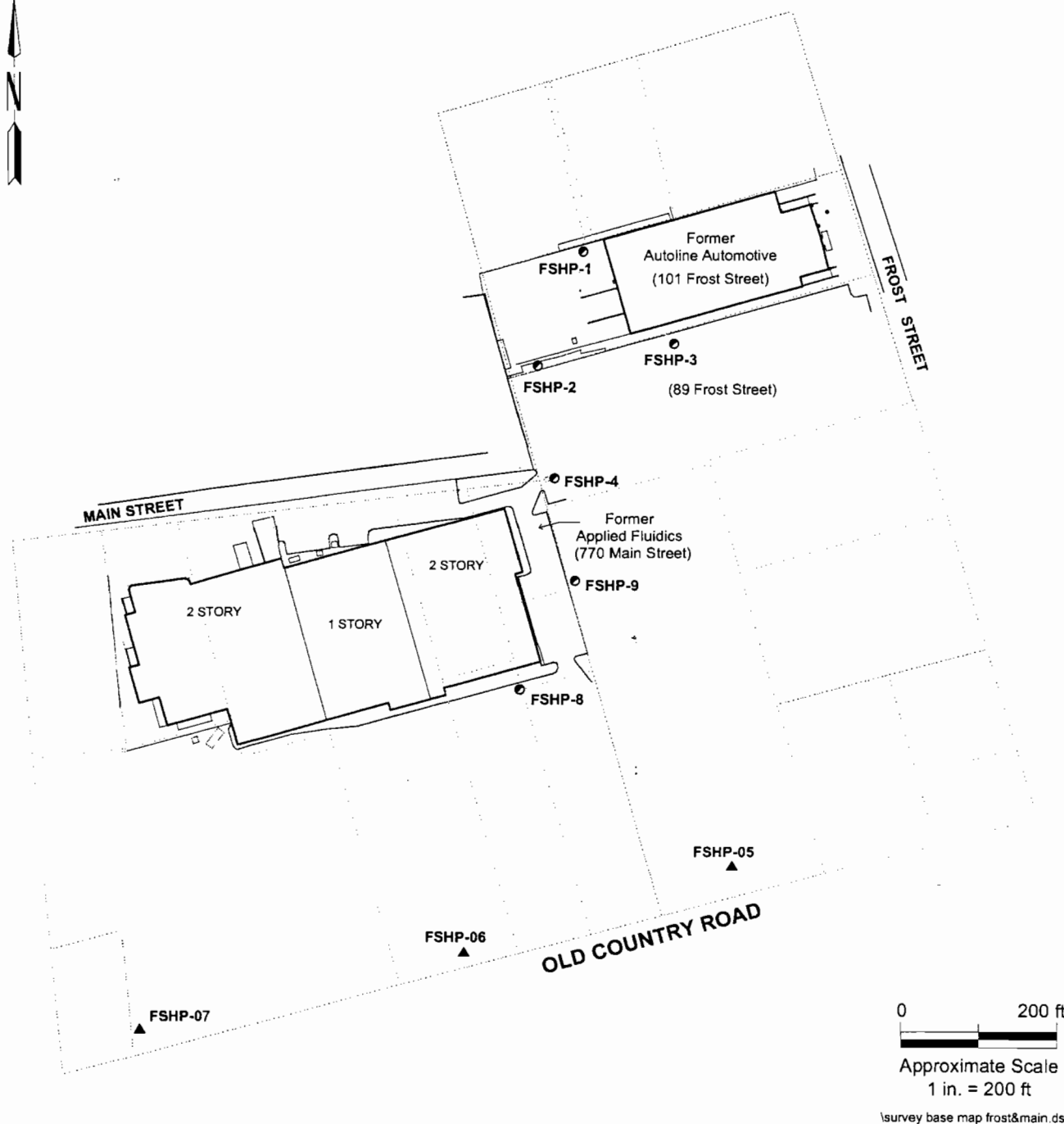
Legend

FSGP-# ♦ Soil and groundwater probe

Figure 3-2
Additional
Soil and Groundwater Probe Locations

FROST STREET SITES
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043 I, L, and M

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York



Legend

- FSHP-0# ● Hydropunch sampling locations -
former Autoline Automotive and
89 Frost Street sites
- FSHP-0# ▲ Hydropunch sampling locations -
offsite investigation

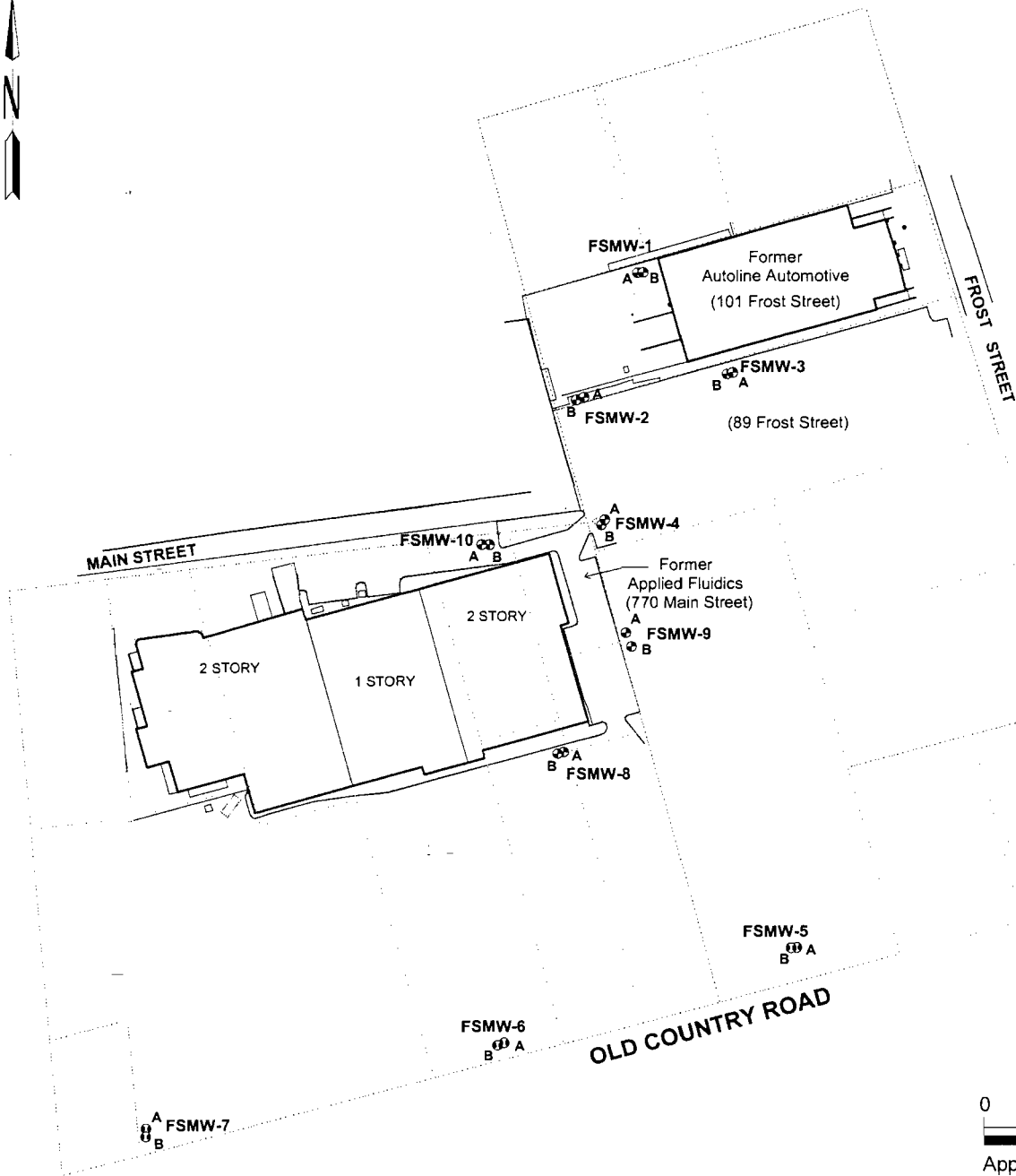
Map source: YEC survey, 1998.

Figure 3-3

Hydropunch Locations Frost Street Sites and Offsite

FROST STREET SITES
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043 I, L, and M

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York



0 200 ft
Approximate Scale
1 in. = 200 ft

\\survey base map frost&main.dsf

LEGEND

FSMW-# A B

Monitoring well

FSMW-#A 70-ft deep well

FSMW-#B 150-ft deep well



Off-site monitoring well

FSMW-#A 70-ft deep well

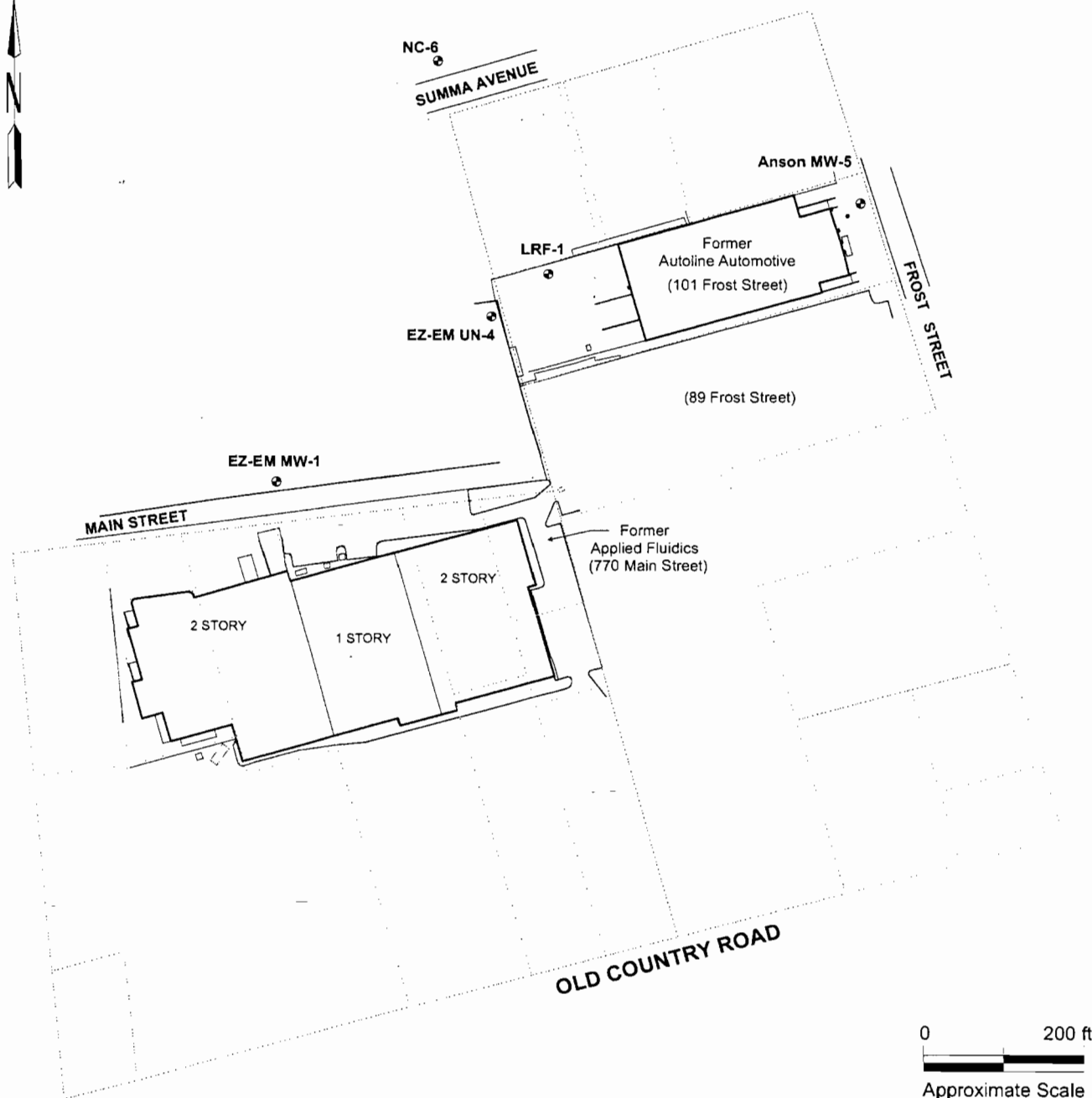
FSMW-#B 150-ft deep well

Figure 3-4

Monitoring Well Locations

FROST STREET SITES
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043 I, L, and M

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York



\\survey base \map frost&main.dsf

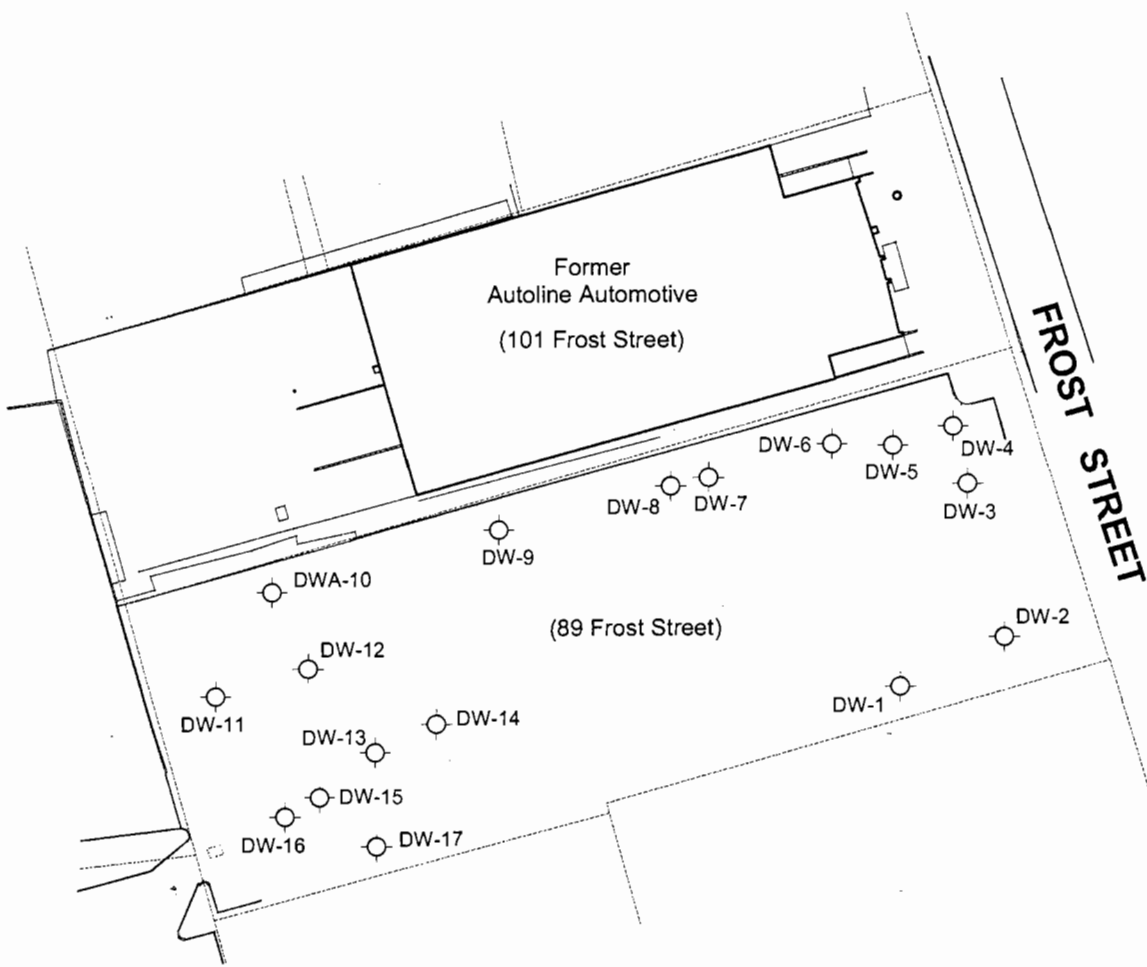
Legend

- Existing monitoring well location

Figure 3-5 Existing Monitoring Well Locations

FROST STREET SITES
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043 I, L, and M

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York



Approximate Scale
1 in. = 100 ft

\\survey base map frost only 100'.dsf

Legend

DW-#  Dry well

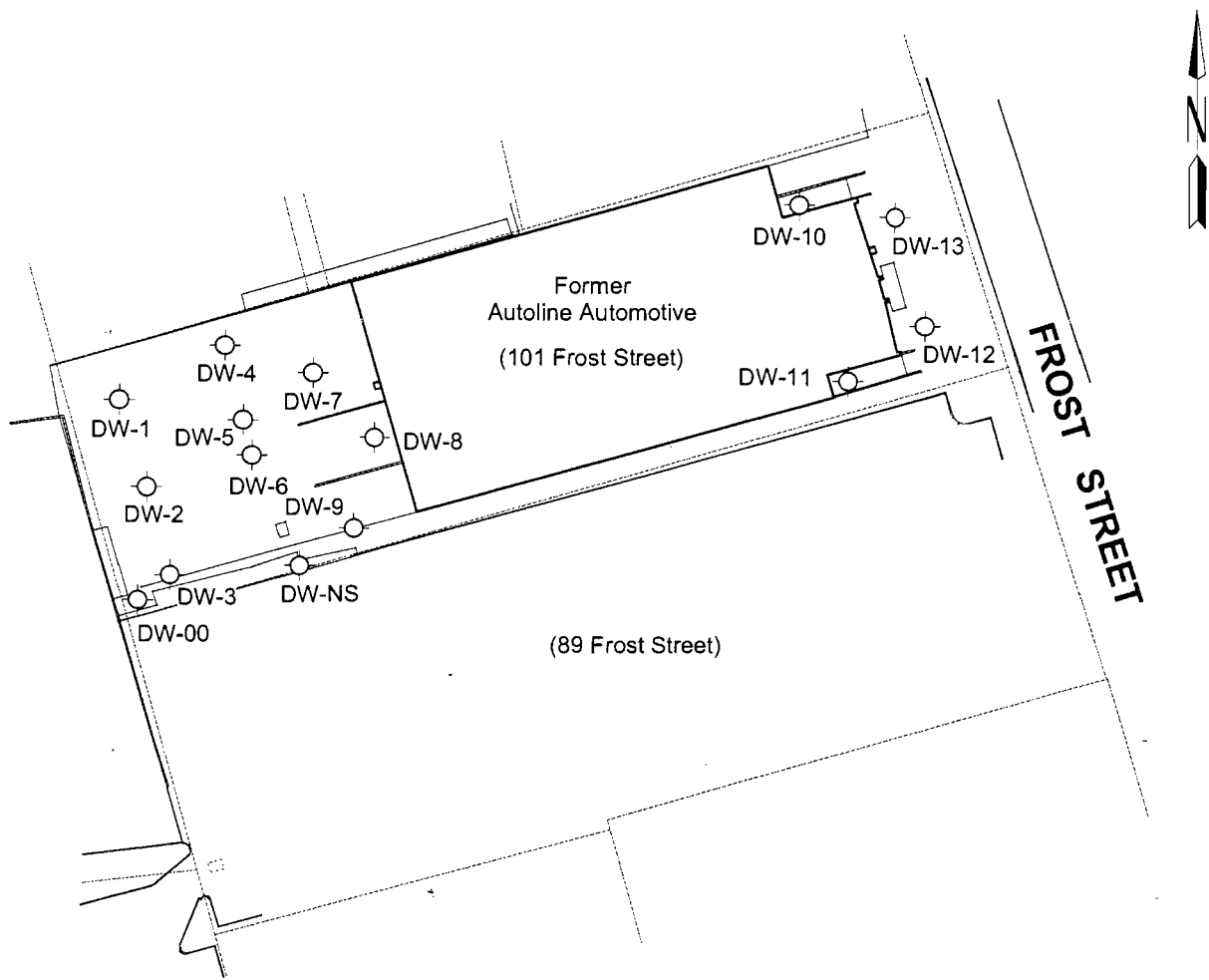
Map source: YEC, 1998.

Figure 3-6

**Dry Well Locations
89 Frost Street**

FROST STREET SITES
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043 I, L, and M

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Pearl River, New York



Approximate Scale
1 in. = 100 ft

\\survey base map frost only 100'.dsf

Legend

DW-#  Dry well

Map source: YEC, 1998.

Figure 3-7
Dry Well Locations
101 Frost Street
(Former Autoline Automotive)

FROST STREET SITES
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043 I, L, and M

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Pearl River, New York

Details on each field activity that was part of this investigation are found below.

3.2 SURFACE SOIL SAMPLING

Surface soil samples were obtained from the first 3 to 6 in. of soil depending on the nature of the surface material, i.e., in grassy areas up to 6 in. of soil was required to obtain a sufficient sample amount. Leaves, grass, and surface debris were removed from the area to be sampled using a clean stainless steel spoon or trowel. Samples were collected with laboratory-cleaned dedicated stainless steel spoons and homogenized in a stainless steel bowl before placement into sample bottles. Soil was collected in laboratory-cleaned bottles labeled with the appropriate site name, job number, sample location/identification, date, time, sampler's name, and parameters for analysis. All samples were stored in coolers maintained at 4°C prior to transport to Envirotech. Surface soil sampling logs are presented in Appendix A.

Surface soil samples collected at the site were analyzed by Envirotech for the full target compound list (TCL) and target analyte list (TAL) suite of compounds using NYSDEC Analytical Services Protocol (ASP) (December 1991) methods.

The work plan called for the collection of six surface soil samples. During the selection of the final sampling locations, only two locations with exposed surface soils were found.

3.3 SOIL AND GROUNDWATER PROBES

A total of 14 probe soil and groundwater locations (all preselected) were sampled during this RI. The probes were located on 89 Frost Street, the former Autoline Automotive, and the former Fluidics properties (Figure 3-2).

3.3.1 Soil Probe Procedures

The soil probe samples at FSGP-1, -2, -11, -12, -13, -14, and -15 were collected using a truck-mounted probe utilizing a direct-push hydraulic hammer system. Soil samples were collected at depths of 18-22 ft and 50-54 ft. The soil samples were collected in a 4-ft-long acetate liner attached to a length of 1.25-in. steel rods. This column of rods and liner

is contained inside a column of 2.125-in. steel rods fitted with an open-ended cutting shoe. The column of smaller rods and the liner fit snugly to the cutting shoe, and the soil is collected as the rods are advanced using the probing unit. Upon completion of an interval, the smaller rods and the liner are removed, leaving the larger rods in place. The liner is then replaced with a steel point, and both columns are hammered to the top of the next interval. The procedure is repeated until all desired depths have been achieved. The refusal criteria used during this RI was 1 in./min of downward movement of the rods. Two refusals were allowed per hole, after which time the probe at that location was abandoned. Both outer and inner rods were decontaminated following completion of all sampling intervals. Upon removal from the sampler, the soil sample was scanned using a photoionization detector (PID) to detect VOCs. PID readings were noted on a test boring log (Figure 3-8), along with information regarding sample interval, soil description, moisture content, color, and evidence of contamination (odor, sheen). Boring logs can be found in Appendix B.

The soil probe samples at FSGP-3, -4, -6, -7, -8, -9, and -10 were collected using a truck-mounted drilling rig using 4.25-in. hollow stem augers at depths of 19-21 ft, and 50-52 ft, except for FSGP-4, which was sampled at 9-11 ft, 19-21 ft, 31-33 ft, 41-43 ft, and 51 to 53 ft because this sample location was also used as a sampling point adjacent to a dry well. As the boring was advanced, soil samples were collected using a 1.375-in. inside diameter (I.D.) split-spoon sampler according to the standard penetration test method ASTM 1586-D. Upon removal from the sampler, the soil sample was scanned using a PID to detect VOCs. PID readings were noted on a test boring log (Figure 3-8) along with information regarding blow counts, sample interval, soil description, moisture content, color, and evidence of contamination (odor, sheen). Boring logs are found in Appendix B.

Soil samples were transferred to laboratory-cleaned glass jars and labeled with the appropriate sample location, interval, date, time, sampler's name, and required analyses. Each of these soil samples was turned over to the on-site mobile laboratory (Target, of Jessup, Md) for the analysis of VOCs using U.S. Environmental Protection Agency (EPA) Method 8010. EPA Method 8020 was added to the analysis on 24 August 1998. Ten percent of these samples were sent as confirmatory samples to the base analytical laboratory (Envirotech of Edison, NJ), a New York State Department of Health (NYSDOH) laboratory certified for analysis of VOCs using EPA Method 8010/8020.

Test Boring Log

Boring No.:

Sheet

of

Project Name:

Project No.:	

Client:

Date:	Start

Driller:

Finish

Drilling Method:

Total Depth:

Boring Location:

Depth to Water:

Coordinates:

Surf. Elevation

Logged By:

Hole Diameter:

Monitoring Instrument(s):[illegible]

Figure 3-8

Test Boring Sampling Log

**FROST STREET SITES
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043 I, L, and M**

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

\\650421NC-Samplers.dsf

3.3.2 Groundwater Probe Procedures

The groundwater probe samples at FSGP-1, -2, -11, -12, -13, -14, and -15 were collected using a truck-mounted probe utilizing a direct-push hydraulic hammer system. Water samples were collected adjacent to the soil probes at depths of 63-64 ft, 79-80 ft, and 93-94 ft. The bottom rod was fitted with a screen, over which a disposable tip holder is attached. The groundwater screen sampler enables samples to be collected from discrete 4-ft intervals. A disposable tip was set into the holder and the rods were pushed to the desired depth. The water samples were collected by pushing the 1.25-in. rods equipped with a disposable tip approximately 2 ft past the bottom interval. Once the screen sampler reached the desired depth, the rods were pulled up 2 ft, releasing the disposable tip and exposing the screen. A static water level (SWL) indicator was used to determine the height of the water column. A dedicated length of polyethylene tubing was fitted with a check valve and was then inserted through the probe rods to the screen. By manually surging the tubing, water was drawn to the surface. Prior to acquiring the sample, the tubing was surged until at least three times the volume of water in the probe rods was purged to ensure that the groundwater sample was from the correct interval. The sample was then collected by transferring it directly to the sample containers. Once the deepest sample was obtained, the entire assembly was raised to the next sampling interval above. A new length of dedicated tubing, fitted with a check valve, was then inserted through the probe rods and the process repeated. After the sample was collected, the entire assembly was raised to the shallow interval and the entire process repeated. Refusal occurred when the rate of downward movement of the rods fell below 1 in./min, resulting in the removal of all rods and beginning the hole again. Two refusals were allowed per hole, after which time the probe at that location was abandoned. All rods were decontaminated following completion of all sampling intervals.

The groundwater probe samples at FSGP-3, -4, -6, -7, -8, -9, and -10 were collected at depths of 60-65 ft, 78 ft, and 92 ft using a truck-mounted drilling rig equipped with a 4.25-in. hollow-steam auger with a screened lead auger and hydropunch tool. For the first groundwater sample, at the top of the watertable, the rods were removed and a steam-cleaned Teflon[®] bailer was lowered into the augers and then allowed to fill with the groundwater sample. At each of the hydropunch sampling depths, the drilling rods were removed from the boring and a steam-cleaned hydropunch tool was attached to the rods. The rods were then lowered back into the boring and the hydropunch driven to the

desired sampling depth. Once the hydropunch tool had been driven to the desired depth, it was retracted several inches to expose the sample port. The hydropunch tool was then allowed to fill with the groundwater sample. Once the hydropunch tool was filled, it was returned to the surface and the sample transferred to the appropriate sample container.

Groundwater samples were transferred to laboratory-cleaned glass jars and labeled with the appropriate sample location, interval, date, time, sampler's name, and required analyses. Each of these water samples was turned over to Target for the analysis of VOCs using EPA Method 8010. EPA Method 8020 was added to the analysis on 24 August 1998. Ten percent of these samples were sent as confirmatory samples to Envirotech. For quality assurance/quality control (QA/QC) purposes, each sample shipment to Envirotech included a trip blank.

3.4 DRY WELL SAMPLING

Sampling of sediment/sludge and standing water sampling was conducted in the dry wells at 89 Frost Street (Figure 3-6) from 8 through 12 July 1998 and in the dry wells at the former Autoline Automotive site (Figure 3-7) from 24 through 26 August 1998. A soil sample was also collected about 10 ft below the sediment layer. The sediment/sludge and soil samples were collected with a truck-mounted direct-push probe rig with hydraulic piston sampling capabilities. A 2.5-in.-diameter galvanized steel pipe was lowered into the dry well and set on the sediment to support lateral movement of the probe rods. A sample tube was then pushed via a hydraulic piston system directly into the sediment at the bottom of the dry well. The sample tube was fitted with a disposable acetate liner in which the sediment/sludge samples were collected. The macro-core sampler extracted a 45-in.-long by 1.5-in.-diameter (1302-ml) core. A large-bore sample tube was then advanced about 10 ft below the sediment/sludge layer. The large-bore sampler recovers a 22-in. by 1-in.-diameter core at a discreet sample interval. The core samples were split and characterized according to the Burmister Soil Classification System. All soil samples were scanned with a PID for the presence of VOCs. An LMS geologist recorded the resulting information on a test boring log (Figure 3-8), along with information regarding sample interval, soil description, moisture content, color, and evidence of contamination (odor, sheen). Boring logs are found in Appendix C.

Envirotech analyzed grab samples collected from the sediment/sludge layer at 29 dry wells located at 89 Frost Street and 101 Frost Street (former Autoline Automotive site) for TCL VOCs according to NYSDEC ASP Contract Laboratory Protocol (CLP) Method 95-1. Sediment/sludge samples from three dry wells at 89 Frost Street (89-DW-10, -11, -12) and the 13 dry wells at the former Autoline Automotive site were also submitted to Envirotech for SVOC, pesticide/PCB, and TAL metals plus cyanide analysis according to NYSDEC ASP CLP Methods 95-2, 95-3, and CLM-M/335.2 (December 1991). All 13 dry wells at the former Autoline Automotive site (except 101-DW-11 which was sampled at a later date due to access problems) were also analyzed for VOCs by Target according to EPA SW-846 8010/8020 methods. At 89 Frost Street, 89-DW-5, sediment/sludge was not sampled because of debris in the bottom of the dry well; 89-DW-6 was not sampled because the dry well could not be located during this sampling event.

Soil samples were collected from all 15 dry wells at the former Autoline Automotive site and all 17 dry wells, except 89-DW-6, at 89 Frost Street at about 10 ft below the sediment layer. The samples from 89 Frost Street were submitted to Envirotech for VOC analysis according to NYSDEC ASP CLP Method 95-1. The samples from the former Autoline Automotive site were submitted to Target for VOC analysis according to EPA Methods SW-846 8010/8020 except 101-DW-11, which was sent to Envirotech for VOC analysis according to NYSDEC ASP CLP Method 95-1 as it was sampled at a later date. At 89 Frost Street, 89-DW-6 was not sampled because the dry well could not be located.

Water was collected from 17 dry wells - 10 at 89 Frost Street (89-DW-2, -7, -9, -10, -11, -12, -14, -15, -16, and -N/S) and seven at the former Autoline Automotive site (101-DW-2, -3, -5, -7, -8, -9, and -10) - using dedicated Teflon[®] bailers. All the samples from 89 Frost Street and one from the former Autoline Automotive site (101-DW-9, as part of a matrix spike/matrix spike duplicate [MS/MSD] set) were sent to Envirotech for VOCs analysis according to NYSDEC ASP CLP Method 95-1. All the samples from the former Autoline Automotive site were submitted to Target for VOC analysis according to EPA Methods SW-846 8010/8020

Soil was collected adjacent to the dry wells at 31 locations on the 89 and 101 Frost Street properties. The soil probe samples were collected using a truck-mounted probe utilizing a direct-push hydraulic hammer system. The probe points were placed approximately 8 ft to the southwest of each dry well, to account for groundwater flow, and sampled at

intervals of 8-12, 18-22, 30-34, 40-44, and 50-54 ft below ground surface (bgs). The soil probe sampling techniques and methods used are the identical to those described in Section 3.3.1.

The groundwater probe samples from adjacent to the dry wells were collected using a truck-mounted probe utilizing a direct-push hydraulic hammer system. Water samples were collected adjacent to the soil probes at depths of 60 to 64, 76 to 80, and 90 to 94 ft bgs. The groundwater probe sampling techniques and methods used are identical to those described in Section 3.3.2.

3.5 MONITORING WELL INSTALLATION

3.5.1 Drilling

American Auger & Ditching Co., Inc. (AA), of Constantia, New York, was subcontracted to complete hydropunch groundwater sampling (Figure 3-3) and install 20 monitoring wells at the site (Figure 3-4). Three well couplets of two wells each were installed at off-site locations, for a total of six wells. The remaining 14 wells were installed on-site as seven well couplets. Each monitoring well set contained one shallow well (designated with an "A") and one deeper well (designated with a "B"). AA used a Foremost truck-mounted drill rig to install the well sets with 4.25-in. hollow-stem augers. All drilling, well construction, installation, and logging were supervised by an LMS geologist.

Soil sampling was conducted from 4 through 31 August 1998 according to the standard penetration test method ASTM 1586-D. This procedure involves sampling the overburden in 2-ft intervals with a 2-ft-long, 2-in. outside diameter (O.D.) split-spoon sampler driven by a 140-lb hammer falling 30 in.

Soil samples were examined and described on a boring log (Figure 3-8), noting the following characteristics: moisture content, lithology, color, texture, and evidence of contamination (e.g., odor, staining, sheen, organic vapor readings). Depth, blow counts, and sample recovery were also noted on the same log. The soil samples were scanned with a PID immediately upon opening the split-spoon sampler to detect the presence of any VOCs. Boring logs are found in Appendix C.

Based on the results of the hydropunch samples, a deep B well was installed in the borehole drilled during hydropunch sampling. The drill rig was then offset approximately 5 ft and a shallow A well was installed.

The monitoring wells were located in a commercial area. All investigation-derived wastes, including drilling cuttings and fluids, were containerized in a neat and orderly fashion and transported to a staging area for later disposal. Analytical data from the drilling cuttings indicated that the soils were uncontaminated, and they were disposed of accordingly. All drilling and sampling equipment that came into contact with potentially contaminated soil, groundwater, or dust was decontaminated before being removed from the site and between each sample location.

The well seals were constructed of bentonite. In cases where the well seal had to be placed at depth, a bentonite slurry mixed to the consistency of thick pudding was used. For shallow wells, bentonite pellets were used to form the well seal. Adequate time was allowed for the pellets to fully hydrate before the well was completed. The cement-bentonite grout for the monitoring wells was made from Type 1 portland cement, bentonite powder, and potable water in the following proportions: 94 lb of portland cement, 3 to 5 lb of bentonite powder, and 6.5 gal of water.

At the surface, each monitoring well was fitted with a secured protective flush-mount casing. The flush-mounted casings included positive sealing covers and inner locking caps. Each flush-mounted casing was outfitted with an internal drain consisting of a layer of No. 1 Morie sand or equivalent in direct hydraulic contact with the surrounding formation. The concrete pad for a flush-mounted casing was a minimum of 2 ft² and was slightly raised and sloped from the well to provide for drainage away from the well.

3.5.1.1 *Specific Monitoring Well Details*

FSMW-1 Well Couplet. Two wells were installed in the northeast corner of the parking lot behind the former Autoline site, believed to be in an upgradient position (Figure 3-4). Drilling was completed on 18 August 1998; FSMW-1A was completed on 19 August 1998 and FSMW-1B was completed on 11 August 1998. Both wells were completed with flush-mounted curb boxes.

FSMW-1B was set at approximately 125 ft bgs due to the presence of dry clay, starting at 125 ft bgs and continuing down to at least 132 ft bgs. As this is believed to be an upgradient well, and FSHP-3 (downgradient) was nondetect (ND) at 150 ft bgs, any contamination would likely be found at the top of the clay. It was also decided that the well would not produce much water if it were set deeper in the clay. Extra sand was used in the well pack to assist with water production. FSMW-1A was set at 69 ft bgs.

FSMW-2 Well Couplet. Two wells were installed in the southwest corner of the property at 101 Frost Street. Well FSMW-2A was completed on 14 August 1998, and FSMW-2B was completed on 12 August 1998. Both wells were completed with flush-mounted curb boxes.

The same layer of dry, dark gray clay found at FSMW-01B was encountered at FSMW-2B at 120 ft bgs. It was decided to set this well near the top of the clay at 127 ft bgs. FSMW-2A was set at 70 ft bgs.

FSMW-3 Well Couplet. These two wells were installed at approximately the midpoint of the northern property line of 89 Frost Street. The wells were set at 70 and 147 ft bgs for FSMW-3A and B, respectively. Well FSMW-3A was completed on 7 August 1998, and FSMW-3B was completed on 5 August 1998. Both wells were completed with flush-mounted curb boxes.

FSMW-4 Well Couplet. This set is located in the southwest corner of 89 Frost Street. FSMW-4A was set at 70 ft bgs and FSMW-4B was set at 150 ft bgs. FSMW-4A and -4B were set on 6 August 1998. Both wells were completed with flush-mounted curb boxes.

FSMW-5 Well Couplet. These wells were located off-site in a downgradient position, just north of Old Country Road, in the front parking lot of the car dealership on Old Country Road. Both wells were completed on 21 August 1998 at depths of 70 and 142 ft bgs for FSMW-5A and -5B, respectively. Both wells were completed with flush-mounted curb boxes.

FSMW-6 Well Couplet. These wells are located off-site in a downgradient position in the middle of the plume path, just north of Old Country Road in the front parking lot of the newly built department store on Old Country Road. Both wells were completed on 26

August 1998 at depths of 70 and 150 ft bgs for FSMW-6A and -6B, respectively. Both wells were completed with flush-mounted curb boxes.

FSMW-7 Well Couplet. These wells were located off-site in a downgradient position, just north of Old Country Road, next to the bank near the corner of Old Country Road and Bond Street. FSMW-7A was completed on 27 August 1998, and FSMW-7B was completed on 25 August 1998 at depths of 70 and 150 ft bgs, respectively. Both wells were completed with flush-mounted curb boxes.

FSMW-8 Well Couplet. These wells were located in a downgradient position at the southwestern corner of 770 Main Street, at the southeast corner of the newly built department store on Old Country Road. Both FSMW-8A and -8B were completed on 13 August 1998 at the respective depths of 75 and 142 ft bgs. Both wells were completed with flush-mounted curb boxes.

FSMW-9 Well Couplet. FSMW-9B was originally completed on 19 August 1998. On 20 August 1998 it was noticed that it had collapsed at approximately 60 ft bgs. This well was abandoned in place, and FSMW-9B-2 was completed on 31 August. The original hydropunch went to 150 ft bgs. The replacement well was set at only 140 ft bgs due to mechanical problems with the drilling equipment. FSMW-9A was completed on 19 August 1998 at 70 ft bgs. Both wells were completed with flush-mounted curb boxes.

FSMW-10 Well Couplet. The FSMW-10 well set was in the northwest corner of 770 Main Street. FSMW-10A was completed on 31 August 1998 at 70 ft bgs, and FSMW-10B was completed 18 August 1998 at 147 ft bgs.

3.5.2 Hydropunch Sampling

Groundwater samples were collected using the hydropunch sampling equipment at seven locations (Figure 3-3). Four 150-ft-deep hydropunches (two at former Autoline Automotive and two at 89 Frost Street) were completed to determine the depth and placement of monitoring wells (Figure 3-3). Three additional 150-ft-deep hydropunches were completed downgradient of the Frost Street sites to determine the depth and placement of monitoring wells for the off-site investigation. The locations for these hydropunches are also shown on Figure 3-3. Hydropunch groundwater samples were collected from the

watertable (~60-ft) to 150 ft in 10-ft intervals. The sampling depths were 55-65, 80, 90, 100, 110, 120, 130, 140, and 150 ft at FSHP-3, -4, and -7; 50-60, 75, 85, 95, 115, and 125 ft at FSHP-1; 50-60, 75, 85, 95, 105, 115, 125, 135, and 145 ft at FSHP-5; 50-60, 70, 80, 90, 100, 110, 120, 130, 140, and 150 ft at FSHP-6; and 55-65, 80, 90, 100, 110, 120, and 130 ft at FSHP-2.

The hydropunch sampling resulted in a total of 59 samples. Each of these water samples was hand-delivered to Target for the analysis of VOCs using EPA Method 8010, with EPA Method 8020 added to the analysis on 24 August 1998.

The sampling intervals and depths were based on results from previous hydropunches in the area, which showed two distinct zones of high contamination. The first zone of contamination roughly corresponded with the bottom of the UGA (80 to 150 ft bgs). The second zone was located in an upper sandy zone of the Magothy Aquifer (130 to 150 ft bgs). The maximum sampling depth as defined in the scope of work was 150 ft bgs for this RI.

Once completed, the hydropunch boreholes were completed as monitoring wells (see Section 3.5.1).

The hydropunch locations were in a commercial area. All investigation-derived wastes, including drilling cuttings and fluids were containerized in a neat and orderly fashion and transported to a staging area for later disposal. Analytical data from the drilling cuttings indicated that the soils were uncontaminated and were disposed of accordingly. All drilling and hydropunch sampling equipment that came into contact with potentially contaminated soil, groundwater, or dust was decontaminated before being removed from the site and between each sample location.

3.5.3 Monitoring Well Development

The monitoring wells were allowed to set for a minimum of 24 hrs prior to being developed by the drilling subcontractor. The goal of the development was to provide a low-turbidity sample by removing any fine-grained materials from the well case and sand pack. The wells were developed using a submersible pump fitted with dedicated tubing. Developing involves quickly pumping high volumes of water from the screened zone of

the well. The rapid removal of water causes the water within the well and screen to rapidly rush into the well. This action serves to flush any fines from the well casing and sand pack. As development continued, the tubing in the well was also rapidly surged up and down within the screened zone to allow for additional flushing action in the well. At several points during the development, estimates of well yield and measurements of turbidity, temperature, pH, and conductivity were made. The new monitoring wells were developed until the groundwater reached a turbidity of 50 nephelometric turbidity units (NTU) or less, or until the development continued for 2 to 4 hrs.

During the development process, turbidity, temperature, pH, and conductance were measured at routine intervals to track the purging process and provide development chemistries. Development logs can be found in Appendix D.

The existing five monitoring wells were redeveloped along with the newly installed monitoring wells. The purpose of the redevelopment was to lower the turbidity of the groundwater in the wells, as fine sediment may have accumulated in the well and sand pack since it was last developed or sampled. The redevelopment of the existing monitoring wells was conducted by LMS using a submersible pump fitted with dedicated tubing. Redevelopment of each existing monitoring well did not exceed 1 hr.

3.6 MOBILE LABORATORY ANALYSIS

A majority of the soil, groundwater, and sediment samples collected during this RI were analyzed by Target Environmental Services, Inc., of Jessup, Maryland, which operated an on-site mobile gas chromatograph (GC) laboratory for most of the duration of the RI activities.

Samples were delivered to Target under chain-of-custody protocols as they were collected, then analyzed for VOCs using EPA Method 8010, with EPA Method 8020 added to the analysis on 24 August 1998. A total of 326 samples, consisting of 172 soil and sediment samples and 154 groundwater samples, were collected over the period of 30 July through 4 September 1998.

The target compounds for this investigation consisted of:

1,1-Dichloroethene (1,1-DCE)	1,1,1-Trichloroethane (1,1,1-TCA)
trans-1,2-Dichloroethene (trans-1,2-DCE)	1,2-Dichloroethane (1,2-DCA)
1,1-Dichloroethane (1,1-DCA)	Trichloroethene (TCE)
cis-1,2-Dichloroethene (cis-1,2-DCE)	Tetrachloroethene (PCE)

3.6.1 Mobile Laboratory Procedures

Soil and water samples were collected and delivered to Target under chain-of-custody protocol for GC analysis of VOCs. All samples were analyzed for chlorinated VOCs. Starting 24 August 1998, analysis was also performed for BTEX. Procedures for Determination of Soil Moisture were performed according to ASTM D-2216-92, Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock.

Method 8010 is used to determine the concentration of various halogenated VOCs. The detection limits are determined according to EPA 40 CFR Part 136 Appendix B utilizing EPA Method 3810 sample introduction using custom gas-based and methanolic-based NIST traceable standards.

Method 8010 provides gas CG conditions for the detection of halogenated VOCs. Samples are introduced into the GC using static heated headspace EPA Method 3810. A temperature program is used in the GC to separate the organic compounds. Detection is achieved by using either an electron capture detector (ECD) or an electrolytic conductivity detector (ELCD, or Hall).

Method 8020 provides GC conditions for the detection of aromatic VOCs. Samples are introduced into the GC using static heated headspace EPA Method 3810. A temperature program is used in the GC to separate the organic compounds. Detection is achieved by using a flame ionization detector (FID) or PID.

The GC is an analytical system complete with a temperature-programmable GC (Shimadzu GC14A or equivalent) suitable for automated heated static head space introduction (Shimadzu HSS-2B or equivalent) and all required accessories, including

syringes, analytical columns, gasses, detector, and strip-chart recorder or hardware to store, interpret, and print chromatograms (see Appendix F).

3.6.2 Confirmatory Sampling

Twenty-eight samples submitted to Target for analysis were submitted as splits, i.e., additional sample jars were filled simultaneously with samples collected at each location and submitted under chain-of-custody protocol to Envirotech. This measure was instituted to provide external QA regarding the mobile laboratory's performance. The same mobile laboratory equipment, methods, and protocols were used throughout the RI field activities. Results of the mobile and base analytical laboratory analyses are compared in Section 5.3.

3.7 GROUNDWATER SAMPLING AND ANALYSIS

3.7.1 Existing Monitoring Well Sampling

Monitoring well sampling began on 1 September 1998. Based on the SWL and the total depth of the well, the volume of water in the well was calculated. All of the wells were purged three well volumes, except NC-6 and MW-5 (which were purged dry at least once). All existing wells were purged using a Grundfos submersible pump. Monitoring well sampling logs can be found in Appendix E.

During the purging process, turbidity, temperature, pH, and conductance were measured at routine intervals to track the purging process and provide sampling chemistries. All samples were collected from the top of the water column using new, dedicated Teflon[®] bailers and rope. Sample chemistries, including temperature, turbidity, pH, and specific conductance, were taken when sufficient volume of water was available.

3.7.2 Newly Installed Monitoring Well Sampling

Monitoring well sampling began on 31 August 1998. Based on the static water level and the total depth of the well, the volume of water in the well was calculated. All of the wells were purged three well volumes. If a well did not produce sufficient water to allow three well volumes to be purged, it was purged dry. Wells FSMW-1, -2, -3B, -4, -5B, -6,

-7, -8, -9, and -10A were purged using a Grundfos submersible pump. Wells FSMW-3A, -5A, and -10B were purged with a Whale pump. Monitoring well sampling logs can be found in Appendix E.

During the purging process, turbidity, temperature, pH, and conductance were measured at routine intervals to track the purging process and provide sampling chemistries. All samples were collected from the top of the water column using new, dedicated Teflon[®] bailers and rope. Sample chemistries, including temperature, turbidity, pH, and specific conductance, were taken when sufficient volume of water was available.

CHAPTER 4

PHYSICAL CHARACTERISTICS

4.1 TOPOGRAPHY

The land surface at the Frost Street sites is essentially level, with an elevation of approximately 120 ft above mean sea level. The land in this area naturally has only a very gentle southward slope and the flatness likely has been enhanced in the area surrounding the site by grading during construction of the large number of surrounding buildings.

4.2 SURFACE WATER

Because of the density of commercial property and industrial buildings, there are no significant sources of surface water directly surrounding the Frost Street sites. Virtually every open space in the industrial area has been covered by asphalt, concrete, or buildings. The nearest sources are several small ponds in and around Eisenhower Memorial Park, approximately 2 miles southwest of the site across Old Country Road.

4.3 DEMOGRAPHY AND LAND USE

The Frost Street sites are located in the town of North Hempstead (Nassau County, New York). Based on the 1990 census, the population of the county is 1.3 million and of North Hempstead about 200,000 (U.S. Department of Commerce 1990). The NCIA is a heavily industrialized area of small- to medium-sized businesses covering about 25 blocks. The NCIA is bounded to the north by the Long Island Railroad, to the south by Old Country Road, to the east by Frost Street, and to the west by Grand Boulevard. For miles east and west of the NCIA, along Old Country Road, commercial property dominates; land use north and south of the area consists primarily of residential property.

4.4 ECOLOGY

Based on NYSDEC's ecological communities classification system, the NCIA consists entirely of a terrestrial cultural community. The terrestrial cultural subsystem is defined by those communities that are direct results of the influence of human activities or those that are

modified to such an extent as to be significantly changed from the community as it was before alteration by humans (NYSDEC 1990).

From the NYSDEC classification system, five ecological communities dominate the NCIA. The first community (NYSDEC terrestrial cultural community #16) accounts for approximately 20% of the NCIA and is characterized by roads and paths paved with asphalt, concrete, brick, and stone and only sparse vegetation present in cracks in the surface. Junkyards (NYSDEC terrestrial cultural community #30), sites that have been utilized for storage of refuse, are another component of the NCIA ecology and account for approximately 10% of the NCIA. Urban vacant lots (NYSDEC terrestrial cultural community #31) also constitute about 10% of the NCIA. These lots are characterized by debris-laden, sparsely vegetated open sites within a developed area where construction is pending or demolition has occurred. Urban structure exteriors (community #32) and interiors of nonagricultural buildings (community #35) compose the majority of the NCIA. Approximately 35% of the area is made up of the interior of nonagricultural buildings, including those used for commercial or industrial purposes. Urban structure exteriors make up approximately 25% of the area of the NCIA and include exteriors of commercial buildings or any inorganic structural surface. Typically, only sparse vegetation is present, but birds and insects are common (NYSDEC 1990).

4.5 CLIMATOLOGY

The climate of Long Island is moderated by its proximity to the ocean and land surfaces that are very close to sea level. Precipitation, distributed evenly throughout the year, averages about 44 in. per year, with a range between approximately 32 and 58 in. per year. Rainfall amounts reach a maximum in August, with 3 to 4.5 in. recorded in a typical year. Temperatures range from an average low of 32°F in January to an average high of about 75°F in July. The average annual temperature on Long Island over an 85-year period is 52.7°F (USGS 1963).

4.6 GEOLOGY

4.6.1 Regional Geology

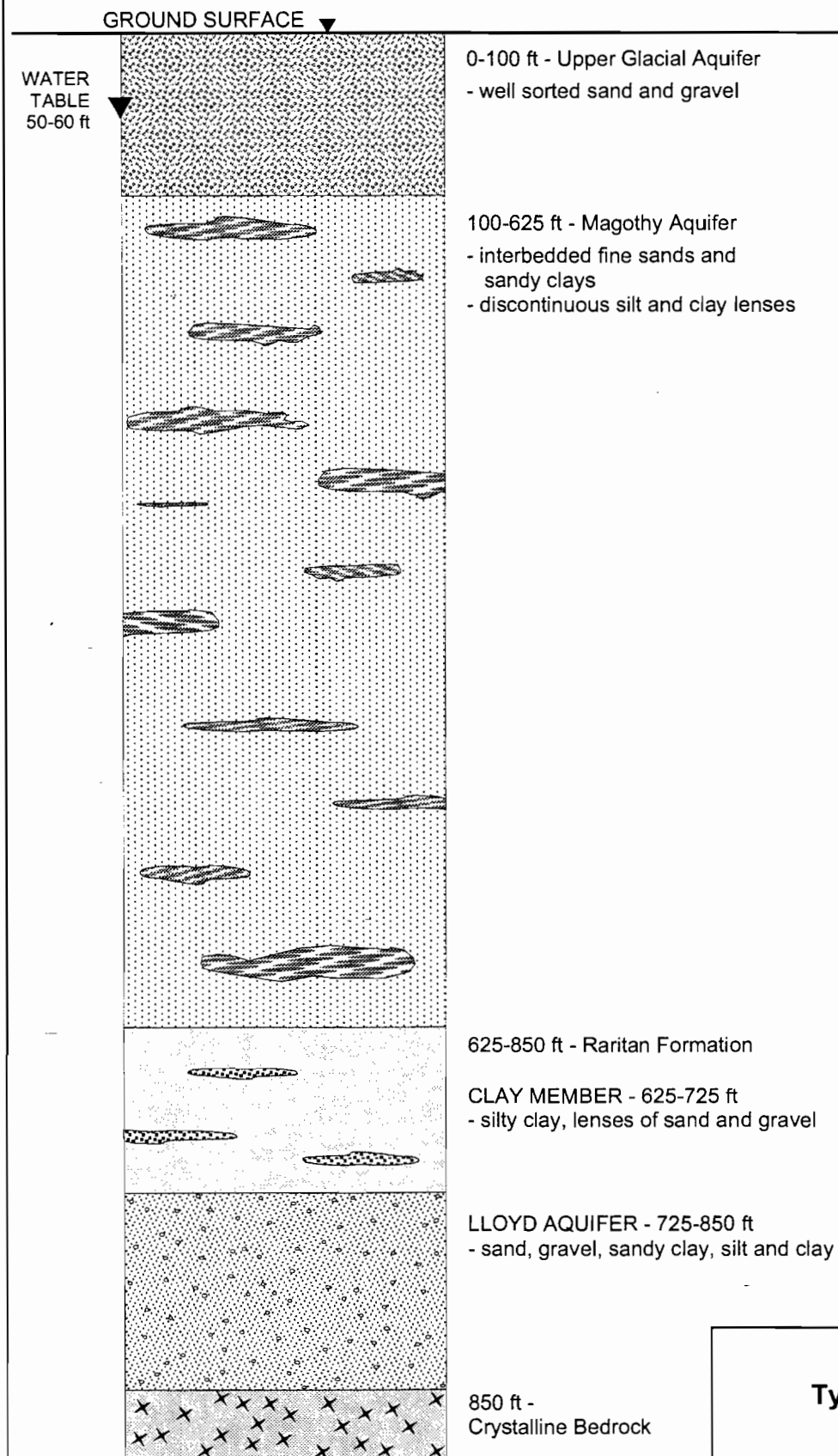
Long Island regional geology consists of a significant thickness of unconsolidated sediments (Cretaceous and Pleistocene age) overlying Precambrian and Paleozoic basement bedrock consisting of gneiss, schist, and granite that forms the base of Long Island (Figure 4-1). The bedrock surface is found at an average depth of approximately 1000 ft below sea level and dips southward to the south shore of the island (USGS 1989).

Directly above the bedrock lies the Raritan Formation, composed of the lower Lloyd Sand Member and an upper confining layer of clay. The Lloyd Sand Member, one of three important aquifers in the study area, consists of poorly sorted quartzose sands and gravel. The top of the Raritan Formation is encountered at an average depth of approximately 400 ft below sea level, with a maximum thickness of about 700 ft (USGS 1989).

Unconformably overlying the Raritan Formation is the Magothy Formation, consisting of interbedded lenses and layers of fine to medium sand, clayey sand, and solid clay with a basal gravel zone. The Magothy Aquifer is the major aquifer for public supply to nearly all of Long Island. The depth of the upper surface of the Magothy is found at about 100 ft below sea level and the formation thickens to the south, reaching a maximum thickness of 1100 ft in some locations.

What lies above the Magothy Formation is a function of the geographical location on the island. In eastern Nassau County and Suffolk County the Monmouth greensand, a glauconitic greenish-gray to greenish-black sand, silt, and clay, overlies the Magothy. This member acts as an upper confining unit for the Magothy; however, it has a very limited areal extent, pinching out about 3 miles inland from the south shore and disappearing altogether at the far eastern end of the island. Farther west, in Kings and Queens counties, the Jameco Gravel, a mix of poorly sorted sands and small gravel, can be found in a layer approximately 100 ft thick extending from the south shore to the middle of the island (USGS 1989)

The Gardiners Clay is another confining unit for the Magothy Formation or Jameco Gravel (if present), but it also has a relatively small areal extent. The occurrence of the Gardiners Clay is limited to the south shore of the island, pinching out 5 to 10 miles inland from the



\\650NC-Samplers.dsf

Figure 4-1

**Typical Cross Section
in the Site Vicinity**

FROST STREET SITES
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043 I, L, and M

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

shore. As the name implies, the Gardiners is characterized by grayish-green, glauconitic, silty clay with a maximum thickness of approximately 150 ft (more typically about 50 ft) (USGS 1989).

Above the Gardiners Clay or the Magothy (where the Gardiners is absent) are Upper Pleistocene deposits of clay, sand, gravel and boulders commonly referred to as the UGA. These deposits are composed of glacial till (morainal materials to the north and outwash deposits to the south) and constitute another important water source for the island (Buxton and Modica 1992).

4.6.2 Study Area Geology

The geology underlying the Frost Street sites in east-central Nassau County is somewhat simpler than the regional geology detailed above. The Upper Pleistocene deposits of poorly sorted sands and gravel that make up the UGA are found from the surface to a depth of approximately 80 ft below the surface. The site is located far enough north and east in Nassau County such that the Gardiners Clay, Jameco Gravel, and Monmouth greensand are all absent between the UGA and the underlying Magothy Formation. In general, the upper surface of the Magothy Formation is found at least 100 ft below ground surface (USGS 1989). However, based on observations made during installation of wells for this investigation and on published cross sections of the area (USGS 1989), the Magothy is found at significantly shallower depths (60-87 ft bgs) in the Westbury (New Cassel) area than in many other areas of the island.

The nature of the materials collected in split spoons during the installation of FSHP-1, -2, -3, -4, -5, -6, -7, FSMW-8B, -9B and -10B were relatively consistent down to an average depth of approximately 60 ft bgs, showing signs typical of UGA material: orange-brown, poorly sorted sands and quartz gravel. At depths of 50-80 ft bgs, the material in the split spoons became significantly finer and displayed a variety of colors. Very fine sand and silt became common in these samples, and stringers of gray and colored clay also began to appear. This was interpreted as the transition from the UGA to the Magothy. It is not known whether the deposits in the transitional zone between the two are of Cretaceous Age (Magothy Formation) or reworked materials from the Magothy Formation that were deposited early in the Pleistocene. Regardless of their age, the materials are believed to exhibit hydrogeologic characteristics similar to those of the Magothy Formation. Beginning

at depths of 90-120 ft bgs, the multicolored banding of material became less prominent and iron staining was observed in the samples. For the most part, silt, fine sand, and silty clay constituted the majority of the material in this interval. Based on the samples that were recovered, the contact between the two aquifers is between 60 and 87 ft bgs.

Gray clay was encountered at 120 ft bgs to the bottom of FSHP-1 at 132 ft bgs; at 120 ft bgs to the bottom of FSHP-2 at 127 ft bgs; and from 141 to 142 ft bgs in FSMW-8.

4.7 SOILS

The soils in the area around the Frost Street sites are medium-coarse-grained, well-drained soils of the Haven Variant Association. This association is typically a deep soil formed on the nearly level land (0-3% gradient) of the southern outwash plain. At depths between 20 and 36 in. the loamy, upper soils are underlain by stratified sands and gravel. The upper soil material is moderately permeable, while the deeper sand and gravel has a very high permeability (USSCS 1976).

4.8 HYDROGEOLOGY

4.8.1 Regional Hydrogeology

As outlined in the description of the regional geology of the area, three principal aquifers exist in the stratigraphic sequence of Long Island (Figure 4-1). The deepest of these aquifers is the Lloyd Sand Member of the Raritan Formation, which is confined on the bottom by the metamorphic and igneous basement rock and by the overlying Raritan confining unit. The Lloyd is characterized as poorly to moderately permeable with hydraulic conductivities on the order of 10 ft/day. The anisotropy ratio ($K_x:K_z$) of the Lloyd Aquifer is approximately 10:1 (USGS 1989). Above the Lloyd aquifer is the Magothy Aquifer, confined on the bottom by the Raritan confining unit and, in places, on top by the Monmouth greensand or the Gardiners Clay. The Magothy is an extensive aquifer with horizontal hydraulic conductivities averaging about 50 ft/day and an anisotropy ratio of 100:1. The Jameco Gravel is a relatively thin, water-bearing unit stratigraphically above the Magothy that is found only in the far western extent of Long Island. Overlying the Magothy is another extensive aquifer, the UGA. The UGA serves as the unconfined water table aquifer from the ground surface to depths up to 700 ft and covers all of Long Island. Horizontal hydraulic

conductivities in the UGA average over 200-ft/day with an anisotropy ratio of 10:1. Conductivities of UGA material from the southern half of the island (outwash) are about twice that of northern UGA material (morainal) (Buxton and Modica 1992). Due to the southward dip of the sedimentary sequences, the younger UGA is in direct hydraulic connection with the Lloyd Sand Member Aquifer as well as the Magothy Formation.

4.8.2 Study Area Hydrogeology

The hydrogeology of the area surrounding the Frost Street sites is relatively simple, consisting of two main water-bearing units, the UGA and the deeper Magothy Aquifer. The Lloyd Sand Member of the Raritan Formation was not considered in this investigation as it is found at a depth of over 600 ft in the study area. The UGA is an unconfined aquifer consisting of poorly sorted sands and gravels. The Magothy is the sole-source aquifer for the study area and consists of finer sand, silt and small amounts of clay. Following NYSDEC and EPA regulations, both the UGA and Magothy are protected as sole-source aquifers on Long Island.

A confining layer between the UGA and the Magothy, the Gardiners Clay, is not evident in the borings done during this investigation; therefore, the UGA and Magothy are in direct hydraulic connection. Depth to water is about 52.5 ft bgs in the study area, and the hydraulic gradient is approximately 0.0016 ft/ft to the southwest.

Based on analysis of in situ hydraulic tests performed during this investigation, hydraulic conductivity values for the UGA in the study area range from 0.15 to 217 ft/day. Hydraulic conductivity values based on slug tests conducted in deeper wells (Magothy Aquifer) were generally lower, ranging from 0.15 to 84 ft/day. A compilation of the data used in determining these values and a table of all hydraulic conductivities determined through in situ testing are found in Appendix C.

CHAPTER 5

INVESTIGATION ANALYTICAL RESULTS

5.1 PREVIOUS INVESTIGATIONS

Because of extensive VOC contamination of groundwater beneath the NCIA (NCDOH 1986), NYSDEC classified the entire NCIA as a hazardous waste site in 1988. LMS was contracted by NYSDEC in 1992 to conduct an SI for the NCIA. The initial SIs conducted in 1993 and 1994 identified several areas of significant groundwater contamination within the NCIA, including a large PCE plume centered in tax Block 328 (LMS 1995). The Block 328 site included the area bounded by Frost Street, Summa Avenue, Bond Street, and Old Country Road. Based on the results of the SI the properties within Block 328 remained potential registry sites; additional investigations were conducted by LMS during a Multisite PSA in 1995 (LMS 1996). Based on the data collected until 1995, the three Frost Street sites were added as Class 2 sites on the New York State Registry of Inactive Hazardous Waste Disposal Sites (LMS 1997). The three Frost Street sites were 101 Frost Street (the former Autoline Automotive), 89 Frost Street, and 770 Main Street (the former Applied Fluidics). The SI and Multisite PSA included the collection of a large number of soil and groundwater samples, in addition to several rounds of groundwater sampling on existing wells in the NCIA. Two additional investigations have been conducted by NYSDEC downgradient of the Frost Street sites in 1997 to 1998. The investigations included the installation of four early warning wells for the Bowling Green supply wells (LMS 1997) and the installation of groundwater probes and hydropunch sampling north and south of the NCIA (LMS 1998).

In addition to the sampling and analysis conducted during the NYSDEC investigations, several investigations were conducted in the Frost Street area by consultants for the sites PRPs. Typically, these investigations were limited to the sampling and analysis of soils around old leach pools/dry wells, and shallow groundwater.

In summarizing the previous data for the Frost Street area, the data are broken down into the following sections based on the media sampled and the method of collection: Groundwater Probe Sampling Results (Section 5.1.1), Soil Probe Sampling Results

(Section 5.1.2), Previous Monitoring Well Sampling Results (Section 5.1.3), and Previous Hydropunch Sampling Results (Section 5.1.4).

5.1.1 Groundwater Probe Sampling Results

5.1.1.1 NYSDEC SI Groundwater Probe Results. The groundwater probe results from the NYSDEC SIs include sample data collected in 1993 (Phase I SI) and 1994 (Phase II SI). A detailed presentation and discussion of these results is found in the SI report (LMS 1995). The sampling locations and results relevant to the RI at the Frost street Sites are shown on Figure 5-1.

5.1.1.2 Multisite PSA (1996) and Task 4 Report (1997) Groundwater Probe Results. The groundwater probe locations and results of the mobile laboratory VOC analyses performed on the groundwater probe samples collected by LMS during the Multisite PSA are found on Figure 5-1. Within the Block 328 PSA area a total of 20 groundwater samples were taken. Extremely high concentrations of PCE-related compounds were found in this area, with the highest concentrations found at the 65- to 85-ft depth. The highest concentrations of PCE-related contaminants were found in GP-131 and GP-145 (65 to 85 ft). At GP-131 PCE-related contaminants were found at 50,000 µg/l (50,000 µg/l of PCE), while GP-145 had 40,200 µg/l (1000 µg/l of cis-1,2-DCE, 2200 µg/l of TCE, 37,000 µg/l of PCE). At the shallow depth (watertable to 65- ft) the highest concentrations of PCE-related contaminants were found near 770 Main Street (GP-131, GP-134, and GP-145); at the greatest depth (85 ft) the highest levels of PCE-related contaminants were found south of Main Street near 770 Main (GP-125, GP-131, GP-126, and GP-141). A number of TCA-related contaminants were also found in the area of the Block 328 site. The results indicate that TCA-related contaminants in excess of 100 µg/l are confined to only several points across each depth range.

5.1.1.3 Results of NCIA Preliminary Off-site Immediate Investigation Work Assignment (IIWA) Probe Groundwater Sampling. The objective of this IIWA was to conduct a preliminary investigation of the impact of the various plume areas on off-site locations downgradient of the NCIA. A total of 10 geoprobe groundwater sample locations and five hydropunch sampling locations were completed during this IIWA investigation in September 1997 (Figure 5-2). Five of the geoprobe sampling points (GP-

256, GP-257, GP-258, GP-264, and GP-265) were located directly downgradient of the Frost Street sites in off-site locations.

The results of GP-256 indicated concentrations of VOCs in excess of NYSDEC class GA groundwater standards only at the deepest depth sampled (92-96 ft). PCE (150 µg/l) and TCE (5 µg/l) were the only VOCs found. Total VOCs at the two shallow depths (60-64 and 72-76 ft) were 3 and 4 µg/l, respectively. The concentrations with depth below 96 ft are not known as geoprobe sampling was not conducted below this depth. It is suspected that higher concentrations exist at depths below 96 ft based on other sampling in the area.

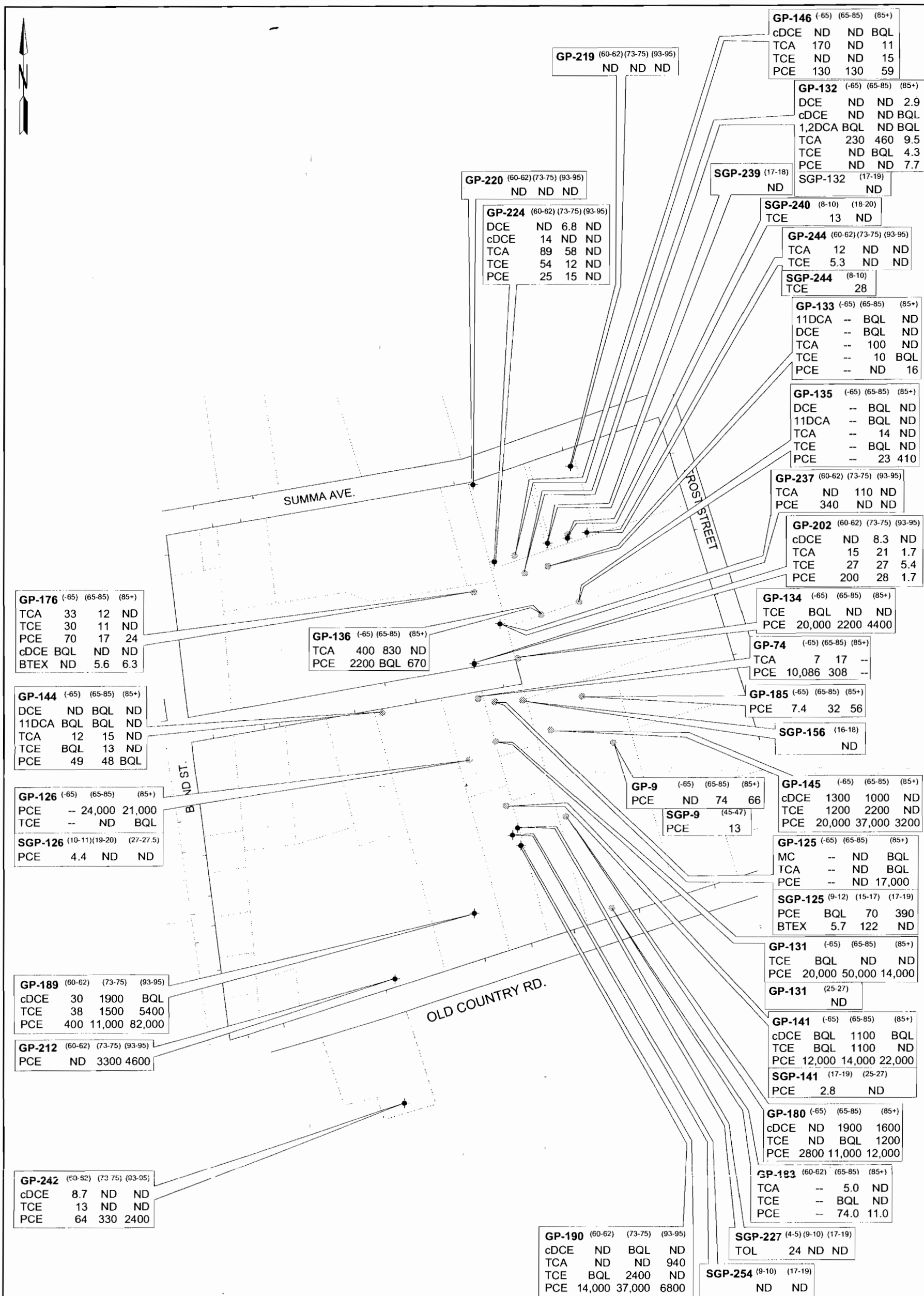
The results of GP-257 indicated concentrations of VOCs in excess of NYSDEC class GA groundwater standards at two of the depths sampled (72-76 and 92-96 ft). Total VOCs at the two shallow depths (60-64 and 72-76 ft) were 5 and 15 µg/l, respectively. At the deepest depth (92-96 ft) total VOCs were 125 µg/l, including 90 µg/l of PCE, 9 µg/l of TCE, 13 µg/l of cis-1,2 DCE, 11 µg/l of 1,1,1-TCA, and 2 µg/l of 1,1-DCE. The concentrations with depth below 96 ft are not known. Higher concentrations are also likely at depths greater than 96 ft at this location.

Only two samples were collected at GP-258 (60-64 and 68-72 ft). At 60-64 ft only 2 µg/l of 1,1,1-TCA was detected. Total VOCs at 68-72 ft were 12 µg/l, including 6 and 4 µg/l of TCE and 1,1,1-TCA, respectively.

The results of GP-264 did not show concentrations of VOCs in excess of NYSDEC class GA groundwater standards at any of the three depths sampled. The results of GP-265 also did not show concentrations of VOCs in excess of NYSDEC class GA groundwater standards at the single depth that was sampled (Figure 5-2).

5.1.1.4 PRP Groundwater Probe Sampling. Prior to 1995 none of the private investigations in this Frost Street area included groundwater probe sampling.

In 1997 the PRP conducted a limited investigation (Levine-Fricke-Recon 1997) that included one geoprobe inside the building at 770 Main Street. The single groundwater sample contained three compounds in excess of the NYSDEC Class GA groundwater standards, including cis-1,2-DCE (351 µg/l), TCE (563 µg/l), and PCE (6010 µg/l).



Legend
◆ 1996 geoprobe sample location
GP-# Groundwater geoprobe sample I.D.
SGP-# Soil geoprobe sample I.D.

ABBREVIATIONS
-- Not sampled
ND No detection
BQL Below detection limit
11DCA 1,1-dichloroethane
12DCA 1,2-dichloroethane
cDCE cis-dichloroethene
DCE Dichloroethene

TCA 1,1,1-trichloroethane
TCE Trichloroethane
PCE Tetrachloroethene
MC Methylene chloride
TOL Toluene
BTEX Benzene/toluene/ethyl benzene/xylenes

NOTE:
Combined samples include both numbers in box
All depths measured in ft from grade
All data is given in µg/l

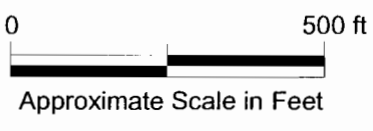


Figure 5-1
Previous Sampling Results
NYSDEC and Multi-PSA
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043 N and O
LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

\\Frost\\S\\EZEMP\\prevdata.dsf

5.1.2 Soil Probe Sampling Results

5.1.2.1 ***NYSDEC SI Soil Probe Results.*** The soil probe results from the NYSDEC SI include sample data collected in 1993 (Phase I SI) and 1994 (Phase II SI). A detailed presentation and discussion of these results is found in the SI report (LMS 1995). The data from these soil probes are also shown on Figure 5-1.

5.1.2.2 ***Multisite PSA (1996) and Task 4 Report (1997) Soil Probe Results.*** The Multisite PSA soil probe data are summarized on Figure 5-1. In general, the contaminant levels in the soils were much lower than those in the groundwater. The latest data collected during this RI indicate many of the Multisite PSA soil probe samples were not located directly over suspected source areas, which accounts for the generally low concentrations that were found. Soil probe sample concentrations in the Block 328 area ranged from none detected (ND) in SGP-132 and SGP-156 to as high as 70 µg/kg of PCE-related contaminants and 122 µg/kg of BTEX-related contaminants in SGP-125 (15 to 17 ft).

5.1.2.3 ***PRP Soil Probe Results.*** Eleven subsurface soil samples from 30-32 ft below the surface were collected by Anson Environmental during a Phase II investigation of properties located at 750 and 770 Main Street and 1099 and 1111 Old Country Road (Anson 1992). All analytical parameters tested had concentrations below the laboratory detection limit, with the exception of methylene chloride and acetone. These two compounds, common laboratory contaminants, were identified in the laboratory blank and were attributed to laboratory contamination.

5.1.3 Previous Monitoring Well Sampling Results

5.1.3.1 ***NYSDEC SI Monitoring Well Sampling Results.*** The monitoring well sampling results from the NYSDEC SI include sample data collected in 1993 (Phase I SI) and 1994 (Phase II SI). The results that are applicable to the Frost Street sites include the sampling results from ANSON MW-3, ANSON MW-4, ANSON MW-6, and ANSON MW-10. Overall, only trace levels of contamination were detected with the exception of ANSON MW-10, which contained 121 µg/l of PCE-related contaminants.

5.1.3.2 Results of Multisite PSA Monitoring Well Groundwater Sampling. Two monitoring wells in the Block 328 area were sampled by LMS during the 1995

zone of the Magothy. During the installation of the deeper well, hydropunch groundwater samples were collected at 10-ft intervals from the watertable to 150 ft bgs, at 20-ft intervals from 170 to 250 ft bgs, and every 50 ft from 300 to 500 ft bgs. A total of 31 hydropunch groundwater samples were collected and the results are summarized on Figure 5-3.

5.1.4.2 Results of NCIA Preliminary Off-site IWA Hydropunch Sampling (1997). In addition to the 10 geoprobe groundwater sample locations, four hydropunch sampling locations were also completed during the preliminary off-site groundwater IWA. Two of the hydropunch sampling locations (HP-01 and HP-02) were located directly downgradient of the Frost Street sites in off-site locations (Figure 5-2).

The results of HP-01 indicated concentrations of VOCs in excess of NYSDEC class GA groundwater standards at 80, 100, 110, 120, 130, 140, and 150 ft bgs. Total VOCs at 150 ft were 552 µg/l, including 200 µg/l of PCE, 175 µg/l of TCE, 129 µg/l of cis-1,2 DCE, 29 µg/l of 1,1,1 TCA, 5 µg/l of 1,1 DCE, and 14 µg/l of total dichlorobenzene.

The results of HP-02 indicated concentrations of VOCs in excess of NYSDEC class GA groundwater standards at 70, 80, 90, and 130 ft bgs. PCE was the only contaminant detected; at 70 ft a concentration of 27 µg/l of PCE was found, and concentrations in the deeper samples ranged from 2 to 9 µg/l.

5.2 REMEDIAL INVESTIGATION ANALYTICAL RESULTS

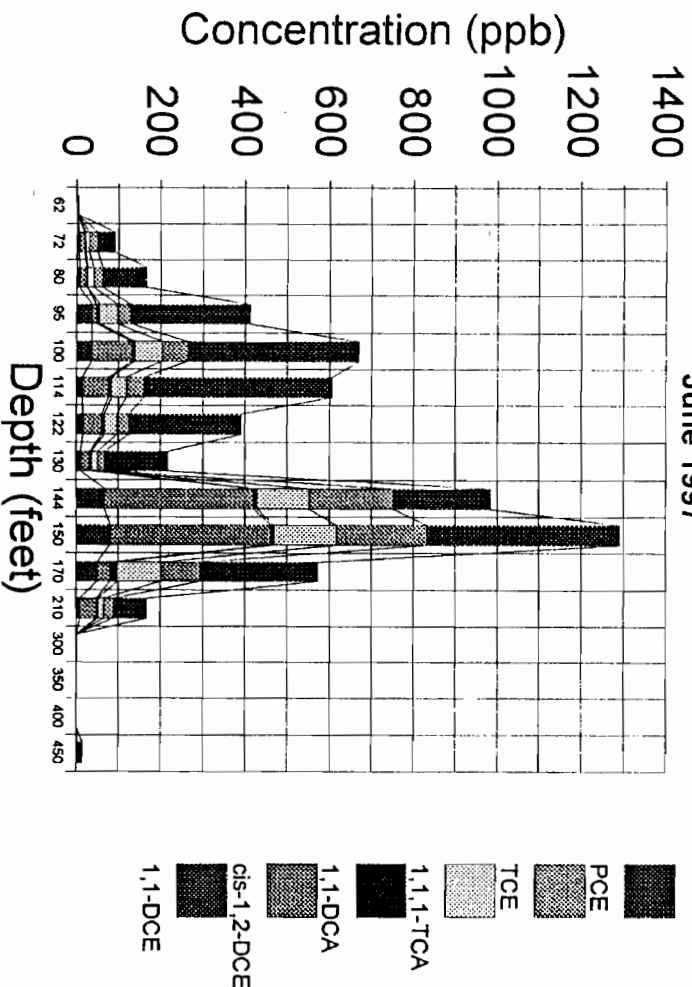
The following sections describe the results of chemical analyses performed on soil and water from 8 July through 4 December 1998 at the former Autoline Automotive site (101 Frost Street), 89 Frost Street, the former Applied Fluidics site (770 Main Street), and at off-site locations.

Laboratory analytical data sheets are contained in Appendix G and the data validation and usability report is contained in Appendix H.

Well:	EW-01C																
Depth (ft.):	62	72	80	95	100	114	122	130	144	150	170	210	300	350	400	450	
1,1-DCE	1	5	6	37	36	16	17	10	67	81	51	9	0	0	0	0	
cis-1,2-DCE	0	15	18	11	96	60	44	22	353	380	31	40	0	0	0	3	
1,1-DCA	1	2	2	8	7	8	7	5	8	17	17	4	0	0	0	0	
1,1,1-TCA	1	8	14	41	64	35	29	15	124	147	102	13	0	0	0	0.5	
TCE	0	20	22	31	61	41	29	15	201	216	93	23	0	0	0	0	
PCE	1	42	104	283	406	446	263	151	232	459	279	79	1	1	0	12	
chloroform	0	0	0	1	4	0	0	0	0	0	0	0	0	0	0	2	
met chloride	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	
1,2-DCA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total Dichlorobenzene	0	0	0	1	0	1	0	0	0	0	0	21.5	0	0	0	0	
Total VOC's	4	92	166	415	674	607	389	218	985	1291	573	189.5	1	1	0	17.5	
all results in ppb																	

Preliminary Screening Results Bowling Green EW-01C

June 1997*



NOTE: Individual hydropunch samples collected during drilling in June 1997.

Well:	EW-02C																	
Depth (ft.):	62	80	90	100	110	120	130	140	170	190	212	230	250	300	350	400	450	
1,1-DCE	3	151	112	11	3	8	6	5	0	4	6	1	0	0	0	0	0	
cis-1,2-DCE	2	0	22	82	17	19	165	56	25	14	10	36	33	0	0	0	0	
1,1-DCA	0	141	32	12	3	4	0	2	0	0	0	0	0	1	0	2	0	
1,1,1-TCA	7	649	243	20	7	12	0	3	4	5	9	1	0	0	0	0	0	
TCE	4	5	19	90	28	81	274	202	79	77	40	87	59	0	0	0	0	
PCE	7	38	129	11	0	3	289	25	10	79	37	35	17	2	0	0	0	
VOC	0	0	0	40	2	6	217	16	0	0	0	0	0	0	0	0	0	
TCF's	0	0	0	28	44	93	0	3	0	0	0	0	0	0	0	0	0	
1,2-DCA	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	
Chlorodibromomethane	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1,2,3-Trichloropropane	0	20.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Toluene	0	0	0	0	0	0	0	0	41	5	0	0	0	0	0	0	0	
Total dichlorobenzene	0	0	0	0	0	0	0	1	0	3	2	0	1	0	0	0	0	
met chlorine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total VOC's	23	1009.5	557	294	104	226	961	313	169	187	104	161	110	3	NT	2	NT	
all results in ppb																		
NT=not taken, DRY																		

Preliminary Screening Results Bowling Green EW-02C

June 1997*

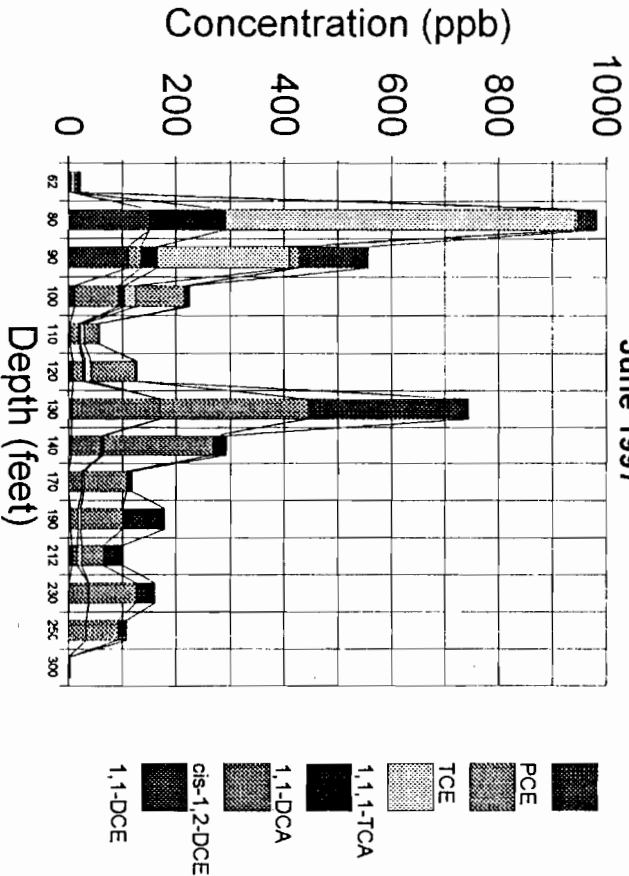


Figure 5-3

Bowling Green Early Warning Wells
Preliminary Hydropunch Data From
the Town of Hempstead Laboratory

5.2.1 Surface Soil Samples

Envirotech analyzed surface soil samples collected from two locations at 101 Frost Street (former Autoline Automotive) for TCL VOCs, SVOCs, pesticides/PCBs, and TAL metals plus cyanide analysis according to NYSDEC ASP CLP Methods 95-1, 95-2, 95-3, and CLM-M/335.2 (December 1991). Table 5-2 shows the results and Figure 5-4 graphically summarizes the results of the sampling analyses. The table also shows eastern U.S. background soil metals concentrations, and NYSDEC soil cleanup objectives (NYSDEC 1994a). Results in bold face type exceed the cleanup objective/background levels.

VOCs were ND in 101-SS-1, and only a trace of PCE was found in 101-SS-2. SVOCs found in 101-SS-1 exceeding the recommended soil cleanup objective included benz(a)anthracene [benz(a)an] at 890 µg/kg, chrysene at 1200 µg/kg, benzo(k)fluoranthene [benzo(k)fl] at 1400 µg/kg, benzo(a)pyrene [benzo(a)py] at 910 µg/kg, and dibenz(a,h)anthracene [dibenz(a,h)] at 150 µg/kg. In the sample taken at 101-SS-2, phenol (3 µg/kg) was also found, as were benz(a)an (740 µg/kg), chrysene (960 µg/kg), benzo(k)fl 1300 µg/kg, benzo(a)py (850 µg/kg), and dibenz(a,h) (110 µg/kg). Traces of 4,4'-DDE, 4,4'-DDT, a-chlordane, and g-chlordane were found in both 101-SS-1 and -2, while 101-SS-1 also had traces of dieldrin, endrin, and E keytone. Both 101-SS-1 and -2 had iron in excess of recommended soil cleanup objectives, but well below the eastern background soil concentrations. 101-SS-1 had seven metals (antimony, chromium, copper, lead, magnesium, nickel, and zinc) greatly exceeding both the recommended soil cleanup objective and the eastern background soil concentrations, with the respective concentrations of 18,500, 254,000, 1,120,000, 5,410,000, 10,300,000, 125,000, and 804,000 µg/kg. 101-SS-2 had magnesium (18,200,000 µg/kg) and zinc (159,000 µg/kg) greatly exceeding both criteria.

5.2.2 Subsurface Soils and Sediments

Subsurface soils and sediments consist of soil samples taken in, below, and adjacent to the dry wells (sample designations Street#-DW-#-S, Street#-DW-##, and Street#-DWA-##, respectively). Additional probes are indicated by the prefix FSGP. Soil and sediment samples were collected and analyzed by two laboratories to determine the contamination

SURFACE SOIL DATA SUMMARY

Base Analytical Laboratory

LMS Sample ID	101-SS-1	101-SS-2	S.S.E.B.-1 ²	Trip_Blank	RECOMMENDED
Lab Sample Number	78279	78277	78545	78546	SOIL CLEANUP
Sampling Date	08/18/98	08/18/98	08/19/98	08/19/98	OBJECTIVE (a)
VOLATILE ORGANIC COMPOUNDS (µg/kg)					
Methylene Chloride	ND	ND	ND	ND	100
Acetone	14	14	ND	7 j	200
Carbon Disulfide	ND	ND	ND	ND	2,700
1,2-Dichloroethene(total)	ND	ND	ND	ND	300
1,2-Dichloroethane	ND	ND	ND	ND	100
2-Butanone	ND	ND	ND	ND	300
Trichloroethene	ND	ND	ND	ND	700
1,1,1-Trichloroethane	ND	ND	ND	ND	800
4-Methyl-2-Pentanone	ND	ND	ND	ND	1,000
Tetrachloroethene	ND	0.9 j	ND	ND	1,400
Toluene	ND	ND	ND	ND	1,500
Chlorobenzene	ND	ND	ND	ND	1,700
Ethylbenzene	ND	ND	ND	ND	5,500
Xylenes(Total)	ND	ND	ND	ND	1,200

(a) - NYSDEC Technical Administrative Guidance Memorandum, January 1994.

bold - Value exceeds recommended criteria.

j - Estimated concentration; compound present below quantitation limit.

ND - Not detected at analytical detection limit.

N/A - Not applicable.

2 - Equipment Blank.

SURFACE SOIL DATA SUMMARY

Base Analytical Laboratory

LMS Sample ID	101-SS-1	101-SS-2	S.S.E.B.-1 ²	RECOMMENDED
Lab Sample Number	78279	78277	78545	SOIL CLEANUP
Sampling Date	08/18/98	08/18/98	08/19/98	OBJECTIVE (a)
	[DL:10:1]	[DL:5:1]		
SEMIVOLATILE ORGANIC COMPOUNDS (µg/kg)				
Phenol	ND g	30 jgd	ND	30 or MDL
1,4-Dichlorobenzene	ND g	ND g	ND	N/A
4-Methylphenol	ND g	ND g	ND	900
1,2,4-Trichlorobenzene	ND g	ND g	ND	N/A
Naphthalene	ND g	ND g	ND g	13000
2-Methylnaphthalene	ND g	ND g	ND	36400
Acenaphthylene	ND g	48 j	ND	41000
3-Nitroaniline	ND g	ND g	ND	500 or MDL
Acenaphthene	45 j	47 j	ND	50000***
4-Nitrophenol	ND g	ND g	ND	100 or MDL
Dibenzofuran	ND g	28 j	ND	6200
Fluorene	67 j	66 j	ND	50000***
Phenanthrene	1,200 j	940 j	ND	50000***
Anthracene	190 j	190 j	ND	50000***
Carbazole	160 j	130 j	ND	N/A
Di-n-butylphthalate	ND g	ND g	ND	8100
Fluoranthene	2,300 j	1.9	ND	50000***
Pyrene	1,800 j	1,400 j	ND	50000***
Butylbenzylphthalate	ND g	ND g	ND	50000***
Benzo(a)anthracene	890 j	740 j	ND	224 or MDL
Chrysene	1,200 j	960 j	ND	400***
bis(2-Ethylhexyl)phthalate	ND	ND	ND	50000***
Di-n-octylphthalate	ND g	ND g	ND	50000***
Benzo(b)fluoranthene	1,400 j	1,300 j	ND	1100
Benzo(k)fluoranthene	570 j	510 j	ND	1100
Benzo(a)pyrene	910 j	850 j	ND	61 or MDL
Indeno(1,2,3-cd)pyrene	580 j	350 j	ND	3200
Dibenzo(a,h)anthracene	150 j	110 j	ND	14 or MDL
Benzo(g,h,i)perylene	520 j	320 j	ND	50000***

- (a) - NYSDEC Technical Administrative Guidance Memorandum, January 1994.
bold - Value exceeds recommended criteria.
j - Estimated concentration; compound present below quantitation limit.
ND - Not detected at analytical detection limit.
N/A - Not applicable.
2 - Equipment Blank.
g - Value considered estimated based on data validator's report (Appendix H).
d - Concentration recovered from diluted sample.

SURFACE SOIL DATA SUMMARY

Base Analytical Laboratory

LMS Sample ID	101-SS-1	101-SS-2	S.S.E.B.-1 ²	RECOMMENDED
Lab Sample Number	78279	78277	78545	SOIL CLEANUP
Sampling Date	08/18/98	08/18/98	08/19/98	OBJECTIVE (a)
PESTICIDES/PCBs (µg/kg)				
Dieldrin	6.9 p	ND	ND	44
4,4'-DDE	12 p	3.9 p	ND	2,100
4,4'-DDD	ND	ND	ND	2,900
Endrin	17	ND	ND	100
Endosulfansulfate	ND	ND	ND	1,000
4,4'-DDT	14 pg	15 pg	ND	2,100
Endrin aldehyde	ND	ND	ND	N/A
Endrin keytone	4.9	ND	ND	N/A
alpha-Chlordane	6.4 p	7.7 p	ND	540
gamma-Chlordane	7.3 p	6.6 p	ND	540

(a) - NYSDEC Technical Administrative Guidance Memorandum, January 1994.

bold - Value exceeds recommended criteria.

p - Pesticide/Aroclor target analyte has >25% difference for the detected concentrations between the two GC columns.

2 - Equipment Blank.

g - Value considered estimated based on data validator's report (Appendix H).

ND - Not detected at analytical detection limit.

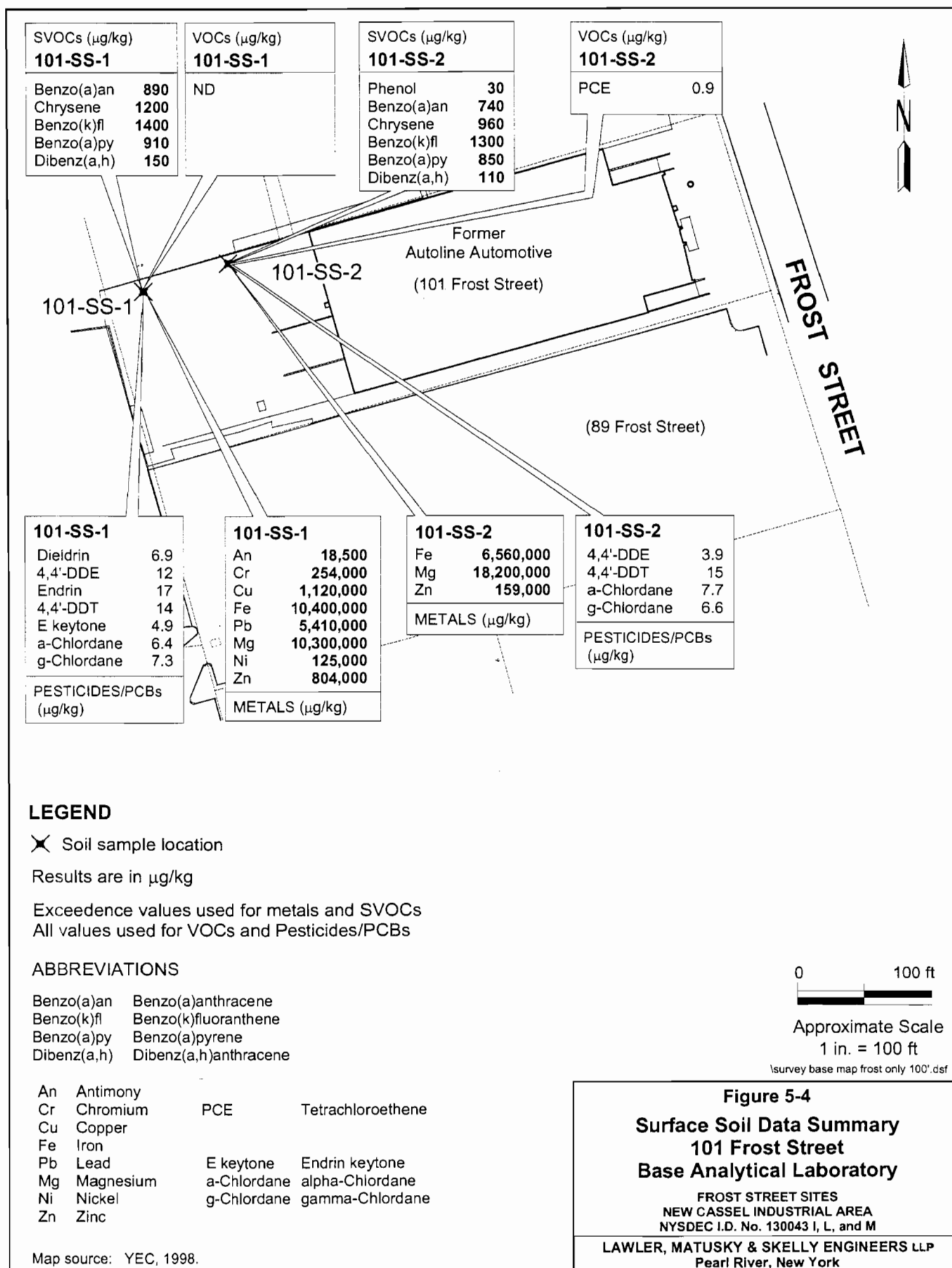
N/A - Not applicable.

SURFACE SOIL DATA SUMMARY

Base Analytical Laboratory

LMS Sample ID	101-SS-1	101-SS-2	S.S.E.B.-1 ²	RECOMMENDED	EASTERN USA
Lab Sample Number	78279	78277	78545	SOIL CLEANUP	BACKGROUND SOIL
Sampling Date	08/18/98	08/18/98	08/19/98	OBJECTIVE (a)	CONCENTRATIONS (a)
METALS(µg/kg)					
Aluminum	4,080,000	2,480,000	95,600 B	SB	33,000,000
Antimony	18,500	ND	ND	SB	600 - 10,000 (n)
Arsenic	3,000	1,600 B	ND	7,500 or SB	3,000 - 12,000 æ
Barium	22,700 B	26,900 B	ND	300,000 or SB	15,000 - 600,000
Beryllium	160 B	120 B	ND	160 or SB	0 - 1,750
Cadmium	980 B	260 B	ND	1,000 or SB	100 - 1,000
Calcium	19,300,000 Rg	33,300,000 R	183,000 B	SB	130,000 - 35,000,000 æ
Chromium	254,000 Rg	8,100 R	ND	10,000 or SB	1,500 - 40,000 æ
Cobalt	6,000 BR	2,600 BR	ND	30,000 or SB	2,500 - 60,000 æ
Copper	1,120,000 Rg	17,600 R	ND	25,000 or SB	1,000 - 50,000
Iron	10,400,000	6,560,000	ND	2,000,000 or SB	2,000,000 - 550,000,000
Lead	5,410,000	45,800	ND	SB*	200,000 - 500,000*
Magnesium	10,300,000 Rg	18,200,000 R	ND	SB	100,000 - 5,000,000
Manganese	142,000	111,000	620 B	SB	50,000 - 5,000,000
Mercury	80 B	ND	ND	100	1 - 200
Nickel	125,000 NRg	9,500 NR	ND	13,000 or SB	500 - 25,000
Potassium	347,000 B	408,000 B	ND	SB	8,500,000 - 43,000,000 æ
Selenium	ND	ND	ND	2,000 or SB	100 - 3,900
Silver	4,800	ND	ND	SB	100 - 5,000 (n)
Sodium	142,000 B	331,000 B	425,000 B	SB	6,000,000 - 8,000,000
Thallium	ND	ND	ND	SB	100 - 800 (q)
Vanadium	25,000	29,300	ND	150,000 or SB	1,000 - 300,000
Zinc	804,000	159,000	3,500 B	20,000 or SB	9,000 - 50,000
Cyanide	ND	ND	ND	**	N/A

- * - Background levels for lead range from 4,000 - 61,000 ppb in undeveloped, rural areas to 200,000 - 500,000 ppb in metropolitan or suburban areas or near highways.
- ** - Some forms of Cyanide are complex and stable while other forms are pH dependent and hence are very unstable. Site-specific form(s) of Cyanide should be taken into consideration when establishing soil cleanup objectives.
- æ - New York State background concentration.
- (a) - NYSDEC Technical Administrative Guidance Memorandum, January 1994.
- (n) - Dragun, J., The Soil Chemistry of Hazardous Materials.
- (q) - Bowan, H.J., Environmental Chemistry of the Elements.
- bold - Value exceeds recommended criteria.
- B - Value is less than the contract-required detection limit but greater than the instrument detection limit.
- MDL - Method detection limit.
- ND - Not detected at analytical detection limit.
- N/A - Not applicable.
- g - Value considered estimated based on data validator's report (Appendix H).
- 2 - Equipment Blank.
- N - Spiked sample recovery is not within control limits.
- R - Duplicate analysis not within control limits.



at the Frost Street Sites. A majority of the samples were analyzed by an on-site mobile laboratory (Target), some were analyzed by an off-site base analytical laboratory (Envirotech), and some samples were analyzed by both laboratories. The samples were delivered to the laboratories under proper chain-of-custody protocols during the sampling effort.

5.2.2.1 Mobile Laboratory Results.

101 Frost Street Sediment and Soil Samples. A total of 62 samples were taken from 21 locations: 12 dry wells, six adjacent to dry wells, and two additional probes. Sediment was sampled in the 12 dry wells, one of them twice (101-DW-10 and 101-DW-10A). A detailed summary of mobile laboratory VOC sampling results for the soil samples is contained on Table 5-3, and Figure 5-5 graphically summarizes results of the sampling analysis.

The sediment samples from the twelve dry wells (101-DW-1 (S), -2 (S), -3, -4, -5, -6 -7, -8, -9, -10 (twice), -12, and -13) were analyzed by Target for VOCs using EPA Methods 8010 and 8020.

Traces of PCE alone were found in samples 101-DW-1 (S), -2 (S), -3 (S), -10 (S), -10A (S), and -13 (S). Traces of TCE and PCE were found in 101-DW-6 (S). Traces of 1,1,1-TCA, TCE, and PCE were found in 101-DW-4 (S). 101-DW-5 (S) had traces of TCE, PCE, toluene, and trans-1,2-DCE. PCE and toluene traces were found in 101-DW-9 (S); only a trace of toluene was found in 101-DW-7 (S). Traces of benzene, toluene, ethylbenzene, o-xylene, and m&p-xylenes were found in 101-DW-8 (S). In 101-DW-12 (S), traces of PCE and ethylbenzene were found, along with o-xylene, and m&p-xylenes, which were found in concentrations above the recommended soil cleanup objectives, (5195 and 6614 µg/kg, respectively).

Of the 12 soil samples taken below the dry wells, four were ND; the other eight had trace amounts of PCE. The 30 adjacent samples were ND in 16 and had only traces of PCE in ten; traces of PCE and TCE were found in one. The level of PCE in 101-DWA-4 (50-54 ft) was extremely high and the PCE concentration exceeded the limits of the mobile laboratory, making it unable to report a concentration value for PCE. The levels noted were well above the recommended soil cleanup objective. As with the high

TABLE 5-3 (Page 1 of 10)

SOIL AND SEDIMENT DATA SUMMARY

101 Frost Street
Mobile Laboratory

LMS Sample ID Lab Sample ID	101-DW-1 (S) DW-1	101-DW-1 (27-29') DW-1_27-29'	101-DWA-1 (8-12') DWA-1_8-12'	101-DWA-1 (18-22') DWA-1_18-22'	101-DWA-1 (30-34') DWA-1_30-34'	101-DWA-1 (40-44') DWA-1_40-44'	RECOMMENDED SOIL CLEANUP OBJECTIVE (a)
VOLATILE ORGANIC COMPOUNDS (µg/kg)							
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	400
<i>trans</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	300
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	200
<i>cis</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	300
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	800
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	100
Trichloroethene	ND	0.64	ND	ND	ND	ND	700
Tetrachloroethene	21.0 e	9.52 e	ND	ND	ND	ND	1400
Benzene	ND	ND	♦	♦	♦	♦	60
Toluene	ND	ND	♦	♦	♦	♦	1500
Ethylbenzene	ND	ND	♦	♦	♦	♦	5500
<i>o</i> -Xylene	ND	ND	♦	♦	♦	♦	1200
<i>m</i> & <i>p</i> -Xylenes	ND	ND	♦	♦	♦	♦	1200

♦ - Not analyzed.

- Value exceeds recommended criteria.

(a) - NYSDEC Technical Administrative Guidance Memorandum, January 1994.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

DL - Diluted sample analysis.

NR - Analysis not reportable due to extremely high concentrations of PCE.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-3 (Page 2 of 10)

SOIL AND SEDIMENT DATA SUMMARY

101 Frost Street
Mobile Laboratory

LMS Sample ID Lab Sample ID	101-DWA-1 (50-54') DWA-1_50-54'	101-DW-2 (S) DW-2	101-DW-2 (28-30') DW-2_28-30'	101-DWA-2 (8-12') DWA-2_8-12'	101-DWA-2 (18-22') DWA-2_18-22'	101-DWA-2 (30-34') DWA-2_30-34'	RECOMMENDED SOIL CLEANUP OBJECTIVE (a)
VOLATILE ORGANIC COMPOUNDS (µg/kg)							
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	400
<i>trans</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	300
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	200
<i>cis</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	300
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	800
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	100
Trichloroethene	ND	ND	ND	ND	ND	ND	700
Tetrachloroethene	ND	1.64	ND	ND	ND	ND	1400
Benzene	♦	ND	ND	ND	ND	ND	60
Toluene	♦	ND	ND	ND	ND	ND	1500
Ethylbenzene	♦	ND	ND	ND	ND	ND	5500
<i>o</i> -Xylene	♦	ND	ND	ND	ND	ND	1200
<i>m&p</i> -Xylenes	♦	ND	ND	ND	ND	ND	1200

♦ - Not analyzed.

bold - Value exceeds recommended criteria.

(a) - NYSDEC Technical Administrative Guidance Memorandum, January 1994.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

DL - Diluted sample analysis.

NR - Analysis not reportable due to extremely high concentrations of PCE.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

SOIL AND SEDIMENT DATA SUMMARY

101 Frost Street

Mobile Laboratory

LMS Sample ID	101-DWA-2 (40-44')	101-DWA-2 (50-54')	101-DW-3 (S)	101-DW-3 (26-28')	101-DW-4 (S)	101-DW-4 (24-26')	101-DWA-4 (8-12')	RECOMMENDED SOIL CLEANUP OBJECTIVE (a)
Lab Sample ID	DWA-2_40-44'	DWA-2_50-54'	DW-3	DW-3_26-28'	DW-4	DW-4_24-26'	DWA-4_8-12'	
VOLATILE ORGANIC COMPOUNDS (µg/kg)								
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	400
<i>trans</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	300
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	200
<i>cis</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	300
1,1,1-Trichloroethane	ND	ND	ND	ND	89.6 e	ND	ND	800
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	100
Trichloroethene	ND	ND	ND	ND	0.61	ND	ND	700
Tetrachloroethene	ND	ND	17.5 e	0.93	11.9 e	0.8	ND	1400
Benzene	ND	ND	ND	ND	ND	ND	ND	60
Toluene	ND	ND	ND	ND	ND	ND	ND	1500
Ethylbenzene	ND	ND	ND	ND	ND	ND	ND	5500
<i>o</i> -Xylene	ND	ND	ND	ND	ND	ND	ND	1200
<i>m&p</i> -Xylenes	ND	ND	ND	ND	ND	ND	ND	1200

♦ - Not analyzed.

bold - Value exceeds recommended criteria.

(a) - NY/DEC Technical Administrative Guidance Memorandum, January 1994.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

DL - Diluted sample analysis.

NR - Analysis not reportable due to extremely high concentrations of PCE.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-3 (Page 4 of 10)

SOIL AND SEDIMENT DATA SUMMARY

101 Frost Street
Mobile Laboratory

LMS Sample ID Lab Sample ID	101-DWA-4 (18-22') DWA_4_18-22'	101-DWA-4 (30-34') DWA_4_30-34'	101-DWA-4 (40-44') DWA_4_40-44'	101-DWA-4 (50-54') DWA_4_50-54'	101-DW-5 (S) DW-5	101-DW-5 (22-24') DW-5_22-24'	RECOMMENDED SOIL CLEANUP OBJECTIVE (a)
VOLATILE ORGANIC COMPOUNDS (µg/kg)							
1,1-Dichloroethene	ND	ND	ND	NR	ND	ND	400
<i>trans</i> -1,2-Dichloroethene	ND	ND	ND	NR	8.54	ND	300
1,1-Dichloroethane	ND	ND	ND	NR	ND	ND	200
<i>cis</i> -1,2-Dichloroethene	ND	ND	ND	NR	ND	ND	300
1,1,1-Trichloroethane	ND	ND	ND	NR	ND	ND	800
1,2-Dichloroethane	ND	ND	ND	NR	ND	ND	100
Trichloroethene	ND	ND	ND	NR	0.37	ND	700
Tetrachloroethene	ND	ND	ND	NR	3.74 e	ND	1400
Benzene	ND	ND	ND	NR	ND	ND	60
Toluene	ND	ND	ND	NR	7.76	ND	1500
Ethylbenzene	ND	ND	ND	NR	ND	ND	5500
<i>o</i> -Xylene	ND	ND	ND	NR	ND	ND	1200
<i>m&p</i> -Xylenes	ND	ND	ND	NR	ND	ND	1200

♦ - Not analyzed.

♦ - Value exceeds recommended criteria.

(a) - NYSDEC Technical Administrative Guidance Memorandum, January 1994.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

DL - Diluted sample analysis.

NR - Analysis not reportable due to extremely high concentrations of PCE.

ND - Not detected at analytical detection limit.

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TABLE 5-3 (Page 5 of 10)

SOIL AND SEDIMENT DATA SUMMARY

101 Frost Street
Mobile Laboratory

LMS Sample ID Lab Sample ID	101-DWA-5 (8-12') DWA-5_8-12'	101-DWA-5 (18-22') DWA-5_18-22'	101-DWA-5 (32-36') DWA-5_32-36'	101-DWA-5 (40-44') DWA-5_40-44'	101-DWA-5 (50-54') DWA-5_50-54'	101-DW-6 (S) DWA-6	RECOMMENDED SOIL CLEANUP OBJECTIVE (a)
VOLATILE ORGANIC COMPOUNDS (µg/kg)							
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	400
<i>trans</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	300
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	200
<i>cis</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	300
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	800
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	100
Trichloroethene	ND	ND	ND	ND	ND	0.32	700
Tetrachloroethene	1.74	1.12	1.13	1.04	0.98	37.0 e	1400
Benzene	ND	ND	ND	ND	ND	ND	60
Toluene	ND	ND	ND	ND	ND	ND	1500
Ethylbenzene	ND	ND	ND	ND	ND	ND	5500
<i>o</i> -Xylene	ND	ND	ND	ND	ND	ND	1200
<i>m&p</i> -Xylenes	ND	ND	ND	ND	ND	ND	1200

♦ - Not analyzed.

- Value exceeds recommended criteria.

(a) - NYSDEC Technical Administrative Guidance Memorandum, January 1994.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

DL - Diluted sample analysis.

NR - Analysis not reportable due to extremely high concentrations of PCE.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-3 (Page 6 of 10)

SOIL AND SEDIMENT DATA SUMMARY

101 Frost Street

Mobile Laboratory

LMS Sample ID	101-DWA-6 (8-12')	101-DWA-6 (18-22')	101-DW-6 (27-29')	101-DWA-6 (30-34')	101-DWA-6 (40-44')	101-DWA-6 (50-54')	RECOMMENDED SOIL CLEANUP
Lab Sample ID	DWA-6_8-12'	DWA-6_18-22'	DWA-6_27-29'	DWA-6_30-34'	DWA-6_40-44'	DWA-6_50-54'	OBJECTIVE (a)
VOLATILE ORGANIC COMPOUNDS (µg/kg)							
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	400
<i>trans</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	300
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	200
<i>cis</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	300
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	800
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	100
Trichloroethene	ND	ND	ND	ND	ND	ND	700
Tetrachloroethene	ND	0.69	ND	ND	0.79	2.4	1400
Benzene	ND	ND	ND	ND	ND	ND	60
Toluene	ND	ND	ND	ND	ND	ND	1500
Ethylbenzene	ND	ND	ND	ND	ND	ND	5500
<i>o</i> -Xylene	ND	ND	ND	ND	ND	ND	1200
<i>m</i> & <i>p</i> -Xylenes	ND	ND	ND	ND	ND	ND	1200

♦ - Not analyzed.

bold - Value exceeds recommended criteria.

(a) - NYSDEC Technical Administrative Guidance Memorandum, January 1994.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

DL - Diluted sample analysis.

NR - Analysis not reportable due to extremely high concentrations of PCE.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-3 (Page 7 of 10)

SOIL AND SEDIMENT DATA SUMMARY

101 Frost Street

Mobile Laboratory

LMS Sample ID Lab Sample ID	101-DW-7 (S) DW-7	101-DW-7 (28-30') DW-7_28-30'	101-DW-8 (S) DW-8	101-DW-8 (20-22') DW-8_20-22'	101-DW-9 (S) DW-9	101-DW-9 (26-28') DW-9_26-28'	101-DW-10 (S) DW-11	RECOMMENDED SOIL CLEANUP OBJECTIVE (a)
VOLATILE ORGANIC COMPOUNDS (µg/kg)								
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	400
<i>trans</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	300
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	200
<i>cis</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	300
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	800
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	100
Trichloroethene	ND	ND	ND	ND	ND	ND	ND	700
Tetrachloroethene	ND	ND	ND	3.40 e	3.50 e	1.94	4.42 e	1400
Benzene	ND	ND	15	ND	ND	ND	ND	60
Toluene	13.7	ND	132 e	ND	14.00	ND	ND	1500
Ethylbenzene	ND	ND	19.1	ND	ND	ND	ND	5500
<i>o</i> -Xylene	ND	ND	20.2	ND	ND	ND	ND	1200
<i>m&p</i> -Xylenes	ND	ND	26.2	ND	ND	ND	ND	1200

♦ - Not analyzed.

- Value exceeds recommended criteria.

(a) - NYSDEC Technical Administrative Guidance Memorandum, January 1994.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

DL - Diluted sample analysis.

NR - Analysis not reportable due to extremely high concentrations of PCE.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-3 (Page 8 of 10)

SOIL AND SEDIMENT DATA SUMMARY

101 Frost Street
Mobile Laboratory

LMS Sample ID	101-DW-10 (19-21')	101-DW-10A (S)	101-DW-12 (S)	101-DW-12 (27-29')	101-DW-13 (S)	101-DW-13 (27-29')	RECOMMENDED
Lab Sample ID	DW-11_19-21'	DW-10A	DW-12	DW-12_27-29'	SMH-13	SMH-13_27-29'	SOIL CLEANUP
							OBJECTIVE (a)
VOLATILE ORGANIC COMPOUNDS (µg/kg)							
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	400
<i>trans</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	300
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	200
<i>cis</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	300
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	800
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	100
Trichloroethene	ND	ND	ND	ND	ND	ND	700
Tetrachloroethene	3.30 e	1.27	3.70 e	3.51 e	18.8 e	12.6 e	1400
Benzene	ND	ND	ND	ND	ND	ND	60
Toluene	ND	ND	ND	ND	ND	ND	1500
Ethylbenzene	ND	ND	2773 e	ND	ND	ND	5500
<i>o</i> -Xylene	ND	ND	5195 e	ND	ND	ND	1200
<i>m&p</i> -Xylenes	ND	ND	6614 e	ND	ND	ND	1200

♦ - Not analyzed.

bold - Value exceeds recommended criteria.

(a) - NY/DEC Technical Administrative Guidance Memorandum, January 1994.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

DL - Diluted sample analysis.

NR - Analysis not reportable due to extremely high concentrations of PCE.

ND - Not detected at analytical detection limit.

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TABLE 5-3 (Page 9 of 10)

SOIL AND SEDIMENT DATA SUMMARY

101 Frost Street
Mobile Laboratory

LMS Sample ID Lab Sample ID	101-DWA-N/S (9-11') DWA-19_9-11'	101-DWA-N/S (19-21') DWA-19_19-21'	101-DWA-N/S (31-33') DWA-19_31-33'	101-DWA-N/S (41-43') DWA-19_41-43'	101-DWA-N/S (51-53') DWA-19_51-53'	RECOMMENDED SOIL CLEANUP OBJECTIVE (a)
VOLATILE ORGANIC COMPOUNDS (µg/kg)						
1,1-Dichloroethene	ND	ND	ND	ND	ND	400
<i>trans</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	300
1,1-Dichloroethane	ND	ND	ND	ND	ND	200
<i>cis</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	300
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	800
1,2-Dichloroethane	ND	ND	ND	ND	ND	100
Trichloroethene	ND	ND	ND	ND	3775 e	700
Tetrachloroethene	68.9 e	417 e	207 e	2008 e	24209 e	1400
Benzene	ND	ND	ND	ND	ND	60
Toluene	ND	ND	ND	ND	ND	1500
Ethylbenzene	ND	ND	ND	ND	ND	5500
<i>o</i> -Xylene	ND	ND	ND	ND	ND	1200
<i>m&p</i> -Xylenes	ND	ND	ND	ND	ND	1200

♦ - Not analyzed.

bold - Value exceeds recommended criteria.

(a) - NYSDEC Technical Administrative Guidance Memorandum, January 1994.

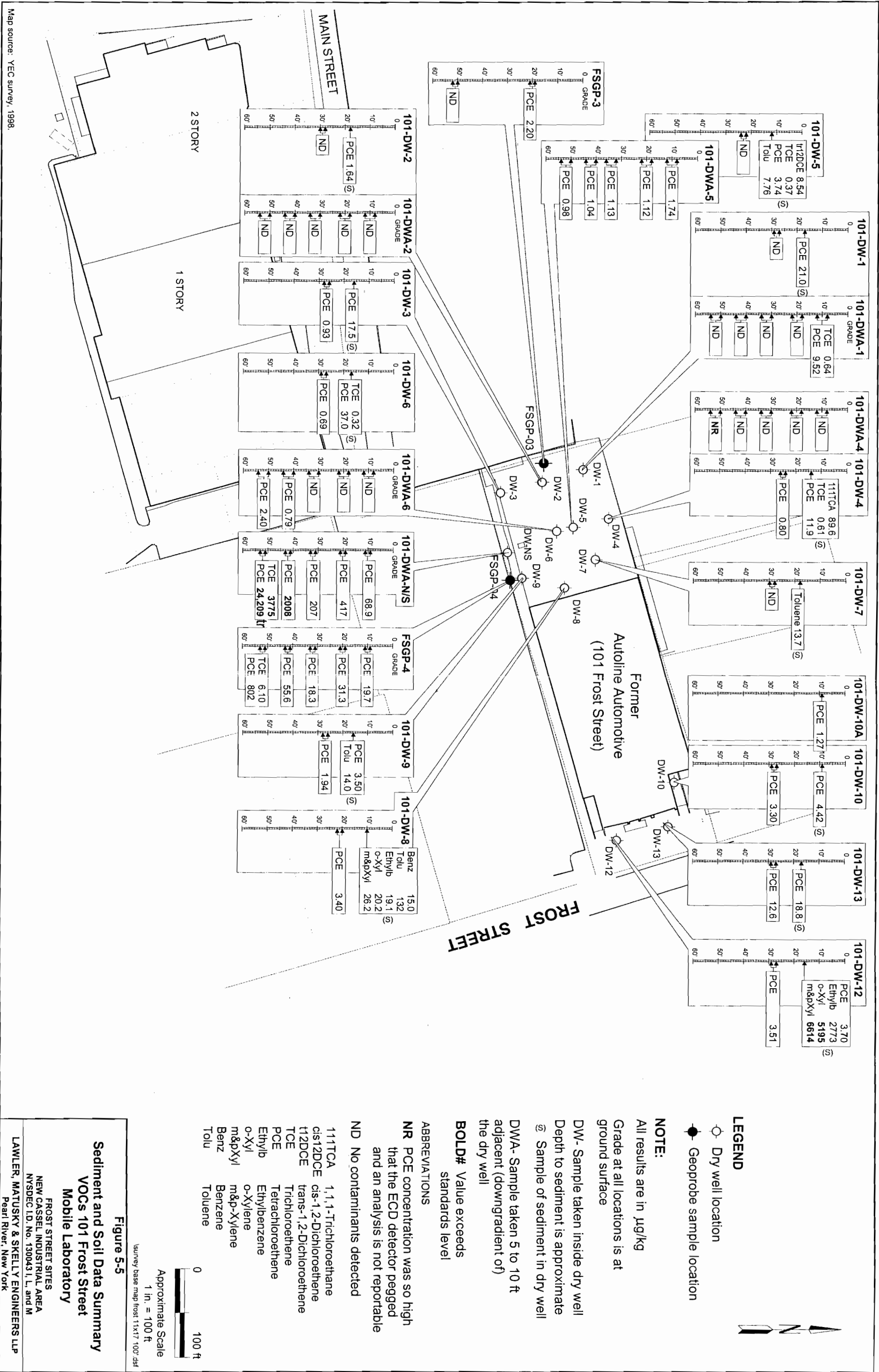
e - The quantified value exceeds the linear calibration range and the true value may be higher.

DL - Diluted sample analysis.

NR - Analysis not reportable due to extremely high concentrations of PCE.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.



concentrations of PCE in 89-DWA 14 (51-53 ft), the presence of other compounds may have been masked in 101-DWA-4 (50-54 ft). Two samples from 101-DWA-N/S exhibited concentrations over the recommended soil cleanup objective with 2008 µg/kg of PCE in the shallow sample (41-43 ft) and 3775 µg/kg of TCE and 24,209 µg/kg of PCE in the deeper sample (51-53 ft).

There were traces of PCE alone in five of the seven additional probe samples, traces of PCE and TCE in one, and the other sample was ND.

89 Frost Street Soil Samples. A total of 99 samples were taken from 22 locations at this site, one of which was sampled twice (89-DWA-12, and 89-DWA-12A). Seventeen of these locations were adjacent to existing dry wells; five were additional probe locations. A detailed summary of mobile laboratory VOC sampling results for the soil samples is contained on Table 5-4, and Figure 5-6 graphically summarizes the results of the sampling analysis.

The sample from 89-DWA-14 (51-53 ft) was the only sample that exhibited concentrations over the recommended soil cleanup objectives. The level of PCE in 89-DWA-14 (51-53 ft) was extremely high and the PCE concentration exceeded the limits of the mobile laboratory, making it unable to report a concentration value for PCE. The levels noted were well above the recommended soil cleanup objective. This high concentration of PCE may have masked the presence of lower concentrations of other compounds in the sample. Twenty-three samples had nondetects (ND). Traces (less than soil cleanup objectives) of PCE alone were found in 44 samples; PCE and TCE in 24 samples; PCE, TCE, and 1,1,1-TCA in one sample; and PCE, TCE, and cis-1,2-DCE in six samples, three of which also had toluene, ethylbenzene, and/or xylenes.

770 Main Street Soil Samples. Ten samples were taken from five additional probe locations. A detailed summary of VOC sampling results for the soil samples is contained on Table 5-5, and Figure 5-7 graphically summarizes the results of the sampling analysis.

One location was ND, six had traces of PCE alone, and the remaining three had traces of PCE and TCE.

TABLE 5-4 (Page 1 of 17)

SOIL DATA SUMMARY**89 Frost Street****Mobile Laboratory**

LMS Sample ID	89-DWA-1 (9-11') DWA-1_9-11'	89-DWA-1 (19-21') DWA-1_19-21'	89-DWA-1 (31-33') DWA-1_31-33'	89-DWA-1 (41-43') DWA-1_41-43'	89-DWA-1 (51-53') DWA-1_51-53'	89-DWA-2 (9-11') DWA-2_9-11'	RECOMMENDED SOIL CLEANUP OBJECTIVE (a)
VOLATILE ORGANIC COMPOUNDS (µg/kg)							
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	400
<i>trans</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	300
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	200
<i>cis</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	300
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	800
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	100
Trichloroethene	ND	ND	ND	ND	ND	ND	700
Tetrachloroethene	4.98 e	4.85 e	1.58	5.93 e	1.49	ND	1400
Benzene	ND	ND	ND	ND	ND	♦	60
Toluene	ND	ND	ND	ND	ND	♦	1500
Ethylbenzene	ND	ND	ND	ND	ND	♦	5500
<i>o</i> -Xylene	ND	ND	ND	ND	ND	♦	1200
<i>m&p</i> -Xylenes	ND	ND	ND ♦	ND	ND	♦	1200

♦ - Not analyzed.

bold - Value exceeds recommended criteria.

(a) - NYSDEC Technical Administrative Guidance Memorandum, January 1994.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

DL - Diluted sample analysis.

NR - Analysis not reportable due to extremely high concentrations of PCE.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-4 (Page 2 of 17)

SOIL DATA SUMMARY

89 Frost Street
Mobile Laboratory

LMS Sample ID	89-DWA-2 (19-21')	89-DWA-2 (31-33')	89-DWA-2 (41-43')	89-DWA-2 (51-53')	89-DWA-3 (9-11')	89-DWA-3 (19-21')	RECOMMENDED
Lab Sample ID	DWA-2_19-21'	DWA-2_31-33'	DWA-2_41-43'	DWA-2_51-53'	DWA-3_9-11'	DWA-3_19-21'	SOIL CLEANUP OBJECTIVE (a)
VOLATILE ORGANIC COMPOUNDS (µg/kg)							
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	400
<i>trans</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	300
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	200
<i>cis</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	300
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	800
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	100
Trichloroethene	ND	ND	ND	ND	ND	ND	700
Tetrachloroethene	ND	ND	ND	ND	ND	ND	1400
Benzene	♦	♦	♦	♦	♦	♦	60
Toluene	♦	♦	♦	♦	♦	♦	1500
Ethylbenzene	♦	♦	♦	♦	♦	♦	5500
<i>o</i> -Xylene	♦	♦	♦	♦	♦	♦	1200
<i>m&p</i> -Xylenes	♦	♦	♦	♦	♦	♦	1200

♦ - Not analyzed.

♦ - Value exceeds recommended criteria.

(a) - NYSEEC Technical Administrative Guidance Memorandum, January 1994.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

DL - Diluted sample analysis.

NIR - Analysis not reportable due to extremely high concentrations of PCE.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-4 (Page 3 of 17)

SOIL DATA SUMMARY

89 Frost Street

Mobile Laboratory

LMS Sample ID	89-DWA-3 (31-33')	89-DWA-3 (41-43')	89-DWA-3 (51-53')	89-DWA-4 (9-11')	89-DWA-4 (19-21')	89-DWA-4 (31-33')	RECOMMENDED
Lab Sample ID	DWA-3_31-33'	DWA-3_41-43'	DWA-3_51-53'	DWA-4_9-11'	DWA-4_19-21'	DWA-4_31-33'	SOIL CLEANUP OBJECTIVE (a)
VOLATILE ORGANIC COMPOUNDS (µg/kg)							
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	400
<i>trans</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	300
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	200
<i>cis</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	300
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	800
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	100
Trichloroethene	ND	ND	ND	ND	ND	ND	700
Tetrachloroethene	ND	ND	ND	ND	ND	ND	1400
Benzene	♦	♦	♦	♦	♦	♦	60
Toluene	♦	♦	♦	♦	♦	♦	1500
Ethylbenzene	♦	♦	♦	♦	♦	♦	5500
<i>o</i> -Xylene	♦	♦	♦	♦	♦	♦	1200
<i>m&p</i> -Xylenes	♦	♦	♦	♦	♦	♦	1200

♦ - Not analyzed.

bold - Value exceeds recommended criteria.

(a) - NYSDEC Technical Administrative Guidance Memorandum, January 1994.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

DL - Diluted sample analysis.

NR - Analysis not reportable due to extremely high concentrations of PCE.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-4 (Page 4 of 17)

SOIL DATA SUMMARY

89 Frost Street
Mobile Laboratory

LMS Sample ID	89-DWA-4 (41-43')	89-DWA-4 (51-53')	89-DWA-5 (9-11')	89-DWA-5 (19-21')	89-DWA-5 (31-33')	89-DWA-5 (41-43')	RECOMMENDED
Lab Sample ID	DWA-4_41-43'	DWA-4_51-53'	DWA-5_9-11'	DWA-5_19-21'	DWA-5_31-33'	DWA-5_41-43'	SOIL CLEANUP OBJECTIVE (a)
VOLATILE ORGANIC COMPOUNDS (µg/kg)							
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	400
<i>trans</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	300
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	200
<i>cis</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	300
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	800
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	100
Trichloroethene	ND	ND	ND	ND	ND	ND	700
Tetrachloroethene	ND	ND	1.09	0.98	1.27	1.06	1400
Benzene	♦	♦	ND	ND	ND	ND	60
Toluene	♦	♦	ND	ND	ND	ND	1500
Ethylbenzene	♦	♦	ND	ND	ND	ND	5500
<i>o</i> -Xylene	♦	♦	ND	ND	ND	ND	1200
<i>m&p</i> -Xylenes	♦	♦	ND	ND	ND	ND	1200

♦ - Not analyzed.

bold - Value exceeds recommended criteria.

(a) - NYSDEC Technical Administrative Guidance Memorandum, January 1994.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

DL - Diluted sample analysis.

NR - Analysis not reportable due to extremely high concentrations of PCE.

ND - Not detected at analytical detection limit.

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TABLE 5-4 (Page 5 of 17)

SOIL DATA SUMMARY**89 Frost Street****Mobile Laboratory**

LMS Sample ID	89-DWA-5 (51-53')	89-DWA-6 (9-11')	89-DWA-6 (19-21')	89-DWA-6 (31-33')	89-DWA-6 (41-43')	89-DWA-6 (51-53')	RECOMMENDED
Lab Sample ID	DWA-5_51-53'	DWA-18_9-11'	DWA-18_19-21'	DWA-18_31-33'	DWA-18_41-43'	DWA-18_51-53'	SOIL CLEANUP
							OBJECTIVE (a)
VOLATILE ORGANIC COMPOUNDS (µg/kg)							
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	400
<i>trans</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	300
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	200
<i>cis</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	300
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	800
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	100
Trichloroethene	ND	ND	ND	ND	ND	ND	700
Tetrachloroethene	0.87	ND	ND	ND	ND	ND	1400
Benzene	ND	ND	ND	ND	ND	ND	60
Toluene	ND	ND	ND	ND	ND	ND	1500
Ethylbenzene	ND	ND	ND	ND	ND	ND	5500
<i>o</i> -Xylene	ND	ND	ND	ND	ND	ND	1200
<i>m&p</i> -Xylenes	ND	ND	ND	ND	ND	ND	1200

♦ Not analyzed.

- Value exceeds recommended criteria.

(a) - NYSDC Technical Administrative Guidance Memorandum, January 1994.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

DL - Diluted sample analysis.

NR - Analysis not reportable due to extremely high concentrations of PCE.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-4 (Page 6 of 17)

SOIL DATA SUMMARY

89 Frost Street

Mobile Laboratory

LMS Sample ID	89-DWA-7 (8-12')	89-DWA-7 (18-22')	89-DWA-7 (30-34')	89-DWA-7 (40-44')	89-DWA-7 (50-54')	89-DWA-8 (8-12')	RECOMMENDED
Lab Sample ID	DWA-7_8-12'	DWA-7_18-22'	DWA-7_30-34'	DWA-7_40-44'	DWA-7_50-54'	DWA-7A_8-12'	SOIL CLEANUP OBJECTIVE (a)
VOLATILE ORGANIC COMPOUNDS (µg/kg)							
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	400
<i>trans</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	300
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	200
<i>cis</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	300
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	800
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	100
Trichloroethene	ND	ND	ND	ND	ND	ND	700
Tetrachloroethene	0.97	0.50	ND	ND	9.21 e	0.95	1400
Benzene	♦	♦	♦	♦	♦	♦	60
Toluene	♦	♦	♦	♦	♦	♦	1500
Ethylbenzene	♦	♦	♦	♦	♦	♦	5500
<i>o</i> -Xylene	♦	♦	♦	♦	♦	♦	1200
<i>m</i> & <i>p</i> -Xylenes	♦	♦	♦	♦	♦	♦	1200

♦ - Not analyzed.

bold - Value exceeds recommended criteria.

(a) - NYSDC Technical Administrative Guidance Memorandum, January 1994.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

DL - Diluted sample analysis.

NR - Analysis not reportable due to extremely high concentrations of PCE.

ND - Not detected at analytical detection limit.

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TABLE 5-4 (Page 7 of 17)

SOIL DATA SUMMARY

89 Frost Street
Mobile Laboratory

LMS Sample ID	89-DWA-8 (18-22') DWA-7A_18-22'	89-DWA-8 (30-34') DWA-7A_30-34'	89-DWA-8 (40-44') DWA-7A_40-44'	89-DWA-8 (50-54') DWA-7A_50-54'	89-DWA-9 (8-12') DWA-08_8-12'	89-DWA-9 (18-22') DWA-08_18-22'	RECOMMENDED SOIL CLEANUP OBJECTIVE (a)
VOLATILE ORGANIC COMPOUNDS (µg/kg)							
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	400
<i>trans</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	300
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	200
<i>cis</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	300
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	800
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	100
Trichloroethene	ND	ND	ND	ND	ND	ND	700
Tetrachloroethene	3.36 e	1.85	1.94	10.3 e	1.10	2.11	1400
Benzene	♦	♦	♦	♦	♦	♦	60
Toluene	♦	♦	♦	♦	♦	♦	1500
Ethylbenzene	♦	♦	♦	♦	♦	♦	5500
<i>o</i> -Xylene	♦	♦	♦	♦	♦	♦	1200
<i>m&p</i> -Xylenes	♦	♦	♦	♦	♦	♦	1200

♦ - Not analyzed.

bold - Value exceeds recommended criteria.

(a) - NY/DEC Technical Administrative Guidance Memorandum, January 1994.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

DL - Diluted sample analysis.

NR - Analysis not reportable due to extremely high concentrations of PCE.

ND - Not detected at analytical detection limit.

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SOIL DATA SUMMARY

89 Frost Street

Mobile Laboratory

LMS Sample ID	89-DWA-9 (30-34')	89-DWA-9 (40-44')	89-DWA-9 (50-54')	89-DWA-10 (9-11')	89-DWA-10 (19-21')	89-DWA-10 (31-33')	RECOMMENDED
Lab Sample ID	DWA-08_30-34'	DWA-08_40-44'	DWA-08_50-54'	DWA-10_9-11'	DWA-10_19-21'	DWA-10_31-33'	SOIL CLEANUP
							OBJECTIVE (a)
VOLATILE ORGANIC COMPOUNDS (µg/kg)							
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	400
<i>trans</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	300
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	200
<i>cis</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	300
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	800
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	100
Trichloroethene	ND	12.2 e	0.67	4.07 e	2.38	700	
Tetrachloroethene	1.98	60.8 e	5.84 e	28.4 e	43.5 e	1400	
Benzene	♦	♦	ND	ND	ND	ND	60
Toluene	♦	♦	ND	ND	ND	ND	1500
Ethylbenzene	♦	♦	ND	ND	ND	ND	5500
<i>o</i> -Xylene	♦	♦	ND	ND	ND	ND	1200
<i>m&p</i> -Xylenes	♦	♦	ND	ND	ND	ND	1200

♦ - Not analyzed.

bold - Value exceeds recommended criteria.

(a) - NYSDEC Technical Administrative Guidance Memorandum, January 1994.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

DL - Diluted sample analysis.

NR - Analysis not reportable due to extremely high concentrations of PCE.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-4 (Page 9 of 17)

SOIL DATA SUMMARY**89 Frost Street**

Mobile Laboratory

LMS Sample ID	89-DWA-10 (41-43')	89-DWA-10 (51-53')	89-DWA-11 (9-11')	89-DWA-11 (19-21')	89-DWA-11 (31-33')	RECOMMENDED
Lab Sample ID	DWA-10_41-43'	DWA-10_51-53'	DWA-11_9-11'	DWA-11_19-21'	DWA-11_31-33'	SOIL CLEANUP OBJECTIVE (a)
VOLATILE ORGANIC COMPOUNDS (µg/kg)						
1,1-Dichloroethene	ND	ND	ND	ND	ND	400
<i>trans</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	300
1,1-Dichloroethane	ND	ND	ND	ND	ND	200
<i>cis</i> -1,2-Dichloroethene	18	ND	44.2 e	ND	ND	300
1,1,1-Trichloroethane	ND	0.71	ND	ND	ND	800
1,2-Dichloroethane	ND	ND	ND	ND	ND	100
Trichloroethene	74.5 e	62	0.85	ND	ND	700
Tetrachloroethene	255 e	84.2 e	2.84	ND	13.2 e	1400
Benzene	ND	ND	ND	ND	ND	60
Toluene	6.29	ND	ND	ND	ND	1500
Ethylbenzene	20.5	ND	ND	ND	ND	5500
<i>o</i> -Xylene	18.8	ND	ND	ND	ND	1200
<i>m&p</i> -Xylenes	35.0	ND	ND	ND	ND	1200

♦ - Not analyzed.

bold - Value exceeds recommended criteria.

(a) - NYSDCE Technical Administrative Guidance Memorandum, January 1994.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

DL - Diluted sample analysis.

NR - Analysis not reportable due to extremely high concentrations of PCE.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-4 (Page 10 of 17)

SOIL DATA SUMMARY

89 Frost Street
Mobile Laboratory

LMS Sample ID	89-DWA-11 (41-43') DWA-11_41-43'	89-DWA-11 (51-53') DWA-11_51-53'	89-DWA-12 (8-12') DWA-15_8-12'	89-DWA-12 (18-22') DWA-15_18-22'	89-DWA-12 (30-34') DWA-15_30-34'	89-DWA-12 (40-44') DWA-15_40-44'	RECOMMENDED SOIL CLEANUP OBJECTIVE (a)
VOLATILE ORGANIC COMPOUNDS (µg/kg)							
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	400
<i>trans</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	300
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	200
<i>cis</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	300
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	800
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	100
Trichloroethene	ND	9.22 e	ND	ND	ND	ND	700
Tetrachloroethene	34.5 e	55.0 e	1.73	1.62	3.82 e	15.8 e	1400
Benzene	ND	ND	♦	♦	♦	♦	60
Toluene	ND	ND	♦	♦	♦	♦	1500
Ethylbenzene	ND	ND	♦	♦	♦	♦	5500
<i>o</i> -Xylene	ND	ND	♦	♦	♦	♦	1200
<i>m&p</i> -Xylenes	ND	ND	♦	♦	♦	♦	1200

♦ - Not analyzed.

bold - Value exceeds recommended criteria.

(a) - NYSDEC Technical Administrative Guidance Memorandum, January 1994.

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DL - Diluted sample analysis.

