# PHASE II REMEDIAL INVESTIGATION

**Sunnyside Yard**
**Queens, New York**

**Volume I of V**

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# ACRONYM AND UNIT DEFINITIONS

| | |
|---|---|
| **ADT** | Aquifer Drilling and Testing, Inc. |
| **AMTRAK** | National Railroad Passenger Corporation |
| **API** | American Petroleum Institute |
| **ARARs** | applicable or relevant and appropriate requirements |
| **ASP** | Analytical Services Protocols |
| **ASTM** | American Society for Testing and Materials |
| **ATSDR** | Agency for Toxic Substances and Disease Registry |
| **bls** | below land surface |
| **BTEX** | benzene, toluene, ethylbenzene and xylenes |
| **CERCLA** | Comprehensive Environmental Response, Compensation and Liability Act |
| **CFR** | Code of Federal Regulations |
| **CLP** | Contract Laboratory Program |
| **Conrail** | Consolidated Rail Corporation |
| **Eh** | redox potential |
| **ELAP** | Environmental Laboratory Approval Program |
| $f_{oc}$ | fraction organic carbon |
| **FOIA** | Freedom Of Information Act |
| **FS** | feasibility study |
| $ft^3$ | cubic feet |
| **ft/d** | feet per day |
| $ft^2/d$ | square feet per day |
| **ft/ft** | feet per foot |
| **Galson** | Galson Laboratory |
| **gpm** | gallons per minute |

| | |
|---|---|
| $I_H$ | horizontal hydraulic gradient |
| $I_V$ | vertical hydraulic gradient |
| **IEA** | Industrial and Environmental Analysis, Inc. |
| **IRM** | interim remedial measures |
| $K_d$ | distribution coefficient |
| $K_H$ | horizontal hydraulic conductivity |
| $K_{oc}$ | organic carbon partition coefficient |
| $K_{ow}$ | octanol-water partition coefficient |
| $K_V$ | vertical hydraulic conductivity |
| $K_V:K_H$ | anisotropy |
| **LAW** | Land, Air, Water Environmental Services, Inc. |
| **LIRR** | Long Island Rail Road |
| **MCL** | Maximum Contaminant Level |
| **MCLG** | Maximum Contaminant Level Goals |
| **mg/kg** | milligrams per kilogram |
| **μg/kg** | micrograms per kilogram |
| **mg/L** | milligrams per liter |
| **μg/L** | micrograms per liter |
| **n** | porosity |
| $n_e$ | effective porosity |
| **NAC** | Northeastern Analytical Corporation |
| **NCP** | National Contingency Plan |
| **ND** | Not detected |
| **NJTC** | New Jersey Transit Corporation |
| **NTUs** | nephelometric turbidity units |

| | |
|---|---|
| **NYCRR** | New York Code of Rules and Regulations |
| **NYSDEC** | New York State Department of Environmental Conservation |
| **OOC** | Order On Consent |
| **ORS** | Oil Recovery Systems |
| **PAHs** | polycyclic aromatic hydrocarbons |
| **PCBs** | polychlorinated biphenyls |
| **PHCs** | petroleum hydrocarbons |
| **PID** | photoionization detector |
| **POTWs** | Publicly-Owned Treatment Works |
| **ppb** | parts per billion |
| **ppm** | parts per million |
| **PVC** | polyvinyl chloride |
| **QA/QC** | quality assurance/quality control |
| **R** | retardation factor |
| **RA** | Risk Assessment |
| **RCRA** | Resource Conservation and Recovery Act |
| **RI** | Remedial Investigation |
| **RMEI** | reasonable maximum exposed individual |
| **RSCOs** | Recommended Soil Cleanup Objectives |
| **S** | elastic storage coefficient |
| **$S_y$** | water-table storage coefficient/specific yield |
| **SCGs** | standards, criteria and guidance |
| **SMP** | Standard Motor Products, Inc. |
| **SVOCs** | semivolatile organic compounds |
| **T** | transmissivity |

| | |
|---|---|
| **TAGM** | Technical and Administrative Guidance Memorandum |
| **TAL** | Target Analyte List |
| **TBC** | To Be Considered |
| **TCL** | Target Compound List |
| **TICs** | tentatively identified compounds |
| **TSCA** | Toxic Substance Control Act |
| **USC** | United States Codification |
| **USEPA** | United States Environmental Protection Agency |
| **USGS** | United States Geological Survey |
| **UST** | underground storage tank |
| $\mathbf{v}$ | velocity |
| $\mathbf{v_c}$ | velocity of the compound of interest |
| **VOCs** | volatile organic compounds |
| **Yard** | Sunnyside Yard, Queens, New York |
| $\rho$ | density |

PHASE II REMEDIAL INVESTIGATION
Sunnyside Yard
Queens, New York

## EXECUTIVE SUMMARY

On behalf of the National Railroad Passenger Corporation (AMTRAK) and the New Jersey Transit Corporation (NJTC), a Phase II Remedial Investigation (RI), including an Addendum, was performed at the Sunnyside Yard, Queens, New York (Yard) by Roux Associates, Inc. (Roux Associates) from August 1992 through August 1994. This work was performed in accordance with the August 5, 1992 "Work Plan for the Phase II Remedial Investigation, Sunnyside Yard, Queens, New York" (Roux Associates, Inc., 1992b) and the August 4, 1993 "Addendum to the August 5, 1992 Work Plan for the Phase II Remedial Investigation, Sunnyside Yard, Queens, New York" (Roux Associates, Inc., 1993j). These work plans were prepared in accordance with the provisions of the Order On Consent (OOC), Index #W2-0081-87-06 between the New York State Department of Environmental Conservation (NYSDEC), AMTRAK and the NJTC and were approved by the NYSDEC prior to implementation.

The Phase II RI work plan was prepared to address the additional delineation recommended by Roux Associates in the January 22, 1992 report titled "Phase I Remedial Investigation, Sunnyside Yard, Queens, New York" (Roux Associates, Inc. 1992a). During performance of the Phase II RI, the integrity of a monitoring well (MW-2) previously installed at the Yard was deemed questionable by the NYSDEC and, therefore, so was the current delineation of the separate-phase petroleum accumulation in Area 1. Furthermore, before the NYSDEC would accept any additional data from the wells, the integrity and usability of each of the previously-installed wells needed to be demonstrated to the NYSDEC. The additional delineation indicated that the separate-phase petroleum accumulation was more arealy extensive than originally estimated. The original estimate was based, in part, on data derived from the previously-installed wells. Based on a review of the results of the above-referenced delineation of the separate-phase petroleum accumulation, the Phase II Addendum work plan was prepared.

At the request of the NYSDEC, the results of two investigations performed between the Phase I RI and Phase II RI were incorporated into this report:

- delineation of the off-site extent of the separate-phase petroleum accumulation in Area 1; and
- investigation and abandonment of the underground storage tank [UST] located in Area 2.

The following additional RI-related work is in progress or was recently completed at the Yard.

- additional investigation of the sewer system;
- additional delineation of polychlorinated biphenyls (PCBs) in soil within Areas of Concern 8, 9 and 17; and
- implementation of the interim remedial measures (IRM) system to mitigate the separate-phase petroleum accumulation in Area 1.

The results of this work have also been incorporated into this Phase II RI document.

The Phase II RI report summarizes all soil and ground-water quality, and geologic and hydrogeologic data generated by Roux Associates during the above-mentioned investigations. These data were utilized in conjunction with data developed during previous investigations to characterize environmental conditions at the Yard. The results from the Baseline Risk Assessment performed at the Yard were incorporated into this report, where appropriate. Additionally, the Phase II RI report identifies areas which require further investigation, IRMs, or consideration during the feasibility study (FS).

Based on all the data that Roux Associates has developed for the Yard and included in this report, the following conclusions have been reached.

## HYDROGEOLOGY

- The Yard is underlain by the following units; fill (predominantly comprised of reworked glacial deposits and railroad ballast), Upper Pleistocene glacial deposits (predominantly comprised of unstratified, poorly sorted mixtures of sand, silt, clay and gravel), and bedrock.

- Based on historical maps, the pre-construction topography of the Yard has undergone substantial changes before obtaining its current, generally flat topography. In general, the southern and eastern portions of the Yard have been scraped down (by as much as 45 feet), and the western portion of the Yard, including part of Dutch Kills, has been filled with that material.

- Ground water beneath the Yard occurs under water-table (unconfined) conditions. The water table lies between 1 and 15 feet below land surface and occurs in either fill deposits (e.g., western part of Yard) or the Upper Pleistocene glacial deposits (e.g., eastern part of Yard). The saturated Upper Pleistocene deposits comprise the Upper Glacial aquifer. Ground water within the shallow deposits flows predominantly west beneath the Yard with some northerly and northwesterly components. Ground water in the deeper deposits predominantly flows west across the Yard.

## SOIL QUALITY

- No VOCs were detected in Yard soil above recommended soil cleanup objectives (RSCOs).

- Nine semivolatile organic compounds (SVOCs), all of which were polynuclear aromatic hydrocarbons (PAHs), were detected above RSCOs. However, since PAHs are ubiquitous in soil, only two compounds (benzo[a]pyrene and chrysene) exceeded the Agency for Toxic Substances and Disease Registry (ATSDR) background ranges for PAHs in urban soil.

- Six metals were detected in Yard soils at concentrations significantly above Yard background ranges; arsenic, copper, lead, mercury, nickel and zinc.

- PCBs were detected above the RSCO of 1,000 micrograms per kilogram ($\mu$g/kg [i.e., 1 part per million]) for shallow soil in 44 of 57 samples analyzed at the Yard. Five of the 18 deeper soil samples analyzed contained PCBs above the RSCO of 10,000 $\mu$g/kg (10 parts per million [ppm]) for deep soil. In addition, all detections of PCBs above 10,000 $\mu$g/kg (10 ppm) were limited to Areas 1, 8, 9 and 17, and will be addressed either as an IRM or in the FS.

- PCBs are the only chemicals present at concentrations above the cleanup objectives developed in the baseline risk assessment (RA).

## SEPARATE-PHASE PETROLEUM CHARACTERISTICS

- The separate-phase petroleum accumulation has been delineated, and is proven to be limited to Area 1, and does not extend offsite beyond the LIRR property boundary. The estimated total volume of the petroleum accumulation is 72,700 gallons, with only 25,450 gallons (35 percent) considered recoverable by conventional methods (i.e., pumping). Nearly 20 percent of the recoverable petroleum (approximately 4,300 gallons) has already been recovered by the IRM system.

- Two isolated occurrences of separate-phase petroleum in Area 1 have also been delineated. However, a sheen on the water table beneath Area 7, which appears to be an isolated occurrence of limited extent, has not been delineated. In addition, the source of the sheen has not been identified. No separate-phase petroleum occurrences have been noted outside of Areas 1 and 7.

## GROUND-WATER QUALITY

- Only four monitoring wells at the Yard contained VOCs in excess of ground-water standards: MW-61, MW-43, MW-44D and MW-63. All of the VOCs that exceeded ground-water standards are chlorinated solvents. Based on ground-water flow patterns at the Yard, all exceedances appear to be directly attributable to offsite, upgradient sources.

- No SVOCs were detected above ground-water standards at the Yard. The low concentrations of SVOCs that were detected within the Yard were limited to two areas of concern: Area 1 and Area 12.

- Eleven metals were detected above ground-water standards at the Yard. However, many of these detections are representative of upgradient ground-water conditions in this industrialized area, or are naturally occurring metals related to anoxic conditions (i.e., manganese and iron) and/or historic salt-water intrusion of the aquifer (i.e., sodium). Metals detected within background ranges are considered to be attributable to natural conditions and not related to Yard activities.

- Ten metals were detected above the ground-water standards in Monitoring Well MW-46, with the highest concentration of each of seven metals occurring in this well.

- No PCBs were detected above ground-water standards at the Yard. Although a limited number of ground-water samples at the Yard contained PCBs, all but one (MW-25A) of the detections were shown to be attributable to suspended sediment (i.e., turbid samples) and/or the collection of PCB-contaminated petroleum (i.e., samples from wells with sheens), and are therefore not representative of ground-water quality.

- No pesticides were detected in Yard ground water.

## SEWER WATER AND SEWER SEDIMENT QUALITY

- No VOCs, SVOCs or metals were detected in sewer-water samples above the applicable standards defined in the New York City Sewer Use Regulations or the Class SD surface-water standards. No PCBs were detected in the sewer-water samples collected from the secondary sewer system. Low levels of total PCBs, ranging from 0.20 µg/L (0.00020 ppm) to 20.6 µg/L (0.0206 ppm), were detected in the unfiltered sewer-water samples collected in seven manholes within the primary sewer system. However, PCBs were only detected at those sampling points having PCBs in sewer-sediment samples and no PCBs were detected in the filtered sewer-water samples, indicating that these detections may be representative of suspended sediment in the sewer water.

- PCBs were detected in all sewer-sediment samples collected within both the primary and secondary sewer systems.

- Work in progress at the Yard, consisting of sewer sediment removal and sewer system monitoring, will determine if a source of PCBs still exists at the Yard or if the detections are residual PCBs caused by an historical source or sources.

## RISK ASSESSMENT RESULTS

- The RA determined that only a limited number of chemicals of potential concern have been released to the environment and that, in general, workers at the Yard are not at a significant risk.

- None of the non-PCB chemicals exceed the cleanup objectives developed in the RA.

- Only three PCBs (Aroclor-1248, Aroclor-1254 and Aroclor-1260) are present in concentrations above the cleanup objectives developed in the RA.

## RECOMMENDATIONS

Based on an assessment of the absence of risks associated with the current environmental conditions at the Yard (Roux Associates, Inc., 1995) and the absence of Yard-related impacts to ground water, no further action is recommended for: Areas 2 through 6, and Areas 10 through 15. In addition, Area 16 was previously removed from the RI/FS program at the request of the NYSDEC.

Although the RA evaluated site-specific considerations (i.e., occupational exposure) and the cleanup levels are 69 ppm for Aroclor-1260 and 180 ppm for Aroclor-1254, Roux Associates recommends an action level of 50 ppm to add an additional margin of safety for the Yard workers.

To proceed in the most timely and efficient manner, we recommend dividing the components of the Yard into operable units as described below.

1. Consider all media in Area 1 (i.e., soil, ground water and separate-phase petroleum) and the petroleum sheen in adjacent Area 7 as one operable unit (OU-1).
2. Consider the Yard-wide sewer system (i.e., both primary and secondary systems) as one operable unit (OU-2).
3. Consider the soil PCB contamination in Areas 8, 9 and 17 as one operable unit (OU-3).
4. Consider Monitoring Well MW-46 and the associated metals in ground water and soil in Areas 11, 13 and 17 as one operable unit (OU-4).

Prior to performance of the FS, Roux Associates recommends that the additional data needs for OU-1, OU-2 and OU-4 be addressed, and that the proposed IRM to mitigate soil PCB contamination in OU-3 be performed. This approach is designed to result in an FS focused on OU-1, and the remainder of the Yard removed from consideration in the FS. Recommended work for the Yard consists of:

- identification of the source and delineation of the extent of the sheen observed on the water table beneath Area 7 (OU-1);
- completion of the sewer system investigation (already in-progress) to determine if there is an ongoing source of PCBs to the Yard sewer system (OU-2);
- performance of the proposed IRM to excavate soil containing greater than the previously defined action level of 25 ppm total PCBs from Areas 8, 9 and 17 (OU-3); and
- verifying if the concentrations of dissolved metals detected in Monitoring Well MW-46 exceed ground-water standards.

The following components of the Yard will be evaluated in the FS:

- the separate-phase petroleum accumulation in Area 1 (OU-1), which contains varying concentrations of Aroclor-1254 and Aroclor-1260;
- the isolated occurrences of separate-phase petroleum or sheens on the water table within Areas 1 and 7 (OU-1); and
- shallow soils within Area 1 (OU-1), which contain PCBs in concentrations that exceed 50 ppm.

In addition, OU-2 will be addressed in the FS or as an IRM if PCBs are detected in the sewer system following sediment removal, OU-3 will be addressed if the soil IRM is not completed, and OU-4 will be addressed in the FS if ground-water sampling verifies that dissolved metals are present above ground-water standards within Monitoring Well MW-46.

Roux Associates will continue to implement recovery of the separate-phase petroleum accumulation using the IRM system already operational in Area 1 (OU-1). To date, the IRM system has recovered nearly 20 percent of the estimated recoverable petroleum.

## 1.0 INTRODUCTION

On behalf of the National Railroad Passenger Corporation (AMTRAK) and the New Jersey Transit Corporation (NJTC), a Phase II Remedial Investigation (RI), including an Addendum, was performed at the Sunnyside Yard, Queens, New York (Yard) by Roux Associates, Inc. (Roux Associates). The location of the Yard is shown in Figure 1. The Phase II RI was performed from August 1992 through August 1994 in accordance with the August 5, 1992 "Work Plan for the Phase II Remedial Investigation, Sunnyside Yard, Queens, New York" (Roux Associates, Inc., 1992b). The supplemental work (Addendum) was performed in accordance with the August 4, 1993 "Addendum to the August 5, 1992 Work Plan for the Phase II Remedial Investigation, Sunnyside Yard, Queens, New York" (Roux Associates, Inc., 1993j). These work plans were prepared in accordance with the provisions of the Order On Consent (OOC), Index #W2-0081-87-06 between the New York State Department of Environmental Conservation (NYSDEC), AMTRAK and the NJTC and were approved by the NYSDEC prior to implementation.

The Phase II RI work plan was prepared to address the additional delineation recommended by Roux Associates in the January 22, 1992 report titled "Phase I Remedial Investigation, Sunnyside Yard, Queens, New York" (Roux Associates, Inc. 1992a), and was designed to:

- further delineate the extent of contaminants detected during the Phase I RI;
- determine if migration of contaminants in ground water is occurring either onsite or offsite;
- develop additional information regarding the hydraulic relationship between the shallow deposits (i.e., saturated fill and shallow Upper Glacial aquifer) and the deeper Upper Glacial aquifer deposits underlying the Yard;
- investigate the potential for off-site migration of contaminants through the sewer system; and
- confirm the analytical results presented in the Phase I RI report.

During performance of the Phase II RI, the integrity of a monitoring well (MW-2) previously installed at the Yard by Geraghty & Miller, Inc. (Geraghty & Miller) was deemed questionable (due to well construction problems) by the NYSDEC and, therefore, so was the current delineation of the separate-phase petroleum accumulation in Area 1 (Plates 1 and 2).

Furthermore, before the NYSDEC would accept any additional data from the wells, the integrity and usability of each of the Geraghty & Miller wells needed to be determined. The additional delineation indicated that the separate-phase petroleum accumulation was more arealy extensive than previously estimated. The previous estimate was based, in part, on data derived from the Geraghty & Miller-installed wells.

Based on a review of the results of the above-referenced delineation of the separate-phase petroleum accumulation, the Phase II Addendum work plan was prepared. The Phase II Addendum was designed to:

- further delineate the nature and extent of both the previously delineated and recently detected separate-phase petroleum accumulations in Area 1; and
- develop additional information regarding the hydraulic relationship between the shallow deposits and the deeper Upper Glacial aquifer deposits underlying the Yard.

After the submittal of the Phase I RI report, but prior to commencement of the Phase II RI, two additional (RI-related) investigations were performed at the Yard. The results of these investigations (the delineation of the off-site extent of the separate-phase petroleum accumulation in Area 1 and the investigation and abandonment of the underground storage tank [UST] located in Area 2) were both presented to the NYSDEC in separate reports.

In addition, at the time of this report preparation the following additional RI-related work is in progress:

- additional investigation of the sewer system; and
- implementation of the interim remedial measures (IRM) system to mitigate the separate-phase petroleum accumulation in Area 1.

The Phase II RI report summarizes all soil and ground-water quality, and geologic and hydrogeologic data generated by Roux Associates during the above-mentioned investigations. These data were utilized in conjunction with data developed during previous investigations to characterize environmental conditions at the Yard. Additionally, the Phase II RI report identifies areas which require further investigation.

### 1.1 Site Description

The Yard is located in an urban area in northwestern Queens County, a borough of New York City, New York. The East River is located approximately one mile to the west (Figure 1). The Yard consists of a railroad maintenance and storage facility which encompasses approximately 105 acres. It functions primarily as a maintenance facility for electric locomotives and railroad cars for both AMTRAK and NJTC. The Yard is surrounded by commercial, light industrial and residential areas.

### 1.2 Site History

The Yard was originally constructed in the early 1900's by the Pennsylvania Tunnel and Terminal Company, a subsidiary of the Pennsylvania Railroad (later known as the Penn Central Transportation Company). On April 1, 1976, the Consolidated Rail Corporation (Conrail) acquired the Yard, and the same day conveyed it to AMTRAK, which has continued to operate it as a storage and maintenance facility for railroad rolling stock. Prior to September 29, 1961, a portion of the Yard was owned by the Long Island Rail Road (LIRR). Today, the LIRR maintains right-of-ways through the Yard.

### 1.3 Previous Investigations

Previous work was performed at the Yard prior to Roux Associates beginning the RI. The following list of previous investigations at the Yard is taken from a letter dated November 22, 1989, from Robert T. Noonan, Senior Director - Environmental Control and Industrial Hygiene for AMTRAK, to the NYSDEC in response to Paragraph III of the OOC Index #W2-0081-87-06 (AMTRAK, 1989). This letter lists the five previous investigations for which AMTRAK has records.

1. On November 1, 1983, representatives of Canberra RMC, Pottstown, Pennsylvania, collected thirty-eight soil samples to determine the extent of polychlorinated biphenyls (PCBs) contamination. These samples were taken from the beds of Tracks 5 through 15, and from areas where soil from the beds of Tracks 3 and 4 was known to be deposited. Soil found to be contaminated at a level above 50 parts per million (ppm) was disposed of offsite.

2. On August 21 and 22, 1985, three soil samples were collected by Atlantic Environmental, Dover, New Jersey, in the area surrounding the Engine House. All three samples were determined to have PCB concentrations below 50 ppm.

3. On November 12, 1985, RMC Environmental Services, Pottstown, Pennsylvania, collected two wall scrapings from the Engine House. The test results indicated both samples to have PCB concentrations below 50 ppm.

4. On November 21, 22, 23, 25 and 26, 1985, all stationary transformers located on AMTRAK's New York Division, which includes the Yard, were analyzed for PCBs by RMC Environmental Services. Of the 49 on-site transformers, nine were determined to have PCB levels above 500 ppm, and five transformers had PCB levels between 50 and 499 ppm.

5. Geraghty & Miller, Plainview, New York, was retained by AMTRAK in February 1986 to conduct an investigation of the former UST area, the Engine House, the former Oil House, and the former fuel transformer area to determine if leakage of hydrocarbon compounds had occurred and, if so, to determine the extent of contamination in both soil and ground water. Their June 1986 report, titled "Results of Hydrogeologic Investigation at the AMTRAK, Sunnyside, Queens, New York Train Yard" (Geraghty & Miller, Inc., 1986) concluded that a plume of separate-phase petroleum exists in the area east of the Engine House, and that this plume appears to have originated at the underground storage tanks of the former fuel storage area and has migrated beyond the Yard's northern property boundary. PCB concentrations in this plume ranged from 5 to 360 ppm, with the highest concentrations being detected in samples collected immediately east of the Engine House. PCBs were also detected in soil samples, with concentrations ranging from 0.19 to 24 ppm in the 0 to 2 feet below land surface (bls) interval, but no PCBs were detected in ground water.

Previous investigations by Roux Associates prior to the Phase II RI include the following:

- Phase I RI;
- delineation of the off-site extent of the separate-phase petroleum accumulation in Area 1; and
- investigation and abandonment of the UST located in Area 2.

These are discussed below and results from these investigations are incorporated into this report to offer a broader understanding of the Yard.

### 1.3.1 Phase I Remedial Investigation

On behalf of AMTRAK and the NJTC, a Phase I RI was performed at the Yard by Roux Associates from October 1990 through March 1991. The RI was undertaken in accordance with the document titled "Work Plan for the Remedial Investigation and Feasibility Study, Sunnyside Yard, Queens, New York" (Roux Associates, Inc., 1990). The remedial investigation/feasibility study (RI/FS) work plan was prepared in accordance with the provisions of the OOC, Index #W2-0081-87-06 between the NYSDEC, AMTRAK, and the NJTC.

The Phase I RI was performed to develop site-specific data necessary to:

- evaluate the nature, extent and potential migration pathways of separate-phase petroleum containing concentrations of PCBs which had previously been identified in a limited area of the Yard; and
- develop hydrogeologic, soil quality and ground-water quality information to determine the nature and extent of other areas of contamination at the Yard.

The RI was performed in the areas of concern described below and also outside of those areas to determine the "facility-wide" environmental conditions.

Based on the results of Yard inspections, previous investigations, and discussions with AMTRAK personnel, 16 areas of concern at the Yard (Plates 1 and 2) were identified in the RI/FS work plan as possible sources of contamination. A brief description of each of these 16 areas is provided below.

| Area | | Description |
|---|---|---|
| Area 1: | Underground Storage Tank and Fueling Area | Nine abandoned USTs, former locomotive fueling station, Engine House, Metro Shop. |
| Area 2: | Material Control Area (Yard receiving area | Central receiving, temporary storage and distribution point for materials and supplies received at the Yard. |

| Area | | Description |
|---|---|---|
| Area 3: | Gas Tank Area | 22,000-gallon UST and pump used for storing and dispensing gasoline. |
| Area 4: | Fuel Oil Tank Area | 20,000-gallon UST used to store fuel oil for Boiler House. |
| Area 5: | Transformer Area | Two transformers containing PCBs are located in this area. |
| Area 6: | Drum Storage Area (Oil House) | Drum and equipment storage area; formerly the Yard receiving area. |
| Area 7: | Storage Area | Reported to be a former empty drum storage area; currently no drums stored there. |
| Area 8: | Transformer Area | Former PCB transformer area. This area is comprised of three distinct areas referred to as Area 8A, 8B and 8C throughout this report. |
| Area 9: | Compressor Area (Substation 1-A) | Contains a two-story brick structure which houses air compressors and transformers. |
| Area 10: | Transformer Area (Substation 44) | Contains PCB transformers. |
| Area 11: | Empty Drum Area | Former empty drum storage area. |
| Area 12: | Car Washer Area | Used to wash railroad cars. |
| Area 13: | Former Storage Area | Former storage area for materials including non-PCB transformers; currently contains a Consolidated Edison transformer substation. |
| Area 14: | Empty Drum Area | Former empty drum storage area. |
| Area 15: | Empty Drum Area | Former empty drum storage area. |
| Area 16: | Underground Storage Tank Area | Approximately twelve USTs are located in this area. These tanks were emptied in 1989. |

In addition, Area 17 (the 68 Spur) was noted as an area of concern during performance of the Phase I RI (Plate 1). This area is primarily used to store maintenance equipment and to stage materials.

To accomplish the objectives of the Phase I RI, Roux Associates performed the following tasks at the Yard.

### Task I: Site Reconnaissance

A site reconnaissance was conducted to characterize surface conditions at the Yard. The information developed was used to assemble a surface drainage survey, to identify potential hydrocarbon source areas, to inspect and inventory the existing monitoring well network and to determine the types of materials stored in the following areas of concern: Area 2 (Material Control Area), Area 6 (Drum Storage Area) and Area 7 (Storage Area).

### Task II: Hydrogeologic Investigation

A facility-wide investigation was performed to determine:

- facility-wide soil quality information (i.e., outside areas of concern);
- ground-water quality; and
- the facility-wide hydrogeologic characteristics.

An Area 1 investigation was performed to:

- determine the nature and extent of petroleum hydrocarbon (PHC) constituents and PCBs in soils;
- further define the extent of separate-phase petroleum and to determine ground-water quality for Area 1; and
- determine Area 1 hydrogeologic characteristics.

### Task III: Soil Investigation

- A soil boring/soil sampling program was conducted to determine the extent of soil contamination in Areas 2 through 16; and
- a soil-gas survey was conducted to further delineate the extent of the separate-phase petroleum in Area 1.

### Phase I Remedial Investigation Results

The report titled "Phase I Remedial Investigation, Sunnyside Yard, Queens, New York" (Roux Associates, Inc., 1992a) was accepted by the NYSDEC on January 22, 1992. The Phase I RI report summarized all soil and ground-water quality, geologic, and hydrogeologic results generated by Roux Associates as part of the Phase I RI investigation. This information was utilized in conjunction with information developed during previous investigations to characterize environmental conditions at the Yard. The Phase I analytical data summary tables are included as Appendix A and the results are summarized below. The use of these data was compromised by noncompliancies in the analytical methods as discussed in Section 2.1.2. However, with the exception of PCB results, the remaining data are considered acceptable.

Soil Quality

- Very low concentrations (less than 0.3 milligrams per kilogram [mg/kg] or ppm) of volatile organic compounds (VOCs) were detected in shallow soil samples collected at the Yard and were primarily detected in Area 2 (Material Control Area), Area 4 (Fuel Oil Tank Area), Area 6 (Drum Storage Area), Area 8A (Transformer Area), Area 12 (Car Washer Area), Area 14 (Empty Drum Area), Area 15 (Empty Drum Area), and Area 16 (Underground Storage Tank Area).

- The distribution and concentrations of semivolatile organic compounds (SVOCs) varies throughout the Yard (i.e, phthalates [common laboratory contaminants] and polynuclear aromatic hydrocarbons [PAHs] commonly associated with fill material such as the fill underlying the Yard).

- Pesticide compounds were only detected in one soil boring sample (S-90).

- PHC concentrations exceeding 500 mg/kg (ppm) were primarily found in all areas of concern, with the exception of Area 5 (Transformer Area), Area 7 (Storage Area) and Area 12 (Car Washer Area). With the exception of Area 1, Area 2, Area 4, Area 16 and a small portion of Area 9, PHC concentrations exceeding 500 mg/kg (ppm) are restricted to the shallow soils (0 to 2 feet bls interval).

- PCB concentrations (primarily Aroclor-1260) across the entire Yard were generally less than 1,000 micrograms per kilogram ($\mu$g/kg [1 ppm]). Only two samples exceeded 10 ppm.

- Metals concentrations in fill samples detected significantly above Yard-specific background concentrations (i.e., one order of magnitude or more above established Yard background levels) in areas of concern were barium, copper, lead and zinc. In addition, arsenic, copper and lead were detected in facility-wide borings at concentrations significantly above the Yard-specific background concentrations.

- One additional potential area of concern was identified during the field investigation. The area, known as 68 Spur (Area 17), is located west of Area 13 and appears to be a potential source area of PHCs. Rail-mounted track repair vehicles are stored, fueled and maintained here.

Ground-Water Quality

- Ground-water quality samples collected from the 11 facility-wide (excluding Area 1) shallow monitoring wells indicate:

    - no VOCs or SVOCs were detected above standards;
    - only a limited number of SVOCs were detected;
    - PCBs were detected in only one monitoring well; and
    - iron, lead, manganese, and sodium were detected at concentrations above the standards in most of the facility-wide ground-water quality samples.

- Separate-phase petroleum accumulations present in Area 1 extend northward from the Metro Shop to the northern property boundary. Apparent petroleum thicknesses measured in monitoring wells within this area have exceeded 4 feet. PCB concentrations in separate-phase petroleum samples collected ranged from 3,600 μg/kg (3.6 ppm) to 122,673 μg/kg (122.673 ppm).

- No VOCs were detected above standards in shallow ground-water quality samples collected along the perimeter of the separate-phase petroleum accumulation. In addition, low concentrations of only a limited number of SVOCs were detected. PCBs, however, were detected in two perimeter monitoring wells.

- Iron, lead, manganese and sodium exceed standards in most of the shallow monitoring wells sampled in Area 1.

- Ground-water quality samples collected from the one deeper Upper Glacial aquifer monitoring well (MW-23D) detected ethylbenzene and total xylenes. In addition, low concentrations of bis(2-ethylhexyl)phthalate and 2-methylnaphthalene were detected.

- Based on the Area 1 and facility-wide ground-water quality data, Yard ground-water quality appears to have been only minimally affected by the separate-phase petroleum accumulation in Area 1 and by the facility-wide Yard activities, including activities performed in Area 2 through Area 16.

### 1.3.2 Delineation of the Off-Site Extent of the Separate-Phase Petroleum Accumulation

When the field investigation for the Phase I RI at the Yard was completed, the access agreements necessary to enter the off-site buildings located along Northern Boulevard, north of the Yard and north of the LIRR property boundary (Plate 1), had not yet been secured. As a result, the five soil borings (S-11 through S-15) and one monitoring well (MW-18) proposed in the RI/FS work plan, were not completed in the buildings. Therefore, while preparing the Phase I RI report, no data existed regarding the presence, if any, of separate-phase petroleum beyond the northern boundary of the LIRR property or the relationship between shallow ground-water flow and the sewer line located along the northern boundary of the LIRR property (Plate 2).

As a result, the off-site work was performed as an extension of the field investigation for the Phase I RI. The purpose of this work was to further delineate the extent of the separate-phase petroleum accumulation above ground water in Area 1 at the Yard and beyond the property boundary (i.e., the LIRR property north of the Yard and the buildings to the north of the LIRR property). This investigation, which commenced during October 1991, showed no evidence of off-site migration of the separate-phase petroleum accumulation. The results of the investigation were presented in an October 13, 1992 letter report from Roux Associates to Mr. James Quinn of the NYSDEC (Roux Associates, Inc., 1992d), and have been incorporated into this Phase II RI report at the request of the NYSDEC.

### 1.3.3 Investigation and Abandonment of the Underground Storage Tank Located in Area 2

During performance of the Phase I RI, an apparent hydrocarbon release was detected in the subsurface at the Material Control Area (Area 2), also known as the Receiving Area (Plate 1). A gasoline odor and a photoionization detector (PID) reading of 240 ppm above background was detected in a soil sample collected from 2 to 4 feet bls in Soil Boring S-41. Upon further investigation, a UST was discovered located between the Flammable Gas Storage and the Radio Shop Storage Building (Figure 2).

On November 7, 1990, a subsequent boring (S-41A) was completed adjacent to Soil Boring S-41 to collect a soil sample for VOC analysis. The sample was analyzed for VOCs by Envirosystems laboratory.

In the soil sample collected from 3.5 to 5.5 feet bls in Soil Boring S-41A, VOCs (acetone, xylenes, ethylbenzene) were detected. A ground-water sample was also collected from the open borehole of S-41A on the same day for VOC analysis. Two VOCs (xylenes, ethylbenzene) were detected. A sample of the tank contents (water/petroleum mixture) was collected on November 16, 1990 for VOC analysis. VOCs including total xylenes, ethylbenzene, toluene and 2-butanone were detected in the water/petroleum mixture. Analytical results are summarized in Appendix B. The concentrations of toluene, ethylbenzene and xylenes (constituents of gasoline) detected in the tank contents suggested that the UST contained hydrocarbons and water. The presence of 2-butanone detected in the tank contents indicated that solvents may have been stored in the tank at one time. The presence of hydrocarbon constituents and solvents detected in the soil and ground-water samples collected in close proximity to the UST suggested that the tank may have been overfilled and/or the tank or associated piping may have leaked.

No construction details or inventory records were available for the UST. However, according to Yard personnel, the UST was most probably used for gasoline storage, but may have subsequently been used for solvent storage from a once active paint shop operation. Based on discussions with Yard personnel, from approximately 1970 to 1976 paints for train car interiors were mixed at this location.

As a result, Roux Associates was retained by AMTRAK to prepare and implement a work plan to remove the UST. The NYSDEC accepted the "Work Plan for the Removal of the Underground Storage Tank Located at the Receiving Area (Area 2), Sunnyside Yard, Queens, New York" (Roux Associates, Inc., 1991d) on October 10, 1991, and Roux Associates began work the same month.

The results of the investigation and the abandonment of the UST located in Area 2 were presented to the NYSDEC by Roux Associates in an October 23, 1992 report titled "Results of Underground Storage Tank Investigation - Area 2, Sunnyside Yard, Queens, New York" (Roux Associates, Inc., 1992e), and have been incorporated into this Phase II report at the request of the NYSDEC.

## 2.0 METHODS OF INVESTIGATION AND SCOPES OF WORK

The methods of investigation employed during the post-Phase I RI work at the Yard are based on Roux Associates Standard Operating Procedures. Summaries of these methods are described in Section 2.1. In addition, detailed summaries of the specific scopes of work are provided in Section 2.2.

### 2.1 Methods of Investigation

The field and analytical methods employed during the investigations are described below. Any necessary modifications to the methods are discussed in the appropriate scope of work or results sections.

### 2.1.1 Field Methods

Field investigations performed at the Yard after the Phase I RI included the following seven tasks:

- Task I: Soil Boring and Sampling;
- Task II: Monitoring Well Installation;
- Task III: Monitoring Well Abandonment;
- Task IV: Water-Level and Separate-Phase Petroleum Thickness Measurements;
- Task V: Bail-Down Testing;
- Task VI: Ground-Water and Separate-Phase Petroleum Sampling; and
- Task VII: Sewer-Water and Sewer-Sediment Sampling.

Sections 2.1.1.1 through 2.1.1.7 present a summary of the actual activities associated with each field investigation task performed following the Phase I RI.

#### 2.1.1.1 Task I: Soil Boring and Sampling

Following the Phase I RI, the soil boring programs collectively consisted of drilling 218 soil borings, 30 monitoring well pilot boreholes and three temporary wellpoint pilot boreholes. Drilling services were performed by Aquifer Drilling and Testing, Inc. (ADT) of Woodside, New York and Land, Air, Water Environmental Services, Inc. (LAW) of Center Moriches, New York under the direction of Roux Associates.

Due to safety concerns related to the abundance of unmarked and unmapped underground utilities, Yard supervisory personnel required that the first three feet of all soil borings be advanced by hand. Further advancement of soil borings to depths greater than three feet below land surface was accomplished either manually (i.e., shovel, posthole digger, hand auger and/or split-spoon sampler driven by hand) or mechanically (i.e., hollow stem auger drill rig or backhoe). The method of advancement was determined by borehole purpose, location, subsurface conditions and/or accessibility. The first three feet of all boreholes and any soil boring completed manually were performed either by Roux Associates, or a drilling company under the direction of Roux Associates. Following numerous hollow-stem auger refusals, and with NYSDEC concurrence, Soil Borings S-122 through S-124 were completed as test pits by AMTRAK personnel using a backhoe under the direction of Roux Associates.

Soil samples were collected from soil borings and monitoring well pilot boreholes to characterize lithologic conditions at the Yard, to evaluate soil-quality conditions in areas of concern, and to confirm or further delineate the extent of contamination in previously defined areas. Soil samples were collected from 75 soil borings and two monitoring well pilot boreholes for laboratory analyses. In addition, soil samples from 87 soil borings were analyzed for PCBs using Millipore EnviroGard™ field test kits. Samples collected for laboratory or field analyses were collected from either unsaturated soil or soil at the water table. All soil samples were field screened for VOCs using a PID. Geologic logs are included as Appendix C.

As specified in the work plans, confirmatory soil samples were collected at the same locations and depth intervals as the original samples. Soil samples at the 0 to 2 feet bls and 2 to 4 feet bls intervals were collected by placing the excavated soils on plastic sheeting, homogenizing them, and then collecting a representative sample. At the request of the NYSDEC, VOC samples were collected as rapidly as possible with minimal agitation. When augering with a drill rig, soil samples were collected from depths greater than 4 feet bls using a split-spoon sampler.

When digging with a backhoe, soil samples for laboratory analysis were collected at the water table using a hand auger. Soil borings specifically designed for visual delineation of the separate-phase petroleum accumulation in Area 1 were completed to a depth of 2 feet (or more) below the water table and allowed to remain open for up to one hour to allow petroleum, if present, to infiltrate into the borehole.

All soil samples intended for laboratory analyses were placed on ice immediately after collection and during transport to the laboratory. Most soil samples were analyzed by Industrial and Environmental Analysis, Inc. (IEA) of Monroe, Connecticut, for specific chemical parameters including Target Compound List (TCL) VOCs, TCL SVOCs, PCBs, and Target Analyte List (TAL) metals. This analytical suite (which does not include pesticides) is referred to as the TCL/TAL throughout this text. In addition, hydrocarbon scans were performed on selected samples to determine the type(s) of petroleum encountered. A limited number of soil samples were analyzed for PCBs by Galson Laboratory (Galson) of Syracuse, New York.

#### 2.1.1.2 Task II: Monitoring Well Installation

To further evaluate hydrogeologic and ground-water quality conditions at the Yard, 30 monitoring wells and three temporary wellpoints were installed following the Phase I RI. Twenty-eight monitoring wells and all temporary wellpoints were installed by ADT under the direction of Roux Associates. Monitoring Wells MW-35 and MW-36 were installed by LAW under the direction of Roux Associates. All monitoring wells were installed in pilot boreholes drilled with a hollow-stem auger rig mounted on an all-terrain vehicle.

The three temporary wellpoints and 24 of the monitoring wells were installed with the top of the well screen set approximately two to three feet above the existing water table, when conditions permitted. The remaining six deep monitoring wells (designated with a "D") were installed with the top of the well screen set approximately 25 feet below the existing water table.

With the exception of Monitoring Wells MW-56 and MW-60, all monitoring wells and temporary wellpoints were installed at their proposed locations. The location of Monitoring Well MW-56 was changed due to numerous auger refusals at the originally proposed location. Monitoring Well MW-60 was originally proposed as an additional monitoring well (designated MW-64) in a December 22, 1993 letter to the NYSDEC (Roux Associates, Inc., 1993m) to address the need for additional delineation in the Turntable Area (Plate 2), as specified in the Addendum work plan. The well's designation was later changed to remain sequential.

Monitoring well construction details are summarized in Table 1. All monitoring wells were constructed with 10 feet of 4-inch diameter well screen and 4-inch diameter polyvinyl chloride (PVC) riser pipe. Nine monitoring wells, MW-50 through MW-56, MW-58 and MW-60, were installed within an area of separate-phase petroleum. As per the NYSDEC requirement adhered to during the Phase I RI, 4-inch diameter, 20-slot (0.020 inch) stainless steel well screens were used to construct these wells. The two wells installed during the off-site separate-phase petroleum delineation (MW-35 and MW-36) were constructed with 20-slot (0.020 inch) PVC well screens. Monitoring Well MW-41, which was installed during the Area 2 UST investigation, was constructed with a 10-slot (0.010 inch) stainless steel well screen. The remaining 18 monitoring wells were constructed with 4-inch diameter, 10-slot (0.010 inch) PVC flush-threaded well screens. The three temporary wellpoints were constructed with 5 feet of 2-inch diameter, 20-slot (0.020 inch) black carbon steel well screen and 2-inch diameter steel riser.

The 10-slot PVC screened wells were packed with No. 0 Morie sand. The 20-slot PVC and stainless steel screened wells were packed with No. 2 Morie sand. The gravel pack extended approximately 1 to 2 feet above the well screen, followed by a 1-foot thick layer of bentonite. The remaining annular space was then filled with a bentonite/cement grout to approximately 1 to 2 feet bls. An outer locking, steel protective casing was then placed over the well casing and the remaining annular space filled with concrete. In areas where the water table was extremely shallow (i.e., less than 5 feet bls) the installation procedure was modified based on the actual conditions encountered. Monitoring well construction logs are included in Appendix D.

When possible, split-spoon samples were collected at continuous 2-feet intervals during drilling above the water table, and every 5 feet thereafter. However, the combination of shallow water table (1 to 2 feet bls) and running sand in a majority of the boreholes prevented the collection of samples from below the water table.

