FINAL DRAFT

INTERIM REMEDIAL MEASURES WORK PLAN

Proposed for:

299 Main Street Site
Site Code 1-30-043S
Westbury, New York

Prepared for:

The New York State Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway
Albany, New York

April 2002

IMPACT ENVIRONMENTAL

a division of impact environmental consulting, inc.

1 VILLAGE PLAZA, KINGS PARK, NEW YORK 11754 ❖ 631.269.8800 TELEPHONE ❖ 631. 269.1599 FACSIMILE ❖ IMPACTENVIRONMENTAL.COM

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Richard S. Parrish
Project Manager

Kevin C. Kleaka
Quality Assurance Officer

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1. INTRODUCTION

This Draft Interim Remedial Measure (IRM) Work Plan documents the remedial activities proposed to address the point pollution sources identified on the property located at 299 Main Street, Westbury, New York, herein identified as the Site. The scope of this work plan is based upon the recommendations presented in the Focused Remedial Investigation (FRI) Report, dated September 2000, prepared by Impact Environmental Consulting, Inc. This IRM Work Plan is submitted in accordance with the provisions of the Order on Consent between the New York State Department of Environmental Conservation (NYSDEC) and 2632 Realty Development Corp. dated June 30, 1999.

In 1997, the Site was listed on the New York State registry of Inactive Hazardous Waste Disposal Sites (IHWDS) resulting from a NYSDEC investigation. The NYSDEC investigation indicated that the Site was potentially a contributing source of regional chlorinated organic groundwater contamination. Consequently, the Site was designated as site code 01-30-043S by the NYSDEC. In 2000, Impact Environmental Consulting, Inc. performed a FRI to define the nature, source and extent of any contamination at the Site. An evaluation of the FRI results confirmed that unsaturated soil contamination was present in isolated areas of the Site that required remedial activities. These confirmed point pollution sources will be the focus of the IRM procedures implemented under the scope of this work plan.

The methodologies used of this work plan were based, in part, upon the following documents: the NYSDEC Technical and Administrative Guidance Memorandum # 4030, Selection of Remedial Action at Inactive Hazardous Waste Sites; the USEPA Compendium of Superfund Field Operations Methods, dated September 1987; and the USEPA Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERLA, dated October 1988.

The tasks to be performed under the scope of the IRM process have been summarized in this report in the following sections.

- **Site Background and Setting**
- **Interim Remedial Measures**
- **Health and Safety Plan**

Presented herein is the proposed Final Draft Interim Remedial Measures Work Plan to be implemented by Impact Environmental Consulting, Inc. for the Site.

2. SITE BACKGROUND AND SETTING

2.1 Site Location

The Site is located at 299 Main Street, Westbury, New York, and is designated by the Nassau County Tax Assessors Office as Section 11, Block 144, Lots 35-46 (see Plate 1: Site Location Map, Westbury, New York). The Site is situated in the western section of the NCIA and encompasses an areal extent of approximately 35,700 square feet. The NCIA is located in the unincorporated Village of Westbury, in the Town of North Hempstead, Nassau County, New York. The NCIA is comprised of individual properties with an aggregate area of approximately 170 acres. The NCIA is bordered by the Long Island Rail Road to the north, Old County Road to the south, Grand Boulevard to the west and Frost Street to the east.

The Site is bordered by Main Street to the south, a salvage yard to the north, Garden Street to the west and Hopper Street to the east (see Plate 2: Site Map, Westbury, New York). The Site was initially developed circa 1956 with one single-story, steel framed, masonry building. Subsequently, the building was improved with several additions and alterations. Presently, the existing building has an approximate footprint of 9,450 square feet.

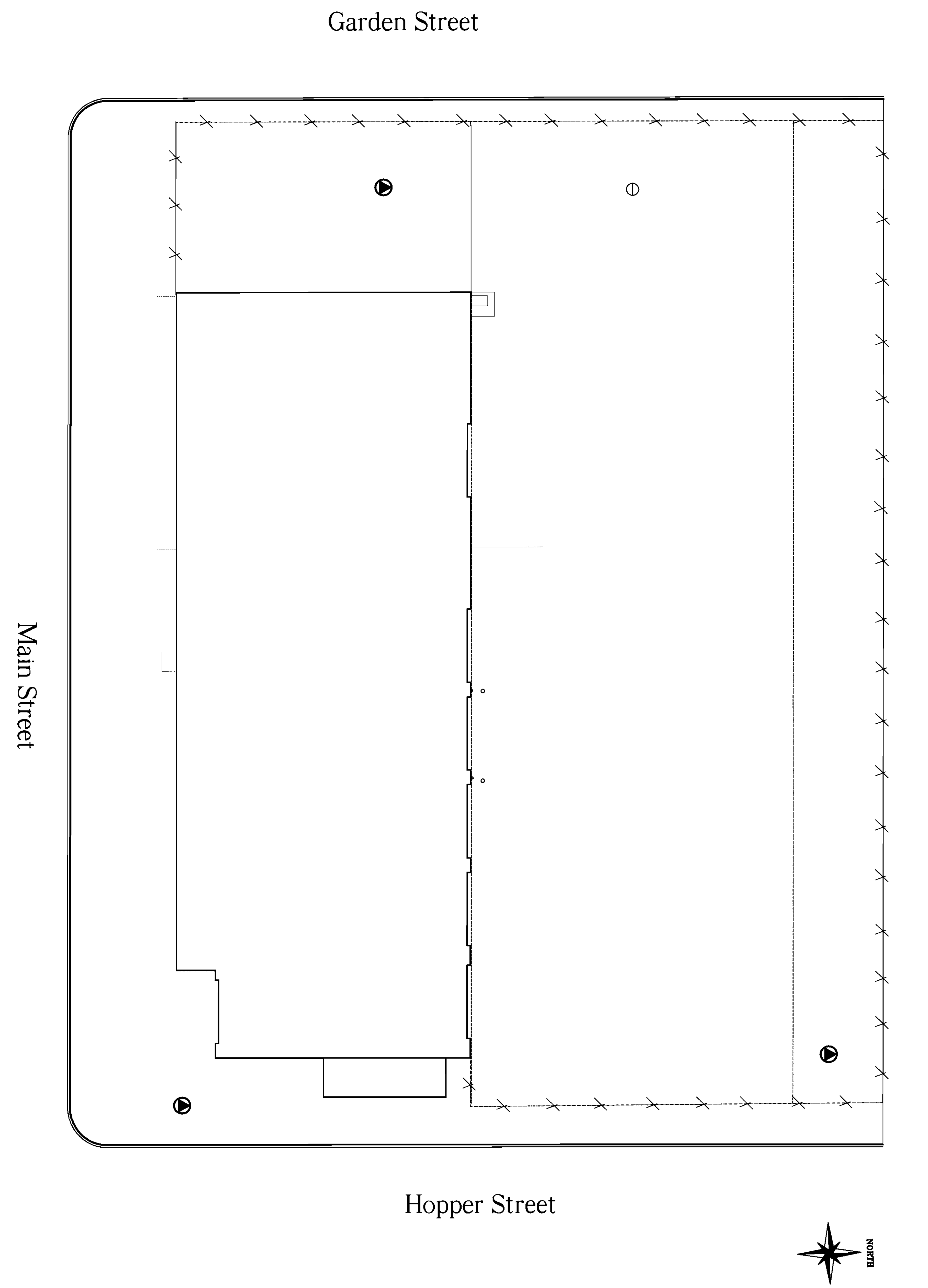
The Site was originally developed for light industrial applications. Such land uses have historically included automotive repair, automotive storage, automotive sales, automotive salvage, and bulk petroleum transportation. The Site is presently vacant.

2.2 Geological Background Study

2.2.1 Subsurface Geology

The geology of Long Island consists of thick deposits of unconsolidated, water bearing sediments resting upon a relatively impermeable, crystalline bedrock surface. The sequence of events that shaped Long Island's geology is not known with certainty, but it probably began with the formation of the original basement rocks in early Paleozoic to Precambrian time more than

Plate 1: Site Location Map, Westbury, New York,



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KINGS PARK, NEW YORK 11754
631.269.8800 TELEPHONE
631.269.1599 FACSIMILE

98-335

Plate 2: Site Map

Westbury, New York

Legend

- monitoring well
- groundwater probe node
- soil probe node

scale: 1" = 20'

400 million years ago. These basement rocks were heated and compressed (metamorphosed) by folding and faulting, producing a rugged, mountainous topography. During the subsequent period ending with the late Cretaceous Epoch 100 million years ago, erosion reduced the land to a nearly planer surface that gently tilted to the southeast.