NR - Analysis not reportable due to extremely high concentrations of PCE.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-4 (Page 11 of 17)

SOIL DATA SUMMARY
89 Frost Street
Mobile Laboratory

LMS Sample ID	89-DWA-12 (50-54')	89-DWA-12A (9-11')	89-DWA-12A (19-21')	89-DWA-12A (31-33')	89-DWA-12A (41-43')	RECOMMENDED
Lab Sample ID	DWA-15_50-54'	DWA-15A_9-11'	DWA-15A_19-21'	DWA-15A_31-33'	DWA-15A_41-43'	SOIL CLEANUP OBJECTIVE (a)
VOLATILE ORGANIC COMPOUNDS (µg/kg)						
1,1-Dichloroethene	ND	ND	ND	ND	ND	400
<i>trans</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	300
1,1-Dichloroethane	ND	ND	ND	ND	ND	200
<i>cis</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	300
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	800
1,2-Dichloroethane	ND	ND	ND	ND	ND	100
Trichloroethene	1.10	0.99	7.66 e	0.37	0.37	700
Tetrachloroethene	30.2 e	24.4 e	120 e	4.04 e	25.8 e	1400
Benzene	♦	ND	ND	ND	ND	60
Toluene	♦	ND	ND	ND	ND	1500
Ethylbenzene	♦	ND	ND	ND	ND	5500
<i>o</i> -Xylene	♦	ND	ND	ND	ND	1200
<i>m&p</i> -Xylenes	♦	ND	ND	ND	ND	1200

- ♦ - Not analyzed.
bold - Value exceeds recommended criteria.
 (a) - NYSDC Technical Administrative Guidance Memorandum, January 1994.
 e - The quantified value exceeds the linear calibration range and the true value may be higher.
 DL - Diluted sample analysis.
 NR - Analysis not reportable due to extremely high concentrations of PCE.
 ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

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SOIL DATA SUMMARY

89 Frost Street

Mobile Laboratory

LMS Sample ID	89-DWA-13 (51-53')	89-DWA-14 (9-11')	89-DWA-14 (19-21')	89-DWA-14 (31-33')	89-DWA-14 (41-43')	89-DWA-14 (51-53')	RECOMMENDED
Lab Sample ID	DWA-SMHW_51-53'	SMHE_9-11'	SMHE_19-21'	SMHE_31-33'	SMHE_41-43'	SMHE_51-53'	SOIL CLEANUP OBJECTIVE (a)
VOLATILE ORGANIC COMPOUNDS (µg/kg)							
1,1-Dichloroethene	ND	ND	ND	ND	ND	NR	400
<i>trans</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	NR	300
1,1-Dichloroethane	ND	ND	ND	ND	ND	NR	200
<i>cis</i> -1,2-Dichloroethene	12.2	ND	ND	14.6	26	NR	300
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	NR	800
1,2-Dichloroethane	ND	ND	ND	ND	ND	NR	100
Trichloroethene	39.1 e	ND	4.09 e	36.2 e	109 e	NR	700
Tetrachloroethene	62.0 e	1.97	81.2 e	167 e	162 e	NR	1400
Benzene	ND	ND	ND	ND	ND	NR	60
Toluene	ND	ND	ND	ND	ND	NR	1500
Ethylbenzene	ND	ND	ND	9.9	49.6	NR	5500
<i>o</i> -Xylene	ND	ND	ND	ND	15.6	NR	1200
<i>m&p</i> -Xylenes	ND	ND	ND	12.2	42.4	NR	1200

♦ Not analyzed.

bold - Value exceeds recommended criteria.

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ND - Not detected at analytical detection limit.

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SOIL DATA SUMMARY

89 Frost Street

Mobile Laboratory

LMS Sample ID	89-DWA-15 (9-11')	89-DWA-15 (19-21')	89-DWA-15 (31-33')	89-DWA-15 (41-43')	89-DWA-15 (51-53')	89-DWA-16 (9-11')	RECOMMENDED
Lab Sample ID	DWA-16_9-11'	DWA-16_19-21'	DWA-16_31-33'	DWA-16_41-43'	DWA-16_51-53'	DWA-12_9-11'	SOIL CLEANUP OBJECTIVE (a)
[DL:10:1]							
VOLATILE ORGANIC COMPOUNDS (µg/kg)							
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	400
trans-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	300
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	200
cis-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	300
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	800
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	100
Trichloroethene	1.93	ND	ND	6.7	6.9	0.6	700
Tetrachloroethene	99.3 e	6.91	10.8 e	547 e	192 e	12.8 e	1400
Benzene	ND	ND	ND	ND	ND	♦	60
Toluene	ND	ND	ND	ND	ND	♦	1500
Ethylbenzene	ND	ND	ND	ND	ND	♦	5500
o-Xylene	ND	ND	ND	ND	ND	♦	1200
m&p-Xylenes	ND	ND	ND	ND	ND	♦	1200

♦ - Not analyzed.

bold - Value exceeds recommended criteria.

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DL - Diluted sample analysis.

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ND - Not detected at analytical detection limit.

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TABLE 5-4 (Page 15 of 17)

SOIL DATA SUMMARY**89 Frost Street****Mobile Laboratory**

LMS Sample ID	89-DWA-16 (19-21') DWA-12_19-21'	89-DWA-16 (31-33') DWA-12_31-33'	89-DWA-16 (41-43') DWA-12_41-43'	89-DWA-16 (51-53') DWA-12_51-53'	89-DWA-17 (9-11') DWA-14_9-11'	89-DWA-17 (19-21') DWA-14_19-21'	RECOMMENDED SOIL CLEANUP OBJECTIVE (a)
VOLATILE ORGANIC COMPOUNDS (µg/kg)							
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	400
<i>trans</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	300
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	200
<i>cis</i> -1,2-Dichloroethene	ND	ND	74.8 e	ND	ND	ND	300
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	800
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	100
Trichloroethene	0.85	ND	61.7 e	ND	ND	ND	700
Tetrachloroethene	54.2 e	29.8 e	38.2 e	56.0 e	5.49 e	1.83	1400
Benzene	♦	♦	♦	♦	♦	♦	50
Toluene	♦	♦	♦	♦	♦	♦	1500
Ethylbenzene	♦	♦	♦	♦	♦	♦	5500
<i>o</i> -Xylene	♦	♦	♦	♦	♦	♦	1200
<i>m&p</i> -Xylenes	♦	♦	♦	♦	♦	♦	1200

♦ - Not analyzed.

bold - Value exceeds recommended criteria.

(a) - NYSDEC Technical Administrative Guidance Memorandum, January 1994.

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DL - Diluted sample analysis.

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TABLE 5-4 (Page 16 of 17)

SOIL DATA SUMMARY

89 Frost Street
Mobile Laboratory

LMS Sample ID	89-DWA-17 (31-33')	89-DWA-17 (51-53')	FSGP-6 (19-21')	FSGP-6 (51-53')	FSGP-7 (19-21')	FSGP-7 (52-54')	RECOMMENDED
Lab Sample ID	DWA-14_31-33'	DWA-14_51-53'	FSGP-6_19-21'	FSGP-6_51-53'	FSGP-7_19-21'	FSGP-7_52-54'	SOIL CLEANUP OBJECTIVE (a)
VOLATILE ORGANIC COMPOUNDS (µg/kg)							
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	400
<i>trans</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	300
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	200
<i>cis</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	300
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	800
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	100
Trichloroethene	ND	10.5 e	ND	ND	4.6	20.8	700
Tetrachloroethene	1.64	37.7 e	0.73	0.53	440 e	282 e	1400
Benzene	♦	♦	ND	ND	ND	ND	60
Toluene	♦	♦	ND	ND	ND	ND	1500
Ethylbenzene	♦	♦	ND	ND	ND	ND	5500
<i>o</i> -Xylene	♦	♦	ND	ND	ND	ND	1200
<i>m&p</i> -Xylenes	♦	♦	ND	ND	ND	ND	1200

♦ - Not analyzed.

bold - Value exceeds recommended criteria.

(a) - NY/DEC Technical Administrative Guidance Memorandum, January 1994.

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DL - Diluted sample analysis.

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TABLE 5-4 (Page 17 of 17)

SOIL DATA SUMMARY**89 Frost Street****Mobile Laboratory**

LMS Sample ID	FSGP-8 (19-21')	FSGP-8 (51-53')	FSGP-9 (19-21')	FSGP-9 (50-52')	FSGP-10 (19-21')	FSGP-10 (50-52')	RECOMMENDED
Lab Sample ID	FSGP-8_19-21'	FSGP-8_51-53'	FSGP-9_19-21'	FSGP-9_50-52'	FSGP-10_19-21'	FSGP-10_50-52'	SOIL CLEANUP
	[DL:10:1]						OBJECTIVE (a)
VOLATILE ORGANIC COMPOUNDS (µg/kg)							
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	400
trans-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	300
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	200
cis-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	300
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	800
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	100
Trichloroethene	3	ND	ND	1.62	ND	0.63	700
Tetrachloroethene	132 e	35.9 e	1.98 *	29.8 e	4.72 e	7.88 e	1400
Benzene	ND	ND	ND	ND	ND	ND	60
Toluene	ND	ND	ND	ND	ND	ND	1500
Ethylbenzene	ND	ND	ND	ND	ND	ND	5500
o-Xylene	ND	ND	ND	ND	ND	ND	1200
m&p-Xylenes	ND	ND	ND	ND	ND	ND	1200

♦ - Not analyzed.

bold - Value exceeds recommended criteria.

(a) - NYSDEC Technical Administrative Guidance Memorandum, January 1994.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

DL - Diluted sample analysis.

NR - Analysis not reportable due to extremely high concentrations of PCE.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

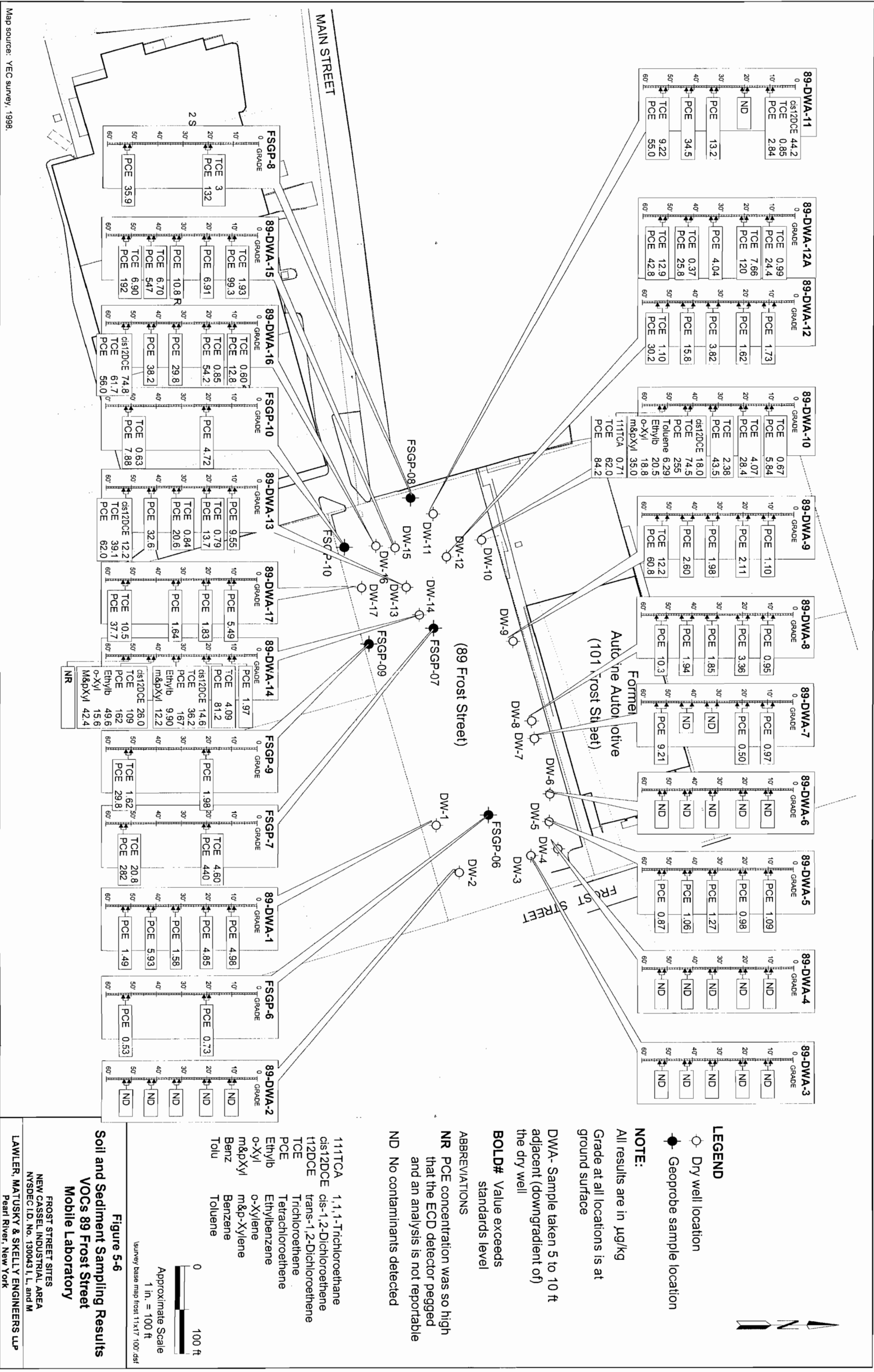


TABLE 5-5 (Page 1 of 2)

SOIL DATA SUMMARY

770 Main Street

Mobile Laboratory

LMS Sample ID	FSGP-11 (18-22')	FSGP-11 (50-54')	FSGP-12 (18-22')	FSGP-12 (50-54')	FSGP-13 (18-22')	RECOMMENDED SOIL CLEANUP OBJECTIVE (a)
VOLATILE ORGANIC COMPOUNDS (µg/kg)						
1,1-Dichloroethene	ND	ND	ND	ND	ND	400
<i>trans</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	300
1,1-Dichloroethane	ND	ND	ND	ND	ND	200
<i>cis</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	300
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	800
1,2-Dichloroethane	ND	ND	ND	ND	ND	100
Trichloroethene	ND	1.25	ND	ND	ND	700
Tetrachloroethene	0.66	32.9	ND	6.47 e	0.82	1400

bold - Value exceeds recommended criteria.

(a) - NYSDEC Technical Administrative Guidance Memorandum, January 1994.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

DL - Diluted sample analysis.

ND - Not detected at analytical detection limit.

TABLE 5-5 (Page 2 of 2)

SOIL DATA SUMMARY**770 Main Street****Mobile Laboratory**

LMS Sample ID	FSGP-13 (50-54')	FSGP-14 (18-22')	FSGP-14 (50-54')	FSGP-15 (18-22')	FSGP-15 (50-54')	RECOMMENDED SOIL CLEANUP OBJECTIVE (a)
VOLATILE ORGANIC COMPOUNDS (µg/kg)						
1,1-Dichloroethene	ND	ND	ND	ND	ND	400
<i>trans</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	300
1,1-Dichloroethane	ND	ND	ND	ND	ND	200
<i>cis</i> -1,2-Dichloroethene	ND	ND	ND	ND	ND	300
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	800
1,2-Dichloroethane	ND	ND	ND	ND	ND	100
Trichloroethene	0.92	4.51 e	ND	ND	ND	700
Tetrachloroethene	54.2 e	68.6 e	9.16 e	6.23 e	5.82 e	1400

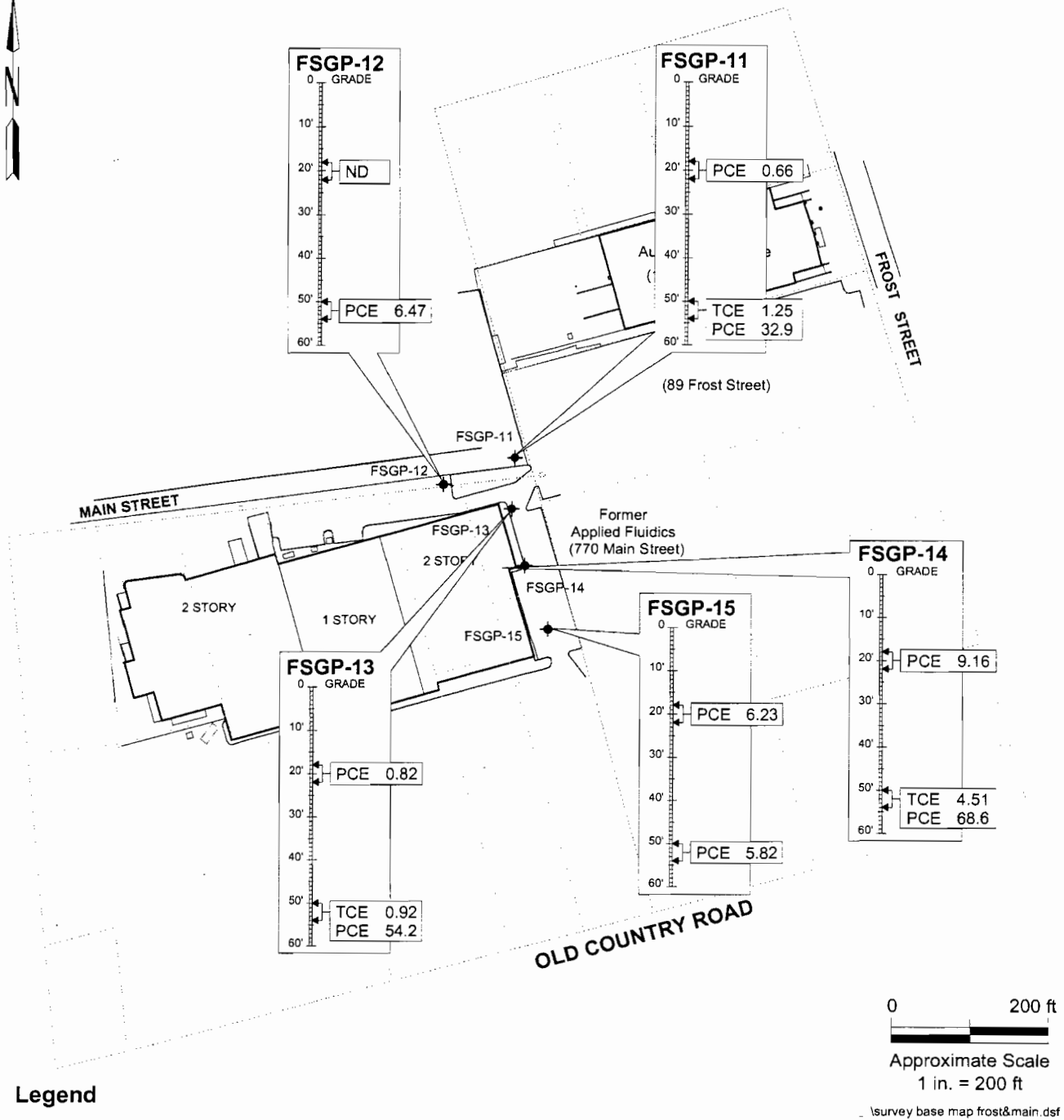
bold - Value exceeds recommended criteria.

(a) - NYSDEC Technical Administrative Guidance Memorandum, January 1994.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

DL - Diluted sample analysis.

ND - Not detected at analytical detection limit.



Legend

- ◆ Geoprobe sample location

All results are in $\mu\text{g/kg}$ Grade at all locations is at ground surface

ABBREVIATIONS

ND No contaminants detected

TCE Trichloroethene

PCE Tetrachloroethene

Map source: YEC survey, 1998.

Figure 5-7

Soil Data Summary 770 Main Street Mobile Laboratory

FROST STREET SITES
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043 I, L, and M

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

5.2.2.2 *Analytical Laboratory Results.*

101 Frost Street Sediment and Soil Samples. There were 46 samples from 24 locations collected at this site and analyzed for VOCs: sediment from inside 13 dry wells, one twice (101-DW-10 [S]); soil from below three dry wells; adjacent to eight dry wells; and three additional probes. Sediment from dry wells 101-DW-1 (S) through 101-DW-13 (S) was also analyzed for SVOCs, pesticides/PCBs, and metals, except for 101-DW-11 (S), for which pesticides/PCBs analysis was not performed. Table 5-6 contains a detailed summary of the sampling results, and Figures 5-8 to 5-11 graphically summarize the results of the sampling analysis.

Of the 16 sediment samples, fourteen were analyzed for VOCs. Only traces of PCE, 1,1,1-TCA, and several other compounds were detected.

The soil from below the dry wells did not show any VOCs in two samples submitted for analyses; the third sample (101-DW-N/S) had traces of PCE and toluene. VOCs were also not detected in 14 of the samples from adjacent to the dry wells. Ten of the samples from adjacent to the dry wells had traces of CDS alone, while one had a trace of toluene, and one had a trace of PCE. All four additional probe samples were ND for VOCs.

Two of the 14 sediment samples submitted for SVOC analysis were ND. Two - 101-DW-3 (S) and -4 (S) - had levels over the cleanup objective for benzo(a)an (4 and 27 µg/kg, respectively). Five had both benzo(a)an and benzo(a)py: 101-DW-2 (S) (4 and 5 µg/kg, respectively); -6 (S) (65 and 85 µg/kg, respectively); -8 (S) (43 and 49 µg/kg, respectively); -9 (S) (42 and 38 µg/kg, respectively); and -11 (S-1) (22 and 4 µg/kg, respectively). 101-DW-5 (S) and -7 (S) also had both benzo(a)an (15 and 110 µg/kg, respectively) and benzo(a)py (17 and 110 µg/kg, respectively), along with phenol (4 and 14 µg/kg, respectively) above the cleanup objectives. 101-DW-13 (S) had the following concentrations over the cleanup objectives for 1,4-dichlorobenzene (77 µg/kg), benzo(a)an (5000 µg/kg), benzo(b)fl (9400 µg/kg), benzo(k)fl (3300 µg/kg), benzo(a)py (4800 µg/kg), and dibenz(a,h) (440 µg/kg).

The sediment in 101-DW-10 was sampled twice - 101-DW-10 (S) and 101-DW-10A (S). These two samples both had the following compounds over cleanup objectives: phenol

TABLE 5-6 (Page 1 of 21)

SOIL AND SEDIMENT DATA SUMMARY

101 Frost Street

Base Analytical Laboratory

LMS Sample ID	101-DW-00 (S)	101-DW-00 (16-20)	101-DW-1 (S)	101-DW-2 (S)	101-DW-3 (S)	101-DWA-3 (8-12)	RECOMMENDED
Lab Sample ID	101 DW00 SS-1	101 DW00_16-20	DW-101-1-S	DW-101-2-S	DW-101-3-S	101_DWA-3_8-12	SOIL CLEANUP
Lab Sample Number	982626A-01	982626A-02	80573	80568	80564	83314	OBJECTIVE (a)
Sampling Date	12/4/98	12/4/98	08/25/98	08/24/98	8/26/98	09/10/98	
VOLATILE ORGANIC COMPOUNDS (µg/kg)							
Methylene Chloride	3 j	4 j	ND	ND	•	ND	100
Acetone	20	19	ND	ND	•	ND	200
Carbon Disulfide	ND	ND	ND	ND	•	17 b	2,700
1,2-Dichloroethene(total)	ND	ND	ND	ND	•	ND	300
1,2-Dichloroethane	ND	ND	ND	ND	•	ND	100
2-Butanone	ND	ND	ND	ND	•	ND	300
Trichloroethene	ND	ND	ND	ND	•	ND	700
1,1,1-Trichloroethane	ND	ND	ND	ND	•	ND	800
4-Methyl-2-Pentanone	ND	ND	ND	ND	•	ND	1,000
Tetrachloroethene	6	ND	ND	0.3 j	•	ND	1,400
Toluene	2 j	ND	0.4 j	ND	•	ND	1,500
Chlorobenzene	ND	ND	ND	ND	•	ND	1,700
Ethylbenzene	ND	ND	ND	ND	•	ND	5,500
Xylenes(Total)	ND	ND	ND	ND	•	ND	1,200

♦ - Not analyzed.

(a) - NYSDCE Technical Administrative Guidance Memorandum, January 1994.

b - Found in associated blanks.

j - Estimated concentration, compound present below quantitation limit.

DL - Diluted sample analysis.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-6 (Page 2 of 21)

SOIL AND SEDIMENT DATA SUMMARY

101 Frost Street

Base Analytical Laboratory

LMS Sample ID	101-DWA-3 (18-22')	101-DWA-3 (30-34')	101-DWA-3 (40-44')	101-DWA-3 (50-53')	101-DW-4 (S)	RECOMMENDED
Lab Sample ID	101_DWA-3_18-22	101_DWA-3_30-34	101_DWA-3_40-44	101_DWA-3_50-53	DW-101-4-S	SOIL CLEANUP
Lab Sample Number	83315	83316	83317	83318	80585	OBJECTIVE (a)
Sampling Date	09/10/98	09/10/98	09/10/98	09/10/98	8/26/98	
VOLATILE ORGANIC COMPOUNDS (µg/kg)						
Methylene Chloride	ND	ND	ND	ND	♦	100
Acetone	ND	ND	ND	ND	♦	200
Carbon Disulfide	20 b	16 b	13 b	20 b	♦	2,700
1,2-Dichloroethene (total)	ND	ND	ND	ND	♦	300
1,2-Dichloroethane	ND	ND	ND	ND	♦	100
2-Butanone	ND	ND	ND	ND	♦	300
Trichloroethene	ND	ND	ND	ND	♦	700
1,1,1-Trichloroethane	ND	ND	ND	ND	♦	800
4-Methyl-2-Pentanone	ND	ND	ND	ND	♦	1,000
Tetrachloroethene	ND	ND	ND	ND	♦	1,400
Toluene	ND	ND	ND	ND	♦	1,500
Chlorobenzene	ND	ND	ND	ND	♦	1,700
Ethylbenzene	ND	ND	ND	ND	♦	5,500
Xylenes (Total)	ND	ND	ND	ND	♦	1,200

♦ - Not analyzed.

(a) - NYSDEC Technical Administrative Guidance Memorandum, January 1994.

b - Found in associated blanks.

j - Estimated concentration; compound present below quantitation limit.

DL - Diluted sample analysis.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-6 (Page 3 of 21)

SOIL AND SEDIMENT DATA SUMMARY
 101 Frost Street
 Base Analytical Laboratory

LMS Sample ID	101-DW-5 (S)	101-DWA-5 (40-44")	101-DW-6 (S)	101-DWA-6 (50-54")	101-DW-7 (S)	101-DWA-7 (8-12")	RECOMMENDED
Lab Sample ID	DW-101-5-S	101-DWA-5_40-44	DW-101-6-S	101-DWA-6_50-54	DW-101-7-S	101-DWA-7_8-12	SOIL CLEANUP
Lab Sample Number	80571	80567	80572	81101	80589	82907	OBJECTIVE (a)
Sampling Date	08/24/98	8/26/98	08/24/98	8/31/98	08/24/98	09/09/98	
VOLATILE ORGANIC COMPOUNDS (µg/kg)							
MethyleneChloride	ND	ND	ND	2 j b	ND	ND	100
Acetone	ND	ND	ND	12 b	ND	ND	200
Carbon Disulfide	ND	ND	ND	ND	0.8 j	17 b	2,700
1,2-Dichloroethene(total)	ND	ND	ND	ND	ND	ND	300
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	100
2-Butanone	ND	ND	ND	ND	10 j	ND	300
Trichloroethene	ND	ND	ND	ND	ND	ND	700
1,1,1-Trichloroethane	0.7 j	ND	ND	ND	0.6 j	ND	800
4-Methyl-2-Pentanone	ND	ND	ND	ND	ND	ND	1,000
Tetrachloroethene	2 j	74	ND	ND	2 j	ND	1,400
Toluene	0.6 j	0.4 j	ND	ND	2 j	ND	1,500
Chlorobenzene	ND	ND	ND	ND	ND	ND	1,700
Ethylbenzene	ND	ND	ND	ND	0.5 j	ND	5,500
Xylenes(Total)	ND	ND	ND	ND	2 j	ND	1,200

♦ - Not analyzed.

(a) - NYSDDEC Technical Administrative Guidance Memorandum, January 1994.

b - Found in associated blanks.

j - Estimated concentration; compound present below quantitation limit.

DL - Diluted sample analysis.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-6 (Page 4 of 21)

SOIL AND SEDIMENT DATA SUMMARY

101 Frost Street

Base Analytical Laboratory

LMS Sample ID	101-DWA-7 (18-22')	101-DWA-7 (30-34')	101-DWA-7 (40-44')	101-DWA-7 (50-54')	101-DW-8 (S)	RECOMMENDED
Lab Sample ID	101_DWA-7_18-22	101_DWA-7_30-34	101_DWA-7_40-44	101_DWA-7_50-54	DW-101-8-S	SOIL CLEANUP
Lab Sample Number	82908	82909	82910	82911	80570	OBJECTIVE (a)
Sampling Date	09/09/98	09/09/98	09/09/98	09/09/98	08/24/98	
VOLATILE ORGANIC COMPOUNDS (µg/kg)						
Methylene Chloride	ND	ND	ND	ND	ND	100
Acetone	ND	ND	ND	ND	ND	200
Carbon Disulfide	16 b	18 b	16 b	20 b	ND	2,700
1,2-Dichloroethene(total)	ND	ND	ND	ND	ND	300
1,2-Dichloroethane	ND	ND	ND	ND	ND	100
2-Butanone	ND	ND	ND	ND	ND	300
Trichloroethene	ND	ND	ND	ND	ND	700
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	800
4-Methyl-2-Pentanone	ND	ND	ND	ND	ND	1,000
Tetrachloroethene	ND	ND	ND	ND	ND	1,400
Toluene	ND	ND	ND	ND	7 j	1,500
Chlorobenzene	ND	ND	ND	ND	0.6 j	1,700
Ethylbenzene	ND	ND	ND	ND	ND	5,500
Xylenes(Total)	ND	ND	ND	ND	3 j	1,200

♦ - Not analyzed.

(a) - NYSDEC Technical Administrative Guidance Memorandum, January 1994.

b - Found in associated blanks.

j - Estimated concentration; compound present below quantitation limit.

DL - Diluted sample analysis.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-6 (Page 5 of 21)

SOIL AND SEDIMENT DATA SUMMARY

101 Frost Street

Base Analytical Laboratory

LMS Sample ID	101-DWA-8 (8-12')	101-DWA-8 (18-22')	101-DWA-8 (30-34')	101-DWA-8 (40-44')	101-DW-9 (S)	101-DW-10 (S)	RECOMMENDED
Lab Sample ID	101_DWA-8_8-12	101_DWA-8_18-22	101_DWA-8_30-34	101_DWA-8_40-44	DW-101-9-S	DW-101-11-S	SOIL CLEANUP
Lab Sample Number	83319	83320	83321	83322	80574	80577	OBJECTIVE (a)
Sampling Date	9/10/98	9/10/98	9/10/98	9/10/98	08/25/98	08/25/98	
VOLATILE ORGANIC COMPOUNDS (µg/kg)							
Methylene Chloride	ND	ND	ND	ND	ND	ND	100
Acetone	ND	ND	ND	ND	ND	ND	200
Carbon Disulfide	ND	ND	ND	ND	ND	ND	2,700
1,2-Dichloroethene(total)	ND	ND	ND	ND	ND	ND	300
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	100
2-Butanone	ND	ND	ND	ND	ND	ND	300
Trichloroethene	ND	ND	ND	ND	ND	ND	700
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	800
4-Methyl-2-Pentanone	ND	ND	ND	ND	ND	ND	1,000
Tetrachloroethene	ND	ND	ND	ND	ND	ND	1,400
Toluene	ND	ND	ND	ND	6 j	1 j	1,500
Chlorobenzene	ND	ND	ND	ND	0.6 j	ND	1,700
Ethylbenzene	ND	ND	ND	ND	ND	ND	5,500
Xylenes(Total)	ND	ND	ND	ND	ND	ND	1,200

♦ - Not analyzed.

(a) - NYSDEC Technical Administrative Guidance Memorandum, January 1994.

b - Found in associated blanks

j - Estimated concentration; compound present below quantitation limit.

DL - Diluted sample analysis.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-6 (Page 6 of 21)

SOIL AND SEDIMENT DATA SUMMARY

101 Frost Street
Base Analytical Laboratory

LMS Sample ID	101-DW-10A (S)	101-DW-11 (S)	101-DW-11 (20-24')	101-DW-12 (S)	101-DWA-12 (8-12')	RECOMMENDED
Lab Sample ID	DW-101-10A-S	101-DW11_SS-1	101-DW11_20-24	DW-101-12-S	101-DWA12_8-12	SOIL CLEANUP
Lab Sample Number	80566	84252	84253	80575	84254	OBJECTIVE (a)
Sampling Date	08/26/98	9/14/98	9/14/98	08/25/98	09/14/98	
VOLATILE ORGANIC COMPOUNDS (µg/kg)						
Methylene Chloride	ND	ND	ND	ND	ND	100
Acetone	ND	ND	ND	ND	ND	200
Carbon Disulfide	ND	ND	ND	ND	ND	2,700
1,2-Dichloroethene(total)	ND	ND	ND	ND	ND	300
1,2-Dichloroethane	ND	ND	ND	ND	ND	100
2-Butanone	ND	ND	ND	ND	ND	300
Trichloroethene	ND	ND	ND	ND	ND	700
1,1,1-Trichloroethane	0.6 j	ND	ND	ND	ND	800
4-Methyl-2-Pentanone	ND	ND	ND	ND	ND	1,000
Tetrachloroethene	1 j	ND	ND	0.5 j	ND	1,400
Toluene	ND	ND	ND	ND	ND	1,500
Chlorobenzene	ND	ND	ND	ND	ND	1,700
Ethylbenzene	ND	ND	ND	34	ND	5,500
Xylenes(Total)	ND	ND	ND	170	ND	1,200

* Not analyzed.

(a) - NYSDep Technical Administrative Guidance Memorandum, January 1994.

b - Found in associated blanks.

j - Estimated concentration; compound present below quantitation limit.

DL - Diluted sample analysis.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-6 (Page 7 of 21)

SOIL AND SEDIMENT DATA SUMMARY

101 Frost Street

Base Analytical Laboratory

LMS Sample ID	101-DWA-12 (18-22')	101-DWA-12 (30-34')	101-DWA-12 (40-44')	101-DWA-12 (50-54')	101-DW-13 (S) RECOMMENDED
Lab Sample ID	101-DWA12_18-22	101-DWA12_30-34	101-DWA12_40-44	101-DWA12_50-54	SMH-101-13-S SOIL CLEANUP
Lab Sample Number	84255	84256	84257	84258	80576
Sampling Date	09/14/98	09/14/98	09/14/98	9/14/98	08/25/98
OBJECTIVE (a)					
VOLATILE ORGANIC COMPOUNDS (µg/kg)					
Methylene Chloride	ND	ND	ND	ND	ND
Acetone	ND	ND	ND	ND	ND
Carbon Disulfide	ND	ND	ND	ND	ND
1,2-Dichloroethene(total)	ND	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND	ND
2-Butanone	ND	ND	ND	ND	ND
Trichloroethene	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND	ND
4-Methyl-2-Pentanone	ND	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND	ND
Toluene	ND	ND	ND	ND	0.5 j
Chlorobenzene	ND	ND	ND	ND	ND
Ethylbenzene	ND	ND	ND	ND	ND
Xylenes(Total)	ND	ND	ND	ND	ND
					100
					200
					2,700
					300
					100
					300
					700
					800
					1,000
					1,400
					1,500
					1,700
					5,500
					1,200

♦ - Not analyzed.

(a) - NYSDDEC Technical Administrative Guidance Memorandum, January 1994.

b - Found in associated blanks.

j - Estimated concentration; compound present below quantitation limit.

DL - Diluted sample analysis.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-6 (Page 8 of 21)

SOIL AND SEDIMENT DATA SUMMARY
 101 Frost Street
 Base Analytical Laboratory

LMS Sample ID	101-DWA-13 (8-12)	101-DWA-13 (18-22)	101-DWA-13 (30-34)	101-DWA-13 (40-44)	101-DW-N/S (S)	101-DW-N/S (27-29)	RECOMMENDED
Lab Sample ID	101_DWA-13_8-12	101_DWA-13_18-22	101_DWA-13_30-34	101_DWA-13_40-44	DW-9_S-1	DW-9_27-29	SOIL CLEANUP
Lab Sample Number	84711	84712	84713	84714	71038	71039	OBJECTIVE (a)
Sampling Date	9/17/98	9/17/98	9/17/98	9/17/98	07/12/98	07/12/98	
VOLATILE ORGANIC COMPOUNDS (µg/kg)							
Methylene Chloride	ND	ND	ND	ND	ND	ND	100
Acetone	ND	ND	ND	ND	ND	ND	200
Carbon Disulfide	ND	ND	ND	ND	ND	ND	2,700
1,2-Dichloroethene(total)	ND	ND	ND	ND	ND	ND	300
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	100
2-Butanone	ND	ND	ND	ND	ND	ND	300
Trichloroethene	ND	ND	ND	ND	0.6 j	ND	700
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	800
4-Methyl-2-Pentanone	ND	ND	ND	ND	ND	ND	1,000
Tetrachloroethene	ND	ND	ND	ND	0.5 j	560	1,400
Toluene	ND	ND	ND	ND	0.7 j	3 j	1,500
Chlorobenzene	ND	ND	ND	ND	ND	ND	1,700
Ethylbenzene	ND	ND	ND	ND	ND	ND	5,500
Xylenes(Total)	ND	ND	ND	ND	ND	ND	1,200

♦ - Not analyzed.

(a) - NYSDCE Technical Administrative Guidance Memorandum, January 1994.

b - Found in associated blanks.

j - Estimated concentration; compound present below quantitation limit.

DL - Diluted sample analysis.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-6 (Page 9 of 21)

SOIL AND SEDIMENT DATA SUMMARY

101 Frost Street

Base Analytical Laboratory

LMS Sample ID	101-DWA-N/S (31-33')	FSGP-01 (18-22')	FSGP-02 (18-22')	FSGP-02 (50-54')	FSGP-04 (19-21')	RECOMMENDED
Lab Sample ID	89_DWA-19_31-33	FSGP-01_18-22	FSGP-02_18-22	FSGP-02_50-54	FSGP-04_19-21	SOIL CLEANUP
Lab Sample Number	82145	86000	86001	86002	82144	OBJECTIVE (a)
Sampling Date	9/3/98	09/23/98	09/24/98	09/24/98	9/3/98	
VOLATILE COMPOUNDS (µg/kg)						
Methylene Chloride	ND	ND	ND	ND	ND	100
Acetone	ND	ND	ND	ND	ND	200
Carbon Disulfide	ND	ND	ND	ND	ND	2,700
1,2-Dichloroethene (total)	ND	ND	ND	ND	ND	300
1,2-Dichloroethane	ND	ND	ND	ND	ND	100
2-Butanone	ND	ND	ND	ND	ND	300
Trichloroethene	ND	ND	ND	ND	ND	700
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	800
4-Methyl-2-Pentanone	ND	ND	ND	ND	ND	1,000
Tetrachloroethene	2 j	ND	ND	ND	ND	1,400
Toluene	ND	ND	ND	ND	ND	1,500
Chlorobenzene	ND	ND	ND	ND	ND	1,700
Ethylbenzene	ND	ND	ND	ND	ND	5,500
Xylenes (Total)	ND	ND	ND	ND	ND	1,200

♦ - Not analyzed.

(a) - NYSDCE Technical Administrative Guidance Memorandum, January 1994.

b - Found in associated blanks.

j - Estimated concentration; compound present below quantitation limit.

DL - Diluted sample analysis.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

SOIL AND SEDIMENT DATA SUMMARY
101 Frost Street
Base Analytical Laboratory

LMS Sample ID	101-DW-1 (S)	101-DW-2 (S)	101-DW-3 (S)	101-DW-4 (S)	RECOMMENDED
Lab Sample ID	DW-101-1-S	DW-101-2-S	DW-101-3-S	DW-101-4-S	SOIL CLEANUP
Lab Sample Number	80573	80568	80564	80565	OBJECTIVE (a)
Sampling Date	8/25/98	8/24/98	8/26/98	08/26/98	
					[DL:5:1]
SEMIVOLATILE ORGANIC COMPOUNDS (µg/kg)					
Phenol	ND	ND	ND	ND g	30 or MDL
1,4-Dichlorobenzene	ND	ND	ND	ND g	N/A
4-Methylphenol	ND	ND	ND	ND g	900
1,2,4-Trichlorobenzene	ND	ND	ND	ND g	N/A
Naphthalene	ND	ND	ND g	ND g	13000
2-Methylnaphthalene	ND	ND	ND	ND g	36400
Acenaphthylene	ND	ND	ND	ND g	41000
3-Nitroaniline	ND	ND	ND	ND g	500 or MDL
Acenaphthene	ND	ND	ND	ND g	50000***
4-Nitrophenol	ND	ND	ND	ND g	100 or MDL
Dibenzofuran	ND	ND	ND	ND g	6200
Fluorene	ND g	ND g	ND	ND g	50000***
Phenanthrene	ND	ND	ND	ND g	50000***
Anthracene	ND	ND	ND	ND g	50000***
Carbazole	ND	ND	ND	ND g	N/A
Di-n-butylphthalate	ND	ND	ND	ND g	8100
Fluoranthene	ND	10 j	10 j	35 jgd	50000***
Pyrene	ND g	7 j	8 j	31 jgd	50000***
Butylbenzylphthalate	ND	ND	ND	ND g	50000***
Benzo(a)anthracene	ND	4 j	4 j	27 jgd	224 or MDL
Chrysene	ND	5 j	4 j	26 jgd	400***
bis(2-Ethylhexyl)phthalate	ND	48 j	96 j	ND g	50000***
Di-n-octylphthalate	ND	ND	62 j	ND g	50000***
Benzo(b)fluoranthene	ND	5 j	6 j	37 jgd	1100
Benzo(k)fluoranthene	ND	4 j	ND	ND g	1100
Benzo(a)pyrene	ND	5 j	ND	ND g	61 or MDL
Indeno(1,2,3-cd)pyrene	ND g	ND g	ND	ND g	3200
Dibenzo(a,h)anthracene	ND	ND	ND	ND g	14 or MDL
Benzo(g,h,i)perylene	ND	ND	ND	ND g	50000***

*** - As per TAGM #4046, Total VOCs < 10,000 ppb, Total SVOCs < 500,000 ppb, and individual SVOCs < 50,000 ppb.

(a) - NYSDEC Technical Administrative Guidance Memorandum, January 1994.

bold - Value exceeds recommended criteria.

j - Estimated concentration; compound present below quantitation limit.

DL - Diluted sample analysis.

MDL - Method detection limit.

N/A - Not applicable.

ND - Not detected at analytical detection limit.

g - Value considered estimated based on data validator's report (Appendix H).

d - Concentration recovered from diluted sample.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys.
The Lab Sample ID is the field sample designation.

SOIL AND SEDIMENT DATA SUMMARY

101 Frost Street

Base Analytical Laboratory

LMS Sample ID	101-DW-5 (S)	101-DW-6 (S)	101-DW-7 (S)	101-DW-8 (S)	RECOMMENDED
Lab Sample ID	DW-101-5-S	DW-101-6-S	DW-101-7-S	DW-101-8-S	SOIL CLEANUP
Lab Sample Number	80571	80572	80569	80570	OBJECTIVE (a)
Sampling Date	08/24/98	08/24/98	08/24/98	08/24/98	
SEMIVOLATILE ORGANIC COMPOUNDS ($\mu\text{g/kg}$)					
	[DL:5:1]		[DL:5:1]		
Phenol	4 j	ND g	14 j	ND g	30 or MDL
1,4-Dichlorobenzene	ND	ND g	ND	ND g	N/A
4-Methylphenol	ND	ND g	10 j	ND g	900
1,2,4-Trichlorobenzene	ND	ND g	ND	ND g	N/A
Naphthalene	ND	ND g	ND	130 jgd	13000
2-Methylnaphthalene	ND	ND g	ND	460 jgd	36400
Acenaphthylene	ND	ND g	5 j	ND g	41000
3-Nitroaniline	ND	ND g	ND	ND g	500 or MDL
Acenaphthene	ND	ND g	4 j	ND g	50000***
4-Nitrophenol	ND	ND g	ND	ND g	100 or MDL
Dibenzofuran	ND	ND g	ND	ND g	6200
Fluorene	ND g	ND g	8 jg	ND g	50000***
Phenanthrene	16 j	62 jgd	100 j	62 jgd	50000***
Anthracene	ND	ND g	11 j	ND g	50000***
Carbazole	ND	ND g	16 j	ND g	N/A
Di-n-butylphthalate	ND	ND g	76 j	ND g	8100
Fluoranthene	38 j	120 jgd	290 j	90 jgd	50000***
Pyrene	28 jg	88 jgd	230 j	65 jgd	50000***
Butylbenzylphthalate	ND	ND g	150 j	640 jgd	50000***
Benzo(a)anthracene	15 j	65 jgd	110 j	43 jgd	224 or MDL
Chrysene	18 j	69 jgd	130 j	55 jgd	400***
bis(2-Ethylhexyl)phthalate	190 j	780 jgd	2000	1400 jgd	50000***
Di-n-octylphthalate	ND	ND g	2900	260 jgd	50000***
Benzo(b)fluoranthene	35 j	130 jgd	210 j	84 jgd	1100
Benzo(k)fluoranthene	11 j	50 jgd	61 j	26 jgd	1100
Benzo(a)pyrene	17 j	85 j	110 j	49 jgd	61 or MDL
Indeno(1,2,3-cd)pyrene	17 jg	82 jgd	55 jg	ND g	3200
Dibenzo(a,h)anthracene	ND	ND g	ND	ND g	14 or MDL
Benzo(g,h,i)perylene	20 j	80 jgd	44 j	ND g	50000***

*** - As per TAGM #4046, Total VOCs < 10,000 ppb, Total SVOCs < 500,000 ppb, and individual SVOCs < 50,000 ppb.

(a) - NYSDEC Technical Administrative Guidance Memorandum, January 1994.

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j - Estimated concentration; compound present below quantitation limit.

DL - Diluted sample analysis.

MDL - Method detection limit.

N/A - Not applicable.

ND - Not detected at analytical detection limit.

g - Value considered estimated based on data validator's report (Appendix H).

d - Concentration recovered from diluted sample.

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The Lab Sample ID is the field sample designation.

SOIL AND SEDIMENT DATA SUMMARY
101 Frost Street
Base Analytical Laboratory

LMS Sample ID	101-DW-9 (S)	101-DW-10 (S)	101-DW-10A (S)	RECOMMENDED
Lab Sample ID	DW-101-9-S	DW-101-11-S	DW-101-10A-S	SOIL CLEANUP
Lab Sample Number	80574	80577	80566	OBJECTIVE (a)
Sampling Date	08/25/98	08/25/98	08/26/98	
SEMIVOLATILE ORGANIC COMPOUNDS (µg/kg)				
	[DL:2:1]	[DL:2:1]		
Phenol	ND	31 jd	12 j	30 or MDL
1,4-Dichlorobenzene	ND	ND	ND g	N/A
4-Methylphenol	ND	20 jd	7 j	900
1,2,4-Trichlorobenzene	ND	ND	ND g	N/A
Naphthalene	ND	60 jd	25 j	13000
2-Methylnaphthalene	ND	17 jd	10 j	36400
Acenaphthylene	ND	1100 d	330 j	41000
3-Nitroaniline	ND	ND	ND	500 or MDL
Acenaphthene	ND	16 jd	6 jg	50000***
4-Nitrophenol	ND	ND	ND	100 or MDL
Dibenzofuran	ND	36 jd	17 j	6200
Fluorene	ND g	54 jd	31 jg	50000***
Phenanthrene	73 jd	1800 d	660	50000***
Anthracene	ND	820 d	210 j	50000***
Carbazole	ND	170 jd	58 j	N/A
Di-n-butylphthalate	ND	810 d	270 j	8100
Fluoranthene	140 jd	4800 d	1600	50000***
Pyrene	120 jg	3400 d	1400 g	50000***
Butylbenzylphthalate	ND	140 jd	160 j	50000***
Benzo(a)anthracene	42 jd	1900 d	660	224 or MDL
Chrysene	110 jd	2700 d	1000	400***
bis(2-Ethylhexyl)phthalate	650 jd	1300 d	590	50000***
Di-n-octylphthalate	ND	ND	45 j	50000***
Benzo(b)fluoranthene	97 jd	3500 d	1100	1100
Benzo(k)fluoranthene	25 jd	1300 d	370	1100
Benzo(a)pyrene	38 jd	1700 d	700	61 or MDL
Indeno(1,2,3-cd)pyrene	29 jg	860 d	400 g	3200
Dibenzo(a,h)anthracene	ND	200 jd	81 j	14 or MDL
Benzo(g,h,i)perylene	34 jd	550 jd	290 j	50000***

*** - As per TAGM #4046, Total VOCs < 10,000 ppb, Total SVOCs < 500,000 ppb, and individual SVOCs < 50,000 ppb.

(a) - NYSDEC Technical Administrative Guidance Memorandum, January 1994.

bold - Value exceeds recommended criteria.

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DL - Diluted sample analysis.

MDL - Method detection limit.

N/A - Not applicable.

ND - Not detected at analytical detection limit.

g - Value considered estimated based on data validator's report (Appendix H).

d - Concentration recovered from diluted sample.

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SOIL AND SEDIMENT DATA SUMMARY

101 Frost Street

Base Analytical Laboratory

LMS Sample ID	101-DW11 (S-1)	101-DW-12 (S)	101 DW-13 (S)	RECOMMENDED
Lab Sample ID	101-DW11_SS-1	DW-101-12-S	SMH-101-13-S	SOIL CLEANUP
Lab Sample Number	84252	80575	80576	OBJECTIVE (a)
Sampling Date	9/14/98	08/25/98	08/25/98	
	[DL:5:1]	[DL:25:1]	[DL:10:1]	
SEMIVOLATILE ORGANIC COMPOUNDS (µg/kg)				
Phenol	ND	ND	77 jd	30 or MDL
1,4-Dichlorobenzene	ND	ND	ND	N/A
4-Methylphenol	ND	ND	53 jd	900
1,2,4-Trichlorobenzene	ND	ND	ND	N/A
Naphthalene	ND	ND	140 jd	13000
2-Methylnaphthalene	ND	ND	40 jd	36400
Acenaphthylene	ND	ND	2500 jd	41000
3-Nitroaniline	ND	ND	ND	500 or MDL
Acenaphthene	ND	ND	ND	50000***
4-Nitrophenol	ND	ND	ND	100 or MDL
Dibenzofuran	ND	ND	94 jd	6200
Fluorene	ND	ND g	190 jgd	50000***
Phenanthrene	28 jd	ND	5000	50000***
Anthracene	ND	ND	1400 jd	50000***
Carbazole	ND	ND	480 jd	N/A
Di-n-butylphthalate	ND	ND	ND	8100
Fluoranthene	61 jd	ND	16000 d	50000***
Pyrene	46 jd	ND g	8300 gd	50000***
Butylbenzylphthalate	ND	ND	ND	50000***
Benzo(a)anthracene	22 jd	ND	5000 d	224 or MDL
Chrysene	35 jd	ND	6300	400***
bis(2-Ethylhexyl)phthalate	230 jd	ND	850 j	50000***
Di-n-octylphthalate	ND	ND	ND	50000***
Benzo(b)fluoranthene	61 jd	ND	9400	1100
Benzo(k)fluoranthene	24 jd	ND	3300 j	1100
Benzo(a)pyrene	4 jd	ND	4800	61 or MDL
Indeno(1,2,3-cd)pyrene	33 jd	ND g	1500 jgd	3200
Dibenzo(a,h)anthracene	ND	ND	440 j	14 or MDL
Benzo(g,h,i)perylene	68 jd	ND	990 j	50000***

*** - As per TAGM #4046, Total VOCs < 10,000 ppb, Total SVOCs < 500,000 ppb, and individual SVOCs < 50,000 ppb.

(a) - NYSDEC Technical Administrative Guidance Memorandum, January 1994.

bold - Value exceeds recommended criteria.

j - Estimated concentration; compound present below quantitation limit.

DL - Diluted sample analysis.

MDL - Method detection limit.

N/A - Not applicable.

ND - Not detected at analytical detection limit.

g - Value considered estimated based on data validator's report (Appendix H).

d - Concentration recovered from diluted sample.

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SOIL AND SEDIMENT DATA SUMMARY
101 Frost Street
Base Analytical Laboratory

LMS Sample ID	101-DW-1 (S)	101-DW-2 (S)	101-DW-3 (S)	101-DW-4 (S)	101-DW-5 (S)	RECOMMENDED
Lab Sample ID	DW-101-1-S	DW-101-2-S	DW-101-3-S	DW-101-4-S	DW-101-5-S	SOIL CLEANUP
Lab Sample Number	80573	80568	80564	80565	80571	OBJECTIVE (b)
Sampling Date	8/25/98	8/24/98	8/26/98	8/26/98	8/24/98	
PESTICIDES/PCBs (µg/kg)						
Dieldrin	ND	ND	ND	ND g	ND	44
4,4'-DDE	ND	ND	ND	ND g	ND	2,100
4,4'-DDD	ND	ND	ND	ND g	ND	2,900
Endrin	ND	ND	ND	ND g	ND	100
Endosulfansulfate	ND	ND	ND	28 g	ND	1000
4,4'-DDT	ND	ND	ND	ND g	ND	2,100
Endrin aldehyde	ND	ND	ND	12 g	ND	N/A
Endrin ketone	ND	ND	ND	ND g	ND	N/A
alpha-Chlordane	ND	ND	ND	ND g	ND	540
gamma-Chlordane	ND	ND	ND	ND g	ND	540

bold - Value exceeds recommended criteria.

DL - Diluted sample analysis.

N/A - Not applicable.

ND - Not detected at analytical detection limit.

g - Value considered estimated based on data validator's report (Appendix H).

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The Lab Sample ID is the field sample designation.

SOIL AND SEDIMENT DATA SUMMARY
101 Frost Street
Base Analytical Laboratory

LMS Sample ID	101-DW-6 (S)	101-DW-7 (S)	101-DW-8 (S)	101-DW-9 (S)	RECOMMENDED
Lab Sample ID	DW-101-6-S	DW-101-7-S	DW-101-8-S	DW-101-9-S	SOIL CLEANUP
Lab Sample Number	80572	80569	80570	80574	OBJECTIVE (a)
Sampling Date	8/24/98	8/24/98	8/24/98	8/25/98	
PESTICIDES/PCBs (µg/kg)					
Dieldrin	ND	ND	ND	ND	44
4,4'-DDE	ND	ND	15	ND	2,100
4,4'-DDD	ND	ND	350 d	ND	2,900
Endrin	ND	ND	ND	ND	100
Endosulfansulfate	ND	ND	ND	ND	1000
4,4'-DDT	4.8	8.3	25 p	ND	2,100
Endrin aldehyde	ND	ND	ND	ND	N/A
Endrin ketone	ND	ND	ND	ND	N/A
alpha-Chlordane	ND	ND	7.1	ND	540
gamma-Chlordane	ND	ND	4.7 p	ND	540

- bold** - Value exceeds recommended criteria.
p - Pesticide/Aroclor target analyte has >25% difference for the detected concentrations between the two GC columns.
DL - Diluted sample analysis.
MDL - Method detection limit.
ND - Not detected at analytical detection limit.
SB - Site background.
d - Concentration recovered from diluted sample [DL:10:1].
- Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys.
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SOIL AND SEDIMENT DATA SUMMARY
101 Frost Street
Base Analytical Laboratory

LMS Sample ID	101-DW-10 (S)	101-DW-10A (S)	101-DW-12 (S)	101-DW-13 (S)	RECOMMENDED
Lab Sample ID	DW-101-11-S	DW-101-10A-S	DW-101-12-S	SMH-101-13-S	SOIL CLEANUP
Lab Sample Number	80577	80566	80575	80576	OBJECTIVE (a)
Sampling Date	8/25/98	8/26/98	8/25/98	8/25/98	
[DL:5:1]					
PESTICIDES/PCBs (µg/kg)					
Dieldrin	ND	ND	ND	ND	44
4,4'-DDE	9.6 p	6.6 p	170	2100 d2	2,100
4,4'-DDD	45	15	860 pd1	2,400 pd2	2,900
Endrin	ND	ND	ND	ND	100
Endosulfansulfate	ND	ND	ND	ND	1000
4,4'-DDT	34	15	1700 d1	20000 d2	2,100
Endrin aldehyde	ND	ND	ND	ND	N/A
Endrin keytone	ND	ND	ND	ND	N/A
alpha-Chlordane	4.8 p	2.7 p	16 p	13 p	540
gamma-Chlordane	5.7	2.8 p	14 p	18	540

bold - Value exceeds recommended criteria.

p - Pesticide/Aroclor target analyte has >25% difference for the detected concentrations between the two GC columns.

DL - Diluted sample analysis.

MDL - Method detection limit.

ND - Not detected at analytical detection limit.

d1 - Concentration recovered from diluted sample [DL:50:1].

d2 - Concentration recovered from diluted sample [DL:500:1].

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys.

The Lab Sample ID is the field sample designation.

SOIL AND SEDIMENT DATA SUMMARY
101 Frost Street
Base Analytical Laboratory

LMS Sample ID	101-DW-1 (S)	101-DW-2 (S)	101-DW-3 (S)	RECOMMENDED	EASTERN USA
Lab Sample ID	DW-101-1-S	DW-101-2-S	DW-101-3-S	SOIL CLEANUP	BACKGROUND SOIL
Lab Sample Number	80573	80568	80564	OBJECTIVE (a)	CONCENTRATIONS (a)
Sampling Date	08/25/98	08/24/98	08/26/98		
METALS (µg/kg)					
Aluminum	1,040,000	575,000	1,260,000	SB	33,000,000
Antimony	ND	ND	ND	SB	600 - 10,000 (n)
Arsenic	ND	ND	850 B	7,500 or SB	3,000 - 12,000 æ
Barium	4,600 B	4,200 B	8,700 B	300,000 or SB	15,000 - 600,000
Beryllium	150 B	70 B	100 B	160 or SB	0 - 1,750
Cadmium	ND	ND	ND	1,000 or SB	100 - 1,000
Calcium	74,900 B	98,500 B	699,000 B	SB	130,000 - 35,000,000 æ
Chromium	5,000 gR	2,000 BR	2,400 R	10,000 or SB	1,500 - 40,000 æ
Cobalt	750 B	480 B	1,300 B	30,000 or SB	2,500 - 60,000 æ
Copper	2,500 B	1,800 B	4,100 B	25,000 or SB	1,000 - 50,000
Iron	3,900,000 gR	2,110,000 R	3,620,000 R	2,000,000 or SB	2,000,000 - 550,000,000
Lead	1,600 g	1,100 g	2,900 g	SB*	200,000 - 500,000*
Magnesium	194,000 B	123,000 B	537,000 B	SB	100,000 - 5,000,000
Manganese	34,600	22,700	69,600	SB	50,000 - 5,000,000
Mercury	ND	ND	ND	100	1 - 200
Nickel	1,700 B	750 B	1,400 B	13,000 or SB	500 - 25,000
Potassium	109,000 B	66,300 B	178,000 B	SB	8,500,000 - 43,000,000 æ
Selenium	ND	ND	ND	2,000 or SB	100 - 3,900
Silver	ND	ND	ND	SB	100 - 5,000 (n)
Sodium	103,000 B	138,000 B	102,000 B	SB	6,000,000 - 8,000,000
Thallium	ND	ND	ND	SB	100 - 800 (q)
Vanadium	4,200 B	2,100 B	5,000 B	150,000 or SB	1,000 - 300,000
Zinc	6,300	12,100	19,500	20,000 or SB	9,000 - 50,000
Cyanide	ND	ND	ND	**	N/A

* - Background levels for lead range from 4,000 - 61,000 ppb in undeveloped, rural areas to 200,000 - 500,000 ppb in metropolitan or suburban areas or near highways.

** - Some forms of Cyanide are complex and stable while other forms are pH dependent and hence are very unstable. Site-specific form(s) of Cyanide should be taken into consideration when establishing soil cleanup objectives.

æ - New York State background concentration.

(a) - NYSDEC Technical Administrative Guidance Memorandum, January 1994.

(n) - Dragun, J., The Soil Chemistry of Hazardous Materials.

(q) - Bowan, H.J., Environmental Chemistry of the Elements.

bold - Value exceeds recommended criteria.

B - Value is less than the contract-required detection limit but greater than the instrument detection limit.

N/A - Not applicable.

ND - Not detected at analytical detection limit.

SB - Site background.

R - Duplicate analysis not within control limits.

g - Value considered estimated based on data validator's report (Appendix H).

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

SOIL AND SEDIMENT DATA SUMMARY
101 Frost Street
Base Analytical Laboratory

LMS Sample ID	101-DW-4 (S)	101-DW-5 (S)	101-DW-6 (S)	RECOMMENDED	EASTERN USA
Lab Sample ID	DW-101-4-S	DW-101-5-S	DW-101-6-S	SOIL CLEANUP	BACKGROUND SOIL
Lab Sample Number	80565	80571	80572	OBJECTIVE (a)	CONCENTRATIONS (a)
Sampling Date	08/26/98	08/24/98	08/24/98		
METALS (µg/kg)					
Aluminum	992,000	834,000	1,070,000	SB	33,000,000
Antimony	ND	ND	ND	SB	600 - 10,000 (n)
Arsenic	1,300 B	1,500 B	910 B	7,500 or SB	3,000 - 12,000 æ
Barium	3,700 B	21,600 B	9,200 B	300,000 or SB	15,000 - 600,000
Beryllium	80 B	130 B	140 B	160 or SB	0 - 1,750
Cadmium	420 B	240 B	160 B	1,000 or SB	100 - 1,000
Calcium	1,220,000	304,000 B	1,570,000	SB	130,000 - 35,000,000 æ
Chromium	4,500 R	2,800 R	5,000 R	10,000 or SB	1,500 - 40,000 æ
Cobalt	970 B	6,700 B	1,400 B	30,000 or SB	2,500 - 60,000 æ
Copper	17,400	57,600	8,900	25,000 or SB	1,000 - 50,000
Iron	4,470,000 R	5,850,000 R	6,740,000 R	2,000,000 or SB	2,000,000 - 550,000,000
Lead	75,400 g	4,400 g	10,300 g	SB*	200,000 - 500,000*
Magnesium	774,000 B	232,000 B	752,000 B	SB	100,000 - 5,000,000
Manganese	33,400	32,400	115,000	SB	50,000 - 5,000,000
Mercury	230	330	ND	100	1 - 200
Nickel	2,900 B	1,200 B	3,000 B	13,000 or SB	500 - 25,000
Potassium	56,200 B	117,000 B	88,500 B	SB	8,500,000 - 43,000,000 æ
Selenium	ND	ND	ND	2,000 or SB	100 - 3,900
Silver	ND	ND	ND	SB	100 - 5,000 (n)
Sodium	123,000 B	120,000 B	124,000 B	SB	6,000,000 - 8,000,000
Thallium	ND	ND	ND	SB	100 - 800 (q)
Vanadium	5,700 B	3,800 B	7,800 B	150,000 or SB	1,000 - 300,000
Zinc	39,500	38,800	56,300	20,000 or SB	9,000 - 50,000
Cyanide	ND	ND	ND	**	N/A

* - Background levels for lead range from 4,000 - 61,000 ppb in undeveloped, rural areas to 200,000 - 500,000 ppb in metropolitan or suburban areas or near highways.

** - Some forms of Cyanide are complex and stable while other forms are pH dependent and hence are very unstable. Site-specific form(s) of Cyanide should be taken into consideration when establishing soil cleanup objectives.

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N/A - Not applicable.

ND - Not detected at analytical detection limit.

SB - Site background.

R - Duplicate analysis not within control limits.

g - Value considered estimated based on data validator's report (Appendix H).

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SOIL AND SEDIMENT DATA SUMMARY

101 Frost Street

Base Analytical Laboratory

LMS Sample ID	101-DW-7 (S)	101-DW-8 (S)	101-DW-9 (S)	RECOMMENDED	EASTERN USA
Lab Sample ID	DW-101-7-S	DW-101-8-S	DW-101-9-S	SOIL CLEANUP	BACKGROUND SOIL
Lab Sample Number	80569	80570	80574	OBJECTIVE (a)	CONCENTRATIONS (a)
Sampling Date	08/24/98	08/24/98	08/25/98		
METALS (µg/kg)					
Aluminum	1,000,000	905,000	1,250,000	SB	33,000,000
Antimony	ND	ND	ND	SB	600 - 10,000 (n)
Arsenic	1,300 B	1,200 B	ND	7,500 or SB	3,000 - 12,000 æ
Barium	8,600 B	13,400 B	6,400 B	300,000 or SB	15,000 - 600,000
Beryllium	110 B	80 B	100 B	160 or SB	0 - 1,750
Cadmium	380 B	740 B	100 B	1,000 or SB	100 - 1,000
Calcium	7,010,000	2,240,000	795,000 B	SB	130,000 - 35,000,000 æ
Chromium	7,300 R	13,400 R	4,200 R	10,000 or SB	1,500 - 40,000 æ
Cobalt	940 B	1,600 B	1,100 B	30,000 or SB	2,500 - 60,000 æ
Copper	9,400	36,200	7,900	25,000 or SB	1,000 - 50,000
Iron	3,400,000 R	3,720,000 R	3,250,000 R	2,000,000 or SB	2,000,000 - 550,000,000
Lead	15,100 g	95,100 g	13,100 g	SB*	200,000 - 500,000*
Magnesium	2,750,000	1,250,000	605,000 B	SB	100,000 - 5,000,000
Manganese	40,700	26,500	36,900	SB	50,000 - 5,000,000
Mercury	ND	130	ND	100	1 - 200
Nickel	2,800 B	5,300 B	3,400 B	13,000 or SB	500 - 25,000
Potassium	74,200 B	61,400 B	99,600 B	SB	8,500,000 - 43,000,000 æ
Selenium	ND	ND	ND	2,000 or SB	100 - 3,900
Silver	ND	240 B	ND	SB	100 - 5,000 (n)
Sodium	118,000 B	126,000 B	115,000 B	SB	6,000,000 - 8,000,000
Thallium	ND	ND	ND	SB	100 - 800 (q)
Vanadium	5,600 B	9,900 B	6,600 B	150,000 or SB	1,000 - 300,000
Zinc	97,600	111,000	83,300	20,000 or SB	9,000 - 50,000
Cyanide	ND	ND	ND	**	N/A

* - Background levels for lead range from 4,000 - 61,000 ppb in undeveloped, rural areas to 200,000 - 500,000 ppb in metropolitan or suburban areas or near highways.

** - Some forms of Cyanide are complex and stable while other forms are pH dependent and hence are very unstable. Site-specific form(s) of Cyanide should be taken into consideration when establishing soil cleanup objectives.

æ - New York State background concentration.

(a) - NYSDEC Technical Administrative Guidance Memorandum, January 1994.

(n) - Dragun, J., The Soil Chemistry of Hazardous Materials.

(q) - Bowan, H.J., Environmental Chemistry of the Elements.

bold - Value exceeds recommended criteria.

B - Value is less than the contract-required detection limit but greater than the instrument detection limit.

N/A - Not applicable.

ND - Not detected at analytical detection limit.

SB - Site background.

R - Duplicate analysis not within control limits.

g - Value considered estimated based on data validator's report (Appendix H).

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys.

The Lab Sample ID is the field sample designation.

SOIL AND SEDIMENT DATA SUMMARY
101 Frost Street
Base Analytical Laboratory

LMS Sample ID	101-DW-10 (S)	101-DW-10A (S)	101-DW-11 (S)	RECOMMENDED	EASTERN USA
Lab Sample ID	DW-101-11-S	DW-101-10A-S	101-DW-11_SS-1	SOIL CLEANUP	BACKGROUND SOIL
Lab Sample Number	80577	80566	84252	OBJECTIVE (a)	CONCENTRATIONS (a)
Sampling Date	08/25/98	08/26/98	9/14/98		
METALS (µg/kg)					
Aluminum	1,860,000	1,170,000	1,290,000	SB	33,000,000
Antimony	ND	ND	ND	SB	600 - 10,000 (n)
Arsenic	2,600	1,000 B	ND	7,500 or SB	3,000 - 12,000 æ
Barium	23,500 B	12,500 B	8,800 B	300,000 or SB	15,000 - 600,000
Beryllium	140 B	100 B	50 B	160 or SB	0 - 1,750
Cadmium	990 B	410 B	350 B	1,000 or SB	100 - 1,000
Calcium	2,030,000	4,350,000	8,960,000	SB	130,000 - 35,000,000 æ
Chromium	14,600 R	9,000 gR	4,800	10,000 or SB	1,500 - 40,000 æ
Cobalt	2,400 B	1,500 B	1,400 B	30,000 or SB	2,500 - 60,000 æ
Copper	25,700	17,500	54,800 gN	25,000 or SB	1,000 - 50,000
Iron	6,650,000 R	4,550,000 gR	4,160,000 R	2,000,000 or SB	2,000,000 - 550,000,000
Lead	112,000 g	63,300 g	98,700	SB*	200,000 - 500,000*
Magnesium	1,120,000	1,040,000 B	2,910,000	SB	100,000 - 5,000,000
Manganese	99,500	54,100	44,100	SB	50,000 - 5,000,000
Mercury	100 B	ND	ND	100	1 - 200
Nickel	8,400 B	4,700	3,800 B	13,000 or SB	500 - 25,000
Potassium	169,000 B	82,500 B	ND	SB	8,500,000 - 43,000,000 æ
Selenium	ND	ND	ND	2,000 or SB	100 - 3,900
Silver	ND	ND	ND	SB	100 - 5,000 (n)
Sodium	128,000 B	194,000 B	148,000 B	SB	6,000,000 - 8,000,000
Thallium	ND	ND	ND	SB	100 - 800 (q)
Vanadium	12,600	6,600 B	8,200 B	150,000 or SB	1,000 - 300,000
Zinc	276,000	216,000	84,600 B	20,000 or SB	9,000 - 50,000
Cyanide	2,800	ND	ND	**	N/A

- * - Background levels for lead range from 4,000 - 61,000 ppb in undeveloped, rural areas to 200,000 - 500,000 ppb in metropolitan or suburban areas or near highways.
- ** - Some forms of Cyanide are complex and stable while other forms are pH dependent and hence are very unstable. Site-specific form(s) of Cyanide should be taken into consideration when establishing soil cleanup objectives.
- æ - New York State background concentration.
- (a) - NYSDEC Technical Administrative Guidance Memorandum, January 1994.
- (n) - Dragun, J., The Soil Chemistry of Hazardous Materials.
- (q) - Bowan, H.J., Environmental Chemistry of the Elements.
- bold - Value exceeds recommended criteria.
- B - Value is less than the contract-required detection limit but greater than the instrument detection limit.
- N/A - Not applicable.
- ND - Not detected at analytical detection limit.
- SB - Site background.
- N - Spiked sample recovery is not within control limits.
- R - Duplicate analysis not within control limits.
- g - Value considered estimated based on data validator's report (Appendix H)
- Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

SOIL AND SEDIMENT DATA SUMMARY

101 Frost Street

Base Analytical Laboratory

LMS Sample ID	101-DW-12 (S)	101-DW-13 (S)	RECOMMENDED	EASTERN USA
Lab Sample ID	DW-101-12-S	SMH-101-13-S	SOIL CLEANUP	BACKGROUND SOIL
Lab Sample Number	80575	80576	OBJECTIVE (a)	CONCENTRATIONS (a)
Sampling Date	08/25/98	08/25/98		
METALS (µg/kg)				
Aluminum	1,060,000	1,880,000	SB	33,000,000
Antimony	ND	ND	SB	600 - 10,000 (n)
Arsenic	ND	2,200 B	7,500 or SB	3,000 - 12,000 æ
Barium	5,400 B	12,300 B	300,000 or SB	15,000 - 600,000
Beryllium	80 B	120 B	160 or SB	0 - 1,750
Cadmium	120 B	740 B	1,000 or SB	100 - 1,000
Calcium	234,000 B	31,800,000	SB	130,000 - 35,000,000 æ
Chromium	3,200 R	17,500 R	10,000 or SB	1,500 - 40,000 æ
Cobalt	1,100 B	3,300 B	30,000 or SB	2,500 - 60,000 æ
Copper	12,200	65,300	25,000 or SB	1,000 - 50,000
Iron	3,460,000 R	7,800,000 R	2,000,000 or SB	2,000,000 - 550,000,000
Lead	62,800 g	288,000 g	SB*	200,000 - 500,000*
Magnesium	306,00 B	2,370,000	SB	100,000 - 5,000,000
Manganese	60,800	137,000	SB	50,000 - 5,000,000
Mercury	200	360	100	1 - 200
Nickel	2,900 B	18,600	13,000 or SB	500 - 25,000
Potassium	86,200 B	115,000 B	SB	8,500,000 - 43,000,000 æ
Selenium	ND	ND	2,000 or SB	100 - 3,900
Silver	ND	ND	SB	100 - 5,000 (n)
Sodium	121,000 B	238,000 B	SB	6,000,000 - 8,000,000
Thallium	ND	ND	SB	100 - 800 (q)
Vanadium	5,100 B	28,600	150,000 or SB	1,000 - 300,000
Zinc	28,300	153,000	20,000 or SB	9,000 - 50,000
Cyanide	ND	ND	**	N/A

* - Background levels for lead range from 4,000 - 61,000 ppb in undeveloped, rural areas to 200,000 - 500,000 ppb in metropolitan or suburban areas or near highways.

** - Some forms of Cyanide are complex and stable while other forms are pH dependent and hence are very unstable. Site-specific form(s) of Cyanide should be taken into consideration when establishing soil cleanup objectives.

æ - New York State background concentration.

(a) - NYSDEC Technical Administrative Guidance Memorandum, January 1994.

(n) - Dragun, J., The Soil Chemistry of Hazardous Materials.

(q) - Bowan, H.J., Environmental Chemistry of the Elements.

bold - Value exceeds recommended criteria.

B - Value is less than the contract-required detection limit but greater than the instrument detection limit.

N/A - Not applicable.

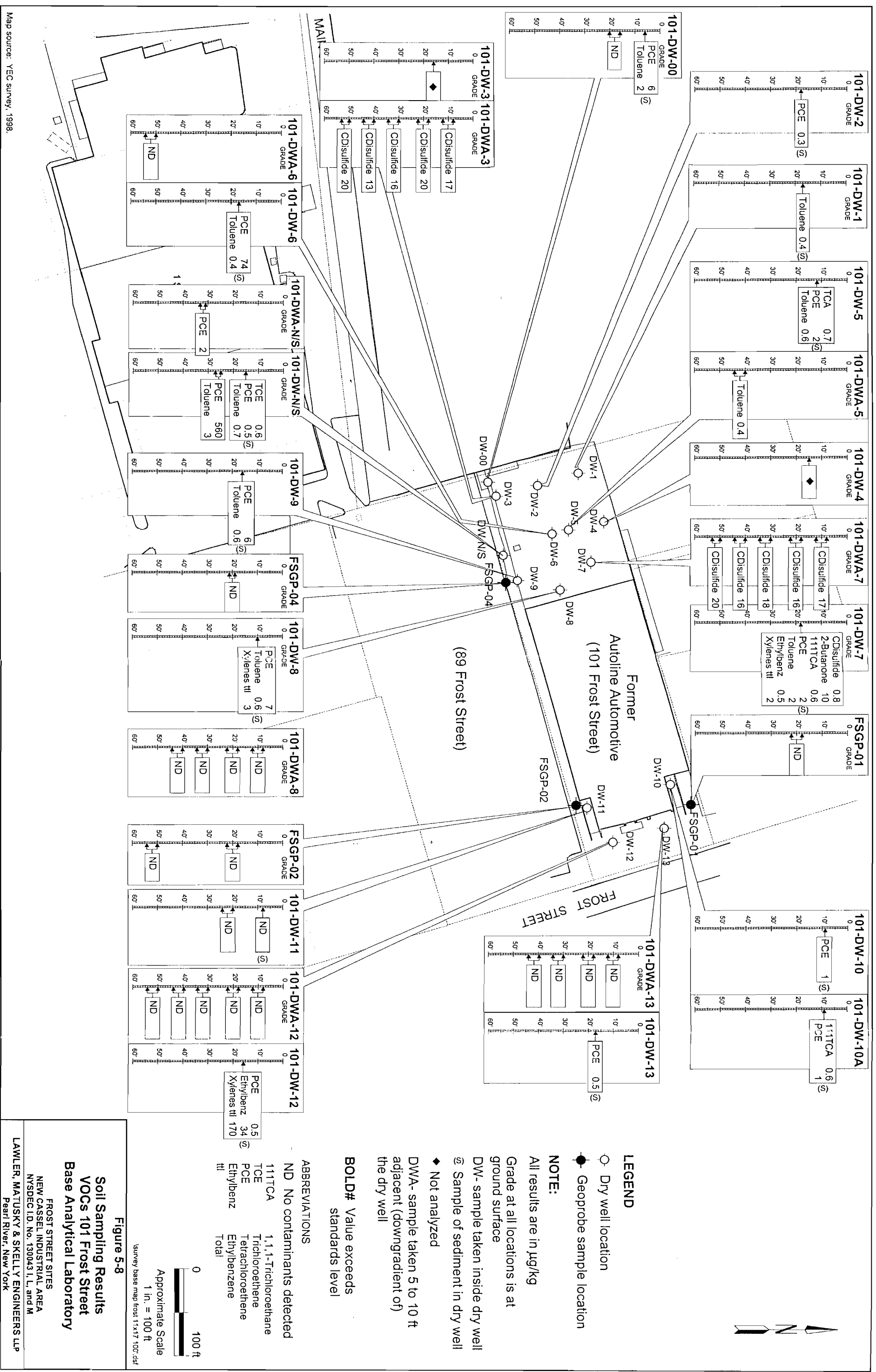
ND - Not detected at analytical detection limit.

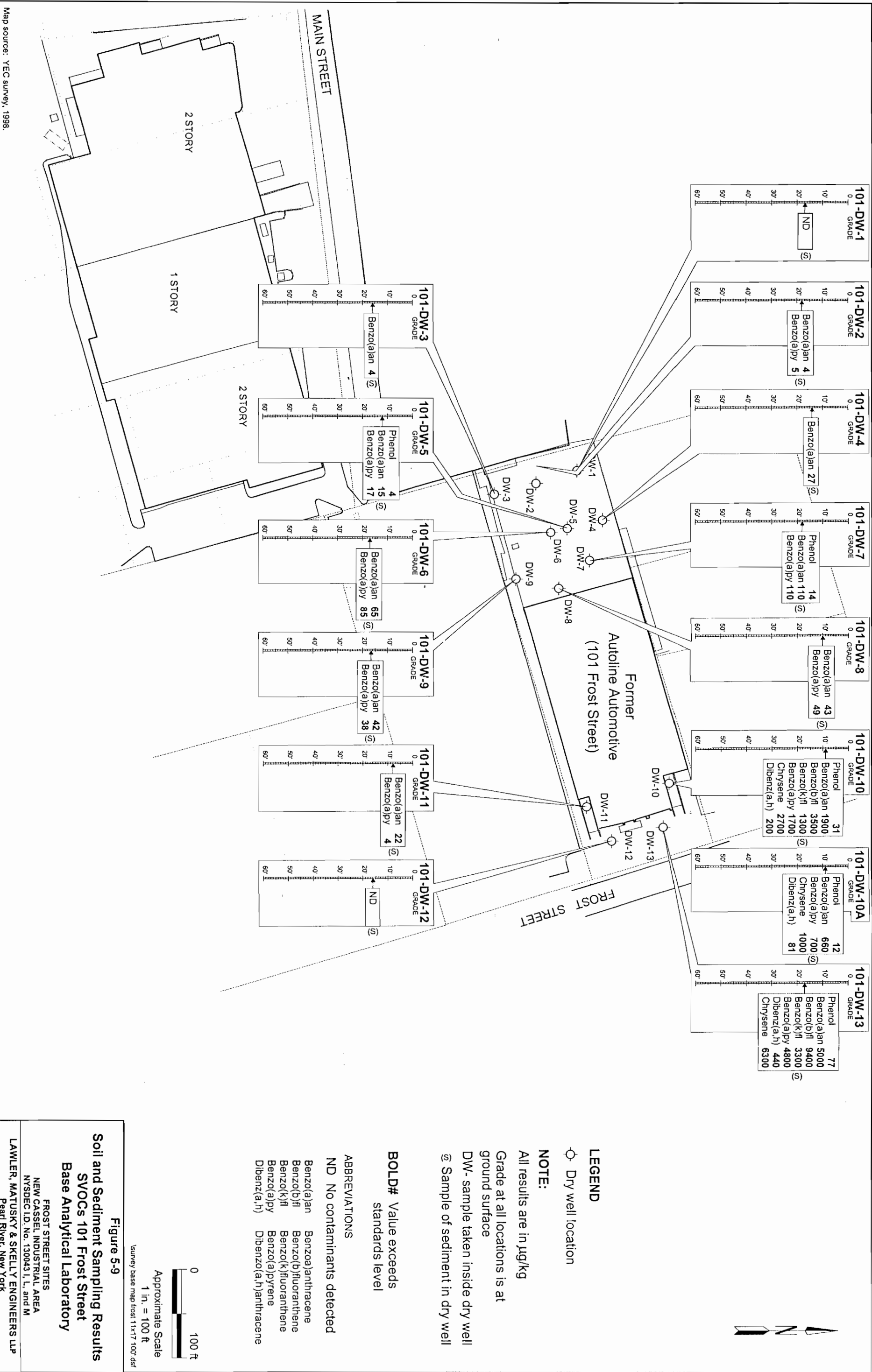
SB - Site background.

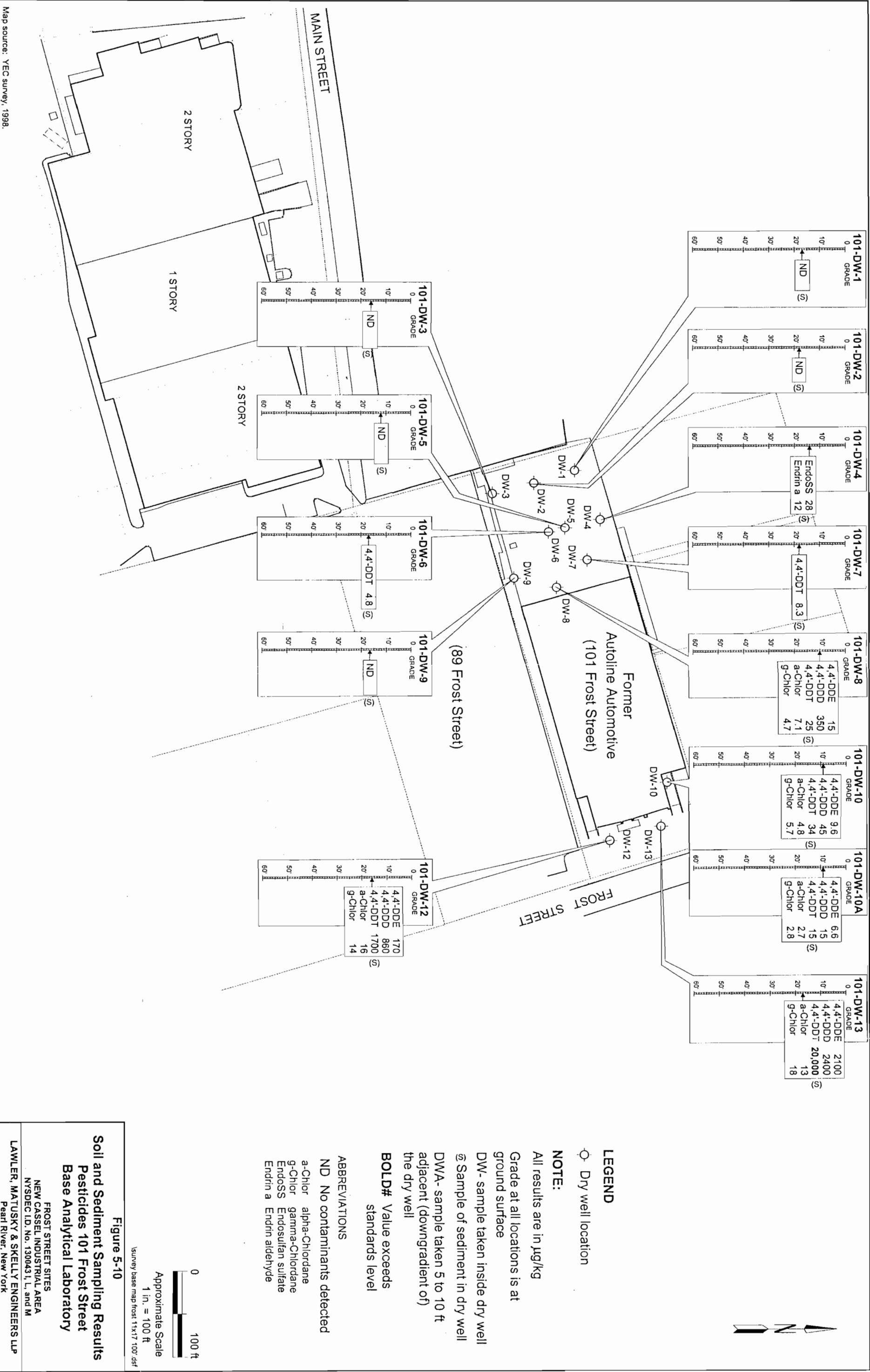
R - Duplicate analysis not within control limits.

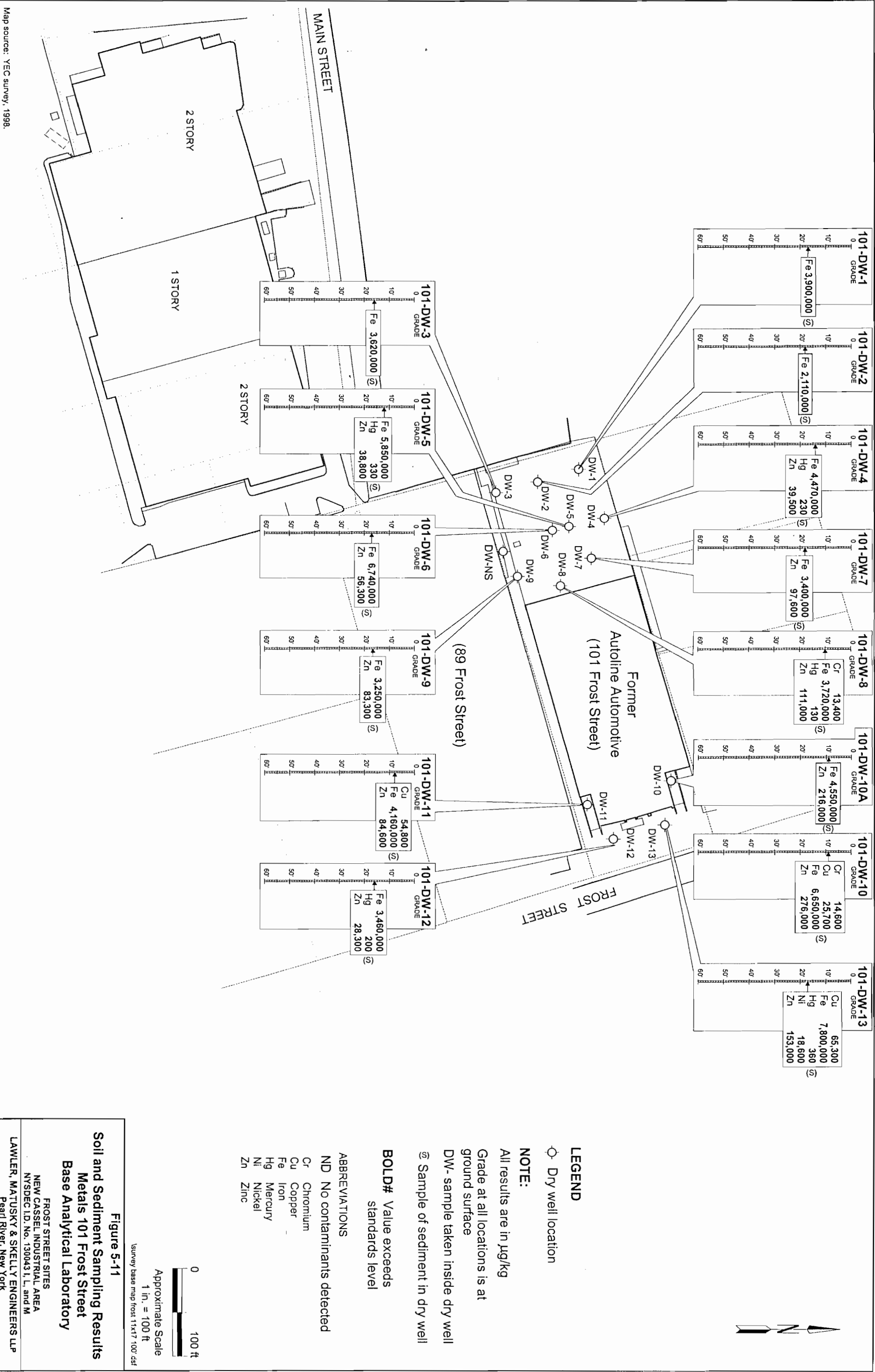
g - Value considered estimated based on data validator's report (Appendix H)

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.









(31 and 12 µg/kg, respectively); benzo(a)an (1900 and 660 µg/kg, respectively); benzo(a)py (1700 and 700 µg/kg, respectively); and dibenz(a,h) (200 and 81 µg/kg, respectively). 101-DW-10A (S) also had benzo(b)fl (3500 µg/kg) and benzo(k)fl (1300 µg/kg) over the cleanup objectives.

Contaminants were ND in five of the 13 samples analyzed for pesticides and PCBs. 101-DW-4 (S) was the only sample to have traces of endosulfansulfate and endrin aldehyde; 101-DW-6 (S) and -7 (S) had only traces of 4,4'-DDT. The other five samples had traces of 4,4'-DDE, 4,4'-DDD, 4,4'-DDT, alpha-chlordane, and gamma-chlordane, except for 101-DW-13 (S), which was over the cleanup objective for 4,4'-DDT, with a concentration of 20,000 µg/kg.

Fourteen sediment samples were submitted for TAL metals plus cyanide analysis. All the samples were over the cleanup objectives for iron; four were also over the cleanup objective for zinc: 101-DW-6 (S) at 56,300 µg/kg; 101-DW-10A (S) at 216,000 µg/kg; 101-DW-7 (S) at 97,600 µg/kg; and 101-DW-9 (S) at 83,300 µg/kg. However, 101-DW-10 (S) also had chromium (14,600 µg/kg) and copper (25,700 µg/kg) at levels exceeding the cleanup objectives. Three samples [101-DW-4 (S), -5 (S), -, and -12 (S)] also had mercury and zinc at the following concentrations (respectively): 230 and 39,500 µg/kg; 330 and 38,800 µg/kg; and 200 and 28,300 µg/kg. 101-DW-11 (S) had copper and zinc exceeding the cleanup objectives at concentrations of 54,800 and 84,600 µg/kg, respectively. The sample from 101-DW-8 (S) exceeded cleanup objectives for chromium (13,400 µg/kg), mercury (130 µg/kg), and zinc (111,000 µg/kg). 101-DW-13 (S) exceeded the cleanup objectives for copper (65,300 µg/kg), mercury (360 µg/kg), nickel (18,600 µg/kg), and zinc (153,000 µg/kg).

89 Frost Street Sediment and Soil Samples. Samples were taken from 25 locations at this site, resulting in a total of 40 samples to be analyzed for VOCs and five samples to be analyzed for SVOCs and TAL metals plus cyanide. Table 5-7 contains a detailed summary of the sampling results, and Figures 5-12 to 5-14 graphically summarize the results of the sampling analysis. One sample [89-DW-10 (S-1)] was not analyzed for VOCs due to a laboratory error. Sixteen of these locations were sediment samples taken from inside dry wells, one of which was sampled twice (DW-11). Soil was sampled

TABLE 5-7 (Page 1 of 11)

SOIL AND SEDIMENT DATA SUMMARY
89 Frost Street
Base Analytical Laboratory

LMS Sample ID	89-DW-1 (S)	89-DW-1 (23-25')	89-DW-2 (S)	89-DW-2 (28-30')	89-DW-3 (S)	89-DW-3 (28-30')	RECOMMENDED
Lab Sample ID	DW-1_S-1	DW-1_23-25	DW-2_S-1	DW-2_28-30	DW-3_S-1	DW-3_28-30	SOIL CLEANUP
Lab Sample Number	71006	71007	71021	71022	71023	71024	OBJECTIVE (a)
Sampling Date	07/10/98	07/10/98	07/11/98	07/11/98	07/11/98	07/11/98	
VOLATILE ORGANIC COMPOUNDS (µg/kg)							
Methylene Chloride	ND	ND	ND	ND	ND	ND	100
Acetone	ND	ND	ND	ND	ND	ND	200
Carbon Disulfide	ND	ND	0.7 j	ND	ND	ND	2,700
1,2-Dichloroethene(total)	ND	ND	ND	ND	ND	ND	300
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	100
2-Butanone	ND	ND	6 j	ND	ND	ND	300
Trichloroethene	ND	ND	ND	ND	ND	ND	700
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	800
4-Methyl-2-Pentanone	ND	ND	ND	ND	ND	ND	1,000
Tetrachloroethene	ND	ND	0.1 j	ND	ND	ND	1,400
Toluene	ND	ND	ND	ND	ND	ND	1,500
Chlorobenzene	ND	ND	ND	ND	ND	ND	1,700
Ethylbenzene	ND	ND	0.1 j	ND	0.2 j	ND	5,500
Xylenes(Total)	ND	ND	0.5 j	0.4 j	0.3 j	ND	1,200

(a) - NYSDEC Technical Administrative Guidance Memorandum, January 1994.

bold - Value exceeds recommended criteria.

b - Found in associated blanks.

j - Estimated concentration; compound present below quantitation limit.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-7 (Page 2 of 11)

SOIL AND SEDIMENT DATA SUMMARY

89 Frost Street

Base Analytical Laboratory

LMS Sample ID	89-DW-4 (S)	89-DW-4 (30-32)	89-DW-5 (25-27)	89-DWA-5 (9-11)	89-DWA-6 (51-53)	89-DW-7 (S)	RECOMMENDED
Lab Sample ID	DW-4 S-1	DW-4 30-32	DW-5 25-27	89-DWA-05	89DWA-18 51-53	DW-6 S-1	SOIL CLEANUP
Lab Sample Number	71025	71026	71027	80579	81444	71029	OBJECTIVE (a)
Sampling Date	07/11/98	07/11/98	07/11/98	8/26/98	9/1/98	07/11/98	
VOLATILE ORGANIC COMPOUNDS (µg/kg)							
Methylene Chloride	ND	ND	ND	ND	ND	ND	100
Acetone	ND	ND	ND	ND	ND	ND	200
Carbon Disulfide	ND	ND	ND	ND	ND	ND	2,700
1,2-Dichloroethene(total)	ND	ND	ND	ND	ND	ND	300
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	100
2-Butanone	ND	ND	ND	5 j	ND	9 j	300
Trichloroethene	ND	ND	ND	ND	ND	ND	700
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	800
4-Methyl-2-Pentanone	ND	ND	ND	ND	ND	ND	1,000
Tetrachloroethene	ND	ND	ND	1 j	ND	ND	1,400
Toluene	ND	ND	ND	0.7 j	ND	0.9 j	1,500
Chlorobenzene	ND	ND	ND	ND	ND	ND	1,700
Ethylbenzene	ND	ND	ND	ND	ND	ND	5,500
Xylenes(Total)	ND	ND	ND	2 j	ND	ND	1,200

(a) - NYSDC Technical Administrative Guidance Memorandum, January 1994.

bold - Value exceeds recommended criteria.**b** - Found in associated blanks.**j** - Estimated concentration; compound present below quantitation limit.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-7 (Page 3 of 11)

SOIL AND SEDIMENT DATA SUMMARY

89 Frost Street

Base Analytical Laboratory

LMS Sample ID	89-DW-7 (19-26")	89-DWA-7 (40-44")	89-DW-8 (S)	89-DW-8 (25-27")	89-DW-9 (S)	89-DW-9 (22-24")	RECOMMENDED
Lab Sample ID	DW-6 19-26	DWA-7 40-44	DW-7 S-1	DW-7 25-27	DW-8 S-1	89-DW-8 22-24	SOIL CLEANUP
Lab Sample Number	71030	76699	71031	71032	71034	71035	OBJECTIVE (a)
Sampling Date	07/11/98	08/10/98	07/12/98	07/12/98	07/12/98	07/12/98	
VOLATILE ORGANIC COMPOUNDS (µg/kg)							
Methylene Chloride	ND	2 j b	ND	ND	ND	ND	100
Acetone	ND	ND	ND	ND	ND	ND	200
Carbon Disulfide	ND	ND	ND	ND	ND	ND	2,700
1,2-Dichloroethene(total)	ND	ND	ND	ND	ND	ND	300
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	100
2-Butanone	ND	ND	ND	ND	14	ND	300
Trichloroethene	ND	ND	ND	ND	ND	ND	700
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	800
4-Methyl-2-Pentanone	ND	ND	ND	ND	ND	ND	1,000
Tetrachloroethene	ND	ND	1 j	0.4 j	0.5 j	ND	1,400
Toluene	0.8 j	ND	ND	ND	0.6 j	ND	1,500
Chlorobenzene	ND	ND	ND	ND	ND	ND	1,700
Ethylbenzene	ND	ND	ND	ND	ND	ND	5,500
Xylenes(Total)	ND	ND	ND	ND	ND	ND	1,200

(a) - NYSDEC Technical Administrative Guidance Memorandum, January 1994.

b - Value exceeds recommended criteria.**j** - Found in associated blanks.**j** - Estimated concentration; compound present below quantitation limit.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-7 (Page 4 of 11)

SOIL AND SEDIMENT DATA SUMMARY

89 Frost Street

Base Analytical Laboratory

LMS Sample ID	89-DW-10 (S)	89-DW-10 (26-28)	89-DW-11 (S-1)	89-DW-11 (S-2)	89-DW-11 (28-32)	89-DW-12 (S)	RECOMMENDED
Lab Sample ID	DW-10_S-1	DW-10_26-28	DW-11_S-1	DW-11_S-2	DW-11_28-32	DW-15_S-1	SOIL CLEANUP
Lab Sample Number	70699	70700	70694	71040	70693	70691	OBJECTIVE (a)
Sampling Date	7/9/98	7/9/98	7/9/98	07/12/98	7/9/98	7/9/98	
[DL:100:1]							
VOLATILE ORGANIC COMPOUNDS (µg/kg)							
Methylene Chloride	1	ND g	ND	ND	ND	ND	100
Acetone	1	ND g	ND	ND	ND	ND	200
Carbon Disulfide	1	ND g	ND	ND	ND	ND	2,700
1,2-Dichloroethene(total)	1	ND g	ND	2 j	ND	ND	300
1,2-Dichloroethane	1	ND g	ND	ND	ND	ND	100
2-Butanone	1	ND g	ND	21	ND	ND	300
Trichloroethene	1	800 jd	6 j	2 j	1,600 jd	ND	700
1,1,1-Trichloroethane	1	ND g	ND	ND	ND	ND	800
4-Methyl-2-Pentanone	1	ND g	ND	ND	ND	ND	1,000
Tetrachloroethene	1	450 jd	11 j	1 j	47,000 d	0.6 j	1,400
Toluene	1	140 jd	1 j	8 j	ND	1 j	1,500
Chlorobenzene	1	ND g	1 j	ND	ND	ND	1,700
Ethylbenzene	1	59 jd	0.3 j	ND	ND	0.7 j	5,500
Xylenes(Total)	1	ND g	1 j	ND	ND	ND	1,200
[DL:1000:1]							

(a) - NYSDC Technical Administrative Guidance Memorandum, January 1994.

bold - Value exceeds recommended criteria.

b - Found in associated blanks.

j - Estimated concentration; compound present below quantitation limit.

ND - Not detected at analytical detection limit.

1 - Due to laboratory error, there are no VOC results for this sample. See Appendix G.

g - Value considered estimated based on data validator's report (Appendix H).

DL - Diluted sample analysis.

d - Concentration recovered from diluted sample.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-7 (Page 5 of 11)

SOIL AND SEDIMENT DATA SUMMARY

89 Frost Street
Base Analytical Laboratory

LMS Sample ID	89-DW-12 (26-28')	89-DW-13 (S)	89-DW-13 (24-26')	89-DWA-13 (51-53')	89-DW-14 (S)	89-DW-14 (24-26')	RECOMMENDED
Lab Sample ID	DW-15_26-28	SMH-W_S-1	SMH-W_24-26	89-DWA-SMH-W	SMH-E_S-1	SMH-E_24-26	SOIL CLEANUP
Lab Sample Number	70692	71000	71001	80578	71002	71003	OBJECTIVE (a)
Sampling Date	7/9/98	7/10/98	7/10/98	8/25/98	7/10/98	7/10/98	
VOLATILE ORGANIC COMPOUNDS (µg/kg)							
Methylene Chloride	ND	ND	ND	ND	ND	ND	100
Acetone	ND	ND	ND	ND	ND	ND	200
Carbon Disulfide	ND	ND	ND	ND	ND	ND	2,700
1,2-Dichloroethene(total)	ND	ND	ND	ND	ND	ND	300
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	100
2-Butanone	ND	ND	ND	ND	ND	ND	300
Trichloroethene	ND	1 j	ND	ND	ND	ND	700
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	800
4-Methyl-2-Pentanone	ND	ND	ND	ND	ND	ND	1,000
Tetrachloroethene	ND	48	160	60	8 j	170	1,400
Toluene	ND	0.6 j	0.7 j	ND	0.5 j	1 j	1,500
Chlorobenzene	ND	ND	ND	ND	ND	ND	1,700
Ethylbenzene	ND	ND	ND	ND	ND	ND	5,500
Xylenes(Total)	ND	ND	ND	ND	ND	ND	1,200

(a) - NYSDCE Technical Administrative Guidance Memorandum, January 1994.

b - Value exceeds recommended criteria.

j - Found in associated blanks.

j - Estimated concentration; compound present below quantitation limit.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-7 (Page 6 of 11)

SOIL AND SEDIMENT DATA SUMMARY

89 Frost Street

Base Analytical Laboratory

LMS Sample ID	89-DWA-14 (51-53')	89-DW-15 (S)	89-DW-15 (27-31')	89-DWA-15 (31-33')	89-DW-15 (SWA)	89-DW-15 (SWB)	RECOMMENDED
Lab Sample ID	89-DWA-SMHE	DW-16_S-1	DW-16_27-31	89DWA-16_31-33	DW-16_SWA	DW-16_SWB	SOIL CLEANUP
Lab Sample Number	80580	70696	70695	81701	71804	71805	OBJECTIVE (a)
Sampling Date	8/26/98	7/9/98	7/9/98	9/2/98	07/15/98	07/15/98	
VOLATILE ORGANIC COMPOUNDS (µg/kg)							
Methylene Chloride	ND	ND	ND	ND	ND	ND	100
Acetone	ND	ND	ND	ND	ND	ND	200
Carbon Disulfide	ND	0.9 j	ND	ND	ND	ND	2,700
1,2-Dichloroethene (total)	ND	2 j	ND	ND	ND	ND	300
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	100
2-Butanone	ND	18	ND	ND	ND	ND	300
Trichloroethene	ND	0.7 jg	ND	ND	ND	ND	700
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	800
4-Methyl-2-Pentanone	ND	ND g	ND	ND	ND	ND	1,000
Tetrachloroethene	2,400	1 jg	0.3 j	ND	ND	ND	1,400
Toluene	ND	1 jg	ND	ND	ND	ND	1,500
Chlorobenzene	ND	2 jg	ND	ND	ND	ND	1,700
Ethylbenzene	ND	0.4 jg	ND	ND	ND	ND	5,500
Xylenes (Total)	ND	2 jg	0.5 j	ND	ND	ND	1,200

(a) - NYSDEC Technical Administrative Guidance Memorandum, January 1994.

bold - Value exceeds recommended criteria.**b** - Found in associated blanks.**j** - Estimated concentration; compound present below quantitation limit.**ND** - Not detected at analytical detection limit.**g** - Value considered estimated based on data validator's report (Appendix H).

Note LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-7 (Page 7 of 11)

SOIL AND SEDIMENT DATA SUMMARY
89 Frost Street
Base Analytical Laboratory

LMS Sample ID	89-DW-16 (S)	89-DW-16 (29-31')	89-DW-17 (S)	89-DW-17 (21-23')	Field_Blank	RECOMMENDED
Lab Sample ID	89-DW-12 S-1	DW-12_29-31	DW-14_S-1	DW-14_21-23	Field_Blank	SOIL CLEANUP
Lab Sample Number	70698	70697	71004	71005	71010	OBJECTIVE (a)
Sampling Date	7/8/98	7/8/98	7/10/98	7/10/98	07/10/98	
VOLATILE ORGANIC COMPOUNDS (µg/kg)						
Methylene Chloride	ND	ND	ND	ND	ND	100
Acetone	ND	ND	ND	ND	ND	200
Carbon Disulfide	ND	ND	ND	ND	ND	2,700
1,2-Dichloroethene(total)	0.3 j	ND	ND	ND	ND	300
1,2-Dichloroethane	ND	ND	ND	ND	ND	100
2-Butanone	5 j	ND	ND	ND	ND	300
Trichloroethene	0.3 j	ND	ND	ND	ND	700
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	800
4-Methyl-2-Pentanone	2 j	ND	ND	ND	ND	1,000
Tetrachloroethene	0.4 j	1 j	1 j	ND	ND	1,400
Toluene	3 j	ND	ND	ND	ND	1,500
Chlorobenzene	ND	ND	ND	ND	ND	1,700
Ethylbenzene	0.2 j	ND	ND	ND	ND	5,500
Xylenes(Total)	1 j	ND	ND	ND	ND	1,200

(a) - NYSDEC Technical Administrative Guidance Memorandum, January 1994.

bold - Value exceeds recommended criteria.**b** - Found in associated blanks.**j** - Estimated concentration; compound present below quantitation limit.**ND** - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

SOIL AND SEDIMENT DATA SUMMARY

89 Frost Street

Base Analytical Laboratory

LMS Sample ID	89-DW-10 (S)	89-DW-11 (S-2)	89-DW-12 (S)	RECOMMENDED
Lab Sample ID	DW-10_S-1	DW-11_S-2	DW-12_S-1	SOIL CLEANUP
Lab Sample Number	70699	71040	70691	OBJECTIVE (a)
Sampling Date	7/9/98	7/12/98	7/9/98	
SEMIVOLATILE ORGANIC COMPOUNDS (µg/kg)				
Phenol	ND	1000 j	ND	30 or MDL
1,4-Dichlorobenzene	ND	2600 j	ND	N/A
4-Methylphenol	ND	ND	ND	900
1,2,4-Trichlorobenzene	150 j	ND	ND	N/A
Naphthalene	ND	ND	ND	13000
2-Methylnaphthalene	ND	ND	ND	36400
Acenaphthylene	ND	ND	ND	41000
3-Nitroaniline	ND	ND	ND	500 or MDL
Acenaphthene	ND	ND	ND	50000***
4-Nitrophenol	ND	ND g	ND g	100 or MDL
Dibenzofuran	ND	ND	ND	6200
Fluorene	ND	ND	ND	50000***
Phenanthrene	990 j	1300 j	740 j	50000***
Anthracene	160 j	ND	ND	50000***
Carbazole	ND	ND	ND	N/A
Di-n-butylphthalate	ND	ND	ND	8100
Fluoranthene	2200 j	2400 j	1200 j	50000***
Pyrene	1500 j	2100 j	950 j	50000***
Butylbenzylphthalate	ND	ND	ND	50000***
Benzo(a)anthracene	760 j	1100 j	520 j	224 or MDL
Chrysene	1200 j	1200 j	780 j	400***
bis(2-Ethylhexyl)phthalate	5100 j	9800 j	8400 j	50000***
Di-n-octylphthalate	ND	ND	ND	50000***
Benzo(b)fluoranthene	1900 j	1900 j	1100 j	1100
Benzo(k)fluoranthene	820 j	ND	430 j	1100
Benzo(a)pyrene	1000 j	770 j	540 j	61 or MDL
Indeno(1,2,3-cd)pyrene	600 j	ND	410 j	3200
Dibenzo(a,h)anthracene	ND	ND	ND	14 or MDL
Benzo(g,h,i)perylene	520 j	ND	440 j	50000***

*** - As per TAGM #4046, Total VOCs < 10,000 ppb, Total SVOCs < 500,000 ppb, and individual SVOCs < 50,000 ppb.

æ - New York State background concentration.

(a) - NYSDEC Technical Administrative Guidance Memorandum, January 1994.

bold - Value exceeds recommended criteria.

j - Estimated concentration; compound present below quantitation limit.

DL - Diluted sample analysis.

MDL - Method detection limit.

N/A - Not applicable.

ND - Not detected at analytical detection limit.

g - Value considered estimated based on data validator's report (Appendix H).

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys.

The Lab Sample ID is the field sample designation.

SOIL AND SEDIMENT DATA SUMMARY

89 Frost Street

Base Analytical Laboratory

LMS Sample ID	89-DW-15 (SWA)	89-DW-15 (SWB)	Field_Blank	RECOMMENDED
Lab Sample ID	DW-16_SWA	DW-16_SWB	Field_Blank	SOIL CLEANUP
Lab Sample Number	71804	71805	71010	OBJECTIVE (a)
Sampling Date	7/15/98	7/15/98	07/10/98	
SEMIVOLATILE ORGANIC COMPOUNDS (µg/kg)				
Phenol	21 j	38 j	11	30 or MDL
1,4-Dichlorobenzene	ND	ND	11	N/A
4-Methylphenol	ND	ND	11	900
1,2,4-Trichlorobenzene	ND	ND	11	N/A
Naphthalene	ND	ND	11	13000
2-Methylnaphthalene	ND	ND	11	36400
Acenaphthylene	ND	ND	11	41000
3-Nitroaniline	ND	ND	11	500 or MDL
Acenaphthene	ND	ND	11	50000***
4-Nitrophenol	ND	ND	27	100 or MDL
Dibenzofuran	ND	ND	11	6200
Fluorene	ND	ND	11	50000***
Phenanthrene	ND	ND	11	50000***
Anthracene	ND	ND	11	50000***
Carbazole	ND	ND	11	N/A
Di-n-butylphthalate	ND	ND	11	8100
Fluoranthene	ND	ND	11	50000***
Pyrene	ND	ND	11	50000***
Butylbenzylphthalate	ND	ND	11	50000***
Benzo(a)anthracene	ND	ND	11	224 or MDL
Chrysene	ND	ND	11	400***
bis(2-Ethylhexyl)phthalate	ND	ND	11	50000***
Di-n-octylphthalate	ND	ND	11	50000***
Benzo(b)fluoranthene	ND	ND	11	1100
Benzo(k)fluoranthene	ND	ND	11	1100
Benzo(a)pyrene	ND	ND	11	61 or MDL
Indeno(1,2,3-cd)pyrene	ND	ND	11	3200
Dibenzo(a,h)anthracene	ND	ND	11	14 or MDL
Benzo(g,h,i)perylene	ND	ND	11	50000***

*** - As per TAGM #4046, Total VOCs < 10,000 ppb, Total SVOCs < 500,000 ppb, and individual SVOCs < 50,000 ppb.

æ - New York State background concentration.

(a) - NYSDEC Technical Administrative Guidance Memorandum, January 1994.

bold - Value exceeds recommended criteria.

j - Estimated concentration; compound present below quantitation limit.

DL - Diluted sample analysis.

MDL - Method detection limit.

N/A - Not applicable.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys.

The Lab Sample ID is the field sample designation.

SOIL AND SEDIMENT DATA SUMMARY

89 Frost Street

Base Analytical Laboratory

LMS Sample ID	89-DW-10 (S)	89-DW-11 (S-2)	89-DW-12 (S)	RECOMMENDED	EASTERN USA
Lab Sample ID	89-DW-10_S-1	DW-11_S-2	89-DW-15_S-1	SOIL CLEANUP	BACKGROUND SOIL
Lab Sample Number	70699	71040	70691	OBJECTIVE (a)	CONCENTRATIONS (a)
Sampling Date	7/9/98	7/12/98	7/9/98		
METALS (µg/kg)					
Aluminum	3,940,000 R	3,920,000 gR	5,070,000 R	SB	33,000,000
Antimony	ND N	203,000 BgN	1,700 BN	SB	600 - 10,000 (n)
Arsenic	2,000 B	1,300 B	2,800	7,500 or SB	3,000 - 12,000 æ
Barium	42,900 B	42,900 B	46,200 B	300,000 or SB	15,000 - 600,000
Beryllium	ND	ND	ND	160 or SB	0 - 1,750
Cadmium	1,000 B	1,300 B	3,400	1,000 or SB	100 - 1,000
Calcium	3,590,000	2,540,000	3,980,000	SB	130,000 - 35,000,000 æ
Chromium	21,300 R	18,900 gR	33,300 R	10,000 or SB	1,500 - 40,000 æ
Cobalt	4,900 B	4,100 B	6,500 B	30,000 or SB	2,500 - 60,000 æ
Copper	73,700 R	85,200 gR	141,000 R	25,000 or SB	1,000 - 50,000
Iron	9,690,000	8,360,000	12,500,000	2,000,000 or SB	2,000,000 - 550,000,000
Lead	239,000 g	146,000 g	364,000 gR	SB*	200,000 - 500,000*
Magnesium	2,460,000	1,590,000	3,110,000	SB	100,000 - 5,000,000
Manganese	64,500	55,300	69,200	SB	50,000 - 5,000,000
Mercury	430 g	90 Bg	210 g	100	1 - 200
Nickel	13,700	12,900	25,000	13,000 or SB	500 - 25,000
Potassium	251,000 B	309,000 B	286,000 B	SB	8,500,000 - 43,000,000 æ
Selenium	ND	ND	ND	2,000 or SB	100 - 3,900
Silver	ND	430 B	500 B	SB	100 - 5,000 (n)
Sodium	190,000 B	281,000 B	235,000 B	SB	6,000,000 - 8,000,000
Thallium	ND	ND	ND	SB	100 - 800 (q)
Vanadium	34,900	32,900	46,400	150,000 or SB	1,000 - 300,000
Zinc	222,000 NR	446,000 gNR	509,000 NR	20,000 or SB	9,000 - 50,000
Cyanide	ND N	ND gN	ND N	**	N/A

* - Background levels for lead range from 4,000 - 61,000 ppb in undeveloped, rural areas to 200,000 - 500,000 ppb in metropolitan or suburban areas or near highways.

æ - New York State background concentration.

(n) - Dragun, J., The Soil Chemistry of Hazardous Materials.

bold - Value exceeds recommended criteria.

B - Value is less than the contract-required detection limit but greater than the instrument detection limit.

MDL - Method detection limit.

N/A - Not applicable.

ND - Not detected at analytical detection limit.

SB - Site background.

N - Spiked sample recovery is not within control limits.

R - Duplicate analysis not within control limits.

g - Value considered estimated based on data validator's report (Appendix H)

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys.

The Lab Sample ID is the field sample designation.

SOIL AND SEDIMENT DATA SUMMARY

89 Frost Street

Base Analytical Laboratory

LMS Sample ID	89-DW-15 (SWA)	89-DW-15 (SWB)	Field_Blank	RECOMMENDED	EASTERN USA
Lab Sample ID	DW-16-SWA	DW-16-SWB	Field_Blank	SOIL CLEANUP	BACKGROUND SOIL
Lab Sample Number	71804	71805	71010	OBJECTIVE (a)	CONCENTRATIONS (a)
Sampling Date	7/15/98	07/15/98	07/10/98		
METALS (µg/kg)					
Aluminum	1,250,000 R	1,140,000 R	86,900 R	SB	33,000,000
Antimony	ND N	ND N	5,400 N	SB	600 - 10,000 (n)
Arsenic	ND	ND	3,500	7,500 or SB	3,000 - 12,000 æ
Barium	6,000 B	5,900 B	2,600	300,000 or SB	15,000 - 600,000
Beryllium	ND	ND	500	160 or SB	0 - 1,750
Cadmium	ND	ND	800	1,000 or SB	100 - 1,000
Calcium	105,000 B	109,000 B	44,900	SB	130,000 - 35,000,000 æ
Chromium	2,700 R	1,600 BR	1,700 R	10,000 or SB	1,500 - 40,000 æ
Cobalt	900 B	690	1,500	30,000 or SB	2,500 - 60,000 æ
Copper	1,900 BR	2,000 BR	5,000 R	25,000 or SB	1,000 - 50,000
Iron	3,100,000	2,760,000	80,700	2,000,000 or SB	2,000,000 - 550,000,000
Lead	2,200 gR	3,700 gR	2,900 R	SB*	200,000 - 500,000*
Magnesium	240,000 B	217,000 B	41,800	SB	100,000 - 5,000,000
Manganese	56,200	47,200	1,600	SB	50,000 - 5,000,000
Mercury	60 Bg	ND	100	100	1 - 200
Nickel	2,600 B	1,200 B	1,800	13,000 or SB	500 - 25,000
Potassium	129,000 B	141,000 B	236,000	SB	8,500,000 - 43,000,000 æ
Selenium	ND	ND	4,700	2,000 or SB	100 - 3,900
Silver	ND	ND	1,200	SB	100 - 5,000 (n)
Sodium	ND	ND	567,000	SB	6,000,000 - 8,000,000
Thallium	ND	ND	4,100	SB	100 - 800 (q)
Vanadium	2,800 B	3,000 B	2,800	150,000 or SB	1,000 - 300,000
Zinc	6,600 NR	7,500 NR	5,800	20,000 or SB	9,000 - 50,000
Cyanide	ND N	ND N	10,000	**	N/A

* - Background levels for lead range from 4,000 - 61,000 ppb in undeveloped, rural areas to 200,000 - 500,000 ppb in metropolitan or suburban areas or near highways.

æ - New York State background concentration.

(n) - Dragun, J., The Soil Chemistry of Hazardous Materials.

bold - Value exceeds recommended criteria.

B - Value is less than the contract-required detection limit but greater than the instrument detection limit.

MDL - Method detection limit.

N/A - Not applicable.

ND - Not detected at analytical detection limit.

SB - Site background.

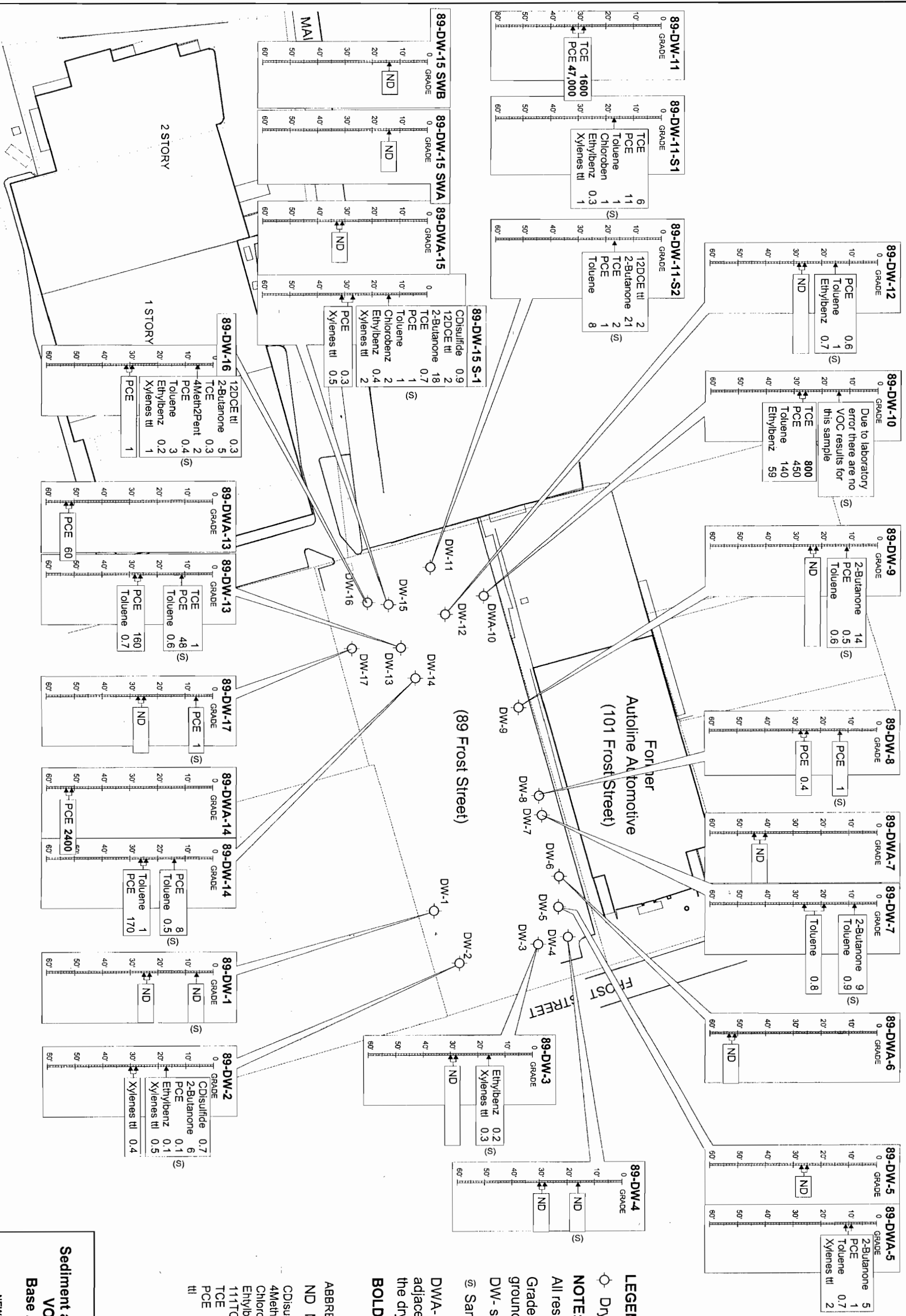
N - Spiked sample recovery is not within control limits.

R - Duplicate analysis not within control limits.

g - Value considered estimated based on data validator's report (Appendix H).

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys.

The Lab Sample ID is the field sample designation.



LEGEND

 Dry well location

NOTE:

All results are in $\mu\text{g/kg}$
Grade at all locations is at
ground surface

DW- sample taken inside dry well

DWA- sample taken 5 to 10 ft adjacent (downgradient of) the dry well

BOLD# Value exceeds standards level

ABBREVIATIONS

ND No contaminants detected

CDisulfide Carbon Disulfide

4-Methyl-2-Pentanone

Chloroben	Chlorobenzene
Ethylbenz	Ethylbenzene

111TCA 1,1,1-Trichloroethane

Trichloroethene
TCE
DCE

1,4-tetrachlorobenzene

1

2

Approximate

1 in. = 10
approximate

Survey base map from 11

Figure 5-12

diment and Soil Sampling Re

VOCs 89 Frost Street

Base Analytical Laboratory

FROST STREET SITES

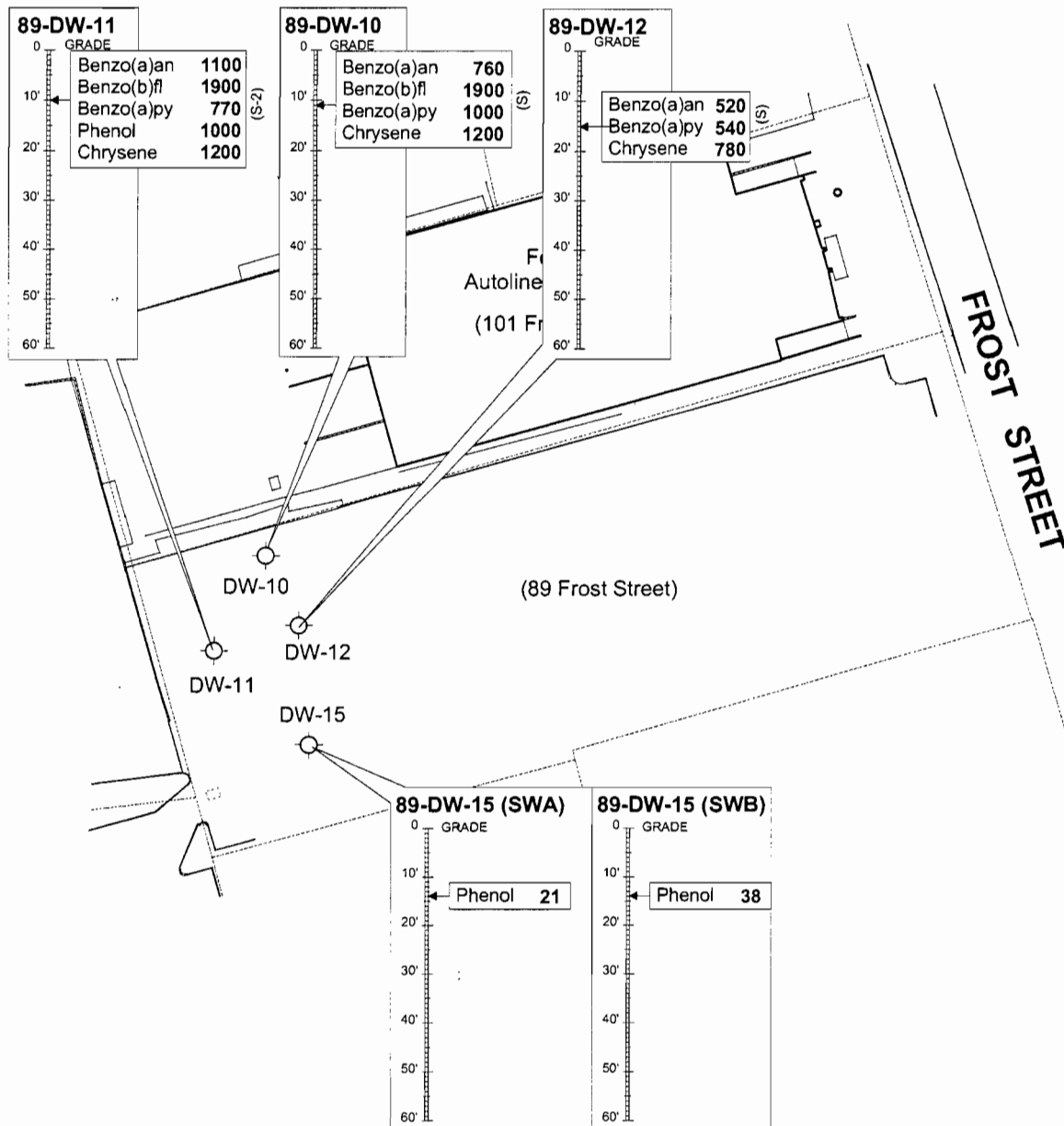
NEW CASSELL INDUSTRIAL AREA
NYSDEC I.D. No. 130043 I.L. and M

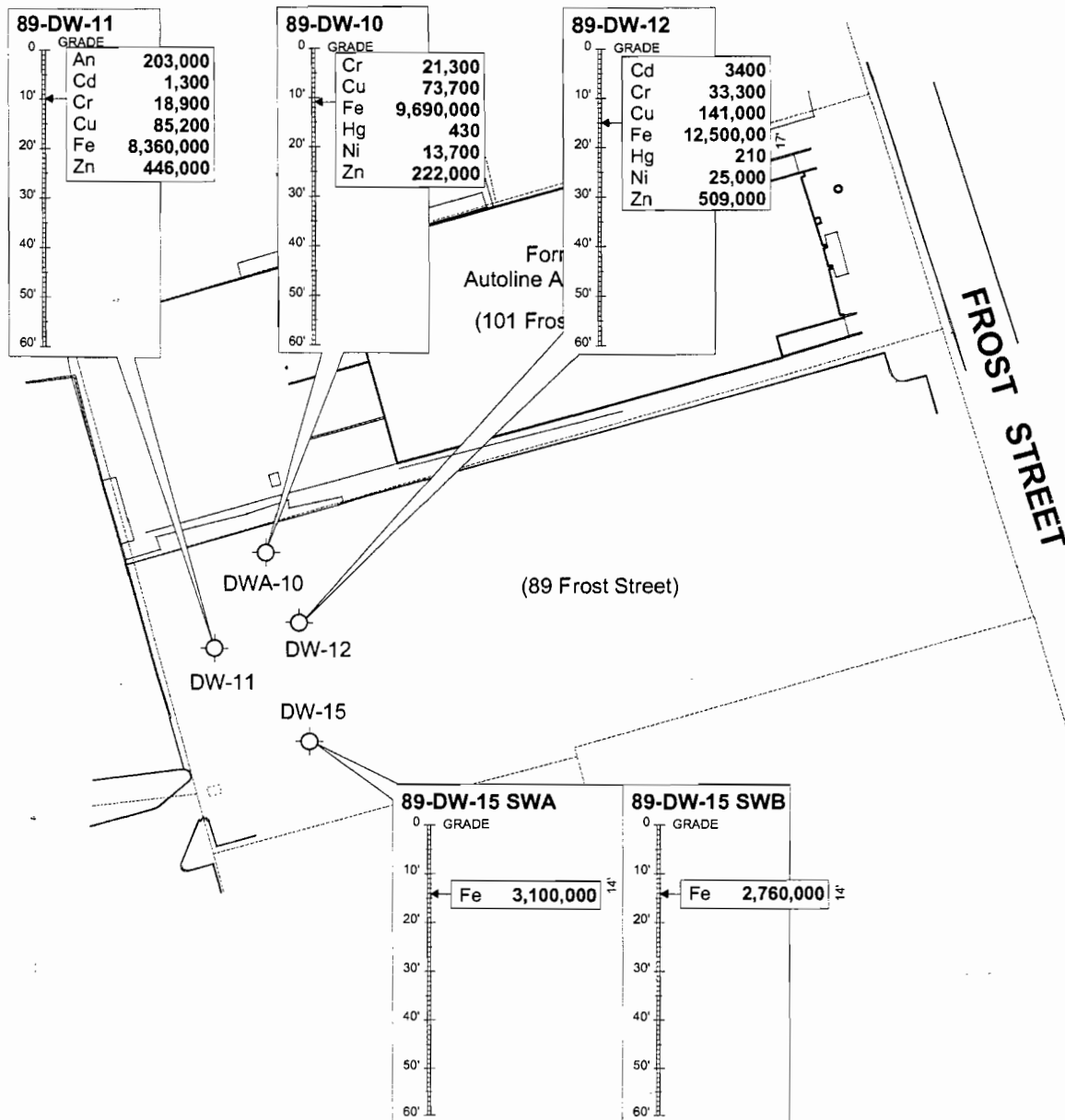
AWLER, MATUSKY & SKELLY ENGINEERS

AWLER, MATUSKY & SKELLY ENGINEERS
Pearl River, New York

Pearl River, New York

Map source: YEC survey, 1998.





LEGEND

○ Dry well location

NOTE:

All results are in µg/kg

Grade at all locations is at ground surface

DW- sample taken inside drywell

BOLD# Value exceeds standards level

ABBREVIATIONS

ND No contaminants detected

An Antimony
Cd Cadmium
Cr Chromium
Cu Copper
Fe Iron
Hg Mercury
Ni Nickel
Zn Zinc

note - also check depths & fig no on the other 5-8 for Svocs

Approximate Scale
1 in. = 100 ft

survey base map frost only 100'.dsf

Figure 5-14 Sediment and Soil Sampling Results Metals 89 Frost Street Base Analytical Laboratory

FROST STREET SITES
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043 I, L, and M

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

below 16 dry wells and adjacent to six dry wells. Soil was also sampled from two sidewalls of one dry well that was removed.

Fourteen samples were ND for all VOCs, including two sediment samples and the two sidewall samples. The rest of the sediment and soil samples, except for 89-DW-10 (26-28 ft), 89-DW-11 (28-32 ft), and 89-DWA-14 (51-53 ft) had trace amounts (less than the recommended soil cleanup objectives), or were ND for any of the other compounds analyzed for. Approximately 10 ft below the bottom of 89-DW-11, from 28-32 ft, TCE was found at 1600 µg/kg, while PCE was 47,000 µg/kg. 89-DW-10 (26-28 ft) had 800 µg/kg of TCE, and traces of PCE, toluene, and ethylbenzene; 89-DWA-14 (51-53 ft) had 2400 µg/kg of PCE alone.

The sediment sample for 89-DW-10 (S) had the following compounds in concentrations above the recommended soil cleanup objectives for SVOCs and metals: benzo(a)an (760 µg/kg); benzo(b)fl (1900 µg/kg); benzo(a)py (1000 µg/kg); chromium (21,300 µg/kg); copper (73,700 µg/kg); iron (9,690,000 µg/kg); mercury (430 µg/kg); nickel (13,700 µg/kg); and zinc (222,000 µg/kg).

The sediment sample for 89-DW-11 (S-2) had the following compounds in concentrations above the recommended soil cleanup objectives for SVOCs and metals: benzo(a)an (1100 µg/kg); benzo(b)fl (1900 µg/kg); benzo(a)py (770 µg/kg); antimony (203,000 µg/kg); cadmium (1300 µg/kg); chromium (18,900 µg/kg); copper (85,200 µg/kg); iron (8,360,000 µg/kg); and zinc (446,000 µg/kg).

The sediment sample for 89-DW-12 (S1) had the following compounds above the recommended soil cleanup objectives for SVOCs and metals: benzo(a)an (520 µg/kg); benzo(a)py (540 µg/kg); cadmium (3400 µg/kg); chromium (33,300 µg/kg); copper (141,000 µg/kg); iron (12,500,000 µg/kg); mercury (210 µg/kg); nickel (25,000 µg/kg); and zinc (509,000 µg/kg).

The only SVOC above the cleanup objective to appear in the two sidewall samples was phenol at 21 µg/kg in 89-DW-15 (SWA) and 38 µg/kg in 89-DW-15 (SWB). The only metal that was over the cleanup objective was iron, which showed up in concentrations of

3,100,000 and 2,760,000 µg/kg at 89-DW-15 (SWA) and 89-DW-15 (SWB), respectively.

5.2.3 Groundwater Sampling Data

The groundwater samples consist of water samples taken from in, below, and adjacent to the dry wells (samples titled Street#-DW-#-SW, Street#-DW-##, and Street#-DWA-##, respectively), as well as additional probes (FSGP-#) and hydropunches (FSHP-#). The hydropunch information was used only in the field for use in placement of monitoring wells.

5.2.3.1 Mobile Laboratory Results. The target compounds for this investigation were 1,1-DCE, trans-1,2-DCE, 1,1-DCA, cis-1,2-DCE, 1,1,1-TCA, 1,2-DCA, TCE, and PCE. On 24 August 1998 benzene, toluene, ethylbenzene, o-xylene, and m&p-xylenes were added to the analysis.

101 Frost Street Groundwater Samples. A total of 40 groundwater samples were taken from 15 locations at this site. Six locations were the standing water inside the dry wells [101-DW-# (SW)], five locations were adjacent to dry wells (101-DWA-#), two were additional probe locations (FSGP-#), and two were hydropunches (FSHP-#). A detailed summary of VOC sampling results is presented on Table 5-8 and Figure 5-15 graphically summarizes the results of the sampling analysis.

Contaminants were ND in one surface water sample; traces of PCE were detected in the other two surface water samples (Table 5-9). PCE was found in trace concentrations in 13 samples. It was found above the NYSDEC Class GA standard in 101-DWA-8 in the deep sample (93-94 ft) at a concentration of 5.69 µg/l, and in the two samples at 101-DWA-N/S in concentrations of 19.6 µg/l in the 63-64 ft sample and 83.4 µg/l in the 79-80 ft sample.

The intermediate sample (79-80 ft) at 101-DWA-N/S exceeded the NYSDEC Class GA groundwater standard for TCE with a concentration of 5.67 µg/l. Traces of TCE were also found in nine other samples.

TABLE 5-8 (Page 1 of 6)

GROUNDWATER DATA SUMMARY

101 Frost Street

Mobile Laboratory

LMS Sample ID	101-DWA-1 (63-64')	101-DWA-1 (79-80')	101-DWA-1 (94-95')	101-DWA-4 (63-64')	NYSDEC CLASS GA
Lab Sample ID	DWA-1_63-64'	DWA-1_79-80'	DWA-1_94-95'	DWA-4_63-64'	STANDARDS (b)
VOLATILE ORGANIC COMPOUNDS (µg/l)					
1,1-Dichloroethene	ND	ND	ND	ND	5
trans-1,2-Dichloroethene	ND	ND	ND	ND	5
1,1-Dichloroethane	ND	ND	ND	ND	5
cis-1,2-Dichloroethene	ND	ND	ND	ND	5
1,1,1-Trichloroethane	11.5 e	9.51	0.99	5.68	5
1,2-Dichloroethane	ND	ND	ND	ND	0.6
Trichloroethene	ND	0.43	ND	0.35	5
Tetrachloroethene	2.68	0.33	0.65	0.36	5
Benzene	♦	♦	♦	ND	1
Toluene	♦	♦	♦	ND	5
Ethylbenzene	♦	♦	♦	ND	5
o-Xylene	♦	♦	♦	ND	5
m&p-Xylenes	♦	♦	♦	ND	5

♦ - Not analyzed.

bold - Value exceeds recommended criteria.