All split-spoon samples were examined for lithology, visual evidence of contamination, and field screened for VOCs using a PID. All observations were recorded in the field book. Geologic logs are included in Appendix C.

Following installation of all monitoring wells, each well was developed to ensure hydraulic connection with the surrounding saturated deposits. All wells were developed until the pH, conductivity, and temperature of the discharged water had stabilized and the turbidity was less than or equal to 50 nephelometric turbidity units (NTUs) or stabilized. Temporary wellpoints were not developed prior to sampling and were removed immediately following sampling. Each monitoring well was surveyed for horizontal and vertical coordinates by AWT-Professional Land Surveyor of Plainview, New York.

#### 2.1.1.3 Task III: Monitoring Well Abandonment

During the Phase II RI and Addendum, Monitoring Wells MW-2, MW-24, MW-25 and MW-26 were determined to be unusable, and therefore, were abandoned. With the exception of MW-26, the well screens and casing were removed. A cement/bentonite grout was then used to seal the borehole to within 5 feet of land surface. The remaining borehole was then backfilled with soil and compacted.

Monitoring Well MW-26 was damaged and the casing broken approximately 5 feet bls during construction of the new Car Washer Area. Due to the Car Washer construction, the area was not accessible to a drill rig, and therefore, the well screen and remaining casing were not removed. The screen zone was first sealed with a cement/bentonite grout to approximately 4 feet bls. A cement mixture was then used to fill the remaining borehole to land surface and finish flush with the existing concrete pad.

### 2.1.1.4 Task IV: Water-Level and Separate-Phase Petroleum Thickness Measurements

Following Phase II RI monitoring well installation and development, one round of water-level measurements was performed (February 8, 1993). Following the Phase II RI Addendum monitoring well installation and development, two rounds of water-level measurements were performed (February 1 and 2, 1994 and June 14, 1994). Water levels were measured to the nearest 0.01 foot using a steel measuring tape and chalk.

In wells containing separate-phase petroleum, the water level and petroleum thickness were measured to the nearest 0.01 foot using an electronic oil/water interface probe. Detections of petroleum at less than 0.01 foot (i.e., sheen) were visually verified with the use of a clear Teflon™ bailer.

### 2.1.1.5 Task V: Bail-Down Testing

Separate-phase petroleum bail-down tests were conducted in seven monitoring wells (MW-17, MW-22, MW-36, MW-50, MW-53, MW-54 and MW-60) containing significant (i.e., greater than 0.5 foot) petroleum thicknesses. Using an electronic oil/water interface probe, the depth to water and the depth to petroleum were measured and the petroleum thickness determined. Petroleum was then bailed from the wells as quickly and carefully as possible using a 1-gallon PVC bailer. Depth to water followed by depth to petroleum measurements were then collected and repeated as rapidly as possible (averaging four measurements per minute) for approximately five minutes as petroleum recovered in the well. The frequency of measurements was then gradually reduced until the tests were concluded.

#### 2.1.1.6 Task VI: Ground-Water and Separate-Phase Petroleum Sampling

Ground-water sampling was conducted at the Yard on January 15, 22 and 26, 1993; February 8 and 9, 1993; December 6, 1993; and February 17, 1994. Ground-water samples were only collected from wells that did not contain separate-phase petroleum. Monitoring wells were purged then sampled within 24 hours after purging was completed. After collection, ground-water samples were packed on ice and submitted to IEA laboratory for analyses including, but not limited to, TCL VOCs, TCL SVOCs, PCBs and TAL metals. Temperature, pH, and conductivity measurements of the ground-water samples were taken and recorded in the field.

Separate-phase petroleum samples were collected on February 8, 1993 and February 17, 1994. Monitoring wells containing separate-phase petroleum were not purged prior to petroleum sampling. After collection, samples were packed on ice and submitted to IEA laboratory for analyses including, but not limited to, PCBs, a hydrocarbon scan, kinematic viscosity and specific gravity.

#### 2.1.1.7 Task VII: Sewer-Water and Sewer-Sediment Sampling

Sewer-water and sewer-sediment sampling for the Phase II RI was conducted on February 8 and 9, 1993, and April 25 through 28, 1994. Sewer-water samples were collected at manhole and catch basin locations using a PVC sampler which was lowered into the sewer water stream. Sewer-sediment samples were collected at manhole and catch basin locations using the same sampler. At sampling locations where both water and sediment were collected, water samples were collected first. Following collection, samples were packed on ice and submitted to IEA laboratory for analyses. Samples collected February 8 and 9, 1993, were analyzed for PCBs with select water samples additionally analyzed for TCL VOCs, TCL SVOCs and TAL metals. Samples collected on April 25 through 28, 1994 were analyzed for PCBs.

### 2.1.2 Analytical Methods

The laboratory analytical work for the Phase I RI was provided by Envirosystems, Inc. of Columbia, Maryland (Envirosystems) in 1990 and 1991. Samples were analyzed for TCL VOCs, TCL SVOCs, TCL pesticides/PCBs, TAL metals, and total PHCs. Validation of the sample results was performed by Data Validation Services, Inc. (Data Validation Services) of North Creek, New York. Data Validation Services noted numerous protocol noncompliancies by Envirosystems. The data validation report was included in the Phase I RI report (Roux Associates, Inc., 1992a).

Based on the review of the Phase I RI report and analytical results produced by Envirosystems, the NYSDEC requested that Roux Associates prepare a data point by data point Data Usability Report to assess the acceptability of these results (Roux Associates, Inc., 1991c). The Data Usability Report (which was included in the Phase I RI report), as revised on October 5, 1991, concluded that:

- VOC, SVOC and metals data were generally supported by the raw data, and were generated in compliance with the protocols;
- although the protocol for pesticides was not followed, detection limits were not affected (and pesticides were detected in only one sample);
- PHC data had blank and method limitations, but were acceptable for screening; and
- PCB analyses had multiple noncompliancies.

To address the effects of the noncompliancies, Roux Associates proposed to collect confirmatory samples in conjunction with the Phase II RI, as outlined in Task IV of the Phase II RI work plan (Roux Associates, 1992b). A comparison of the Phase I RI and confirmatory data is provided in Appendix E.

Analytical services for the off-site delineation work and the Area 2 UST investigation were performed by Northeastern Analytical Corporation (NAC) of Marlton, New Jersey. Soil samples collected from Track 21 during March 1992 were analyzed by Galson.

Analytical services for the Phase II RI and related work were performed by IEA. Galson, NAC and IEA are all certified New York State Department of Health Environmental Laboratory Approval Program (ELAP) laboratories. IEA is a New York State certified Analytical Services Protocols (ASP) laboratory. Data were validated by Data Validation Services. The data validation reports for all data developed during the Phase II RI and related work are included in Appendix F. The associated data usability report prepared by Roux Associates is included in Appendix G.

For ease of discussion, the data validation qualifiers assigned to each analytical value are not included in the text. These qualifiers are included in the data tables along with explanations to define each qualifier.

In cases where primary and duplicate sample results are not the same, the highest usable concentration detected for each constituent was (conservatively) considered the actual value. In cases where a sample was diluted and re-run, analytical results from the diluted sample were only used for those constituents that exceeded the instrument range in the first run (undiluted) sample.

As specified in the Phase II RI and Addendum work plans, and approved by the NYSDEC, the following methods were required to be performed in accordance with the NYSDEC 1991 ASP.

- TCL VOCs - United States Environmental Protection Agency (USEPA) Method 8240;
- TCL SVOCs - USEPA Method 8270;
- PCBs - USEPA Method 8080 (soils), and Method 608 (aqueous); and
- TAL metals - USEPA Methods 6010 and 7000 series.

Differences in quality assurance/quality control (QA/QC) requirements for the USEPA Test Methods for Evaluating Solid Waste (SW-846) specified above, and the ASP methods, required IEA to develop the modifications discussed below.

- TCL VOCs in soil and water were analyzed by USEPA Method 8240 using a capillary column and TCL SVOCs were analyzed by Method 8270 integrating QA/QC from the 1991 ASP as follows:
    - response factors were updated from the 50 parts per billion (ppb) calibration check standard; and
    - tentatively identified compounds (TICs) are reported.
- Aqueous samples requiring a low detection limit for PCBs were analyzed using ASP 89-3 method. Soil and petroleum samples were analyzed for PCBs using a modified USEPA Method 8080.
- Analyses of inorganics were performed using the ASP digestion procedures followed by the requirements for the specific SW-846 methods (i.e., 6010, 7000 series).

The sample results are presented in the format required by ASP (i.e., Category B deliverables package). Since pesticides were only analyzed during the Phase I RI, the suite of TCL VOCs, TCL SVOCs and PCBs are collectively referred to as the TCL throughout this report for ease of discussion. When performed, pesticide analyses are specified.

Hydrocarbon scans were performed on selected soil and petroleum samples using gas chromatography analysis with a flame ionization detector following the laboratory internal standard operating procedure. In addition, specific gravity and kinematic viscosity were determined for petroleum samples collected during the Addendum using the American Society for Testing and Materials (ASTM) Methods D-1298 and D-445, respectively.

Millipore Envirogard™ immunoassay soil test kits were utilized by Roux Associates to delineate the extent of PCBs in soil in select areas of concern. The testing procedure used in this investigation allowed a semi-quantitative determination of the total PCB concentration (i.e., sum of all Aroclor species). In addition, 11 percent of the samples were submitted to IEA for confirmatory laboratory analysis using USEPA Method 8080 for PCBs in soil. Soil samples were placed in 8-ounce (i.e., 227 gram) jars and the extracts for the test kit analyses were prepared using only 5 grams of soil, while the laboratory confirmatory samples were prepared using the remaining soil from the same depth interval. As a result, the samples were not exact duplicates. Therefore, some variations in field test kit results versus laboratory results were expected.

## 2.2 Scopes of Work

Since completion of the Phase I RI, Roux Associates has performed the following RI-related work at the Yard:

- Delineation of the Off-Site Extent of the Separate-Phase Petroleum Accumulation in Area 1;
- Investigation and Abandonment of the UST Located in Area 2;
- Phase II RI;
- Delineation of the Separate-Phase Petroleum Accumulation in Area 1;
- Addendum to the Phase II RI;
- Additional Investigation of the Sewer System; and
- Additional Delineation of Areas of Concern 8, 9 and 17.

As previously discussed, to more completely understand the current conditions at the Yard, all results of the above-referenced work are summarized in the nature and extent section of this report. Therefore, the scopes of work are described below.

### 2.2.1 Delineation of the Off-Site Extent of the Separate-Phase Petroleum Accumulation in Area 1

The off-site delineation work to define the extent of separate-phase petroleum migration north of the Yard originally presented in the RI/FS Work Plan for the Yard, was modified in a June 18, 1991 letter to the NYSDEC (Roux Associates, Inc., 1991a). In response to the NYSDEC comments contained in a June 24, 1991 letter to Roux Associates (NYSDEC, 1991a), the off-site delineation proposal was further modified in a September 5, 1991 letter to the NYSDEC (Roux Associates, Inc., 1991b). The delineation commenced in October 1991, once the necessary access agreements were secured.

The proposed scope of work consisted of drilling soil borings and installing monitoring wells both between the sewer line and the off-site buildings north of the Yard, and within the off-site buildings north of the Yard. However, based on additional information obtained during the initial field work, the scope of work was further modified to consist of:

- installing Monitoring Wells MW-35 and MW-36 at locations to determine if the sewer line affected ground-water flow or the migration of separate-phase petroleum;
- inspecting existing sumps in the off-site buildings north of Monitoring Wells MW-20, MW-35 and MW-36;
- completing eight hand borings, designated HB-1 through HB-8, around the perimeter of the known separate-phase petroleum accumulation;
- collecting sewer-water samples from the same volume of water as it moved downstream between manhole locations MH-3 and MH-5 where sheens were noted, and analyzing these samples for PHCs (a hydrocarbon scan) and PCBs.

Sampling locations and the known extent of the separate-phase petroleum on October 23, 1991 are shown in Plates 3 and 4. The results of this work were reported to the NYSDEC in an October 13, 1992 letter report (Roux Associates, Inc., 1992d), and are summarized in Section 4.1.2.1 and Appendix B.

### 2.2.2 Investigation and Abandonment of the UST Located in Area 2

To define the nature and extent of potential contamination for soil excavation, stockpiling, and disposal purposes, the following preliminary work was performed.

- Three pre-excavation soil borings, S-96, S-97 and S-98 (Figure 2) were drilled on October 30, 1991;
- soil samples were collected (using a split-spoon sampler), visually inspected for staining and then screened with a PID for VOCs; and
- based on the above screening and the location of the borings relative to the UST, three representative soil samples were submitted to the laboratory for TCL VOC analysis.

Geologic logs, including PID readings, are included in Appendix C. Soil samples submitted for laboratory analyses were all collected above the water table, which was encountered at approximately 6 to 7 feet bls. The following three soil samples were selected for TCL VOC analysis.

- Sample S-97 (4 to 6 feet) was selected on the basis of having low PID readings with respect to background;
- Sample S-97 (6 to 8 feet) was selected on the basis of having staining and high PID readings with respect to background; and
- Sample S-98 (4 to 6 feet) was selected on the basis of having staining and intermediate PID readings with respect to background.

No sample was selected for analysis from soil boring S-96 due to the absence of staining and no PID readings above background. Samples were analyzed for TCL VOCs. The analytical results from these samples were used to determine the nature and extent of contaminated soil to estimate the volume of soil to be stockpiled prior to disposal.

To characterize ground-water quality downgradient of the UST, Monitoring Well MW-41 was installed on October 30, 1991 approximately 30 feet northwest (hydraulically downgradient) of the UST (Figure 2). The well was developed after installation using a centrifugal pump and intermittent surging for approximately 2 hours. No separate-phase petroleum was observed and approximately 500 gallons of water were removed. One week after development, a ground-water sample was collected from Monitoring Well MW-41 for TCL VOC analysis by USEPA Method 624, according to NYSDEC December 1989 ASP procedures.

Soil and ground-water samples were placed in ice-filled coolers and shipped via Federal Express overnight delivery to NAC for analysis.

The results of this investigation were presented to the NYSDEC in an October 23, 1992 report (Roux Associates, Inc. 1992e), and are summarized in Section 4.2 and Appendix B.

### 2.2.3 Phase II Remedial Investigation

Prior to preparation of the Phase II RI work plan, Roux Associates conducted a site inspection with the NYSDEC on February 24, 1992 to discuss potential locations of soil borings and monitoring wells. The results of the site inspection were incorporated into the work plan.

The scope of work for the Phase II RI was detailed in the Roux Associates document titled "Work Plan for the Phase II Remedial Investigation, Sunnyside Yard, Queens, New York" dated August 5, 1992 (Roux Associates, 1992b).

The Phase II RI was designed to:

- further delineate the extent of contaminants detected during the Phase I RI;
- determine if migration of contaminants in ground water is occurring either onsite or offsite;
- develop additional information regarding the hydraulic relationship between the shallow deposits and the deeper Upper Glacial aquifer deposits underlying the Yard;
- investigate the potential for off-site migration of contaminants through the sewer system; and
- confirm the analytical results presented in the Phase I RI report.

These data will be used to conduct a comprehensive risk assessment (RA) and will be used during the feasibility study (FS) to identify and evaluate remedial alternatives, if needed.

The Phase II RI scope of work was organized into the following field tasks to permit efficient acquisition of data necessary to support the RA and FS.

- Task I: Additional Delineation Investigation;
- Task II: Investigation of the Upper Glacial Aquifer;
- Task III: Sewer System Investigation; and
- Task IV: Confirmatory Sampling.

The above tasks were performed in accordance with the Phase II RI work plan and the project operation plans, which outlined the standard operating procedures to be used during the performance of all tasks of the Phase II RI. Summaries of the soil quality, separate-phase petroleum, ground-water quality, sewer-water quality and sewer-sediment quality sampling programs are provided in Tables 2 through 6.

#### 2.2.3.1 Task I: Additional Delineation Investigation

This task consisted of an additional investigation of hydrogeologic, soil quality, and ground-water quality conditions at the Yard to further delineate the extent of known contamination in areas of concern and to delineate potential contaminant source areas identified in the Phase I RI. The investigation consisted of:

- completion of 17 soil borings and collecting soil samples from 15 of the borings;
- collecting five supplemental soil samples from Area 8B;
- collecting 12 confirmatory soil samples throughout the Yard;
- installing eight additional monitoring wells and two temporary wellpoints;
- sampling 11 monitoring wells and two temporary wellpoints; and
- collecting a comprehensive round of water-level measurements.

The monitoring well and soil boring sampling locations for this task are shown in Plate 1 and 2.

#### Areas of Concern

Area 1 - The off-site delineation work to define the extent of separate-phase petroleum migration north of the Yard was previously performed as a supplemental investigation to the Phase I RI, as modified in a June 18, 1991 letter from Roux Associates to the NYSDEC (Roux Associates, Inc., 1991a). The scope and results of this work were reported to the NYSDEC in an October 13, 1992 letter report (Roux Associates, Inc., 1992d), and are discussed in Sections 2.2.1 and 4.1.2.1 of this report. The majority of the Phase II RI scope of work was postponed, as previously discussed, due to the Geraghty & Miller well construction problem. However, a separate-phase petroleum sample was collected from

MW-36 on February 8, 1993 to be analyzed for PCBs (Table 3) and a ground-water sample was collected from well MW-23D on February 9, 1993 to be analyzed for TCL VOCs and PCBs (Table 4). These samples were collected at the request of the NYSDEC. In addition, the NYSDEC requested that two soil borings (S-116 and S-117) be drilled to the water table at locations west of the separate-phase petroleum accumulation to determine if preferential migration was occurring along the track beds.

Area 2 - The need for additional delineation information in this area was addressed by the UST investigation performed at the Receiving Area by Roux Associates between October 30 and November 6, 1991. The results of this UST investigation, which were reported to the NYSDEC in an interim report on October 23, 1992 (Roux Associates, Inc., 1992e), are discussed in Section 4.2 of this report. However, in a letter to Roux Associates on November 19, 1992, Mr. James Quinn of the NYSDEC expressed concern that ground water near the abandoned UST may not be flowing northwest toward Monitoring Well MW-41, but that ground water may be flowing in a more northerly direction (NYSDEC, 1992b). To address this concern, Roux Associates installed two temporary wellpoints as part of the Phase II RI. This work was proposed in a December 23, 1992 letter from Roux Associates to Mr. James Quinn of the NYSDEC (Roux Associates, Inc., 1992f), and modified in a January 19, 1993 letter (Roux Associates, Inc., 1993a). Each black carbon steel wellpoint was driven into the ground, as opposed to being installed within augered pilot boreholes which the NYSDEC felt would disturb the aquifer. The locations of these wellpoints, TW-1 and TW-2, are shown in Plate 1.

On January 26, 1993 a ground-water sample was collected from each temporary wellpoint and analyzed for TCL VOCs by USEPA Method 8240, following the December 1991 NYSDEC ASP (Table 4). In addition, two QA/QC samples were analyzed for the same parameters. A field blank was collected using laboratory-supplied distilled water to determine the efficiency of the decontamination procedures, and a laboratory-supplied trip blank accompanied the sample bottles throughout shipment. Approximately two weeks later (February 9, 1993), a ground-water sample was collected from Monitoring Well MW-41, and analyzed for TCL VOCs according to the protocols previously stated (Table 4).

Area 4 - A shallow (i.e., intersecting the water table) monitoring well (MW-42) was installed hydraulically downgradient of the UST located in Area 4, between the AMTRAK outbound motor track and the LIRR property boundary (Plate 1). A ground-water sample was collected on February 9, 1993 and analyzed for fuel-related constituents (TCL VOCs and TCL SVOCs) to determine if the UST and/or its associated piping may have leaked and impacted the ground water in the area (Table 4).

Area 6 - A ground-water sample was originally proposed to be collected from Monitoring Well MW-11, located downgradient of Area 6. However, due to Geraghty & Miller well construction problems discovered by Roux Associates on January 11, 1993, this work (and other Area 1 and Area 7 work) was postponed and later modified. The new scope of work regarding these areas is discussed in the Phase II Addendum scope of work (Section 2.2.5).

Area 7 - A shallow monitoring well (MW-37) was originally proposed for installation and sampling upgradient of Area 7. However, as discussed above, this scope of work was postponed and later modified. As originally proposed, a soil sample was collected from a shallow (0 to 2 feet) soil boring (S-99) on January 18, 1993 and analyzed for the TCL/TAL to further define the extent of contamination in the area and determine if an upgradient hydrocarbon source area exists (Table 2).

Areas 8A, 8B and 8C - During the February 24, 1992 site walk conducted at the Yard to address the NYSDEC request regarding monitoring well and soil boring locations for the proposed Phase II RI, it was discovered that Area 8A and 8B, previously defined as areas of concern, had been significantly altered during the "body track" rehabilitation program. The track had been removed and the top two feet (approximately) of ballast had been removed. As a result, five supplemental soil samples (T-21A through T-21E) were collected from Track 21 in Area 8B. These post-excavation soil samples were analyzed for PCBs using non-ASP methods (Table 2).

The proposed soil boring/sampling locations for Areas 8A, 8B, and 8C were subsequently revised to address these new conditions. However, additional track rehabilitation was performed on Track 20 after the soil sampling program was revised, but before Roux

Associates began field work in Area 8. This additional track rehabilitation, which consisted of removing Track 20 and the underlying ballast (approximately the top two feet) in Area 8B, prompted further revisions to the soil sampling scope of work. Since the shallow soils had already been removed from Area 8B, proposed soil samples S-109 and S-110 (0 to 2 feet) were not collected. The resulting scope of work consisted of collecting one additional soil sample from each of ten shallow (0 to 2 feet) boring locations; S-104 through S-108 (Area 8C), and S-111 through S-115 (Area 8A). Sampling took place on January 20, 1993 (Area 8A) and January 25, 1993 (Area 8C). All soil samples were analyzed for PCBs (Table 2). Soil boring locations are shown in Figure 3.

Area 9 - To characterize ground-water quality conditions downgradient from Area 9, one shallow monitoring well (MW-45) was installed (Plate 1). On February 9, 1993 a ground-water sample was collected from this well and analyzed for the TCL/TAL (Table 4). To determine if soil quality in this area has been impacted by PCBs, a shallow (0 to 2 feet) soil boring (S-103) was completed in front of the Compressor Building on January 19, 1993 and a soil sample was collected and analyzed for PCBs (Table 2).

Area 11 - A shallow monitoring well (MW-46) was installed downgradient of Areas 11, 13 and 17 (Plate 1). To characterize the ground-water quality downgradient of these areas, a ground-water sample was collected from Monitoring Well MW-46 on February 9, 1993 and analyzed for the TCL/TAL (Table 4).

Area 12 - Although no organic compounds were detected in ground water from Monitoring Well MW-26 during the Phase I RI, data validation determined that the SVOC results for this well were unusable. As part of the Phase II RI, the NYSDEC requested that Roux Associates resample Monitoring Well MW-26 for TCL SVOC and PCB analyses to confirm the ground-water quality in this area. However, the well had been damaged during AMTRAK's reconstruction of the Car Washer. As a result, this work was modified and is discussed as part of the scope of work for the Phase II RI Addendum (Section 2.2.5).

Area 13 - To further characterize the soil quality in this area, a shallow (0 to 2 foot) soil boring (S-100) was completed on January 18, 1993 and a soil sample collected and analyzed for the TCL/TAL (Table 2). As mentioned above (Area 11), Monitoring Well MW-46 was installed downgradient of Areas 11, 13 and 17. A ground-water sample was collected from MW-46 and analyzed for the TCL/TAL (Table 4).

Area 17 - Since PHCs were detected in Area 17 soils during the Phase I RI, additional soil quality data was required to determine the extent of contamination in the area. During the previously-mentioned February 24, 1992 site walk, it was determined that the location chosen for proposed Monitoring Well MW-46 would be located downgradient of Area 17 (Plate 1), in addition to Areas 11 and 13. As previously stated, this well was installed to characterize ground-water quality (TCL/TAL) downgradient of these areas of concern (Table 4). To characterize soil quality in Area 17, soil samples were collected from two shallow (0 to 2 feet) soil borings, S-101 and S-102 (Plate 1). Samples were collected on January 18, 1993 and analyzed for the TCL/TAL (Table 2).

Facility Wide - To verify the ground-water quality in the portion of the Yard north of Area 15 (Plate 1), an additional sample was collected from MW-25 on March 17, 1992 and analyzed for PCBs. PCBs were detected at a concentration similar to that obtained during the Phase I RI. Based on this data, additional information was required to determine if the PCB detections in MW-25 are indicative of ground-water quality or are the result of PCBs being bound to suspended particles within the well. Therefore, a shallow monitoring well (MW-25A) was installed adjacent to and as a replacement for Monitoring Well MW-25 as part of the Phase II RI. In addition, shallow Monitoring Well MW-47 was installed upgradient of MW-25A, and near the upgradient boundary of the Yard. These two wells were sampled on January 22, 1993 to further delineate PCBs in ground water (Table 4). In addition, Monitoring Well MW-25 was properly abandoned (following confirmatory sampling, as described in Section 2.2.3.4).

To determine if contaminants are present in the ground water and migrating onto the Yard from off-site sources, a two-well cluster, MW-47 (shallow) and MW-48D (deep), was installed in the vicinity of S-30 (Plate 1) near the upgradient property boundary. Monitoring well installation was performed in accordance with the methods described in Section 2.1.1.2 with one exception; air rotary drilling was attempted (unsuccessfully) at location MW-48D after the first two attempts using hollow-stem augers were unsuccessful. This well was eventually installed with a more powerful hollow-stem auger rig. Monitoring well construction details are summarized in Table 1.

A second two-well cluster, MW-43 (shallow) and MW-44D (deep), was installed between the AMTRAK outbound Motor Track and the LIRR property boundary northeast of Area 3 (Plate 1) to determine if contaminants are present in the ground water and migrating offsite. As shown in Plate 1, this cluster is part of a line of downgradient monitoring wells located along the property boundary. Ground-water samples were collected from these four wells on February 9, 1993 and analyzed for the TCL/TAL (Table 4).

#### 2.2.3.2 Task II: Investigation of the Upper Glacial Aquifer

This task consisted of a hydrogeologic investigation to:

- determine the relationship between the shallow deposits and the deeper Upper Glacial aquifer;
- determine the vertical hydraulic gradients and deeper ground-water flow patterns; and
- characterize the ground-water quality in the Upper Glacial aquifer.

These objectives were accomplished by installing and sampling both deep and shallow monitoring wells.

**Areas of Concern**

Area 1: The proposed hydrogeologic work in Area 1 was to consist of installing and sampling three deep (Upper Glacial aquifer) monitoring wells: MW-38D, MW-39D and MW-40D. However, as previously discussed, well construction problems discovered during the early stages of the Phase II RI field work resulted in the need for additional delineation of the separate-phase petroleum accumulation. Therefore, the proposed hydrogeologic work for Area 1 was postponed until further delineation efforts could be performed. The completion of the hydrogeologic work following the additional delineation efforts are discussed in Section 2.2.5.

**Facility Wide**

Comprehensive rounds of water-level measurements were taken at the well clusters (i.e., MW-19/MW-39D, MW-43/MW-44D, MW-47/MW-48D, MW-49/MW-38D, MW-57/MW-40D and MW-61/MW-62D) to determine:

- vertical gradients;
- deeper ground-water flow patterns; and
- the hydraulic relationship between the shallow and deeper deposits.

However, with the exception of one comprehensive round of water-level measurements taken on February 8, 1993 (Table 7), the hydrogeologic work was postponed until the separate-phase petroleum accumulation in Area 1 was fully delineated. The results of all of the water-level elevation data are discussed in Section 3.

#### 2.2.3.3 Task III: Sewer System Investigation

This task was designed to determine if the primary or secondary combined sewer system beneath the Yard, as defined in the Phase I RI, may be acting as a conduit for off-site migration of contaminants. This investigation consisted of the collection of seven aqueous sewer samples and three sewer sediment samples.

To determine if fluids containing PCBs are flowing into the primary sewer system located in Area 1, five water samples were collected from the sewer and analyzed for PCBs (Table 5). Specifically, samples were collected from the following locations, as shown in Plate 2.

- MH-3 and MH-5, two manhole locations situated along the sewer line that runs parallel with and beyond the northern property boundary;
- MH-6, the first manhole located downstream of the Engine House (located on the west side of the Engine House); and

- MH-7 and MH-8, the two manholes situated along sewer lines leaving the Metro Shop (located on the north side of the Metro Shop).

A sixth water sample was planned to be collected from Area 1. However, manhole location MH-4 was inaccessible.

In addition to the water samples, sediment samples were scheduled to be collected from sewer manhole locations MH-3, MH-6, MH-7 and MH-8 and analyzed for PCBs. However, only two sediment samples were collected (MH-3 and MH-8) due to a lack of sediment at locations MH-6 and MH-7 (Table 6). Although there was enough sediment collected for PCB analyses from locations MH-3 and MH-8, there were insufficient quantities of sediment available to perform grain size analyses.

To determine if fluids containing contaminants are flowing into the facility-wide sewer system and exiting the Yard, two water samples were collected;

- MH-1 was collected at the closest accessible manhole location to the point where the secondary sewer system exits the Yard (Plate 1); and
- MH-2 was collected from the closest accessible manhole location to the point where the primary sewer system exits the Yard (Plate 1).

The samples collected from locations MH-1 and MH-2 were analyzed for the TCL/TAL (Table 5). In addition, a sediment sample was collected from the sewer line at manhole location MH-2 and analyzed for PCBs (Table 6).

To identify substances or compounds being introduced into the primary sewer system from off-site sources, presumably located along Skillman Avenue, a water sample was attempted to be collected from the spillway located southwest of the Car Washer Area, Area 12 (Plate 1). However, there was no water present in the spillway during the sewer sampling round, therefore no sample was collected.

#### 2.2.3.4 Task IV: Confirmatory Sampling

The goal of this task was to confirm the usability of portions of the analytical data collected during the Phase I RI, as presented in the October 5, 1991 Revised Data Usability Report (Roux Associates, Inc., 1991c). This was accomplished by collecting and analyzing 12 soil and five ground-water samples that duplicate the sampling and analyses performed as part of the Phase I RI. Confirmatory soil samples were collected from newly drilled boreholes adjacent to the original boreholes, while confirmatory ground-water samples were collected from previously sampled monitoring wells. Confirmatory soil boring sampling locations (designated with the prefix "CS" or "CMW") and confirmatory ground-water sampling locations are shown in Figure 3 and Plates 1 and 2. The sampling locations and analyses performed for this task are summarized below.

| Location | Sample Designations | Analysis | Matrix |
|---|---|---|---|
| Area 1 | MW-1 | PCBs/<br>TAL metals | Water |
| | MW-23D | TCL SVOCs | Water |
| | CS-1 (0-2') | PCBs | Soil |
| | CS-76 (0-0.5') | PCBs | Soil |
| Area 2 | CS-43 (0-2') | PCBs/Mercury | Soil |
| Area 4 | CMW-31 (0-2') | PCBs | Soil |
| | CS-49 (2-4') | PCBs | Soil |
| Area 5 | CS-50 (0-2') | PCBs | Soil |
| | CS-51 (0-2') | PCBs | Soil |
| Area 6 | CS-64 (2-3') | PCBs | Soil |
| Area 8A | CS-53 (0-2') | PCBs | Soil |
| Area 8C | CS-6 (0-2') | PCBs | Soil |
| Area 9 | MW-27 | PCBs | Water |

| Location | Sample Designations | Analysis | Matrix |
|---|---|---|---|
| Area 10 | CS-83 (0-2') | PCBs | Soil |
| Area 13 | CS-75 (0-2') | PCBs | Soil |
| Facility wide | MW-25 | TAL metals | Water |
| | MW-29 | TAL metals | Water |

The originally-proposed scope of work was modified, as follows, in a Roux Associates September 10, 1992 letter to Mr. James Quinn of the NYSDEC (Roux Associates, Inc., 1992c).

- Proposed boring CS-84 was replaced by CS-83, because the previous Soil Boring S-84 could not be located.
- Ground-water samples from Monitoring Wells MW-25 and MW-29 were added as confirmatory samples for TAL metals at the request of the NYSDEC.
- The depth of confirmatory soil sample CS-64 was changed from 0-2' to 2-3' bls to coincide with the original Phase I RI sample interval;
- Confirmatory soil sample CS-52 was replaced by CMW-31 (northwest of Area 4) due to Area 8B track rehabilitation (i.e., the top 2 feet of ballast had been removed from location S-52).
- Confirmatory soil sample CS-64 replaced CS-58 and confirmatory soil sample CS-75 replaced CS-60 at the request of the NYSDEC because PCBs were not analyzed from the original S-58 and S-60 boreholes.

Confirmatory results were used in conjunction with the Phase I soil results (considered a screening) and the additional Phase II analyses to further define the nature and extent of contamination. In addition, the confirmatory results were compared with original Phase I data to determine the usability of the original data. This comparison is discussed in detail in Appendix E.

As previously discussed, shortly after commencement of the Phase II RI field work (i.e., during January 1993), construction problems involving the existing Geraghty & Miller monitoring wells at the Yard were discovered by Roux Associates in the presence of the NYSDEC. The NYSDEC's concern over these construction problems, which are discussed in detail below, prompted additional delineation of the separate-phase petroleum accumulation, postponement of well installation activities in Area 1, and additions and modifications to the Phase II RI scope of work.

### 2.2.4 Delineation of the Separate-Phase Petroleum Accumulation in Area 1

The additional delineation of the separate-phase petroleum accumulation was performed in four phases, as discussed in a series of Roux Associates letters to the NYSDEC (Roux Associates, Inc., 1993b through 1993h). The scope of the additional delineation work is described below.

As previously discussed, the integrity of a monitoring well (MW-2) previously installed at the Yard by Geraghty & Miller was deemed questionable by the NYSDEC during performance of the Phase II RI. Monitoring Well MW-2, which had been destroyed by Yard activities, was scheduled to be abandoned and replaced as part of the Phase II activities. Existing gauging data for this well indicate that no separate-phase petroleum has been measured at this location since April 1986 (Geraghty & Miller, Inc., 1986).

On January 7, 1993, Roux Associates attempted to install proposed Monitoring Well MW-40D, install replacement well MW-2R, and properly abandon MW-2. At that time, in the presence of the NYSDEC, separate-phase petroleum was noted flowing into a 3-foot deep hand-dug boring prior to installing MW-40D hydraulically downgradient of MW-2. At the request of the NYSDEC, additional hand-dug boreholes were completed adjacent to, and upgradient of MW-2. The borehole adjacent to MW-2 (designated GM-2) also contained separate-phase petroleum, however, only sheens were noted at the two upgradient locations. At the request of the NYSDEC, the remaining upper portion of MW-2 was exposed for examination. Bentonite and cement grout was found within the top 1.5 to 2 feet of the screen zone (the section of the screen which intersected the top of the current water table), thus preventing the petroleum from entering the well. Monitoring Well MW-2 was then abandoned by removing the remaining well screen and casing and plugging the remaining borehole with bentonite pellets.

As a result of this observation, the NYSDEC verbally informed Roux Associates and AMTRAK that the integrity of all monitoring wells installed by Geraghty & Miller was now considered questionable, as well as the data previously derived from them. Furthermore, before any additional data would be accepted from the wells, the integrity and usability of each of the Geraghty & Miller wells (fifteen in total) needed to be determined. At that time, all of the Phase II RI work scheduled for Area 1 was postponed.

The status of the fifteen Geraghty & Miller wells was as follows.

- Previously abandoned: MW-4, MW-6 and MW-14;
- Replaced: MW-13 (Roux Associates, 1990);
- Destroyed and abandoned: MW-2 (as discussed above);
- Intact, located within separate-phase petroleum accumulation: MW-5, MW-7, MW-8 and MW-15; and
- Intact, presumably located outside perimeter of separate-phase petroleum accumulation: MW-1, MW-3, MW-9, MW-10, MW-11 and MW-12 (Plate 5).

#### 2.2.4.1 Phase 1

To address the NYSDEC's concern regarding the integrity and usability of the Geraghty & Miller wells, a preliminary screening was conducted on January 11 and 12, 1993. The screening consisted of assessing the integrity of four selected Geraghty & Miller wells: MW-3, MW-9, MW-10 and MW-12. These wells were chosen based on their locations relative to the separate-phase petroleum accumulation and historical information. Based on preliminary observations, Monitoring Well MW-11 was also examined.

For each well, a post-hole digger or shovel was used to dig a 3- to 4-feet deep excavation to the water table adjacent to the monitoring well location. A split-spoon sampler was then driven by hand approximately 2 feet below the water table. The ground water flowing into the excavations/boreholes and soil samples were examined for visual evidence of separate-phase petroleum or sheens. Boreholes were left open for approximately one hour to allow separate-phase petroleum to accumulate, if present. In addition, a PID was used (weather permitting) to measure the concentrations of VOCs within the samples and excavations. Prior to digging the boreholes, water-level and petroleum thickness measurements were obtained in the monitoring wells, and the wells were examined for odors and sheens. The fluid levels measured in the monitoring wells were then correlated with the fluid levels noted in the boreholes. Hand boring locations (designated "GM") are shown in Plate 5.

These results were conveyed to the NYSDEC during a January 13, 1993 telephone conversation with Roux Associates, and reported to the NYSDEC in a January 19, 1993 letter report (Roux Associates, Inc., 1993b). Based on the results of the screening (i.e., the lack of correlation between the observations made in the hand-dug boreholes adjacent to the wells and observations made within the actual wells) the NYSDEC determined that the wells should no longer be used as monitoring points since the data obtained from them was invalid. As a result, the NYSDEC required additional delineation of the separate-phase petroleum accumulation in Area 1.

#### 2.2.4.2 Phase 2

The second phase of additional delineation of the separate-phase petroleum accumulation in Area 1 was performed on January 22 and 25, 1993, and consisted of hand-dug borings around the previously-reported boundary of the separate-phase petroleum accumulation (Roux Associates, Inc., 1993c). These borings were completed following the same procedure used for Phase 1. By digging borings manually as opposed to utilizing a drill rig, the access and logistical problems that are encountered when working in Area 1 of the Yard were significantly reduced. However, as with the Phase 1 work, the data derived from these borings were considered usable for screening purposes only. These data were considered in development of the next phase of delineation, and selection of permanent monitoring well locations in Area 1, where necessary.

Although twenty-one borings were proposed in the January 1993 scope of work (PD-1 through PD-21), some modifications were necessary due to actual field conditions encountered.

- PD-2, PD-3 and PD-8 were not completed because the water table was too deep to reach by hand;
- PD-20 and PD-21 were omitted because no petroleum or sheen was present on the water table at locations PD-17 and PD-18; and
- PD-22 and PD-23 were added to the scope of work.

Eighteen boreholes were actually completed. Boring locations and the observations associated with each location are shown in Plate 5. Results of the phase 2 additional delineation screening were presented in a February 4, 1993 letter to the NYSDEC (Roux Associates, Inc., 1993d).

#### 2.2.4.3 Phase 3

Phase 3 of the additional delineation was performed on February 19, 1993, and consisted of completing 15 additional hand-dug borings following the same procedure used for the previous two phases, with the exception that mechanical means (i.e., jackhammer) were employed to drill through paved areas, frozen ground, and other obstructions. The scope of this third phase of delineation work was proposed in a letter to the NYSDEC dated February 10, 1993 (Roux Associates, Inc., 1993e). Although 17 borings were originally proposed (PD-24 through PD-40), some modifications to the original scope of work were necessary due to actual field conditions encountered.

- PD-31 was omitted because a wooden walkway was present in the proposed location; and
- PD-33 was omitted due to time constraints.

The locations of the 15 borings completed during phase 3 are shown in Plate 5. Results of the phase 3 additional delineation screening were presented in a February 25, 1993 letter to the NYSDEC (Roux Associates, Inc., 1993f).

### 2.2.4.4 Phase 4

Based on the results of phase 3 of the additional delineation of the separate-phase petroleum accumulation in Area 1, the phase 4 scope of work was developed. Phase 4 was performed on April 7, 1993 by Roux Associates and consisted of nine hand-dug borings, installed in the same manner used in previous phases. In addition, two soil samples were collected for PCB analyses. The objective of this phase was to complete the petroleum delineation in three areas: 1) the southeast boundary of the petroleum accumulation, south of the Metro Shop and east of the Locker Room/Shop; 2) the northeast boundary of the petroleum accumulation, downgradient of the Turntable; and 3) west of the Engine House (southwest of MW-12 and GM-12).

The phase 4 scope of work was detailed in a March 12, 1993 letter to the NYSDEC (Roux Associates, Inc., 1993g). A total of eight borings were proposed (PD-41 through PD-48), with a contingency for up to five additional borings (PD-49 through PD-53), as needed. Only one of the additional borings, PD-53, was necessary. The locations of the nine borings completed during phase 4 are shown in Plate 5. Two soil samples that showed evidence of petroleum contamination from borings PD-45 and PD-47 were collected for non-ASP PCB analyses for screening purposes (Table 2). Results of the phase 4 additional delineation screening were presented in an April 26, 1993 letter to the NYSDEC (Roux Associates, Inc., 1993h).

The results of the additional delineation investigations, phases 1 through 4, indicated that the previously delineated northern, western and southwestern boundaries of the separate-phase petroleum accumulation were accurate. However, the extent of the accumulation was not fully delineated to the east and southeast (Plate 5). The information obtained during phases 1 through 4 was used to modify the locations of permanent monitoring wells proposed for the Phase II RI, and determine locations of additionally required wells resulting from the newly-delineated extent of separate-phase petroleum. As a result, the Phase II RI Addendum was developed.

### 2.2.5 Phase II Remedial Investigation Addendum

The objectives of the Phase II RI Addendum were to complete the previously postponed Phase II RI and to adequately delineate (using permanent monitoring wells) the extent of the separate-phase petroleum accumulation recently detected to the east and southeast of the previously delineated accumulation. The scope of work for the Phase II RI Addendum was submitted to the NYSDEC on May 28, 1993, and revised on August 4, 1993 (Roux Associates, Inc., 1993j).

The Addendum scope of work included the following:

- completion of the field work previously proposed for Area 1 (i.e., installation and sampling of one shallow and three deep monitoring wells) in the August 5, 1992 work plan for the Phase II RI;
- completion of 24 soil borings and collection of five soil samples to delineate the nature and extent of the separate-phase petroleum accumulation in Area 1, including the isolated occurrences recently detected adjacent to MW-10, MW-12, and to the north and west of the Turntable;
- completion of 13 monitoring well pilot boreholes and collection of two soil samples, and installation and sampling of 13 monitoring wells to delineate the nature and extent of the separate-phase petroleum accumulation in Area 1 including the recently detected area south of the Metro Shop;
- proper abandonment of Monitoring Wells MW-24 and MW-26 that were found during the Phase II RI to have been destroyed;
- installation and sampling of one shallow monitoring well to replace the destroyed Monitoring Wells MW-24 and MW-26;
- installation and sampling of one deep monitoring well in a cluster with the MW-24 and MW-26 replacement well to further characterize the hydraulic relationship between the shallow deposits and the Upper Glacial aquifer;
- resampling of three monitoring wells to verify low levels of PCBs in ground water;
- installation and sampling of a temporary wellpoint (TW-3) in the vicinity of MW-26; and
- performance of bail-down tests on seven monitoring wells containing greater than 0.5 feet of separate-phase petroleum to determine the true thickness of the separate-phase petroleum accumulation in the surrounding formation and to estimate petroleum recharge rates.