During the late Cretaceous Epoch (60-100 million years ago), streams brought sediments from the north and the west to the Long Island area on the continental margin, forming a permeable sand layer (Lloyd Sand Member of the Raritan Formation) and overlying clay member (clay member of the Raritan Formation) upon the bedrock surface. After a short period of erosion or non-deposition, thick, permeable beds of river delta clay, sand, and gravel were deposited on the Raritan Formation; these deposits comprise the Magothy Aquifer. Toward the close of the Late Cretaceous period (approximately 60 million years ago), a sand and clay unit (Monmouth Group) of low permeability was deposited in shallow marine waters in the area that now constitutes Long Island's south shore.

A long period of non-deposition, or possibly deposition followed by erosion, occurred after the Cretaceous era. Geologic activities during this time left few sedimentary traces, but streams flowing across Long Island cut deep valleys into the Magothy. It was not until late Pleistocene (Wisconsinian) glaciation- some 20 to 200 thousand years ago- that there were any significant additions to Long Island's geologic record. Valleys were filled and the other deposits were almost completely buried by glacial deposits. Prior to the southward movement of the Pleistocene ice sheets to Long Island, an extensive clay unit (Gardiners Clay) was deposited in shallow marine and brackish waters along the shores of what is now Suffolk County. This unit rested upon the Magothy and Monmouth Group, and acted as a confining layer. The northern portions of the Gardiners were subsequently eroded by advancing ice and glacial meltwaters, and Gardiners Clay beds are now found only in the south shore area.

In the area of the Site the bedrock exists at an elevation of approximately seven hundred feet below sea level. The top of the Raritan confining unit exists at an elevation of five hundred feet below sea level (Smolensky and Feldman, 1988). The top of the Magothy Aquifer exists at an elevation of approximately 30 feet above sea level. There is no confining layer with extensive horizontal continuity overlying the Magothy Aquifer. In many areas of Westbury and Hicksville there is no confining layer between the Magothy and Glacial Aquifers. They are only differentiated by their hydraulic conductivities (50 vs. 270 ft/day) (Franke and Cohen, 1972). Localized clay lenses are present within this area of the Magothy Aquifer, but their location and extent have not been delineated.

2.2.2 Topography

The Pleistocene glaciation created the hilly Ronkonkoma moraine along Long Island's "spine" and south fork, and the Harbor Hill Moraine along the North shore and the North fork. Erosion of these morainal deposits (as the glacier melted away from Long Island) created extensive outwash plains of sand and gravel in the intermorainal area and south to the Atlantic Ocean. These highly permeable deposits comprise the upper glacial aquifer and represent the majority of Long Island's surficial sediments. Some local confining clay units were also formed from glacial materials in intermorainal lakes and tidal lagoons. Since the end of glaciation, about 12,000 years ago, Holocene beach and marsh deposits have been formed along the marine edge, and within stream corridors and ponds.

The elevation of the Site, as presented on the United States Geologic Survey (USGS), Hicksville Quadrangle Map, approximates one hundred twenty (120) feet above sea level. The USGS Map, which was base dated 1943, field checked in 1967, and photorevised in 1979, did not depict a structure on the Site (the property is within an area in which only landmark buildings were mapped).

2.2.3 Soil Component Identification

Nassau County is divided into ten general soil units, or groups of soils geographically associated in a characteristic repeating pattern, according to the Soil Survey of Nassau County, New York (U.S. Department of Agriculture, U.S. Soil Conservation Service). The general soil component of the Site, as defined by this publication, is the Urban Land Association. This Association consists of dominantly nearly level or gently sloping areas that are covered by buildings, roads, sidewalks, and parking lots on plains and low hills.

The Soil Survey also describes detailed soil units that each represent an area on the landscape consisting of one or more soils for which the unit is named. The detailed component of the Site is identified by this Survey as the Urban Land-Hempstead Complex (Uh). This soil type consists of urbanized areas and very deep, well-drained soils on nearly level plains. Slope ranges from 0 to 3 percent, and slope is less than 2 percent in most of the areas that are not near drainage-ways or depressions.

This unit is described as a soil complex because the urbanized areas and Hempstead soils are so intermingled that it was not practical to classify them separately. This soil complex is made up of about 75 percent urbanized areas, 20 percent Hempstead soils, and 5 percent other soils. The urbanized areas consist of buildings, roads, driveways, parking lots, and other man-made structures.

Typical sequence, depth and composition of the layers of Hempstead Series Soils are as follows:

Depth In Soil Profile	Soil Description
Surface to 11 inches	black silt loam
11 to 15 inches	dark brown silt loam
15 to 29 inches	yellowish brown silt loam
29 to 33 inches	strong brown very gravelly loamy sand
33 to 60 inches or more	very pale brown sand and gravel

2.2.4 Hydrology

The Site lies within Hydrogeologic Zone I, The Deep Flow - Magothy Recharge Area (Nassau-Suffolk 208 Study - Water Management Zones in Nassau and Suffolk). Zone I is characterized by deep groundwater recharge and vertical groundwater flow.

2.2.5 Regional Groundwater Characteristics

Regional groundwater flow direction in the area of the Site is toward the south-southwest. The water table is encountered at approximately fifty-five feet below grade.

2.2.6 Site Groundwater Characteristics

The elevation of groundwater was gauged at the monitoring wells installed at the Site during the performance of the FRI. The elevations were used to graphically define the planimetric surface of the water table beneath the Site. The elevations of the top of the casings were represented with respect to each other and were based on an estimated surface elevation of 120 feet (approximate elevation above mean sea level). The groundwater elevations were based as a function of the depth to water and the surface elevation. The average elevation of the water table (based on the estimated surface elevation) is 66 feet above mean sea level.

Water-table potentiometric contours were constructed from the measurement of groundwater elevations, and are presented in Figure 1. Based on these contours, the hydraulic gradient was approximated to be 0.00439 ft/ft. The calculated normal to the gradient indicated a south-southwest groundwater flow direction.

Figure 1: Potentiometric Contour Map

2.2.7 Site Groundwater Quality

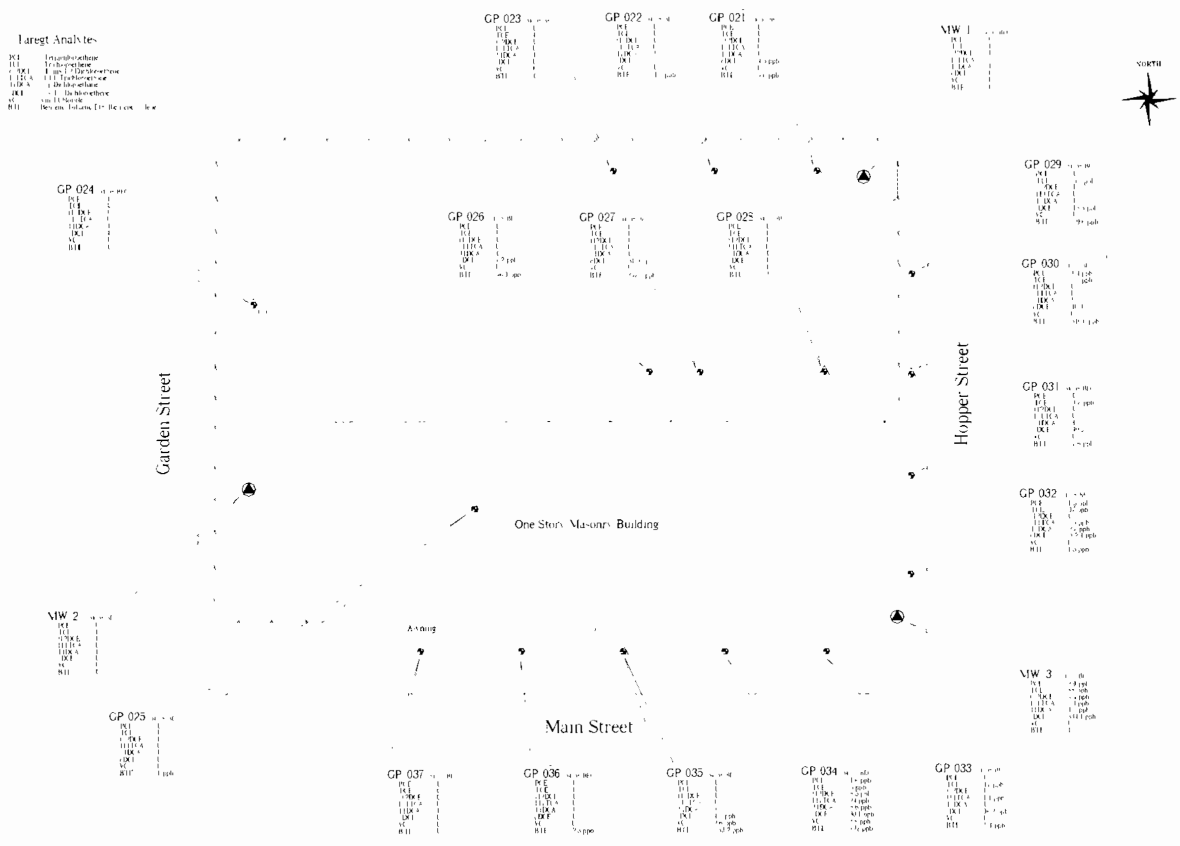
In general, the detected groundwater contaminants were limited to the southeast portion of the Site. The groundwater samples secured from the southeast portion of the Site (locations GP-029 through GP-037 and MW-3) were contaminated with both chlorinated organic, and gasoline and diesel related target analytes.