(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

DL - Diluted sample analysis.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-8 (Page 2 of 6)

GROUNDWATER DATA SUMMARY

101 Frost Street
Mobile Laboratory

LMS Sample ID	101-DWA-4 (79-80')	101-DWA-4 (92-93')	101-DWA-6 (63-64')	101-DWA-6 (79-80')	101-DWA-6 (93-94')	NYSDEC CLASS GA
Lab Sample ID	DWA-4_79-80'	DWA-4_92-93'	DWA-6_63-64'	DWA-6_79-80'	DWA-6_93-94'	STANDARDS (b)
VOLATILE ORGANIC COMPOUNDS (µg/l)						
1,1-Dichloroethene	ND	ND	ND	ND	ND	5
trans-1,2-Dichloroethene	ND	ND	ND	ND	ND	5
1,1-Dichloroethane	ND	ND	ND	ND	ND	5
cis-1,2-Dichloroethene	ND	ND	ND	ND	ND	5
1,1,1-Trichloroethane	1.9	5.43 e	26.3 e	12.1 e	0.75	5
1,2-Dichloroethane	ND	ND	ND	ND	ND	0.6
Trichloroethene	ND	1.26	ND	0.89	3.2	5
Tetrachloroethene	0.31	1.09	0.56	0.59	ND	5
Benzene	ND	ND	ND	ND	ND	1
Toluene	ND	ND	ND	ND	ND	5
Ethylbenzene	ND	ND	ND	ND	ND	5
o-Xylene	ND	ND	ND	ND	ND	5
m&p-Xylenes	ND	ND	ND	ND	ND	5

♦ - Not analyzed.

bold - Value exceeds recommended criteria.

(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

DL - Diluted sample analysis.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-8 (Page 3 of 6)

GROUNDWATER DATA SUMMARY

101 Frost Street

Mobile Laboratory

LMS Sample ID	101-DWA-8 (83-84')	101-DWA-8 (79-80')	101-DWA-8 (93-94')	NYSDEC CLASS GA
Lab Sample ID	DWA-8_83-84'	DWA-8_79-80'	DWA-8_93-94'	STANDARDS (b)
VOLATILE ORGANIC COMPOUNDS (µg/l)				
1,1-Dichloroethene	ND	ND	ND	5
trans-1,2-Dichloroethene	ND	ND	ND	5
1,1-Dichloroethane	ND	ND	ND	5
cis-1,2-Dichloroethene	ND	ND	ND	5
1,1,1-Trichloroethane	6.92 e	19.1 e	ND	5
1,2-Dichloroethane	ND	ND	ND	0.6
Trichloroethene	1.04	4.45	ND	5
Tetrachloroethene	1.21	2.76	5.69 e	5
Benzene	ND	ND	ND	1
Toluene	ND	ND	ND	5
Ethylbenzene	ND	ND	ND	5
o-Xylene	ND	ND	ND	5
m&p-Xylenes	ND	ND	ND	5

♦ - Not analyzed.

bold - Value exceeds recommended criteria.

(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

DL - Diluted sample analysis.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample

TABLE 5-8 (Page 4 of 6)

GROUNDWATER DATA SUMMARY

101 Frost Street

Mobile Laboratory

LMS Sample ID	101-DWA-N/S (63-64')	101-DWA-N/S (79-80')	101-DWA-N/S (94-95')	FSGP-3 (60-65')	FSGP-3 (73-78')	FSGP-3 (92')	FSGP-4 (60-65')	CLASS GA
Lab Sample ID	DWA-9_63-64'	DWA-9_79-80'	DWA-9_94-95'	FSGP-3_60-65'	FSGP-3_73-78'	FSGP-3_92'	FSGP-4_60-65'	STANDARDS (b)
VOLATILE ORGANIC COMPOUNDS (µg/l)								
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	5
trans-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	5
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	5
cis-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	5
1,1,1-Trichloroethane	2.44	38.9 e	5.17 e	22.4 e	20.9 e	0.86	8.16	5
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	0.6
Trichloroethene	1.58	5.67 e	0.93	6.7 e	1.8	ND	67.8 e	5
Tetrachloroethene	19.6 e	83.4 e	3.87	9.85 e	4.9 e	1.95	458 e	5
Benzene	♦	♦	♦	ND	ND	ND	ND	1
Toluene	♦	♦	♦	ND	ND	ND	ND	5
Ethylbenzene	♦	♦	♦	ND	ND	ND	ND	5
o-Xylene	♦	♦	♦	ND	ND	ND	ND	5
m&p-Xylenes	♦	♦	♦	ND	ND	ND	ND	5

[DL:10:1]

♦ - Not analyzed.

bold - Value exceeds recommended criteria.

(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

DL - Diluted sample analysis.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-8 (Page 5 of 6)

GROUNDWATER DATA SUMMARY

101 Frost Street
Mobile Laboratory

LMS Sample ID	FSGP-4 (78')	FSGP-4 (92')	FSHP-01 (50-60')	FSHP-01 (75')	FSHP-01 (85')	FSHP-01 (96')	FSHP-01 (116')	FSHP-01 (125')	NYSDEC CLASS GA
Lab Sample ID	FSGP-4_78'	FSGP-4_92'	FSHP-01_50-60'	FSHP-01_75'	FSHP-01_85'	FSHP-01_95'	FSHP-01_115'	FSHP-01_125'	STANDARDS (b)
[DL:10:1] [DL:10:1]									
VOLATILE ORGANIC COMPOUNDS (µg/l)									
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	5
trans-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	5
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	5
cis-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	5
1,1,1-Trichloroethane	42.9 e	123 e	6.08 e	10.8	ND	ND	ND	ND	5
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	0.6
Trichloroethene	3.35	7.8	ND	1.37	ND	ND	ND	ND	5
Tetrachloroethene	86.6 e	49.7 e	3.05	1.77	0.61	ND	0.62	ND	5
Benzene	ND	ND	♦	♦	♦	♦	♦	♦	1
Toluene	ND	ND	♦	♦	♦	♦	♦	♦	5
Ethylbenzene	ND	ND	♦	♦	♦	♦	♦	♦	5
o-Xylene	ND	ND	♦	♦	♦	♦	♦	♦	5
m&p-Xylenes	ND	ND	♦	♦	♦	♦	♦	♦	5

♦ - Not analyzed.

bold - Value exceeds recommended criteria.

(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

DL - Diluted sample analysis.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-8 (Page 6 of 6)

GROUNDWATER DATA SUMMARY

101 Frost Street

Mobile Laboratory

LMS Sample ID	FSHP-02 (55-55')	FSHP-02 (80')	FSHP-02 (90')	FSHP-02 (100')	FSHP-02 (110')	FSHP-02 (120')	FSHP-02 (130')	NYSDEC CLASS GA
Lab Sample ID	FSHP-02_55-55'	FSHP-02_80'	FSHP-02_90'	FSHP-02_100'	FSHP-02_110'	FSHP-02_120'	FSHP-02_130'	STANDARDS (b)
[DL:60:1] [DL:100:1] [DL:100:1] [DL:100:1]								
VOLATILE ORGANIC COMPOUNDS (µg/l)								
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	5
trans-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	5
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	5
cis-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	5
1,1,1-Trichloroethane	ND	57.4	359	ND	ND	1.82	ND	5
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	0.6
Trichloroethene	78	ND	ND	ND	2.86	1.22	ND	5
Tetrachloroethene	1020 e	994 e	51.6	116	1.76	9.78 e	2.33	5
Benzene	♦	♦	♦	♦	♦	♦	♦	1
Toluene	♦	♦	♦	♦	♦	♦	♦	5
Ethylbenzene	♦	♦	♦	♦	♦	♦	♦	5
o-Xylene	♦	♦	♦	♦	♦	♦	♦	5
m&p-Xylenes	♦	♦	♦	♦	♦	♦	♦	5

♦ - Not analyzed.

bold - Value exceeds recommended criteria.

(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

DL - Diluted sample analysis.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

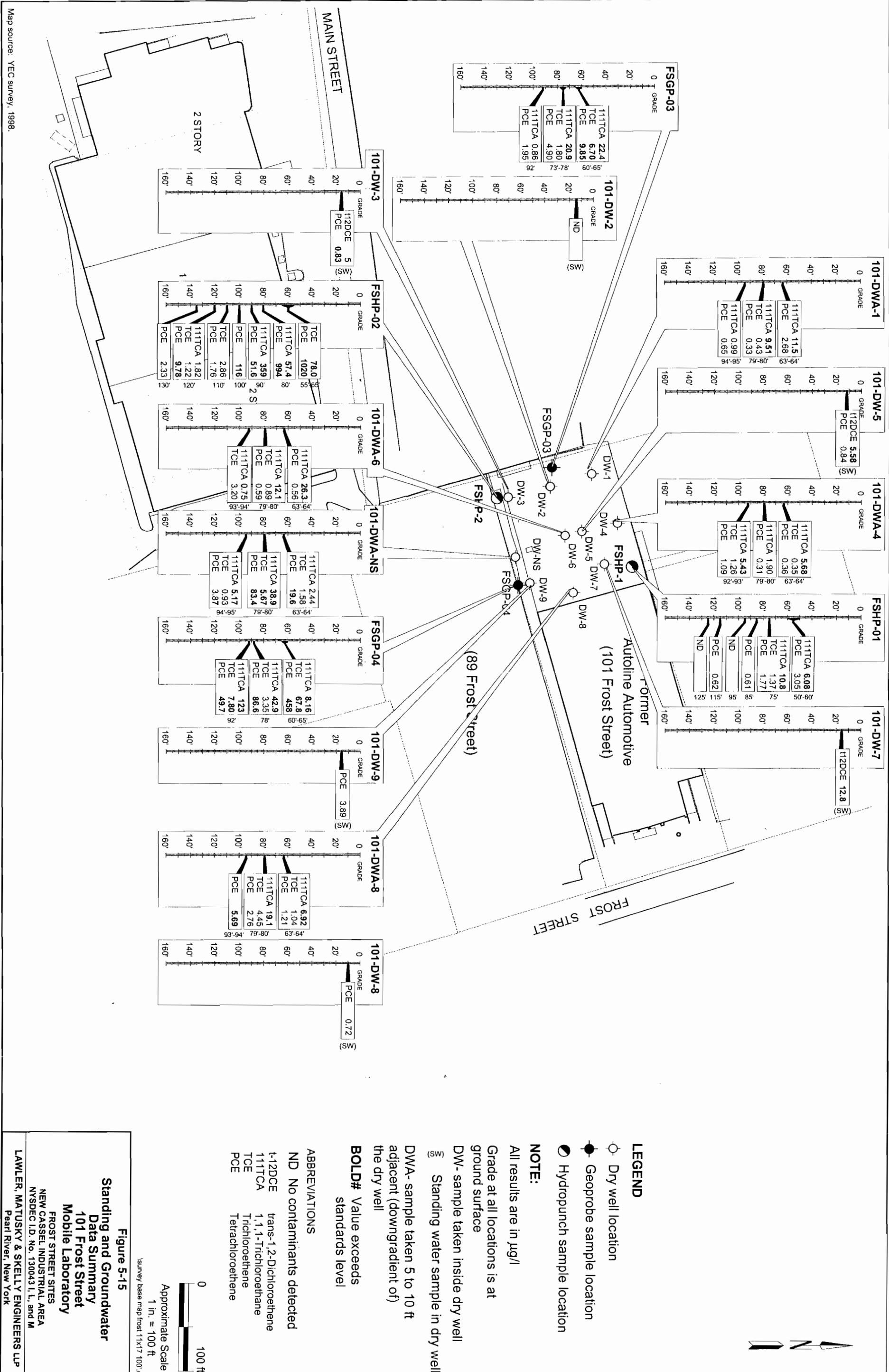


TABLE 5-9
(Page 1 of 1)

**STANDING WATER
DATA SUMMARY**
101 Frost Street
Mobile Laboratory

LMS Sample ID Lab Sample ID	101-DW-2 (SW) DW_2-SW	101-DW-3 (SW) DW_3-SW	101-DW-5 (SW) DW_5-SW	101-DW-7 (SW) DW_7-SW	101-DW-8 (SW) DW_8-SW	101-DW-9 (SW) DW_9-SW	NYSDEC CLASS GA STANDARDS (b)
VOLATILE ORGANIC COMPOUNDS (µg/l)							
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	5
trans-1,2-Dichloroethene	ND	5	5.58	12.8	ND	ND	5
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	5
cis-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	5
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	5
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	0.6
Trichloroethene	ND	ND	ND	ND	ND	ND	5
Tetrachloroethene	ND	0.83	0.84	ND	0.72	3.89	5
Benzene	♦	♦	♦	♦	♦	♦	1
Toluene	♦	♦	♦	♦	♦	♦	5
Ethylbenzene	♦	♦	♦	♦	♦	♦	5
o-Xylene	♦	♦	♦	♦	♦	♦	5
m&p-Xylenes	♦	♦	♦	♦	♦	♦	5

- ♦ - Not analyzed.
- bold** - Value exceeds recommended criteria.
- (b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.
- e - The quantified value exceeds the linear calibration range and the true value may be higher.
- DL - Diluted sample analysis.
- ND - Not detected at analytical detection limit.
- SW - Surface Water

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

In the three samples taken at 101-DWA-1, the compound 1,1,1-TCA was found in concentrations of 11.5 and 9.51 µg/l in the shallow (63-64 ft) and the intermediate (79-80 ft) samples, respectively; there was only a trace in the deep sample (94-95 ft). 1,1,1-TCA was also found above standards in the shallow sample (63-64 ft) and deepest sample (92-93 ft) at 101-DWA-4 at concentrations of 5.68 and 5.43 µg/l, respectively; only a trace was found in the intermediate sample (79-80 ft). Two samples at 101-DWA-6 (63-64 and 79-80 ft) had 1,1,1-TCA in concentrations of 26.3 µg/l for the shallow sample and 12.1 µg/l for the intermediate sample. The shallow sample (63-64 ft) at 101-DWA-8 had a concentration of 6.92 µg/l, and the intermediate sample (79-80 ft) had a concentration of 19.1 µg/l of 1,1,1-TCA. 101-DWA-N/S (79-80 ft) had 38.9 µg/l, and 101-DWA-N/S (94-95 ft) had 5.17 µg/l. Traces of 1,1,1-TCA were also found in two other samples.

Trans-1,2-DCE was found as a trace compound in one sample; it was above the Class GA standard in 101-DW-5 (SW) at 5.58 µg/l and in 101-DW-7 (SW) at 12.8 µg/l.

Concentrations of 1,1,1-TCA were detected above the Class GA standard in the shallow (60-65 ft) and intermediate (73-78 ft) samples at FSGP-3 at 22.4 and 20.9 µg/l, respectively; traces were detected in the deep sample (92 ft). 1,1,1-TCA was found above the standard in all three samples taken from FSGP-4 (60-65, 78, and 92 ft) at 8.16, 42.9, and 123 µg/l, respectively. TCE was found in trace amounts in two of the six samples and ND in one. It was over the standard in the shallow sample (60-65 ft) at both FSGP-3 and -4 (6.7 and 67.8 µg/l, respectively) and detected at 7.8 µg/l in the deep sample at FSGP-4. PCE was found above the standard in the 60-65 ft sample at FSGP-3 (6.7 µg/l), with traces at the two deeper depths. It was found at FSGP-4 in concentrations of 8.16 µg/l from 60-65 ft, 42.9 µg/l at 78 ft, and 123 µg/l at 92 ft.

The results of the analysis of FSHP-1 indicate concentrations of VOCs in excess of NYSDEC Class GA groundwater standards at 50-60 and 75 ft bgs. The primary contaminant of concern is 1,1,1-TCA. The 50-60 ft sample contained 6.08 µg/l of 1,1,1-TCA while the 75 ft sample contained 10.8 µg/l. TCE and PCE were also detected, but at levels below NYSDEC class GA groundwater standards.

The results of the analysis of FSHP-2 indicate concentrations of VOCs in excess of NYSDEC class GA groundwater standards at 50-65, 80, 90, 100, and 120 ft bgs. The

primary contaminants of concern are PCE, TCE and 1,1,1-TCA. The highest concentrations were found at 55-65 ft for PCE and TCE and at 90 ft for 1,1,1-TCA. At 55-65 ft, 1020 µg/l of PCE was detected. Concentrations in the deeper samples ranged from 994 µg/l (80 ft sample) to 1.76 µg/l (110 ft sample). 1,1,1-TCA was found at 359 µg/l at 90 ft and at 57.4 µg/l at 80 ft. At all other depths, 1,1,1-TCA was either below NYSDEC Class GA groundwater standards or ND. TCE was found at 78 µg/l in the 55-65 ft sample; at all other depths, it was either below NYSDEC Class GA groundwater standards or ND.

89 Frost Street Groundwater Samples. A total of 72 groundwater samples were taken from 21 locations at this site. Two other samples [89-DWA-2 (63-64 ft) and 89-DWA-2 (79-80 ft)] were not analyzed. Fourteen of these locations were adjacent to existing dry wells, five were additional probe locations, and two were hydropunch locations. A detailed summary of VOC sampling results for the soil samples is presented in Table 5-10, and Figure 5-16 graphically summarizes the results of the sampling analysis.

Target compounds were not found in three of the 39 groundwater samples that were taken adjacent to the dry wells. Trace concentrations of PCE, below the NYSDEC Class GA groundwater standard, were found in 14 of the samples. The remaining 22 samples had PCE concentrations in excess of the NYSDEC Class GA standard for PCE (5 µg/l), with concentrations ranging from 6.4 to 4986 µg/l. At 89-DWA-1 the PCE concentration was 6.4 µg/l in the 60-65 ft sample; a concentration of 12 µg/l was found in the deeper sample (92 ft). Three samples were collected at 89-DWA-10; the PCE concentrations in the 60-65, 78, and 92 ft samples were 4986, 1792, and 2830 µg/l, respectively. At 89-DWA-11 the PCE concentration was 271 µg/l in the shallow sample (60-65 ft), 356 µg/l in the intermediate sample (79-80 ft), and 291 µg/l at the greatest depth (93-94 ft). At 89-DWA-12 the PCE concentration was 49.9 µg/l in the 63-64 ft sample, 10.3 µg/l in the 79-80 ft sample, and 13.5 µg/l in the 93-94 ft sample. Three samples were collected at 89-DWA-14; the PCE concentrations in the 60-65, 78, and 92 ft sample were 500, 143, and 351 µg/l, respectively. Three samples were also collected at 89-DWA-15; the PCE concentrations in the 60-65, 78, and 92 ft sample were 1855, 351, and 347 µg/l, respectively. Only two samples at 89-DWA-16 exceeded the NYSDEC Class GA groundwater standard for PCE: 289 µg/l in the 79-80 ft sample and 395 µg/l in the 93-94

TABLE 5-10 (Page 1 of 13)

GROUNDWATER DATA SUMMARY

89 Frost Street

Mobile Laboratory

LMS Sample ID	89-DWA-1 (60-65')	89-DWA-1 (78')	89-DWA-1 (92')	89-DWA-2 (63-64')	89-DWA-2 (79-80')	89-DWA-2 (93-94')	NYSDEC CLASS GA
Lab Sample ID	DWA-1_60-65'	DWA-1_78'	DWA-1_92'	DWA-2_63-64'	DWA-2_79-80'	DWA-2_93-94'	STANDARDS (b)
VOLATILE ORGANIC COMPOUNDS (µg/l)							
1,1-Dichloroethene	ND	ND	ND	♦	♦	ND	5
trans-1,2-Dichloroethene	ND	ND	ND	♦	♦	ND	5
1,1-Dichloroethane	ND	ND	ND	♦	♦	ND	5
cis-1,2-Dichloroethene	ND	ND	ND	♦	♦	ND	5
1,1,1-Trichloroethane	ND	ND	ND	♦	♦	ND	5
1,2-Dichloroethane	ND	ND	ND	♦	♦	ND	0.6
Trichloroethene	ND	0.8	ND	♦	♦	ND	5
Tetrachloroethene	6.4	4.16 e	12 e	♦	♦	ND	5
Benzene	ND	ND	ND	♦	♦	♦	1
Toluene	ND	ND	ND	♦	♦	♦	5
Ethylbenzene	ND	ND	ND	♦	♦	♦	5
o-Xylene	ND	ND	ND	♦	♦	♦	5
m&p-Xylenes	ND	ND	ND	♦	♦	♦	5

♦ - Not analyzed.

bold - Value exceeds recommended criteria.

(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

DL - Diluted sample analysis.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-10 (Page 2 of 13)

GROUNDWATER DATA SUMMARY

89 Frost Street

Mobile Laboratory

LMS Sample ID	89-DWA-4 (63-64')	89-DWA-4 (79-80')	89-DWA-4 (93-94')	89-DWA-5 (63-64')	89-DWA-5 (79-80')	89-DWA-5 (93-94')	NYSDEC CLASS GA
Lab Sample ID	DWA-4_63-64'	DWA-4_79-80'	DWA-4_93-94'	DWA-5_63-64'	DWA-5_79-80'	DWA-5_93-94'	STANDARDS (b)
VOLATILE ORGANIC COMPOUNDS (µg/l)							
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	5
trans-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	5
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	5
cis-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	5
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	5
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	0.6
Trichloroethene	ND	ND	ND	ND	ND	ND	5
Tetrachloroethene	1.46	0.8	0.53	ND	0.64	2.92	5
Benzene	ND	ND	ND	ND	ND	ND	1
Toluene	ND	ND	ND	ND	ND	ND	5
Ethylbenzene	ND	ND	ND	ND	ND	ND	5
o-Xylene	ND	ND	ND	ND	ND	ND	5
m&p-Xylenes	ND	ND	ND	ND	ND	ND	5

♦ - Not analyzed.

bold - Value exceeds recommended criteria.

(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

DL - Diluted sample analysis.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

GROUNDWATER DATA SUMMARY

89 Frost Street

Mobile Laboratory

LMS Sample ID	89-DWA-6 (60-65')	89-DWA-6 (78')	89-DWA-6 (92')	89-DWA-7 (63-64')	89-DWA-7 (79-80')	89-DWA-7 (93-94')	NYSDEC
Lab Sample ID	DWA-18_60-65'	DWA-18_78'	DWA-18_92'	DWA-7_63-64'	DWA-7_79-80'	DWA-7_93-94'	CLASS GA STANDARDS (b)
VOLATILE ORGANIC COMPOUNDS (µg/l)							
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	5
trans-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	5
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	5
cis-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	5
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	5
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	0.6
Trichloroethene	ND	ND	ND	ND	ND	ND	5
Tetrachloroethene	0.7	1.45	0.59	ND	1.31	3.93	5
Benzene	ND	ND	ND	♦	♦	♦	1
Toluene	ND	ND	ND	♦	♦	♦	5
Ethylbenzene	ND	ND	ND	♦	♦	♦	5
o-Xylene	ND	ND	ND	♦	♦	♦	5
m&p-Xylenes	ND	ND	ND	♦	♦	♦	5

♦ - Not analyzed.

bold - Value exceeds recommended criteria.

(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

DL - Diluted sample analysis.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-10 (Page 5 of 13)

GROUNDWATER DATA SUMMARY

89 Frost Street

Mobile Laboratory

LMS Sample ID	89-DWA-11 (63-64')	89-DWA-11 (79-80')	89-DWA-11 (93-94')	89-DWA-12 (63-64')	89-DWA-12 (79-80')	89-DWA-12 (93-94')	89-DWA-15 (79-80')	NYSDEC CLASS GA
Lab Sample ID	DWA-11_63-64'	DWA-11_79-80'	DWA-11_93-94'	DWA-15_63-64'	DWA-15_79-80'	DWA-15_93-94'	DWA-15_79-80'	STANDARDS (b)
VOLATILE ORGANIC COMPOUNDS (µg/l)								
1,1-Dichloroethene	ND	ND	ND	ND	7.09	ND	5	5
trans-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	5	5
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	5	5
cis-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	5	5
1,1,1-Trichloroethane	3.09	74.9 e	16.4	8.71 e	35.7 e	ND	5	5
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	0.6	0.6
Trichloroethene	27.5	21.1	23	9.26 e	0.95	ND	5	5
Tetrachloroethene	271 e	356 e	291 e	49.9 e	10.3 e	ND	5	5
Benzene	ND	ND	ND	ND	ND	ND	1	1
Toluene	ND	ND	ND	ND	ND	ND	5	5
Ethylbenzene	ND	ND	ND	ND	ND	ND	5	5
o-Xylene	ND	ND	ND	ND	ND	ND	5	5
m&p-Xylenes	ND	ND	ND	ND	ND	ND	5	5

♦ - Not analyzed.

bold - Value exceeds recommended criteria.

(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

DL - Diluted sample analysis.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-10 (Page 6 of 13)

GROUNDWATER DATA SUMMARY

89 Frost Street

Mobile Laboratory

LMS Sample ID	89-DWA-12 (93-94')	89-DWA-14 (60-65')	89-DWA-14 (78')	89-DWA-14 (92')	89-DWA-15 (60-65')	89-DWA-15 (78')	89-DWA-16 (78')	NYSDEC CLASS GA
Lab Sample ID	DWA-15_93-94'	SMHE_60-65'	SMHE_78'	SMHE_92'	DWA-16_60-65'	DWA-16_78'	DWA-16_78'	STANDARDS (b)
VOLATILE ORGANIC COMPOUNDS (µg/l)								
	[DL:10:1]	[DL:10:1]	[DL:10:1]	[DL:10:1]	[DL:10:1]	[DL:10:1]	[DL:10:1]	
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	5
trans-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	5
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	5
cis-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	5
1,1,1-Trichloroethane	19.1 e	ND	211 e	223 e	9.44	190 e	190 e	5
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	0.6
Trichloroethene	9.06 e	183 e	ND	24.9	1200 e	12.6	12.6	5
Tetrachloroethene	13.5 e	500 e	143 e	351 e	1855 e	351 e	351 e	5
Benzene	♦	ND	ND	ND	ND	ND	ND	1
Toluene	♦	ND	ND	ND	ND	ND	ND	5
Ethylbenzene	♦	ND	ND	ND	ND	ND	ND	5
o-Xylene	♦	ND	ND	ND	ND	ND	ND	5
m&p-Xylenes	♦	ND	ND	ND	ND	ND	ND	5

♦ - Not analyzed.

bold - Value exceeds recommended criteria.

(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

DL - Diluted sample analysis.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-10 (Page 8 of 13)

GROUNDWATER DATA SUMMARY

89 Frost Street
Mobile Laboratory

LMS Sample ID	89-DWA-17 (92')	FSGP-6 (53-58')	FSGP-6 (78')	FSGP-6 (92')	FSGP-7 (58-63')	FSGP-7 (78')	NYSDEC CLASS GA
Lab Sample ID	DWA-14_92'	FSGP-6_53-58'	FSGP-6_78'	FSGP-6_92'	FSGP-7_58-63'	FSGP-7_78'	STANDARDS (b)
[DL:10:1]							
VOLATILE ORGANIC COMPOUNDS (µg/l)							
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	5
trans-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	5
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	5
cis-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	5
1,1,1-Trichloroethane	29.2	ND	ND	ND	9.88 e	ND	5
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	0.6
Trichloroethene	110 e	ND	0.9	ND	38.6 e	7.39	5
Tetrachloroethene	389 e	5.54 e	10.7 e	5.64 e	146 e	98.2 e	5
Benzene	♦	ND	ND	ND	ND	ND	1
Toluene	♦	ND	ND	ND	ND	ND	5
Ethylbenzene	♦	ND	ND	ND	ND	ND	5
o-Xylene	♦	ND	ND	ND	ND	ND	5
m&p-Xylenes	♦	ND	ND	ND	ND	ND	5

♦ - Not analyzed.

bold - Value exceeds recommended criteria.

(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

DL - Diluted sample analysis.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-10 (Page 9 of 13)

GROUNDWATER DATA SUMMARY

89 Frost Street

Mobile Laboratory

LMS Sample ID	FSGP-7 (92')	FSGP-8 (60-65')	FSGP-8 (78')	FSGP-8 (92')	FSGP-9 (60-65')	NYSDEC CLASS GA
Lab Sample ID	FSGP-7_92'	FSGP-8_60-65'	FSGP-8_78'	FSGP-8_92'	FSGP-9_60-65'	STANDARDS (b)
[DL:10:1]						
VOLATILE ORGANIC COMPOUNDS (µg/l)						
1,1-Dichloroethene	ND	ND	ND	ND	ND	5
trans-1,2-Dichloroethene	ND	ND	ND	ND	ND	5
1,1-Dichloroethane	ND	ND	ND	ND	ND	5
cis-1,2-Dichloroethene	ND	ND	ND	ND	46.8 e	5
1,1,1-Trichloroethane	ND	5.85	10.8	20.9	1.13	5
1,2-Dichloroethane	ND	ND	ND	ND	ND	0.6
Trichloroethene	13.6	606 e	49.7 e	279 e	36.8 e	5
Tetrachloroethene	123 e	855 e	245 e	371 e	32.1 e	5
Benzene	ND	ND	ND	ND	ND	1
Toluene	ND	ND	ND	ND	ND	5
Ethylbenzene	ND	ND	ND	ND	ND	5
o-Xylene	ND	ND	ND	ND	ND	5
m&p-Xylenes	ND	ND	ND	ND	ND	5

* Not analyzed.

bold - Value exceeds recommended criteria.

(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

DL - Diluted sample analysis.

ND - Not detected at analytical detection limit.

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TABLE 5-10 (Page 10 of 13)

GROUNDWATER DATA SUMMARY

89 Frost Street
Mobile Laboratory

LMS Sample ID	FSGP-9 (78')	FSGP (92')	FSGP-10 (60-65')	FSGP-10 (78')	FSGP-10 (92')	NYSDEC CLASS GA
Lab Sample ID	FSGP-9-78'	FSGP-9-92'	FSGP-10_60-65'	FSGP-10_78'	FSGP-10_92'	STANDARDS (b)
VOLATILE ORGANIC COMPOUNDS (µg/l)						
	[DL:10:1]	[DL:10:1]	[DL:10:1]	[DL:10:1]	[DL:10:1]	
1,1-Dichloroethene	ND	ND	ND	ND	ND	5
trans-1,2-Dichloroethene	ND	ND	ND	ND	ND	5
1,1-Dichloroethane	ND	ND	ND	ND	ND	5
cis-1,2-Dichloroethene	ND	ND	1334 e	ND	ND	5
1,1,1-Trichloroethane	ND	ND	7.3	18.8 e	158 e	5
1,2-Dichloroethane	ND	ND	ND	ND	ND	0.6
Trichloroethene	3.34	ND	990 e	72.7 e	44.2 e	5
Tetrachloroethene	14 e	5.33 e	715 e	426 e	99.9 e	5
Benzene	ND	ND	ND	ND	ND	1
Toluene	ND	ND	ND	ND	ND	5
Ethylbenzene	ND	ND	ND	ND	ND	5
o-Xylene	ND	ND	ND	ND	ND	5
m&p-Xylenes	ND	ND	ND	ND	ND	5

♦ - Not analyzed.

bold - Value exceeds recommended criteria.

(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

DL - Diluted sample analysis.

ND - Not detected at analytical detection limit.

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TABLE 5-10 (Page 11 of 13)

GROUNDWATER DATA SUMMARY
89 Frost Street
Mobile Laboratory

LMS Sample ID	FSHP-03 (55-65')	FSHP-03 (80')	FSHP-03 (90')	FSHP-03 (100')	FSHP-03 (110')	FSHP-03 (120')	NYSDEC CLASS GA
Lab Sample ID	FSHP-03_55-65'	FSHP-03_80'	FSHP-03_90'	FSHP-03_100'	FSHP-03_110'	FSHP-03_120'	STANDARDS (b)
VOLATILE ORGANIC COMPOUNDS (µg/l)							
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	5
trans-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	5
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	5
cis-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	5
1,1,1-Trichloroethane	7.91 e	1.93	ND	ND	ND	ND	5
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	0.6
Trichloroethene	6.03 e	2.31	1.79	1.38	0.3	1.1	5
Tetrachloroethene	28.0 e	20.5 e	17.8 e	17.8 e	14 e	17.4 e	5
Benzene	♦	♦	♦	♦	♦	♦	1
Toluene	♦	♦	♦	♦	♦	♦	5
Ethylbenzene	♦	♦	♦	♦	♦	♦	5
o-Xylene	♦	♦	♦	♦	♦	♦	5
m&p-Xylenes	♦	♦	♦	♦	♦	♦	5

♦ - Not analyzed.

bold - Value exceeds recommended criteria.

(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

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ND - Not detected at analytical detection limit.

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TABLE 5-10 (Page 12 of 13)

GROUNDWATER DATA SUMMARY

89 Frost Street

Mobile Laboratory

LMS Sample ID	FSHP-03 (130')	FSHP-03 (140')	FSHP-03 (150')	FSHP-04 (55-65')	FSHP-04 (80')	FSHP-04 (90')	NYSDEC CLASS GA
Lab Sample ID	FSHP-03_130'	FSHP-03_140'	FSHP-03_150'	FSHP-04_55-65'	FSHP-04_80'	FSHP-04_90'	STANDARDS (b)
VOLATILE ORGANIC COMPOUNDS (µg/l)							
1,1-Dichloroethene	ND	ND	ND	ND	ND	8.21	5
trans-1,2-Dichloroethene	ND	ND	ND	6.39	ND	ND	5
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	5
cis-1,2-Dichloroethene	ND	ND	ND	274 e	153 e	ND	5
1,1,1-Trichloroethane	ND	ND	ND	2.9	5.88 e	34.6 e	5
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	0.6
Trichloroethene	0.3	0.34	0.55	97.7 e	67.3	3.06	5
Tetrachloroethene	12.8 e	12.6 e	10.4	92.3 e	132 e	33.2 e	5
Benzene	♦	♦	♦	♦	♦	♦	1
Toluene	♦	♦	♦	♦	♦	♦	5
Ethylbenzene	♦	♦	♦	♦	♦	♦	5
o-Xylene	♦	♦	♦	♦	♦	♦	5
m&p-Xylenes	♦	♦	♦	♦	♦	♦	5

♦ - Not analyzed.

bold - Value exceeds recommended criteria.

(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.

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TABLE 5-10 (Page 13 of 13)

GROUNDWATER DATA SUMMARY

89 Frost Street

Mobile Laboratory

LMS Sample ID	FSHP-04 (100')	FSHP-04 (110')	FSHP-04 (120')	FSHP-04 (130')	FSHP-04 (140')	FSHP-04 (150')	NYSDEC CLASS GA
Lab Sample ID	FSHP-04_100'	FSHP-04_110'	FSHP-04_120'	FSHP-04_130'	FSHP-04_140'	FSHP-04_150'	STANDARDS (b)
VOLATILE ORGANIC COMPOUNDS (µg/l)							
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	5
trans-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	5
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	5
cis-1,2-Dichloroethene	7.01	ND	ND	ND	ND	ND	5
1,1,1-Trichloroethane	25.3 e	1.28	0.53	3.02	0.56	0.82	5
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	0.6
Trichloroethene	26.6 e	3.58	1.5	2.78	0.66	2.98	5
Tetrachloroethene	44.1 e	32.8 e	14.2 e	21.6 e	11.5 e	16.8 e	5
Benzene	♦	♦	♦	♦	♦	♦	1
Toluene	♦	♦	♦	♦	♦	♦	5
Ethylbenzene	♦	♦	♦	♦	♦	♦	5
o-Xylene	♦	♦	♦	♦	♦	♦	5
m&p-Xylenes	♦	♦	♦	♦	♦	♦	5

♦ - Not analyzed.

bold - Value exceeds recommended criteria.

(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.

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Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

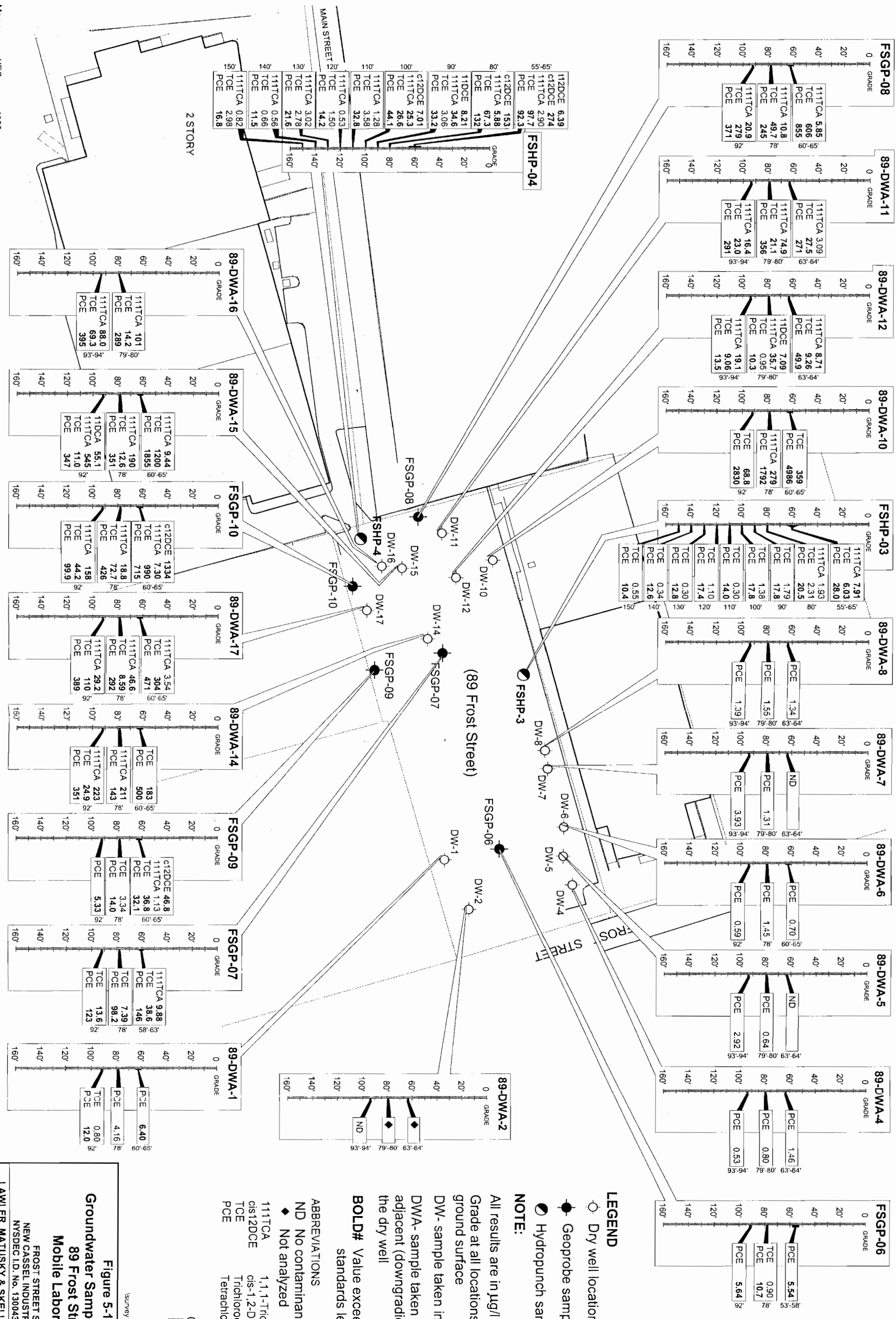


Figure 5-16
Groundwater Sampling Results
89 Frost Street
Mobile Laboratory

FROST STREET SITES
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043 I, L, and M

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

Map source: YEC survey, 1998.

ft sample. Three samples were collected at 89-DWA-17; the PCE concentrations were 471, 292, and 389 µg/l in the 60-65, 78, and 92 ft samples, respectively.

Concentrations were also over the Class GA standard for PCE in the five additional probe locations, with concentrations ranging from 5.54 to 855 µg/l. At FSGP-6 the PCE concentration was 5.54 µg/l in the 53-58 ft sample, while a concentration of 10.7 µg/l was found in the intermediate sample (78 ft) and 5.64 µg/l at the greatest depth (92 ft). The PCE concentrations in the 58-63, 78, and 92 ft samples at FSGP-7 were 146, 98.2, and 123 µg/l, respectively. At FSGP-8 the PCE concentrations in the 60-65, 78, and 92 ft samples were 855, 245, and 371 µg/l, respectively. At FSGP-9 the PCE concentrations were 32.1 µg/l in the shallow sample (60-65 ft), 14 µg/l in the intermediate sample (78 ft), and 5.33 µg/l at the greatest depth (92 ft). At FSGP-10 the PCE concentrations in the 60-65, 78, and 92 ft samples were 715, 426, and 99.9 µg/l, respectively.

Trace amounts of TCE were found in four samples. Seventeen of the samples, from seven locations adjacent to dry wells, had concentrations of TCE in excess of the NYSDEC Class GA standard for TCE (5 µg/l), with concentrations ranging from 8.59 to 1200 µg/l. At 89-DWA-10 the TCE concentration was 359 µg/l in the 60-65 ft sample while 68.8 µg/l was found in the deeper sample (92 ft). At 89-DWA-11 the TCE concentrations were 27.5 µg/l in the shallow sample (63-64 ft), 21.1 µg/l in the intermediate sample (79-80 ft), and 23 µg/l at the greatest depth (93-94 ft). Only two samples at 89-DWA-12 exceeded the NYSDEC Class GA groundwater standard: 9.26 µg/l in the 63-64 ft sample and 9.06 µg/l in the 93-94 ft sample. At 89-DWA-14 the TCE concentration was 183 µg/l in the shallow sample (60-65 ft) and 24.9 µg/l in the deep sample (92 ft). Three samples were collected at 89-DWA-15; the TCE concentrations in the 60-65, 78, and 92 ft sample were 1200, 12.6, and 11 µg/l, respectively. Only two samples were taken at 89-DWA-16; both exceeded the NYSDEC Class GA groundwater standard for TCE: 14.2 µg/l in the 79-80 ft sample and 69.3 µg/l in the 93-94 ft sample. Three samples were collected at 89-DWA-17; the TCE concentrations were 304, 8.59, and 110 µg/l in the 60-65, 78, and 92 ft samples, respectively.

Concentrations were also over the Class GA standard for TCE in the following 10 additional probe samples: all three samples from FSGP-7 (58-63, 78, and 92 ft) with concentrations of 38.6, 7.39, and 13.6 µg/l, respectively; the three samples at FSGP-8

(60-65, 78, and 92 ft), with concentrations of 606, 49.7, and 279 µg/l, respectively; only the shallow sample at FSGP-9 (60-65 ft) at 36.8 µg/l; and the three samples collected at FSGP-10, where the TCE concentrations in the 60-65, 78, and 92 ft samples were 990, 72.7, and 44.2 µg/l, respectively. All the other additional probes were either ND or had concentrations below the NYSDEC Class GA groundwater standard.

Trace amounts of 1,1,1-TCA were found in two samples adjacent to the dry wells. Concentrations over the Class GA standard of 5 µg/l were found in 15 samples, ranging from 8.71 to 545 µg/l. The intermediate sample at 89-DWA-10 (78 ft) had a concentration of 279 µg/l; the intermediate and deep samples (79-80 and 93-94 ft) at 89-DWA-11 had 74.9 µg/l and 16.4 µg/l, respectively. At 89-DWA-12, all three depths (63-64, 79-80, and 93-94 ft) were above the Class GA standard for 1,1,1-TCA at concentrations of 8.71, 35.7, and 19.1 µg/l, respectively. The intermediate sample (78 ft) and the deeper sample at 89-DWA-14 (92 ft) were above the standard, with concentrations of 211 and 223 µg/l, respectively. Three samples were taken at 89-DWA-15. The shallow sample (60-65 ft) had a concentration of 9.44 µg/l; the intermediate sample (78 ft) had a concentration of 190 µg/l; and the deep sample (92 ft) had a concentration of 545 µg/l. At 89-DWA-16 only two samples were taken, an intermediate depth (79-80 ft) and a deep sample (93-94 ft), both of which were above the standard at concentrations of 101 and 88 µg/l, respectively. The two deeper samples at 89-DWA-17 (78 ft) and (92 ft) also were above the standard, with the of 46.6 µg/l and 29.2 µg/l, respectively.

Traces of 1,1,1-TCA were also found in one of the additional probes, while concentrations over the Class GA standard were found in seven samples. FSGP-7 had a concentration of 9.88 µg/l in the shallow sample (58-63 ft). FSGP-8 had concentrations over the standard in all three samples: the 60-65, 78, and 92 ft samples contained 5.85, 10.8, and 20.9 µg/l, respectively. FSGP-10 also had concentrations exceeding the standards in all three samples, with the shallow sample (60-65 ft) having 7.3 µg/l, the intermediate sample (78 ft) having 18.8 µg/l, and the deeper sample (92 ft) having 158 µg/l.

Cis-1,2-DCE was found in only two shallow samples (60-65 ft) from the additional probes at FSGP-9 (46.8 µg/l) and at FSGP-10 (1334 µg/l).

1,1-DCE was found above the Class GA standard (0.7 µg/l) at a concentration of 7.09 µg/l in 89-DWA-12 (79-80 ft); 1,1-DCA was found in 89-DWA-15 (92 ft) above the Class GA standard of 5 µg/l at a concentration of 55.1 µg/l.

The results of FSHP-3 showed concentrations of VOCs in excess of NYSDEC Class GA groundwater standards at 55-65, 80, 90, 100, 110, 120, 130, 140, and 150 ft bgs. The contaminants in these samples are PCE, TCE, and 1,1,1-TCA. The concentrations of each of the compounds was highest at 55-65 ft bgs, including 28 µg/l of PCE, 6.03 µg/l of TCE, and 7.91 µg/l of 1,1,1-TCA. PCE was the only compound in excess of NYSDEC Class GA groundwater standards between 80 and 150 ft bgs, with TCE and 1,1,1-TCA either below NYSDEC Class GA groundwater standards or ND. The concentrations of PCE ranged from 10.4 µg/l in the 150 ft sample to 20.5 µg/l in the 80 ft sample.

The results of FSHP-4 showed concentrations of VOCs in excess of NYSDEC class GA groundwater standards at 55-65, 80, 90, 100, 110, 120, 130, 140, and 150 ft bgs. The contaminants in these samples are trans-1,2-DCE, cis-1,2-DCE, 1,1-DCE, PCE, TCE, and 1,1,1-TCA. 1,1-DCE was only present in the 90 ft sample at a concentration of 8.21 µg/l. At 55-65 ft bgs only trans-1,2-DCE was present at a concentration of 6.39 µg/l. The highest concentrations of 1,1,1-TCA were found at 90 ft bgs (34.6 µg/l), with concentrations in excess of NYSDEC Class GA groundwater standards at 80 ft (5.88 µg/l) and 100 ft bgs (25.3 µg/l); levels were below NYSDEC Class GA groundwater standards at all other depths. TCE is in excess of NYSDEC Class GA groundwater standards at 55-65 ft bgs (97.7 µg/l), 80 ft bgs (67.3 µg/l), and at 100 ft bgs (26.6 µg/l). All other depths were below NYSDEC Class GA groundwater standards. PCE was found at 92.3 µg/l at 55-65 ft bgs, 132 µg/l at 80 ft bgs; PCE ranged between 44.1 and 11.5 µg/l in samples from all other depths. Cis-1,2-DCE was found at 274 µg/l at 55-65 ft bgs, 153 µg/l at 80 ft bgs, and 7.01 µg/l at 100 ft bgs. Cis-1,2-DCE was not detected at all other depths.

770 Main Street Groundwater Samples. Fifteen samples were taken from five additional probe locations on this site. A detailed summary of VOC sampling results for these

groundwater samples is contained on Table 5-11, and Figure 5-17 graphically summarizes the results of the sampling analysis.

Three samples were taken at FSGP-11: a shallow sample from 63-64 ft, an intermediate sample from 79-80 ft, and a deep sample from 93-94 ft. All three samples were above the Class GA standard for 1,1-DCE (6.01, 11.5 and 19.6 µg/l, respectively); 1,1,1-DCA (12.5, 20.1, and 32.6 µg/l, respectively); 1,1,1-TCA (30.6, 35.8, and 38.9 µg/l, respectively); and PCE (38.3, 36.4, and 34.6 µg/l, respectively). Cis-1,2-DCE was above the standard at 63-64 ft, with 16.3 µg/l, and ND in the other two samples. TCE was also found at 45.5 and 8.98 µg/l, in the shallow and intermediate samples.

Three samples were taken at FSGP-12: a shallow sample from 63-64 ft, an intermediate sample from 79-80 ft, and a deep sample from 93-94 ft. All three samples contained concentrations above the Class GA standard for PCE, with concentrations of 24, 29, and 11 µg/l in the shallow, intermediate, and deep samples, respectively. Traces of TCE were found in all three, along with traces of 1,1,1-TCA in the top two samples; the deepest sample had 23.1 µg/l of 1,1,1-TCA. The deepest sample also had 1,1-DCA above the standard, with a concentration of 6 µg/l.

Three samples were taken at FSGP-13: a shallow sample from 63-64 ft, an intermediate sample from 80-81 ft, and a deep sample from 90-94 ft taken. All three samples were above the Class GA standard for 1,1,1-TCA (15.5, 8.87, and 32.2 µg/l, respectively); TCE (79.6, 6.52, and 16.1 µg/l, respectively); and PCE (35.9, 21.6, and 24.9 µg/l, respectively). Cis-1,2-DCE was found only in the shallow sample (101 µg/l) and the deep sample (9.7 µg/l), while 1,1-DCA was found in the intermediate sample (12.9 µg/l) and deep sample (8.43 µg/l). The deep sample was the only sample to have trans-1,2-DCE, at a concentration of 12.7 µg/l.

Three samples were taken at FSGP-14: a shallow sample from 63-64 ft, an intermediate sample from 79-80 ft, and a deep sample from 93-94 ft. All three samples were above the Class GA standard for cis-1,2-DCE (230, 239, and 60.7 µg/l, respectively); TCE (65.8, 56.4, and 30.2 µg/l, respectively); and PCE (62.3, 50.3, and 35.3 µg/l, respectively). 1,1,1-TCA was above the standard in the intermediate sample, with a concentration of 8.04 µg/l; only a trace was found in the other two samples.

GROUNDWATER DATA SUMMARY

770 Main Street
Mobile Laboratory

LMS Sample ID	FSGP-11 (63-64)	FSGP-11 (79-80)	FSGP-11 (93-94)	FSGP-12 (63-64)	FSGP-12 (79-80)	FSGP-12 (93-94)	NYSDEC CLASS GA
Lab Sample ID	FSGP-11_63-64	FSGP-11_79-80	FSGP-11_93-94	FSGP-12_63-64	FSGP-12_79-80	FSGP-12_93-94	STANDARDS (b)
VOLATILE ORGANIC COMPOUNDS (µg/l)							
1,1-Dichloroethene	6.01	11.5	19.6	ND	ND	ND	5
trans-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	5
1,1-Dichloroethane	12.5	20.1	32.6 e	ND	ND	6	5
cis-1,2-Dichloroethene	16.3	ND	ND	ND	ND	ND	5
1,1,1-Trichloroethane	30.6 e	35.8 e	38.9 e	1.86	2.54	23.1 e	5
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	0.6
Trichloroethene	45.5 e	8.98 e	2.26	2.49	2.43	3.2	5
Tetrachloroethene	38.3 e	36.4 e	34.6 e	24 e	29	11 e	5

bold - Value exceeds recommended criteria.
 (b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.
 e - The quantified value exceeds the linear calibration range and the true value may be higher.
 DL - Diluted sample analysis.
 ND - Not detected at analytical detection limit.
 Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

GROUNDWATER DATA SUMMARY

770 Main Street
Mobile Laboratory

LMS Sample ID	FSGP-13 (63-64')	FSGP-13 (80-81')	FSGP-13 (90-94')	FSGP-14 (63-64')	FSGP-14 (79-80')	NYSDEC CLASS GA
Lab Sample ID	FSGP-13_63-64'	FSGP-13_80-81'	FSGP-13_90-94'	FSGP-14_63-64'	FSGP-14_79-80'	STANDARDS (b)
VOLATILE ORGANIC COMPOUNDS (µg/l)						
1,1-Dichloroethene	ND	ND	ND	ND	ND	5
trans-1,2-Dichloroethene	ND	ND	12.7	ND	ND	5
1,1-Dichloroethane	ND	12.9	8.43	ND	ND	5
cis-1,2-Dichloroethene	101 e	ND	9.7	230 e	239 e	5
1,1,1-Trichloroethane	15.5 e	8.87 e	32.2 e	2.42	8.04 e	5
1,2-Dichloroethane	ND	ND	ND	ND	ND	0.6
Trichloroethene	79.6 e	6.52 e	16.1 e	65.8 e	56.4 e	5
Tetrachloroethene	35.9 e	21.6 e	24.9 e	62.3 e	50.3 e	5

bold - Value exceeds recommended criteria.

(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

DL - Diluted sample analysis.

ND - Not detected at analytical detection limit.

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GROUNDWATER DATA SUMMARY

770 Main Street
Mobile Laboratory

LMS Sample ID	FSGP-14 (93-94)	FSGP-15 (63-64)	FSGP-15 (77-78)	FSGP-15 (91-92)	NYSDEC CLASS GA
Lab Sample ID	FSGP-15_93-94	FSGP-15_63-64	FSGP-15_77-78	FSGP-15_91-92	STANDARDS (b)
VOLATILE ORGANIC COMPOUNDS (µg/l)					
1,1-Dichloroethene	ND	ND	ND	5.68	5
trans-1,2-Dichloroethene	ND	ND	ND	ND	5
1,1-Dichloroethane	ND	5.24	ND	ND	5
cis-1,2-Dichloroethene	60.7 e	641 e	463 e	ND	5
1,1,1-Trichloroethane	2.98	3.68	4.32 e	12.2 e	5
1,2-Dichloroethane	ND	ND	ND	ND	0.6
Trichloroethene	30.2 e	80 e	72 e	11.1 e	5
Tetrachloroethene	35.3 e	82.4 e	86.2 e	25.6 e	5

bold - Value exceeds recommended criteria.

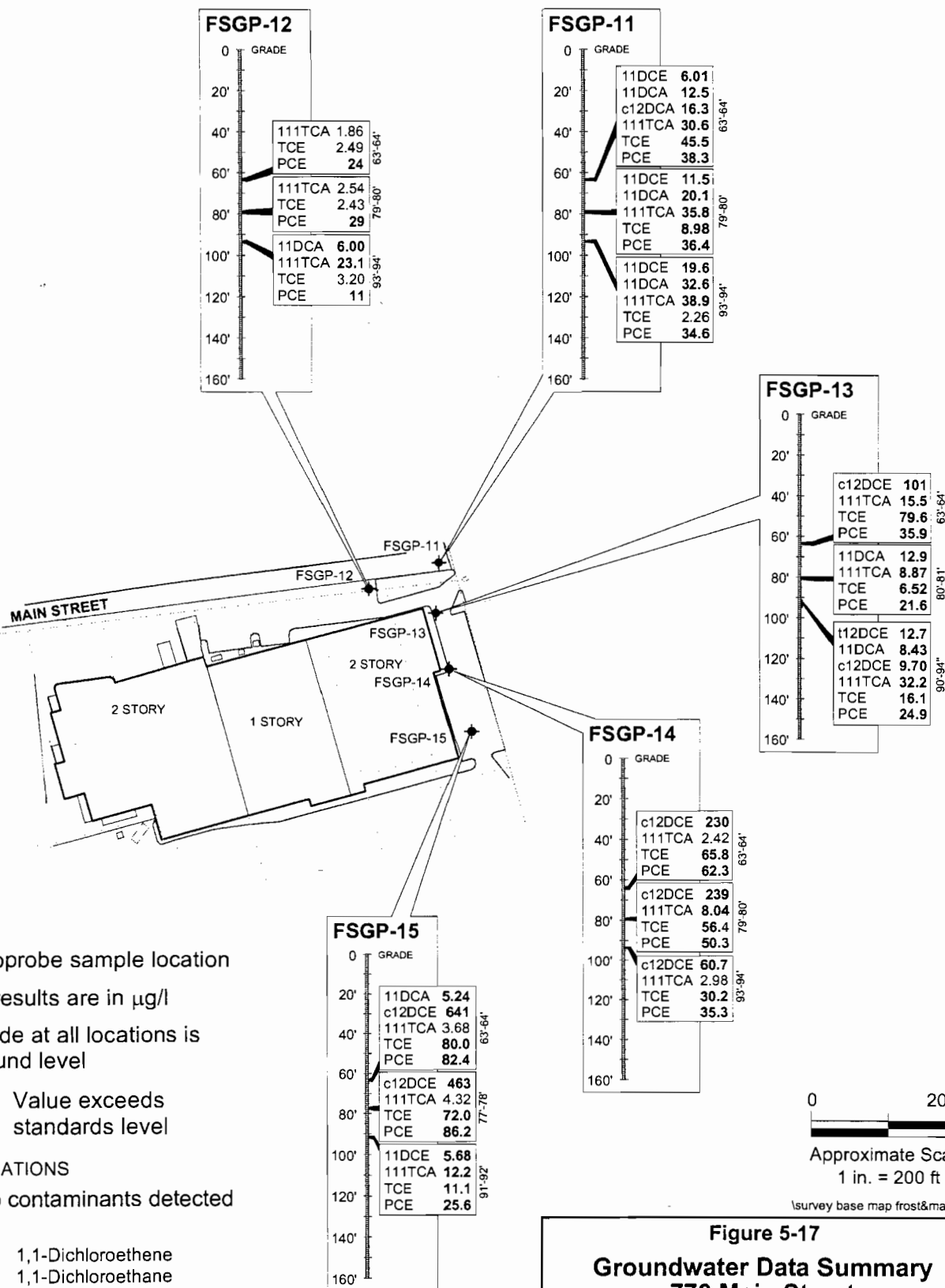
(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

DL - Diluted sample analysis.

ND - Not detected at analytical detection limit.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation



Three samples were taken at FSGP-15: a shallow sample from 63-64 ft, an intermediate sample from 77-78 ft, and a deep sample from 91-92 ft. All three samples were above the Class GA standard for TCE (80, 72, and 11.1 µg/l, respectively) and PCE (82.4, 86.2, and 25.6 µg/l, respectively). 1,1-DCE was above the standard in the deep sample at a concentration of 5.68 µg/l; 1,1-DCA was found only in the shallow sample at 5.24 µg/l. The shallow and intermediate samples had concentrations of 641 and 463 µg/l, respectively, of cis-1,2-DCE. The deep sample had a concentration of 1,1,1-TCA over the standard, with a concentration of 12.2 µg/l, and the other two samples had only trace amounts.

Off-site Groundwater Samples. Twenty-eight samples were taken from three locations (FSHP-5, -6, and -7). A detailed summary of VOC sampling results for these groundwater samples is presented in Table 5-12, and Figure 5-18 graphically summarizes the results of the sampling analysis. The results of the FSHP-5 analysis showed concentrations of VOCs in excess of NYSDEC Class GA groundwater standards at 85 and 95 ft bgs. The primary contaminant of concern is PCE, with the highest concentration found at 85 ft bgs (10.9 µg/l). At 95 ft bgs, the PCE concentration was 70.6 µg/l; it was either below NYSDEC Class GA groundwater standards or ND at all other depths sampled.

The results of FSHP-6 exhibited concentrations of VOCs in excess of NYSDEC Class GA groundwater standards at 90, 100, 110, 120, 130, 140, and 150 ft bgs. The primary contaminants of concern are 1,1-DCE, PCE, TCE, and 1,1,1-TCA. 1,1-DCE was present only at 110 ft bgs (64.9 µg/l). 1,1,1-TCA was found at 164 µg/l in the 110 ft sample and was ND or below NYSDEC Class GA groundwater standards at all other depths except 140 ft bgs, where it was found at 5.3 µg/l. TCE was found at 7.2 µg/l in the 100 ft sample and at 211 µg/l at 110 ft bgs. From 120-150 ft the concentrations ranged from 10.8 to 28.2 µg/l. PCE was detected below NYSDEC Class GA groundwater standards at 2.99 µg/l at 80 ft bgs. PCE concentrations between 90 and 150 ft bgs ranged from 13.3 to 255 µg/l.

TABLE 5-12
(Page 1 of 4)

GROUNDWATER DATA SUMMARY

Off Site

Mobile Laboratory

LMS Sample ID	FSHP-5 (50-60')	FSHP-5 (75')	FSHP-5 (85')	FSHP-5 (95')	FSHP-5 (105')	FSHP-5 (115')	FSHP-5 (125')	NYSDEC CLASS GA STANDARDS (p)
VOLATILE ORGANIC COMPOUNDS (µg/l)								
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	5
trans-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	5
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	5
cis-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	5
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	5
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	0.6
Trichloroethene	ND	ND	ND	ND	ND	ND	ND	5
Tetrachloroethene	2.69	1.45	10.9 e	70.6 e	ND	0.67	ND	5
Benzene	♦	♦	♦	♦	♦	♦	♦	1
Toluene	♦	♦	♦	♦	♦	♦	♦	5
Ethylbenzene	♦	♦	♦	♦	♦	♦	♦	5
o-Xylene	♦	♦	♦	♦	♦	♦	♦	5
m&p-Xylenes	♦	♦	♦	♦	♦	♦	♦	5

- ♦ - Not analyzed.
- bold** - Value exceeds recommended criteria.
- (b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.
- e - The quantified value exceeds the linear calibration range and the true value may be higher.
- DL - Diluted sample analysis.
- ND - Not detected at analytical detection limit.

GROUNDWATER DATA SUMMARY

Off Site
Mobile Laboratory

LMS Sample ID	FSHP-5 (135')	FSHP-5 (145')	FSHP-6 (50-60')	FSHP-6 (70')	FSHP-6 (80')	FSHP-6 (90')	FSHP-6 (100')	NYSDEC CLASS GA STANDARDS (b)
VOLATILE ORGANIC COMPOUNDS (µg/l)								
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	5
trans-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	5
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	5
cis-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	5
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	5
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	0.6
Trichloroethene	ND	ND	ND	ND	ND	ND	7.2	5
Tetrachloroethene	0.58	0.97	ND	2.99	13.3	97.4 e	ND	5
Benzene	♦	♦	ND	ND	ND	ND	ND	1
Toluene	♦	♦	ND	ND	ND	ND	ND	5
Ethylbenzene	♦	♦	ND	ND	ND	ND	ND	5
o-Xylene	♦	♦	ND	ND	ND	ND	ND	5
m&p-Xylenes	♦	♦	ND	ND	ND	ND	ND	5

- ♦ - Not analyzed.
- bold - Value exceeds recommended criteria.
- (b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.
- e - The quantified value exceeds the linear calibration range and the true value may be higher.
- DL - Diluted sample analysis.
- ND - Not detected at analytical detection limit.

GROUNDWATER DATA SUMMARY

Off Site

Mobile Laboratory

LMS Sample ID	FSHP-6 (110')	FSHP-6 (120')	FSHP-6 (130')	FSHP-6 (140')	FSHP-6 (150')	FSHP-7 (55-65')	NYSDEC CLASS GA STANDARDS (b)
VOLATILE ORGANIC COMPOUNDS (µg/l)							
1,1-Dichloroethene	64.9	ND	ND	ND	ND	ND	5
trans-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	5
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	5
cis-1,2-Dichloroethene	241	ND	ND	ND	ND	ND	5
1,1,1-Trichloroethane	164 e	ND	3	5.3	3.63	ND	5
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	0.6
Trichloroethene	211 e	10.9	19.4	28.2	16	ND	5
Tetrachloroethene	255 e	112 e	129 e	130 e	113 e	0.51	5
Benzene	ND	ND	ND	ND	ND	ND	1
Toluene	ND	ND	ND	ND	ND	ND	5
Ethylbenzene	ND	ND	ND	ND	ND	ND	5
o-Xylene	ND	ND	ND	ND	ND	ND	5
m&p-Xylenes	ND	ND	ND	ND	ND	ND	5

- ♦ - Not analyzed.
- bold** - Value exceeds recommended criteria.
- (b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.
- e - The quantified value exceeds the linear calibration range and the true value may be higher.
- DL - Diluted sample analysis.
- ND - Not detected at analytical detection limit.

GROUNDWATER DATA SUMMARY

Off Site

Mobile Laboratory

LMS Sample ID	FSHP-7 (80')	FSHP-7 (90')	FSHP-7 (100')	FSHP-7 (110')	FSHP-7 (120')	FSHP-7 (130')	FSHP-7 (140')	FSHP-7 (150')	NYSDEC CLASS GA STANDARDS (b)
VOLATILE ORGANIC COMPOUNDS (µg/l)									
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	5
trans-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	5
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	5
cis-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	5
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	5
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	0.6
Trichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	5
Tetrachloroethene	1.77	2.17	0.82	1.34	1.74	0.93	0.89	ND	5
Benzene	ND	ND	ND	ND	ND	ND	ND	ND	1
Toluene	ND	ND	ND	ND	ND	ND	ND	ND	5
Ethylbenzene	ND	ND	ND	ND	ND	ND	ND	ND	5
o-Xylene	ND	ND	ND	ND	ND	ND	ND	ND	5
m&p-Xylenes	ND	ND	ND	ND	ND	ND	ND	ND	5

- ♦ - Not analyzed.
- bold - Value exceeds recommended criteria.
- (b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.
- e - The quantified value exceeds the linear calibration range and the true value may be higher.
- DL - Diluted sample analysis.
- ND - Not detected at analytical detection limit.

FSHP-07

0'	GRADE
20'	
40'	PCE 0.51
60'	ND
80'	PCE 1.77
100'	PCE 2.17
120'	PCE 0.82
140'	TCE 0.34 PCE 1.34 Toluene 6.02
160'	TCE 1.74 PCE 0.68
	PCE 0.93
	TCE 0.35 PCE 0.89

FSHP-06

0'	ND
20'	ND
40'	PCE 2.99
60'	PCE 13.3
80'	TCE 7.2 PCE 97.4
100'	11DCE 64.9 c12DCA 241 111TCA 164 TCE 211 PCE 255
120'	TCE 10.9 PCE 112
140'	111TCA 3 TCE 19.4 PCE 129
160'	111TCA 5.3 TCE 28.2 PCE 130
	111TCA 3.63 TCE 16 PCE 113

FSHP-05

0'	GRADE
20'	
40'	PCE 2.69
60'	PCE 1.45
80'	PCE 10.9
100'	PCE 70.6
120'	ND
140'	PCE 0.67
160'	ND
	PCE 0.58
	PCE 0.97

MAIN STREET

Former
Autoline Autom
(101 Frost Street)

(89 Frost Street)

Former
Applied Fluidics
(770 Main Street)

FSHP-6

FSHP-5

OLD COUNTRY ROAD

FSHP-7

0 200 ft



Approximate Scale
1 in. = 200 ft

Map source: YEC survey, 1998.
survey base map frost&main.dsf

ABBREVIATIONS

ND No contaminants detected

c12DCA cis-1,2-Dichloroethane

11DCA 1,1-Dichloroethane

111TCA 1,1,1-Trichloroethane

TCE Trichloroethene

PCE Tetrachloroethene

Legend

- Hydropunch location

All results are in µg/l

BOLD# Value exceeds standards level

Map source: YEC survey, 1998.

Figure 5-18

Groundwater Data Summary Offsite Mobile Laboratory

FROST STREET SITES
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043 I, L, and M

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

The results of the FSHP-7 analysis did not show concentrations of VOCs in excess of NYSDEC class GA groundwater standards. PCE and TCE were detected below NYSDEC Class GA groundwater standards at all depths.

Monitoring Well Sampling. Two monitoring wells (EZ-EM UN-4 and FSMW-9A) were analyzed by Target for VOCs. A detailed summary of VOC sampling results for these water samples is presented in Table 5-13, and Figure 5-19 graphically summarizes the results of the sampling analysis. 1,1,1-TCA was found in EZ-EM UN-4 at a concentration of 74.2 µg/l; 1,1-DCA was found in FSMW-9A at a concentration of 1426 µg/l. TCE and PCE were found in EZ-EM UN-4 at concentrations of 66.2 and 193 µg/l, respectively, and in FSMW-9A at 1249 and 680 µg/l, respectively.

5.2.3.2 *Analytical Laboratory Results*

The groundwater samples consist of water samples taken from in, below, and adjacent to the dry wells (samples titled Street#-DW-#-SW, Street#-DW-##, and Street#-DWA-##, respectively), as well as additional probes (FSGP-#).

101 Frost Street. Twenty samples taken from 10 locations, including the standing water in two dry wells, groundwater adjacent to four dry wells, and four additional probe samples, were analyzed for VOCs. A detailed summary of the sampling results for these water samples is presented in Table 5-14, Table 5-15 and Figure 5-20 graphically summarizes the results of the sampling analysis.

Analysis of the standing water in one dry well resulted in ND; the standing water in the other - 101-DW-9 (SW) - had trace amounts of chloroform, PCE, and toluene. Three samples were taken at 101-DWA-7: a shallow sample (63-64 ft), an intermediate sample (80-81 ft), and a deep sample (90-91 ft). The intermediate sample had 1,1,1-TCA (13 µg/l) and TCE (7 µg/l) above the Class GA standard; the deep sample was above the standard for 1,1-DCE (20 µg/l), 1,1,1-TCA (20 µg/l), TCE (20 µg/l), benzene (4 µg/l), and PCE (20 µg/l). The shallow and deep samples also had trace amounts of 2-butanone and toluene; the deep sample had additional traces of 4-methyl-2-pentanone and total xylenes. The shallow sample had traces of 1,1,1-TCA, TCE, and benzene.

TABLE 5-13

MONITORING WELL SAMPLING DATA SUMMARY Mobile Laboratory

LMS Sample ID	EZ-EM-UN-4	FSMW-09A	NYSDEC
Lab Sample ID	UN-4_EZ-EM	FSMU_09A	CLASS GA
Sampling Date	9/4/98	9/4/98	STANDARDS (b)
VOLATILE ORGANIC COMPOUNDS (µg/l)			
	[DL:10:1]	[DL:10:1]	
1,1-Dichloroethene	ND	ND	5
trans-1,2-Dichloroethene	ND	ND	5
1,1-Dichloroethane	ND	1426 e	5
cis-1,2-Dichloroethene	ND	ND	5
1,1,1-Trichloroethane	74.2 e	ND	5
1,2-Dichloroethane	ND	ND	0.6
Trichloroethene	66.2 e	1249 e	5
Tetrachloroethene	193 e	680 e	5
Benzene	ND	ND	1
Toluene	ND	ND	5
Ethylbenzene	ND	ND	5
o-Xylene	ND	ND	5
m&p-Xylenes	ND	ND	5

- ♦ - Not analyzed.
- bold** - Value exceeds recommended criteria.
- (b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.
- e - The quantified value exceeds the linear calibration range and the true value may be higher.
- DL - Diluted sample analysis.
- ND - Not detected at analytical detection limit.
- Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.



EZ-EM UN-4

111TCA **74.2**
TCE **66.2**
PCE **193**

EZ-EM UN-4

Former
Autoline Automotive
(101 Frost Street)

FROST STREET

(89 Frost Street)

MAIN STREET

FSMW-09A

11DCA **1426**
TCE **1249**
PCE **680**

Former
Applied Fluidics
(770 Main Street)

A FSMW-9

2 STORY

2 STORY

1 STORY

FSGP-15

OLD COUNTRY ROAD

Legend

- Monitoring well location
(-A = shallow well)

All results are in $\mu\text{g/l}$

BOLD# Value exceeds standards level

ABBREVIATIONS

ND No contaminants detected

11DCA 1,1-Dichloroethane
111TCA 1,1,1-Trichloroethane
TCE Trichloroethene
PCE Tetrachloroethane

0 200 ft

Approximate Scale
1 in. = 200 ft

survey base map frost&main.dsf

Figure 5-19 Monitoring Well Sampling Data Summary Mobile Laboratory

FROST STREET SITES
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043 I, L, and M

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

TABLE 5-14 (Page 1 of 5)

GROUNDWATER DATA SUMMARY
101 Frost Street
Base Analytical Laboratory

LMS Sample ID	101-DWA-7 (63-64')	101-DWA-7 (80-81')	101-DWA-7 (90-91')	101-DWA-8 (79-80')	NYSDEC
Lab Sample ID	101DW-7-63-64	101DW-7-80-81	101DW-7-90-91	101DW-8-79-80	
Lab Sample Number	84717	84716	84715	81443	CLASS GA
Sampling Date	09/16/98	09/16/98	09/16/98	9/1/98	STANDARDS (b)
VOLATILE ORGANIC COMPOUNDS (µg/l)					
Methylene Chloride	ND	ND	ND	ND	5
Acetone	ND	ND	400 bd	15	50
Carbon Disulfide	ND	ND	ND	0.9 j	50
1,1-Dichloroethene	ND	1 j	20 d	2 j	5
1,1-Dichloroethane	ND	ND	ND	1 j	5
1,2-Dichloroethene (total)	ND	ND	ND	ND	5
Chloroform	ND	ND	ND	ND	7
2-Butanone	7 j	ND	74 d	ND	N/A
1,1,1-Trichloroethane	4 j	13	20 d	38	5
Trichloroethene	3 j	7 j	20 d	6 j	5
4-Methyl-2-Pentanone	ND	ND	4 jd	ND	N/A
Dibromochloromethane	ND	ND	ND	ND	50 ^{gv}
Benzene	0.9 j	ND	4 jd	ND	1
Tetrachloroethene	ND	ND	20 d	3 j	5
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	5
Toluene	1 j	ND	3 jd	0.7 j	5
Ethylbenzene	ND	ND	ND	ND	5
Xylenes(Total)	ND	ND	1 jd	ND	5

[DL:2:1]

bold - Value exceeds recommended criteria.
(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.
b - Found in associated blanks.
j - Estimated concentration; compound present below quantitation limit.
DL - Diluted sample analysis.
N/A - Not applicable.
ND - Not detected at analytical detection limit.
d - Concentration recovered from diluted sample.
gv - Guidance Value.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

GROUNDWATER DATA SUMMARY

101 Frost Street

Base Analytical Laboratory

LMS Sample ID	101-DWA-12 (63-64')	101-DWA-12 (79-80')	101-DWA-12 (90-91')	Trip_Blank	NYSDEC
Lab Sample ID	101DW-12-63-34	101DW-12-79-80	101DW-12-90-91	Trip_Blank	
Lab Sample Number	84261	84260	84259	84262	CLASS GA
Sampling Date	09/15/98	09/15/98	09/15/98	09/15/98	STANDARDS (b)
VOLATILE ORGANIC COMPOUNDS (µg/l)					
Methylene Chloride	ND	ND	ND	2 j b	5
Acetone	ND	ND	ND	6 j b	50
Carbon Disulfide	ND	ND	ND	ND	50
1,1-Dichloroethene	ND	ND	ND	ND	5
1,1-Dichloroethane	ND	ND	ND	ND	5
1,2-Dichloroethene (total)	ND	ND	ND	ND	5
Chloroform	ND	ND	ND	ND	7
2-Butanone	6 j	8 j	7 j	ND	N/A
1,1,1-Trichloroethane	ND	ND	ND	ND	5
Trichloroethene	ND	ND	ND	ND	5
4-Methyl-2-Pentanone	ND	ND	ND	ND	N/A
Dibromochloromethane	ND	ND	ND	ND	50 ^{gv}
Benzene	0.4 j	ND	0.4 j	ND	1
Tetrachloroethene	ND	ND	ND	ND	5
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	5
Toluene	0.7 j	0.8 j	1 j	ND	5
Ethylbenzene	ND	ND	ND	ND	5
Xylenes(Total)	ND	ND	ND	ND	5

bold - Value exceeds recommended criteria.

(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.

b - Found in associated blanks.

j - Estimated concentration; compound present below quantitation limit.

DL - Diluted sample analysis.

N/A - Not applicable.

ND - Not detected at analytical detection limit.

gv - Guidance Value.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-14 (Page 3 of 5)

GROUNDWATER DATA SUMMARY

101 Frost Street

Base Analytical Laboratory

LMS Sample ID	Trip_Blank	101-DWA-13 (63-64')	101-DWA-13 (79-80')	101-DWA-13 (90-91')	Trip_Blank	NYSDEC
Lab Sample ID	Trip_Blank	101DWA-13-63-64	101DWA-13-79-80	101DWA-13-90-91	Trip_Blank	
Lab Sample Number	84721	84720	84719	84718	76700	CLASS GA
Sampling Date	09/16/98	09/16/98	09/16/98	09/16/98	7/24/98	STANDARDS (b)
VOLATILE ORGANIC COMPOUNDS (µg/l)						
Methylene Chloride	1 j	ND	ND	ND	ND	5
Acetone	ND	ND	ND	ND	ND	50
Carbon Disulfide	ND	ND	ND	ND	ND	50
1,1-Dichloroethene	ND	ND	ND	ND	ND	5
1,1-Dichloroethane	ND	ND	ND	ND	ND	5
1,2-Dichloroethene (total)	ND	ND	ND	ND	ND	5
Chloroform	ND	ND	ND	ND	ND	7
2-Butanone	ND	ND	9 j	ND	ND	N/A
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	5
Trichloroethene	ND	ND	ND	ND	ND	5
4-Methyl-2-Pentanone	ND	ND	ND	ND	ND	N/A
Dibromochloromethane	ND	ND	ND	ND	ND	50 ^{pp}
Benzene	ND	ND	1 j	0.6 j	ND	1
Tetrachloroethene	ND	ND	ND	1 j	ND	5
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	5
Toluene	ND	ND	1 j	0.7 j	ND	5
Ethylbenzene	ND	ND	ND	ND	ND	5
Xylenes(Total)	ND	ND	ND	ND	ND	5

bold - Value exceeds recommended criteria.

(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.

b - Found in associated blanks.

j - Estimated concentration; compound present below quantitation limit.

DL - Diluted sample analysis.

N/A - Not applicable.

ND - Not detected at analytical detection limit.

gv - Guidance Value.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

GROUNDWATER DATA SUMMARY

101 Frost Street
Base Analytical Laboratory

LMS Sample ID	Trip_Blank	FSGP-01 (60-61')	FSGP-01 (80-81')	FSGP-01 (91-92')	FSGP-02 (63-64')	NYSDEC
Lab Sample ID	Trip_Blank	FSGP-1-60-61	FSGP-1-80-81	FSGP-1-91-92	FSGP-2-63-64	CLASS GA
Lab Sample Number	78278	86974	86973	86972	86977	STANDARDS (b)
Sampling Date	7/24/98	9/28/98	9/28/98	9/28/98	9/29/98	
VOLATILE ORGANIC COMPOUNDS (µg/l)						
Methylene Chloride	8 j	ND	ND	ND	ND	5
Acetone	ND	ND	ND	ND	ND	50
Carbon disulfide	ND	ND	ND	ND	ND	50
1,1-Dichloroethene	ND	ND	ND	ND	ND	5
1,1-Dichloroethane	ND	ND	ND	ND	ND	5
1,2-Dichloroethene (total)	ND	ND	ND	ND	ND	5
Chloroform	ND	ND	ND	ND	ND	7
2-Butanone	ND	ND	ND	ND	ND	N/A
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	5
Trichloroethene	ND	ND	ND	ND	ND	5
4-Methyl-2-Pentanone	ND	ND	ND	ND	ND	N/A
Dibromochloromethane	ND	ND	ND	ND	ND	50 ^g
Benzene	ND	ND	0.2 j	0.3 b	0.8 j	1
Tetrachloroethene	ND	0.3 j	0.7 j	1 j	ND	5
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	5
Toluene	ND	ND	0.4 j	ND	ND	5
Ethylbenzene	ND	ND	ND	ND	ND	5
Xylenes (Total)	ND	ND	ND	ND	ND	5

bold - Value exceeds recommended criteria.

(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.

b - Found in associated blanks.

j - Estimated concentration; compound present below quantitation limit.

DL - Diluted sample analysis.

N/A - Not applicable.

ND - Not detected at analytical detection limit.

gv - Guidance Value.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-14 (Page 5 of 5)

GROUNDWATER DATA SUMMARY

101 Frost Street
Base Analytical Laboratory

LMS Sample ID	FSGP-02 (79-80')	FSGP-02 (91-92')	FSGP-03 (60-65')	FSGP-04 (60-65')	Trip_Blank	NYSDEC
Lab Sample ID	FSGP-2-79-80	FSGP-2-91-92	FSGP-3-60-65	FSGP-4-60-65	Trip_Blank	
Lab Sample Number	86976	86975	81442	82143	86978	CLASS GA
Sampling Date	9/29/98	9/29/98	9/1/98	9/3/98	9/29/98	STANDARDS (b)
VOLATILE ORGANIC COMPOUNDS (µg/l)						
Methylene Chloride	ND	ND	ND	52 jd	4 j	5
Acetone	ND	ND	ND	ND	ND	50
Carbon disulfide	ND	ND	ND	ND	ND	50
1,1-Dichloroethene	ND	ND	2 j	ND	ND	5
1,1-Dichloroethane	ND	ND	2 j	ND	ND	5
1,2-Dichloroethene (total)	ND	ND	3 j	ND	ND	5
Chloroform	ND	ND	ND	ND	ND	7
2-Butanone	12	ND	ND	ND	ND	N/A
1,1,1-Trichloroethane	ND	ND	75	ND	ND	5
Trichloroethene	ND	ND	13	41 jd	ND	5
4-Methyl-2-Pentanone	ND	ND	ND	ND	ND	N/A
Dibromochloromethane	ND	ND	ND	ND	ND	50 ^{gv}
Benzene	0.8 j	ND	ND	ND	ND	1
Tetrachloroethene	0.3 j	0.9 j	40	3200 d	ND	5
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	5
Toluene	0.6 j	ND	ND	ND	ND	5
Ethylbenzene	ND	ND	ND	ND	ND	5
Xylenes (Total)	ND	ND	ND	ND	ND	5

[DL:50:1]

- bold** - Value exceeds recommended criteria.
 (b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.
 b - Found in associated blanks.
 j - Estimated concentration; compound present below quantitation limit.
 DL - Diluted sample analysis.
 N/A - Not applicable.
 ND - Not detected at analytical detection limit.
 d - Concentration recovered from diluted sample.
 gv - Guidance Value.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-15 (Page 1 of 1)

STANDING WATERS DATA SUMMARY

101 Frost Street

Base Analytical Laboratory

LMS Sample ID	101-DW-00 (SW)	101-DW-9 (SW)	101-DW-N/S (SW)	NYSDEC
Lab Sample ID	101-DW-00 (SW)	101DW-9-SW	101-DW-N/S SW	CLASS GA
Lab Sample Number	982626A-03	78276	71037	STANDARDS (b)
Sampling Date	12/4/98	8/18/98	7/12/98	
VOLATILE ORGANIC COMPOUNDS (µg/l)				
Methylene Chloride	ND	ND	ND	5
Acetone	ND	ND	ND	50
Carbon Disulfide	ND	ND	ND	50
1,1-Dichloroethene	ND	ND	ND	Z
1,1-Dichloroethane	ND	ND	ND	5
1,2-Dichloroethene (total)	ND	ND	ND	5
Chloroform	ND	2 j	ND	7
2-Butanone	ND	ND	ND	N/A
1,1,1-Trichloroethane	ND	ND	ND	5
Trichloroethene	ND	ND	ND	5
4-Methyl-2-Pentanone	ND	ND	ND	N/A
Dibromochloromethane	ND	ND	ND	50 ^{gv}
Benzene	ND	ND	ND	1
Tetrachloroethene	ND	4 j	ND	5
1,1,2,2-Tetrachloroethane	ND	ND	ND	5
Toluene	ND	1 j	ND	5
Ethylbenzene	ND	ND	ND	5
Xylenes(Total)	ND	ND	ND	5

bold - Value exceeds recommended criteria.

(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.

b - Found in associated blanks.

j - Estimated concentration; compound present below quantitation limit.

DL - Diluted sample analysis.

N/A - Not applicable.

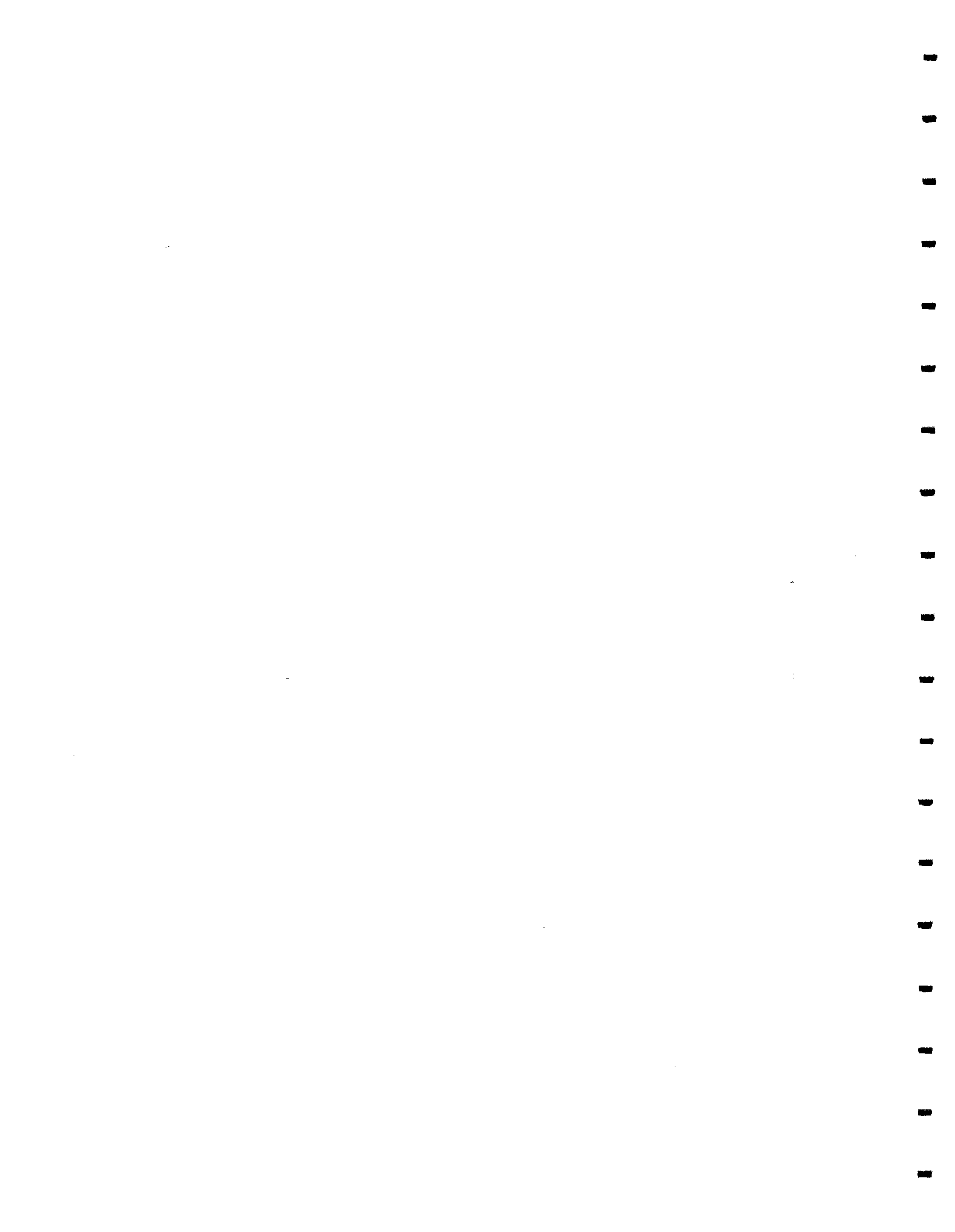
ND - Not detected at analytical detection limit.

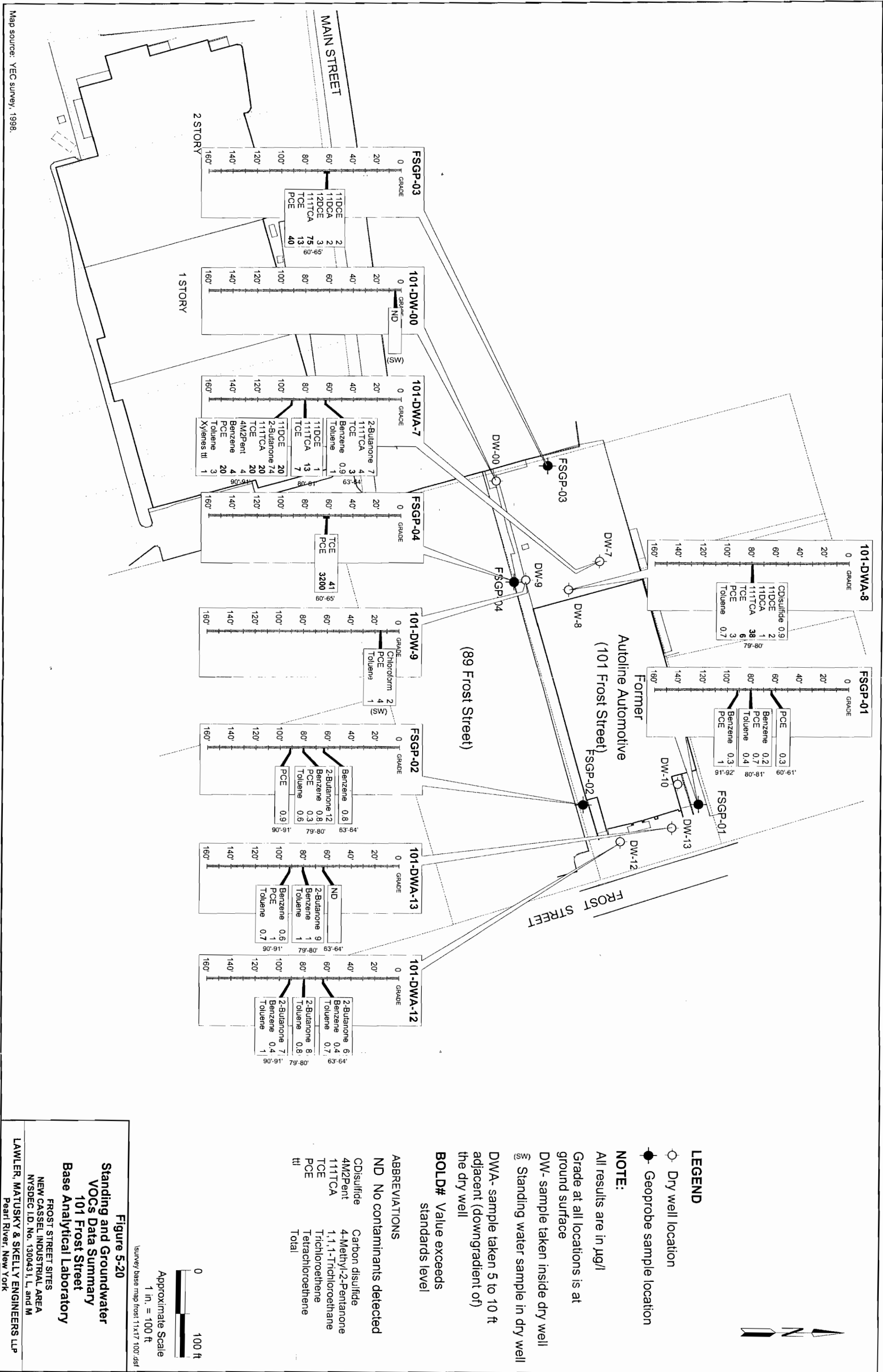
SW - Surface Water.

d - Concentration recovered from diluted sample.

gv - Guidance Value.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys.
The Lab Sample ID is the field sample designation.





The sample taken at 101-DWA-8 (79-80) had 1,1,1-TCA (38 µg/l) and TCE (6 µg/l) over the standard, with traces of CDS, 1,1-DCE, 1,1-DCA, PCE, and toluene.

In the rest of the adjacent to dry well samples, one sample was ND for all compounds, while traces of 2-butanone and benzene in four; and traces of toluene in five. The additional probes had traces of benzene in four samples and traces of PCE in five samples, with FSGP-3 (60-65 ft) and FSGP4 (60-65 ft) both having concentrations over the standard (40 and 3200 µg/l, respectively). Traces of toluene were found in two samples and traces of 2-butanone in one sample. FSGP-3 (60-65 ft) also had traces of 1,1-DCE, 1,1-DCA, and 1,2-DCE total, along with 1,1,1-TCA (75 µg/l) and TCE (13 µg/l), which were over the standard. The sample from FSGP-4 (60-65 ft) also had TCE at levels over the standard, with a concentration of 41 µg/l.

89 Frost Street. Twelve samples were taken from 12 locations in and adjacent to dry wells, including the standing water inside the dry wells. A detailed summary of VOC sampling results for these water samples is presented in Table 5-16, Table 5-17 and Figure 5-21 graphically summarizes the results of the sampling analysis.

The standing water in three of the dry wells had traces of TCE, toluene, ethylbenzene, and/or total xylenes. One sample, 89-DW-11 (SW), also had benzene above the Class GA standard at a concentration of 7 µg/l; one adjacent sample, 89-DWA-14 (60-65 ft), had both TCE and PCE at levels above the standards at 130 and 5600 µg/l, respectively.

Monitoring Well Sampling. Twenty-five newly installed and existing monitoring wells were sampled during the RI. A detailed summary of VOC sampling results for these water samples is presented in Table 5-18, and Figure 5-22 graphically summarizes the results of the sampling analysis.

Results for two existing (NC-6 and Anson-MW-5), and one new monitoring well (FSMW-1B) were ND. CDS was found in trace amounts in FSMW-1A. Total 1,2-DCE was found in trace concentrations in two monitoring wells and above the Class GA standard in the following five monitoring wells: FSMW-4A (660 µg/l); FSMW-6B (7 µg/l); FSMW-8B (8 µg/l); FSMW-9A (330 µg/l); and EZ-EM UN-4 (24 µg/l). 1,1-DCE was also found in trace amounts in two of the groundwater samples. Traces of 1,1,1-

TABLE 5-16 (Page 1 of 1)

GROUNDWATER DATA SUMMARY

89 Frost Street

Base Analytical Laboratory

LMS Sample ID	89-DWA-8 (79-80') 89-DWA-14 (60-65')	Trip_Blank	Trip_Blank	Trip_Blank	Trip_Blank	NYSDEC
Lab Sample ID	DWA-7a_79-80 DWA-SMHE_60-65	Trip_Blank	Trip_Blank	Trip_Blank	Trip_Blank	CLASS GA
Lab Sample Number	76698	81702	70690	71009	71036	STANDARDS (b)
Sampling Date	8/11/98	9/2/98	07/07/98	07/07/98	07/07/98	
[DL:100:1]						
VOLATILE ORGANIC COMPOUNDS (µg/l)						
Methylene chloride	ND	ND	ND	ND	1 j	5
Acetone	ND	ND	ND	ND	ND	50
Carbon Disulfide	ND	ND	ND	ND	ND	50
1,1-Dichloroethene	ND	ND	ND	ND	ND	5
1,1-Dichloroethane	ND	ND	ND	ND	ND	5
1,2-Dichloroethene (total)	ND	ND	ND	ND	ND	5
Chloroform	ND	ND	ND	ND	ND	7
2-Butanone	ND	ND	ND	ND	ND	N/A
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	5
Trichloroethene	ND	130 jd	ND	ND	ND	5
4-Methyl-2-Pentanone	ND	ND	ND	ND	ND	N/A
Dibromochloromethane	ND	ND	ND	ND	ND	50 ^{gv}
Benzene	ND	ND	ND	ND	ND	1
Tetrachloroethene	2 j	5600 d	ND	ND	ND	5
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	5
Toluene	ND	ND	ND	ND	ND	5
Ethylbenzene	ND	ND	ND	ND	ND	5
Xylenes (Total)	ND	ND	ND	ND	ND	5

(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.

bold - Value exceeds recommended criteria.

j - Estimated concentration; compound present below quantitation limit.

DL - Diluted sample analysis.

N/A - Not available.

ND - Not detected at analytical detection limit.

SW - Surface Water

gv - Guidance Value.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-17 (Page 1 of 2)

STANDING WATER DATA SUMMARY

89 Frost Street

Base Analytical Laboratory

LMS Sample ID	89-DW-2 (SW)	89-DW-7 (SW)	89-DW-9 (SW)	89-DW-10 (SW)	89-DW-11 (SW)	NYSDEC
Lab Sample ID	DW-2	DW-6	DW-8	DW-10	DW-11	CLASS GA
Lab Sample Number	71020	71028	71033	70687	70685	STANDARDS (b)
Sampling Date	07/11/98	07/11/98	07/12/98	07/09/98	07/09/98	
VOLATILE ORGANIC COMPOUNDS (µg/l)						
Methylene chloride	ND	ND	ND	ND	ND	5
Acetone	ND	ND	ND	ND	17	50
Carbon Disulfide	ND	ND	ND	ND	ND	50
1,1-Dichloroethene	ND	ND	ND	ND	ND	5
1,1-Dichloroethane	ND	ND	ND	ND	ND	5
1,2-Dichloroethene (total)	ND	ND	ND	ND	ND	5
Chloroform	ND	ND	ND	ND	ND	7
2-Butanone	ND	ND	ND	ND	ND	N/A
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	5
Trichloroethene	ND	ND	ND	ND	ND	5
4-Methyl-2-Pentanone	ND	ND	ND	ND	ND	N/A
Dibromochloromethane	ND	ND	ND	ND	ND	50 ^{gv}
Benzene	ND	ND	ND	ND	ND	1
Tetrachloroethene	ND	ND	ND	ND	7 j	5
1,1,2,2-Tetrachloroethane	ND	ND	ND	4 j	0.5 j	5
Toluene	ND	ND	ND	ND	ND	5
Ethylbenzene	ND	ND	ND	ND	0.6 j	5
Xylenes (Total)	ND	ND	ND	ND	ND	5

(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.

bold - Value exceeds recommended criteria.

j - Estimated concentration; compound present below quantitation limit.

DL - Diluted sample analysis.

N/A - Not available.

ND - Not detected at analytical detection limit.

SW - Surface Water

gv - Guidance Value.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-17 (Page 2 of 2)

STANDING WATER DATA SUMMARY

89 Frost Street

Base Analytical Laboratory

LMS Sample ID	89-DW-12 (SW)	89-DW-14 (SW)	89-DW-15 (SW)	89-DW-16 (SW)	NYSDEC
Lab Sample ID	DW-15	SMH-E	DW-16	DW-12	CLASS GA
Lab Sample Number	70689	71008	70688	70686	
Sampling Date	07/09/98	07/10/98	07/09/98	07/08/98	STANDARDS (b)
VOLATILE ORGANIC COMPOUNDS (µg/l)					
Methylene chloride	ND	ND	ND	ND	5
Acetone	ND	ND	ND	ND	50
Carbon Disulfide	ND	ND	ND	ND	50
1,1-Dichloroethene	ND	ND	ND	ND	5
1,1-Dichloroethane	ND	ND	ND	ND	5
1,2-Dichloroethene (total)	ND	ND	ND	ND	5
Chloroform	ND	ND	ND	ND	7
2-Butanone	ND	ND	ND	ND	N/A
1,1,1-Trichloroethane	ND	ND	ND	ND	5
Trichloroethene	ND	0.5 j	ND	ND	5
4-Methyl-2-Pentanone	ND	ND	ND	ND	N/A
Dibromochloromethane	ND	ND	ND	ND	50 ^{gv}
Benzene	ND	ND	ND	ND	1
Tetrachloroethene	0.8 j	21	ND	ND	5
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	5
Toluene	1 j	ND	ND	ND	5
Ethylbenzene	0.5 j	ND	ND	ND	5
Xylenes (Total)	3 j	ND	ND	ND	5

(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.

bold - Value exceeds recommended criteria.

j - Estimated concentration; compound present below quantitation limit.

DL - Diluted sample analysis.

N/A - Not available.

ND - Not detected at analytical detection limit.

SW - Surface Water

d - Concentration recovered from diluted sample.

gv - Guidance Value.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

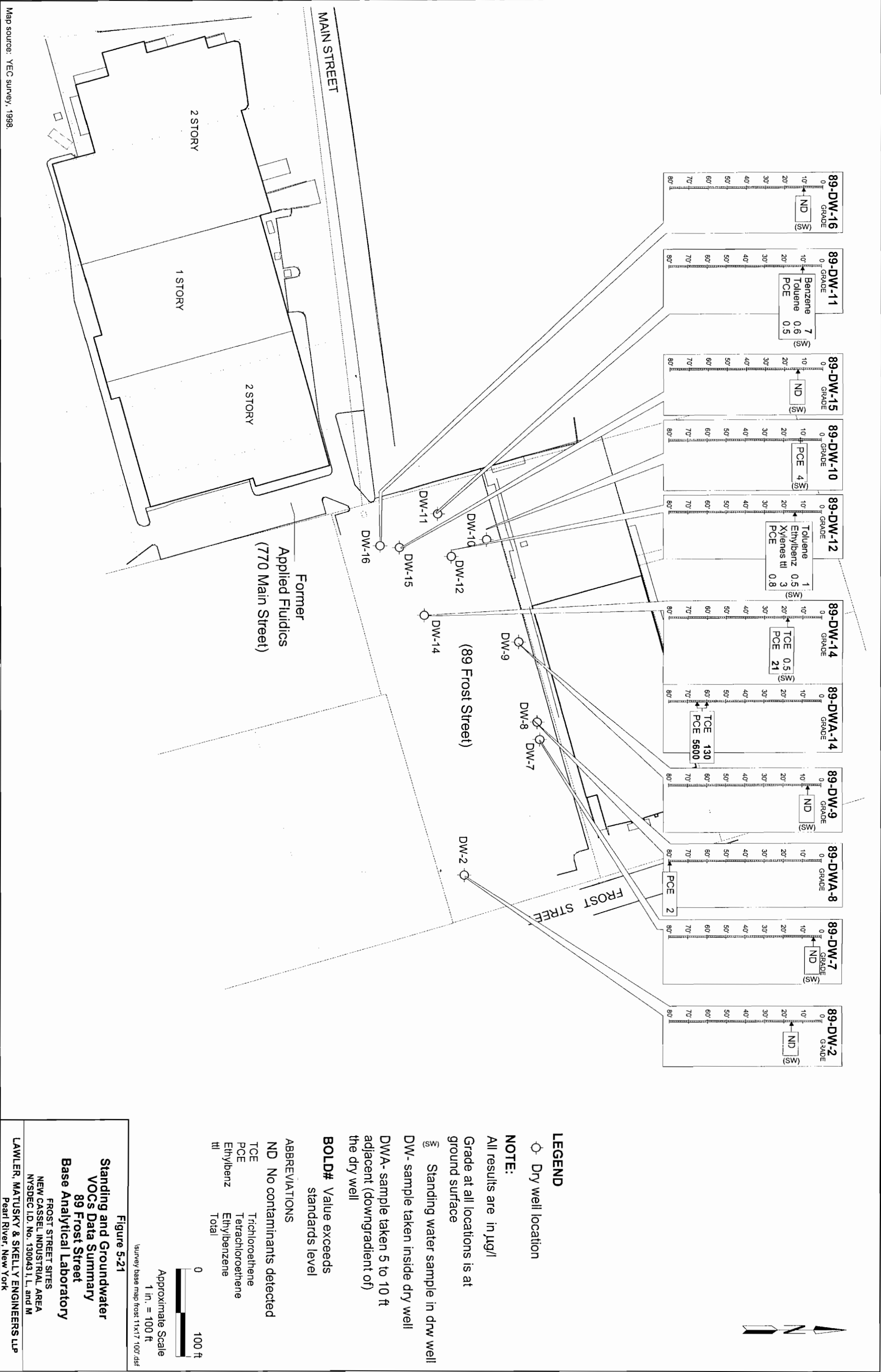


TABLE 5-18
(Page 1 of 5)

MONITORING WELL SAMPLING DATA SUMMARY
Base Analytical Laboratory

LMS Sample ID	FSMW-01A	FSMW-01B	FSMW-02A	FSMW-02B	FSMW-02C (bd)	Trip Blank	NYSDEC
Lab Sample ID	FSMW-01A	FSMW-01B	FSMW-02A	FSMW-02B	FSMW-02C	Trip Blank	
Lab Sample Number	81699	81698	81437	81438	81439	81441	CLASS GA
Sampling Date	9/2/98	9/2/98	9/1/98	9/1/98	9/1/98	9/1/98	STANDARDS (b)
[DL:250:1]							
VOLATILE ORGANIC COMPOUNDS (µg/l)							
Methylene chloride	ND	ND	ND	ND	ND	ND	5
Acetone	ND	ND	ND	ND	ND	ND	50
Carbon Disulfide	ND	ND	180 jd	ND	ND	ND	50
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	5
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	5
1,2-Dichloroethene (total)	ND	ND	ND	ND	ND	ND	5
Chloroform	ND	ND	ND	ND	ND	ND	7
2-Butanone	ND	ND	ND	ND	ND	ND	N/A
1,1,1-Trichloroethane	4 j	ND	ND	1 j	1 j	ND	5
Trichloroethene	0.9 j	ND	ND	ND	ND	ND	5
4-Methyl-2-Pentanone	ND	ND	ND	ND	ND	ND	N/A
Dibromochloromethane	ND	ND	ND	ND	ND	ND	50 ^{gv}
Benzene	ND	ND	ND	ND	ND	ND	1
Tetrachloroethene	4 j	ND	18000 d	50	47	ND	5
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	5
Toluene	1 j	ND	ND	ND	ND	ND	5
Ethylbenzene	ND	ND	ND	ND	ND	ND	5
Xylenes (Total)	ND	ND	ND	ND	ND	ND	5

bold - Value exceeds recommended criteria.

(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.

j - Estimated concentration; compound present below quantitation limit.

DL - Diluted sample.

N/A - Not applicable.

ND - Not detected at analytical detection limit.

gv - Guidance Value.

d - Concentration recovered from diluted sample.

bd - Blind duplicate of FSMW-02B.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-18
(Page 2 of 5)

MONITORING WELL SAMPLING DATA SUMMARY Base Analytical Laboratory

LMS Sample ID	FSMW-03A	FSMW-03B	Trip Blank	FSMW-04A	FSMW-04B	FSMW-05A	FSMW-05B	NYSDEC
Lab Sample ID	FSMW-03A	FSMW-03B	Trip Blank	FSMW-04A	FSMW-04B	FSMW-05A	FSMW-05B	
Lab Sample Number	82148	82149	82150	81440	81697	83863	83326	CLASS GA
Sampling Date	9/3/98	9/3/98	9/3/98	9/1/98	9/2/98	9/11/98	9/10/98	STANDARDS (b)
[DL:1000:1]								
VOLATILE ORGANIC COMPOUNDS (µg/l)								
Methylene chloride	ND	ND	1 j	ND	ND	ND	ND	5
Acetone	ND	ND	9 j	ND	ND	ND	ND	50
Carbon Disulfide	ND	ND	ND	ND	ND	ND	ND	50
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	5
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	5
1,2-Dichloroethene (total)	0.6 j	ND	ND	660 jd	ND	ND	ND	5
Chloroform	ND	ND	ND	ND	ND	ND	ND	7
2- Butanone	ND	ND	ND	ND	ND	ND	10	N/A
1,1,1-Trichloroethane	5 j	ND	ND	ND	ND	ND	ND	5
Trichloroethene	3 j	ND	ND	3600 jd	2 j	ND	ND	5
4-Methyl-2-Pentanone	ND	ND	ND	ND	ND	ND	ND	N/A
Dibromochloromethane	ND	ND	ND	ND	ND	ND	ND	50 ^{gv}
Benzene	0.9 j	ND	ND	ND	ND	ND	ND	1
Tetrachloroethene	75	2 j	ND	120,000 d	26	22	4 j	5
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND	5
Toluene	4 j	ND	ND	ND	ND	3 j	0.7 j	5
Ethylbenzene	ND	ND	ND	ND	ND	ND	0.5 j	5
Xylenes (Total)	0.6 j	ND	ND	ND	ND	ND	ND	5

bold - Value exceeds recommended criteria.
 (b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.
 j - Estimated concentration; compound present below quantitation limit.
 DL - Diluted sample.
 N/A - Not applicable.
 ND - Not detected at analytical detection limit.
 gv - Guidance Value.
 d - Concentration recovered from diluted sample.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-18
(Page 3 of 5)

MONITORING WELL SAMPLING DATA SUMMARY Base Analytical Laboratory

LMS Sample ID	FSMW-06A	FSMW-06B	FSMW-07A	FSMW-07B	Trip Blank	Trip Blank	Trip Blank	Trip Blank	NYSDEC
Lab Sample ID	FSMW-06A	FSMW-06B	FSMW-07A	FSMW-07B	Trip Blank	Trip Blank	Trip Blank	Trip Blank	
Lab Sample Number	82705	82706	83325	82704	83864	82607	81102	81102	CLASS GA
Sampling Date	9/8/98	9/8/98	9/10/98	9/8/98	9/11/98	9/4/98	8/31/98	8/31/98	STANDARDS (b)
VOLATILE ORGANIC COMPOUNDS (µg/l)									
(DL:2-1)									
Methylene chloride	ND	ND	ND	ND	ND	1 j	ND	ND	5
Acetone	ND	ND	ND	ND	ND	10	ND	ND	50
Carbon Disulfide	ND	ND	ND	ND	ND	ND	ND	ND	50
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	5
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	5
1,2-Dichloroethene (total)	ND	7 jd	ND	ND	ND	ND	ND	ND	5
Chloroform	ND	ND	ND	ND	ND	ND	ND	ND	7
2-Butanone	ND	ND	ND	ND	ND	ND	ND	ND	N/A
1,1,1-Trichloroethane	ND	3 jd	ND	ND	ND	ND	ND	ND	5
Trichloroethene	ND	9 jd	ND	1 j	ND	ND	ND	ND	5
4-Methyl-2-Pentanone	ND	ND	ND	ND	ND	ND	ND	ND	N/A
Dibromochloromethane	ND	ND	ND	ND	ND	ND	ND	ND	50 ^g
Benzene	ND	ND	ND	ND	ND	ND	ND	ND	1
Tetrachloroethene	13	220 d	5 j	1 j	ND	ND	ND	ND	5
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND	ND	5
Toluene	3 j	1 jd	ND	0.9 j	ND	ND	ND	ND	5
Ethylbenzene	0.1 j	ND	ND	ND	ND	ND	ND	ND	5
Xylenes (Total)	1 j	ND	ND	0.7 j	ND	ND	ND	ND	5

bold - Value exceeds recommended criteria.
(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.
j - Estimated concentration; compound present below quantitation limit.
DL - Diluted sample.
N/A - Not applicable.
ND - Not detected at analytical detection limit.
gv - Guidance Value.
d - Concentration recovered from diluted sample.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-18
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MONITORING WELL SAMPLING DATA SUMMARY

Base Analytical Laboratory

Sample ID	Trip Blank	FSMW-08A	FSMW-08B	FSMW-09A	FSMW-09B	FSMW-10A	FSMW-10B	NYSDEC
Lab Sample ID	Trip Blank	FSMW-08A	FSMW-08B	FSMW-09A	FSMW-09B	FSMW-10A	FSMW-10B	
Lab Sample Number	81700	82146	82147	82605	82914	82912	82913	CLASS GA
Sampling Date	9/2/98	9/3/98	9/3/98	9/4/98	9/9/98	9/9/98	9/9/98	STANDARDS (b)
VOLATILE ORGANIC COMPOUNDS (µg/l)								
	[DL:500:1]	[DL:2:1]	[DL:500:1]	[DL:10:1]				
Methylene chloride	ND	ND	490 jd	ND	ND	ND	ND	5
Acetone	ND	15 jd	ND	ND	ND	ND	ND	50
Carbon Disulfide	ND	ND	ND	ND	ND	ND	ND	50
1,1-Dichloroethene	ND	ND	ND	ND	0.7 j	ND	ND	5
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	5
1,2-Dichloroethene (total)	ND	8 jd	330 jd	2 j	ND	ND	ND	5
Chloroform	ND	1 jd	ND	ND	ND	ND	ND	7
2- Butanone	ND	ND	ND	ND	ND	ND	ND	N/A
1,1,1-Trichloroethane	ND	ND	ND	ND	14 jd	2 j	ND	5
Trichloroethene	ND	18 jd	1,400 jd	6 j	17 jd	4 j	ND	5
4-Methyl-2-Pentanone	ND	ND	ND	ND	ND	ND	ND	N/A
Dibromochloromethane	ND	ND	ND	ND	ND	ND	ND	50 ^{gv}
Benzene	ND	ND	ND	ND	ND	ND	0.8 j	1
Tetrachloroethene	ND	390 d	26,000 d	100	1,100 d	58	ND	5
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND	5
Toluene	ND	ND	ND	0.5 j	ND	9 j	ND	5
Ethylbenzene	ND	ND	ND	ND	ND	0.7 j	ND	5
Xylenes (Total)	ND	ND	ND	ND	ND	4 j	ND	5

bold - Value exceeds recommended criteria.
 (b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.
 j - Estimated concentration; compound present below quantitation limit.
 DL - Diluted sample.
 N/A - Not applicable.
 ND - Not detected at analytical detection limit.
 gv - Guidance Value.
 d - Concentration recovered from diluted sample.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

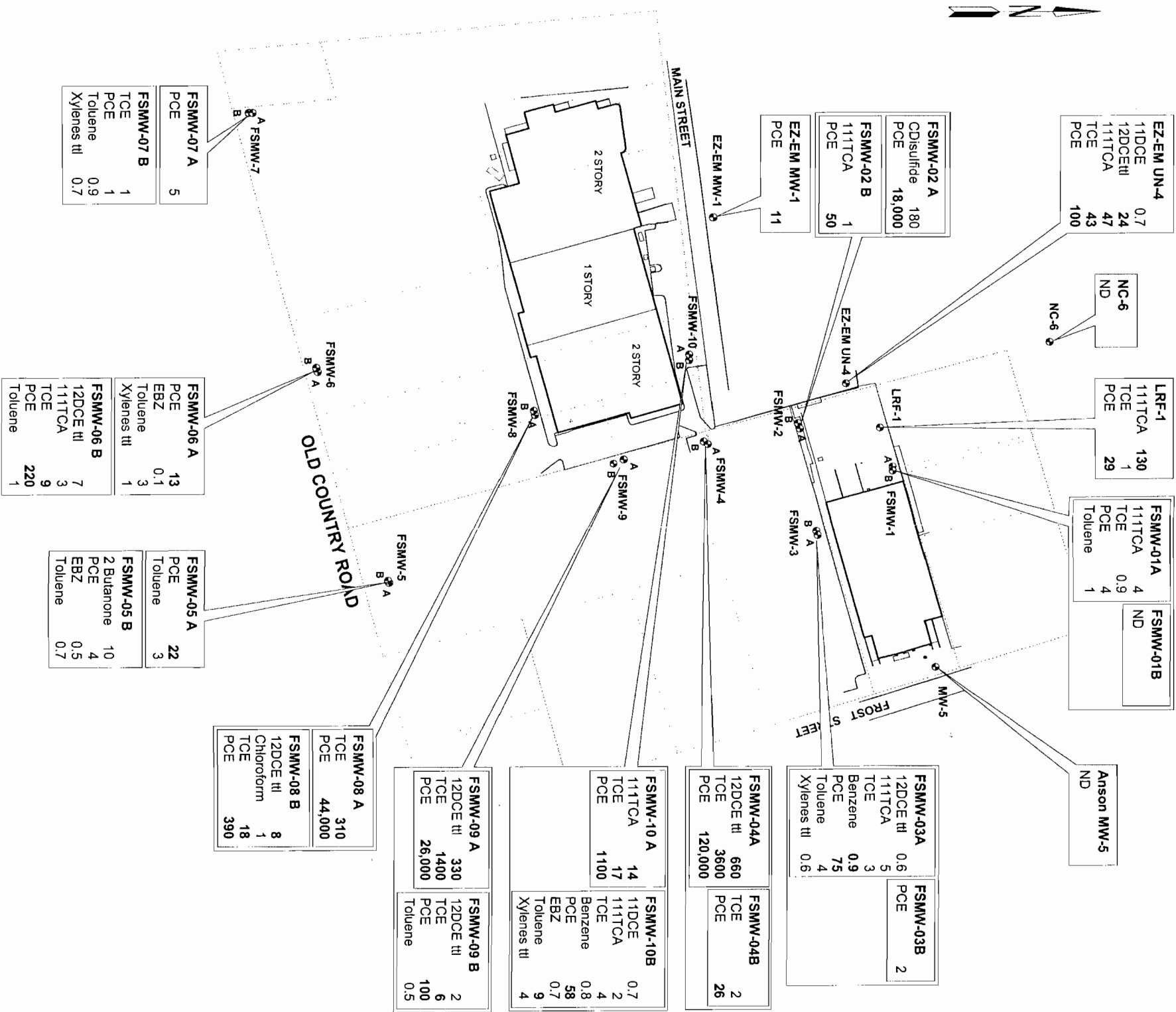
TABLE 5-18
(Page 5 of 5)

MONITORING WELL SAMPLING DATA SUMMARY Base Analytical Laboratory

LMS Sample ID	Trip Blank	Trip Blank	Trip Blank	NC-6	EZ-EM-UN-4	LRF-1	Anson MW-5	EZ-EM-MW-1	NYSDEC
Lab Sample ID	Trip Blank	Trip Blank	Trip Blank	NC-6	UN-4-EZ-EM	LRF-1 FROST	MW-5-ANSON	MW-1-EZ-EM	
Lab Sample Number	82915	83323	82707	83324	82606	81099	81098	81100	CLASS GA
Sampling Date	9/9/98	9/10/98	9/8/98	9/10/98	9/4/98	8/31/98	8/31/98	8/31/98	STANDARDS (b)
[DL:2:1]									
VOLATILE ORGANIC COMPOUNDS (µg/l)									
Methylene chloride	ND	ND	ND	ND	ND	ND	ND	ND	5
Acetone	ND	ND	ND	ND	ND	ND	ND	ND	50
Carbon Disulfide	ND	ND	ND	ND	ND	ND	ND	ND	50
1,1-Dichloroethene	ND	ND	ND	ND	0.7 j	ND	ND	ND	5
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	5
1,2-Dichloroethene (total)	ND	ND	ND	ND	24	ND	ND	ND	5
Chloroform	ND	ND	ND	ND	ND	ND	ND	ND	7
2- Butanone	ND	ND	ND	ND	ND	ND	ND	ND	N/A
1,1,1-Trichloroethane	ND	ND	ND	ND	47	130 d	ND	ND	5
Trichloroethene	ND	ND	ND	ND	43	1 jd	ND	ND	5
4-Methyl-2-Pentanone	ND	ND	ND	ND	ND	ND	ND	ND	N/A
Dibromochloromethane	ND	ND	ND	ND	ND	ND	ND	ND	50 ^{gv}
Benzene	ND	ND	ND	ND	ND	ND	ND	ND	1
Tetrachloroethene	ND	ND	ND	ND	100	29 d	ND	ND	5
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND	ND	5
Toluene	ND	ND	ND	ND	ND	ND	ND	ND	5
Ethylbenzene	ND	ND	ND	ND	ND	ND	ND	ND	5
Xylenes (Total)	ND	ND	ND	ND	ND	ND	ND	ND	5

bold - Value exceeds recommended criteria.
(b) - Division of Water Technical and Operational Guidance Series (1.1.1) June 1998.
j - Estimated concentration; compound present below quantitation limit.
DL - Diluted sample.
N/A - Not applicable.
ND - Not detected at analytical detection limit.
gv - Guidance Value.
d - Concentration recovered from diluted sample

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.



LEGEND

- Monitoring well location
- Shallow (~70')
- Deep (~150')

NOTE:

All results are in µg/l

Grade at all locations is at ground surface

BOLD# Value exceeds standards level

ABBREVIATIONS

ND No contaminants detected

111TCA 1,1,1-Trichloroethane

cis12DCE cis-1,2-Dichloroethene

11DCE 1,1-Dichloroethene

12DCE tll 1,2-Dichloroethene total

TCE Trichloroethene

PCE Tetrachloroethene

EBZ Ethylbenzene

CDsulfide Carbon disulfide



Figure 5-22

Monitoring Well Summary

Base Analytical Laboratory

FROST STREET SITES
NEW CASSEL INDUSTRIAL AREA
NYSDC I.D. No. 1300431, L, and M
LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

TCA were found in five monitoring wells while three wells: FSMW-10A (14 µg/l), EZ-EM UN-4 (47 µg/l), and LRF-1 (130 µg/l) had concentrations above the Class GA standard.. FSMW-10B contained 9 µg/l of toluene, while trace levels of toluene were also found in eight other wells. Two samples had traces of benzene; three had traces of ethylbenzene; one had traces of 2-butanone; and four had traces of total xylenes. Six samples had traces of TCE, and eight monitoring wells (FSMW-4A, -6B, -8A, -8B, -9A, -9B, -10A, and EZ-EM-UN-4) had TCE concentrations over the standard (3600, 9, 310, 18, 1400, 6, 17, and 43 µg/l, respectively).

PCE was found in trace concentrations in five of the wells and over the standard in shallow monitoring wells FSMW-2A (18,000 µg/l), FSMW-3A (75 µg/l), FSMW-4A (120,000 µg/l), FSMW-5A (22 µg/l), FSMW-6A (13 µg/l), FSMW-8A (44,000 µg/l), FSMW-9A (26,000 µg/l), FSMW-10A (1100 µg/l), EZ-EM-UN-4 (100 µg/l), and LRF-1 (29 µg/l) and in deep wells FSMW-2B (50 µg/l), FSMW-4B (26 µg/l), FSMW-6B (220 µg/l), FSMW-8B (390 µg/l), FSMW-9B (100 µg/l), and FSMW-10B (58 µg/l).

5.3 COMPARISON OF MOBILE AND FIXED LABORATORY DATA.

The majority of samples taken were analyzed in the field in a mobile laboratory by Target. As per the Field Activities Plan (FAP), 26 samples (approximately 10%) were sent to both Envirotech and Target for analysis. Thirteen of these were soil samples taken at 101 Frost Street; five were soil samples taken at 89 Frost Street; four were water samples taken at 101 Frost Street; two were water samples from 89 Frost Street; and two were monitoring well samples. Detailed summaries of the comparisons are on Tables 5-19 through 5-23, respectively.

In general, the concentrations measured by Target were confirmed by Envirotech. A number of compounds analyzed by Target were flagged with an "e" qualifier, indicating a value that exceeds the linear calibration range and the true value may be higher. Even though these values are estimated, they provide an idea of the concentration.

Overall, the levels of compounds found in the soil at 89 and 101 Frost Street are generally similar, except for at 101-DW-12 (S). Ethylbenzene and total xylenes were higher in the Target sample (2773 and 11,809 µg/kg, respectively) than in the base

TABLE 5-19
(Page 1 of 4)

SOIL AND SEDIMENT DATA SUMMARY
101 Frost Street
Comparison

LMS Sample ID Lab Sample ID Sampling Date Laboratory	101-DW-1 (S)		101-DW-1 (S)		101-DW-2 (S)		101-DW-2 (S)		101-DW-5 (S)		101-DW-5 (S)		101-DWA-5 (40-44')		101-DWA-5 (40-44')	
	DW-1	8/25/98	DW-101-1-S	8/25/98	DW-2	8/24/98	DW-101-2-S	8/24/98	DW-5	8/24/98	DW-101-5-S	8/24/98	DWA-5_40-44'	8/26/98	101-DWA-5_40-44'	8/26/98
	Mobile	Analytical	Mobile	Analytical	Mobile	Analytical	Mobile	Analytical	Mobile	Analytical	Mobile	Analytical	Mobile	Analytical	Mobile	Analytical
VOLATILE ORGANIC COMPOUNDS (µg/kg)																
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethene ¹	ND	ND	ND	ND	ND	ND	ND	ND	8.54	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	0.37	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	3.74 e	2 j	ND	ND	1	ND	ND	ND
Tetrachloroethene	21.0 e	ND	ND	0.3 j	1.64	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzene	ND	ND	ND	ND	ND	ND	ND	ND	7.76	0.6 j	ND	ND	ND	ND	ND	0.4 j
Toluene	ND	0.4 j	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Xylenes ²	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

bold - Value exceeds recommended criteria.
j - Estimated concentration; compound present below quantitation limit.
e - The quantified value exceeds the linear calibration range and the true value may be higher.
ND - Not detected at analytical detection limit.
1 - Mobile result is Trans + Cis, Analytical result is a total value.
2 - Mobile result a total value, Analytical result is o + m&p.
 Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-19
(Page 2 of 4)

SOIL AND SEDIMENT DATA SUMMARY
101 Frost Street
Comparison

LMS Sample ID	101-DWA-6 (50-54')	101-DWA-6 (50-54')	101-DW-7 (S)	101-DW-7 (S)	101-DW-8 (S)	101-DW-8 (S)	101-DW-9 (S)	101-DW-9 (S)
Lab Sample ID	DWA-6_50-54'	101-DWA-6_50-54	DW-7	DW-101-7-S	DW-8	DW-101-8-S	DW-9	DW-101-9-S
Sampling Date	8/31/98	8/31/98	8/24/98	8/24/98	8/24/98	8/24/98	8/25/98	8/25/98
Laboratory	Mobile	Analytical	Mobile	Analytical	Mobile	Analytical	Mobile	Analytical
VOLATILE ORGANIC COMPOUNDS (µg/kg)								
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethene ¹	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene	2.4	ND	ND	2 j	ND	7 j	3.50 e	6 j
Benzene	ND	ND	ND	ND	15	ND	ND	ND
Toluene	ND	ND	13.7	2 j	132 e	0.6 j	14	0.6 j
Ethylbenzene	ND	ND	ND	0.5 j	19.1	ND	ND	ND
Xylenes ²	ND	ND	ND	2 j	46.4	3 j	ND	ND

bold - Value exceeds recommended criteria.
j - Estimated concentration; compound present below quantitation limit.
e - The quantified value exceeds the linear calibration range and the true value may be higher.
ND - Not detected at analytical detection limit.
1 - Mobile result is Trans + Cis, Analytical result is a total value.
2 - Mobile result a total value, Analytical result is o + m&p.
Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-19
(Page 3 of 4)

SOIL AND SEDIMENT DATA SUMMARY
101 Frost Street
Comparison

LMS Sample ID	101-DW-10 (S)	101-DW-10 (S)	101-DW-10A (S)	101-DW-10A (S)	101-DW-12 (S)	101-DW-12 (S)	101-DW-13 (S)	101-DW-13 (S)
Lab Sample ID	DW-11	DW-101-11-S	DW-10A	DW-101-10A-S	DW-12	DW-101-12-S	SMH-13	SMH-101-13-S
Sampling Date	8/25/98	8/25/98	8/26/98	8/26/98	8/25/98	8/25/98	8/25/98	8/25/98
Laboratory	Mobile	Analytical	Mobile	Analytical	Mobile	Analytical	Mobile	Analytical
VOLATILE ORGANIC COMPOUNDS (µg/kg)								
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethene ¹	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene	4.42 e	1 j	1.27	1 j	3.70 e	0.5 j	18.8 e	0.5 j
Benzene	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	ND	ND	ND	ND	2773 e	34	ND	ND
Xylenes ²	ND	ND	ND	ND	11809 e	170	ND	ND

bold - Value exceeds recommended criteria.
j - Estimated concentration; compound present below quantitation limit.
e - The quantified value exceeds the linear calibration range and the true value may be higher.
ND - Not detected at analytical detection limit.
1 - Mobile result is Trans + Cis, Analytical result is a total value.
2 - Mobile result a total value, Analytical result is o + m&p.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-19
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SOIL AND SEDIMENT DATA SUMMARY
101 Frost Street
Comparison

LMS Sample ID	FSGP-4 (19-21')	FSGP-04 (19-21')
Lab Sample ID	FSGP-4_19-21'	FSGP-04_19-21
Sampling Date	9/3/98	9/3/98
Laboratory	Mobile	Analytical
VOLATILE ORGANIC COMPOUNDS (µg/kg)		
1,1-Dichloroethene	ND	ND
1,2-Dichloroethene ¹	ND	ND
1,1-Dichloroethane	ND	ND
1,1,1-Trichloroethane	ND	ND
1,2-Dichloroethane	ND	ND
Trichloroethene	ND	ND
Tetrachloroethene	31.3 e	ND
Benzene	ND	ND
Toluene	ND	ND
Ethylbenzene	ND	ND
Xylenes ²	ND	ND

bold - Value exceeds recommended criteria.
i - Estimated concentration; compound present below quantitation limit.
e - The quantified value exceeds the linear calibration range and the true value may be higher.
ND - Not detected at analytical detection limit.
1 - Mobile result is Trans + Cis, Analytical result is a total value.
2 - Mobile result a total value, Analytical result is o + m&p.
Note: LMS Sample ID is the sample designation used in the report and is based on the available sit
The Lab Sample ID is the field sample designation.

TABLE 5-20
(Page 1 of 2)

SOIL DATA SUMMARY
89 Frost Street
Comparison

LMS Well ID	89-DWA-6 (51-53')	89-DWA-6 (51-53')	89-DWA-7 (40-44')	89-DWA-7 (40-44')	89-DWA-13 (51-53')	89-DWA-13 (51-53')
Lab Well ID	DWA-18 51-53'	89-DWA-18 51-53	DWA-7 40-44'	DWA-7 40-44	DWA-SMHW 51-53'	89-DWA-SMHW
Sampling Date	9/1/98	9/1/98	8/10/98	8/10/98	8/25/98	8/25/98
Laboratory	Mobile	Analytical	Mobile	Analytical	Mobile	Analytical
VOLATILE ORGANIC COMPOUNDS (µg/kg)						
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND
1,2-Dichloroethene ¹	ND	ND	ND	ND	12.2	ND
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND
Trichloroethene	ND	ND	ND	ND	39.1 e	ND
Tetrachloroethene	ND	ND	ND	ND	62.0 e	60

bold - Value exceeds recommended criteria.
e - The quantified value exceeds the linear calibration range and the true value may be higher.
NR - Analysis not reportable due to extremely high concentrations of PCE.
ND - Not detected at analytical detection limit.
1 - Mobile result is Trans + Cis, Analytical result is a total value.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

TABLE 5-20
(Page 2 of 2)

SOIL DATA SUMMARY
89 Frost Street
Comparison

LMS Well ID	89-DWA-14 (51-53') SMHE_51-53'	89-DWA-14 (51-53') 89-DWA-SMHE	89-DWA-15 (31-33') DWA-16_31-33'	89-DWA-15 (31-33') 89-DWA-16_31-33'
Lab Well ID	8/26/98	8/26/98	7/15/98	7/15/98
Sampling Date	Mobile	Analytical	Mobile	Analytical
Laboratory				
VOLATILE ORGANIC COMPOUNDS (µg/kg)				
1,1-Dichloroethene	NR	ND	ND	ND
1,2-Dichloroethene ¹	NR	ND	ND	ND
1,1-Dichloroethane	NR	ND	ND	ND
1,1,1-Trichloroethane	NR	ND	ND	ND
1,2-Dichloroethane	NR	ND	ND	ND
Trichloroethene	NR	ND	ND	ND
Tetrachloroethene	NR	2,400	10.8 e	ND

bold - Value exceeds recommended criteria.
e - The quantified value exceeds the linear calibration range and the true value may be higher.
NR - Analysis not reportable due to extremely high concentrations of PCE.
ND - Not detected at analytical detection limit.
1 - Mobile result is Trans + Cis, Analytical result is a total value.
Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample

STANDING AND GROUNDWATER DATA SUMMARY 101 Frost Street Comparison

LMS Sample ID	101-DWA-8 (79-80')	101-DWA-8 (79-80')	101-DW-9 (SW)	101-DW-9 (SW)
Lab Sample ID	DWA-8_79-80'	101-DWA-8_79-80	DW_9-SW	101-DW-9-SW
Sampling Date	9/1/98	9/1/98	8/18/98	8/18/98
Laboratory	Mobile	Analytical	Mobile	Analytical
VOLATILE ORGANIC COMPOUNDS (µg/l)				
1,1-Dichloroethene	ND	2 j	ND	ND
1,2-Dichloroethene ¹	ND	ND	ND	ND
1,1-Dichloroethane	ND	1 j	ND	ND
1,1,1-Trichloroethane	19.1 e	38	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND
Trichloroethene	4.45	6 j	ND	ND
Tetrachloroethene	2.76	3 j	3.89	4 j

bold - Value exceeds recommended criteria.
e - The quantified value exceeds the linear calibration range and the true value may be higher.
j - Estimated concentration; compound present below quantitation limit.
DL - Diluted sample analysis.
ND - Not detected at analytical detection limit.
SW - Standing Water
1 - Mobile result is Trans + Cis. Analytical result is a total value.
Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys.
The Lab Sample ID is the field sample designation.

TABLE 5-21
(Page 2 of 2)

STANDING AND GROUNDWATER DATA SUMMARY
101 Frost Street
Comparison

LMS Sample ID	FSGP-3 (60-65') FSGP-03 (60-65')	FSGP-4 (60-65') FSGP-04 (60-65')
Lab Sample ID	FSGP-3_60-65' FSGP-03_60-65'	FSGP-4_60-65' FSGP-04_60-65'
Sampling Date	9/1/98 9/1/98	9/3/98 9/3/98
Laboratory	Mobile Analytical	Mobile Analytical
VOLATILE ORGANIC COMPOUNDS (µg/l)		
1,1-Dichloroethene	ND	ND
1,2-Dichloroethene ¹	ND	ND
1,1-Dichloroethane	ND	ND
1,1,1-Trichloroethane	22.4 e	8.16
1,2-Dichloroethane	ND	ND
Trichloroethene	6.7 e	67.8 e
Tetrachloroethene	9.85 e	458 e

bold - Value exceeds recommended criteria.
e - The quantified value exceeds the linear calibration range and the true value may be higher.
j - Estimated concentration; compound present below quantitation limit.
DL - Diluted sample analysis.
ND - Not detected at analytical detection limit.
SW - Standing Water
1 - Mobile result is Trans + Cis, Analytical result is a total value.
Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys.
The Lab Sample ID is the field sample designation.

TABLE 5-22

GROUNDWATER DATA SUMMARY

89 Frost Street

Comparison

LMS Sample ID	89-DWA-8 (79-80')	DWA-8 (79-80')	89-DWA-14 (60-65')	89-DWA-14 (60-65')
Lab Sample ID	DWA-7A_79-80'	DWA-7a_79-80'	SMHE_60-65'	DWA-SMHE_60-65'
Sampling Date	8/11/98	8/11/98	9/2/98	9/2/98
Laboratory	Mobile	Analytical	Mobile	Analytical
VOLATILE ORGANIC COMPOUNDS (µg/l)				
1,1-Dichloroethene	ND	ND	ND	ND
1,2-Dichloroethene ¹	ND	ND	ND	ND
1,1-Dichloroethane	ND	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND
Trichloroethene	ND	ND	183 e	130 jd
Tetrachloroethene	1.55	2 j	500 e	5600 d

bold

- Value exceeds recommended criteria.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

j - Estimated concentration; compound present below quantitation limit.

d - Concentration obtained from diluted sample.

DL - Diluted sample analysis.

ND - Not detected at analytical detection limit.

1 - Mobile result is Trans + Cis, Analytical result is a total value.

Note: LMS Sample ID is the sample designation used in the report and is based on the available site surveys. The Lab Sample ID is the field sample designation.

Table 5-23

MONITORING WELL SAMPLING DATA SUMMARY **Comparison**

LMS Sample ID	EZ-EM-UN-4	EZ-EM-UN-4	FSMW-09A	FSMW-09A
Lab Sample ID	UN-4_EZ-EM	UN-4_EZ-EM	FSMU_09A	FSMU_09A
Sampling Date	9/4/98	9/4/98	9/4/98	9/4/98
Laboratory	Mobile	Analytical	Mobile	Analytical
VOLATILE ORGANIC COMPOUNDS (µg/l)			[DL:500:1]	
1,1-Dichloroethene	ND	0.7 j	ND	ND
1,2-Dichloroethene ¹	ND	24	ND	330 j
1,1-Dichloroethane	ND	ND	1426 e	ND
1,1,1-Trichloroethane	74.2 e	47	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND
Trichloroethene	66.2 e	43	1249 e	1400 j
Tetrachloroethene	193 e	100	680 e	26000
Benzene	ND	ND	ND	ND
Toluene	ND	ND	ND	ND
Ethylbenzene	ND	ND	ND	ND
Xylenes ²	ND	ND	ND	ND

bold - Value exceeds recommended criteria.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

j - Estimated concentration; compound present below quantitation limit.

DL - Diluted sample analysis.

ND - Not detected at analytical detection limit.

1 - Mobile result is Trans + Cis, Analytical result is a total value.

2 - Mobile result a total value, Analytical result is o + m&p.

analytical laboratory data (34 and 170 µg/kg, respectively). This is a sediment sample from inside a dry well and is therefore most likely heterogeneous in nature and difficult to duplicate.