The proposed scope of work also included the proper abandonment of eleven monitoring wells previously installed by Geraghty & Miller in Area 1 (Task 2). However, this task has been postponed and therefore was not completed as part of the Phase II RI Addendum.

The scope of work was divided into the following six tasks:

- **Task 1:** Soil Borings;
- **Task 2:** Monitoring Well Abandonment;
- **Task 3:** Monitoring Well Installation;
- **Task 4:** Water-Level Measurements;
- **Task 5:** Bail-Down Testing; and
- **Task 6:** Sampling and Analysis.

In addition to the work specified in the Addendum work plan, 16 confirmatory soil samples were collected throughout the Yard for PCB analyses (Roux Associates, Inc., 1993i). The results of the confirmatory analyses are incorporated into Section 4, and a comparison of the Phase I RI and confirmatory data are included in Appendix E.

#### 2.2.5.1 Task 1: Soil Borings

Soil borings were completed according to the methods previously described in Section 2.1.1.1, except where otherwise specified. Soil borings were performed in four general areas surrounding the separate-phase petroleum accumulation in Area 1: the Turntable Area, the area south of the Metro Shop, and the areas adjacent to existing Monitoring Wells MW-10 and MW-12.

### Turntable Area

To determine the source of the sheens (e.g., emanating from the Turntable or a part of the previously identified accumulation), five soil borings, S-118 through S-121 and S-129 were completed to the water table. Based on field observations, one soil sample exhibiting evidence of contamination (e.g., staining, sheen, odors) from Soil Boring S-129 was selected for laboratory analysis. The sample, S-129 (3 to 5 feet), was collected on November 29, 1993 and analyzed for the TCL/TAL and PHCs (a hydrocarbon scan) (Table 2).

Based on an evaluation of the results of soil borings S-120, S-121 and S-129, Roux Associates proposed three additional soil borings (S-140 through S-142) to further delineate the extent of the separate-phase petroleum accumulation within Area 1 (Roux Associates, Inc., 1993m). The locations of these borings are shown in Plate 2.

### Area South of the Metro Shop

To determine if the separate-phase petroleum accumulation south of the Metro Shop and the Locker Room/Shop (Area 1) extends south of the retaining wall, three test pits (S-122 through S-124) were dug at the locations shown in Plate 2. Soil borings and a monitoring well that were planned for installation south of the retaining wall (located south of the Metro Shop and Locker Room/Shop) could not be installed due to the difficult drilling conditions encountered. These boreholes were attempted a second time using a tripod rig, without success (Roux Associates, Inc., 1993m). Therefore, in place of the boreholes, three test pits (S-122 through S-124) were dug with a backhoe during April 1994 (Roux Associates, Inc., 1994b) between Tracks 4 and 5. The results of the test pits were evaluated to determine the need for additional delineation south of the retaining wall (Plate 5). One soil sample from test pit S-122 (7.5 to 8.5 feet) was selected for laboratory analyses for the TCL/TAL and a hydrocarbon scan (Table 2). Since no separate-phase petroleum was encountered in the test pits (to be discussed in Section 4.1.2.2), a monitoring well (originally proposed as designation MW-60) and additional soil borings (S-125 through S-128) that were proposed south of the Metro Shop were not required.

The results of the additional delineation hand borings (PD-46 and PD-53) indicated that the petroleum accumulation does not extend significantly beyond the northwest corner of the former inspection pit (Plate 5). To confirm these findings and attempt to determine the type(s) of petroleum encountered, soil samples from the MW-54 and MW-58 monitoring well pilot boreholes were collected for laboratory analyses for the TCL/TAL and a hydrocarbon scan (Table 2).

### Area Adjacent to Monitoring Well MW-10

To determine the extent of the isolated occurrence of separate-phase petroleum detected adjacent to Monitoring Well MW-10, five soil borings were drilled to the water table in this area. Soil Borings S-130 through S-134 were installed around MW-10 (Plate 2). To determine the nature of contamination in this area, a soil sample exhibiting evidence of contamination was collected on November 8, 1993, from Soil Boring S-134 (2 to 4 feet) for laboratory analyses. The sample was analyzed for the TCL/TAL and a hydrocarbon scan (Table 2). As proposed in a December 22, 1993 letter to the NYSDEC, three additional borings (S-143 through S-145) were drilled downgradient of Monitoring Well MW-10 in response to the results of the S-130 through S-134 borings (Roux Associates, Inc., 1993m).

### Area Adjacent to Monitoring Well MW-12

To determine the extent of the isolated occurrence of separate-phase petroleum detected west of the Engine House near Monitoring Well MW-12, five soil borings were installed. Soil Borings S-135 through S-139 were drilled to the water table at the locations shown in Plate 2. To determine the nature of contamination in this area, soil samples exhibiting evidence of contamination were collected on December 7, 1993, from Soil Borings S-135 (3 to 3.5 feet) and S-139 (3 to 3.1 feet) for laboratory analyses. The samples were analyzed for the TCL/TAL and a hydrocarbon scan (Table 2). Although not originally proposed, the S-135 soil sample was collected for analysis because a clear oily substance was observed in the 3 to 3.5 feet interval.

### 2.2.5.2 Task 2: Monitoring Well Abandonment

Monitoring Wells MW-24 (located along the loop track) and MW-26 (Car Washer Area) were abandoned on November 11, 1993 as part of the Phase II RI Addendum field work (Plate 1). Monitoring Well MW-24 (which was installed with a locking steel protective casing) appeared to have been filled with railroad ballast and destroyed by vandals. Monitoring Well MW-24 was abandoned according to the procedures described below.

- The well casing was removed (pulled) from the ground.
- The open borehole (which had collapsed to a depth of 12 feet bls) was sealed by pressure injection with cement bentonite grout using a tremie pipe. The upper two feet of the borehole was backfilled with appropriate native materials and compacted to avoid settlement.
- The sealed site was restored to a safe condition, and inspected for settlement periodically after sealing.

Monitoring Well MW-26 was destroyed but left in place during construction of the new Car Washer in Area 12. Since the well is surrounded by a thick concrete slab, and not accessible to a drill rig, overdrilling was not practical. After removing a 3 to 4-foot section of unattached casing, the remaining portion of the well casing and open borehole were grouted to one foot below land surface to preclude the possible introduction of contaminants into the well or around the annular space outside of the casing. The top one foot of the borehole was then filled with cement flush with the concrete slab.

### 2.2.5.3 Task 3: Monitoring Well Installation

As previously discussed, the monitoring wells that replace the Geraghty & Miller-installed monitoring wells located in Area 1 and the monitoring well that replaces Monitoring Wells MW-24 and MW-26 located along the Loop tracks were installed as part of the Phase II RI Addendum.

### Area 1 - Geraghty & Miller Wells

Since the Geraghty & Miller-installed wells were deemed unusable and will be abandoned in the future, replacement monitoring wells were installed to allow for the continued delineation of the petroleum accumulation. Some of the wells were designed to be monitoring points within the accumulation, and others were designed to delineate the extent of accumulation (i.e., perimeter). Nine monitoring wells (MW-49 through MW-55, MW-57 and MW-63) were installed in Area 1 at the locations shown in Plate 2. The locations were chosen based on a review of previous monitoring data, data derived from Roux Associates-installed monitoring wells in Area 1, and the results of the additional delineation (Section 4.1.2.2). Monitoring well construction details are summarized in Table 1. Geologic logs and monitoring well construction logs for these wells are included in Appendices C and D, respectively.

### Monitoring Wells MW-24 and MW-26

The isolated location of MW-24 rendered it susceptible to additional acts of vandalism, therefore, a replacement well at the same location was not recommended. Rather, Monitoring Well MW-61 was installed at a location between monitoring well locations MW-24 and MW-26, as a replacement for both wells. This location provides sufficient hydraulic control to characterize shallow ground-water flow in the southeast portion of the Yard (Plate 1). In addition, a deep well screened in the Upper Glacial aquifer (MW-62D) was proposed at this location based on the results of the Phase II RI ground-water analytical results. This well was installed as a cluster with shallow Monitoring Well MW-61 to:

- determine the hydraulic relationship between the shallow deposits and the deeper Upper Glacial aquifer;
- determine vertical hydraulic gradients and deeper ground-water flow patterns; and
- characterize ground-water quality entering the Yard.

The geologic logs and monitoring well construction logs for well cluster MW-61/MW-62D are included in Appendices C and D, respectively.

At the request of the NYSDEC, a temporary wellpoint (TW-3) was also installed in the immediate vicinity of MW-26 (abandoned) so that a ground-water sample could be collected, as proposed for MW-26 as part of the Phase II RI.

### Additional Delineation of the Separate-Phase Petroleum Accumulation in Area 1

To further delineate the extent of the petroleum accumulation located south of the Metro Shop and possibly in the vicinity of the Turntable, four additional shallow monitoring wells, MW-56, and MW-58 through MW-60, were installed at the locations shown in Plate 2. Locations were chosen based on the additional delineation hand-dug boring results (Plate 5). Monitoring Wells MW-56, MW-58 and MW-59 were installed south of the Metro Shop. Monitoring Well MW-60, which was originally proposed to be designated MW-64 (Roux Associates, Inc., 1993m), was installed downgradient of the Turntable and renumbered to remain sequential. Monitoring well construction details are summarized in Table 1, and geologic logs and monitoring well construction logs are included in Appendices C and D, respectively.

In response to the NYSDEC's request for additional delineation of the separate-phase petroleum in the areas adjacent to MW-10 and MW-12, a review of the results of the soil boring data collected during the Addendum have indicated that these isolated petroleum occurrences have been delineated.

### Completion of Proposed Phase II RI

Due to the postponement of the Phase II RI in Area 1, previously proposed Monitoring Wells MW-37 (shallow), and MW-38D, MW-39D and MW-40D (deep) were installed as part of the Phase II RI Addendum. The monitoring wells were installed in accordance with the Phase II work plan. However, since the proposed deep Monitoring Wells MW-38D and MW-40D were to be installed as clusters adjacent to existing Geraghty & Miller-installed wells, the proposed well locations were revised. Monitoring Wells MW-38D and MW-40D were instead installed as clusters to shallow wells MW-49 and MW-57, respectively. In addition, MW-37 was relocated to a position downgradient of Areas 1, 6 and 7. Monitoring well construction details are summarized in Table 1. The geologic logs and monitoring well construction logs for these wells are included in Appendices C and D, respectively.

These deep monitoring wells were installed in Area 1 and ground-water samples were collected to further define the extent of VOCs and SVOCs, and verify that PCBs are not present in the deeper deposits, and to determine the hydraulic relationship between the water table and the deeper Upper Glacial aquifer.

### 2.2.5.4 Task 4: Water-Level Measurements

Following installation of all new monitoring wells, two comprehensive rounds of water-level and separate-phase petroleum thickness measurements were performed at all specified monitoring wells (i.e., all existing monitoring wells in Area 1, all newly-installed replacement wells, all newly-installed additional delineation wells and the newly-installed remaining Phase II RI wells). Water levels were measured to the nearest 0.01 foot using a steel measuring tape and chalk. In wells containing separate-phase petroleum, the petroleum thickness and water levels were measured to the nearest 0.01 foot using an oil/water interface probe. Water-level measurements were performed on February 1 and 2, 1994 and June 14, 1994 as part of the Phase II RI Addendum (Table 7).

### 2.2.5.5 Task 5: Bail-Down Testing

Separate-phase petroleum bail-down tests were conducted in all monitoring wells at the Yard containing significant (i.e., greater than 0.5 feet) thicknesses of petroleum. Based on this criteria, seven monitoring wells were tested: MW-17, MW-22, MW-36, MW-50, MW-53, MW-54 and MW-60. The newly-installed wells were monitored to ensure that the separate-phase petroleum thicknesses had equilibrated before testing was performed. The tests were conducted to evaluate the true petroleum accumulation thickness in the formation, as well as petroleum recharge rates. These data allow for more accurate estimates of the total volume of separate-phase petroleum beneath Area 1 and the total recoverable volume. This information will be used to support the FS.

The bail-down tests were conducted on March 14 and 16, 1994, in accordance with the procedures described in Section 2.1.1.5 which are based on the technical paper titled "Volume Determination and Recoverability of Free Hydrocarbon" (Testa and Paczkowski, 1989). The separate-phase petroleum removed from the wells during the bail-down tests was placed in the on-site holding tank connected to the IRM system.

#### 2.2.5.6 Task 6: Sampling and Analysis

Soil, ground-water and separate-phase petroleum samples were collected as part of the Phase II RI Addendum. All samples were analyzed using the USEPA and NYSDEC ASP methods specified in the Addendum work plan (Roux Associates, Inc., 1993j).

Soil

Seven soil samples were submitted for laboratory analysis. These soil samples, S-122, S-129, S-134, S-135, S-139, MW-54 and MW-58, were analyzed by IEA for the TCL/TAL (Table 2). In addition, hydrocarbon scans were performed to determine the type(s) of petroleum encountered. With the exception of S-129, S-134 and S-139, which were designated to be analyzed, additional soil samples were collected for analysis based on the actual field conditions encountered.

Ground-Water

Prior to sampling, the Area 1 monitoring wells were screened for the presence of separate-phase petroleum, including sheens. Ground-water samples were not collected from monitoring wells that contained evidence of separate-phase petroleum (i.e., MW-50 through MW-56, MW-58 and MW-60). Twelve monitoring wells were sampled on February 17, 1994. Samples were shipped to IEA for analyses. Newly-installed Monitoring Wells MW-37, MW-49, MW-57, MW-59, MW-61, MW-62D and MW-63 were sampled and analyzed for the TCL/TAL. Ground-water samples from Monitoring Wells MW-38D, MW-39D and MW-40D were analyzed for TCL VOCs, TCL SVOCs and PCBs. In addition, Monitoring Wells MW-35 and MW-46 were resampled and analyzed for PCBs to confirm earlier detections of low level PCBs.

A ground-water sample was proposed to be collected from Monitoring Well MW-26 during the Phase II RI. As a result of Monitoring Well MW-26 being damaged, the scope of work was modified to consist of properly abandoning Monitoring Well MW-26, and installing a replacement well for both MW-24 and MW-26 approximately equidistant between the two. Therefore, an alternate sampling point was needed in the Car Washer Area. As requested by the NYSDEC, a temporary wellpoint was installed adjacent to MW-26. The Temporary Wellpoint TW-3 was sampled on December 6, 1993 and analyzed for TCL SVOCs and PCBs.

Separate-Phase Petroleum

Monitoring Wells MW-50 through MW-55, and MW-60 were installed within the separate-phase petroleum accumulation in Area 1. A sufficient volume of petroleum existed within Monitoring Wells MW-50, MW-53, MW-54 and MW-60 to collect separate-phase petroleum samples. Petroleum samples were analyzed for PCBs, specific gravity and kinematic viscosity. In addition, hydrocarbon scans were performed to determine the type(s) of petroleum encountered. The analytical data were used to evaluate the potential for multiple source areas, and will be used to support the FS.

Confirmatory Sampling

As proposed in a May 24, 1993 letter to the NYSDEC (Roux Associates, Inc., 1993i), 16 confirmatory soil samples were collected at previously sampled Phase I RI locations. Samples were analyzed for PCBs to confirm previous analyses that were determined to be useful for screening purposes only. The confirmatory sample locations are described below.

| Area | Confirmatory Sample Location and Designation | Justification |
|---|---|---|
| 1 | Hand boring CS-3 (3-5') adjacent to S-3 | Confirm non detect with high-detection limit. |
| 1 | Hand boring CMW-22 (0-2') adjacent to MW-22 | PCBs detected in ground water during Phase I RI. |
| 1 | Hand boring CMW-20 (0-2') adjacent to MW-20 | Confirm medium detection. |
| 1 | Hand boring CS-5 (0-2') adjacent to S-5 | Previous result was unusable at high concentration. |
| 1 | Hand boring CS-10 (0-2') adjacent to S-10 | Confirm low detection. |
| 2 | Hand boring CS-41/41A (3.5-5.5') adjacent to S-41/41A | Confirm non detect with high detection limit. |
| 4 | Hand boring CS-47 (2-4') adjacent to S-47 | Based on previous confirmation results of Area 4. |

| Area | Confirmatory Sample Location and Designation | Justification |
|---|---|---|
| 6 | Hand boring CS-61 (5-7') adjacent to S-61 | Confirm non detect with low detection limit. |
| 7 | Hand boring CS-67 (0-2') adjacent to S-67 | Previous result was unusable at low concentration. |
| 9 | Hand boring CS-59 (0-2') adjacent to S-59 | Confirm non detect with low detection limit. |
| 13 | Hand boring CS-77 (0-2') adjacent to S-77 | Confirm low detection in suspect area. |
| 15 | Hand boring CS-82 (0-2') adjacent to S-82 | Confirm only sample result for this area. |
| Facility Wide | Hand boring CS-16 (0-2') adjacent to S-16 | Confirm low detection adjacent to Area 8. |
| Facility Wide | Hand boring CS-22 (0-2') adjacent to S-22 | Confirm low detection on LIRR Right of Way. |
| Facility Wide | Hand boring CMW-30 (0-2') adjacent to MW-30 | Confirm low detection. |
| Facility Wide | Hand boring CMW-34 (0-2') adjacent to MW-34 | Confirm low detection outside transformer area. |

The results of these soil samples are discussed in Section 4, and a comparison of this data with the original Phase I RI data is included in Appendix E.

### 2.2.6 Additional Investigation of the Sewer System

After completing the sewer sampling tasks described in Section 2.2.3.3 - Task III, it was determined that additional sewer investigation was required to accomplish the following objectives.

- Determine if the previously detected PCBs in the sewer system are representative of historical events or indicate ongoing sources of contaminants.
- Further delineate the extent of PCBs currently in the sewer water and sediment outside of Area 1 at the Yard.
- Determine if the PCBs detected in sewer-water samples are actually in the sewer water or were attached to sediment (i.e., filtered and unfiltered water samples).

- Determine if PCBs have migrated offsite through the sewer system.
- Determine the Yard-wide areas that require sediment removal.
- Identify the possible source areas, if the existence of continuing source areas are indicated.

As a result, the Roux Associates document titled "Work Plan for the Additional Investigation of the Sewer System" (Roux Associates, Inc., 19931) was prepared and subsequently submitted to the NYSDEC.

The additional investigation of the sewer system scope of work was designed to follow a phased approach, which is outlined below.

- **Task 1:** Sewer Sampling;
- **Task 2:** Sediment Removal;
- **Task 3:** Oil/Water Separator Inspection and Evaluation; and
- **Task 4:** Sewer System Monitoring.

#### 2.2.6.1 Task 1: Sewer Sampling

Sewer sampling consisted of the collection and analysis of 18 water samples and 18 sediment samples from manhole and catch basin locations to further delineate the extent of PCBs in the primary and secondary sewer systems at the Yard, and identify locations requiring sediment removal. The samples collected during April 1994 included the following.

- Sewer-water and sewer-sediment samples were collected at the last manhole before leaving the Yard boundary for both the primary (MH-40) and secondary (MH-1) sewer systems;
- multiple influent sampling was performed at five (MH-39, MH-40, MH-43, MH-52 and MH-69) of six proposed manhole locations; and
- filtered and unfiltered water samples were collected from three select locations (MH-2, MH-40 and MH-52) to determine if PCBs are in the water or the sediment.

Eleven unfiltered sewer water, three filtered sewer water, and 14 sediment samples were collected from the primary sewer system. Three unfiltered sewer water, one filtered sewer water, and four sediment samples were collected from the secondary sewer system. Twelve of the proposed sediment and seven of the proposed water samples were not collected due to insufficient quantities of water or sediment at the proposed manhole or catch basin location. In addition, three of the sediment samples collected (MH-38, MH-59 and MH-72) could not be analyzed by the laboratory due to insufficient sample volumes. Although MH-1 was chosen for multiple influent sampling, there appeared to be only one influent source within the manhole. Therefore, only one sediment and one water sample (this sample was submitted to the laboratory both filtered and unfiltered) were collected from within MH-1.

All samples were submitted to IEA laboratory for analyses. Water samples were analyzed for PCBs according to NYSDEC ASP Method 89-3 (Table 5). Sediment samples were analyzed for PCBs according to USEPA Method 8080 (Table 6). The NYSDEC 1991 ASP were followed for all sampling and analysis procedures. Sampled locations are shown in Plate 1.

#### 2.2.6.2 Task 2: Sediment Removal

Based on the results of Task 1 (i.e., PCB contamination was detected within the manhole's sediment), manhole locations requiring sediment removal were identified. The pump out was designed to evaluate the source(s) of the PCBs and remove the contaminated sediment from the manhole locations to preclude the immediate possibility of off-site transport through the sewer system. This task has not yet been performed, and is discussed in more detail in Section 7.1.

#### 2.2.6.3 Task 3: Oil/Water Separator Inspection and Evaluation

Task 3 consisted of inspecting and evaluating the oil/water separator in Area 1 located at the northeast corner of the Engine House (Plate 2). This inspection was performed since no construction design of the separator existed, separate-phase petroleum was present within one of the two vessels that comprise the separator, the source of petroleum to and current operational status of this unit had not been determined, and the water from the separator apparently discharges to the sewer system in Area 1. As part of this investigation, the oil/water separator was pumped out and examined to determine the condition and status of the system. The examination included taking detailed dimensional data, denoting inlet and outlet sizes and elevations, and observing the condition of the separator to determine if it was currently functioning as intended.

#### 2.2.6.4 Task 4: Sewer System Monitoring

Task 4 consists of development and implementation of a monitoring program to evaluate the source(s) of the PCBs in the sewer systems. The monitoring program will involve collecting and analyzing both sediment and water from the pumped out primary and secondary manhole/catch basin locations. After the contaminated sediment has been removed from the manholes/catch basins, each of the removal locations will be visually inspected with regard to sediment buildup according to a pre-determined schedule.

The pumped out manhole and catch basin locations will be monitored to evaluate the source of the PCBs (i.e., historical or continuing). During the monitoring schedule if sediment is observed to be accumulating at any removal location, and a sufficient volume exists, a sample will be collected and analyzed to determine if PCBs are present. If contaminated sediment re-occurs following completion of the initial sediment removal, additional work will be performed to further define the source(s) of the contamination and, if necessary, an IRM will be proposed. The scope of work is discussed in more detail in Section 7.1.

Thus far, Task 1 (Sewer Sampling) and Task 3 (Oil/Water Separator Inspection and Evaluation) have been completed, and recommendations have been made regarding Task 2 (Sediment Removal) locations. Upon approval of the sediment removal locations by the NYSDEC, Task 2 will be implemented and the sewer system monitoring program (Task 4) will be initialized. An estimated schedule for implementation of the sediment removal and monitoring program is included in Figure 4.

### 2.2.7 Additional Delineation of Areas 8, 9 and 17

Soil quality data generated during performance of the Phase I and II RIs identified Areas 8A, 8B, 8C, 9 and 17 as requiring additional delineation for PCBs. The July 28, 1993 "Work Plan for the Additional Delineation of Areas A-8, A-9 and A-17, Sunnyside Yard, Queens, New York" (Roux Associates, Inc., 1993k) was accepted by the NYSDEC on October 27, 1993. This work plan was designed to delineate PCBs in the above-mentioned areas of concern to be used to support the determination of an appropriate IRM, if necessary, to address the PCBs in soil.

Millipore Envirogard™ immunoassay soil test kits were utilized by Roux Associates to delineate the extent of PCBs in soil in these areas of concern. The testing procedure used in this investigation allowed a semi-quantitative determination of the total PCB concentration (i.e., sum of all Aroclor species). In addition, 11 percent of the samples were submitted to IEA for confirmatory laboratory analysis using USEPA Method 8080 for PCBs in soil.

The July 28, 1993 work plan outlined three field tasks to complete PCB delineation within these areas. Brief summaries of each task are provided below.

**Task I: Additional Delineation of Areas 8A, 8B and 8C**

This task consisted of hand augering and sampling 18 soil borings (SB-1 through SB-18). Seven of these borings were completed to a depth of 6 feet below land surface with samples collected at consecutive 1-foot intervals for PCB field screening analysis. The remaining 11 borings were initially completed to three feet below land surface with samples collected from consecutive 1-foot intervals for PCB field screening analysis. Samples from consecutive 1-foot intervals at each of the 11 locations were analyzed until the concentration of PCBs detected was less than 25 ppm or the boring reached a depth of six feet below land surface. A total of 18 soil samples were collected in Area 8A from Soil Borings SB-1 through SB-4, 18 samples were collected in Area 8B from Soil Borings SB-5 through SB-9, and 42 samples were collected in Area 8C from Soil Borings SB-10 through SB-18 for PCB field screening analyses. A total of 94 samples were analyzed in the field during performance of this task.

**Task II: Additional Delineation of Area 9**

This task consisted of hand augering nine soil borings to a depth of up to three feet below land surface and collecting a representative sample from consecutive 1-foot intervals at each boring for PCB field screening analysis. Samples from consecutive 1-foot intervals at each location were analyzed until the concentration of PCBs detected was less than 25 ppm or the boring reached a depth of six feet below land surface. A total of nine soil samples were collected in Area 9 from Soil Borings SB-19 through SB-27 for PCB field screening analyses. All nine samples were analyzed in the field during performance of this task.

**Task III: Additional Delineation of Area 17**

This task consisted of hand augering 28 soil borings to a depth of up to six feet below land surface and collecting a representative sample from consecutive 1-foot intervals at each boring for PCB field screening analysis. Samples from consecutive 1-foot intervals at each location were analyzed until the concentration of PCBs detected was less than 25 ppm or the boring reached a depth of six feet below land surface. A total of 81 soil samples were collected from Soil Borings SB-28 through SB-55 for PCB field screening analyses, and 79 of these samples were analyzed.

### 2.2.8 Further Delineation of Areas 8A, 8C, and 17

Based on the results of the additional delineation investigation, the following conclusions were drawn.

- No further delineation is necessary in Area 8B since no PCBs were detected at concentrations greater than 25 ppm.
- No further delineation is necessary in Area 9 since no PCBs were detected at concentrations greater than 25 ppm.
- Further delineation is required within Areas 8A, 8C and 17 since soil intervals showing 25 ppm or less of PCBs were not encountered within all borings performed in these areas.

Therefore, on June 2, 1994, an additional scope of work was proposed to the NYSDEC to complete delineation of PCBs within these Areas 8A, 8C and 17 (Roux Associates, Inc., 1994c). This scope of work is described below.

### Task I: Further Delineation of Areas 8A and 8C

This task consisted of drilling and sampling 20 soil borings located at or around detections of PCBs at concentrations greater than 25 ppm identified in Area 8 during the initial implementation of the work plan. Sixteen new borings, SB-56 through SB-71, were designed to further delineate the extent of PCBs greater than 25 ppm. This was accomplished by drilling the borings on a five feet spacing around previous PCB detections. These 16 borings were completed to three feet below land surface with samples collected from each consecutive 1-foot interval. Additional sampling was performed at the four existing soil borings, SB-12, SB-13, SB-16, and SB-17 to further delineate the vertical extent of PCBs. The four borings were begun at the last interval that was sampled and analyzed, and each boring was advanced an additional five feet below land surface with samples collected at consecutive 1-foot intervals. Samples from consecutive intervals at each boring location were analyzed for PCBs using Millipore EnviroGard™ immunoassay test kits. Sample analyses were discontinued when the concentration of PCBs detected was less than 25 ppm. A total of 35 soil samples were analyzed in the field during performance of this task.

### Task II: Further Delineation of Area 17

This task consisted of drilling and sampling 17 soil borings located at or around detections of PCBs at concentrations greater than 25 ppm identified in Area 17 during the initial implementation of the work plan. Sixteen new borings, SB-72 through SB-87, were designed to further delineate the extent of PCBs greater than 25 ppm. This was accomplished by drilling the borings on a five feet spacing around previous PCB detections. These 16 borings were completed to three feet below land surface with samples collected from each consecutive 1-foot interval for PCB analysis. Additional sampling was performed at the existing boring SB-45, to further delineate the vertical extent of PCBs. Boring at location SB-45 began at the last interval sampled and analyzed, and was advanced an additional five feet below land surface with samples collected at consecutive 1-foot intervals. Samples from consecutive intervals at each boring location were analyzed for PCBs using Millipore EnviroGard™ immunoassay test kits. Sample analyses were discontinued when the concentration of PCBs detected was less than 25 ppm. A total of 25 soil samples were analyzed during the performance of this task.

The above two tasks were conducted from August 9 through August 18, and August 25 through August 29, 1994. Soil borings were completed by LAW under the supervision of a Roux Associates hydrogeologist. Of the 60 samples analyzed for PCBs using the field test kits during August 1994, eight were sent to IEA laboratory for confirmatory analyses by USEPA Method 8080.

## 3.0 PHYSICAL CHARACTERISTICS OF THE YARD

Physical characteristics of the Yard, including surface features, surface water, geology, hydrogeology and man-made structures, have been investigated throughout the RI process and are discussed below.

### 3.1 Surface Features

The Yard encompasses approximately 105 acres and lies in a basin-like area with ground elevations that range from approximately 10 to 25 feet below the surrounding land surface. The topography is generally flat and slopes gently to the west. The Yard topography and drainage patterns are strongly influenced by the large number of railroad tracks and bulkheaded areas throughout the Yard. Overland surface runoff does not appear to be a source of contamination to adjacent properties.

The Yard is underlain by a combined sanitary/storm sewer drainage system, consisting of two drainage subsystems that connect catch basins located throughout the Yard. The primary subsystem serves approximately 90 percent of the Yard. Storm water from the primary subsystem leaves the Yard to the north, approximately 360 feet west of Honeywell Street. The secondary drainage subsystem is located in the southwest corner of the Yard and services approximately 10 percent of the Yard. Storm water from the secondary subsystem exits the Yard to the south, approximately 360 feet west of the intersection of Skillman and Thompson Avenues.

Area 1 discharges surface water and ground water into the primary sewer drainage system from the following identified sources:

- storm water and surface runoff into 13 catch basins located throughout Area 1;
- water from an oil/water separator located east of the Engine House that is connected to the former fuel transfer area;
- storm water and/or ground water from service bays Pit 3 and Pit 4 located directly north of the Engine House; and
- ground water from the service bay located in the Metro Shop.

In Area 1, most of the sewer appears to be located below the water table and surface runoff with sheens was observed flowing into some of the catch basins during periods of precipitation.

## 3.2 Geology

Published geologic data, historical maps, and geologic logs for borings drilled during the investigations were evaluated to define the current geologic conditions observed at the Yard.

### 3.2.1 Regional Geology

The Yard is located within the Atlantic Coastal Plain Physiographic Province. The regional subsurface geology consists of unconsolidated sand, silt, clay and gravel deposits that overlie crystalline bedrock. The strata in the area dip gently to the southeast, following the topography of the bedrock surface (Soren, 1978). Boreholes drilled within northwestern Queens County indicate that the unconsolidated deposits are predominantly Upper Pleistocene glacial deposits that range from approximately 30 to 150 feet in thickness. These borehole logs also indicate that Lower Pleistocene deposits, consisting of the Jameco gravel overlain by the Gardiner's clay unit, may be discontinuously present beneath the Yard. These Lower Pleistocene deposits unconformably overlie bedrock.

The Upper Pleistocene deposits are covered by a thin veneer of recent and Holocene deposits. Unconsolidated Upper Pleistocene glacial (ground moraine) deposits of unstratified, poorly sorted mixtures of sand and silt with some gravel and cobbles (Buxton, et al., 1981) overlie the Lower Pleistocene deposits (where present), which overlie crystalline bedrock. The saturated portion of the Upper Pleistocene deposits form the Upper Glacial aquifer of Long Island.

### 3.2.2 Yard Geology

The geologic logs of soil borings drilled on the Yard during the investigations indicate that the Yard is underlain by the following units (in order by increasing depth); fill, Upper Pleistocene glacial deposits (including both till and channel deposits), and bedrock. The fill is predominantly comprised of reworked glacial deposits (sand, silt, clay and gravel) and railroad ballast, with minor amounts of construction debris and other materials.

The Upper Pleistocene glacial deposits consist mainly of ground moraine deposits; unstratified, poorly sorted mixtures of sand, silt, clay and gravel (as previously described). In addition, a cobble layer was encountered in three deep soil borings drilled at the Yard. This unit may represent a relict stream channel that was formed by glacial meltwaters. One borehole was drilled to the bedrock surface beneath the Yard. In this soil boring (P-3D), located within Area 1, bedrock was encountered at a depth of 74 feet below land surface (i.e., 53 feet below mean sea level). In the southwestern portion of the Yard, a Holocene wetland deposit was encountered below the fill and above the Upper Glacial formation. This deposit consisted of organic silty clay and meadow mat. As discussed below, this deposit is associated with a buried stream channel.

Published information, interviews with Yard workers, and site-specific data derived from drilling activities (geologic logs) during the first phase of the RI process indicated that a significant amount of fill was present at the Yard, overlying natural deposits. Factors indicating large volumes of fill included early reports that the Yard was a reclaimed marshland, the construction of the elevated LIRR right-of-way, and several extensive bulkheaded areas throughout the Yard. In addition, fill or reworked deposits of sand and gravel at the Yard are visually indistinguishable from natural, unstratified sand and gravel deposits. Based on this information, the Phase I RI reported that the entire Yard was underlain by fill, ranging in thickness from 8 to 27 feet. However, based on information obtained during the Phase II RI, a better understanding as to the origin of the current topography has been developed.

During evaluation of the geologic and hydrogeologic data for the Yard, a historical topographic map for western Queens, dated 1890, was obtained for reference (Julius Bien & Co., 1890). Utilizing this map, a 1910 Yard map and recent area maps, a comparison was made between the historical and current topographic features of the Yard (Figures 1 and 4). This comparison indicated that:

- the majority of topographic changes that occurred at the Yard took place between 1890 and 1910;
- current land surface elevation throughout much of the Yard is actually lower than original elevation;

- two former surface-water bodies at the Yard have been filled; and
- the current elevation of the LIRR main line approximately correlates with 1890 topography.

The topography shown on the 1890 map for the land now occupied by the Yard is much different than present topographic conditions. The map (Figure 5) indicates that approximately 750 feet east of Dutch Kills (which flowed through the western portion of the Yard) land surface begins a rapid increase from less than 10 to greater than 60 feet above mean sea level west of Honeywell Street. Although this topographic high is still present south of the Yard, the mound no longer exists across the Yard. West of Honeywell Street land surface gradually sloped to the north, from a high elevation of approximately 80 feet above mean sea level along Skillman Avenue (designated Skilman Avenue on the 1890 map) to a low of about 30 feet above mean sea level at the wetland along Northern Boulevard (designated Jackson Avenue on the 1890 map). A comparison of the 1890 topographic map, the 1910 Yard map, and recent site plans indicate that major topographic changes took place at the Yard between 1890 and 1910, bringing the Yard close to its present, generally flat, topographic condition. These changes are discussed below.

Although only a limited number of landmarks and surveyed points could be correlated between the 1890 and more recent maps, this comparison suggests that the central portion of the Yard has been scraped down rather than filled to reach its present elevation. One portion of the Yard that had an elevation of approximately 60 feet above mean sea level in 1890 (near the corner of Hill Street and the new Skillman Avenue), now lies 45 feet lower at approximately 15 feet above mean sea level. Although it is apparent that surficial fill (ballast) is located throughout the Yard, this information suggests that the sand and gravel deposits underlying the ballast in this area are native glacial deposits, as opposed to fill or reworked deposits.

Two surface-water bodies are also indicated on the 1890 map; a wetland is shown along Northern Boulevard (Jackson Avenue) near the northeast corner of the Yard, and a stream, Dutch Kills, is indicated in the northwest corner of the Yard flowing southwest to Newtown Creek. Present conditions prove that these areas have been filled since 1890. Presumably, the glacial deposits that were excavated from the central portion of the Yard were used to fill these wetland and stream areas between 1890 and 1910. Geologic logs from borings in the northwest corner of the Yard (MW-30 and S-32) describe fine to medium sands overlying wetland-deposited meadow mat and clays. These logs support the theory that local glacial deposits were used to fill the former wetland (Appendix C). A 48-inch diameter sewer line charted on the 1910 Yard map indicates that the Dutch Kills drainage is culverted beneath the northwest corner of the Yard.

A comparison of the LIRR main line elevation with 1890 topographic contours indicates that this right-of-way is similar to original land surface elevation. These data suggest that the LIRR main line, which is elevated more than 20 feet above the adjacent Yard, was not built up during its construction. Instead, the right-of-way may reflect original (or close to original) land surface, with the surrounding Yard having been excavated or scraped down to its present, low-lying elevation.

During the Phase II RI, six deep boreholes were drilled at the Yard; MW-38D, MW-39D, MW-40D, MW-44D, MW-48D and MW-62D. These data supplemented the current understanding of geologic conditions beneath the Yard. Based on these geologic logs, an approximately 4-foot thick cobble zone is located in the subsurface at locations MW-40D, MW-44D and MW-48D. The cobble unit is encountered at an elevation of approximately 2.3 feet above mean sea level at MW-48D, and deepens to the west, where it is encountered at approximately 18 feet below mean sea level at MW-44D. This unit may be a relict stream channel deposit, and therefore may not be laterally continuous.

Based on information obtained from the NYSDEC, the bedrock surface appears to be highly irregular in this area. Boreholes drilled adjacent to the Yard indicate that the depth to bedrock ranges from approximately 30 to 150 feet bls (i.e., 10 to 130 feet below mean sea level). As part of additional work at the Yard one borehole (P-3D), located approximately 15 feet from Monitoring Well MW-40D, was drilled to the bedrock surface. Bedrock was encountered at a depth of 74 feet bls (53 feet below mean sea level).

### 3.3 Hydrogeology

Published hydrogeologic data and Yard-specific water-level elevation and aquifer test data were evaluated to define the current hydrogeologic conditions observed at the Yard. These data were used to prepare water-level elevation maps, calculate horizontal and vertical gradients, estimate the hydraulic coefficients, and calculate ground-water flow rates.

#### 3.3.1 Regional Hydrogeology

Ground water in the area occurs under water-table (unconfined) conditions in the Upper Glacial aquifer. Regional ground-water flow in the area is to the northwest, eventually discharging to the East River approximately one mile northwest of the Yard (McClymonds and Franke, 1972). Vertical flow within the aquifer changes from a downward flow in central Queens to an upward flow nearing the East River, where ground water discharges. The published horizontal hydraulic conductivity of the Upper Glacial aquifer in Queens County ranges from 214 feet per day (McClymonds and Franke, 1972) to 270 feet per day (Franke and Cohen, 1972).

To obtain historical pumping and ground-water flow data for northwestern Queens, Roux Associates performed a Freedom of Information Act (FOIA) file and well search at the NYSDEC offices. This search identified numerous wells and test borings within a 2-mile radius of the Yard. Well construction details, date of installation, geologic logs, abandonment information, pumping/injection rates, historical water-level elevations, general water quality and water use were provided on a well completion report for many of these wells. Geologic logs, including the depth to bedrock, were available for many of the test borings. A summary of the information obtained from the well search is included in Appendix H.

Although pumping information and the status of the well was provided on many of the well completion forms, according to the NYSDEC this information has not been updated in many years. From the available well information, approximately 21 Upper Glacial aquifer wells may still be active. Of these 21 Upper Glacial wells, five are described as being diffusion wells, while the remainder are pumping wells. These pumping wells are (or were) predominantly used to supply water for car washing, with a smaller number of wells used to supply cooling water. Approximately ten of the bedrock wells identified during the well search are potentially active pumping wells. All wells that were active upon last inspection (for which the NYSDEC was unable to supply dates) were installed between 1924 and 1966. This suggests that many of these "potentially" active wells may no longer be in use.

In addition to the FOIA search, hydrogeologic information for northwestern Queens was solicited from the United States Geological Survey (USGS). Roux Associates discussed the hydrogeology of the area with Julian Soren, who has performed numerous studies on Long Island geology and hydrogeology. Mr. Soren provided Roux Associates with information regarding pumping wells in northwestern Queens County. Water-level data were obtained for USGS observation well Q-3122, located approximately 1,400 feet north of the Yard. A hydrograph of these data indicate that water levels have fluctuated more than 3 feet since 1982 (Fanning, Phillips & Molnar Engineers, 1992).

Published water-level data for Long Island show that from the early 1930's to about 1960 the water table within Kings County and western Queens County was depressed to elevations below sea level due to over pumpage. The cone of depression caused significant salt-water intrusion into the Upper Glacial and confined aquifers beneath these areas, and as far inland as the center of the Kings County (Smolensky, 1983). Historical data for wells near the Yard indicate that salt-water intrusion also affected the aquifers beneath the Yard. In documentation obtained during the FOIA search, two bedrock wells (Q-173 and Q-58) are noted as having brackish water conditions during 1925 and 1932, respectively. Both wells are located northeast of the Yard, with well Q-173 being the closest (within 500 feet of the Yard). Due to the corrosive nature of the water, well Q-173 went out of use around 1921 and well Q-58 eventually went dry in 1936. However, published data indicate that by the late-1950s the cone of depression within Queens County had recovered (Smolensky, 1983). Current water-level elevations at the Yard range from 8 to 23 feet above mean sea level, precluding salt-water intrusion in this area. However, the effects of the historical salt-water intrusion can still be detected in ground-water quality, which exhibits elevated concentrations of sodium and chloride (Soren, 1971).

Regional ground-water quality of the Upper Glacial aquifer is characterized as having a wide range of iron and manganese concentrations (Buxton, et al., 1981). Concentrations of iron and manganese increase as conditions become anoxic (i.e., as the dissolved oxygen context decreases). Anoxic conditions are typically associated with swamp or wetland deposits, such as those identified in the western portion of the Yard.

### 3.3.2 Yard Hydrogeology

Ground water beneath the Yard occurs under water-table (unconfined) conditions. The water table lies between 1 and 15 feet below land surface and occurs in either fill deposits (e.g., western part of Yard) or the Upper Pleistocene glacial deposits (e.g., eastern part of Yard). The saturated Upper Pleistocene deposits comprise the Upper Glacial aquifer. Beneath the Yard, the saturated fill deposits and the shallow Upper Glacial aquifer were not always distinguishable, and are, therefore, collectively referred to as shallow deposits (which contain the water table). Deeper wells at the Yard (designated by a "D") are screened within the deeper Upper Glacial aquifer.

Multiple rounds of water-level measurements were taken in the well clusters at the Yard to determine vertical hydraulic gradients, ground-water flow patterns within the Upper Glacial aquifer, and the hydraulic relationship between the shallow deposits and the deeper Upper Glacial aquifer. Seven well clusters currently exist across the Yard: four clusters within Area 1 (MW-19/MW-39D, MW-16/MW-23D, MW-49/MW-38D and MW-57/MW-40D) and three clusters facility wide (MW-43/MW-44D, MW-47/MW-48D, and MW-61/MW-62D). Water-level data for these wells are included in Table 7. Measurements obtained from Monitoring Well MW-16 were not used because the well contains separate-phase petroleum and is currently part of the IRM system.