The highest single concentration of any chlorinated target analyte detected in the southeast corner of the Site was 562.4 ppb of cis-1,2 dichloroethene (location GP-032). This concentration, as well as ten others from five other sample locations, was in excess of the applicable 5 ppb SCG value. In general, the concentrations of the target chlorinated organic analytes that were above ambient were predominantly higher entering the Site than exiting. This fact is evident in the following table.

Analyte	Incoming Concentrations/Outgoing Concentrations [ppb]					
Sample Location	GP-032/GP-033	MW-3/GP-033	GP-031/GP-034	GP-030/GP-035	GP-029/GP-036	GP-021/GP-025
PCE	1.5/U	3.9/U	U/1.6	1.4/U	U/U	U/U
TCE	97/17	88/17	4.7/5	1.5/U	5.7/U	U/U
t-1,2 DCE	U/U	4.4/U	U/8.5	U/U	U/U	U/U
c-1,2 DCE	562.4/96.2	334.1/96.2	40.5/30.1	46/4	18.5/U	4.3/U
1,1,1 TCA	7.5/1.1	5.3/1.1	U/24	U/U	U/U	U/U
1,1 DCA	2.7/U	1.7/U	U/8.6	U/U	U/U	U/U
VC	U/U	U/U	U/3.8	U/2.6	U/U	U/U

Figure 2 presents the groundwater sampling locations on the Site and the corresponding contaminant concentrations identified during the performance of the FRI.

Figure 2: Target Analyte Concentration Map



3. INTERIM REMEDIAL MEASURES

The IRM activities proposed for the Site relate to specific pollution sources identified during the performance of the FRI. The extent of these pollution sources were determined to be confined within Site-specific structures or isolated to the unsaturated subsurface soil of the Site. Accordingly, the treatment technologies developed for the pollution sources at the Site have been designed to permanently remove or significantly decrease the toxicity, mobility and volume of contaminants to the maximum extent practicable. An evaluation of the effectiveness of the IRM activities will be implemented through the performance of a sampling and analysis plan or an operations and maintenance plan to assure compliance with applicable New York State Standards, Criteria and Guidelines (SCGs).

3.1 Pollution Source Summary

All of the information presented in this section of the report was compiled during the performance of the FRI. The results of the FRI revealed that three (3) pollution sources exist at the Site requiring remedial activities. These pollution sources will be addressed under the scope of the IRM activities (see Plate 3: Pollution Source Map). Figure 3 presents the subsurface soil sampling locations for each confirmed pollution source (except PS-7 and PS-8). The pollution sources identified from the performance of the FRI are presented in the following table.

Pollution Source Code	Pollution Source Structures	Affected Media
PS-1	Underground Injection Well	Soil Quality
PS-5	Underground Storage Tanks	Soil Quality
PS-7 and PS-8	Service Pits	Soil Quality

The analytical data generated for the pollution sources during the performance of the FRI is presented in Table 1 and provides a comparison of the detected contaminant concentrations against the applicable standards, criteria and guidances (SCGs).

Table 1: Contaminant Concentration and Applicable SCGs (1of 4)

Volatile Organic Soil Analysis

Westbury, New York

Site 01-30-043S

Sample ID	GP-005-SS30	GP-005-SS45	GP-006-SS10	GP-006-SS15	GP-006-SS30	GP-006-SS45	GP-007-SS10	GP-007-SS15	GP-007-SS30	**Applicable SCG**
Unit	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg
Volatiles:										
1,2,4-Trimethylbenzene	U	28.0	U	U	U	U	U	U	U	NA
1,2-Dichlorobenzene	U	5.5	U	U	U	U	U	U	U	7900
1,3,5-Trimethylbenzene	U	12.0	U	U	U	U	U	U	U	NA
1,4-Dichlorobenzene	U	5.7	U	U	U	U	U	U	U	NA

Sample ID	GP-007-SS45	GP-008-SS10	GP-008-SS15	GP-008-SS30	GP-008-SS45	**Applicable SCG**
Unit	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg
Volatiles:						
Benzene	U	U	U	U	U	60
1,2,4-Trimethylbenzene	U	39900E	98400E	8.1	11400	NA
1,2-Dichlorobenzene	U	U	U	U	U	NA
1,3,5-Trimethylbenzene	U	21200	40800E	J	3000	NA
2-Chlorotoluene	U	J	1300	U	U	NA
4-Chlorotoluene	U	J	1200	U	U	NA
4-Isopropyltoluene	U	950	2600	U	J	NA
Ethylbenzene	U	U	U	U	J	5500
Isopropylbenzene	U	U	U	U	U	NA
Napthanlene	U	U	15800	U	2,300	13000
n-Propylbenzene	U	U	1200	U	880	880
sec-Butylbenzene	U	J	2000	U	J	NA
tert-Butylbenzene	U	U	U	U	U	NA
Tetrachloroethene	U	U	U	U	U	1400
Toluene	U	U	U	U	U	1500

Shaded box repersents an SCG excedence.

NA: Not Available

U: Indicates the comound was analyzed for, but was not detected.

J: Indicates an estimated value detected below the MDL.

E: Indicates the analyte concentration exceeds the instrument calibration limits.

Table 1: Contaminant Concentration and Applicable SCGs (2 of 4)

Volatile Organic Soil Analysis

Westbury New York

Site 01-30-043S

Sample ID	GP-009-SS10	GP-009-SS30	GP-009-SS45	GP-010-SS15	GP-010-SS30	GP-010-SS45	GP-011-SS15	GP-011-SS30	GP-011-SS45	GP-012-SS15	GP-012-SS30	GP-012-SS45	**Applicable SCG**
Unit	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	**µg/Kg**
Volatiles:													
Acetone	U	U	U	U	U	8.2	U	U	U	U	24	18	110
1,2,4-Trimethylbenzene	62900E	U	7.5	U	2.5	U	13	U	4.9	4.6	8	U	NA
1,2-Dichlorobenzene	U	110	U	U	U	U	U	U	U	U	U	U	7900
1,3,5-Trimethylbenzene	160700E	810E	2.6	1400	U	U	4.2	U	U	U	U	U	NA
2-Chloroethyl Vinyl Ether	U	U	U	U	U	U	25	U	U	U	U	U	NA
2-Chlorotoluene	9500	570E	U	U	U	U	U	U	U	U	U	U	NA
2-Methylnaphthalene	1600	U	U	U	U	U	U	U	U	U	U	U	NA
4-Chlorotoluene	9100	U	U	U	U	U	U	U	U	U	U	U	NA
4-Isopropyltoluene	14200	100	U	720	U	U	U	U	U	U	U	U	NA
Benzene	3800	U	U	U	U	U	U	U	U	U	U	U	60
cis-1,2-Dichloroethene	43800E	8	3.8	U	U	U	13.0	U	U	U	U	U	NA
Diethylphtalate	U	U	U	U	U	U	U	U	U	U	U	U	NA
Ethylbenzene	39800E	360E	2.0	U	U	U	6.1	U	U	U	U	U	5500
Isopropylbenzene	16000	180	U	U	U	U	U	U	U	U	U	U	NA
m+p-Xylenes	154800E	710E	8.3	U	U	U	27	U	U	8	U	U	1200
Methylene Chloride	U	U	U	U	U	U	U	U	3.3	4.9	U	U	100
Napthanlene	47100E	U	U	720	U	U	5	U	U	U	U	U	NA
o-Xylene	68900E	690E	3.3	U	3.7	3.1	8.5	U	U	2.5	U	U	1200
sec-Butylbenzene	10900	U	U	U	U	U	U	U	U	U	U	U	NA
Tetrachloroethene	1200	4.8	U	U	U	U	U	U	U	U	U	U	1400
Toluene	89100E	400	8.6	U	3.4	2.9	30.0	U	U	8.9	U	U	1500
Semi-Volatiles:													
Fluorene	U	310	U	U	U	U	U	U	U	U	U	U	350000
Benzo-a-Anthracene	220	40	U	U	U	U	U	U	U	U	U	U	300
Benzo-a-Pyrene	U	J	U	U	U	U	U	U	U	U	U	U	11000
Benzo-b-Fluoroanthene	U	J	U	U	U	U	U	U	U	U	U	U	1100
Benzo-k-Fluoroanthene	U	J	U	U	U	U	U	U	U	U	U	U	1100
Bis(2-Ethylhexyl)Phthalate	1900	110	U	1200	U	U	U	U	U	J	U	U	435000
Chrysene	280	49	U	U	U	U	U	U	U	U	U	U	400
Di-n-Butylphthalate	U	U	U	U	U	120	U	U	U	U	U	U	8100
Di-n-Octylphthalate	U	U	U	42	U	U	U	U	U	U	U	U	120000
Fluoranthene	2100	97	34	61	U	U	U	U	U	59	U	U	1900000
Phenanthrene	U	370	35	110	U	U	U	U	U	U	U	U	220000
Pyrene	1000	120	U	87	U	U	U	U	U	75	U	U	665000

Shaded box repersents an SCG excedence.