The groundwater samples from 89 and 101 Frost Street also are generally similar. The “e” qualifier from Target indicates that the compound exceeds the linear calibration range, while Envirotech verified the presence of contamination in those samples.

The two monitoring well samples also are generally similar. For 1,1-DCA in the FSMW-09A sample, Target reports 1,1-DCA at a concentration of 1426 µg/l. The Envirotech sample was diluted 500 times, with the resulting detection limit of 5000 µg/l; therefore, Envirotech did not detect the 1,1-DCA. The results would suggest that other VOCs are likely present at significant concentrations, but below the elevated detection limits in the extremely contaminate samples.

CHAPTER 6

INDIVIDUAL SITE DISCUSSION

6.1 FORMER AUTOLINE AUTOMOTIVE SITE (101 Frost Street)

6.1.1 Site History

The former Autoline Automotive site is located at 101 Frost Street in the NCIA. The site encompasses approximately 3 acres of land and consists of a 35,000-ft² building, which was erected in 1962. The site is bounded by commercial buildings and parking lots to the west, commercial buildings and parking lots to the north, Frost Street to the east, and 89 Frost Street to the south. The site was listed on the New York State Registry of Inactive Hazardous Waste Disposal Sites (NYSDEC Site No. 1-30-043I) as a Class 2 Site in 1996.

According to records obtained from Nassau County Department of Public Works (NCDPW), two cesspools are located on the west side of the building and one cesspool is located on the east side of the building. No floor drains were noted inside the building during a site inspection for a NYSDEC SI (LMS 1994). The building was connected to the Nassau County municipal sewer system in February 1983.

Several facilities occupied the building at this site, including a toy warehouse (1968), a home laboratory supply company (1972), textile companies (1974-1983), and an automotive ignition parts manufacturer (1984-1992). The building has been most recently occupied by Distribution Systems of America, Inc. (DSA), which distributes and assembles newspaper inserts; currently the building is vacant. The most recent occupant did not use any chemicals as part of its operation.

From 1984 to 1992 Autoline Automotive Corporation, a manufacturer of ignition wires and wire harness sets, occupied the building. Autoline Automotive also occupied the building at 115 Frost Street from 1982 to 1990. NCDOH records indicate that Autoline Automotive used degreasers at their facility at 115 Frost Street. NCDOH records also indicate that a textile company, National Bassen Textiles, which occupied 101 Frost Street from 1974 to 1982, had documented use of degreasers and used 300 gal of unknown chemicals annually.

A 1996 New York State Superfund Contract Multi-Site PSA Report indicated that ground-penetrating radar (GPR) surveys conducted at the site revealed two anomalous areas in the western section of the site. These results may confirm the presence of two cesspools, which are believed to be located west of the building. Analyses of groundwater samples collected during the PSA investigation indicated that PCE and TCA-related compounds were found in very high concentrations in the western portion of the site. Concentrations of PCE as high as 20,000 µg/l (65 ft bgs) were found in the groundwater directly downgradient of the western portion of the site, while only 130 µg/l of PCE was detected in a sample collected from the groundwater upgradient of the site. Samples along the southern boundary of the site also contained high concentrations of 1,1,1-TCA (830 µg/l at 65-85 ft bgs). The concentrations of TCA-related compounds detected upgradient of the site were lower (170 µg/l). Based on the suspected prior use of chemicals at the site by Autoline Automotive and the textile company, the high down-gradient vs upgradient levels of PCE and 1,1,1-TCA concentrations, and the high levels of both compounds found in the groundwater under the site, the site was included on the New York State Registry of Inactive Hazardous Waste Disposal Sites.

In 1997 additional investigations were conducted on this property by the PRP, the investigation was limited in scope in terms of the sample locations and numbers.

6.1.2 Nature and Extent of On-site Soil Contamination

The soil investigation at 101 Frost Street consisted of collecting 109 samples from various depths to be analyzed for VOCs. The compounds found in the soil in excess of the recommended soil cleanup objectives are PCE and TCE. Two locations had VOCs at levels above the recommended soil cleanup objectives.

Two samples analyzed by the mobile laboratory had levels of PCE and/or TCE in concentrations above the recommended soil cleanup objectives. A third sample [101-DWA-4 (50-54 ft)] had PCE at such a high concentration that the GC was not able to record the value. The two samples from 101-DWA-N/S (41-43 ft and 51-53 ft) had concentrations of PCE exceeding the cleanup objective, with concentrations of 2008 and 24,209 µg/kg, respectively. The deeper sample (51-53 ft) also had TCE at levels above the recommended soil cleanup objective (3775 µg/kg).

At the 101 Frost Street site an area estimated to be 800 ft² of primarily PCE-contaminated soil was found during the RI. The highest concentrations were found in the western side of the site at depths of 41-43 and 51-53 ft at 101-DWA-N/S and at 51-53 ft at 101-DW-4. The noted concentrations indicate that hazardous wastes were discharged to the site soils through the dry wells located on-site or through careless handling of these compounds during on-site activities.

Fourteen dry well sediment samples (two from 101-DW-10) were analyzed for SVOCs. Eleven had SVOCs in concentrations above the recommended soil cleanup objective. The compound found in the soil that exceeded the cleanup objective in the 11 samples was benzo(a)an, while benzo(a)py was found in nine of the samples, and phenol was found in four. The two dry wells in the front (101-DW-10 and -13) had other SVOCs at levels well over the cleanup objectives, including those previously mentioned, as well as benzo(b)fl, benzo(k)fl, and dibenz(a,h). The sample from 101-DW-10A was also over the cleanup objective, but at slightly lower concentrations. 101-DW-13 also had 4,4'-DDT well over the cleanup objective at a concentration of 20,000 µg/kg.

The same 14 sediment samples were also analyzed for TAL metals plus cyanide. Chromium, copper, mercury, nickel, and/or zinc were found in concentrations above the cleanup objective in 11 of the 14 samples and are believed to be related to site activities. Only copper, mercury, and zinc were found in excess of both the cleanup objective and eastern background soil concentrations. Copper was detected at levels above the cleanup objective in three samples. Two of these (101-DW-11 and -13) contained concentrations slightly higher than the eastern background soil concentrations. Mercury was detected above the recommended soil cleanup objective in five samples; three of these (101-DW-4, -5, and -13) contained concentrations slightly higher than the eastern background soil concentrations. Zinc was detected above the cleanup objective in 11 samples; seven of these (101-DW-7, -8, -9, -10, -10A, -11, and -13) contained concentrations much higher than the eastern background soil concentrations. The presence of copper, mercury, and zinc above the recommended soil cleanup objective can be attributed to past activities at this site. However, the concentrations which were found although elevated above eastern background soil concentrations, are likely typical of a highly industrialized area.

Chromium was found above the cleanup objective in 101-DW-8 (13,400 µg/kg) and -10 (14,600 µg/kg); nickel was also found in 101-DW-13 at 18,600 µg/kg, slightly above the cleanup objectives. Iron was also found above the cleanup objective in all 14 samples, but the values are within the eastern background soil concentrations and are believed to represent site background levels.

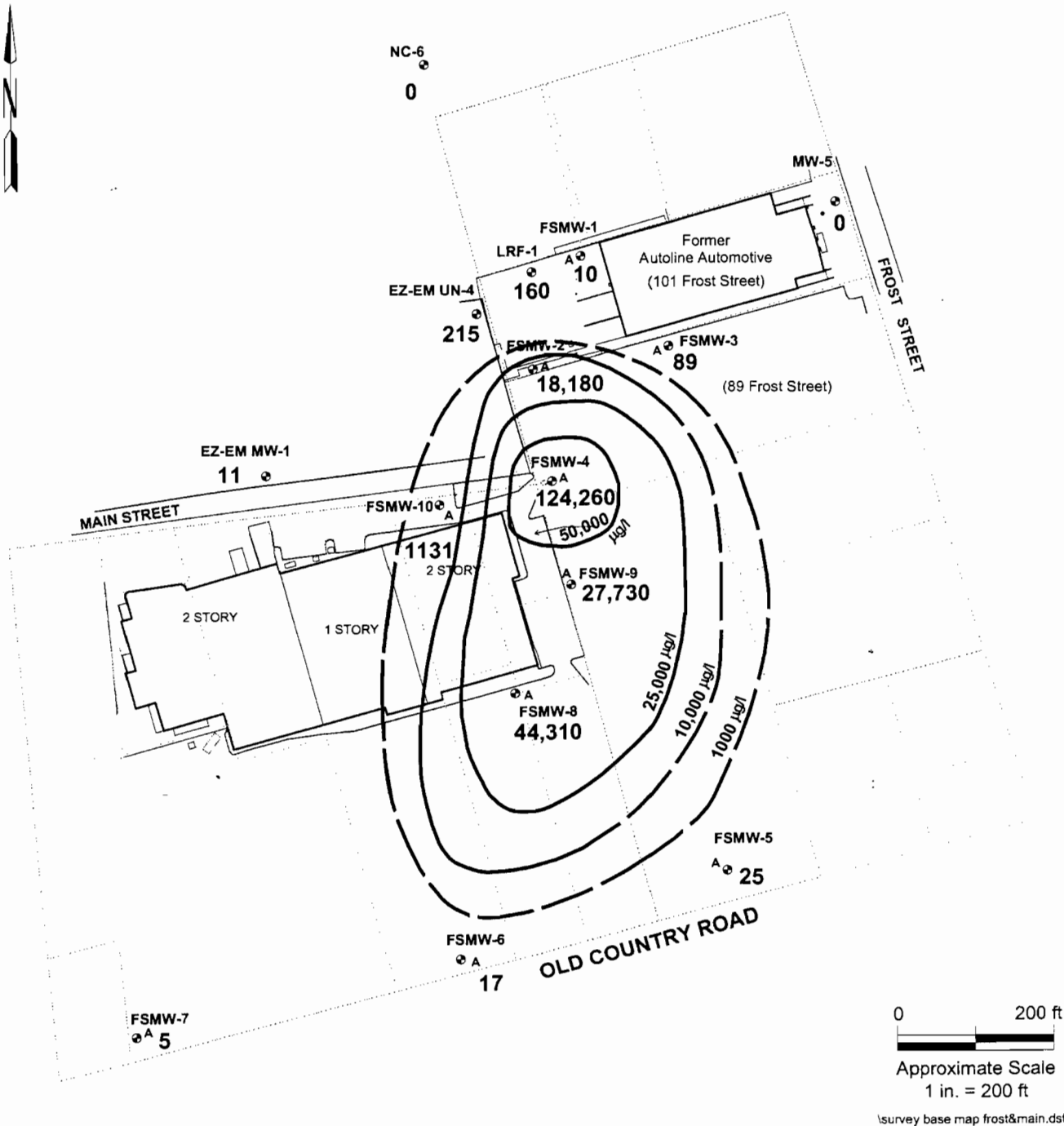
SVOCs and metals are commonly found above applicable standards in dry well bottom sediments in industrialized areas. Typically, the extent of these contaminants are limited to the bottom sediments and soils immediately below the dry well location.

6.1.3 Nature and Extent of On-site Groundwater Contamination

The groundwater investigation at 101 Frost Street consisted of collecting and analyzing 60 samples taken from 22 locations for VOCs. Ten locations (two additional probes, two hydropunches, and six adjacent to dry wells) sampled at various depths had VOCs in concentrations above the NYSDEC Class GA standard. The compounds found in the groundwater that exceed the Class GA groundwater standard are PCE, TCE, 1,1,1-TCA and their breakdown products. Figure 6-1 presents the total VOC concentrations in the shallow wells and Figure 6-2 presents the total VOC concentrations in the deep wells. The distribution of the individual contaminants which were found in the shallow and deep wells at the former Autoline Automotive are shown on Figures 6-3 and 6-4 respectively.

1,1,1-TCA was found above NYSDEC Class GA standard in the western section of the accessible portion of the property at levels ranging from 5.17 to 359 µg/l. The higher values were found in the southwestern portion of the property, with the greater concentrations at 90 ft (FSHP-2 at 359 µg/l) and 92 ft (FSGP-4 at 123 µg/l).

Samples taken on the east side of the property had low or non-detectable concentrations of PCE, TCE, 1,1,1-TCA and their breakdown products. Figure 6-5 shows the extent of the PCE contamination in the groundwater on-site. The northwestern quadrant of the property had 1,1,1-TCA above the standard, while the southwestern area had higher concentrations of 1,1,1-TCA as well as some TCE and PCE.



Legend

- Monitoring well location
- (-B = deep well)
- 4 Total VOC (µg/l)

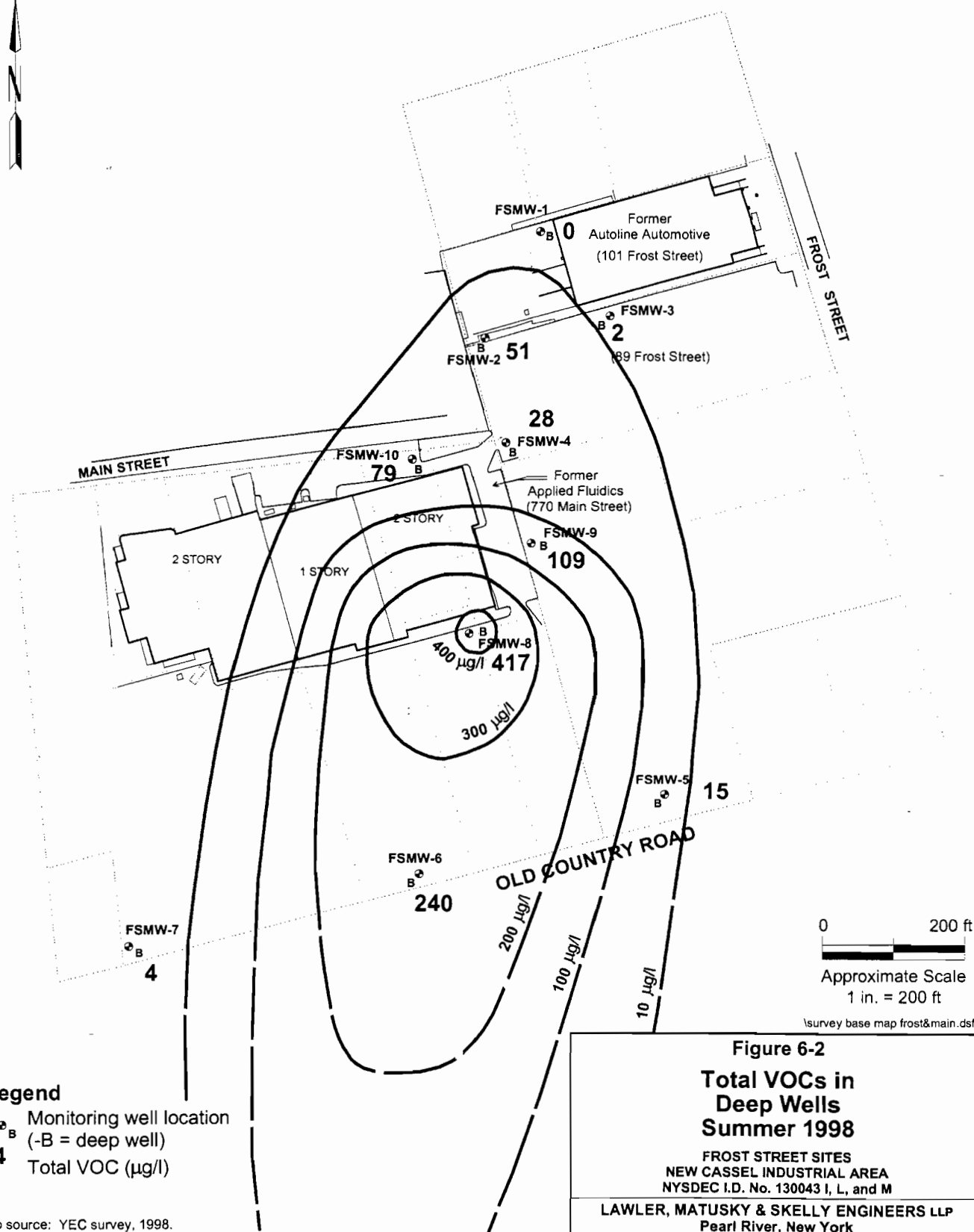
Map source: YEC survey, 1998.

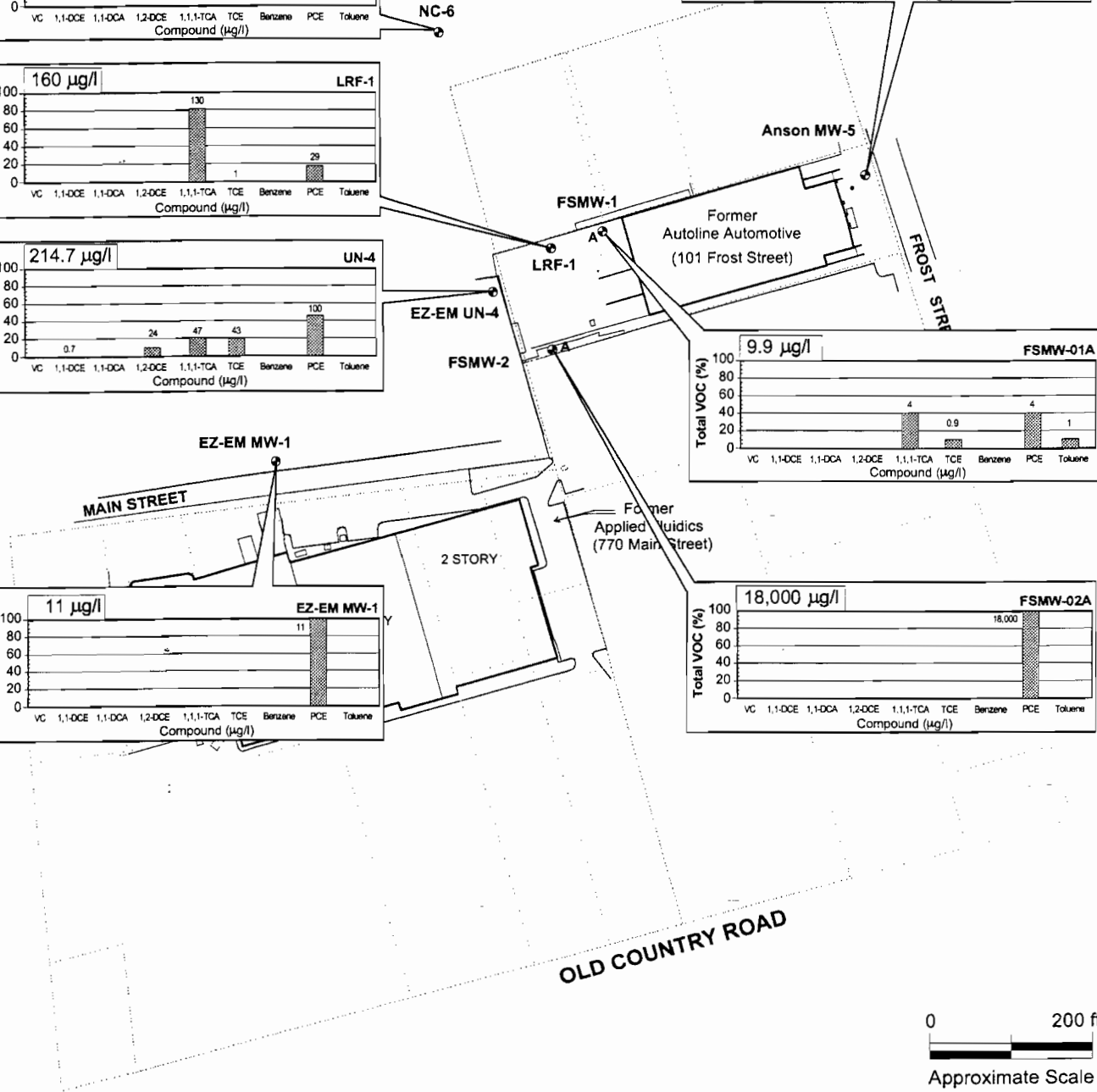
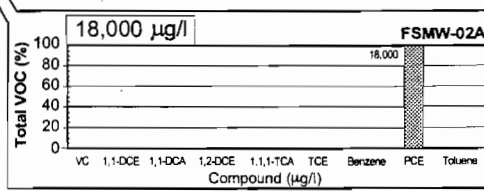
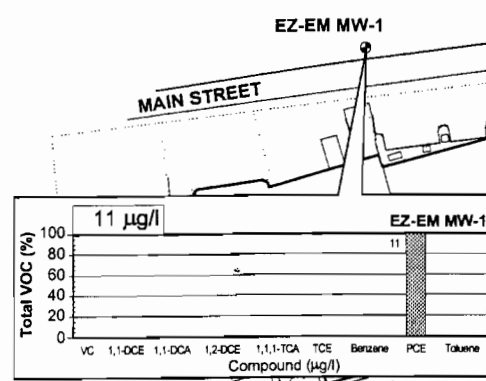
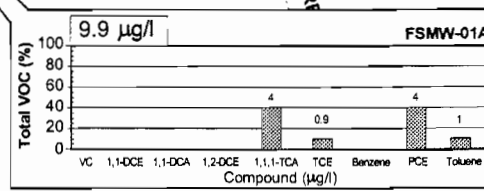
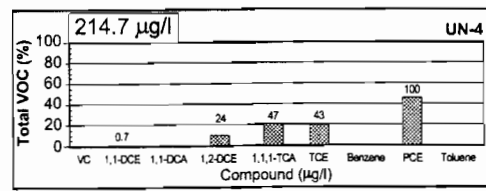
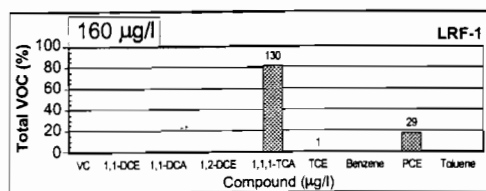
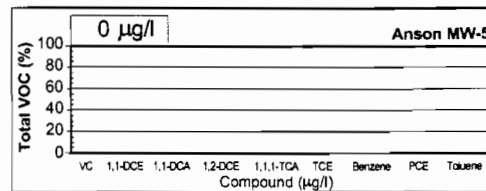
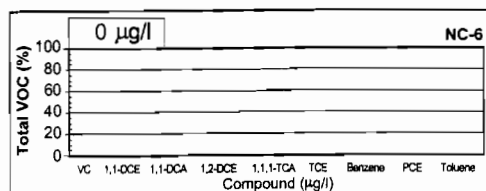
Figure 6-1

Total VOCs in Shallow Wells Summer 1998

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Legend

Monitoring well location
(-A = shallow well)

ABBREVIATIONS

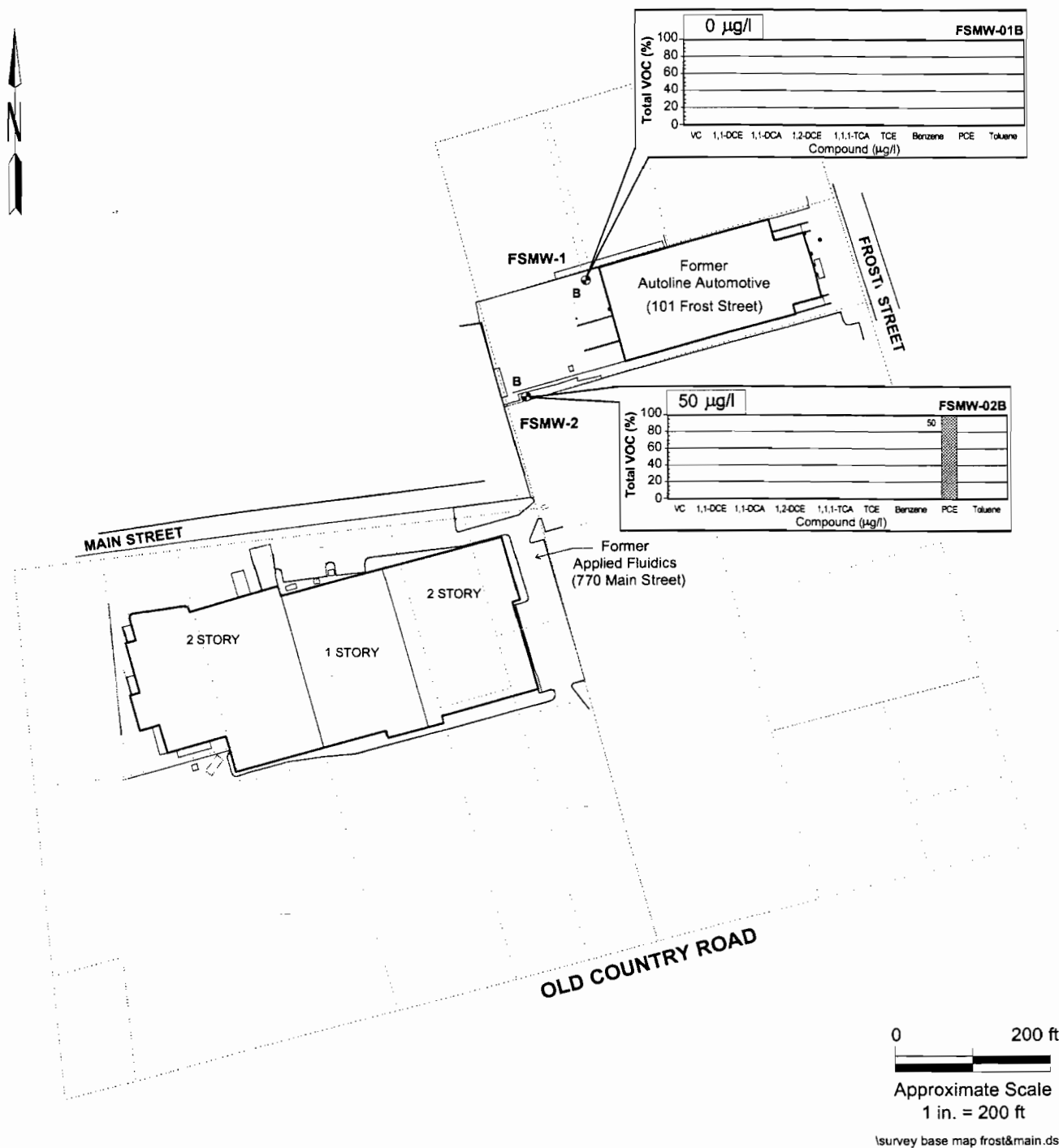
VC	Vinyl chloride	1,1,1-TCA	1,1,1-Trichloroethane
1,1-DCE	1,1-Dichloroethene	TCE	Trichloroethene
1,1-DCA	1,1-Dichloroethane	PCE	Tetrachloroethene
1,2-DCE	1,2-Dichloroethene		

Map source: YEC survey, 1998.

Figure 6-3
VOC Groundwater Contamination Distribution
101 Frost Street Shallow Wells

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Legend

- Monitoring well location
(-B = deep well)

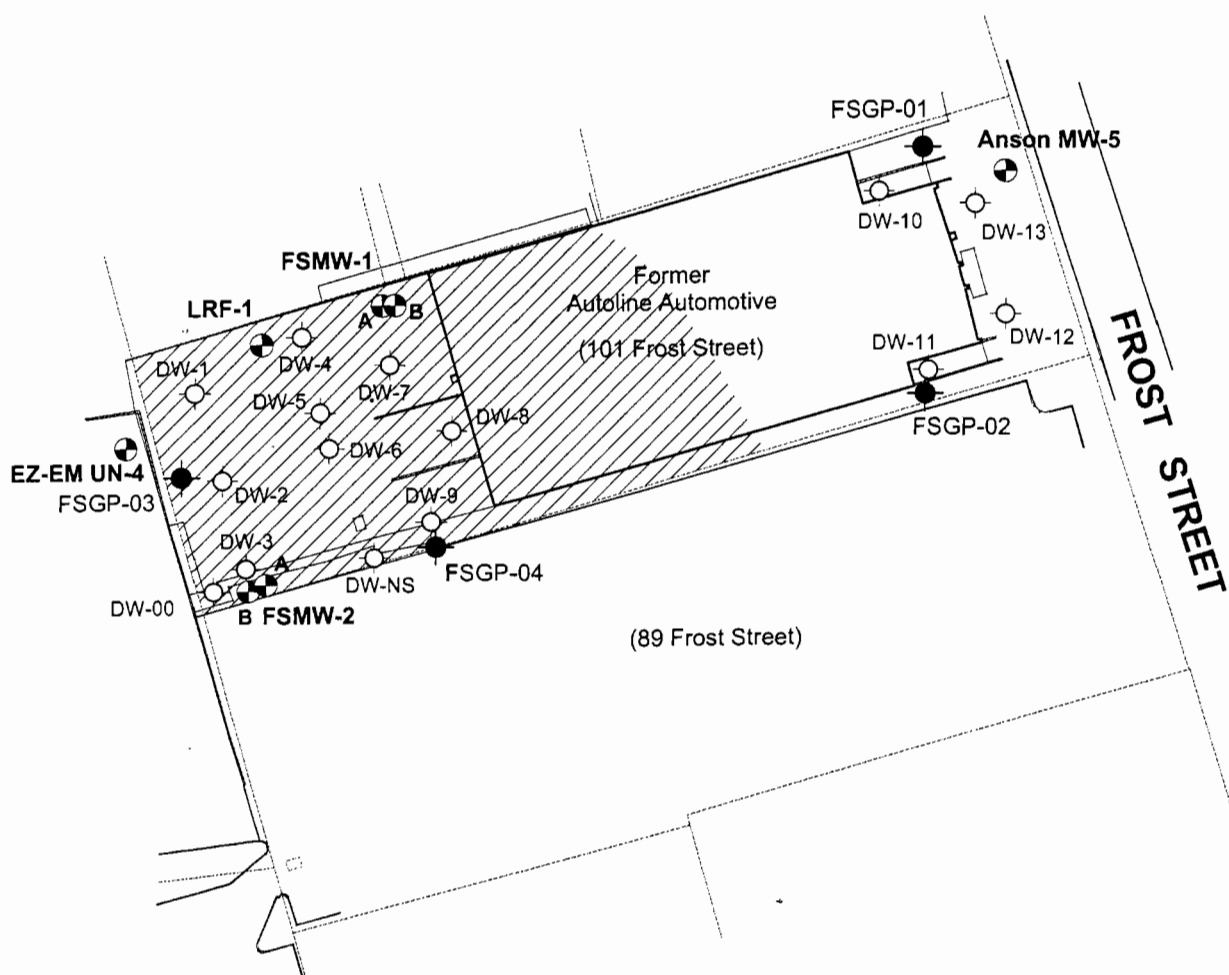
ABBREVIATIONS

VC	Vinyl chloride	1,1,1-TCA	1,1,1-Trichloroethane
1,1-DCE	1,1-Dichloroethene	TCE	Trichloroethene
1,1-DCA	1,1-Dichloroethane	PCE	Tetrachloroethene
1,2-DCE	1,2-Dichloroethene		

Figure 6-4 VOC Groundwater Contamination Distribution 101 Frost Street Deep Wells

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LEGEND

Area of groundwater contamination

DW- Dry well

FSMW- Monitoring well

A Shallow (70-ft deep well)

B Deep (150-ft deep well)

FSGP- Geoprobe sample location

0 100 ft

Approximate Scale
1 in. = 100 ft

\\survey base map frost only 100'.dsf

Figure 6-5

**101 Frost Street
(Former Autoline Automotive)
Area of Groundwater Contamination**

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Map source: YEC, 1998.

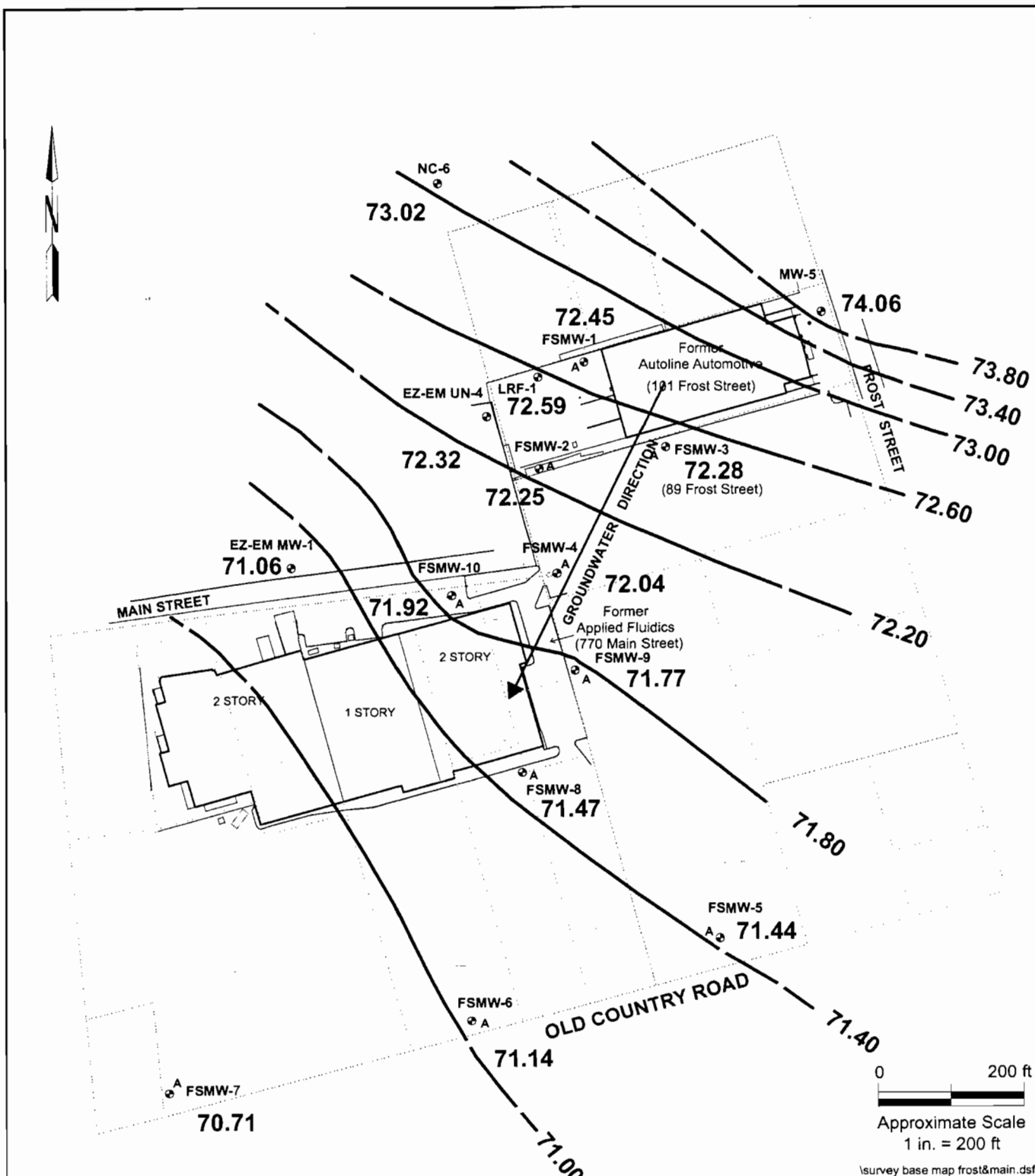
PCE is the primary contaminant of concern at this site, with concentrations ranging up to 3200 µg/l at FSGP-04 (60-65 ft). Very high concentrations were also found in FSHP-2 (55-60 ft - 1020 µg/l) and FSHP-2 (80 ft - 994 µg/l).

Two existing monitoring wells sampled at upgradient locations (Anson MW-5 and NC-6) did not exhibit any VOCs. The most upgradient deep well (FSMW-1B) was also found to be free of VOCs, while FSMW-1A had VOC concentrations below the standard. An existing monitoring well (LRF-1) in the northwest corner of this property had 1,1,1-TCA at a concentration of 130 µg/l, TCE at 1 µg/l, and PCE at 29 µg/l. EZ-EM UN-4, another off-site well, had concentrations of 1,1,1-TCA at 47 µg/l, TCE at 43 µg/l, and PCE at 100 µg/l as determined by the base analytical laboratory. EZ-EM MW-1, another existing monitoring well to the west of 101 Frost Street, had PCE at 11 µg/l. The deep well at FSMW-2 (B) had PCE over the standard, with a concentration of 50 µg/l; however, the shallow well (A) had PCE well above the standard, with a concentration of 18,000 µg/l. The existing data indicate that the on-site plume on this property is contributing to the groundwater contamination found off-site and downgradient of this property. Based on the measured groundwater elevations (Figure 6-6 and 6-7) this site is in the most upgradient position of the three sites.

At the 101 Frost Street site an area (45,000 ft²) of primarily PCE groundwater contamination was found during the RI (Figure 6-5). The highest concentrations were found in the southwest quadrant of the site, mostly at depths of approximately 55-65 ft. However, the PCE concentrations exceeded the Class GA groundwater standards at greater depths (as much as 120 ft) in several locations.

6.1.4 Quantity of Contaminated Media

6.1.4.1 Shallow Subsurface Soils and Subsurface Soils at Depth. The quantities of contaminated soils are based on the NYSDEC recommended soil cleanup objectives for each of the contaminants of concern. The recommended soil cleanup objectives are based on the prevention of the continued migration of the contaminants present in the soils to the groundwater. If necessary, the quantities of contaminated soils and sediments will be modified based on the health exposure pathway analysis and the selected remedial action objectives established for the site. Based on the soil samples that were collected at the former Autoline site (101 Frost Street), four locations were found to contain soils with



Legend

- Monitoring well location
(-A = shallow well)
- 70.XX** Groundwater elevation (ft relative to MSL)
- Groundwater contour (dashed where inferred)

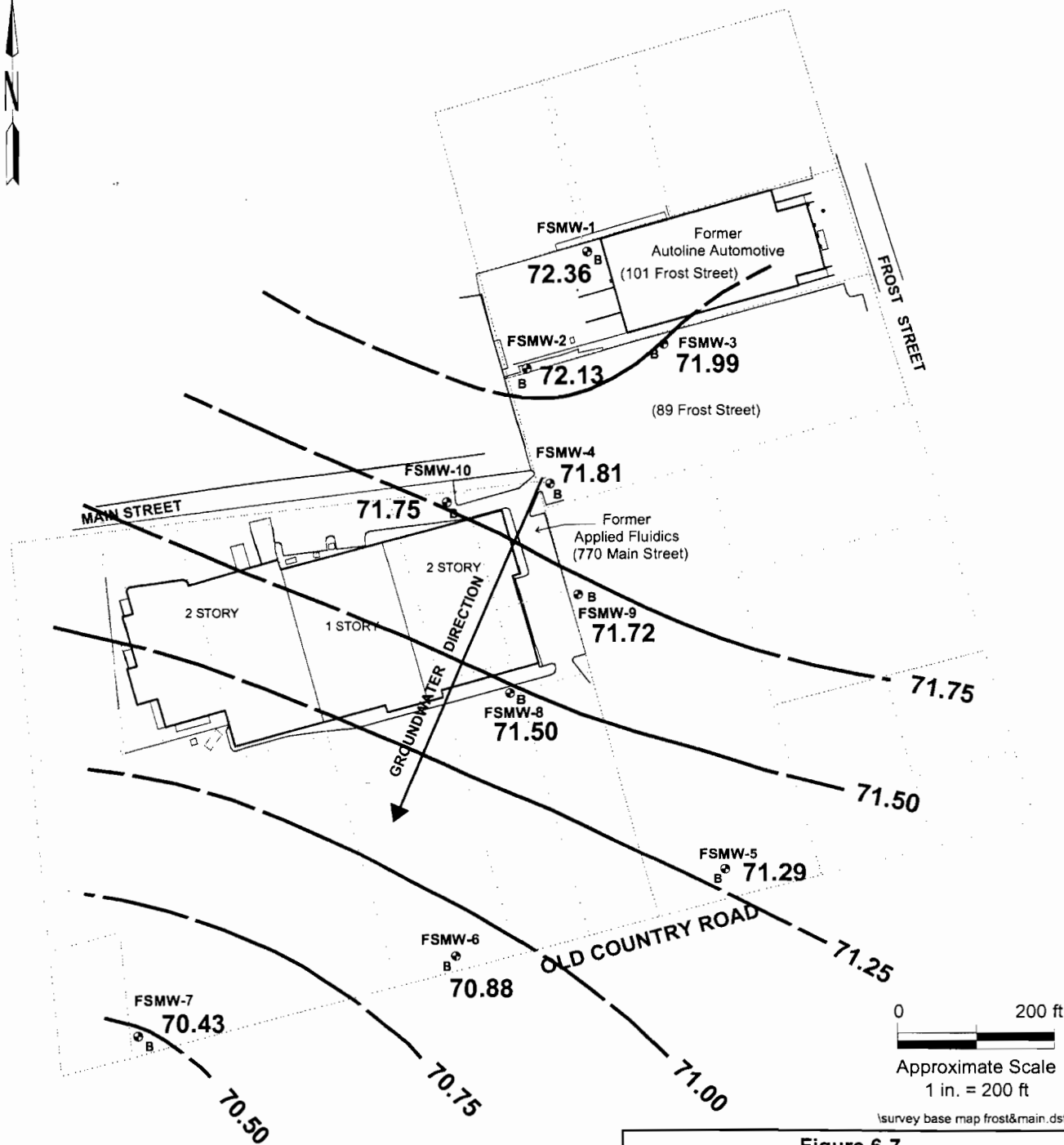
Map source: YEC survey, 1998.

Figure 6-6

Groundwater Contours Shallow Wells September 1998

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Legend

- Monitoring well location
(-B = deep well)
- 70.XX Groundwater elevation (ft relative to MSL)
- Groundwater contour (dashed where inferred)

Map source: YEC survey, 1998.

Figure 6-7 Groundwater Contours Deep Wells September 1998

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contaminant concentrations that were in excess of the recommended soil cleanup objectives. Area 1 on this site (Figure 6-8) is an area of subsurface contamination with depth that is associated with two dry wells at this location (101-DW-N/S and 101-DW-4) that contained soils with concentrations of PCE at levels above the soil cleanup objective. The contaminated soil covers an area of approximately 800 ft² with a total thickness of 15 ft (40-55 ft bgs). The total quantity of contaminated soil in Area 1 is approximately 450 yd³. Area 2 on this site (Figure 6-9) is associated with two dry wells (101-DW-12 and 101-DW-11) that contained several compounds above the soil cleanup objectives. The total quantity of contaminated soil in Area 2 is approximately 68 yd³ including 60 yd³ at 101-DW-12 and 8 yd³ at 101-DW-11. Area 3 on this site (Figure 6-10) includes the bottom sediments in eight dry wells (101-DW-2, -3, -4, -5, -6, -7, -8, and -9) located to the rear of the existing building. The bottom sediments in these dry wells exhibited concentrations of metals (zinc and mercury) in excess of the recommended soil cleanup objective. A total of 61 yd³ of contaminated soils were found in these eight dry wells, assuming that a 2-ft thickness of soil over a 100-ft² area at each dry well is contaminated. Area 4 at this site (Figure 6-11) includes the bottom sediments in two dry wells (101-DW-10 and -13) located in the front of the building. Samples from both dry wells exceeded the recommended soil cleanup objective for several SVOCs and metals; in addition, DDT was found in 101-DW-13 at a relatively high concentration (20,000 µg/l). A total of approximately 15 yd³ of contaminated soils were found in these two dry wells, assuming a 2 ft thickness of soil over a 100-ft² area at each dry well is contaminated.

The soil samples collected during the RI indicate that the total estimated quantity of contaminated soil at 101 Frost Street in excess of the NYSDEC soil cleanup objective is approximately 320 yd³. However, it appears that the contamination associated with 101-DW-N/S extends off-site onto 89 Frost Street. It is also possible that additional soil contamination may be found associated with the piping and drainage structures under the slab of the building.

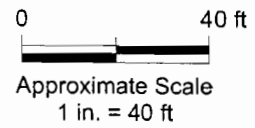
6.1.4.2 On-site Groundwater. The quantity of contaminated groundwater is based on the NYSDEC Class GA groundwater standards applicable to the upper glacial and Magothy aquifers, which are found below the site. The compounds found in the groundwater that exceed the Class GA groundwater standard are PCE, TCE, 1,1,1-TCA, and their breakdown products. If necessary, the quantities of contaminated groundwater will be modified based on the health exposure pathway analysis and the selected remedial action objectives



Former
Autoline Automotive
(101 Frost Street)

Area 1

(89 Frost Street)



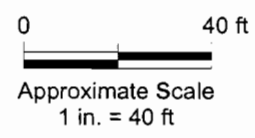
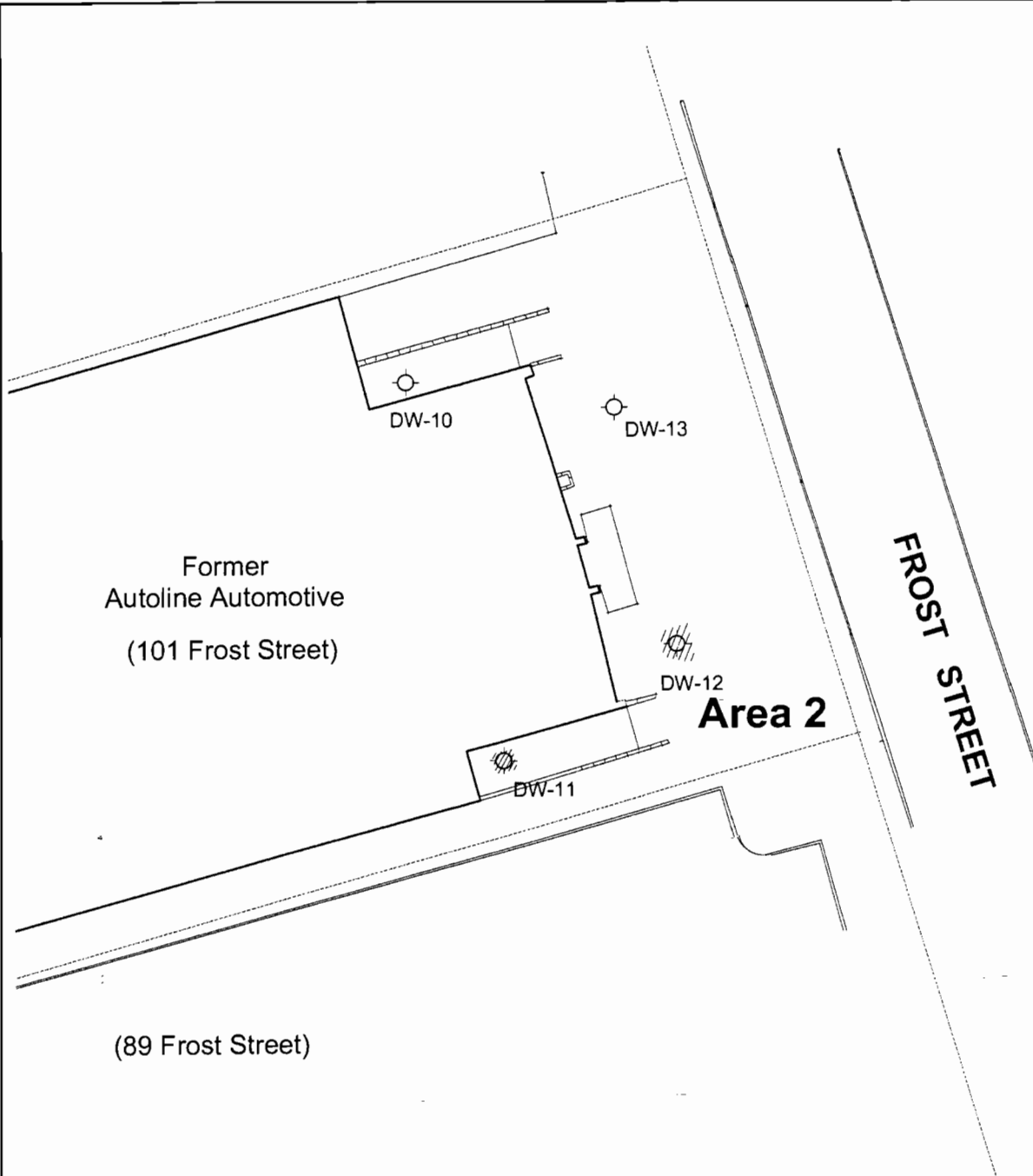
LEGEND

-  Dry well location
-  Area 1 of soil contamination

Figure 6-8
101 Frost Street
(Former Autoline Automotive)
Soil Contamination, Area 1

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LEGEND

-  Dry well
-  Area 2 of soil contamination

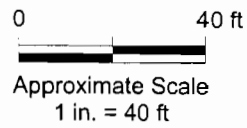
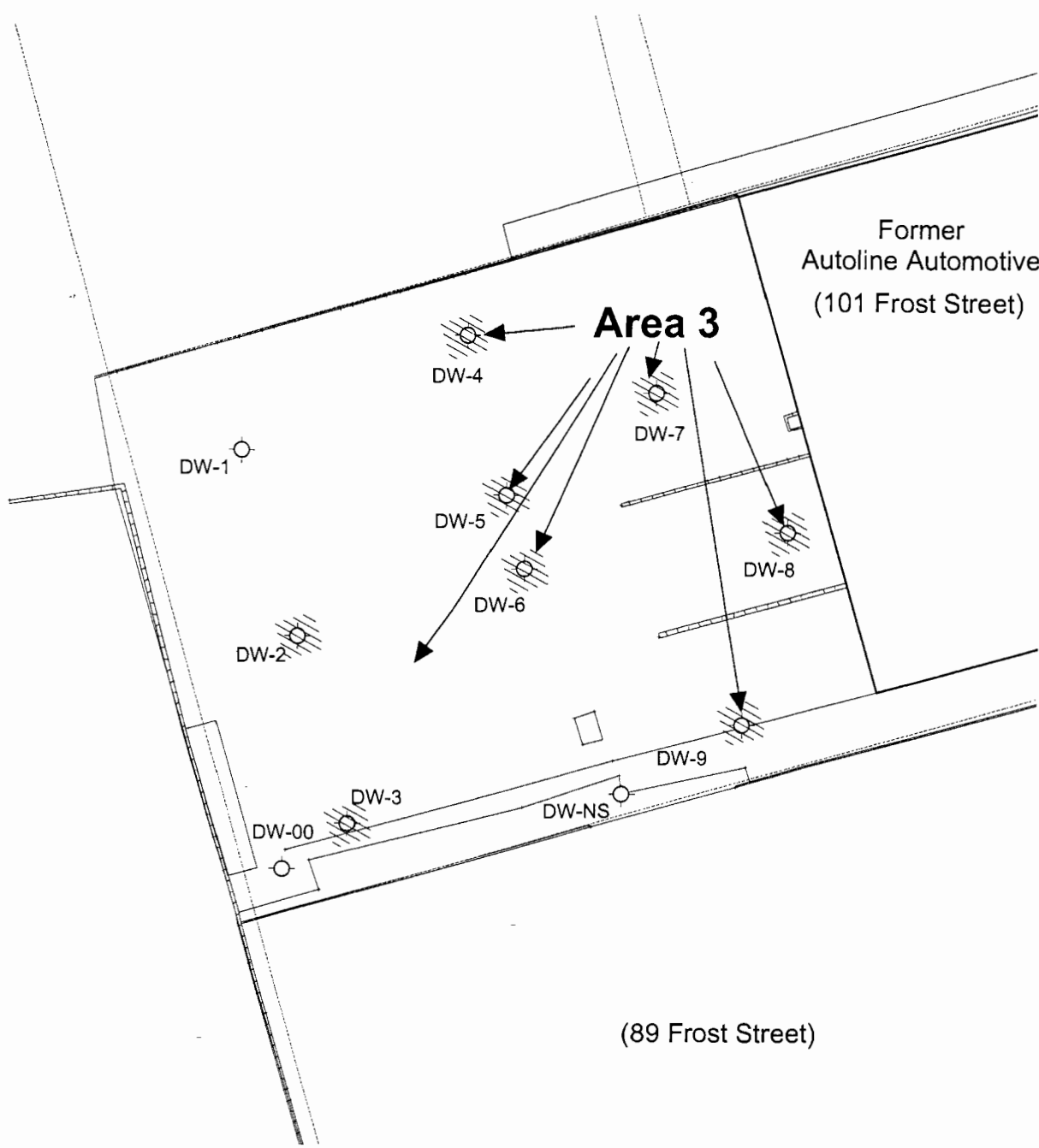
Map source: YEC, 1998.

\\101-e frost soil closeup.dsf

Figure 6-9
101 Frost Street
(Former Autoline Automotive)
Soil Contamination, Area 2

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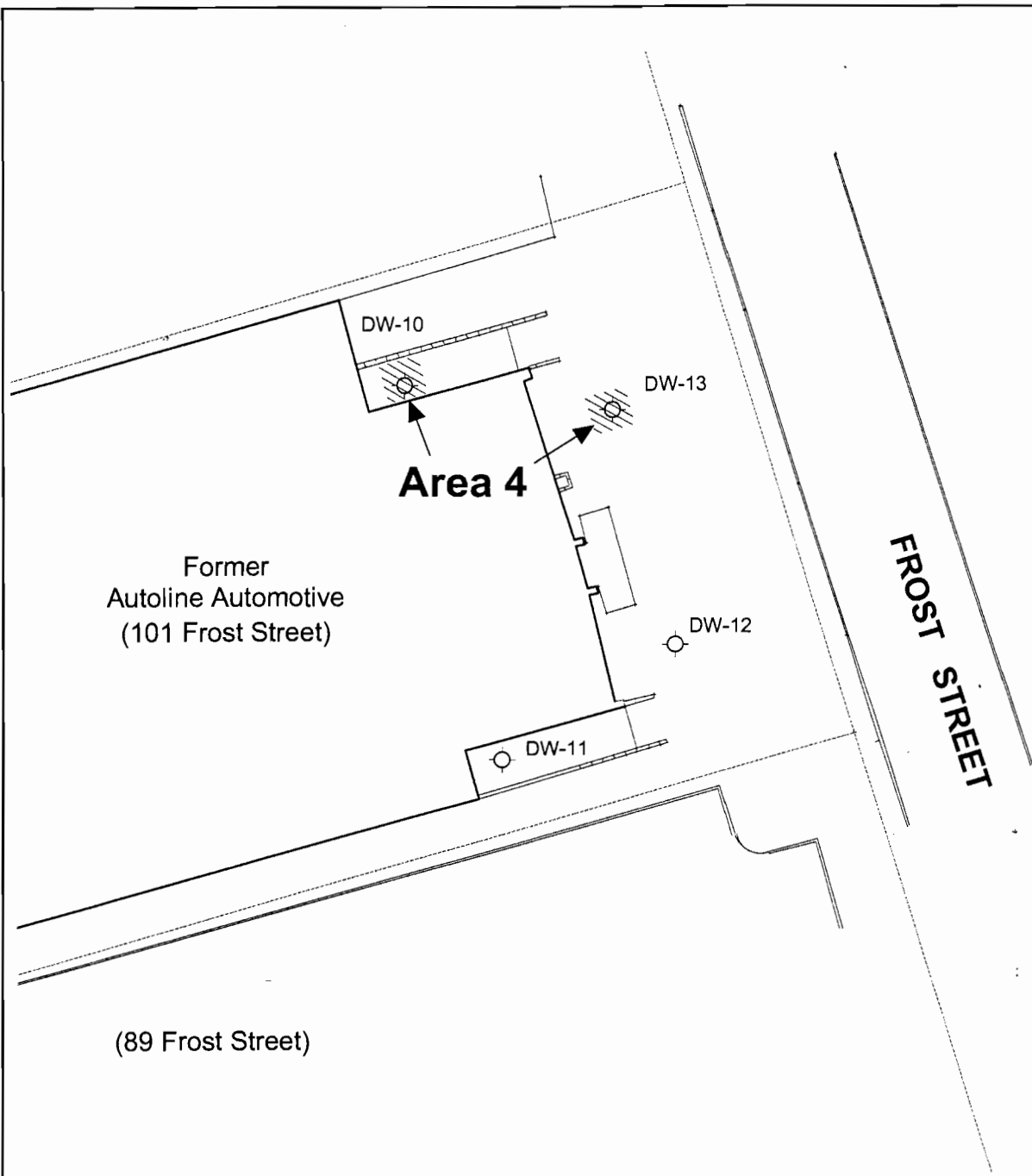
LEGEND

-  Dry well location
-  Area 3 of soil contamination

Figure 6-10
101 Frost Street
(Former Autoline Automotive)
Soil Contamination, Area 3

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Former
Autoline Automotive
(101 Frost Street)

(89 Frost Street)

FROST STREET

LEGEND

- DW- Dry well
- Area 4 of soil contamination

0 40 ft
Approximate Scale
1 in. = 40 ft

Figure 6-11
101 Frost Street
(Former Autoline Automotive)
Soil Contamination, Area 4

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established for the site. The on-site PCE plume that exceeds the Class GA standards on this property is much larger than the plumes of the other compounds. The total area of the PCE plume on-site is approximately 45,000 ft² (Figure 6-5). Assuming the on-site plume extends from approximately 55 to 80 ft below the ground surface (although the contamination in some areas may be deeper) and an average porosity of 0.20, the total estimated quantity of contaminated groundwater on-site is 1.7 million gallons. The extent of the off-site groundwater plume is discussed in Section 6.4.

6.2 89 FROST STREET

6.2.1 Site History

The 89 Frost Street site is currently used as a paved parking area for the department store located southwest of the property. The property is approximately 3.5 acres and the former 55,565-ft² warehouse building was removed in the summer of 1998. A parking lot and Main Street bound the site to the west, the former Autoline Automotive site is to the north, Frost Street is to the east, and a commercial building and parking lot are to the south. The site was listed on the New York State Registry of Inactive Hazardous Waste Disposal Sites (NYSDEC Site No. 1-30-043L) as a Class 2 Site in 1996.

Records indicate that the 55,565-ft² structure was built between 1968 and 1970. Records dating back to 1971 indicate that several facilities occupied this building, including a music amplifier manufacturer, a manufacturer of double-coated adhesive tape and a processing and finishing company. The building was connected to the Nassau County municipal sewer system in February 1983. NCDPW plans indicate two cesspools located on the west side of the building and one cesspool on the east side of the building. No floor drains were noted inside the building during a site inspection conducted as part of a NYSDEC SI (LMS 1994).

Unicord, a manufacturer of music amplifiers, occupied the building between 1980 and 1987. According to NCDOH records, Unicord used the following chemicals at the site per year:

- Solder flux 5 gal
- Varnish 10 gal
- Varnish thinners 10 gal

Adchem Corporation, a double-coated adhesive tape manufacturer, occupied this address from 1971 to 1973. NCDOH records indicated that Adchem was also located at 625 Main Street during this time and used the following chemicals at that address per year:

- Hydrocarbon resins No quantity specified
- Toluene 30,000 lb
- Methyl ethyl ketone 30,000 lb

In 1992 Marvex Corporation (a processing and finishing company) was issued an EPA identification number from the Office of Air and Radiation. The occupancy dates for Marvex Corporation are unknown. A record and file review produced no additional information for Marvex Corporation.

The last known occupant of 89 Frost Street was Korg Electronics. Korg used the site primarily as a distribution location for electronic keyboards and other electronic musical equipment. Some of the offices and workrooms were used for research and development purposes; only minor electronic repairs were conducted at a small work station in the rear of the warehouse area (Anson 1992). Korg had no documented use of any chemical compounds that may be related to the contamination in the soils and groundwater.

A 1996 New York State Superfund Contract Multi-Site PSA Report indicated that high concentrations of PCE and PCE-related compounds were detected in the groundwater upgradient and downgradient of the site. Analyses of groundwater samples indicated that concentrations of PCE as high as 37,000 µg/l (at 65 to 85 ft bgs) and 20,000 µg/l (at <65 ft bgs) were found in the groundwater directly downgradient of the western portion of the site, while only 2200 µg/l (<65 ft bgs) of PCE was detected in a sample collected from the groundwater upgradient of the western portion of the site. Based on the high downgradient vs upgradient groundwater concentrations of PCE, the high levels of PCE found in the groundwater under the site, and the past history of chemical use and suspected chemical use by former site occupants, the site was included on the New York State Registry of Inactive Hazardous Waste Disposal Sites as a Class 2 site.

In 1997 additional investigations were conducted on this property by the PRP. The investigation was limited in scope in terms of the sample locations and numbers.

In 1998, during construction activities at this site to create a paved parking area, the existing building was demolished and many of the drainage structures were removed or altered. These construction activities occurred early in the RI, and LMS collected a number of samples from the existing drainage structures at that time. The results for these samples are presented in Chapter 5.

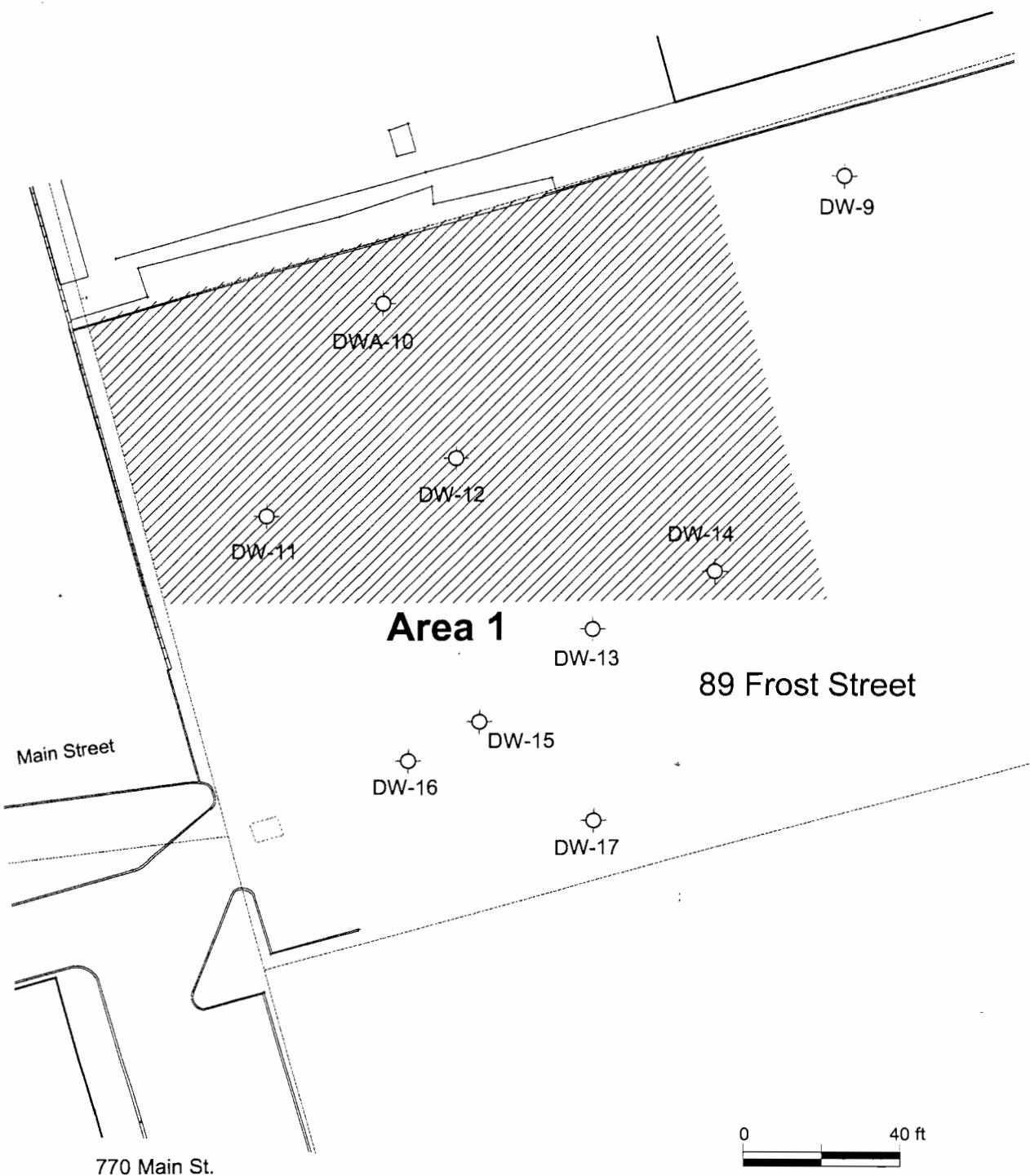
6.2.2 Nature and Extent of On-site Soil Contamination

The soil investigation at 89 Frost Street consisted of collecting 140 samples from various depths in, below, and adjacent to dry wells. Three locations had VOCs (PCE and TCE) in concentrations above the recommended soil cleanup objectives.

Four samples taken in the northwest quadrant of the property had concentrations of PCE and/or TCE at levels above the cleanup objective. Figure 6-12 shows the extent of the PCE contamination in the soil on-site. Two samples were from the same location [89-DWA-14 (51-53 ft)]. The sample analyzed by the mobile laboratory had a concentration of PCE so high that the GC was unable to record the values, while the sample sent to the base laboratory had a concentration of 2400 µg/kg. The sample taken at 89-DWA-10 (26-28 ft) had 800 µg/kg TCE; the sample at 89-DW-11 (28-32 ft) had 1600 µg/kg of TCE and 47,000 µg/kg of PCE.

At the 89 Frost Street site an area (22,500 ft²) of primarily PCE-contaminated soil was found during the RI (Figure 6-12). The highest concentrations were found in the northwest quadrant of the site at depths of 26-28, 28-32, and 51-53 ft. It is not believed that the soil VOC contamination can be treated as separate distinct areas of soil contamination.

SVOCs are commonly found above applicable standards in dry well bottom sediments in industrialized areas. Typically, the extent of these contaminants are limited to the bottom sediments and soils immediately below the dry well location. Five samples from four locations (two were sidewall samples; two inside dry wells) were analyzed for SVOCs. All five had SVOCs in concentrations above the recommended soil cleanup objective. The compounds found in the soil that exceeded the cleanup objective are phenol, benzo(a)an, benzo(b)fl, and benzo(a)py. Phenol alone was found in both sidewall samples at 89-DW-15-SWA at a concentration of 21 µg/kg and -SWB with 38 µg/kg.



LEGEND

-  Dry well location
-  Area 1 of soil contamination

Map source: YEC, 1998.

\\89 frost soil closeup.dsf

Figure 6-12

89 Frost Street Soil Contamination, Area 1

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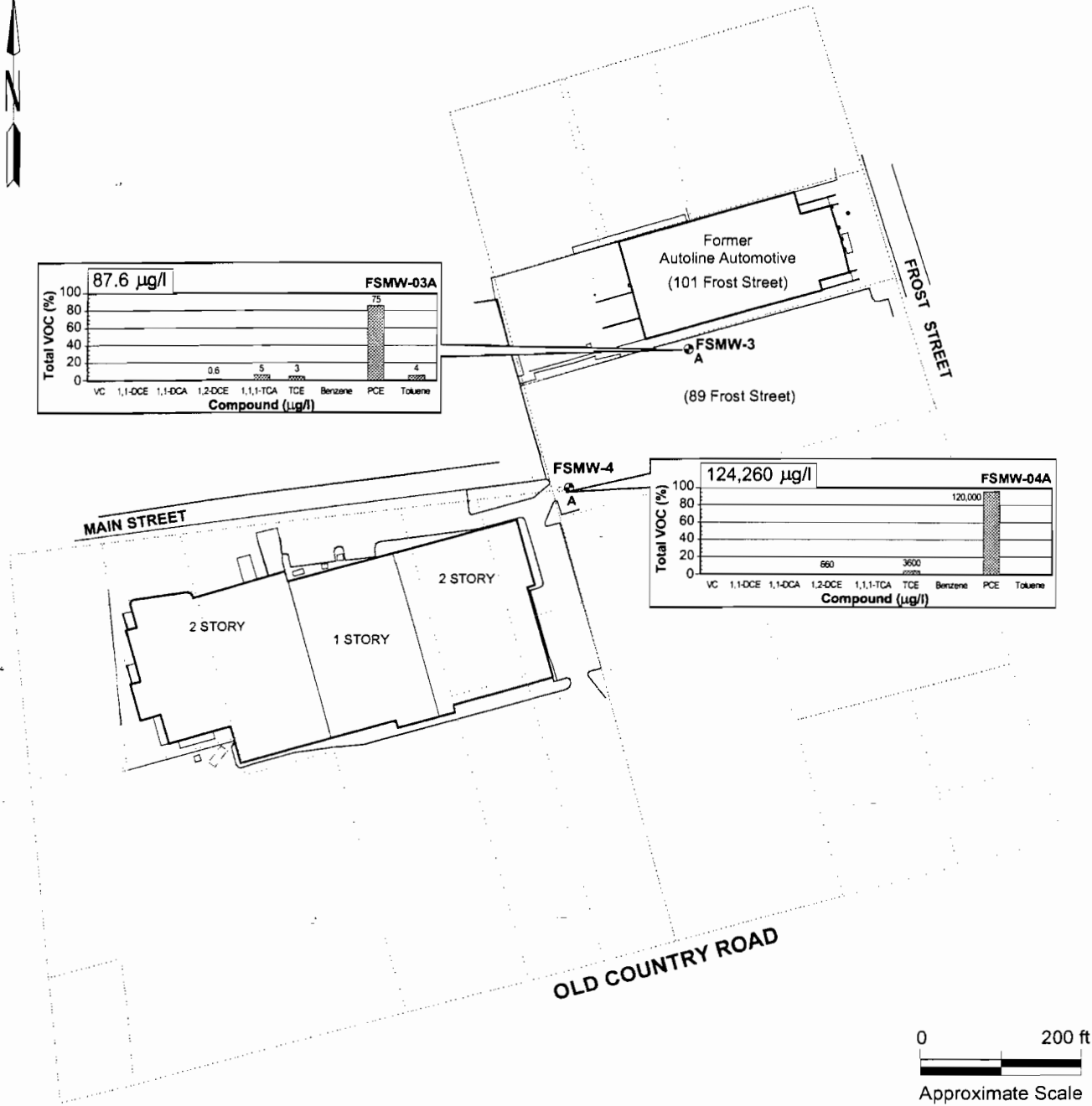
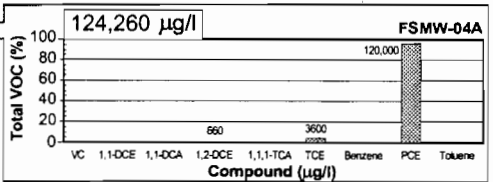
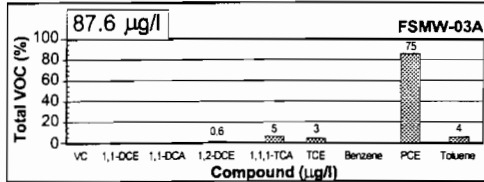
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Phenol was also found in 89-DW-11 (S-2) at a concentration of 1000 µg/kg, along with benzo(a)an (1100 µg/kg), benzo(b)fl (1900 µg/kg), and benzo(a)py (770 µg/kg). 89-DW-12 (S) had benzo(a)an in excess of the cleanup objective with a concentration of 520 µg/kg and benzo(a)py with 540 µg/kg. 89-DW-10 (S) had benzo(a)an (760 µg/kg), benzo(b)fl (1900 µg/kg), and benzo(a)py (1000 µg/kg) in excess of the cleanup objective.

Metals are also commonly found above applicable standards in dry well bottom sediments in industrialized areas. Five sediment samples were analyzed for TAL metals plus cyanide. Antimony, cadmium, chromium, copper, mercury, nickel, and/or zinc were found above the cleanup objective in three of the five samples and are believed to be related to site activities. Only antimony, cadmium, copper, mercury, and zinc were found in concentrations above both the cleanup objective and eastern background soil concentrations. At three locations [89-DW-10 (S), -11 (S-2), and -12 (S)] several metals greatly exceeded the eastern background soil concentrations: 89-DW-10 (S) had copper (73,700 µg/kg), mercury (430 µg/kg), and zinc (222,000 µg/kg); 89-DW-11 (S-2) had antimony (203,000 µg/kg), copper (85,200 µg/kg), and zinc (446,000 µg/kg); and 89-DW-12 (S) had cadmium (3400 µg/kg), copper (141,000 µg/kg), and zinc (509,000 µg/kg). Cadmium (1300 µg/kg) in 89-DW-11 (S-2) slightly exceeded the eastern background soil concentration, as did mercury (210 µg/kg) in 89-DW-12 (S). Iron was also found above the cleanup objective in all five samples; however, the values are within the eastern background soil concentrations and are believed to represent site background levels.

6.2.3 Nature and Extent of On-site Groundwater Contamination

The groundwater investigation at 89 Frost Street consisted of collecting and analyzing 85 samples taken from 30 locations for VOCs. Fifteen locations (five additional probes, two hydropunches, and eight adjacent to dry wells), sampled at various depths, had VOCs above the NYSDEC Class GA standard. The compounds found in the groundwater that exceed the Class GA groundwater standard are PCE, TCE, 1,1,1-TCA and their breakdown products, with PCE being the primary contaminant of concern. The total VOC concentrations found in the onsite wells are shown on Figures 6-1 and 6-2. The distribution of the individual contaminants which were found in the shallow and deep wells at the 89 Frost Street site are shown on Figures 6-13 and 6-14 respectively.



Legend

- Monitoring well location
(-A = shallow well)

ABBREVIATIONS

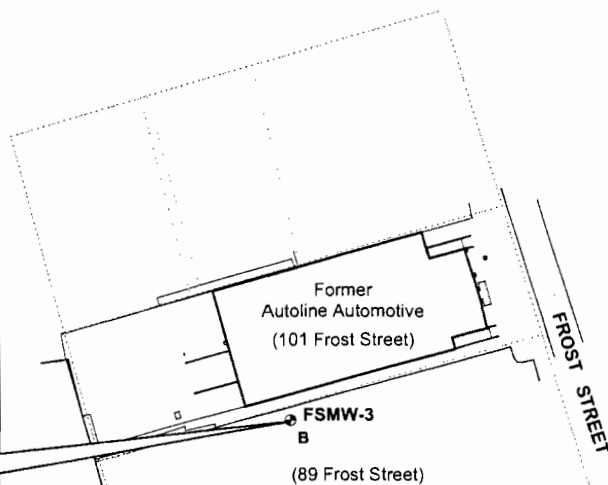
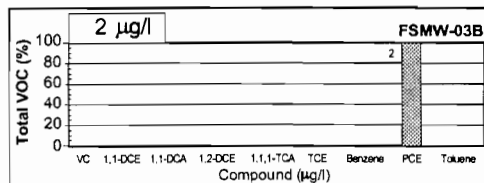
VC	Vinyl chloride	1,1,1-TCA	1,1,1-Trichloroethane
1,1-DCE	1,1-Dichloroethene	TCE	Trichloroethene
1,1-DCA	1,1-Dichloroethane	PCE	Tetrachloroethene
1,2-DCE	1,2-Dichloroethene		

Map source: YEC survey, 1998.

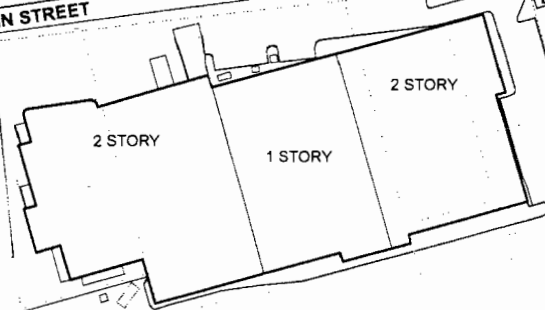
Figure 6-13 VOC Groundwater Contamination Distribution 89 Frost Street Shallow Wells

FROST STREET SITES
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043 I, L, and M

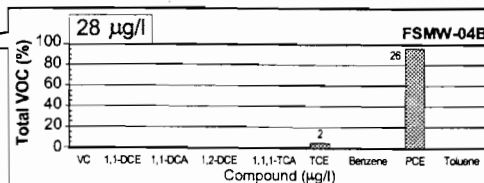
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MAIN STREET



OLD COUNTRY ROAD



0 200 ft

Approximate Scale
1 in. = 200 ft

\\survey base map frost&main.dsf

Legend

- Monitoring well location
(-B = deep well)

ABBREVIATIONS

VC	Vinyl chloride	1,1,1-TCA	1,1,1-Trichloroethane
1,1-DCE	1,1-Dichloroethene	TCE	Trichloroethene
1,1-DCA	1,1-Dichloroethane	PCE	Tetrachloroethene
1,2-DCE	1,2-Dichloroethene		

Map source: YEC survey, 1998.

Figure 6-14 VOC Groundwater Contamination Distribution 89 Frost Street Deep Wells

FROST STREET SITES
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043 I, L, and M

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Pearl River, New York

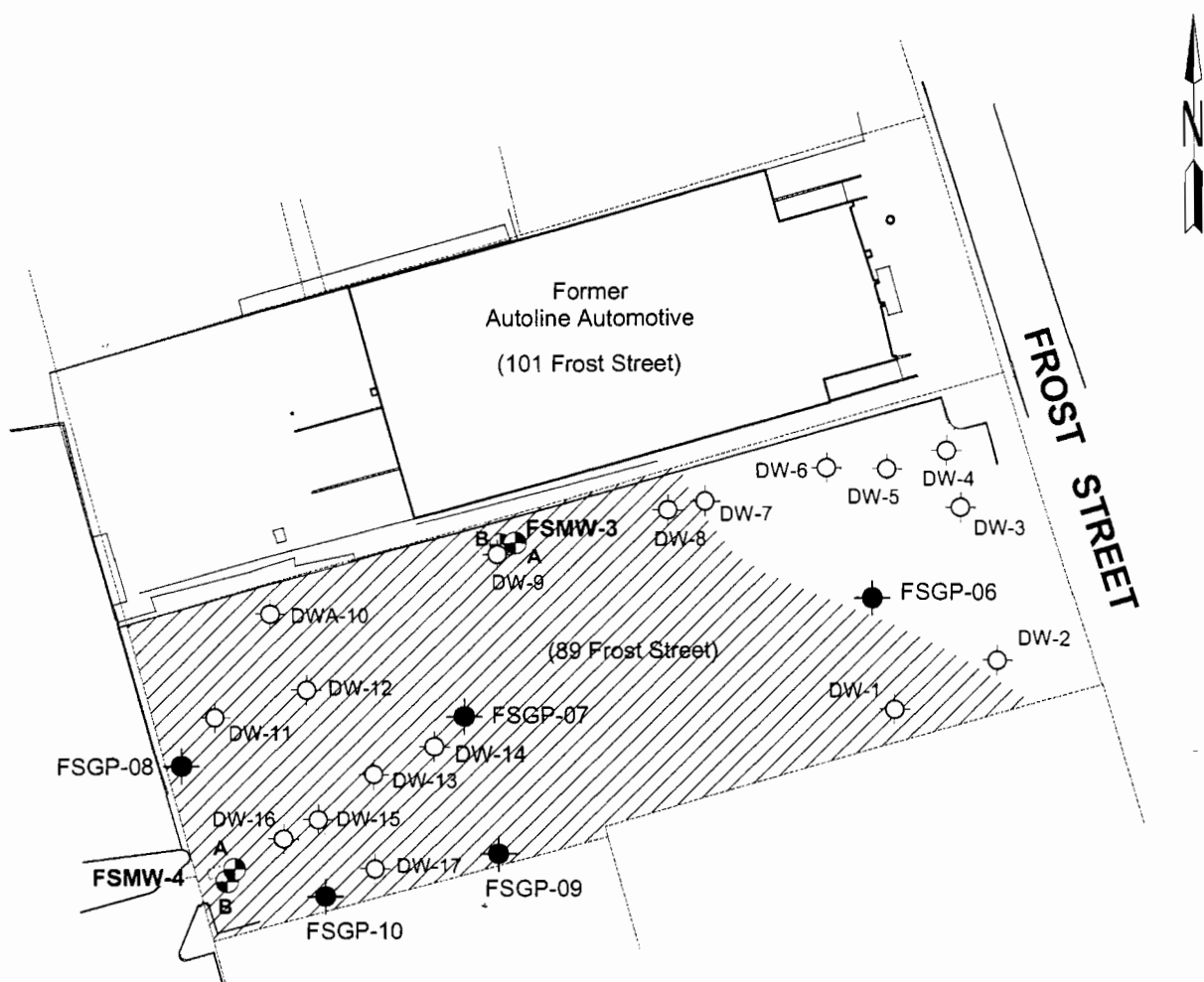
Samples taken on the east side of the property had relatively low concentrations of PCE, TCE, and 1,1,1-TCA and their breakdown products. Figure 6-15 shows the extent of the PCE contamination in the groundwater on-site. FSHP-03, FSGP-06, and 89-DWA-1, the three locations farthest to the east, had only PCE above the standard, except for FSHP-03 at the shallowest level (55-65 ft), where it also had 1,1,1-TCA (7.91 µg/l) and TCE (6.03 µg/l) above the standard. PCE was found at up to 5600 µg/l in 89-DWA-14 (60-65 ft). PCE was also found in very high concentrations in 89-DWA-15 (60-65 ft) with a concentration of 1855 µg/l and in all three samples at 89-DWA-10, with 4986, 1792, and 2830 µg/l at 60-65, 78, and 92 ft, respectively.

The two deep monitoring wells on-site (FSMW-3B and -4B) have relatively low levels of TCE and PCE, with concentrations of ND and 2 µg/l of TCE, respectively, and 2 and 26 µg/l of PCE, respectively. FSMW-3A, at the north side of the site, had TCE at a level of only 3 µg/l and PCE at 75 µg/l. FSMW-4A, in the southwest corner, however, had much higher concentrations of TCE (3600 µg/l) and PCE (120,000 µg/l). The existing data indicate that the on-site plume on this property is contributing to the groundwater contamination found off-site and downgradient of this property. 89 Frost Street is located downgradient of 101 Frost Street and upgradient of 770 Main Street (Figure 6-6 and 6-7).

At the 89 Frost Street site an area (62,500 ft²) of primarily PCE groundwater contamination was found during the RI (Figure 6-15). The highest concentrations were found in the west quadrant of the site, mostly at depths of 60-65 ft. However, the PCE concentrations exceeded the Class GA groundwater standards at deeper depths (approximately 80 and 92 ft) in several locations.

6.2.4 Quantity of Contaminated Media

6.2.4.1 Shallow Subsurface Soils and Subsurface Soils at Depth. The quantities of contaminated soils are based on the NYSDEC recommended soil cleanup objectives for each of the contaminants of concern. The recommended soil cleanup objectives are based on the prevention of the continued migration of the contaminants present in the soils to the groundwater. If necessary, the quantities of contaminated soils and sediments will be modified based the health exposure pathway analysis and the selected remedial action objectives established for the site. Based on the samples that were collected at 89 Frost



LEGEND

Area of groundwater contamination

DW- Dry well

FSMW- Monitoring well
 A Shallow (70-ft deep well)
 B Deep (150-ft deep well)

FSGP- Geoprobe sample location

0 100 ft

Approximate Scale
 1 in. = 100 ft

\\survey base map frost only 100'.dsf

Figure 6-15 89 Frost Street Area of Groundwater Contamination

FROST STREET SITES
 NEW CASSEL INDUSTRIAL AREA
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Map source: YEC, 1998.

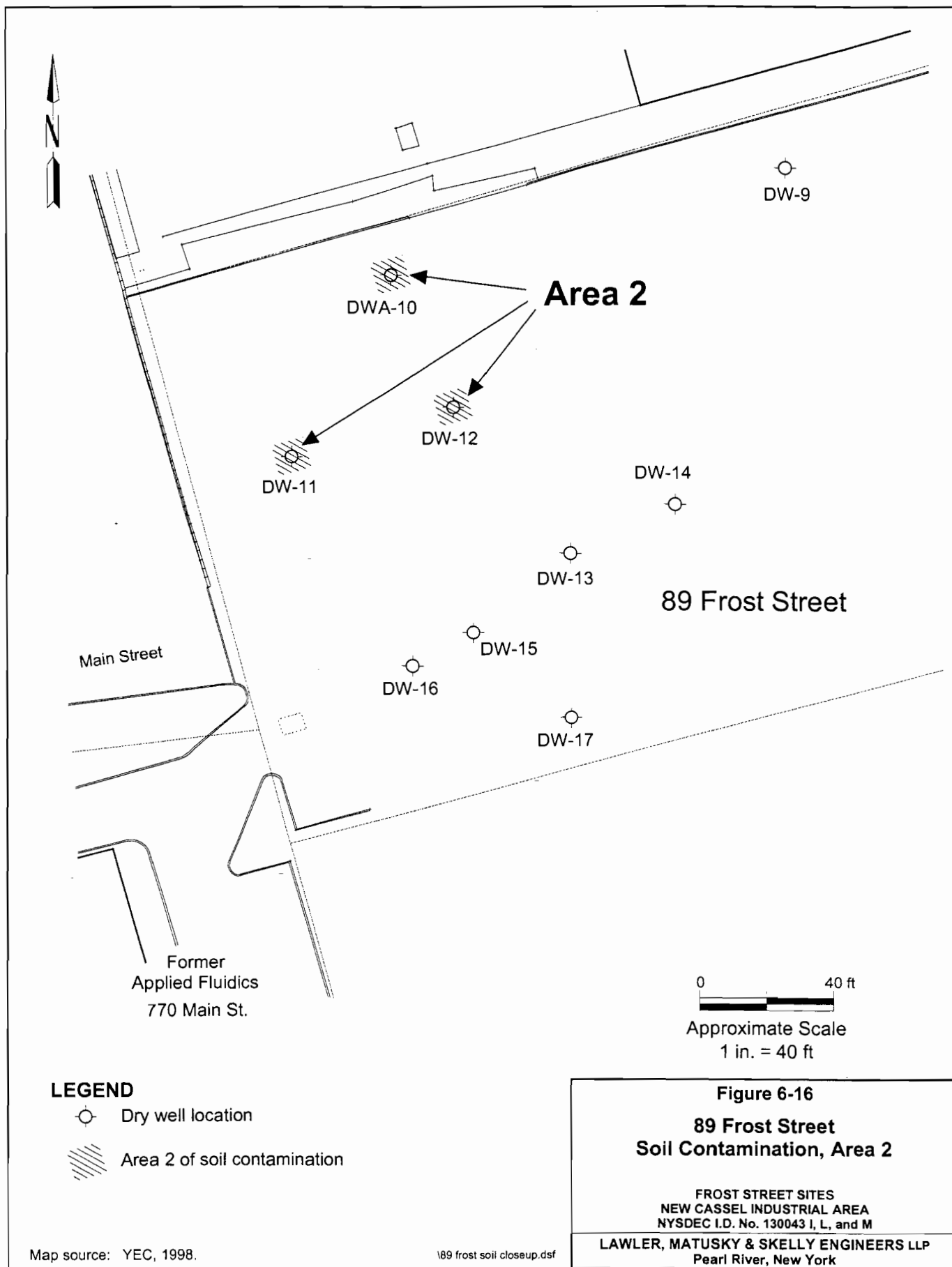
Street, two areas were found to exhibit soils with contaminant concentrations that were in excess of the recommended soil cleanup objectives.

Area 1 on this site (Figure 6-12) is an area of subsurface soil contamination at depth that is associated with a series of dry wells (89-DW-10, -11, -12, and 89-DWA-14) found in the northwest quadrant of this site that exhibited soils with concentrations of PCE and TCE, SVOCs, and metals above the soil cleanup objectives over an area of approximately 22,500 ft² with a total assumed thickness of 15 ft. A total thickness of 15 ft was assumed based on the presence of the contamination at several different depths; it is not believed this contamination can be treated as separate distinct areas of contamination. The total quantity of contaminated soil in Area 1 is approximately 12,500 yd³.

Area 2 at 89 Frost Street includes the bottom sediments in three dry wells (89-DW-10, -11, and -12) located in the northwestern quadrant of the property (Figure 6-16). The bottom sediments in these dry wells exhibited concentrations of metals and SVOCs in excess of the recommended soil cleanup objective. A total of 30 yd³ of contaminated soils are found in these three dry wells, assuming that a 2-ft thickness of soil over a 100-ft² area at each dry well is contaminated.

The soil samples collected during the RI indicate that the total estimated quantity of contaminated soil on this site at 89 Frost Street in excess of the NYSDEC soil cleanup objective is approximately 12,530 yd³. This includes 12,500 yd³ of subsurface soils at depth and 30 yd³ of shallow subsurface soils. However, as part of construction activities at this site during development into a paved parking area, many of the drainage structures were removed or altered. Although it was beyond the scope of this RI to monitor construction activities at this site during the redevelopment, the existing drainage structure layout and observations made during the fieldwork suggest that hazardous wastes may have been improperly removed from this site.

6.2.4.2 On-site Groundwater. The quantity of contaminated groundwater is based on the NYSDEC Class GA groundwater standards applicable to the upper glacial and Magothy aquifers, which are found below the site. The compounds found in the groundwater that exceed the Class GA groundwater standard are PCE, TCE, 1,1,1-TCA, and their breakdown products. If necessary, the quantities of contaminated groundwater will be modified based on the health exposure pathway analysis and the selected remedial action objectives



established for the site. The PCE on-site plume that exceeds the Class GA standards on this property is also much larger than the plumes of the other compounds. The total area of the PCE plume on-site is approximately 80,000 ft² (Figure 6-15). Assuming an average on-site plume thickness of approximately 25 ft (although the contamination in some areas may be deeper) and an average porosity of 0.20, the total estimated quantity of contaminated groundwater on-site is 3.0 million gallons. The existing data indicate that the on-site plume on this property is contributing to the groundwater contamination found off-site and downgradient of this property. The extent of the off-site groundwater plume is discussed in Section 6.4. It also appears that groundwater contamination is entering 89 Frost Street from upgradient (101 Frost Street).

6.3 FORMER APPLIED FLUIDICS SITE (770 Main Street)

6.3.1 Site History

The former Applied Fluidics site is located at 770 Main Street in the NCIA. The site is located on approximately 1 acre of land and is bounded by Main Street to the north, a parking lot to the east, and a parking lot to the south. A newly built, large department store (Century Twenty-one) now occupies the site formerly occupied by Applied Fluidics. The site is entirely paved or covered with the footprint of the building. The site was listed on the New York State Registry of Inactive Hazardous Waste Disposal Sites (NYSDEC Site No. 1-30-043M) as a Class 2 Site in 1996.

The former building on the site, which was erected in 1961, was approximately 9746 ft² in size. The building was used until 1997 as a warehouse for storage of juvenile furniture, toys, and accessories for the retail operation located at 1111 Old Country Road. Other former occupants of the building include Applied Fluidics (1974-1988), which was a division of Allard Instruments, a Nassau County defense contractor that manufactured research instruments and leak detectors.

According to NCDPW, a cesspool is located in front of the building (north side). The building was hooked up to the Nassau County municipal sewer system in May 1983. According to NCDOH records, Applied Fluidics used the following chemicals at this facility per year:

- Adhesives 1 gal
- Methyl ethyl ketone 10 gal
- Paint thinners 5 gal
- Petroleum distillates 10 gal
- Trichloroethylene 10 gal

770 Main Street was a one-story block building built in 1961 that covered the entire lot except for a parking area along Main Street. The building at 770 Main Street was attached to the main Coronet building at 1111 Old Country Road by a walkway addition. According to NCDOH records, Applied Fluidics (1974-1988) had documented usage of TCE of 10 gal/year, as well as other compounds possibly containing PCE-related contaminants. Soil samples collected during a Multi-Site PSA investigation indicate concentrations of PCE at 15-17 ft bgs of 70 µg/kg and at 17-19 ft of 390 µg/kg. This soil sample was collected in close proximity to a dry well/cesspool documented during an investigation for a previous NYSDEC Phase II done in February 1995. The location of the dry well/cesspool was confirmed by a ground penetrating radar (GPR) survey conducted at the site as part of the 1996 Multi-Site PSA investigation. High concentrations of PCE were detected in groundwater samples from the site. Groundwater samples collected upgradient of the site contained 4,400 µg/l of PCE-related compounds (>85 ft). Downgradient groundwater samples contained concentrations of PCE-related compounds of up to 50,000 µg/l (65-85 ft bgs). Samples collected directly below the suspected cesspool source contained 17,000 µg/l of PCE-related compounds (>85 ft bgs). Based on documented usage of TCE, a documented on-site source, and elevated PCE-related contaminants downgradient of the site, the site was included on the New York State Registry of Inactive Hazardous Waste Disposal Sites as a Class 2 site.

In 1997 additional investigations were conducted on this property by the PRP. The investigation was limited in scope in terms of the sample locations and numbers. Later in that year the existing building was removed as part of the redevelopment in the area. The demolition and excavation plans for the redevelopment included the removal of all of the existing drainage structures. Field observations by NYSDEC and LMS personnel indicate that large quantities of soils and demolition debris, including the former drainage structures, were removed from this site. These removal actions were conducted by the PRP without authorization from NYSDEC. The PRP refused to enter into a consent order with NYSDEC to investigate and remediate the site prior to redevelopment. The

nature and extent of the contamination in the material that was removed from the site are not known.

6.3.2 Nature and Extent of On-site Soil Contamination

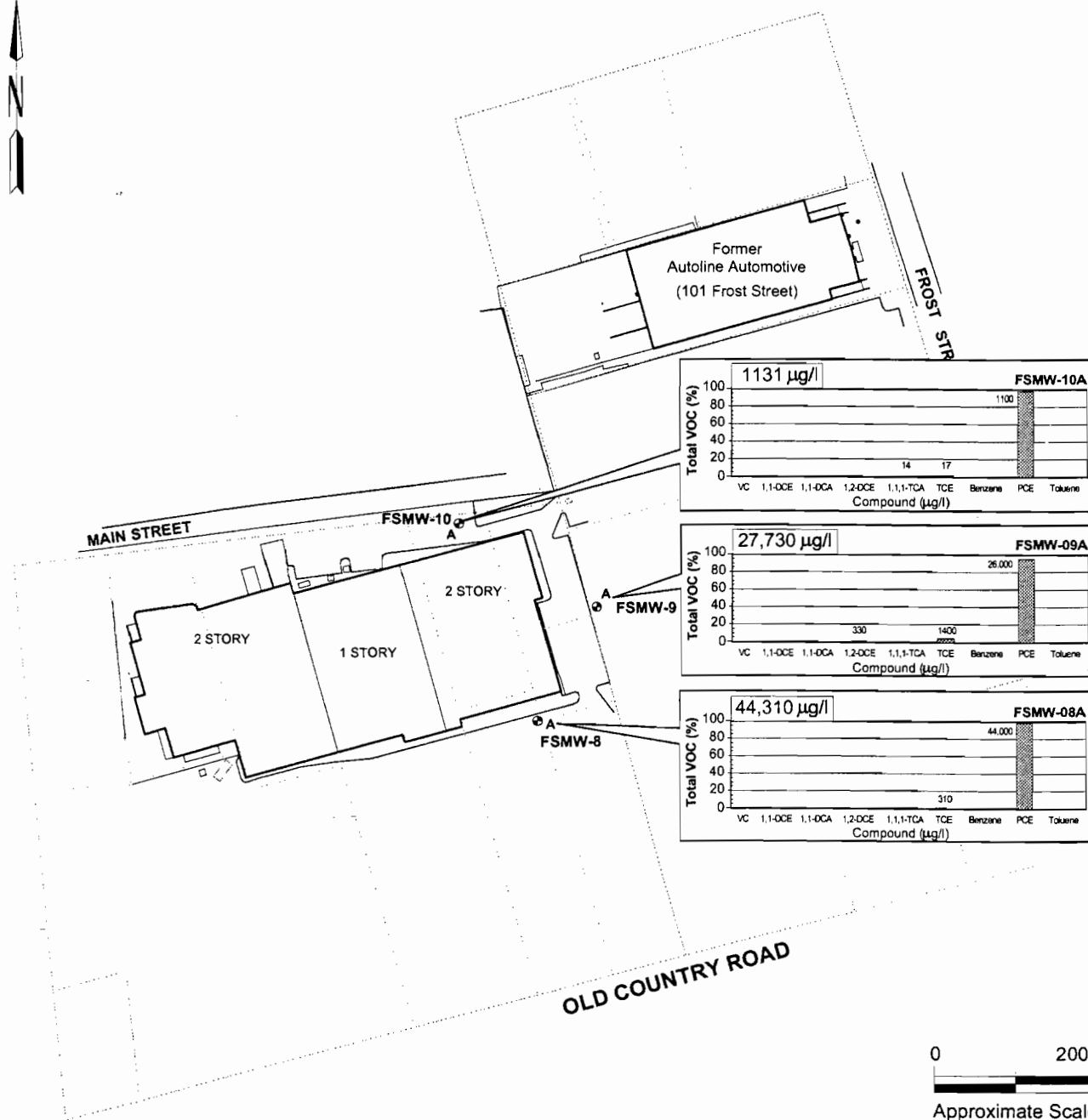
The soil investigation consisted of collecting and analyzing 10 samples taken from five additional probe locations, each sampled at two depths (20-22 and 50-54 ft) and analyzed for VOCs. Only traces of TCE and PCE were found during the RI sampling activities. The redevelopment of this property included the removal of all of the existing drainage structures. Large quantities of soils and demolition debris, including the former drainage structures, were removed from this site. The nature and extent of the on-site soil contamination could not be determined as a result of the site redevelopment.

6.3.3 Nature and Extent of On-site Groundwater Contamination

The groundwater investigation consisted of collecting and analyzing groundwater samples from five probe locations and several monitoring wells. All the samples, taken at various depths, had VOCs in concentrations above the NYSDEC Class GA standards. The compounds found at concentrations in the groundwater that exceed the Class GA groundwater standard are PCE, TCE, 1,1,1-TCA, and their breakdown products, with PCE being the primary contaminant of concern. The total VOC concentrations found in the onsite wells are shown on Figures 6-1 and 6-2. The distribution of the individual contaminants which were found in the shallow and deep wells at the former Applied Fluidics site are shown on Figures 6-17 and 6-18 respectively.

1,1,1-TCA was found above NYSDEC Class GA standard in all five of the probe locations at relatively low levels, ranging up to 38.9 µg/l; the higher values were found in the northeastern corner of the property.

PCE, the primary contaminant of concern at this site, had concentrations ranging up to 86.2 µg/l at FSGP-15 (77-78 ft). Cis-1,2-DCE was also found at this site in relatively high concentrations in FSGP-13 (63-64 ft), FSGP-14 (63-64 and 79-80 ft), and FSGP-15 (63-64 and 77-78 ft) (101, 230, 239, 641, and 463 µg/l, respectively). Cis-1,2-DCE is a primary degradation product of PCE. In general the probe groundwater concentrations were much less than found in the monitoring well groundwater samples. The variations in the



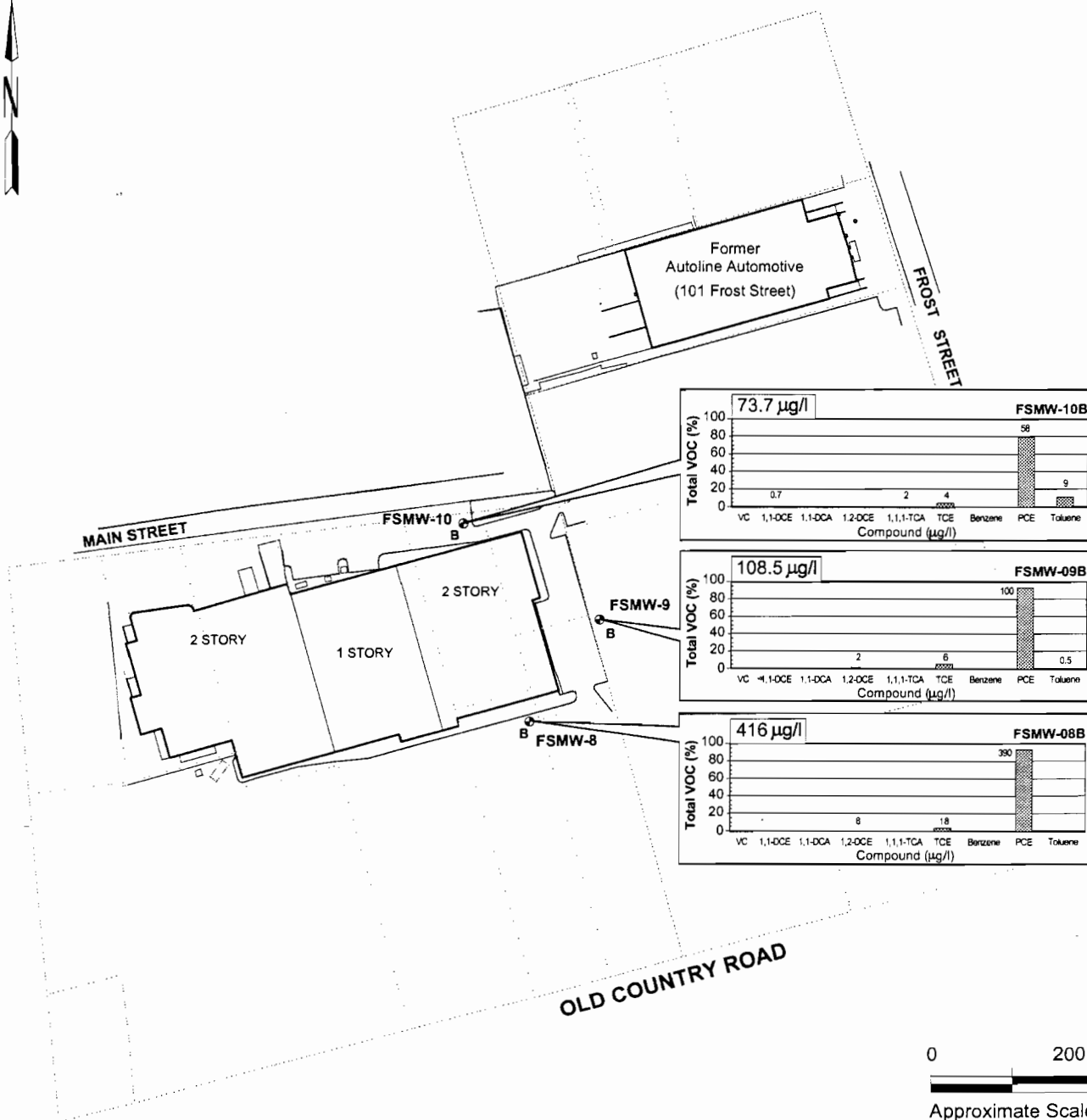
survey base map frost&main.dsf

Figure 6-17 **VOC Groundwater Contamination** **Distribution** **770 Main Street Shallow Wells**

FROST STREET SITES
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Map source: YEC survey, 1998.



Legend

- Monitoring well location
- (-B = deep well)

ABBREVIATIONS

VC	Vinyl chloride	1,1,1-TCA	1,1,1-Trichlorethane
1,1-DCE	1,1-Dichloroethene	TCE	Trichloroethene
1,1-DCA	1,1-Dichloroethane	PCE	Tetrachloroethene
1,2-DCE	1,2-Dichloroethene		

Map source: YEC survey, 1998.

Figure 6-18 VOC Groundwater Contamination Distribution 770 Main Street Deep Wells

FROST STREET SITES
NEW CASSEL INDUSTRIAL AREA
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concentrations between the probe samples and monitoring well samples are likely the result of varying concentrations with depth as a result of the heterogeneous nature of the subsurface material.

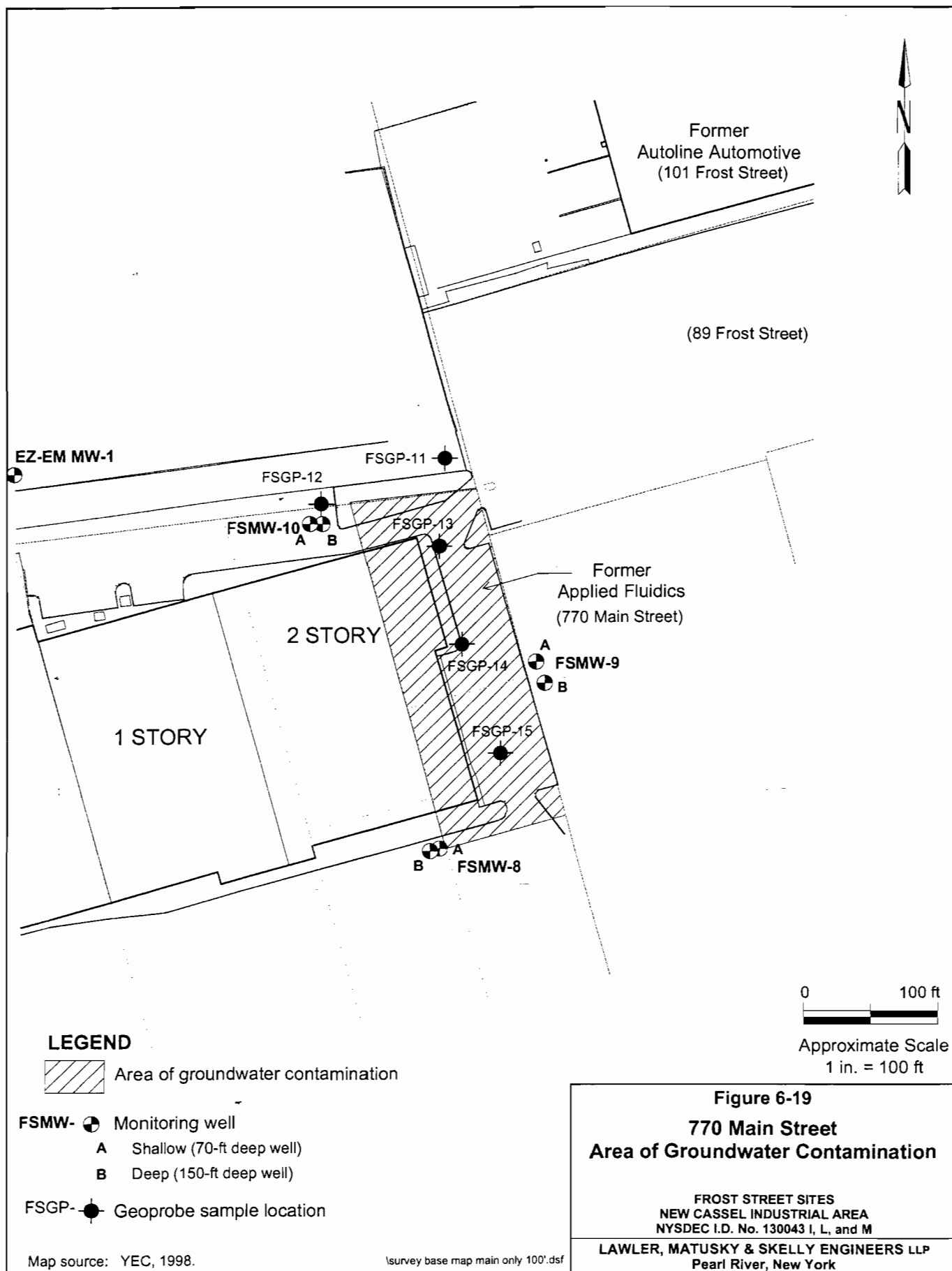
Three couplets of wells were installed at 770 Main Street, each consisting of a shallow and deep well. Samples from all six wells had PCE well over the NYSDEC Class GA standard, with the concentrations increasing in a downgradient direction. The shallow wells (FSMW-8A, -9A, and 10-A) had concentrations of 44,000, 26,000, and 1100 µg/l, respectively. The deep wells (FSMW-8B, -9B, and 10-B) had concentrations of PCE at 390, 100, and 58 µg/l, respectively. Figure 6-19 shows the extent of the PCE contamination in the groundwater on-site.

Five of the wells had concentrations of TCE above the standard: FSMW-8 (A and B), FSMW-9 (A and B), and FSMW-10A at concentrations of 310, 18, 1400, 6, and 17 µg/l, respectively. Concentrations of total 1,2-DCE were also found above the standard in FSMW-09A (330 µg/l) and FSMW-08B (8 µg/l). The Target sample from FSMW-09A also had 1,1-DCA at a concentration of 1426 µg/l. 1,1,1-TCA was found over the standard in FSMW-10A (14 µg/l), while benzene and toluene were found over the standard at levels of 0.8 and 9 µg/l, respectively, in FSMW-10B. The existing data indicate that the on-site plume on this property is contributing to the groundwater contamination found off-site and downgradient of this property.

At the 770 Main Street site an area (13,500 ft²) of primarily PCE groundwater contamination was found during the RI (Figure 6-19). The highest concentrations were found in the southern portion of the site.

6.3.4 Quantity of Contaminated Media

6.3.4.1 *Subsurface Soils and Drainage Structure Sediments.* All the existing drainage structures at this site were removed as part of the redevelopment of this site in 1998. It is not known whether soils in excess of the recommended soil cleanup objective were present on this site prior to the removal of the drainage structures. During the PSA, sampling concentrations of PCE below the soil cleanup objective were noted on this site.



6.3.4.2 On-site Groundwater. The quantity of contaminated groundwater is based on the NYSDEC Class GA groundwater standards applicable to the upper glacial and Magothy aquifers, which are found below the site. The compounds found in the groundwater that exceed the Class GA Groundwater standard are PCE, TCE, and 1,1,1-TCA and their breakdown products. If necessary, the quantities of contaminated groundwater will be modified based on the health exposure pathway analysis and the selected remedial action objectives established for the site. The PCE on-site plume that exceeds the Class GA standards on this site is much larger than the plumes of the other compounds. The total area of the PCE plume on-site is approximately 30,000 ft² (Figure 6-19). Assuming that the on-site plume extends from approximately 55 to 150 ft below the ground surface and an average porosity of 0.20, the total estimated quantity of contaminated groundwater on-site is 4.3 million gallons. The existing data indicate that the on-site plume on this property is contributing to the groundwater contamination found off-site and downgradient of this property. The extent of the off-site groundwater plume is discussed in Section 6.4. It also appears that groundwater contamination is entering from upgradient (101 Frost Street and 89 Frost Street).

6.4 Off-site Investigation

The off-site groundwater investigation for this RI consisted of collecting and analyzing 34 groundwater samples taken from six locations downgradient of the three sites. The sampling locations during the RI were limited to areas north of Old Country Road. However, several previous investigations (LMS 1997, LMS 1998) have focused on collecting data further downgradient of the three Frost Street sites.

6.4.1 Summary of Previous Investigations

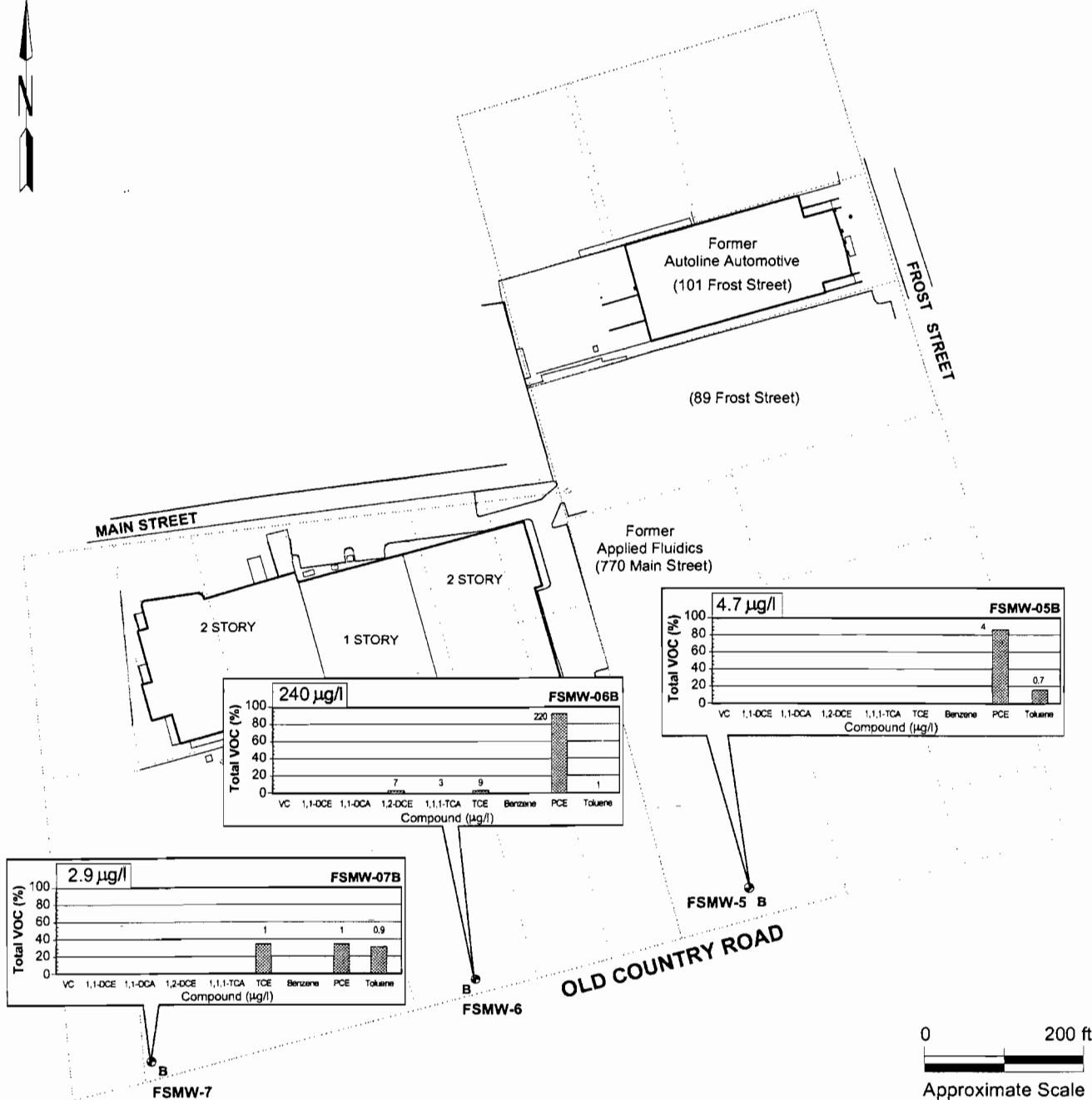
During the Multisite PSA (LMS 1997) extremely high concentrations of PCE-related compounds were found in off-site locations (Figure 5-1), with the highest concentrations found at the 65 to 85 ft depth. The highest concentrations of PCE-related contaminants were found in GP-131 and GP-145 near 770 Main Street. A majority of these off-site data points were located north of Old Country Road. Additional previous sampling during the NCIA off-site IWA groundwater sampling (LMS 1998) and the Bowling Green early warning well groundwater sampling (LMS 1997) indicate that the PCE groundwater plume has migrated well past the Bowling Green supply wells. The available

data indicates that the PCE groundwater plume is vertically stratified and exhibits several zones of high contamination (Figure 5-2).

6.4.2 Nature and Extent of Off-site Groundwater Contamination

Twelve of the RI groundwater samples had VOCs above the NYSDEC Class GA standard. The compounds found in the groundwater that exceed the Class GA groundwater standard are PCE, TCE, 1,1,1-TCA, and their breakdown products, with PCE being the primary contaminant of concern. The distribution of the individual contaminants which were found in the shallow and deep wells off-site are shown on Figures 6-20 and 6-21 respectively. In general the levels of contamination found in the samples were lower than the previous investigations since the RI sample locations were used to define the limits of the plume north of Old Country Road. Previous data collected downgradient of Old Country Road also shows that PCE is the primary contaminant of concern and concentrations in excess of the Class GA Standard are found as far downgradient as HP-02 (Figure 6-22)

Based on the previous data from off-site locations the PCE groundwater contamination from the Frost Street sites was found to extend at least 2000 ft downgradient. The maximum extent of the PCE contamination above Class GA groundwater standards is found in the shallow groundwater. The plume also appears to be vertically stratified and several zones of higher concentrations exist downgradient (Figure 6-22).



Legend

- Monitoring well location
(-B = deep well)

ABBREVIATIONS

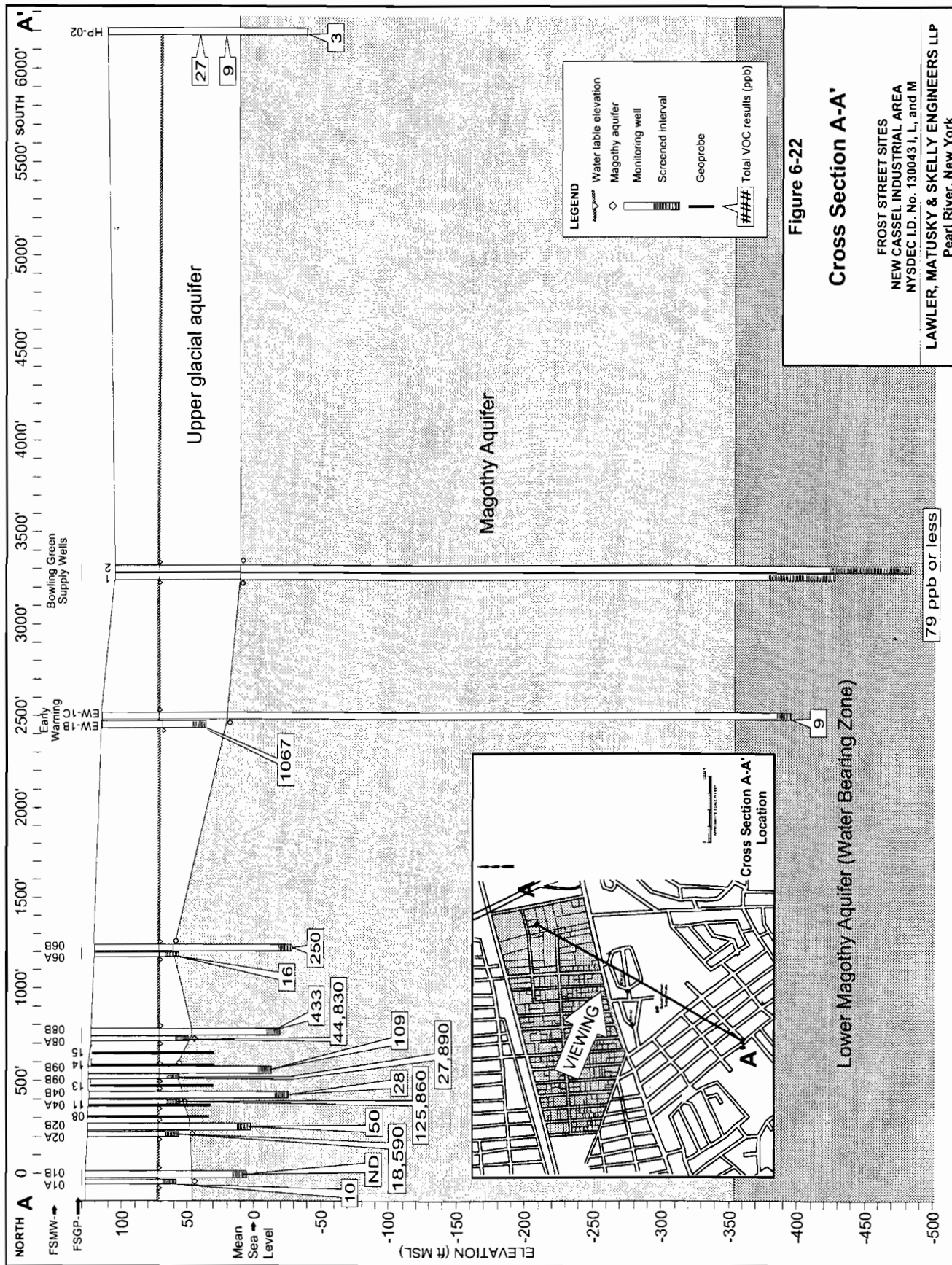
VC	Vinyl chloride	1,1,1-TCA	1,1,1-Trichloroethane
1,1-DCE	1,1-Dichloroethene	TCE	Trichloroethene
1,1-DCA	1,1-Dichloroethane	PCE	Tetrachloroethene
1,2-DCE	1,2-Dichloroethene		

Map source: YEC survey, 1998.

Figure 6-21 VOC Groundwater Contamination Distribution Offsite Deep Wells

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CHAPTER 7

SUMMARY AND CONCLUSIONS OF THE REMEDIAL INVESTIGATION

7.1 FIELD INVESTIGATION

The RI at the Frost Street sites was performed to further characterize the nature and extent of the groundwater and soil contamination discovered during the previous investigations at these three sites. The field investigation included completing a number of soil and groundwater probes at suspected former disposal locations across the site, hydropunch groundwater sampling, monitoring well installation, and sampling the site monitoring wells.

A total of 74 soil probe locations were sampled; an on-site mobile laboratory analyzed the soil samples for VOCs. A portion of these soil samples were also analyzed by a NYSDOH-certified base analytical laboratory for VOCs and SVOCs, pesticides/PCBs, and metals plus cyanide. A majority of these soil probes were installed in and adjacent to the dry wells that are found across the sites. Groundwater probe samples were also collected at locations immediately downgradient of the drainage structures and at additional probe locations to fill in any data gaps in the groundwater data set. Both laboratories analyzed each of the groundwater probe samples for VOCs.

A total of 59 hydropunch groundwater samples were collected during the drilling operations conducted to install the new monitoring wells at the site. Each of the hydropunch groundwater samples was submitted to on-site mobile laboratory for VOC analysis. A total of 20 additional monitoring wells were installed during the Frost Street sites RI: 10 shallow and 10 deep monitoring wells to determine the vertical distribution of the contaminants. The shallow wells were completed near the bottom of the UGA or in the transition zone between the UGA and Magothy. The deep wells were set into the upper zone of the Magothy Aquifer at approximately 125 to 150 ft bgs. After installation and development, the wells were sampled along with five existing wells from previous on-site and off-site investigations. Each of these groundwater samples was analyzed for VOCs by a NYSDOH-certified base analytical laboratory.

7.2 FORMER AUTOLINE - DATA INTERPRETATION

7.2.1 Surface Soils

Two samples were taken at the former Autoline Automotive site to conduct a health risk assessment. The two samples were taken along the northern property line. The main contaminants found in the surface soil samples were SVOCs and metals. The analytical data indicate that only low levels of VOCs and pesticides/PCBs were found in the surface soils. SVOCs in excess of the recommended soil cleanup objective [phenol, benzo(a)an, chrysene, benzo(b)fl, benzo(a)py, and dibenz(a,h)] were found in the two samples. The presence of SVOCs in the surface soil samples are likely the result of the past industrial activities in the area. It is likely that similar concentrations of SVOCs would be found throughout the industrial area and the measured concentrations at this site are typical of the area.

Metals above the recommended soil cleanup objective were also found in the surface soil samples. 101-SS-2 had magnesium (18,200,000 µg/kg) and zinc (159,000 µg/kg) greatly in excess of both the recommended soil cleanup objective and the eastern background soil concentrations. The other surface soil sample (101-SS-1) had seven metals (antimony, chromium, copper, lead, magnesium, nickel, and zinc) greatly in excess of both the recommended soil cleanup objective and the eastern background soil concentrations, with the respective concentrations of 18,500, 254,000, 1,120,000, 5,410,000, 10,300,000, 125,000, and 804,000 µg/kg. The presence of metals in the surface soil samples are likely the result of past industrial activities in the area. It is likely that similar concentrations of metals would be found through out the industrial area and the measured concentrations at this site are typical of the area.

7.2.2 Subsurface Soils and Sediments

The site history for the former Autoline Automotive site indicates that the main contaminants of concern in the subsurface soils and sediments are VOCs and SVOCs. The VOCs are primarily halogenated VOCs used in degreasing or cleaning operations; the SVOCs were used as lubricants. Several areas with elevated concentrations of metals

(copper, mercury, and zinc) and one area exhibiting elevated concentration of 4,4'-DDT were also found on this site.

Analytical data from the subsurface soil samples indicate that VOCs in excess of the recommended soil cleanup objective are found in two locations (101-DWA-4 and 101-DW-N/S). These two locations are existing dry well locations which appear to have been used to discharge hazardous waste to the subsurface. The unsaturated subsurface soil sample collected at 101-DWA-4 (50-54 ft) contained such high levels of PCE that a value for the concentration could not be reported. This dry well is located in the northwest quadrant of the site to the rear of the existing building. The subsurface soil samples collected at 101-DWA-N/S indicates that the PCE concentrations increase with depth, and the deepest soil samples (41-43 ft, and 51-53 ft) have the highest concentration of PCE (2008 and 24,209 µg/kg, respectively). This dry well is located along the southern property boundary. Based on the concentration in subsurface soils at this dry well, the soil contamination clearly impacts off-site locations and groundwater below the site.

Each of the on-site drainage structures contained varying amounts of bottom sediments. The bottom sediments are typically fine-grained organic materials that exhibit elevated concentrations of VOCs, SVOCs, and metals. VOCs (xylenes) in excess of the recommended soil cleanup objective were found in one location (101-DW-12). SVOCs were found above the recommended soil cleanup objective in 101-DW-10 and -13. Several metals were found exceeding the recommended soil cleanup objectives in 101-DW-4, -5, -6, -7, -8, -9, -10, -11, and -13. 4,4'-DDT was also found in 101-DW-13 at a very high concentration (20,000 µg/kg). The noted contamination in the bottom sediments are limited to the areas immediately adjacent and below the drainage structures (shallow subsurface soils). Much of the contamination is likely bound to the fine grained materials, however they represent a potential source of contamination to the groundwater through continued leaching by stormwater through these materials.

At the former Autoline Automotive site an area (800 ft²) of primarily PCE-contaminated soil was found during the RI (Figure 6-8). The vertical extent of the PCE soil contamination has been approximated at 15 ft based on the presence of contamination at several different depths in the soil column. The total volume of PCE contaminated soils above the recommended soil cleanup objective is 450 yd³ at the former Autoline

Automotive. The total volume of bottom sediments (shallow subsurface soils) which were found to be contaminated above the recommended soil cleanup objective is approximately 150 yd³.

The RI data indicate that the soil contamination at this site is a result of disposal of hazardous wastes into the on-site dry wells. The primary contaminant of concern is PCE. It is not known when the hazardous wastes were deposited in the dry wells; the levels of contamination noted in the soils indicate that much of the contamination has migrated from the soils to the groundwater. In general, the levels of contamination detected in the groundwater are much greater than the levels of contamination found in the soils at this site. The existing data also indicate that the disposal was likely limited to the dry wells found to the rear of the property.

7.2.3 Groundwater

The site history for the former Autoline Automotive site indicates that the main contaminants of concern are VOCs. The VOCs are primarily halogenated VOCs used in degreasing or cleaning operations. A total of six on-site monitoring wells (MW-5, LRF-1, FSMW-1A, FSMW-1B, FSMW-2A, and FSMW-2B) were sampled during the RI. The on-site monitoring wells sampled include both shallow and deep monitoring wells. Analytical data from the six on-site wells indicate that VOCs in excess of the Class GA standards are found in three of the six monitoring wells (Figures 6-3 and 6-4). Although several of the shallow monitoring wells contained significant concentrations of VOCs the concentrations found in FSMW-2A were two orders of magnitude greater than the other wells. This well was installed adjacent to the suspected source area at the existing dry well located along the southern property boundary (101-DW-N/S). The hydropunch groundwater samples (FSHP-2) collected near the suspected source area indicate that the PCE groundwater concentrations are decreasing with depth between 60 and 150 ft bgs, and the shallow groundwater has the highest concentration of PCE (1020 µg/l in the 55-65 ft sample). The highest on-site groundwater concentrations of PCE (18,000 µg/l) were found in the shallow well, FSMW-2A, located along the southern property boundary. Based on the concentrations in this well, the groundwater contaminant plume clearly extends to off-site locations. The high concentration of PCE in this well suggests the presence of DNAPL at this location. The exact extent of the groundwater contamination off-site as a result of past

disposal practices at this site could not be determined as additional sources of groundwater contamination were found downgradient of this site. The maximum vertical extent of the groundwater contamination in excess of the Class GA standards as indicated by data from previous studies appears to be approximately 130 ft. The soil description with depth for this location does not indicate a significant change in the subsurface materials until 120 ft below the ground surface, although a general fining with depth was noted. At 120 ft a clay-rich zone was found that may limit the vertical migration of contaminants. The thickness or continuity of the clay zone below 120 ft is unknown. At this site, the groundwater gradients are downward from the UGA to the Magothy Aquifer. The groundwater contamination has affected the UGA, the transition zone between the UGA and the Magothy Aquifer, and the upper zones of the Magothy Aquifer at this site.

7.3 89 FROST STREET - DATA INTERPRETATION

7.3.1 Surface Soils

This site was entirely paved during the surface soil sampling and no surface soils were collected as part of this RI.

7.3.2 Subsurface Soils and Sediments

The site history for 89 Frost Street indicates that the main contaminants of concern are VOCs, and SVOCs. The VOCs are primarily halogenated VOCs used in degreasing or cleaning operations; the SVOCs were used as lubricants. Analytical data from the subsurface soil samples indicate that VOCs in excess of the recommended soil cleanup objective are found in three locations (89-DW-10, 89-DW-11, and 89-DWA-14). The highest concentration of PCE found was 47,000 µg/kg at 89-DW-11 (28-32 ft). TCE was also found above the recommended soil cleanup objective in this sample. At 89-DW-10 TCE concentrations were above the recommended cleanup objective in the 26 to 28 ft sample. At 89-DWA-14 PCE was found above the recommended soil cleanup objective in the 51 to 53 ft sample. The subsurface soil samples collected in this area indicate that the soils in this area are a source area of PCE contamination. The presence of PCE in the subsurface soils at several depths and locations in this area suggest that hazardous wastes were discharged to the subsurface through one or more of the dry wells located to the rear

of 89 Frost Street. At the 89 Frost Street site the PCE source area appears to be approximately 22,500 ft². The vertical extent of the PCE soil contamination has been approximated at 15 ft based on the presence of contamination at several different depths in the soil column. The total volume of PCE contaminated soils above the recommended soil cleanup objective is approximately 12,500 yd³ at this site.

The bottom sediments (shallow subsurface soils) in the on-site drainage structures contained several contaminants above the recommended soil cleanup objective. Phenol was found above soil cleanup objectives in the two sidewall samples taken at 89-DW-15 (SWA and SWB); several other SVOCs were also found in 89-DW-10(S), -11(S-2), and -12(S). Antimony, cadmium, copper, mercury, and zinc were above the recommended soil cleanup objectives and eastern background soil concentrations in the bottom sediments at 89-DW-10, -11, and -12. The total volume of bottom sediments which were found to be contaminated above the recommended soil cleanup objective is approximately 30 yards. It is believed that the extent of the contamination is likely limited to the bottom sediments and the immediately surrounding soils.

The RI data indicates that the soil contamination at this site is a result of disposal of hazardous wastes into the on-site dry wells. PCE is also the primary contaminant in the subsurface soils at this site. The levels of PCE contamination noted in the soils and the drainage structure bottom sediments indicate that much of the contamination has migrated from the soils to the groundwater. The disposal activities associated with the noted contamination likely occurred before the facility was connected to the county sewer system.

7.3.3 Groundwater

The site history for 89 Frost Street indicates that the main contaminants of concern are VOCs, primarily halogenated VOCs used in degreasing or cleaning operations. A total of four on-site monitoring wells (FSMW-3A, -3B, -4A, and -4B) were sampled during the RI (Figures 6-13 and 6-14). The on-site monitoring wells sampled include both shallow and deep monitoring wells. Analytical data from the four on-site wells indicate that VOCs in excess of the Class GA standards are found in three of the wells. Extremely high concentrations of PCE were found in the groundwater near the FSMW-4 well pair. In the

shallow well at this location (FSMW-4A) total VOCs were 124,260 µg/l, with PCE accounting for a majority of the contamination (120,000 µg/l) (Figure 6-13). The solubility limit of PCE in water is 150,000 µg/l, and the noted concentrations in the groundwater are approximately 80% of the solubility limit of PCE. This suggests that non-aqueous phase liquid (NAPL) may be present in the vicinity of this location. If a NAPL consisting primarily of PCE is present, the non-aqueous phase would be heavier than water (i.e., dense non-aqueous phase liquid [DNAPL]) and would tend to move downward under the force of gravity. However, the movement of DNAPLs in saturated porous media also depends on a number of other factors that make it difficult to predict its potential movement. The hydropunch sampling indicated that PCE concentrations in excess of the Class GA groundwater standards are found at every depth sampled, including 150 ft. The PCE concentrations below 150 ft are unknown; however, it appears that the concentrations decrease with depth. The vertical groundwater flow gradients are downward on this site from the UGA to the Magothy.

The source of the extremely high concentrations of PCE in the groundwater was not found in the shallow soils at the site. It is believed the high concentrations of PCE in the groundwater are a result of disposal of hazardous wastes into dry wells or former sanitary cesspools on-site or at 770 Main Street. The exact extent of the groundwater contamination off-site as a result of past disposal practices at this site could not be determined as additional sources of groundwater contamination were found upgradient of this site. The groundwater contamination has affected the UGA, the transition zone between the UGA and the Magothy Aquifer, and the upper zones of the Magothy Aquifer. The likely presence of DNAPL in this area indicates that a large mass of contaminants are present and will continue to act as a significant source of groundwater contamination to off-site locations.

7.4 FORMER APPLIED FLUIDICS - DATA INTERPRETATION

7.4.1 Surface Soils

This site had been re-graded and excavated during the site re-development. No surface soils were sampled since they had been significantly altered during the redevelopment.

7.4.2 Subsurface Soils and Sediments

Five soil probe locations spread across the site were sampled during the RI since the drainage structures had been removed during the site redevelopment. Analytical data from the soil probes did not show VOCs in excess of the recommended soil cleanup objective at any of the locations (FSGP-11, -12, -13, -14, and -15) which were sampled. Only traces of TCE and PCE were found during the RI sampling activities. The nature and extent of the on-site soil contamination could not be determined as a result of the site redevelopment since all of the drainage structures were removed by the PRP prior to the RI sampling activities.

7.4.3 Groundwater

The site history for the former Applied Fluidics site indicates that the main contaminants of concern are VOCs, primarily halogenated VOCs used in degreasing or cleaning operations during manufacturing processes. A total of six monitoring wells (FSMW-10A, FSMW-10B, FSMW-8A, FSMW-8B, FSMW-9A, and FSMW-9B) were sampled during the RI to determine the nature and extent of the on-site groundwater contamination. The monitoring wells sampled include both shallow and deep monitoring wells. Analytical data from the six wells indicate that VOCs in excess of the Class GA standards are found in all six of the monitoring wells. Extremely high concentrations of PCE were found in the groundwater near the FSMW-10, FSMW-8, and FSMW-9 well pairs (Figures 6-17 and 6-18). The concentrations found in an off-site well cluster near the northeast corner of the property (FSMW-4) indicate that DNAPL is present in the shallow groundwater at this location (see Section 7.3.3). The concentrations found in FSMW-8A and FSMW-9A also exhibit PCE concentrations that suggest that DNAPL is present. At FSMW-8A the PCE concentration was 44,000 µg/l (29% of the solubility limit), and at FSMW-9A the PCE concentration was 26,000 µg/l (17% of the solubility limit). The PCE concentrations in the deeper wells (FSMW-8B and FSMW-9B) are much lower and not indicative of DNAPL. However, when comparing the PCE concentrations in the deep wells moving downgradient from FSMW-4B through FSMW-9B to FSMW-8B, the PCE concentrations clearly increase (Figure 6-18). This indicates that the DNAPL zone is moving vertically downward but has not yet reached the 150-ft level at the monitoring well locations. This conclusion is

supported by the previous data collected during the PSA. The highest concentrations of PCE are found in the shallow groundwater samples in the upgradient positions; in the downgradient positions the deeper samples show the highest concentrations. Seven of the PSA groundwater probes exhibited PCE concentrations that would suggest the presence of DNAPL. The single highest concentration of PCE was found at GP-189, which had a PCE concentration of 82,000 µg/l (54% of the solubility limit) in the 93-95 ft groundwater sample.

Based on the site history and sampling data, it appears that the groundwater contamination at this site is a result of disposal of hazardous wastes into on-site drainage structures (dry wells or cesspools). The primary contaminant of concern is PCE and its breakdown products. It is not known when the hazardous wastes were deposited in the drainage structures. It is likely that the wastes were process-related hazardous wastes that were disposed of into the drainage structures prior to the facility being attached to the county sewer system. A detailed investigation of the on-site soil was not conducted as the drainage structures were removed and much of the site excavated to a depth of approximately 20 ft by the PRP to construct a new department store. The groundwater contamination has affected the UGA, the transition zone between the UGA and the Magothy Aquifer, and the upper zones of the Magothy Aquifer. The exact vertical and horizontal limits of the plume as a result of contributions by this site could not be determined due to the presence of upgradient groundwater contamination. The distribution of individual contaminants suggests that a large source of separate-phase PCE contamination is located on (or in the vicinity of) this site. The likely presence of DNAPL in this area indicates that a large mass of contaminants are present and will continue to act as a significant source of groundwater contamination to downgradient locations. Other contaminants (1,1,1-TCA and PCE breakdown products) may also be present on-site and off-site.