Ground-Water Flow Patterns

Ground water within the shallow deposits flows predominantly west beneath the Yard (Plates 6 through 9). However, between Queens Boulevard and Honeywell Street, ground water flows northerly and northwesterly toward the East River. This flow pattern was exhibited in both the February 1994 and June 1994 water-level data (Plates 8 and 9). These ground-water flow lines appear to mimic the topographic contours of the 1890 map, which depict a topographic high (presumably consisting of glacial till) in the area between Queens Boulevard and Honeywell Street (Figure 5). Since in-situ glacial till is much less permeable than reworked glacial till (fill), horizontal flow gradients are expected to be much steeper within these till deposits. Other factors may also be causing anomalously high water-level elevations in well MW-29 including: a tidal influence associated with the relict stream channel of Dutch Kills; extensive bulkheaded areas; or parking lot drainage.

Water-level elevations from the deep wells were used to prepare a water-level elevation map to determine ground-water flow patterns within the deeper Upper Glacial aquifer. As shown in Plate 10, ground water in the deeper deposits predominantly flows west across the Yard. The area of northerly flow shown in the shallow deposits is not evident on the deep ground-water flow map, however, this may be an expression of the limited distribution of monitoring points, rather than natural conditions.

As illustrated in Plates 8 through 10, monitoring well clusters MW-47/MW-48D and MW-61/MW-62D were installed at locations hydraulically upgradient of the Yard. During the Phase II RI and related work, ground-water analytical data from these four wells were used to determine background ranges for metals in ground water. Although other wells are located upgradient of the Yard (i.e., MW-24, MW-30 and MW-34), metals data were not developed for these wells. However, data from all upgradient wells were used to determine background ground-water quality, and identify contaminants migrating onto the Yard from upgradient, off-site sources.

### Horizontal Gradients

Horizontal flow gradients within the shallow deposits range from approximately 0.001 feet per foot from the Metro Shop area east to Area 14, up to 0.008 feet per foot in the vicinity of Areas 4, 5 and 6. The average shallow horizontal flow gradient for the Yard, calculated between wells MW-32 and MW-42, is 0.004 feet per foot. An average horizontal gradient for the Yard of 0.003 feet per foot was calculated for the deeper deposits between wells MW-48D and MW-44D. These values are indicative of a relatively flat water-table surface.

When compared to the geologic features of the Yard, lower horizontal gradients (i.e., a flatter water-table or potentiometric surface) appear to correspond with areas of the Yard known to have been filled. These filled areas generally contain much less compact and, therefore, more permeable materials than the undisturbed glacial deposits. These areas include the western portion of the Yard north of the LIRR right-of-way, and the central portion of the Yard between the Turntable and Area 17. Areas of the Yard showing steeper horizontal gradients (i.e., less permeable deposits) include the portion of the Yard east of 39th Street, the southwest portion of Area 1, and the area including and south of the LIRR right-of-way between Queens Boulevard and Honeywell Street.

Vertical Gradients

The vertical gradients at each well cluster were calculated according to the following formula.

$$\frac{\text{Water-Level Elevation (shallow well)} - \text{Water-Level Elevation (deep well)}}{\text{Elevation of Screen Center (shallow well)} - \text{Elevation of Screen Center (deep well)}}$$

Based on this formula, a negative number represents an upward gradient, and a positive number represents a downward gradient. Vertical gradients were calculated using the February 8, 1993 measurements for the three clusters that existed at that time. These calculations (included in Appendix I) indicate the following:

- at upgradient cluster MW-47/MW-48D, ground water is flowing downward at an approximate vertical gradient of 0.0801 feet per foot;
- at Area 1 cluster MW-16/MW-23D, the vertical direction of ground water cannot be determined with any certainty due to the significant separate-phase petroleum thickness present in Monitoring Well MW-16; and
- at downgradient cluster MW-43/MW-44D, ground water is flowing slightly upward with an approximate vertical gradient of -0.0030 feet per foot.

An additional round of water levels was completed at the Yard on June 14, 1994. These data were utilized to determine vertical gradients for all newly-installed clusters and confirm the vertical gradients previously calculated for clusters MW-43/MW-44D and

MW-47/MW-48D. As previously stated, vertical gradients were not calculated for cluster MW-16/MW-23D due to the significant separate-phase petroleum thickness within Monitoring Well MW-16. The June 1994 data indicate that:

- at upgradient cluster MW-47/MW-48D, ground water is flowing downward at an approximate vertical gradient of 0.1212 feet per foot, confirming the previous flow direction calculated for this cluster;
- at upgradient cluster MW-61/MW-62D, ground water is flowing slightly downward at an approximate vertical gradient of 0.0011 feet per foot;
- at Area 1 clusters MW-19/MW-39D and MW-49/MW-38D, ground water is flowing upward with approximate vertical gradients of -0.0274 and -0.0270 feet per foot, respectively, while ground water is flowing very slightly upward at -0.0008 feet per foot (nearly horizontal flow) at cluster MW-57/MW-40D; and
- at downgradient cluster MW-43/MW-44D, ground water is flowing slightly upward with an approximate vertical gradient of -0.0015 feet per foot, confirming the previous upward flow direction calculated for this cluster.

The downward gradients at cluster MW-47/MW-48D indicate that the area near the northeastern corner of the Yard is a ground-water recharge area. Recharge is expected in this location based on historical information, which shows that a wetland was located in this area prior to being filled. Vertical gradients change from downward to upward with nearing proximity to the East River, the ground-water discharge area. The upward flow measured within Area 1 and along the downgradient property boundary indicate that the northwest portion of the Yard is a discharge zone. Historical documentation confirms upward flow in the central portion of the Yard. State of New York Conservation Department Water Power and Control Commission field investigation notes document four wells (approximately 30 feet deep) onsite located west of Honeywell Street between Northern Boulevard and Skillman Avenue, and describe these wells as being "partly flowing" (Appendix H). These wells were abandoned during 1926. A second group of four flowing wells was formerly located south of Skillman Avenue and west of Bridge Plaza (59th Street).

Stronger upward gradients are expected to occur with closer proximity to the East River. This can be seen in Area 1 clusters MW-19/MW-39D and MW-49/MW-38D, and downgradient cluster MW-43/MW-44D when compared to the slight upward flow (nearly horizontal flow) seen at cluster MW-57/MW-40D. The upward flow observed in Area 1 and the downgradient portion of the Yard prevents (or slows) the downward migration of contaminants within the aquifer. In addition, the upward gradients in Area 1 assist in containment of the separate-phase petroleum accumulation and may lessen the petroleum's impact on underlying ground-water quality.

Hydraulic Coefficients

Hydraulic coefficients for the saturated fill deposits and Upper Glacial aquifer at the Yard were determined during the Phase I RI and preliminary design of the construction and dewatering activities regarding construction of the proposed High-Speed Rail Service Facility. Initially, estimates of the horizontal hydraulic conductivity ($K_H$) were calculated from slug tests performed during the Phase I RI. These data suggest a $K_H$ range of 0.59 feet per day (ft/d) to 60 ft/d within fill, and estimates $K_H$ to be 2.13 ft/d within the Upper Glacial aquifer (calculated for well MW-23D).

During the construction and dewatering activities design work, a pumping test and multiple slug tests were performed within Area 1, and two slug tests were performed south of Area 1. Six piezometers were installed in the vicinity of Monitoring Well MW-40D prior to performing the pumping test on this well. Geologic and well construction logs for these piezometers are included in Appendices C and D.

Hydraulic coefficients derived from these additional slug tests suggest that $K_H$ values within Area 1 are higher than those determined facility-wide, with calculated values ranging from 2.36 ft/d in the shallow deposits (MW-49) to approximately 127 ft/d in the deeper deposits (MW-40D). The following hydraulic coefficients for the water-table aquifer were calculated from data derived during the pumping test performed on well MW-40D; an average $K_H$ of 462 ft/d, an average transmissivity (T) of 33,135 square feet per day ($ft^2/d$), an elastic storage coefficient range of 0.00001 to 0.036, a specific yield or water-table storage coefficient range of 0.02 to 0.280, and an average vertical hydraulic conductivity ($K_V$) of 48 ft/d. Using the average values calculated for $K_H$ and $K_V$, the anisotropy ($K_V$:$K_H$) of the water-table aquifer was calculated to be 0.10. All calculations are based on a saturated thickness of 70.59 feet determined near MW-40D.

These hydraulic coefficients suggest that the aquifer is highly transmissive. In general, higher hydraulic conductivity and transmissivity values were obtained for wells screened within the deeper deposits. The average $K_H$ and T values calculated for the shallow wells/piezometers near MW-40D are 410 ft/d and 28,950 $ft^2/d$, respectively. The average $K_H$ and T values calculated for the deeper deposits screened by MW-40D and nearby piezometers are 500 ft/d and 35,300 $ft^2/d$, respectively. Since the pumping well (MW-40D) screens a cobble layer, the calculated hydraulic coefficients were compared to published values for gravels, sand and gravel, and coarse sands of the Upper Glacial aquifer. According to McClymonds and Franke (1972), the average $K_H$ for these deposits is 270 ft/d to 400 ft/d, which approximates the $K_H$ value calculated for the Yard within Area 1. Since the hydraulic coefficients derived from pumping test data are considered more accurate than slug test data and agree with published values, these data will be used in the ground-water flow rate calculations.

## Ground-Water Flow Rates

Based on data previously derived for the Yard (hydraulic conductivity values) and horizontal flow gradients calculated from recent water-level data, an average ground-water flow velocity was calculated for the Yard.

$$v=K_H \frac{I_H}{n_e}$$

where:

$v$ = the velocity of ground water along a segment of a flow line (ft/d);

$K_H$ = the horizontal hydraulic conductivity of the aquifer along the segment of a flow line (ft/d);

$I_H$ = the horizontal hydraulic gradient along a segment of the flow line (ft/ft); and

$n_e$ = the effective porosity of the aquifer (dimensionless).

Using an average $K_H$ of 410 ft/d for the shallow deposits at the Yard, an average horizontal hydraulic gradient of 0.004 feet per foot for the water table on June 14, 1994, and an estimated effective porosity of 0.25 (Walton, 1991), the ground-water flow velocity through the shallow deposits was calculated to be 6.6 feet per day. Using an average horizontal hydraulic conductivity of 500 ft/d for the deeper deposits at the Yard, an average horizontal gradient of 0.003 feet per foot for the deeper deposits on June 14, 1994, and an average estimate porosity of 0.35 for coarser deposits (Walton, 1991), the ground-water flow velocity through the deeper deposits was calculated to be 4.3 feet per day.

## 4.0 NATURE AND EXTENT OF CONTAMINATION

The evaluation of nature and extent of contamination included below was based on soil, ground-water, sewer water, sewer sediment and separate-phase petroleum data developed during the RIs, and related work (i.e., previous and supplemental investigations) at the Yard. These data do not include analytical results of the soil or ground water PCB or total PHC data from the Phase I RI. However, as discussed in Section 2.1.2, issues regarding the validity of the data rendered it usable for screening purposes only. Therefore, these data were utilized for screening while determining the scopes of work for additional investigations and therefore, are not discussed further in this section. Although the confirmatory sample results are included within the area of concern results, a discussion of the comparison between the Phase I and confirmatory data is provided in Appendix E. In addition, Phase I RI soil data indicate that the two most prevalent VOCs (acetone and methylene chloride) and the most prevalent SVOC (bis[2-ethylhexyl]phthalate) detected in facility-wide soil are all commonly introduced laboratory contaminants. Since low detections of these compounds are not considered representative of soil quality, these detections have been excluded from the nature and extent discussions. Laboratory analytical results for samples collected during the Phase I RI and supplemental work are tabulated in Appendices A and B, respectively.

To perform an assessment of metals results, and delineate any areas which have been impacted by Yard activities, a determination of site-specific background soil conditions was established during the Phase I RI. Therefore, only metals concentrations that exceed these site-specific background ranges by at least one order of magnitude are discussed in this section, but all detections are presented in the analytical data summary tables. Although the site-specific background soil samples collected during the Phase I RI have been used for comparison purposes in this section, these data were not used in the RA due to the limited number of samples collected (three) and the uneven distribution of these samples across the Yard.

To evaluate any impacts to ground-water quality, background (upgradient) locations (MW-47/MW-48D, MW-61/MW-62D, MW-24, MW-30 and MW-34 were selected based on ground-water flow patterns to develop a range of background concentrations. Only metals detected above background are summarized in this section, but all detections are presented in the analytical data summary tables.

The discussions of the sampled media provided below are organized by area of concern, as identified in the Phase I RI.

### 4.1 Area 1 Results

The media investigated in Area 1 include soil, separate-phase petroleum and ground water (deep and shallow). The results of the investigations performed are discussed below. Sewer water and sewer sediment results are discussed in Section 4.19.

#### 4.1.1 Soil

During the Phase I RI, work within Area 1 included analyzing five shallow soil samples for lead: S-2, S-10, MW-19, MW-20 and MW-21. With the exception of MW-21, each sample contained lead in concentrations greater than one order of magnitude above background. Analytical results are included in Appendix A.

Phase II RI Addendum soil sampling within Area 1 consisted of TCL/TAL analyses and hydrocarbon scans of the following seven samples: S-122 (7.5-8.5 feet bls), S-129 (3 to 5 feet bls), S-134 (2 to 4 feet bls), S-135 (3 to 3.5 feet bls), S-139 (3 to 3.1 feet bls), MW-54 (3 to 5 feet bls) and MW-58 (2 to 3 feet bls). In addition, nine samples were analyzed for PCBs (i.e., seven confirmatory samples and two non-ASP analyses performed for screening purposes only). Results are discussed below, and soil analytical data are presented in Tables 8 through 12 and Plates 11 through 13.

Additional soil boring sampling was performed in four general areas including:

- northwest and west of the Turntable;
- south of the Metro Shop;

- adjacent to Monitoring Well MW-10; and
- adjacent to Monitoring Well MW-12.

The findings of these investigations are discussed below.

Turntable Area

One soil sample, S-129 (3 to 5 feet) and one monitoring well pilot borehole MW-54 (3 to 5 feet), were analyzed for the TCL/TAL and a hydrocarbon scan. Although a sheen was noted at location S-129, no VOCs were detected in the sample. Ethylbenzene was detected in MW-54 at 640 μg/kg (0.64 ppm). Fourteen SVOCs (predominantly PAHs) were detected in S-129 and five SVOCs (all PAHs) were detected in MW-54. No metals were detected significantly above background ranges. Aroclor-1260 was detected at a concentration of 190 μg/kg (0.19 ppm) in S-129, while 140 μg/kg (0.14 ppm) Aroclor-1248 and 33 μg/kg (0.033 ppm) Aroclor-1260 were detected in MW-54 soil. No. 2 fuel oil was detected by the hydrocarbon scan in both S-129 (770 mg/kg [ppm]) and MW-54 (11,300 mg/kg [ppm]).

Area South of the Metro Shop

Soil samples that showed evidence of petroleum contamination from hand borings PD-45 and PD-47 were collected for PCB analyses (non-ASP). The two samples, which were collected for screening purposes only, were analyzed by IEA. The results indicated that low levels of PCBs (i.e., less than 1 ppm) were present in both samples. Soil from PD-45 (3 to 4 feet) contained Aroclor-1260 at an estimated concentration of 14 μg/kg (0.014 ppm). Soil from PD-47 (6.5 to 7 feet) contained the following: Aroclor-1242 (140 μg/kg [0.14 ppm]), Aroclor-1254 (390 μg/kg [0.39 ppm]), and Aroclor-1260 (270 μg/kg [0.27 ppm]).

Monitoring well pilot borehole MW-58 was drilled and one soil sample collected for TCL/TAL analyses and a hydrocarbon scan. No VOCs were detected in the MW-58 (2 to 3 feet bls) soil sample. Ten SVOCs were detected. Five of these SVOCs (naphthalene, 2-methylnaphthalene, fluorene, phenanthrene and pyrene) are known constituents of No. 2 fuel oil, which was detected at a concentration of 13,900 mg/kg (ppm). Copper, lead, and zinc exceeded background concentrations by more than one order of magnitude. Three PCBs were detected in the MW-58 soil sample: Aroclor-1248 (100 µg/kg [0.1 ppm]), Aroclor-1254 (340 µg/kg [0.34 ppm]) and Aroclor-1260 (290 µg/kg [0.29 ppm]).

One soil sample from test pit S-122 was collected for TCL/TAL analyses and a hydrocarbon scan. No VOCs were detected. Eight SVOCs (predominantly PAHs) were detected, ranging in concentration from 15 µg/kg (0.015 ppm) to 48 µg/kg (0.048 ppm). No metals exceeded the background metals concentrations by an order of magnitude. Aroclor-1260 was detected at a concentration of 37 µg/kg (0.037 ppm). No PHCs were detected in this soil sample.

### Area Adjacent to Monitoring Well MW-10

Soil sample S-134 was analyzed for the TCL/TAL and PHCs (a hydrocarbon scan). No VOCs were detected in the S-134 soil sample. Eleven SVOCs were detected in the sample. Two of the PAHs detected in this sample (phenanthrene and pyrene) are known constituents of No. 2 fuel oil, which was detected at a total concentration of 1,350 mg/kg (ppm). Copper, lead and zinc were detected significantly above background concentrations. Aroclor-1254 and Aroclor-1260 were present at 110 µg/kg (0.11 ppm) and 390 µg/kg (0.39 ppm), respectively.

### Area Adjacent to Monitoring Well MW-12

Soil samples were collected from borings S-135 (3 to 3.5 feet) and S-139 (3 to 3.1 feet) for laboratory analyses for the TCL/TAL and PHCs (a hydrocarbon scan). Although a clear oily substance was observed at approximately 3 to 3.5 feet bls in Soil Boring S-135, only low levels of one VOC and two SVOCs were detected: 1 µg/kg (0.001 ppm) xylenes (total), 17 µg/kg (0.017 ppm) dibenzofuran and 31 µg/kg (0.031 ppm) fluorene. PHCs were not detected in the hydrocarbon scan. Metals were not detected at concentrations significantly above background. Aroclor-1254 was detected at 12 µg/kg (0.012 ppm).

No VOCs were detected in soil sample S-139 (3 to 3.1 feet). Nine SVOCs (predominantly PAHs) were detected in S-139. No metals were detected significantly above background. PHCs were not detected in the hydrocarbon scan. Aroclor-1260 was detected at a concentration of 140 μg/kg (0.14 ppm).

Confirmatory Sampling

Seven soil samples (CS-1, CS-3, CS-5, CS-10, CS-76, CMW-20 and CMW-22) were collected to confirm the concentrations of PCBs previously detected in Area 1. PCBs were also detected in all seven samples. Shallow soil samples CS-1 and CS-76 each contained Aroclor-1248 and Aroclor-1260. CS-1 (0 to 2 feet bls) soil concentrations were as follow: Aroclor-1248 at 700 μg/kg (0.7 ppm), and Aroclor-1260 at 8,600 μg/kg (8.6 ppm). The CS-76 (0 to 0.5 feet bls) soil sample contained Aroclor-1248 at 2,900 μg/kg (2.9 ppm), and Aroclor-1260 at 73,000 μg/kg (73 ppm). Only Aroclor-1260 was detected in CS-10 at 370 μg/kg (0.37 ppm). Two Aroclor species, Aroclor-1254 and Aroclor-1260, were detected in the CS-3, CS-5, CMW-20 and CMW-22 samples. Soil sample CS-3 was collected from 3 to 5 feet bls and contained 850 μg/kg (0.85 ppm) Aroclor-1254 and 1,400 μg/kg (1.4 ppm) Aroclor-1260. Aroclor-1254 was detected at 440 μg/kg (0.44 ppm) and Aroclor-1260 was detected at 1,700 μg/kg (1.7 ppm) in soil sample CS-5 (0 to 2 feet bls). Aroclor-1254 and Aroclor-1260 were detected in CMW-20 at 190 μg/kg (0.19 ppm) and 360 μg/kg (0.36 ppm), respectively. Sample CMW-22 showed concentrations similar to CS-5; 400 μg/kg (0.4 ppm) of Aroclor-1254 and 1,100 μg/kg (1.1 ppm) of Aroclor-1260.

In summary, only two detections of VOCs occurred in Area 1. SVOCs (predominantly PAHs) and PCBs were detected throughout the area. Three metals (copper, lead and zinc) were detected significantly above background at locations S-134 and MW-58. No metals were detected significantly above background in all other soil samples analyzed from Area 1.

### 4.1.2 Separate-Phase Petroleum

As previously discussed in the Phase I RI, an accumulation of separate-phase petroleum is present on the ground water in Area 1.

#### 4.1.2.1 Offsite Extent of Separate-Phase Petroleum Accumulation

The offsite extent of the separate-phase petroleum accumulation was determined by performing monitoring well installation, inspecting sumps within offsite buildings, completing hand borings, and sampling the sewer that parallels the northern property boundary. The results of these tasks are discussed below. The delineation work commenced on October 15, 1991 in the presence of the NYSDEC.

Monitoring Well MW-35, located north (hydraulically downgradient) of the sewer line, was installed first. No soil staining or petroleum odors were detected during drilling of this well and no separate-phase petroleum was detected during well development or subsequent water-level gauging. Soil staining, a strong petroleum odor, and separate-phase petroleum were encountered during drilling and development of Monitoring Well MW-36, located south (hydraulically upgradient) of the sewer line. Geologic logs and monitoring well construction logs are included in Appendices C and D, respectively.

On October 16, 1991 an inspection of the off-site buildings was conducted by Roux Associates personnel and the NYSDEC. During the inspection, a basement dewatering sump was noted in the southeast corner of the basement of the building located at 34-00 Northern Boulevard, directly north of Monitoring Wells MW-35 and MW-36 (Plate 3). The sump contained water with no sheen or petroleum odor. A second sump was noted in the same basement located northwest (downgradient) of the first sump, which contained a black, odorless oily substance similar to lubricating oil. The nature of the oil and location within the building suggests the petroleum in the sump is attributable to a source other than the accumulation at the Yard.

During a previous inspection in the basement of the building located at 34-18 Northern Boulevard (Plate 3) with the NYSDEC, Roux Associates personnel were informed of an excavation where separate-phase petroleum was encountered at a depth of approximately 2 feet beneath the basement floor. The elevation of the basement floor was approximately 3.5 feet higher than the elevation of land surface at Monitoring Well MW-20 (the closest well to this building), which is located approximately 80 feet southeast (upgradient and on the opposite side of the sewer line) from the basement excavation. The top of the separate-phase petroleum accumulation in Monitoring Well MW-20 has been measured at approximately 3 feet bls, or about 6.5 feet below the building basement. Since this reported petroleum accumulation was at an elevation approximately 4.5 feet higher than the accumulation measured in Monitoring Well MW-20, a source area other than the Yard is indicated.

Water-level and separate-phase petroleum thickness measurements were collected on October 16 and 23, 1991 from the monitoring wells located in Area 1. Water-table elevations, the shallow ground-water flow direction and the extent of the separate-phase petroleum accumulation measured on October 23, 1991 are shown in Plates 3 and 4. As shown in the plates, separate-phase petroleum is present south, but not north of the sewer. Also, shallow ground water flows in a northwest direction across Area 1, however, in the immediate vicinity of the sewer, shallow ground-water flow is parallel to the sewer line (westerly) and ground-water elevations were slightly lower on the north side of the sewer. Visual inspection of the sewer and a review of the ground-water elevation data indicated the sewer line intersects the water table in the study area. These data indicate that the sewer is acting as a barrier to shallow ground-water flow. Moreover, based on the fact that no separate-phase petroleum has been detected to the north of the sewer in monitoring wells MW-19 and MW-35, the sewer appears to be acting as a barrier to the northward migration of the separate-phase petroleum accumulation floating on the ground-water, thereby preventing off-site migration.

To further delineate the extent of the separate-phase petroleum accumulation on the south (upgradient) side of the sewer, eight hand borings (designated HB-1 through HB-8) were completed to a depth below the water table (Plate 3). Geologic logs are included in Appendix C. Each hand boring remained open for approximately one hour to allow separate-phase petroleum, if present, to enter the borehole. The following observations were made upon completion of the borings:

- a sheen was present in Hand Borings HB-1 and HB-2;
- separate-phase petroleum was present in Hand Borings HB-3, HB-4, HB-5 and HB-6; and

- no separate-phase petroleum or sheen was detected in Hand Borings HB-7 and HB-8.

These data indicate that the separate-phase petroleum accumulation does not appear to have migrated offsite beyond the sewer line.

While determining proper placement of Monitoring Well MW-35 on October 15, 1991, the manhole cover at MH-3 was removed to determine the exact location of the sewer line. At that time, during a steady, light rain, a sheen was observed on the sewer discharge water. On October 16, 1991 (no precipitation), a sheen was also observed. Therefore, the NYSDEC requested an interim sample be collected and analyzed for PHCs (a hydrocarbon scan) and PCBs to determine if the sewer line was acting as a conduit for off-site migration of PHCs or PCBs.

Roux Associates collected sewer-water samples from manhole locations MH-3 and MH-5 on October 23, 1991 to be analyzed for PHCs (a hydrocarbon scan) and PCBs. There were no PHCs or PCBs detected in the samples. Analytical results are included in Appendix B. However, it should be noted that no sheen was present during the scheduled sampling on October 23, 1991.

The results of the off-site delineation work indicated that the separate-phase petroleum accumulation has not migrated northward beyond the sewer line, was not present beneath the buildings located along Northern Boulevard, and was not migrating offsite in the sewer (Plates 3 and 4). The sewer line which parallels the northern boundary of the LIRR property is apparently acting as a physical barrier to the northward migration of ground water and the separate-phase petroleum accumulation.

#### 4.1.2.2 Onsite Extent of Separate-Phase Petroleum Accumulation

Following completion of the Phase I RI, further delineation of the onsite extent of the separate-phase petroleum accumulation in Area 1 was accomplished by:

- completing four phases of hand borings;
- drilling 24 soil borings during the Phase II Addendum; and

- installing and gauging 13 monitoring wells during the Phase II Addendum.

The results of these tasks are discussed below.

Hand Borings

Prior to the placement of permanent monitoring wells onsite during the Phase II Addendum, the extent of the separate-phase petroleum accumulation in Area 1 was further defined during four phases of additional delineation. These investigations consisted of the completion of 52 hand borings to the water table in Area 1. These hand borings were used as a screening tool to determine the presence or absence of separate-phase petroleum. The actual placements of the Addendum soil borings and permanent monitoring wells were based on the results of the hand borings that are described below.

Phase 1 of the additional delineation consisted of completing nine hand borings (GM-2, GM-2A, GM-2B, GM-2C, GM-3 and GM-9 through GM-12) next to Geraghty & Miller wells. Hand boring locations are shown in Plate 5, and the results of these borings are tabulated below.

| Screening Location | Monitoring Well Results | Hand Boring | Hand Excavation Results |
|---|---|---|---|
| MW-2 | No petroleum or odors noted | GM-2 | Measurable petroleum thickness noted |
| Downgradient of MW-2 | Not applicable | GM-2A | Measurable petroleum thickness noted |
| Upgradient of MW-2 | Not applicable | GM-2B,<br>GM-2C | Sheen and PID readings above background |
| MW-3 | Very slight sheen, very slight petroleum odor noted | GM-3 | Obvious sheen, very strong petroleum odor noted |
| MW-9 | No petroleum or odors noted | GM-9 | No petroleum or odors noted |
| MW-10 | No petroleum or odors noted | GM-10 | Measurable petroleum thickness noted |

| Screening Location | Monitoring Well Results | Hand Boring | Hand Excavation Results |
|---|---|---|---|
| MW-11 | No petroleum or odors noted (however, at the time of inspection, water table was above screened interval) | GM-11 | No petroleum or odors noted |
| MW-12 | No petroleum or odors noted | GM-12 | Obvious sheen noted |

Based on the results of the screening (i.e., the lack of correlation between the observations made in the hand-dug boreholes adjacent to the wells and observations made within the actual wells) the NYSDEC determined that the wells should no longer be used as monitoring points since the data obtained from them was invalid. As a result, the NYSDEC required additional delineation of the separate-phase petroleum accumulation in Area 1. These results were used to develop the scope of work for phase 2 of the additional delineation.

Phase 2 of the delineation consisted of completing 19 hand borings (PD-1, PD-4 through PD-19, PD-22 and PD-23). No petroleum or sheen was present on the water table within borings PD-1, PD-13 through PD-15, PD-17 and PD-18, confirming the previous delineation results along the western and southwestern boundaries of the separate-phase petroleum accumulation. Petroleum was observed on the water table within borings PD-10, PD-16 and PD-23, confirming the presence of the previously identified accumulation. With the exception of PD-19 (which is located west of the accumulation), all remaining borings (PD-4 through PD-9, PD-11, PD-12 and PD-22) contained either petroleum or a sheen on the water table, extending the former eastern boundary of the separate-phase petroleum accumulation further east toward the Turntable and further southeast (Plate 5). A sheen was also noted within PD-19, and appeared to be an isolated occurrence.

Based on these observations, a determination regarding the extent of petroleum accumulation was made. Plate 6 shows a shaded area depicting the separate-phase petroleum accumulation drawn from data collected on February 8, 1993 during a synoptic water-level and petroleum-thickness measurement round during the Phase II RI. The additional delineation results are also shown in Plate 6 as a dashed line depicting the current delineation of the accumulation. PD-19 and GM-12 (phase 1) were the only borings that contained petroleum hydraulically downgradient of the previously determined separate-phase petroleum accumulation. At the request of the NYSDEC, these isolated occurrences of petroleum required additional delineation.

Phase 3 of the additional delineation consisted of completing 15 hand borings (PD-24 through PD-30, PD-32 and PD-34 through PD-40). No petroleum or sheen was present on the water table at locations PD-25 and PD-26, located east of the Turntable. However, petroleum or a sheen was observed in boreholes PD-24 and PD-27 through PD-29, extending the separate-phase petroleum accumulation boundary further east and southeast. No petroleum or sheen was noted in PD-30 and, therefore, the southwest corner of the separate-phase petroleum accumulation was delineated (Plate 5). Borings PD-32 and PD-34 were installed to delineate the petroleum observed in GM-10 (adjacent to MW-10). No sheen or petroleum was observed on the water table within either boring, confirming the opinion that the petroleum noted at location GM-10 is an isolated occurrence. Borings PD-35 through PD-40 were installed to delineate the petroleum observed on the water table within GM-12 (adjacent to MW-12). Results show that petroleum or a sheen was present in each upgradient boring (PD-35, PD-36 and PD-38), and absent in the crossgradient (PD-37) and each downgradient boring (PD-39 and PD-40). Therefore, the petroleum observed on the water table at location GM-12 also appears to be an isolated occurrence.

These data indicate that the separate-phase petroleum accumulation was not completely delineated to the southeast, south of the Metro Shop and east of the Locker Room/Shop. In addition, a sheen was observed downgradient (northwest) of the Turntable.

Phase 4 of the additional delineation was scoped based on the results of phase 3 (above). Phase 4 consisted of completing nine hand borings (PD-41 through PD-48 and PD-53). No petroleum or sheen was present on the water table at locations PD-44 and PD-46, located south of the Metro Shop and east of the Locker Room/Shop. However, petroleum was noted in PD-45 and a sheen was observed in borehole PD-47, prompting completion of an additional boring to the east (PD-53). No petroleum or sheen was observed in PD-53, therefore delineating the southeastern extent of separate-phase petroleum. No petroleum or sheen was observed in two of the borings located downgradient of the Turntable (PD-42 and PD-43), and only a sheen was noted in PD-41. These data complete the delineation of the northeast edge of the separate-phase petroleum accumulation in Area 1. No sheen or petroleum was observed on the water table of PD-48. These data delineated the separate-phase petroleum detected near MW-12 (GM-12), confirming that this is an isolated occurrence of petroleum and not part of the larger Area 1 accumulation (Plate 5).

The results of the additional delineation investigations, phases 1 through 4, indicated that the previously delineated northern, western and southwestern boundaries of the separate-phase petroleum accumulation were accurate. However, the extent of the accumulation was not fully delineated to the east and southeast. The information obtained during Phases 1 through 4 was used to modify the locations of permanent monitoring wells proposed for the Phase II RI, and determine locations of additionally required wells resulting from the newly-delineated extent of separate-phase petroleum.

Soil Borings

**Northwest and West of the Turntable** - Eight soil borings (S-118 through S-121, S-129, and S-140 through S-142) and one monitoring well pilot borehole (MW-54) were drilled northwest and west of the Turntable (Plate 2). These borings were drilled to confirm the extent of the separate-phase petroleum accumulation determined by the four phases of hand borings. No evidence of petroleum was detected in soil borings S-118, S-119 and S-140. Soil staining and petroleum odors were noted within soil at locations S-121 (PID reading was 39.4 ppm above background), S-141 and S-142. Separate-phase petroleum was detected at the water table in soil boring S-120 (PID reading was 84.4 ppm above background). At location S-129 (PID reading was 27.8 ppm above background) a sheen was present on the water table. The data collected from the Turntable Area indicate that separate-phase petroleum is present west of the Turntable and between the retaining walls, but is absent at S-119 and north of location S-119. In addition, separate-phase petroleum was measured in Monitoring Well MW-60, located west of the Turntable and between the retaining walls.

Based on these results and observations of surface soil, the separate-phase petroleum detected west of the Turntable is a part of the larger previously identified accumulation (Plate 5).

**South of the Metro Shop** - Monitoring well pilot borehole MW-58 was drilled south of the Metro Shop and Locker Room/Shop to confirm the edge of the separate-phase petroleum accumulation. Staining and a petroleum odor were noted in soils at the water table in monitoring well pilot borehole MW-58. South of MW-58 and south of the retaining wall, three test pits (S-122 through S-124) were dug to determine if the accumulation extends beyond the retaining wall. Test Pits S-122 through S-124 were dug to the water table, approximately 7.5 to 8 feet bls in that area. No staining, odors or evidence of separate-phase petroleum were encountered in the test pits. In addition, no PID readings above background were noted during this work. The Phase II data collected south of the Metro Shop indicate that separate-phase petroleum is present south of both the Metro Shop and Locker Room/Shop, but does not extend south beyond the retaining wall. Based on these results, additional borings and wells were not required in this area.

**Adjacent to Monitoring Well MW-10** - Soil Borings S-130 through S-134 and S-143 through S-145 were completed around MW-10 (south of the Engine House), to determine the extent of the isolated separate-phase petroleum detections near MW-10 (Plate 2). These soil borings were drilled to the water table. Although dark staining was noted in the shallow soil (0 to 2 feet) of borings S-130 through S-133, a petroleum odor was only detected at locations S-133 and S-134. West of borings S-130 through S-134, a sheen was noted at S-143 and separate-phase petroleum was observed at S-144. However, there was no evidence of petroleum at location S-145, approximately 15 feet west of S-144. This indicates that the separate-phase petroleum detected in MW-10 is only present between S-133 (east) and a point between S-144 and S-145 (west), and between S-130 (north) and S-131 (south). The limited extent of this separate-phase petroleum indicates that it is an isolated occurrence, not related to the previously identified separate-phase petroleum accumulation located east of the Engine House (Plate 6).

**Adjacent to Monitoring Well MW-12** - Separate-phase petroleum was delineated around MW-12 by completing five hand-augered borings to the water table. Soil Borings S-135 through S-139 each showed hydrocarbon staining within the shallow soils only (less than 3 feet bls). No measurable separate-phase petroleum or sheens were noted on the water table within these borings. The limited extent of this separate-phase petroleum in the vicinity of MW-12 indicates that it is an isolated occurrence, not related to the previously identified separate-phase petroleum accumulation (Plate 6).

Monitoring Wells

In addition to the soil borings, the 13 monitoring well locations in Area 1 (MW-49 through MW-60 and MW-63) were designed to confirm the extent of the separate-phase petroleum accumulation (Plate 2). During drilling activities, hydrocarbon odor and/or staining was observed within soil below the water table at locations MW-50 through MW-56, MW-58 and MW-60. No evidence of petroleum was noted in soil at locations MW-49, MW-57, MW-59 and MW-63.

#### 4.1.2.3 Separate-Phase Petroleum Characteristics

Petroleum-thickness gauging, bail-down testing, and separate-phase petroleum sampling and analyses were performed to determine characteristics of the separate-phase petroleum accumulation in Area 1. These characteristics include: the areal extent of the petroleum, true thicknesses, recharge rates, an estimated total volume, the type(s) of PHCs comprising the accumulation, occurrence of PCBs, and the physical characteristics of the petroleum (i.e, specific gravity and kinematic viscosity).

Petroleum Thickness Gauging Results

On February 1 and 2, 1994 and June 14, 1994, Area 1 monitoring wells were screened for the presence of separate-phase petroleum, including sheens. The results of these measurements are included in Table 7. Measured (i.e., apparent) separate-phase petroleum thicknesses ranged from a sheen in wells near the periphery of the petroleum accumulation and Monitoring Well MW-13 (apparently an isolated occurrence), to 4.56 feet in Monitoring Well MW-50.

No petroleum or sheen was observed in Monitoring Wells MW-49, MW-57, MW-59 or MW-63 during either gauging round. Monitoring Wells MW-21, MW-52, MW-55, MW-56 and MW-58 each contained a sheen on the water table during one or both of the February and June 1994 gauging rounds, presumably indicating the edge of the petroleum accumulation. Approximately one foot of petroleum was measured on the water table within Monitoring Well MW-60 in February 1994. This decreased to 0.74 feet in June 1994. A review of these data resulted in an elongated accumulation to the east toward the Turntable, as previously discussed. As suggested by the soil boring results, the separate-phase petroleum accumulation extends north to soil borings S-141 and S-129, east to the Turntable, southeast past the Locker Room/Shop (but not to the Inspection Pit), and south to the retaining wall.

The results of the gauging were used to define the areal extent of the separate-phase petroleum accumulation (Plates 6 and 7). Compared to previous data, the northwestern and western limits of the accumulation have not changed significantly, but has been more accurately delineated. Based on the installation of Monitoring Well MW-49, the western edge of the accumulation does not extend as far west as previously estimated. However, the upgradient edge of the petroleum accumulation now extends east to the Turntable, and southeast beyond the Locker Room/Shop to the retaining wall. As previously mentioned, Monitoring Wells MW-21, MW-52 and MW-55 appear to delineate the boundary of the separate-phase petroleum accumulation.

### Bail-Down Testing Data Evaluation and Results

Separate-phase petroleum bail-down tests were conducted on seven monitoring wells within Area 1: MW-17, MW-22, MW-36, MW-50, MW-53, MW-54 and MW-60. The data collected during these tests were plotted as graphs of depth to water/depth to petroleum (in feet bls) versus elapsed time (in minutes) for each well tested. These graphs were used to determine the "true" petroleum thickness by:

- identifying the inflection point of the depth-to-water graph (i.e., the point where the graph changes from a positive to a negative slope);
- reading the elapsed time that corresponds to the inflection point (i.e., the inflection point time) off the graph; and

- determining the petroleum thickness that occurred at the inflection point time, which is the "true" petroleum thickness. This information can be read off a graph of measured petroleum thickness versus elapsed time (Testa and Paczkowski, 1989).

Graphs and tables of the bail-down test data are included in Appendix J. In general, the true petroleum thickness within each well had recharged in 10 minutes or less, and the pre-test measured thickness had recharged in about 30 minutes.

The results of the data evaluation indicate that the thickest portion of the petroleum accumulation occurs at Monitoring Well MW-50, which showed a measured petroleum thickness of 4.14 feet and a true petroleum thickness of 1.22 feet. A similar true petroleum thickness is indicated for Monitoring Well MW-17 (1.09 feet), which had a measured thickness of 3.62 feet. All other wells tested contained true petroleum thicknesses that were equal to or less than 0.5 feet. A true petroleum thickness of 0.5 feet was obtained for Monitoring Well MW-60, located downgradient of the Turntable. For Monitoring Wells MW-22, MW-53 and MW-54, petroleum thicknesses were determined to be 0.20, 0.19 and 0.14 feet, respectively (Appendix J).

Monitoring Well MW-36 contained a measured petroleum thickness of 0.56 feet. The bail-down test on this well was performed in the same manner as the previous tests, with all petroleum being bailed from the well. The petroleum recovered to a thickness of 0.03 feet after 1.13 minutes. However, although recovery was monitored for greater than four hours, the inflection point of the depth-to-water readings was never attained. Therefore, the test performed on Monitoring Well MW-36 was inconclusive. The recovered petroleum thickness remained at 0.03 feet more than four hours after petroleum was bailed from the well. These data indicate that the true petroleum thickness at this location is equal to or greater than 0.03 feet.

The true petroleum thicknesses determined from the bail-down tests performed during March 1994 are shown in Plates 6 and 7. A review of the thickness contours on these plates indicates that the majority of the separate-phase petroleum accumulation in Area 1 is less than one-foot thick. Thicknesses greater than one foot are limited to the IRM petroleum recovery area. This area includes wells MW-50, MW-17 and RW-3, and is presumed to include well RW-1. Monitoring Well MW-16, which is currently being used as a recovery well in place of RW-2, is estimated to contain less than one foot of separate-phase petroleum as a result of petroleum recovery.

Using the methodology described by Testa and Paczkowski (1989), an estimate of the actual volume of petroleum was calculated. The planar areas of the petroleum accumulation between the zero and one-foot contours and within the one-foot contour were calculated with the use of a digitizer and AutoCAD™. The area within the one-foot contour was estimated to be 11,195 square feet, and has an average actual petroleum thickness of 1.155 feet. The area between the zero and one-foot contours was estimated to be 122,405 square feet, and has an average actual petroleum thickness of 0.212 feet. Since the majority of the Yard deposits consist of glacial till (both undisturbed and reworked), a soil porosity of 0.25 was assumed (Walton, 1991). The calculation is shown below.

$$(Area_{1\text{-ft}} * Ave.\ PT_{1\text{-ft}} * \eta) + (Area_{<1\text{-ft}} * Ave.\ PT_{<1\text{-ft}} * \eta) = Actual\ Volume$$

$$(11{,}195\ ft^2 * 1.155\ ft * 0.25) + (122{,}405\ ft^2 * 0.212\ ft * 0.25) = 9{,}720\ ft^3$$

$$9{,}720\ ft^3 * 7.48\ \frac{gallons}{ft^3} = 72{,}705\ gallons$$

Therefore, the actual total volume of petroleum in Area 1 is estimated to be approximately 72,700 gallons. According to published data, between 15 and 50 percent of the total petroleum could be recoverable (Testa and Paczkowski, 1989). Assuming 35 percent recoverability based on the characteristics of the petroleum and soil, approximately only 25,500 gallons of petroleum is estimated to be recoverable by conventional methods.

### Petroleum Analytical Results

A separate-phase petroleum sample was collected from Monitoring Well MW-36. The petroleum sample from well MW-36 was analyzed for PCBs. Aroclor-1260 was detected at a concentration of 14,000 $\mu$g/kg (14 ppm) (Table 13 and Plate 14). On February 17, 1994, separate-phase petroleum samples were collected from four monitoring wells within Area 1:

MW-50, MW-53, MW-54 and MW-60. A sufficient volume of petroleum existed within these wells to be analyzed for PCBs, PHCs (a hydrocarbon scan), specific gravity and kinematic viscosity. Analytical results are included in Tables 13 and 14.

PCBs were detected in all four samples. Two samples contained only Aroclor-1260: MW-50 (18,000 μg/kg [18 ppm]), located north of the Engine House, and MW-60 (830 μg/kg [0.83 ppm]), located downgradient of the Turntable. The remaining two samples each contained both Aroclor-1260 and Aroclor-1254. Samples MW-53 and MW-54 contained similar concentrations of Aroclor-1254: 5,300 μg/kg (5.3 ppm) and 5,200 μg/kg 5.2 ppm), respectively. Aroclor-1260 was detected in MW-53 at 3,100 μg/kg (3.1 ppm), and in MW-54 at 2,200 μg/kg (2.2 ppm). Analytical results are presented in Plate 14.