NA: Not Available

U: Indicates the comound was analyzed for, but was not detected.

J: Indicates an estimated value detected below the MDL.

E: Indicates the analyte concentration exceeds the instrument calibration limits.

Table 1: Contaminant Concentration and Applicable SCGs (3 of 4)

Inorganic and TPH Soil Analysis

Westbury New York

Site 01-30-043S

Sample ID	GP-009-SS10	GP-010-SS15	GP-011-SS15	GP-012-SS15	**Applicable SCG**	**Background Levels**
Unit	Mg/Kg	Mg/Kg	Mg/Kg	Mg/Kg	Mg/Kg	Mg/Kg
Inorganics:						
Alumimium	993	609	712	U	SB	33000
Antimony	U	U	U	U	SB	NA
Arsenic	4.3	U	1.2	U	7.5 or SB	12
Barium	124	U	U	U	300 or SB	600
Beryllium	2.5	U	U	U	0.16 or SB	1.75
Cadmium	4.3	0.85	U	U	10 or SB	1
Calcium	1600	U	U	U	SB	35,000
Chromium	U	3.1	12.9	U	10 or SB	40
Cobalt	U	U	U	U	30 or SB	60
Copper	90	17.8	6.2	U	25 or SB	50
Iron	4040	1800	3680	28.6	2000 or SB	550,000
Lead	273	8.6	1.5	U	SB	500
Magnesium	1260	U	U	U	SB	5000
Manganese	40	5.4	42.4	U	SB	5,000
Mercury	U	U	U	U	0.1	0.2
Nickel	388	U	U	U	13 or SB	25
Potassium	U	U	U	U	SB	43000
Selenium	U	U	U	U	2 or SB	3.9
Silver	U	U	U	U	SB	NA
Sodium	U	U	U	2510	SB	8000
Thallium	U	U	U	U	SB	NA
Vanadium	1810	U	U	U	150 or SB	300
Zinc	62	35.2	4	U	20 or SB	50
Cyanide	U	U	U	U	NA	NA
Unit	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg
Total Petroleum Hydrocarbons:	3670	1520	41	U	NA	NA

Shaded box repersents an SCG excedence.

NA: Not Available

U: Indicates the comound was analyzed for, but was not detected.

J: Indicates an estimated value detected below the MDL.

E: Indicates the analyte concentration exceeds the instrument calibration limits.

Table 1: Contaminant Concentration and Applicable SCGs (4 of 4)

Organic Soil Analysis

Westbury New York

Site 01-30-043S

Sample ID	GP-013-SS8	GP-013-SS12	GP-014-SS8	GP-014-SS12	GP-015-SS8	GP-015-SS12	GP-016-SS8	GP-016-SS12	GP-017-SS8	GP-017-SS12	GP-018-SS8	GP-018-SS12	GP-019-SS8	GP-019-SS12	GP-020-SS8	GP-020-SS12	Applicable SCG
Unit	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg
Volatiles:																	
Ethylbenzene	U	U	U	U	U	U	U	820	U	U	U	U	U	U	U	U	100
1,2,4-Trimethylbenzene	U	U	5.3	74	U	960	12300	20500	330	12700	U	8700	5.8	19900	5.1	1400E	100
1,3,5-Trimethylbenzene	U	5600	2.3	90	U	7100	6900	8000	390E	6600	2400	7100	3.3	6400	U	560E	100
isopropylbenzene	U	U	U	U	U	U	U	460	U	U	U	U	U	610	U	U	100
m+p-Xylenes	U	1400	U	13	U	U	2800	13200	200	2100	460	2000	2.7	6800	2.9	230	200
n-Propylbenzene	U	U	U	U	U	U	U	1700	U	U	U	U	U	1800	U	U	100
o-Xylene	U	1400	U	14	U	680	3900	8800	310E	2500	580	1900	2.1	4200	U	210E	100
Sec-Butlylbenzene	U	U	U	U	U	U	U	570	U	U	U	530	U	1700	U	U	100
tert-Butylbenzene	U	10600	U	U	U	U	U	U	U	U	1200	U	U	U	U	U	100
Toulene	U	U	U	U	U	U	U	U	26	U	U	U	U	510	U	3.3	100
Semi-Volatiles:																	
Anthracene	U	U	U	U	U	U	U	U	U	200	U	U	U	U	U	U	1,000
Benzo[a]anthracene	U	U	U	U	U	U	U	U	U	U	150	570	U	U	U	U	NA
Benzo[a]pyrene	U	U	U	U	U	U	U	U	U	U	130	440	U	U	U	U	NA
Benzo[b]fluoranthene	U	U	U	U	U	U	U	U	U	U	U	400	U	U	U	U	NA
Benzo[g,h,I]perylene	U	U	U	U	U	U	U	U	U	U	U	150	U	U	U	U	NA
Benzon[k]fluoranthene	U	U	U	U	U	U	U	U	U	U	140	460	U	U	U	U	NA
Chrysene	U	U	U	U	U	U	U	U	U	U	160	550	U	46	U	U	NA
Fluorene	U	290	U	U	U	84	400	160	U	770	U	490	U	920	U	360	1000
Flouranthene	U	U	U	U	U	U	U	U	U	160	350	1300	U	120	U	U	1000
Indeno[1,2,3-cd]pyrene	U	U	U	U	U	U	U	U	U	U	U	85	U	U	U	U	NA
Napthalene	U	910	U	U	U	U	1500	870	U	U	U	U	U	2700	U	360	200
Phenanthrene	U	220	U	U	U	57	440	300	U	1300	320	1300	U	1400	U	610	1000
Pyrene	U	150	U	U	120	U	170	120	230	230	480	1600	U	310	U	120	1000

Sample ID	GP-24-GW01	GP-25-GW01	GP-27-GW01	GP-28-GW01	SCG
Unit	µg/Kg	µg/Kg	µg/Kg	µg/Kg	µg/Kg
Volatiles:					
Benzene	U	U	2.8	U	0.7
1,2-Dichlorobenzene	U	U	11	U	5.0
Ethylbenzene	U	U	81	U	5.0
m+p Xylenes	U	U	98	U	5.0
o-Xylene	U	U	75	U	5.0
Toluene	U	1.4	91	U	5.0

Shaded box repersents an SCG excedence.

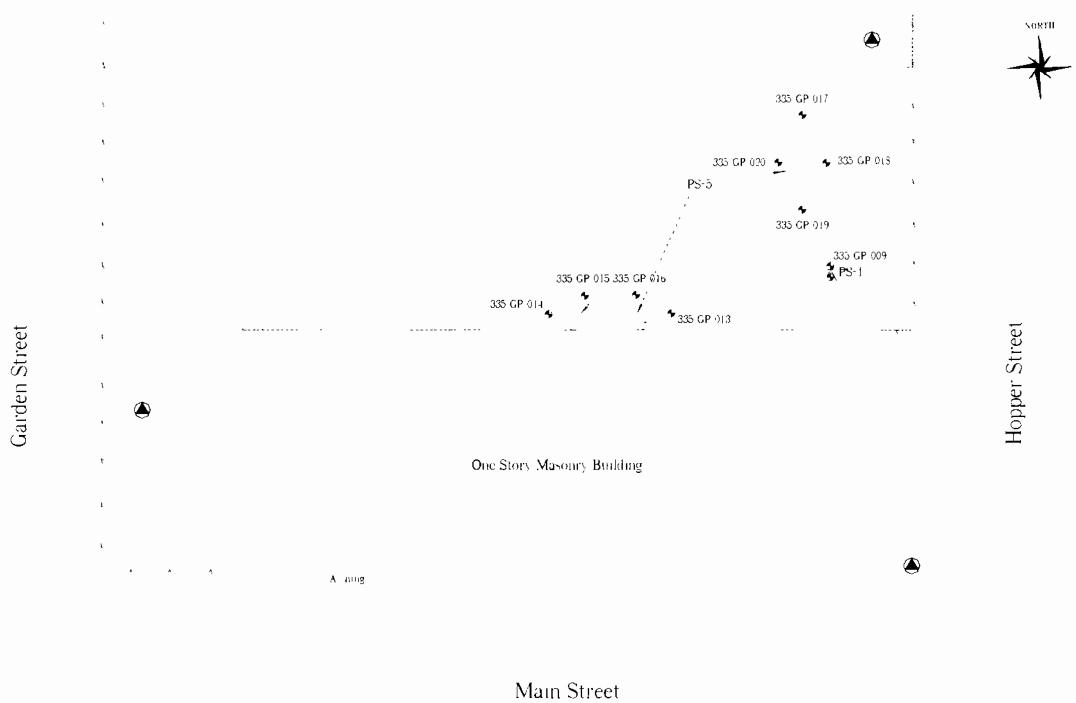
NA: Not Available

U: Indicates the comound was analyzed for, but was not detected.