7.5 OVERALL DATA INTERPRETATION, INCLUDING DOWNGRAIENT INVESTIGATION

7.5.1 Surface Soils

Concentrations of SVOCs and metals exceeded recommended soil cleanup objectives in the surface soil samples which were collected. The presence of SVOCs and metals in the surface soil samples are likely the result of the past industrial activities in the area. It is likely that similar concentrations of SVOCs and metals would be found through out the industrial area and the measured concentrations at this site are typical of industrial area soils.

7.5.2 Subsurface Soils and Sediment Samples

The analytical data from subsurface soil samples and sediment samples (shallow subsurface soils) identified a number of areas on two of the sites (former Autoline Automotive and 89 Frost Street) which exhibited contamination in excess of the recommended soil cleanup objectives. The data indicates that the on-site soils on these two sites have been impacted by past activities at these sites. Highly elevated concentrations of PCE and other chlorinated solvents were found in several subsurface soil samples at each of the sites. The highest measured concentrations of PCE (47,000 and 24,209 $\mu\text{g/kg}$) were found in the soil sample approximately 10 ft below the bottom of 89-DW-11 (28-32 ft) and in the deepest soil sample (51-53 ft) collected at 101-DWA-N/S. A number of the existing dry wells at the former Autoline Automotive and 89 Frost Street were found to have bottom sediments which were contaminated with VOCs, SVOC, metals, and in one case pesticides.

7.5.3 Groundwater

The analytical data from the monitoring wells, hydropunch groundwater samples, and groundwater probes were used to define the nature and extent of the groundwater contamination associated with the Frost Street sites. Highly elevated concentrations of PCE and other chlorinated solvents in groundwater sample data indicate that groundwater

has been impacted by past activities at the three Frost Street sites. Highly elevated concentrations of PCE and other chlorinated solvents were found in the groundwater at each of the sites. The plume appears to originate in the southwest corner of 101 Frost Street (Figures 6-1 and 6-2). At this location the highest measured concentrations were found in the shallow groundwater samples. From 101 Frost Street the plume of groundwater contamination extends in the direction of groundwater flow (Figures 6-6 and 6-7) toward 89 Frost Street and 770 Main Street. At 89 Frost Street extremely high concentrations of PCE were found centered about the FSMW-4 well pair. In the shallow well at this location the concentration of PCE was 120,000 µg/l (80% of the solubility limit of PCE), which suggests the presence of a NAPL near this location. High concentrations are also seen further downgradient in the FSMW-9, -8, and -6 well pairs. In general, the concentrations decrease in the shallow wells downgradient of FSMW-4A and increase in the deeper monitoring wells. The downgradient hydropunch sampling conducted during the RI indicates that the groundwater plume has migrated south of Old Country Road between well pairs FSMW-7 and FSMW-5. The PCE groundwater plume at Old Country Road (FSHP-06) extends from 80 ft (2.99 µg/l) to over 150 ft bgs (at greater than 113 µg/l). Additional groundwater sampling south of Old Country Road was not conducted during this RI. However, several other investigations of the groundwater quality south of Old Country Road indicate that the PCE plume extends beyond the Bowling Green Estates Water District located south of the site.

The Bowling Green Estates Water District uses two production wells (Well #1 and Well #2) located south of Old Country Road in the Town of Hempstead. Both wells were installed in 1975 and are completed in the basal portion of the Magothy Aquifer. Each have a permitted capacity of 1400 gpm. Well #1 is 532.5 ft deep with a screened zone from 478 to 527.5 ft. Well #2 is 583.5 ft deep with a screened zone from 524 ft to 583.5 ft. Raw water from both wells currently contains VOCs in excess of the NYSDOH drinking water standards. In Well #1 both 1,1,1-TCA and TCE predominate, while in Well #2 TCE predominates. An air stripper and carbon filters currently treat the well water; its average pumping rate is approximately 1200 gpm, with one well pumped at a time.

In 1997 four early warning wells were installed upgradient of the Bowling Green wells. During the installation of the early warning wells, hydropunch groundwater samples were

collected and analyzed. Total VOCs ranged from ND (EW-1C [400 ft]) to 1291 µg/l (EW-1C [150 ft]). The primary contaminants in EW-1C are PCE and its breakdown products. In general, two relatively high concentration zones are found at approximately 100 ft and 150 ft. The high concentration zone at 100 ft is believed to be within the transition zone between the UGA and Magothy Aquifer, while the high concentration zone at 150 ft is believed to be a fine-grained zone in the upper section of the Magothy Aquifer. EW-1C is directly downgradient of the Frost Street sites, and the contamination at this location is attributed to past activities at the Frost Street sites. Total VOCs at the other early warning well location ranged from 2 µg/l (EW-2C [400 ft]) to 1010 µg/l (EW-2C [80 ft]). The primary contaminants in EW-2C are 1,1,1-TCA, TCE, and PCE. Significant concentrations of vinyl chloride (VC) were also detected in EW-2C. Two relatively high concentration zones are also found in EW-2C at approximately 80 ft and 130 ft. The high concentration zone at 80 ft is believed to be within the transition zone between the UGA and Magothy Aquifer. The high concentration zone at 130 ft appears to have a contaminant suite (limited concentrations of 1,1,1-TCA and high concentrations of VC and PCE) different from the shallow (80 ft) high concentration zone.

In both wells (EW-1C and EW-2C) the concentrations rapidly drop off below a depth of 300 ft. Based on the observations during the drilling, the presence of limited volumes of groundwater, and the analytical results, it appears that a fine-grained zone of silts and clays extend from approximately 300 ft to over 400 ft at the two early warning well locations.

The maximum downgradient extent of the off-site plume from the Frost Street sites appears to be as far south as Salisbury Road near Washington Avenue, which is over 2000 ft downgradient of the Frost Street sites. At this location, a single hydropunch (HP-2) completed during the preliminary off-site groundwater IIWA indicated that PCE concentrations ranged from ND to 27 µg/l in the 10 samples collected. Four of the 10 hydropunch groundwater samples from HP-2 showed PCE concentrations in excess of the NYSDEC Class GA groundwater standards. Although the limits of the downgradient plume have not been fully defined, it appears that PCE is the primary contaminant of concern and the plume is approximated at 2000 ft long and 500 ft wide. The available data also indicate that the plume is likely vertically stratified in off-site locations.

CHAPTER 8

APPLICABLE STANDARDS, CRITERIA, AND GUIDANCE

8.1 INTRODUCTION

This chapter identifies applicable standards, criteria, and guidance that are used in the development of the health exposure pathway analysis (Chapter 9) and the feasibility study (Chapters 10 through 15) for the Frost Street sites. Applicable requirements are defined as those promulgated Federal or state requirements (e.g., drinking water standards or standards of control) that specifically address a hazardous substance, pollutant, or contaminant found at a Federal Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site. Relevant and appropriate requirements are those Federal or state requirements that, while not directly applicable, address items that are sufficiently similar to those encountered at CERCLA sites. Collectively, these terms are commonly referred to as applicable or relevant and appropriate requirements, or ARARs. In addition to ARARs, other criteria, advisories, or guidance may apply to the conditions found at a site; these are referred to as to-be-considered (TBC) items. TBCs are not legally binding but may be useful in evaluating site risks and determining site cleanup goals.

The Frost Street sites are classified as New York State Inactive Hazardous Waste Disposal sites. In the New York State regulations (6 NYCRR Part 375), the equivalent term for "ARARs" is "standards and criteria" and the equivalent term for "TBCs" is "guidance". Within New York State regulations, these terms are grouped together and referred to as "standards, criteria, and guidance" or SCGs.

SCGs are generally divided into three item-specific categories: chemical, location, and action. Chemical-specific SCGs provide guidance on acceptable or permissible contaminant concentrations in environmental media such as soil, air, and water. Location-specific SCGs govern activities in critical environments such as floodplains, potable source aquifers, wetlands, endangered species habitats, or historically significant areas. Action-specific SCGs are technology- or activity-based requirements. The SCGs described in this chapter are of possible importance to the health exposure pathway analysis and the FS.

Some SCGs establish numerical values to limit the discharge or ambient concentration for a particular contaminant. In order to determine if a condition or activity complies with applicable SCGs, a list of specific contaminants of concern (COCs) is organized based on site-specific environmental data. At the Frost Street sites, the list of COCs includes those contaminants that are present in significant concentrations in soil and groundwater, as identified in the RI and determined in the health exposure pathway analysis (Chapter 9). In surface soils, zinc, benzo(a)pyrene, and dibenzo(a,h)anthracene are included as COCs. Shallow subsurface soils are defined for purposes of this FS as subsurface soils located less than 25 feet below ground surface (ft bgs). In shallow subsurface soils, the list of COCs includes zinc, cadmium, 4,4'-DDT, benzo(a)anthracene, benzo(a)pyrene, and dibenzo(a,h)anthracene. Subsurface soils at depth are defined as subsurface soils located 25 ft bgs or deeper, for purposes of this FS. In subsurface soils at depth, the list of COCs includes TCE, and PCE. In groundwater, the list includes cis-1,2-DCE, trans 1,2-DCE, TCE, and PCE. For dry well water, the contaminants of concern identified include 1,2-DCE and PCE. The SCGs for these COCs are summarized in Table 8-1 and discussed below.

8.2 CHEMICAL SPECIFIC SCGs

8.2.1 New York State Groundwater Standards

Aquifers underlying the Frost Street sites are each designated as "Class GA" groundwater, which is defined as follows: "The best usage of Class GA waters is as a source of potable water supply. Class GA waters are fresh groundwaters found in the saturated zone of unconsolidated deposits and consolidated rock or bedrock." Therefore, the Class GA groundwater standards are intended for protection of human health where groundwater is used as a drinking water. Numerical groundwater standards and guidance values are presented in 6 NYCRR Part 703 and NYSDEC's Division of Water (DOW) Technical and Operational Guidance Series (TOGS) 1.1.1 titled "Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations" (NYSDEC 1998). The Class GA groundwater standards are equivalent to criteria established by the New York State Department of Health (NYSDOH) for public water supplies. The NYSDOH criteria were promulgated in the New York Code of Rules and Regulations (NYCRR) Title 10 Chapter I (State Sanitary Code) subpart 5-1. The New York State standards are equivalent to or are more stringent than Federal MCLs established by the USEPA. At the Frost Street sites, these groundwater standards may be used to determine

remedial action objectives and treatment objectives for wastewater effluent. Groundwater standards for the sites' COCs are summarized in Table 8-1.

Discharges to an on-site injection system (i.e., leaching pools or injection wells) may require a permit or permit equivalent under the State Pollution Discharge Elimination System (SPDES). SPDES permit requirements are presented in 6 NYCRR Part 750.

According to the Nassau County Department of Health (NCDOH), any discharge to a public stormwater system would need to meet the groundwater standards. A public stormwater system in the sites' vicinity discharges to local sumps where stormwater is recharged to the underlying aquifer.

8.2.2 New York State Groundwater Effluent Limitations (Class GA)

The NYSDEC DOW regulates point source discharges to Class GA groundwater primarily through the use of effluent limitations that have been established statewide. The effluent limitations are set at concentrations that should prevent contaminants from exceeding New York State ambient groundwater standards and guidance values. These numerical values are also presented in NYSDEC's TOGS 1.1.1 (NYSDEC 1998) and summarized in Table 8-1.

8.2.3 U.S. Environmental Protection Agency (USEPA) Drinking Water Standards

These federal standards include the Safe Drinking Water Act (SDWA) promulgated by the National Primary Drinking Water Standards (40 CFR Part 141) for the regulation of contaminants in all surface or groundwaters 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, and the technical and economic feasibility of removing the contaminants from the water supply. MCLGs are enforceable standards for specific contaminants based on human health factors, and the technical and economic feasibility of removing the contaminants from the water supply. MCLGs are nonenforceable standards that do not consider the feasibility of contaminant removal. The SDWA also includes secondary MCLs (40 CFR Part 143) that are nonenforceable guidelines for those contaminants that may adversely affect the aesthetic quality of drinking water, such as taste, color, and odor. The constituents addressed in the SDWA

are also addressed in the New York State Groundwater Standards. Table 8-1 summarizes the drinking water standards for the sites' COCs.

8.2.4 USEPA Drinking Water Health Advisories

These advisories are nonenforceable guidelines developed by the USEPA for chemicals that may be encountered in drinking water. USEPA has prepared short-term (1- to 10-day) and long-term (several years to lifetime) health advisories for subchronic effects of contaminants. A drinking water equivalent level (DWEL) is calculated as a lifetime health advisory based on a 2-liter/day water consumption rate for an adult weighing 70-kg. The DWEL is the most appropriate guideline for evaluation of contaminant levels in a potable water supply. Table 8-1 presents the applicable DWELs for the Frost Street sites.

8.2.5 Federal Ambient Water Quality Criteria

In accordance with Section 304(a) of the Clean Water Act, EPA has developed the Federal Ambient Water Quality Criteria (AWQC) for priority toxic pollutants. AWQCs are not legally enforceable, but may be referenced by states when developing enforceable water quality standards. AWQCs are available for both the protection of human health from exposure to contaminants in drinking water and for the protection of aquatic life. Table 8-1 summarizes the criteria applicable to the Frost Street sites' COCs.

8.2.6 Sewage Discharge Pretreatment Standards

Federal regulations (40 CFR Part 403) require sewer districts to establish and enforce pretreatment standards for the users of their sewer system. A user is prohibited from discharging waste to the sewer that contains contaminants that exceed the pretreatment standards. The user must treat the waste to meet the pretreatment standards prior to discharging it to the sewer. Pretreatment standards vary by municipality. Conversations with the Nassau County Department of Public Works indicate that effluent from a remediation system (i.e., treated groundwater) cannot be discharged to their sewer system. Therefore, sewage pretreatment standards will only be discussed as they apply to other sewer discharges, such as small quantities from a pilot study.

8.2.7 New York State Recommended Soil Cleanup Objectives

These objectives have been prepared by NYSDEC in a revised Technical and Administrative Guidance Memorandum (TAGM #4046) issued on 24 November 1994 (NYSDEC 1994). This guidance document outlines the basis and procedure for determining soil cleanup levels at state Superfund sites. Soil cleanup objectives are based on the protection of human health and groundwater quality, and are dependent on soil total organic carbon (TOC) content for organic compounds. TAGM #4046 also includes eastern US native soil concentration ranges for metals. The soil cleanup objectives may be used at the Frost Street sites to develop remedial action objectives for on-site soils. These objectives are summarized in Table 8-1 for the sites' COCs.

8.2.8 HEAST and IRIS Tables

EPA's Health Effects Assessment Summary Tables (HEAST) and Integrated Risk Information System (IRIS) contain information used in risk assessment calculations, specifically in establishing the health risk of carcinogenic and noncarcinogenic chemicals. The most recent publications are available on the Internet.

8.2.9 Clean Air Act

The Clean Air Act (CAA) was passed in 1977 and governs air emissions resulting from remedial actions at CERCLA sites. National Ambient Air Quality Standards (NAAQS), presented in 40 CFR Part 50, have been promulgated under the CAA for six criteria pollutants, including airborne particular matter. No specific CAA standards have been promulgated for the sites' COCs. The CAA is considered a relevant SCG for the Frost Street sites only to the extent that remedial actions (e.g., soil or groundwater treatment processes) undertaken at the sites emit constituents that are regulated by the CAA. New York State has also established ambient air quality standards. The standards are summarized in Table 8-1 for the sites' COCs.

8.2.10 New York State Air Guide One

The NYS Air Guide One (AG-1) provides guidance for the control of toxic ambient air contaminants in New York State. The guidelines outlined in this document are applicable to both chemical contaminants directly addressed by NYS or Federal regulations and

those for which no state or Federal ambient air quality standards exist. These guidelines are primarily intended for use in conjunction with the permitting authority and regulations found in 6 NYCRR Parts 200, 201, 212, and 257. If treatment processes at the Frost Street sites cause an air emission, the activity must comply with the AG-1 guidelines. Table 8-1 lists the short-term and average guideline concentrations (SGCs and AGCs) for the sites' COCs.

8.2.11 Occupational Safety and Health Administration

The Occupational Safety and Health Administration (OSHA) has promulgated permissible exposure limits (PELs) for a variety of contaminants in the air (29 CFR 1910, Subpart Z). The PELs are based on time-weighted average (TWA) concentrations to which workers may be exposed over an 8-hr exposure period without adverse effects. PELs and TWAs are intended for adult workers exposed in an occupational setting, and are not directly applicable to CERCLA or NYS inactive hazardous waste disposal sites. The PELs and TWAs may be used as guidance values to determine whether long-term exposures to contaminants in air during remediation activities may pose a human health risk. Table 8-1 summarizes the OSHA PELs for the sites' COCs.

8.2.12 National Institute for Occupational Safety and Health

The National Institute for Occupational Safety and Health (NIOSH) has developed concentrations for contaminants in the air that are immediately dangerous to life or health (IDLH) for individuals in occupational settings. The IDLH is the maximum concentration, in the event of respirator failure, that could be tolerated for 30-min without experiencing any escape-impairing or irreversible health effects. The IDLHs are appropriate only for subchronic exposures to noncarcinogenic compounds or effects of compounds in air. These values are not directly applicable to CERCLA or inactive hazardous waste disposal sites; however, they may provide guidance concerning the upper bound of safe inhalation exposures to contaminants for on-site workers during remediation. NIOSH has also established recommended exposure limits (RELs) for several contaminants. A REL is generally a time-weighted average based on toxicological and industrial hygiene data. Applicable NIOSH IDLHs and RELs are presented in Table 8-1.

8.2.13 American Conference of Governmental Industrial Hygienists

The American Conference of Governmental Industrial Hygienists (ACGIH) has developed threshold limit values (TLVs) for contaminants in air that are updated annually. The TLV is a time-weighted average concentration under which most people can work consistently for 8 hours per day, over time, and receive no harmful effects. These values should be considered when developing a remediation plan to protect on-site workers during remediation activities. Table 8-1 summarizes the TLVs for the sites' COCs.

8.3 LOCATION SPECIFIC SCGs

8.3.1 Well Usage Permit

6 NYCRR Part 602 requires that any well installed in Kings, Queens, Nassau, or Suffolk counties to withdraw water for any purpose other than for a public water supply must have a permit if the total capacity of such a well or wells on any one property is in excess of 45 gallons per minute (64,800 gallons per day). This regulation encompasses temporary and permanent dewatering wells. If a remediation alternative is selected that includes groundwater extraction, a permit may need to be obtained to satisfy this regulation.

8.3.2 New York State Protection of Sole Source Aquifer

6 NYCRR Part 370 defines a sole source aquifer as being the principal drinking water source for an area. If contamination were to occur in such a sole source aquifer, it would pose a significant hazard to the health of the public. The Long Island Aquifer System is among those specific sole source aquifers that are listed. This system includes aquifers underlying the counties of Kings, Queens, Nassau, and Suffolk in New York State. Certain remediation activities may be restricted due to the sole source aquifer designation.

8.3.4 Federal Protection of Sole Source Aquifer

40 CFR Part 149 of the Code of Federal Regulations (CFR) describes the criteria for identifying critical aquifer protection areas pursuant to Section 1427 of the Safe Drinking

Water Act. Subpart 149.3 includes criteria that define a sole source aquifer and states that programs to reduce or prevent the contamination of sole source aquifers be implemented when it is reasonably likely that contamination of such aquifers will occur. Certain remediation activities may be restricted due to the sole source aquifer designation.

8.3.5 Article IV of the Nassau County Public Health Ordinance

The intent of Article IV is to prohibit the installation of a private water system in those areas served by a public water system. The Frost Street sites and the surrounding properties are serviced by a public water system, therefore this ordinance prohibits the installation of a new private water system to provide drinking water.

8.4 ACTION SPECIFIC SCGs

8.4.1 Comprehensive Environmental Response, Compensation, and Liability Act

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 was amended by the Superfund Amendment and Reauthorization Act (SARA) of 1986. CERCLA, specifically Section 121 (42 USC 9621, Cleanup Standards), states that the selected remedial alternative must attain a cleanup level that is protective of human health and the environment, that is cost effective, and that utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. The extent to which each of the remedial alternatives for the sites complies with this requirement will be assessed during the detailed evaluation of alternatives.

8.4.2 New York State Inactive Hazardous Waste Disposal Sites

6 NYCRR Part 375 regulates the activities at inactive hazardous waste disposal sites. This regulation states that the selected remedy shall eliminate or mitigate all significant threats to public health and the environment presented by hazardous waste disposed at a site through the proper application of scientific and engineering principles. The extent to which each of the remedial alternatives for the sites complies with this requirement will be assessed during the detailed evaluation of alternatives.

NYSDEC developed TAGM HWR-89-4025 titled "Guidelines for Remedial Investigations/Feasibility Studies" to provide guidance for conducting RI/FS to comply with the requirements of 6 NYCRR Part 375. The FS for the Frost Street sites will be prepared using the guidelines presented in this TAGM.

8.4.3 Resource Conservation and Recovery Act (RCRA) and New York State Hazardous Waste Regulations

The selected remedial alternatives may include activities that require the generation, storage, treatment, transport, or disposal of hazardous waste. Handling of waste soil or groundwater that is determined to be "hazardous" must be performed in accordance with the federal hazardous waste regulations (40 CFR Parts 260-268) promulgated under the Resource Conservation and Recovery Act (RCRA), as well as New York State hazardous waste regulations (6 NYCRR Parts 364 and 370-376).

A waste can be identified as hazardous under two categories. 1) a waste is a "listed" hazardous waste if it is specifically listed in 40 CFR Part 261 or 6 NYCRR Part 371, or 2) a waste is a "characteristically" hazardous waste if it exhibits the characteristic of ignitability, corrosivity, reactivity, or toxicity as defined in 40 CFR Part 261 or 6 NYCRR Part 371.

At the Frost Street sites, soil and groundwater that is removed from the sites would not be considered to be a listed hazardous waste. Soil and groundwater that is removed from the ground may be considered to be characteristically hazardous based on the constituent concentrations found in representative samples. If concentrations in samples exceed the regulatory level for toxicity characteristic, the waste is considered a characteristically hazardous waste and must be treated or disposed of as such. Table 8-2 summarizes some of the EPA classifications and regulatory levels for hazardous wastes that may be generated at the Frost Street sites during the remedial action phase.

Federal and state land disposal restrictions (LDRs) (40 CFR Part 268 and 6 NYCRR Part 376, respectively) identify hazardous wastes that are restricted from land disposal. A hazardous waste may be land disposed only if its constituent concentrations or an extract of the waste does not exceed regulatory constituent concentrations. Hazardous wastes containing halogenated organic compounds (HOCs) in concentrations greater than or equal to 1000 ppm are also restricted from land disposal. However, a hazardous waste

TABLE 8-2

MAXIMUM TOXICITY CHARACTERISTIC CONCENTRATIONS
Frost Street Sites

EPA Hazardous Waste Number	Contaminant	RCRA Hazardous Waste Criteria * (mg/l)
D006	Cadmium	1.0
D007	Chromium	5.0
D009	Mercury	0.2
D039	Tetrachloroethylene	0.7
D040	Trichloroethylene	0.5

* - 40 CFR part 261, subpart C.

may be treated to reduce its constituent concentrations below the regulatory LDR limits and subsequently be land disposed. If a soil is found to be characteristically hazardous by exceeding the Toxicity Characteristic (TC) limit, it must be disposed of in an approved hazardous waste facility or treated on-site. If treatment standards are achieved, the soil is no longer subject to hazardous waste requirements and can be land disposed at a non-hazardous off-site facility.

Contaminated groundwater that is pumped to the surface is subject to similar regulations if it is found to be characteristically hazardous during the remedial action. As with soil, groundwater that exhibits the TC is subject to the same treatment standards as the characteristic waste with which it is contaminated. Groundwater containing 1000 ppm or greater HOCs is also prohibited from land disposal. If treatment standards are met, the groundwater can be discharged on land. Transportation of hazardous wastes must be conducted in accordance with all applicable regulations, including 40 CFR Part 263 and 6 NYCRR Part 372.

8.4.4 EPA Presumptive Remedies

Since Superfund's inception in 1980, the remedial and removal programs have found that certain categories of sites have similar characteristics, such as types of contaminants present, types of disposal practices, or how environmental media are affected. Based on information acquired from evaluating and cleaning up these sites, the Superfund program is undertaking an initiative to develop presumptive remedies to accelerate future cleanups at these types of sites. Presumptive remedies are preferred technologies for common categories of sites, based on historical patterns of remedy selection and EPA's scientific and engineering evaluation of performance data on technology implementation. The objective of the presumptive remedies initiative is to use the program's past experience to streamline site investigation and speed up selection of cleanup actions.

For the Frost Street sites, two EPA presumptive remedy directives should be considered in formulating and selecting remediation alternatives. The first is titled "Site Characterization and Technology Selection for CERCLA Sites with Volatile Organic Compounds in Soils," which identifies soil vapor extraction (SVE), thermal desorption, and incineration as the presumptive remedies for Superfund sites with VOC-contaminated soils assuming the site characteristics meet certain criteria (EPA 1993). The second is titled "Presumptive Response Strategy and Ex-situ Treatment Technologies

for Contaminated Groundwater at CERCLA Sites" (EPA 1996), which identifies presumptive technologies for the ex-situ treatment component of a groundwater remedy that are expected to be used for sites where extraction and treatment is part of the remedy. For treatment of dissolved organic contaminants, the presumptive technologies include air stripping, granular activated carbon (GAC), chemical/ultraviolet light oxidation, and aerobic biological reactors. For treatment of dissolved inorganic contaminants, the presumptive technologies include chemical precipitation, ion exchange/adsorption, electrochemical methods, and aeration. For treatment of both organic and inorganic constituents, a combination of technologies listed above is recommended.

EPA's presumptive remedies will be considered in the development and screening of technologies phase of the FS and in developing the remedial alternatives for the Frost Street sites.

8.4.5 EPA Guidance on Remedial Action for Contaminated Groundwater at Superfund Sites

This EPA guidance (EPA/540/G-88/003) provides guidance for making key decisions in developing, evaluating, and selecting groundwater remedial actions at Superfund sites (EPA 1988). This document focuses on policy issues and the decision-making approach and highlights key considerations that should be addressed during the remedy selection process. Guidance offered by this document will be considered in developing remedial alternatives.

8.4.6 EPA Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA

This EPA guidance (EPA/540/G-89/004) establishes the methodology that the Superfund program has established for characterizing the nature and extent of the risks posed by uncontrolled hazardous waste sites and for evaluating potential remedial options (EPA 1988). This document will be used as a guide in preparing the FS for the Frost Street sites.

8.4.7 Risk Assessment Guidance for Superfund

The Risk Assessment Guidance for Superfund (Volume I, Human Health Evaluation Manual [Part A]) was developed by EPA to provide guidance for developing health risk

information at Superfund sites and to support CERCLA's requirement to protect human health and the environment (EPA 1989). This guidance was referenced in preparing the health exposure pathway analysis for the Frost Street sites.

8.4.8 NYSDEC Selection of Remedial Actions at Inactive Disposal Sites

As presented in TAGM HWR-90-4030, NYSDEC's guidance establishes a hierarchy of remedial technologies for inactive hazardous waste disposal sites in New York State and describes the preliminary screening and detailed analysis of remedial alternatives. (NYSDEC 1990) The guidelines set forth in this TAGM will be used in developing the FS for the Frost Street sites.

CHAPTER 9

HEALTH EXPOSURE PATHWAY ANALYSIS

9.1 INTRODUCTION

A health exposure pathway analysis was conducted for the Frost Street sites to evaluate the baseline exposures to human health from environmental contamination at the sites. The exposure pathway analysis was completed in accordance with EPA's Risk Assessment Guidance for Superfund – Volume I: Human Health Evaluation Manual (EPA 1989a). Results of this health exposure pathway analysis were used to determine the need for remedial action at the sites and to select site remedial action objectives.

This exposure pathway analysis involved the following steps:

- Collection and evaluation of available data obtained from remedial investigation (RI) activities;
- Identification of potential contaminants of concern (COCs) for the sites to be evaluated in a qualitative exposure assessment;
- Screening of the potential COCs via concentration-toxicity calculations;
- Identification of potential pathways for human exposure to site contaminants;
- Toxicity assessment/hazard identification for the selected COCs; and
- Developing conclusions on exposures to COCs for the sites.

These steps are described in detail in the following sections. An exposure pathway analysis does not quantify the risks associated with the exposures; that is done in risk assessment. A qualitative evaluation of the uncertainty involved in the exposure pathway analysis procedures is also included in this chapter.

As each of the three Frost Street sites is associated with a different previously responsible party (PRP), and since future property boundaries and site uses may remain separate for the three sites, a separate health exposure pathway analysis was conducted for each of the

sites. An overall evaluation and discussion of exposure pathways common to all three sites is also presented, using the results from the three separate exposure pathway analyses.

This health exposure pathway analysis is organized into the following sections:

- 9.1 Introduction
- 9.2 Applicable Standards, Criteria, and Guidance
- 9.3 Data Collection and Evaluation
- 9.4 Exposure Assessment
- 9.5 Toxicity Assessment
- 9.6 Uncertainty Analysis
- 9.7 Conclusions

9.2 APPLICABLE STANDARDS, CRITERIA, AND GUIDANCE

ARARs used in the derivation and evaluation of the COCs at the Frost Street sites are presented in Chapter 8, as are SCGs and TBCs that are of importance to the sites. Tables 8-1 and 8-2 provide ARAR, SCG, and TBC information for each COC.

9.3 DATA COLLECTION AND EVALUATION

9.3.1 Collection of Relevant Site Data

All available analytical data from the remedial investigation for surface soils, shallow subsurface soils (i.e., soils at depths less than 25 ft bgs), subsurface soils at depth (i.e., soils at depths of 25 ft bgs or greater), groundwater, and dry well water were evaluated for use in the health exposure pathway analysis. In accordance with EPA guidance (EPA 1989a), only positive sample results were used in this pathway exposure analysis. All tentatively identified compounds (TICs) were eliminated from further consideration, as these compounds were not positively identified. In general, the TICs detected at the sites were present at low concentrations and were not assumed to pose a significant risk to humans.

To meet the remedial investigation objectives for the sites, environmental samples collected were analyzed for VOCs by an on-site, mobile laboratory (Target

Environmental Services, Inc.) as described in the RI report. The mobile laboratory was used as a tool to rapidly screen environmental media for VOC concentrations. A percentage (8.5 percent) of the samples were also sent to an off-site base analytical laboratory (Envirotech) for purposes of confirming the mobile laboratory's VOC results and to further analyze samples for SVOCs, metals, and pesticides in order to more thoroughly identify on-site contamination. Results from all environmental samples that were collected at each site and analyzed by the on-site, mobile laboratory and off-site, fixed laboratory are included in Tables 5-2 through 5-23 of the RI report.

For this exposure pathway analysis, the following methods were used to select data when information from both the mobile and base laboratories existed for a discrete environmental sample.

- Data from the base analytical laboratory were chosen over mobile laboratory data in cases where both types of data existed for a single environmental sample because data from a certified, base analytical laboratory is generally considered to be reflective of greater instrument sensitivity, quality assurance, and controlled laboratory conditions than a mobile laboratory.
- For samples where only mobile laboratory data existed, that data was used in the exposure pathway analysis. This was often the case, since the majority of samples collected at the sites were analyzed solely by the mobile laboratory.

A comparison of analytical results generated by both laboratories is included in Tables 5-20 and 5-23 in the RI report.

To appropriately focus the health exposure pathway analysis, a subset of the contaminants detected at each site, referred to as COCs, was selected for further evaluation. COCs are those compounds that pose the greatest potential public health risk at a particular site based on the concentrations detected and the relative toxicity of the compounds. Sections 9.3.2 and 9.3.3 discuss the identification and selection of COCs, respectively, for each of the Frost Street sites.

9.3.1.1 **Overview of RI Data Collection Activities.** The objectives of the RI were to:

- Determine the nature and extent of soil contamination at each of the sites;
- Determine the nature and extent of contamination in the groundwater beneath the sites; and
- Conduct a downgradient groundwater investigation to supplement the existing off-site groundwater data in the vicinity of the three Frost Street sites.

This exposure pathway analysis was conducted only for on-site conditions; no off-site exposure scenarios were evaluated.

Two surface soil samples were collected at 101 Frost Street for use in this exposure pathway analysis. Figure 3-1 of the RI report displays these two surface soil sample locations. No surface soil samples were collected at either 89 Frost Street or 770 Main Street since both of these sites were entirely paved or covered with the footprint of a building and no exposed surface soils were present during sampling.

A total of 14 probe soil and groundwater sample locations were investigated during the RI (see Figure 3-2 of the RI report). The probes were located on all three Frost Street sites. A total of seven hydropunch sampling locations (Figure 3-3 of the RI report) were also included as part of the investigation at 101 Frost Street and 89 Frost Street to supplement the information obtained during the probe investigation.

Ten monitoring well couplets (2- wells) were installed as part of the RI. All 20 newly installed wells (refer to Figure 3-4 of the RI report) were sampled during RI activities.

Samples were also collected from 15 dry wells at 101 Frost Street and 17 dry wells at 89 Frost Street (see Figures 3-6 and 3-7 of the RI report for dry well locations). Dry well structures at 770 Main Street were removed and replaced by the property owners prior to RI activities. Soils at 770 Main Street were also excavated to an approximate depth of 20 ft bgs at several locations by the property owners. Dry wells on 101 Frost Street were undisturbed at the time of RI field work; however, the dry wells on 89 Frost Street, which were investigated for the RI, were subsequently excavated and replaced by the property owners during site redevelopment activities that followed the RI dry well sampling episode. Samples (shallow subsurface soil and standing water) collected during the RI were taken from within and below each dry well, where possible.

The following subsections summarize data collection activities that occurred during the RI at each of the three Frost Street sites. A complete discussion of RI data collection activities is included within the RI report. The following summaries are divided by type of environmental medium (i.e., surface soil, groundwater) that was sampled during RI activities.

9.3.1.2 *Former Autoline Automotive (101 Frost Street).*

Surface Soils. Two surface soil samples were collected at 101 Frost Street.

Subsurface Soils. Subsurface soil samples were collected from 21 locations at 101 Frost Street, as follows:

- Shallow subsurface soil samples collected within and beneath dry wells at depths less than 25 ft bgs;
- Subsurface soil at depth samples collected from below and at locations adjacent to dry wells at depths greater than or equal to 25 ft bgs;
- Additional probes.

Groundwater. Groundwater samples were collected from 13 locations at the site.

Dry Well Water. Grab water samples were collected from six dry wells at 101 Frost Street.

9.3.1.3 *89 Frost Street.*

Surface Soils. No surface soil samples were collected at 89 Frost Street.

Subsurface Soils. Subsurface soil samples were collected from 22 locations at 89 Frost Street, as follows:

- Shallow subsurface soil samples collected within and beneath dry wells at depths less than 25 ft bgs;
- Subsurface soil at depth samples collected from below and at locations adjacent to dry wells at depths greater than or equal to 25 ft bgs;

- Additional probes.

Groundwater. Groundwater samples were collected from 23 locations at the site.

Dry Well Water. Dry well water samples were collected from nine locations at 89 Frost Street.

9.3.1.2 Former Applied Fluidics (770 Main Street).

Surface Soils. No surface soil samples were collected at 770 Main Street.

Subsurface Soils. Ten subsurface soil samples were collected at depth (generally greater than about 20 ft bgs) from five locations on 770 Main Street. As no on-site dry wells were investigated during the RI, no shallow subsurface sample locations were present.

Groundwater. Groundwater samples were collected from seven locations at 770 Main Street.

Dry Well Water. Dry wells at 770 Main Street were not investigated in the RI.

9.3.2 Identification of Potential Contaminants of Concern

Three criteria were used to identify the potential COCs at the Frost Street sites. The first was the comparison of positive sample results for each sample matrix to applicable New York State standards; chemicals exceeding standards were given higher priority for selection as COCs. All soil (including surface soil, shallow subsurface soil, and subsurface soil at depth) sample results were compared to NYSDEC TAGM #4046. Inorganic soil constituents were also compared to typical values of natural or native concentration ranges for each contaminant; chemicals exceeding the maximum of the range were given higher priority for selection as a COC. Groundwater and dry well water sample results were compared to NYSDEC Guidance Values for Class GA groundwater. The degree to which a chemical concentration exceeded the standard or guidance value was also taken into consideration as part of this criterion. For instance, if a chemical concentration exceeded the applicable standard by several orders of magnitude, the chemical was typically given more weight for consideration as a potential COC than a chemical that minimally exceeded its standard.

The second criterion was an evaluation of the frequency of chemical detection; the higher the frequency, the higher the priority given for consideration as a COC. If a chemical was detected in all of the samples collected in a given matrix, more than 50 percent of those detected values typically had to exceed the standard for that chemical to be given further consideration in the COC selection process. All samples within a given matrix were not necessarily analyzed for every contaminant that is listed in the frequency tables, resulting in different denominators in the “frequency of detection” columns in some instances. In addition, if a chemical was identified as a potential COC in more than one environmental matrix at a site, it was given stronger consideration as a potential COC in a given matrix than a contaminant that was identified as a potential COC in only one on-site matrix.

The third criterion was whether the chemical was related to suspected discharges that were reported to have historically occurred at the sites (i.e., discharges of wastes to dry wells). Contaminants possibly associated with discharges or other site activities were given special consideration. Contaminants that were in concentrations more typical of urban areas were not considered as strongly as potential COCs as those not typical of urban areas. For instance, the presence of certain SVOCs in environmental media is often associated with the use of asphalt pavement and roofing materials, as occurs in urban areas.

9.3.2.1 *Former Autoline Automotive (101 Frost Street).*

Surface Soils. Analytical results for the two surface soil samples collected at 101 Frost Street are summarized in Table 9-1. The samples were analyzed for VOCs, SVOCs, pesticides, and metals. All analyses were conducted by the base analytical laboratory. Results were compared to NYSDEC soil cleanup objectives (TAGM #4046); metals results were also compared to eastern United States native soil concentration ranges.

Three potential COCs, zinc, benzo(a)pyrene, and dibenzo(a,h)anthracene, were identified in surface soils. None of the VOC or pesticide constituents that were analyzed for exceeded the soil cleanup objectives. Of the SVOCs, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(a)pyrene, and dibenzo(a,h)anthracene were each detected in two of two samples, with all of the detected concentrations exceeding soil cleanup criteria. Three of the SVOCs detected, benzo(a)anthracene, chrysene, and benzo(b)fluoranthene, exceeded the soil cleanup criteria but were within one order of

TABLE 9-1 (Page 1 of 4)

POTENTIAL CONTAMINANTS OF CONCERN IN SURFACE SOILS
101 Frost Street
Frost Street Sites

PARAMETER	FREQUENCY OF DETECTION	RANGE OF DETECTED CONCENTRATIONS (mg/kg)	SOIL CLEANUP OBJECTIVES ¹ (mg/kg)	PERCENTAGE ABOVE STANDARD ²	POTENTIAL COC
VOLATILE ORGANICS (mg/kg)					
Methyl chloride	2/2	0.003 jb	0.1	0%	No
Acetone	2/2	0.014	0.2	0%	No
Carbon Disulfide	0/2	ND	2.7	0%	No
1,2-Dichloroethene (total)	0/2	ND	0.3	0%	No
1,2-Dichloroethane	0/2	ND	0.1	0%	No
2-Butanone	0/2	ND	0.3	0%	No
Trichloroethene	0/2	ND	0.7	0%	No
1,1,1-Trichloroethane	0/2	ND	0.8	0%	No
4-Methyl-2-Pentanone	0/2	ND	1	0%	No
Tetrachloroethene	1/2	0.0009 j	1.4	0%	No
Toluene	0/2	ND	1.5	0%	No
Chlorobenzene	0/2	ND	1.7	0%	No
Ethylbenzene	0/2	ND	5.5	0%	No
Xylene (total)	0/2	ND	1.2	0%	No

¹ - NYSDEC Division Technical and Administrative Guidance Memorandum (TAGM), 1/94.

² - Percent of detected values that are above the standard.

b - Found in associated blanks.

j - Estimated concentration; compound present below quantitation limit.

ND - Not detected at analytical detection limit.

TABLE 9-1 (Page 2 of 4)

POTENTIAL CONTAMINANTS OF CONCERN IN SURFACE SOILS
101 Frost Street
Frost Street Sites

PARAMETER	FREQUENCY OF DETECTION	RANGE OF DETECTED CONCENTRATIONS (mg/kg)	SOIL CLEANUP OBJECTIVES ¹ (mg/kg)	PERCENTAGE ABOVE STANDARD ²	POTENTIAL COC
SEMIVOLATILE ORGANICS (mg/kg)					
Phenol	1/2	0.003 j	0.03 or MDL	0%	No
1,4-Dichlorobenzene	0/2	ND	NS	0%	No
4-Methylphenol	0/2	ND	0.9	0%	No
1,2,4-Trichlorobenzene	0/2	ND	NS	0%	No
Naphthalene	0/2	ND	13	0%	No
2-Methylnaphthalene	0/2	ND	36.4	0%	No
Acenaphthylene	1/2	0.048 j	41	0%	No
3-Nitroaniline	0/2	ND	50.0 ***	0%	No
Acenaphthene	2/2	0.045 j - 0.047 j	0.100 or MDL	0%	No
4-Nitrophenol	0/2	ND	6.2	0%	No
Dibenzofuran	1/2	0.028 j	50	0%	No
Fluorene	2/2	0.066 j - 0.067 j	0.500 or MDL	0%	No
Phenanthrene	2/2	0.940 j - 1.200 j	50	0%	No
Anthracene	2/2	0.190 j	50 ***	0%	No
Carbazole	2/2	0.130 j - 0.160 j	NS	0%	No
Di-n-butylphthalate	0/2	ND	8.1	0%	No
Fluoranthene	2/2	0.0019 - 2.300 j	50 ***	0%	No
Pyrene	2/2	1.400 j - 1.800 j	50	0%	No
Butylbenzylphthalate	0/2	ND	50 ***	0%	No
Benzo(a)anthracene	2/2	0.740 j - 0.890 j	0.224 or MDL	100%	No
Chrysene	2/2	0.960 j - 1.200 j	0.4	100%	No
bis(2-Ethylhexyl)phthalate	2/2	0.360 j - 1.100 j ^b	50 ***	0%	No
Di-n-octylphthalate	0/2	ND	50 ***	0%	No
Benzo(b)fluoranthene	2/2	1.300 j - 1.400 j	1.1	100%	No
Benzo(k)fluoranthene	2/2	0.510 j - 0.570 j	1.1	0%	No
Benzo(a)pyrene	2/2	0.850 j - 0.910 j	0.061 or MDL	100%	Yes
Indeno(1,2,3-c,d)pyrene	2/2	0.350 j - 0.580 j	3.2	0%	No
Dibenzo(a,h)anthracene	2/2	0.110 j - 0.150 j	0.014 or MDL	100%	Yes
Benzo(g,h,i)perylene	2/2	0.320 j - 0.520 j	50 ***	0%	No

*** - As per TAGM #4046, Total VOCs < 10 ppm, Total SVOCs < 500 ppm, and individual SVOCs < 50 ppm

1 - NYSDEC Division Technical and Administrative Guidance Memorandum (TAGM), 1/94.

2 - Percent of detected values that are above the standard

b - Found in associated blanks.

j - Estimated concentration; compound present below quantitation limit

MDL - Method detection limit.

ND - Not detected at analytical detection limit

NS - No standard.

TABLE 9-1 (Page 3 of 4)

POTENTIAL CONTAMINANTS OF CONCERN IN SURFACE SOILS
101 Frost Street
Frost Street Sites

PARAMETER	FREQUENCY OF DETECTION	RANGE OF DETECTED CONCENTRATIONS (mg/kg)	SOIL CLEANUP OBJECTIVES ¹ (mg/kg)	PERCENTAGE ABOVE STANDARD ²	POTENTIAL COC
Pesticide (mg/kg)					
Dieldrin	1/2	0.0069 p	0.044	0%	No
4,4'-DDE	2/2	0.0039 p - 0.012	2.1	0%	No
4,4'-DDD	0/2	ND	2.9	0%	No
Endrin	1/2	0.017	0.1	0%	No
Endosulfansulfate	0/2	ND	1	0%	No
4,4'-DDT	2/2	0.014 p - 0.015 p	2.1	0%	No
Endrin aldehyde	0/2	ND	NS	0%	No
Endrin ketone	1/2	0.0049	NS	0%	No
alpha-Chlordane	2/2	0.0064 p - 0.0077 p	0.54	0%	No
gamma-Chlordane	2/2	0.0066 p - 0.0073 p	0.54	0%	No

1 - NYSDEC Division Technical and Administrative Guidance Memorandum (TAGM), 1/94.

2 - Percent of detected values that are above the standard.

p - Pesticide/Aroclor target analyte has >25% difference for the detected

ND - Not detected at analytical detection limit.

NS - No standard.

TABLE 9-1 (Page 4 of 4)

POTENTIAL CONTAMINANTS OF CONCERN IN SURFACE SOILS
101 Frost Street
Frost Street Sites

PARAMETER	FREQUENCY OF DETECTION	RANGE OF DETECTED CONCENTRATIONS (mg/kg)	SOIL CLEANUP OBJECTIVES ¹ (mg/kg)	EASTERN USA BACKGROUND SOIL CONCENTRATIONS ¹ (mg/kg)	PERCENTAGE ABOVE STANDARD ²	POTENTIAL COC
TAL METALS (mg/kg)						
Aluminum	2/2	2,480 - 4,080	SB	33,000	0%	No
Antimony	1/2	18.5	SB	0.6 - 10 (n)	100%	No
Arsenic	2/2	1.6 b - 3.0	7.5 or SB	3 - 12æ	0%	No
Barium	2/2	22.7 b - 26.9 b	300 or SB	15 - 600	0%	No
Beryllium	2/2	0.12 b - 0.16 b	0.16 or SB	0 - 1.75	0%	No
Cadmium	2/2	0.26 b - 0.98 b	1 or SB	0.1 - 1	0%	No
Calcium	2/2	19,300 - 33,300	SB	130 - 35,000 æ	0%	No
Chromium	2/2	8.10 - 254	10 or SB	1.5 - 405 æ	0%	No
Cobalt	2/2	2.6 b - 6.0 b	30 or SB	2.5 - 60 æ	0%	No
Copper	2/2	17.6 - 1,120	25 or SB	1 - 50	50%	No
Iron	2/2	6,560 - 10,400	2,000 or SB	2,000 - 550,000	0%	No
Lead	2/2	45.8 - 5,410	SB*	200 - 500 *	50%	No
Magnesium	2/2	10,300 - 18,200	SB	100 - 5,000	100%	No
Manganese	2/2	111 - 142	SB	50 - 5,000	0%	No
Mercury	1/2	0.080 b	0.1	0.001 - 0.2	0%	No
Nickel	2/2	9.5 - 125	13 or SB	0.5 - 25	50%	No
Potassium	2/2	347 - 408	SB	8,500 - 43,000 æ	0%	No
Selenium	0/2	ND	2 or SB	0.1 - 3.9	0%	No
Silver	1/2	4.8	SB	0.1 - 5 (n)	0%	No
Sodium	2/2	142 - 331	SB	6,000 - 8,000	0%	No
Thallium	0/2	ND	SB	0.1 - 0.8 (q)	0%	No
Vanadium	2/2	25 - 29.3	150 or SB	1 - 300	0%	No
Zinc	2/2	159 - 804	20 or SB	9 - 50	100%	YES
Cyanide	0/2	ND	**	N/A	0%	No

* - Background levels for lead range from 4 - 61 ppm in undeveloped, rural areas to 200 - 500 ppm in metropolitan or suburban areas or near highways

** - Some forms of Cyanide are complex and stable while other forms are pH dependent and hence are very unstable. Site-specific form(s) of Cyanide should be taken into consideration when establishing soil cleanup objectives.

1 - NYSDEC Division Technical and Administrative Guidance Memorandum (TAGM), 1/94.

2 - Percent of detected values that are above the standard.

æ - New York State background concentration.

(n) - Dragun, J., The Soil Chemistry of Hazardous Materials

(q) - Bowan, H. J., Environmental Chemistry of the Elements.

b - Found in associated blanks.

N/A - Not available.

ND - Not detected at analytical detection limit

SB - Site background.

magnitude of the cleanup standards. In addition, these three compounds were not considered to be COCs in surface soil because of their normal association with pavement blacktop and asphalt areas that are ubiquitous at the site. Since benzo(a)pyrene and dibenzo(a,h)anthracene were detected in surface soil at concentrations significantly exceeding the cleanup criteria (i.e., by more than an order of magnitude), they were retained as potential COCs. In addition, these two SVOCs were detected in shallow subsurface soils at the site.

Most metal concentrations did not exceed the soil cleanup criteria. Zinc, however, was detected in both surface soil samples at concentrations (159 and 804 mg/kg) well in exceedance of applicable criteria and was therefore retained as a potential COC. Zinc was also identified as a potential COC in on-site shallow subsurface soil. The presence of zinc in both of these media is possibly attributed to industrial activities that were historically conducted at and in the vicinity of the site. Copper, lead, and nickel were in exceedance of the respective criteria in one of two samples (50%) and were thus not retained as potential COCs. In addition, copper is considered an essential nutrient and is usually toxic only at very high concentrations and is generally not included in health exposure analyses. None of these three metals was identified as a potential contaminant of concern in any other matrix at the site. Antimony was detected in one of two samples at the site, and the detected concentration (18.5 mg/kg) slightly exceeded the typical soil background concentration (by less than one order of magnitude). As antimony was not detected in any other media at the site, it was not retained as a potential COC. Magnesium was detected in two of two surface soil samples at the site, with both detected concentrations exceeding the applicable criteria. Magnesium is considered an essential nutrient and is usually toxic only at very high concentrations and is generally not included in health exposure analyses. Like SVOCs, metals are present in surface soils at 101 Frost Street in concentrations typical of urban areas.

Subsurface Soils at Depth. Analytical results for samples of subsurface soil at depth collected at 101 Frost Street are summarized in Table 9-2. For purposes of this FS, subsurface soils at depth include soils existing at depths of 25 ft bgs or greater; they do not include shallow subsurface soils that are found at shallower depths in the subsurface. These soils are evaluated separately in the exposure analysis. Locations and depths of all subsurface soil samples at depth are described in detail in the RI report. All subsurface soil samples were analyzed for VOCs. As described earlier, when data from both the

TABLE 9-2 (Page 1 of 1)

POTENTIAL CONTAMINANTS OF CONCERN IN SUBSURFACE SOILS AT DEPTH (≥ 25 ft bgs)101 Frost Street
Frost Street Sites

PARAMETER	FREQUENCY OF DETECTION	RANGE OF DETECTED CONCENTRATIONS (mg/kg)	SOIL CLEANUP OBJECTIVES ¹ (mg/kg)	PERCENTAGE ABOVE STANDARD ²	POTENTIAL COC
VOLATILE ORGANICS (mg/kg)					
Methylene chloride	1/18	0.002 j b	0.1	0%	NO
Acetone	1/18	0.012 b	0.2	0%	NO
Carbon Disulfide	6/18	0.013 - 0.020 b	2.7	0%	NO
1,2-Dichloroethene (total)	0/46	ND	0.3	0%	NO
1,2-Dichloroethane	0/46	ND	0.1	0%	NO
1,1-Dichloroethane	0/46	ND	0.2	0%	NO
1,1-Dichloroethene	0/46	ND	0.4	0%	NO
2-Butanone	0/18	ND	0.3	0%	NO
Trichloroethene	2/46	0.0061 - 3.775 e	0.7	50%	Yes
1,1,1-Trichloroethane	0/46	ND	0.8	0%	NO
4-Methyl-2-Pentanone	0/18	ND	1	0%	NO
Tetrachloroethene	16/46	0.00069 - (NR) 24.209 e	1.4	19%	Yes*
Chlorobenzene	0/18	ND	1.7	0%	NO
Benzene	0/43	ND	0.06	0%	NO
Toluene	2/43	0.0004 j - 0.003 j	1.5	0%	NO
Ethylbenzene	0/43	ND	5.5	0%	NO
Xylene (total)	0/43	ND	1.2	0%	NO

* - PCE in one sample was presumably identified at a concentration well above the mobile laboratory's calibration range and therefore could not be accurately quantified (NR). Highest quantified on-site subsurface soil at depth PCE concentration was used.

1 - NYSDEC Division Technical and Administrative Guidance Memorandum (TAGM), 1/94.

2 - Percent of detected values that are above the standard.

b - Found in associated blanks.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

j - Estimated concentration; compound present below quantitation limit.

ND - Not detected at analytical detection limit.

mobile and base laboratories exist for a single sample in a given matrix, the base laboratory data was selected for use in evaluating potential COCs.

Two chemicals were identified as potential COCs for the subsurface soils at depth at 101 Frost Street. Tetrachloroethene (PCE) was detected at a relatively high frequency in subsurface soil at depth samples (in 16 of 46 samples). In addition, 19% of the samples in which PCE was detected contained concentrations that exceeded the applicable New York State soil cleanup criterion. Although less than 50% of the subsurface soil samples in which PCE was detected had concentrations exceeding the criterion, PCE was retained as a potential COC since it was identified as a potential contaminant of concern in on-site groundwater and dry well water. In addition, PCE was believed to have been historically used and disposed of on-site.

Trichloroethene (TCE) was also detected at a concentration exceeding the soil cleanup criterion. Even though TCE was detected at a very low frequency (in 2 of 46 samples), it was retained as a potential COC since it was identified as a potential contaminant of concern in on-site groundwater. TCE was also suspected to have been historically used and disposed of on-site.

Shallow Subsurface Soils. Analytical results for this matrix (i.e., shallow subsurface soils located at depths less than 25 ft bgs) are summarized in Table 9-3. Samples were analyzed for VOCs, SVOCs, pesticides, and metals. Where data from both laboratories (mobile and base) existed for a single environmental sample, the fixed laboratory data were selected for use in identifying potential COCs. The New York State soil cleanup criteria (TAGM #4046) were used in evaluating these shallow subsurface soils. Locations and depths of all dry wells and shallow subsurface soil samples collected at 101 Frost Street are described in detail in the RI report.

Six potential COCs were identified for the shallow subsurface soils at 101 Frost Street: 4,4'-DDT, benzo(a)anthracene, chrysene, benzo(a)pyrene, dibenzo(a,h)anthracene, and zinc. None of the VOC concentrations exceeded the soil cleanup objectives in any sample. 4,4'-DDT, a pesticide, was detected in 7 of 13 shallow subsurface soil samples at the site, and one sample had an elevated concentration of 20,000 ug/kg. As DDT may be indicative of specific on-site disposal activities that may have occurred, and was detected at such a high concentration, it was retained as a potential COC.

TABLE 9-3 (Page 1 of 4)

POTENTIAL CONTAMINANTS OF CONCERN IN SHALLOW SUBSURFACE SOILS (<25 ft bgs) *
101 Frost Street
Frost Street Sites

PARAMETER	FREQUENCY OF DETECTION	RANGE OF DETECTED CONCENTRATIONS (mg/kg)	SOIL CLEANUP OBJECTIVES ¹ (mg/kg)	PERCENTAGE ABOVE STANDARD ²	POTENTIAL COC
VOLATILE ORGANICS (mg/kg)					
Methylene chloride	2/29	0.003 j - 0.004 j	0.1	0%	NO
Acetone	2/29	0.019 - 0.02	0.2	0%	NO
Carbon Disulfide	5/29	0.0008 j - 0.02 b	2.7	0%	NO
1,2-Dichloroethene (total)	0/48	ND	0.3	0%	NO
1,2-Dichloroethane	0/48	ND	0.1	0%	NO
2-Butanone	1/29	0.010 j	0.3	0%	NO
Trichloroethene	3/48	0.0006 j - 0.00064	0.7	0%	NO
1,1,1-Trichloroethane	4/48	0.0006 j - 0.0896 e	0.8	0%	NO
4-Methyl-2-Pentanone	0/29	ND	1	0%	NO
Chlorobenzene	0/29	ND	1.7	0%	NO
Tetrachlorethene	23/48	0.0003 j - 0.417 e	1.4	0%	NO
Benzene	0/46	ND	0.06	0%	NO
Toluene	8/46	0.0004 j - 0.002 j	1.5	0%	NO
Ethylbenzene	2/46	0.0005 j - 0.034	5.5	0%	NO
Xylene (total)	3/46	0.002 j - 0.170	1.2	0%	NO

* - Shallow subsurface soils beneath dry wells.

1 - NYSDEC Division Technical and Administrative Guidance Memorandum (TAGM), 1/94.

2 - Percent of detected values that are above the standard.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

j - Estimated concentration; compound present below quantitation limit.

ND - Not detected at analytical detection limit.

TABLE 9-3 (Page 2 of 4)

POTENTIAL CONTAMINANTS OF CONCERN IN SHALLOW SUBSURFACE SOILS (<25 ft bgs)*
101 Frost Street
Frost Street Sites

PARAMETER	FREQUENCY OF DETECTION	RANGE OF DETECTED CONCENTRATIONS (mg/kg)	SOIL CLEANUP OBJECTIVES ¹ (mg/kg)	PERCENTAGE ABOVE STANDARD ²	POTENTIAL COC
SEMIVOLATILE ORGANICS (mg/kg)					
Phenol	5/14	0.004 j - 0.077 jd	0.03 or MDL	40%	NO
1,4-Dichlorobenzene	0/14	ND	NS	0%	NO
4-Methylphenol	4/14	0.007 j - 0.053 j	0.9	0%	NO
1,2,4-Trichlorobenzene	0/14	ND	NS	0%	NO
Naphthalene	4/14	0.025 j - 0.140 j	13	0%	NO
2-Methylnaphthalene	4/14	0.010 j - 0.460 j	36.4	0%	NO
Acenaphthylene	4/14	0.005 j - 2.5 j	41	0%	NO
Acenaphthene	3/14	0.004 j - 0.016 j	50.0 ***	0%	NO
4-Nitrophenol	1/14	0.870 j	0.100 or MDL	100%	NO
Dibenzofuran	3/14	0.017 j - 0.094 j	6.2	0%	NO
Fluorene	4/14	0.008 j - 0.190 j	50	0%	NO
3-Nitroaniline	0/14	ND	0.500 or MDL	0%	NO
Phenanthrene	9/14	0.016 j - 5	50	0%	NO
Anthracene	4/14	0.011 j - 1.4 j	50 ***	0%	NO
Carbazole	4/14	0.016 j - 0.480 j	NS	0%	NO
Di-n-butylphthalate	3/14	0.076 j - 0.810	8.1	0%	NO
Fluoranthene	12/14	0.010 j - 16	50 ***	0%	NO
Pyrene	12/14	0.007 j - 8.3	50	0%	NO
Butylbenzylphthalate	4/14	0.140 j - 0.640 j	50 ***	0%	NO
Benzo(a)anthracene	12/14	0.004 j - 5	0.224 or MDL	25%	YES
Chrysene	12/14	0.004 j - 6.3	0.4	25%	YES
bis(2-Ethylhexyl)phthalate	11/14	0.048 j - 2	50 ***	0%	NO
Di-n-octylphthalate	4/14	0.045 j - 2.9	50 ***	0%	NO
Benzo(b)fluoranthene	12/14	0.005 j - 9.4	1.1	17%	NO
Benzo(k)fluoranthene	10/14	0.004 j - 3.3 j	1.1	20%	NO
Benzo(a)pyrene	10/14	0.004 j - 4.8	0.061 or MDL	50%	YES
Indeno(1,2,3-c,d)pyrene	8/14	0.017 j - 1.5 j	3.2	0%	NO
Dibenzo(a,h)anthracene	3/14	0.081 j - 0.440 j	0.014 or MDL	100%	YES
Benzo(g,h,i)perylene	8/14	0.020 j - 0.990 j	50 ***	0%	NO

* - Shallow subsurface soils beneath dry wells.

*** - As per TAGM #4046, Total VOCs < 10 ppm, Total SVOCs < 500 ppm, and individual SVOCs < 50 ppm.

1 - NYSDEC Division Technical and Administrative Guidance Memorandum (TAGM), 1/94.

2 - Percent of detected values that are above the standard.

d - Concentration recovered from diluted sample.

j - Estimated concentration; compound present below quantitation limit.

MDL - Method detection limit.

ND - Not detected at analytical detection limit.

NS - No standard.

TABLE 9-3 (Page 3 of 4)

POTENTIAL CONTAMINANTS OF CONCERN IN SHALLOW SUBSURFACE SOILS (<25 ft bgs)*
101 Frost Street
Frost Street Sites

PARAMETER	FREQUENCY OF DETECTION	RANGE OF DETECTED CONCENTRATIONS (mg/kg)	SOIL CLEANUP OBJECTIVES ¹ (mg/kg)	PERCENTAGE ABOVE STANDARD ²	POTENTIAL COC
PESTICIDES (mg/kg)					
Dieldrin	0/13	ND	0.044	0%	NO
4,4'-DDE	5/13	0.0066 p - 2.10	2.1	0%	NO
4,4'-DDD	5/13	0.015 - 2.4 p	2.9	0%	NO
Endrin	0/13	ND	0.1	0%	NO
Endosulfansulfate	1/13	0.028	1	0%	NO
4,4'-DDT	7/13	0.0048 - 20	2.1	14.3%	YES
Endrin aldehyde	1/13	0.012	NS	0%	NO
Endrin keytone	0/13	ND	NS	0%	NO
alpha-Chlordane	5/13	0.0027 p - 0.016 p	0.54	0%	NO
gamma-Chlordane	5/13	0.0028 p - 0.018	0.54	0%	NO

* - Shallow subsurface soils beneath dry wells.

1 - NYSDEC Division Technical and Administrative Guidance Memorandum (TAGM), 1/94.

2 - Percent of detected values that are above the standard.

p - Pesticide/Aroclor target analyte has >25% difference for the detected

ND - Not detected at analytical detection limit.

NS - No standard.

TABLE 9-3 (Page 4 of 4)

POTENTIAL CONTAMINANTS OF CONCERN IN SHALLOW SUBSURFACE SOILS (<25 ft bgs) *
101 Frost Street
Frost Street Sites

PARAMETER	FREQUENCY OF DETECTION	RANGE OF DETECTED CONCENTRATIONS (mg/kg)	SOIL CLEANUP OBJECTIVES ¹ (mg/kg)	EASTERN USA BACKGROUND SOIL CONCENTRATIONS ¹ (mg/kg)	PERCENTAGE ABOVE STANDARD ²	POTENTIAL COC
TAL METALS (mg/kg)						
Aluminum	14/14	575 - 1,880	SB	33,000	0%	NO
Antimony	0/14	ND	SB	0.6 - 10 (n)	0%	NO
Arsenic	9/14	0.85 b - 2.6	7.5 or SB	3 - 12 æ	0%	NO
Barium	14/14	4.2 b - 23.5 b	300 or SB	15 - 600	0%	NO
Beryllium	14/14	0.05 b - 0.15 b	0.16 or SB	0 - 1.75	0%	NO
Cadmium	11/14	0.10 b - 0.99 b	1 or SB	0.1 - 1	0%	NO
Calcium	14/14	74.9 b - 31,800	SB	130 - 35,000 æ	0%	NO
Chromium	14/14	2 b - 17.5	10 or SB	1.5 - 405 æ	0%	NO
Cobalt	14/14	0.48 b - 6.7 b	30 or SB	2.5 - 60 æ	0%	NO
Copper	14/14	1.8 b - 65.3	25 or SB	1 - 50	21%	NO
Iron	14/14	2,110 - 7,800	2,000 or SB	2,000 - 550,000	0%	NO
Lead	14/14	1.10 - 288	SB	200 - 500 ^x	0%	NO
Magnesium	14/14	123 b - 2,910	SB	100 - 5,000	0%	NO
Manganese	14/14	22.7 - 137	SB	50 - 5,000	0%	NO
Mercury	6/14	0.10 b - 0.36	0.1	0.001 - 0.2	83%	NO
Nickel	14/14	0.75 b - 18.6	13 or SB	0.5 - 25	0%	NO
Potassium	13/14	56.2 - 178	SB	8,500 - 43,000 æ	0%	NO
Selenium	0/14	ND	2 or SB	0.1 - 3.9	0%	NO
Silver	1/14	0.24 b	SB	0.1 - 5 (n)	0%	NO
Sodium	14/14	102 b - 238 b	SB	6,000 - 8,000	0%	NO
Thallium	0/14	ND	SB	0.1 - 0.8 (q)	0%	NO
Vanadium	14/14	2.1 b - 28.6	150 or SB	1 - 300	0%	NO
Zinc	14/14	6.3 - 276	20 or SB	9 - 50	57%	YES
Cyanide	1/14	2.8	**	N/A	0%	NO

* - Shallow subsurface soils beneath dry wells.

** - Some forms of Cyanide are complex and stable while other forms are pH dependent and hence are very unstable. Site-specific form(s) of Cyanide should be taken into consideration when establishing soil cleanup objectives

x - Background levels for lead range from 4 - 61 ppm in undeveloped, rural areas to 200 - 500 ppm in metropolitan or suburban areas or near highways.

1 - NYSDEC Division Technical and Administrative Guidance Memorandum (TAGM), 1/94.

2 - Percent of detected values that are above the standard.

æ - New York State background concentration.

(n) - Dragun, J., The Soil Chemistry of Hazardous Materials.

(q) - Bowan, H.J., Environmental Chemistry of the Elements.

b - Found in associated blanks.

N/A - Not available.

ND - Not detected at analytical detection limit.

SB - Site background.

Four SVOCs, benzo(a)anthracene, chrysene, benzo(a)pyrene, and dibenzo(a,h)anthracene were identified as potential COCs for shallow subsurface soils at 101 Frost Street based on high frequency of detection and/or presence in concentrations significantly exceeding soil criteria. Although benzo(a)anthracene, chrysene, and benzo(a)pyrene were not detected at concentrations above the soil criteria in more than 50% of all samples in which they were detected, they were retained as potential COCs since they were present in concentrations exceeding the cleanup criteria by more than an order of magnitude. Shallow subsurface soils from within and beneath dry wells may have historically acted as sinks for SVOCs.

Four other SVOCs (phenol, 4-Nitrophenol, benzo(b)fluoranthene, and benzo(k)fluoranthene) were detected in shallow subsurface soils in concentrations greater than the applicable criteria but were not retained as potential COCs. Phenol was detected in only 5 of 14 samples, and less than 50% of the detected concentrations exceeded the standard. 4-Nitrophenol was present in only 1 of 14 samples, and the detected concentration was within one order of magnitude of the criteria. Benzo(b)fluoranthene and benzo(k)fluoranthene each had relatively high frequencies of detection (12/14 and 10/14, respectively); however, the highest concentrations noted for both of these SVOCs was within an order of magnitude of the applicable criteria. In addition, these four SVOCs seem to be present in shallow subsurface soils at levels typical of urban locations and are likely related to on-site paved asphalt areas.

The majority of the metals had concentrations that were below the soil cleanup criteria or eastern United States native soil concentration ranges. The concentrations of most metals detected were typical of concentrations found in urban areas. Zinc, however, was detected in 14 of 14 samples, and 57% of the concentrations were in exceedance of the applicable soil cleanup criteria and therefore was retained as a potential COC. Zinc was also identified as a potential COC in on-site surface soil. It is possible that the presence of zinc in both surface soil and shallow subsurface soil at 101 Frost Street can be attributed to historical industrial activities (i.e., possible plating and electrical work associated with automotive ignition parts manufacturing) that may have occurred. Copper and mercury were also detected at concentrations exceeding the soil criteria in shallow subsurface soil samples at the site. Copper, however, was not retained as a potential COC because the criterion was exceeded in only 21% of the detected concentrations. In addition, copper is considered an essential nutrient, is usually toxic only at very high concentrations, and is generally not included in health exposure

analyses. Mercury was also not retained as a potential COC for on-site shallow subsurface soils because it was detected in only 6 of 14 samples, and the highest detected concentration was within an order of magnitude of the soil criterion. Neither copper nor mercury was identified as a potential contaminant of concern in other site matrices.

Groundwater. VOC analytical results for groundwater samples collected at 101 Frost Street are summarized in Table 9-4. As described previously, when data from both the mobile and base laboratories existed for a single sample, the base laboratory data was selected for use in evaluating potential COCs. Locations of all monitoring wells and hydropunch/probe locations, along with sampling depths, are discussed in detail in the RI report.

Three potential COCs were identified in groundwater at 101 Frost Street. PCE, TCE, and 1,1,1-trichloroethane (1,1,1-TCA) were retained as potential COCs based on high frequencies of detection (42/54, 24/54, and 30/54, respectively) and groundwater concentrations that were in exceedance of New York State Class GA groundwater standards. PCE and TCE were also identified as potential contaminants of concern in other site matrices: PCE in subsurface soil at depth and dry well water; TCE in subsurface soil at depth. In addition, it is believed that all three contaminants may have been historically used on-site and possibly disposed of in dry wells from where they may have leached to the groundwater.

Dry Well Water. Analytical results for dry well water grab samples collected at 101 Frost Street are summarized in Table 9-5. The grab water samples were analyzed for VOCs. As with other media, when data from both laboratories existed for a discrete sample, the base analytical laboratory data was selected for use in evaluating potential COCs. Dry well water does not include groundwater that was sampled from monitoring wells or hydropunch/probe devices during the RI; dry well samples were grab samples of standing water in the on-site dry wells. Locations of all dry wells and depths to standing water are described in the RI report. For purposes of identifying potential COCs, dry well water sample concentrations were compared to New York State Class GA groundwater criteria.

Two potential COCs were determined for dry well water at 101 Frost Street: PCE and 1,2-dichloroethene (1,2-DCE). 1,2-DCE was detected in 3 of 8 grab water samples collected, and two of the samples had concentrations greater than the applicable criterion. Although PCE was not identified in concentrations exceeding applicable Class GA

TABLE 9-4 (Page 1 of 1)

POTENTIAL CONTAMINANTS OF CONCERN IN ON-SITE GROUNDWATER
101 Frost Street
Frost Street Sites

PARAMETER	FREQUENCY OF DETECTION	RANGE OF DETECTED CONCENTRATIONS (ug/l)	NYSDEC CLASS GA OBJECTIVES ¹ (ug/l)	PERCENTAGE ABOVE STANDARD ²	POTENTIAL COC
VOLATILE ORGANICS (ug/l)					
Methylene chloride	1/24	52 jd	5	100.0%	NO
Acetone	2/24	15 - 400 bd	50	50.0%	NO
Carbon Disulfide	2/24	0.9 j - 180 jd	50	0.0%	NO
1,1-Dichloroethene	4/54	1 j - 20	5	25.0%	NO
1,1-Dichloroethane	2/54	1 j - 2 j	5	0.0%	NO
1,2-Dichloroethane	0/31	ND	0.6	0.0%	NO
1,2-Dichloroethene (total)	1/54	3 j	5	0.0%	NO
Chloroform	0/24	ND	7	0.0%	NO
2-Butanone	7/24	6 j - 74 d	NS	0.0%	NO
1,1,1-Trichloroethane	30/54	0.75 - 359	5	72.4%	YES
Trichloroethene	24/54	0.35 - 41 jd	5	41.7%	YES
4-Methyl-2-Pentanone	1/24	4 jd	NS	0.0%	NO
Dibromochloromethane	0/24	ND	50 gv	0.0%	NO
Tetrachlorethene	42/54	0.3 j - 18,000 d	5	38.0%	YES
1,1,2,2-Tetrachloroethane	0/24	ND	5	0.0%	NO
Benzene	10/36	0.2 j - 4 jd	1	10.0%	NO
Toluene	11/36	0.4 j - 3 jd	5	0.0%	NO
Ethylbenzene	0/36	ND	5	0.0%	NO
Xylene (total)	1/36	1 jd	5	0.0%	NO

1 - Division of water Technical and Operational Guidance Series (1.1.1) June 1998.

2 - Percent of detected values that are above the standard.

d - Concentration recovered from diluted sample.

j - Estimated concentration, compound present below quantitation limit.

gv - Guidance value.

ND - Not detected at analytical detection limit.

NS - No standard.

TABLE 9-5 (Page 1 of 1)

POTENTIAL CONTAMINANTS OF CONCERN IN DRY WELL WATER
101 Frost Street
Frost Street Sites

PARAMETER	FREQUENCY OF DETECTION	RANGE OF DETECTED CONCENTRATIONS (ug/l)	NYSDEC CLASS GA OBJECTIVES ¹ (ug/l)	PERCENTAGE ABOVE STANDARD ²	POTENTIAL COC
VOLATILE ORGANICS (ug/l)					
Methylene chloride	0/3	ND	5	0%	NO
Acetone	0/3	ND	50	0%	NO
Carbon Disulfide	0/3	ND	50	0%	NO
1,1-Dichloroethene	0/8	ND	5	0%	NO
1,1-Dichloroethane	0/8	ND	5	0%	NO
1,2-Dichloroethene (total)	3/8	5 - 12.8	5	66%	YES
Chloroform	1/3	2 j	7	0%	NO
2-Butanone	0/3	ND	NS	0%	NO
1,1,1-Trichloroethane	0/8	ND	5	0%	NO
Trichloroethene	0/8	ND	5	0%	NO
4-Methyl-2-Pentanone	0/3	ND	NS	0%	NO
Dibromochloromethane	0/3	ND	NS	0%	NO
Tetrachloroethene	4/8	0.72 - 4 j	5	0%	YES
1,1,2,2-Tetrachloroethane	0/3	ND	5	0%	NO
Benzene	0/3	ND	1	0%	NO
Toluene	1/3	1 j	5	0%	NO
Ethylbenzene	0/3	ND	5	0%	NO
Xylene (total)	0/3	ND	5	0%	NO

1 - Division of water Technical and Operational Guidance Series (1.1.1) June 1998.

2 - Percent of detected values that are above the standard.

j - Estimated concentration; compound present below quantitation limit

ND - Not detected at analytical detection limit

NS - No standard.

groundwater standards, it was detected in 4 of 8 samples. In addition, PCE was retained as a potential COC for on-site dry well water since it was identified as a contaminant of concern in on-site groundwater and subsurface soils at depth. Also, both potential COCs were believed to have been historically used on-site and possibly disposed of in the dry wells.

9.3.2.2 **89 Frost Street.**

Subsurface Soils at Depth. Analytical results for subsurface soil samples collected at depth at 89 Frost Street are summarized in Table 9-6. Again, subsurface soils at depth include soils at depths of 25 ft bgs or greater; they do not include shallow subsurface soils collected from beneath on-site dry wells which are evaluated separately. Locations and depths of all subsurface soil samples collected at 89 Frost Street are described in detail in the RI report. All subsurface soil at depth samples were analyzed for VOCs. When data from both the mobile and base laboratories exist for a single sample in a given matrix, the base laboratory data was selected for use in evaluating potential COCs.

Two chemicals were identified as potential COCs for the subsurface soils at 89 Frost Street: PCE and TCE. Both chemicals were detected at relatively high frequencies: PCE was detected in 50 of 70 samples and TCE in 20 of 70 samples. Although relatively low percentages of the detected concentrations were above the soil cleanup criteria, both PCE and TCE were retained as potential COCs since they were identified as potential contaminants of concern in on-site groundwater. In addition, both compounds were believed to have been historically used at the site, and possibly disposed into the subsurface in dry well structures.

Shallow Subsurface Soils. Analytical results for shallow subsurface soils located beneath the dry well structures (at depths less than 25 ft bgs) are summarized in Table 9-7. Shallow subsurface soil samples were analyzed only by the base laboratory for VOCs, SVOCs, and metals. In evaluating these samples, New York State soil cleanup criteria (TAGM #4046 and eastern U.S. background soil concentrations) were used. Locations and depths of all dry wells and shallow subsurface soil samples collected at 89 Frost Street are described in detail in the RI report. During on-site construction activities, all dry well structures that were investigated for the RI at 89 Frost Street were removed and replaced by the property owner.

TABLE 9-6 (Page 1 of 1)

POTENTIAL CONTAMINANTS OF CONCERN IN SUBSURFACE SOILS AT DEPTH (≥ 25 ft bgs)89 Frost Street
Frost Street Sites

PARAMETER	FREQUENCY OF DETECTION	RANGE OF DETECTED CONCENTRATIONS (mg/kg)	SOIL CLEANUP OBJECTIVES ¹ (mg/kg)	PERCENTAGE ABOVE STANDARD ²	POTENTIAL COC
VOLATILE ORGANICS (mg/kg)					
Methylene chloride	1/17	0.002 jb	0.1	0%	NO
Acetone	0/17	ND	0.2	0%	NO
Carbon Disulfide	0/17	ND	2.7	0%	NO
1,1-Dichloroethene	0/70	ND	0.4	0%	NO
1,1-Dichloroethane	0/70	ND	0.2	0%	NO
1,2-Dichloroethene (total)	4/70	0.0146 - 0.0748 e	0.3	0%	NO
1,2-Dichloroethane	0/70	ND	0.1	0%	NO
2-Butanone	0/17	0.005 j	0.3	0%	NO
Trichloroethene	20/70	0.00037 - 1.6 jd	0.7	10%	YES
1,1,1-Trichloroethane	1/70	0.00071	0.8	0%	NO
4-Methyl-2-Pentanone	0/17	ND	1	0%	NO
Chlorobenzene	0/17	ND	1.7	0%	NO
Tetrachlorethene	50/70	0.0003 j - 47 d	1.4	4%	YES
Benzene	0/45	ND	0.06	0.0%	NO
Toluene	4/45	0.0007 j - 0.14 jd	1.5	0%	NO
Ethylbenzene	4/45	0.0099 - 0.059 jd	5.5	0%	NO
Xylene (total)	5/45	0.0004 j - 0.0538	1.2	0%	NO

1 - NYSDEC Division Technical and Administrative Guidance Memorandum (TAGM), 1/94

2 - Percent of detected values that are above the standard

b - Found in associated blanks.

d - Concentration recovered from diluted sample

j - Estimated concentration, compound present below quantitation limit.

ND - Not detected at analytical detection limit

TABLE 9-7 (Page 1 of 3)

POTENTIAL CONTAMINANTS OF CONCERN IN SHALLOW SUBSURFACE SOILS (<25 ft bgs) *
89 Frost Street
Frost Street Sites

PARAMETER	FREQUENCY OF DETECTION	RANGE OF DETECTED CONCENTRATIONS (mg/kg)	SOIL CLEANUP OBJECTIVES ¹ (mg/kg)	PERCENTAGE ABOVE STANDARD ²	POTENTIAL COC
VOLATILE ORGANICS (mg/kg)					
Methylene chloride	0/22	ND	0.1	0%	NO
Acetone	0/22	ND	0.2	0%	NO
Carbon Disulfide	2/22	0.0007 j - 0.0009 j	2.7	0%	NO
1,2-Dichloroethene (total)	4/62	0.0003 j - 0.0442 e	0.3	0%	NO
1,2-Dichloroethane	0/62	ND	0.1	0%	NO
2-Butanone	7/22	0.005 j - 0.021	0.3	0%	NO
Trichloroethene	17/62	0.0003 j - 0.00766 e	0.7	0%	NO
1,1,1-Trichloroethane	0/62	ND	0.8	0%	NO
4-Methyl-2-Pentanone	1/22	0.002 j	1	0%	NO
Chlorobenzene	2/22	0.001 j - 0.002 j	1.7	0%	NO
Tetrachlorethene	43/62	0.0001 j - 0.132 e	1.4	0%	NO
Benzene	0/45	ND	0.06	0%	NO
Toluene	11/45	0.0005 j - 0.008 j	1.5	0%	NO
Ethylbenzene	6/45	0.0001 j - 0.0007 j	5.5	0%	NO
Xylene (total)	6/45	0.0003 j - 0.002 j	1.2	0%	NO

* - Shallow subsurface soils beneath dry wells.

1 - NYSDEC Division Technical and Administrative Guidance Memorandum (TAGM), 1/94

2 - Percent of detected values that are above the standard.

j - Estimated concentration; compound present below quantitation limit.

ND - Not detected at analytical detection limit.

TABLE 9-7 (Page 2 of 3)

POTENTIAL CONTAMINANTS OF CONCERN IN SHALLOW SUBSURFACE SOILS (<25 ft bgs)*
89 Frost Street
Frost Street Sites

PARAMETER	FREQUENCY OF DETECTION	RANGE OF DETECTED CONCENTRATIONS (mg/kg)	SOIL CLEANUP OBJECTIVES ¹ (mg/kg)	PERCENTAGE ABOVE STANDARD ²	POTENTIAL COC
SEMIVOLATILE ORGANICS (mg/kg)					
Phenol	3/5	0.38 j - 1.0 j	0.03 or MDL	100%	NO
1,4-Dichlorobenzene	1/5	2.6 j	NS	0%	NO
4-Methylphenol	0/5	ND	0.9	0%	NO
1,2,4-Trichlorobenzene	1/5	0.15 j	NS	0%	NO
Naphthalene	0/5	ND	13	0%	NO
2-Methylnaphthalene	0/5	ND	36.4	0%	NO
Acenaphthylene	0/5	ND	41	0%	NO
Acenaphthene	0/5	ND	50.0 ***	0%	NO
4-Nitrophenol	0/5	ND	0.100 or MDL	0%	NO
Dibenzofuran	0/5	ND	6.2	0%	NO
Fluorene	0/5	ND	50	0%	NO
3-Nitroaniline	0/5	ND	0.500 or MDL	0%	NO
Phenanthrene	3/5	0.74 j - 1.3 j	50	0%	NO
Anthracene	1/5	0.16 j	50 ***	0%	NO
Carbazole	0/5	ND	NS	0%	NO
Di-n-butylphthalate	0/5	ND	8.1	0%	NO
Fluoranthene	3/5	1.2 j - 2.4 j	50 ***	0%	NO
Pyrene	3/5	0.95 j - 2.1 j	50	0%	NO
Butylbenzylphthalate	0/5	ND	50 ***	0%	NO
Benzo(a)anthracene	3/5	0.52 j - 1.10 j	0.224 or MDL	100%	NO
Chrysene	3/5	0.78 j - 1.2 j	0.4	100%	NO
bis(2-Ethylhexyl)phthalate	3/5	5.1 j - 9.8 j	50 ***	0%	NO
Di-n-octylphthalate	0/5	ND	50 ***	0%	NO
Benzo(b)fluoranthene	3/5	1.1 j - 1.9 j	1.1	67%	NO
Benzo(k)fluoranthene	2/5	0.43 j - 0.82 j	1.1	0%	NO
Benzo(a)pyrene	3/5	0.54 j - 1.0 j	0.061 or MDL	100%	NO
Indeno(1,2,3-c,d)pyrene	2/5	0.41 j - 0.6 j	3.2	0%	NO
Dibenzo(a,h)anthracene	0/5	ND	0.014 or MDL	0%	NO
Benzo(g,h,i)perylene	2/5	0.44 j - 0.52 j	50 ***	0%	NO

* - Shallow subsurface soils beneath dry wells.

*** - As per TAGM #4046, Total VOCs < 10 ppm, Total SVOCs < 500 ppm, and individual SVOCs < 50 ppm.

1 - NYSDC Division Technical and Administrative Guidance Memorandum (TAGM), 1/94.

2 - Percent of detected values that are above the standard.

j - Estimated concentration; compound present below quantitation limit.

MDL - Method detection limit.

NS - No standard.

ND - Not detected at analytical detection limit.

TABLE 9-7 (Page 3 of 3)

POTENTIAL CONTAMINANTS OF CONCERN IN SHALLOW SUBSURFACE SOILS (<25 ft bgs)*
89 Frost Street
Frost Street Sites

PARAMETER	FREQUENCY OF DETECTION	RANGE OF DETECTED CONCENTRATIONS (mg/kg)	SOIL CLEANUP OBJECTIVES ¹ (mg/kg)	EASTERN USA BACKGROUND SOIL CONCENTRATIONS ¹ (mg/kg)	PERCENTAGE ABOVE STANDARD ²	POTENTIAL COC
TAL METALS (mg/kg)						
Aluminum	5/5	3,920 - 5,070	SB	33,000	0%	NO
Antimony	2/5	1.7 b - 203 b	SB	0.6 - 10 (n)	50%	NO
Arsenic	3/5	1.3 b - 2.8	7.5 or SB	3 - 12æ	0%	NO
Barium	5/5	5.9 - 46.2 b	300 or SB	15 - 600	0%	NO
Beryllium	0/5	ND	0.16 or SB	0 - 1.75	0%	NO
Cadmium	3/5	1.0 b - 3.4	1 or SB	0.1 - 1	67%	YES
Calcium	5/5	105 - 3,980	SB	130 - 35,000 æ	0%	NO
Chromium	5/5	1.6 b - 33.3	10 or SB	1.5 - 405 æ	0%	NO
Cobalt	5/5	0.699 - 6.5 b	30 or SB	2.5 - 60 æ	0%	NO
Copper	5/5	1.9 b - 141	25 or SB	1 - 50	60%	NO
Iron	5/5	2,760 - 12,500	2,000 or SB	2,000 - 550,000	0%	NO
Lead	5/5	2.2 - 364	SB	200 - 500 *	0%	NO
Magnesium	5/5	217 - 3,110	SB	100 - 5,000	0%	NO
Manganese	5/5	47.2 - 69.2	SB	50 - 5,000	0%	NO
Mercury	4/5	0.06 b - 0.43	0.1	0.001 - 0.2	50%	NO
Nickel	5/5	1.2 - 25	13 or SB	0.5 - 25	0%	NO
Potassium	5/5	129 b - 309 b	SB	8,500 - 43,000 æ	0%	NO
Selenium	0/5	ND	2 or SB	0.1 - 3.9	0%	NO
Silver	2/5	0.43 b - 0.50 b	SB	0.1 - 5 (n)	0%	NO
Sodium	3/5	190 b - 281 b	SB	6,000 - 8,000	0%	NO
Thallium	0/5	ND	SB	0.1 - 0.8 (q)	0%	NO
Vanadium	5/5	28 - 46.4	150 or SB	1 - 300	0%	NO
Zinc	5/5	6.6 - 509	20 or SB	9 - 50	60%	YES
Cyanide	0/5	ND	**	N/A	0%	NO

* - Shallow subsurface soils beneath dry wells.

** - Some forms of Cyanide are complex and stable while other forms are pH dependent and hence are very unstable. Site-specific form(s) of Cyanide should be taken into consideration when establishing soil cleanup objectives.

x - Background levels for lead range from 4 - 61 ppm in undeveloped, rural areas to 200 - 500 ppm in

1 - NYSDEC Division Technical and Administrative Guidance Memorandum (TAGM), 1/94.

2 - Percent of detected values that are above the standard.

æ - New York State background concentration.

(n) - Dragun, J., The Soil Chemistry of Hazardous Materials.

(q) - Bowan, H.J., Environmental Chemistry of the Elements.

b - Found in associated blanks.

N/A - Not available.

ND - Not detected at analytical detection limit.

SB - Site background.

Two potential COCs, cadmium and zinc, were identified for the shallow subsurface soils at 89 Frost Street. Although some VOCs were detected, none was detected at a concentration exceeding soil cleanup criteria. Five SVOCs (phenol, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, and benzo(a)pyrene) were detected in shallow subsurface soils at concentrations exceeding applicable criteria, but were not retained as potential COCs because they were generally within one order of magnitude of the applicable soil criteria. In addition, no SVOCs were identified as potential contaminants of concern in other environmental media at 89 Frost Street. The dry wells and shallow subsurface soils at the site may have historically functioned as sinks for SVOCs.

Most metal concentrations did not exceed the soil cleanup criteria or eastern United States native soil concentration ranges. Two metals, cadmium and zinc, however, were retained as potential COCs, as they were detected at concentrations significantly exceeding applicable criteria (exceedances greater than one order of magnitude). It is possible that the presence of these two metals in shallow subsurface soil at 89 Frost Street can be attributed to historic industrial activities that occurred at and in the vicinity of the site. Antimony, copper, and mercury were also detected at concentrations greater than the soil standards; however, they were not retained as potential COCs for shallow subsurface soils. Since only 50% of the samples in which antimony and mercury were detected were in exceedance of the criteria, these two metals were excluded from further consideration as potential COCs. Copper is considered an essential nutrient and is usually toxic only at very high concentration; copper is generally not included in health exposure analyses. Concentrations of most metals detected were typical of concentrations encountered in urban areas.

Groundwater. Analytical results for groundwater samples collected at 89 Frost Street are summarized in Table 9-8. The samples were analyzed for VOCs. As previously described, when data from both the mobile and base laboratories existed for a single sample, the base laboratory data was selected for use in evaluating potential COCs. Locations of all monitoring wells and hydropunch/probe locations, along with sampling depths, are discussed in detail in the RI report.

Four potential COCs were identified in groundwater at 89 Frost Street. PCE, TCE, and 1,1,1-TCA were retained as potential COCs based on high frequencies of detection (73/76, 53/76, and 37/76, respectively) and groundwater concentrations that were in exceedance of New York State Class GA groundwater standards. In addition, PCE and

TABLE 9-8 (Page 1 of 1)

POTENTIAL CONTAMINANTS OF CONCERN IN ON-SITE GROUNDWATER
89 Frost Street
Frost Street Sites

PARAMETER	FREQUENCY OF DETECTION	RANGE OF DETECTED CONCENTRATIONS (ug/l)	NYSDEC CLASS GA OBJECTIVES ¹ (ug/l)	PERCENTAGE ABOVE STANDARD ²	POTENTIAL COC
VOLATILE ORGANICS (ug/l)					
Methylene chloride	0/6	ND	5	0%	NO
Acetone	0/6	ND	50	0%	NO
Carbon Disulfide	0/6	ND	50	0%	NO
1,1-Dichloroethene	2/76	7.09 - 8.21	5	100%	NO
1,1-Dichloroethane	1/76	55.1	5	100%	NO
1,2-Dichloroethene (total)	7/76	0.6 j - 1334 e	5	85.7%	YES
1,2-Dichloroethane	0/70	ND	0.6	0%	NO
Chloroform	0/6	ND	7	0%	NO
2-Butanone	0/6	ND	NS	0%	NO
1,1,1-Trichloroethane	37/76	0.53 - 545 e	5	70.3%	YES
Trichloroethene	53/76	0.30 - 3600 j	5	62.3%	YES
4-Methyl-2-Pentanone	0/6	ND	NS	0%	NO
Dibromochloromethane	0/6	ND	NS	0%	NO
Tetrachloroethene	73/76	0.53 - 120,000 d	5	79.5%	YES
1,1,2,2-Tetrachloroethane	0/6	ND	5	0%	NO
Benzene	1/48	0.9 j	1	0%	NO
Toluene	1/48	4 j	5	0%	NO
Ethylbenzene	0/48	ND	5	0%	NO
Xylene (total)	1/48	0.6 j	5	0%	NO

1 - Division of water Technical and Operational Guidance Series (1 1 1) June 1998

2 - Percent of detected values that are above the standard

d - Concentration recovered from diluted sample

e - The quantified value exceeds the linear calibration range and the true value may be higher

j - Estimated concentration, compound present below quantitation limit.

ND - Not detected at analytical detection limit.

NS - No standard.

TCE were retained because they were also identified as potential contaminants of concern in subsurface soils at depth at 89 Frost Street. Although 1,2-DCE was detected in only 7 of 76 groundwater samples at the site, it was also retained as a potential COC because a high percentage of detected concentrations exceeded the applicable criterion. It is believed that all four contaminants may have been historically used on the site, and possibly disposed of in on site dry wells from where they may have leached to the groundwater.

Dry Well Water. Analytical results for dry well water grab samples collected at 89 Frost Street are summarized in Table 9-9. The grab water samples were analyzed by the base analytical laboratory for VOCs. Dry well water does not include groundwater that was sampled from monitoring wells or hydropunch/probe devices during the RI; dry well samples were grab samples of standing water in the dry wells. Locations of all dry wells and depths to standing water are described in the RI report.

Since the dry wells that were investigated at 89 Frost Street were removed and replaced during on-site construction activities that occurred subsequent to RI field work, it was concluded that no potential COCs associated with these former dry well structures exist at 89 Frost Street. However, shallow subsurface soils associated with former dry well locations at the site will be addressed, as indicated above. The new dry wells that were installed at 89 Frost Street were not addressed as part of the RI or FS.

9.3.2.3 *Former Applied Fluidics (770 Main Street).*

Subsurface Soils at Depth. Analytical results for subsurface soil samples collected at depth (generally greater than about 20 ft bgs) at 770 Main Street are summarized in Table 9-10. All subsurface soil samples were analyzed only by the mobile laboratory for VOCs. No on-site dry wells or shallow subsurface soils were investigated at this site during the RI. Locations and depths of all subsurface soil samples collected at 770 Main Street are described in detail in the RI report.

Two chemicals were identified as potential COCs for the subsurface soils at 770 Main Street: PCE and TCE. PCE was detected in 9 of 10 samples and TCE in 3 of 10 samples. No other VOCs analyzed for were detected in any subsurface soil sample at the site. Although PCE and TCE were not detected at concentrations exceeding New York State soil cleanup criteria, they were retained as potential COCs because they were believed to

TABLE 9-9 (Page 1 of 1)

POTENTIAL CONTAMINANTS OF CONCERN IN DRY WELL WATER
89 Frost Street
Frost Street Sites

PARAMETER	FREQUENCY OF DETECTION	RANGE OF DETECTED CONCENTRATIONS (ug/l)	NYSDEC CLASS GA OBJECTIVES ¹ (ug/l)	PERCENTAGE ABOVE STANDARD ²	POTENTIAL COC [*]
VOLATILE ORGANICS (ug/l)					
Methylene chloride	0/9	ND	5	0%	NA
Acetone	1/9	17	50	0%	NA
Carbon Disulfide	0/9	ND	50	0%	NA
1,1-Dichloroethene	0/9	ND	5	0%	NA
1,1-Dichloroethane	0/9	ND	5	0%	NA
1,2-Dichloroethene (total)	0/9	ND	5	0%	NA
Chloroform	0/9	ND	7	0%	NA
2-Butanone	0/9	ND	NS	0%	NA
1,1,1-Trichloroethane	0/9	ND	5	0%	NA
Trichloroethene	1/9	0.5 j	5	0%	NA
4-Methyl-2-Pentanone	0/9	ND	NS	0%	NA
Dibromochloromethane	0/9	ND	NS	0%	NA
Tetrachlorethene	4/9	0.5 j - 21	5	25%	NA
1,1,2,2-Tetrachloroethane	0/9	ND	5	0%	NA
Benzene	1/9	7 j	1	100%	NA
Toluene	2/9	0.6 j - 1 j	5	0%	NA
Ethylbenzene	1/9	0.5 j	5	0%	NA
Xylene (total)	1/9	3 j	5	0%	NA

* - Since dry wells were removed during site development activities, potential COCs for dry well water at 89 Frost Street could not be identified.

1 - Division of water Technical and Operational Guidance Series (1 1.1) June 1998

2 - Percent of detected values that are above the standard.

j - Estimated concentration; compound present below quantitation limit

ND - Not detected at analytical detection limit

NS - No standard.

TABLE 9-10 (Page 1 of 1)

POTENTIAL CONTAMINANTS OF CONCERN IN SUBSURFACE SOILS AT DEPTH **

770 Main Street
Frost Street Sites

PARAMETER	FREQUENCY OF DETECTION	RANGE OF DETECTED CONCENTRATIONS (mg/kg)	SOIL CLEANUP OBJECTIVES ¹ (mg/kg)	PERCENTAGE ABOVE STANDARD ²	POTENTIAL COC
VOLATILE ORGANICS (mg/kg)					
1,1-Dichloroethene	0/10	ND	0.4	0.0%	NO
1,1-Dichloroethane	0/10	ND	0.2	0.0%	NO
1,1,1-Trichloroethane	0/10	ND	0.8	0.0%	NO
Trichloroethene	3/10	0.00092 - 0.00451 e	0.7	0.0%	YES
Tetrachloroethene	9/10	0.00066 - 0.0686 e	1.4	0.0%	YES
trans-1,2-Dichloroethene	0/10	ND	0.3	0.0%	NO
cis-1,2-Dichloroethene	0/10	ND	0.3	0.0%	NO
1,2-Dichloroethane	0/10	ND	0.1	0.0%	NO

1 - NYSDEC Division Technical and Administrative Guidance Memorandum (TAGM), 1/94.

2 - Percent of detected values that are above the standard.

e - Estimated concentration; exceeds GC/MS calibration range.

ND - Not detected at analytical detection limit.

** - subsurface soils at depth at 770 Main Street site were generally collected at depths greater than about 20 ft bgs

have been historically used on-site, and possibly disposed of to the subsurface via dry wells. In addition, both contaminants were identified as potential contaminants of concern in groundwater at 770 Main Street.

Groundwater. Analytical results for groundwater samples collected at 770 Main Street are summarized in Table 9-11. The samples were analyzed for VOCs. Fifteen of the groundwater samples collected from monitoring wells and hydropunch/probe devices installed for RI purposes were analyzed on-site by the mobile laboratory only. Two samples collected from an existing monitoring well at the site were analyzed by the base laboratory. Monitoring wells, hydropunch, and probe locations, along with depths of groundwater samples, are described in detail in the RI report.

Six potential COCs were identified in groundwater at 770 Main Street: PCE, TCE, 1,1,1-TCA, 1,1-dichloroethene (1,1-DCE), 1,1-dichloroethane (1,1-DCA), and 1,2-DCE. As discussed in the RI report and shown in Table 9-11, all six contaminants were detected relatively frequently in on-site groundwater samples and at concentrations in exceedance of New York State Class GA groundwater standards. In addition, it is believed that all six contaminants may have been used on-site, and possibly disposed of in on-site dry wells from where they may have leached to the groundwater. PCE and TCE were also identified as potential contaminants of concern in subsurface soils at depth at the site. Methylene chloride was detected in 2 of 6 groundwater samples at concentrations exceeding the standard. However, since this constituent is a common laboratory contaminant and was detected in trip blank samples, it was not retained as a potential COC for groundwater. Toluene was detected in 2 of 6 samples but was not retained as a potential COC since only 50% (1 of 2) of the detected concentrations were in exceedance of the Class GA criterion.

9.3.3 Concentration-Toxicity Screening

A concentration-toxicity screening of the preliminary lists of COCs for each of the three Frost Street sites was conducted to develop a final list of COCs. This screening procedure identifies those contaminants in each matrix that are most likely to substantially contribute to the human health risk resulting from exposure to that matrix. This assessment is conducted by calculating a chemical score (R_i) for each potential COC in each matrix according to the following equations:

TABLE 9-11 (Page 1 of 1)

**POTENTIAL CONTAMINANTS OF CONCERN IN ON-SITE GROUNDWATER
770 Main Street
Frost Street Sites**

PARAMETER	FREQUENCY OF DETECTION	RANGE OF DETECTED CONCENTRATIONS (ug/l)	NYSDEC CLASS GA OBJECTIVES ¹ (ug/l)	PERCENTAGE ABOVE STANDARD ²	POTENTIAL COC
VOLATILE ORGANICS (ug/l)					
Methylene chloride	2/6	490 jd - 520 jd	5	100%	NO
Acetone	1/6	15 jd	50	0%	NO
Carbon Disulfide	0/6	ND	50	0%	NO
1,1-Dichloroethene	5/21	0.7 j - 19.6	5	80%	YES
1,1-Dichloroethane	7/21	5.24 - 32.6 e	5	100%	YES
1,2-Dichloroethene (total)	11/21	16.3 - 641 e	5	91%	YES
Chloroform	1/6	1 jd	7	0%	NO
2-Butanone	0/6	ND	NS	0%	NO
1,1,1-Trichloroethane	17/21	1.86 - 38.9 e	5	58.8%	YES
Trichloroethene	21/21	2.26 - 1,400 jd	5	76%	YES
4-Methyl-2-Pentanone	0/6	ND	NS	0%	NO
Dibromochloromethane	0/6	ND	NS	0%	NO
Tetrachlorethene	21/21	11 e - 44,000 d	5	100%	YES
1,1,2,2-Tetrachloroethane	0/6	ND	5	0%	NO
Benzene	1/6	0.8 j	1	0%	NO
Toluene	2/6	0.5 j - 9 j	5	50%	NO
Ethylbenzene	1/6	0.7 j	5	0%	NO
Xylene (total)	1/6	4 j	5	0%	NO

1 - Division of water Technical and Operational Guidance Series (1.1.1) June 1998.

2 - Percent of detected values that are above the standard.

d - Concentration recovered from diluted sample.

e - The quantified value exceeds the linear calibration range and the true value may be higher.

j - Estimated concentration, compound present below quantitation limit

ND - Not detected at analytical detection limit.

NS - No standard.

- Noncarcinogenic effects:

$$R_i = \frac{\text{Maximum contaminant concentration}}{\text{RfD}}$$

where RfD equals the reference dose.

- Carcinogenic effects:

$$R_i = \text{Maximum contaminant concentration} \times \text{slope factor}$$

The maximum contaminant concentration used in these equations is the maximum detected concentration for each COC in a particular matrix, as shown in Tables 9-1 through 9-11. The slope factors and reference doses (RfDs) used in these equations were obtained from the EPA's on-line database (updated 12 April, 1999). The oral RfD for a contaminant was used to calculate the chemical score unless the inhalation value (reference concentration, RfC or RfDi) was more conservative (i.e., smaller than the oral value). The inhalation slope factor for carcinogenic effects was used unless no inhalation value was available or the oral slope factor was more conservative (i.e., larger than the inhalation slope factor).

Following the calculations of chemical scores for both the noncarcinogenic and the carcinogenic effects for each potential COC in a matrix, the chemical scores for that matrix were summed (R_i). Chemical scores for noncarcinogenic and carcinogenic effects were summed separately. A relative risk for each contaminant was then calculated by dividing the contaminant's chemical score by the total of the noncarcinogenic or carcinogenic chemical scores (as appropriate) for that matrix, as follows:

$$\text{Relative risk} = \frac{R_i}{R_i}$$

This calculated relative risk is not a quantitative assessment of the risk posed by a particular contaminant and is used only for comparative purposes in the concentration-toxicity screening. The concentration-toxicity screening calculations for each matrix at each site are included in Tables 9-12 through 9-21.

TABLE 9-12 (Page 1 of 1)
CONCENTRATION-TOXICITY SCREENING FOR CONTAMINANTS OF CONCERN
SURFACE SOIL SAMPLES
 101 Frost Street
 Frost Street Sites

ANALYTE	MAXIMUM CONCENTRATION DETECTED (mg/kg)	SLOPE FACTOR ^a (mg/kg/day) ⁻¹	REFERENCE DOSE ^b (mg/kg/day)	CHEMICAL SCORE (Ri)	Ri/Rt
NONCARCINOGENIC					
Zinc	804	-	3.0E-01	2.7E+03	1.0E+00
Benzo(a)pyrene	0.91	-	NV	-	-
Dibenzo(a,h)anthracene	0.15	-	NV	-	-
CARCINOGENIC					
Zinc	804	NV	-	-	-
Benzo(a)pyrene	0.91	7.3E+00	-	6.6E+00	8.6E-01
Dibenzo(a,h)anthracene	0.15	7.3E+00	-	1.1E+00	1.4E-01

NV - No value available.

a - Slope factor based on inhalation unit risk unless oral unit risk more conservative.

Source: EPA's Integrated Risk Information System (IRIS) (October 1998 update) or the Health Effects Assessment Summary Tables (HEAST) Report.

b - Chronic RfD for ingestion unless inhalation value more conservative. Source: EPA's

Integrated Risk Information System (IRIS) (October 1998 update) or the Health Effects Assessment Summary Tables (HEAST) Report

TABLE 9-13 (Page 1 of 1)
CONCENTRATION-TOXICITY SCREENING FOR CONTAMINANTS OF CONCERN
SUBSURFACE SOIL AT DEPTH (≥ 25 ft bgs)
101 Frost Street
Frost Street Sites

ANALYTE	MAXIMUM CONCENTRATION DETECTED (mg/kg)	SLOPE FACTOR ^a (mg/kg/day) ⁻¹	REFERENCE DOSE ^b (mg/kg/day)	CHEMICAL SCORE (Ri)	Ri/Rt
NONCARCINOGENIC					
VOCs					
Tetrachloroethene	24.209	-	1.0E-02	2.4E+03	7.9E-01
Trichloroethene	3.775	-	6.0E-03	6.3E+02	2.1E-01
CARCINOGENIC					
VOCs					
Tetrachloroethene	24.209	5.2E-02	-	1.3E+00	9.7E-01
Trichloroethene	3.775	1.1E-02	-	4.2E-02	3.2E-02

a - Slope factor based on inhalation unit risk unless oral unit risk more conservative.

Source: EPA's Integrated Risk Information System (IRIS) (October 1998 update) or the Health Effects Assessment Summary Tables (HEAST) Report.

b - Chronic RfD for ingestion unless inhalation value more conservative. Source: EPA's Integrated Risk Information System (IRIS) (October 1998 update) or the Health Effects Assessment Summary Tables (HEAST) Report.

TABLE 9-14 (Page 1 of 1)
CONCENTRATION-TOXICITY SCREENING FOR CONTAMINANTS OF CONCERN
SUBSURFACE SOIL AT DEPTH (≥ 25 ft bgs)
89 Frost Street
Frost Street Sites

ANALYTE	MAXIMUM CONCENTRATION DETECTED (mg/kg)	SLOPE FACTOR ^a (mg/kg/day) ⁻¹	REFERENCE DOSE ^b (mg/kg/day)	CHEMICAL SCORE (Ri)	Ri/Rt
NONCARCINOGENIC					
VOCs					
Tetrachloroethene	47	-	1.00E-02	4.7E+03	9.5E-01
Trichloroethene	1.6	-	6.0E-03	2.7E+02	5.4E-02
CARCINOGENIC					
VOCs					
Tetrachloroethene	47	5.2E-02	-	2.4E+00	9.9E-01
Trichloroethene	1.6	1.1E-02	-	1.8E-02	7.1E-03

a - Slope factor based on inhalation unit risk unless oral unit risk more conservative.

Source: EPA's Integrated Risk Information System (IRIS) (October 1998 update) or the Health Effects Assessment Summary Tables (HEAST) Report.

b - Chronic RfD for ingestion unless inhalation value more conservative. Source: EPA's Integrated Risk Information System (IRIS) (October 1998 update) or the Health Effects Assessment Summary Tables (HEAST) Report.

TABLE 9-15 (Page 1 of 1)
CONCENTRATION-TOXICITY SCREENING FOR CONTAMINANTS OF CONCERN
SUBSURFACE SOIL AT DEPTH
770 Main Street
Frost Street Sites

ANALYTE	MAXIMUM CONCENTRATION DETECTED (mg/kg)	SLOPE FACTOR ^a (mg/kg/day) ⁻¹	REFERENCE DOSE ^b (mg/kg/day)	CHEMICAL SCORE (Ri)	Ri/Rt
NONCARCINOGENIC					
VOCs					
Tetrachloroethene	0.0686	-	1.00E-02	6.9E+00	9.0E-01
Trichloroethene	0.00451	-	6.0E-03	7.5E-01	9.9E-02
CARCINOGENIC					
VOCs					
Tetrachloroethene	0.0686	5.2E-02	-	3.6E-03	9.9E-01
Trichloroethene	0.00451	1.1E-02	-	5.0E-05	1.4E-02

a - Slope factor based on inhalation unit risk unless oral unit risk more conservative.

Source: EPA's Integrated Risk Information System (IRIS) (October 1998 update) or the Health Effects Assessment Summary Tables (HEAST) Report.

b - Chronic RfD for ingestion unless inhalation value more conservative. Source: EPA's Integrated Risk Information System (IRIS) (October 1998 update) or the Health Effects Assessment Summary Tables (HEAST) Report.

TABLE 9-16 (Page 1 of 1)
CONCENTRATION-TOXICITY SCREENING FOR CONTAMINANTS OF CONCERN
SHALLOW SUBSURFACE SOIL (<25 ft bgs) *
101 Frost Street
Frost Street Sites

ANALYTE	MAXIMUM CONCENTRATION DETECTED (mg/kg)	SLOPE FACTOR ^a (mg/kg/day) ⁻¹	REFERENCE DOSE ^b (mg/kg/day)	CHEMICAL SCORE (Ri)	Ri/Rt
NONCARCINOGENIC					
4-4' DDT	20	-	5.0E-04	4.0E+04	9.8E-01
Benzo(a)anthracene	5	-	NV	-	-
Benzo(a)pyrene	4.8	-	NV	-	-
Chrysene	6.3	-	NV	-	-
Dibenzo(a,h)anthracene	0.44	-	NV	-	-
Zinc	276	-	3.00E-01	9.2E+02	2.2E-02
CARCINOGENIC					
4-4' DDT	20	3.40E-01	-	6.8E+00	1.4E-01
Benzo(a)anthracene	5	7.30E-01	-	3.7E+00	7.5E-02
Benzo(a)pyrene	4.8	7.30E+00	-	3.5E+01	7.2E-01
Chrysene	6.3	7.30E-03	-	4.6E-02	9.4E-04
Dibenzo(a,h)anthracene	0.44	7.30E+00	-	3.2E+00	6.6E-02
Zinc	276	NV	-	-	-

NV - No value available.

a - Slope factor based on inhalation unit risk unless oral unit risk more conservative.

Source: EPA's Integrated Risk Information System (IRIS) (October 1998 update) or the Health Effects Assessment Summary Tables (HEAST) Report.

b - Chronic RfD for ingestion unless inhalation value more conservative. Source: EPA's

Integrated Risk Information System (IRIS) (October 1998 update) or the Health Effects Assessment Summary Tables (HEAST) Report

* - Shallow subsurface soils beneath dry wells.

TABLE 9-17 (Page 1 of 1)
CONCENTRATION-TOXICITY SCREENING FOR CONTAMINANTS OF CONCERN
SHALLOW SUBSURFACE SOIL (<25 ft bgs)*
89 Frost Street
Frost Street Sites

ANALYTE	MAXIMUM CONCENTRATION DETECTED (mg/kg)	SLOPE FACTOR ^a (mg/kg/day) ⁻¹	REFERENCE DOSE ^b (mg/kg/day)	CHEMICAL SCORE (Ri)	Ri/Rt
NONCARCINOGENIC					
Cadmium **	3.4	-	5.00E-04	6.8E+03	8.0E-01
Zinc	509	-	3.00E-01	1.7E+03	2.0E-01
CARCINOGENIC					
Cadmium	3.4	6.30E+00	-	2.1E+01	1.0E+00
Zinc	509	NV	-	-	-

NV - No value available.

a - Slope factor based on inhalation unit risk unless oral unit risk more conservative.

Source: EPA's Integrated Risk Information System (IRIS) (October 1998 update) or the

Health Effects Assessment Summary Tables (HEAST) Report.

b - Chronic RfD for ingestion unless inhalation value more conservative. Source: EPA's Integrated Risk Information System (IRIS) (October 1998 update) or the Health Effects Assessment Summary Tables (HEAST) Report

** - Reference Dose for Cadmium in water used (more conservative value).

* - Shallow subsurface soils beneath dry wells.

TABLE 9-18 (Page 1 of 1)
CONCENTRATION-TOXICITY SCREENING FOR CONTAMINANTS OF CONCERN
ON-SITE GROUNDWATER SAMPLES
101 Frost Street
Frost Street Sites

ANALYTE	MAXIMUM CONCENTRATION DETECTED (ug/l)	SLOPE FACTOR ^a (mg/kg/day) ⁻¹	REFERENCE DOSE ^b (mg/kg/day)	CHEMICAL SCORE (Ri)	Ri/Rt
NONCARCINOGENIC					
VOCs:					
Tetrachloroethene	18,000	-	1.00E-02	1.80E+06	9.9E-01
Trichloroethene	41	-	6.00E-03	6.83E+03	3.7E-03
1,1,1-Trichloroethane	359	-	2.00E-02	1.80E+04	9.8E-03
CARCINOGENIC					
VOCs:					
Tetrachloroethene	18,000	5.20E-02	-	9.36E+02	1.0E+00
Trichloroethene	41	1.10E-02	-	4.51E-01	4.8E-04
1,1,1-Trichloroethane	359	NV	-	-	-

NV - No value available.

a - Slope factor based on inhalation unit risk unless oral unit risk more conservative.

Source: EPA's Integrated Risk Information System (IRIS) (October 1998 update) or the Health Effects Assessment Summary Tables (HEAST) Report.

b - Chronic RfD for ingestion unless inhalation value more conservative. Source: EPA's

Integrated Risk Information System (IRIS) (October 1998 update) or the Health Effects Assessment Summary Tables (HEAST) Report

TABLE 9-19 (Page 1 of 1)
CONCENTRATION-TOXICITY SCREENING FOR CONTAMINANTS OF CONCERN
ON-SITE GROUNDWATER SAMPLES
89 Frost Street
Frost Street Sites

ANALYTE	MAXIMUM CONCENTRATION DETECTED (ug/l)	SLOPE FACTOR ^a (mg/kg/day) ⁻¹	REFERENCE DOSE ^b (mg/kg/day)	CHEMICAL SCORE (Ri)	Ri/Rt
NONCARCINOGENIC					
VOCs:					
Tetrachloroethene	120,000	-	1.00E-02	1.20E+07	9.4E-01
Trichloroethene	3,600	-	6.00E-03	6.00E+05	4.7E-02
1,1,1-Trichloroethane	545	-	2.00E-02	2.73E+04	2.1E-03
1,2- Dichloroethene	1,334	-	1.00E-02	1.33E+05	1.0E-02
CARCINOGENIC					
VOCs:					
Tetrachloroethene	120,000	5.20E-02	-	6.24E+03	9.9E-01
Trichloroethene	3,600	1.10E-02	-	3.96E+01	6.3E-03
1,1,1-Trichloroethane	545	NV	-	-	-
1,2- Dichloroethene	1,334	NV	-	-	-

NV - No value available.

a - Slope factor based on inhalation unit risk unless oral unit risk more conservative.

Source: EPA's Integrated Risk Information System (IRIS) (October 1998 update) or the Health Effects Assessment Summary Tables (HEAST) Report.

b - Chronic RfD for ingestion unless inhalation value more conservative. Source: EPA's

Integrated Risk Information System (IRIS) (October 1998 update) or the Health Effects Assessment Summary Tables (HEAST) Report

TABLE 9-20 (Page 1 of 1)
CONCENTRATION-TOXICITY SCREENING FOR CONTAMINANTS OF CONCERN
ON-SITE GROUNDWATER SAMPLES
770 Main Street
Frost Street Sites

ANALYTE	MAXIMUM CONCENTRATION DETECTED (ug/l)	SLOPE FACTOR ^a (mg/kg/day) ⁻¹	REFERENCE DOSE ^b (mg/kg/day)	CHEMICAL SCORE (Ri)	Ri/Rt
NONCARCINOGENIC					
VOCs:					
Tetrachloroethene	44000	-	1.00E-02	4.40E+06	9.4E-01
Trichloroethene	1400	-	6.00E-03	2.33E+05	5.0E-02
1,1,1-Trichloroethane	38.9	-	2.00E-02	1.95E+03	4.1E-04
1,2-Dichloroethene	641	-	1.00E-02	6.41E+04	1.4E-02
1,1-Dichloroethane	32.6	-	1.00E-02	3.26E+03	6.9E-04
1,1-Dichloroethene	19.6	-	9.00E-03	2.18E+03	4.6E-04
CARCINOGENIC					
VOCs:					
Tetrachloroethene	44000	5.20E-02	-	2.29E+03	9.9E-01
Trichloroethene	1400	1.10E-02	-	1.54E+01	6.7E-03
1,1,1-Trichloroethane	38.9	NV	-	-	-
1,2-Dichloroethene	641	NV	-	-	-
1,1-Dichloroethane	32.6	NV	-	-	-
1,1-Dichloroethene	19.6	6.00E-01	-	1.18E+01	5.1E-03

NV - No value available.

a - Slope factor based on inhalation unit risk unless oral unit risk more conservative.

Source: EPA's Integrated Risk Information System (IRIS) (October 1998 update) or the Health Effects Assessment Summary Tables (HEAST) Report.

b - Chronic RfD for ingestion unless inhalation value more conservative. Source: EPA's

Integrated Risk Information System (IRIS) (October 1998 update) or the Health Effects Assessment Summary Tables (HEAST) Report

TABLE 9-21 (Page 1 of 1)
CONCENTRATION-TOXICITY SCREENING FOR CONTAMINANTS OF CONCERN
DRY WELL WATER SAMPLES
101 Frost Street
Frost Street Sites

ANALYTE	MAXIMUM CONCENTRATION DETECTED (ug/l)	SLOPE FACTOR ^a (mg/kg/day) ⁻¹	REFERENCE DOSE ^b (mg/kg/day)	CHEMICAL SCORE (Ri)	Ri/Rt
NONCARCINOGENIC					
VOCs:					
Tetrachloroethene	3.89	-	1.00E-02	3.9E+02	2.3E-01
1,2-Dichloroethene	12.8	-	1.00E-02	1.3E+03	7.7E-01
CARCINOGENIC					
VOCs:					
Tetrachloroethene	3.89	5.20E-02	-	2.0E-01	1.0E+00
1,2-Dichloroethene	12.8	NV	-	-	-

NV - No value available.

a - Slope factor based on inhalation unit risk unless oral unit risk more conservative.

Source: EPA's Integrated Risk Information System (IRIS) (October 1998 update) or the Health Effects Assessment Summary Tables (HEAST) Report.

b - Chronic RfD for ingestion unless inhalation value more conservative. Source: EPA's Integrated Risk Information System (IRIS) (October 1998 update) or the Health Effects Assessment Summary Tables (HEAST) Report

Based on the calculated relative risks for each matrix, those contaminants that did not contribute substantially to the overall risk to human health from exposure to that matrix (i.e., those contaminants presenting a relative risk equal to or less than 0.01, or 1.0% of the total risk) were eliminated. Table 9-22 summarizes the final list of COCs for each matrix, including both carcinogenic and noncarcinogenic effects, that were retained for each site before evaluation by the concentration-toxicity screening. The results of the concentration-toxicity screening are shown in Table 9-23.

9.4 EXPOSURE ASSESSMENT

The purpose of an exposure assessment is to identify the on-site exposure pathways by which humans may contact the matrix-specific COCs. Pathways were identified for both “current use” and “future use” scenarios, and only on-site potential exposure pathways were analyzed.

9.4.1 Identification and Screening of Exposure Pathways

An exposure pathway consists of a source and mechanism of contaminant release, a receiving matrix, a point of potential human contact with the contaminated matrix (i.e., exposure point), and an exposure route (i.e., inhalation, ingestion, or dermal contact). If an exposure pathway is not complete because it does not include a receiving matrix, a point of potential human contact, or an exposure route, then no risk exists. For current and future land use scenarios, only exposure pathways that potentially exist on one or more of the three Frost Street sites are discussed; off-site pathways are not included. Potential exposure pathways for the Frost Street sites that have been identified and screened are included in Tables 9-24 through 9-26 (current land use scenario) and Tables 9-27 through 9-29 (future use scenario).

The pathways have been arranged according to the receiving matrices (i.e., surface soils, subsurface soils at depth, shallow subsurface soils, groundwater, and standing water from on-site dry wells) that were determined to be contaminated based on environmental monitoring conducted at the sites. The release source and mechanism by which the receiving matrix became contaminated are then identified, followed by the exposure points and routes by which humans may realistically encounter the COCs on-site in the receiving media. The potential exposure pathways were then evaluated (screened) to identify complete pathways (refer to Tables 9-24 to 9-29).

TABLE 9-22

**POTENTIAL CONTAMINANTS OF CONCERN FOR INCLUSION
IN THE HEALTH EXPOSURE ASSESSMENT
(ALL MATRICES)**

(Prior to the Concentration-Toxicity Screening)

Frost Street Sites

LOCATION	NONCARCINOGENIC EFFECTS	CARCINOGENIC EFFECTS
Surface Soil		
101 Frost Street	Zinc	Benzo(a)pyrene Dibenzo(a,h)anthracene
Subsurface Soils at Depth		
101 Frost Street	PCE TCE	PCE TCE
89 Frost Street	PCE TCE	PCE TCE
770 Main Street	PCE TCE	PCE TCE
Shallow Subsurface Soils *		
101 Frost Street	4-4' - DDT Zinc	4-4' - DDT Benzo(a)anthracene Benzo(a)pyrene Dibenzo(a,h)anthracene Chrysene
89 Frost Street	Cadmium Zinc	Cadmium
Groundwater		
101 Frost Street	PCE TCE 1,1,1 - TCA	PCE TCE
89 Frost Street	PCE TCE 1,1,1 - TCA 1,2 - DCE	PCE TCE
770 Main Street	PCE TCE 1,1,1 - TCA 1,2 - DCE 1,1 - DCA 1,1 - DCE	PCE TCE 1,1 - DCE
Dry Well Water		
101 Frost Street	PCE 1,2 - DCE	PCE

N/A - Not applicable.

* - Shallow subsurface soils beneath dry wells (<25 ft bgs).

TABLE 9-23

**POTENTIAL CONTAMINANTS OF CONCERN FOR INCLUSION
IN THE HEALTH EXPOSURE ASSESSMENT
(ALL MATRICES)
(After the Concentration-Toxicity Screening)
Frost Street Sites**

LOCATION	NONCARCINOGENIC EFFECTS	CARCINOGENIC EFFECTS
Surface Soil		
101 Frost Street	Zinc	Benzo(a)pyrene Dibenzo(a,h)anthracene
Subsurface Soils at Depth		
101 Frost Street	PCE TCE	PCE TCE
89 Frost Street	PCE TCE	PCE
770 Main Street	PCE TCE	PCE TCE
Shallow Subsurface Soils *		
101 Frost Street	4-4' - DDT Zinc	4-4' - DDT Benzo(a)anthracene Benzo(a)pyrene Dibenzo(a,h)anthracene
89 Frost Street	Cadmium Zinc	Cadmium
Groundwater		
101 Frost Street	PCE	PCE
89 Frost Street	PCE TCE 1,2 - DCE	PCE
770 Main Street	PCE TCE 1,2 - DCE	PCE
Dry Well Water		
101 Frost Street	PCE 1,2 - DCE	PCE

N/A - Not applicable.

* - Shallow subsurface soils beneath dry wells (<25 ft bgs).

Table 9-24
SCREENING OF POTENTIAL EXPOSURE PATHWAYS
CURRENT LAND USE SCENARIO
101 Frost Street
Frost Street Sites

RECEIVING MATRIX	RELEASE SOURCE	RELEASE MECHANISM	EXPOSURE POINT	EXPOSURE ROUTES	PATHWAY RETAINED?	EXPOSURE TIMEFRAME	SCREENING COMMENTS
Surface Soil	Entire industrialized NCIA.	Wind blown soils; fugitive dusts.	On-site	Inhalation; Ingestion; Dermal Contact.	No	Not applicable	Surface soil pathways not retained because very small quantity of exposed surface soils currently exists at the site.
Subsurface Soil at Depth (>25 ft bgs)	Historic discharge of wastes to dry wells/on-site disposal systems.	Leaching.	On-site	None identified	No	Not applicable	Although COCs were identified for subsurface soils at depth at the site, no significant exposure route was identified.
Shallow Subsurface Soil* (< 25 ft bgs)	Historic discharge of wastes to dry wells/on-site disposal systems; stormwater discharge.	Surface Water runoff; leaching.	On-site	Inhalation; Ingestion; Dermal Contact.	Yes	Short-term	Shallow subsurface soils (depths to 25 ft bgs) retained as current, short-term exposure mechanism at the site for utility workers. It is assumed that during the implementation of soil remedies, potential exposure pathways can be eliminated by engineering controls.
Groundwater	Historic discharge of wastes to dry wells/on-site disposal systems.	Leaching/groundwater migration.	On-site	Inhalation; Ingestion; Dermal Contact.	No	Not applicable	Exposure route to on-site occupants and visitors exists via potable water; however, exposure pathway not retained because potable water treated prior to consumption.
Drywell Water	Historic discharge of wastes to dry wells/on-site disposal systems; stormwater discharge.	Surface Water runoff; leaching.	On-site	Inhalation; Ingestion; Dermal Contact.	Yes	Short-term	Drywell water retained as current, short-term exposure mechanism for utility workers. It is assumed that during implementation of soil remedies, potential exposure pathways can be eliminated by engineering controls.

* - Shallow subsurface soil beneath dry wells.

Table 9-25
SCREENING OF POTENTIAL EXPOSURE PATHWAYS
CURRENT LAND USE SCENARIO
89 Frost Street
Frost Street Sites

RECEIVING MATRIX	RELEASE SOURCE	RELEASE MECHANISM	EXPOSURE POINT	EXPOSURE ROUTES	PATHWAY RETAINED?	EXPOSURE TIMEFRAME	SCREENING COMMENTS
Surface Soil	Entire industrialized NCI/A.	Wind blown soils; fugitive dusts.	On-site	Inhalation; Ingestion; Dermal Contact.	No	Not applicable	Surface soil pathways not retained because very small quantity of exposed surface soils currently exists at the site.
Subsurface Soil at Depth (>25 ft bgs)	Historic discharge of wastes to dry wells/on-site disposal systems.	Leaching.	On-site	None identified	No	Not applicable	Although COCs were identified for subsurface soils at depth at the site, no significant exposure route was identified.
Shallow Subsurface Soil* (<25 ft bgs)	Historic discharge of wastes to dry wells/on-site disposal systems; stormwater discharge.	Surface Water runoff; leaching.	On-site	Inhalation; Ingestion; Dermal Contact.	Yes	Short-term	Shallow subsurface soils (depths to 25 ft bgs) retained as current, short-term exposure mechanism at the site for utility workers. It is assumed that during the implementation of soil remedies, potential exposure pathways can be eliminated by engineering controls.
Groundwater	Historic discharge of wastes to dry wells/on-site disposal systems.	Leaching/groundwater migration.	On-site	Inhalation; Ingestion; Dermal Contact.	No	Not applicable	Exposure route to on-site occupants and visitors exists via potable water; however, exposure pathway not retained because potable water treated prior to consumption.
Drywell Water	Historic discharge of wastes to dry wells/on-site disposal systems; stormwater discharge.	None	Not applicable	None Identified	No	Not applicable	Drywells were removed and replaced subsequent to RI fieldwork.

* - Shallow subsurface soil beneath dry wells.

Table 9-26
SCREENING OF POTENTIAL EXPOSURE PATHWAYS
CURRENT LAND USE SCENARIO
770 Main Street
Frost Street Sites

RECEIVING MATRIX	RELEASE SOURCE	RELEASE MECHANISM	EXPOSURE POINT	EXPOSURE ROUTES	PATHWAY RETAINED?	EXPOSURE TIMEFRAME	SCREENING COMMENTS
Surface Soil	Entire industrialized NCIA.	Wind blown soils; fugitive dusts.	On-site	Inhalation; Ingestion; Dermal Contact.	No	Not applicable	Surface soil pathways not retained because very small quantity of exposed surface soils currently exists at the site.
Subsurface Soil at Depth	Historic discharge of wastes to dry wells/on-site disposal systems.	Leaching.	On-site	None identified	No	Not applicable	Although COCs were identified for subsurface soils at depth at the site, no significant exposure route was identified.
Shallow Subsurface Soil*	Historic discharge of wastes to dry wells/on-site disposal systems; stormwater discharge.	Surface Water runoff; leaching.	Not applicable	Inhalation; Ingestion; Dermal Contact.	No	Not applicable	Drywells and soils were removed and replaced subsequent to RI fieldwork.
Groundwater	Historic discharge of wastes to dry wells/on-site disposal systems.	Leaching/groundwater migration.	On-site	Inhalation; Ingestion; Dermal Contact.	No	Not applicable	Exposure route to on-site occupants and visitors exists via potable water; however, exposure pathway not retained because potable water treated prior to consumption.
Drywell Water	Historic discharge of wastes to dry wells/on-site disposal systems; stormwater discharge.	None	Not applicable	None Identified	No	Not applicable	Drywells were removed and replaced prior to RI activities.

* - Shallow subsurface soil beneath dry wells.

Table 9-27
SCREENING OF POTENTIAL EXPOSURE PATHWAYS
FUTURE LAND USE SCENARIO
101 Frost Street
Frost Street Sites

RECEIVING MATRIX	RELEASE SOURCE	RELEASE MECHANISM	EXPOSURE POINT	EXPOSURE ROUTES	PATHWAY RETAINED?	EXPOSURE TIMEFRAME	SCREENING COMMENTS
Surface Soil	Entire Industrialized NCLA.	Wind blown soils; fugitive dusts.	On-site	Inhalation; Ingestion; Dermal Contact.	No	Not applicable	No COCs are expected to be identified in on-site surface soils in future. Entire on-site surface area anticipated to be paved or covered with building footprint.
Subsurface Soil at Depth (>25 ft bgs)	Historic discharge of wastes.	Leaching	On-site	Inhalation; Ingestion; Dermal Contact.	No	Not applicable	Short-term exposure to construction and remediation workers may exist, but pathway not retained because engineering controls can be implemented. Potential future inhalation exposure routes to normal on-site workers, occupants and visitors may exist if in-situ treatment system established, but pathway not retained because engineering controls can be implemented.
Shallow Subsurface Soil* (<25 ft bgs)	No anticipated release source identified in future.	Not applicable	Not applicable	Not applicable	No	Not applicable	Pathway not retained because it is assumed that engineering controls can be implemented.
Groundwater	Historic discharge of wastes.	Leaching/ groundwater migration	On-site	Inhalation; Ingestion; Dermal Contact.	No	Not applicable	Short-term exposure to construction and remediation workers may exist, but pathway not retained because engineering controls can be implemented. Potential future inhalation exposure routes to normal on-site workers, occupants and visitors may exist if in-situ treatment system established, but pathway not retained because engineering controls can be implemented. Future exposure routes to on-site occupants and visitors exists via potable water; however, exposure pathway not retained because institutional treatment measures are expected to continue.
Drywell Water	No anticipated release source identified.	Not applicable	Not applicable	Not applicable	No	Not applicable	Drywells at site assumed to be excavated and replaced. No dry well water contamination anticipated in future.

* - Shallow subsurface soil beneath dry wells.

Table 9-28
SCREENING OF POTENTIAL EXPOSURE PATHWAYS
FUTURE LAND USE SCENARIO
89 Frost Street
Frost Street Sites

RECEIVING MATRIX	RELEASE SOURCE	RELEASE MECHANISM	EXPOSURE POINT	EXPOSURE ROUTES	PATHWAY RETAINED?	EXPOSURE TIMEFRAME	SCREENING COMMENTS
Surface Soil	Entire Industrialized NCIA.	Wind blown soils; fugitive dusts.	On-site	Inhalation; Ingestion; Dermal Contact.	No	Not applicable	No COCs are expected to be identified in on-site surface soils in future. Entire on-site surface area anticipated to be paved or covered with building footprint.
Subsurface Soil at Depth (>25 ft bgs)	Historic discharge of wastes.	Leaching	On-site	Inhalation; Ingestion; Dermal Contact.	No	Not applicable	Short-term exposure to construction and remediation workers may exist, but pathway not retained because engineering controls can be implemented. Potential future inhalation exposure routes to normal on-site workers, occupants and visitors may exist if in-situ treatment system established, but pathway not retained because engineering controls can be implemented.
Shallow Subsurface Soil* (<25 ft bgs)	No anticipated release source identified in future.	Not applicable	Not applicable	Not applicable	No	Not applicable	Pathway not retained because it is assumed that engineering controls can be implemented.
Groundwater	Historic discharge of wastes.	Leaching/ groundwater migration	On-site	Inhalation; Ingestion; Dermal Contact.	No	Not applicable	Short-term exposure to construction and remediation workers may exist, but pathway not retained because engineering controls can be implemented. Potential future inhalation exposure routes to normal on-site workers, occupants and visitors may exist if in-situ treatment system established, but pathway not retained because engineering controls can be implemented. Future exposure routes to on-site occupants and visitors exists via potable water; however, exposure pathway not retained because institutional treatment measures are expected to continue.
Drywell Water	No anticipated release source identified.	Not applicable	Not applicable	Not applicable	No	Not applicable	No dry well water contamination anticipated in future.

* - Shallow subsurface soil beneath dry wells.

Table 9-29
SCREENING OF POTENTIAL EXPOSURE PATHWAYS
FUTURE LAND USE SCENARIO
770 Main Street
Frost Street Sites

RECEIVING MATRIX	RELEASE SOURCE	RELEASE MECHANISM	EXPOSURE POINT	EXPOSURE ROUTES	PATHWAY RETAINED?	EXPOSURE TIMEFRAME	SCREENING COMMENTS
Surface Soil	Entire Industrialized NCIA.	Wind blown soils; fugitive dusts.	On-site	Inhalation; Ingestion; Dermal Contact.	No	Not applicable	No COCs are expected to be identified in on-site surface soils in future. Entire on-site surface area anticipated to be paved or covered with building footprint.
Subsurface Soil at Depth	Historic discharge of wastes.	Leaching	On-site	Inhalation; Ingestion; Dermal Contact.	No	Not applicable	Short-term exposure to construction and remediation workers may exist, but pathway not retained because engineering controls can be implemented. Potential future inhalation exposure routes to normal on-site workers, occupants and visitors may exist if in-situ treatment system established, but pathway not retained because engineering controls can be implemented.
Shallow Subsurface Soil*	No anticipated release source identified in future.	Not applicable	Not applicable	Not applicable	No	Not applicable	No shallow subsurface soil contamination noted at the site.
Groundwater	Historic discharge of wastes.	Leaching/ groundwater migration	On-site	Inhalation; Ingestion; Dermal Contact.	No	Not applicable	Short-term exposure to construction and remediation workers may exist, but pathway not retained because engineering controls can be implemented. Potential future inhalation exposure routes to normal on-site workers, occupants and visitors may exist if in-situ treatment system established, but pathway no retained because engineering controls can be implemented. Future exposure routes to on-site occupants and visitors exists via potable water; however, exposure pathway not retained because institutional treatment measures are expected to continue.
Drywell Water	No anticipated release source identified.	Not applicable	Not applicable	Not applicable	No	Not applicable	No dry well water contamination anticipated in future.

* - Shallow subsurface soil beneath dry wells.

The current land use scenario for all three Frost Street sites is based on the existing on-site "Industrial-B" (I-B) use of the properties, as depicted on a zoning map from the Town of North Hempstead Planning Department (1988). The future land use scenario is based on the presumption of continued, commercial/industrial use of the properties as zoned.

9.4.1.1 Current Land Use Scenario. On-site exposure pathways were not retained for surface soils as they do not constitute a current exposure matrix because the vast majority of the surface area on each of the three sites is presently paved or covered with the footprint of a building. Thus, no significant exposure mechanism (i.e., direct contact, wind blown soils) exists for surface soils.

An exposure pathway was not identified for subsurface soils at depth. While it was assumed that excavation for the implementation of soil and groundwater remedies and utility servicing may result in short-term exposures to some subsurface soils by workers, excavation to the depths of the contamination in this medium (approximately 25 to 53 ft below ground surface) is highly unlikely. It is also assumed that any VOCs (PCE, TCE) in the subsurface soils at depth exist at depths that are typically too great to allow migration of contaminants into buildings that may be on or partly below-grade. Thus, on-site subsurface soils at depth were not considered as a potential current exposure medium.

Shallow subsurface soils beneath dry well structures at 101 Frost Street and former dry well locations at 89 Frost Street may constitute a current exposure matrix, thus, an exposure pathway was retained for this matrix. Excavation for soil remedies and utility work in these areas may result in short-term exposure to shallow subsurface soils by individuals involved in excavation activities. Exposure pathways retained for evaluation were short-term inhalation, ingestion, and dermal contact by utility workers. For remediation workers installing soil remedies at the sites, it is assumed that potential exposure pathways can be eliminated by engineering controls, personal protective equipment, and appropriate site health and safety monitoring. Although it is possible for contaminated shallow subsurface soil to become airborne in the form of fugitive dusts during the implementation of remedial activities, it is assumed that engineering controls will be implemented to mitigate such an exposure. No current exposure pathway exists for the commercial/industrial site workers and visitors since there is no contact with the contaminated shallow subsurface soils.

No current exposure pathway was identified for groundwater at the sites. Groundwater contamination from the sites has been traced to off-site early warning monitoring wells and two potable supply wells (located approximately 2000 ft south of the 770 Main Street property) in the Bowling Green Water District. A potential route (ingestion, inhalation, and dermal contact) with groundwater via potable water for normal on-site occupants (e.g., workers at department store at 770 Main Street) and visitors (e.g., on-site shoppers) has been identified; however, no actual exposure pathway or potential risk exists since institutional controls (air stripping of VOCs and granular activated carbon filtration) at the Bowling Green supply wells prevent the contaminants in the groundwater from entering the public drinking water supply. In addition, no private wells were identified at the sites, and, under Article IV (1987) of the Nassau County Public Health Ordinance, it is mandated that on-site groundwater cannot be used as a drinking water supply. Although it is possible that a short-term exposure route for COCs in groundwater may exist during implementation of groundwater remedies, it is assumed that such potential short-term exposure pathways can be eliminated through engineering controls, personal protective equipment, and site health and safety monitoring. In addition, groundwater at the sites exists at depths (approximately 50 to 55 ft below ground surface) that do not present exposure pathways for remediation workers implementing soil remedies or utility workers, as excavation for these activities is likely to occur only in the unsaturated zone. Therefore, contaminated groundwater was not considered as a current exposure medium.