The results of the hydrocarbon scans indicate that the petroleum within the four wells sampled most resembled No. 2 fuel oil. The petroleum sample was therefore quantified to a No. 2 fuel oil standard. Reported concentrations of No. 2 fuel oil range from 920,000 mg/kg (ppm) in sample MW-60 to 1,550,000 mg/kg (ppm) in sample MW-54. As shown in Table 14, the results for the MW-50 and MW-54 samples represent more than 100 percent of No. 2 fuel oil. However, the analytical laboratory stated that the petroleum was extremely weathered and was therefore not a clear match to any of the laboratory standards, and the petroleum may be either kerosene, diesel or No. 2 fuel oil, or a mixture of these products since they have very similar characteristics. Discussions with Yard personnel indicate that No. 2 fuel oil has been used to fuel trains since the Yard converted from coal use (year unknown). Historical documentation shows that these USTs were installed during the 1930s and abandoned in place during 1984. This information suggests that the age of the separate-phase petroleum is within the range of 10 to 64 years. Based on its estimated age, the petroleum is expected to be degraded and therefore heavily oxidized. As the petroleum degrades, retention times (during gas chromatograph analyses) increase and the petroleum is less likely to appear on a chromatograph. This information may explain why the samples were not clear matches to any of the pure undegraded petroleum standards used by the laboratory.

Chemical properties of the separate-phase petroleum samples are summarized in Table 14. The specific gravity of the four samples were similar, ranging from 0.8704 (MW-54) to 0.8799 (MW-50). These specific gravity values are similar to those documented for No. 2 fuel oil (American Petroleum Institute, 1989). The kinematic viscosity of the samples ranged from 5.35 (MW-53) to 7.70 (MW-50). These data will be used during the feasibility study for remedial alternative screening.

Based on the above data and our understanding of historical operations at the Yard, the source of the separate-phase petroleum is attributable to the former fuel storage areas and former fueling areas north of the Metro Shop. Although the same PCB species were found in the petroleum within Monitoring Wells MW-50 and MW-60, the levels of Aroclor-1260 detected in these two samples vary by greater than one order of magnitude. These data indicate different sources of PCBs for these two locations, and suggest that the separate-phase petroleum is not mixing and is therefore variable in nature. In addition, the petroleum may be greater than 60 years old and is severely degraded.

### 4.1.3 Ground-Water

The Phase I RI ground-water sampling program within Area 1 included one deep and two shallow monitoring wells. (As previously discussed, data from the Geraghty & Miller-installed monitoring wells has been excluded due to the questionable integrity of the well constructions). Seven shallow and four deep monitoring wells were sampled as part of the Phase II RI and Addendum. Ground-water samples were only collected from monitoring wells that did not contain separate-phase petroleum. Sampling was performed by Roux Associates in accordance with the procedures described in Section 2.1.1.6. Analytical results for shallow and deeper ground water are discussed below.

### Shallow Ground-Water Quality

During the Phase I RI, ground-water quality samples were collected from January 3 through 7, 1991. The wells sampled included shallow Monitoring Wells MW-13 and MW-19, which are located outside the extent of the separate-phase petroleum. Analyses performed on these samples included VOCs, SVOCs, pesticides and metals. Phase I RI analytical data are included in Appendix A.

During the Phase I RI, VOCs were only detected in one shallow monitoring well in Area 1, with 2.9 $\mu$g/L (0.0029 ppm) tetrachloroethene and 2.0 $\mu$g/L (0.002 ppm) trichloroethene detected at MW-19. It is important to note that MW-19 is located on LIRR property adjacent to a sewer, and is situated downgradient of a known off-site source of chlorinated solvents (as discussed below). No VOCs were detected in the shallow ground-water sample of MW-13. Excluding bis(2-ethylhexyl)phthalate, a common laboratory contaminant, five SVOCs were detected in MW-13. No SVOCs were detected in MW-19. Phase I RI metals results indicate that lead, manganese and mercury exceeded background in both of these shallow monitoring wells (MW-13 and MW-19). In addition, Monitoring Well MW-13 contained concentrations of aluminum, arsenic, nickel and zinc in excess of background ranges. No pesticides were detected in these two wells.

Phase II ground-water sampling within Area 1 was limited to sampling two shallow monitoring wells on February 9, 1993; MW-1 and MW-35. Analytical data are presented in Tables 15 through 18 and Plates 15 through 17.

No separate-phase petroleum was observed in MW-35, therefore, a ground-water sample was collected and analyzed for the TCL/TAL. No VOCs were detected. Five SVOCs (all PAHs) were detected in concentrations ranging from 0.9 $\mu$g/L (0.0009 ppm) to only 5 $\mu$g/L (0.005 ppm). Nine metals were detected above background ranges in MW-35 ground water: arsenic, barium, copper, iron, lead, manganese, mercury, sodium and zinc. Aroclor-1254 was detected (0.089 $\mu$g/L [0.000089 ppm]) in this sample, which prompted a recommendation for resampling to determine if the PCBs are representative of ground-water quality or of suspended particles within the ground-water sample. The well was redeveloped and resampled as part of the Phase II RI Addendum. No PCBs were detected in the second, non-turbid sample (as discussed below).

One shallow confirmatory ground-water sample, MW-1, was collected within Area 1 on February 9, 1993 as part of the Phase II RI. The MW-1 sample was analyzed for metals and PCBs. The following eight metals were detected above background ranges: aluminum, barium, calcium, copper, magnesium, manganese, nickel and zinc. Aroclor-1260 was detected at a concentration of 0.29 $\mu$g/L (0.00029 ppm). Since these analytical data are representative of ground-water quality in a Geraghty & Miller-installed well that is scheduled for abandonment, the data have not been included in the plates. However, these data have been compared to the Phase I RI ground-water data for MW-1 as discussed in Appendix E. In addition, ground-water data was derived during February 1994 (Phase II Addendum) from Monitoring Well MW-63, which was installed adjacent to MW-1 (Plate 17). The MW-63 analytical results are discussed below.

Phase II RI Addendum shallow ground-water sampling was performed during February 17, 1994. Five newly-installed shallow monitoring wells (MW-37, MW-49, MW-57, MW-59 and MW-63), consisting of replacement wells, additional delineation wells, and previously proposed Phase II RI wells, were sampled for TCL/TAL analyses. In addition, Monitoring Well MW-35 was resampled for PCB analyses.

Of the five shallow monitoring wells that were sampled and analyzed for VOCs within Area 1, VOCs were only detected in MW-63. Monitoring Well MW-63 contained four VOCs: 23 $\mu$g/L (0.023 ppm) of tetrachloroethene, 24 $\mu$g/L (0.024 ppm) of trichloroethene, 14 $\mu$g/L (0.014 ppm) of 1,2-dichloroethene (total) and 3 $\mu$g/L (0.003 ppm) of 1,1-dichloroethane (Table 15). All four of these VOCs are chlorinated solvents.

Based on ground-water flow patterns determined for the Yard and a knowledge of the compounds used at the Yard, these detections of chlorinated solvents are not attributable to Yard operations, but rather to an offsite, upgradient source. Standard Motor Products, Inc. (SMP), which is located between Northern Boulevard and the Yard, lies hydraulically upgradient (east) of Monitoring Well MW-63, MW-19 (Phase I RI data) and Area 1. As documented in the Remedial Investigation Report for Standard Motor Products, Inc. (Holzmacher, McLendon & Murrell, P.C., 1992), both soil and ground water beneath the SMP site have been contaminated with chlorinated solvents. The source of this contamination appears to be the SMP loading dock area, where drum washing took place and VOCs are present in soil greater than 20 feet bls.

Per the SMP RI report, total VOCs were detected in SMP soil at concentrations of up to 35,300 μg/kg (35.3 ppm). However, many of the SMP soil samples were collected below the water table which suggests that the analytical results are more representative of ground-water quality. Known contamination reportedly extends to a depth of greater than below land surface at the SMP Site (Holzmacher, McLendon & Murrell, P.C., 1992). All six wells installed on the SMP site contained VOCs. A total of ten different VOCs (chlorinated solvents and BTEX) were detected beneath the SMP site (Holzmacher, McLendon & Murrell, P.C., 1992). These solvents, which include all four VOCs detected in Monitoring Well MW-63 and the two solvents detected in MW-19, were detected in concentrations equal to or greater than those found in MW-63. In addition, the RI Report for SMP concluded that the contaminants detected at the site have migrated radially outward from the SMP loading dock in both stormwater runoff and ground water. Water-level data collected by Roux Associates indicate that ground water is flowing west (parallel to the sewer line) from the SMP site toward the northern part of Area 1 (i.e., MW-63). However, the water table is nearly flat beneath the eastern part of Area 1, causing the VOC plume to spread radially outward from its source (Plates 6 and 15). These hydrological conditions also explain the detection of tetrachloroethene in deep Monitoring Well MW-40D, located south of both MW-63 and the Metro Shop.

SVOCs were detected in three shallow wells, MW-37, MW-49 and MW-63. Three SVOCs (all PAHs) were detected in MW-37, nine SVOCs (all PAHs) were detected in MW-49, and Monitoring Well MW-63 contained one PAH and one phthalate compound (Table 16 and Plate 11). These SVOCs were detected at estimated concentrations ranging from 0.1 μg/L (0.0001 ppm) to only 3 μg/L (0.003 ppm). No SVOCs were detected in MW-57 and MW-59.

Eight metals were detected above background within Area 1 during the Phase II Addendum sampling event: arsenic, barium, calcium, cobalt, iron, manganese, sodium and zinc. The MW-37 ground-water sample contained sodium and manganese above background. The MW-49 ground-water sample contained the following metals above background: arsenic, barium, cobalt, iron, manganese and zinc. Ground water from MW-57 contained only manganese above its background range. The MW-63 ground-water sample contained both calcium and manganese above background. No metals were detected above background in ground water from Monitoring Well MW-59 (Table 17 and Plate 16).

Analytical data within the Holzmacher, McLendon & Murrell, P.C. report (1992) indicate that ten metals exceed ground-water standards beneath the SMP site (i.e., upgradient of MW-63 and Area 1). Iron, manganese and sodium exceeded standards most often at the SMP site, and exceeded standards by the greatest margins (Holzmacher, McLendon & Murrell, P.C., 1992). Since the SMP site is located upgradient of Area 1, metals in SMP ground water were compared to metals detections within Area 1. The results of this comparison indicate that all 14 metals detected above Yard background within Area 1 ground water were detected in greater concentrations beneath the SMP site, with the exception of two sodium occurrences. These data confirm that elevated concentrations of iron, manganese and sodium are indicative of ground-water quality within the shallow deposits, as supported by published data.

According to published data for Queens County (Buxton, et al., 1981), manganese concentrations vary within the Upper Glacial aquifer from less than 100 $\mu$g/L (0.1 ppm) to greater than 10,000 $\mu$g/L (10 ppm), increasing as conditions become anoxic. Published data also indicate that high manganese concentrations are associated with high iron concentrations. As previously discussed, sodium occurrences are attributable to historical salt-water intrusion of the aquifer beneath the Yard, rather than related to Yard activities (Soren, 1971). In addition, the remaining metals detected within Area 1 are indicative of local upgradient ground-water quality (i.e., SMP).

During the Phase II RI Addendum, eight metals were detected above background in ground-water samples. Six metals exceeded background in MW-49: arsenic, barium, cobalt, iron, manganese and zinc. Calcium and manganese exceeded background in MW-63. Manganese and sodium were above background in MW-37. Only manganese exceeded background in MW-57. No metals exceeded background in MW-59.

During the Phase II RI Addendum, no PCBs were detected in the six monitoring wells sampled within Area 1. This includes MW-35, MW-37 and MW-49 which are downgradient of the separate-phase petroleum accumulation. Although PCBs were detected in a turbid ground-water sample from MW-35, the well was redeveloped and resampled as part of the Addendum. No PCBs were detected in the second, non-turbid sample. In addition, data from Monitoring Well MW-63 shows that PCBs are not present in shallow ground water in the vicinity of Monitoring Well MW-1 (which is adjacent to MW-63), supporting the position that PCBs detected in turbid samples are indicative of suspended particles and not ground-water quality (Table 18 and Plate 17).

In summary, the shallow ground-water quality data for Area 1 (including all three sampling rounds) indicate that relatively low concentrations of total VOCs (chlorinated solvents) were detected in Monitoring Wells MW-19 (4.9 μg/L [0.0049 ppm]) and MW-63 (64 μg/L [0.064 ppm]). Based on ground-water flow patterns and analytical data for both the Yard and SMP, all of these VOC detections are attributable an offsite, upgradient source (SMP). In addition, the concentrations of these VOCs decrease with increasing distance from SMP. SVOCs were detected in five shallow wells within Area 1 (i.e., MW-13, MW-35, MW-37, MW-49 and MW-63). The majority of SVOC detections were PAHs at concentrations of 14 μg/L or less, with the exception of 66 μg/L 2-methylnaphthalene detected in Monitoring Well MW-13. The following fourteen metals were detected above Yard background ranges: arsenic, aluminum, barium, calcium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, sodium and zinc. However, these metals are indicative of local upgradient ground-water quality. No PCBs or pesticides are present in shallow Area 1 ground water.

### Deep Ground-Water Quality

On January 7, 1991 as part of the Phase I RI, two VOCs (ethylbenzene and xylenes) and two SVOCs (fluorene and 2-methylnaphthalene) were detected in deep Monitoring Well MW-23D. This sample also contained five metals above background concentrations; barium, lead, manganese, mercury and sodium. No pesticides were detected. Data are presented in Appendix A.

During the Phase II RI, a ground-water sample was collected on February 9, 1993 from deep well MW-23D. The sample was analyzed to verify previous VOC and PCB delineation results within Area 1. Two VOCs were detected: 1,1-dichloroethane (2 μg/L [0.002 ppm]) and xylenes (1 μg/L [0.001 ppm]). No PCBs were detected in MW-23D ground water. Also, a confirmatory ground-water sample was collected from MW-23D for SVOC analyses to confirm previous data. Four SVOCs were detected including 23 μg/L (0.023 ppm) 2-methylnaphthalene, 4 μg/L (0.004 ppm) acenaphthene, 4 μg/L (0.004 ppm) dibenzofuran, and 2 μg/L (0.002 ppm) phenanthrene. Analytical results are presented in Tables 15, 16 and 18 and Plates 15 and 17.

February 1994 (Phase II Addendum) analytical results for deep wells MW-38D, MW-39D and MW-40D indicate that of the wells sampled, two contained VOCs. Monitoring Well MW-40D contained 5 μg/L (0.005 ppm) of tetrachloroethene, and Monitoring Well MW-38D contained 3 μg/L (0.003 ppm) of 1,1-dichloroethane. These detections also appear to be attributable to SMP, the upgradient, off-site source of VOCs. As shown in Plate 7, MW-38D is downgradient of MW-63 and SMP. Although MW-40D is not located directly downgradient of SMP, the water table is nearly flat between MW-63 and MW-40D suggesting that the VOC plume is spreading radially away from the SMP site. Although there is an upward vertical gradient within Area 1, contamination at the SMP site reportedly extends greater than 42 feet bls, which is deeper than the screen zones of all Area 1 monitoring wells. Only one SVOC was detected in deep ground water within Area 1; naphthalene was present in MW-39D at a concentration of 1 μg/L (0.001 ppm). No PCBs were detected.

In summary, low concentrations of two VOCs (ethylbenzene and xylenes) were detected in ground water beneath the separate-phase petroleum accumulation (i.e., MW-23D). All other VOC detections are attributable to an offsite, upgradient source of chlorinated solvents. Six SVOCs (predominantly PAHs) were detected at low concentrations in deep ground water beneath Area 1. No pesticides or PCBs were detected in deep Area 1 ground water. These data indicate that the deeper Upper Glacial aquifer within Area 1 has not been significantly impacted by the separate-phase petroleum accumulation, and that the VOCs detected in Monitoring Well MW-23D are limited in extent. Results are presented in Tables 15 through 18 and Plates 15 through 17).

### 4.2 Area 2 Results

Phase I work performed in Area 2 included soil boring and soil sampling. Analyses for soil samples S-41A and S-43 included VOCs, SVOCs, pesticides and metals. Phase I RI data are summarized in Appendix A.

As previously discussed, an investigation of the UST in Area 2 was performed after the Phase I RI but prior to the Phase II RI. This additional investigation included drilling three soil borings (S-96 through S-98), collecting soil samples (S-97 and S-98), and collecting a ground-water sample (MW-41). Analytical results of this supplemental work are tabulated in Appendix B. The UST was emptied and cleaned during the additional UST investigation. However, tank removal and soil excavation were unsuccessfully attempted due to surrounding structures and numerous underground utilities. As a result, the UST was properly abandoned in-place.

Phase II RI work performed within Area 2 included additional delineation of VOCs in ground water (MW-41, TW-1 and TW-2). Samples were collected from temporary wellpoints (TW-1 and TW-2) as a result of the NYSDEC request to obtain an additional ground-water sample to prove that PHCs or PHC-related compounds are not present in ground water downgradient of the Area 2 UST. Two confirmatory soil samples were collected; CS-41A was analyzed for PCBs, and CS-43 was analyzed for mercury and PCBs. Figure 2 shows the soil and ground-water sample locations within Area 2. Phase II RI analytical data are presented in Tables 10, 11 and 15, and Plates 18 through 20.

### 4.2.1 Soil Quality

During the Phase I RI, acetone, ethylbenzene, and xylenes were detected in soil sample S-41A (3.5 to 5.5 feet bls). No SVOCs or pesticides were detected, and no metals were detected significantly above background. As part of the Phase II RI, one deep confirmatory soil sample, CS-41A (3.5 to 5.5 feet), was collected on December 15, 1993 and analyzed for PCBs. Aroclor-1260 was detected in the soil sample at a concentration of 42 μg/kg (0.042 ppm). No other Aroclors were detected.

Phase I RI soil sample S-43 (0 to 2 feet bls) had detections of two VOCs (chloroform and xylenes), 11 SVOCs (all PAHs) ranging from 1,966 μg/kg (1.966 ppm) anthracene to 19,700 μg/kg (19.7 ppm) fluoranthene and four metals (barium, copper, lead and zinc) detected in concentrations significantly above background ranges. No pesticides were detected. Mercury was detected in confirmatory soil sample CS-43 (0 to 2 feet bls) at a concentration of 22.5 mg/kg (ppm) which significantly exceeds Yard background. Aroclor-1260 was detected at a concentration of 1,400 μg/kg (1.400 ppm).

Excluding laboratory contaminants, no VOCs were detected in sample S-97 (4 to 6 feet). Three VOCs were detected in sample S-97 (6 to 8 feet) in the following concentrations: total xylenes (249,000 μg/kg [249 ppm]), ethylbenzene (27,000 μg/kg [27 ppm]) and chloroform (6,600 μg/kg [6.6 ppm]). There were no VOCs detected in sample S-98 (4 to 6 feet).

Based on these data, VOCs (chloroform, ethylbenzene and xylenes) are present in deep soil in Area 2. However, these detections were limited to soil located within 10 feet of the abandoned UST. Eleven SVOCs and one Aroclor were also detected. Five metals significantly exceed background ranges; barium, copper, lead, mercury and zinc. Based on the data, an isolated source of mercury appears to exist in the north corner of Area 2. No pesticides were detected in Area 2 soil.

### 4.2.2 Ground-Water Quality

During the UST investigation on November 6, 1991, no VOCs were detected in MW-41 ground water (Appendix B).

Phase II RI analytical results for Temporary Wellpoints TW-1 and TW-2, and Monitoring Well MW-41 are shown in Table 15 and Plate 14. No VOCs were detected in the ground-water samples collected January 26, 1993 from Temporary Wellpoints TW-1 and TW-2, located northwest of the abandoned UST. On February 9, 1993, ethylbenzene was detected in ground water from MW-41 at an estimated concentration of 2 μg/L (0.002 ppm). The detection of ethylbenzene in the MW-41 ground-water sample appears to confirm the originally-determined ground-water flow direction for this area (northwest). A detail of Area 2 is shown in Figure 2.

### 4.3 Area 3 Results

During the Phase I RI, a shallow well (MW-28) located immediately downgradient of Area 3 was sampled for analyses that included VOCs, SVOCs, pesticides and metals.

No VOCs, SVOCs or pesticides were detected. However, five metals were detected in concentrations above background: lead, manganese, mercury, nickel and sodium. As previously discussed, elevated manganese levels are related to anoxic conditions (Buxton, et al., 1981) and elevated sodium concentrations are attributable to historical salt-water intrusion of the aquifer (Soren, 1971). Analytical data are provided in Appendix A.

### 4.4 Area 4 Results

During the Phase I RI, soil boring and sampling was performed in Area 4. Soil analyses for samples S-47 and S-49 included VOCs, SVOCs, pesticides and metals. Data is included in Appendix A.

Phase II RI work within Area 4 consisted of defining ground-water quality downgradient of the fuel oil UST by installing one shallow monitoring well, MW-42 (Plate 1). The ground-water sample from MW-42 was analyzed for VOCs and SVOCs. One confirmatory soil sample (CS-47) was collected for PCB analyses. During the Phase II RI Addendum, one additional confirmatory sample (CS-49) was collected for PCB analyses. Phase II RI and Addendum results are included in Table 11 and Plate 18.

### 4.4.1 Soil Quality

No VOCs were detected in soil sample S-47 (2 to 4 feet bls). However, five SVOCs; were detected, consisting of four PAHs (benzo[b+k]fluoranthene, fluoranthene, phenanthrene and pyrene) and one phthalate compound (di-n-butylphthalate). Lead was the only metal that exceeded the background range by more than one order of magnitude in the S-47 sample. Deep confirmatory soil sample CS-47 (2 to 4 feet) contained two PCBs. Aroclor-1254 was detected at 29,000 μg/kg (29 ppm), and Aroclor-1260 was detected at 20,000 μg/kg (20 ppm).

Excluding laboratory contaminants, no VOCs were detected in Phase I RI soil sample S-49 (4 to 6 feet bls). One SVOC, benzo(a)pyrene (415 μg/kg [0.45 ppm]), was detected. However, no pesticides were detected, and no metals were detected significantly above background. Confirmatory soil sample CS-49 (2 to 4 feet bls) was collected on February 1, 1993 and analyzed for PCBs and contained Aroclor-1260 at a concentration of 17,000 μg/kg (17 ppm). Since the UST in Area 4 has reportedly only been used to contain fuel oil, it appears that the PCB detections are not associated with the UST.

Based on these data developed for Area 4, SVOCs and PCBs are present in soil. Only one metal, lead, occurred in concentrations significantly above background. In addition, no VOCs or pesticides were detected.

### 4.4.2 Ground-Water Quality

No VOCs or SVOCs were detected in the ground-water sample collected on February 9, 1993 from Monitoring Well MW-42. Analytical results for MW-42 are presented in Tables 15 and 16, and Plate 20.

Based on these analytical results, ground water has not been impacted by the presence and use of the UST. In addition, these data suggest that no contamination is migrating offsite in the vicinity of Area 4.

### 4.5 Area 5 Results

Phase II RI work performed in Area 5 consisted of collecting two confirmatory soil samples for PCB analyses. Shallow soil samples CS-50 and CS-51 were collected. Both samples contained only Aroclor-1260 at concentrations of 270 μg/kg (0.27 ppm) and 1,100 μg/kg (1.1 ppm), respectively. Analytical results are shown in Table 11 and Plate 18.

Based on these data, PCBs are present in shallow soil within Area 5.

### 4.6 Area 6 Results

Work performed in Area 6 during the Phase I RI included analysis of three soil samples (S-61, S-62 and S-64) for VOCs, SVOCs, metals and pesticides. Phase I RI data are included in Appendix A.

Phase II RI work performed within Area 6 consisted of confirmatory PCB soil sampling at one location adjacent to the drum storage platform (CS-64). As part of the Phase II RI Addendum work, one downgradient shallow well (MW-37) was sampled for the TCL/TAL, and one deep confirmatory soil sample (CS-61) was collected for PCB analyses. Phase II RI and Addendum results are presented in Table 11 and Plate 13.

#### 4.6.1 Soil Quality

Excluding laboratory contaminants, two VOCs (carbon disulfide and toluene) were detected in soil samples S-61 (5 to 7 feet bls) and S-62 (0 to 2 feet bls), and no VOCs were detected in S-64 (2 to 3 feet bls) soil. The following four metals were detected in Area 6 soil at concentrations of more than one order of magnitude above background; barium, copper, lead and zinc. No SVOCs or pesticides were detected in Area 6 during the Phase I RI.

Two confirmatory soil samples were collected from Area 6 for PCB analyses. Confirmatory soil sample CS-61 (5 to 7 feet) contained 97 μg/kg (0.097 ppm) of Aroclor-1260 and soil sample CS-64 (2 to 3 feet bls) contained Aroclor-1260 at a concentration of 1,500 μg/kg (1.5 ppm). No other Aroclors were detected in these samples.

These data indicate that VOCs (carbon disulfide and toluene) and PCBs are present in Area 6 soil. In addition, four metals were detected significantly above background: barium, copper, lead, and zinc. However, no SVOCs or pesticides were detected.

### 4.6.2 Ground-Water Quality

Monitoring Well MW-37 was sampled on February 17, 1994 for TCL/TAL analyses. The location of this monitoring well, situated in Area 1, was chosen to provide ground-water quality data downgradient of Areas 6 and 7. As previously discussed (Section 4.1.3), no VOCs were detected in the ground-water sample. Three SVOCs (all PAHs) were detected in concentrations of 1 $\mu$g/L (0.001 ppm) or less. Two metals, sodium and manganese, were detected in concentrations above background. These metals detections are probably attributable to historical salt-water intrusion of the aquifer (Soren, 1971) and anoxic conditions beneath the Yard (Buxton, et, al, 1981), rather than related to Yard activities (Plate 21). No PCBs were detected in MW-37 ground water.

These data indicate that ground water downgradient of Area 6 has not been impacted by organic compounds. In addition, delineation of the separate-phase petroleum occurrence north of Area 6 (near MW-12) indicates that the petroleum is isolated, limited in extent, and does not appear to extend beneath Area 6. This conclusion is supported by observations made while completing borings CS-61 and CS-64. Although black staining was present in two soil horizons at locations CS-61 (0 to 2 and 5 to 7 feet bls), no sheen or petroleum accumulation was observed on the water table at either CS-61 or CS-64 (Appendix C).

## 4.7 Area 7 Results

Phase II RI work within Area 7 consisted of further defining the extent of contamination in soil by sampling a shallow soil boring, S-99. The sample was analyzed for the TCL/TAL. As part of the Phase II RI Addendum, a confirmatory soil sample (CS-67) was collected for PCB analyses, and, as previously discussed, one shallow downgradient well MW-37 was sampled. Analytical data are presented in Tables 8 through 11 and 15 through 18, and Plates 11 through 13 and 15 through 17.

### 4.7.1 Soil Quality

No VOCs were detected in soil sample S-99 (0 to 2 feet). Sixteen different SVOCs (all PAHs) were detected (Table 9). Arsenic was the only metal detected significantly above background concentrations. Aroclor-1260 was detected at a concentration of 120 μg/kg (0.12 ppm).

One shallow confirmatory soil sample was collected from Area 7. Aroclor-1260 was detected at a concentration of 430 μg/kg (0.43 ppm) in sample CS-67 (0 to 2 feet).

Based on these data, it is unclear whether an upgradient hydrocarbon source exists. The geologic logs for soil borings S-66 and S-69 (drilled during Phase I) document the presence of hydrocarbons on the water table but not within the soil above the water table, indicating that the sheens present on the water table are not attributable to a surface source within Area 7. Based on the relocation of Monitoring Well MW-37, the upgradient source of the Area 7 petroleum was not further investigated. However, the separate-phase petroleum appears to be an isolated occurrence of limited extent.

### 4.7.2 Ground-Water Quality

As discussed above, no VOCs or PCBs were detected in ground water downgradient of Area 7 (MW-37). Three SVOCs (all PAHs) were detected in concentrations of 1 μg/L (0.001 ppm) or less. The metals are probably not attributable to Yard activities.

These data indicate that ground water downgradient of Area 7 has not been impacted by organic compounds. Though a source of the hydrocarbon sheen noted on the water table beneath Area 7 was not identified during the Phase II RI work, analytical results for MW-37 and the lack of hydrocarbons on the water table in Areas 6 and 7 soil borings indicate that the petroleum is only a sheen and is limited in extent.

## 4.8 Area 8A, 8B and 8C Results

During the Phase I RI, the investigation of Area 8 (A, B and C) included collecting deep soil sample S-53 (Area 8A) and analyzing the sample for VOCs, SVOCs, pesticides and metals. Phase II RI work within Area 8 consisted of drilling and sampling an additional five soil borings in Area 8A and five soil borings in Area 8C to further delineate PCBs in soil, and collecting five post-excavation soil samples along Track 21 in Area 8B to be analyzed for PCBs. Two confirmatory soil samples were also collected for PCB analyses; CS-53 from Area 8A, and CS-6 from Area 8C. Following the Phase II RI sampling, PCBs were additionally delineated in soil using Millipore EnviroGard™ immunoassay soil test kits (test kits) in the field. A summary of the additional delineation soil samples collected and associated field observations is included as Table 19. The additional delineation results were presented to the NYSDEC in an October 1994 report (Roux Associates, Inc., 1994e).

Of the 182 samples analyzed using the test kits (including samples collected from Areas 8, 9 and 17, as discussed in upcoming sections), 20 samples were sent to IEA for confirmatory analyses. The results of the laboratory analyses, included in Table 20, were in close agreement with the test kit results. As expressed to the NYSDEC in an April 8, 1993, letter from Mr. R. Noonan of AMTRAK, a PCB concentration of 25 ppm was used for this delineation and would also be used as the action level for the soil IRM, if required (AMTRAK, 1993).

### Area 8A

With the exception of laboratory contaminants, no VOCs or SVOCs were detected in deep soil sample S-53 (5 to 7 feet bls). No pesticides were detected. In addition, no metals were detected in concentrations greater than one order of magnitude above background. Analytical results are included in Appendix A.

Soil samples from shallow borings S-111 through S-115 (0 to 2 feet bls) in Area 8A were collected for PCB analyses. The results of the soil analyses show that Aroclor-1260 is present throughout Area 8A. The concentrations of Aroclor-1260 detected are as follow: 1,500 μg/kg (1.5 ppm) in sample S-111, 1,700 μg/kg (1.7 ppm) in sample S-112, 3,100 μg/kg (3.1 ppm) in sample S-113, 90,000 μg/kg (90 ppm) in sample S-114, and 590 μg/kg (0.59

ppm) in sample S-115. Aroclor-1260 was detected in confirmatory soil sample CS-53 (0-2 feet bls) at a concentration of 88,000 $\mu$g/kg (88 ppm). Analytical results are presented in Table 11 and Figure 6.

Of the 15 initial samples analyzed from Soil Borings SB-1 through SB-4 using test kits, PCB concentrations greater than 48 ppm were detected in the 0 to 1 foot samples from SB-1 through SB-3. Soil PCB concentrations of 1 to 15.8 ppm were detected in the deeper samples from borings SB-1 through SB-3, and in the 0 to 1 foot sample from SB-4. Based on these results, supplemental PCB delineation was performed. Four shallow soil samples were analyzed from the supplemental Soil Borings SB-56 through SB-59 for PCBs using the test kits. All four samples contained soil PCB concentrations of less than 25 ppm, with PCB concentrations ranging from 0.3 ppm (SB-59) to 24.5 ppm (SB-56). The results of all 19 additional delineation samples analyzed from Area 8A using the test kits are provided in Tables 20 and 21 and Plate 22.

### Area 8B

Following "body track" rehabilitation along Track 21 in Area 8B, post-excavation soil samples T-21A through T-21E were collected from 0 to 0.5 feet bls at the locations shown in Figure 3. Samples were collected on March 2, 1992. The results of the non-ASP PCB analyses show that Aroclor-1260 was present in all five samples, ranging from 130 $\mu$g/kg (0.13 ppm) to 2,400 $\mu$g/kg (2.4 ppm). Sample T-21A also contained Aroclor-1248 at a concentration of 88 $\mu$g/kg (0.088 ppm). Analytical results are shown in Table 11 and Figure 6.

PCB concentrations in six samples analyzed from Soil Borings SB-5 through SB-9 using test kits ranged from 1 to 4 ppm. The results of the additional delineation are shown in Tables 20 and 21 and Plate 22.

Area 8C

Samples from shallow soil borings S-104 through S-108 (0 to 2 feet bls) in Area 8C were collected for PCB analyses. The results of the soil analyses for Area 8C indicate that the PCB Aroclor-1260 is present at all five locations: S-104 (860,000 μg/kg [860 ppm]), S-105 (15,000,000 μg/kg [15,000 ppm]), S-106 (20,000,000 μg/kg [20,000 ppm]), S-107 (63,000 μg/kg [63 ppm]) and S-108 (5,600 μg/kg [5.6 ppm]). Aroclor-1260 was detected in confirmatory soil sample CS-6 (0 to 2 feet bls) at a concentration of 62,000 μg/kg (62 ppm). Analytical data is shown in Table 11 and Figure 6.

Of the 38 initial samples analyzed from Soil Borings SB-10 through SB-18 using test kits, PCBs were detected at or above 48 ppm at all sampling locations except SB-10. Soil PCB concentrations of greater than or equal to 48 ppm were detected in all samples from SB-12, SB-13, and SB-17, and most samples from SB-16 and SB-18. PCBs exceeded 25 ppm to a depth of 2 feet at borings SB-14 and SB-18, and to a depth of 3 feet in borings SB-11 and SB-15. PCB concentrations of less than 0.75 ppm to 14.4 ppm were detected in the deeper samples from borings SB-11, SB-14, SB-15 and SB-18. Based on these data, supplemental PCB delineation was performed. Twenty-five soil samples from the supplemental Soil Borings SB-60 through SB-71, and six deeper samples from Soil Borings SB-12, SB-13, SB-16 and SB-17 were analyzed for PCBs using the test kits. Soil PCB concentrations of less than 25 ppm were detected in Soil Boring SB-12 at 6 to 7 feet bls (14.9 ppm) in SB-13 at 3 to 4 feet bls (5.8 ppm), in Soil Boring SB-16 at a depth of 7 to 8 feet bls (3.7 ppm), and in Soil Boring SB-71 to 1 to 2 feet bls (5.8 ppm). The concentration of PCBs exceeded 100 ppm in Soil Boring SB-62 to a depth of 2 feet bls, and the 2 to 3 feet depth intervals of Soil Borings SB-66 through SB-68 and SB-70. Concentrations of 90 ppm or greater were detected in SB-69 from 0 to 3 ft bls. The results of all 69 samples analyzed from Area 8C are presented in Tables 20 and 21 and Plate 22. As shown in Plate 22, soil PCB concentrations of 25 ppm or greater were detected at all sampling locations except Soil Borings SB-10, SB-60, SB-61, SB-63, SB-64 and SB-65.

In summary, Phase I RI data indicate that VOCs, SVOCs and pesticides were not detected in Area 8A soil. In addition, no metals were detected in concentrations greater than one order of magnitude above background. Based on the Phase II data, PCBs in soils were detected in the highest concentrations of the Yard along Track 26 in Area 8C. However, PCBs were detected in all three sections of Area 8 (A, B and C) near former transformer locations.

### 4.9 Area 9 Results

Phase II RI work within Area 9, the Compressor Area, consisted of additional delineation of contaminants within soil (S-103) and ground water (MW-45), and confirmatory ground-water sampling (MW-27). As part of the Phase II RI Addendum, one confirmatory soil sample was collected (CS-59). Additional delineation of PCBs in soil using field immunoassay test kits, as discussed in Section 4.8, was also performed in Area 9. The results of the additional delineation were presented to the NYSDEC in an October 1994 report (Roux Associates, Inc., 1994e).

### 4.9.1 Soil Quality

Soil sample S-103 (0 to 2 feet bls) was collected and analyzed for PCBs. Aroclor-1260 was detected at a concentration of 65,000 μg/kg (65 ppm). No other Aroclors were detected. Confirmatory soil sample CS-59 (0 to 2 feet) was collected and analyzed for PCBs. Aroclor-1254 at 35 μg/kg (0.035 ppm) and Aroclor-1260 at 200 μg/kg (0.200 ppm) were detected in the soil. Analytical results are shown in Table 11 and Plate 18.

Of the nine total samples analyzed from Soil Borings SB-19 through SB-27 using test kits, all concentrations of PCBs were less than 25 ppm (2 to 7.7 ppm), as shown in Table 22 and Figure 7.

Based on these data, soil containing greater than 25 ppm total PCBs has been completely delineated within Area 9.

### 4.9.2 Ground-Water Quality

Monitoring Well MW-45 was installed within the shallow deposits, northwest and downgradient of Area 9. The ground-water sample collected on February 9, 1993 was analyzed for the TCL/TAL. Analytical results for this well indicate that no metals are present in concentrations above the background concentrations. One VOC, 1,1,1-trichloroethane, was detected at an estimated concentration of 2 $\mu$g/L (0.002 ppm). No SVOCS or PCBs were detected. On February 8, 1993 a sample was collected from Monitoring Well MW-27 for PCB analyses. No PCBs were detected in this confirmatory ground-water sample. Results are included in Tables 15 through 18, and shown in Plates 20 and 21.

In summary, the Phase II RI data for Area 9 indicate that PCBs in soil have been delineated. In addition, PCBs are not impacting downgradient ground water (MW-27 and MW-45).

### 4.10 Area 10 Results

Phase II work within Area 10 consisted of collecting one confirmatory soil sample and analyzing the sample for PCBs. Confirmatory soil sample CS-83 was collected from 0 to 2 feet bls. Aroclor-1260 was detected at a concentration of 4,400 $\mu$g/kg (4.4 ppm). Results are shown in Table 11 and Plate 18.

Based on these data, PCBs are present in shallow soil within Area 10.

### 4.11 Area 11 Results

Additional ground-water delineation work performed in Area 11 for the Phase II RI consisted of installing and sampling one shallow well (MW-46). Ground water was analyzed for the TCL/TAL. As previously discussed, Monitoring Well MW-46 was installed downgradient of three areas of concern: Areas 11, 13 and 17 (Plate 1). Monitoring Well MW-46 was re-developed and resampled for PCBs as part of the Phase II RI Addendum.

No VOCs or SVOCs were detected in ground water collected on February 9, 1993 from Monitoring Well MW-46. Seventeen metals were detected in concentrations above background: aluminum, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, vanadium and zinc. Aroclor-1254 and Aroclor-1260 were detected at concentrations of 0.59 $\mu$g/L (0.00059 ppm) and 1.7 $\mu$g/L (0.0017 ppm), respectively. The detections of PCBs in this sample prompted a recommendation for resampling to determine if the PCBs are representative of ground-water quality or of suspended particles within the ground-water sample due to high sample turbidity. Therefore, as part of the Phase II RI Addendum work, Monitoring Well MW-46 was re-developed and resampled on February 17, 1994. PCBs were not detected in this sample. Analytical data are shown in Tables 15 through 18 and Plates 20 and 21.

Based on these data, only metals are present in ground water downgradient of Areas 11, 13 and 17. However, the concentrations of iron and manganese exceed background by greater than one order of magnitude. In addition, the highest concentrations of each of seven metals detected in ground water at the Yard occurred in the MW-46 ground-water sample. These Phase II RI data indicate that a source (or sources) of metals may be located in Area 11, 13 and/or 17.

## 4.12 Area 12 Results

During the Phase I RI, soil sample MW-26 (9 to 11 feet bls) and ground-water sample MW-26 were collected for analyses including VOCs, SVOCs, pesticides and metals. However, the ground-water SVOC data were not considered usable by the NYSDEC, and are, therefore, not discussed. Phase II RI work included collecting a ground-water sample from Temporary Wellpoint TW-3 for SVOC and PCB analyses.

### 4.12.1 Soil Results

Deep soil sample MW-26 (9 to 11 feet bls) was collected on December 5, 1990. Excluding laboratory contaminants, no VOCs were detected. In addition, no pesticides were detected and no metals were detected in concentrations significantly above background. Analytical data are included in Appendix A.

### 4.12.2 Ground-Water Results

A ground-water sample was collected from Monitoring Well MW-26 on January 4, 1991. This sample represents ground-water quality downgradient of the Car Washer. Analyses included VOCs, pesticides and metals. No VOCs or pesticides were detected. The following ten metals were detected above background ranges: aluminum, barium, chromium, cobalt, iron, lead, manganese, mercury, nickel and zinc. Analytical data are summarized in Appendix A.

During the Phase II RI, Monitoring Well MW-26 was discovered to have been destroyed. Since a ground-water sample was needed from this location for SVOC and PCB analyses, a temporary well was proposed. On December 6, 1993, Temporary Wellpoint TW-3 was installed as close as possible to former Monitoring Well MW-26 (which was properly abandoned). Temporary Wellpoint TW-3 was sampled and analyzed for SVOCs and PCBs. Four SVOCs were detected in ground water from TW-3. All four SVOCs were detected at low concentrations ranging from 0.7 $\mu$g/L (0.0007 ppm) to 10 $\mu$g/L (0.01 ppm). Aroclor-1254 (2.4 $\mu$g/L [0.0024 ppm]) and Aroclor-1260 (1.9 $\mu$g/L [0.0019 ppm]) were detected in TW-3. Two of the SVOCs (naphthalene and pyrene) are known constituents of No. 2 fuel oil. Based on the high turbidity of this sample, it is suspected that these PCB and PAH detections are probably attributable to suspended particles and are not representative of ground-water quality. These conditions also occurred in other Yard wells, as previously discussed.

These data for Area 12 indicate that immediately downgradient of the Car Washer, ground water contains low concentrations of four SVOCs, and nine different metals in concentrations above background ranges. However, no VOCs or pesticides were detected, and the detection of PCBs appears to be attributable to suspended particles and therefore not representative of ground-water conditions.

### 4.13 Area 13 Results

Phase II RI work for Area 13 consisted of additional delineation of contaminants in soil (S-100) and ground water (MW-46), and confirmatory soil sampling (CS-75). An additional confirmatory soil sample (CS-77) was collected and MW-46 ground water was resampled as part of the Phase II RI Addendum.

#### 4.13.1 Soil Quality

To further characterize the soil quality in this area, shallow soil sample S-100 (0 to 2 feet bls) was collected and analyzed for the TCL/TAL. No VOCs were detected in the sample. Sixteen SVOCs (all PAHs) were detected. Three metals were detected in concentrations greater than one order of magnitude above background: copper, lead and zinc. Aroclor-1260 was detected at a concentration of 4,100 $\mu$g/kg (4.1 ppm).

Confirmatory soil samples CS-75 (0 to 2 feet bls) and CS-77 (0 to 2 feet bls) were collected for PCB analyses. Aroclor-1260 was detected in CS-75 soil at a concentration of 6,900 μg/kg (6.9 ppm). Two Aroclors were detected in CS-77 soil: 370 μg/kg (0.37 ppm) Aroclor-1254, and 550 μg/kg (0.55 ppm) Aroclor-1260. Results are presented in Table 11 and Plate 18.

These data indicate that SVOCs, metals significantly above background, and PCBs are present in shallow soil within Area 13. However, no VOCs were detected.