J: Indicates an estimated value detected below the MDL.

E: Indicates the analyte concentration exceeds the instrument calibration limits.

Figure 3: Pollution Source - Soil Sampling Location Map



3.1.1 Pollution Source PS-1

The underground injection well identified as being connected to an interior floor drain was investigated. A destructive survey was performed that involved using a hydraulic probing tool to detect the presence of the well structures (i.e. the block walls and domes) and to obtain subsurface pilot samples. Pilot probe samples obtained from a depth of eight feet at the target location was found to contain uncompacted stained organic silts and fine sands indicative of sediment. Furthermore, a substantial void space was encountered at the location, suggestive of an open cavity such as an injection well. The injection well was considered a confirmed point pollution source.

To evaluate the impact of PS-1 on Site soil quality, soil samples were secured from its center at three depths extending to forty-seven feet below existing grade (immediately above the water table). Said sampling location was designated GP-009. Samples secured from this location were secured at depths of 10 to 18 feet BEG, 30 to 32 feet BEG, and 45 to 47 feet BEG for subsequent laboratory analysis. The soil samples secured from its center (location GP-009) were contaminated with chlorinated organic, and gasoline and diesel related target analytes. The highest single concentration of any chlorinated organic analyte detected from this sample location was 43,800 ppb of cis-1,2-dichlroroethene.The highest single concentration of any gasoline and diesel related analyte detected from this sample location was 160,700 ppb of 1,3,5-trimethylbenzene. These concentrations decreased to below that of the applicable SCGs in the samples obtained at 45 feet BEG. The inorganic analysis of the sample secured from the underground injection well at 10-18 feet BEG detected elevated concentrations of beryllium, cadmium, copper, nickel, vanadium and zinc. The concentrations of inorganic analytes were above the applicable SCGs at 10-18 feet BEG.

To evaluate the impact of PS-1 on Site groundwater quality, one groundwater sample, identified as sample GP-028-GW01, was secured from the water table. Additionally, two groundwater samples, identified as GP-029-GW01 and GP-MW-1-GW01 were secured from locations hydraulically up-gradient of the source location, and three groundwater samples, identified as GP-33-GW01, GP-34-GW01 and GP-35-GW01 were secured from locations hydraulically down-gradient of the source location.

3.1.2 Pollution Source PS-5

An interpretation of the imagery obtained from the performance of a ground penetrating radar survey of the Site revealed three anomalous features consistent with that of underground storage tanks. The underground storage tanks are located adjacent to the north side of the building. The orientation of two of the tanks appeared to be such that their long axis run parallel to the building (east-west). The long axis of the third tank runs perpendicular to the building. These tanks were identified as confirmed point pollution sources.

To evaluate the impact of these sources on Site soil quality, soil samples were secured from locations adjacent to the walls of each tank from two depths. As two of the tanks were positioned end-to-end, and were immediately adjacent to the building, samples were obtained from only two of their four walls. The sampling locations installed around the tanks were designated GP-013, GP-014, GP-015, GP-016, GP-017, GP-018, GP-019 and GP-020. Samples secured from these locations were secured at depths of 8 to 10 feet BEG and 12 to 14 feet BEG for subsequent laboratory analysis.

The majority of the detected soil contamination on the Site was identified proximal to these three abandoned underground petroleum storage tanks. The soil samples secured from around the tanks (locations GP-013 through GP-020) and from the grid sample in the area of the tanks (location GP-008) were all contaminated with gasoline and diesel related target analytes (including their transformation analytes). The soil samples generated the highest contaminant concentrations at a depth of 12 feet BEG. Said depth corresponds to the base of the storage tanks. The highest single concentration of any organic analyte detected from these sample locations was 20,500 parts per billion (ppb) of 1,2,4-trimethylbenzene (location GP-016 at a depth of 12 feet BEG). The concentrations of target analytes detected within samples secured from 7 of the 8 probes sited around the storage tanks were elevated above the applicable SCGs.

3.1.3 Pollution Source PS-7

This structure consisted of a large rectangular cut within the floor. The feature measured approximately forty feet in length (running north-south) and five feet in width (east-west). This appeared to be a former engine service pit that was filled-in and capped with a concrete patch. There were a number of cut-outs and discontinuities within the cap that were potentially utilized as floor drains. Therefore, it was suspected that said feature, as defined by its function, represented an abandoned underground injection well (if it had an earthen invert) or a semi-permeable tank (if it had a concrete invert). Said feature was subjected to a destructive survey.

The structure was accessed with a masonry cutting saw and a hydraulic probing tool. The tool penetrated the feature to its base (7 feet below grade), which was confirmed to be solid concrete bottom. The medium used to backfill the pit was observed to be stained with a petrochemical substance. Said substance exhibited a gasoline-like odor. The feature was determined to contain four feet of standing water as evidenced by observations made on the probe rods (rods were wet). This structure was determined to function as a semi-permeable storage tank. As such, it was identified as a confirmed non-point pollution source.

To evaluate the impact of this source on Site groundwater quality, three groundwater samples, identified as GP-034-GW01, GP-035-GW01 and GP-036-GW01 were secured from locations hydraulically down-gradient of the source location. Additionally, three groundwater samples, identified as GP-021-GW01, GP-029-GW01 and GP-030-GW01 were secured from locations hydraulically up-gradient of the source location.

3.1.4 Pollution Source PS-8

This structure consisted of a large rectangular cut within the floor. The structure measured approximately forty feet in length (running north-south) and four feet in width (east-west). This appeared to be a former engine service pit (used to access the bottom of vehicle mounted engines) that was filled-in and capped with concrete. There were a number of cut-outs and discontinuities within the cap that were potentially utilized as floor drains. Therefore, it was suspected that said feature, as defined by its function, represented an abandoned underground injection well (if it had an earthen invert) or a semi-permeable tank (if it had a concrete invert). Said structure was subjected to a destructive survey.

The structure was accessed with a hydraulic probing tool. The tool penetrated the feature to its base (6 feet below grade), which was determined to be solid concrete bottom. The structure was determined to contain standing water as evidenced by observations of liquid on the probe rods. This structure was determined to function as a semi-permeable storage tank. As such, it was identified as a confirmed non-point pollution source.

To evaluate the impact of this source on Site groundwater quality, three groundwater samples, identified as GP-035-GW01, GP-036-GW01 and GP-037-GW01 were secured from locations hydraulically down-gradient of the source location. Additionally, three groundwater samples, identified as GP-021-GW01, GP-022-GW01 and GP-023-GW01 were secured from locations hydraulically up-gradient of the source location.