Standing water in dry wells constitutes a current exposure medium at 101 Frost Street. Dry wells and standing water were previously cleaned and removed from 89 Frost Street and 770 Main Street. Similar to on-site shallow subsurface soils, excavation for soil remedies and utilities may result in short-term exposures to dry well water by remediation and utility workers. Thus, short-term inhalation, ingestion, and dermal contact with standing dry well water were retained as potential exposure pathways for utility workers. For remediation workers installing soil remedies at the sites, it is assumed the potential exposure pathways can be eliminated by the use of engineering controls, personal protective equipment, and appropriate site health and safety monitoring. No current exposure pathway exists for commercial/industrial site workers and visitors since there is no contact with contaminated dry well water. Tables 9-24 through 9-26 summarize current land use exposure scenarios for each site.

9.4.1.2 ***Future Land Use Scenario.*** Because the entire surface area at all three sites is anticipated to be paved or covered with the footprint of a building, exposure to surface soils does not constitute a complete exposure pathway in a future land use scenario.

Individuals involved in future site development, construction, or remedial activities at the sites may be exposed to contaminated subsurface soils at depth. However, the exposure pathway for these workers is likely to be eliminated through the use of engineering controls, personal protective equipment, and appropriate site health and safety monitoring. Subsurface soils at depth are not considered to present a complete exposure pathway in the future for routine utility work because these soils are found at depths of approximately 25-53 ft below ground surface, which are substantially greater depths than at which utility work is expected to occur. It is also assumed that any VOCs (PCE, TCE) in the subsurface soils at depth exist at depths that are typically too great to allow migration of contaminants into buildings that may be partly below-grade. Thus, a future human inhalation pathway is very unlikely. Although it is possible that exposure routes for COCs in this matrix may exist in the future (e.g., inhalation of off-gas from an in-situ soil treatment system), it is assumed that engineering controls will be implemented as needed, and no future exposure pathways will exist for regular site workers, occupants, and visitors. Therefore, on-site subsurface soils at depth were not considered to be a potential future exposure medium.

Individuals involved in future site development, construction, or remedial activities at 101 Frost Street and 89 Frost Street may be exposed to contaminated shallow subsurface soils. The exposure pathways can be eliminated, however, through the use of engineering controls, personal protective equipment, and appropriate site health and safety monitoring. Although it is possible that exposure routes for COCs in this matrix may exist in the future (e.g., inhalation of off-gas from an in-situ soil treatment system), it is assumed that engineering controls will be implemented as needed, and no future exposure pathways will exist for regular site workers, occupants, and visitors. Thus, shallow subsurface soils were not considered to be a potential exposure medium in the future.

On-site groundwater is also not considered to be a potential future exposure medium. Groundwater is not considered to constitute a complete exposure pathway in the future for individuals conducting routine utility work because groundwater exists at the sites at depths (approximately 50 – 55 ft below ground surface) which are substantially greater than depths at which utility work is expected to occur. Although it is possible that an

exposure route for COCs in groundwater may exist in the future (i.e., inhalation of off-gas from an in-situ groundwater treatment system), it is assumed that engineering controls will be implemented as needed, and no future exposure pathways will exist for site occupants and visitors. As noted in the current land use scenario, groundwater contamination from the sites has been traced to off-site early warning monitoring wells and two potable supply wells in the Bowling Green Water District. A potential exposure route (ingestion, inhalation, and dermal contact of contaminated potable water) may exist to future occupants and visitors to the sites; however, institutional controls are expected to be continually implemented into the future at the Bowling Green supply wells to prevent public exposure to groundwater contaminants from the drinking water supply. Thus, no future exposure pathway or risk to on-site occupants/visitors was identified.

As potential future exposure to dry well water at 101 Frost Street is anticipated to be eliminated or controlled by the use of engineering controls, personal protective equipment, and appropriate site health and safety measures, it does not constitute a future exposure medium. Dry wells have already been removed by the property owners at 89 Frost Street and 770 Main Street; it is anticipated that dry well water at 101 Frost Street would be removed during future remedial activities. Future land use scenarios are summarized in Tables 9-27 through 9-29.

9.5 TOXICITY ASSESSMENT

This section discusses the currently documented health effects that have been associated with exposure to the site COCs (PCE, TCE, 1,2-DCE, Benzo(a)anthracene, Benzo(a)pyrene, Dibenzo(a,h)anthracene, 4-4' DDT, Cadmium, and Zinc).

9.5.1 Tetrachloroethene (PCE)

Tetrachloroethene enters the body via the inhalation of the vapor, ingestion, and skin and eye contact. Short-term exposure can cause irritation to the nose, mouth and throat, dizziness, headaches, and lightheadedness. Exposure to high concentrations can cause difficulty in breathing, weakness, loss of muscle control, irritability, tremors, convulsions, paralysis, coma, heart irregularities, and death. Long-term exposure can cause irritation to the respiratory tract, nausea, headache, sleeplessness, abdominal pains, dizziness, increased perspiration, fatigue, skin infection, kidney and liver damage, fluid in the lungs, and coma. Many of these effects will cease after the exposure is stopped (Sittig 1991).

9.5.2 Trichloroethene (TCE)

The short-term effects of exposure to low levels of TCE include headaches, sleepiness, nausea, vomiting, dizziness, and coughing. Long-term exposure effects include giddiness, nervous exhaustion, and an increased sensitivity to alcohol. Exposure to higher concentrations can alter the heart rate. Repeated dermal contact can cause excessive dryness, cracking, burning, and loss of the sense of touch or temporary paralysis of the fingers. Most of these effects will go away after the exposure has stopped. The routes of entry into the body are through inhalation, ingestion, and skin and eye contact (Sittig 1991).

9.5.3 1,2-Dichloroethene (1,2-DCE)

This chemical's routes of entry into the body are via the inhalation of the vapor, by ingestion, and by skin and eye contact. Therefore, the respiratory system, the eyes, and the central nervous system are greatly affected by 1,2-DCE. As a liquid, it can act as a primary irritant, producing dermatitis and irritation of mucous membranes. Symptoms of acute exposure to high concentrations include dizziness, nausea, and frequent vomiting, and central nervous system intoxication similar to that caused by alcohol (Sittig 1991).

9.5.4 Benzo(a)anthracene

Benzo(a)anthracene (B[a]A) can enter the body via the inhalation of vapors, ingestion of liquid, and absorption from skin and/or eye contact. Following oral absorption, B[a]A preferentially accumulates in the adipose and mammary tissues. Generally it is metabolized to conjugated derivatives and excreted predominantly in the feces. However, the metabolized products are reactive derivatives that are thought to be responsible for mutagenic activity making B[a]A a weak experimental carcinogen by the dermal route of exposure and possible by the oral route as well. Its carcinogenicity by inhalation has not been studied. Some mutation is thought to be necessary for the carcinogenic effects to take place (Sittig 1991).

9.5.5 Benzo(a)pyrene

This chemical's routes of entry include inhalation, ingestion, and absorption from skin or eye contact. Benzo(a)pyrene (B[a]P) has produced tumors in all of the nine species exposed to the chemical via oral, skin and intratracheal routes. B[a]P has both local and

systematic carcinogenic effects. A number of studies indicate that B[a]P is a more potent carcinogen than most polycyclic aromatic hydrocarbons (PAHs). Coal tar, cigarette smoke, and other materials which are known to be carcinogenic to man may contain B[a]P. A 1% solution applied to the skin can cause skin irritation and coloration, swelling, flaking, and formation of warts (Sittig 1991).

9.5.6 Dibenzo(a,h)anthracene

Dibenzo(a,h)anthracene is a PAH formed during the incomplete burning of organic matter. It is a toxic chemical that has been shown to cause cancer in laboratory animals when it is ingested or applied to their skin. Dibenzo(a,h)anthracene has not been well studied, and, consequently, it is not known whether breathing can cause cancer or if the compound can cause harmful effects other than cancer (Sittig 1991).

9.5.7 4-4' DDT

DDT can enter the body via inhalation, ingestion, and eye and skin contact. Short term exposure via inhalation can produce dizziness. Very high concentrations exposed to the skin and eyes can cause irritation. Ingestion has caused nausea, vomiting, headache and convulsions. Other symptoms include weakness, restlessness, dizziness, incoordination, numbness of face and extremities, abdominal pain, diarrhea, tremors, and, in extreme cases, death. Symptoms observed from long term exposure range from skin and eye irritation to alteration of genetic material. DDT levels build up and remain in the body for long periods of time. DDT causes cancer in mice, however it is unknown whether it causes cancer in humans (Sittig 1991).

9.5.8 Cadmium

The exposure routes for this metal include inhalation or ingestion of fumes or dust. The effects of a short term exposure include irritation of nose and throat if inhaled. If ingested, cadmium may cause increased salivation, choking, vomiting, abdominal pain, anemia, kidney malfunction, diarrhea, and persistent desire to empty the bladder. Heart and lung failure may also occur. Long term exposure to low levels of cadmium in air may cause irreversible lung injury, abnormal lung function, and kidney disease. There is an increased risk of prostate cancer and possible kidney and respiratory cancer in people working

closely with cadmium. Cadmium causes birth defects in rats, mice and hamsters; whether it causes birth defects in humans is not known (Sittig 1991).

9.5.9 Zinc

The major exposure route of concern for zinc is through inhalation; however, it does have harmful effects if ingested or comes in contact with skin. Zinc toxicity from excessive ingestion is uncommon, but gastrointestinal distress and diarrhea have been reported following ingestion of beverages standing in galvanized cans and from use of galvanized utensils. Zinc dust particles can irritate the eyes (Sittig 1991).

9.6 UNCERTAINTY ANALYSIS

Uncertainty is introduced to an exposure pathway analysis through a number of sources. Uncertainty can occur in the measurement of contaminant concentrations in site media and in toxicity values (reference doses and cancer slope factors) used for evaluating the health risks.

As noted in the analytical summary data in the RI report, a number of compound values have been qualified by the data validator, indicating uncertainty in the data as to the contaminant concentrations present in the sample. The uncertainty associated with the data therefore results in uncertainty in the chemical scores obtained in the concentration-toxicity screening of the COCs.

The slope factors developed by EPA are generally conservative and are intended to represent an upper-bound limit of the probability of a cancer response. Thus, the actual risk of cancer due to exposure to a contaminant is likely to be lower than the risk calculated using the EPA value. The reference doses are also conservative; however, they are generally considered to have an uncertainty of an order of magnitude or more. Consequently, the chemical scores calculated for the Frost Street sites' COCs during the concentration-toxicity screening (using published reference doses for noncarcinogenic effects and slope factors for carcinogenic effects) may differ from true values.

9.7 CONCLUSIONS

A focused, qualitative health exposure pathway analysis was conducted for the three Frost Street sites to determine site COCs and likely exposure routes. Five different on-site environmental matrices were evaluated: surface soil, subsurface soil at depth, shallow subsurface soil, groundwater, and dry well water. Contaminants of concern (COCs) were selected by reviewing the analytical data obtained in the RI and determining the frequencies of detection and ranges of detected concentrations of site contaminants. A concentration-toxicity screening was then performed to identify those contaminants most likely to contribute significantly to the human health risk at the sites. COCs identified primarily included VOCs (PCE, TCE and 1,2-DCE, with PCE accounting for the majority of VOC contamination); however, SVOCs (benzo(a)anthracene, benzo(a)pyrene, and dibenzo(a,h)anthracene), heavy metals (cadmium and zinc), and one pesticide (4,4'-DDT) were also retained as COCs.

Current exposure routes that have been identified include short-term inhalation, ingestion, and dermal contact with environmental media (refer to Tables 9-24 through 9-26). Exposure pathways retained for the current use scenario include:

- 101 Frost Street: inhalation, ingestion, and dermal contact with shallow subsurface soils and dry well water.
- 89 Frost Street: inhalation, ingestion, and dermal contact with shallow subsurface soils.

Any resulting exposure pathways are expected to be of limited duration to individuals conducting excavation work (i.e., implementation of soil remedies or performing utility work) and can be appropriately addressed by using personal protective equipment and/or engineering control.

No exposure pathways were retained for the future land use scenario at the Frost Street sites. No exposure pathways associated with site development or remedial activities (e.g., operation of in-situ groundwater and soil treatment systems) were identified for workers, site occupants, or visitors in the future. Although exposure routes may exist (i.e., inhalation, ingestion, and dermal contact with COCs), pathways can be eliminated with engineering controls, personal protective equipment, and appropriate site health and safety monitoring.

As alluded to, there were no current or future direct exposure pathways identified for COCs through groundwater ingestion, inhalation, or dermal contact by site occupants or visitors because institutional treatment controls are implemented by the Bowling Green Water District.

CHAPTER 10

OBJECTIVES OF THE FEASIBILITY STUDY

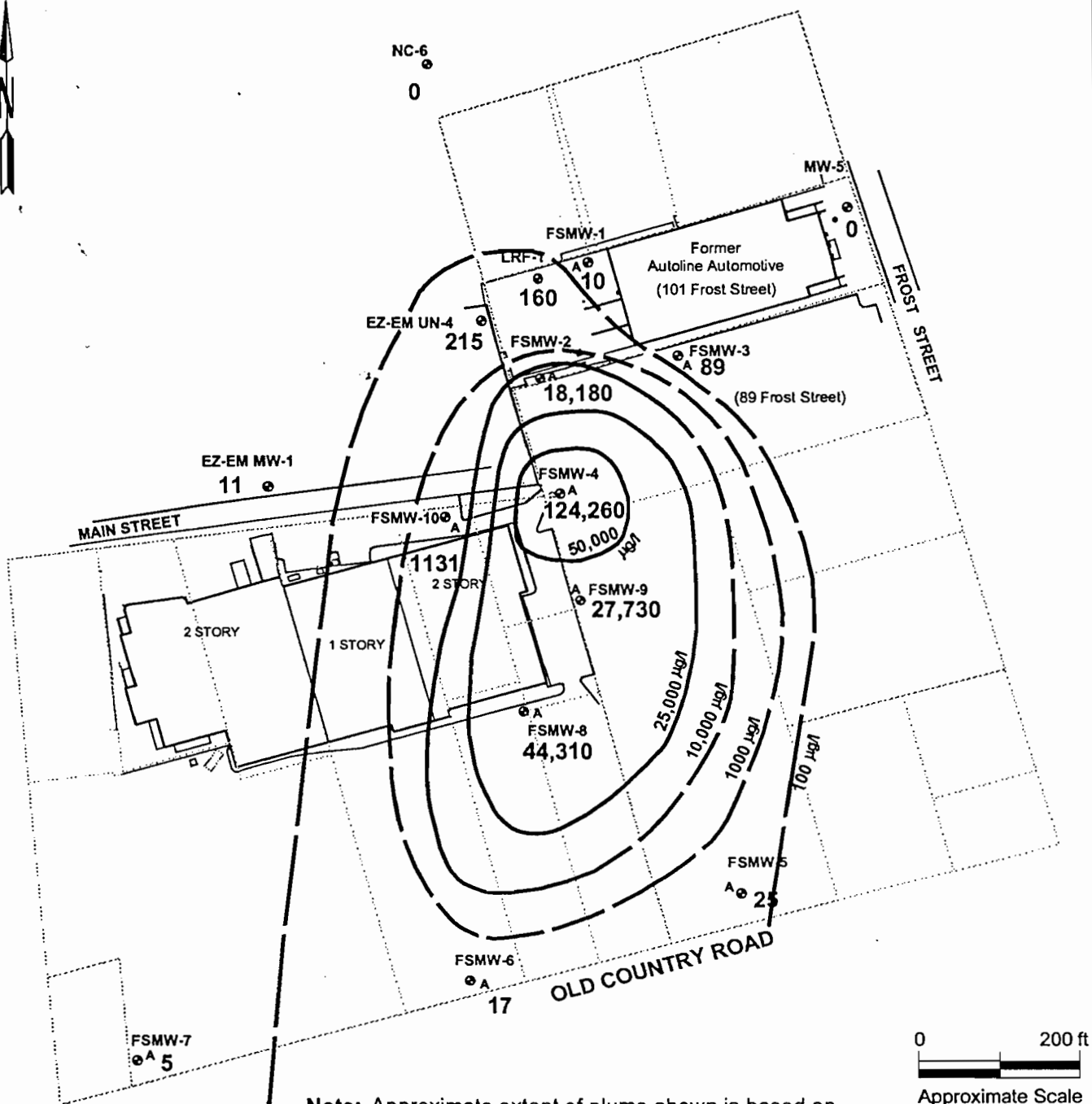
10.1 INTRODUCTION

The feasibility study (FS) portion of this RI/FS report is presented in Chapters 10 through 13. The primary objective of the FS is to ensure that appropriate remedial alternatives are developed and evaluated such that relevant information concerning remedial action can be presented to a decision-maker (i.e., NYSDEC) and an appropriate remedy selected.

This FS presents remedial alternatives for three impacted environmental media at the Frost Street sites: shallow subsurface soils, subsurface soils at depth, and near-field groundwater. In this FS, shallow subsurface soils are defined as those contaminated soils located between the surface and 25 ft bgs. In most cases the shallow subsurface soils include the sediments found in the dry well and immediately below the bottom of the dry well. At the three sites, shallow subsurface soils are contaminated beneath some dry wells at 89 and 101 Frost Street. Soils at 25-ft bgs and deeper (to the groundwater table) are defined as subsurface soils at depth. The subsurface soils at depth include natural sand, gravel, and silt that have been contaminated as hazardous chemicals have migrated downward through them. Contaminated subsurface soils at depth are found at the 89 and 101 Frost Street sites. The near-field groundwater contaminant plume is defined as the VOC contaminant plume attributed to the Frost Street sites located north of Old Country Road, as shown in Figures 10-1 (shallow wells at 70 ft bgs). Remedial alternatives addressing the far-field groundwater contaminant plume of the Frost Street sites will be addressed by on-going investigations of the known groundwater contamination throughout the New Cassel Industrial Area (LMS 1999). For the purposes of this FS, the far-field contaminant plume is defined as the VOC contaminant plume attributed to the Frost Street sites located south of Old Country Road.

10.2 OBJECTIVES OF THE FEASIBILITY STUDY

The FS process (1) identifies remedial action objectives, (2) identifies potential treatment and containment technologies that will satisfy these objectives, (3) screens the technologies based on their effectiveness, implementability, and cost, and (4) assembles technologies and their associated containment or disposal requirements into alternatives



Note: Approximate extent of plume shown is based on monitoring well data collected in September 1998.

0 200 ft
Approximate Scale
1 in. = 200 ft

Survey base map frost&main.dsf

Legend

- Monitoring well location
- (-B = deep well)
- 4 Total VOC ($\mu\text{g/l}$) at ~ 70 ft below grade

Map source: YEC survey, 1998.

Figure 10-1 Approximate Location of Nearfield Contaminant Plume (70 ft bgs) Based on Monitoring Well Data

FROST STREET SITES
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043 I, L, and M

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

for the contaminated media at the site. Remedial alternatives are developed and evaluated with the first seven criteria specified by the NCP and New York State hazardous waste regulations (6 NYCRR Part 375). These evaluation criteria are (1) protection of human health and the environment, (2) compliance with SCGs, (3) reduction of toxicity, mobility, and volume, (4) short term effectiveness, (5) long term effectiveness and permanence, (6) implementability, and (7) cost. The process of alternative development, screening, and evaluation is done in context with remedial action objectives developed for the site and the quantities of contaminated materials present. The eighth and ninth criteria, community and state acceptance, are also to be considered in evaluating the remedial alternatives. Community acceptance cannot be assessed until public comments have been received on the RI/FS report and proposed remedial action plan (PRAP). The record of decision (ROD) for the site will address community acceptance. State acceptance of the proposed remedial action plan will also be addressed in the ROD.

This chapter presents the remedial action objectives applied to the three Frost Street sites and a review of the quantities of VOC-contaminated environmental media including shallow subsurface soil, subsurface soil at depth, and near-field groundwater.

10.3 REMEDIAL ACTION OBJECTIVES

Remedial action objectives are developed for a site to determine the levels to which contaminant concentrations must be reduced to protect human health and the environment. The remedial goals should establish cleanup levels for carcinogens that provide protection within the risk range of 10^{-4} to 10^{-6} , in accordance with Federal NCP requirements developed by the EPA (40 CFR Section 300.430). An acceptable risk of 10^{-6} , thus, has been established for this project. Remedial action objectives are also based on reference doses for compounds, i.e., estimates of the daily chemical exposure doses to which individuals can be exposed without an appreciable risk of noncarcinogenic or systemic health effects over a lifetime of exposure (EPA 1993). To evaluate possible risk from exposure to noncarcinogenic contaminants, a hazard quotient (HQ) is calculated by dividing the exposure dose by the reference dose (RfD):

$$HQ = \frac{\text{Exposure Data}}{RfD}$$

If the HQ is less than 1, the contaminant is considered unlikely to pose a health hazard to individuals exposed under the given scenario (EPA 1989). This acceptable risk for noncarcinogens (i.e., HQ less than 1) has also been established for this project.

A human health exposure pathway analysis was prepared for the Frost Street sites (Chapter 9). A pathway analysis, unlike a risk assessment, determines the significant exposure routes and receptors, but does not calculate the chronic daily intake for the COCs or the final carcinogenic and non-carcinogenic risks. Based on this analysis and a review of the applicable standards, criteria, and guidance (Chapter 8), remedial action objectives were established for contaminants in subsurface soil and groundwater.

The remedial action objectives for the Frost Street sites serve to:

- Prevent human exposure (inhalation, ingestion, and dermal contact) to subsurface soils containing unacceptable levels of the COCs.
- Prevent human exposure (inhalation, ingestion, and dermal contact) to the contaminants in the near-field groundwater plume, which is contaminated with unacceptable levels of the COCs.
- Prevent further discharge of contaminants into groundwater.

For the Frost Street sites, the remedial action objectives for the soil medium are established as the NYS recommended soil cleanup objectives listed in NYSDEC's TAGM #4046 (NYSDEC 1994). The remedial action objectives for the groundwater medium are established as NYSDEC's Class GA groundwater standards (NYSDEC 1998). Achievement of these objectives is believed to be protective of human health and the environment. The locations of contaminated media at the Frost Street sites are described below.

10.3.1 Shallow Subsurface Soil

Contaminated shallow subsurface soils (less than 25 ft bgs) are present at the 101 and 89 Frost Street sites. At the 101 Frost Street site, Area 2 (Figure 6-9) is associated with two dry wells (101-DW-11 and 101-DW-12) that contains shallow subsurface soils with

concentrations of mercury, zinc, and/or SVOCs above the soil cleanup objectives. Area 2 contains an area of approximately 100 ft² with a total thickness of 4 ft at dry well 101-DW-12 and an area of 100 ft² and a 2-ft thickness. Area 3 at this site (Figure 6-10) includes the bottom sediments of eight dry wells (101-DW-2, -3, -4, -5, -6, -7, -8, and -9) located to the rear of the existing building. The bottom sediments exhibited concentrations of metals (zinc and/or mercury) and SVOCs in excess of the recommended soil cleanup objective. The contaminated soil covers an area of approximately 100-ft² and a 2-ft thickness at each dry well. Area 4 at this site (Figure 6-11) includes the bottom sediments in two dry wells (101-DW-10 and -13) located in the front of the building. Samples from both dry wells exceeded the recommended soil cleanup objective for SVOCs and metals (zinc and/or mercury); in addition, 4,4'-DDT was found in 101-DW-13. In Area 4, shallow subsurface soils are assumed to be contaminated over a 2-ft thickness with a 100-ft² area at each dry well.

At the 89 Frost Street site, a single area of shallow subsurface soil contamination was found (Figure 6-16), including the bottom sediments in three dry wells (89-DW-10, -11, and -12) located in the site's northwestern quadrant. The bottom sediments in these dry wells exhibited concentrations of metals and SVOCs (PAHs in all and phenol in 89-DW-11) in excess of the recommended soil cleanup objective. The shallow subsurface soils in the dry wells are assumed to be contaminated over a 2-ft thickness within a 100-ft² area at each dry well.

At the 770 Main Street site, the nature and extent of the on-site soil contamination could not be determined because the site was recently redeveloped (discussed in Chapter 6).

The objective of a remedial action on shallow subsurface soil is to attain contaminant concentrations below the NYSDEC recommended soil cleanup objectives. These numerical goals are summarized in Table 10-1 for the COCs and other contaminants detected above the recommended soil cleanup objectives.

10.3.2 Subsurface Soil at Depth

At the 101 Frost Street site, Area 1 (Figure 6-8) contains subsurface soils at depth with concentrations of PCE at levels above the soil cleanup objective. At dry well 101-DW-4, contaminated soils were found in an area of approximately 400 ft² at a thickness of 5 ft

TABLE 10-1

CLEANUP OBJECTIVES FOR SOILS

Frost Street Sites

Contaminant	Recommended Soil Cleanup Objective* [mg/l]
Benzo(a)anthracene	0.224 or MDL
Benzo(a)pyrene	0.061 or MDL
Benzo(b)fluoranthene	1.1
Benzo(k)fluoranthene	1.1
Chromium	10 or SB
Chrysene	0.4
Dibenzo(a,h)anthracene	0.014 or MDL
Mercury	0.1
Nickel	13 or SB
Phenol	0.03 or MDL
Tetrachloroethene	1.4
Trichloroethene	0.7
Zinc	20 or SB

* - NYSDEC Technical and Administrative Guidance Memorandum 40-46, January 1994

MDL - Method detection limit.

SB - Site background.

(50 to 55 ft bgs). At dry well 101-DW-NS, contaminated soils were found in an area of approximately 100 ft² at a thickness of 15 ft (40 to 55 ft bgs).

At the 89 Frost Street site, Area 1 on this site (Figure 6-12) is an area of subsurface contamination at depth. Area 1 is associated with a series of dry wells (89-DW-10, -11, -12, and 89-DWA-14) found in the northwest quadrant that exhibited soils with concentrations of PCE and TCE, SVOCs, and/or metals above the soil cleanup objectives. Area 1 is approximately 22,500 ft² in size and is conservatively assumed to have a total thickness of 25 ft.

At the 770 Main Street site, the nature and extent of the on-site soil contamination could not be determined because the site was recently redeveloped (discussed in Chapter 6).

Similar to shallow subsurface soil, the objective of a remedial action on subsurface soil at depth is to attain contaminant concentrations below the NYSDEC recommended soil cleanup objectives. These numerical goals are summarized in Table 10-1 for the COCs and other detected contaminants.

10.3.3 Near-field Groundwater

The data from the RI demonstrated that the groundwater underlying the Frost Street sites is contaminated with VOCs. More specifically, 1,1-DCE, 1,1-DCA, 1,1,1-TCA, 1,2-DCA, cis-1,2-DCE, trans-1,2-DCE, TCE, and PCE have been identified in shallow (approximately 70 ft bgs) and deep (approximately 150 ft bgs) monitoring wells. Because of the complexity of the on-site and off-site contaminated groundwater issue, the groundwater contamination will be discussed in terms of a near-field and far-field plume. The near-field plume, located north of Old Country Road, encompasses a smaller areal extent with higher total VOC concentrations (shown in Figure 10-1). According to the RI results, the near-field plume extends vertically into the Magothy Aquifer to at least 150 ft bgs. The far-field plume covers a much larger area and generally contains lower VOC concentrations than the near-field plume.

The remedial action objective for the near-field groundwater medium is to satisfy NYSDEC's Class GA groundwater standards (NYSDEC 1998). A summary of these numerical cleanup goals as they pertain to the site COCs is provided in Table 10-2.

TABLE 10-2

CLEANUP OBJECTIVES FOR GROUNDWATER

Frost Street Sites

Contaminant	Class GA Groundwater Standard ¹ [ug/l]
Tetrachloroethene	5
Trichloroethene	5
1,1-Dichloroethene	5 *
1,1-Dichloroethane	5 *
1,1,1-Trichloroethane	5
1,2-Dichloroethane	0.6
cis-1,2-Dichloroethene	5 *
trans-1,2-Dichloroethene	5 *

¹ - NYSDEC Division of Water Technical and Operational Guidance Series (1 1.1), June 1998.

* - Principal organic contaminant standard applies.

MDL - Method detection limit.

SB - Site background.

10.4 QUANTITIES OF CONTAMINATED MEDIA

Chapter 6 describes the quantities of contaminated media present at each of the three Frost Street sites. The remedial action objectives discussed in the previous section were used to estimate the quantities of contaminated media present at these sites. The estimated quantities of contaminated media are used to evaluate potential remedial alternatives for the three sites, including their cost-effectiveness. Table 10-3 summarizes the estimated quantities of contaminated media for the three Frost Street sites.

10.4.1 Contaminated Shallow Subsurface Soil

As described in Chapter 6, shallow subsurface soils are defined in the FS section of this report as those unsaturated soils present between the surface and 25 ft bgs. The total quantity of contaminated shallow subsurface soil at the Frost Street sites is estimated at 125 yd³ (100 yd³ at the 101 Frost Street site and 25 yd³ at the 89 Frost Street site). At the 101 and 89 Frost Street sites, shallow subsurface soils contain varying levels of PAH, metals, TCE, PCE and/or DDT above the NYSDEC recommended soil cleanup objectives. Contaminated shallow subsurface soils were not identified during the RI at the 770 Main Street site.

10.4.2 Contaminated Subsurface Soil at Depth

The total quantity of contaminated subsurface soil at depth at the Frost Street sites is estimated at 21,300 yd³. Approximately 300 yd³ of contaminated subsurface soils at depth exist at 101 Frost Street and an estimated 21,000 yd³ of contaminated subsurface soil at depth exists at 89 Frost Street. At both sites, subsurface soils are contaminated with PCE and/or TCE above the NYSDEC recommended soil cleanup objectives. Contaminated shallow subsurface soils were not identified during the RI at the 770 Main Street site.

10.4.3 Contaminated Near-field Groundwater

Highly elevated concentrations of PCE and other chlorinated VOCs were found in the groundwater at the three Frost Street sites. A contaminant plume appears to originate in the southwest corner of 101 Frost Street, where the highest measured concentrations of chlorinated VOCs were found. From 101 Frost Street, the plume of groundwater

TABLE 10-3

ESTIMATED QUANTITY OF CONTAMINATED MEDIA

Frost Street Sites

Medium		Contaminated Volume
Shallow Subsurface Soils		
101 Frost Street Site		
Area 2		25 yd ³
Area 3		85 yd ³
Area 4		15 yd ³
89 Frost Street Site		
Area 2		25 yd ³
Total		150 yd ³
On-site Subsurface Soils at Depth		
101 Frost Street Site		
Area 1		300 yd ³
89 Frost Street Site		
Area 1		21,000 yd ³
Total		21,300 yd ³
Near-field Groundwater Plume		72 million gallons*

* - Assumes the near-field contaminated groundwater is contained within an area that varies in areal extent but averages 600,000 ft² with an approximate porosity of 20%.

contamination extends in the direction of groundwater flow toward 89 Frost Street and 770 Main Street (Figure 10-1). At 89 Frost Street, extremely high concentrations of PCE were found centered around the FSMW-4 well pair. In the shallow well at this location, the concentration of PCE was 120,000 $\mu\text{g/l}$ (80% of the solubility limit), which suggests the presence of a NAPL near this location. High concentrations were also detected further downgradient in the FSMW-9, -8, and -6 well pairs.

The near-field contaminant plume is located on the Frost Street sites north of Old Country Road. One of the objectives of a remedial action is to reduce contaminant concentrations in the near-field plume such that the contaminants no longer act as a continuous source. Approximately 98 percent of the total VOC contaminant mass associated with the plume from the Frost Street sites (as of the summer of 1998) is contained north of Old Country Road (from approximately 55 to 150-ft bgs).

The near-field contaminant plume varies in areal extent but on average covers approximately 600,000 ft^2 between the source area and Old Country Road. The plume's thickness varies with distance but is assumed to extend from 55 to 150-ft bgs (75-ft thickness). The estimated quantity of contaminated groundwater within the near-field contaminant plume (north of Old Country Road) totals 72 million gallons.

CHAPTER 11

IDENTIFICATION AND SCREENING OF TECHNOLOGIES

11.1 INTRODUCTION

The first step in developing a range of alternatives to achieve the remedial action objectives for the Frost Street sites is to identify potentially applicable remedial technologies. An initial screening is performed in which the applicability of the identified technologies is evaluated in terms of site conditions, contaminants, and contaminated media characteristics. The most promising technologies are combined into site-wide remedial alternatives (Chapter 12), which are then included in the detailed analysis of alternatives section (Chapter 13) of this report.

11.2 GENERAL RESPONSE ACTIONS

The remedial technologies identified for potential application to the contaminated soils and groundwater are evaluated in this chapter. Some soil and groundwater remedial technologies generate air emissions within the treatment process. As the air emissions may contain elevated contaminant levels, air emissions control technologies may be needed and are thus evaluated in this FS.

The technologies have been grouped by impacted media and general response actions. For the purposes of this discussion, remedial actions addressing the sites' impacted media are separated into three categories: (1) source controls are applicable remedial technologies for contaminated on-site soils, (2) groundwater responses are applicable remedial technologies for contaminated near-field groundwater, and (3) air emission controls are applicable technologies for controlling air emissions generated by a remediation activity. General response actions place the technologies into categories that represent a particular approach to achieving the remedial action objectives. For instance for soil remediation, the general response actions include no action, institutional measures, containment, in situ treatment, removal, ex-situ treatment, and disposal.

General response categories are further defined by technology types and process options. Technology types are general categories of technologies (e.g., chemical treatment), while process options are specific processes within each technology type (e.g., chemical

treatment via oxidation). This review is not an exhaustive list of all available remediation technologies, but summarizes potentially applicable technologies considered for the Frost Street sites.

11.3 REMEDIAL TECHNOLOGY SCREENING PROCESS

Tables 11-1, 11-2, and 11-3 list the source control, groundwater response, and air emissions control technologies, respectively, identified for potential use at the Frost Street sites. The technologies have been grouped according to the medium they address (although a particular technology may be applicable to more than one matrix) and by general response action.

The initial screening was based on the criteria of effectiveness for treating the contaminated media present at the site, implementability given site-specific constraints, and relative cost. At the Frost Street sites, COCs retained for shallow subsurface soils include chlorinated VOCs (PCE and TCE), SVOCs (PAHs, specifically benzo(a)anthracene and benzo(a)pyrene), heavy metals (cadmium and zinc), and the pesticide 4,4'-DDT. Other contaminants that are present but not identified as COCs include phenol, mercury, chromium, and nickel. For subsurface soils at depth, chlorinated VOCs (PCE and TCE) were retained as COCs. For the near-field groundwater, the COCs were also identified as chlorinated VOCs. In groundwater, elevated concentrations of some VOCs suggest the presence of dense non-aqueous phase liquids (DNAPLs). The groundwater treatment technologies were screened for their effectiveness in reducing the volume and toxicity of dissolved VOCs as well as DNAPLs. If a technology was incapable of remediating DNAPLs, it was screened out of the evaluation.

In Tables 11-1, 11-2, and 11-3, the technologies that are appropriate for treating the medium-specific contaminants were designated as “Yes” for their applicability to the sites. A technology that has a site-specific constraint that would prohibit implementation was screened out of the analysis (i.e., designated as “No”). Some technologies were designated as “Maybe” for their applicability because additional site-specific information is necessary to confirm their effectiveness.

A treatment technology is considered innovative if it has limited full-scale application at hazardous waste sites. A bench- and/or pilot-scale study may be required if an innovative

SUMMARY OF REMEDIAL TECHNOLOGIES FOR SOURCE CONTROL

Frost Street Sites

GENERAL RESPONSE ACTION	TECHNOLOGY TYPE/PROCESS OPTION	APPLICABILITY TO SITE	SCREENING COMMENTS
No Action	None	Yes	Required by NCP.
Institutional Measures	A. Access restrictions	No	Would significantly interfere with current site operations. Restricting access is unnecessary as the sites are covered, preventing direct human contact with contaminants.
	B. Deed restrictions	Yes	May be used to prevent human contact with contaminants; will not prevent continued migration of contaminants to groundwater.
	C. Development restrictions	Yes	Same as deed restrictions.
Containment	Capping or surface sealing	No	Construction of a cap would significantly interfere with current site operations. Stormwater, which is currently recharged to the ground on-site, would have to be rerouted to another area.
In-situ Treatment	A. Biological	No	Microbial populations are not expected to be present in large numbers. Breakdown compounds may be more harmful than original compounds and may not be controlled.
	B. Thermal	No	Energy intensive processes that would not be effective.
	1. Vitrification	No	Process is energy intensive and would not be effective.
	2. Radio frequency/electrical heating	No	This is an innovative technology that is still being tested for its effectiveness.
	C. Physical/chemical	Yes	Effective for removal/immobilization of metals and organics.
	1. Solidification/stabilization	No	This technology is not applicable to the removal of VOCs in soil.
	2. Soil flushing	No	Would require flushing wash solution through source area, which is presently covered by a parking lot; may not be uniformly effective on soils and there is difficulty in capturing the resulting solution.
	3. Dilution	No	Mixing of clean soils with contaminated soils to reduce concentrations to acceptable levels may be limited by volume of clean soils required and by depth of contamination. Generally not acceptable to regulatory agencies.

SUMMARY OF REMEDIAL TECHNOLOGIES FOR SOURCE CONTROL

Frost Street Sites

GENERAL RESPONSE ACTION	TECHNOLOGY TYPE/PROCESS OPTION	APPLICABILITY TO SITE	SCREENING COMMENTS
<i>In-situ Treatment (Continued)</i>	4. Soil vapor extraction	Yes	Proven, effective technology for VOC treatment; may be more cost effective than excavation and disposal alternatives; causes minimal disruption to the surrounding area; may be highly effective over the short duration. Presumptive remedy for VOC-contaminated soils.
	5. Photolysis	No	Application limited to surface soils.
	6. Electroacoustic separation	No	Emerging technology that removes inorganic contaminants from clayey soils. This technology is not applicable to the removal of VOCs in soil.
	7. Electrokinetics	No	Innovative technology that removes inorganics and some organics through electroosmosis and ion migration. This technology is not applicable to the removal of VOCs in soil.
<i>Removal</i>	Excavation	Yes	Excavation is feasible but may not be cost effective because the contaminants of concern are at depths in excess of 25 ft.
<i>Ex-situ Treatment</i>	A. Biological	No	Suitable for organic contaminants but other technologies exist that require less maintenance control.
	B. Thermal	Yes	Effective in reducing concentrations of VOCs. Due to space limitations and current land use, treatment should be performed off-site.
	1. Low-temperature thermal desorption	Yes	Most cost efficient of thermal treatment technologies. Could be considered as an off-site treatment technology.
	2. High-temperature thermal desorption	No	Not as cost effective as low-temperature thermal desorption due to higher operating temperatures.
	3. Vitrification	No	Expensive, energy-intensive process.
	4. Incineration (rotary kiln, fluidized bed, liquid injection, multiple hearth, or infrared)	No	Not as cost effective as low-temperature thermal desorption due to higher operating temperatures.
	5. Pyrolysis	No	Innovative technology that has not been commercially demonstrated.
	6. Molten salt/plasma arc	No	Innovative technology; application to hazardous waste sites has not been commercially demonstrated.

SUMMARY OF REMEDIAL TECHNOLOGIES FOR SOURCE CONTROL

Frost Street Sites

GENERAL RESPONSE ACTION	TECHNOLOGY TYPE/PROCESS OPTION	APPLICABILITY TO SITE	SCREENING COMMENTS
Ex-situ Treatment (Continued)	C. Physical/Chemical	Yes	Due to space limitations and current land use, treatment should be performed off-site.
	1. Solidification/stabilization	No	Ineffective for VOC treatment.
	2. Soil washing	No	Space limitations on site prohibit use. Residues may require further treatment and ultimate disposal.
	3. Dehalogenation (glycolate/base-catalyzed)	Yes	Space limitations on site prohibit use. Could be considered as an off-site treatment technology. Residues may require further treatment and ultimate disposal.
	4. X-ray treatment	No	Emerging technology that has limited application.
Disposal	A. Off-site landfill	Yes	Hazardous wastes exceeding LDR levels require treatment to satisfy numeric treatment standards prior to disposal. Nonhazardous wastes can be landfilled.
	B. On-site landfill	No	Likely to meet public opposition. Will not satisfy remedial action objectives.
	C. Off-site TSDF	Yes	Excavated wastes may be transported to a permitted TSDF for treatment (i.e., thermal, physical, chemical, etc.) and disposal.
	D. Waste pile	No	Wastes could not merely be collected and stored; they would require treatment. Does not achieve ultimate disposal goals of SARA. Appropriate only for temporary storage.
	E. Temporary storage	No	Space limitations prohibit use at the sites.

SUMMARY OF REMEDIAL TECHNOLOGIES FOR GROUNDWATER RESPONSE

Frost Street Sites

GENERAL RESPONSE ACTION	TECHNOLOGY TYPE / PROCESS OPTION	APPLICABILITY TO SITE	SCREENING COMMENTS
No Action	None	Yes	Required by the NCP.
Institutional Measures	A. Deed and Development Restrictions	Yes	May be used to prevent human contact with contaminants; will not prevent continued migration of contaminants in the groundwater.
	B. Groundwater Use Restrictions	Yes	Effective in preventing use of contaminated groundwater for potable or process source water.
Containment	A. Capping or surface sealing	No	Current land use prohibits the installation of a surface cap.
	B. Barriers	No	Must be tied into a low permeable formation, which does not exist at the Frost Street sites. Difficult to implement at depths of 100 ft below grade. Impractical to implement at site.
Collection	A. Groundwater pumping	Yes	Used in conjunction with other remedial actions to lower groundwater table and/or to extract contaminated groundwater for treatment and disposal.
1. Function			
	a. Extraction	Yes	Effective groundwater and contaminant plume control mechanism. This technology is dependent on aquifer characteristics and plume dimensions. Moderate aquifer transmissivities are desirable.
	b. Injection	Yes	Effluent from a pump and treat system can be discharged to injection wells.

SUMMARY OF REMEDIAL TECHNOLOGIES FOR GROUNDWATER RESPONSE

Frost Street Sites

GENERAL RESPONSE ACTION	TECHNOLOGY TYPE / PROCESS OPTION	APPLICABILITY TO SITE	SCREENING COMMENTS
Collection (Continued)	2. System Options		
	a. Well points or shallow wells	Yes	May be used to inject nutrients or chemicals into the ground or extract groundwater.
	b. Deep wells	Yes	May be used to extract groundwater to the surface.
	c. Pulsed pumping	Maybe	Innovative technology that encourages diffusion of contaminants from stagnation zones into capture zones while reducing the volume of recovered groundwater. Additional study of this technology is necessary to determine its suitability.
	B. Subsurface collection system	No	Impractical at Frost Street sites because groundwater is encountered at depths over 50 ft below grade.
In-Situ Treatment	A. Biological	No	A sufficient microbial populations is not believed to exist to conduct in situ bioremediation.
	B. Thermal	No	Not a primary remediation technology.
	1. Hot water or steam heating enhancement	No	Enhancement technique for vaporization of organic compounds.
	C. Physical/chemical	Yes	Potentially effective in reducing VOC concentrations.
	1. Passive treatment walls	No	Innovative technology for the removal of contaminants in subsurface permeable walls. Saturation of bed materials, plugging with precipitates, and short life of treatment materials make technology suitable primarily for temporary remediation.
	2. Funnel and gate systems	No	Combination of barriers and passive treatment walls. Similar limitations to passive treatment walls.
	3. Bioslurping	No	May not be effective in treating DNAPL contaminants.
	4. Hydraulic or pneumatic fracturing	No	Used to increase the permeability of low permeability formations, such as clays, tills, and bedrock, for subsequent in-situ treatment or groundwater extraction, especially for volatile organic contamination.

SUMMARY OF REMEDIAL TECHNOLOGIES FOR GROUNDWATER RESPONSE

Frost Street Sites

GENERAL RESPONSE ACTION	TECHNOLOGY TYPE / PROCESS OPTION	APPLICABILITY TO SITE	SCREENING COMMENTS
<i>In-Situ Treatment (Continued)</i>			
	5. Air sparging	Yes	May cause unsaturated zone to become more contaminated than it currently is. Generally implemented in conjunction with SVE to collect volatilized contaminants. Site-specific geological constraints may limit technology's effectiveness.
	6. Surfactants	No	Enhancement technology for increasing mobility and solubility of organic contaminants to improve pump and treat performance. Not widely applied to hazardous waste sites to date.
	7. Cosolvents	No	Enhancement technology for increasing mobility and solubility of organic contaminants to improve pump and treat performance. Not widely applied to hazardous waste sites to date.
	8. Electrokinetics	No	Innovative technology that removes inorganics and some organics through electro-osmosis and ion migration. Application has not been demonstrated extensively; significant bench- and pilot-scale tests would be required.
	9. Dual phase extraction	No	At the Frost Street sites, soil and groundwater contamination do not exist in the same vicinity. Use is impractical at sites.
	10. In-well air stripping	Yes	Pumping costs and permitting issues are reduced or eliminated. Simultaneous vadose zone treatment can occur via bioventing or soil vapor extraction.
	11. Monitored natural attenuation	No	Not expected to be able to reduce contaminant concentrations within a reasonable time frame.

SUMMARY OF REMEDIAL TECHNOLOGIES FOR GROUNDWATER RESPONSE

Frost Street Sites

GENERAL RESPONSE ACTION	TECHNOLOGY TYPE / PROCESS OPTION	APPLICABILITY TO SITE	SCREENING COMMENTS
Ex-Situ Treatment	A. Biological	No	Requires more operator attention than other similarly effective treatment technologies.
B. Thermal		No	Energy intensive; not usually effective for liquid contamination in the parts per million.
C. Physical		Yes	May be used in conjunction with other processes, as determined by waste characterization and treatability studies.
	1. Flow equalization	Yes	Mixing wastes of different concentrations; effective when combined with other treatment technologies.
	2. Sedimentation	Yes	Effective on particulate-phase contaminants only, such as suspended iron.
	3. Carbon adsorption	Yes	Applicable for effluent polishing. Effective in removing organics (through adsorption). Presumptive treatment technology for treatment of dissolved organic contaminants at CERCLA sites.
	4. Ion exchange	No	Generally effective for removal of inorganic contaminants only.
	5. Reverse osmosis	No	Expensive process in comparison with other treatment technologies. Membrane subject to chemical attack, fouling, and plugging.
	6. Air stripping	Yes	Effective for removal of volatile organics that is commonly applied at hazardous waste sites. Presumptive treatment technology for treatment of dissolved organic contaminants at CERCLA sites.
	7. Ultrafiltration	No	Effective for the removal of dissolved metals. Other inorganics or organics present as suspended or colloidal solids may also be removed.
	8. Synthetic sorptive resins	No	Effective, but is more suitable for thermally unstable compounds (i.e., explosives).
	9. X-ray	No	Emerging technology breaks down organic contaminants to nontoxic compounds. Commercial demonstration of this technology has not been performed.

SUMMARY OF REMEDIAL TECHNOLOGIES FOR GROUNDWATER RESPONSE

Frost Street Sites

GENERAL RESPONSE ACTION	TECHNOLOGY TYPE / PROCESS OPTION	APPLICABILITY TO SITE	SCREENING COMMENTS
Ex-Situ Treatment (Continued)	D. Chemical	Yes	May be used in conjunction with other processes, as determined by waste characterization and treatability studies.
1. Precipitation		Yes	Not effective for removal of organics, but may be needed to pretreat water prior to VOC treatment to remove iron and manganese.
2. Flocculation/coagulation		Yes	May be needed to pretreat water prior to VOC treatment to remove iron and manganese.
a. Chemical additives		Yes	Not effective for removal of organics, but may be needed to pretreat water prior to VOC treatment to remove iron and manganese.
b. Alternating current electrocoagulation		No	Not a proven technology used at hazardous waste sites.
3. Oxidation		Maybe	May effectively remove halogenated volatiles when combined with other processes. Incomplete oxidation may result in the presence of more toxic constituents (e.g., vinyl chloride).
a. Hydrogen peroxide oxidation		Maybe	Effective for the removal of organics.
b. Chlorine dioxide oxidation		No	Treats only cyanide; does not remove organics.
c. Catalytic oxidation		Maybe	May be applicable to removal of organics.
4. Reduction (sulfur dioxide, sodium bisulfite, sodium metabisulfite, or sodium hydrosulfite)		Maybe	May be effective for removal of halogenated volatiles from wastewaters when combined with other processes. Incomplete oxidation may result in presence of more toxic constituents (e.g., vinyl chloride).
5. Neutralization		No	Not effective for removing contaminants but may be necessary as pretreatment for other processes.
6. Chlorination		No	Treats only cyanide, not effective for organics.
7. UV oxidation/ozonation		No	Have high energy requirements or involve the use of hazardous materials.

SUMMARY OF REMEDIAL TECHNOLOGIES FOR GROUNDWATER RESPONSE

Frost Street Sites

GENERAL RESPONSE ACTION	TECHNOLOGY TYPE / PROCESS OPTION	APPLICABILITY TO SITE	SCREENING COMMENTS
Disposal/	A. Off-site treatment and/or disposal	No	Contaminated wastes (e.g., treatment residue) exceeding Land Disposal Restrictions (LDR) require pretreatment to satisfy standards prior to disposal.
	1. Publicly owned treatment works (POTW)	No	Discussions with local officials indicate that discharge to the POTW is not an option.
	2. Discharge via stormwater system	No	Contaminated groundwater will require pretreatment to satisfy the surface water standards prior to discharge to a stormwater collection system. Will likely meet local opposition.
	3. TSDF	No	Pumped groundwater may be transported to a permitted TSDF for treatment and disposal. Not cost-effective for large volumes of contaminated water. Treatment residue may need to be treated prior to disposal.
	B. On-site Discharge	Yes	Treated effluent could be discharged on-site.
	1. Deep well injection	No	Deep well injection requires penetrating confined layer beneath the contaminated aquifer. This may form a pathway for the contamination to expand below the confining layer.
	2. Seepage basin / Dry well injection	Yes	Treated effluent would require treatment to meet effluent limitations prior to discharge.
	3. Surface impoundment	No	Liquid wastes could not merely be collected and stored; would require treatment. Does not achieve ultimate disposal goals of SARA. Would require large area that is not available at site.
	C. Temporary storage	No	Space limitation prohibits use at the sites.

TABLE 11-3

SUMMARY OF REMEDIAL TECHNOLOGIES FOR AIR EMISSIONS CONTROLS

Frost Street Sites

GENERAL RESPONSE ACTION	TECHNOLOGY TYPE / PROCESS OPTION	APPLICABILITY TO SITE	SCREENING COMMENTS
No Action	None	Yes	The emissions generated from a treatment process may be below standards, in which case no air treatment would be required.
Institutional Measures	Access restrictions	Yes	Can prevent human contact with contaminants through restrictions on site uses.
Containment	A. Dust/particulate control measures	Yes	May be effective for controlling exposure to particulate-borne contaminants during remedial activities. Not intended for long-term controls.
	1. Water spraying	Yes	Not intended to be a long term control.
	2. Wind fences/screens	Maybe	May be effective in preventing dust migration from active work areas to other site areas if soil is exposed at any of these sites.
	3. Synthetic dust covers	Maybe	Used for preventing generation of airborne particulates from waste piles; may be needed if excavation of soil is required for the groundwater remediation.
	B. Capping or surface sealing	No	Capping via asphalt pavement already exists on a majority of the surface area of the three sites.
	C. Vertical barriers	No	Not necessary for gas control alone.
Collection	A. Dust collection - sweeping/vacuuming	Yes	Effective in removing dust from paved areas; not effective in active work areas.
	B. Gas collection	Maybe	May apply if a substantial amount of organic vapors are generated from other processes.
Treatment	A. Carbon adsorption	Yes	For off-gas treatment from other processes only. Not for direct site control. Spent carbon will require off-site regeneration or disposal.
	B. Catalytic Oxidation	Yes	For off-gas treatment from other processes only. Not for direct site control. Process generates hydrochloric acid.
	C. Photocatalytic Oxidation	Yes	For off-gas treatment from other processes only. Not for direct site control.

technology is to be implemented at the Frost Street sites. The use of innovative remedial technologies at the Frost Street sites is limited by the lack of data on the performance of the innovative. Some potentially applicable emerging technologies were also identified. Emerging technologies are defined as technologies that are proven in concept, but have not been demonstrated as being consistently effective at hazardous waste sites. Since emerging technologies are still under development, they are screened out of the analysis.

11.3.1 Source Controls

Source control technologies retained in this screening are those that are capable of remediating the shallow subsurface soils or the subsurface soils at depth. For the shallow subsurface soils, attractive remediation technologies include ones that are capable of remediating soils contaminated with chlorinated VOCs, PAHs, heavy metals, and pesticides. For the subsurface soils at depth, the COCs are PCE and TCE; therefore, different technologies may apply. The shallow subsurface soils and subsurface soils at depth, collectively, are referred to in this report as the “source area.” Contaminants in the source area could continue to leach to the underlying groundwater. Additional sampling may be required prior to the remedial design phase to further delineate the extent of subsurface soil contamination.

Control measures for the source area are discussed below. General response actions as source controls include institutional measures, containment, in-situ treatment, removal, ex-situ treatment, and disposal.

11.3.1.1 No Action. The no action option is included as a basis for comparison with active soil remedial technologies in accordance with the NCP and 6 NYCRR Part 375. If no remedial action is taken, contaminants already present in the soil will remain in place or continue to leach to the underlying groundwater. Additionally, contaminants, particularly chlorinated VOCs, may transform to form other compounds over time. In the absence of active soil remediation, any decreases in the contaminant mass will occur as a result of natural attenuation processes. The no action alternative is retained for further evaluation.

11.3.1.2 Institutional Measures. Institutional measures applicable to the site include access, deed, and development restrictions. Access restrictions include the installation of physical barriers, such as fencing, which would prevent unauthorized access to site areas.

Access restrictions are impractical at the Frost Street sites because they would significantly interfere with current site operations. Access restrictions are screened out of the technology evaluation analysis. Deed and development restrictions are intended to prevent human contact with contaminated media through restrictions on site uses. Deed restrictions limit or prohibit certain uses or development of the site in the event of a property transfer and serve to notify prospective owners of the existence of remaining contamination at the site. Development restrictions serve similar purposes to those of deed restrictions but apply to any new construction initiated by the current property owners. Deed and development restrictions are retained for further evaluation.

11.3.1.3 Containment. The in-place containment of contaminated soils may be accomplished through capping or surface sealing. These containment technologies would prevent stormwater infiltration to contaminated areas, thereby eliminating a pathway of contaminant migration to groundwater. All three of the Frost Street sites are currently covered with pavement or occupied by buildings. Stormwater that collects on the pavement and building rooftops is channeled to on-site dry wells, where it is injected into the ground. In order for a cap to be effective, the stormwater would need to be rerouted to another area (e.g., rerouted off-site) where it would not impact the soil contaminants. Rerouting of the on-site stormwater system would negatively impact on-site operations and may be prohibited by the local public works department. Current land use prohibits the installation of a surface cap to contain contaminated soils. Therefore, containment options are screened out of the evaluation.

11.3.1.4 In-Situ Treatment. In-situ soil treatment technologies potentially applicable to this site include biological, thermal, and physical/chemical treatment processes. Many of these processes are innovative technologies, with limited commercial demonstration at hazardous waste sites; therefore, their applicability to the site and feasibility may require further evaluation in a treatability or pilot-scale study.

Biological Treatment. Biological treatment technologies include biodegradation, bioventing, and phytoremediation. Biodegradation is a process in which indigenous or inoculated microorganisms (i.e., fungi, bacteria, and other microbes) degrade (metabolize) organic contaminants in soil or groundwater. In the presence of sufficient oxygen (aerobic conditions), microorganisms will ultimately convert many organic contaminants to carbon dioxide, water, and microbial cell mass. In the absence of oxygen (anaerobic conditions), the contaminants will be ultimately metabolized to

methane, a limited amount of carbon dioxide, and trace amounts of hydrogen gas. In situ bioremediation of soil typically involves the percolation or injection of groundwater or uncontaminated water mixed with nutrients and saturated with dissolved oxygen. Biological treatment technologies do not appear to be appropriate for application on site soils because microbial populations are not expected to be present to stimulate sufficient biodegradation at the Frost Street sites. Additionally, the breakdown compounds of some of the contaminants may be more harmful than the target contaminant. Due to the concerns raised above, biological treatment technologies were screened out of the evaluation.

Thermal Treatment. Thermal treatment processes for soil decontamination include vitrification and radiofrequency/electrical resistance heating. In situ vitrification (ISV) uses an electric current to melt soil at extremely high temperatures (1600 to 2000°C), thereby immobilizing most inorganics and destroying organic pollutants by pyrolysis. Vitrification results in significant subsidence of the treated soils and would preclude future construction in or near treated areas. Vitrification is an expensive, energy intensive process. Radiofrequency or microwave heating generates superheated steam from the groundwater to vaporize organic constituents present in the unsaturated zone. Radiofrequency and microwave heating are generally used in conjunction with an extraction technology, such as soil vapor extraction. Radio frequency and microwave heating are technologies that have not had wide spread application and are still being demonstrated. For the reasons explained above, in situ thermal treatment technologies were screened from the evaluation.

Physical/Chemical Treatment. A wide variety of physical/chemical treatment technologies are available for application to soils, including solidification/stabilization (S/S), soil flushing, chemical degradation/detoxification, dilution, soil vapor extraction (SVE), pneumatic and hydraulic fracturing, photolysis, electroacoustic separation, and electrokinetics. S/S is a common technology for treatment of heavy metals in soils, but is not applied to VOC-contaminated soils, therefore, S/S is not considered to be applicable at the Frost Street sites.

In-situ soil flushing is the extraction of contaminants from in-place soil by introducing a flushing fluid to dissolve adsorbed contaminants using an injection or infiltration process. The flushing solution must be recaptured and appropriately treated, recycled, and/or disposed of. At the Frost Street sites, it may be difficult to apply the flushing solution

uniformly and then recapture it since the sites are covered by buildings and parking lots. Furthermore, it would be difficult to apply the flushing solution uniformly to contaminated soils that are present at 25 ft bgs and deeper. For this analysis, soil flushing is eliminated from further consideration due to the concerns discussed above.

Dilution involves mixing contaminated soils with clean soils to reduce the overall contaminant concentrations to acceptable levels. This option is generally not acceptable to regulatory agencies and is screened out of the evaluation.

In SVE, a vacuum is applied to vapor extraction points installed in the soil. The vacuum creates a pressure gradient that induces volatilized contaminants to diffuse through the soils to the extraction wells for removal. The SVE technology has been successfully demonstrated to remove VOC-contaminants from soils. In fact, SVE is a presumptive remedy for CERCLA sites with VOCs in soils (EPA 1993). Presumptive remedies are preferred technologies for common categories of sites, based on historical patterns of remedy selection and EPA's scientific and engineering evaluation of performance data on technology implementation. The application of SVE causes minimal disruption to site operations, which is beneficial given the industrialized/commercialized use of the Frost Street sites. Therefore, SVE is retained as a viable technology to apply at the Frost Street sites.

Photolysis is the destruction of organic contaminants by exposure to light (e.g., sunlight or ultraviolet [UV] light). The application of photolysis is limited to surface soils if applied in-situ. Photolysis is not effective in degrading contaminants present in deep subsurface soils and is not given further consideration.

Electrokinetic remediation is an innovative technology that is conducted using direct currents across electrodes. The contaminants are either deposited at the electrode or removed from the conditioning fluid that circulates at the electrodes by a purification process. Electroacoustic separation employs the electrokinetic remediation technology with the added feature of an acoustic source, which is used to generate acoustic waves to increase the leaching rate of contaminants. Due to the limited application of the electrokinetic remediation and electroacoustic separation technologies, they are not given further consideration for use at the Frost Street sites.

11.3.1.5 Removal. Through excavation contaminants are permanently removed from the site, although appropriate treatment and/or disposal of the excavated materials is required prior to landfilling or reuse. Soil excavation may be accomplished using conventional earthmoving equipment (e.g., clamshell excavator or vacuum truck); however, it may be difficult and cost prohibitive at the depths where contaminated soils exist (25 to 50 ft bgs). The sidewalls of any excavation deeper than 4 ft would need to be supported to prevent collapse. Dewatering may also be needed. Since these anticipated difficulties are within the realm of normal construction contingencies, excavation is retained as a feasible alternative.

11.3.1.6 Ex-situ Treatment. Most excavated contaminated soils will require treatment prior to disposal. Treatment technologies would need to successfully reduce contaminant levels in order to reuse or dispose of the soils. Because the Frost Street properties are currently used to operate commercial or industrial businesses, soil could not be treated on-site. Therefore, only off-site commercially available treatment technologies are retained in the technology screening evaluation.

Biological Treatment. Biological treatment options for excavated soils include slurry and solid-phase biodegradation processes and landfarming. Slurry-phase biological treatment involves the controlled treatment of excavated and processed soil in a bioreactor. Soil and nutrient-amended water are combined to form an aqueous-phase slurry of 10 to 40% solids by weight; the solids are kept in suspension and oxygen is supplied to promote the bacterial metabolism of contaminants, primarily organics. Upon completion, the soil slurry is dewatered. In solid-phase bioremediation, the excavated soil is generally mixed with nutrients and placed on a treatment area that includes leachate collection systems and some form of aeration. The landfarming technology involves applying contaminated soils on a lined surface and periodically turning them for aeration. All three biological treatment processes have been demonstrated to remove volatile nonhalogenated organic and hydrocarbon contaminants, but have been less effective on metals, volatile halogenated organics, semi-volatile organics, and pesticides. In comparison to biological treatment technologies, more cost-effective ex situ treatment technologies exist to remove chlorinated VOCs from soils. Therefore, biological treatment technologies were screened out of the analysis.

Thermal Treatment. The thermal treatment techniques that have the potential to handle on-site soils include low- and high-temperature thermal desorption, vitrification,

incineration, and pyrolysis. Thermal desorption is a process that physically separates volatile contaminants from soil by heating the contaminated media. Low-temperature thermal desorption units typically run at temperatures between 200 and 600°F, while high-temperature units run between 600 and 1000°F. Offgases may be burned in an afterburner, condensed to reduce the volume to be disposed of, or captured by carbon adsorption beds. Ex situ vitrification is similar to in situ vitrification except that the contaminated soil is conditioned and blended to promote more uniform treatment. Incineration uses high temperatures (1600 to 2200°F) to volatilize and combust contaminants. Incineration technologies include rotary kiln, fluidized bed, multiple hearth, pyrolytic, infrared, plasma arc, and molten salt systems. Thermal desorption and incineration are both presumptive remedies for CERCLA sites with VOCs in soils (EPA 1993). If thermal desorption or incineration is used, treated soil may require additional treatment to remove heavy metal and pesticide contaminants. All of the thermal treatment technologies described above are applicable, however, the most cost-effective of these, and the only one that is retained for further evaluation, is low-temperature thermal desorption.

Physical/Chemical Treatment. Physical or chemical treatment technologies for excavated soils include S/S, soil washing, dehalogenation, x-ray treatment, and photolysis (including UV light treatment). S/S is generally applied to immobilize inorganic contaminants and is therefore not applicable at the Frost Street sites. In soil washing, contaminants sorbed onto soil particles are separated from the soils using a washing fluid. Space limitations at the Frost Street sites preclude the use of soil washing as a feasible technology. Dehalogenation and x-ray treatments also require large amounts of space for soil stockpiling, which the Frost Street sites do not have and, therefore, these technologies are eliminated from further consideration. If these technologies are commercially available at off-site locations, the cost and feasibility of treating site soils should be evaluated in the design stage.

11.3.1.7 *Disposal.* Disposal options for excavated soils include disposal to an off- or on-site landfill; a treatment, storage, and disposal facility (TSDF); or a waste pile. Land disposal of contaminated materials, partially treated materials, and fully treated materials can only be conducted off-site as on-site disposal would receive negative public criticism and not be feasible. If necessary, contaminated materials may be temporarily stored on-site prior to being disposed of off-site.

Untreated excavated wastes may be transported to an approved waste handling facility or treatment, storage, and disposal facility (TSDF) based on TCLP results. Treatment of hazardous waste performed by TSDFs could include low-temperature thermal desorption, incineration, or dechlorination. The ash, residue, or stabilized product generated from treatment may then be disposed of in a secure landfill depending on the chemical and leaching characteristics of the waste. The contaminated soils would not be suitable for land application either on- or off-site except as fill, however, the wastes would need to be treated to meet all applicable requirements prior to land placement. As waste piles are not an acceptable disposal option, appropriately constructed piles (i.e., lined, covered, and bermed) may be necessary for temporary storage of waste prior to treatment or off-site transport. The number of storage options is limited at the site due to space restrictions; storage options include drums, roll-off containers, and dump trucks.

11.3.2 Groundwater Response

Control measures for the near-field groundwater contaminant plume are discussed in the following subsections. General response actions for groundwater response include no action, institutional measures, containment, collection, in-situ treatment, on-site treatment, and disposal.

11.3.2.1 No Action. The no action option is included as a basis for comparison with active groundwater remedial technologies in accordance with the NCP and New York State hazardous waste regulations (6 NYCRR Part 375). Contaminants already present in the groundwater will continue to migrate from the Frost Street sites with this no action general response action.

11.3.2.2 Institutional Measures. Institutional measures applicable to these sites include deed and development restrictions. Deed and development restrictions are intended to prevent human contact with contaminated media through restricted on-site uses. Deed and development restrictions may restrict future actions involving the groundwater medium at the sites. Deed restrictions limit or prohibit certain uses or development of the sites in case of a property transfer, and serve to notify prospective owners of the existence of remaining contamination at the site. Development restrictions serve similar purposes to those of deed restrictions, but apply to any new construction initiated by the current property owners. Groundwater use restrictions may be applied to prevent future site

users from employing contaminated groundwater as a potable or process water source. Institutional measures are retained for further consideration in the screening process.

11.3.2.3 **Containment.** Capping, or surface sealing, will prevent the infiltration of storm water thereby minimizing the flow of uncontaminated runoff water into the contaminated groundwater. All three of the Frost Street sites are currently covered with pavement or occupied by buildings, which act as a surface cap. However, stormwater that collects on the pavement and building rooftops is channeled into on-site dry wells where it infiltrates into the ground. In order for a cap to be effective, the stormwater would need to be rerouted to another area (e.g., rerouted off-site) where it would not impact the soil contaminants. Rerouting of the on-site stormwater system would negatively impact on-site operations and may be prohibited by the local public works department. Current land use (on-site businesses) prohibits the installation of a surface cap. Therefore, surface capping and sealing options are screened out of the evaluation.

Vertical or horizontal barriers are another type of technology for containing contaminated groundwater and/or preventing contaminant migration. Their applicability is dependent on site-specific geological conditions. A number of different subsurface barrier options are available for groundwater containment, including vertical barrier placement options and construction materials. Barriers may be placed downgradient from the area of highest concentration to decrease or prevent the migration of contaminated groundwater into uncontaminated areas. They may also be placed upgradient from the area of highest concentration to decrease or prevent the flow of uncontaminated groundwater into the area of the highest contamination. The most effective method of barrier wall placement is to completely surround the contaminant plume, thereby isolating the area of highest concentration. Vertical barriers must be keyed into a low permeability formation (e.g., bedrock, or clay). The use of vertical barriers at the Frost Street sites is not recommended because of the impracticality of containing the near-field plume. The zone of contamination is known to extend beyond 100-ft deep and there is no low permeability formation to key in a barrier. Horizontal barriers may be installed to form a “floor” beneath the area of highest concentration; this technique is referred to as “bottom sealing”. However, construction of a horizontal barrier at depths of over 100 ft and over such a wide area is impractical. For these reasons, vertical and horizontal barriers were screened out of the technology evaluation.

11.3.2.4 Collection. Groundwater pumping is the most common collection method and is used to extract contaminated groundwater for subsequent treatment and discharge. Pumping may also be used to lower the water table in specific areas of the site to prevent the leaching of contaminants into the groundwater and to reduce and/or reverse the direction of groundwater flow. Pumping can be instituted alone or in conjunction with other remedial technologies.

Extraction wells can be used for plume containment, groundwater restoration, or both. Application of this technology is dependent on aquifer characteristics and plume dimensions, as well as extracted groundwater treatment and disposal options. The relatively coarse and unconsolidated nature of the on-site soil is such that hollow stemmed auger drilling could be used to install remediation wells.

Wells can be used to inject nutrients, steam, or hot water, if required by a remedial technology. In order to be effective, moderate aquifer transmissivity is desirable. Gravity fed injection wells are usually used for shallow contamination and are placed close together because the injected reagent flows mostly downward and not laterally. To enable more lateral flow, shallow gravity fed injection wells are used in conjunction with extraction wells. Pressurized injections are used for deeper wells, where the reagents are released at the bottom of the well. Shallow and/or deep wells may be needed on the Frost Street sites to achieve the remedial objectives.

Another groundwater pumping system option is an innovative technology called pulsed pumping. Pulsed pumping involves the use of a noncontinuous pumping regime to encourage the diffusion of contaminants from stagnation zones into capture zones while reducing the overall volume of recovered groundwater. Additional study of this technology is necessary to determine its suitability on these sites.

Subsurface collection systems are effective groundwater and runoff collection mechanisms. These two mechanisms may be useful for controlling the movement of groundwater at each site. This technology acts to centralize groundwater collection by increasing hydraulic conductivity locally within the saturated zone, and could be designed to enhance the capture and avoid the escape of contaminants around the collection system. Process options for a subsurface collection system include French drains, interceptor trenches, and pipe drains. Groundwater at the Frost Street sites is encountered at depths of over 50 ft making subsurface collection systems impractical to

implement. Subsurface collection systems are better implemented at sites where the groundwater table is shallow.

11.3.2.5 In-Situ Treatment. In-situ treatment technologies include remedial technologies that treat groundwater contaminants in place without bringing them to the surface (via pumping). These techniques are most effective where the contaminant plume is controllable, well defined, homogeneous, shallow in depth, and relatively small in areal extent. In-situ groundwater treatment technologies that are potentially applicable to the Frost Street sites include biological, thermal, and physical/chemical treatment processes. Also, monitored natural attenuation is introduced in this section as a potentially viable in-situ technology.

Biological Treatment. Enhanced biodegradation exploits the ability of indigenous or introduced bacteria to biodegrade organic compounds under favorable soil conditions by optimizing such factors as oxygen content, pH, and temperature of the groundwater. Some chlorinated compounds, such as PCE and TCE, are biodegraded in the environment, but the process is slow and the degradation products may still be toxic. This in-situ technology requires injection of nutrients into the subsurface. Nitrate enhancement has proven to be effective only for gasoline constituents to date. Oxygen enhancement with peroxide is usually used in conjunction with pump and treat systems to enhance the rate of biodegradation of organic contaminants by naturally occurring microbes. Discussions with NYSDEC have indicated that a sufficient microbial population is not believed to exist to conduct in situ bioremediation. Therefore, enhanced biological treatment is not evaluated further in this analysis.

Thermal Treatment. In-situ thermal treatment processes strive to enhance the recovery of volatile and semi-volatile organic contaminants by volatilization. In this process, hot water or steam is forced into the aquifer via injection wells. Vaporized contaminants rise to the unsaturated zone where they can be removed by vacuum extraction and then treated. Thermal treatment techniques can be used to enhance contaminant recovery, but are not recommended as a primary treatment technology. Thermal treatment technologies are not retained for further consideration in the FS.

Physical/Chemical Treatment. Physical and chemical in-situ treatment technologies include passive treatment walls, funnel and gate systems, bioslurping, hydraulic or pneumatic fracturing, air sparging, surfactants, cosolvents, electrokinetics, dual phase

extraction, and in-well air stripping. The application of some of these technologies may be limited at deeper depths in the saturated zone (e.g., greater than 80 ft bgs). Passive treatment walls or beds are an innovative technology for the removal of contaminants from groundwater by subsurface beds (commonly called in-situ reactors) filled with adsorptive or reactive media (e.g., ion-exchange resins or limestone) through which contaminated groundwater flows. Within the adsorptive or reactive media, contaminants are captured and degrade over time. Disadvantages of this technology may include saturation of bed materials in a relatively short time and plugging of the bed with precipitates. The system also requires consistent control of pH levels to maintain the effectiveness of the treatment wall. Due to the areal extent and great depth of the contaminant plume, it may be difficult or impossible to construct and install the treatment beds. A funnel and gate system consists of strategically placed in-situ barriers that direct groundwater flow into passive treatment walls, thereby reducing the size of the treatment wall required. The "gate" part of this treatment system, i.e., the passive treatment wall, is subject to the same limitations as described above. For the reasons given, passive treatment walls and the funnel and gate system were eliminated from the screening process.

Bioslurping uses vacuum-enhanced dewatering techniques to minimize the amount of groundwater and air that is extracted and will need treatment. This technology is best suited toward removing light non-aqueous phase liquid (LNAPL). After the free product has been removed, the system can be converted into a conventional bioventing system. Bioslurping has been screened from further discussions because it treats LNAPLs, not the dense non-aqueous phase liquids (DNAPLs) that are believed to be present in the groundwater.

Hydraulic or pneumatic fracturing is usually applied to low permeable formation, such as clays, till and bedrock. None of these formations are present at the Frost Street Sites and the technology is screened out of the analysis.

Air sparging is an in-situ groundwater treatment technology applicable for the removal of VOCs and is applied by forcing compressed air into the subsurface to volatilize the contaminants present. The volatilized contaminants rise to the unsaturated zone where they are usually captured with a soil vapor extraction system and brought to the surface for treatment. Air emissions generated must be monitored and treated appropriately. This technology is best suited for sites with coarse-grained materials (e.g., sand); this

technology is not suitable in formations containing low permeability lenses or at depths where the sparging activity cannot be controlled. Air sparging has been retained as a feasible technology for use at the Frost Street sites.

Controlled injection of surfactants or cosolvents into the groundwater is an emerging technology that is used to mobilize or dissolve contaminants. The surfactant and cosolvent flushing methods are used in conjunction with a conventional groundwater pump-and-treat system to increase the removal rate of non-aqueous phase liquids (NAPL) by increasing the apparent solubility of the contaminant and reducing interfacial tension between the water and the NAPL. The use of surfactants and cosolvents at hazardous waste sites has not been fully demonstrated; furthermore, there is the potential for an undesirable condition to develop, such as the degradation of contaminants into more toxic compounds or a plume that is uncontrollable. For these reasons, surfactants and cosolvents were not retained in the screening process.

Electrokinetic remediation is an innovative treatment technology that separates and extracts heavy metals and some organic contaminants from saturated soils by applying a low intensity direct current on either side of a contaminated area. The electrical current causes electro-osmosis and ion migration, which moves the aqueous phase contaminants in the subsurface from one electrode to the other. The contaminants are then extracted and placed into a recovery system or deposited at the electrode. The electrokinetic remediation process has had limited commercial application at hazardous waste sites and is, therefore, screened from the technology review process.

Dual phase extraction is applied by simultaneously removing liquid and gas from low permeability formations using a vacuum extraction well that is screened in the unsaturated and saturated zones. As the vacuum is applied to the well, soil vapor is extracted and groundwater is entrained by the extracted vapors. Once above grade, the extracted vapors and groundwater are separated and treated. Dual phase extraction is generally combined with other technologies (e.g., air sparging or bioventing) that are intended to extract VOCs. Dual phase extraction wells are effective when soil and groundwater contamination exist directly below one another, which is not the case at the Frost Street sites; therefore this technology is not further evaluated.

In-well air stripping consists of two major components: 1) pressurized air flow generation and delivery and 2) vacuum extraction. These wells are placed in the areas of the highest

VOC contaminant concentrations and in areas to contain off-site contaminant migration. Vertical wells are installed and connected to a vacuum system. Many types of in-well air stripping have been proven to successfully treat DNAPLs. This technology has the best results in sandy soils and, according to commercial vendors, can be applied at depths of 150-ft bgs. In-well air stripping has been retained in the technology screening process.

Monitored Natural Attenuation. Monitored natural attenuation (MNA) refers to the remediation technology wherein natural processes that reduce contaminant concentrations in the environment are periodically monitored. Natural processes that reduce contaminant concentrations in the environment include biodegradation, oxidation, volatilization, and dilution. Due to the relatively high concentrations of chlorinated VOCs at the three sites, it is not anticipated that natural attenuation can produce a 99.99% reduction (greater than 10,000 µg/l to below 5 µg/l) in VOC concentrations over a reasonable period of time (less than approximately 30 years). Therefore, MNA has not been retained in this evaluation for further analysis.

11.3.2.6 Ex-Situ Treatment. A wide variety of technologies are available for the treatment of collected groundwater when it is brought up to the surface, including biological, thermal, physical, and chemical methods. The choice of an appropriate treatment technology is dependent on the nature and concentration of the contaminants present as well as the relative cost and effectiveness of each of the technologies. The presence of more than one type of contaminant in the water stream may require the use of more than one process option in a treatment train. A brief discussion is presented below which describes the available process options for treating collected groundwater via biological thermal physical and chemical technologies.

Biological Treatment. Biological treatment technologies that may be applicable to collected groundwater include treatment in an aerobic and anaerobic reactor. Examples of aerobic reactors include activated sludge, trickling filters, and rotating biological contactors. These technologies are generally applicable for the removal of organic constituents (volatile and semi-volatile compounds) only; the presence of heavy metals may inhibit biological treatment. Activated sludge or trickling filters may be used in conjunction with other treatment processes for the removal of metals. The applicability of these processes to treating collected groundwater needs to be determined in a treatability study. Rotating biological contactors can handle relatively low-strength wastes as compared to the activated sludge and trickling filter processes. Anaerobic

filters are generally used for pretreatment of strong wastes. Biological treatment technologies generally require more operator attention than other types of technologies, therefore, they are screened out of the evaluation.

Thermal Treatment. Thermal treatment technologies may be effective for removing organic constituents from collected groundwater. Appropriate treatment of air emissions is required to remove any volatilized constituents prior to their release into the atmosphere. Thermal treatment units that have the potential to handle liquids include incinerators (e.g., rotary kiln, fluidized or circulating bed, liquid injection, or infrared), wet air oxidation, and molten salt/plasma arc units. Incineration is an energy-intensive process and is not generally effective for liquid streams with parts per million (ppm) contaminant concentrations. Wet-air oxidation and molten glass/plasma arc are both innovative treatment technologies that have not yet been commercially demonstrated at hazardous waste sites, therefore, their reliability and effectiveness are unknown. Administrative difficulties, including air emissions permitting requirements and potential public opposition, may make thermal treatment less likely to be implementable than other comparable treatment technologies. For these reasons, none of these thermal technologies have been retained in the screening process.

Physical Treatment. Numerous physical treatment processes are available for removing organic constituents from collected groundwater. Flow equalization (i.e., mixing of waste streams of different strengths) and sedimentation are commonly applied technologies for reducing contaminant concentrations. Sedimentation is a technology that captures settleable solids from a liquid stream. Sedimentation, in the form of clarification, is retained as a feasible technology option. Activated carbon is a commonly used treatment process for removing organics (through adsorption) and metals (through filtration). Granular activated carbon (GAC) adsorption is a presumptive treatment technology for treatment of dissolved organic contaminants in groundwater of CERCLA sites (EPA 1996). Activated carbon adsorption is also used as an effluent polishing step. Flow equalization and activated carbon adsorption have been retained for further evaluation.

Ion exchange can remove dissolved metals and radionuclides from an aqueous solution. Oil, grease, and suspended solids may decrease the efficiency of this technology. A wastewater is produced that would require treatment. This technique has not been retained because it does not effectively treat volatile organics. Reverse osmosis is a

separation process that forces water through a membrane. The water containing the contaminants that was not able to pass through the membrane is recirculated back to a treatment unit where organic vapors are extracted by a vacuum and then are condensed, thereby minimizing air releases. This wastewater is a small fraction of the original amount of water that needs to be treated, but will need to be disposed of. Because the membrane is susceptible to chemical attack and being clogged, this process has not been continued for further discussion.

Air stripping is a full-scale technology that removes volatile organics from the groundwater by greatly increasing the surface area of the contaminated water that is exposed to the air. Air stripping is a presumptive treatment technology for treatment of dissolved organic contaminants in groundwater of CERCLA sites (EPA 1996). There are many types of aeration techniques that could be utilized (e.g., packed towers, diffused aeration, tray aeration, and spray aeration). This technology has been retained for further study because of its ability to remove volatiles and DNAPLs from the groundwater.

Ultrafiltration is a mechanical separation process based on particle size. The particles are separated by forcing liquid through a semipermeable membrane, whereby only the particles that are smaller than the openings in the membrane can fit through. This technology has not been retained. Synthetic sorptive resins are similar to the carbon adsorption process and can be designed to achieve higher degrees of selectivity and adsorption capacity for certain compounds than activated carbon. The synthetic resin process is more suitable for thermally unstable compounds, such as explosives, and is therefore screened from further discussions. Using x-rays to break down organic contaminants into nontoxic compounds is an emerging technology that has not been commercially demonstrated and is, therefore, not continued in the screening processing.

Of the physical treatment technologies, flow equalization, sedimentation, carbon adsorption, and air stripping have been retained for further evaluation.

Chemical Treatment. Chemical treatment technologies that may be applicable at these sites in conjunction with other processes include precipitation, flocculation/coagulation, oxidation, reduction, neutralization, chlorination, and ultra-violet (UV) light oxidation/ozonation. Both precipitation and flocculation/coagulation with chemical additions have proved effective for the removal of heavy metals. Precipitation may be needed to pretreat the contaminated groundwater prior to VOC removal of iron and

manganese. Flocculation/coagulation may also be conducted using alternative current electrocoagulation, however this is not a commonly used, or proven technology at hazardous waste sites. These processes are effective primarily in the removal of inorganics; treatability studies may need to be conducted to evaluate their effectiveness and optimum operating conditions. Precipitation, flocculation, and coagulation are retained as feasible technologies.

Oxidation and reduction may effectively remove inorganics and VOC when combined with other processes. Incomplete oxidation or reduction may result in the presence of more toxic constituents. Oxidation using hydrogen peroxide is effective for the removal of organics only, while chlorine dioxide oxidation and chlorination are effective primarily for cyanide removal and do not remove metals or organics. Catalytic oxidation uses metal oxides (e.g., nickel oxide, copper oxide, manganese dioxide, and chromium oxide) to oxidize VOCs. Oxidation with hydrogen peroxide and catalytic oxidation have been retained; chlorine dioxide oxidation has not been retained.

Neutralization is not generally effective for the removal of metals, but may be required to meet discharge limitations or as pretreatment for other processes. Chlorination has been shown to treat cyanides, and is not effective for organic removal. UV oxidation or ozonation treatment may be effective in removing organics when used in conjunction with other processes. UV oxidation is a presumptive treatment technology for treatment of dissolved organic contaminants in groundwater of CERCLA sites (EPA 1996). However, UV oxidation has high-energy requirements and ozonation requires the use of hazardous chemicals in its operations. Neutralization, chlorination, and UV oxidation/ozonation have been eliminated from further discussions.

11.3.2.7 Disposal. Disposal, or discharge, options for collected groundwater are dependent on the quantities of water for disposal, pretreatment/treatment requirements, and regulatory considerations. Disposal options were divided into off-site and on-site options and discussed below.

Off-site Discharge. Off-site facilities that may potentially accept effluent from these sites include the local publicly owned treatment works (POTW), local stormwater collection system, or a treatment, storage, or disposal facility (TSDF). The POTW will likely require pretreatment of the collected groundwater to meet the POTW pretreatment standards prior to being discharged. Conversations with the local public works

department indicate that the sewer authority will not accept a continuous flow of groundwater into the sewer system. Therefore, discharge to the local POTW was eliminated as an option.

Any effluent discharged to the local stormwater collection system would need to satisfy the NYSDEC groundwater standards (6 NYCRR Part 700) prior to discharge. The underground piping may need to be upgraded in order to accept a continuous flow from the Frost Street sites. Due to these limitations, discharge to an off-site stormwater collection system is eliminated as an option.

On-site Discharge. On-site discharge options include deep well injection, infiltration through recharge basins and/or dry wells, or containment in a surface impoundment. On-site discharge would require treatment to meet applicable NYSDEC groundwater quality standards. Deep well injection is not a practical option at the Frost Street sites due to the site-specific geologic conditions. Injection into recharge basins is an acceptable discharge option as the effluent is allowed to infiltrate into the ground below the Frost Street sites. Appropriate permits or permit equivalents would need to be obtained for this disposal option. Surface impoundments could not be used at the Frost Street sites due to space limitations and the current use of the sites.

11.3.3 Air Emissions Controls

At the Frost Street sites, the use of air emissions controls should be evaluated and implemented if: 1) if a source control or groundwater response treatment technology produces air emissions that require control under regulatory requirements, or 2) if soil excavation produces air borne dust that may cause harmful exposure to chemicals.

Air emissions control measures are discussed in the following subsections. General response actions for air emissions controls include no action, institutional measures, containment, collection, and treatment.

11.3.3.1 No Action. The no action option is included as a basis for comparison with active air emissions control technologies in accordance with the NCP. In the no action option, there are no specified air emissions controls. The no action general response has been retained.

11.3.3.2 ***Institutional Measures.*** Institutional measures for air emissions controls are intended to reduce the possibility of human contact with contaminants present at these sites, however their effectiveness is limited as they provide a small deterrent to unauthorized access and do not provide protection for workers at these sites. Institutional measures, such as fencing, are generally used in conjunction with other remedial actions. Institutional measures have been retained in the screening process.

11.3.3.3 ***Containment.*** Dust/particulate control measures such as water spraying, wind fences or screens, and synthetic dust covers may be cost-effective measures to reduce concentrations of air contaminants during remedy implementation. Periodic wetting (with water) of unpaved surfaces may also help minimize the generation of dust. Wind fences or screens may be used to prevent dust migration from the active work areas to other site areas, and synthetic covers may prevent the generation of airborne particulates from excavated waste piles. These dust/particulate control measures are short-term actions only; they are not intended as long-term remedial measures. All of these dust control measures have been retained for further discussions.

Capping and surface sealing are already being implemented at the Frost Street sites as the sites are covered by asphalt pavement or buildings. Capping and surface sealing would not control air emissions during active remediation processes, therefore, capping and surface sealing are eliminated from the screening process.

Vertical barriers may also be used to control the migration of gases in the subsurface, but are more commonly used for groundwater response or structural stabilization. If used for groundwater response off-gas production, gas control may be a secondary benefit; however, vertical barriers are not deemed necessary at this site for gas control alone. Vertical barriers were discussed in detail in a previous part of the groundwater response section and have been eliminated from further discussions as an air control measure.

11.3.3.4 ***Collection.*** Sweeping and vacuuming are effective dust and particulate control methods that may be implemented at this site. They are effective in paved areas only, however, and cannot be used in any active work areas that may be present during the time of the remediation activities. Volatilized organics may be collected at the site using gas extraction wells, collection headers, and vacuum blowers or compressors if substantial amounts of vapor organics are generated in the remedial process. Dust collection and gas collection have been retained in the screening process.

11.3.3.5 **Treatment.** Several technologies exist for the treatment of collected gases or off-gases (containing VOCs) from other treatment technologies employed at the site; including carbon adsorption, catalytic oxidation, and photocatalytic oxidation (PCO) treatment. All three process options are effective in removing VOC contaminants and are not designed to remove metals, if present, from the collected gases. The selection of a particular gas treatment option depends on the selection of the primary process option, the specific contaminants to be removed or destroyed, and the relative costs of each technology. For the Frost Street sites, the air emissions control technology must be capable of reducing low-level VOC concentrations from a remediation unit (e.g., air stripper) to satisfy regulatory requirements.

Carbon adsorption treatment involves transferring an air stream into vapor phase granular activated carbon to remove VOCs. Catalytic oxidation treatment provides thermal destruction of contaminants at relatively low temperatures and has proven to be effective with many dilute VOC contaminated air emissions. Catalyst activity may be negatively affected by the presence of chlorine or sulfur in treated air emissions. Treatment of chlorinated VOCs will result in the generation of hydrogen chloride, which may require further treatment. (RTN 1999)

Photocatalytic Oxidation (PCO) is a destructive process for the treatment of gas-phase waste streams. It is best suited for treating waste streams with contaminant concentrations of 1000 ppm or less, and with low to medium flow rates of less than 20,000 cubic feet per minute. This technology is applicable to chlorinated solvents such as TCA, TCE, and PCE. The PCO technology utilizes a titanium compound catalyst, usually titanium dioxide (TiO_2), and near-ultraviolet light to contact a continuously flowing contaminated air stream. PCO causes significant reaction rates to occur at or near room temperature and it is energy efficient. An advantage of the PCO technology is that it does not require reloading with expensive metal as the catalyst does not foul readily. Unlike catalytic oxidation, hydrogen peroxide is not generated in the process. The process requires both oxygen and water but particulate matter must be removed first, so that it does not foul the catalyst (RTN 1999).

11.4 EVALUATION OF TECHNOLOGIES AND SELECTION OF REPRESENTATIVE TECHNOLOGIES

Tables 11-4, 11-5, and 11-6 indicate the technologies that successfully passed the technology screening process (i.e., those technologies listed as "yes" or "maybe" in their applicability to the site). These technologies were considered for inclusion in the remedial alternatives based on their applicability to site conditions and expected effectiveness. Technologies that were not expected to be effective in treating the COCs were screened out, as shown in Tables 11-1, 11-2, and 11-3. If a technology cannot be implemented due to a site constraint or if its cost is relatively high compared to other technologies, it was also eliminated from further discussion.

11.4.1 Remaining Source Control Technologies

The source control technologies that were retained following the technology screening evaluation are summarized in the following sections, separated by general response action (Table 11-4). Source control technologies apply to remediating impacted shallow subsurface soil and subsurface soil at depth.

11.4.1.1 *No Action.* Although no action does not address the contamination present at the site through remedial measures, it has been retained for comparison with other options in accordance with the NCP. Natural attenuation of contaminant levels may be expected to occur over time, particularly for biodegradable compounds, under this no action scenario. Natural attenuation may be appropriate after the remedial measures have been implemented.

11.4.1.2 *Institutional Measures.* In the institutional measure category, deed and development restrictions were retained as appropriate controls to reduce human exposure with contaminants remaining at the site. These have been retained because of their low cost, ease of implementation, and effectiveness, assuming that the restrictions are enforced over time. Institutional measures may be included as part of a remedial alternative.

11.4.1.3 *Containment.* No containment technologies were retained as source controls. Pavement and buildings already mostly cover the sites and prevent stormwater from infiltrating some areas of the sites.

TABLE 11-4

SOURCE CONTROL TECHNOLOGIES RETAINED

Frost Street Sites

GENERAL RESPONSE ACTION	TECHNOLOGY TYPE / PROCESS OPTION
<i>No Action</i>	No action/natural attenuation
<i>Institutional Measures</i>	A. Deed restrictions B. Development restrictions
<i>Containment</i>	None retained
<i>In situ Treatment</i>	Soil vapor extraction
<i>Removal</i>	Excavation
<i>Ex situ Treatment</i>	Low temperature thermal desorption
<i>Disposal</i>	A. TSDF B. Double-lined landfill

TABLE 11-5

GROUNDWATER RESPONSE TECHNOLOGIES RETAINED

Frost Street Sites

GENERAL RESPONSE ACTION	TECHNOLOGY TYPE / PROCESS OPTION
<i>No Action</i>	No action/natural attenuation
<i>Institutional Measures</i>	A. Deed and Development Restrictions B. Groundwater Use Restrictions
<i>Containment</i>	None retained
<i>Collection</i>	Groundwater pumping 1. Function a. Extraction b. Injection 2. System options - Pulsed pumping
<i>In situ Treatment</i>	B. Physical/chemical 1. Air Sparging 2. In-well air stripping
<i>Ex situ Treatment</i>	A. Physical 1. Flow equalization 2. Sedimentation 3. Carbon adsorption 4. Air stripping B. Chemical 1. Precipitation 2. Flocculation/Coagulation 3. Oxidation 4. Reduction
<i>Disposal</i>	A. On-site Discharge 1. Seepage basin / Wet well injection

TABLE 11-6

AIR EMISSIONS CONTROL TECHNOLOGIES RETAINED

Frost Street Sites

GENERAL RESPONSE ACTION	TECHNOLOGY TYPE / PROCESS OPTION
<i>No Action</i>	None
<i>Institutional Measures</i>	Access restrictions
<i>Containment</i>	Dust/particulate control measures 1. Water spraying 2. Wind fences/screens 3. Synthetic dust covers
<i>Collection</i>	A. Dust collection - sweeping/vacuuming B. Gas collection
<i>Treatment</i>	Granular activated carbon

11.4.1.4 ***In Situ Treatment.*** Of the source control technologies, only SVE was retained as an in-situ treatment process. SVE was selected for inclusion in the final remedial alternatives based on its ability to treat VOC contamination effectively and its proven application at hazardous waste sites. Specifically, SVE is most effective in remediating compounds with a Henry's law constant greater than 0.01 and a vapor pressure greater than 0.5 mm Hg. Since the primary contaminants, PCE and TCE, have Henry's Law constants of 0.018 and 0.020 and vapor pressures of 18 and 74 mm Hg respectively, SVE is an appropriate technology for use in remediating the subsurface soils at the Frost Street sites.

11.4.1.5 ***Removal.*** Excavation and removal of the contaminated soils is a feasible option at the Frost Street sites. Generally, excavation is a cost effective remediation solution where contaminants are identified near the surface or at shallow depths. At the Frost Street sites, contaminated soils are encountered at shallow depths (less than 25 ft) and depths in excess of 25 ft below grade. Excavation at the depths in excess of 25 ft or greater may be difficult and costly. Excavation would disturb current on-site operations. In accessing the contaminated subsurface soils at depth, the top 25 ft of uncontaminated or trace-contaminated soils must be excavated first, resulting in additional excavation, backfill, or disposal costs. In addition, excavation to depths as great as 55 ft bgs would require extended-arm excavation equipment, clam shell excavators, excavation shoring, and foundation supports, thereby increasing safety hazards and remedial costs (LMS 1999).

11.4.1.6 ***Ex Situ Treatment.*** Soils that are to be disposed off-site may require treatment prior to land disposal or reuse. If treatment is necessary, the low-temperature thermal desorption technology has been retained as a method of reducing VOC concentrations. It is anticipated that soil requiring disposal will not require additional treatment to reduce concentrations of contaminants other than VOCs (i.e., metals, PAHs, pesticides, or phenol); however, low temperature thermal desorption treatment may have the additional benefit of reducing some of these contaminant concentrations.

11.4.1.7 ***Disposal.*** Disposal options retained from the screening analysis include disposal to an off-site landfill or a TSDF. Waste acceptance by a landfill facility will depend on the results of a waste characterization. Soils exhibiting the toxicity characteristic will be transported to a TSDF, where they will be treated to satisfy land

disposal restrictions prior to being landfilled. Treatment of hazardous waste performed by TSDFs could include low-temperature thermal desorption, incineration, or dechlorination. Soils that do not exhibit the toxicity characteristic will be transported to an industrial waste landfill (i.e., double-lined landfill) and disposed.

11.4.2 Remaining Groundwater Response Technologies

The groundwater remedial technologies that were retained following the technology screening process are summarized below, separated by general response action (Table 11-5).

11.4.2.1 No Action. Although no action does not address the contamination present at the site through remedial measures, it has been retained for comparison with other options in accordance with the NCP. Natural attenuation of contaminant levels may be expected to occur over time, particularly for biodegradable compounds, under this no action scenario. Natural attenuation may be appropriate for this site after other remedial measures have been implemented.

11.4.2.2 Institutional Measures. In the institutional measures category, deed, development, and groundwater use restrictions were retained as feasible institutional controls to minimize human exposure with contaminants remaining at the site. These have been retained because of their low cost, ease of implementation, and effectiveness, assuming that the restrictions are enforced over time. Institutional measures may be selected as part of a remedial alternative.

11.4.2.3 Containment. No containment technologies were retained as groundwater response controls largely because their implementation at the site is impractical.

11.4.2.4 Collection. Of the groundwater collection technologies, extraction and injection wells have been retained for further discussion. Groundwater pumping via extraction wells has been proven to be an effective contaminant plume control mechanism. Pulsed pumping has also been retained for further discussion as an enhancement to groundwater extraction.

11.4.2.5 In Situ Treatment. In situ treatment technologies that were retained include thermal and physical/chemical processes. Air sparging and in-well air stripping were retained as physical and/or chemical technologies applicable to the Frost Street sites. In

order to be effective, air sparging must be combined with SVE. Both air sparging and in-well air stripping have been shown to treat organic contaminants and DNAPL successfully. The use of the air sparging/soil vapor extraction technology at depths greater than approximately 80-ft bgs is not recommended due to the interspersed layers of low permeability soil found in the upper Magothy Aquifer.

11.4.2.6 *Ex Situ Treatment.* Some of the physical technologies (e.g., flow equalization, sedimentation, carbon adsorption, and air stripping) were retained for further evaluation. Flow equalization can mix low concentrations of contaminants with high concentrations to make the relative concentration that needs treatment about the same. Sedimentation, carbon adsorption, and air stripping were retained for use in a treatment train to remove inorganic and organic contaminants from liquids prior to discharge. Chemical ex-situ treatments that were retained include precipitation, flocculation, coagulation, oxidation and reduction. Precipitation, flocculation, and coagulation may be needed to pretreat the contaminated groundwater prior to being transferred to a VOC removal unit. Oxidation or reduction technologies may be used to reduce VOC concentrations in the liquid phase.

11.4.2.7 *Disposal.* No off-site treatment and disposal options were retained. One feasible on-site discharge option is the use of a seepage basin (also referred to as an infiltration gallery or a series of wet wells). Contaminant concentrations in the effluent would need to satisfy applicable regulatory requirements. Temporary storage of extracted groundwater is not a feasible option at the sites because of space limitations. Temporary storage was screened from the evaluation.

11.4.3 Remaining Air Emissions Control Technologies

Air emissions control technologies that were retained following the screening evaluation are summarized below and in Table 11-6. Air emissions controls may be needed to meet state and Federal air discharge requirements if a remediation process generates an air emission.

The no action and institutional measures options were retained in the evaluation for the case where no air emissions controls are required on remediation processes. If controls are necessary, options include containment, collection, or treatment. For dust controls resulting from excavation activities, containment technologies, such as water spraying, wind fences, and dust covers, were retained for potential use. Dust may also be collected for subsequent disposal.

A review of feasible technologies to reduce VOC concentrations in an air stream was conducted to identify the one that is most cost effective. The evaluation included three air treatment technologies commonly used at hazardous waste sites: carbon adsorption, catalytic oxidation, and photocatalytic oxidation. The capital and operating costs associated with these technologies were obtained from EPA publications and vendor estimates (RTN 1999). Actual costs will vary depending on the design flow rate, characteristics of the air stream (e.g., moisture content and particulate concentration), and contaminant concentration. A design flow rate of 500 cfm was assumed in evaluating the estimated cost of implementing each technology. Table 11-7 summarizes the estimated capital and operating costs for each technology. Of the three air treatment technologies, carbon adsorption has the lowest overall capital and operating costs. Based on this analysis, the catalytic and photocatalytic oxidation technologies were screened from the technology evaluation and carbon adsorption was retained for further review.

TABLE 11-7

COST COMPARISON OF AIR EMISSIONS CONTROL TECHNOLOGIES

Frost Street Sites

Air Treatment Technology	Estimated Capital Cost¹	Estimated Annual Operating Cost¹
A. Vapor-Phase Granular Activated Carbon	\$5000 to \$10,000	\$15,000 to \$25,000
B. Catalytic Oxidation	\$200,000 to \$300,000	\$20,000 to \$40,000
C. Photocatalytic Oxidation	\$30,000 to \$160,000	\$3000 to \$45,000

- 1 - Source: RIMS 1999. Capital and operating costs estimated for a groundwater remediation system generating an air exhaust of 500 cfm.

CHAPTER 12

DEVELOPMENT AND SCREENING OF SOURCE CONTROL ALTERNATIVES

12.1 INTRODUCTION

In accordance with NYSDEC's TAGM HWR-89-4025, Guidelines for Remedial Investigations/Feasibility Studies (NYSDEC 1989) and HWR-90-4030, Selection of Remedial Actions at Inactive Hazardous Waste Disposal Sites (NYSDEC 1990), preliminary remedial alternatives for a site are developed by combining the remedial technologies that have successfully passed the screening stage into a range of alternatives. The goal of the screening process is to reduce the number of alternatives that will be included for subsequent detailed analysis by identifying those that are most compatible with the conditions of the site.

Chapter 11 identified and screened the available remedial technologies for treating contaminated soils at the Frost Street sites. Based on the relatively small number of potentially applicable technologies and existing site constraints, it was decided in consultation with NYSDEC, that the development and formal evaluation of a wide range of unlikely preliminary alternatives was unnecessary. Instead, a group of remedial alternatives that appeared most feasible and appropriate for soils at the sites was developed for detailed evaluation. This chapter presents these remedial alternatives developed to address the shallow subsurface soils and subsurface soils at depth at two of the Frost Street sites: 101 Frost Street and 89 Frost Street. Collectively, the contaminated soils at these two sites are referred to as the "source area"; therefore, the term "source control alternative" refers to a remediation alternative intended to control further contaminant migration from the sites' soil medium. During the RI, contaminated soil was not identified at the 770 Main Street site; therefore, no soil remediation activities are considered for this site.

Groundwater response alternatives for the three sites are discussed in Chapter 13 where the development and selection of a final range of groundwater response alternatives is discussed.

12.2 REGULATORY REQUIREMENTS

New York State hazardous waste regulations and the NCP include requirements for the development of remedial alternatives to ensure that the alternatives selected will provide decision-makers with an appropriate range of options, as well as sufficient information to compare the alternatives. The range of options depends on the site-specific conditions but, to the extent possible, the development of one or more alternatives in each of the following categories is recommended:

1. The no or minimal action alternative.
2. A range of alternatives that includes treatment to reduce the toxicity, mobility, or volume of contaminants present, including:
 - a. An alternative that removes or destroys contaminants to the maximum extent possible and minimizes the need for long-term management of remaining wastes or waste treatment residuals.
 - b. One or more alternatives that vary in the degree of treatment and long-term management required.
 - c. An alternative that involves little or no treatment but protects human health and the environment through containment or institutional controls to prevent exposure to hazardous materials.
3. A range of alternatives that achieve the contaminant-specific remedial action levels within different time periods.
4. One or more innovative treatment technologies, if any such technologies appear promising (i.e., comparable or superior performance for lower cost).

The development and selection of a final range of remedial alternatives which addresses the New York State and NCP requirements of feasibility studies are developed in Chapter 12 for site soils and Chapter 13 for site groundwater.

To simplify the discussion of the alternatives, source control remedial alternatives were considered separately for the 101 and 89 Frost Street sites. Each alternative is labeled with the prefix "S" to indicate a source control alternative. Preceding the "S" is the site identification "101" for the 101 Frost Street site and "89" for the 89 Frost Street site.

12.3 DEVELOPMENT OF SOURCE CONTROL ALTERNATIVES FOR THE 101 FROST STREET SITE

Table 11-4 in Chapter 11 indicates source control technologies that successfully passed the screening (i.e., were listed as "yes" or "maybe" in relation to their applicability to the site). These technologies were considered for inclusion in the source control remedial alternatives for 101 Frost Street based on their applicability to site conditions and expected effectiveness on the media to which they can be applied. Technologies that were retained but not subsequently incorporated into source control alternatives may be used in substitution of any technology that proves to be ineffective following a bench or pilot scale study.

Five remedial alternatives were selected for inclusion in the detailed evaluation of source control alternatives at 101 Frost Street. The technical elements included in each of these alternatives are summarized in Table 12-1. Detailed descriptions of the five selected source control remedial alternatives for the 101 Frost Street site are provided below. Chapter 14 presents the evaluation of these source control alternatives against the criteria of protection of human health and the environment; compliance with state and Federal SCGs; short-term impacts and effectiveness; long-term impacts, effectiveness, and permanence; reduction of toxicity, mobility, or volume; implementability; and cost.

12.3.1 Alternative 101-S1: No Action

Alternative 101-S1 is considered to be the no action alternative required by the NCP because it does not include active treatment of the contaminated media (contaminated shallow subsurface soils and subsurface soils at depth). Alternative 101-S1 does include institutional controls (e.g., deed and development restrictions) to minimize contact with the contaminated media. Deed and development restrictions will prohibit construction in specified areas of the site that would expose workers, or the surrounding public, to any

TABLE 12-1

REMEDIAL SOURCE CONTROL ALTERNATIVES FOR DETAILED EVALUATION **101 Frost Street Site**

ALTERNATIVE	GENERAL RESPONSE ACTION/TECHNOLOGY TYPE
ALTERNATIVE 101-S1: No Action	• Deed and development restrictions
ALTERNATIVE 101-S2: Excavation of Shallow Subsurface Soils and Subsurface Soils at Depth	• Excavation of shallow subsurface soils • Excavation of subsurface soils at depth • Post excavation soil sampling • Off-site disposal of contaminated soils
ALTERNATIVE 101-S3: Excavation of Shallow Subsurface Soils/Soil Vapor Extraction for Subsurface Soils at Depth	• Excavation of shallow subsurface soils • Post excavation soil sampling • Off-site disposal of contaminated soils • Soil vapor extraction points (subsurface soils at depth) • Vapor treatment system • Air emissions control (GAC) • Air emission • System performance monitoring
ALTERNATIVE 101-S4: Soil Vapor Extraction for Shallow Subsurface Soils and Subsurface Soils at Depth	• Soil vapor extraction points • Vapor treatment systems • Air emissions control (GAC) • Air emission • System performance monitoring
ALTERNATIVE 101-S5: No Action for Shallow Subsurface Soils and Soil Vapor Extraction for Subsurface Soils at Depth	• Institutional measures for shallow subsurface soils • Soil vapor extraction points for subsurface soils at depth • Vapor treatment systems • Air emissions control (GAC) and air emission • System performance monitoring

remaining subsurface soil contaminants. Notices on deeds and building permits will act as reminders of these development restrictions.

12.3.2 Alternative 101-S2: Excavation of Shallow Subsurface Soils and Subsurface Soils at Depth/Off-Site Disposal

12.3.2.1 Shallow Subsurface Soils. The site history for the former Autoline Automotive site indicates that the main contaminants in the shallow subsurface soils are VOCs, SVOCs, pesticides, and metals. Three areas of contaminated shallow subsurface soils (Areas 2, 3, and 4) were identified at 101 Frost Street, as described in Chapter 10 and shown on Figures 12-1 and 12-2. It is estimated that the contaminated shallow subsurface soil identified at the site is contained in 10 ft by 10 ft areas located immediately below each of the twelve dry well structures shown on Figures 12-1 and 12-2 and described in Chapter 10. It is assumed that the thickness of contamination below each dry well at 101 Frost Street is 2 ft, with the exception of DW-12 (Area 2) where the contamination is assumed to be 4 ft thick, based on RI data. Thus, the combined quantity of contaminated shallow subsurface soil at the 101 Frost Street site is approximately 100 yd³.

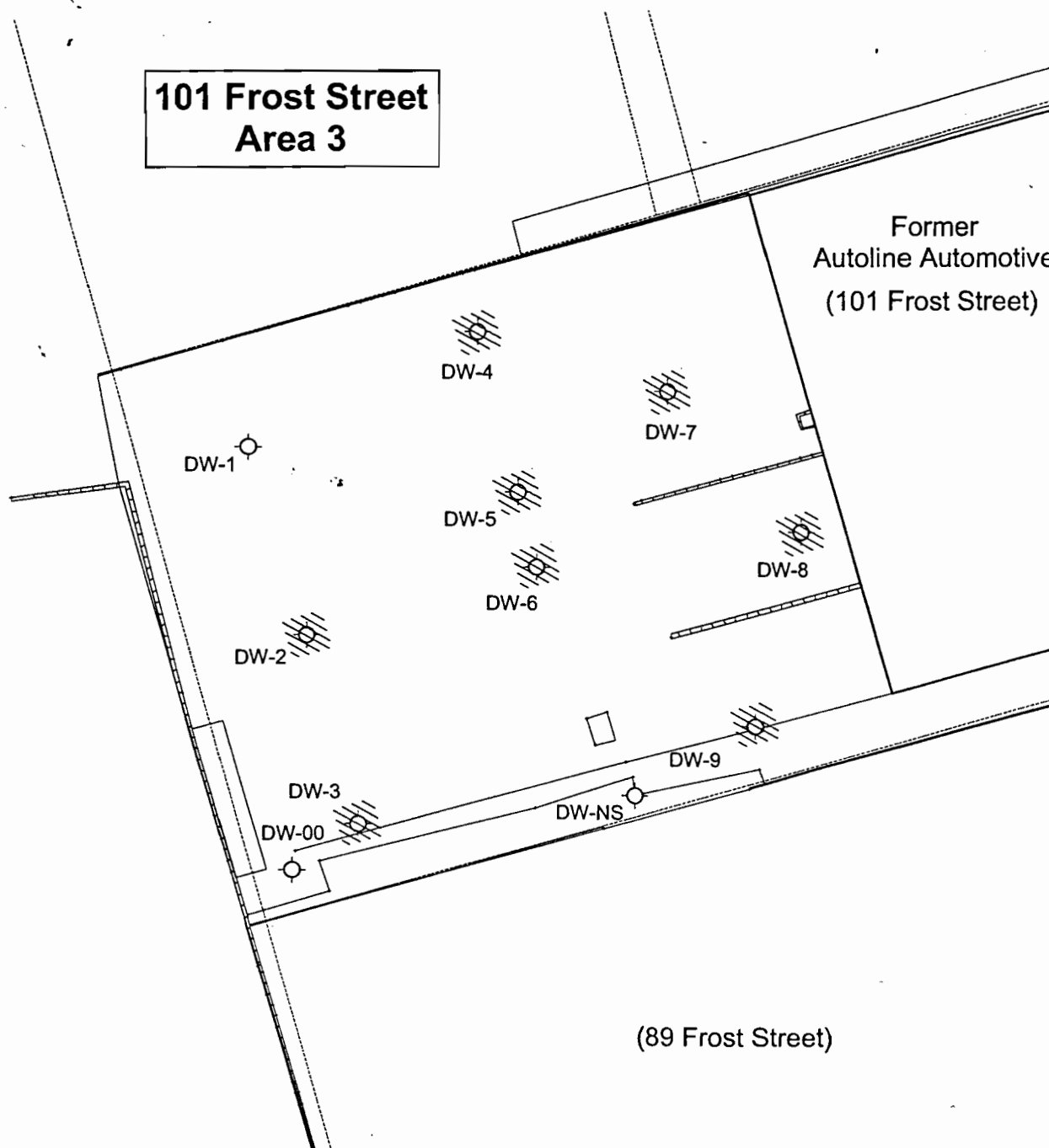
A preliminary evaluation of the remedial alternative of excavation and off-site disposal of contaminated shallow subsurface soils at the 101 Frost Street site was developed based on the following assumptions:

- At a maximum, excavation depths to approximately 20 ft bgs (i.e., the approximate depth to the bottom of the deepest area of contamination) were assumed. Uncontaminated or trace-contaminated soils overlying the contaminated areas at depth would also need to be excavated and staged on-site to be used as fill or disposed of off-site. Thus, the total amount of soil to be excavated would be greater than the above-noted volume of contaminated soil.
- Hand excavation to a depth of about 4 ft bgs in some areas will be required to avoid interference with utilities and subsurface debris (if present).

101 Frost Street Area 3



Former
Autoline Automotive
(101 Frost Street)



NOTE

Contamination within Area 3 assumed to be 100 sq. ft and 2 ft thick below bottom of dry well in each dry well area.

LEGEND

- Dry well location
- Area of shallow subsurface soil contamination

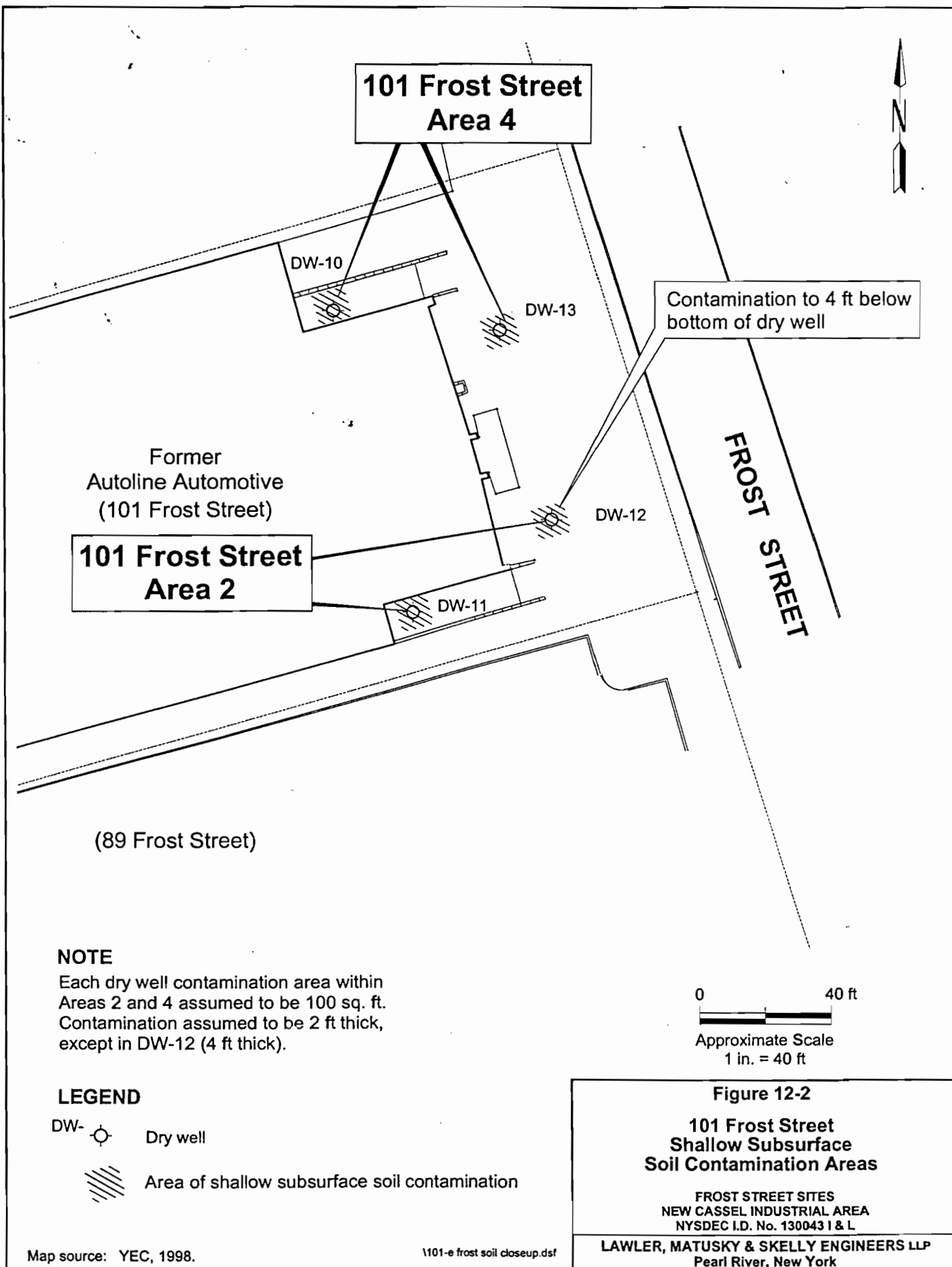
0 40 ft
Approximate Scale
1 in. = 40 ft

Figure 12-1

101 Frost Street Shallow Subsurface Soil Contamination Areas

FROST STREET SITES
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043 I

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York



- Excavation to depths of approximately 20 ft (as required) can be achieved using conventional excavation equipment and no utility relocation would likely be required. These assumptions should be confirmed during the final design.
- Shoring and bracing will be required since sloping of excavations may not be possible due to site logistics and since some excavations on the 101 Frost Street site are in close proximity to the on-site building. Types and configurations of shoring/bracing should be specified in the final design.

All excavation work is to be performed in accordance with OSHA regulations (specific excavation requirements such as 29 CFR Subpart 1926.651). For cost estimating purposes, the potential for water infiltration into excavation areas was not addressed for this alternative. However, water infiltration should be considered in the final design. Some of the excavated soils will be transported and disposed of off-site in approved solid waste disposal facilities (landfills). For cost estimating purposes, it was assumed that 10% of the targeted contaminated soils (approximately 10 yd³) will be excavated and classified as “hazardous” (fulfilling the RCRA definition of a hazardous waste). Hazardous wastes will be transported to and disposed of at an approved hazardous waste facility. It was assumed that approximately 90% of the targeted contaminated soils (about 90 yd³) and a portion (approximately 80 yd³) of soils that are excavated to reach the contaminated shallow subsurface soil areas will require off-site disposal and be classified as “nonhazardous”. Thus, about 170 yd³ of nonhazardous wastes would be transported to and disposed of at an approved local, solid waste disposal facility. The remainder of the excavated soils, not requiring off-site disposal, will be reused at the site during backfill and site restoration activities.

All twelve of the dry well structures identified above will be excavated, cleaned (if necessary), and disposed of off-site as part of the site remedial activities for 101 Frost Street under this alternative. The dry wells will be replaced during site restoration activities.

For cost estimating purposes, it is assumed that the remedial excavation work for the shallow subsurface soils described in this alternative will be completed in a 60 day period. The actual remediation time may be shorter or longer; better estimates may be made during the final design.

Confirmatory Sampling. Once the excavation of shallow subsurface soils is completed, one post-excavation soil sample will be collected from the bottom of each dry well area (12 total soil samples) and analyzed for VOCs, SVOCs, pesticides, and metals. For cost estimating purposes, it was assumed that concentrations of analytes in all of the post-excavation soil samples collected after the initial round of soil excavation will be within regulatory limits and that no additional soil excavation will be required. However, based on the results of the sampling event, it is possible that additional excavation of shallow subsurface soils may be required in some areas of the site. If so, additional rounds of confirmatory post-excavation soil sampling will need to be conducted following any additional excavation activities.

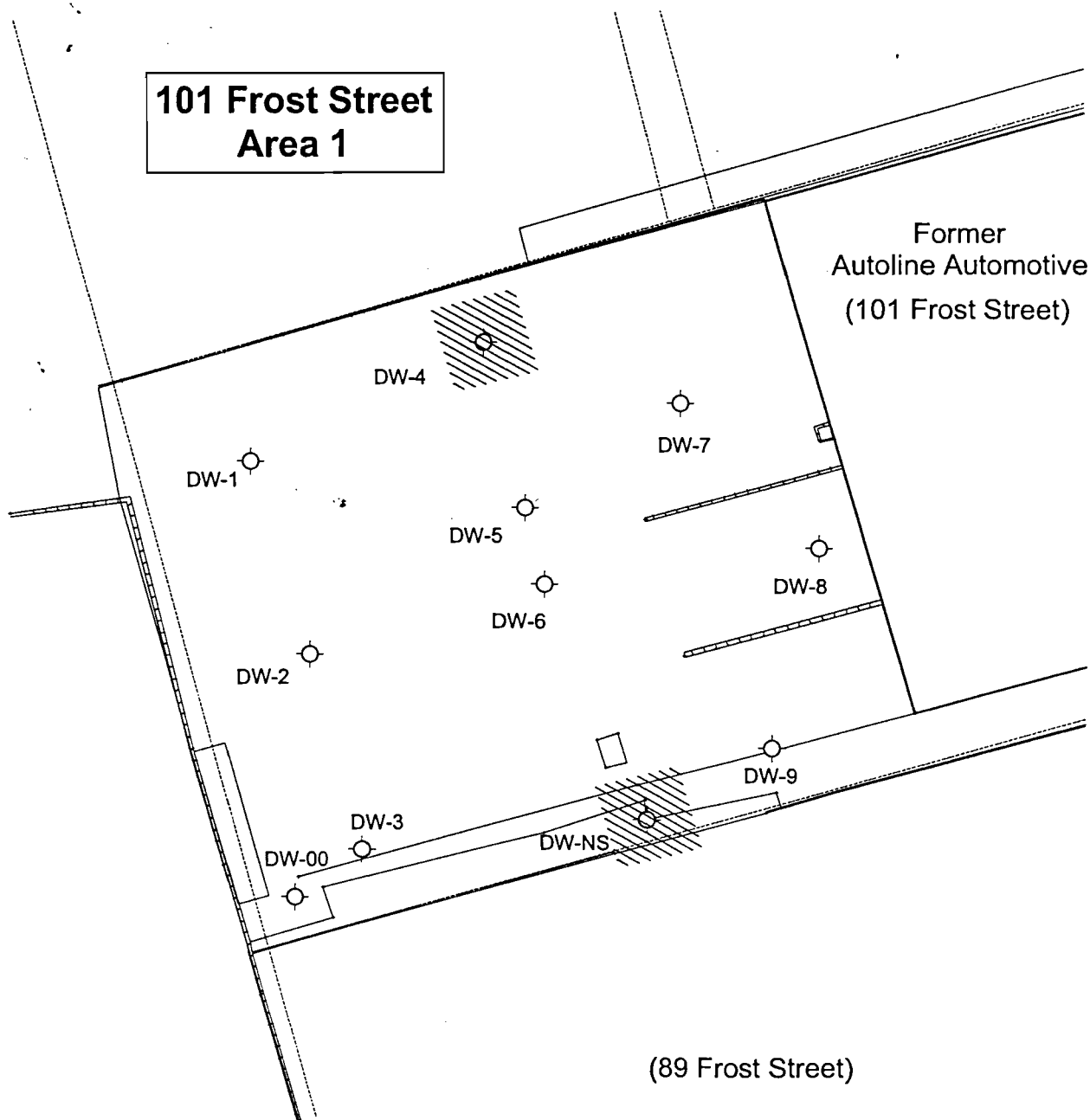
12.3.2.2 Subsurface Soils at Depth. Analytical data from subsurface soils at depth indicate that VOCs in excess of the recommended soil cleanup objectives were found in two locations at 101 Frost Street: beneath DW-4 and DW-N/S (Area 1). As shown in Figure 12-3, dry well DW-4 is located west of the existing building, near the northern property line. Contamination in subsurface soils at depth was located below DW-4 and was determined to be approximately 5 ft in thickness (located at 50 to 55 ft bgs). Dry well DW-N/S is located west of the on-site building, along the southern property boundary (see Figure 12-3). VOC contamination in the subsurface soils at depth below this dry well is estimated to exist at approximately 40 to 55 ft bgs (i.e., a 15-ft thick area of contamination). Thus, the total quantity of VOC contamination in subsurface soils at depth at 101 Frost Street is estimated to be 300 yd³. The vertical extent of the VOC soil contamination in these two areas appears to be to approximately 55 ft bgs, based on the presence of contamination at different depths in the soil column.

A preliminary evaluation of the remedial alternative of excavation and off-site disposal of contaminated subsurface soils at depth at the site was developed based on the following assumptions:



**101 Frost Street
Area 1**

Former
Autoline Automotive
(101 Frost Street)



(89 Frost Street)

NOTES

- ▶ Contamination in Area 1 assumed to be 400 sq. ft around both DW-4 and DW-N/S.
- ▶ Contamination at DW-4 assumed to exist at 50-55 ft below ground surface.
- ▶ Contamination at DW-N/S assumed to exist at 40-55 ft below ground surface.

LEGEND

- Dry well location
- Area of subsurface soil at depth contamination

0 40 ft

Approximate Scale
1 in. = 40 ft

Figure 12-3
101 Frost Street
Subsurface Soil at Depth
Contamination Areas

FROST STREET SITES
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043 I

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

- Excavation depths to approximately 55 ft bgs would be required, as identified in the RI. Uncontaminated or trace-contaminated soils overlying the contaminated areas at depth would also need to be excavated and staged on-site to be used as fill or disposed of off-site. Thus, the total amount of soil to be excavated would be much greater than the above-noted volume of contaminated soil.
- Hand excavation to a depth of about 4 ft bgs in some areas will be required to avoid interference with utilities and subsurface debris (if present).
- Excavation to depths of approximately 55 ft bgs can be achieved using excavation equipment with extended reach modifications. However, excavation to these depths may require special excavation procedures. The implementability of all excavation approaches should be fully evaluated in the final design.
- Shoring and bracing will be required at each area of subsurface soil at depth contamination, since relying completely on sloping the excavation would not be viable due to site use constraints. Types and configurations of shoring/bracing should be specified in the final design. For cost estimating purposes, it is assumed that shoring/bracing will be installed in 20 ft depth increments during excavation activities.
- Additional shoring and site health and safety considerations must be specified for excavations exceeding approximately 20 ft bgs in the final design.
- It is assumed that utility relocation is not required.

All excavation work is to be performed in accordance with OSHA regulations (e.g., specific excavation requirements of 29 CFR 1926.651). As noted, for costing purposes the potential for water infiltration into excavation areas was not addressed. However, water infiltration should be considered in the final design. Some of the excavated soils will be transported and disposed of off-site in approved solid waste disposal facilities. For cost estimating purposes, it was assumed that 10% of the targeted contaminated soils (approximately 30 yd³) will be excavated and classified as "hazardous". Hazardous wastes would be transported to and disposed of at an approved hazardous waste facility. It was assumed that approximately 90% of the targeted contaminated soils

(approximately 270 yd³) and a portion (approximately 200 yd³) of the soils excavated to reach the contaminated subsurface soils at depth will require off-site disposal and be classified as “nonhazardous”. Thus, approximately 470 yd³ of nonhazardous wastes would be transported to and disposed of at an approved local, solid waste disposal facility. The remainder of the excavated soils, not requiring off-site disposal, will be reused at the site during backfill and site restoration activities.

For cost estimating purposes, it is assumed that the remedial excavation work for the subsurface soils at depth described in this alternative will be completed in a 45 day period. The actual remediation time may be shorter or longer; better estimates may be made during the final design.

Confirmatory Sampling. Once the excavation of subsurface soils at depth is completed, approximately twelve post-excavation soil samples will be collected from Area 1 and analyzed for VOCs. Two samples will be collected from each of the excavation bottoms, and four sidewall samples will be collected from each Area 1 excavation area (i.e., six post-excavation samples beneath dry well DW-4 and six post-excavation samples beneath DW-N/S). For cost estimating purposes, it was assumed that concentrations of analytes in all of the post-excavation soil samples collected after the initial round of subsurface soil at depth excavation will be within regulatory limits and that no additional soil excavation will be required. However, based on the results of the sampling event, it is possible that additional excavation of subsurface soils at depth may be required at the site. If so, additional rounds of post-excavation soil sampling will need to be conducted following the additional excavation activities.

12.3.3 Alternative 101-S3: Excavation/Off-Site Disposal of Shallow Subsurface Soils/SVE for Subsurface Soils at Depth

12.3.3.1 Shallow Subsurface Soils. Shallow subsurface soils under this alternative are addressed in the same manner as described in Section 12.3.2.1 of Alternative 101-S2.

12.3.3.2 Subsurface Soils at Depth. Following the technology screening process, soil vapor extraction (SVE) was identified as an appropriate technology for remediating VOC-impacted, deep subsurface soils. SVE is a presumptive remedy at CERCLA sites for

remediating VOCs in soils (EPA 1993). The objective of SVE is to collect volatile compounds from the unsaturated zone and bring them to the surface where they can be treated.

Alternative 101-S3 does not include institutional measures or a long-term monitoring program as human exposure to contaminants in subsurface soils at depth are likely to be very limited, because contaminants are present only at depths of 25 ft bgs or greater. Since future excavations are not expected to extend to 25 ft bgs, institutional measures are not warranted to prevent exposure to future on-site workers.

SVE System Components. The objective of SVE is to induce airflow in the unsaturated zone by creating a pressure gradient through the withdrawal of air from wells, or vapor extraction points (VEPs), in the subsurface. The SVE gas flow enhances evaporation of VOCs, volatilization of contaminants dissolved in pore water, and desorption of contaminants from the surfaces of soil particles. The effectiveness of SVE on halogenated VOCs in soils has been demonstrated at many sites (USACE 1995).

The system includes the installation of (VEPs), piping, and treatment equipment. Other components include a blower, moisture separator, vapor recovery system (vapor phase granular activated carbon), and electrical controls. Vapor is withdrawn from the contaminated unsaturated zone and passed through a vapor recovery system before being emitted. The vapor recovery system reduces the moisture of the air stream and collects VOCs by passing the air stream through a granular activated carbon (GAC) medium. When the GAC is spent, it is regenerated or disposed of off-site and replaced with new media.

Prior to final design of the system, a pilot-scale treatability study should be conducted to determine the optimal extraction rate and configuration of the VEPs. A pilot-scale test will determine the optimal operating pressures and flow rates to remove contaminants from the subsurface and will evaluate the airflow distribution. The results of the pilot test will be used to predict the minimum amount of time the SVE system needs to operate to achieve soil-specific remedial action objectives.

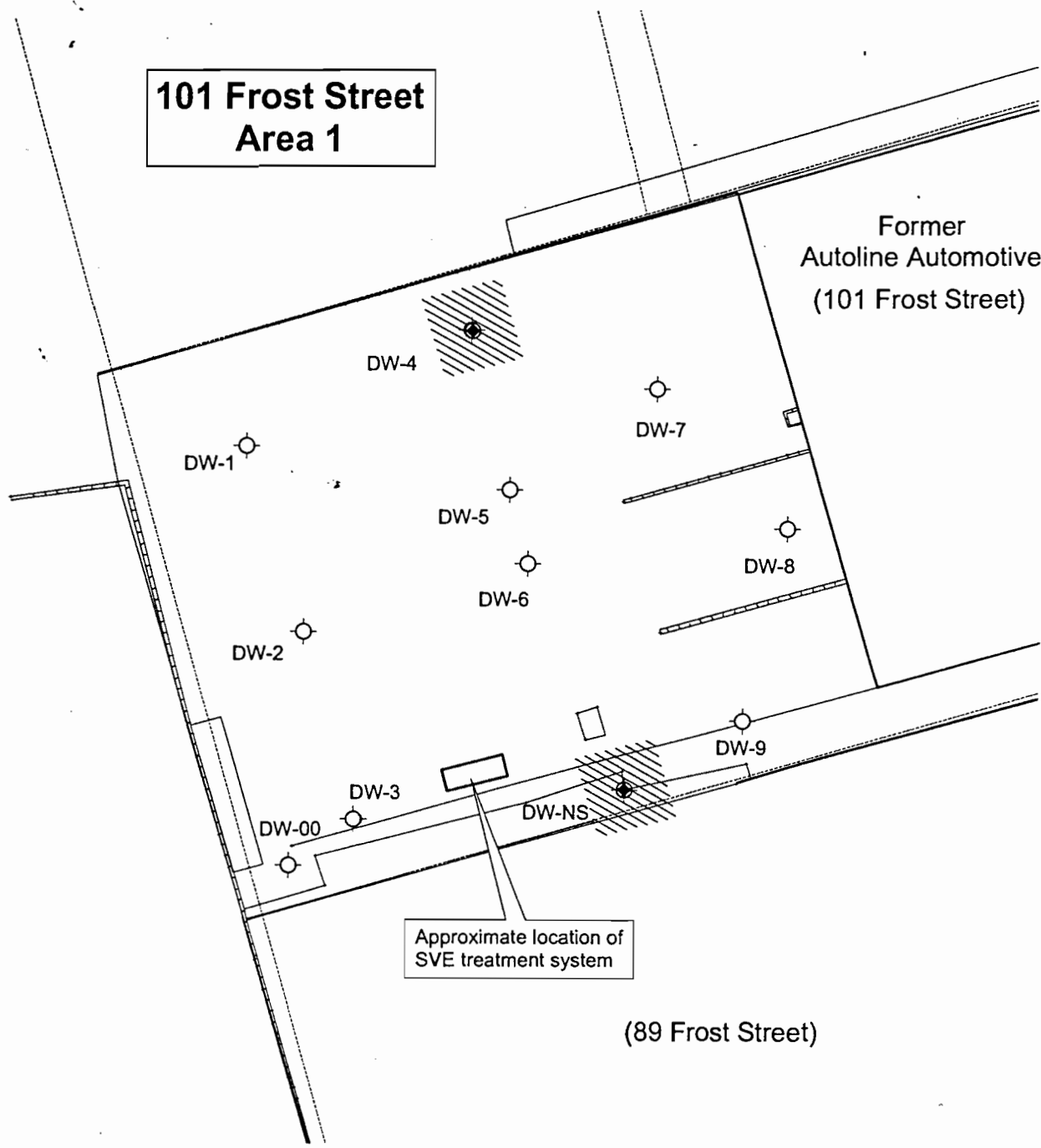
Based on the geological information compiled during the RI and assumptions regarding system performance, it is estimated that two VEPs and one blower with a 1 hp motor will be sufficient to vent the contaminated zones at depth at the site. This blower is sized to achieve a 15-ft radius of influence (conservatively) in each of the two VEPs at 101 Frost Street (i.e., one VEP each at DW-4 and DW-N/S). In the absence of pilot test data, these assumptions were made using the EPA guidance software Hyperventilate Version 2.0 ®. The proposed locations for these VEPs are shown in Figure 12-4. Piping would be installed below grade as not to interfere with site operations and to minimize piping and equipment on the ground surface. A small building (approximately 100 ft²) would be constructed to store and operate the treatment system; the proposed location of this building is shown in Figure 12-4.

Operation and maintenance costs associated with the remediation system include electrical, pump and system maintenance, and operator attention (quarter time). Wastes produced by the remediation process include condensate from the moisture separator and spent vapor phase GAC. It is assumed that these wastes will be disposed of or recycled at approved off-site locations. For the purposes of this FS, it was assumed that the condensate and vapor phase GAC are classified nonhazardous wastes for disposal. Representative waste characterization samples should be collected and analyzed to confirm that the wastes (i.e., materials contaminated with VOCs) are nonhazardous for disposal (i.e., do not exceed standards for toxicity, ignitability, corrosivity, and reactivity).

For cost estimating purposes, it is assumed that the remedial objectives for the subsurface soil at depth under this alternative will be met in three years (based on discussions with SVE vendors and review of case studies). The actual cleanup time may be longer or shorter than three years; better estimates of cleanup time can be made based on the pilot-scale treatability study.

It was assumed that vapor phase treatment of the extracted air would be needed for the life of the system. However, vapor phase treatment may become unnecessary if contaminant emissions satisfy regulatory requirements. Periodic testing (once every two months) of the extracted air stream would determine if contaminant levels have dropped below regulatory levels. The SVE system will continue to operate until consecutive air monitoring samples yield acceptable or non-detectable VOC concentrations in the exhaust gas.

101 Frost Street Area 1



Former
Autoline Automotive
(101 Frost Street)

(89 Frost Street)

LEGEND

-  Dry well location
-  Area of subsurface soil at depth contamination
-  Vapor extraction point (VEP)

0 40 ft

Approximate Scale
1 in. = 40 ft

Figure 12-4 101 Frost Street Proposed SVE Configuration Subsurface Soil at Depth Contamination Areas

FROST STREET SITES
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043 I

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Confirmatory Sampling. Once the SVE system is shut down and it is believed that remedial action objectives have been satisfied, confirmatory soil samples would be collected. Approximately ten soil samples would be collected in the remediation areas (i.e., five in the vicinity of DW-4 and five in the vicinity of DW-N/S, at depths varying between about 25 to 50 ft bgs) and analyzed for VOCs. If all of the samples have concentrations which satisfy the remedial action objectives, soil remediation may be deemed complete. For the purposes of this FS study, it is assumed that one round of confirmatory sampling would be performed.