### 4.13.2 Ground-Water Quality

As mentioned above (Area 11), Monitoring Well MW-46 was installed downgradient of Areas 11, 13 and 17. The resulting data indicate that only metals are present in ground water downgradient of Areas 11, 13 and 17. Analytical data is presented in Tables 15 through 18 and Plates 20 and 21.

In summary, the Phase II results for Area 13 show that metals exceed the background concentrations in both soil (S-100) and in downgradient ground water (MW-46). These data indicate that the metals detected in ground water downgradient of Areas 11, 13 and 17 may be attributable (or partially attributable) to Area 13 soils (S-100).

### 4.14 Area 14 Results

During the Phase I RI, analyses on soil sample S-80 (2 to 4 feet bls) included VOCs, SVOCs, pesticides and metals. Four VOCs were detected: 229 μg/L (0.229 ppm) acetone, 19 μg/L (0.019 ppm) carbon disulfide, 302 μg/L (0.302 ppm) methylene chloride and 30 μg/L (0.030 ppm) toluene. Di-n-butylphthalate was the only SVOC detected. No pesticides were detected, and no metals were detected in concentrations significantly above background. Analytical data are presented in Appendix A.

These data indicate that VOCs and one SVOC are present in Area 14 soil. However, no pesticides were detected, and no metals were detected significantly above background.

### 4.15 Area 15 Results

Phase I RI work within Area 15 included VOC, SVOC, pesticide and metal analyses of shallow soil from Soil Boring S-82. Phase II work consisted of the collection of a confirmatory soil sample (CS-82) for PCB analyses.

Excluding laboratory contaminants, two VOCs were detected in soil sample S-82 (0 to 2 feet bls); carbon disulfide (7.1 $\mu$g/kg [0.0071 ppm]) and toluene (4.8 $\mu$g/kg [0.0048 ppm]). Benzo(b+k)fluoranthene (1,233 $\mu$g/kg [1.233 ppm]) was the only SVOC detected. No pesticides were detected, and no metals were detected in concentrations significantly above background. Analytical data are included in Appendix A.

Shallow confirmatory soil sample CS-82 was collected for PCB analyses. Aroclor-1254 and Aroclor-1260 were detected at concentrations of 4,100 $\mu$g/kg (4.1 ppm) and 4,600 $\mu$g/kg (4.6 ppm), respectively. Analytical data are shown in Table 11 and Plate 18.

Based on these data, VOCs, one SVOC, and PCBs are present in Area 15 shallow soil. However, no pesticides were detected, and no metals were detected significantly above background.

### 4.16 Area 16 Results

As previously requested by the NYSDEC (NYSDEC, 1991b) and discussed in the Phase I RI (Roux Associates, 1992a), this area of concern has been eliminated from the RI/FS. However, analytical results for soil and ground-water samples collected in Area 16 are included in Appendix A. In addition to the Phase I RI, other work was performed in Area 16 by Roux Associates and others. This work consisted of: UST abandonment and monitoring by OHM Corporation from October 1991 through April 1992. Soil boring and monitoring well drilling and sampling to support construction activities by EGS Associates, Inc. in February 1992; and soil boring and sampling by Roux Associates in April 1994 to support construction activities. The results of these investigations are summarized in Roux Associates' October 1994 report titled "The Results of the Soil Sampling to Support the Static Frequency Converter Station Construction Project" presented to the NYSDEC (Roux Associates, Inc., 1994f).

### 4.17 Area 17 Results

Phase I RI work within Area 17 included VOC, SVOC, pesticide and metals analyses of a deep soil sample (S-60). Phase II work within Area 17 consisted of additional delineation of contaminants in both ground water (MW-46) and soil (S-101 and S-102). The Phase II samples were each analyzed for the TCL/TAL. PCBs in soil were additionally delineated in the field by completing Soil Borings SB-28 through SB-55 and SB-72 through SB-87 and analyzing soil using test kits. The additional delineation results were presented to the NYSDEC in an October 1994 report (Roux Associates, Inc., 1994e).

#### 4.17.1 Soil Quality

Excluding laboratory contaminants, no VOCs were detected within deep soil sample S-60 (4 to 6 feet bls). No SVOCs or pesticides were detected. In addition, no metals were detected in concentrations significantly above background. Analytical results are included in Appendix A.

One shallow soil sample was collected from each of two borehole locations (S-101 and S-102). VOCs were not detected in either soil sample. Numerous SVOCs were detected in each soil sample (18 compounds in S-101 and 16 compounds in S-102). An additional analysis (designated by a "+" on Table 9) was performed on each of these two samples due to matrix interference. These additional samples also showed matrix interference, and therefore are not discussed further. Total SVOC concentrations in the S-101 and S-102 soil samples were 49,391 $\mu$g/L (49.391 ppm) and 10,655 $\mu$g/L (10.655 ppm), respectively. The following three metals exceeded background ranges by greater than one order of magnitude within samples S-101 and S-102: arsenic, copper and lead. In addition, mercury, nickel and zinc were detected significantly above background in the S-102 soil sample. Aroclor-1260 was detected at both locations: S-101 (71,000 $\mu$g/kg [71 ppm]) and S-102 (1,400 $\mu$g/kg [1.4 ppm]). Analytical results are provided in Tables 8 through 11 and Plates 18 and 19.

During the initial phase of additional delineation, a total of 54 samples were analyzed from Soil Borings SB-28 through SB-55 using test kits. PCBs were detected above 25 ppm (29.1 to greater than 48 ppm) in soil from SB-30, SB-45, SB-47, SB-49 and SB-50. PCB concentrations exceeded 25 ppm in soil from the 0 to 1 foot samples from SB-30, SB-47 and

SB-50, down to 2 feet in boring SB-49, and down to 3 feet in boring SB-45. Concentrations of PCBs were less than 25 ppm in the deeper samples from Soil Borings SB-30, SB-47, SB-49 and SB-50 (Table 23 and Plate 23). Based on the results of these analyses, further delineation was required. Therefore, 23 soil samples from supplemental Soil Borings SB-72 through SB-87, and two deeper samples from Soil Boring SB-45 were analyzed for PCBs using the test kits. Concentrations of PCBs exceeded 25 ppm in the 0 to 1 foot depth intervals from Soil Borings SB-80 (70 ppm), SB-83 (65 ppm) and SB-84 (43 ppm). However, the soil PCB concentrations were less than 25 ppm in the next deeper samples (1 to 2 feet bls) from these locations (5 ppm, 2.1 ppm and 3.4 ppm, respectively).

A total of 79 samples (i.e., initial and supplemental) from Area 17 were analyzed for PCBs using the test kits. As shown in Table 23 and Plate 23, soil PCB concentrations of 25 ppm or greater were detected in the 0 to 1 foot sample interval from Soil Borings SB-30, SB-47, SB-50, SB-80, SB-83 and SB-84, to the 1 to 2 foot sample interval from Soil Boring SB-49, and to the 2 to 3 feet sample interval from Soil Boring SB-45. Soil PCB concentrations of less than 25 ppm were detected in the next deeper sample interval from all the above-mentioned soil borings ranging from 1.3 ppm in SB-45 (3 to 4 feet) to 22.9 ppm in SB-30 (1 to 2 feet).

In summary, VOCs were not detected in Area 17. Numerous SVOCs are present, including several PAHs. PCBs were detected throughout Area 17, however, PCB levels of 25 ppm or greater have been delineated. No pesticides were detected. The following six metals exceeded background ranges by greater than one order of magnitude within Area 17 soil: arsenic, copper, lead, mercury, nickel and zinc.

### 4.17.2 Ground-Water Quality

As mentioned in previous sections, Monitoring Well MW-46 was installed downgradient of Areas 11, 13 and 17 and the resulting data indicate that only metals are present in ground water downgradient of these areas. However, the highest concentrations of each of seven metals detected in ground water at the Yard occurred in the MW-46 ground-water sample. No PCBs were detected in MW-46 ground water following re-development of the well. Analytical data are presented in Tables 15 through 18 and Plates 20 and 21.

Although numerous SVOC compounds were detected in Area 17 soil, no SVOCs were detected in downgradient ground water (MW-46). This indicates that SVOCs in Area 17 soils are not affecting ground-water quality. Arsenic, copper, lead, mercury, nickel and zinc were detected in Area 17 soils in concentrations exceeding background by more than one order of magnitude. All of these metals were also detected above background in MW-46 ground water. These data suggest that Area 17 (specifically locations S-101 and S-102), in addition to Area 13 (S-100), may be contributing to the presence of metals in downgradient ground water (MW-46).

### 4.18 Facility Wide Results

As described in the RI/FS work plan and the Phase I RI report, all sample points outside of areas of concern 1 through 17 are considered facility wide. The Phase I RI work performed facility wide included analyzing ten soil samples for VOCs, SVOCs, pesticides and metals, and analyzing five shallow soil samples for lead. In addition, three facility wide ground-water samples were collected: MW-25, MW-29 and MW-33. Analyses included VOCs, SVOCs, pesticides and metals.

Tasks performed facility wide as part of the Phase II RI included additional delineation of contaminants in ground water, an investigation of the deeper Upper Glacial aquifer, confirmatory soil sampling for PCBs, and confirmatory ground-water sampling for metals analyses. A comprehensive round of water-level measurements was collected on February 8, 1993 (Table 7). In addition, Monitoring Well MW-25 was abandoned as discussed in Section 2.1.1.3.

#### 4.18.1 Soil Quality

During the Phase I RI, VOCs were detected in soil samples S-22, 0 to 2 feet bls (carbon disulfide and toluene) and MW-25, 4 to 6 feet bls (styrene). With the exception of common laboratory contaminants, no other VOCs were detected in facility-wide soil samples (i.e., S-17, S-30, S-33, S-35, S-37, S-38, S-39 and MW-34). SVOCs (excluding bis[2-ethylhexyl]phthalate, a common laboratory contaminant) were detected in four shallow facility-wide soil samples during the Phase I RI. Eleven SVOCs were detected in sample S-22, nine SVOCs were detected in sample MW-34, five SVOCs were detected in sample S-17, and one SVOC was detected in sample S-30. No pesticides were detected.

Phase I RI metals data for samples S-30, S-33 and S-35 were used to develop the background ranges for metals in Yard soil. Based on the remaining facility-wide Phase I RI soil analytical data, arsenic, copper and lead were detected significantly above background. All were detected significantly above background in shallow soil samples S-17 and S-22. Shallow soil sample MW-34 contained lead and copper significantly above background. No metals were detected in concentrations significantly above background in deep samples S-37 (4 to 6 feet bls), S-38 (2 to 4 feet bls), S-39 (2 to 4 feet bls) and MW-25 (4 to 6 feet bls). Of the five shallow soil samples analyzed for lead only (S-26, S-32, S-34, S-36 and MW-31), all contained lead in concentrations significantly above background, with the exception of S-36. Analytical data is included in Appendix A.

Five facility-wide shallow confirmatory soil samples (CS-16, CS-22, CMW-30, CMW-31 and CMW-34) were collected during the Phase II RI. All of these samples contained PCBs. Sample CS-16, contained 790 $\mu$g/kg (0.79 ppm) of Aroclor-1254 and 1,600 $\mu$g/kg (1.6 ppm) of Aroclor-1260. CS-22 contained 7.3 $\mu$g/kg (0.0073 ppm) of Aroclor-1254 and 16 $\mu$g/kg (0.016 ppm) of Aroclor-1260. Sample CMW-30 also contained Aroclor-1254 and Aroclor-1260 at concentrations of 300 $\mu$g/kg (0.3 ppm) and 310 $\mu$g/kg (0.31 ppm), respectively. Aroclor-1260 was detected in CMW-31 at a concentration of 10,000 $\mu$g/kg (10 ppm). Only Aroclor-1254 was detected in CMW-34 at 3.5 $\mu$g/kg (0.0035 ppm). These facility-wide confirmatory results are shown in Table 11 and Plate 18.

### 4.18.2 Ground-Water Quality

Phase I RI facility-wide ground-water sampling performed during January 1991 included sampling three shallow wells (MW-25, MW-29 and MW-33) for VOCs, SVOCs, pesticides and metals (Appendix A).

Phase II RI ground-water sampling was performed during January and February 1993. Two facility-wide, confirmatory ground-water samples were collected as part of the Phase II RI; shallow Monitoring Wells MW-25 and MW-29 were sampled for metals analyses. In addition, further delineation of PCBs in ground water was performed by sampling shallow Monitoring Well MW-25A. Three facility wide well clusters were installed and sampled for TCL/TAL analyses during the Phase II (MW-43/MW-44D, MW-47/MW-48D) and Addendum (MW-61/MW-62D). Clusters MW-47/MW-48D and MW-61/MW-62D are located on the upgradient side of the Yard, and therefore provide background ground-water quality data to determine if contaminants are migrating onto the Yard from off-site sources (Plate 1). As previously discussed in Section 3.3.2, ground-water analytical data from the two upgradient well clusters were used to determine background ranges for metals in ground water. Shallow Monitoring Well MW-47 also serves as an upgradient well for Monitoring Well MW-25. Cluster MW-43/MW-44D is located on the downgradient side of the Yard, and therefore provides analytical data representative of the quality of ground water migrating offsite. MW-47 was resampled and its adjacent deep well, MW-48D, was sampled for the first time during the Phase II Addendum. Analytical data are presented in Tables 15 through 18, and Plates 20 and 21.

Shallow Ground-Water Quality

During the Phase I RI, no VOCs, SVOCs (excluding bis[2-ethylhexyl]phthalate, a common laboratory contaminant) or pesticides were detected in shallow Monitoring Wells MW-25, MW-29 and MW-33. However, data validation deemed that the SVOC data for MW-29 were unusable. Metals were detected above background in all three wells. MW-25 is located near the northeastern property boundary of the Yard. Thirteen metals were detected above background in Monitoring Well MW-25. However, a supplementary sample was collected for metals analyses during the Phase II due to high sample turbidity. This well was subsequently abandoned and replaced with Monitoring Well MW-25A. The ground-water sample from MW-29 contained arsenic, lead, manganese, mercury and sodium above background ranges, also prompting a confirmatory sample to be collected during the Phase II RI. Three metals, cobalt, nickel and zinc, were detected slightly above background in MW-33 ground water. Lead was also detected above background in the MW-33 duplicate sample. Analytical data are included in Appendix A.

During the Phase II RI, 11 metals were detected in MW-25 above the ground-water background ranges: aluminum, beryllium, chromium, cobalt, copper, iron, lead, manganese, nickel, vanadium and zinc. Some of these detections of metals may be attributable to suspended particles in the ground-water sample, and therefore not indicative of ground-water quality.

On January 22, 1993, ground-water samples from Monitoring Wells MW-25A and MW-47 were collected for PCB analyses. Aroclor-1260 was detected in the MW-25A ground-water sample at a concentration of 0.067 $\mu$g/L (0.000067 ppm). However, no PCBs were detected in the upgradient ground-water sample, MW-47.

Shallow Monitoring Well MW-29 is located along the western edge of the Yard. On February 9, 1993, five metals were detected in concentrations above ground-water background: arsenic, iron, lead, manganese and sodium. As previously stated, the detected concentrations of manganese and sodium are probably attributable to anoxic conditions (Buxton, et al., 1981) and historical salt-water intrusion of the aquifer beneath the Yard (Soren, 1971), rather than related to Yard activities.

Monitoring Wells MW-47 and MW-61 represent ground-water quality upgradient of Yard operations. Monitoring Well MW-47, located in the northeast corner of the Yard, was sampled and analyzed for the TCL/TAL during the Phase II RI (February 9, 1993), including an additional sample for PCB analysis. No VOCs, SVOCs or PCBs were detected in MW-47.

Monitoring Well MW-61, located in the southeast upgradient corner of the Yard, was sampled during the Phase II RI Addendum (February 17, 1994) for TCL/TAL analyses. No SVOCs or PCBs were detected. However, one VOC was detected; 9 $\mu$g/L (0.009 ppm) of tetrachloroethene. These data indicate that tetrachloroethene in ground water is migrating onto the southeast portion of the Yard from an upgradient, offsite source.

The metals results for MW-47 and MW-61 are shown in Table 17 and Plate 21. As previously discussed, metals data for Monitoring Well clusters MW-47/MW-48D and MW-61/MW-62D were used to determine background ranges for metals in ground water. The concentrations of metals detected in these upgradient wells are compared to ground-water standards in Sections 6.3.1 and 8.

Monitoring Well MW-43 is located along the downgradient property boundary (Plate 1). A ground-water sample was collected from MW-43 during the Phase II RI (February 9, 1993) and analyzed for the TCL/TAL. Two VOCs were detected in Monitoring Well MW-43; 11 $\mu$g/L (0.011 ppm) of trichloroethene, and 2 $\mu$g/L (0.002 ppm) of 1,2-dichloroethene (total). No SVOCs or PCBs were detected in MW-43 ground water. Two metals were detected above background: manganese (3,470 $\mu$g/L [0.47 ppm]) and sodium (213,000 $\mu$g/L [213 ppm]).

In summary, no SVOCs or pesticides were detected in facility-wide shallow ground water. Five metals were detected in MW-29 ground water in concentrations above background: arsenic, iron, lead, manganese and sodium. However, manganese and sodium are probably attributable to anoxic conditions (Buxton, et al., 1981) and historical salt-water intrusion (Soren, 1971). Tetrachloroethene was detected in upgradient Monitoring Well MW-61, and two degradation products of tetrachloroethene (i.e., trichloroethene and 1,2-dichloroethene [total]) were detected in downgradient well MW-43. Based on ground-water flow patterns determined for the Yard, MW-43 is directly downgradient of MW-61. Therefore, all of the VOCs detected in these two facility-wide wells appear to be attributable to an offsite, upgradient source, and not related to Yard activities. Low concentrations of PCBs were detected in only one facility-wide monitoring well, MW-25A.

Deep Ground-Water Quality

The two deep wells that represent ground-water quality upgradient of Yard operations are MW-48D and MW-62D. Ground-water quality downgradient of the Yard was determined by sampling Monitoring Well MW-44D.

During the Phase II RI, Monitoring Well MW-48D was sampled on February 9, 1993 for TCL/TAL analyses. This monitoring well is located in the northeast corner of the Yard. No VOCs, SVOCs or PCBs were detected in this upgradient well.

During the Phase II Addendum, Monitoring Well MW-62D was sampled on February 17, 1994 for TCL/TAL analyses. PCBs were not detected. This deep well is located in the southeast corner of the Yard. One VOC and one SVOC were detected in this well; tetrachloroethene (3 μg/L [0.003 ppm]) and naphthalene (0.4 μg/L [0.0004 ppm]), respectively. These data indicate that tetrachloroethene and naphthalene are migrating onto the Yard from an off-site, upgradient source.

Monitoring Well MW-44D, located along the downgradient property boundary, was sampled on February 9, 1993 for TCL/TAL analyses. No SVOCs or PCBs were detected in the MW-44D ground water. Four metals were detected in concentrations exceeding background ranges: barium, calcium, magnesium and manganese. As with its adjacent shallow well (MW-43), Monitoring Well MW-44D also contained concentrations of VOCs: 75 μg/L (0.075 ppm) of trichloroethene, 46 μg/L (0.046 ppm) of 1,2-dichloroethene (total), and 2 μg/L (0.002 ppm) of 1,1,2,2-tetrachloroethane. These VOCs (chlorinated solvents) are degradation products of tetrachloroethene, the compound detected in upgradient well MW-62D.

In summary, the analytical results for downgradient well MW-44D suggest that three VOCs (trichloroethene, 1,2-dichloroethene [total] and 1,1,2,2-tetrachloroethane) and four metals (barium, calcium, magnesium and manganese) may be migrating offsite with deep ground water. However, MW-62D data indicate that tetrachloroethene and naphthalene are migrating onto the Yard from an off-site, upgradient source. Since MW-44D is directly downgradient of MW-62D, the VOCs (all chlorinated solvents) detected in these two facility-wide wells appear to be attributable to an offsite, upgradient source, and not related to Yard activities. SVOCs and PCBs are not present in any of the deep wells, and, therefore, are not migrating offsite in ground water. As previously discussed, manganese detections are probably attributable to anoxic conditions beneath the Yard (Buxton, et al., 1981).

## 4.19 Sewer System Investigation

The investigation of the combined sanitary/stormwater sewer system at the Yard was performed in two phases. Initially, seven sewer-water and three sewer-sediment samples were collected in February 1993 during the Phase II RI. Based on the results of those samples, an additional investigation of the sewer system was deemed necessary. The additional investigation was begun in April 1994 and is still in progress. The results of both phases of the investigation, including the additional 18 sewer-water and 15 sewer-sediment samples, were presented to the NYSDEC in an interim report (Roux Associates, Inc., 1994d), and are presented in this report.

Seven sewer-water samples and three sewer-sediment samples were collected from the sanitary/stormwater sewer system at the Yard on February 8 and 9, 1993. One sewer-water sample (MH-1) was collected from the secondary sanitary/stormwater sewer system, which provides drainage for the west portion of the Yard. All remaining samples were collected from the primary sewer system, which underlies the majority of the Yard between Queens Boulevard and 39th Street (Plate 24).

Sample MHW-1 was collected from manhole MH-1, which represents water exiting the Yard through the secondary sewer system (Plate 25). The sample was analyzed for the TCL/TAL. Analytical data are presented in Tables 24 through 27. BTEX, 1,1,1-trichloroethane and chloroform were detected in water sample MHW-1 collected February 9, 1993. Two SVOCs were detected: naphthalene (2 $\mu$g/L [0.002 ppm]) and 2-methylnaphthalene (1 $\mu$g/L [0.001 ppm]). Thirteen metals were detected in the MHW-1 sample. No PCBs were detected in sewer water at location MH-1 (Table 27).

Both water and sediment samples were collected from location MH-2, which was the closest accessible manhole location to the point where the primary sewer system exits the Yard (Plates 25 and 26). This manhole appears to be downstream of several areas of concern (Areas 2 through 13). The water sample was analyzed for the TCL/TAL, and the sediment sample was analyzed for PCBs. The sewer-water sample, designated MHW-2, contained 5 $\mu$g/L (0.005 ppm) of chloroform, low concentrations (i.e., 0.7 $\mu$g/L [0.0007 ppm] to 16 $\mu$g/L [0.016 ppm]) of 10 different SVOCs, and 14 metals (Tables 24 through 26). As shown in

Table 27, two Aroclors were detected: Aroclor-1254 (1.1 μg/L [0.0011 ppm]) and Aroclor-1260 (1.2 μg/L [0.0012 ppm]). PCBs were also detected in the sewer-sediment sample designated MHS-2, collected from Manhole MH-2. Sample MHS-2, as shown in Table 28, contained the same two Aroclors detected in the sewer-water sample: Aroclor-1254 (24,000 μg/L [24.000 ppm]) and Aroclor-1260 (58,000 μg/L [58.000 ppm]).

Five sewer-water samples and two sewer-sediment samples were collected from primary sewer system manholes located within Area 1 of the Yard and downstream of Area 14. These samples were analyzed for PCBs. Manhole locations MH-3, MH-4 (not accessible, therefore not sampled), MH-5, MH-6, MH-7 and MH-8 are shown in Plate 24.

PCBs were detected in sewer-water samples from the two manholes located immediately north and downstream of the Metro Shop, MH-7 and MH-8 (sample designations MHW-7 and MHW-8, respectively). Sample MHW-7 contained three Aroclors: Aroclor-1248 (2.6 μg/L [0.0026 ppm]), Aroclor-1254 (5.9 μg/L [0.0059 ppm]), and Aroclor-1260 (6.3 μg/L [0.0063 ppm]). Sample MHW-8 contained two Aroclors: Aroclor-1254 (9.6 μg/L [0.0096 ppm]) and Aroclor-1260 (11 μg/L [0.011 ppm]). However, no PCBs were detected in the two sewer-water samples collected downstream of MH-7 and MH-8; MHW-3 and MHW-5, respectively. As shown in Plate 24, Manhole MH-5 is located downstream of MH-8, and Manhole MH-3 is located downstream of Manholes MH-5, MH-7 and MH-8. No PCBs were detected in the sewer-water sample collected from Manhole MH-6 (sample MHW-6), located adjacent to the drum storage area (Area 6) and downstream of the Engine House (Table 27 and Plate 24).

PCBs were detected in sewer-sediment sample MHS-8: Aroclor-1254 (1,300 μg/L [1.300 ppm]) and Aroclor-1260 (2,900 μg/L [2.900 ppm]). In addition, three Aroclors were detected in downstream sewer sediment collected at location MH-3 (sample designation MHS-3) at higher concentrations than detected upstream: Aroclor-1242 (3,000 μg/kg [3.000 ppm]), Aroclor-1254 (29,000 μg/kg [29.000 ppm]) and Aroclor-1260 (22,000 μg/kg [22.000 ppm]). Sewer-sediment analytical data are shown in Table 28 and Plate 24.

Based on the above Phase II RI data, contaminants do not appear to be exiting the Yard through the secondary sewer system. However, PCBs may be exiting the Yard through the primary sewer. This is suggested by the data for downstream samples of the primary sewer system: MHS-3, which is downstream of the Metro Shop in Area 1 (and also downstream of Area 14), and MHW-2/MHS-2, which are the downstream samples for the Yard between Queens Boulevard and 39th Street, which all contain PCBs. Based on these data, additional delineation of PCBs in the primary and secondary sewer systems was proposed. This additional work consisted of performing a preliminary sewer survey, followed by supplementary sewer sampling and analyses (Roux Associates, Inc., 1993l).

On May 19 and 20, 1993 Roux Associates, accompanied by a representative of AMTRAK's Building and Bridge Division, conducted a preliminary sewer (i.e., primary and secondary) survey to confirm the current understanding (based on Yard engineering drawings), and to identify any previously unknown conditions of the sewer system at the Yard. A site walk was conducted verifying the manholes and catch basins identified on AMTRAK-supplied sewer maps. Manhole and catch basin locations identified on the maps were opened if found (i.e., not buried or paved over) and inspected to confirm sewer line diameters and flow directions, the existence of sediment, and for comparison, the relative flow velocity and volume of water in the sewer (Tables 29 and 30). The locations and designations of these manhole locations are shown in Plates 25 and 26. The results of the survey are presented below.

It is important to note that flow increases to the north across the "Body Tracks" between MH-43 and MH-2, and MH-47 and MH-52, indicating the presence of track drains not shown on the sewer maps but identified by AMTRAK personnel and observed by Roux Associates in the western section of the "Body Tracks." In addition, the planned construction of a new "Honey House" to be located west of the new Commissary Building and connected to the sewer at MH-72, will result in an increase in flow toward MH-2.

Several discrepancies were noted between the sewer maps and the actual conditions observed in the field. Plates 25 and 26 were prepared using the revised data.

Based on historical (i.e., early 1900s) engineering drawings, it appears that an outfall from the secondary sewer system to the Dutch Kills (i.e., surface water) existed at that time. However, telephone discussions with representatives of the Queens Borough Section of the New York City Sewer Department indicated that all sewers located north of the Long Island Expressway in Queens County (i.e., where the Yard is situated) discharge to the Bowery Bay Sewage Treatment Plant in Astoria, Queens.

Based on a review of the above results, it was determined that all of the manholes sampled in Area 1 at the Yard would require sediment removal and that additional delineation of PCBs in the sewer should be performed entirely outside of Area 1 (Roux Associates, Inc., 1993l).

The additional delineation of PCBs in the sewer systems was performed by Roux Associates during April 1994 according to the "Work Plan for Additional Investigation of the Sewer System at the Sunnyside Yard, Queens, New York" (Roux Associates, Inc., 1993l). Analytical results for this work are summarized in Tables 27 and 28. Sewer-water and sewer-sediment results are shown in Plates 25 and 26, respectively. The data validation report for this phase of sampling is included in Appendix F.

As evidenced in the analytical results, PCBs were detected in sewer-sediment samples collected within the primary and secondary sewer systems. PCBs were not detected in the sewer-water samples collected from the secondary sewer system. Low levels of PCBs, ranging from 0.20 $\mu$g/L (0.00020 ppm) to 4.4 $\mu$g/L (0.0044 ppm), were observed in the unfiltered sewer-water samples collected in five manholes within the primary sewer system: MH-2, MH-39, MH-40, MH-43 (duplicate) and MH-69. However, of the sewer-water samples collected with corresponding sediment samples, PCBs were only observed in water from those manholes having PCBs within the sewer sediment. This could be in part due to suspending the contaminated sediment particles in the sewer water by agitation or sampling turbid water during the collection of sewer-water samples. This conclusion is supported by the fact that the unfiltered sewer-water samples collected from Manholes MH-2 and MH-40 contained PCBs, while the filtered sewer-water samples from these same two locations did not. In addition, no PCBs were detected in any of the filtered sewer-water samples collected from the primary and secondary sewers.

All of the 10 primary sewer system manholes sampled during April 1994 for sewer sediment contained PCBs. Aroclor-1260 was detected in all samples at concentrations ranging from 170 μg/kg (0.170 ppm) in manhole MH-29 to 38,000 μg/kg (38.000 ppm) in MH-42. Three other Aroclors were detected in the primary sewer system. Aroclor-1242 was detected once; 700 μg/kg (0.700 ppm) in manhole MH-35. Aroclor-1248 was detected in four primary sewer system manholes ranging from 53 μg/kg (0.053 ppm) in MH-45 to 13,000 μg/kg (13.000 ppm) in MH-42. Aroclor-1254 was detected in three manholes at concentrations of 700 μg/kg (0.700 ppm) in MH-45 to 13,000 μg/kg (13.000 ppm) in MH-55. Concentrations of total PCBs in sewer sediment ranged from 170 μg/kg (0.170 ppm) in MH-29 to 82,000 μg/L (82 ppm) in MH-2.

As with the primary sewer system, all of the three secondary sewer system locations that were sampled and analyzed for PCBs in sediment contained Aroclor-1260. Aroclor-1248 (MH-65) and Aroclor-1254 (MH-1 and CB-28) were also detected. Concentrations of total PCBs ranged from 490 μg/kg (0.490 ppm) in Catch Basin CB-28 to 3,500 μg/kg (3.500 ppm) in manhole MH-1.

Based on the above-mentioned additional analytical results (Task 1) and the initial Phase II RI sewer sampling results, locations have been chosen for sediment removal. However, sediment removal (Task 2) has not yet been performed at the Yard. These locations have been proposed to the NYSDEC for approval, and are as follows.

Yard-Wide

| | |
|---|---|
| Primary Sewer System: | MH-2, MH-29, MH-35, MH-37, MH-40, MH-42, MH-45, MH-52, MH-55 and MH-69 |
| Secondary Sewer System: | MH-1, MH-65 and CB-28 |

Area 1

| | |
|---|---|
| Primary Sewer System: | MH-3, MH-5, MH-7, MH-8, CB-1 through CB-4, CB-6 and CB-7 |

Upon approval of the sediment removal locations and scope of work by the NYSDEC, the sediment removal program (i.e., Area 1 and Yard-wide) will be implemented. Details regarding this proposed work are included in Section 7.1.

Roux Associates performed an inspection and evaluation of the Area 1 oil/water separator (Task 3) on April 25, 27, and 28, 1994. The approximate location of the oil/water separator (between CB-3 and CB-4) and location of existing sewer piping in the area are shown in Plate 24. The liquid contents of the separator were pumped out and an inspection was made to determine the condition and status of the system.

After the pumpout, Roux Associates personnel investigated the status of the oil/water separator for three days. On the third day, after it had rained the night before, water was observed to have accumulated in the separator.

Based on the results of the oil/water separator inspection and evaluation at the Yard, Roux Associates recommends that the oil/water separator in Area 1 be properly abandoned during the future Area 1 construction activities and remediation work. However, the sludge that was noted in the oil/water separator will be pumped out during the initiation of the Area 1 sediment removal program.

Following completion of sediment removal from the manholes and catch basins, the sewer system monitoring program (Task 4) will be implemented. The results will be submitted to the NYSDEC throughout the scheduled program. Details of the proposed monitoring program and a sampling and inspection schedule are included in Section 7.1.

## 5.0 CONTAMINANT FATE AND TRANSPORT

An evaluation of the environmental fate and transport of contaminants at the Yard was performed to support the RA and FS. This evaluation consisted of: 1) compilation of information regarding physicochemical properties that can influence the fate of contaminants; and 2) an evaluation of contaminant transport and degradation processes.

### 5.1 Physicochemical Properties of Contaminants

Physical and chemical properties that will affect the fate and transport of contaminants in soil and ground water include:

- solubility;
- specific gravity;
- vapor pressure;
- Henry's Law constant;
- organic carbon partition coefficient ($K_{oc}$); and
- octanol-water partition coefficient ($K_{ow}$).

Solubility is the maximum concentration of a chemical that will dissolve in water at a given temperature without forming a separate phase.

Specific gravity is the ratio of the density of a pure chemical to the density of water. As a separate phase, a compound with a specific gravity less than 1.0, such as benzene or toluene, will float on top of the water table, while a chemical with a specific gravity greater than 1.0, like trichloroethene, will sink.

Vapor pressure is a property of a chemical in its pure state and is an indicator of the rate of volatilization of a chemical in an aqueous environment.

Henry's Law constant is the ratio of a chemical's concentration in the vapor phase above water to its concentration in the aqueous phase, at equilibrium. It indicates the tendency of the chemical to evaporate from a water solution.

The organic carbon partition coefficient ($K_{oc}$) is the ratio of a chemical's concentration bound to soil organic carbon to its concentration in soil pore water, at equilibrium.

The octanol-water partition coefficient ($K_{ow}$) is the ratio of a chemical's concentration in the n-octanol phase to its concentration in the aqueous phase of an octanol-water mixture at equilibrium. The $K_{ow}$ gives an indication of how the chemical will preferentially distribute into a solvent or water. Low $K_{ow}$ values indicate that the contaminant is more hydrophilic; that is, a large fraction will be dissolved in the water phase. Low $K_{ow}$ values also imply higher mobility.

Table 31 lists values for these properties obtained from literature references for the contaminants detected at the Yard.

### 5.2 Processes Affecting Contaminant Migration

The processes by which chemicals at the Yard can migrate include: 1) leaching from soil to ground water; 2) transport in ground water; 3) discharge from ground water to surface water; and 4) volatilization from soil and surface water. The parameters controlling contaminant transport by these processes are described below.

### 5.2.1 Leaching From Soil to Ground Water

The leaching of contaminants from soil into ground water depends on the degree of binding of the chemical to soil, the amount of water the soil-bound chemical comes in contact with, and the chemical characteristics of the soil and recharging water. The degree of soil binding is reflected in the $K_{oc}$ values, with higher $K_{oc}$'s indicating greater binding and lower leaching rates. Since $K_{oc}$ values are available for only a few chemicals, it should be noted that $K_{oc}$ has been found to be directly related to $K_{ow}$, so that higher $K_{ow}$'s also indicate greater binding to soil. The actual distribution coefficient (the ratio of bound to dissolved concentration at equilibrium, $K_d$) for the binding of chemicals to soil must take into account the soil's organic content. This is included in the $K_d$ value, as discussed later. The amount of water available to leach chemicals is a function of annual rainfall and the fraction of rainfall that percolates downward. The key chemical characteristics of the soil and water that influence the ability to leach contaminants are Eh (redox potential), pH and the presence of dissolved co-solvents. Eh influences the predominant oxidation state of metals, and therefore the solubilities of those metals. Water with low pH (acidic) is more efficient in leaching some metals from the soil. Co-solvents act to increase the solubilities of organic chemicals in water.

### 5.2.2 Transport in Ground Water

The transport of contaminants in ground water is affected by the hydrologic properties of the aquifer, chemical composition of the aquifer and chemical nature of the contaminants. The hydrologic properties of the aquifer are described in terms of advective and dispersive flow. The aquifer's organic carbon content and physical properties, along with the $K_d$ of the chemical, are then used to calculate a retardation factor (R) for the chemical in the aquifer.

Advection and Dispersion

Advective flow is used to describe the transport of a non-reactive, water-soluble tracer at an average ground-water velocity (Freeze and Cherry, 1979). Darcian flow is assumed. Advective flow is usually the dominant transport mechanism in aquifer systems. The equation to describe advective flow is:

$$v=K_H \frac{I_H}{n_e}$$

where:

$v$ = seepage velocity, in units of length per time

$n_e$ = effective porosity [dimensionless]

$K_H$ = hydraulic conductivity, in units of length per time

$I_H$ = horizontal hydraulic gradient, in units of length per length

The advective flow equation describes the flow velocity in an ideal system (that is, a system where the seepage velocity depends only on the aquifer properties and the hydraulic gradient). The main application of the simple advective flow equation is to determine the average time it takes for water to reach a certain location.

Dispersion can result in a spreading of the arrival time of this idealized ground-water flow. The arrival time of the center of mass of the contaminant can be calculated by the advection equation, but some of the contaminant arrives earlier than the center of mass, and some contaminant arrives later. Dispersion is controlled by molecular diffusion and mechanical mixing within the aquifer.

Retardation

Advection determines the rate of flow of ground water in a formation. However, because most contaminants have chemical properties different from those of ground water, the contaminants can move at velocities slower than that of ground water due to binding reactions with the solids in the aquifer matrix. This is termed retardation.

Sorption on naturally-occurring organic matter is the predominant mechanism by which organic compounds are retarded in ground-water systems. The rate of movement of these compounds relative to ground water has been directly linked to the $K_{ow}$ for the individual compounds (Lyman et al., 1982). The $K_{ow}$ is a measurement of a compound's tendency to concentrate in an organic phase in preference to water. In ground-water systems, the compounds with lower $K_{ow}$ values concentrate in the mobile water phase rather than in the immobile solid organic matter phase. Therefore, those compounds will migrate faster than other compounds with higher $K_{ow}$ values.

The retardation of a specific compound is strongly influenced by the amount of organic matter in the aquifer matrix. The distribution coefficient, $K_d$, is calculated prior to determining retardation factors and provides another means of ranking organic compound mobilities in a specific geologic material. An equation of the form:

$$\log K_d = 1.00 \log K_{ow} + \log (f_{oc}) - 0.21$$

can be used to estimate $K_d$ values (Lyman et al., 1982). The fraction organic carbon ($f_{oc}$) is obtained from the percentage of organic matter in the aquifer matrix. The equation to calculate $K_d$'s assumes the organic carbon content has a uniform effect on all contaminants, although this is not always the case (Garbarini and Lion, 1986).

The $K_d$'s calculated using the above equation incorporate the chemical characteristics of the organic contaminant and the aquifer material into one term. The overall retardation characteristics of the aquifer are included in the calculation of retardation factors (R) by the equation:

$$R = 1 + \left(\frac{\rho}{n}\right) K_d = \frac{v}{v_c};$$

where $\rho$ is the bulk density of the soil, and n is the soil porosity (Freeze and Cherry, 1979). The retardation factor is the ratio of the velocity of the ground water (v) compared to the velocity of the compound of interest ($v_c$). Compounds that have $K_d$'s of zero would move at the same velocity as the ground water, and hence have a retardation factor of 1.0.

Table 32 shows the results of calculating R-values for the contaminants detected at the Yard, and categorizes chemicals with regard to their relative mobility based upon R. Contaminants which have R-values ranging from 1.0 to 2.0 (i.e., those chemicals which would travel at velocities greater than one-half of the ground-water velocity) are classified as having a high relative mobility; contaminants for which R ranges from 2.1 to 20 are classified as having medium relative mobility; contaminants for which R ranges from 21 through 50 are classified as having low relative mobility; and those compounds with R greater than 50 are considered relatively immobile. The classification scheme described above is useful for comparing the relative mobilities of the contaminants found at the Yard. In general, the aromatics (e.g., ethylbenzene) range from immobile to medium mobility. Halogenated aliphatics (e.g., trichloroethene) are rated either medium or highly mobile. The ketone (acetone) characterized was of high mobility. The two phenols for which R-values could be calculated (4-methylphenol and 4-chloro-3-methylphenol) were characterized as having medium and negligible mobility, respectively. The phthalate esters, PAHs, and PCBs were either of low mobility or immobile. Benzoic acid shows medium mobility.

The mobility of cationic metals depends upon the ground-water conditions and the nature of the aquifer matrix. For example, most metals are adsorbed more readily under alkaline pH conditions. The presence of clay minerals and iron hydroxides will also increase the extent of adsorption. Precipitation can also play a role in reducing contaminant concentrations for most metals. The metal can either form its own mineral phase or can be incorporated as a trace metal in another precipitating solid. The redox potential of the ground water, Eh, can affect the redox state of metals dissolved in ground water. Lower Eh-values indicate the presence of reducing potential (for instance, $Fe^{++}$), and can lead to the prevalence of the reduced forms of redox-active metals like chromium, iron, and manganese.

### 5.2.3 Discharge from Ground Water to Surface Water

Dissolved contaminants can be transferred from ground water to surface water offsite by discharge of the ground water to the East River and Dutch Kills. Discharge of ground water to surface water will occur when the hydraulic head of ground water is higher than the head of surface water to which it is hydraulically connected. This process can cause removal of some of the dissolved organics in the ground water by adsorption to the stream sediments, because the latter often contains a higher organic content than the aquifer matrix. As ground water discharges through the sediments, contaminants can be immobilized temporarily or permanently. The relative $f_{oc}$-values of stream sediment and aquifer matrix will determine the degree of binding during discharge. The higher the $f_{oc}$ of the stream sediment, the greater will be the binding of dissolved organic contaminants from ground water. Contaminants bound to stream sediments would then be subject to migration downstream if the sediment were carried with the surface water.

### 5.2.4 Volatilization from Soil and Surface Water

Volatilization can be an important migration mechanism whereby contaminants are removed from surface water, soil, and (to a lesser extent) ground water, and transferred to air. Chemicals with high vapor pressures and low solubilities are generally most affected by this process. Those compounds with large Henry's Law constants (Table 31) will readily evaporate into the atmosphere (Nyer et al., 1991) where they may be degraded by reaction with sunlight (photolysis, as described in Section 5.3). Although Henry's Law constants were unavailable for many of the compounds in Table 31, it would be predicted from their vapor pressures and solubilities that the aromatic compounds and the halogenated aliphatics would have Henry's Law constants large enough for significant removal from waters and soil by this process. The more soluble compounds, such as the phenols, and the less volatile compounds, such as the PCBs, are not readily volatilized from water.

## 5.3 Degradation Processes

Degradation processes include biologically mediated degradation and chemical, or abiotic, degradation. Various naturally-occurring processes can result in the transformation of organic compounds to other compounds of the same type, to products of a different type (such as conversion of alcohols to carboxylic acids), or to the ultimate degradation products of organics: carbon dioxide and water (Nyer et al., 1991). Several factors must be considered in the evaluation of these reactions. The biological and abiotic degradation pathways for a given contaminant may produce different products, and the proportion of these products may vary depending upon the various reaction rates. Typically, the biologically mediated reactions will be faster than the strictly abiotic reactions. However, the biological reaction rates are also much more variable than the abiotic rates because of the extreme dependence of biological degradations on the conditions around the microbial colonies in the soil and aquifer matrix. These conditions include pH, Eh, temperature, contaminant concentration, and the presence of other nutrients or biological toxins in the soil pore water or ground water. It is therefore not possible to predict degradation rates with certainty.

Photolysis occurs when a compound is broken down to smaller compounds by the action of light. It is dependent upon non-chemical-specific factors such as the intensity of the sunlight and the depth and turbidity of the surface-water body.