3.2 Development, Screening and Selection of Remedial Alternatives

3.2.1 Remedial Action Objectives

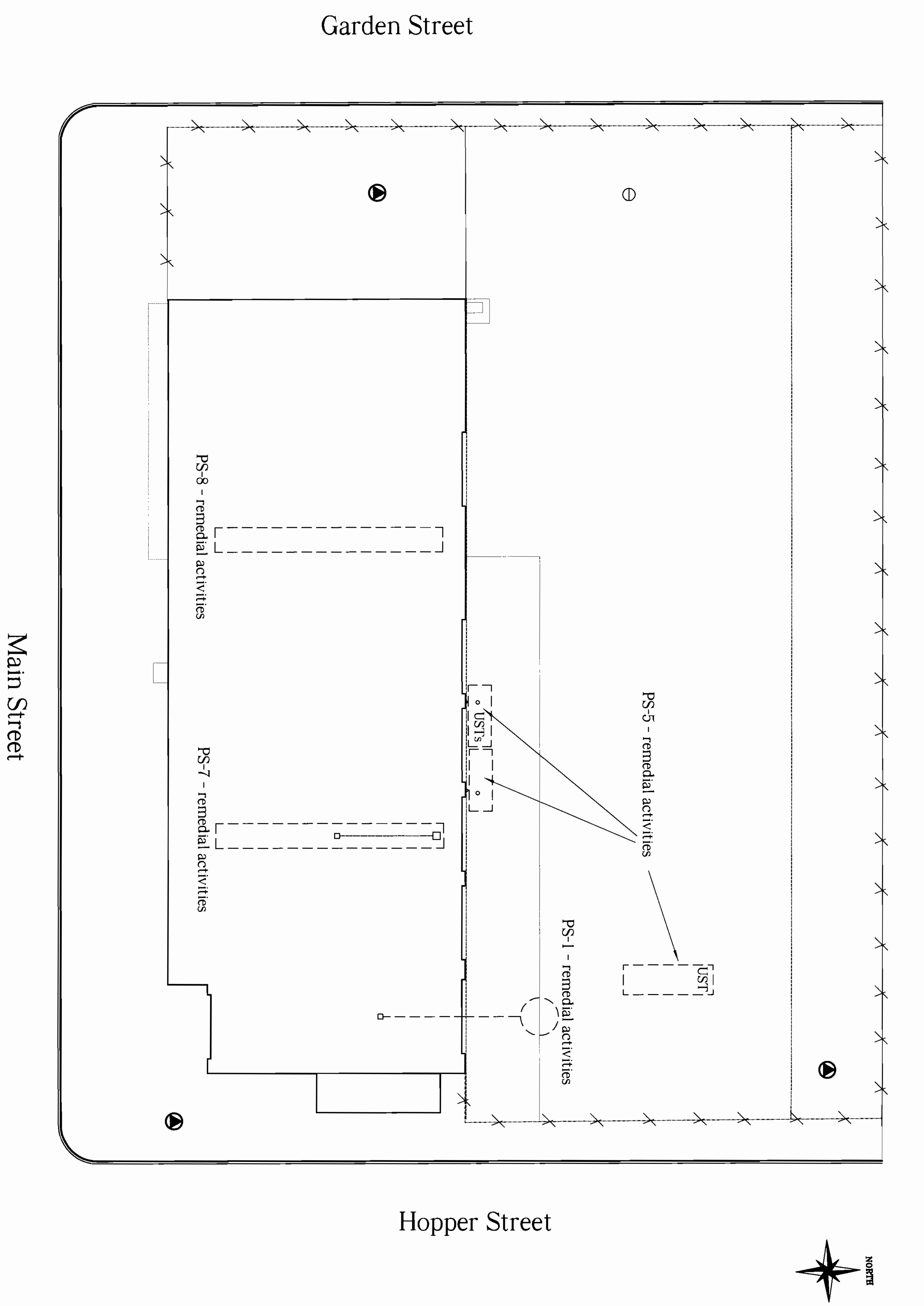
The remedial action objectives for the IRM activities proposed for the pollution sources at the Site are to permanently remove or significantly decrease the toxicity, mobility and volume of contaminants in accordance with the applicable New York State Standards, Criteria and Guidelines (SCGs). The purpose of meeting these objectives shall be for the overall protection of human health and the environment. The applicable SCGs for Site soil quality is defined under the New York State Department of Environmental Conservation Technical and Administrative Guidance Memorandum (TAGM) #4046, Determination of Soil Cleanup Objectives. The applicable SCGs for Site air quality is defined under the New York State Department of Environmental Conservation Guidelines for the Control of Toxic Ambient Air Contaminants, DAR-1, Air Guide 1.

3.2.2 Development and Screening of Remedial Alternatives

The development of remedial alternatives will consider four fundamental options based on the nature and extent of contaminants identified at the Site pollution sources. The primary contaminants identified at the Site from the performance of the FRI consisted of industrial organic and inorganic contaminants. The remedial alternatives to be considered for the Site pollution sources include: 1) removal and off-site disposal; 2) in-situ treatment or extraction; 3) isolation; and 4) no action, and are discussed below.

Removal and Off-Site Disposal

The remedial alternative identified as removal and off-site disposal involves the physical removal of contaminated media from a known pollution source and the off-site disposal of the contaminated media at a proper waste disposal facility. This type of remedial action is limited by the nature and extent of the contaminants, and the capabilities of the construction equipment performing the work. The nature of the contaminants, which includes type and concentrations, must be within acceptable limits for waste disposal facilities to receive and properly dispose of



IMPACT ENVIRONMENTAL
a division of Impact Environmental Consulting Inc.
1 Village Plaza
Kings Park, New York 11754
631.269.8800 TELEPHONE
631.269.1599 FACSIMILE

98-335

Plate 3: Pollution Source Map

Westbury, New York

Legend
- monitoring well
- groundwater probe node
- soil probe node

scale: 1" = 20'

the waste. The location and extent of the contaminants may limit the ability of conventional construction equipment to adequately remove the soil contamination. Therefore, an assessment of the horizontal and vertical extent of Site contaminants requiring remedial action must be determined. This includes determining the accessibility of the construction equipment into the location of source area (i.e. within a building). This type of remedial action will sufficiently meet the remedial action objectives to permanently remove contaminants (in a timely fashion) when performed on pollution sources that are limited or isolated in extent. To assess the effectiveness of this type of remedial action, it is necessary to design and implement a sampling and analysis program subsequent to the performance of the remedial activities. This program will include securing representative samples for analysis to determine if any residual contamination exists at the pollution source. If residual contaminants are identified at a pollution source exceeding the applicable SCGs subsequent to the performance of remedial activities, it may be necessary to consider further remedial alternatives to meet remedial action objectives.

In-Situ Treatment or Extraction (Non-Biological)

The remedial alternative identified as in-situ extraction involves the in-place treatment of contaminated media by technological processes without the physical removal of the affected media. The contaminants are stripped or volatilized from the contaminated media by altering subsurface conditions to that which induces the removal of contaminants. This type of remedial action will mitigate or permanently remove contaminants from the affected media over a certain time period. The time period and effectiveness for which the contaminants are removed or extracted is dependent on the nature and extent of the contaminants at the pollution sources and the subsurface geology at the Site. The nature of the contaminants must be primarily composed of compounds with relatively light molecular weights. Such compounds typically consist of volatile organic compounds and are readily volatilized upon introducing vacuum pressures into the subsurface. The extent of the contaminants at the pollution sources must be significantly beyond the capabilities of the removal and disposal remedial alternative. The extent of the contamination is typically greater than ten feet below grade and has a significant volume. When applying this type of remedial action, Site-specific factors such as geology and hydrology must be considered. The soil type that is being treated must have an adequate porosity and permeability for the contaminants to desorb and/or volatilize. In addition, the groundwater elevations must be typically greater than five feet below grade. To assess the effectiveness of this type of remedial action, it may be necessary to secure representative samples of the affected media in the future to monitor the progress or completeness of the action for meeting the applicable SCGs.

The contaminants stripped from the affected media using this type of remedial action are typically released into the atmosphere. Remedial action objectives for this type of remedial action must consider potential risks of human exposure from contaminants leaving one media (soil) and entering another media (air). For this reason, it is necessary to assess the contaminant concentrations entering the atmosphere to protect human health. This assessment includes gauging the air quality at a release point from the treatment or extraction technology system. In addition, these activities will determine, in part, the effectiveness of the remedial action technology. Based on the rate of contaminant concentrations extracted from the pollution source, it may be necessary to filter or treat the air effluent to meet comprehensive remedial action objectives. To assess the air quality entering the atmosphere, it is necessary to design and implement an operation and maintenance plan during the operation of the remedial technology. This program will include securing representative air samples for analysis to determine what level, if any, of air treatment is necessary. If required, the treatment of air may be implemented using carbon charcoal filters. The waste retained in the filters will require subsequent removal and proper disposal at an off-site disposal facility.

Bio-Inoculation

In-situ groundwater bioremediation is a technology that encourages growth and reproduction of indigenous microorganisms to enhance biodegradation of organic compounds in the saturated zone. In-situ groundwater bioremediation can effectively degrade organic compounds that are dissolved in groundwater. In-situ groundwater bioremediation can be effective for the full range of petroleum hydrocarbons. The low-molecular-weight, more water soluble compounds are degraded more rapidly and to lower residual levels than are high-molecular-weight, less soluble compounds.

Bioremediation generally requires a mechanism for stimulating and maintaining the activity of these microorganisms. This mechanism is usually an inoculation for providing one or more of the following: An electron acceptor (oxygen, nitrate); nutrients (nitrogen, phosphorus); and an energy source (carbon). Generally, electron acceptors and nutrients are the two most critical components of any bio-inoculation.

The key parameters that determine the effectiveness of in-situ groundwater bioremediation are:

- hydraulic conductivity of the aquifer, which controls the distribution of electron acceptors and nutrients in the subsurface.
- biodegradability of the petroleum constituents, which determines both the rate and degree to which constituents will be degraded by microorganisms.
- location of contamination in the subsurface.
- Contaminants must be dissolved in groundwater or adsorbed onto more permeable sediments within the aquifer.

In general, the aquifer medium will determine hydraulic conductivity. Fine-grained media (e.g., clays, silts) have lower permeability than coarse-grained media (e.g., sands, gravels). Bioremediation is generally effective in permeable (e.g., sandy, gravelly) aquifer media. However, depending on the extent of contamination, bioremediation also can be effective in less permeable silty or clayey media. In general, an aquifer medium of lower permeability will require longer to clean up than a more permeable medium. Soil structure and stratification are important to in-situ groundwater bioremediation because they affect groundwater flow rates and patterns when water is extracted or injected. Structural characteristics such as microfracturing can result in higher permeabilities than expected for certain soils (e.g., clays). In this case, however, flow will increase in the fractured media but not in the unfractured media. The stratification of soils with different permeabilities can dramatically increase the lateral flow of groundwater in the more permeable strata while reducing the flow through less permeable strata. This preferential flow behavior can lead to reduced effectiveness and extended remedial times for less-permeable strata.