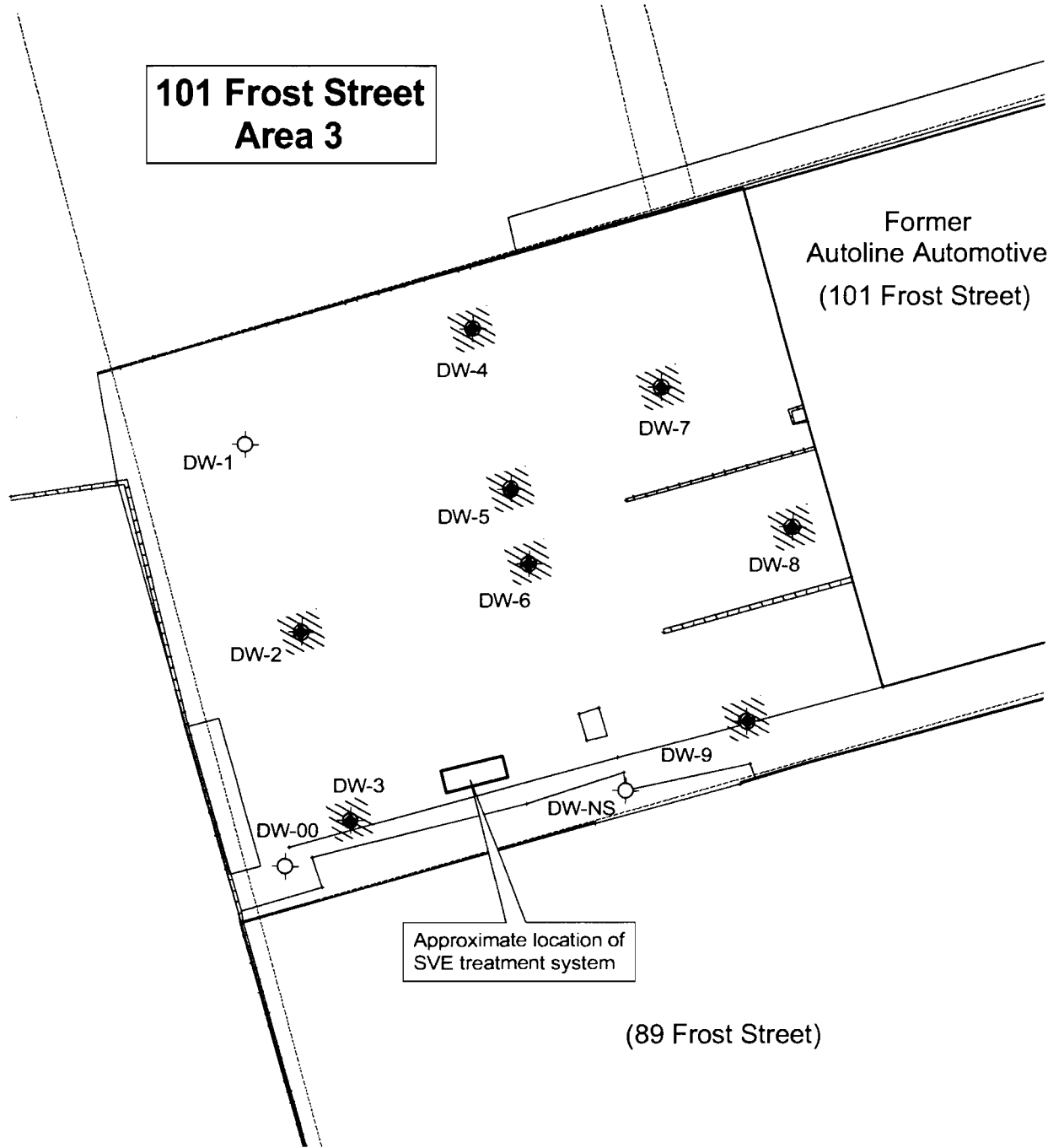
12.3.4 Alternative 101-S4: SVE for Shallow Subsurface Soils and Subsurface Soils at Depth

12.3.4.1 Shallow Subsurface Soils. Alternative 101-S4 includes the implementation of SVE and institutional measures to restrict site access and use, since future excavations may extend to 25 ft bgs. A general discussion of the SVE technology is provided above, within Section 12.3.3.2 for Alternative 101-S3. Prior to designing the system, a pilot-scale treatability study should be conducted to determine the optimal extractions rate and configuration of the VEPs. A pilot-scale test will determine the optimal operating pressures and flow rates to remove contaminants from the subsurface and will evaluate the airflow distribution. The results of the pilot test will be used to predict the minimum amount of time the SVE system needs to operate to achieve soil-specific remedial action objectives. This is especially true for moist and/or heterogeneous shallow subsurface soils at 101 Frost Street that exhibit contamination other than VOCs.

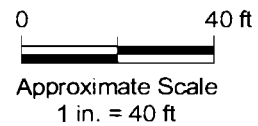
Based on the geological information compiled during the RI and assumptions regarding system performance, it is estimated that twelve VEPs and one blower (with a 5 hp motor) will be sufficient to vent the contaminated zones in the shallow subsurface soils. This blower is sized to achieve a 10-ft radius of influence (conservatively) in each of the twelve VEPs at 101 Frost Street. In the absence of pilot test data, these assumptions were made using the EPA guidance software Hyperventilate Version 2.0 ®. The proposed locations for these wells are shown in Figures 12-5 and 12-6. Piping would be installed below grade as not to interfere with site operations and to minimize system components on the ground surface. A building (approximately 250 ft² in surface area) would be constructed to store

101 Frost Street Area 3

Former
Autoline Automotive
(101 Frost Street)



(89 Frost Street)



LEGEND

-  Dry well location
-  Area of shallow subsurface soil contamination
-  Vapor extraction point (VEP)

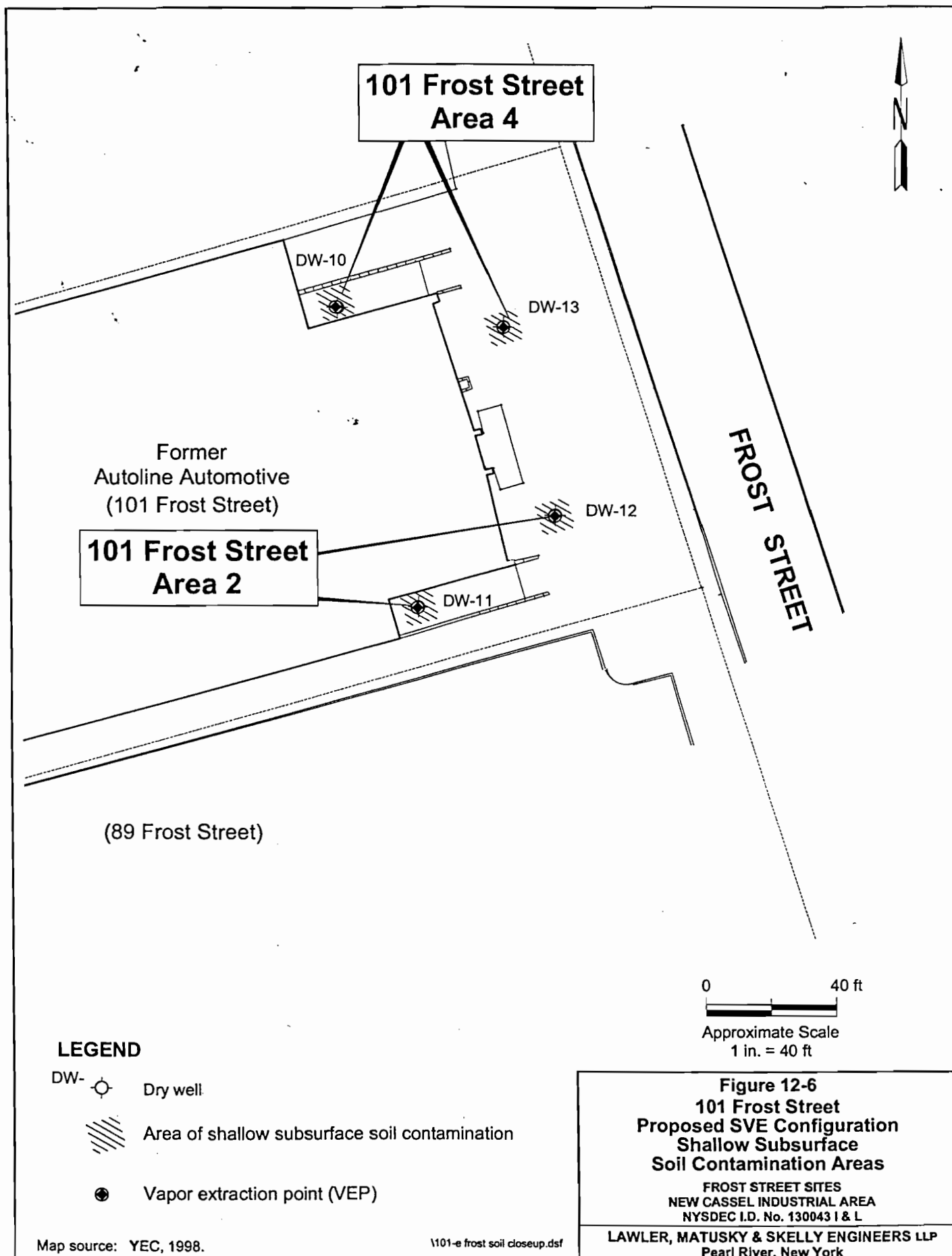
Map source: YEC, 1998.

\\101-w frost soil cleanup.dsf

Figure 12-5
101 Frost Street
Proposed SVE Configuration
Shallow Subsurface Soil
Contamination Areas

FROST STREET SITES
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043 I

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Pearl River, New York



and operate the treatment system; the proposed location of this building is shown in Figure 12-5.

Operation and maintenance costs associated with the remediation system include electrical, pump and system maintenance, and operator attention (half time). Wastes produced by the remediation process include condensate from the moisture separator and spent vapor phase GAC. It is assumed that these wastes will be disposed of or recycled at approved off-site locations. For the purposes of this FS, it was assumed that the condensate and vapor phase GAC are classified nonhazardous waste for disposal. Representative waste characterization samples should be collected and analyzed to confirm that the wastes (i.e., materials contaminated with VOCs, SVOCs, pesticides, and metals) are nonhazardous for disposal (i.e., do not exceed standards for toxicity, ignitability, corrosivity, and reactivity).

For cost estimating purposes, it is assumed that the remedial objectives for the shallow subsurface soils under this alternative will be met in three years (based on discussions with SVE vendors and review of case studies). The actual cleanup time may be longer or shorter than three years; better estimates of cleanup time can be made based on the pilot-scale treatability study.

It was assumed that vapor phase treatment of the extracted air would be needed for the life of the system. However, vapor phase treatment may become unnecessary if contaminant emissions satisfy regulatory requirements. Periodic testing (once every two months) of the extracted air stream would determine if contaminant levels have dropped below regulatory levels. The SVE system will continue to operate until consecutive air monitoring samples yield acceptable or non-detectable VOC concentrations in the exhaust gas.

Confirmatory Sampling. Once the SVE system is shut down and it is believed that remedial action objectives have been satisfied, confirmatory soil samples would be collected. Approximately twelve soil samples would be collected in the remediation areas (i.e., one sample in the vicinity of each of the twelve dry wells associated with shallow subsurface soil contamination, collected at depths between approximately 10 and 25 ft bgs) and analyzed for VOCs, SVOCs, pesticides, and metals. If all of the samples have concentrations which satisfy the remedial action objectives, soil remediation may be

deemed complete. For the purposes of this FS study, it is assumed that one round of confirmatory sampling would be performed.

12.3.4.2 ***Subsurface Soils at Depth.*** Subsurface soils at depth under this alternative are addressed in the same manner as described in Section 12.3.3.2 of Alternative 101-S3.

12.3.5 **Alternative 101-S5: No Action on Shallow Subsurface Soils/SVE for Subsurface Soils at Depth**

12.3.5.1 ***Shallow Subsurface Soils.*** As part of this alternative, no action will be taken on contaminated shallow subsurface soils. Institutional controls (e.g., deed and development restrictions) are included to minimize contact with the contaminated media. Deed and development restrictions will prohibit construction in specified areas of the site that would expose workers, or the surrounding public, to any remaining subsurface soil contaminants. Notices on deeds and building permits will act as reminders of these development restrictions.

12.3.5.2 ***Subsurface Soils at Depth.*** Subsurface soils at depth under this alternative are addressed in the same manner as described in Section 12.3.3.2 of Alternative 101-S3.

12.4 **DEVELOPMENT OF SOURCE CONTROL ALTERNATIVES FOR THE 89 FROST STREET SITE**

Table 11-4 in Chapter 11 indicates source control technologies that successfully passed the screening (i.e., were listed as "yes" or "maybe" in relation to their applicability to the site). These technologies were considered for inclusion in the source control remedial alternatives for 89 Frost Street based on their applicability to site conditions and expected effectiveness on the media to which they can be applied. Technologies that were retained but not subsequently incorporated into source control alternatives may be used in substitution of any technology that proves to be ineffective following a bench or pilot scale study.

Five remedial alternatives were selected for inclusion in the detailed evaluation of source control alternatives at 89 Frost Street. The technical elements included in each of these

alternatives are summarized in Table 12-2. Alternatives are labeled with the prefix “S” to indicate a source (soil) alternative. A detailed description of the five selected source control remedial alternatives for 89 Frost Street is provided below. Chapter 14 presents the evaluation of these alternatives against the criteria of protection of human health and the environment; compliance with state and Federal SCGs; short-term impacts and effectiveness; long-term impacts, effectiveness, and permanence; reduction of toxicity, mobility, or volume; implementability; and cost.

12.4.1 Alternative 89-S1: No Action

Alternative 89-S1 is considered to be the no action alternative required by the NCP because it does not include active treatment of the contaminated media (contaminated shallow subsurface soils and subsurface soils at depth). Alternative 89-S1 does include institutional controls (e.g., deed and development restrictions) to minimize contact with the contaminated media. Deed and development restrictions will prohibit construction in specified areas of the site that would expose workers, or the surrounding public, to any remaining subsurface soil contaminants. Notices on deeds and building permits will act as reminders of these development restrictions.

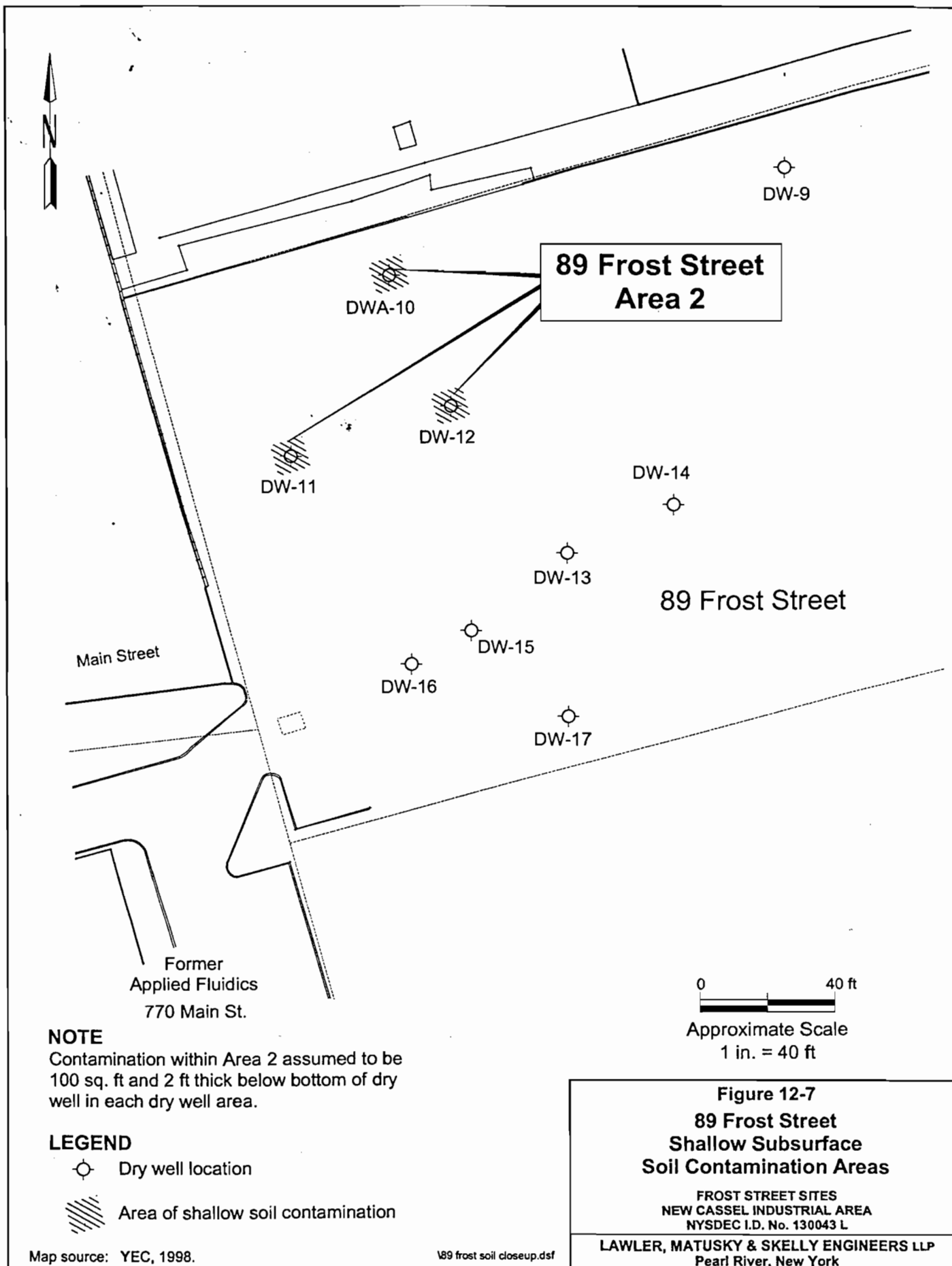
12.4.2 Alternative 89-S2: Excavation of Shallow Subsurface Soils and Subsurface Soils at Depth/Off-Site Disposal

12.4.2.1 *Shallow Subsurface Soils.* The site history for 89 Frost Street indicates that the main contaminants of concern are VOCs, SVOCs, and metals (pesticides were not analyzed for at this site). One area of contaminated shallow subsurface soil (Area 2) was identified at the site, as described in Chapter 10 and shown in Figure 12-7. It is estimated that the contaminated shallow subsurface soil identified at the site is contained in 10 ft by 10 ft areas located immediately below each of the three dry well structures shown on Figure 12-7 and described in Chapter 10. It is assumed that the thickness of contamination below each dry well at 89 Frost Street is 2 ft, based on RI data. Thus, the combined quantity of contaminated shallow subsurface soil at the 89 Frost Street site is approximately 25 yd³.

TABLE 12-2

REMEDIAL SOURCE CONTROL ALTERNATIVES FOR DETAILED EVALUATION
89 Frost Street Site

ALTERNATIVE	GENERAL RESPONSE ACTION/TECHNOLOGY TYPE
ALTERNATIVE 89-S1: No Action	• Deed and development restrictions
ALTERNATIVE 89-S2: Excavation of Shallow Subsurface Soils and Subsurface Soils at Depth	• Excavation of shallow subsurface soils • Excavation of subsurface soils at depth • Post excavation soil sampling • Off-site disposal of contaminated soils
ALTERNATIVE 89-S3: Excavation of Shallow Subsurface Soils/Soil Vapor Extraction for Subsurface Soils at Depth	• Excavation of shallow subsurface soils • Post excavation soil sampling • Off-site disposal of contaminated soils • Soil vapor extraction points (subsurface soils at depth) • Vapor treatment system • Air emissions control (GAC) • Air emission • System performance monitoring
ALTERNATIVE 89-S4: Soil Vapor Extraction for Shallow Subsurface Soils and Subsurface Soils at Depth	• Soil vapor extraction points • Vapor treatment systems • Air emissions control (GAC) • Air emission • System performance monitoring
ALTERNATIVE 89-S5: No Action for Shallow Subsurface Soils and Soil Vapor Extraction for Subsurface Soils at Depth	• Institutional measures for shallow subsurface soils • Soil vapor extraction points for subsurface soils at depth • Vapor treatment systems • Air emissions control (GAC) and air emission • System performance monitoring



A preliminary evaluation of the remedial alternative of excavation and off-site disposal of contaminated shallow subsurface soils at the 89 Frost Street site was developed based on the following assumptions:

- At a maximum, excavation depths to approximately 20 ft bgs (i.e., the approximate depth to the bottom of the deepest area of contamination) were assumed. Uncontaminated or trace-contaminated soils overlying the contaminated area at depth would also need to be excavated and staged on-site to be used as fill or disposed of off-site. Thus, the total amount of soil to be excavated would be greater than the above-noted volume of contaminated soil.
- Hand excavation to a depth of about 4 ft bgs in some areas will be required to avoid interference with utilities and subsurface debris (if present).
- Excavation to depths of approximately 20 ft (as required) can be achieved using conventional excavation equipment and no utility relocation would likely be required. These assumptions should be confirmed during the final design.
- Shoring and bracing will be required since sloping of excavations may not be possible due to site logistics at the 89 Frost Street site. Types and configurations of shoring/bracing should be specified in the final design.

All excavation work is to be performed in accordance with OSHA regulations (e.g., 29 CFR Subpart 1926.651). For cost estimating purposes, the potential for water infiltration into excavation areas was not addressed for this alternative. However, the potential for water infiltration should be considered in the final design. Some of the excavated soils will be transported and disposed of off-site in approved solid waste disposal facilities. For cost estimating purposes, it was assumed that 10% of the targeted contaminated soils (approximately 3 yd³) will be excavated and classified as “hazardous”. Hazardous wastes will be transported to and disposed of at an approved hazardous waste facility. It was assumed that approximately 90% of the targeted contaminated soils (about 20 yd³) and a portion (approximately 30 yd³) of soils that are excavated to reach the contaminated shallow subsurface soil areas will require off-site disposal and be classified as “nonhazardous”. Thus, approximately 50 yd³ of nonhazardous wastes would be

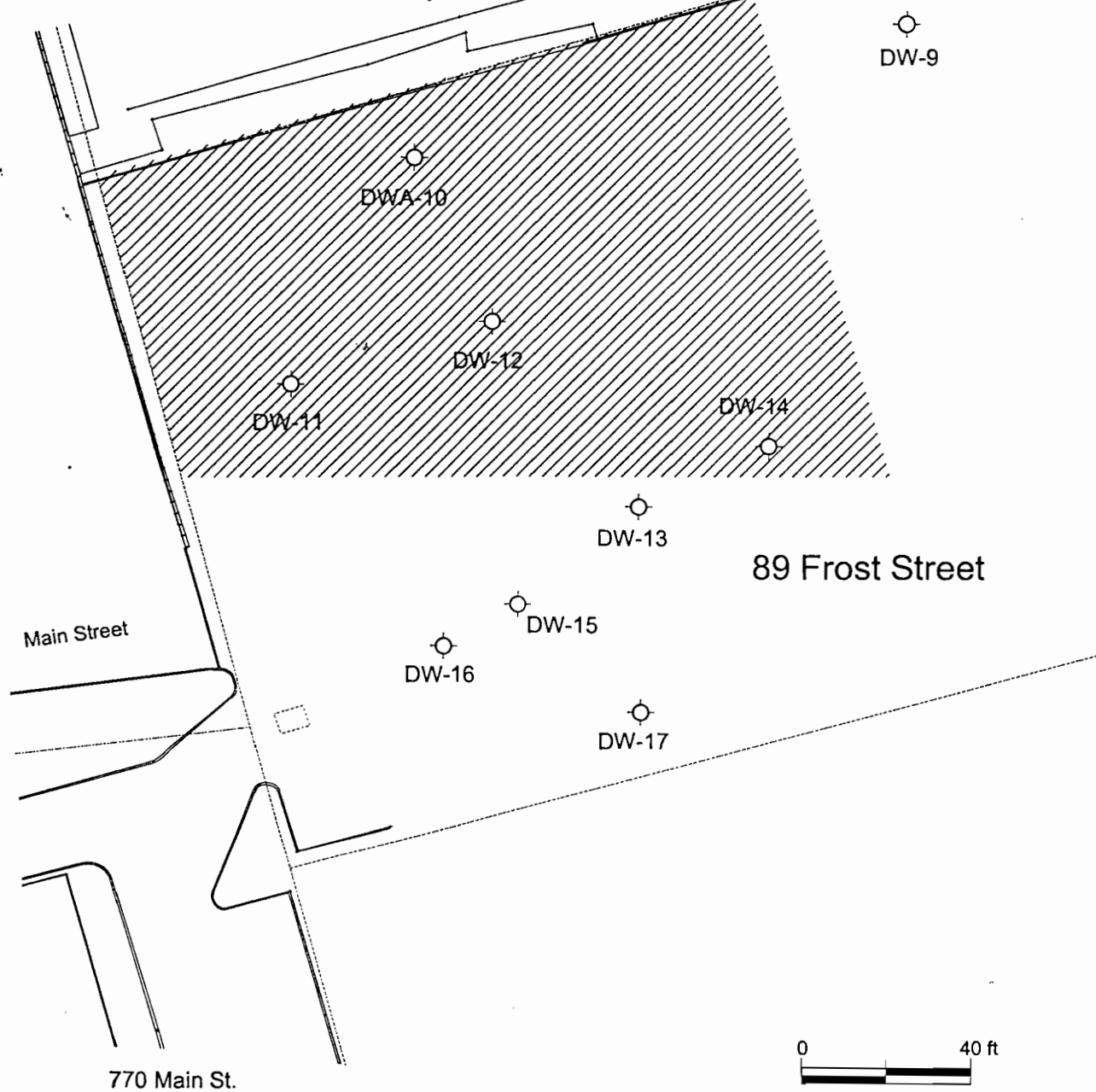
transported to and disposed of at an approved local, solid waste disposal facility. The remainder of the excavated soils, not requiring off-site disposal, will be reused at the site during backfill and site restoration activities.

As dry well structures at 89 Frost Street were previously removed and disposed of by property owners, dry well excavation, disposal, and restoration is not included as part of site remedial activities under this alternative. For cost estimating purposes, it is assumed that the remedial excavation work for the shallow subsurface soils described in this alternative will be completed in a 10 day period. The actual remediation time may be shorter or longer; better estimates may be made during the final design.

Confirmatory Sampling. Once the excavation of shallow subsurface soils is completed, one post-excavation soil sample will be collected from the bottom of each dry well area (three total soil samples) and analyzed for VOCs, SVOCs, and metals. For cost estimating purposes, it was assumed that concentrations of analytes in all of the post-excavation soil samples collected after the initial round of soil excavation will be within regulatory limits and that no additional soil excavation will be required. However, based on the results of the sampling event, it is possible that additional excavation of shallow subsurface soils may be required in some areas of the site. If so, additional rounds of confirmatory post-excavation soil sampling will need to be conducted following any additional excavation activities.

12.4.2.2 Subsurface Soils at Depth. Analytical data from subsurface soils at depth indicate that VOCs in excess of the recommended soil cleanup objectives were found in three locations at 89 Frost Street: beneath DWA-10, DW-11, and DW-14 (Area 1). As shown in Figure 12-8, the three dry well areas are located in the northwest portion of the site, within a paved parking lot area. Subsurface soil at depth contamination at 89 Frost Street was determined to be approximately 22,500 ft² in area. For purposes of this FS, a uniform thickness of contamination of about 25 ft (existing at approximate depths of 25-50 ft bgs) was assumed across Area 1. Thus, the total quantity of VOC contamination in subsurface soils at depth at 89 Frost Street is estimated to be 21,000 yd³. This quantity of contaminated material was estimated based on sample locations investigated for the RI; the actual extent and thickness of contamination in this area may be better delineated with additional soil sampling efforts. The vertical extent of the VOC soil contamination in

89 Frost Street Area 1



NOTE

Area 1 contamination assumed to be 22,500 sq. ft and exist at about 25-50 ft below ground surface.

LEGEND

-  Dry well location
-  Area of subsurface soil at depth contamination

0 40 ft
Approximate Scale
1 in. = 40 ft

Figure 12-8
89 Frost Street
Subsurface Soil at Depth
Contamination Area

FROST STREET SITES
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043 L

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this area appears to be to approximately 55 ft bgs, based on the presence of contamination at different depths in the soil column.

A preliminary evaluation of the remedial alternative of excavation and off-site disposal of contaminated subsurface soils at depth at the site was developed based on the following assumptions:

- Excavation depths to approximately 55 ft bgs would be required, as identified in the RI. Uncontaminated or trace-contaminated soils overlying the contaminated area at depth would also need to be excavated and staged on-site to be used as fill or disposed of off-site. Thus, the total amount of soil to be excavated would be much greater than the above-noted volume of contaminated soil.
- Hand excavation to a depth of about 4 ft bgs in some areas will be required to avoid interference with utilities and subsurface debris (if present).
- Excavation to depths of approximately 55 ft bgs can be achieved using excavation equipment with extended reach modifications. However, excavation to these depths may require special excavation procedures. The implementability of all excavation approaches should be fully evaluated in the final design.
- Shoring and bracing will be required at the area of subsurface soil at depth contamination, since relying completely on sloping the excavation would not be viable due to site use constraints. Types and configurations of shoring/bracing should be specified in the final design. For cost estimating purposes, it is assumed that shoring/bracing will be installed in 20 ft depth increments during excavation activities.
- Additional shoring and site health and safety considerations must be specified for excavations exceeding approximately 20 ft bgs in the final design.
- It is assumed that utility relocation is not required.

As previously mentioned, all excavation work is to be performed in accordance with OSHA regulations. For costing purposes, the potential for water infiltration into excavation areas was not considered. However, water infiltration should be addressed in

the final design. Some of the excavated soils will be transported and disposed of off-site in approved solid waste disposal facilities. For cost estimating purposes, it was assumed that 10% of the targeted contaminated soils will be excavated and classified as “hazardous”. Thus, approximately 2100 yd³ of contaminated soil would be transported to and disposed of at an approved hazardous waste facility. It was assumed that approximately 90% of the targeted contaminated soils (about 19,000 yd³) and a portion (approximately 500 yd³) of soils that are excavated to reach the contaminated subsurface soils at depth will require off-site disposal and be classified as “nonhazardous”. Thus, about 19,500 yd³ of nonhazardous wastes would be transported to and disposed of at an approved local, solid waste disposal facility. The remainder of the excavated soils, not requiring off-site disposal, will be reused at the site during backfill and site restoration activities.

For cost estimating purposes, it is assumed that the remedial excavation work for the subsurface soils at depth described in this alternative will be completed in a 60 day period. The actual remediation time may be shorter or longer; better estimates may be made during the final design.

Confirmatory Sampling. Once the excavation of subsurface soils at depth is completed, approximately 32 post-excavation soil samples will be collected from Area 1 and analyzed for VOCs. Approximately 24 samples will be collected from the excavation bottom, and eight sidewall samples will be collected. For cost estimating purposes, it was assumed that concentrations of analytes in all of the post-excavation soil samples collected after the initial round of subsurface soil at depth excavation will be within regulatory limits and that no additional soil excavation will be required. However, based on the results of the sampling event, it is possible that additional excavation of subsurface soils at depth may be required at the site. If so, additional rounds of post-excavation soil sampling will need to be conducted following the additional excavation activities.

12.4.3 Alternative 89-S3: Excavation/Off-Site Disposal of Shallow Subsurface Soils/ SVE for Subsurface Soils at Depth

12.4.3.1 *Shallow Subsurface Soils.* Shallow subsurface soils under this alternative are addressed in the same manner as described in Section 12.4.2.1 of Alternative 89-S2.

12.4.3.2 ***Subsurface Soils at Depth.*** Alternative 89-S3 includes the implementation of SVE. This alternative does not include institutional measures or a long-term monitoring program as human exposure to soil contaminants is very limited, because contaminants are present only at depths of 25 ft bgs or greater. Likewise, since future excavations are not expected to extend to 25 ft bgs, institutional measures are not warranted to prevent exposure to future on-site workers.

SVE System Components. A general discussion of SVE technology is presented in Section 12.3.3.2 for Alternative 101-S3. Prior to designing the system, a pilot-scale treatability study should be conducted to determine the optimal extractions rate and configuration of the VEPs. A pilot-scale test will determine the optimal operating pressures and flow rates to remove contaminants from the subsurface and will evaluate the airflow distribution. The results of the pilot test will be used to predict the minimum amount of time the SVE system needs to operate to achieve soil-specific remedial action objectives.

Based on the geological information compiled during the RI and assumptions regarding system performance, it is estimated that five VEPs and one blower with a 7.5 hp motor will be sufficient to vent the contaminated zones at depth at this site. This blower is sized to achieve a 50-ft radius of influence (conservatively) in each of the five VEPs in subsurface soils at depth at 89 Frost Street. In the absence of pilot test data, these assumptions were made using the EPA guidance software Hyperventilate Version 2.0 ®. The proposed locations for these wells are shown in Figure 12-9. Piping would be installed below grade as not to interfere with site operations and to minimize piping and equipment on the ground surface. A building (approximately 500 ft²) would be constructed to store and operate the treatment system; the proposed location of this building is shown in Figure 12-9.

Operation and maintenance costs associated with the remediation system include electrical, pump and system maintenance, and operator attention (half time). Wastes produced by the remediation process include condensate from the moisture separator and spent vapor phase GAC. It is assumed that these wastes will be disposed of or recycled at approved off-site locations. For the purposes of this FS, it was assumed that the condensate and vapor phase GAC are classified nonhazardous waste for disposal. Representative waste characterization

89 Frost Street Area 1

Approximate location of
SVE treatment system

DW-9

DWA-10

DW-12

DW-11

DW-14

DW-13

89 Frost Street

Main Street

DW-15

DW-16

DW-17

770 Main St.

0 40 ft

Approximate Scale
1 in. = 40 ft

LEGEND

○ Dry well location

/// Area of subsurface soil at depth contamination

● Vapor extraction point (VEP)

Figure 12-9 89 Frost Street Proposed SVE Configuration Subsurface Soil at Depth Contamination Area

FROST STREET SITES
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043 L

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Map source: YEC, 1998.

189 frost soil closeup.dsf

samples should be collected and analyzed to confirm that the wastes (i.e., materials contaminated with VOCs) are nonhazardous for disposal (i.e., do not exceed standards for toxicity, ignitability, corrosivity, and reactivity).

For cost estimating purposes, it is assumed that the remedial objectives for the subsurface soils at depth under this alternative will be met in ten years (based on discussions with SVE vendors and review of case studies). The actual cleanup time may be longer or shorter than ten years; better estimates of cleanup time can be made based on the pilot-scale treatability study.

It was assumed that vapor phase treatment of the extracted air would be needed for the life of the system. However, vapor phase treatment may become unnecessary if contaminant emissions satisfy regulatory requirements. Periodic testing (once every two months) of the extracted air stream would determine if contaminant levels have dropped below regulatory levels. The SVE system will continue to operate until consecutive air monitoring samples yield acceptable or non-detectable VOC concentrations in the exhaust gas.

Confirmatory Sampling. Once the SVE system is shut down and it is believed that remedial action objectives have been satisfied, confirmatory soil samples would be collected. Approximately 25 soil samples would be collected in the remediation areas (at depths varying between about 25 and 50 ft bgs) and analyzed for VOCs. If all of the samples have concentrations which satisfy the remedial action objectives, soil remediation may be deemed complete. For the purposes of this FS study, it is assumed that one round of confirmatory sampling would be performed.

12.4.4 Alternative 89-S4: SVE for Shallow Subsurface Soils and Subsurface Soils at Depth

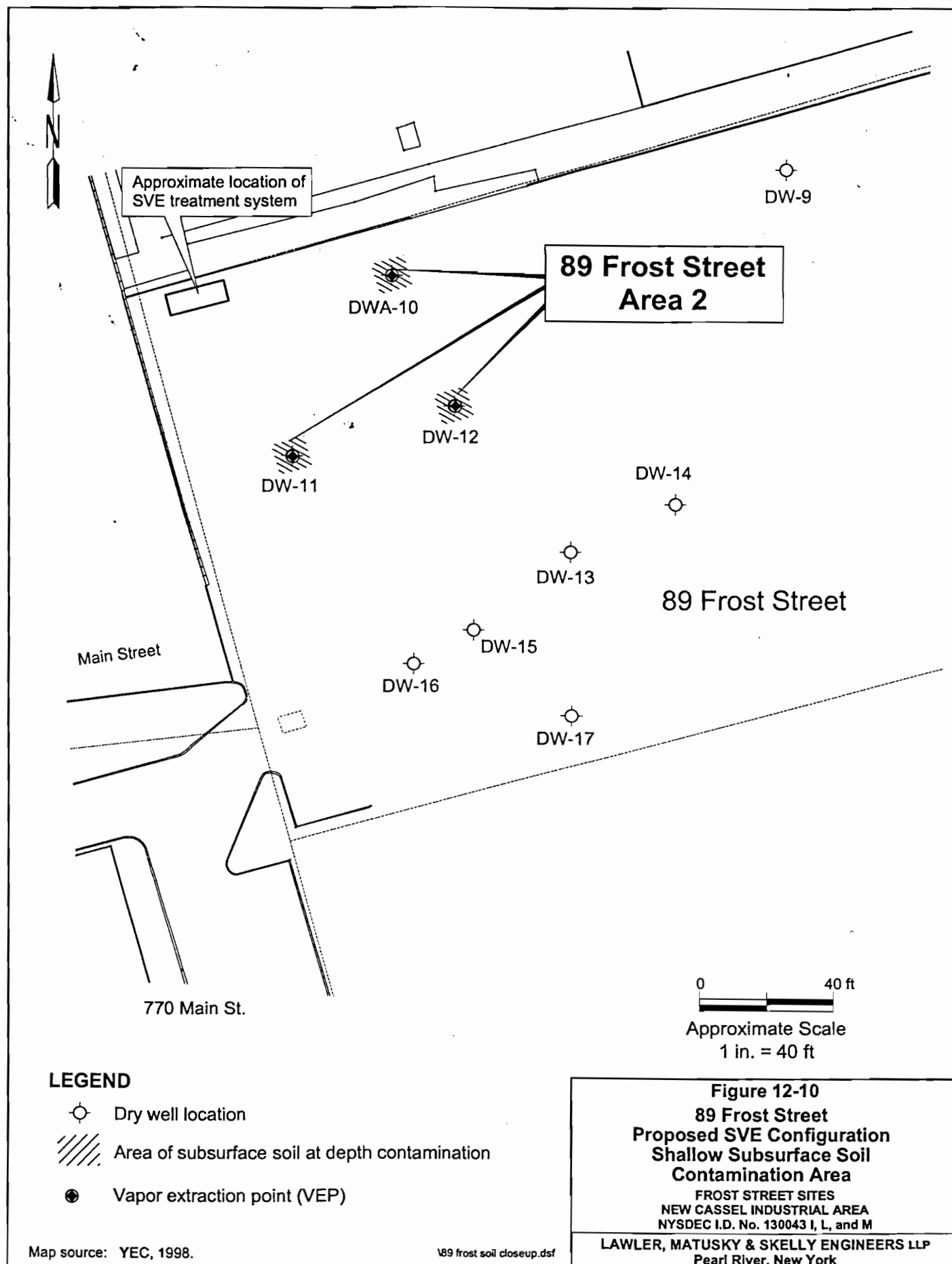
12.4.4.1 *Shallow Subsurface Soils.* Alternative 89-S4 includes the implementation of SVE and institutional measures to restrict site access and use, since future excavations may extend to 25 ft bgs. A general discussion of SVE technology is provided in Section 12.3.3.2 for Alternative 101-S3. Prior to designing the system, a pilot-scale treatability study should be conducted to determine the optimal extraction rate and configuration of the VEPs. A pilot-scale test will determine the optimal operating pressures and flow rates

to remove contaminants from the subsurface and will evaluate the airflow distribution. The results of the pilot test will be used to predict the minimum amount of time the SVE system needs to operate to achieve soil-specific remedial action objectives. This is especially true for moist/heterogeneous shallow subsurface soils at 89 Frost Street that may potentially exhibit contamination other than VOCs.

Based on the geological information compiled during the RI and assumptions regarding system performance, it is estimated that three VEPs and one blower (with a 3 hp motor) will be sufficient to vent the contaminated zones in the shallow subsurface soils. This blower is sized to achieve a 10-ft radius of influence (conservatively) in each of the three VEPs at 89 Frost Street. In the absence of pilot test data, these assumptions were made using the EPA guidance software Hyperventilate Version 2.0 ®. The proposed locations for these wells are shown in Figure 12-10. Piping would be installed below grade as not to interfere with site operations and to minimize piping and equipment on the ground surface. A small building (approximately 500 ft²) would be constructed to store and operate the treatment system; the proposed location of this building is shown in Figure 12-10.

Operation and maintenance costs associated with the remediation system include electrical, pump and system maintenance, and operator attention (half time). Wastes produced by the remediation process include condensate from the moisture separator and spent vapor phase GAC. It is assumed that these wastes will be disposed of or recycled at approved off-site locations. For the purposes of this FS, it was assumed that the condensate and vapor phase GAC are classified nonhazardous waste for disposal. Representative waste characterization samples should be collected and analyzed to confirm that the wastes (i.e., materials contaminated with VOCs, SVOCs, and metals) are nonhazardous for disposal (i.e., do not exceed standards for toxicity, ignitability, corrosivity, and reactivity).

It is assumed that the remedial objectives for the shallow subsurface soils under this alternative will be met in three years (based on discussions with SVE vendors and review of case studies). The actual cleanup time may be longer or shorter than three years; better estimates of cleanup time can be made based on the pilot-scale treatability study. For cost estimation, it was assumed that the timeframe for SVE treatment of the shallow subsurface soil contamination at the 89 Frost Street site will be ten years, to match the cleanup time derived for the subsurface soils at depth under this alternative.



It was assumed that vapor phase treatment of the extracted air would be needed for the life of the system. However, vapor phase treatment may become unnecessary if contaminant emissions satisfy regulatory requirements. Periodic testing (once every two months) of the extracted air stream would determine if contaminant levels have dropped below regulatory levels. The SVE system will continue to operate until consecutive air monitoring samples yield acceptable or non-detectable VOC concentrations in the exhaust gas.

Confirmatory Sampling. Once the SVE system is shut down and it is believed that remedial action objectives have been satisfied, confirmatory soil samples would be collected. Approximately three soil samples would be collected in the remediation areas (i.e., one sample in the vicinity of each of the three dry wells associated with shallow subsurface soil contamination, collected at a depth between approximately 10 and 25 ft bgs) and analyzed for VOCs, SVOCs, and metals. If all of the samples have concentrations which satisfy the remedial action objectives, soil remediation may be deemed complete. For the purposes of this FS study, it is assumed that one round of confirmatory sampling would be performed.

12.4.4.2 **Subsurface Soils at Depth.** Subsurface soils at depth under this alternative are addressed in the same manner as described in Section 12.4.3.2 of Alternative 89-S3.

12.4.5 **Alternative 89-S5: No Action on Shallow Subsurface Soils/SVE for Subsurface Soils at Depth**

12.4.5.1 **Shallow Subsurface Soils.** As part of this alternative, no action will be taken on contaminated shallow subsurface soils. Institutional controls (e.g., deed and development restrictions) are included to minimize contact with the contaminated media. Deed and development restrictions will prohibit construction in specified areas of the site that would expose workers, or the surrounding public, to any remaining subsurface soil contaminants. Notices on deeds and building permits will act as reminders of these development restrictions.

12.4.5.2 **Subsurface Soils at Depth.** Subsurface soils at depth under this alternative are addressed in the same manner as described in Section 12.4.3.2 of Alternative 89-S3.

CHAPTER 13

DEVELOPMENT AND SCREENING OF GROUNDWATER RESPONSE ALTERNATIVES

13.1 INTRODUCTION

Chapter 13 presents the remedial alternatives that have been developed to address the near-field groundwater contaminant plume at the three Frost Street sites. In Chapter 13, remediation alternatives have been formulated to address the groundwater contaminant plume present at all three sites collectively (i.e., not just the portion of the overall plume at each individual site). Remedial alternatives that address groundwater contamination (i.e., the near-field groundwater plume) are referred to as "groundwater response" alternatives. These groundwater response alternatives are intended to control the further migration of contaminants in the sites' groundwater medium. Groundwater response alternatives have the prefix "G" in their title, as in "Alternative G1".

13.2 DEVELOPMENT OF GROUNDWATER RESPONSE ALTERNATIVES

Table 11-5 in Chapter 11 indicates the groundwater response technologies that successfully passed the screening. These technologies were considered for inclusion in the remedial alternatives based on their applicability to site conditions and expected effectiveness on reducing groundwater contaminant concentrations in a reasonable time frame. Technologies that were retained but not subsequently incorporated into alternatives may be substituted for any technology that proves to be ineffective following a bench or pilot scale study.

Four groundwater response alternatives were selected for inclusion in the detailed evaluation of alternatives. The technical elements of each are summarized in Table 13-1. This chapter provides a detailed description of the four selected groundwater response alternatives. Chapter 15 presents the evaluation of these alternatives against the criteria of protection of human health and the environment, compliance with state and Federal SCGs; short-term impacts and effectiveness; long-term impacts, effectiveness, and permanence; reduction of toxicity, mobility, or volume; implementability; and cost.

**GROUNDWATER RESPONSE
REMEDIAL ALTERNATIVES FOR DETAILED EVALUATION
Frost Street Sites**

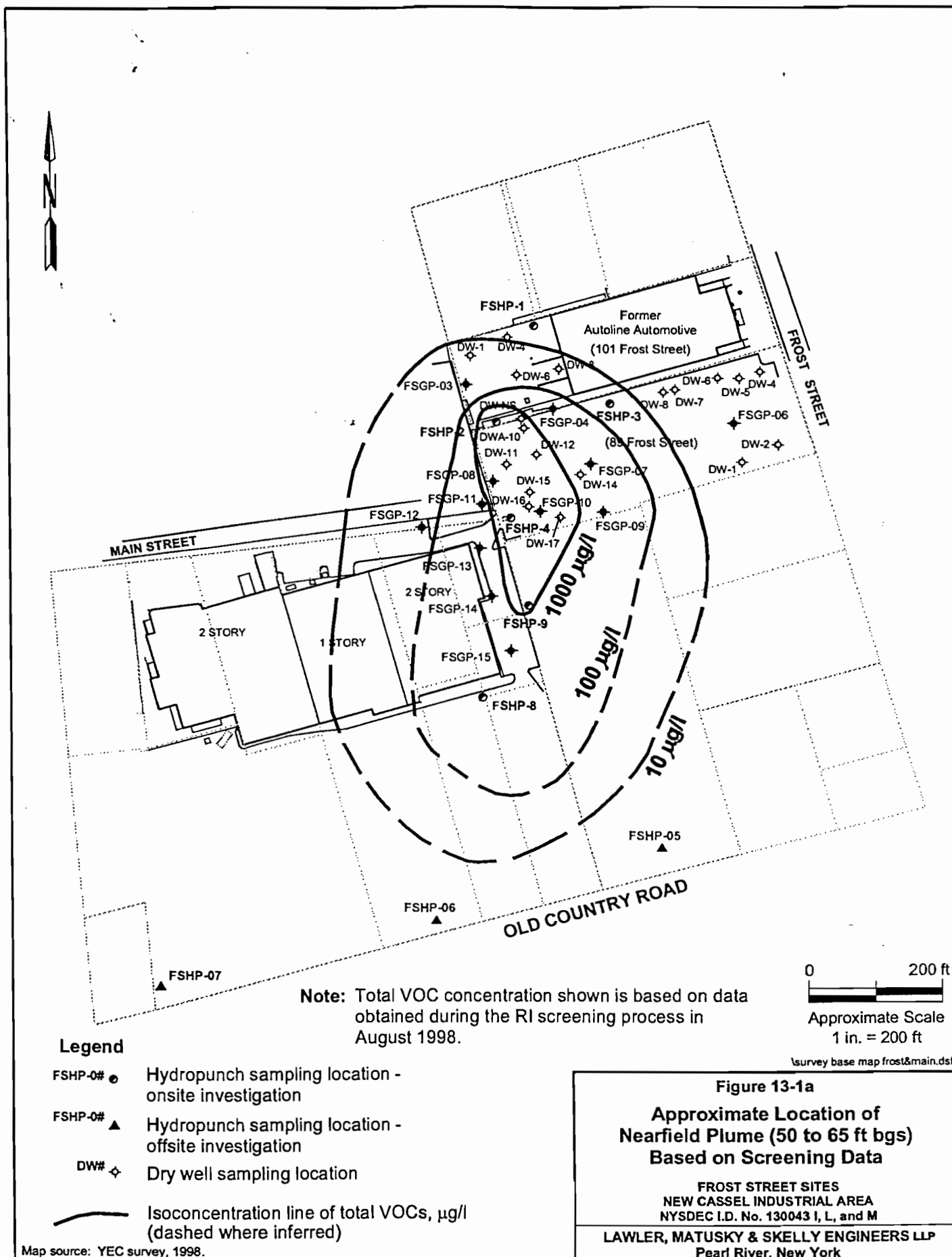
ALTERNATIVE	GENERAL RESPONSE ACTION/TECHNOLOGY TYPE
ALTERNATIVE G1: No Action	• Deed, development and groundwater use restrictions • Long-term groundwater monitoring • Natural attenuation
ALTERNATIVE G2: Air Sparging/Soil Vapor Extraction for Area Near Source; In-Well Air Stripping for Curtain Area/ Vapor Treatment	• Air sparging points • Soil vapor extraction points • In-well groundwater circulation system • Contaminant phase transfer • Vapor treatment system • Air emissions control (GAC) • System performance monitoring
ALTERNATIVE G3: Sitewide In-Well Vapor Stripping/ Vapor Treatment	• In-well groundwater circulation system • Contaminant phase transfer • Vapor collection • Vapor treatment system • Air emissions control (GAC) • System performance monitoring
ALTERNATIVE G4: Groundwater Extraction/ Air Stripping/ Reinjection/ Vapor Treatment	• Groundwater extraction wells • Groundwater treatment system • Sludge generation and off-site disposal • Air emissions control (GAC) • Reinjection of treated effluent • System performance monitoring

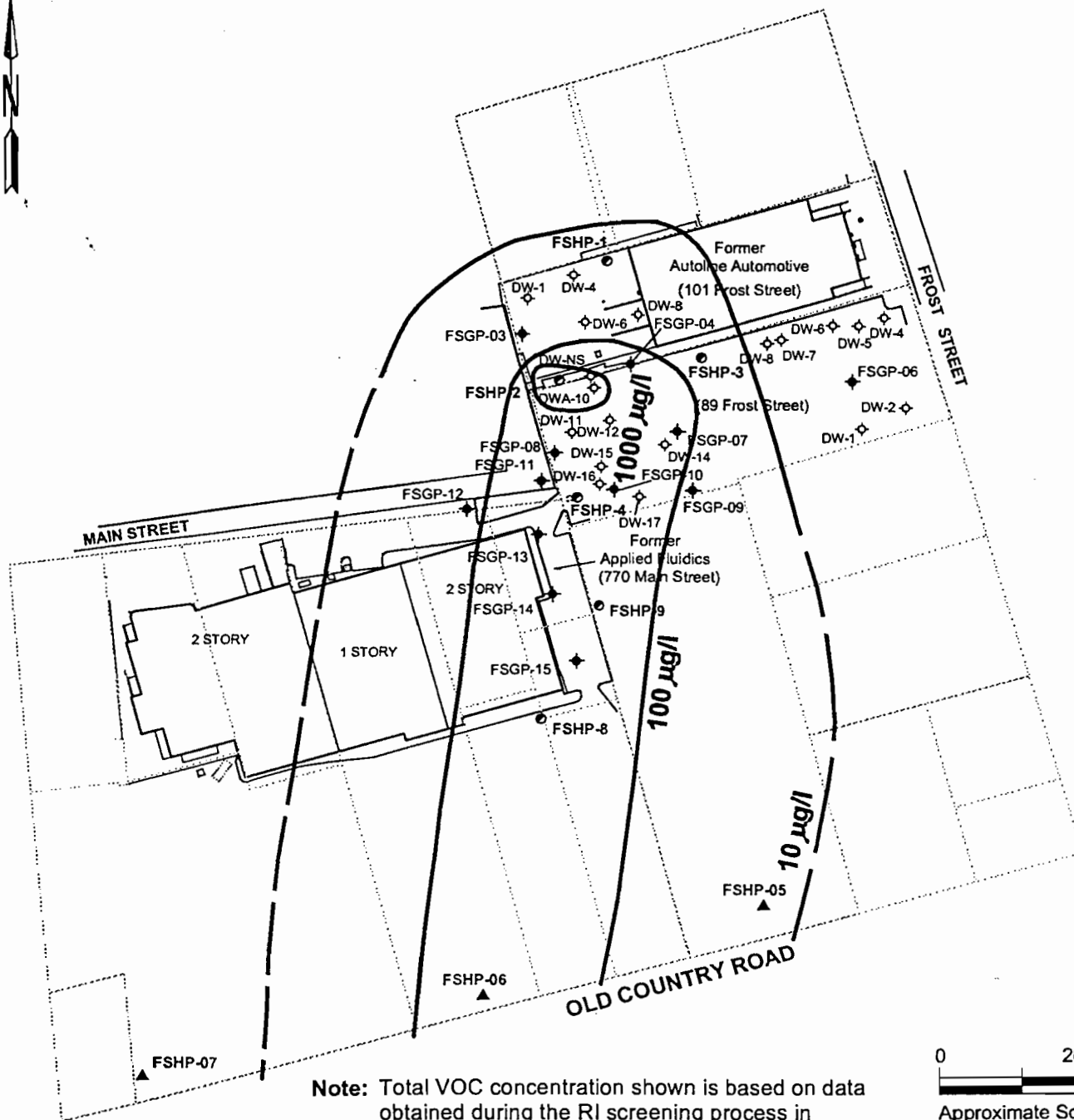
The groundwater response alternatives are intended to remediate near-field contaminant plume, as previously defined, associated with the Frost Street sites. Remediation systems proposed in this FS focus on treating the groundwater near the source area down to 80 ft bgs and the groundwater near the southern site border down to 150 bgs. Implementing this remediation strategy will significantly reduce VOC concentrations in the groundwater near the source area and control groundwater contaminants from migrating off-site. Contaminated groundwater located outside of the near-field plume (i.e., the far-field plume) will be addressed as part of the forthcoming New Cassel Industrial Area (NCIA) RI/FS. The approximate location of the near-field plume is shown in Figures 13-1a through 13-1e.

13.2.1 Alternative G1: No Action

Alternative G1 is considered to be the no action alternative required by the NCP because it does not include active treatment of the contaminant plume. The plume will simply be monitored to track its spread and contaminant concentration over time. Alternative G1 also includes institutional controls in the form of deed, development, and groundwater use restrictions. These controls will prohibit land use of and/or construction in specified areas of the site that would expose workers, or the surrounding public, to any remaining groundwater contaminants. Notices on deeds and buildings will act as reminders of these development restrictions. Groundwater use restrictions will be implemented to prevent development of the underlying groundwater as a potable or a process water source without necessary water quality treatment as determined by NYSDEC. Implementation of deed and development restrictions is a method of enforcing groundwater use restrictions.

The purpose of the long-term groundwater monitoring program is to monitor any migration of the groundwater plume or change in contaminant concentration. The monitoring program includes 18 wells, which were selected based on their position in and around the near-field contaminant plume. Monitoring well locations are listed in Table 13-2 and shown in Figure 6-1. A 30-yr monitoring program has been assumed in order to allow for cost comparisons among the other alternatives. The need for such a monitoring program may be re-evaluated and possibly discontinued at any time during the 30-yr period. If contaminant levels continue to exceed the remedial action objectives at the end of the 30-yr period, the monitoring program may be extended, or other remedial actions





Legend

- FSHP-0# ● Hydropunch sampling location - onsite investigation
- FSHP-0# ▲ Hydropunch sampling location - offsite investigation
- DW# ◆ Dry well sampling location
- Isoconcentration line of total VOCs, µg/l (dashed where inferred)

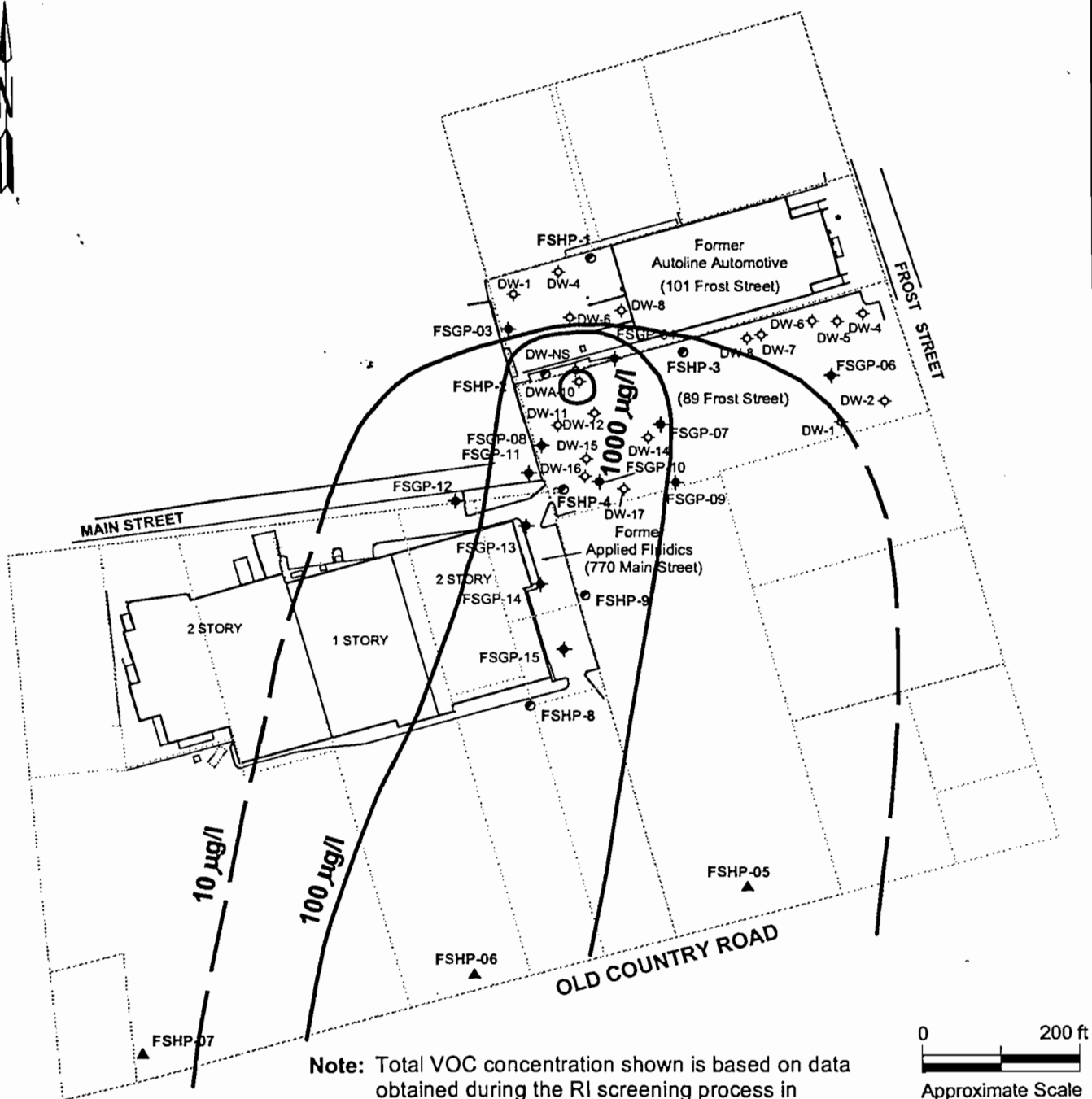
Map source: YEC survey, 1998.

Figure 13-1b

**Approximate Location of
Nearfield Plume (>65 to 90 ft bgs)
Based on Screening Data**

FROST STREET SITES
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043 I, L, and M

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York



Legend

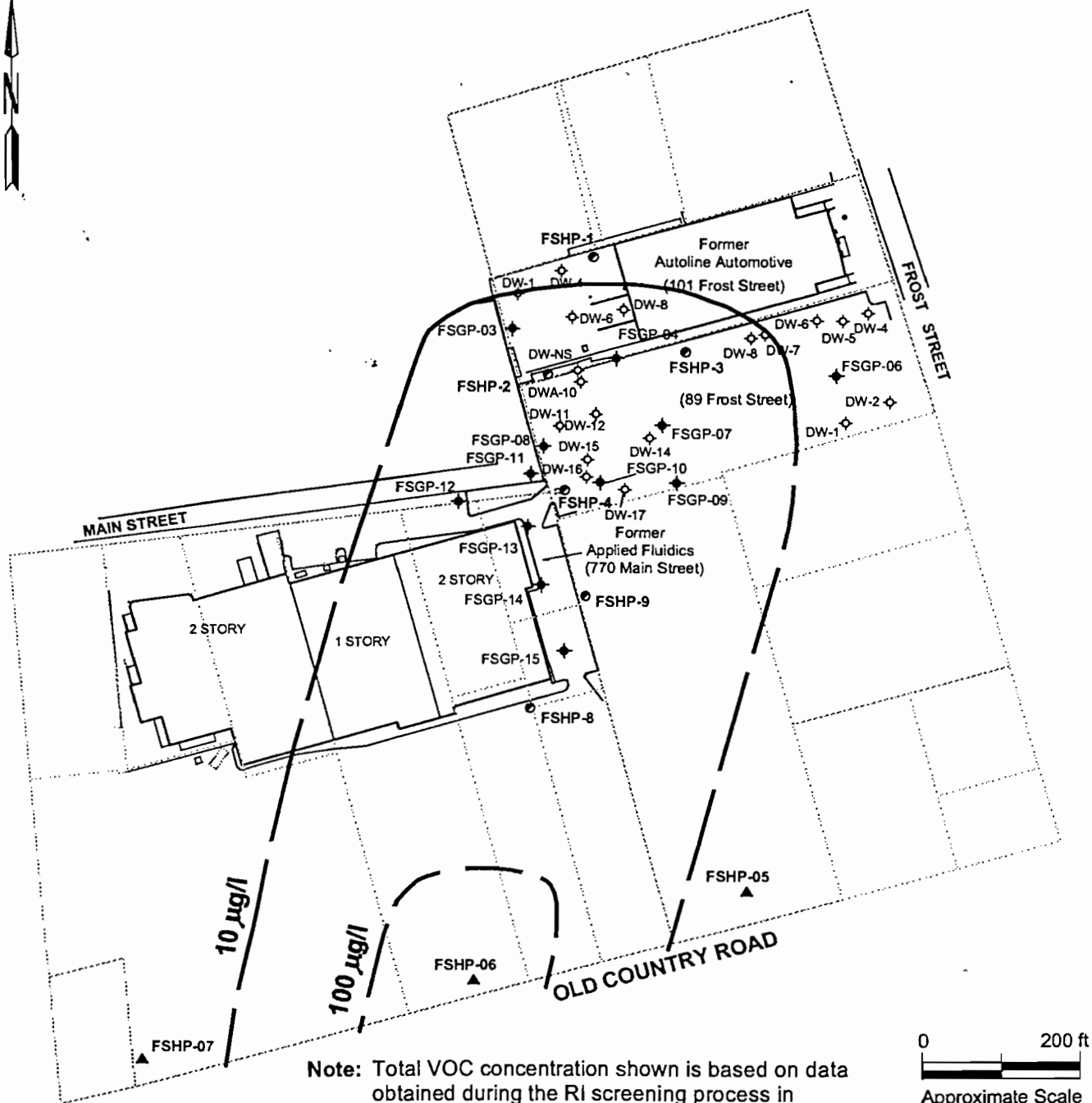
- FSHP-0# ● Hydropunch sampling location - on-site investigation
- FSHP-0# ▲ Hydropunch sampling location - off-site investigation
- DW# ◇ Dry well sampling location
- Isoconcentration line of total VOCs, µg/l (dashed where inferred)

Map source: YEC survey, 1998.

Isurvey base map frost&main.dsf

Figure 13-1c
Approximate Location of
Nearfield Plume (>90 to 110 ft bgs)
Based on Screening Data

FROST STREET SITES
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043 I, L, and M
LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York



Legend

- FSHP-0# ○ Hydropunch sampling location - onsite investigation
- FSHP-0# ▲ Hydropunch sampling location - offsite investigation
- DW# ◇ Dry well sampling location
- Isoconcentration line of total VOCs, µg/l (dashed where inferred)

Map source: YEC survey, 1998.

Figure 13-1d

Approximate Location of Nearfield Plume (>110 to 130 ft bgs) Based on Screening Data

FROST STREET SITES
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043 I, L, and M

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

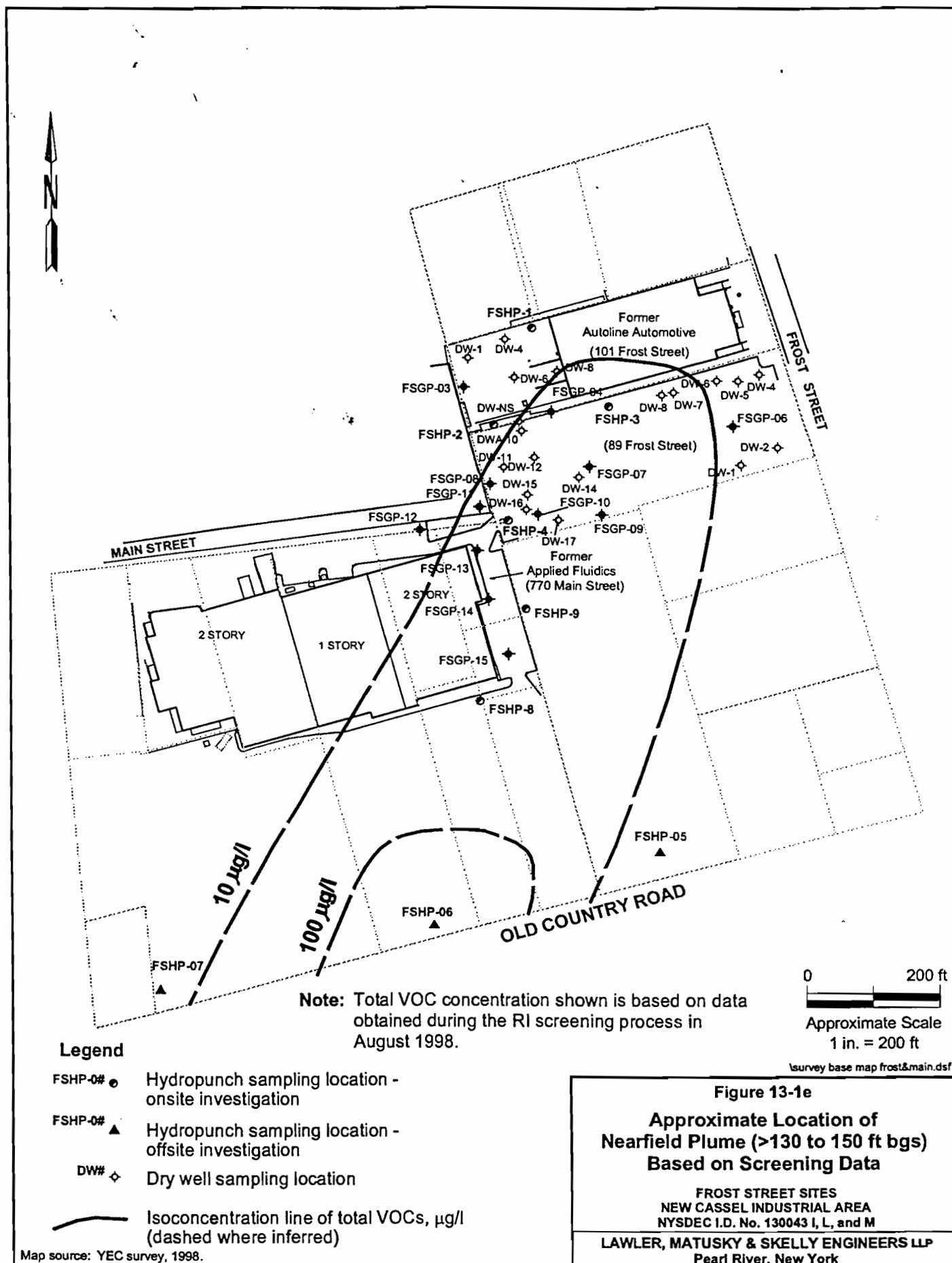


TABLE 13-2

**ALTERNATIVE G1 - NO ACTION
MONITORING PROGRAM SUMMARY ¹
Frost Street Sites**

WELL	DEPTH ²	<u>SAMPLING SCHEDULE ³</u>	<u>SAMPLING SCHEDULE ⁴</u>
		YEARS 1-5	YEARS 6-30
FSMW - 01A	shallow	X	X
FSMW - 02A	shallow	X	X
FSMW - 03A	shallow	X	X
FSMW - 04A	shallow	X	X
FSMW - 05A	shallow	X	X
FSMW - 06A	shallow	X	X
FSMW - 07A	shallow	X	X
FSMW - 08A	shallow	X	X
FSMW - 09A	shallow	X	X
FSMW - 10A	shallow	X	X
NC-6	shallow	X	X
EZ-EM-UN-4	shallow	X	X
LRF-1	shallow	X	X
Anson MW-5	shallow	X	X
EZ-EM-MW-1	shallow	X	X
FSMW-4B	deep	X	X
FSMW-6B	deep	X	X
FSMW-8B	deep	X	X
TOTAL:		18	18

X - Sampling is recommended.

O - Sampling is not recommended.

1 - This is a preliminary monitoring program developed for cost estimation purposes; the final monitoring program will be established during the remedial design phase; depending on the sample results, the schedule may be modified.

2 - Shallow wells have an approximate depth of 70-ft bgs; deep wells have an approximate depth of 150-ft bgs.

3 - All samples will be analyzed for VOCs quarterly.

4 - All samples will be analyzed for VOCs annually.

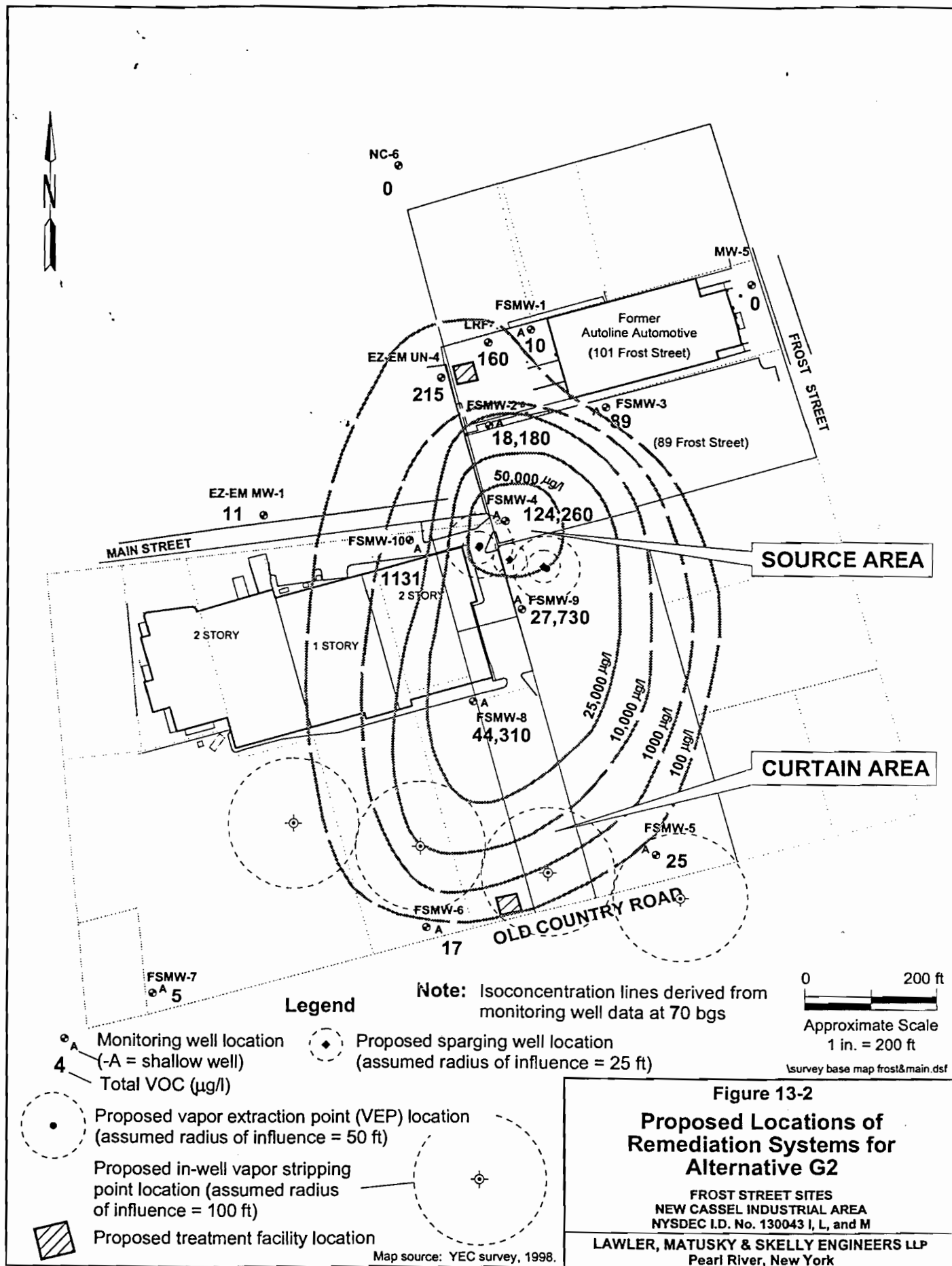
taken. In costing this alternative, it was assumed that the existing wells will be sufficient to assess the long term effects of the groundwater plume.

Records of contaminant concentrations over time will be kept and periodically evaluated to monitor trends. The cost estimate for this long-term groundwater monitoring program (provided in Chapter 15) assumes replacement of two of the monitoring wells being sampled every three years during the 30 years of monitoring. The replacement cost is necessary because a well could become plugged, the casing could collapse, or the monitoring well could be damaged.

13.2.2 Alternative G2: Air Sparging/Soil Vapor Extraction for Area Near Source; In-Well Vapor Stripping for Curtain Area

Alternative G2 uses a combination of the air sparging/soil vapor extraction (AS/SVE) technology and in-well vapor stripping technology to remediate the near field groundwater contamination at the Frost Street sites. An AS/SVE system is comprised of wells, known as sparging wells, installed in the zone of contaminated groundwater. Clean air is forced into the groundwater through the sparging wells. The induced air flow enhances the volatilization of the contaminants, causing upward migration to the vadose zone where they are captured by the SVE system. Collected vapors are treated aboveground to remove contaminants prior to discharging to the atmosphere. As part of this alternative, a network of AS/SVE points will be installed near the “source” area, or the area of highest contaminant concentration located in the southwest corner of 89 Frost Street (see Figure 13-2). As the use of the AS/SVE technology at depths exceeding approximately 80 ft bgs is limited by the site geology, the in-well vapor stripping technology will be used to treat groundwater to depths of 150 ft bgs. A network of in-well vapor stripping points will be installed in an area near the site’s southern boundary, referred to as the “curtain” area (see Figure 13-2). A “curtain” configuration is a common term used in remediation engineering to describe a remediation system setup that acts to contain contaminants on-site and prevent them from being transported to downgradient areas.

A long-term groundwater monitoring program is included in Alternative G2 to monitor the performance of the AS/SVE system and to ensure that contaminant concentrations are decreasing at an acceptable rate.



13.2.2.1 Air Sparging/Soil Vapor Extraction System for Source Area. AS/SVE is a demonstrated in-situ physical/chemical treatment alternative for remediating contaminated groundwater, as per EPA's Superfund Innovative Technology Evaluation (SITE) program. In the AS/SVE technology, compressed air is injected into air sparging wells at controlled pressures and volumes to introduce air channels into the contaminated saturated zone. The air channels induce in-situ air stripping of dissolved VOCs and volatilize trapped and adsorbed phase contamination present in the aquifer. In addition, aerobic biodegradation of the contaminants may also occur, depending on site-specific conditions. The air channels containing contaminants travel from the saturated zone up to the unsaturated zone. The injection sparging wells are arranged such that the entire area requiring treatment is effectively aerated, which may involve creating overlapping zones of influence.

An SVE system then collects vapor-phase VOCs and transports them to the surface for subsequent treatment. The SVE system consists of vapor extraction points (VEPs) placed in the unsaturated zone above the contaminated groundwater and a vacuum system at the ground surface to remove vapors from the VEPs.

Air compressors or blowers are typically used to deliver a stream of air under pressure to the subsurface via the sparging wells, and vacuum pumps are utilized for the removal of contaminants in the vapor phase. The aboveground AS/SVE system components also typically include a vapor treatment system and a process control system to monitor and adjust air delivery and removal equipment for maximum remediation efficiency.

For this FS, a preliminary assessment has been made of the AS/SVE system configuration, radii of influence, and air flow rates based on historical application and reported subsurface conditions. The goal of the AS/SVE system is to remediate the area of highest contaminant concentration located in the southwest corner of 89 Frost Street where the VOC concentration exceed 50,000 ug/l. At the Frost Street sites, an air sparging system would include the installation of approximately three air sparging wells, each consisting of 2-in diameter Schedule 40 PVC. The number of sparging wells was derived based on an anticipated radius of influence of approximately 25 ft from each sparging well. Figure 13-2 shows the approximate locations of the air sparging wells. Each well will be mounted flush with the existing ground surface and installed to approximate depths of 85 ft bgs. A 5 hp air blower unit should be capable of producing a

free flow rate of approximately 30 scfm (approximately 10 scfm per well). Pilot testing and field measurements in the design phase of the work will more accurately determine the exact number and placement of each of the air sparging wells, along with specific subsurface air distribution patterns expected to result.

Approximately two vapor extraction points (VEPs) will be necessary to address the removal of VOCs transported through the unsaturated zone. Figure 13-2 displays the proposed locations of the VEPs. Pilot testing and field measurements in the design phase of the work will determine the exact number, placement, and depth of each of the VEPs. Each VEP will be 2 in. in diameter, and constructed of Schedule 40 PVC, mounted flush with the existing ground surface, and installed within the unsaturated zone. A 3-hp vacuum blower with a suction flow rate of approximately 100 scfm will be used for the SVE system. The radius of influence of each VEP is anticipated to be 50 ft. The conceptual design presented in this FS assumes a 25% overlap between radii of influence.

Components of the AS/SVE system include air compressor blowers, inlet filters, and associated piping; a vacuum blower, filters, associated piping, and moisture separator; vapor-phase GAC units (described below); piping; system control equipment (i.e., valves, meters, electronics, gauges, etc.); and a structure to house system components and vapor treatment equipment. One 700 ft² (approximate) building will be constructed to house the treatment equipment (i.e., the treatment facility and associated units should be low profile as to blend-in with the surroundings and on-site operations) and will be located near the source area. A part-time operator will be needed to operate and supervise the AS/SVE process and treatment plants. All piping that lies outside the treatment building will be installed below grade and trenched areas will be restored with a paved surface.

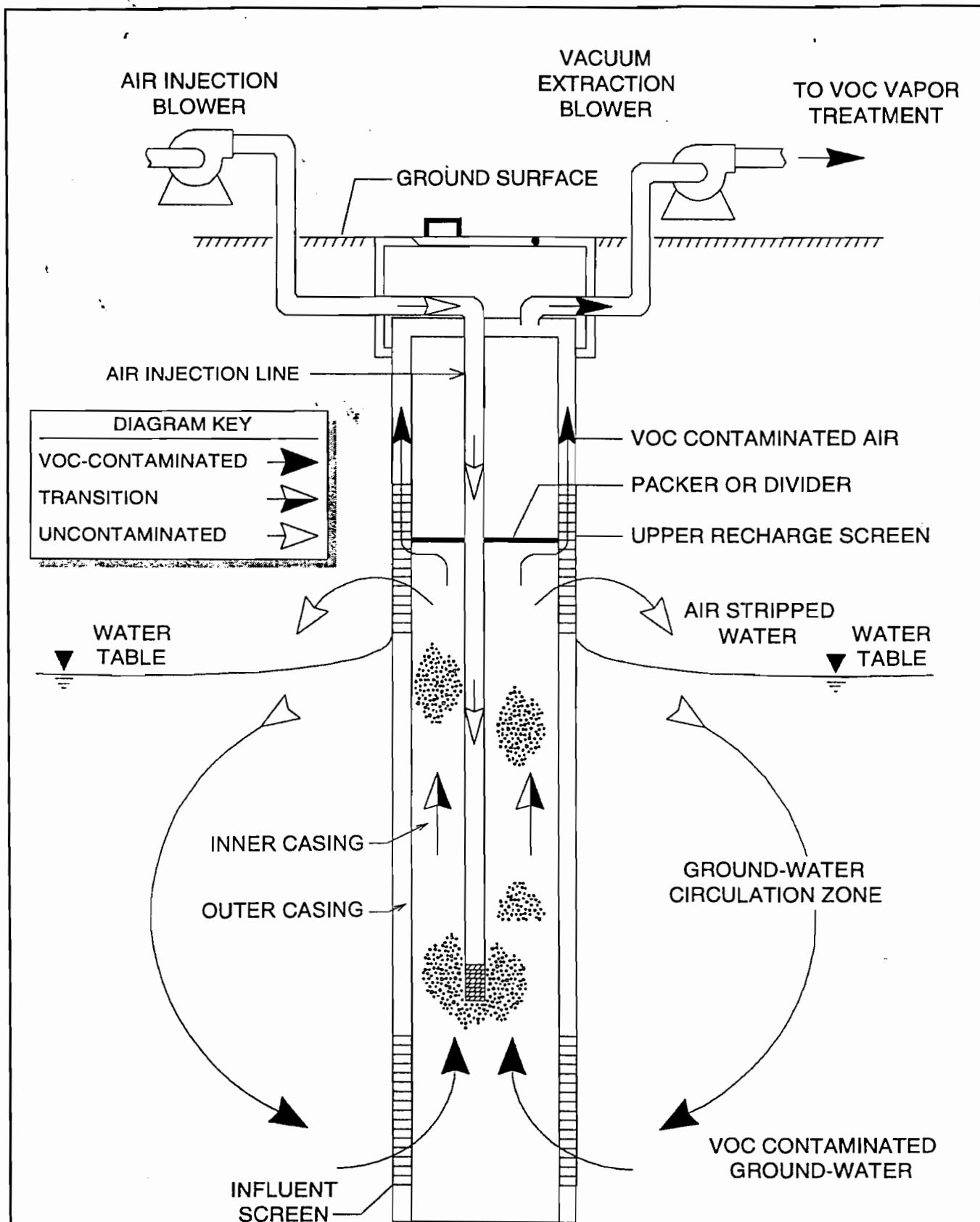
Operation and maintenance costs include electricity; periodic repair and replacement of system parts/components; routine operator inspection of the system; and system monitoring. System inspection and monitoring activities consist of routine visits to the site to inspect the air sparging and SVE components and collect real-time air measurements, as necessary.

Prior to final design, a pilot-scale treatability study should be performed to determine the overall effectiveness of the AS/SVE technology along with configurations (aerial locations and depths) of the sparging wells, VEPs, and system piping at the site. Site-

specific design parameters, such as zones of air distribution, injection air pressures, injection flow rates, and mass removal efficiency, can be obtained from a pilot test. A pilot scale test can also evaluate vapor phase treatment approaches. In addition, the extent of channeling at the site can be evaluated. The results of the pilot test would also be used to better estimate the run time and power requirements of the system.

Based on the literature, it was assumed that the AS/SVE system would take 10 yr to achieve the site's remedial objectives, after which the system will be shut down. The remediation time was estimated based on discussions with vendors and review of case studies. The actual cleanup time may be shorter or longer than 10 years; better estimates of cleanup time can be made based on a pilot-scale treatability study. Remedial objectives are considered to be achieved when all compliance monitoring results meet specified criteria in two consecutive sampling episodes. For this FS, a contingency of an additional two years is applied to the treatment time to account for rebounding. Rebounding is the term given to a common condition whereby a sudden increase in contaminant concentration occurs following system shutdown. Therefore, it is assumed the AS/SVE system will operate for a 12-year period.

13.2.2.2 *In-Well Vapor Stripping for Curtain Area.* In-well vapor stripping (also known as in-situ vacuum, vapor, or air stripping) is a demonstrated in-situ physical/chemical treatment alternative for remediating contaminated groundwater, as per EPA's SITE program. The technology involves the creation of groundwater circulation patterns, or "cells", in the subsurface surrounding specially designed wells and simultaneous aeration within the wells to volatilize VOCs from the circulating groundwater. Contaminated vapors are typically extracted from the wells and treated at the surface; however, unlike conventional groundwater remediation systems, in-well vapor stripping does not require groundwater to be pumped to and treated at the surface. This in-well air stripping technology is most applicable to VOCs (such as PCE and TCE); however, modifications of the basic remedial process are proposed for applications to treat SVOCs, pesticides, and inorganics. In-well vapor stripping has been used in unconfined and confined aquifers and applied to geologic materials with a range of characteristics. A schematic of the in-well vapor stripping process is shown in Figure 13-3.



Source: GWRTAC, 1997.

VFrost StreetVaporStrippingDiagram.dsf

An in-well stripping well consists of an inner and an outer casing that are hydraulically separated from one another, usually by a packer or divider plate. This separation ensures one-directional flow of groundwater into the well at its base (through a lower screened interval) and out of the well near the water table (through an upper screened interval). Air is injected into the well through a gas injection line and diffuser, releasing bubbles into contaminated groundwater in the well. These bubbles aerate the water and form a type of air-lift pumping system (due to an imparted density gradient) that causes groundwater to flow upward in the well. As the bubbles rise, VOC compounds in the water are transferred from the dissolved state to the vapor state through an air stripping process.

The air/water mixture rises in the well until it encounters the dividing device within the inner casing. The divider is designed and located within the well to maximize volatilization. The air/water mixture flows from the inner casing to the outer casing through the upper screen. A vacuum is applied in the outer casing, and contaminated vapors are drawn upward through the annular space between the two casings and typically treated at the ground surface. The partially treated groundwater, from which some of the VOCs have been removed, re-enters the subsurface through the upper screen and infiltrates back to the aquifer and the zone of contamination where it is eventually cycled back into the well. This pattern of groundwater movement forms a circulation cell in the subsurface around the well that allows groundwater to undergo sequential treatment cycles until remedial objectives are achieved. A continuous VOC-rich vapor stream is created as contaminant concentrations in groundwater are significantly reduced.

Several commercial variations of the in-well vapor stripping process have been developed. Proprietary variations of this technology include, but are not limited to, the Unterdruck-Verdampfer-Brunnen (UVB) or “vacuum vaporizer well” system, the NoVOCs™ system, and the Density Driven Convection (DDC) system.

At the Frost Street sites, the in-well vapor stripping and AS/SVE systems would be located in separate areas of the site. The in-well vapor stripping system would include the installation of four groundwater circulation/stripping wells (approximately 8-in. diameter) to address the groundwater contamination near the source area based on contaminant depths and the anticipated radius of influence. Figure 13-2 shows the approximate locations of these wells placed perpendicular to groundwater flow. Each

well will be mounted flush with the existing ground surface and installed to approximate depths of 160 ft bgs. The estimated groundwater flow rate in each well is 60 gallons per minute (gpm). Each stripping well, based on a 95-ft thick zone of contamination (located at approximated depths of 55-150 ft bgs across the sites), is estimated to produce a radius of influence of approximately 100 ft. The upper screened intervals in the wells will be installed at depths ranging from approximately 45-110 ft bgs to provide routes of groundwater reinfiltration to the subsurface. The lower screened intervals are estimated to be at about 110-160 ft bgs in each well. Pilot testing and field measurements in the design phase of the work will more accurately determine the construction details and placement of each of the four in-well vapor stripping wells, along with specific groundwater circulation/treatment patterns expected to result.

Components of the in-well vapor stripping system include: air injection blowers and associated piping; vacuum extraction blowers (for vapor collection) and associated piping; moisture separators and condensate storage containers; system control equipment (i.e., valves, meters, electronics, gauges, etc.); and an iron sequestering/pH control system. Equipment will be housed in a 700 ft² (approximate) treatment building, which will be located near the area to be treated.

VOCs in the vapor phase are collected from each well and pumped with a vacuum extraction blower to a GAC treatment system. The vapor flow rate for the proposed system is expected to be approximately 2000 scfm. In each treatment area, the vapors containing VOCs are passed through the GAC medium, adsorbed, and then vented to the atmosphere. Initial carbon usage rates were estimated to be approximately 145 lb/day. It is assumed that as VOC concentrations in the groundwater and vapor streams are reduced over time, the carbon usage rates will also decrease. More information on the anticipated carbon usage rates is provided in the next section.

Operation and maintenance costs include electricity; periodic repair and replacement of system parts/components; iron control chemical replenishment; routine operator inspection of the system; and system monitoring. System inspection and monitoring activities consist of routine visits to the sites to inspect the in-well vapor stripping components and collect real-time air measurements, as necessary.

Prior to final design, a pilot-scale treatability study should be performed to determine the overall effectiveness of the in-well vapor stripping technology and well/piping configurations at the sites. A pilot scale test can also determine optimal operating pressures and flow rates to remove contaminants from the groundwater and evaluate the airflow distribution and vapor phase treatment approaches. In addition, control of iron and pH in the subsurface can be evaluated. The results of the pilot test will also be used to better estimate the run time and power requirements of the system. The duration of the pilot study is estimated to be four months.

Based on discussions with vendors and review of case studies, it was assumed that the in-well vapor stripping system would take 10 years to achieve the site's remedial objectives, after which the system will be shut down. The actual cleanup time may be shorter or longer than 10 years; better estimates of cleanup time can be made based on a pilot-scale treatability study. Remedial objectives are considered to be achieved when all compliance monitoring results meet specified criteria in two consecutive sampling episodes. For this FS, a contingency of an additional two years is applied to the treatment time to account for rebounding as previously described. Therefore, it is assumed the in-well vapor stripping system will operate for a 12-year period.

13.2.2.3 Vapor Phase Treatment. Vapors from the AS/SVE and in-well vapor stripping processes will be collected separately. Each system will collect the vapors and transfer them with a vacuum extraction blower to separate GAC treatment systems (located as shown in Figure 13-2). Each treatment system will be housed in a treatment building, which will house the blowers, vacuum pumps, controls, and GAC vapor treatment units for the vapor extraction system. As shown in Figure 13-2, the proposed locations of the two treatment buildings are on the western side of the 101 Frost Street site and on the southeastern portion of the 770 Main Street site. The exact locations of the treatment buildings will be determined in the design phase.

The vapor phase flow rates are expected to be approximately 100 scfm for the AS/SVE system near the source area and 2000 scfm for the in-well vapor stripping system near the curtain area. Collected vapors containing VOCs are passed through a GAC medium, adsorbed, and then vented to the atmosphere. Initial carbon usage rates were estimated to be approximately 240 lb/day for the AS/SVE system and 120 lb/day for the in-well vapor stripping system. It is assumed that as VOC concentrations in the groundwater and vapor

streams are reduced over time, the carbon usage rates will also decrease. When GAC is spent (i.e., saturated with VOCs), it is transported off-site and replaced with fresh material.

High relative humidity of the treated vapor (i.e., above about 50%) reduces the adsorption efficiency of the GAC. In addition, moisture and condensate can accumulate within the vapor extraction piping. To address these issues, vacuum extraction blowers will be specified so that sufficient heat is imparted to the vapor stream and the relative humidity is maintained within satisfactory limits. Any condensate that is created in the system will be collected and periodically disposed of at an approved off-site facility.

A preliminary review of the VOC constituents and respective vapor phase concentrations indicates that an emission stack will probably not be required. However, the ultimate configuration of the entire vapor recovery/treatment system, including GAC usage rates over time, should be based on the results from the pilot study. Air monitoring and inspection of the vapor treatment system after startup may also determine system requirements. Based on the desktop evaluation presented in Chapter 10, GAC was the assumed vapor phase treatment option for the AS/SVE and in-well vapor stripping technologies. However, other vapor phase treatment options (i.e., catalytic oxidation and UV treatment) should be reevaluated during the final design and treatability study.

13.2.2.4 Waste Disposal. It is estimated that approximately 15 yd³ of uncontaminated, nonhazardous soil will require off-site disposal from the installation of the AS/SVE and in-well vapor stripping systems. In addition, approximately 4000 ft² of asphalt will also be excavated in the trenching process and require off-site disposal.

It is conservatively estimated that approximately 260 gallons per month of condensate will accumulate aboveground in the vapor extraction treatment area and 1230 gallons per month will accumulate from the in-well vapor stripping operation. As noted, condensate will be periodically collected and disposed of at an approved off-site facility. Analytical sampling of the condensate and any other materials generated during remedial activities will be conducted to characterize the wastes and identify disposal options.

13.2.2.5 System Performance Monitoring. To confirm that the combined AS/SVE and in-well vapor stripping systems are achieving remedial objectives, groundwater samples

will be collected from piezometers installed for system performance monitoring and analyzed for VOCs. The results of these analyses will be used to determine whether remedial action objectives are being satisfied, and whether changes in system design, configuration, and operation are required.

Long-term groundwater monitoring will be conducted on a periodic basis to determine if remedial objectives are being met. For cost estimating purposes, it was assumed that groundwater monitoring will be conducted semi-annually for the first five years, and annually for years six through twelve. Table 13-3 lists the 13 wells to be sampled for the Alternative G2 groundwater monitoring program.

The need for monitoring can be re-evaluated and possibly discontinued at any time during the 12-yr period. If groundwater contaminant levels remain below the site remedial action objectives for two consecutive sampling events, the monitoring program may be discontinued. If contaminant levels continue to exceed the remedial action objectives at the end of the 12-yr period, the monitoring program and system operation will be extended and/or other remedial actions may be taken.

13.2.3 Alternative G3: Sitewide In-Well Vapor Stripping

Alternative G3 includes remediating the near-field plume at the Frost Street sites by implementing in-well vapor stripping, an in-situ remediation technology, and off-gas treatment. This alternative also includes long-term monitoring of the groundwater plume to define treatment effectiveness and contaminant levels.

The reported advantages of using the in-well vapor stripping technology alone over other methods for remediating contaminated groundwater include:

TABLE 13-3

**ALTERNATIVE G2 - AIR SPARGING/SOIL VAPOR EXTRACTION FOR AREA NEAR
SOURCE; IN-WELL VAPOR STRIPPING FOR CURTAIN AREA
MONITORING PROGRAM SUMMARY**

Frost Street Sites

WELL	DEPTH ¹	<u>SAMPLING SCHEDULE</u> YEARS 1-5 ²	<u>SAMPLING SCHEDULE</u> YEARS 6-12 ³
FSMW - 02A	shallow	X	X
FSMW - 03A	shallow	X	X
FSMW - 04A	shallow	X	X
FSMW - 06A	shallow	X	X
FSMW - 07A	shallow	X	X
FSMW - 08A	shallow	X	X
FSMW - 09A	shallow	X	X
FSMW - 10A	shallow	X	X
EZ-EM-UN-4	shallow	X	X
EZ-EM-MW-1	shallow	X	X
FSMW-4B	deep	X	X
FSMW-6B	deep	X	X
FSMW-8B	deep	X	X
TOTAL:		13	13

X - Sampling is recommended.

1 - Shallow wells have an approximate depth of 70-ft bgs; deep wells have an approximate depth of 150-ft bgs.

2 - All samples will be analyzed for VOCs semi-annually.

3 - All samples will be analyzed for VOCs annually.

- Cost savings because there is no need to pump, handle, and treat groundwater at the surface; only contaminated vapor is extracted and treated in this technology.
- Easy integration with other remediation techniques (such as soil vapor extraction).
- Simplicity of design.
- Limited maintenance requirements.
- The system can be designed to run continuously with only routine maintenance.

Some limitations reported for this technology include:

- Possible clogging of well screens due to precipitation of iron or other nutrients present in the subsurface.
- Potential to spread contaminants in the subsurface if the system is not properly designed or constructed.
- Lower effectiveness in shallow aquifers (due to limited area for groundwater recirculation).

As discussed in the previous section (Alternative 2), several commercial variations of the in-well vapor stripping process are commercially available.

13.2.3.1 In-Well Vapor Stripping. As the in-well vapor stripping technology was discussed in the previous section, only a brief synopsis of the technology will be presented below. In-well vapor stripping is a demonstrated in-situ physical/chemical treatment alternative for remediating contaminated groundwater, as per EPA's SITE program. A schematic of the in-well vapor stripping process is shown in Figure 13-3.

The proposed in-well vapor stripping system under Alternative 3 would include the installation of six groundwater circulation/stripping wells (approximately 8-in. diameter), two in the area near the source and four in the curtain area. These six wells will address the near-field groundwater contamination plume given the contaminant depths and expected radii of influence. Figure 13-4 shows approximate locations of the wells placed

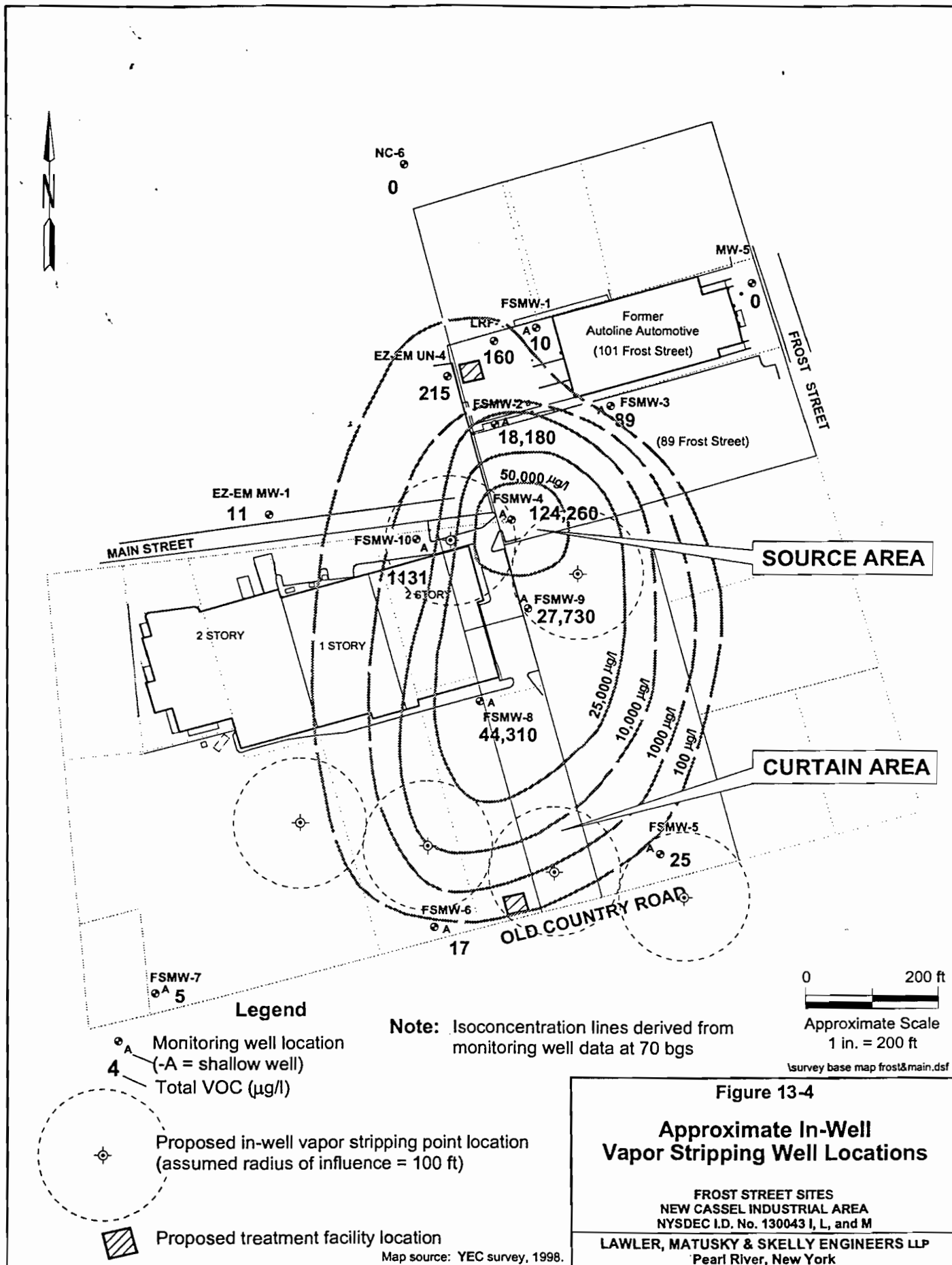


Figure 13-4

Approximate In-Well Vapor Stripping Well Locations

FROST STREET SITES
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043 I, L, and M

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

Map source: YEC survey, 1998.

perpendicular to groundwater flow. Each well will be mounted flush with the existing ground surface and installed to an approximate depth of 100 ft bgs near the source area and 160 ft in the curtain area. The estimated groundwater flow rate in each well ranges between 50 and 60 gallons per minute (gpm). Near the source area, each stripping well will have a radius of influence of approximately 140 ft based on a 35-ft thick zone of contamination (located at approximated depths of 55-90 ft bgs across the sites). The upper screened intervals in the wells will be installed at depths ranging from approximately 45-60 ft bgs to provide routes of groundwater reinfiltration to the subsurface. The lower screened intervals are estimated to be at about 85-95 ft bgs in each well. Pilot testing and field measurements in the design phase of the work will more accurately determine the construction details and placement of each of the four in-well vapor stripping wells, along with specific groundwater circulation/treatment patterns expected to result. Near the curtain area, each stripping well will have a radius of influence of approximately 100 ft based on a 95-ft thick zone of contamination (located at approximated depths of 55 and 150 ft bgs). The upper screened intervals in the wells will be installed at depths ranging from approximately 45-110 ft bgs to provide routes of groundwater reinfiltration to the subsurface. The lower screened intervals are estimated to be at about 110-160 ft bgs in each well.

Components of the in-well vapor stripping system include: air injection blowers and associated piping; vacuum extraction blowers (for vapor collection) and associated piping; moisture separators and condensate storage containers; system control equipment (i.e., valves, meters, electronics, gauges, etc.); an iron sequestering/pH control system; and two structures to house system components and vapor treatment equipment. Two system housings, approximately 700 ft² apiece, will be necessary in order to reduce the lateral distances between air injection and vapor extraction blowers and the stripping wells. Decreases in lateral pipe runs may result in electrical use savings over time and a decrease in the amount of noise generated by the system.

Operation and maintenance costs include electricity; periodic repair and replacement of system parts/components; iron control chemical replenishment; routine operator inspection of the system; and system monitoring. System inspection and monitoring activities consist of routine visits to the sites to inspect the in-well vapor stripping components and collect real-time air measurements, as necessary.

Prior to final design, a pilot-scale treatability study should be performed to determine the overall effectiveness of the in-well vapor stripping technology and well/piping configurations at the sites. A pilot scale test can also determine optimal operating pressures and flow rates to remove contaminants from the groundwater and evaluate the airflow distribution and vapor phase treatment approaches. In addition, control of iron and pH in the subsurface can be evaluated. The results of the pilot test will also be used to better estimate the run time and power requirements of the system. The duration of the pilot study is estimated to be four months.

For cost estimating purposes, it is assumed that the remedial objectives for the near-field groundwater contaminant plume at the Frost Street sites will be met in 10 years (based on discussion with vendors and review of case studies). The actual cleanup time may be longer than 10 years; better estimates of cleanup time can be made based on a pilot-scale treatability study. Remedial objectives are considered to be achieved when all compliance monitoring results meet specified criteria in two consecutive sampling episodes. For this FS, a contingency of an additional two years is applied to the treatment time, for an assumed active project life of twelve years.

13.2.3.2 Vapor Phase Treatment. VOCs in the vapor phase are collected from each well and pumped with a vacuum extraction blower to a GAC treatment system. As shown on Figure 13-4, two aboveground treatment areas were assumed for the six stripping wells. The blowers and GAC vapor treatment units for the two northernmost stripping wells will be housed in an area near the source, called Area 1 in this discussion (see Figure 13-4). Assuming an air-to-water ratio of 75:1, the vapor phase flow rate to Area 1 is expected to be approximately 1000 standard cubic feet per minute (scfm). Area 2, located east of the existing parking lot at 770 Main Street (near the curtain area), will house the blowers and GAC units for the remaining four stripping wells. The vapor flow rate to Area 2 is expected to be approximately 2000 scfm. In each treatment area, the vapors containing VOCs are passed through the GAC medium, adsorbed, and then vented to the atmosphere. Initial carbon usage rates were estimated to be approximately 240 lb/day in Area 1 and 120 lb/day in Area 2. It is assumed that as VOC concentrations in the groundwater and vapor streams are reduced over time, the carbon usage rates will also decrease. When GAC is spent (i.e., saturated with VOCs), it is transported off-site and replaced with fresh material.

If the relative humidity of the vapor to be treated is above a certain limit (typically about 50%), the adsorption efficiency of the GAC may be reduced. In addition, moisture and condensate can accumulate within the vapor extraction piping. To address these issues, vacuum extraction blowers will be specified so that sufficient heat is imparted to the vapor stream and the relative humidity is maintained within satisfactory limits. Any condensate that is created in the system will be collected and periodically disposed of at an approved off-site facility.

A preliminary review of the VOC constituents and respective vapor phase concentrations indicates that an emission stack is not warranted. However, the ultimate configuration of the entire vapor recovery/treatment system, including GAC usage rates over time, should be based on the final design and results from the pilot study. Air monitoring and inspection of the vapor treatment system after startup may also determine system requirements. For cost estimating purposes, GAC was the assumed vapor phase treatment option for the in-well vapor stripping alternative.

13.2.3.3 Waste Disposal. It is estimated that approximately 30 yd³ of soil will require off-site disposal from the installation of the four stripping wells and piping associated with air injection and vapor vacuum extraction. This soil is assumed to be nonhazardous. In addition, approximately 3800 ft² of asphalt will also be excavated and require off-site disposal.

It is estimated that approximately 1700 gallons per month of condensate will accumulate aboveground in the two in-well vapor stripping treatment areas. As noted, condensate will be periodically collected and disposed of at an approved off-site facility. Analytical sampling of the condensate and any other materials generated during remedial activities will be conducted to characterize the wastes and identify disposal options.

13.2.3.4 System Performance Monitoring. To confirm that the in-well vapor stripping system is achieving remedial objectives, groundwater samples will be collected from 13 existing monitoring wells at the Frost Street sites and analyzed for VOCs. The results of these analyses will be used to determine whether remedial action objectives are being satisfied, and whether changes in system design, configuration, and operation are required. Groundwater monitoring will be conducted twice per year for the first five years, and once per year for years six through twelve. Table 13-4 itemizes the 12-yr

TABLE 13-4

ALTERNATIVE G3 - SITEWIDE IN-WELL VAPOR STRIPPING MONITORING PROGRAM SUMMARY

Frost Street Sites

WELL	DEPTH ¹	<u>SAMPLING</u> <u>SCHEDULE</u>	<u>SAMPLING</u> <u>SCHEDULE</u>
		YEARS 1-5 ²	YEARS 6-12 ³
FSMW - 02A	shallow	X	X
FSMW - 03A	shallow	X	X
FSMW - 04A	shallow	X	X
FSMW - 06A	shallow	X	X
FSMW - 07A	shallow	X	X
FSMW - 08A	shallow	X	X
FSMW - 09A	shallow	X	X
FSMW - 10A	shallow	X	X
EZ-EM-UN-4	shallow	X	X
EZ-EM-MW-1	shallow	X	X
FSMW-4B	deep	X	X
FSMW-6B	deep	X	X
FSMW-8B	deep	X	X
TOTAL:		13	13

X - Sampling is recommended.

1 - Shallow wells have an approximate depth of 70-ft bgs; deep wells have an approximate depth of 150-ft bgs.

2 - All samples will be analyzed for VOCs semi-annually.

3 - All samples will be analyzed for VOCs annually.

groundwater monitoring schedule for in-well vapor stripping at the Frost Street sites; it is assumed that no additional groundwater sampling will be required after twelve years.

The continued need for monitoring can be re-evaluated and possibly discontinued at any time during the 12-yr period. If groundwater contaminant levels remain below the site remedial action objectives for two consecutive sampling events, the monitoring program may be discontinued. If contaminant levels continue to exceed the remedial action objectives at the end of the 12-yr period, the monitoring program, and system operation, will be extended and/or other remedial actions may be taken.

13.2.4 Alternative G4: Groundwater Extraction/Air Stripping/Re-injection

Alternative G4 has been developed to evaluate the feasibility of using a groundwater recovery/extraction system at the Frost Street sites to capture the VOC-contaminated groundwater in the near-field plume and treat it at the surface (i.e., ex situ). The approximate extent of the near-field plume is shown in Figure 13-1.

The objective of groundwater extraction is to draw contaminated groundwater into the recovery well's zone of capture. The recovery well's flow rate is increased until the capture zone radius is believed to exceed the lateral dimensions of the plume or the area of concern. The recovery well should be located sufficiently downgradient of the highest contaminated area in the plume so that the majority of the contaminated groundwater will naturally flow into the capture zone. This alternative includes a recovery/extraction well pattern designed to reduce the VOC concentrations in the near-field groundwater contaminant plume.

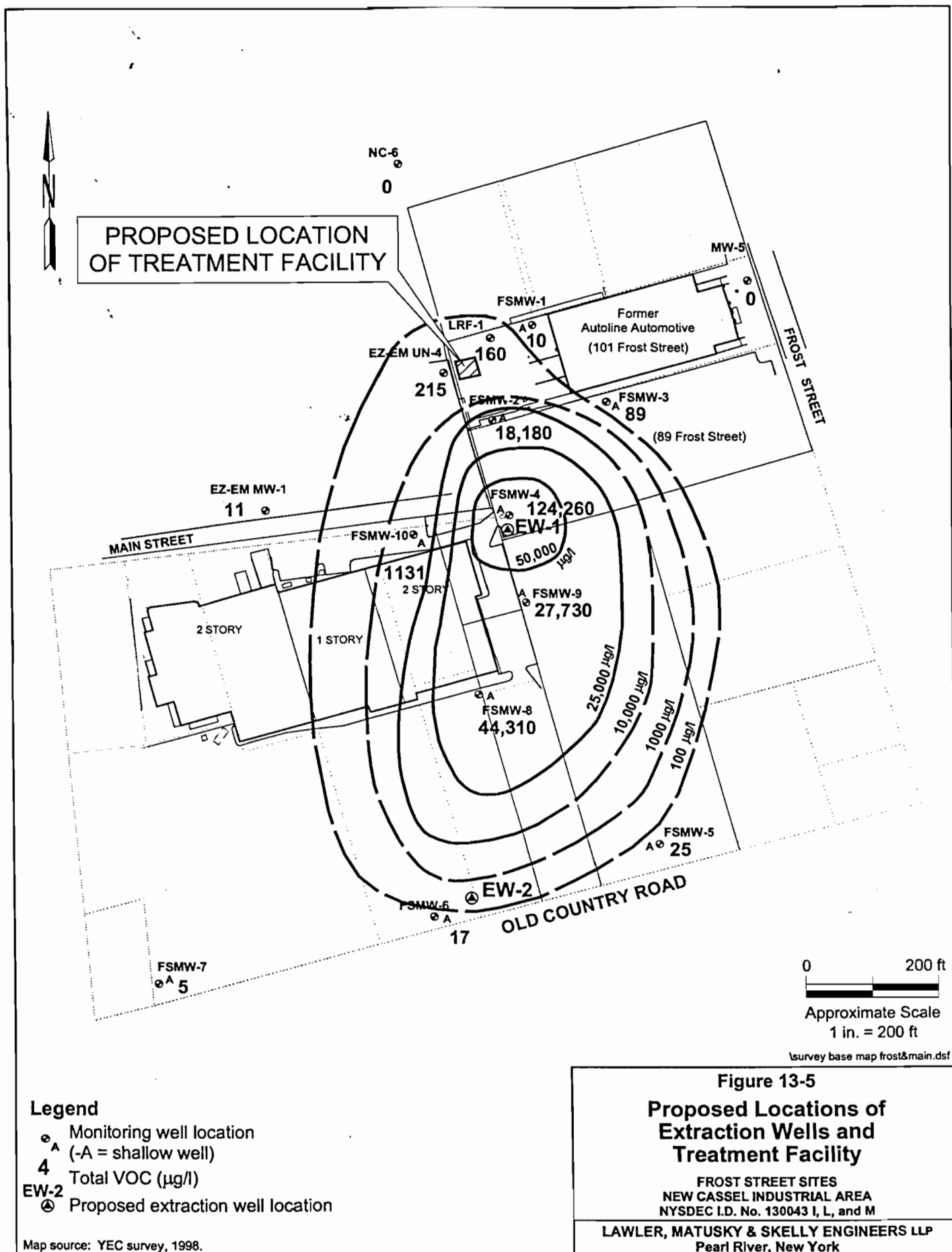
When simulating this groundwater extraction and treatment option, the number of wells, pumping rates, and well locations have been optimized by determining which combination would effectively capture the highest percentage of contaminated groundwater in the near-field of the shallow groundwater plume. This analysis was based on data obtained during the RI, which did not include aquifer pump test data to determine aquifer characteristics. In the RI, hydrogeologic parameters, such as hydraulic conductivity, were derived using slug test data. Since a slug test does not provide as precise information about aquifer characteristics as a pump test, an aquifer pump test should be performed prior to the design to verify assumptions made here regarding well spacing, zone of capture, flow rates, and remediation time.

13.2.4.1 **Extraction Wells.** This alternative includes the installation of two extraction wells within the contaminant plume (proposed locations shown in Figure 13-5). As described above, these wells were located by considering the natural direction of groundwater flow and hydraulic conductivity using the slug test data from the RI.

In-situ hydraulic tests (i.e., slug tests) were performed during the RI. The results indicate that the hydraulic conductivity varies greatly over the Frost Street sites (Appendix C). The wide range of hydraulic conductivity is partly due to the limited area of the aquifer which is tested by the individual slug tests. The results directly reflect local heterogeneity (clay lenses, gravel zones) surrounding the monitoring well screens. Appendix C contains the monitoring well completion logs that show the screening intervals of each well and the boring logs that classify the types of material that were encountered when drilling the well.

Another reason for the wide range in hydraulic conductivity is that the wells are screened in different aquifers. The approximate division of the UGA and the Magothy aquifer is between 60-87 ft bgs in the area of the Frost Street sites. While the UGA is composed of well sorted sand and gravel, the Magothy has interbedded fine sands and sandy clays and also contains silt and clay lenses. The UGA has higher hydraulic conductivity values than the Magothy because it is generally a coarser-grained, well sorted material. The range of hydraulic conductivity for the shallow wells (most screened in the UGA) was from 2.40 to 216.72 ft/day; the range for the deeper wells (most screened in the Magothy) was from 0.15 to 83.64 ft/day. Even though these ranges are very broad, they demonstrate that there is generally a lower hydraulic conductivity in the Magothy, as compared to the UGA.

Prior to final design, a 72-hr aquifer pump test should be completed to more precisely determine hydraulic conductivity values. The pump test should be completed at, or near, the proposed location of EW-2. An existing monitoring well cannot be used for the pump test because a well containing a minimum diameter of 6 in. is needed. The new well, EW-2, will be a minimum of 6-in. in diameter and have a stainless steel screen approximately 30-ft long; the remainder of the casing will be comprised of steel. A 7.5 to 15 hp submersible pump with a 4-in. outlet should be used to pump groundwater at a flow rate of 200-500 gpm. It is assumed that the extracted groundwater generated during



the aquifer test will be treated with a granular activated carbon filter and the treated effluent discharged to existing stormwater wet wells.

To facilitate the collection of the contaminated groundwater for a pump and treat alternative at the Frost Street Sites, a minimum of two extraction wells will be needed. The screens will be constructed of stainless steel, including the casing. The first extraction well (EW-1) will be placed slightly downgradient of the highest groundwater contaminant concentrations at the southwest corner of 89 Frost Street (Figure 13-5). This extraction well will be installed to 90 ft bgs and screened between 45 and 80 ft bgs. Contaminated groundwater will be pumped at a rate of about 20 gpm producing a capture zone of approximately 500 ft; this estimate is based on methods developed by Grubb for determining stagnation point, zone of capture, and the dividing streamline for an unconfined aquifer (Groundwater, 1993). The extraction wells will be designed to collect the DNAPL phase, if present. For this extraction well to operate at a pumping rate of 20 gpm, a 1.5 hp submersible pump with a 1.5-in. outlet will be needed to fit into the 6-in. diameter well.

A second extraction well (EW-2) will be placed southwest of EW-1, on the 770 Main Street property (Figure 13-5). EW-2 will be a 6-in. diameter well installed to 160 ft bgs and screened between 45 and 150 ft. Contaminated groundwater will be transferred at a rate of 40 gpm to effect a 600-ft wide capture zone. EW-2 will operate by using a 3 hp pump with a 2-in. outlet.

The actual remedial pumping rates for the extraction wells should be optimized based on the results of the pump test and a comprehensive groundwater flow model of the site. The objective of the optimization process would be to create the required capture zone while minimizing the amount of groundwater which must be extracted.

A rough estimate of the remediation time was calculated based on assumptions in aquifer characteristics, well placement and flow rates, and contaminant properties. The section of the aquifer containing the near-field plume will be considered "remediated" when total VOC concentrations fall below 5 $\mu\text{g/l}$. Based on the computational, a remediation time of approximately 15 years is assumed for this FS. Because of the uncertainty in hydrogeological parameters, such as hydraulic conductivity, the results of the

computation yielded a two order of magnitude range of remediation time. An improved estimate of remediation time can be calculated following an aquifer pump test.

The contaminated groundwater from each extraction well will travel through separate 2-in. pipes to the on-site groundwater treatment plant (described below). Prior to any treatment, the pumped groundwater will be metered and controlled to control the flow near the extraction well itself. Also, with the meters and flow control devices inside of the facility, the likelihood of vandalism is greatly decreased.

13.2.4.2 Groundwater Treatment and Discharge. In order to satisfy SCGs, specifically groundwater treatment effluent limitations, the extracted groundwater must be treated to remove inorganic and organic compounds. A 2,000-ft² groundwater treatment plant is proposed to be constructed on the western edge of the vacant portion of 101 Frost Street (Figure 13-5). A schematic of the proposed unit operations of this treatment plant is presented in Figure 13-6. For costing purposes in the FS, a total peak flow of approximately 60 gpm is expected from the extraction well network; therefore, the components of the treatment system have been sized based on a peak flow rate of 60 gpm.

After the pumped groundwater has been metered inside of the treatment facility, it will enter an equalization tank (with a mixer) to equalize the flows from the two pumping wells. The water will then flow via gravity into a pH adjustment/reaction tank. With the addition of a base compound (i.e., sodium hydroxide), the pH will be raised to about 8 to 10 and a coagulant will be added into the reaction tank to help flocculate and precipitate the solids. A mixer will ensure that the base and the coagulant become completely mixed before passing (via gravity) into the settling tank/clarifier unit. In the settling tank, a sludge will be produced as the iron, manganese, and other inorganic compounds settle to the bottom of the tank. The sludge will be dewatered to form a sludge cake, which will be disposed of off-site. It is assumed in the cost estimate that this sludge cake will be disposed of as hazardous waste; this assumption should be verified in the remedial design phase with a TCLP waste characterization analysis. The filtrate from the dewatering process will be recycled back into the equalization tank.

The contaminated groundwater that passes through the settling tank will then be pumped into a media filter to remove dissolved solids. An acidic compound (i.e., sulfuric acid)

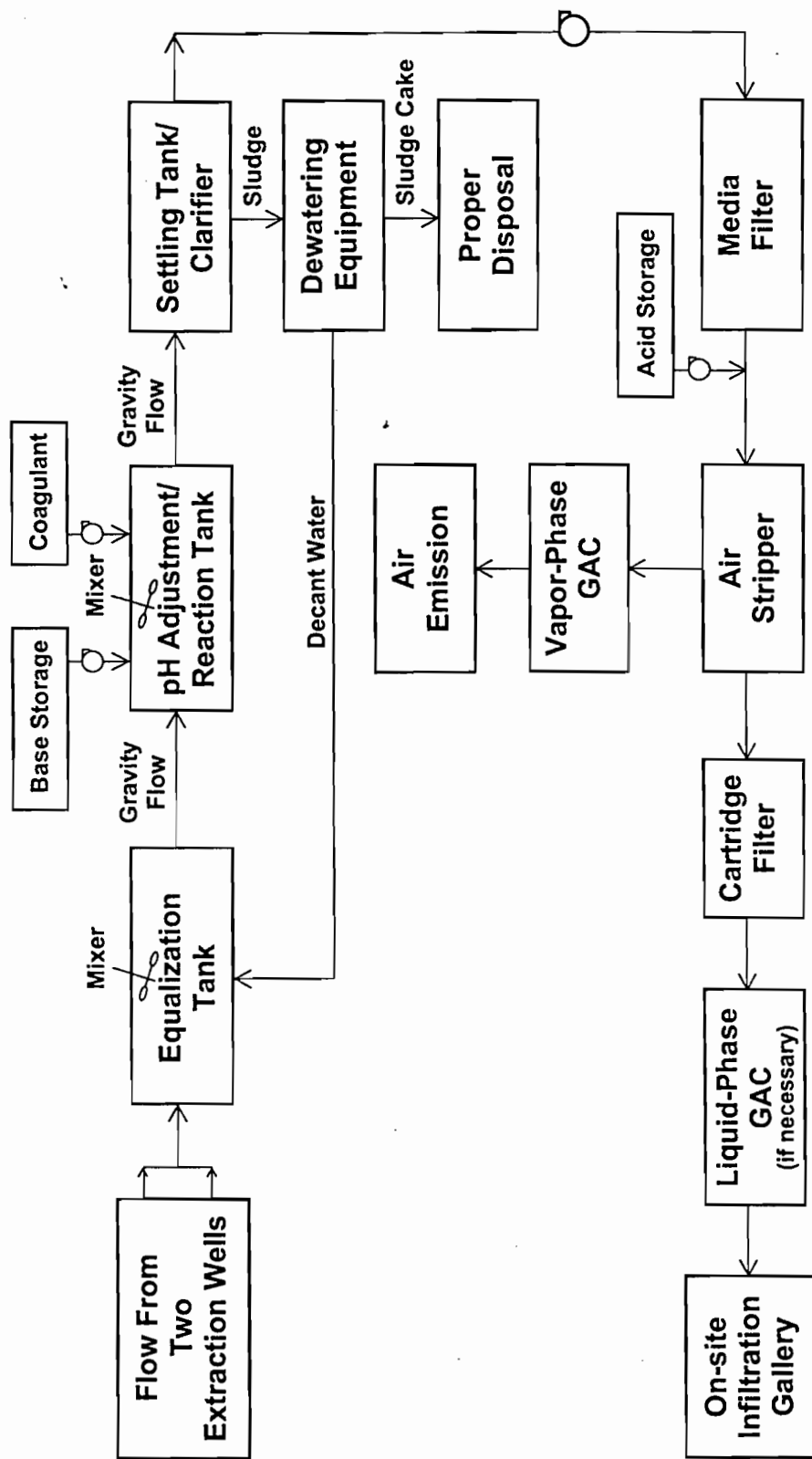


Figure 13-6

Schematic of Groundwater Treatment Operations

FROST STREET SITES
NEW CASSEL INDUSTRIAL AREA
NYSDEC I.D. No. 130043 I, L, and M

LAWLER, MATUSKY & SKELLY ENGINEERS LLP
Pearl River, New York

will be added to lower the pH to about 6 to 7 before the water is fed into a low profile tray air stripper. The low profile stripper is better suited than an air stripping tower in this area because of the surrounding building being one or two stories in height. The vapor phase emitted from the air stripper will undergo treatment via GAC to remove the volatiles. Following vapor phase GAC treatment, the air emission will be discharged to the atmosphere via a stack.

The liquid effluent leaving the air stripper will be passed through a cartridge filter to remove any remaining solids before being discharged into an on-site infiltration gallery. The infiltration gallery will consist of five wet wells (a type of injection well) on the 101 Frost Street site each having a 12-ft diameter and an approximate depth of 25 ft bgs. The discharged water will be released at a point upgradient of the plume and will act to flush the contaminated portion of the aquifer. The wet wells will be operated in parallel to handle overflow and maintenance periods.

The discharged effluent is subject to the New York State groundwater effluent limitations - Class GW (Table 13-5). The discharge standards will be detailed in a State Pollutant Discharge Elimination System (SPDES) permit or equivalent as issued by the NYSDEC.

Chemical consumption for these treatment processes include: approximately 480 gal/month (or 5800 gal/year) sodium hydroxide, about 240 gal/month of sulfuric acid (or 2,900 gal/year), and approximately 6,600 lbs/year of iron chloride (FeCl_3).

The estimated amount of sludge production for this treatment system is about 30 lbs/day or almost 11,000 lbs/year, assuming a constant total dissolved solids (TSS) loading. Carbon usage was estimated to be 75 lbs/day (initially) or approximately 125,000 lbs/year (on average over the 15-yr time period) based on an estimated VOC production of 500 ft³/min.

Due to the long-term need for a treatment facility at the selected location, an appropriate building would need to be constructed to house the treatment equipment (i.e., the treatment facility and associated units and piping should be low profile as to blend-in with the surroundings). A full-time operator will be needed to operate and supervise the pumping wells and the treatment plant.

TABLE 13-5

EFFLUENT LIMITATIONS FOR COCs

Chemical Constituent	Effluent Limitation ¹ (µg/l)
Tetrachloroethylene	5
Trichloroethylene	5
1,2-Dichloroethylene	5
Iron and Manganese (total)	1,000

1 - Ambient Water Quality Standards and Guidance Values and
Groundwater Effluent Limitations, Table 5 (NYSDEC 1998).

A bench-scale treatability study and/or a pilot-scale study would be conducted prior to the preparation of the detailed design for the groundwater treatment facility. The purpose of these pre-design studies is to confirm chemical dosage rates as well as to optimize the contact times in the tanks. The treatability studies will also help to evaluate the ability of the treatment processes to meet discharge requirements. If discharge limitations are not satisfied, polishing with carbon adsorption may be necessary. The treated effluent will be periodically monitored (i.e., SPDES permit) to ensure that discharge limits are met (sampling frequencies are described in the next section).

13.2.4.3 System Performance Monitoring. For the purposes of this FS, it is assumed that the extraction and treatment system will operate for at least 15 years. This estimate was based on the time it would take for the furthest contaminant in the near-field plume to be captured by the groundwater extraction system. The controlling retardation factor, which affects contaminant transport velocity, was for PCE. An average hydraulic conductivity of 40 ft/day was used in the calculation. Many parameters used in deriving this estimate can vary widely, which would impact the remediation time.

The long-term monitoring program included in this alternative is intended to assess the effectiveness of groundwater extraction and treatment on the contaminant levels in the aquifer over time. Monitoring will consist of system performance monitoring and groundwater quality monitoring. During the first three months that the treatment plant is in operation, VOC samples from both of the influent pipes and the single effluent pipe will be collected once per week to evaluate the efficiency and effectiveness of the treatment plant. The effluent sample analysis will be used to demonstrate that the SPDES requirements are being met. For the remainder of the 15-yr time frame, VOC sampling of the influent and the effluent at the treatment plant will be collected once per month. Samples will be analyzed for conventional parameters (e.g., pH, solids, and alkalinity) as well as VOC content.

Each monitoring well will have VOC samples taken on a semi-annual basis for the first five years to monitor the contaminant transport and transformation and response to the remediation system (as summarized in Table 13-6). During years 6 through 15, VOC samples will be collected annually from the monitoring wells.

TABLE 13-6

**ALTERNATIVE G4 -
GROUNDWATER EXTRACTION/AIR STRIPPING/REINJECTION
MONITORING PROGRAM SUMMARY**

Frost Street Sites

WELL	DEPTH ¹	<u>SAMPLING</u> <u>SCHEDULE</u>	<u>SAMPLING</u> <u>SCHEDULE</u>
		YEARS 1-5 ²	YEARS 6-15 ³
FSMW - 02A	shallow	X	X
FSMW - 03A	shallow	X	X
FSMW - 04A	shallow	X	X
FSMW - 06A	shallow	X	X
FSMW - 07A	shallow	X	X
FSMW - 08A	shallow	X	X
FSMW - 09A	shallow	X	X
FSMW - 10A	shallow	X	X
EZ-EM-UN-4	shallow	X	X
EZ-EM-MW-1	shallow	X	X
FSMW-4B	deep	X	X
FSMW-6B	deep	X	X
FSMW-8B	deep	X	X
TOTAL:		13	13

X - Sampling is recommended.

O - Sampling is not recommended.

1 - Shallow wells have an approximate depth of 70-ft bgs; deep wells have an approximate depth of 150-ft bgs.

2 - All samples will be analyzed for VOCs semi-annually.

3 - All samples will be analyzed for VOCs annually.

The continued need for a monitoring program may be re-evaluated and possibly discontinued at any time during the 15-yr period. If groundwater contaminant levels remain below the site remedial action objectives for two consecutive sampling events, the monitoring program may be evaluated as to be discontinued. If contaminant levels continue to exceed the remedial action objectives at the end of the 15-yr period, the monitoring program, and system operation, will be extended. In costing this alternative, it was assumed that the existing wells will be sufficient to assess the long term effects of the groundwater plume.

CHAPTER 14

DETAILED EVALUATION OF SOURCE CONTROL ALTERNATIVES

14.1 INTRODUCTION

This chapter presents the detailed evaluation of the source control remedial alternatives described in Chapter 12. The purpose of the evaluation is to identify the advantages and disadvantages of each alternative as well as key tradeoffs among the alternatives. The first seven of nine criteria used to evaluate the alternatives are specified in the EPA guidance document, "Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA" (EPA 1988), and NYSDEC TAGM HWR-90-4030, "Selection of Remedial Actions at Inactive Hazardous Waste Sites" (NYSDEC 1990), and are as follows:

- **Overall Protection of Human Health and the Environment:** This criterion evaluates the extent to which the alternative will achieve and maintain protection of human health and the environment and how the protection will be achieved, i.e., through treatment, engineering, or institutional controls.
- **Compliance with SCGs:** This criterion evaluates the compliance of the alternative with all identified chemical-, location-, and action-specific SCGs. Chemical-specific SCGs for the sites' COCs are listed in Chapter 8.
- **Reduction of Toxicity, Mobility, and Volume Through Treatment:** The NCP specifies that preference be given to alternatives that reduce the toxicity, mobility, or volume of contamination present through treatment. The degree to which each alternative results in a reduction is evaluated by this criterion.
- **Short-Term Effectiveness:** This criterion evaluates the impacts of each alternative on human health and the environment during the construction and implementation of the remedy.
- **Long-Term Effectiveness and Permanence:** Each alternative is evaluated for its long-term effectiveness in protecting human health and the environment following completion of the remedial action.
- **Implementability:** The technical and administrative feasibility of implementing each alternative, including site features that may restrict application of the alternative, are evaluated for this criterion.

- **Cost:** The relative capital costs have been estimated for each source control alternative. Operations and maintenance (O&M) costs for some of the source control alternatives are also included based on a 30-year life (EPA 1988). Actual operational time frames (i.e., time for achievement of soil remedial action objectives) for these alternatives are likely to be shorter than 30 years. The cost estimates included in this FS are for comparative purposes; detailed cost estimates are prepared in the remedial design phase.

Community and state acceptance, the eighth and ninth criteria, is also to be considered in evaluating the remedial alternatives. Community acceptance cannot be assessed until public comments have been received on the RI/FS report and proposed remedial action plan. The RODs for the sites will address community acceptance. State acceptance of the proposed remedial action plan will also be addressed in the ROD.

In order to be effective in reducing sitewide contaminants, the selected source control alternative should be combined with a groundwater response alternative.

14.2 SOURCE CONTROL ALTERNATIVES FOR THE 101 FROST STREET SITE

The individual analysis of the source control remedial alternatives for 101 Frost Street with respect to the first seven evaluation criteria is presented below and summarized in Table 14-1. Following the evaluation criteria discussion, a comparative analysis of alternatives for the 101 Frost Street site is presented.

14.2.1 Alternative 101-S1: No Action

14.2.1.1 *Protection of Human Health and the Environment.* Institutional measures included in Alternative 101-S1 serve to protect human health by preventing human contact with the contaminants in shallow subsurface soils and subsurface soils at depth that will remain at the site; however, the potential for human exposure to the contaminants in shallow subsurface soils will remain. In addition, the site may continue to impact the surrounding environment through the migration of contaminants from soils to groundwater.

14.2.1.2 *Compliance with SCGs.* Under this no action alternative, it is highly unlikely that NYSDEC soil standards will be achieved in a short time frame. Because this alternative does not include any active remedial measures, no air releases are expected; therefore no NAAQS apply. As no active remedy is proposed under Alternative 101-S1,

TABLE 14-1 (Page 1 of 1)

SUMMARY OF DETAILED EVALUATION OF SOURCE CONTROL REMEDIAL ALTERNATIVES

101 Frost Street Site

ALTERNATIVE	OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	COMPLIANCE WITH SCGs	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	SHORT-TERM EFFECTIVENESS	LONG-TERM EFFECTIVENESS AND PERMANENCE	IMPLEMENTABILITY	COST
ALTERNATIVE 101-S1: No Action	Minimal prevention of human contact through institutional controls only. Contaminants remain in the environment.	Will not quickly or actively achieve soil SCGs.	Does not reduce toxicity, mobility, or volume of contamination present in site soils.	Does not result in disruption of site operations or pose a short-term threat to health or the environment.	Does not provide long-term effectiveness or permanence; contaminants will remain at site.	No constraints to implementation of institutional measures.	Capital: \$ 0 O&M: \$0/yr Present Worth: \$ 0
ALTERNATIVE 101-S2: Excavation of shallow subsurface soils and subsurface soils at depth	Potentially offers the greatest protection to human health and the environment by eliminating the source areas. Site selected for disposal of excavated material will require maintenance and monitoring.	Applicable NYSDEC soil cleanup objectives achieved through removal and disposal.	Greatest potential reduction in the mobility and volume of VOCs at the site by removal of contaminants from the soil and off-site disposal.	Will result in disruption of site operations during implementation. Will generate noise and traffic.	Alternative offers the potentially greatest long-term effectiveness by elimination of on-site source areas.	Alternative is technically implementable but will require detailed evaluation of excavation approaches during final design. Alternative may not be feasible for subsurface soils at depth. Space required for excavated soil and equipment storage. Duration of alternative estimated to be 6 months.	Capital: \$ 2,708,000 O&M: \$0/yr Present Worth: \$2.7 million
ALTERNATIVE 101-S3: Excavation of shallow subsurface soils/Soil Vapor Extraction for subsurface soils at depth	Protects human health and the environment by (1) removal and off-site disposal of contaminants in shallow subsurface soils, and (2) transferring contaminants in subsurface soils at depth to vapor phase and treating. Prevents further vertical migration of contaminants.	Applicable NYSDEC soil cleanup objectives achieved for shallow subsurface soils through removal and disposal. Applicable soil standards achieved for subsurface soils at depth through treatment. Air emissions must be controlled to meet SCGs.	Reduction of mobility and volume of contaminants in shallow subsurface soils through removal and off-site disposal. Significant reduction in mobility and volume of contaminants (VOCs) in subsurface soils at depth through treatment.	Will result in disruption of site operations during implementation. Will generate some noise and traffic. Space required (approx. 100 sf) for SVE treatment equipment.	Alternative offers the potentially greatest long-term effectiveness for shallow subsurface soils by eliminating VOC concentrations in subsurface soils at depth. SVE system may limit future site uses.	Alternative is technically implementable. SVE pilot test should be conducted prior to implementation. Detailed excavation plans and space required for shallow subsurface soil. The estimated duration of excavation/off-site disposal of shallow subsurface soils is 60 days. Time required for SVE to achieve soil cleanup objectives is estimated at 3 years.	Capital: \$1,302,000 O&M (Yr 1-3): \$29,000/yr Present Worth: \$1.4 million
ALTERNATIVE 101-S4: Soil Vapor Extraction for shallow subsurface soils and subsurface soils at depth	Protects human health and the environment by transferring VOCs in subsurface soils to vapor phase and treating. May not be as effective on SVOCs, pesticides, and metals. Prevents further vertical migration of contaminants.	Applicable soil standards may be achieved for subsurface soils at depth through treatment. SVE may not effectively achieve soil SCGs for contaminants other than VOCs. Air emissions must be controlled to meet SCGs.	Potential significant reduction in mobility and volume of VOC contaminants in subsurface soils at depth through treatment. SVOC, pesticide, and metal contaminants in shallow subsurface soils may not be as efficiently reduced.	Will result in disruption of site operations during implementation. Will generate noise and traffic. Approximately 250 sf is required for SVE treatment equipment.	SVE very effective for reducing VOC concentrations in subsurface soils at depth. Applicability of SVE to shallow subsurface soil contamination (SVOCs, pesticides, metals) may need to be evaluated in detail. SVE system components may limit future site uses in some areas.	SVE system is readily implemented and available, depending on site logistics. The estimated time to achieve soil cleanup objectives using SVE is 3 years.	Capital: \$243,000 O&M (Yr 1-3): \$48,000/yr Present Worth: \$0.37 million
ALTERNATIVE 101-S5: No action for shallow subsurface soils and soil vapor extraction for subsurface soils at depth	Protects human health and the environment by transferring VOCs in subsurface soils to vapor phase and treating but contaminants in shallow subsurface soils will remain in the environment. Institutional controls applied for shallow subsurface soils.	Applicable soil standards may be achieved for subsurface soils at depth through treatment. Contaminants in shallow subsurface soils will remain in the environment. Air emissions from SVE treatment process must be controlled to meet SCGs.	Potential significant reduction in mobility and volume of VOC contaminants in subsurface soils at depth through treatment. VOC, SVOC, pesticide, and metal contaminant concentrations in shallow subsurface soils will not be reduced through treatment.	Will result in disruption of site operations during implementation. Will generate noise and traffic. Approximately 250 sf is required for SVE treatment equipment.	SVE very effective for reducing VOC concentrations in subsurface soils at depth. SVE system components may limit future site uses in some areas. Does not provide long-term effectiveness or permanence for shallow subsurface soil contaminants as they will remain on site.	SVE system is readily implemented and available, depending on site logistics. The estimated time to achieve soil cleanup objectives in subsurface soils at depth using SVE is 3 years.	Capital: \$94,000 O&M (Yr 1-3): \$28,000/yr Present Worth: \$0.17 million

location-specific SCGs do not apply. As Alternative 101-S1 does not include any active remediation activities, there are no action-specific TBCs that apply to this alternative. As no on-site remedial activities are included as part of this alternative, requirements of other TBCs do not apply to this alternative either.