## 5.4 Contaminant Fate and Transport at the Yard

For the groups of compounds identified in Table 32, the following processes are considered to be important in affecting their concentrations over time. Given the high $K_{ow}$'s (and resulting high retardation factors) for PAHs, PCBs and phthalate esters, these compounds are expected to be strongly retarded by naturally occurring organic matter in the soil and the aquifer matrix. They will be relatively immobile in ground water. However, sediments containing these compounds may be transported from areas exposed to surface-water runoff and flooding. The aromatics, phenols, halogenated aliphatics, and ketones display varying degrees of mobility in ground-water systems. Volatilization from soil and ground water occurs very slowly, due to lack of mixing of ground water and tortuous diffusion pathways in soil. Volatilization from these two media is not considered to be a significant transport route. Volatilization from surface water may be a factor in reducing the concentrations of aromatic and halogenated aliphatic compounds. Degradation of aromatics, halogenated aliphatics, ketones, phenols, phthalate esters and polycyclic aromatics, is observed to occur at measurable rates in soil and ground water, although the rates carry large uncertainties (Howard et al., 1991).

The migration of contaminants in each of the media at the Yard is discussed below.

Soil

Contaminants within the unsaturated soils at the Yard are generally not covered with pavement or buildings (Plates 11 through 13, 18 and 19). Moreover, the depth to ground water varies from 0.5 ft to 10 ft across the Yard, increasing the potential for contaminated soil to impact ground water.

Soil contamination at the Yard is primarily characterized by PAHs and PCBs of low or zero mobility. These compounds tend to remain tightly bound to soil particles, and do not have as great a potential for migration into ground water as smaller and more soluble compounds. However, these compounds are exposed in surface soil. Surface runoff during precipitation may result in the transport of contaminated sediment into the sewer system and subsequently offsite. Detection of PCBs in sediments from the Yard sewer system indicates that this transport pathway is present.

The metals detected in soil at the Yard (Table 10 and Plates 12 and 19) are also subject to migration via either precipitation runoff to the sewer system or leaching from soil to ground water. The metals detected in soil above background concentrations or recommended soil cleanup objectives (see Section 6.3.2) were: aluminum, antimony, arsenic, beryllium, cadmium, calcium, chromium, copper, iron, manganese, mercury, nickel, potassium, and zinc. Of these metals, seven (antimony, beryllium, chromium, copper, iron, manganese and zinc) have been detected in ground water, and their fate and transport will be discussed below. The other metals are assumed to be completely immobilized in soil at the Yard. Their mobilization and release from the soil could only occur as a result of a release of strong acid or alkali onto the soil at the Yard.

Ground Water

Ground-water contamination in the saturated fill deposits and the Upper Glacial aquifer at the Yard is characterized by the presence of petroleum-derived VOCs and PAHs, and PCBs. Chlorinated VOCs were also detected in three areas. The non-chlorinated VOCs (i.e., aromatics, ketones and other volatiles) range from high to negligible mobility in water, and in the dissolved state will migrate along with the ground-water flow, being partially retarded due to adsorption on the aquifer matrix. The chlorinated VOCs show high or medium mobility. PAHs and PCBs are essentially immobile in ground water due to their affinity for aquifer matrix and, therefore, they will not migrate significantly from their source.

Ground water beneath the Yard also contains the following metals at concentrations above ambient water-quality standards (Section 6.3.1): antimony, barium, beryllium, chromium, copper, iron, lead, magnesium, manganese, sodium and zinc. These metals exhibit different chemical properties that control their migration abilities in ground water. Barium, beryllium, magnesium, and sodium exist as soluble metal ions and are mobile in ground water. Antimony, chromium, copper, iron, lead, manganese and zinc can exist in different oxidations states. Under most environmental conditions of Eh and pH (including those at the Yard), antimony exists as antimony(III) oxide, $Sb_2O_3$, which is partially soluble and mobile. The two major chromium oxidation states, Cr(VI) and Cr(III), show drastically different properties. Cr(VI) is very mobile in water as chromate, $CrO^{=}_4$ which is a carcinogen. Cr(III), on the other hand, forms insoluble $Cr(OH)_3$ at neutral pH and is immobile. Since Cr(VI) is a strong oxidant, the Cr(III) form predominates due to the reduction of Cr(VI) in the presence of almost any reductant, including organic contaminants. The oxidized forms of copper [Cu(II)], lead [Pb(II)] and zinc [Zn(II)] all form insoluble hydroxides at mildly acidic to mildly alkaline pH's. Under oxidizing conditions, iron exists as Fe(III), which forms insoluble FeO (OH), ferric oxyhydroxide, at neutral or alkaline pH. Under reducing conditions, iron will exist as soluble Fe(II) species. Manganese forms insoluble $MnO_2$ in the oxidized [Mn(IV)] form and exists as soluble Mn(II) species in the reduced form. Since ground water at the Yard is generally neutral and probably tends toward anaerobic (reducing) conditions, some of the iron and manganese would be expected to migrate as soluble species with very little retardation in ground water.

Ground-water flow is controlled by natural and artificial (i.e., resulting from historic cut and fill activities) hydraulic gradients. As shown in Plates 9 and 10, horizontal flow in the saturated fill and Upper Glacial aquifer underlying the Yard is generally toward the west and northwest, toward the East River. It is also possible that some ground water discharges to Dutch Kills, which appears to be buried to the west of the Yard but emerges before joining Newtown Creek. No sampling has been performed to confirm or eliminate this potential migration pathway.

Calculated vertical hydraulic gradients between the shallow deposits and the Upper Glacial aquifer deposits indicate that ground-water flow is predominantly horizontal, but has both downward and upward components at different locations at the Yard. All Yard ground water discharges upward as it moves west and northwest toward the East River.

## 6.0 PRELIMINARILY IDENTIFIED ARARs

Consistent with the National Contingency Plan (NCP) (USEPA, 1990a) and the "CERCLA Compliance with Other Laws Manual" (USEPA, 1988), applicable or relevant and appropriate requirements (ARARs) continue to be developed at multiple stages of the remedy selection process for the Yard, including during the scoping and Yard characterization phases of the RI. Preliminary potential ARARs identified during the scoping phase were presented in the RI/FS work plan. Site characterization data obtained during this RI were used to further identify potential chemical- and location-specific ARARs. The results of the identification of action-specific ARARs will be presented in the FS. Continued development of ARARs will be performed during the FS, and a final presentation of chemical-, location-, and action-specific ARARs will be provided in the FS report. An RA report has been completed and will be used to establish health-based remediation goals for the Yard.

In the following sections, an overview of ARARs in the remedy selection process is presented, the procedure used to identify ARARs for the Yard is outlined, and Yard-specific chemical- and location-specific ARARs are presented.

### 6.1 Definition and Overview of ARARs

ARARs are defined as follows (40 CFR 300.5) (USEPA, 1990a).

Applicable requirements are:

> "Those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations, promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) site. Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable."

Relevant and appropriate requirements are:

> "Those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those state standards that are identified in a timely manner and are more stringent than federal requirements may be relevant and appropriate."

The three different types of ARARs are:

1. Ambient- or chemical-specific ARARS are health or risk-based numerical values or methodologies. Chemical-specific ARARs establish the amount or concentration of a chemical that may be found in, or discharged to, the environment;
2. Action-specific ARARs are usually technology- or activity-based requirements or limitations on actions taken with respect to hazardous wastes; and
3. Location-specific ARARs set restrictions on the concentration of hazardous substances or the conduct of activities based on the specific location of the site (USEPA, 1988b).

In New York State, remedy selection must also conform to standards and criteria that are generally applicable, consistently applied, and officially promulgated. The site's program should be designed with consideration being given to guidance determined, after the exercise of engineering judgement, to be applicable on a case-specific basis.

The terms "standards and criteria" and "guidance" (SCGs) include both those of the state and those of the United States to the extent that they are more stringent than those of this state (6 NYCRR 375-1.10).

In addition to ARARs/SCGs, to-be-considered materials (TBCs) are also identified as part of the remedy selection process. TBCs are nonpromulgated advisories, criteria, or guidance developed by Federal or State governments that may be useful in developing CERCLA remedies (40 CFR 300.400[g][3]) (USEPA, 1990a).

CERCLA Section 121 requires selection of a remedial action that is protective of human health and the environment (42 USC 9621[b][1][G]). The two threshold criteria for selection of a remedial alternative are overall protection of human health and the environment and compliance with ARARs (40 CFR 300.430[f][1][i][A]) (USEPA, 1990a).

During the FS, remedial action objectives will be established and will specify contaminants and media of concern, potential exposure pathways, and remediation goals. Initially, preliminary remediation goals are determined based on readily available information, such as chemical-specific ARARs or other reliable information. Final remediation goals are determined when the remedy is selected. Remediation goals establish acceptable exposure levels that are protective of human health and the environment and are developed by consideration listed below.

- ARARs, if available, and the following factors:
    - For systemic toxicants, acceptable exposure levels shall represent concentrations to which the human population can be exposed without adverse effect during a lifetime or part of a lifetime, incorporating an adequate margin of safety;
    - For known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between $10^{-4}$ and $10^{-6}$. The $10^{-6}$ risk level is used as the point of departure for determining remediation goals for alternatives when ARARs are not available or are not sufficiently protective because of the presence of multiple contaminants at a site or multiple pathways of exposure;
    - Factors related to technical limitations such as detection/quantitation limits for contaminants;
    - Factors related to uncertainty;
    - Other pertinent information (40 CFR 300.430[e][2][i][A][1 through 5]) (USEPA, 1990a);

- Maximum Contaminant Level Goals (MCLGs) set at levels above zero are to be attained by remedial actions for ground water or surface waters that are current or potential sources of drinking water, where MCLGs are relevant and appropriate under the circumstances of the release based on the factors in 40 CFR 300.400(g)(2). If an MCLG is determined not to be relevant and appropriate, or if an MCLG is set at a level of zero, the corresponding Maximum Contaminant Level (MCL) shall be attained where relevant and appropriate to the circumstances of the release based on the factors in 40 CFR 300.400(g)(2) (USEPA, 1990a);

- In cases involving multiple contaminants or pathways where attainment of chemical-specific ARARs would result in cumulative risk in excess of $10^{-4}$, criteria listed at 40 CFR 300.430(e)(2)(i)(A) (USEPA, 1990a) may be considered when determining the cleanup level to be attained;

- Water quality criteria established under Sections 303 or 304 of the Clean Water Act are to be attained where relevant and appropriate under the circumstances of the release;

- An alternate concentration limit may be established in accordance with CERCLA Section 121(d)(2)(B)(ii); and

- Environmental evaluations are to be conducted to assess threats to the environment, especially sensitive habitats and critical habitats of species protected under the Endangered Species Act (40 CFR 300.430[e][2][i][B through G]) (USEPA, 1990a).

## 6.2 Procedure for Identifying ARARs

The process of identifying potential ARARs/SCGs and TBCs for the Yard consisted of the following activities.

- Pertinent facts concerning the chemicals detected in Yard media and the location of the Yard were identified.

- Federal regulations and State SCGs were reviewed to identify potential ARARs.

- The "CERCLA Compliance with Other Laws Manual" (USEPA, 1988) was reviewed for lists of all potential chemical- and location-specific Federal ARARs. Requirements contained in these lists, together with any requirements promulgated subsequent to the issuance of the "CERCLA Compliance with Other Laws Manual" were considered during the identification of potential Federal chemical- and location-specific ARARs for the Yard. The list of potential State ARARs, together with any requirements promulgated subsequent to the publication date of the list, were considered during the identification of potential State chemical- and location-specific ARARs for the Yard.

- Provisions of each potential ARAR were reviewed to obtain pertinent information, including the following:
    - substances regulated by the requirement;
    - types of facilities regulated by the requirement;
    - locations regulated by the requirement; and
    - persons or entities regulated or affected by the requirement.
- The concentrations of contaminants detected in Yard soils and ground water and facts concerning the type and location of facility were compared to the provisions of the identified potential ARARs/SCGs. If all pertinent provisions for a requirement were met, the requirement was deemed applicable. If all pertinent provisions for a requirement were not met, the following comparison of Yard-specific factors was made to determine if a requirement was both relevant and appropriate:
    - the purpose of the requirement and the purpose of the action at the Yard;
    - the medium regulated or affected by the requirement and the medium contaminated or affected at the Yard;
    - the substances regulated by the requirement and the substances found at the Yard;
    - the type of place regulated and the type of place affected by the release;
    - the type and size of structure or facility regulated and the type and size of structure or facility affected by the release; and
    - any consideration of use or potential use of affected resources in the requirement and the use or potential use of the affected resource at the Yard (40 CFR 300.400 [g] [2] [i through iii and vi through viii]) (USEPA, 1990a).

A requirement may have been determined to be potentially relevant because it closely matched the Yard on some of the factors listed above, but may have been determined to be not appropriate because the Yard circumstances differed significantly on other key factors. Portions of a requirement may be relevant and appropriate even if a requirement in its entirety is not (USEPA, 1988).

In addition to ARARs/SCGs, TBCs were also identified from the list contained in the "CERCLA Compliance with Other Laws Manual" (USEPA, 1988), as well as from TBCs issued after publication of the "CERCLA Compliance with Other Laws Manual."

### 6.3 Potential Chemical-Specific ARARs

The data developed during the RI were used to further define the potential chemical-specific ARARs/SCGs and TBCs for each medium listed in the work plans for all investigations discussed in this report. As discussed in Section 5 of this RI, the migration pathways for constituents of concern include ground water, soil, sewer water, and sewer sediments. Chemical-specific ARARs/SCGs and TBCs for ground water, soil, sewer water, sewer sediment and separate-phase petroleum are discussed below.

#### 6.3.1 Ground Water

The New York Public Water Supply Regulations (10 NYCRR 5-1) regulate the water systems within the state that supply drinking water that may affect public health. This regulation sets MCLs for select inorganic and organic constituents listed under the federal regulations (40 CFR 141.11 through 141.91 and 143.3). The NCP requires that where relevant and appropriate under the circumstances of the release, non zero MCLGs and MCLs are to be attained for remedial actions for ground waters that are current or potential sources of drinking water (300 CFR 430[e][2][i][b and c]) (USEPA, 1990a). MCLs and MCLGs are considered potentially relevant and appropriate requirements.

New York water classifications and quality standards for ground water are the maximum allowable concentrations which may be tolerated without creating a threat to human health, or which would otherwise render the ground water unsuitable for its intended best usage (6 NYCRR 700-704). Ambient Water Quality Standards and Guidance Values for toxic and non-conventional pollutants are presented in the NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1). The authority for these values is derived from Article 17 of the Environmental Conservation Law and 6 NYCRR Parts 700 through 705, Water Quality Regulations. The standards and guidance values are the maximum allowable concentrations which may be tolerated to protect human health and drinking water sources and are referenced to protect the best usage of the water body as specified by the water classifications at the location of the discharger at locations that may be affected by such discharge.

Three VOCs and nine metals exceeded the ambient water quality standards. A summary of concentrations for the most recent ground-water samples for each well and the maximum allowable concentration exceedances is presented below.

- 1,2-Dichloroethene (total): ND to 46 μg/L (0.046 ppm) detected; exceeded ground-water standard (5 μg/L [0.005 ppm]) in two samples.
- Trichloroethene: ND to 75 μg/L (0.075 ppm) detected; exceeded ground-water standard (5 μg/L [0.005 ppm]) in three samples.
- Tetrachloroethene: ND to 23 μg/L (0.023 ppm) detected; exceeded ground-water standard (5 μg/L [0.005 ppm]) in two samples.
- Antimony: ND to 46.9 μg/L (0.0469 ppm) detected; exceeded ground-water standard (3 μg/L [0.003 ppm]) in two samples.
- Barium: 18.1 μg/L (0.0181 ppm) to 1,030 μg/L (1.03 ppm) detected; exceeded ground-water standard (1,000 μg/L [1.000 ppm]) in one sample.
- Beryllium: ND to 3.7 μg/L (0.0037 ppm) detected; exceeded ground-water standard (3 μg/L [0.003 ppm]) in one sample.
- Chromium: ND to 146 μg/L (0.146 ppm) detected; exceeded ground-water standard (50 μg/L [0.050 ppm]) in one sample.
- Copper: ND to 421 μg/L (0.421 ppm) detected; exceeded ground-water standard (200 μg/L [0.200 ppm]) in one sample.
- Iron: 377 μg/L (0.377 ppm) to 152,000 μg/L (152 ppm) detected; exceeded ground-water standard (300 μg/L [0.300 ppm]) in 22 samples.
- Lead: ND to 207 μg/L (0.207 ppm) detected; exceeded ground-water standard (25 μg/L [0.025 ppm]) in nine samples.
- Magnesium: 1,540 μg/L (1.54 ppm) to 49,800 μg/L (49.8 ppm) detected; exceeded ground-water guidance value (35,000 μg/L [35.000 ppm]) in four samples.
- Manganese: 85 μg/L (0.085 ppm) to 9,410 μg/L (9.41 ppm) detected; exceeded ground-water standard (300 μg/L [0.300 ppm]) in 17 samples.

- Sodium: 12,700 μg/L (12.7 ppm) to 213,000 μg/L (213 ppm) detected; exceeded ground-water standard (20,000 μg/L [20.000 ppm]) in 17 samples.
- Zinc: ND to 696 μg/L (0.696 ppm) detected; exceeded ground-water standard (300 μg/L [0.300 ppm]) in one sample.

The NYSDEC Water Quality Standards are considered applicable due to the media and the type of substances detected at the Yard.

Pursuant to the New York Environmental Conservation Law, Article 17, it is declared to be public policy of the State of New York to maintain reasonable standards to safeguard the waters of the State from pollution by preventing any new pollution and abating pollution existing to protect public health and permit management of the ground waters for their best usage.

The ground water at the Yard is classified as GA. This classification is intended for ground waters which are considered suitable for drinking in their natural state, but may require treatment to improve quality related to natural conditions. Water Quality Standards for Class GA ground waters are listed in 6 NYCRR 703.

### 6.3.2 Soil

The NYSDEC recognizes that restoration to predisposal conditions is not always feasible, therefore, the Division of Hazardous Waste Remediation issued a Technical and Administrative Guidance Memorandum (TAGM): Determination of Soil Cleanup Objectives and Cleanup Levels (1994). This TAGM provides the basis and procedures to determine soil cleanup levels at State Superfund Sites. At a minimum, these generic soil cleanup objectives are designed to eliminate all significant threats to human health and/or the environment. A summary of compounds and metals that were detected above the recommended soil cleanup objectives (RSCO) is presented below.

- Benzo(a)anthracene: ND to 12,600 μg/kg (12.6 ppm) detected; exceeded RSCO (224 μg/kg [0.224] ppm) in seven samples.
- Benzo(b)fluoranthene: ND to 3,200 μg/kg (3.200 ppm) detected; exceeded RSCO (1,100 μg/kg [1.100 ppm]) in two samples.

- Benzo(k)fluoranthene: ND to 5,100 μg/kg (5.1 ppm) detected; exceeded RSCO (1,100 μg/kg [1.100 ppm]) in one sample.

- Benzo(a)pyrene: ND to 5,760 μg/kg (5.76 ppm) detected; exceeded RSCO (61 μg/kg [0.061 ppm]) in nine samples.

- Chrysene: ND to 10,100 μg/kg (10.1 ppm) detected; exceeded RSCO (400 μg/kg [0.400 ppm]) in seven samples.

- Dibenzo(a,h)anthracene: ND to 2,090 μg/kg (2.09 ppm) detected; exceeded RSCO (14 μg/kg [0.014 ppm]) in three samples.

- Indeno(1,2,3-cd)pyrene: ND to 4,640 μg/kg (4.64 ppm) detected; exceeded RSCO (3,200 μg/kg [3.2 ppm]) in one sample.

- 2-Methylnaphthalene: ND to 45,000 μg/kg (45 ppm) detected; exceeded RSCO (36,400 μg/kg [36.400 ppm]) in one sample.

- Naphthalene: ND to 20,000 μg/kg (20 ppm) detected; exceeded RSCO (13,000 μg/kg [13.000 ppm]) in one sample.

- PCBs: ND to 20,000,000 μg/kg (20,000 ppm) detected; exceeded RSCO for shallow soil (1,000 μg/kg [1.000 ppm]) in 44 samples.

- PCBs: ND to 380,000 μg/kg (380 ppm) detected; exceeded RSCO for deep soil (10,000 μg/kg [10.000 ppm]) in five samples.

The cleanup objectives for metals is presented with either a standard or Yard background, or in some instances (i.e., aluminum), as only Yard background. Three background samples were collected and analyzed during the Phase I RI to represent Yard background. These results are used for the comparisons stated below.

- Aluminum: 1,600 to 11,100 mg/kg (ppm) detected; exceeded Yard background concentrations (3,950 to 4,770 mg/kg [ppm]) in eight samples.

- Antimony: ND to 4.9 mg/kg (ppm) detected; exceeded Yard background concentrations (2.4 mg/kg [ppm]) in four samples.

- Arsenic: ND to 26 mg/kg (ppm) detected; exceeded RSCO (7.5 mg/kg [ppm]) in ten samples.

- Beryllium: ND to 0.63 mg/kg (ppm) detected; exceeded RSCO (0.16 mg/kg [ppm]) in seven samples.

- Cadmium: ND to 9.2 mg/kg (ppm) detected; exceeded RSCO (1.0 mg/kg [ppm]) in seven samples.

- Calcium: 425 mg/kg (ppm) to 18,100 mg/kg (ppm) detected; exceeded Yard background concentrations (1,400 to 6,850 mg/kg [ppm]) in two samples.

- Chromium: 5.1 mg/kg (ppm) to 124 mg/kg (ppm) detected; exceeded RSCO (10 mg/kg [ppm]) in 20 samples and Yard background concentrations (7.5 to 13 mg/kg [ppm]) in 18 samples.

- Copper: 4.8 mg/kg (ppm) to 629 mg/kg (ppm) detected; exceeded RSCO (25 mg/kg [ppm]) in 23 samples.

- Iron: 3,910 mg/kg (ppm) to 91,800 mg/kg (ppm) detected; exceeded RSCO (2,000 mg/kg [ppm]) in 33 samples and Yard background concentrations (5,610 to 11,200 mg/kg [ppm]) in 17 samples.

- Manganese: 82 mg/kg (ppm) to 667 mg/kg (ppm) detected; exceeded Yard background concentrations (165 to 224 mg/kg [ppm]) in 15 samples.

- Mercury: ND to 22.5 mg/kg (ppm) detected; exceeded RSCO (0.1 mg/kg [ppm]) in 16 samples.

- Nickel: ND to 168 mg/kg (ppm) detected; exceeded RSCO (13 mg/kg [ppm]) in 14 samples.

- Potassium: 286 mg/kg (ppm) to 1,240 mg/kg (ppm) detected; exceeded Yard background concentrations (567 to 861 mg/kg [ppm]) in three samples.

- Zinc: 16 mg/kg (ppm) to 1,310 mg/kg (ppm) detected; exceeded RSCO (20 mg/kg [ppm]) in 29 samples and Yard background concentrations (18 to 22 mg/kg [ppm]) in 27 samples.

PAHs are ubiquitous in soil (ATSDR, 1994). For this reason, the Agency for Toxic Substances and Disease Registry (ATSDR) has provided background concentrations for rural, agricultural and urban soil. Due to the historical presence of industrial processes and automobiles, urban areas such as the Yard have the highest background PAH concentrations. Therefore, the ATSDR Draft Toxicological Profile for Polycyclic Aromatic Hydrocarbons is considered a TBC. ATSDR background ranges for PAHs in urban soil are available for six of the nine PAHs detected above the RSCO. Of these six PAHs, only two were detected at the Yard above the ATSDR background ranges. A summary of detected concentrations of PAHs which exceeded ATSDR background ranges are presented below.

- Chrysene: ND to 10,100 μg/kg (10.1 ppm) exceeded the ATSDR background range (251 to 640 μg/kg [0.251 to 0.64 ppm]) in five samples.

- Benzo(a)pyrene: ND to 5,760 μg/kg (5.76 ppm) exceeded the ATSDR background range (165 to 220 μg/kg [0.165 to 0.22 ppm]) in eight samples.

Regulations promulgated under the federal Toxic Substance Control Act (TSCA) establish criteria to determine the adequacy of the cleanup of spills resulting from the release of materials containing PCBs at concentrations of 50 ppm or greater [40 CFR 761.60(d)(1)]. The concentrations of PCBs in some areas exceed 50 ppm, therefore, this regulation is considered potentially relevant and appropriate. TSCA requirements do not apply to PCBs at concentrations less than 50 ppm. The anti-dilution provision in TSCA (40 CFR 761.1[b]) was enacted to eliminate the dilution of waste in order to avoid regulation. However, under CERCLA the concentration of the PCB contamination is evaluated "as found" at the site; therefore, the anti-dilution provision of the PCB rules should not be applied. The TSCA spill cleanup policy establishes criteria to determine the adequacy of the cleanup of spills resulting from the release of materials containing PCBs at concentrations of 50 ppm or greater (40 CFR 761.120-135), which occur after May 4, 1987. This policy is not a regulation and applies only to recent spills; therefore, it is not an ARAR. However, this policy provides a technical and scientific evaluation for developing cleanup levels (25 to 50 ppm for soils). For this reason it is considered a TBC. PCBs were detected onsite at concentrations up to 20,000 ppm.

As stated in the "Guidance on Remedial Actions for Superfund Sites with PCB Contamination" (USEPA, 1990b), there are various scenarios and considerations pertinent to determining the appropriate level of PCBs that may remain in soil to achieve protection of human health and the environment. For sites where the exposure scenario is industrial, 25 ppm is considered a preliminary remediation goal. This document is a potential TBC for the remedy selection process for PCB-contaminated sites. As PCBs have been detected onsite, this guidance is retained as a potential TBC.

A revised USEPA directive, "Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities" (USEPA, 1994), sets a cleanup action level for lead in soil and takes into account various site-specific factors. As lead was detected in Yard soil, this directive is considered a potential TBC. Detected concentrations of lead in Yard soil (5.4 to 1,290 mg/kg [ppm]) exceeded the 400 mg/kg (ppm) lead action level in eight samples.

The NYSDEC Bureau of Spill Prevention and Response issued a Petroleum Contaminated Soil Guidance Policy (Spill Technology and Remediation Series [STARS] Memo #1) to provide guidance in determining whether soils have been contaminated to levels which require investigation and remediation. Because there are areas of concern which have been impacted by fuel oil, this policy is considered a potential TBC. However, based on past and current NYSDEC involvement (i.e., Division of Hazardous Waste Remediation rather than Bureau of Spill Prevention and Response) the soil samples have been evaluated using the NYSDEC TAGM for soil cleanup objectives. The STARS policy may be used for disposal/remediation purposes during the FS.

### 6.3.3 Sewer Water

All sewers at the Yard reportedly discharge to the Bowery Bay Sewage Treatment Plant in Astoria, Queens. New York City Sewer Use Regulations define pretreatment standards for Publicly-Owned Treatment Works (POTWs). These regulations are considered TBCs for the Yard. Only one chemical (benzene) was detected at concentrations equal to the New York City Sewer Use Regulation pretreatment standards (6 $\mu$g/L [0.006 ppm]), and no chemicals or metals were detected at concentrations exceeding standards.

The New York State TAGM: Ambient Water Quality Standards and Guidance Values has guidance values for Class SD surface waters. Bowery Bay, the final discharge point of treated sewer water from the Yard, is defined as a Class SD surface-water body by the NYSDEC (Becker, pers. comm., 1994). This classification applies to waters that would support fish survival and wildlife consumption of fish. Applying Class SD water quality standards to sewer-water samples is considered a conservative approach, therefore, this TAGM is considered a TBC. Only PCBs (Aroclor-1254 and Aroclor-1260) exceeded the SD surface-water standard (0.001 $\mu$g/L) in two samples.

### 6.3.4 Sewer Sediment

The November 1993 NYSDEC document titled "Technical Guidance for Screening Contaminated Sediments" offers that equilibrium partitioning based sediment criteria should only be derived for sediments with organic carbon fractions between 0.2 and 12 percent (USEPA Science Advisory Board, 1992). Based on a conversation with a NYSDEC Division of Fish and Wildlife representative (Sennett, pers. comm., 1994), sewer samples generally contain greater than 12 percent total organic carbon, and are therefore outside the range for applying the sediment criteria. Therefore, there are no ARARs/SCGs or TBCs for sewer sediments.

### 6.3.5 Separate-Phase Petroleum

A Guide to the Assessment and Remediation of Underground Petroleum Releases issued by the American Petroleum Institute (API, 1989) provides guidance on cleanup objectives and criteria for various hydrocarbon phases. It states that the plume should be contained, and as much separate-phase petroleum as possible should be removed. Adequate removal will be determined with the presence of only traces of free hydrocarbons in monitoring wells. This document is a potential TBC and will be further discussed in the FS.

## 6.4 Location-Specific ARARs

The Federal Floodplain Management Act (16 USC 661 et seq) evaluates adverse effects associated with direct and indirect development of a floodplain. This act is not considered applicable (no development presently occurring), but it is considered potentially relevant and appropriate for future use (including potential remediation).

The Federal Fish and Wildlife Coordination Act (16 USC 661 through 666) states that whenever waters of any stream are controlled or modified for any purpose, the department or agency of the United States responsible for the stream or the public or private agency managing the stream under Federal permit or license, must consult with the Department of the Interior and the United States Fish and Wildlife Service. Although not presently applicable, this regulation is considered potentially relevant and appropriate due to Yard conditions.

The National Historic Preservation Act (36 CFR Part 65) addresses facilities where alteration of terrain may threaten significant, scientific, prehistorical, historical, or archeological data. Although there is no knowledge that the Yard has historical significance, this regulation is considered a potential ARAR.

## 7.0 WORK IN PROGRESS

Work currently in progress at the Yard includes a continuation of the sewer system investigation and implementation of an IRM to mitigate the separate-phase petroleum accumulation in Area 1.

### 7.1 Sewer System

As scoped in the Roux Associates August 10, 1993 document titled "Work Plan for the Additional Investigation of the Sewer System" (Roux Associates, Inc., 1993l), the following tasks of the sewer investigation remain in-progress at the Yard:

- sediment removal (Task 2); and
- sewer system monitoring (Task 4).

Both sediment removal and monitoring are proposed for 23 manhole and catch basin locations across the Yard. The chosen locations were proposed to the NYSDEC on September 6, 1994 (Roux Associates, Inc., 1994d). Upon NYSDEC's approval, Roux Associates will perform sediment removal and implement the sewer system monitoring program.

Sediment Removal

The 23 manhole/catch basin locations requiring sediment removal were chosen based on the sewer sampling results (Section 4.19). The locations and justifications for each are summarized below.

| Manhole/Catch Basin Designation | Justification |
|---|---|
| MH-1<br>MH-65 | Eliminate contaminated sediments from manholes located on south side of Thompson Avenue in secondary sewer system and to evaluate the source(s) of PCBs |
| MH-2<br>MH-52<br>MH-55 | Eliminate contaminated sediments from manholes located on west side of primary sewer system and to evaluate the source(s) of PCBs |
| MH-35<br>MH-37<br>MH-40<br>MH-42 | Eliminate contaminated sediments from manholes located on west side of Honeywell Street in primary sewer system and to evaluate the source of PCBs |

| **Manhole/Catch Basin Designation** | **Justification** |
|---|---|
| MH-69 | Eliminate contaminated sediments from primary sewer system manhole located on southwest side of the New Commissary Building and to evaluate the source of PCBs |
| MH-45 | Eliminate contaminated sediments from primary sewer system manhole located northeast of Honeywell Street and Skillman Avenue intersection and to evaluate the source of PCBs |
| MH-29 | Eliminate contaminated sediments from primary sewer system manhole located on north side of Wheel House and to evaluate the source of PCBs |
| CB-28 | Eliminate contaminated surface runoff sediments from catch basin in secondary sewer system north of Thompson Avenue and to evaluate the source(s) of PCBs |
| CB-1<br>CB-2<br>CB-3<br>CB-4 | Eliminate contaminated surface runoff from catch basins of the primary sewer system at the east side of the Engine House (Area 1) in the vicinity of the former fuel transfer area and to evaluate the source(s) of PCBs |
| CB-6<br>CB-7 | Eliminate contaminated surface runoff sediments from catch basins of the primary sewer system at the west side of the Engine House (Area 1) in the vicinity of the drum storage area and to evaluate the source(s) of PCBs |
| MH-3 | Eliminate contaminated sediments from primary sewer system manhole located on LIRR property to the north of Area 1 and to evaluate the source(s) of PCBs |
| MH-5 | Eliminate potentially contaminated sediments downgradient of contaminated sediments in MH-8 of the primary sewer system (Area 1) and to evaluate the source(s) of PCBs |
| MH-7<br>MH-8 | Eliminate contaminated sediments from primary sewer system manholes located adjacent to the Metro Shop (Area 1) and to evaluate the source(s) of PCBs |

A remediation contractor will be chosen to remove sediment from the selected manholes and catch basins through the use of a vacuum truck or similar pumping mechanism, capable of pumping out sediment, debris and any associated liquids from the bottom of the manholes and catch basins. Once the program is completed, sediment and water collected during the process will be disposed of in accordance with applicable state and federal regulations. A letter report will be submitted to the NYSDEC summarizing the sediment removal program.

## Sewer System Monitoring

To determine if PCBs are no longer being introduced into the sewer system (i.e., contamination resulted from historical events) or are still being introduced into the sewer system (i.e., contamination is resulting from a continuous source[s]), post sediment-removal monitoring will be performed. The monitoring will consist of inspecting the removal locations and collecting sewer-water and/or sewer-sediment samples.

After sediment removal is completed and the contaminated sediment has been removed from the manholes/catch basins, each of the removal locations will be visually inspected with regard to sediment buildup in accordance with the following schedule:

- the day following the completion of sediment removal;
- once each week for the first three months;
- once every two weeks for the next three months;
- once each month for the next six months; and
- following the first precipitation event after sediment removal.

During the monitoring schedule if sediment is observed to be accumulating at any removal location, and a sufficient volume exists, a sample will be collected and analyzed to determine if PCBs are present.

Concurrent with the post-removal sewer-sediment monitoring, sewer water will be sampled (unfiltered) and analyzed from each of the sediment removal locations in accordance with the following schedule:

- one week following the completion of sediment removal;
- one month after sediment removal;
- three months after sediment removal; and
- following the first precipitation event after sediment removal.

If PCBs are detected during this scheduled monitoring program, filtered and unfiltered samples will be collected and the monitoring will be performed monthly to verify the existence of the PCB contamination.

If PCBs are not detected in water during the initial stages (i.e., as of the three month sample) of the monitoring program, then only Manholes MH-1 and MH-2 will be sampled every three months for the remainder of one year after sediment removal. If PCBs are detected in either MH-1 or MH-2, the monitoring/sampling will revert back to being performed monthly at all of the sediment removal locations on that branch of the sewer system in an effort to pinpoint the source(s) of contamination.

A letter report summarizing the results of the monitoring program will be submitted to the NYSDEC monthly for the first three months following sediment removal and then every three months for the remainder of one year. After the one year sampling is performed, a summary report including a schedule for future monitoring will be provided to the NYSDEC.

If PCBs are detected in the sediment or water samples, the NYSDEC will be notified immediately. If PCBs are detected in any manhole during two consecutive monthly sampling rounds, a work plan for an additional investigation to determine the source area(s) of continuing contamination will be submitted to the NYSDEC. The work plan will be designed to provide the data necessary to mitigate the source of continuing contamination through an IRM, if necessary.

If sediment buildup is not observed during the monitoring period, or if a buildup occurs, but does not contain PCBs and PCBs are not detected during the concurrent water sampling, the source(s) will be considered historical (i.e., not indicative of continuing sources). In addition, it will be assumed that under the conditions at that time, contaminated sediment is not being transported off-site through the sewer system and therefore, an IRM will not be necessary.

## 7.2 Implementation of the Interim Remedial Measures System to Mitigate the Separate-Phase Petroleum Accumulation in Area 1

Roux Associates developed IRMs in conjunction with the Phase I RI work plan that were designed to recover and contain the separate-phase petroleum accumulation present above ground water in Area 1 of the Yard. The IRMs were based on Roux Associates' review of site-specific hydrogeologic and contaminant information that was developed during a previous investigation (Geraghty & Miller, 1986), and upon information developed while conducting the RI field investigation.

The installation of the IRMs proceeded in phases. The first phase, as proposed in the RI/FS work plan, installed in early 1990 (system operation commenced on January 31, 1990), was designed to mitigate the flow of separate-phase petroleum into the service pit located in the Metro Shop and recover petroleum in the general Metro Shop area. The proposed locations were modified based on the actual field conditions that were encountered. Three petroleum recovery trenches (Trench 1, Trench 2 and Trench 3) were installed along the western end of the Metro Shop, one along the southern side and two along the northern side (Plate 2). The trenches are approximately 25, 35 and 40 feet in length, respectively. Each trench contains a recovery sump which consists of 4-foot diameter perforated concrete rings installed to a depth of six feet below land surface. These sumps span the water table allowing separate-phase petroleum to accumulate within them. Each sump was outfitted with an Oil Recovery Systems (ORS) large diameter filter scavenger, product-only recovery pump which pumps the petroleum to two, 2,000-gallon capacity above-ground tanks for storage.

During performance of the Phase I RI field investigation, additional data was obtained regarding the extent of the separate-phase petroleum accumulation. Based on a review of this data and the performance of Phase I of the IRM, Roux Associates and AMTRAK decided to institute Phase II of the IRM in an attempt to recover additional separate-phase petroleum. Phase II of the IRM is an addition to the IRM proposed in the RI/FS work plan.

Phase II of the IRM consisted of the installation of three recovery wells (RW-1, RW-2 and RW-3) in the area immediately northeast of the Engine House where the apparent separate-phase petroleum thickness was greatest (Table 7; actual petroleum thickness shown in Plates 6 and 7). These recovery wells were constructed of 4-inch diameter, 10-feet long, 20 slot stainless steel well screens set between one and four feet above the first fluid level encountered while drilling the borehole. Each well is fitted with an ORS small diameter filter scavenger product-only recovery pump to recover separate-phase petroleum. Since ground water and the separate-phase petroleum accumulation were so shallow, the screened intervals begin between 0.5 and 2.0 feet bls. As a result, standard well construction procedures were modified. Small diameter recovery wells were chosen instead of large diameter sumps to avoid compromising the integrity of the many railroad tracks in the immediate area. The recovered petroleum is pumped through an underground conduit into one of the above-ground storage tanks.

The Phase I IRM system was shut down in June 1991 to be replaced by the Phase II IRM system. Performance monitoring (i.e., water-level and separate-phase petroleum thickness measurements, and separate-phase petroleum sampling and analysis) and operation and maintenance (O&M) have been performed on the Phase II system since startup on July 29, 1991. Based on these data, the following modifications have been made.

- Monitoring Well MW-16 was converted to a recovery well and RW-2 was disconnected from the system.
- Recovery Trench 1, located on the north side of the Metro Shop, was integrated into the Phase II system.
- Recovery Trench 2, located on the north side of the Metro Shop, no longer contained a recoverable volume of petroleum and was disconnected from the system.
- Recovery Trench 3, located on the south side of the Metro Shop, no longer contained a recoverable volume of petroleum and was disconnected from the system.

As of August 1994, approximately 4,300 gallons have been recovered by the IRM system since its February 1990 start-up, at an average rate of approximately 955 gallons per year.

## 8.0 SUMMARY AND CONCLUSIONS

Based on all the data that Roux Associates has developed for the Yard and included in this report, the following conclusions have been reached.

### 8.1 Geology and Hydrogeology

The geologic logs of soil borings drilled on the Yard during the investigations indicate that the Yard is underlain by the following units (in order by increasing depth); fill, Upper Pleistocene glacial deposits (including both till and channel deposits), and bedrock. The fill is predominantly comprised of reworked glacial deposits (sand, silt, clay and gravel) and railroad ballast, with minor amounts of construction debris and other materials. The Upper Pleistocene glacial deposits consist mainly of ground moraine deposits; unstratified, poorly sorted mixtures of sand, silt, clay and gravel (as previously described). In addition, a cobble layer was encountered in three deep soil borings drilled at the Yard.

Based on a comparison of current and historical maps, the topography of the Yard has undergone substantial changes since 1890. In general, the southern and eastern portions of the Yard have been scraped down (by as much as 45 feet), and the western portion of the Yard, including the part of Dutch Kills, has been filled. The fill apparently consists of the native materials excavated from the south and east sides of the Yard. These changes brought the Yard close to its current, generally flat topography.

Ground water beneath the Yard occurs under water-table (unconfined) conditions. The water table lies between 1 and 15 feet below land surface and occurs in either fill deposits (e.g., western part of Yard) or the Upper Pleistocene glacial deposits (e.g., eastern part of Yard). The saturated Upper Pleistocene deposits comprise the Upper Glacial aquifer. Regional ground-water flow in the area is to the northwest, eventually discharging to the East River approximately one mile northwest of the Yard (McClymonds and Franke, 1972). Ground water within the shallow deposits flows predominantly west beneath the Yard. However, between Queens Boulevard and Honeywell Street, ground water flows northerly and northwesterly toward the East River. Ground water in the deeper deposits predominantly flows west across the Yard.

The average horizontal flow gradient of the water table across the Yard is 0.004 feet per foot. An average horizontal gradient of 0.002 feet per foot was calculated for the deeper deposits. Downward vertical hydraulic gradients occur on the upgradient, east side of the Yard while upward flow occurs within Area 1 and along the downgradient, west side of the Yard. Stronger upward gradients were measured with nearing proximity to the East River, which is the ground-water discharge zone for the area.

Based on pumping test data developed within Area 1, the hydraulic coefficients of the Upper Glacial aquifer were estimated for the Yard. The average horizontal hydraulic conductivity ($K_H$) was calculated to be 462 ft/d; the average transmissivity (T) value was calculated to be 33,135 $ft^2/d$; the specific yield/water-table storage coefficient ($S_y$) ranged from 0.02 to 0.28; and the average vertical hydraulic conductivity ($K_V$) was calculated to be 48 ft/d. In general, higher hydraulic conductivity and transmissivity values were obtained for wells screened within the deeper deposits. Using these values and an estimated effective porosity of 0.25 (Freeze and Cherry, 1979), the ground-water flow velocity through the Yard was calculated to be 7.4 ft/d.

### 8.2 Nature and Extent of Contamination

Analytical results of the Phase I and Phase II RIs and the related work completed at the Yard were evaluated to determine current environmental conditions at the Yard. In cases where multiple samples were collected from a sampling point, the most recent analytical data that exists for each parameter was used. Current environmental conditions are discussed below for each media investigated: soil, separate-phase petroleum, ground water, sewer water and sewer sediment.