The biodegradability of a petroleum compound is a measure of its ability to be metabolized by hydrocarbon-degrading bacteria or other microorganisms. The chemical characteristics of the contaminants will dictate their biodegradability. For example, heavy metals are not degraded by bioremediation. The biodegradability of organic compounds depends on their chemical structures and physical/chemical properties (e.g., water solubility, water partition coefficient). Highly soluble organic compounds with low molecular weights will tend to be more rapidly degraded than slightly soluble compounds with high molecular weights. The low water solubilities of the more complex compounds render them less bioavailable to petroleum-degrading organisms. Consequently, the larger, more complex chemical compounds may be slow to degrade or may even be recalcitrant to biological degradation.

The location, distribution, and disposition of petroleum contamination in the subsurface can significantly influence the likelihood of success for bioremediation. This technology generally works well for dissolved contaminants and contamination adsorbed onto higher permeability sediments (sands and gravels). However, if the majority of contamination is (1) in the unsaturated zone; (2) trapped in lower permeability sediments, or (3) outside the "flow path" for nutrients and electron acceptors, this technology will have reduced impact or no impact.

Nutrient injection systems may not be necessary at all, if the groundwater contains adequate amounts of nutrients, such as nitrogen and phosphorus. Microorganisms require inorganic nutrients such as nitrogen and phosphate to support cell growth and sustain biodegradation processes. Nutrients may be available in sufficient quantities in the aquifer but, more frequently, nutrients need to be added to maintain adequate bacterial populations.

Isolation or Capsulation

The remedial alternative identified as isolation involves the controlled containment or capsulation of contaminants at Site pollution sources. The contaminants at the pollution sources are isolated in mobility by designing barriers or containment structures that prevent or limit migration pathways. This alternative is effective in the short-term by reducing human health exposure risks. However, this alternative does not decrease the toxicity or volume of the contaminated media for long-term effectiveness and therefore will not meet the applicable SCGs.

The pollution source remains persistent in the environment and may be exposed in the future during property redevelopment or demolition activities.

Natural Attenuation

The remedial alternative identified as no action involves the natural attenuation or breakdown of contaminants at pollution sources without any remedial action. This type of remedy will not permanently remove or significantly decrease the toxicity, mobility and volume of contaminants in the short-term. This type of remedy is typically limited to pollution sources that pose nominal risk to human health and the environment. The long-term effectiveness is dependant on the nature and extent of the contaminants at the Site pollution sources. Site pollution sources that are relatively persistent in the environment will typically exhibit residual traces of contaminants over prolonged time and present future exposure and pathway risks.

3.2.3 Selection of Remedial Alternatives

The primary consideration for selecting the remedial alternatives for the Site pollution sources was effectiveness in achieving remedial action objectives. Each remedial alternative was evaluated for technical and administrative feasibility. The following presents the remedial alternatives selected for each individual pollution source identified at the Site.

Code	Pollution Source Structures	Selected Remedial Alternative
PS-1	Underground Injection Well	Removal and In-Situ Extraction
PS-5	Underground Storage Tanks	Removal
PS-7 and PS-8	Service Pits	Removal

Based on an understanding of the nature and extent of pollution sources identified from the performance of the FRI, the remedial alternatives selected for the Site include removal / off-site disposal and in-situ extraction or a combination of each. The pollution sources that will be most appropriately addressed by removal and off-site disposal include the underground storage tanks (PS-5) and the abandoned service pits within the building (PS-7 and PS-8). These pollution sources were determined to be isolated to Site soil or contained within Site structures. Further, the vertical extent of these pollution sources are limited in depth and can be effectively removed by conventional construction equipment. The nature of these pollution sources primarily consists of non-hazardous industrial petroleum waste, which should be accepted into a disposal facility at a reasonable cost. This selection should sufficiently meet the remedial action objectives and the applicable SCGs.

The remedial action alternatives selected for pollution source PS-1 will consist of removal and off-site disposal in conjunction with in-situ extraction. The nature of the contaminants identified within the underground injection well (PS-1) consisted of industrial organic and inorganic compounds. The depth of the inorganic contaminants confined within the structure extended to approximately eighteen feet below grade (presumed invert of the structure). The depth of the organic contaminants existed beyond the base of the structure and extended into the subsurface soil approximately forty-five feet below grade. It was determined that the organic contaminant concentrations were below the applicable SCGs at an approximate depth of thirty-five feet below grade. Accordingly, the removal and off-site disposal alternative will be applied to permanently remove the organic and inorganic contaminated soil to an approximate depth of eighteen feet below grade. This contaminated media, which is considered hazardous waste (F002) will be removed from the Site and disposed of at an appropriate disposal facility. The organic contaminated soil (contained-in) that will remain in the soil subsequent the removal and disposal process will be mitigated utilizing a soil vapor extraction system. The operation of this remedial technology will enhance the soil quality of the pollution source over time to sufficiently meet the applicable SCGs by significantly decreasing the toxicity, mobility and volume of the organic contaminants.

3.3 Detailed Analysis of Remedial Alternatives

3.3.1 Removal and Off-Site Disposal at PS-1, PS-5, PS-7 & PS-8

PS-1

The underground injection well, identified as PS-1 in the FRI, will be uncovered and accessed utilizing a backhoe. The contaminated sediment within the underground injection well will be excavated to a maximum depth feasible utilizing a clam shell. The objective of the excavation activities will be to remove contaminated sediment to the invert or base of the structure. The underground injection well structure will remain unaffected from the removal activities to efficiently remove the contaminated sediment. Prior to excavation activities, the ground surface of this area will be covered with heavy gauge plastic sheeting to prevent the potential contact between any spilled contaminated soil with the ground surface. The contaminated sediment removed from the underground injection well will be placed in a dedicated waste container for subsequent removal and off-site disposal. Upon removal of the contaminated sediment to the extent feasible, the waste container will be covered with plastic sheeting for vapor suppression. A sampling and analysis plan will be implemented preceding the backfilling of the excavation.

One sample will be secured from the invert of the excavation. The sample will be analyzed utilizing USEPA Test Method 6010 for priority pollutant inorganic analytes consistent with the data quality objectives performed for the FRI. The open excavation will be backfilled with clean fill (sand) to grade. The contaminated media will be transported by a licensed waste hauler to an approved waste disposal facility.

PS-5

Three underground storage tanks, identified as PS-5 in the FRI, and their associated piping will be unearthed and removed from the ground utilizing a hydraulic excavator. As necessary, all standing liquids (diesel, gasoline or water residuals) contained within the USTs will be pumped, transported and disposed of as a regulated waste. Subsequent to removal, each of the USTs will be visually inspected for pitting, holes, and corrosion. The USTs will be cut, and the interior surfaces cleaned of all residues and vapors on-Site. The cleaned USTs will be transferred from the property for proper disposal as scrap material. All associated piping and appurtenances will also be removed from the property for proper disposal.

Subsequent to the removal activities, the contaminated soil beneath and surrounding the former USTs will be excavated and placed into a dedicated waste container for subsequent removal and off-site disposal. The contaminated soil will be excavated to a maximum depth feasible. The objective of the excavation activities will be to remove contaminated soil to approximately five feet beneath the former bases of the USTs (approximately twelve to fourteen feet below grade). Upon removal of the contaminated sediment to the extent feasible, the waste container will be covered with plastic sheeting for vapor suppression. A sampling and analysis plan will be implemented preceding the backfilling of the excavation. The sampling and analysis plan will conform the NYSDEC protocol for UST closures as published in the document Spill Prevention and Operations Technology Series No. 14. Approximately six post-excavation endpoint samples will be secured from within each UST excavation. The samples will be analyzed utilizing USEPA Test Method 8021 (STARS) for target volatile organic analytes and USEPA Test Method 8270 (STARS) for target semi-volatile organic analytes consistent with the data quality objectives performed for the FRI. The open excavation will be backfilled with clean fill (sand) to grade. The contaminated media, which will be managed as a non-hazardous industrial waste, will be transported by a licensed waste hauler to an approved waste disposal facility. Upon obtaining data results, the effectiveness of the remedial alternative will be evaluated. If significant residual soil contamination is still present, further remedial alternatives will be considered.

PS-7 & PS-8

Two abandoned service pits, identified as PS-7 and PS-8 in the FRI, will be uncovered and accessed utilizing concrete cutting tools and an excavator. As necessary, all standing liquids (diesel, gasoline or water residuals) contained within the USTs will be pumped, transported and disposed of as a regulated waste.