Alternative 101-S1 does not comply with the Federal or state requirements which state that the selected remedial alternative must attain a cleanup level that eliminates, reduces, or controls risks to human health and the environment.

14.2.1.3 *Reduction of Toxicity, Mobility, and Volume Through Treatment.* Alternative 101-S1 will not result in a reduction in the toxicity, mobility, or volume of contaminated wastes present in site soils.

14.2.1.4 *Short-term Effectiveness.* Alternative 101-S1 does not result in disruption of site operations or pose a short-term threat to health or the environment as no active remedial activities will occur at the site.

14.2.1.5 *Long-term Effectiveness and Permanence.* The no action alternative does not provide long-term effectiveness and permanence, and soil contaminants will remain on-site. Although human health risks may be mitigated through the use of deed and development restrictions, these institutional measures may not eliminate the potential for human exposure to site contaminants (e.g., dermal contact with contaminated shallow subsurface soils).

14.2.1.6 *Implementability.* Implementation of this alternative is straightforward and does not depend on the availability of vendors, materials, or services. Institutional measures/restrictions would be implemented by NYSDEC or the municipality.

14.2.1.7 *Cost.* For Alternative 101-S1, capital costs include legal and administrative costs associated with implementing institutional measures, the costs of which would be determined in the future depending on the way the institutional measures are implemented. There are no direct capital costs associated with Alternative 101-S1 (see Table 14-2).

TABLE 14-2

**COST ESTIMATE FOR ALTERNATIVE 101-S1:
NO ACTION**

101 Frost Street Site

ITEM	UNIT COST (\$)	QUANTITY	COST (1999 \$)
CAPITAL COSTS			
A. Direct Costs			
<i>Institutional Measures</i>			
Deed & development restrictions			- a
		Subtotal	- a
B. Indirect Costs			
			- a
O & M Costs (none)			
			\$0
PRESENT WORTH			
			\$0
<i>Based on a 30 year life and a 5% intrerest rate.</i>			

a - Legal and administrative costs to community that are not included in cost estimate.

14.2.2 **Alternative 101-S2: Excavation of Shallow Subsurface Soils and Subsurface Soils at Depth/Off-Site Disposal**

14.2.2.1 ***Protection of Human Health and the Environment.*** Alternative 101-S2 aims to protect human health and the environment by excavating and removing source areas of contamination in shallow subsurface soils and subsurface soils at depth at the site. Post-excavation confirmatory soil sampling, as included in this alternative, will assess whether or not the source area contamination at the site has been sufficiently removed.

14.2.2.2 ***Compliance with SCGs.*** Under this alternative, applicable NYSDEC soil standards will be achieved in a relatively short time frame by excavating and removing soil contamination. The only location-specific SCG that applies to the site is related to the sole source aquifer that underlies the site. Remedial activities proposed under this alternative must be conducted as to prevent contaminant releases to the underlying aquifers.

Action-specific SCGs identified for the activities proposed in Alternative 101-S2 include Federal and state regulations that require a selected remedial alternative to attain a cleanup level that eliminates, reduces, or controls risks to human health and the environment. Alternative 101-S2 complies with these requirements.

Other TBCs include the NIOSH IDLH, OSHA PELs, and ACGIH TLVs for contaminants in air, and OSHA excavation guidelines, which will be used to define worker health and safety practices during the implementation of this alternative.

14.2.2.3 ***Reduction of Toxicity, Mobility, and Volume Through Treatment.*** Alternative 101-S2 will result in a reduction in the toxicity, mobility, and volume of contaminated wastes present at the site by removing source contamination in shallow subsurface soils and subsurface soils at depth.

14.2.2.4 ***Short-term Effectiveness.*** Implementing Alternative 101-S2 may result in the exposure of workers and the public to contaminants through dust created during excavation work. However, it is assumed that appropriate engineering controls and health and safety monitoring will be conducted to eliminate such exposures. Implementation of Alternative 101-S2 will likely result in a temporary increase in site traffic and noise, as well as the potential for interference with normal site operations.

14.2.2.5 **Long-term Effectiveness and Permanence.** Alternative 101-S2 provides a high measure of long-term effectiveness and permanence, as soil contaminants will be removed from the site.

14.2.2.6 **Implementability.** Implementation of this alternative is technically feasible but will require a detailed evaluation of excavation, shoring/bracing, and worker safety approaches, especially for subsurface soils at depth. Space will be required for soil staging and equipment storage. Duration of alternative estimated to be 105 days (or about six months).

14.2.2.7 **Cost.** Estimated capital costs for Alternative 101-S2 are included in Table 14-3. No O&M costs are associated with this alternative. These costs are based on the assumptions included in the description of the alternative provided in Chapter 12 and have a range of accuracy of -30 to +50%.

14.2.3 **Alternative 101-S3: Excavation/Off-Site Disposal of Shallow Subsurface Soils/SVE for Subsurface Soils at Depth**

14.2.3.1 **Protection of Human Health and the Environment.** Alternative 101-S3 aims to protect human health and the environment by excavating and removing source areas of contamination in shallow subsurface soils and treating VOC contamination in subsurface soils at depth with SVE.

14.2.3.2 **Compliance with SCGs.** Under this alternative, applicable NYSDEC soil standards will be achieved in shallow subsurface soils in a relatively short time frame by excavating and removing soil contamination. Alternative 101-S3 will also achieve the recommended soil cleanup objectives by reducing contaminant concentrations in subsurface soils at depth through SVE treatment. SVE will be performed at the site under this alternative until VOC levels in subsurface soils at depth are substantially reduced. Air emissions that may result from the SVE treatment system will be controlled with GAC to meet applicable New York State air emission guidelines.

The only location-specific SCG that applies to the site is related to the sole source aquifer that underlies the site. Remedial activities proposed under this alternative must be conducted as to prevent contaminant releases to the underlying aquifers.

TABLE 14-3 (Page 1 of 2)

**COST ESTIMATE FOR ALTERNATIVE 101-S2:
EXCAVATION AND DISPOSAL OF SHALLOW SUBSURFACE SOILS AND
SUBSURFACE SOILS AT DEPTH / OFF-SITE DISPOSAL**

101 Frost Street Site

ITEM	UNIT COST (\$)	QUANTITY	COST (1999 \$) ^a
CAPITAL COSTS			
A. Direct Costs			
Site Preparation			
Contractor mobilization/demobilization	LS	1	\$90,000
Utility clearance	LS	1	\$1,000
Construction of Soil Staging Areas	LS	1	\$2,000
			<u>\$93,000</u>
Shallow Subsurface Soils			
Removal and Disposal of Dry Well Liquids (assumed hazardous)	LS	1	\$22,000
Removal and Disposal of Dry Well Structures	\$1,200 /dry well	12 dry wells	\$14,000
Excavation (Hand)	\$40 /cy	45 cy	\$2,000
Excavation (Machine)	\$35 /cy	830 cy	\$29,000
Excavation Shoring	\$49 /sf	12,000 sf	\$588,000
Confirmatory Waste Sampling/Characterization TCLP Analysis	\$1,400 /sample	2 samples	\$3,000
Transportation & Off-site Disposal			
Hazardous material	\$325 /cy	10 cy	\$3,000
Nonhazardous material	\$110 /cy	170 cy	\$19,000
Backfill & Compaction	\$10 /cy	250 cy	\$3,000
Securing Excavation Areas	LS	1	\$5,000
Post-Excavation Soil Samples	\$950 /sample	12 samples	\$11,000
Site Restoration (includes dry well restoration)	LS	1	\$50,000
			<u>\$749,000</u>
Subsurface Soils at Depth			
Excavation (Hand)	\$40 /cy	30 cy	\$1,000
Excavation (Machine)	\$35 /cy	2,000 cy	\$70,000
Excavation Shoring	\$78 /sf	9,600 sf	\$749,000
Confirmatory Waste Sampling/Characterization TCLP Analysis	\$1,400 /sample	10 samples	\$14,000
Transportation & Off-site Disposal			
Hazardous material	\$325 /cy	30 cy	\$10,000
Nonhazardous material	\$110 /cy	470 cy	\$52,000
Backfill & Compaction	\$15 /cy	1,000 cy	\$15,000
Securing Excavation Areas	LS	1	\$5,000
Post-Excavation Soil Sampling	\$250 /sample	12 samples	\$3,000
Site Restoration	LS	1	\$5,000
			<u>\$924,000</u>

TABLE 14-3 (Page 2 of 2)

**COST ESTIMATE FOR ALTERNATIVE 101-S2:
EXCAVATION AND DISPOSAL OF SHALLOW SUBSURFACE SOILS AND
SUBSURFACE SOILS AT DEPTH / OFF-SITE DISPOSAL**

101 Frost Street Site

ITEM	UNIT COST (\$)	QUANTITY	COST (1999 \$) ^a
<i>Additional Health & Safety/Inspection Items</i>			
Health & Safety and Air Monitoring (during excavation)	LS	1	\$30,000
Personal Protective Equipment	LS	1	\$5,000
Excavation and Shoring Inspector (structural engineer)	LS	1	\$3,000
			\$38,000
		Subtotal	\$1,804,000
B. Indirect Costs			
<i>Engineering and Design @ 15%</i>			\$271,000
<i>Legal and Administrative @ 10%</i>			\$180,000
<i>Contingency @ 25%</i>			\$451,000
		Total	\$2,706,000
O & M Costs (none)			\$0
PRESENT WORTH			
<i>Based on a 30 year life and a 5% interest rate.</i>			\$2,706,000
			SAY \$2.7 MILLION

a - Costs rounded to the nearest \$1,000.
LS - Lump sum.

Action-specific SCGs identified for the activities proposed in Alternative 101-S3 include Federal and state regulations that require a selected remedial alternative to attain a cleanup level that eliminates, reduces, or controls risks to human health and the environment. Alternative 101-S3 complies with these requirements.

Other TBCs include the NIOSH IDLH, OSHA PELs, and ACGIH TLVs for contaminants in air, and OSHA excavation guidelines, which will be used to define worker health and safety guidelines during the implementation of this alternative.

14.2.3.3 *Reduction of Toxicity, Mobility, and Volume Through Treatment.* Alternative 101-S3 will result in a reduction in the toxicity, mobility, and volume of contaminated wastes present in site soils by removing source contamination in shallow subsurface soils and treating contaminants in-situ in subsurface soils at depth.

14.2.3.4 *Short-term Effectiveness.* Implementing Alternative 101-S3 may result in the exposure of workers and the public to contaminants through dust created during excavation work or VOC air emissions from the SVE system. However, it is assumed that appropriate engineering controls (e.g., treatment of SVE system air emissions) and health and safety monitoring will be conducted to eliminate such exposures. Implementation of Alternative 101-S3 will likely result in a temporary increase in site traffic and noise, as well as the potential for interference with normal site operations. Approximately 100 sf of space will be needed to construct the aboveground components of the SVE system, such as the structure where vapor extraction and treatment will occur.

14.2.3.5 *Long-term Effectiveness and Permanence.* Alternative 101-S3 provides a high measure of long-term effectiveness and permanence for shallow subsurface soils, as contaminants in this medium will be removed from the site. The extraction of contaminants from subsurface soils at depth with SVE will reduce VOC concentrations in this medium. A pilot test should be conducted to verify the expected operating time of the SVE system to achieve the remedial action objectives for the subsurface soils at depth. Following system shutoff, rebounding (i.e., a sudden increase in VOC concentrations) is commonly experienced. If this occurs, the SVE system will be brought back online and will continue to operate until the remedial action objectives are consistently achieved.

If this alternative is implemented, future use of the site property may be limited by physical structures and components associated with the SVE system.

14.2.3.6 Implementability. Implementation of this alternative is technically feasible but will require an evaluation of excavation practices for the shallow subsurface soils. Space will be required for staging soil and excavation equipment. For subsurface soils at depth, SVE is a commonly applied technology at hazardous waste sites and is implementable by remediation contractors. Preliminary estimates suggest that the length of operation time of the system at 101 Frost Street under Alternative 101-S3 is approximately three years, though this time frame may vary widely depending on site conditions. A pilot test should be completed prior to designing a full-scale system. The pilot test would determine key operating parameters of the SVE technology at the site and yield a better estimate of operating time.

14.2.3.7 Cost. Estimated capital and long-term O&M costs for Alternative 101-S3 are included in Table 14-4. These costs are based on the assumptions included in the description of the alternative provided in Chapter 12 and have a range of accuracy of -30 to +50%. Annual O&M costs (included for SVE system only) are estimated based on a 30-year implementation basis and on a 5% interest rate (EPA 1988) to estimate the present worth cost.

14.2.4 Alternative 101-S4: SVE for Shallow Subsurface Soils and Subsurface Soils at Depth

14.2.4.1 Protection of Human Health and the Environment. Alternative 101-S4 includes the in-situ treatment of shallow subsurface soils and subsurface soils at depth with SVE. This alternative aims to protect human health and the environment by reducing contaminant levels in subsurface soils.

14.2.4.2 Compliance with SCGs. Alternative 101-S4 will achieve the recommended soil cleanup objectives by reducing contaminant concentrations in subsurface soils through SVE treatment. SVE will be performed at the site under this alternative until contaminant levels in subsurface soils are substantially reduced. Air emissions that may result from the SVE treatment system will be controlled with GAC to meet applicable New York State air emission guidelines.

**COST ESTIMATE FOR ALTERNATIVE 101-S3:
EXCAVATION AND DISPOSAL OF SHALLOW SUBSURFACE SOILS &
SOIL VAPOR EXTRACTION FOR SUBSURFACE SOILS AT DEPTH**

101 Frost Street Site

ITEM	UNIT COST (\$)	QUANTITY	COST (1999 \$) ^a
CAPITAL COSTS			
A. Direct Costs			
Site Preparation			
Contractor mobilization/demobilization	LS		\$41,000
Utility clearance	LS		\$1,000
Construction of soil staging areas	LS		\$1,000
Pilot test for SVE system ^b	LS		\$15,000
			<u>\$58,000</u>
Shallow Subsurface Soils			
Same as for Alternative 101-S2			\$749,000
Subsurface Soils at Depth			
Soil Vapor Extraction System			
Vapor extraction point installation	\$4,100 /VEP	1 VEPs	\$4,000
Underground piping, excavation, & installation	\$35.00 /lf	200 lf	\$7,000
Asphalt removal, disposal, restoration	\$20.94 /lf	200 lf	\$4,000
Equipment shed	LS		\$5,000
Blower and SVE system equipment	LS		\$15,000
Soil Disposal (nonhazardous)	\$110.00 /cy	10 cy	\$1,000
Vapor treatment system installation	LS		\$5,000
			<u>\$41,000</u>
Additional Health & Safety/Inspection Items			
Health & Safety and Air Monitoring (during excavation)	LS	1	\$15,000
Personal Protective Equipment	LS	1	\$2,000
Excavation and Shoring Inspector (structural engineer)	LS	1	\$3,000
			<u>\$20,000</u>
		Subtotal	\$868,000
B. Indirect Costs			
Engineering and Design @ 15%			\$130,000
Legal and Administrative @ 10%			\$87,000
Contingency @ 25%			\$217,000
		Total	\$1,302,000

**COST ESTIMATE FOR ALTERNATIVE 101-S3:
EXCAVATION AND DISPOSAL OF SHALLOW SUBSURFACE SOILS &
SOIL VAPOR EXTRACTION FOR SUBSURFACE SOILS AT DEPTH**

101 Frost Street Site

ITEM	UNIT COST (\$)	QUANTITY	COST (1999 \$) ^a
O&M COSTS			
SVE System			
Electricity for blower	\$0.10 /kw-hr	10,000 kw-hr	\$1,000 /yr
System maintenance	\$500 /event	1 events	\$1,000 /yr
Maintenance contract (quarter time)	LS		\$15,000 /yr
Condensate disposal (Nonhazardous)	\$2.50 /gal	500 gal	\$1,000 /yr
Replace spent vapor phase GAC media	\$2.50 /lb	100 lbs	\$1,000
	Annual cost for years 1 - 3:		\$1,000 /yr
System Monitoring			
Sampling of soil gas (once per 2 months)	\$1,500 /event	6 events	\$9,000 /yr
Confirmatory Sampling			
Deep soil sampling and VOC analysis (Year 3)	\$400 /sample	10 samples	\$3,000
	Annual cost for years 1 - 3:		\$1,000 /yr
	Annual O&M cost for years 1 - 3:		\$29,000 /yr
	Annual O&M cost for years 4 - 30:		\$0 /yr
PRESENT WORTH			
Based on a 30 year life and a 5% intrerest rate.			\$1,381,000
SAY \$1.4 MILLION			

a - Costs rounded to the nearest \$1,000.

b - Includes cost of constructing one vapor extraction point.

LS - Lump sum.

The only location-specific SCG that applies to the site is related to the sole source aquifer that underlies the site. Remedial activities proposed under this alternative must be conducted as to prevent contaminant releases to the underlying aquifers.

Action-specific SCGs identified for the activities proposed in Alternative 101-S4 include Federal and state regulations that require a selected remedial alternative to attain a cleanup level that eliminates, reduces, or controls risks to human health and the environment. Alternative 101-S4 complies with these requirements.

Other TBCs include the NIOSH IDLH, OSHA PELs, and ACGIH TLVs for contaminants in air, which will be used to define worker health and safety guidelines during the implementation of this alternative.

14.2.4.3 *Reduction of Toxicity, Mobility, and Volume Through Treatment.* Alternative 101-S4 will result in a reduction in the toxicity, mobility, and volume of VOC-contaminated wastes present at the site by reducing the contaminant concentrations in subsurface soils. However, SVOCs, pesticides, and metals in shallow subsurface soils may not be as effectively reduced in this alternative.

14.2.4.4 *Short-term Effectiveness.* Implementing Alternative 101-S4 may result in the exposure of workers and the public to contaminants through generation of VOC air emissions from the SVE system. However, it is assumed that appropriate engineering controls (e.g., treatment of SVE system air emissions) and health and safety monitoring will be conducted to eliminate such exposures. Implementation of Alternative 101-S4 will likely result in a temporary increase in site traffic and noise, as well as the potential for interference with normal site operations. Approximately 250 sf of space will be needed to construct the aboveground components of the SVE system, such as the structure where vapor extraction and treatment will occur.

14.2.4.5 *Long-term Effectiveness and Permanence.* Alternative 101-S4 provides long-term effectiveness and permanence, as contaminants will be reduced in on-site subsurface soils. A pilot test should be conducted to verify the expected operating time of the SVE system to achieve the remedial action objectives of the subsurface soils at depth. A pilot test can also determine the effectiveness of SVE at removing contaminants other than VOCs (i.e., SVOCs, pesticides, and metals) in the shallow subsurface soils. Following system shutoff, rebounding (i.e., a sudden increase in VOC concentrations) is commonly

experienced. If this occurs, the SVE system will be brought back online and will continue to operate until the remedial action objectives are consistently achieved.

If this alternative is implemented, future use of the site property may be limited by physical structures and components associated with the SVE system.

14.2.4.6 Implementability. SVE is a commonly applied technology at hazardous waste sites and is implementable by remediation contractors. Preliminary estimates suggest that the length of operation time of the system at 101 Frost Street under Alternative 101-S4 is approximately three years, though this time frame may vary widely depending on site conditions. A pilot test should be completed prior to designing a full-scale system. The pilot test would determine key operating parameters of the SVE technology at the site and yield a better estimate of operating time. The pilot test can also evaluate the effectiveness of SVE in treating contamination in shallow subsurface soils at the site, which may be characteristically heterogeneous and moist and may exhibit contamination other than VOCs.

14.2.4.7 Cost. Estimated capital and long-term O&M costs for Alternative 101-S4 are included in Table 14-5. These costs are based on the assumptions included in the description of the alternative provided in Chapter 12 and have a range of accuracy of -30 to +50%. Annual O&M costs are estimated based on a 30-year implementation basis and on a 5% interest rate (EPA 1988) to estimate the present worth cost.

14.2.5 Alternative 101-S5: No Action on Shallow Subsurface Soils/SVE for Subsurface Soils at Depth

14.2.5.1 Protection of Human Health and the Environment. Alternative 101-S5 aims to protect human health and the environment by treating VOC contamination in subsurface soils at depth with SVE. However, contaminants in shallow subsurface soils will remain in the environment.

14.2.5.2 Compliance with SCGs. Alternative 101-S5 will achieve the recommended soil cleanup objectives by reducing contaminant concentrations in subsurface soils at depth through SVE treatment. SVE will be performed at the site until VOC levels in subsurface soils at depth are substantially reduced. Air emissions that may result from the SVE treatment system will be controlled with GAC to meet applicable New York State air

TABLE 14-5 (Page 1 of 2)

**COST ESTIMATE FOR ALTERNATIVE 101-S4:
SOIL VAPOR EXTRACTION**

101 Frost Street Site

ITEM	UNIT COST (\$)	QUANTITY	COST (1999 \$) ^a
CAPITAL COSTS			
A. Direct Costs			
<i>Site Preparation</i>			
Contractor mobilization/demobilization	LS		\$8,000
Utility clearance	LS		\$1,000
Pilot test for SVE system ^b	LS		\$20,000
<i>Soil Vapor Extraction System</i>			
Vapor extraction point installation (deep)	\$4,100 /VEP	1 VEPs	\$4,000
Vapor extraction point installation (shallow)	\$2,500 /VEP	12 VEPs	\$30,000
Underground piping excavation & installation	\$35.00 /lf	1,000 lf	\$35,000
Asphalt removal, disposal, and restoration	\$20.94 /lf	1,000 lf	\$21,000
Equipment shed	LS		\$8,000
Blower and SVE system equipment	LS		\$25,000
Soil Disposal (nonhazardous)	\$110.00 /cy	15 cy	\$2,000
Vapor Treatment System Installation	LS		\$8,000
		Subtotal	\$162,000
B. Indirect Costs			
<i>Engineering and Design @ 15%</i>			\$24,000
<i>Legal and Administrative @ 10%</i>			\$16,000
<i>Contingency @ 25%</i>			\$41,000
		Total	\$243,000

TABLE 14-5 (Page 2 of 2)

**COST ESTIMATE FOR ALTERNATIVE 101-S4:
SOIL VAPOR EXTRACTION**

101 Frost Street Site

ITEM	UNIT COST (\$)	QUANTITY	COST (1999 \$) ^a
O&M COSTS			
SVE System			
Electricity for blower	\$0.10 /kw-hr	55,000 kw-hr	\$6,000 /yr
System maintenance	\$500 /event	2 events	\$1,000 /yr
Maintenance contract (half time)	LS		\$25,000 /yr
Condensate disposal (nonhazardous)	\$2.50 /gal	700 gal	\$2,000 /yr
Replace spent vapor phase GAC media	\$2.50 /lb	200 lbs	\$1,000
	Annual cost for years 1 - 3:		\$1,000 /yr
System Monitoring			
Sampling of soil gas (once per 2 months)	\$1,500 /event	6 events	\$9,000 /yr
Confirmatory Sampling			
Soil sampling and VOC analysis (Year 3)	\$600 /sample	22 samples	\$11,000
	Annual cost for years 1 - 3:		<u>\$4,000 /yr</u>
	Annual O&M cost for years 1 - 3:		\$48,000 /yr
	Annual O&M cost for years 4 - 30:		\$0 /yr
PRESENT WORTH			
Based on a 30 year life and a 5% interest rate.			\$374,000
SAY \$0.4 MILLION			

a - Costs rounded to the nearest \$1,000.

b - Includes cost of constructing one vapor extraction point.

LS - Lump sum.

emission guidelines. No active measures will be taken to reduce contaminant levels in shallow subsurface soils to satisfy the remedial action objectives.

The only location-specific SCG that applies to the site is related to the sole source aquifer that underlies the site. Remedial activities proposed under this alternative must be conducted as to prevent contaminant releases to the underlying aquifers.

Action-specific SCGs identified for the activities proposed in Alternative 101-S5 include Federal and state regulations that require a selected remedial alternative to attain a cleanup level that eliminates, reduces, or controls risks to human health and the environment. Alternative 101-S5 complies with these requirements for subsurface soils at depth but not for shallow subsurface soils.

Other TBCs include the NIOSH IDLH, OSHA PELs, and ACGIH TLVs for contaminants in air, and OSHA excavation guidelines, which will be used to define worker health and safety guidelines during the implementation of this alternative.

14.2.5.3 *Reduction of Toxicity, Mobility, and Volume Through Treatment.* Implementing Alternative 101-S5 will reduce the toxicity, mobility, and volume of contaminated wastes present in subsurface soils at depth by treating contaminants in-situ in subsurface soils at depth. There will be no reduction of the toxicity, mobility, and volume of contaminants through treatment in the shallow subsurface soils.

14.2.5.4 *Short-term Effectiveness.* Implementing Alternative 101-S5 may result in the exposure of workers and the public to contaminants through dust created during the construction and initial operation of the SVE system. However, it is assumed that appropriate engineering controls (e.g., treatment of SVE system air emissions) and health and safety monitoring will be conducted to eliminate such exposures. Implementation of Alternative 101-S5 will likely result in a temporary increase in site traffic and noise, as well as the potential for interference with normal site operations. Approximately 100 ft² of space will be needed to construct the aboveground components of the SVE system, such as the structure where vapor extraction and treatment will occur.

14.2.5.5 *Long-term Effectiveness and Permanence.* Alternative 101-S5 provides a high measure of long-term effectiveness and permanence for subsurface soils at depth, as contaminants in this medium will be removed from the site. However, this alternative

provides no long-term effectiveness or permanence for shallow subsurface soils, which will remain contaminated.

The extraction of contaminants from subsurface soils at depth with SVE will reduce VOC concentrations in this medium. A pilot test should be conducted to verify the expected operating time of the SVE system to achieve the remedial action objectives for the subsurface soils at depth. Following system shutoff, rebounding (i.e., a sudden increase in VOC concentrations) is commonly experienced. If this occurs, the SVE system will be brought back online and will continue to operate until the remedial action objectives are consistently achieved.

If this alternative is implemented, future use of the site property may be limited by physical structures and components associated with the SVE system.

14.2.5.6 Implementability. Implementation of this alternative is technically feasible. For subsurface soils at depth, SVE is a commonly applied technology at hazardous waste sites and is implementable by remediation contractors. Preliminary estimates suggest that the length of operation time of the system at 101 Frost Street under Alternative 101-S5 is approximately three years, though this time frame may vary widely depending on site conditions. A pilot test should be completed prior to designing a full-scale system. The pilot test would determine key operating parameters of the SVE technology at the site and yield a better estimate of operating time.

14.2.5.7 Cost. Estimated capital and long-term O&M costs for Alternative 101-S5 are included in Table 14-6. These costs are based on the assumptions included in the description of the alternative provided in Chapter 12 and have a range of accuracy of -30 to +50%. Annual O&M costs (included for SVE system only) are estimated based on a 30-year implementation basis and on a 5% interest rate (EPA 1988) to estimate the present worth cost.

14.2.6 Comparative Analysis of Source Control Alternatives

In the previous section each of the remedial alternatives was individually evaluated with respect to the seven evaluation criteria. In this section the comparative performance of the alternatives is discussed where common elements exist among them.

**COST ESTIMATE FOR ALTERNATIVE 101-S5:
NO ACTION FOR SHALLOW SUBSURFACE SOILS &
SOIL VAPOR EXTRACTION FOR SUBSURFACE SOILS AT DEPTH**

101 Frost Street Site

ITEM	UNIT COST (\$)	QUANTITY	COST (1999 \$) ^a
CAPITAL COSTS			
A. Direct Costs			
<i>Site Preparation</i>			
Contractor mobilization/demobilization	LS		\$5,000
Utility clearance	LS		\$1,000
Construction of soil staging areas	LS		\$1,000
Pilot test for SVE system ^b	LS		\$15,000
			<u>\$22,000</u>
<i>Subsurface Soils at Depth</i>			
Soil Vapor Extraction System			
Vapor extraction point installation	\$4,100 /VEP	1 VEPs	\$4,000
Underground piping, excavation, & installation	\$35.00 /lf	200 lf	\$7,000
Asphalt removal, disposal, restoration	\$20.94 /lf	200 lf	\$4,000
Equipment shed	LS		\$5,000
Blower and SVE system equipment	LS		\$15,000
Soil Disposal (nonhazardous)	\$110.00 /cy	10 cy	\$1,000
Vapor treatment system installation	LS		\$5,000
			<u>\$41,000</u>
		Subtotal	\$63,000
B. Indirect Costs			
<i>Engineering and Design @ 15%</i>			\$9,000
<i>Legal and Administrative @ 10%</i>			\$6,000
<i>Contingency @ 25%</i>			\$16,000
		Total	\$94,000

**COST ESTIMATE FOR ALTERNATIVE 101-S5:
NO ACTION FOR SHALLOW SUBSURFACE SOILS &
SOIL VAPOR EXTRACTION FOR SUBSURFACE SOILS AT DEPTH**

101 Frost Street Site

ITEM	UNIT COST (\$)	QUANTITY	COST (1999 \$) ^a
O&M COSTS			
SVE System			
Electricity for blower	\$0.10 /kw-hr	10,000 kw-hr	\$1,000 /yr
System maintenance	\$500 /event	1 events	\$1,000 /yr
Maintenance contract (quarter time)	LS		\$15,000 /yr
Condensate disposal (Nonhazardous)	\$2.50 /gal	500 gal	\$1,000 /yr
Replace spent vapor phase GAC media	\$2.50 /lb	100 lbs	\$1,000
	Annual cost for years 1 - 3:		\$1,000 /yr
System Monitoring			
Sampling of soil gas (once per 2 months)	\$1,500 /event	6 events	\$9,000 /yr
Confirmatory Sampling			
Deep soil sampling and VOC analysis (Year 3)	\$400 /sample	10 samples	\$3,000
	Annual cost for years 1 - 3:		\$1,000 /yr
	Annual O&M cost for years 1 - 3:		\$29,000 /yr
	Annual O&M cost for years 4 - 30:		\$0 /yr
PRESENT WORTH			
Based on a 30 year life and a 5% intrerest rate.			\$173,000
SAY \$0.17 MILLION			

a - Costs rounded to the nearest \$1,000.

b - Includes cost of constructing one vapor extraction point.

LS - Lump sum.

14.2.6.1 ***Protection of Human Health and the Environment.*** Alternative 101-S1 provides the least protection of human health and the environment as institutional controls will not be effective in preventing potential human exposure to subsurface soil contamination or the potential migration of the contaminants to groundwater. Alternative 101-S2 potentially offers the greatest protection of human health and the environment by removing the contaminated source areas from the site. Alternative 101-S3 removes shallow subsurface soil contamination from the site and addresses VOC contamination in subsurface soils at depth through in-situ SVE treatment. Alternative 101-S4 reduces levels of volatile soil contaminants through SVE, but non-volatile compounds remain in the environment. Alternative 101-S5 uses SVE to reduce contaminant levels in subsurface soils at depth but allows contaminants in shallow subsurface soils to remain in the environment. The greatest protection of human health and the environment would be achieved if Alternative 101-S2 is implemented. Alternative 101-S3 would also provide adequate protection of human health and the environment, but require a longer implementation time.

14.2.6.2 ***Compliance With SCGs.*** Alternative 101-S1 does not comply with any site SCGs with the exception of the Federal and state requirement to include a "no action" alternative in the range of detailed evaluation. Alternatives 101-S2 and 101-S3 comply with SCGs that relate to soil remediation objectives. Alternative 101-S4 complies with SCGs for subsurface soils at depth; non-volatile contaminants in shallow subsurface soils will remain in the environment. Alternative 101-S5 complies with SCGs for subsurface soils at depth but not for shallow subsurface soils. Thus, implementation of Alternative 101-S2 and 101-S3 would achieve compliance of soil SCGs.

14.2.6.3 ***Reduction of Toxicity, Mobility, and Volume Through Treatment.*** Alternative 101-S1 will not result in any reduction of toxicity, mobility, or volume of contamination present at the site as no active source control remedial measures are included. Alternatives 101-S2, 101-S3, and 101-S4 are expected to result in a decrease in toxicity, mobility, and volume by removing contaminants from subsurface soils. However, applying SVE to shallow subsurface soils (Alternative 101-S4) may not effectively reduce contamination other than VOCs in shallow subsurface soils. In order to reduce the toxicity, mobility, and volume of contaminants in shallow subsurface soils and subsurface soils at depth, Alternative 101-S2 or 101-S3 would need to be selected. Alternative 101-S5 would reduce the toxicity, mobility and volume of contaminants in subsurface soils at depth through SVE

treatment; however, contaminants in shallow subsurface soils would remain in the environment.

14.2.6.4 Short-Term Effectiveness. Alternative 101-S1 results in the least amount of short-term impacts to human health and the environment as no remedial or site activities are included under this alternative. Of the active remedies, Alternatives 101-S2 will cause the greatest disruption to normal site operations and the surrounding community due to the remedial activities to be conducted (i.e., soil excavation, on-site soil staging, traffic and noise associated with soil load-out). Alternatives 101-S4 (in-situ soil treatment) and 101-S5 (in situ treatment only for subsurface soils at depth) are likely to cause the least disruption out of the four active remedies; Alternative 101-S3 (excavation and in-situ soil treatment) is likely to cause site disturbances at a level between the other three active remedies.

14.2.6.5 Long-Term Effectiveness and Permanence. Alternative 101-S2 permanently removes contaminants from the soil media by excavation and off-site disposal. Alternative 101-S3 removes contamination from site subsurface soils by a combination of excavation/off-site disposal and SVE. Alternative 101-S4 employs SVE to shallow subsurface soils and subsurface soils at depth at the site. Alternative 101-S5 provides long-term effectiveness and permanence for subsurface soils at depth but not for shallow subsurface soils. Alternative 101-S1 does not provide long-term effectiveness or permanence as no active remediation measures are proposed. Implementation of Alternative 101-S2, 101-S3, or 101-S4 is expected to provide the greatest degree of long-term effectiveness and permanence for on-site subsurface soils.

Alternative 101-S3 (excavation/off-site disposal of shallow subsurface soils and SVE for VOC contaminants in subsurface soils at depth) appears to be the most effective source control alternative for the site. For instance, excavation of shallow subsurface soil contamination is likely to be more effective than applying SVE treatment to this medium since excavation is readily implementable and since the contaminants (including SVOCs, pesticides, and metals) may not be effectively reduced by SVE. In addition, the VOC contamination in subsurface soils at depth (i.e., to approximately 55 ft bgs) would likely be effectively treated in-situ with SVE; this approach is much more practical than attempting to excavate the contamination in the subsurface soils at depth at this site.

If Alternative 101-S3, 101-S4, or 101-S5 is implemented, future use of some of the property space may temporarily be restricted by SVE system components (i.e., vapor extraction points, underground piping, or a treatment system).

14.2.6.6 Implementability. All five alternatives are implementable. Alternative 101-S1 is the easiest of the five alternatives to implement as only establishment of institutional measures is required. Of the active remedies, Alternatives 101-S3, 101-S4, 101-S5 are estimated to take the longest to implement (three years). Alternative 101-S2 is estimated to be completed in the shortest amount of time (approximately six months). The potential hazards to workers implementing the active remedies and the surrounding public due to implementation of these alternatives are expected to be greatest for Alternative 101-S2 and least for Alternative 101-S4.

The implementation of Alternative 101-S2 will require detailed evaluation of soil excavation approaches, including shoring and bracing of sidewalls and worker health and safety. Extra attention must be given to the excavation of contaminated subsurface soils at depth at the site, since excavation to depths as great as 55 ft bgs will be required under this alternative.

Alternatives 101-S4 and 101-S5 involve the installation of an SVE and vapor treatment system to address contamination in all subsurface soils (shallow and/or deep) at the site. While cleanup of shallow subsurface soils at 101 Frost Street may readily progress, heterogeneity and excessive moisture expected to be encountered in soils below dry well structures may adversely affect the extractability of contaminants with SVE. For Alternative 101-S4, contaminants other than VOCs found in shallow subsurface soils at the site (i.e., SVOCs, pesticides, and metals), may not be readily removed with SVE. Hence, the extractability of contaminants found in shallow subsurface soils at the site may be difficult to predict without pilot test data. Alternative 101-S3 employs a combination of excavation and SVE approaches.

14.2.6.7 Cost. The cost of each remedial alternative is summarized in Table 14-1. Alternative 101-S1, the no action alternative, has no associated costs. Alternative 101-S5 has the second lowest estimated cost (\$0.17 million). Alternative 101-S4, SVE, has the third lowest estimated cost (\$0.37 million). Alternative 101-S3 has the fourth lowest estimated cost (\$1.4 million). Alternative 101-S2 (excavation and off-site disposal) has the highest estimated cost (\$2.7 million).

14.3 SOURCE CONTROL ALTERNATIVES FOR THE 89 FROST STREET SITE

The individual analysis of the source control remedial alternatives for 89 Frost Street with respect to the first seven evaluation criteria is presented below and is summarized in Table 14-7. The criteria evaluation is followed by a comparative analysis of source control alternatives for the 89 Frost Street site.

14.3.1 Alternative 89-S1: No Action

14.3.1.1 *Protection of Human Health and the Environment.* Institutional measures included in Alternative 89-S1 serve to protect human health by preventing human contact with the contaminants in shallow subsurface soils and subsurface soils at depth that will remain at the site; however, the potential for human exposure to the contaminants in shallow subsurface soils will remain. In addition, the site may continue to impact the surrounding environment through the migration of contaminants from soils to groundwater.

14.3.1.2 *Compliance with SCGs.* Under this no action alternative, it is highly unlikely that NYSDEC soil standards will be achieved in a short time frame. Because this alternative does not include any active remedial measures, no air releases are expected; therefore no NAAQS apply. As no active remedy is proposed under Alternative 89-S1, location-specific SCGs do not apply. As Alternative 89-S1 does not include any active remediation activities, there are no action-specific TBCs that apply to this alternative. As no on-site remedial activities are included as part of this alternative, requirements of other TBCs do not apply to this alternative either.

Alternative 89-S1 does not comply with the Federal or state requirements which state that the selected remedial alternative must attain a cleanup level that eliminates, reduces, or controls risks to human health and the environment.

14.3.1.3 *Reduction of Toxicity, Mobility, and Volume Through Treatment.* Alternative 89-S1 will not result in a reduction in the toxicity, mobility, or volume of contaminated wastes in site soils.

TABLE 14-7 (Page 1 of 1)

SUMMARY OF DETAILED EVALUATION OF SOURCE CONTROL REMEDIAL ALTERNATIVES

89 Frost Street Site

ALTERNATIVE	OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	COMPLIANCE WITH SCGs	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	SHORT-TERM EFFECTIVENESS	LONG-TERM EFFECTIVENESS AND PERMANENCE	IMPLEMENTABILITY	COST
ALTERNATIVE 89-S1: No Action	Minimal prevention of human contact through institutional controls only. Contaminants remain in the environment.	Will not quickly or actively achieve soil SCGs.	Does not reduce toxicity, mobility, or volume of contamination present in site soils.	Does not result in disruption of site operations or pose a short-term threat to health or the environment.	Does not provide long-term effectiveness or permanence; contaminants will remain at site.	No constraints to implementation of institutional measures.	Capital: \$0 O&M: \$0/yr Present Worth: \$0
ALTERNATIVE 89-S2: Excavation of shallow subsurface soils and subsurface soils at depth	Potentially offers the greatest protection to human health and the environment by eliminating the source areas. Site selected for disposal of excavated material will require maintenance and monitoring.	Applicable NYSDEC soil cleanup objectives achieved through removal and disposal.	Greatest potential reduction in the mobility and volume of VOCs at the site by removal of contaminants from the soil and off-site disposal.	Will result in disruption of site operations during implementation. Will generate some noise and traffic. Space is required (approx. 500 sf) for SVE treatment equipment.	Alternative offers the potentially greatest long-term effectiveness by elimination of on-site source areas.	Alternative is technically implementable but will require detailed evaluation of excavation approaches during final design. Alternative may not be feasible for subsurface soils at depth. Space required for excavated soil and equipment storage. Duration of alternative estimated to be 4 months.	Capital: \$9,741,000 O&M: \$0/yr Present Worth: \$9.7 million
ALTERNATIVE 89-S3: Excavation of shallow subsurface soils/Soil Vapor Extraction for subsurface soils at depth	Protects human health and the environment via (1) removal and off-site disposal of contaminants in shallow subsurface soils, and (2) extracting and treating volatile contaminants in subsurface soils at depth. Prevents further vertical migration of contaminants.	Applicable NYSDEC soil cleanup objectives achieved for shallow subsurface soils through removal and disposal. Applicable soil standards achieved for subsurface soils at depth through treatment. Air emissions must be controlled to meet SCGs.	Reduction of mobility and volume of contaminants in shallow subsurface soils through removal and off-site disposal. Significant reduction in mobility and volume of contaminants (VOCs) in subsurface soils at depth through treatment.	Will result in disruption of site operations during implementation. Will generate some noise and traffic. Space is required (approx. 500 sf) for SVE treatment equipment.	Alternative offers the potentially greatest long-term effectiveness for shallow subsurface soils by eliminating sources. SVE very effective for reducing VOC concentrations in subsurface soils at depth. SVE system may limit future site uses.	Alternative is technically implementable. SVE pilot test should be conducted prior to implementation. Detailed excavation plan and space required for shallow subsurface soils. The estimated duration of excavation/off-site disposal of shallow subsurface soils is 10 days. Time required for SVE estimated at 10 years.	Capital: \$496,000 O&M (Yr 1-10): \$46,000/yr Present Worth: \$0.85 million
ALTERNATIVE 89-S4: Soil Vapor Extraction for shallow subsurface soils and subsurface soils at depth	Protects human health and the environment by extracting and treating VOCs in site soils. May not be as effective on SVOCs and metals. Prevents further vertical migration of contaminants.	Applicable soil standards may be achieved for subsurface soils at depth through treatment. SVE may not effectively achieve soil SCGs for contaminants other than VOCs. Air emissions must be controlled to meet SCGs.	Potential significant reduction in mobility and volume of VOC contaminants in subsurface soils at depth through treatment. SVOC and metal contaminants in shallow subsurface soils may not be as efficiently reduced.	Will result in disruption of site operations during implementation. Will generate noise and traffic. Approximately 500 sf is required for SVE treatment equipment.	SVE very effective for reducing VOC concentrations in subsurface soils at depth. Applicability of SVE to shallow subsurface soil contamination (SVOCs and metals) may need to be evaluated in detail. SVE system components may limit future site uses.	SVE system is readily implemented and available, depending on site logistics. The time required for SVE estimated at 10 years.	Capital: \$234,000 O&M (Yr 1-10): \$49,000/yr Present Worth: \$0.81 million
ALTERNATIVE 89-S5: No action on shallow subsurface soils/Soil Vapor Extraction for subsurface soils at depth	Protects human health and the environment via removal and off-site disposal of contaminants in subsurface soils at depth but contaminants in shallow subsurface soils will remain in the environment.	Applicable NYSDEC soil cleanup objectives achieved for subsurface soils at depth through treatment. Air emissions must be controlled to meet SCGs. No active measures will be taken to reduce contaminant levels in shallow subsurface soils to meet NYSDEC soil cleanup objectives.	Significant reduction in mobility, toxicity, and volume of contaminants (VOCs) in subsurface soils at depth through treatment. No reduction of mobility and volume of contaminants in shallow subsurface soils.	Will result in disruption of site operations during implementation. Will generate some noise and traffic. Space is required (approx. 500 sf) for SVE treatment equipment.	This alternative eliminates a source of contamination but contaminants in shallow subsurface soils will remain in the environment. SVE would be very effective in reducing VOC concentrations in subsurface soils at depth. SVE system may temporarily limit site use.	Alternative is technically implementable. SVE pilot test should be conducted prior to implementation. Detailed excavation plan and space required for shallow subsurface soils. Time required for SVE is estimated at 10 years.	Capital: \$197,000 O&M (Yr 1-10): \$46,000/yr Present Worth: \$0.55 million

14.3.1.4 **Short-term Effectiveness.** Alternative 89-S1 does not result in disruption of site operations or pose a short-term threat to health or the environment as no active remedial activities will occur at the site.

14.3.1.5 **Long-term Effectiveness and Permanence.** The no action alternative does not provide long-term effectiveness and permanence, and soil contaminants will remain on-site. Although human health risks may be mitigated through the use of deed and development restrictions, these institutional measures may not eliminate the potential for human exposure to site contaminants (e.g., dermal contact with contaminated shallow subsurface soils).

14.3.1.6 **Implementability.** Implementation of this alternative is straightforward and does not depend on the availability of vendors, materials, or services. Institutional measures/restrictions would be implemented by NYSDEC or the municipality.

14.3.1.7 **Cost.** For Alternative 89-S1, capital costs include legal and administrative costs associated with implementing institutional measures, the costs of which would be determined in the future depending on the way the institutional measures are implemented. There are no direct capital costs associated with Alternative 89-S1 (see Table 14-8).

14.3.2 **Alternative 89-S2: Excavation of Shallow Subsurface Soils and Subsurface Soils at Depth/Off-Site Disposal**

14.3.2.1 **Protection of Human Health and the Environment.** Alternative 89-S2 aims to protect human health and the environment by excavating and removing source areas of contamination in shallow subsurface soils and subsurface soils at depth at the site. Post-excavation confirmatory soil sampling, as included in this alternative, will assess whether or not the source area contamination at the site has been sufficiently removed.

14.3.2.2 **Compliance with SCGs.** Under this alternative, applicable NYSDEC soil standards will be achieved in a relatively short time frame by excavating and removing soil contamination. The only location-specific SCG that applies to the site is related to the sole source aquifer that underlies the site. Remedial activities proposed under this alternative must be conducted as to prevent contaminant releases to the underlying aquifers.

TABLE 14-8

**COST ESTIMATE FOR ALTERNATIVE 89-S1:
NO ACTION**

89 Frost Street Site

ITEM	UNIT COST (\$)	QUANTITY	COST (1999 \$)
CAPITAL COSTS			
A. Direct Costs			
<i>Institutional Measures</i>			
Deed & development restrictions			- a
		Subtotal	- a
B. Indirect Costs			
			- a
O & M Costs (none)			
			\$0
PRESENT WORTH			
<i>Based on a 30 year life and a 5% intrerest rate.</i>			
			\$0

a - Legal and administrative costs to community that are not included in cost estimate.

Action-specific SCGs identified for the activities proposed in Alternative 89-S2 include Federal and state regulations that require a selected remedial alternative to attain a cleanup level that eliminates, reduces, or controls risks to human health and the environment. Alternative 89-S2 complies with these requirements.

Other TBCs include the NIOSH IDLH, OSHA PELs, and ACGIH TLVs for contaminants in air, and OSHA excavation guidelines, which will be used to define worker health and safety practices during the implementation of this alternative.

14.3.2.3 *Reduction of Toxicity, Mobility, and Volume Through Treatment.* Alternative 89-S2 will result in a reduction in the toxicity, mobility, and volume of contaminated wastes present at the site by removing source contamination in shallow subsurface soils and subsurface soils at depth.

14.3.2.4 *Short-term Effectiveness.* Implementing Alternative 89-S2 may result in the exposure of workers and the public to contaminants through dust created during excavation work. However, it is assumed that appropriate engineering controls and health and safety monitoring will be conducted to eliminate such exposures. Implementation of Alternative 89-S2 will likely result in a temporary increase in site traffic and noise, as well as the potential for interference with normal site operations.

14.3.2.5 *Long-term Effectiveness and Permanence.* Alternative 89-S2 provides a high measure of long-term effectiveness and permanence, as soil contaminants will be removed from the site.

14.3.2.6 *Implementability.* Implementation of this alternative is technically feasible but will require a detailed evaluation of excavation, shoring/bracing, and worker safety approaches, especially for subsurface soils at depth. Space will be required for soil staging and equipment storage. Duration of alternative estimated to be 70 days (or about four months).

14.3.2.7 *Cost.* Estimated capital costs for Alternative 89-S2 are included in Table 14-9. No O&M costs are associated with this alternative. These costs are based on the assumptions included in the description of the alternative provided in Chapter 12 and have a range of accuracy of -30 to +50%.

TABLE 14-9 (Page 1 of 2)

**COST ESTIMATE FOR ALTERNATIVE 89-S2:
EXCAVATION AND DISPOSAL OF SHALLOW SUBSURFACE SOILS AND
SUBSURFACE SOILS AT DEPTH / OFF-SITE DISPOSAL**

89 Frost Street Site

ITEM	UNIT COST (\$)	QUANTITY	COST (1999 \$) ^a
CAPITAL COSTS			
A. Direct Costs			
Site Preparation			
Contractor mobilization/demobilization	LS	1	\$200,000
Utility clearance	LS	1	\$1,000
Construction of Soil Staging Areas	LS	1	\$5,000
			\$206,000
Shallow Subsurface Soils			
Excavation (Hand)	\$40 /cy	10 cy	\$1,000
Excavation (Machine)	\$35 /cy	320 cy	\$11,000
Excavation Shoring	\$49 /sf	3,000 sf	\$147,000
Confirmatory Waste Sampling/Characterization			
TCLP Analysis	\$1,400 /sample	2 samples	\$3,000
Transportation & Off-site Disposal			
Hazardous material	\$325 /cy	3 cy	\$1,000
Nonhazardous material	\$110 /cy	50 cy	\$6,000
Backfill & Compaction	\$10 /cy	80 cy	\$1,000
Securing Excavation Areas	LS	1	\$1,000
Post-Excavation Soil Samples	\$765 /sample	3 samples	\$2,000
Site Restoration	LS	1	\$4,000
			\$177,000
Subsurface Soils at Depth			
Excavation (Hand)	\$40 /cy	300 cy	\$12,000
Excavation (Machine)	\$35 /cy	50,000 cy	\$1,750,000
Excavation Shoring	\$78 /sf	36,000 sf	\$2,808,000
Confirmatory Waste Sampling/Characterization			
TCLP Analysis	\$1,400 /sample	15 samples	\$21,000
Transportation & Off-site Disposal			
Hazardous material	\$325 /cy	2,100 cy	\$683,000
Nonhazardous material	\$110 /cy	19,500 cy	\$2,145,000
Backfill Material	\$10 /cy	24,000 cy	\$240,000
Backfill & Compaction	\$5 /cy	21,000 cy	\$105,000
Securing Excavation Areas	LS	1	\$12,000
Post-Excavation Soil Sampling	\$250 /sample	32 samples	\$8,000
Site Restoration	LS	1	\$70,000
			\$7,854,000

TABLE 14-9 (Page 2 of 2)

**COST ESTIMATE FOR ALTERNATIVE 89-S2:
EXCAVATION AND DISPOSAL OF SHALLOW SUBSURFACE SOILS AND
SUBSURFACE SOILS AT DEPTH / OFF-SITE DISPOSAL**

89 Frost Street Site

ITEM	UNIT COST (\$)	QUANTITY	COST (1999 \$) ^a
Additional Health & Safety/Inspection Items			
Health & Safety and Air Monitoring (during excavation)	LS	1	\$40,000
Personal Protective Equipment	LS	1	\$4,000
Excavation and Shoring Inspector (structural engineer)	LS	1	\$9,000
			\$53,000
		Subtotal	\$8,290,000
B. Indirect Costs			
<i>Engineering and Design @ 5%</i>			\$415,000
<i>Legal and Administrative @ 2.5%</i>			\$207,000
<i>Contingency @ 10%</i>			\$829,000
		Total	\$9,741,000
O & M Costs (none)			\$0
PRESENT WORTH			
<i>Based on a 30 year life and a 5% interest rate.</i>			\$9,741,000
			SAY \$9.7 MILLION

a - Costs rounded to the nearest \$1,000.

LS - Lump sum.

14.3.3 **Alternative 89-S3: Excavation/Off-Site Disposal of Shallow Subsurface Soils/SVE for Subsurface Soils at Depth**

14.3.3.1 ***Protection of Human Health and the Environment.*** Alternative 89-S3 aims to protect human health and the environment by excavating and removing source areas of contamination in shallow subsurface soils and treating VOC contamination in subsurface soils at depth with SVE.

14.3.3.2 ***Compliance with SCGs.*** Under this alternative, applicable NYSDEC soil standards will be achieved in shallow subsurface soils in a relatively short time frame by excavating and removing soil contamination. Alternative 89-S3 will also achieve the recommended soil cleanup objectives by reducing contaminant concentrations in subsurface soils at depth through SVE treatment. SVE will be performed at the site under this alternative until VOC levels in subsurface soils at depth are substantially reduced. Air emissions that may result from the SVE treatment system will be controlled with GAC to meet applicable New York State air emission guidelines.

The only location-specific SCG that applies to the site is related to the sole source aquifer that underlies the site. Remedial activities proposed under this alternative must be conducted as to prevent contaminant releases to the underlying aquifers.

Action-specific SCGs identified for the activities proposed in Alternative 89-S3 include Federal and state regulations that require a selected remedial alternative to attain a cleanup level that eliminates, reduces, or controls risks to human health and the environment. Alternative 89-S3 complies with these requirements.

Other TBCs include the NIOSH IDLH, OSHA PELs, and ACGIH TLVs for contaminants in air, and OSHA excavation guidelines, which will be used to define worker health and safety practices during the implementation of this alternative.

14.3.3.3 ***Reduction of Toxicity, Mobility, and Volume Through Treatment.*** Alternative 89-S3 will result in a reduction in the toxicity, mobility, and volume of contaminated wastes present in site soils by removing source contamination in shallow subsurface soils and treating contaminants in-situ in subsurface soils at depth.

14.3.3.4 Short-term Effectiveness. Implementing Alternative 89-S3 may result in the exposure of workers and the public to contaminants through dust created during excavation work or VOC air emissions from the SVE system. However, it is assumed that appropriate engineering controls (e.g., treatment of SVE system air emissions) and health and safety monitoring will be conducted to eliminate such exposures. Implementation of Alternative 89-S3 will likely result in a temporary increase in site traffic and noise, as well as the potential for interference with normal site operations. Approximately 500 ft² of space will be needed to construct the aboveground components of the SVE system, such as the structure where vapor extraction and treatment will occur.

14.3.3.5 Long-term Effectiveness and Permanence. Alternative 89-S3 provides a high measure of long-term effectiveness and permanence for shallow subsurface soils, as contaminants in this medium will be removed from the site. The extraction of contaminants from subsurface soils at depth with SVE will reduce VOC concentrations in this medium. A pilot test should be conducted to verify the expected operating time of the SVE system to achieve the remedial action objectives for the subsurface soils at depth. Following system shutoff, rebounding (i.e., a sudden increase in VOC concentrations) is commonly experienced. If this occurs, the SVE system will be brought back online and will continue to operate until the remedial action objectives are consistently achieved.

If this alternative is implemented, future use of the site property may be limited by physical structures and components associated with the SVE system.

14.3.3.6 Implementability. Implementation of this alternative is technically feasible but will require an evaluation of excavation practices for the shallow subsurface soils. Space will be required for staging soils and excavation equipment. For subsurface soils at depth, SVE is a commonly applied technology at hazardous waste sites and is implementable by remediation contractors. Preliminary estimates suggest that the length of operation time of the system at 89 Frost Street under Alternative 89-S3 is approximately ten years, though this time frame may vary widely depending on site conditions. A pilot test should be completed prior to designing a full-scale system. The pilot test would determine key operating parameters of the SVE technology at the site and yield a better estimate of operating time.

14.3.3.7 Cost. Estimated capital and long-term O&M costs for Alternative 89-S3 are included in Table 14-10. These costs are based on the assumptions included in the

**COST ESTIMATE FOR ALTERNATIVE 89-S3:
EXCAVATION AND DISPOSAL OF SHALLOW SUBSURFACE SOILS &
SOIL VAPOR EXTRACTION FOR SUBSURFACE SOILS AT DEPTH**

89 Frost Street Site

ITEM	UNIT COST (\$)	QUANTITY	COST (1999 \$) ^a
CAPITAL COSTS			
A. Direct Costs			
Site Preparation			
Contractor mobilization/demobilization	LS		\$16,000
Utility clearance	LS		\$1,000
Construction of soil staging areas	LS		\$1,000
Pilot test for SVE system ^b	LS		\$20,000
			<u>\$38,000</u>
Shallow Subsurface Soils			
Same as for Alternative 89-S2			\$177,000
Subsurface Soils at Depth			
Soil Vapor Extraction System			
Vapor extraction point installation	\$4,100 /VEP	4 VEPs	\$16,000
Underground piping, excavation, & installation	\$35.00 /lf	500 lf	\$18,000
Asphalt removal, disposal, and restoration	\$20.94 /lf	500 lf	\$10,000
Equipment shed	LS		\$12,000
Blower and SVE system equipment	LS		\$30,000
Soil Disposal (nonhazardous)	\$110.00 /cy	10 cy	\$1,000
Vapor Treatment System Installation	LS		\$12,000
			<u>\$99,000</u>
Additional Health & Safety/Inspection Items			
Health & Safety and Air Monitoring (during excavation)	LS	1	\$9,000
Personal Protective Equipment	LS	1	\$1,000
Excavation and Shoring Inspector (structural engineer)	LS	1	\$6,000
			<u>\$16,000</u>
		Subtotal	\$330,000
B. Indirect Costs			
Engineering and Design @ 15%			\$50,000
Legal and Administrative @ 10%			\$33,000
Contingency @ 25%			\$83,000
		Total	\$496,000

**COST ESTIMATE FOR ALTERNATIVE 89-S3:
EXCAVATION AND DISPOSAL OF SHALLOW SUBSURFACE SOILS &
SOIL VAPOR EXTRACTION FOR SUBSURFACE SOILS AT DEPTH**

89 Frost Street Site

ITEM	UNIT COST (\$)	QUANTITY	COST (1999 \$) ^a
O&M COSTS			
SVE System			
Electricity for blower	\$0.10 /kw-hr	70,000 kw-hr	\$7,000 /yr
System maintenance	\$500 /event	2 events	\$1,000 /yr
Maintenance contract (half time)	LS		\$25,000 /yr
Condensate disposal (Nonhazardous)	\$2.50 /gal	700 gal	\$2,000 /yr
Replace spent vapor phase GAC media	\$2.50 /lb	2,000 lbs	\$5,000
	Annual cost for years 1 - 10:		\$1,000 /yr
System Monitoring			
Sampling of soil gas (once per 2 months)	\$1,500 /event	6 events	\$9,000 /yr
Confirmatory Sampling			
Deep soil sampling and VOC analysis (Year 10)	\$400 /sample	25 samples	\$6,000
	Annual cost for years 1 - 10:		\$1,000 /yr
	Annual O&M cost for years 1 - 10:		\$46,000 /yr
	Annual O&M cost for years 11 - 30:		\$0 /yr
PRESENT WORTH			
Based on a 30 year life and a 5% interest rate.			\$851,000
SAY \$0.85 MILLION			

a - Costs rounded to the nearest \$1,000.

b - Includes cost of constructing one vapor extraction point.

LS - Lump sum.

description of the alternative provided in Chapter 12 and have a range of accuracy of -30 to +50%. Annual O&M costs (included for SVE system only) are estimated based on a 30-year implementation basis and on a 5% interest rate (EPA 1988) to estimate the present worth cost.

14.3.4 Alternative 89-S4: SVE for Shallow Subsurface Soils and Subsurface Soils at Depth

14.3.4.1 *Protection of Human Health and the Environment.* Alternative 89-S4 includes the in-situ treatment of shallow subsurface soils and subsurface soils at depth with SVE. This alternative aims to protect human health and the environment by reducing contaminant levels in subsurface soils.

14.3.4.2 *Compliance with SCGs.* Alternative 89-S4 will achieve the recommended soil cleanup objectives by reducing contaminant concentrations in subsurface soils through SVE treatment. SVE will be performed at the site under this alternative until contaminant levels in subsurface soils are substantially reduced. Air emissions that may result from the SVE treatment system will be controlled with GAC to meet applicable New York State air emission guidelines.

The only location-specific SCG that applies to the site is related to the sole source aquifer that underlies the site. Remedial activities proposed under this alternative must be conducted as to prevent contaminant releases to the underlying aquifers.

Action-specific SCGs identified for the activities proposed in Alternative 89-S4 include Federal and state regulations that require a selected remedial alternative to attain a cleanup level that eliminates, reduces, or controls risks to human health and the environment. Alternative 89-S4 complies with these requirements.

Other TBCs include the NIOSH IDLH, OSHA PELs, and ACGIH TLVs for contaminants in air, which will be used to define worker health and safety guidelines during the implementation of this alternative.

14.3.4.3 *Reduction of Toxicity, Mobility, and Volume Through Treatment.* Alternative 89-S4 will result in a reduction in the toxicity, mobility, and volume of VOC-contaminated wastes present at the site by reducing the contaminant concentrations in

subsurface soils. However, SVOC and metal contamination present in shallow subsurface soils may not be as effectively reduced in this alternative.

14.3.4.4 Short-term Effectiveness. Implementing Alternative 89-S4 may result in the exposure of workers and the public to contaminants through generation of VOC air emissions from the SVE system. However, it is assumed that appropriate engineering controls (e.g., treatment of SVE system air emissions) and health and safety monitoring will be conducted to eliminate such exposures. Implementation of Alternative 89-S4 will likely result in a temporary increase in site traffic and noise, as well as the potential for interference with normal site operations. Approximately 500 sf of space will be needed to construct the aboveground components of the SVE system, such as the structure where vapor extraction and treatment will occur.

14.3.4.5 Long-term Effectiveness and Permanence. Alternative 89-S4 provides long-term effectiveness and permanence, as contaminants will be reduced in on-site subsurface soils. A pilot test should be conducted to verify the expected operating time of the SVE system to achieve the remedial action objectives of the subsurface soils at depth. A pilot test can also evaluate SVE's ability to remove contamination other than VOCs (e.g., SVOCs and metals) from shallow subsurface soils. Following system shutoff, rebounding (i.e., a sudden increase in VOC concentrations) is commonly experienced. If this occurs, the SVE system will be brought back online and will continue to operate until the remedial action objectives are consistently achieved.

If this alternative is implemented, future use of the site property may be limited by physical structures and components associated with the SVE system.

14.3.4.6 Implementability. SVE is a commonly applied technology at hazardous waste sites and is implementable by remediation contractors. Preliminary estimates suggest that the length of operation time of the system at 89 Frost Street under Alternative 89-S4 is approximately ten years, though this time frame may vary widely depending on site conditions. A pilot test should be completed prior to designing a full-scale system. The pilot test would determine key operating parameters of the SVE technology at the site and yield a better estimate of operating time. The pilot test can also evaluate the effectiveness of SVE in treating contamination in shallow subsurface soils at the site, which may be characteristically heterogeneous and moist and may exhibit contamination other than VOCs.

14.3.4.7 **Cost.** Estimated capital and long-term O&M costs for Alternative 89-S4 are included in Table 14-11. These costs are based on the assumptions included in the description of the alternative provided in Chapter 12 and have a range of accuracy of -30 to +50%. Annual O&M costs are estimated based on a 30-year implementation basis and on a 5% interest rate (EPA 1988) to estimate the present worth cost.

14.3.5 **Alternative 89-S5: No Action on Shallow Subsurface Soils/SVE for Subsurface Soils at Depth**

14.3.5.1 **Protection of Human Health and the Environment.** Alternative 89-S5 aims to protect human health and the environment by treating VOC contamination in subsurface soils at depth with SVE. However, contaminants in shallow subsurface soils will remain in the environment.

14.3.5.2 **Compliance with SCGs.** Alternative 89-S5 will achieve the recommended soil cleanup objectives by reducing contaminant concentrations in subsurface soils at depth through SVE treatment. SVE will be performed at the site until VOC levels in subsurface soils at depth are substantially reduced. Air emissions that may result from the SVE treatment system will be controlled with GAC to meet applicable New York State air emission guidelines. No active measures will be taken to reduce contaminant levels in shallow subsurface soils to satisfy the remedial action objectives.

The only location-specific SCG that applies to the site is related to the sole source aquifer that underlies the site. Remedial activities proposed under this alternative must be conducted as to prevent contaminant releases to the underlying aquifers.

Action-specific SCGs identified for the activities proposed in Alternative 89-S5 include Federal and state regulations that require a selected remedial alternative to attain a cleanup level that eliminates, reduces, or controls risks to human health and the environment. Alternative 89-S5 complies with these requirements for subsurface soils at depth but not for shallow subsurface soils.

Other TBCs include the NIOSH IDLH, OSHA PELs, and ACGIH TLVs for contaminants in air, and OSHA excavation guidelines, which will be used to define worker health and safety guidelines during the implementation of this alternative.

**COST ESTIMATE FOR ALTERNATIVE 89-S4:
SOIL VAPOR EXTRACTION**

89 Frost Street Site

ITEM	UNIT COST (\$)	QUANTITY	COST (1999 \$) ^a
CAPITAL COSTS			
A. Direct Costs			
<i>Site Preparation</i>			
Contractor mobilization/demobilization	LS		\$7,000
Utility clearance	LS		\$1,000
Pilot test for SVE system ^b	LS		\$25,000
<i>Soil Vapor Extraction System</i>			
Vapor extraction point installation (deep)	\$4,100 /VEP	4 VEPs	\$16,000
Vapor extraction point installation (shallow)	\$2,500 /VEP	3 VEPs	\$8,000
Underground piping excavation & installation	\$35.00 /lf	750 lf	\$26,000
Asphalt removal, disposal, and restoration	\$20.94 /lf	750 lf	\$16,000
Equipment shed	LS		\$12,000
Blower and SVE system equipment	LS		\$30,000
Soil Disposal (nonhazardous)	\$110.00 /cy	15 cy	\$2,000
Vapor treatment System Installation	LS		\$13,000
		Subtotal	\$156,000
B. Indirect Costs			
<i>Engineering and Design @ 15%</i>			\$23,000
<i>Legal and Administrative @ 10%</i>			\$16,000
<i>Contingency @ 25%</i>			\$39,000
		Total	\$234,000

TABLE 14-11 (Page 2 of 2)

**COST ESTIMATE FOR ALTERNATIVE 89-S4:
SOIL VAPOR EXTRACTION**

89 Frost Street Site

ITEM	UNIT COST (\$)	QUANTITY	COST (1999 \$) ^a
O&M COSTS			
SVE System			
Electricity for blower	\$0.10 /kw-hr	95,000 kw-hr	\$10,000 /yr
System maintenance	\$500 /event	2 events	\$1,000 /yr
Maintenance contract (half time)	LS		\$25,000 /yr
Condensate disposal (Nonhazardous)	\$2.50 /gal	800 gal	\$2,000 /yr
Replace spent vapor phase GAC media	\$2.50 /lb	2,500 lbs	\$6,000
	Annual cost for years 1 - 10:		\$1,000 /yr
System Monitoring			
Sampling of soil gas (once per 2 months)	\$1,500 /event	6 events	\$9,000 /yr
Confirmatory Sampling			
Soil sampling and VOC analysis (Year 10)	\$600 /sample	28 samples	\$10,000
	Annual cost for years 1 - 10:		<u>\$1,000 /yr</u>
	Annual O&M cost for years 1 - 10:		\$49,000 /yr
	Annual O&M cost for years 11 - 30:		\$0 /yr
PRESENT WORTH			
Based on a 30 year life and a 5% interest rate.			\$612,000
SAY \$0.61 MILLION			

a - Costs rounded to the nearest \$1,000.

b - Includes cost of constructing one vapor extraction point.

LS - Lump sum.

14.3.5.3 *Reduction of Toxicity, Mobility, and Volume Through Treatment.*

Implementing Alternative 89-S5 will reduce the toxicity, mobility, and volume of contaminated wastes present in subsurface soils at depth by treating contaminants in-situ in subsurface soils at depth. There will be no reduction of the toxicity, mobility, and volume of contaminants through treatment in the shallow subsurface soils.

14.3.5.4 *Short-term Effectiveness.* Implementing Alternative 89-S5 may result in the exposure of workers and the public to contaminants through dust created during the construction and initial operation of the SVE system. However, it is assumed that appropriate engineering controls (e.g., treatment of SVE system air emissions) and health and safety monitoring will be conducted to eliminate such exposures. Implementation of Alternative 89-S5 will likely result in a temporary increase in site traffic and noise, as well as the potential for interference with normal site operations. Approximately 100 ft² of space will be needed to construct the aboveground components of the SVE system, such as the structure where vapor extraction and treatment will occur.

14.3.5.5 *Long-term Effectiveness and Permanence.* Alternative 89-S5 provides a high measure of long-term effectiveness and permanence for subsurface soils at depth, as contaminants in this medium will be removed from the site. However, this alternative provides no long-term effectiveness or permanence for shallow subsurface soils, which will remain contaminated.

The extraction of contaminants from subsurface soils at depth with SVE will reduce VOC concentrations in this medium. A pilot test should be conducted to verify the expected operating time of the SVE system to achieve the remedial action objectives for the subsurface soils at depth. Following system shutoff, rebounding (i.e., a sudden increase in VOC concentrations) is commonly experienced. If this occurs, the SVE system will be brought back online and will continue to operate until the remedial action objectives are consistently achieved.

If this alternative is implemented, future use of the site property may be limited by physical structures and components associated with the SVE system.

14.3.5.6 *Implementability.* Implementation of this alternative is technically feasible. For subsurface soils at depth, SVE is a commonly applied technology at hazardous waste sites

and is implementable by remediation contractors. Preliminary estimates suggest that the length of operation time of the system at 89 Frost Street under Alternative 89-S5 is approximately three years, though this time frame may vary widely depending on site conditions. A pilot test should be completed prior to designing a full-scale system. The pilot test would determine key operating parameters of the SVE technology at the site and yield a better estimate of operating time.

14.3.5.7 Cost. Estimated capital and long-term O&M costs for Alternative 89-S5 are included in Table 14-12. These costs are based on the assumptions included in the description of the alternative provided in Chapter 12 and have a range of accuracy of -30 to +50%. Annual O&M costs (included for SVE system only) are estimated based on a 30-year implementation basis and on a 5% interest rate (EPA 1988) to estimate the present worth cost.

14.3.6 Comparative Analysis of Source Control Alternatives

In the previous section each of the remedial alternatives was individually evaluated with respect to the seven evaluation criteria. In this section the comparative performance of the alternatives is discussed where common elements exist among them.

14.3.6.1 Protection of Human Health and the Environment. Alternative 89-S1 provides the least protection of human health and the environment as institutional controls will not be effective in preventing potential human exposure to subsurface soil contamination or the potential migration of the contaminants to groundwater. Alternative 89-S2 potentially offers the greatest protection of human health and the environment by removing the contaminated source areas from the site. Alternative 89-S3 removes shallow subsurface soil contamination from the site and addresses VOC contamination in subsurface soils at depth through in-situ SVE treatment. Alternative 89-S4 reduces levels of volatile subsurface soil contaminants through SVE; nonvolatile contaminants will remain in the environment. Alternative 89-S5 reduces levels of contaminants in subsurface soils at depth but leaves contaminants in shallow subsurface soils in the environment. The greatest protection of human health and the environment would be achieved if Alternative 89-S2 is implemented. Alternative 89-S3 would provide adequate protection of human health and the environment, but require a longer implementation time.

**COST ESTIMATE FOR ALTERNATIVE 89-S5:
NO ACTION FOR SHALLOW SUBSURFACE SOILS &
SOIL VAPOR EXTRACTION FOR SUBSURFACE SOILS AT DEPTH**

89 Frost Street Site

ITEM	UNIT COST (\$)	QUANTITY	COST (1999 \$) ^a
CAPITAL COSTS			
A. Direct Costs			
<i>Site Preparation</i>			
Contractor mobilization/demobilization	LS		\$10,000
Utility clearance	LS		\$1,000
Construction of soil staging areas	LS		\$1,000
Pilot test for SVE system ^b	LS		\$20,000
			<u>\$32,000</u>
<i>Subsurface Soils at Depth</i>			
Soil Vapor Extraction System			
Vapor extraction point installation	\$4,100 /VEP	4 VEPs	\$16,000
Underground piping, excavation, & installation	\$35.00 /lf	500 lf	\$18,000
Asphalt removal, disposal, and restoration	\$20.94 /lf	500 lf	\$10,000
Equipment shed	LS		\$12,000
Blower and SVE system equipment	LS		\$30,000
Soil Disposal (nonhazardous)	\$110.00 /cy	10 cy	\$1,000
Vapor Treatment System Installation	LS		\$12,000
			<u>\$99,000</u>
		Subtotal	\$131,000
B. Indirect Costs			
<i>Engineering and Design @ 15%</i>			\$20,000
<i>Legal and Administrative @ 10%</i>			\$13,000
<i>Contingency @ 25%</i>			\$33,000
		Total	\$197,000

**COST ESTIMATE FOR ALTERNATIVE 89-S5:
NO ACTION FOR SHALLOW SUBSURFACE SOILS &
SOIL VAPOR EXTRACTION FOR SUBSURFACE SOILS AT DEPTH**

89 Frost Street Site

ITEM	UNIT COST (\$)	QUANTITY	COST (1999 \$) ^a
O&M COSTS			
SVE System			
Electricity for blower	\$0.10 /kw-hr	70,000 kw-hr	\$7,000 /yr
System maintenance	\$500 /event	2 events	\$1,000 /yr
Maintenance contract (half time)	LS		\$25,000 /yr
Condensate disposal (Nonhazardous)	\$2.50 /gal	700 gal	\$2,000 /yr
Replace spent vapor phase GAC media	\$2.50 /lb	2,000 lbs	\$5,000
	Annual cost for years 1 - 10:		\$1,000 /yr
System Monitoring			
Sampling of soil gas (once per 2 months)	\$1,500 /event	6 events	\$9,000 /yr
Confirmatory Sampling			
Deep soil sampling and VOC analysis (Year 10)	\$400 /sample	25 samples	\$6,000
	Annual cost for years 1 - 10:		\$1,000 /yr
	Annual O&M cost for years 1 - 10:		\$46,000 /yr
	Annual O&M cost for years 11 - 30:		\$0 /yr
PRESENT WORTH			
Based on a 30 year life and a 5% interest rate.			\$552,000
SAY \$0.55 MILLION			

a - Costs rounded to the nearest \$1,000.

b - Includes cost of constructing one vapor extraction point.

LS - Lump sum.

14.3.6.2 ***Compliance With SCGs.*** Alternative 89-S1 does not comply with any site SCGs with the exception of the Federal and state requirement to include a "no action" alternative in the range of detailed evaluation. Alternatives 89-S2 and 89-S3 comply with SCGs that relate to soil remediation objectives. Alternative 89-S5 would achieve compliance with SCGs for subsurface soils at depth, but contaminants in shallow subsurface soils will remain in the environment. Alternative 89-S4 complies with SCGs for the subsurface soils at depth; however, non-volatile contaminants in shallow subsurface soils may not be effectively treated. Thus, implementation of Alternative 89-S2 and 89-S3 would achieve compliance of soil SCGs.

14.3.6.3 ***Reduction of Toxicity, Mobility, and Volume Through Treatment.*** Alternative 89-S1 will not result in any reduction of toxicity, mobility, or volume of contamination present at the site as no active source control remedial measures are included. Alternatives 89-S2, 89-S3, and 89-S4 are expected to result in a decrease in toxicity, mobility, and volume by removing contaminants from subsurface soils. However, applying SVE to shallow subsurface soils (Alternative 89-S4) may not effectively reduce contamination other than VOCs in shallow subsurface soils. In order to reduce the toxicity, mobility, and volume of contaminants in shallow subsurface soils and subsurface soils at depth, Alternative 89-S2 or 89-S3 would need to be selected. Alternative 89-S5 reduces the toxicity, mobility, and volume of contaminants in subsurface soils at depth but provides no treatment for shallow subsurface soils.

14.3.6.4 ***Short-Term Effectiveness.*** Alternative 89-S1 results in the least amount of short-term impacts to human health and the environment as no remedial or site activities are included under this alternative. Of the active remedies, Alternatives 89-S2 will cause the greatest disruption to normal site operations and the surrounding community due to the remedial activities to be conducted (i.e., soil excavation, on-site soil staging, traffic and noise associated with soil load-out). Alternatives 89-S4 and 89-S5 are likely to cause the least disruption out of the four active remedies; Alternative 89-S3 (excavation and in-situ soil treatment) is likely to cause site disturbances at a level between the other three active remedies.

14.3.6.5 ***Long-Term Effectiveness and Permanence.*** Alternative 89-S2 permanently removes contaminants from the soil media by excavation and off-site disposal. Alternative 89-S3 removes contamination from site subsurface soils by a combination of excavation/off-site disposal and SVE. Alternative 89-S4 employs SVE to shallow

subsurface soils and subsurface soils at depth at the site. Alternative 89-S5 provides long-term effectiveness for subsurface soils at depth (by providing SVE treatment) but provides no long-term effectiveness for shallow subsurface soils. Alternative 89-S1 does not provide long-term effectiveness or permanence as no active remediation measures are proposed. Implementation of Alternative 89-S2, 89-S3, or 89-S4 is expected to provide the greatest degree of long-term effectiveness and permanence for on-site subsurface soils.

Alternative 89-S3 (excavation/off-site disposal of shallow subsurface soils and SVE for VOC contaminants in subsurface soils at depth) appears to be the most effective source control alternative for the site. For instance, excavation of shallow subsurface soil contamination is likely to be more effective than applying SVE treatment to this medium since excavation is readily implementable and since the contaminants (including SVOCs and metals) may not be effectively reduced by SVE. In addition, the VOC contamination in subsurface soils at depth (i.e., to approximately 55 ft bgs) would likely be effectively treated in-situ with SVE; this approach is much more practical than attempting to excavate the contamination in the subsurface soils at depth at this site.

If Alternative 89-S3, 89-S4, or 89-S5 is implemented, future use of some of the property space may temporarily be restricted by SVE system components (i.e., vapor extraction points, underground piping, or a treatment system).

14.3.6.6 Implementability. All five alternatives are implementable. Alternative 89-S1 is the easiest of the five alternatives to implement as only establishment of institutional measures is required. Of the active remedies, Alternatives 89-S3, 89-S4, and 89-S5 are estimated to take the longest to implement (10 years). Alternative 89-S2 is estimated to be completed in the shortest amount of time (approximately four months). The potential hazards to workers implementing the active remedies and the surrounding public due to implementation of these alternatives are expected to be greatest for Alternative 89-S2 and least for Alternative 89-S4.

The implementation of Alternative 89-S2 will require detailed evaluation of soil excavation approaches, including shoring and bracing of sidewalls and worker health and safety. Extra attention must be given to the excavation of contaminated subsurface soils at depth at the site, since excavation to depths as great as 55 ft bgs will be required under this alternative.

Alternatives 89-S4 and 89-S5 involve the installation of an SVE and vapor treatment system to address contamination in all subsurface soils (shallow and/or deep) at the site. While cleanup of shallow subsurface soils at 89 Frost Street may readily progress, heterogeneity and excessive moisture expected to be encountered in the soils below locations of former dry well structures may adversely affect the extractability of contaminants with SVE. In addition, contaminants other than VOCs found in shallow subsurface soils at the site (i.e., SVOCs and metals), may not be readily removed with SVE. Hence, the extractability of contaminants found in shallow subsurface soils at the site may be difficult to predict without pilot test data. Alternative 89-S3 employs a combination of excavation and SVE approaches.

14.3.6.7 Cost. The costs of each remedial alternative are summarized in Table 14-7. Alternative 89-S1, the No Action alternative, has no associated costs. Alternative 89-S5 has the second lowest estimated cost (\$0.55 million). Alternative 89-S4 (SVE) has the third lowest estimated cost (\$0.61 million). Alternative 89-S3 has the third lowest estimated cost (\$0.85 million). Alternative 89-S2 (excavation and off-site disposal) has the highest estimated cost (\$9.7 million).

CHAPTER 15

DETAILED EVALUATION OF GROUNDWATER RESPONSE ALTERNATIVES

15.1 INTRODUCTION

This chapter presents the detailed evaluation of the groundwater response alternatives described in Chapter 13. The evaluation is conducted similarly to that presented in Chapter 14 for the source control alternatives. The remedial alternatives will be evaluated for seven criteria, including overall protection of human health and the environment, compliance with SCGs, reduction of toxicity, mobility, and volume through treatment, short-term effectiveness, implementability, and cost. Two other criteria, community and state acceptance, will be considered later in the RI/FS process.

Alternatives G1 through G4 only apply to the groundwater medium. In order to be effective in reducing sitewide contaminants, the selected groundwater response alternative should be combined with a source control alternative.

15.2 INDIVIDUAL ANALYSIS OF ALTERNATIVES

The individual analysis of the four groundwater response alternatives with respect to the evaluation criteria is presented below and is summarized in Table 15-1.

15.2.1 Alternative G1: No Action

15.2.1.1 *Protection of Human Health and the Environment.* Institutional measures included in Alternative G1 serve to protect human health by preventing human contact with the contaminants that will remain at the site; however, the potential for human exposure to the contaminants will remain. In addition, the site may continue to impact the surrounding environment through the migration of VOCs from soils to groundwater. Long-term groundwater monitoring, as included in this alternative, is not protective of human health and the environment, but will assess any migration of the contaminant plume over time to document the nature of any continued risk posed by the contamination.

TABLE 15-1 (Page 1 of 1)

SUMMARY OF DETAILED EVALUATION OF GROUNDWATER RESPONSE ALTERNATIVES
Frost Street Sites

ALTERNATIVE	OVERALL PROTECTION OF OF HUMAN HEALTH AND THE ENVIRONMENT	COMPLIANCE WITH SCGs	REDUCTION OF TOXICITY, MOBILITY OR VOLUME	SHORT-TERM EFFECTIVENESS	LONG-TERM EFFECTIVENESS AND PERMANENCE	IMPLEMENTABILITY	COST
ALTERNATIVE G1: No Action	Minimal prevention of human contact through institutional controls only. Contaminants remain in the environment.	As no active remedial measures are implemented, this alternative will not likely achieve groundwater SCGs.	Relies on natural attenuation to reduce toxicity, mobility, or volume of contamination present in site soils.	Does not result in disruption of site operations or pose a threat to short term health or the environment.	Does not provide long-term effectiveness or permanence; contaminants will remain at site.	No constraints to implementation of institutional measures and monitoring.	Capital: \$0 O&M (30 yr): \$18,000/yr Present Worth: \$0.3 million
ALTERNATIVE G2: Air Sparging/Soil Vapor Extraction for Area Near Source; In-Well Vapor Stripping for Curtain Area	Protects human health and the environment by transferring contaminants from the water phase to the vapor phase and treating them ex-situ. Prevents further downgradient migration of contaminants.	Achieves applicable groundwater standards. Air emissions will be controlled to meet SCGs.	Reduces the mobility and volume of VOCs on the site through in situ treatment of groundwater. Toxicity of VOCs is controlled by treatment.	Will result in disruption of site operations during implementation. Will generate some noise and traffic. Approximately 2000 ft ² is required for chemical storage and treatment equipment.	The estimated operating time for the air sparging/soil vapor extraction system is estimated at 10 to 12 years. Technology permanently removes captured VOCs.	Equipment and installation services for air sparging/soil vapor extraction technology are readily available.	Capital: \$1,166,000 O&M (Yr 1-12): \$175,000/yr Present Worth: \$2.7 million
ALTERNATIVE G3: Sitewide In-Well Vapor Stripping/ Vapor Treatment	Protects human health and the environment by transferring contaminants from the water phase to the vapor phase and treating them ex-situ. Prevents further downgradient migration of contaminants.	Achieves applicable groundwater standards. Air emissions will be controlled to meet SCGs.	Reduces the mobility and volume of VOCs on the site through in situ treatment of groundwater. Toxicity of VOCs is controlled by treatment.	Will result in disruption of site operations during implementation. Will generate some noise and traffic. Approximately 2000 ft ² is required for chemical storage and treatment equipment.	The operating time for the in-well vapor stripping system is estimated at 10 to 12 years. Technology permanently removes captured VOCs.	Installation services for in-well air stripping technology is available through a limited number of vendors. Equipment installation is readily implementable and available.	Capital: \$1,464,000 O&M (Yr 1-12): \$228,000/yr Present Worth: \$3.5 million
ALTERNATIVE G4: Extraction/ Air Stripping/ Vapor Treatment/ Re-injection	Protects human health and the environment by extracting contaminated groundwater from aquifer and treating it ex-situ. Prevents further downgradient migration of contaminants.	Achieves applicable groundwater standards. Air emissions and treated effluent discharge will be controlled to meet SCGs.	Reduces volume and mobility of contaminants in groundwater through extraction; toxicity of extracted groundwater reduced by treatment.	Will result in disruption of site operations during implementation. Will generate noise and traffic. Approximately 2000 sf is required for chemical storage and treatment equipment.	The estimated operating time for the pump and treat system is 15 years. Technology permanently removes captured VOCs.	Well and piping installation and treatment facility construction can be readily implemented	Capital: \$1,158,000 O&M (Yr 1-15): \$203,000/yr Present Worth: \$3.3 million

15.2.1.2 ***Compliance With SCGs.*** Since this alternative does not include an active remedial measure, it is highly unlikely that NYSDEC Class GA Groundwater Standards will be achieved in a short time frame. Although groundwater is withdrawn from the Magothy aquifer downgradient of the sites for potable water purposes (by the Bowling Green Estates water district), the groundwater is currently treated by the water district to remove VOC contaminants prior to being supplied to the users. The water district is responsible for meeting drinking water standards before supplying its users with potable water.

Because this alternative does not include any active remedial measures, no air releases are expected; therefore no NAAQS apply. As no active remedy is proposed under Alternative G1, location-specific SCGs do not apply. As Alternative 1 does not include any active remediation activities, there are no action-specific TBCs that apply to this alternative.

Alternative G1 does not comply with the Federal or state requirements which state that the selected remedial alternative must attain a cleanup level that eliminates, reduces, or controls risks to human health and the environment.

15.2.1.3 ***Reduction of Toxicity, Mobility, and Volume Through Treatment.*** Alternative G1 will not result in a substantial reduction in the toxicity, mobility, or volume of contaminated wastes present at the Frost Street sites. The long-term groundwater monitoring program will however identify any reduction in contaminant concentrations that may occur.

15.2.1.4 ***Short-Term Effectiveness.*** Alternative G1 will result in minimal short-term human or environmental impacts as the only active activity that will occur at the site includes sampling of existing monitoring wells. As sampling has already been accomplished at the site without causing negative short-term effects, sampling conducted in the future is not expected to have adverse impacts.

15.2.1.5 ***Long-Term Effectiveness and Permanence.*** As the no action alternative does not provide a high degree of long-term effectiveness and permanence, environmental degradation may continue to occur due to the migration of contaminants to surrounding media. Although human health risks may be mitigated through the use of deed, development, and groundwater restrictions, these institutional measures will not eliminate

the potential for human exposure to site contaminants (e.g., groundwater uptake in downgradient areas) but continued treatment of the groundwater supply for potable purposes (as is currently done) will minimize the potential for human exposure to site contaminants.

15.2.1.6 Implementability. Implementation of this alternative is straightforward and does not depend on the availability of vendors, materials, or services. Development, deed, and groundwater use restrictions would be implemented by NYSDEC or the municipality. Long-term groundwater monitoring and sampling and are also readily accomplished.

15.2.1.7 Cost. For Alternative G1, capital costs include legal and administrative costs associated with implementing institutional measures, the costs of which would be determined in the future depending on how the institutional measures are implemented. Estimated long-term O&M costs are included in Table 15-2. These costs are based on the assumptions included in the description of the alternative provided in Chapter 13 and have a range of accuracy of -30 to +50%. Annual O&M costs are estimated on a 30-year implementation basis and based on a 5% interest rate (EPA 1988) to estimate the present worth cost.

15.2.2 Alternative G2: Air Sparging/Soil Vapor Extraction for Area Near Source; In-Well Vapor Stripping for Curtain Area

15.2.2.1 Protection of Human Health and the Environment. Alternative G2 includes the installation of an air sparging and soil vapor extraction near the source area and an in-well vapor stripping system near the curtain area. The purpose of implementing these systems is to volatilize and collect contaminants. Extracted vapor is treated at the surface using vapor phase GAC. Alternative G2 is protective of human health and the environment through the active reduction of contaminant levels in the groundwater and by controlling further spread of the contaminant plume.

15.2.2.2 Compliance With SCGs. Alternative G2 will achieve compliance with chemical-specific SCGs for the site that apply to the contaminated groundwater medium, including Class GA Groundwater Standards. Remedial activities for Alternative G2 will be continued until the Class GA standards are met.

TABLE 15-2

COST ESTIMATE FOR ALTERNATIVE G1: NO ACTION

Frost Street Sites

ITEM	UNIT COST (\$)	QUANTITY	COST (1999 \$) ^a
CAPITAL COSTS			
A. Direct Costs			
<i>Institutional Measures</i>			
Deed & development restrictions			- ^b
Groudwater use restrictions			- ^b
		Subtotal	- ^b
B. Indirect Costs			
			- ^b
O&M COSTS			
<i>Long-term groundwater monitoring program</i>			
Quarterly sampling of 18 wells for VOCs for first 5 years	\$500 /sample	360 sample	\$156,000
Annual sampling of 18 wells for VOCs for years 6 through 30	\$500 /sample	450 sample	\$99,000
Replacement of 2 wells every 5 years	\$4,000 /well	10 wells	\$20,000
		Present worth subtotal	\$275,000
		TOTAL ANNUAL O&M COST	\$18,000 /yr
PRESENT WORTH			
<i>Based on a 30-yr life and a 5% interest rate</i>			\$276,000
			SAY \$0.3 million

a - Costs rounded to the nearest \$1,000.

b - Legal and administrative costs to community that are not included in cost estimate.

There are no promulgated air quality standards for the COCs at this site under the NAAQS or NYAAQS. However, emissions from the vapor treatment systems should comply with the guidance values of NYS Air Guide 1 discussed in Chapter 8. The remedial activities included in this alternative, i.e., installation of wells and the treatment of groundwater, are not expected to generate any air emissions that would exceed the NIOSH IDLH levels, OSHA PELs, and ACGIH TLVs for contaminants in air. Air monitoring will be conducted during the remedial activities to ensure that these requirements are met. Any VOCs volatilized and extracted from the groundwater will be treated and released to the atmosphere after treatment. It is expected that VOC concentrations in the extracted air stream may initially be high, but will drop to a low level after a short period of time. Vapors containing VOCs will be treated with GAC prior to being emitted into the atmosphere.

Alternative G2 will comply with location-specific SCGs that regulate remediation construction projects overlying a sole source aquifer by the construction of a secondary spill containment system around any chemical storage areas to prevent spill migration.

Alternative G2 complies with Federal and state regulatory requirements, which state that the selected remedial alternative must attain a cleanup level that eliminates, reduces, or controls risks to human health and the environment, but is applicable to the groundwater medium.

15.2.2.3 *Reduction of Toxicity, Mobility, and Volume Through Treatment.* Alternative G2 will reduce the volume of contamination present by injecting air into a sparging or stripping well, volatilizing the VOCs in the groundwater, and extracting the volatilized contaminants for subsequent treatment. Extracting VOCs from the groundwater phase effectively reduces their toxicity, mobility, and volume in the underlying aquifer. The extracted VOCs will be adsorbed on to vapor phase GAC, where their mobility and volume will be reduced and their toxicity controlled.

15.2.2.4 *Short-Term Effectiveness.* The installation of an AS/SVE system, in-well vapor stripping system, and vapor treatment facilities is expected to result in minimal impacts to human health or the environment. However, site operations may temporarily be impacted during installation and startup and increased traffic noise is expected. Planning and installation of the AS/SVE system is anticipated to last 6 to 9 months. Off-site locations

(south of the 770 Main Street site) will be impacted by the remedial activities due to trenching and treatment system installation. Approximately 2000 ft² (two structures with approximately 1000 ft² apiece) of space will be needed to construct the remedial system proposed under this alternative.

15.2.2.5 Long-Term Effectiveness and Permanence. Alternative G2 is intended to remove VOCs permanently from the near-field contaminant plume. Alternative G2 is not intended to remove VOCs from the contaminated soil areas at the site. The estimated time frame for implementing Alternative G2 is 12 years. The long-term effectiveness of this alternative will be optimized by assessing aquifer characteristics, appropriate design of the air delivery and vapor extraction system, and the rate of chemical reaction and desorption of the VOC contaminants from aquifer soil particles as required prior to volatilization of the contaminants from the groundwater. The actual time frame for this remedial action may be longer if the existing site conditions prove to be less than ideal. Once the AS/SVE and in-well vapor stripping systems are operational, performance will be monitored through periodic vapor and groundwater monitoring. A pilot test (including aquifer pump test) of this technology would lead to better estimates of the required remedial time frame.

15.2.2.6 Implementability. Installation of the AS/SVE points, in-well vapor stripping wells, and equipment can be readily achieved at the site. The vapor treatment system recommended in this alternative is a commonly applied technology that is implementable at the site. However, potential negative public perceptions concerning placement of the remediation system will need to be addressed. Also, the placement and installation of the remediation equipment must not significantly interrupt site operations.

15.2.2.7 Cost. Estimated capital and long-term O&M costs for Alternative G2 are included in Table 15-3. These costs are based on the assumptions included in the description of the alternative provided in Chapter 13 and have a range of accuracy of -30 to +50%. Annual O&M costs are estimated on a 30-year implementation basis and based on a 5% interest rate (EPA 1988) to estimate the present worth cost.

In deriving a cost estimate for Alternative G2, installation of the UVB in-well vapor stripping system was assumed. Costs for several line items were obtained from a vendor familiar with the technology's installation and operations and maintenance. Being that in-well vapor stripping is an innovative technology at hazardous waste sites and is still being

TABLE 15-3 (Page 1 of 2)

**COST ESTIMATE FOR ALTERNATIVE G2:
AIR SPARGING / SOIL VAPOR EXTRACTION FOR AREA NEAR SOURCE;
IN-WELL VAPOR STRIPPING FOR CURTAIN AREA / VAPOR TREATMENT**

Frost Street Sites

ITEM	UNIT COST (\$)	QUANTITY	COST (1999 \$) ^a
CAPITAL COSTS			
A. Direct Costs			
<i>Site Preparation</i>			
Contractor mobilization/demobilization	LS		\$35,000
Utility clearance	LS		\$2,000
Temporary fencing	\$2 /lf	3,000 lf	\$6,000
Pilot test for AS/SVE system b	LS		\$31,000
Pilot test in-well vapor stripping system c	LS		\$137,000
<i>Air Sparging System</i>			
Installation of air sparging points	\$5,700 /wells	3 wells	\$17,000
Piezometer microwells	\$2,000 /wells	5 wells	\$10,000
Underground piping delivery system (shared trench with SVE piping)	\$35.00 /lf	400 lf	\$14,000
Asphalt removal, disposal, restoration	\$20.94 /lf	400 lf	\$8,000
Pressure blower	LS		\$6,000
<i>Soil Vapor Extraction System</i>			
Vapor extraction point installation	\$4,100 /point	2 points	\$8,000
Extraction piping	LS		\$2,000
Blower & moisture separator	LS		\$4,000
Electrical controls	LS		\$10,000
Condensate storage container	\$1,300 /unit	1 unit	\$1,000
Treatment buildings, including HVAC	\$15,000 /building	1 building	\$15,000
System assembly & startup	LS		\$10,000
Soil disposal (nonhazardous)	\$110 /yd ³	20 yd ³	\$2,000
Vapor treatment system installation	LS		\$10,000
<i>In-well Vapor Stripping System</i>			
Stripping wells	\$90,000 /well	3 wells	\$270,000
includes electrical components of wells			
Iron control system	\$3,000 /well	4 wells	\$12,000
Equipment housing	LS		\$50,000
Instruments, electrical, and controls	LS		\$20,000
Phone line and auto dialer	\$700 /unit	1 units	\$1,000
Moisture separators	\$2,000 /unit	1 units	\$2,000
Condensate storage containers	\$1,300 /unit	2 units	\$3,000
Fencing	\$36.58 /lf	400 lf	\$15,000
Signage	LS		\$1,000
Asphalt removal, disposal, restoration	\$20.94 /lf	700 lf	\$15,000
Air injection piping/trenching/installation	\$35.00 /lf	700 lf	\$25,000
Vapor extraction piping/installation	\$10.00 /lf	700 lf	\$7,000
pipe installed in same trench as air injection pipe			
Soil disposal (nonhazardous)	\$110 /cy	25 cy	\$3,000
Vapor treatment installation	LS		\$25,000
Subtotal			\$777,000

TABLE 15-3 (Page 2 of 2)

**COST ESTIMATE FOR ALTERNATIVE G2:
AIR SPARGING / SOIL VAPOR EXTRACTION FOR AREA NEAR SOURCE;
IN-WELL VAPOR STRIPPING FOR CURTAIN AREA / VAPOR TREATMENT**

Frost Street Sites

ITEM	UNIT COST (\$)	QUANTITY	COST (1999 \$) ^a
B. Indirect Costs			
Engineering and Design @ 15%			\$117,000
Legal and Administrative @ 10%			\$78,000
Contingency @ 25%			\$194,000
Total			\$1,166,000
O&M COSTS			
AS/SVE System			
Electrical usage	\$0.10 /kw-hr	84,000 kw-hr	\$8,000 /yr
System maintenance	\$500 /event	2 events	\$1,000 /yr
Condensate disposal (Nonhazardous)	\$2.50 /gal	3,100 gal	\$8,000 /yr
Vapor Phase Carbon Replacement			
Year 0 - 2	\$1.20 /lb	104,000 lb	\$116,000
Year 2 - 5	\$1.20 /lb	39,000 lb	\$39,000
Year 5 - 12	\$1.20 /lb	30,100 lb	\$23,000
Present Worth			\$178,000
Annual cost for years 1 - 12:			\$20,000 /yr
In-Well Vapor Stripping System			
Electrical Usage	\$0.10 /kw-hr	263,000 kw-hr	\$26,000 /yr
Condensate Disposal (Nonhazardous)	\$2.50 /gal	14,800 gal	\$37,000 /yr
Iron Control Chemical Replacement for In-Well System			
Year 0 - 0.5	\$2.45 /lb	13,000 lb	\$32,000
Year 0.5 - 2	\$2.75 /lb	19,000 lb	\$50,000
Year 3 - 12	\$2.75 /lb	15,000 lb	\$29,000
Present Worth			\$111,000
Annual cost for years 1 - 12:			\$13,000 /yr
Vapor Phase Carbon Replacement			
Year 0 - 2	\$1.20 /lb	52,000 lb	\$58,000
Year 3 - 5	\$1.20 /lb	18,000 lb	\$18,000
Year 6 - 12	\$1.20 /lb	14,000 lb	\$11,000
Present Worth			\$87,000
Annual cost for years 1 - 12:			\$10,000 /yr
Operator Attention (Service Contract)	LS		\$30,000 /yr
Repair/replacement of equipment (@ 5% per year)	LS		\$13,000 /yr
Vapor Monitoring			
Sampling of air emission (both systems once per 2 months)	\$1,500 /event	6 events	\$9,000 /yr
Annual O&M cost for years 1 - 12:			\$175,000 /yr
Annual O&M cost for years 13 - 30:			\$0 /yr
PRESENT WORTH			
Based on a 30-yr life and a 5% interest rate			\$2,717,000
SAY \$2.7 Million			

- a - Costs rounded to the nearest \$1,000.
b - Includes cost of constructing one vapor extraction point and one air sparging point.
c - Includes cost of constructing on in-well vapor stripping well.
d - Assumes no additional foundation supports are needed.
LS - Lump sum.

optimized, capital costs for the system are fairly high. Like many innovative technologies, costs decrease with successive applications. Capital costs for the in well vapor stripping technology vary widely; therefore, the cost estimate presented in Table 15-3 may decrease if quotes are received for in-well vapor stripping technologies other than the UVB system. In Alternative G2, the remediation time was assumed to be 12 years. If another in-well vapor stripping vendor technology or the results of a pilot study confirm that the remediation time is less than 12 years, then additional cost savings would be realized.

15.2.3 Alternative G3: Sitewide In-Well Vapor Stripping

15.2.3.1 *Protection of Human Health and the Environment.* Alternative G3 includes the in-situ volatilization of groundwater contaminants from the aquifer (approximately 55 to 80 ft bgs near source area and 55 to 150 ft bgs at curtain area) using the in-well vapor stripping technology. Extracted vapor is treated at the surface using vapor phase GAC. Alternative G3 is protective of human health and the environment through the active reduction of contaminant levels in the groundwater and by controlling further spread of the contaminant plume.

15.2.3.2 *Compliance With SCGs.* Alternative G3 will achieve compliance with chemical-specific SCGs for the site that apply to the contaminated groundwater medium, including Class GA Groundwater Standards. Remedial activities for Alternative G3 will be continued until the Class GA standards are met.

There are no promulgated air quality standards for the COCs at this site under the NAAQS or NYAAQS. However, emissions from the vapor treatment system should comply with the guidance values of NYS Air Guide 1 discussed in Chapter 8. The remedial activities included in this alternative, i.e., installation of wells and the treatment of groundwater, are not expected to generate any air emissions that would exceed the NIOSH IDLH levels, OSHA PELs, and ACGIH TLVs for contaminants in air. Air monitoring will be conducted during the remedial activities to ensure that these requirements are met. Any VOCs volatilized and extracted from the groundwater will be treated and released to the atmosphere after treatment. It is expected that VOC concentrations in the extracted air stream may initially be high, but will drop to a low level after a short period of time. Vapors containing VOCs will be treated with GAC prior to being emitted into the atmosphere.

Alternative G3 will comply with location-specific SCGs that regulate remediation construction projects overlying a sole source aquifer by the construction of a secondary spill containment system around any chemical storage areas to prevent spill migration.

Alternative G3 complies with Federal and state regulatory requirements, which state that the selected remedial alternative must attain a cleanup level that eliminates, reduces, or controls risks to human health and the environment. Alternative G3 only applies to the groundwater medium.

15.2.3.3 *Reduction of Toxicity, Mobility, and Volume Through Treatment.* Alternative G3 will reduce the volume of contamination present by injecting air into a well, volatilizing the VOCs in the groundwater, and extracting the volatilized contaminants for subsequent treatment. Extracting VOCs from the groundwater phase effectively reduces their toxicity, mobility, and volume in the underlying aquifer. The extracted VOCs will be adsorbed on to vapor phase GAC, where their mobility and volume will be reduced and their toxicity controlled.

15.2.3.4 *Short-Term Effectiveness.* The installation of in-well vapor stripping wells, air injection equipment, and a vapor treatment facility is expected to result in minimal impacts to human health or the environment. However, site operations may temporarily be impacted during installation and startup and increased traffic noise is expected. Planning and installation of the in well vapor stripping system is anticipated to last 6 to 9 months. Off-site locations (south of the 770 Main Street site) will be impacted by the remedial activities due to trenching and treatment system installation. Approximately 2000 ft² (two structures with approximately 1000 ft² apiece) of space will be needed to construct the remedial system proposed under this alternative.

15.2.3.5 *Long-Term Effectiveness and Permanence.* Alternative G3 is intended to remove VOCs permanently from the near-field contaminant plume. Alternative G3 is not intended to remove VOCs from the soil medium at the site. The estimated time frame for operating the in-well vapor stripping system, based on information obtained from experienced vendors of the in-well vapor stripping technology, is 12 years. The long-term effectiveness of this alternative will be optimized by assessing aquifer characteristics, appropriate design of the air delivery and vapor extraction system, and the rate of chemical

reaction and desorption of the VOC contaminants from aquifer soil particles as required prior to volatilization of the contaminants from the groundwater. The actual time frame for this remedial action may actually be longer if the existing site conditions prove to be less than ideal. Once the in-well vapor stripping system is operational, performance will be monitored through periodic vapor and groundwater monitoring. A pilot test (including aquifer pump test) of this technology would lead to better estimates of the required remedial time frame.

15.2.3.6 Implementability. Installation of the in-well vapor stripping wells and equipment can be achieved at the site, however a limited number of vendors are available that are licensed to construct and operate the in-well vapor stripping technology. The vapor treatment system recommended in this alternative is a commonly applied technology that is implementable at the site. However, potential negative public perceptions concerning placement of the remediation system will need to be addressed.

15.2.3.7 Cost. Estimated capital and long-term O&M costs for Alternative G3 are included in Table 15-4. These costs are based on the assumptions included in the description of the alternative provided in Chapter 13 and have a range of accuracy of -30 to +50%. Annual O&M costs are estimated on a 30-year implementation basis and based on a 5% interest rate (EPA 1988) to estimate the present worth cost.

In deriving a cost estimate for Alternative G3, installation of the UVB in-well vapor stripping system was assumed. Costs for several line items were obtained from a vendor familiar with the technology's installation and operations and maintenance. Being that in-well vapor stripping is an innovative technology at hazardous waste sites and is still being optimized, capital costs for the system are fairly high. Like many innovative technologies, costs decrease with successive applications. Capital costs for the in well vapor stripping technology vary widely; therefore, the cost estimate presented in Table 15-4 may decrease substantially if quotes are received for in-well vapor stripping technologies other than the UVB system. In Alternative G3, the remediation time was assumed to be 12 years. If another in-well vapor stripping vendor technology or the results of a pilot study confirm that the remediation time is less than 12 years, then additional cost savings would be realized.

**COST ESTIMATE FOR ALTERNATIVE G3:
SITEWIDE IN-WELL VAPOR STRIPPING/VAPOR TREATMENT**

Frost Street Sites

ITEM	UNIT COST (\$)	QUANTITY	COST (1999 \$)*
CAPITAL COSTS			
A. Direct Costs			
<i>Treatability Study</i>	LS		\$186,000
<i>Site Preparation</i>			
Contractor mobilization/demobilization	LS		\$35,000
<i>Well/Remediation System Installation/Start-up</i>			
Stripping Wells	\$90,000 /well	5 wells	\$450,000
includes electrical components of wells			
Iron Control System	\$3,000 /well	6 wells	\$18,000
Equipment Housings (2)	LS		\$100,000
Instruments, Electrical, and Controls	LS		\$34,000
Phone Line and Auto Dialer	\$700 /unit	2 units	\$1,000
Moisture Separators	\$2,000 /unit	2 units	\$4,000
Condensate Storage Containers	\$1,277 /unit	4 units	\$5,000
Fencing	\$36.58 /lf	400 lf	\$15,000
Signage	LS		\$1,000
Asphalt Removal, Disposal, Restoration	\$20.94 /lf	1,100 lf	\$23,000
Air Injection Piping/Trenching/Installation	\$35.00 /lf	1,100 lf	\$39,000
Vapor Extraction Piping/Installation	\$10.00 /lf	1,100 lf	\$11,000
pipe installed in same trench as air injection pipe			
Soil Disposal (nonhazardous)	\$110 /cy	35 cy	\$4,000
Vapor Treatment Installation	LS		\$50,000
		Subtotal	\$976,000
B. Indirect Costs			
<i>Engineering and Design @ 15%</i>			\$146,000
<i>Legal and Administrative @ 10%</i>			\$98,000
<i>Contingency @ 25%</i>			\$244,000
		Total	\$1,464,000

**COST ESTIMATE FOR ALTERNATIVE G3:
IN-WELL VAPOR STRIPPING/VAPOR TREATMENT**

Frost Street Sites

ITEM	UNIT COST (\$)	QUANTITY	COST (1999 \$) ^a
O&M COSTS			
<i>Operator Attention</i>	LS		\$30,000 /yr
<i>Iron Control Chemical Replacement</i>			
Year 0 - 0.5	\$2.45 /lb	19,000 lb	\$47,000
Year 0.5 - 2	\$2.75 /lb	28,000 lb	\$73,000
Year 3 - 12	\$2.75 /lb	22,000 lb	\$42,000
		Present Worth	\$162,000
		Annual cost for years 1 - 12:	\$18,000 /yr
<i>Condensate Disposal</i>	\$2.50 /gal	24,000 gal	\$60,000 /yr
<i>Vapor Phase Carbon Replacement</i>			
Year 0 - 2	\$1.20 /lb	156,000 lb	\$174,000
Year 3 - 5	\$1.20 /lb	58,000 lb	\$57,000
Year 6 - 12	\$1.20 /lb	45,000 lb	\$35,000
		Present Worth	\$266,000
		Annual cost for years 1 - 12:	\$30,000 /yr
<i>Vapor Monitoring</i>			
Sampling of air emission (once per 2 months)	\$1,500 /event	6 events	\$9,000 /yr
<i>Long-term groundwater monitoring program</i>			
Years 1 - 5			
Semiannual VOC sampling of 13 wells	\$500 /well	130 wells	\$56,000
Years 6 - 12			
Annual VOC sampling of 13 wells	\$500 /well	91 wells	\$29,000
Replacement of 2 wells every 5 years	\$4,000 /well	4 wells	\$11,000
		Present Worth	\$96,000
		Annual cost for years 1 - 12:	\$11,000 /yr
<i>Repair/replacement of equipment</i>	LS		\$17,000 /yr
@ 5% per year			
<i>Electricity</i>	\$0.10 /kw-hr	526,000 kw-hr	\$53,000 /yr
		Annual O&M cost for years 1 - 12:	\$228,000 /yr
		Annual O&M cost for years 13 - 30:	\$0 /yr
PRESENT WORTH			
<i>Based on a 30-yr life and a 5% interest rate</i>			\$3,485,000
SAY \$3.5 Million			

a - Costs rounded to the nearest \$1000.

LS - Lump sum.

1 - Includes cost to install one stripping well, including controls.

15.2.3.8 Additional Cost Evaluation. At NYSDEC's request, an additional evaluation was conducted for the remediation system proposed under Alternative G3. Instead of a sitewide approach to remediate the near-field contaminant plume, three individual in-well vapor stripping systems, to be installed and operated on the three individual Frost Street sites (101 Frost Street, 89 Frost Street, and 770 Main Street), were evaluated in the subalternatives. These alternatives are referred to as Alternatives G3A, G3B, and G3C, respectively. Tables 15-5, 15-6, and 15-7 list the cost items associated with implementing Alternative G3A, G3B, and G3C. For each site, assumptions (based on literature reviews and conversations with vendors) were made regarding the number of stripping wells and the system run-time required for remediation. For 101 Frost Street, it was assumed that one vapor stripping well was necessary. For 89 Frost Street, three vapor stripping wells were assumed. Two stripping wells were assumed for 770 Main Street. The operation time of each of the three systems was maintained at 12 years. As with the cost estimate for Alternative G3, the estimated costs for Alternatives G3A through G3C have a range of accuracy of -30 to +50%. Annual O&M costs are estimated on a 30-year implementation basis and based on a 5% interest rate (EPA 1988) to estimate the present worth cost.

At the 89 and 101 Frost Street sites, an added benefit to implementing the individual in-well vapor stripping systems is that they may be configured to treat some of the deep subsurface soils as well as the groundwater plume. This may, depending on well placement, provide a cost savings since it would eliminate the need to use a separate treatment technology, such as SVE, to treat contaminated soils.

15.2.4 Alternative G4: Groundwater Extraction/Air Stripping/Reinjection

15.2.4.1 Protection of Human Health and the Environment. Alternative G4 includes the extraction of contaminated groundwater from the underlying aquifer and groundwater treatment at the surface to remove VOC contaminants. In the air stripping treatment process, VOCs are transferred from the water to the vapor phase, then collected on to GAC filters. The treated effluent is returned to the aquifer via underground injection wells. Alternative G4 is protective of human health and the environment through the reduction of contaminant levels in the groundwater and by controlling further migration of the contaminant plume.

TABLE 15-5 (Page 1 of 2)

**COST ESTIMATE FOR ALTERNATIVE G3A:
IN-WELL VAPOR STRIPPING/VAPOR TREATMENT**

101 Frost Street

ITEM	UNIT COST (\$)	QUANTITY	COST (1999 \$) ^a
CAPITAL COSTS			
A. Direct Costs			
<i>Treatability Study¹</i>	LS		\$137,000
<i>Site Preparation</i>			
Contractor mobilization/demobilization	LS		\$15,000
<i>Well/Remediation System Installation/Start-up</i>			
Stripping Wells ²	\$90,000 /well	0 well	\$0
Iron Control System	\$3,000 /well	1 well	\$3,000
Equipment Housings (1)	LS		\$50,000
Instruments, Electrical, and Controls	LS		\$20,000
Phone Line and Auto Dialer	\$700 /unit	1 unit	\$1,000
Moisture Separators	\$2,000 /unit	1 unit	\$2,000
Condensate Storage Containers	\$500 /unit	1 unit	\$1,000
Fencing	\$36.58 /lf	150 lf	\$5,000
Signage	LS		\$1,000
Asphalt Removal, Disposal, Restoration	\$20.94 /lf	300 lf	\$6,000
Air Injection Piping/Trenching/Installation	\$35.00 /lf	300 lf	\$11,000
Vapor Extraction Piping/Installation	\$10.00 /lf	300 lf	\$3,000
pipe installed in same trench as air injection pipe			
Soil Disposal (nonhazardous)	\$110 /cy	15 cy	\$2,000
Vapor Treatment Installation	LS		\$15,000
		Subtotal	\$272,000
B. Indirect Costs			
<i>Engineering and Design @ 15%</i>			\$41,000
<i>Legal and Administrative @ 10%</i>			\$27,000
<i>Contingency @ 25%</i>			\$68,000
		Total	\$408,000

TABLE 15-5 (Page 2 of 2)

**COST ESTIMATE FOR ALTERNATIVE G3A:
IN-WELL VAPOR STRIPPING/VAPOR TREATMENT**

101 Frost Street

ITEM	UNIT COST (\$)	QUANTITY	COST (1999 \$) ^a
O&M COSTS			
<i>Operator Attention</i>	LS		\$20,000 /yr
<i>Iron Control Chemical Replacement</i>			
Year 0 - 1	\$2.45 /lb	3,000 lb	\$7,000
Year 2 - 12	\$2.75 /lb	7,000 lb	\$14,000
		Present Worth	\$21,000
		Annual cost for years 1 - 12:	\$2,000 /yr
<i>Condensate Disposal</i>	LS		\$14,000 /yr
<i>Vapor Phase Carbon Replacement</i>			
Year 0 - 2	\$1.20 /lb	22,000 lb	\$25,000
Year 3 - 12	\$1.20 /lb	3,700 lb	\$3,000
		Present Worth	\$28,000
		Annual cost for years 1 - 12:	\$3,000 /yr
<i>Vapor Monitoring</i>			
Sampling of air emission (once per 2 months)	\$500 /event	6 events	\$3,000 /yr
<i>Long-term groundwater monitoring program</i>			
Year 0 - 5			
Semiannual VOC sampling of 5 wells	\$500 /well	50 wells	\$22,000
Year 6 - 12			
Annual VOC sampling of 5 wells	\$500 /well	35 wells	\$11,000
Replacement of 2 wells every 5 years	\$4,000 /well	4 wells	\$11,000
		Present Worth	\$44,000
		Annual cost for years 1 - 12:	\$5,000 /yr
<i>Repair/replacement of equipment @ 5% per year</i>	LS		\$8,000 /yr
<i>Electricity</i>	\$0.10 /kw-hr	175,000 kw-hr	\$18,000 /yr
		Annual O&M cost for years 1 - 12:	\$73,000 /yr
		Annual O&M cost for years 13 - 30:	\$0 /yr
PRESENT WORTH			
<i>Based on a 30-yr life and a 5% interest rate</i>			\$1,055,000
SAY \$1.1 Million			

^a - Costs rounded to the nearest \$1000.

LS - Lump sum.

1 - Includes cost to install one stripping well, including controls.

**COST ESTIMATE FOR ALTERNATIVE G3B:
IN-WELL VAPOR STRIPPING/VAPOR TREATMENT**

89 Frost Street

ITEM	UNIT COST (\$)	QUANTITY	COST (1999 \$) ^a
CAPITAL COSTS			
A. Direct Costs			
<i>Treatability Study¹</i>	LS		\$137,000
<i>Site Preparation</i>			
Contractor mobilization/demobilization	LS		\$15,000
<i>Well/Remediation System Installation/Start-up</i>			
Stripping Wells	\$90,000 /well	2 wells	\$180,000
includes electrical components of wells			
Iron Control System	\$3,000 /well	3 wells	\$9,000
Equipment Housings (1)	LS		\$50,000
Instruments, Electrical, and Controls	LS		\$25,000
Phone Line and Auto Dialer	\$700 /unit	1 unit	\$1,000
Moisture Separators	\$2,000 /unit	1 unit	\$2,000
Condensate Storage Containers	\$1,277 /unit	1 unit	\$1,000
Fencing	\$36.58 /lf	200 lf	\$7,000
Signage	LS		\$1,000
Asphalt Removal, Disposal, Restoration	\$20.94 /lf	500 lf	\$10,000
Air Injection Piping/Trenching/Installation	\$35.00 /lf	500 lf	\$18,000
Vapor Extraction Piping/Installation	\$10.00 /lf	500 lf	\$5,000
pipe installed in same trench as air injection pipe			
Soil Disposal (nonhazardous)	\$110 /cy	15 cy	\$2,000
Vapor Treatment Installation	LS		\$30,000
		Subtotal	\$493,000
B. Indirect Costs			
<i>Engineering and Design @ 15%</i>			\$74,000
<i>Legal and Administrative @ 10%</i>			\$49,000
<i>Contingency @ 25%</i>			\$123,000
		Total	\$739,000

**COST ESTIMATE FOR ALTERNATIVE G3B:
IN-WELL VAPOR STRIPPING/VAPOR TREATMENT**

89 Frost Street

ITEM	UNIT COST (\$)	QUANTITY	COST (1999 \$) ^a
O&M COSTS			
<i>Operator Attention</i>	LS		\$30,000 /yr
<i>Iron Control Chemical Replacement</i>			
Year 0 - 0.5	\$2.45 /lb	9,000 lb	\$22,000
Year 0.5 - 2	\$2.75 /lb	13,500 lb	\$36,000
Year 3 - 12	\$2.75 /lb	8,700 lb	\$17,000
		Present Worth	\$75,000
		Annual cost for years 1 - 12:	\$8,000 /yr
<i>Condensate Disposal</i>	LS		\$32,000 /yr
<i>Vapor Phase Carbon Replacement</i>			
Year 0 - 2	\$1.20 /lb	106,000 lb	\$118,000
Year 3 - 12	\$1.20 /lb	70,500 lb	\$59,000
		Present Worth	\$177,000
		Annual cost for years 1 - 12:	\$20,000 /yr
<i>Vapor Monitoring</i>			
Sampling of air emission (once per 2 months)	\$1,000 /event	6 events	\$6,000 /yr
<i>Long-term groundwater monitoring program</i>			
Year 0 - 5			
Semiannual VOC sampling of 10 wells	\$500 /well	100 wells	\$43,000
Year 6 - 12			
Annual VOC sampling of 10 wells	\$500 /well	70 wells	\$23,000
Replacement of 2 wells every 5 years	\$4,000 /well	4 wells	\$11,000
		Present Worth	\$77,000
		Annual cost for years 1 - 12:	\$9,000 /yr
<i>Repair/replacement of equipment @ 5% per year</i>	LS		\$13,000 /yr
<i>Electricity</i>	\$0.10 /kw-hr	350,000 kw-hr	\$35,000 /yr
		Annual O&M cost for years 1 - 12:	\$153,000 /yr
		Annual O&M cost for years 11 - 30:	\$0 /yr
PRESENT WORTH			
<i>Based on a 30-yr life and a 5% interest rate</i>			\$2,095,000
SAY \$2.1 Million			

a - Costs rounded to the nearest \$1000.

LS - Lump sum.

1 - Includes cost to install one stripping well, including controls.

**COST ESTIMATE FOR ALTERNATIVE G3C:
IN-WELL VAPOR STRIPPING/VAPOR TREATMENT**

770 Main Street

ITEM	UNIT COST (\$)	QUANTITY	COST (1999 \$) ^a
CAPITAL COSTS			
A. Direct Costs			
<i>Treatability Study¹</i>	LS		\$137,000
<i>Site Preparation</i>			
Contractor mobilization/demobilization	LS		\$15,000
<i>Well/Remediation System Installation/Start-up</i>			
Stripping Wells	\$90,000 /well	1 well	\$90,000
includes electrical components of wells			
Iron Control System	\$3,000 /well	2 wells	\$6,000
Equipment Housings (1)	LS		\$50,000
Instruments, Electrical, and Controls	LS		\$25,000
Phone Line and Auto Dialer	\$700 /unit	1 unit	\$1,000
Moisture Separators	\$2,000 /unit	1 unit	\$2,000
Condensate Storage Containers	\$1,277 /unit	1 unit	\$1,000
Fencing	\$36.58 /lf	200 lf	\$7,000
Signage	LS		\$1,000
Asphalt Removal, Disposal, Restoration	\$20.94 /lf	500 lf	\$10,000
Air Injection Piping/Trenching/Installation	\$35.00 /lf	500 lf	\$18,000
Vapor Extraction Piping/Installation	\$10.00 /lf	500 lf	\$5,000
pipe installed in same trench as air injection pipe			
Soil Disposal (nonhazardous)	\$110 /cy	15 cy	\$2,000
Vapor Treatment Installation	LS		\$30,000
		Subtotal	\$400,000
B. Indirect Costs			
<i>Engineering and Design @ 15%</i>			\$60,000
<i>Legal and Administrative @ 10%</i>			\$40,000
<i>Contingency @ 25%</i>			\$100,000
		Total	\$600,000

**COST ESTIMATE FOR ALTERNATIVE G3C:
IN-WELL VAPOR STRIPPING/VAPOR TREATMENT**

770 Main Street

ITEM	UNIT COST (\$)	QUANTITY	COST (1999 \$) ^a
O&M COSTS			
<i>Operator Attention</i>	LS		\$30,000 /yr
<i>Iron Control Chemical Replacement</i>			
Year 0 - 0.5	\$2.45 /lb	6,000 lb	\$15,000
Year 0.5 - 2	\$2.75 /lb	9,000 lb	\$24,000
Year 3 - 12	\$2.75 /lb	6,000 lb	\$12,000
		Present Worth	\$51,000
		Annual cost for years 1 - 12:	\$6,000 /yr
<i>Condensate Disposal</i>	LS		\$21,000 /yr
<i>Vapor Phase Carbon Replacement</i>			
Year 0 - 2	\$1.20 /lb	106,000 lb	\$118,000
Year 3 - 12	\$1.20 /lb	70,500 lb	\$59,000
		Present Worth	\$177,000
		Annual cost for years 1 - 12:	\$20,000 /yr
<i>Vapor Monitoring</i>			
Sampling of air emission (once per 2 months)	\$1,000 /event	6 events	\$6,000 /yr
<i>Long-term groundwater monitoring program</i>			
Year 0 - 5			
Semiannual VOC sampling of 10 wells	\$500 /well	100 wells	\$43,000
Year 6 - 12			
Annual VOC sampling of 10 wells	\$500 /well	70 wells	\$23,000
Replacement of 2 wells every 5 years	\$4,000 /well	4 wells	\$11,000
		Present Worth	\$77,000
		Annual cost for years 1 - 12:	\$9,000 /yr
<i>Repair/replacement of equipment @ 5% per year</i>	LS		\$13,000 /yr
<i>Electricity</i>	\$0.10 /kw-hr	263,000 kw-hr	\$26,000 /yr
		Annual O&M cost for years 1 - 12:	\$131,000 /yr
		Annual O&M cost for years 11 - 30:	\$0 /yr
PRESENT WORTH			
<i>Based on a 30-yr life and a 5% interest rate</i>			\$1,761,000
SAY \$1.8 Million			

^a - Costs rounded to the nearest \$1000.

LS - Lump sum.

1 - Includes cost to install one stripping well, including controls.

15.2.4.2 ***Compliance With SCGs.*** Alternative G4 will achieve compliance with chemical-specific SCGs for the site that apply to the contaminated groundwater medium, including Class GA Groundwater Standards. Remedial activities for Alternative G4 will be continued until the Class GA standards are met. Treated effluent from the groundwater treatment system will meet the New York State groundwater effluent limitation prior to being discharged to on-site wet wells.

There are no promulgated air quality standards for the COCs at this site under the NAAQS or NYAAQS. However, emissions from the groundwater treatment plant should comply with the guidance values of NYS Air Guide 1 discussed in Chapter 8. The remedial activities included in this alternative, i.e., installation of wells and the treatment of groundwater, are not expected to generate any air emissions that would exceed the NIOSH IDLH levels, OSHA PELs, and ACGIH TLVs for contaminants in air. Air monitoring will be conducted during the remedial activities to ensure that these requirements are met. Any VOCs volatilized and extracted from the groundwater will be treated and released to the atmosphere after treatment. It is expected that VOC concentrations in the extracted vapor may initially be high, but will drop to a low level after a short period of time. Extracted vapors containing VOCs will be treated with GAC prior to being emitted to the atmosphere.

Alternative G4 will comply with location-specific SCGs that regulate remediation construction projects overlying a sole source aquifer by constructing a secondary spill containment system around any chemical storage areas to prevent spill migration. There were no threatened or endangered species that were identified within the study area; therefore, SCGs related to critical or significant habitats do not apply.

Alternative G4 complies with Federal and state regulatory requirements, which state that the selected remedial alternative must attain a cleanup level that eliminates, reduces, or controls risks to human health and the environment. Alternative G4 only applies to the groundwater medium.

15.2.4.3 ***Reduction of Toxicity, Mobility, and Volume Through Treatment.*** Alternative G4 will reduce the toxicity, mobility, and volume of contaminants underlying the Frost Street sites by extracting and treating the contaminated groundwater. VOCs will be

stripped from the water phase and adsorbed on to vapor phase GAC, where their mobility and volume in the environment will be reduced and their toxicity controlled.

15.2.4.4 Short-Term Effectiveness. The installation of pumping wells, a groundwater treatment system, and injection wells is expected to result in minimal impacts to human health or the environment. However, site operations may temporarily be impacted during installation and startup and increased traffic noise is expected. Planning and installation of the pump and treatment system is anticipated to last 9 to 12 months. Off-site locations will be impacted during system installation due to trenching and structure construction. Approximately 2000 ft² of space will be needed to construct the remedial system proposed under this alternative.

15.2.4.5 Long-Term Effectiveness and Permanence. Alternative G4 is intended to permanently remove VOCs from the near-field contaminant plume. Alternative G4 is not intended to remove VOCs from the soil medium at the site, although VOC concentrations may be reduced through natural attenuation processes. As stated in Chapter 13, the estimated time frame for operating the groundwater extraction and treatment system is 15 years. The long-term effectiveness of this alternative will be optimized by assessing aquifer characteristics, appropriate design of the pumping, treatment, and reinjection systems, and the rate of VOC contaminant removal from the near-field contaminant plume. Once the extraction and treatment system is operational, performance will be monitored through periodic system testing and groundwater monitoring.

15.2.4.6 Implementability. The technologies required for installing extraction and injection wells and constructing groundwater treatment systems are readily available. However, potential negative public perceptions concerning placement of the facilities will need to be addressed.

15.2.4.7 Cost. Estimated capital and long-term O&M costs for Alternative G4 are included in Table 15-8. These costs are based on the assumptions included in the description of the alternative provided in Chapter 13, and have a range of accuracy of -30 to +50%. These costs are estimated on a 30-year implementation basis and based on a 5% interest rate (EPA 1988) to estimate the present worth cost.

**COST ESTIMATE FOR ALTERNATIVE G4:
GROUNDWATER EXTRACTION / AIR STRIPPING / RE-INJECTION**

Frost Street Sites

ITEM	UNIT COST (\$)	QUANTITY	COST (1999 \$) *
CAPITAL COSTS			
A. Direct Costs			
<i>Treatability Study</i>	LS		\$8,000
<i>Aquifer Pump Test ¹ (includes treatment)</i>	LS		\$60,000
<i>Site Preparation</i>			
Contractor Mobilization/Demobilization	LS		\$37,000
<i>Well Installation</i>			
Drilling and Installation of Shallow Extraction Well	\$26,000 /well	1 well	\$26,000
Drilling and Installation of Deep Extraction Well	\$42,000 /well	1 well	\$42,000
Disposal of Soil as Non-hazardous	\$110 /yd ³	5 yd ³	\$1,000
Pump, Transducer, Concrete Encasement	\$7,000 /well	2 wells	\$14,000
<i>Installation of Connection Piping</i>			
Trenching, Bedding, Pipe, Conduit	\$35.00 /lf	900 lf	\$32,000
Asphalt Removal, Disposal, Restoration	\$20.94 /lf	900 lf	\$19,000
<i>Groundwater Treatment</i>			
Treatment System Equipment	\$230,000	-	\$230,000
Air Stripper	\$43,400 /unit	1 unit	\$43,000
Electrical Components and Controls	\$74,000	-	\$74,000
Housing for Treatment Operations	\$161,000	-	\$161,000
<i>Infiltration Gallery</i>			
Wet Well (8-ft diameter, 15-ft deep)	\$5,000 / well	5 wells	\$25,000
		Subtotal:	\$772,000
B. Indirect Costs			
<i>Engineering and Design (15%)</i>			\$116,000
<i>Legal and Administrative (10%)</i>			\$77,000
<i>Contingency (25%)</i>			\$193,000
		Total:	\$1,158,000

**COST ESTIMATE FOR ALTERNATIVE G4:
GROUNDWATER EXTRACTION / AIR STRIPPING / RE-INJECTION**

Frost Street Sites

ITEM	UNIT COST (\$)	QUANTITY	COST (1999 \$) ^a
O&M COSTS			
Electrical Usage	\$0.10 /kW-hr	315,000 kW-hr	\$32,000 /yr
Chemical Usage	LS	-	\$34,000 /yr
Sludge Disposal (Hazardous)	\$3.10 /gallon	6600 gallon	\$20,000 /yr
Vapor Phase GAC			
Carbon, 0 to 5 years	\$1.20 /lb	23,000 lb	\$119,000
Carbon, 6 to 15 years	\$1.20 /lb	13,500 lb	\$98,000
		Present Worth:	\$217,000
		Annual Cost Over 15-yr Period:	\$21,000 /yr
Plant Operator (Full-Time)	LS		\$50,000 /yr
System Monitoring [*]			
Total System Monitoring (Year 1)	LS		\$33,000
Total System Monitoring (Years 2 through 5)	LS		\$49,000
Total System Monitoring (Years 6 through 15)	LS		\$87,000
		Present Worth:	\$169,000
		Annual Cost Over 15-yr Period:	\$16,000 /yr
Long-Term Groundwater Monitoring Program			
Semiannual VOC Sampling of 13 wells (Years 1-5)	\$500 /well	130 wells	\$56,000
Annual VOC Sampling of 13 wells (Years 6-15)	\$500 /well	130 wells	\$39,000
Replacement of 2 wells every five years	\$4,000 /well	4 wells	\$11,000
		Present Worth:	\$106,000
		Annual Cost Over 15-yr Period:	\$10,000 /yr
Repair/Replacement of Equipment/Well Development			
(5% of all treatment equipment)	LS		\$17,000 /yr
(10% of infiltration gallery)	LS		\$3,000 /yr
		Annual O & M Cost for Years 1-15:	\$203,000 /yr
		Annual O & M Cost for Years 16-30:	\$0 /yr
PRESENT WORTH			
Based on a 30-yr Life and a 5% Interest Rate.			\$3,265,000
			SAY \$3.3 Million

a - Costs rounded to the nearest \$1000.

LS - Lump sum.

1 - Includes one pilot test well.

2 - Includes system performance, groundwater monitoring, and air emissions testing.

15.3 COMPARATIVE ANALYSIS OF ALTERNATIVES

In the previous section each of the remedial alternatives was individually evaluated with respect to the seven evaluation criteria. In this section the comparative performance of the alternatives is discussed where common elements exist among them.

15.3.1 Protection of Human Health and the Environment

Alternative G1 provides the least protection of human health and the environment as institutional controls will not be effective in preventing the migration of the contaminant plume. Alternatives G2, G3 and G4 provide similar levels of protection in that they all control further downgradient migration of VOCs in shallow groundwater. However, they do not address the contaminated subsurface soils at the sites, which may continue to act as a contaminant source. The greatest protection of human health and the environment would be achieved if Alternative G2, G3, or G4 is combined with an active source control alternative in the selected remedy.

15.3.2 Compliance With SCGs

Alternative G1 does not comply with any site SCGs with the exception of the Federal and state requirement to include a "no action" alternative in the range of detailed evaluation. Alternatives G2, G3 and G4 comply with SCGs that relate to groundwater cleanup. Implementation of a combination of Alternative G2, G3, or G4 with an active source control alternative would achieve compliance of both soil and groundwater SCGs.

15.3.3 Reduction of Toxicity, Mobility, and Volume Through Treatment

Alternative G1 will not result in any reduction of toxicity, mobility, or volume of contamination present at the Frost Street sites as no active remedial measures are included. Alternatives G2, G3, and G4 would result in a permanent decrease in the toxicity, mobility, and volume of contaminants present in captured soil gas and/or groundwater. In order to reduce the toxicity, mobility, and volume of both soil and groundwater contaminants, a combination of Alternative G2, G3, or G4 and an active source control alternative would need to be selected.

15.3.4 Short-Term Effectiveness

Alternative G1 results in the least amount of short-term impacts to human health and the environment as the only remedial activities included are sampling. Alternatives G2, G3, and G4 will cause similar disruptions to the surrounding community when being implemented. Community disturbance will occur over varying time periods depending on the expected operation time. The implementation time of Alternatives G2 and G3 is expected to be 6 to 9 months whereas that for Alternative G4 is expected to be 9 to 12 months. The potential hazards to on-site workers and the surrounding public are expected to be essentially the same.

15.3.5 Long-Term Effectiveness and Permanence

Alternatives G2, G3, and G4 permanently remove captured VOC contaminants from the groundwater medium. Alternative G2 transfers volatile contaminants from the groundwater to the overlying soil gas. Some clean subsurface soil areas may be temporarily contaminated during the AS/SVE process. Alternative G1 does not provide a high degree of long-term effectiveness or permanence as no active remediation measures are proposed. Implementation of a combination of Alternative G2, G3, or G4 and an active source control alternative is expected to provide the greatest degree of long-term effectiveness and permanence.

Of these alternatives, Alternative G4 is estimated to have the longest operating time, 15 years, while Alternatives G2 and G3 are estimated to be operating for approximately 12 years.

If Alternative G2, G3, or G4 is implemented, future use of some of the property space would temporarily be restricted by constructed wells, underground piping, or a treatment system.

15.3.6 Implementability

All four alternatives are readily implementable. Alternative G1 is the easiest of the four alternatives to implement as only establishment of institutional measures and a monitoring program are required. The AS/SVE and vapor treatment system components of Alternative

G2 are commonly applied technologies at inactive hazardous waste sites. However, the in-well vapor stripping technology of Alternatives G2 and G3 is licensed to a small number of vendors and requires specialized experience to implement. Alternative G4 includes the installation of a groundwater extraction and treatment system, which is a commonly applied technology at inactive hazardous waste site.

15.3.7 Cost

The costs of each remedial alternative are summarized in Table 15-1. Alternative G1, the no action alternative, has the lowest estimated present worth (\$0.3 million) of the remedial alternatives. Alternative G2, the AS/SVE and in-well vapor stripping alternative, has the lowest estimated present worth of the active groundwater response alternatives (\$2.7 million). Alternative G4, the groundwater extraction/air stripping/reinjection alternative, has the next highest present worth (\$3.3 million). Alternative G3, the sitewide in-well vapor stripping/vapor treatment alternative has the highest estimated present worth (\$3.5 million).

In deriving cost estimates for Alternatives G2 and G3, installation of the UVB in-well vapor stripping system was assumed. Costs for several line items were obtained from a vendor familiar with the technology's installation and operations and maintenance. Being that in-well vapor stripping is an innovative technology at hazardous waste sites and is still being optimized, capital costs for the system are fairly high. Like many innovative technologies, costs decrease with successive applications. Capital costs for the in well vapor stripping technology vary widely; therefore, the cost estimate presented in Table 15-4 may decrease substantially if quotes are received for in-well vapor stripping technologies other than the UVB system. In Alternative G2, the remediation time was assumed to be 12 years, similar to the Alternative G3. If another in-well vapor stripping vendor technology or the results of a pilot study confirm that the remediation time is less than 12 years, then additional cost savings would be realized.

The cost analysis conducted for Alternatives G3A, G3B, and G3C (see section 15.2.3.8 for description) demonstrated that by implementing a remedial technology at each site rather than providing a sitewide remedy (i.e., remedy which includes all three of the Frost Street sites), the capital and operations and maintenance costs escalate substantially. The total

cost for implementing Alternatives G3A, G3B, and G3C is \$5.0 million, which represents a 47% increase over the cost (present worth) to implement Alternative G3.