The contaminated sediment contained within the structures will be excavated to the invert of each structure of approximately seven feet BEG and placed into a dedicated waste container for subsequent removal and off-site disposal. The contaminated sediment will be excavated to the base of the structures. The objective of the excavation activities will be to remove all contaminated soil confined within the service pit structures. Upon removal of the contaminated sediment, the waste container will be covered with plastic sheeting for vapor suppression. A sampling and analysis plan will be implemented preceding the backfilling of the excavation activities. The sampling and analysis plan will include coring through the base of each concrete structure at two locations and securing a soil sample for subsequent analysis. The laboratory analysis of the secured samples will be performed utilizing USEPA Test Method 8260 for target volatile organic analytes and USEPA Test Method 8270 for target base-neutral semi-volatile organic analytes. The data quality objectives performed for the FRI. The open excavation will be backfilled with clean fill (sand) to grade. The contaminated media, which will be managed as a non-hazardous industrial waste, will be transported by a licensed waste hauler to an approved waste disposal facility. Upon obtaining data results, the effectiveness of the remedial alternative will be evaluated. If significant residual soil contamination is still present, further remedial alternatives will be considered.

3.3.2 Soil Vapor Extraction System at PS-1

Overview

Soil vapor extraction (SVE), also known as "soil venting" or "vacuum extraction", is an in situ remedial technology that reduces concentrations of volatile organic compounds adsorbed to soil in the unsaturated (vadose) zone. In this technology, a vacuum is applied through wells near the source of contamination in the soil. Volatile compounds of the contaminant mass "evaporate" and the vapors are drawn toward the extraction wells. In this technology, a vacuum is applied to the contaminated soil through extraction wells that create a negative pressure gradient, which causes movement of vapors toward these wells. Volatile compounds in the vapor phase are readily removed from the subsurface through the extraction wells. The extracted vapors are then treated, as necessary, and discharged to the atmosphere. The increased airflow through the subsurface can also stimulate biodegradation of some of the contaminants. Wells may be either vertical or horizontal. In areas of high groundwater levels, water table depression pumps may be required to offset the effect of upwelling induced by the vacuum.

This technology has been proven effective in reducing concentrations of volatile organic compounds and certain semi-volatile organic compounds. SVE is generally more successful when applied to the lighter (more volatile) molecular weight compounds. Diesel fuel, heating oils, and kerosene, which are less volatile than gasoline and/or solvents, are not readily removed by SVE, nor are lubricating oils, which are non-volatile.

SVE is generally not appropriate for sites with a groundwater table located less than three feet below grade. Special considerations must be taken for sites with a groundwater table located less than 10 feet below the land surface because groundwater upwelling can occur within SVE wells under vacuum pressures, potentially occluding well screens and reducing or eliminating vacuum-induced soil vapor flow.

Design Procedures

The primary factors that determine the design of an SVE system include: 1) permeability of the soil; 2) soil structure and stratification; 3) soil moisture; and 4) depth to groundwater.

- The permeability of the soil affects the rate of air and vapor movement through the soil; the higher the permeability of the soil, the faster the movement and (ideally) the greater the amount of vapors that can be extracted.
- Soil structure and stratification are important to SVE effectiveness because they can affect how and where soil vapors will flow within the soil matrix under extraction conditions. Structural characteristics (e.g., layering, fractures) can result in preferential flow behavior that can lead to ineffective or significantly extended remedial times if they are positioned so that the induced air flow occurs outside the area of contamination.
- High moisture content in soils can reduce soil permeability and, consequently, the effectiveness of SVE by restricting the flow of air through soil pores. Fine-grained soils create a thicker capillary fringe than coarse-grained soils. SVE is generally not effective in treating soils below the top of the capillary fringe unless water table depression pumps are used to draw down the water table.

- In the vicinity of the extraction wells the water table responds to the vacuum by rising, or "upwelling", which can cause the well screen to become submerged thereby reducing airflow.

Pilot Study

Pilot studies are an essential part of the design phase. Data provided by pilot studies is necessary to properly design the full-scale SVE system. Pilot studies provide information on the concentration of volatile organic compounds that are likely to be extracted during the early stages of operation of the SVE system. A pilot test will be conducted for evaluating SVE effectiveness and design parameters for the Site. The pilot study will include a short-term extraction of soil vapors from a cluster well (multiple depth screened intervals). Different extraction rates and wellhead vacuums will be applied to the extraction well to determine the radius of influence and optimal operating conditions. Three (3) 1-inch piezometer wells will be installed at radial distances of ten (10), seventeen and one half (17.5) and twenty-five (25) feet away from the primary extraction well (cluster well). The piezometer wells will be screened from twenty (20) to sixty (60) feet below grade and constructed typical to monitoring well installation. Vacuum pressures readings will be taken at the piezometer wells to provide data for determining the radius of influence of the negative pressure gradient applied. Vapor concentrations will also measured at the effluent air stream during the pilot study to estimate initial vapor concentrations of a full-scale system. The vapor concentration, vapor extraction rate and vacuum data will also be used in the design process to select extraction and treatment equipment. In addition, the vent stack height of the SVE will be determined through the pilot study.

Design Radius of Influence (ROI) is the most important parameter to be considered in the design of an SVE system. The ROI is defined as the greatest distance from an extraction well at which a sufficient vacuum and vapor flow can be induced to adequately enhance volatilization and extraction of the contaminants in the soil. Where applicable, extraction wells should be placed so that the overlap in their radii of influence completely cover the area of contamination.

Surface seals might be included in an SVE system design to prevent surface water infiltration that can reduce air flow rates, reduce emissions of fugitive vapors, prevent vertical short-circuiting of air flow, or increase the design ROI. These results are accomplished because surface seals force fresh air to be drawn from a greater distance from the extraction well. If a surface seal is used, the lower pressure gradients result in decreased flow velocities. This condition may require a higher vacuum to be applied to the extraction well.

Soil Vapor Extraction Well

One vertical soil vapor extraction well will be installed on the Site using a six-inch hollow stem auger. The well will be sited within the former underground injection well area (PS-1). The screen of the SVE well will be set within the vadose zone from twenty to forty feet below grade. The well will be constructed with 2 inch PVC 20 slot screen. A filtration media will be used at the screened section and a bentonite seal will be provided above the screened section two to three feet thick. The balance of the well will consist of riser and backfilled with grout.

SVES Piping

All associated piping, to the SVE system and from the extraction well will be constructed of two inch Schedule 40 PVC. Pressure connection and joints will be applied to all joints of the piping network. The extraction well will be piped to the recovery area utilizing schedule 40 PVC piping and connected to a regenerative blower. The recovery equipment will be housed within the vestibule within the eastern portion of the building.

Start-Up

The SVE system will be optimized to match the operational parameters calculated during the system design. After eight hours of operation, a stack effluent sample will be acquired to verify SVES emissions.

Pollution Control

Air emission rates will be calculated utilizing Site-specific data to determine if the unit is operating within the applicable SCGs for air stripper emission limits. If the emission levels tested during system start-up or during operation, exceed said limits, the air emissions will be treated with vapor phase granulated activated carbon filter pollution control device.

3.4 Solid Waste Management

3.4.1 Estimation of Contaminated Media Volume

The extent of contaminants at the Site pollution sources will present a limiting factor for determining the appropriate remedial alternative. Specifically, the estimated volume of contaminated media at each pollution source can be used as a determining factor for the feasibility of a remedial alternative. The following table provides an estimation of the volume of contaminated soil based on performance of the FRI at the Site pollution sources.

Pollution Source	Area	Depth	In-Place Estimated Volume of Contaminated Media
PS-1	50 ft^2	30 ft	Soil - 1,500 ft^3
PS-5	600 ft^2	12 ft	Soil – 6,000 ft^3
PS-7	230 ft^2	7 ft	Soil – 1,600 ft^3
PS-8	230 ft^2	6 ft	Soil – 1,400 ft^3

3.4.2 Transport and Disposal

The selection of the waste disposal facilities for the contaminated soil will be determined by the analysis of representative samples from each pollution source for waste classification prior to disposal. The two general types of waste classifications are hazardous and non-hazardous waste. The solid waste media from each pollution source that is classified as a hazardous F-waste will be handled pursuant to Title 6 NYCRR Part 371 and EPA 40 CFR 261 regulations, transported with waste manifests and disposed in accordance with Title 6 NYCRR Part 360 regulations. Solid waste classified as a hazardous waste shall be transported to and disposed of at the following disposal facility:

Horizon Environmental, Inc.
120 Route 155
Grandes-Piles (Champlain), Canada
USEPA ID Number NYR000078964

The solid waste media from each pollution source that is classified as a non-hazardous waste will be handled, transported with waste charters and disposed in accordance with Title 6 NYCRR Part 371 and EPA 40 CFR 261 Criteria. The following table presents the selected waste disposal facilities corresponding to the waste classification of the contaminated media. Solid waste classified as a non-hazardous waste shall be transported to and disposed of at the following disposal facility:

Soil Remediation of Philadelphia, Inc.
3201 South 61st Street
Philadelphia, Pennsylvania
Facility Permit Number 301220