### 8.2.1 Soil

No VOCs were detected in Yard soil above recommended soil cleanup objectives (RSCOs). Nine SVOCs, all PAHs, were detected above RSCOs. Since PAHs are ubiquitous in soil, the PAHs that exceeded the RSCOs were compared to the ATSDR background ranges for PAHs in urban soil, as tabulated below.

| Compound Detected | Range of Conc. ($\mu$g/kg [ppb]) | Location of Maximum Conc. | RSCO ($\mu$g/kg [ppb]) | No. of Detects Above RSCO | Urban Background Range ($\mu$g/kg [ppb]) | No. of Detects Above Urban Background |
|---|---|---|---|---|---|---|
| Benzo(a)pyrene | ND - 5,760 | S-43 (Area 2) | 61 | 9 | 165 - 220 | 8 |
| Benzo(a)anthracene | ND - 12,600 | S-43 (Area 2) | 224 | 7 | 169 - 59,000 | 0 |
| Chrysene | ND - 10,100 | S-43 (Area 2) | 400 | 7 | 251 - 640 | 5 |
| Dibenzo(a,h)anthracene | ND - 2,090 | S-43 (Area 2) | 14 | 3 | No Data Available | No Data Available |
| Benzo(b)fluoranthene | ND - 3,200 | S-101 (Area 17) | 1,100 | 2 | 15,000 - 62,000 | 0 |
| Benzo(k)fluoranthene | ND - 5,100 | S-101 (Area 17) | 1,100 | 1 | 300 - 26,000 | 0 |
| Indeno(1,2,3-cd)pyrene | ND - 4,640 | S-43 (Area 2) | 3,200 | 1 | 8,000 - 61,000 | 0 |
| 2-Methylnaphthalene | ND - 45,000 | MW-58 (Area 1) | 36,400 | 1 | No Data Available | No Data Available |
| Naphthalene | ND - 20,000 | MW-58 (Area 1) | 13,000 | 1 | No Data Available | No Data Available |

Most of these PAHs are constituents commonly found in diesel fuel and fuel oils (Kramer, et al., 1987; Kostecki, et al., 1989; Testa, et al., 1991; and Environ, 1987). However, these constituents are also commonly associated with fill material containing cinders and/or asphaltic material (including treated railroad ties) such as a portion of the fill underlying the Yard. Therefore, the presence of these constituents in soil at the Yard, especially in samples containing low concentrations, may only reflect urban background conditions and/or the composition of fill material underlying the Yard. In addition, nearly one third of the detections that exceed RSCOs occur in Area 17 and are proposed to be excavated and disposed as part of the IRM for soil in Areas 8, 9 and 17.

Since metals are naturally occurring constituents of soil, detections of metals in soil were compared to Yard background ranges for metals developed during the Phase I RI. The following table summarizes the detections of metals in Yard soil samples that significantly exceed the Yard background ranges. All detections of lead that exceed the action level of 400 mg/kg (ppm) for lead in soil are counted as a significant detection in the summary table.

| Metal Detected | Range of Concentrations (mg/kg [ppm]) | Location of Maximum Concentration | Yard Background (mg/kg [ppm]) | No. of Detects Significantly Above Background |
|---|---|---|---|---|
| Arsenic | ND - 26.0 | S-22<br>(Facility Wide) | <0.68 - <1.2 | 5 |
| Copper | 4.8 - 629 | S-101<br>(Area 17) | 7.8 - 12 | 10 |
| Lead | 5.4 - 1,290 | MW-31<br>(Facility Wide) | 400<br>(action level) | 8 |
| Mercury | ND - 22.5 | CS-43<br>(Area 2) | <0.1 | 2 |
| Nickel | ND - 168 | S-101<br>(Area 17) | 4.7 - 11 | 1 |
| Zinc | 16 - 1,310 | S-101<br>(Area 17) | 18 - 22 | 6 |

All detections summarized in the above table also exceed the RSCOs. However, 25 percent of the metals detections that significantly exceed background occur in Area 17 and are proposed to be excavated and disposed as part of the IRM for soil in Areas 8, 9 and 17.

No pesticides were detected in any area of concern or facility-wide soil samples, with the exception of Area 16. As previously discussed (Section 4.16), Area 16 was removed from the RI/FS program by the NYSDEC (NYSDEC, 1991b).

PCBs were detected above the RSCO of 1,000 μg/kg (1 ppm) for shallow soil in 44 of 57 samples analyzed at the Yard. Five of the 18 deeper soil samples analyzed contained PCBs above the RSCO of 10,000 μg/kg (10 ppm) for deep soil. In addition, all detections of PCBs above 10,000 μg/kg (10 ppm) were limited to Areas 1, 8, 9 and 17, and will be addressed either as an IRM or in the FS. It is important to note that there is no differentiation within the RSCOs to account for industrial versus residential sites. Therefore, the RSCOs for PCBs in soil are intended by the NYSDEC to be protective of human health in a residential setting, rather than an urban industrial setting such as the Yard.

### 8.2.2 Separate-Phase Petroleum Accumulation

Delineation of the separate-phase petroleum accumulation in Area 1 is complete. The separate-phase petroleum accumulation is proven to be limited to Area 1, and does not extend offsite beyond the LIRR property boundary. The accumulation covers an area of approximately 133,600 $ft^2$, and has a maximum true petroleum thickness of 1.22 feet occurring near MW-50, with the majority of the accumulation being less than 0.5 feet in thickness. The estimated total volume of the petroleum accumulation is 72,700 gallons, with only 25,450 gallons (35 percent) considered recoverable by conventional methods. However, as of August 1994, almost 20 percent of the recoverable petroleum (approximately 4,300 gallons) has been recovered by the IRM system. The petroleum predominantly consists of No. 2 fuel oil originating from the former fuel storage areas, and contains varying concentrations of PCB Aroclor-1254 and Aroclor-1260.

Two isolated occurrences of separate-phase petroleum, south and west of the Engine House in Area 1, are also delineated. In addition, separate-phase petroleum that does not appear attributable to Area 7 soil is present on the water table beneath Area 7 (S-66 and S-69). This separate-phase petroleum also appears to be an isolated occurrence of limited extent based on nearby borings.

No separate-phase petroleum occurrences have been noted outside of Areas 1 and 7.

### 8.2.3 Ground Water

To define current ground-water quality conditions at the Yard, all ground-water analytical results (including those collected during the Phase I RI) were compared to the current ground-water standards (October 1993) and evaluated. The results of this evaluation are summarized below.

Only four monitoring wells at the Yard contained VOCs in excess of ground-water standards: MW-61, MW-43, MW-44D and MW-63. All of the VOCs that exceeded ground-water standards are chlorinated solvents. Based on ground-water flow patterns at the Yard, all exceedances appear to be directly attributable to offsite, upgradient sources.

No SVOCs were detected above ground-water standards at the Yard. The low concentrations of SVOCs that were detected within the Yard were limited to two areas of concern: Area 1 and Area 12.

Eleven metals were detected above ground-water standards at the Yard. However, many of these detections are representative of upgradient ground-water conditions in this industrialized area, or are naturally occurring metals related to anoxic conditions (i.e., manganese and iron) and/or historic salt-water intrusion of the aquifer (i.e., sodium). Therefore, metals detected above ground-water standards (or guidance values) but within background ranges are considered to be attributable to natural conditions and not related to Yard activities. A summary of the metals detections that exceeded both ground-water standards and background ranges is provided below.

| Metal Detected | Range of Conc. (µg/L) | Location of Maximum Conc. | NYS Class GA Ground-Water Standard or Guidance Value (µg/L) | No. of Detections Above Standard or Guidance | Background Concentration Range If Above Standard (µg/L) | No. of Detections Above Background Range and Standard |
|---|---|---|---|---|---|---|
| Antimony | ND - 46.9 | MW-62D (Facility Wide, upgradient) | 3 | 2 | ND to 46.9 | 0 |
| Barium | 18.1 - 1,030 | MW-46 (Areas 11, 13 & 17) | 1,000 | 1 | Not Applicable | Not Applicable |
| Beryllium | ND - 3.7 | MW-46 (Areas 11, 13 & 17) | 3 | 1 | Not Applicable | Not Applicable |
| Chromium | ND - 146 | MW-46 (Areas 11, 13 & 17) | 50 | 1 | Not Applicable | Not Applicable |
| Copper | ND - 421 | MW-46 (Areas 11, 13 & 17) | 200 | 1 | Not Applicable | Not Applicable |
| Iron | 377 - 152,000 | MW-46 (Areas 11, 13 & 17) | 300 | 22 | 377-28,500 | 6 |
| Lead | ND - 207 | MW-35 (Area 1) | 25 | 9 | Not Applicable | Not Applicable |
| Magnesium | 1,540 - 49,800 | MW-44D (Facility Wide) | (35,000) | 4 | 21,100-42,900 | 2 |
| Manganese | 85 - 9,410 | MW-46 (Areas 11, 13 & 17) | 300 | 17 | 96.8-721 | 15 |
| Sodium | 12,700 - 213,000 | MW-43 (Facility Wide) | 20,000 | 17 | 19,300 - 130,000 | 6 |
| Zinc | ND - 696 | MW-46 (Areas 11, 13 & 17) | 300 | 1 | Not Applicable | Not Applicable |

Ten metals were detected above the ground-water standards in Monitoring Well MW-46. As shown above, the highest concentration of each of seven metals occurred in Monitoring Well MW-46.

No pesticides were detected in any of the eleven ground-water samples from the Yard that were analyzed for pesticides.

PCBs were detected in a limited number of ground-water samples at the Yard. However, all but one (MW-25A) of the detections were shown to be attributable to suspended sediment (i.e., turbid samples) and/or the collection of PCB-contaminated petroleum (i.e., samples from wells with sheens), and therefore not representative of ground-water quality. The only other PCB detection in ground water, MW-25A, was at a concentration below the ground-water standard of 0.0001 ppm.

### 8.2.4 Sewer System

Sewer-water samples collected from the primary and secondary sewer systems indicate that VOCs, SVOCs and metals do not exceed the applicable standards defined in the New York City Sewer Use Regulations or the Class SD surface-water standards. No PCBs were detected in the sewer-water samples collected from the secondary sewer system. Low levels of total PCBs, ranging from 0.20 $\mu$g/L (0.00020 ppm) to 20.6 $\mu$g/L (0.0206 ppm), were detected in the unfiltered sewer-water samples collected in seven manholes within the primary sewer system. However, of the sewer-water samples collected with corresponding sediment samples, PCBs were only detected at those sampling points having PCBs in sewer-sediment samples, indicating that these detections may be representative of suspended sediment in the sewer water. This conclusion is supported by the fact that no PCBs were detected in the filtered sewer-water samples collected from either the primary and secondary sewers.

PCBs were detected in all sewer-sediment samples collected within both the primary and secondary sewer systems. Sediment from all 12 primary system manholes and all three secondary system manholes contained Aroclor-1260. In addition, Aroclor-1242, Aroclor-1248 and Aroclor-1254 were also detected in some sewer sediment samples.

The results of Phase II RI and additional investigation of the sewer system have further delineated the extent of contaminants within the primary and secondary sewer systems. However, based on the current data available, it is unclear whether contaminants are exiting the Yard through the sewer systems. Work in progress at the Yard, consisting of sewer sediment removal and sewer system monitoring, will determine if a continuing source of PCBs still exists at the Yard or if the detections are residual PCBs caused by an historical source or sources.

## 9.0 SUMMARY OF BASELINE RISK ASSESSMENT RESULTS

In conjunction with preparation of the Phase II RI report, a baseline risk assessment (RA) was performed by Roux Associates. This section summarizes the relevant findings from the RA. Only some of the determinations from the RA are summarized in this section. The complete details and backup documentation of the RA are presented in the January 1995 document titled "Baseline Risk Assessment, Sunnyside Yard, Queens, New York" (Roux Associates, Inc., 1995b), which accompanies this report.

The purpose of the baseline RA was to evaluate potential impacts to human health and the environment posed by chemicals present at the Yard, and where appropriate, define cleanup objectives that are protective of human health and the environment. The Phase II RI report, in conjunction with the RA report, describe the current environmental conditions at the Yard.

While the purpose of the RA was to define potential impacts resulting from exposure to Yard environmental media based on present-day usage, the RA also addresses potential concerns that may exist if the Yard is used for other purposes in the future. By addressing both current and future potential risks, the RA can be used during performance of the FS to scientifically support reasonable and feasible cleanup objectives, if necessary. The RA specifically addresses potential exposures of employees and also looks at limited public exposures to non-native constituents in soils and ground water present at the Yard.

The RA characterizes the chemicals of potential concern, potentially exposed populations, and possible exposure pathways to determine risks which may need to be reduced and to assist in justifying the most efficient remedial processes, if required.

### 9.1 Exposure Scenarios

Two primary potential exposure scenarios were considered in the RA to estimate the range of possible risk associated with present and viable future uses of the Yard. Potential scenarios described were occupational exposures and exposures resulting from construction activities at the Yard.

For each of the exposure scenarios described, potential exposures were estimated using an approach that assumed either a reasonable maximum exposed individual (RMEI) or a range of plausible exposures, with the assistance of Monte Carlo simulation. To better characterize potential exposures and the associated risks, the Yard was divided into operable units that represented Area 1, Areas 8 and 9 combined, and the entire Yard excluding Area 1 or Areas 1, 8 and 9.

The potential intakes for each exposure scenario were estimated for each media appropriate for the scenario. Intakes were summed across exposure routes for each chemical of potential concern with a resulting total estimated daily intake for that chemical. The estimated daily intake for each chemical was used to derive chemical-specific carcinogenic and/or noncarcinogenic risks under a defined set of exposure conditions.

The final step of the RA was to define a range of risk-based cleanup criteria for those chemicals in each media that appear to pose an elevated risk at the Yard based on the interpretation of the Monte Carlo simulation. Cleanup criteria are included for soil since there are no promulgated New York State standards.

For the foreseeable future the Yard will remain as an operating industrial site and as such any exposure to chemicals of potential concern at the Yard will be under occupational or construction exposure scenarios, rather than residential.

### 9.2 Cleanup Objectives for Occupational Exposure

Cleanup objectives have been derived for the following chemicals in surface soil:

- Benzo(a)pyrene;
- Dibenzo(a,h)pyrene;
- Dieldrin;
- Aroclor-1248;
- Aroclor-1254;

- Aroclor-1260; and
- Beryllium.

In addition, a cleanup objective was developed for total PHC. The basis for including a cleanup objective for PHC is that Area 1 is known to have soil saturated with petroleum, and Areas 9 and 17 have noticeable soil staining from petroleum. However, there are insufficient analytical data from surface soil to support the inclusion of PHC from a risk-based perspective. Thus, knowing that the average employment duration of workers at the Yard is in excess of 20 years, to remain health protective, a risk-based cleanup objective was developed for the PHC present in the soil.

The cleanup objectives for chemicals of potential concern in surface soils based on an occupational exposure scenario are as follow:

| **Chemical** | **Soil Cleanup Objectives (mg/kg [ppm])** |
|---|---|
| Benzo(a)pyrene | 72 |
| Dibenzo(a,h)anthracene | 72 |
| Dieldrin | 33 |
| Aroclor-1254 | 180 |
| Aroclor-1260 | 69 |
| Beryllium | 370 |
| PHC/No. 2 Fuel Oil | 25,000 |

### 9.3 Cleanup Objectives for Construction Exposure

The cleanup objectives for chemicals of potential concern in subsurface soils based on a construction exposure scenario are as follow:

| **Chemical** | **Soil Cleanup Objectives (mg/kg [ppm])** |
|---|---|
| Aroclor-1248 | 210 |
| Aroclor-1254 | 180 |
| Aroclor-1260 | 1,400 |
| TPH/Fuel Oil No. 2 | 25,000 |

### 9.4 Conclusions

The baseline RA conducted for the Yard has shown that there are only a limited number of chemicals of potential concern that are present in environmental media. The primary focus of this RA was the potential exposure of people working at the Yard, in the capacity of a railroad employee or as an outside contractor brought in to conduct a variety of construction activities at the Yard.

In general it was found that these workers were not at significant risk. However, to ensure the long-term well being of persons working at the Yard, cleanup objectives were defined for those chemicals in each environmental media that appeared to provide the greatest potential for risk to humans. The cleanup objectives were defined using conservative exposure assumptions and levels of risk that, based on regulatory action for chemicals regulated in the workplace, are sufficiently health protective of the workforce. The cleanup objectives derived for all non-PCB chemicals of potential concern are greater than the maximum observed concentrations in any of the areas of concern. Thus, any remedial action at the Yard should focus on the Aroclors (Aroclor-1248, Aroclor-1254 and Aroclor-1260) present in the environmental media at the Yard.

## 10.0 RECOMMENDATIONS

The following section summarizes the areas of the Yard that require no further action, and presents recommendations regarding additional data needs, proposed IRMs, and the approach of the FS.

Based on an assessment of the absence of risks associated with the current environmental conditions at the Yard (Roux Associates, Inc., 1995b) and the absence of Yard-related impacts to ground water, no further action is recommended for: Areas 2 through 6, and Areas 10 through 15. In addition, Area 16 was previously removed from the RI/FS program at the request of the NYSDEC (NYSDEC, 1991b). Therefore, these areas are not discussed further in this section.

To proceed in the most timely and efficient manner, we recommend dividing the components of the Yard into operable units as described below.

1. Consider all media in Area 1 (i.e., soil, ground water and separate-phase petroleum) and the petroleum sheen in adjacent Area 7 as one operable unit (OU-1).
2. Consider the Yard-wide sewer system (i.e., both primary and secondary systems) as one operable unit (OU-2).
3. Consider the soil PCB contamination in Areas 8, 9 and 17 as one operable unit (OU-3).
4. Consider Monitoring Well MW-46 and the associated metals in ground water and soil in Areas 11, 13 and 17 as one operable unit (OU-4).

Prior to performance of the FS, Roux Associates recommends that the additional data needs for OU-1, OU-2 and OU-4 be addressed, and that the proposed IRM to mitigate soil PCB contamination in OU-3 be performed. This approach is designed to result in an FS focused on OU-1, and the remainder of the Yard removed from consideration in the FS.

### Additional Data Needs:

Collection of additional data is recommended to:

- identify the source and delineate the extent of the sheen observed on the water table beneath Area 7 (OU-1);

- investigate the PCBs detected in the sewer system (OU-2); and
- delineate the occurrence of metals in the vicinity of Monitoring Well MW-46 (OU-4).

The proposed additional work is summarized below.

Area 7

To identify the source and delineate the areal extent of the sheen present on the water table beneath Area 7 (OU-1), Roux Associates recommends additional soil borings. Between five and eight soil borings are proposed in the vicinity of existing soil boring locations S-66 and S-69. Some of these soil borings will be drilled upgradient of S-66 and S-69 to identify the source of the sheen. Soil borings will be drilled to approximately two feet below the water table using the Geoprobe™ technique. The ground water flowing into the boreholes and soil samples will be examined for visual evidence of separate-phase petroleum or sheens and for VOCs using a PID. Once the areal extent of the sheen is delineated, this area will be addressed in the FS as part of OU-1.

Sewer System

Both sediment removal and monitoring are proposed for 23 manhole and catch basin locations (OU-2) across the Yard. The chosen locations were proposed to the NYSDEC on September 6, 1994 (Roux Associates, Inc., 1994d). Upon NYSDEC's approval, Roux Associates will perform sediment removal and implement the sewer system monitoring program at the following locations.

**Facility Wide**

| | |
|---|---|
| Primary Sewer System: | MH-2, MH-29, MH-35, MH-37, MH-40, MH-42, MH-45, MH-52, MH-55 and MH-69. |
| Secondary Sewer System: | MH-1, MH-65 and CB-28. |

**Area 1**

| | |
|---|---|
| Primary Sewer System: | MH-3, MH-5, MH-7, MH-8, CB-1 through CB-4, CB-6 and CB-7. |

The results of this work will be used to determine if PCBs are still being introduced into the sewer system (i.e., contamination is resulting from a continuous source[s]), or are no longer being introduced into the sewer system and therefore attributable to historical events. If PCBs are still entering the sewer system, post sediment-removal monitoring will be performed. Based on the results, the need to address the sewer system with an IRM or in the FS will be considered.

Monitoring Well MW-46

Analytical results for Monitoring Well MW-46 indicate that ten different metals exceed ground-water standards downgradient of Areas 11, 13 and 17 (OU-4). Two of these ten metals, iron and manganese, may occur in elevated concentrations due to natural anoxic conditions within the aquifer. In addition, sodium is attributed to historical salt-water intrusion. However, the remaining seven metals detected above ground-water standards also exceed Yard background ranges, indicating that these occurrences may be a result of Yard activities. The seven metals of concern in MW-46 ground water are: barium, beryllium, chromium, copper, lead, magnesium and zinc. However, since metals are naturally occurring constituents of soil, some of these detections may be attributable to suspended particles within the ground-water sample. Since this well has previously provided turbid samples, which required the well to be re-developed and resampled for PCBs, it is suspected that the metals detections are representative of suspended particles rather than ground-water quality.

To confirm the concentrations of metals in ground water, Roux Associates recommends that Monitoring Well MW-46 be re-developed, then resampled. Ground-water samples will be analyzed for both dissolved (i.e., filtered) and total (i.e., unfiltered) metals. If the concentrations of metals still exceed ground-water standards, delineation of metals in ground water will be proposed.

If additional delineation is required it will consist of the collection of ground-water samples from the following six locations using the Geoprobe™:

- three locations immediately downgradient of Area 17;
- one location immediately downgradient of Area 11;

- one location immediately downgradient of Area 13; and
- one location approximately 200 feet downgradient (northwest) of Monitoring Well MW-46.

Based on the results of metals in ground-water samples, soil samples will be collected using the Geoprobe™ and analyzed for metals from the appropriate locations to determine the extent of the source area(s). If sampling verifies that dissolved metals exceed ground-water standards, OU-4 will be addressed in the FS.

**Proposed IRM:**

Areas 8, 9 and 17

The extent of soil containing PCBs above the 25 ppm NYSDEC-approved action level within Areas 8, 9 and 17 (OU-3) has been delineated. As stated in Section 6.3.2, there are various scenarios and considerations in determining the cleanup criteria for PCBs. In the PCB spill policy, the USEPA allows up to 50 ppm PCBs to remain at outdoor electrical substations. The USEPA retains flexibility to allow less stringent or alternative decontamination measures based on site-specific considerations.

The risk assessment evaluated site-specific considerations (i.e, occupational exposure), and the cleanup levels calculated exceed 50 ppm (i.e., 69 ppm for Aroclor-1260 and 180 ppm for Aroclor-1254). An IRM consisting of soil excavation and removal is recommended for these three areas of concern to address these conditions. A detailed scope of work for the soil IRM in these areas has been presented to the NYSDEC (Roux Associates, Inc., 1995a). Although the RA-derived cleanup objectives are 69 ppm for Aroclor-1260 and 180 ppm for Aroclor-1254, we recommend an action level of 50 ppm for the IRM to add an additional margin of safety for the Yard workers.

**Feasibility Study:**

Based on the results of the RI and the RA cleanup objectives, the following components of the Yard will be evaluated in the FS:

- the separate-phase petroleum accumulation in Area 1 (OU-1), which contains varying concentrations of Aroclor-1254 and Aroclor-1260;

- the isolated occurrences of separate-phase petroleum or sheens on the water table within Areas 1 and 7 (OU-1); and
- shallow soils within Area 1 (OU-1), which contain PCBs in concentrations of 50 ppm or greater.

In addition, OU-2 will be addressed in the FS or as an IRM if PCBs are detected in the sewer system following sediment removal, OU-3 will be addressed if the soil IRM is not completed, and OU-4 will be addressed in the FS if ground-water sampling verifies that dissolved metals are present above ground-water standards within Monitoring Well MW-46.

Furthermore, Roux Associates will continue to implement recovery of the separate-phase petroleum accumulation using the IRM system already operational in Area 1 (OU-1). To date, the IRM system has recovered nearly 20 percent of the estimated recoverable petroleum.

Respectfully Submitted,

ROUX ASSOCIATES, INC.

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Table 1. Summary of Construction Details for Monitoring Wells, Sunnyside Yard, Queens, New York.

| Well Number | Date(s) Installed | Land Surface Elevation (ft relative to mean sea level) | Measuring Point Elevation (ft above mean sea level) | Screen Type | Screen Slot Size | Depth of Boring (ft below land surface) | Screened Interval (ft below land surface) | Interval Gravel Packed (ft below land surface) | Interval Sealed with Bentonite (ft below land surface) | Interval Sealed with Grout (ft below land surface) | Screen Setting (ft relative to mean sea level) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| MW-13(a) | 11/6/90 | 17.64 | 18.52 | SS | 0.020 | 14 | 2 - 12 | 1 - 14 | 0.5 - 1 | 0 - 0.5 | 15.64 - 5.64 |
| MW-16 | 11/7/90 | NM | 20.92 | SS | 0.020 | 14 | 2.5 - 12.5 | 2 - 14 | 1 - 2 | 0 - 1 | NM |
| MW-17 | 11/8/90 | 19.25 | 20.75 | SS | 0.020 | 13 | 2 - 12 | 1.3 - 13 | 0.5 - 1.3 | 0 - 0.5 | 17.25 - 7.25 |
| MW-19 | 12/20/90 | 18.96 | 21.36 | SS | 0.020 | 15 | 4 - 14 | 2 - 15 | 0.5 - 2 | 0 - 0.5 | 14.96 - 4.96 |
| MW-20 | 12/11/90 | 18.28 | 20.33 | SS | 0.020 | 14 | 2.5 - 12.5 | 1.5 - 14 | 0.5 - 1.5 | 0 - 0.5 | 15.78 - 5.78 |
| MW-21 | 12/6/90 | 19.21 | 20.83 | SS | 0.020 | 14 | 2 - 12 | 1 - 14 | 0.3 - 1 | 0 - 0.3 | 17.21 - 7.21 |
| MW-22 | 10/20/90 | 18.09 | 19.44 | SS | 0.020 | 12 | 1 - 11 | 0.5 - 12 | 0 - 0.5 | +0.5 - 0 | 17.09 - 7.09 |
| MW-23D | 12/10/90 | 18.65 | 20.40 | PVC | 0.020 | 37.5 | 26.5 - 36.5 | 22 - 37.5 | 18 - 22 (b) | 0 - 18 | -7.85 - -17.9 |
| MW-24(d) | 11/28/90 | NM | 37.06 | PVC | 0.020 | 27 | 14 - 24 | 11 - 27 | 4 - 11 | 0 - 4 | NM |
| MW-25(d) | 11/17/90 | NM | 22.77 | PVC | 0.020 | 16.5 | 5.5 - 15.5 | 3.5 - 16.5 | 1.5 - 3.5 | 0 - 1.5 | NM |
| MW-25A | 1/6/93 | 23.28 | 26.52 | PVC | 0.010 | 15.5 | 4 - 14 | 2.5 - 15.5 | 1.5 - 2.5 | 0 - 1.5 | 19.28 - 9.28 |
| MW-26(d) | 12/5/90 | NM | 30.67 | PVC | 0.020 | 22.5 | 11 - 21 | 8 - 22.5 | 1.5 - 8 | 0 - 1.5 | NM |
| MW-27 | 12/1/90 | 21.22 | 22.67 | PVC | 0.020 | 19 | 8 - 18 | 6 - 19 | 2 - 6 | 0 - 2 | 13.22 - 3.22 |
| MW-28 | 11/9/90 | 19.89 | 19.44 | PVC | 0.020 | 17 | 6 - 16 | 4 - 17 | 2 - 4 | 0 - 2 | 13.89 - 3.89 |
| MW-29 | 11/17/90 | 10.41 | 13.51 | PVC | 0.020 | 12 | 1 - 11 | 0.5 - 12 | 0 - 0.5 | 0 (c) | 9.41 - -0.59 |
| MW-30 | 11/30/90 | 15.15 | 17.65 | PVC | 0.020 | 16 | 4 - 14 | 2.5 - 16 | 1 - 2.5 | 0 - 1 | 11.15 - 1.15 |
| MW-31 | 11/8/90 | 15.71 | 15.46 | PVC | 0.020 | 13 | 2.5 - 12.5 | 1.5 - 13 | 0.5 - 1.5 | 0 - 0.5 | 13.21 - 3.21 |
| MW-32 | 10/4/90 | 26.37 | 26.07 | PVC | 0.020 | 17 | 2.6 - 12.6 | 1.5 - 17 | 0.5 - 1.5 | 0 - 0.5 | 23.77 - 13.77 |
| MW-33 | 11/15/90 | 25.15 | 24.90 | PVC | 0.020 | 18.5 | 8 - 18 | 6 - 18.5 | 3 - 6 | 0 - 3 | 17.15 - 7.15 |
| MW-34 | 11/29/90 | 27.91 | 30.21 | PVC | 0.020 | 19 | 7.3 - 17.3 | 5 - 19 | 1.5 - 5 | 0 - 1.5 | 20.61 - 10.61 |
| MW-35 | 1/15/91 | 17.62 | 19.92 | PVC | 0.020 | 14 | 3 - 13 | 2 - 14 | 1 - 2 | 0 - 1 | 14.62 - 4.62 |
| MW-36 | 1/15/91 | 18.50 | 21.25 | PVC | 0.020 | 15 | 3 - 13 | 1.5 - 15 | 0.5 - 1.5 | 0 - 0.5 | 15.5 - 5.5 |
| MW-37 | 12/14/93 | 17.01 | 19.09 | PVC | 0.010 | 14 | 1.5 - 11.5 | 0.6 - 14 | 0.1 - 0.6 | 0 - 0.1 | 15.51 - 5.51 |
| MW-38D | 12/10-11/93 | 18.70 | 21.50 | PVC | 0.010 | 44 | 29.5 - 39.5 | 25 - 44 | 23 - 25 | 0 - 23 | -10.8 - -20.8 |
| MW-39D | 12/15-16/93 | 19.15 | 21.35 | PVC | 0.010 | 43.5 | 30.5 - 40.5 | 27 - 43.5 | 23 - 27 | 0 - 23 | -11.4 - -21.4 |
| MW-40D | 11/9/93 | 20.25 | 22.85 | PVC | 0.010 | 42 | 29 - 39 | 26 - 42 | 22 - 26 | 0 - 22 | -8.75 - -18.8 |
| MW-41 | 10/30/91 | 16.76 | 16.21 | SS | 0.010 | 14 | 3.4 - 13.4 | 2 - 14 | 1 - 2 | 0 - 1 | 13.36 - 3.36 |
| MW-42 | 1/18/93 | 15.88 | 16.88 | PVC | 0.010 | 13.5 | 2 - 12 | 0.8 - 13.5 | 0.2 - 0.8 | 0 - 0.2 | 13.88 - 3.88 |
| MW-43 | 1/29/93 | 15.15 | 16.35 | PVC | 0.010 | 14 | 2.5 - 12.5 | 1.5 - 14 | 0.5 - 1.5 | 0 - 0.5 | 12.65 - 2.65 |
| MW-44D | 1/19-20/93 | 15.06 | 15.46 | PVC | 0.010 | 41 | 29.7 - 39.7 | 27.8 - 41 | 26 - 27.8 | 0 - 26 | -14.6 - -24.6 |
| MW-45 | 1/11/93 | 20.97 | 23.77 | PVC | 0.010 | 20 | 7 - 17 | 5 - 20 | 3.5 - 5 | 0 - 3.5 | 13.97 - 3.97 |
| MW-46 | 1/11/93 | 24.81 | 27.71 | PVC | 0.010 | 19 | 6.7 - 16.7 | 4.5 - 19 | 3.0 - 4.5 | 0 - 3.0 | 18.11 - 8.11 |
| MW-47 | 1/5/93 | 27.37 | 30.02 | PVC | 0.010 | 14.5 | 3 - 13 | 2 - 14.5 | 1 - 2 | 0 - 1 | 24.37 - 14.37 |
| MW-48D | 2/1/93 | 27.31 | 30.21 | PVC | 0.010 | 42 | 30 - 40 | 27 - 42 | 25 - 27 | 0 - 25 | -2.69 - -12.7 |
| MW-49 | 12/13/93 | 18.74 | 20.39 | PVC | 0.010 | 14 | 1.7 - 11.7 | 0.8 - 14 | 0.3 - 0.8 | 0 - 0.3 | 17.04 - 7.04 |

Table 1. Summary of Construction Details for Monitoring Wells, Sunnyside Yard, Queens, New York.

| Well Number | Date(s) Installed | Land Surface Elevation (ft relative to mean sea level) | Measuring Point Elevation (ft above mean sea level) | Screen Type | Screen Slot Size | Depth of Boring (ft below land surface) | Screened Interval (ft below land surface) | Interval Gravel Packed (ft below land surface) | Interval Sealed with Bentonite (ft below land surface) | Interval Sealed with Grout (ft below land surface) | Screen Setting (ft relative to mean sea level) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| MW-50 | 12/17/93 | 18.50 | 20.20 | SS | 0.020 | 15 | 2 - 12 | 1 - 15 | 0.3 - 1 | 0 - 0.3 | 16.5 - 6.5 |
| MW-51 | 12/15/93 | 18.75 | 20.42 | SS | 0.020 | 14 | 1.5 - 11.5 | 0.7 - 14 | 0.2 - 0.7 | 0 - 0.2 | 17.25 - 7.25 |
| MW-52 | 12/9/93 | 17.69 | 19.24 | SS | 0.020 | 14 | 1.7 - 11.7 | 1 - 14 | 0.6 - 1 | 0 - 0.6 | 15.99 - 5.99 |
| MW-53 | 12/7/93 | 19.05 | 21.40 | SS | 0.020 | 14 | 1.5 - 11.5 | 0.8 - 14 | 0.2 - 0.8 | 0 - 0.2 | 17.55 - 7.55 |
| MW-54 | 11/29/93 | 18.34 | 20.59 | SS | 0.020 | 14 | 1.3 - 11.3 | 0.7 - 14 | 0.2 - 0.7 | 0 - 0.2 | 17.04 - 7.04 |
| MW-55 | 11/17/93 | 19.10 | 20.45 | SS | 0.020 | 14 | 1.5 - 11.5 | 1 - 14 | 0.5 - 1 | 0 - 0.5 | 17.6 - 7.6 |
| MW-56 | 11/17/93 | 19.38 | 22.68 | SS | 0.020 | 13 | 2 - 12 | 1 - 13 | 0.5 - 1 | 0 - 0.5 | 17.38 - 7.38 |
| MW-57 | 11/10/93 | 20.24 | 23.24 | PVC | 0.010 | 14.5 | 3 - 13 | 1 - 14.5 | 0.5 - 1 | 0 - 0.5 | 17.24 - 7.24 |
| MW-58 | 12/8/93 | 18.15 | 19.60 | SS | 0.020 | 14 | 1.3 - 11.3 | 0.8 - 14 | 0.2 - 0.8 | 0 - 0.2 | 16.85 - 6.85 |
| MW-59 | 12/3/93 | 19.16 | 22.61 | PVC | 0.010 | 12.5 | 1.5 - 11.5 | 0.5 - 12.5 | 0 - 0.5 | NA | 17.66 - 7.66 |
| MW-60 | 12/28/93 | 22.71 | 24.56 | SS | 0.020 | 18 | 4.5 - 14.5 | 3 - 18 | 1.5 - 3 | 0 - 1.5 | 18.21 - 8.21 |
| MW-61 | 11/12-13/93 | 30.59 | 32.19 | PVC | 0.010 | 24 | 12 - 22 | 10 - 24 | 9 - 10 | 0 - 9 | 18.59 - 8.59 |
| MW-62D | 12/1/93 | 30.76 | 31.86 | PVC | 0.010 | 52 | 39 - 49 | 35 - 52 | 31 - 35 | 0 - 31 | -8.24 - -18.2 |
| MW-63 | 12/14/93 | 20.55 | 22.10 | PVC | 0.010 | 14 | 2.5 - 12.5 | 1.5 - 14 | 0.5 - 1.5 | 0 - 0.5 | 18.05 - 8.05 |

SS - Stainless steel continuous slot.
PVC - Polyvinyl chloride schedule 40.
(a) - MW-13 replaced Geraghty & Miller Well No. 13 that had been destroyed.
(b) - Bentonite and formation collapse.
(c) - Cement grout around protective steel casing.
(d) - Abandoned on 11/11/93

Table 2. Summary of Soil Quality Sampling, Sunnyside Yard, Queens, New York.

| Sampling Location | Soil Boring Designation | Sample Depth Interval (ft below land surface) | Analytes |
|---|---|---|---|
| Area 1 | S-122 | 7.5-8.5 | TCL VOCs, TCL SVOCs, PCBs, TAL Metals, Hydrocarbon Scan |
| | S-129 | 3-5 | TCL VOCs, TCL SVOCs, PCBs, TAL Metals, Hydrocarbon Scan |
| | S-134 | 2-4 | TCL VOCs, TCL SVOCs, PCBs, TAL Metals, Hydrocarbon Scan |
| | S-135 | 3-3.5 | TCL VOCs, TCL SVOCs, PCBs, TAL Metals, Hydrocarbon Scan |
| | S-139 | 3-3.1 | TCL VOCs, TCL SVOCs, PCBs, TAL Metals, Hydrocarbon Scan |
| | MW-54 | 3-5 | TCL VOCs, TCL SVOCs, PCBs, TAL Metals, Hydrocarbon Scan |
| | MW-58 | 2-3 | TCL VOCs, TCL SVOCs, PCBs, TAL Metals, Hydrocarbon Scan |
| | PD-45 | 3-4 | PCBs* |
| | PD-47 | 6.5-7 | PCBs* |
| | CS-1 | 0-2 | PCBs |
| | CS-3 | 3-5 | PCBs |
| | CS-5 | 0-2 | PCBs |
| | CS-10 | 0-2 | PCBs |
| | CS-76 | 0-0.5 | PCBs |
| | CMW-20 | 0-2 | PCBs |
| | CMW-22 | 0-2 | PCBs |
| Area 2 | CS-41A | 3.5-5.5 | PCBs |
| | CS-43 | 0-2 | PCBs, Mercury |
| Area 4 | CS-47 | 2-4 | PCBs |
| | CS-49 | 2-4 | PCBs |
| | CMW-31 | 0-2 | PCBs |
| Area 5 | CS-50 | 0-2 | PCBs |
| | CS-51 | 0-2 | PCBs |
| Area 6 | CS-61 | 5-7 | PCBs |
| | CS-64 | 2-3 | PCBs |
| Area 7 | S-99 | 0-2 | TCL VOCs, TCL SVOCs, PCBs, TAL Metals |
| | CS-67 | 0-2 | PCBs |
| Area 8A | S-111 | 0-2 | PCBs |
| | S-112 | 0-2 | PCBs |
| | S-113 | 0-2 | PCBs |
| | S-114 | 0-2 | PCBs |
| | S-115 | 0-2 | PCBs |
| | CS-53 | 0-2 | PCBs |

Table 2. Summary of Soil Quality Sampling, Sunnyside Yard, Queens, New York.

| Sampling Location | Soil Boring Designation | Sample Depth Interval (ft below land surface) | Analytes |
|---|---|---|---|
| Area 8B | T-21A | 0-0.5 | PCBs* |
| | T-21B | 0-0.5 | PCBs* |
| | T-21C | 0-0.5 | PCBs* |
| | T-21D | 0-0.5 | PCBs* |
| | T-21E | 0-0.5 | PCBs* |
| Area 8C | S-104 | 0-2 | PCBs |
| | S-105 | 0-2 | PCBs |
| | S-106 | 0-2 | PCBs |
| | S-107 | 0-2 | PCBs |
| | S-108 | 0-2 | PCBs |
| | CS-6 | 0-2 | PCBs |
| Area 9 | S-103 | 0-2 | PCBs |
| | CS-59 | 0-2 | PCBs |
| Area 10 | CS-83 | 0-2 | PCBs |
| Area 13 | S-100 | 0-2 | TCL VOCs, TCL SVOCs, PCBs, TAL Metals |
| | CS-75 | 0-2 | PCBs |
| | CS-77 | 0-2 | PCBs |
| Area 15 | CS-82 | 0-2 | PCBs |
| Area 17 | S-101 | 0-2 | TCL VOCs, TCL SVOCs, PCBs, TAL Metals |
| | S-102 | 0-2 | TCL VOCs, TCL SVOCs, PCBs, TAL Metals |
| Facility Wide | CS-16 | 0-2 | PCBs |
| | CS-22 | 0-2 | PCBs |
| | CMW-30 | 0-2 | PCBs |
| | CMW-34 | 0-2 | PCBs |

TCL - Target Compound List
TAL - Target Analyte List
VOCs - Volatile Organic Compounds
SVOCs - Semivolatile Organic Compounds
PCBs - Polychlorinated Biphenyls
* - Non-ASP analyses

Table 3. Summary of Separate-Phase Petroleum Sampling, Sunnyside Yard, Queens, New York.

| Sampling Location | Sampling Location/ Designation | Analytes |
|---|---|---|
| Area 1 | MW-36 | PCBs |
| | MW-50 | PCBs, Hydrocarbon Scan, Specific Gravity, Kinematic Viscosity |
| | MW-53 | PCBs, Hydrocarbon Scan, Specific Gravity, Kinematic Viscosity |
| | MW-54 | PCBs, Hydrocarbon Scan, Specific Gravity, Kinematic Viscosity |
| | MW-60 | PCBs, Hydrocarbon Scan, Specific Gravity, Kinematic Viscosity |

PCBs - Polychlorinated Biphenyls

Table 4. Summary of Ground-Water Quality Sampling, Sunnyside Yard, Queens, New York.

| Sampling Location | Sample Location/ Designation | Analytes |
|---|---|---|
| Area 1 | MW-1 | PCBs, TAL Metals |
| | MW-23D | TCL VOCs, TCL SVOCs, PCBs |
| | MW-35 | TCL VOCs, TCL SVOCs, PCBs, TAL Metals |
| | MW-37 | TCL VOCs, TCL SVOCs, PCBs, TAL Metals |
| | MW-38D | TCL VOCs, TCL SVOCs, PCBs |
| | MW-39D | TCL VOCs, TCL SVOCs, PCBs |
| | MW-40D | TCL VOCs, TCL SVOCs, PCBs |
| | MW-49 | TCL VOCs, TCL SVOCs, PCBs, TAL Metals |
| | MW-57 | TCL VOCs, TCL SVOCs, PCBs, TAL Metals |
| | MW-59 | TCL VOCs, TCL SVOCs, PCBs, TAL Metals |
| | MW-63 | TCL VOCs, TCL SVOCs, PCBs, TAL Metals |
| Area 2 | MW-41 | TCL VOCs |
| | TW-1 | TCL VOCs |
| | TW-2 | TCL VOCs |
| Area 4 | MW-42 | TCL VOCs, TCL SVOCs |
| Area 9 | MW-27 | PCBs |
| | MW-45 | TCL VOCs, TCL SVOCs, PCBs, TAL Metals |
| Areas 11, 13, and 17 | MW-46 | TCL VOCs, TCL SVOCs, PCBs, TAL Metals |
| Area 12 | TW-3 | TCL SVOCs, PCBs |
| Facility Wide | MW-25 | TAL Metals |
| | MW-25A | PCBs |
| | MW-29 | TAL Metals |
| | MW-43 | TCL VOCs, TCL SVOCs, PCBs, TAL Metals |
| | MW-44D | TCL VOCs, TCL SVOCs, PCBs, TAL Metals |
| | MW-47 | TCL VOCs, TCL SVOCs, PCBs, TAL Metals |
| | MW-48D | TCL VOCs, TCL SVOCs, PCBs, TAL Metals |
| | MW-61 | TCL VOCs, TCL SVOCs, PCBs, TAL Metals |
| | MW-62D | TCL VOCs, TCL SVOCs, PCBs, TAL Metals |

TCL - Target Compound List
TAL - Target Analyte List
VOCs - Volatile Organic Compounds
SVOCs - Semivolatile Organic Compounds
PCBs - Polychlorinated Biphenyls

Table 5. Summary of Sewer-Water Quality Sampling, Sunnyside Yard, Queens, New York.

| Sampling Location/ Designation | Analytes |
|---|---|
| MHW-1 | TCL VOCs, TCL SVOCs, PCBs, TAL Metals |
| MHW-2 | TCL VOCs, TCL SVOCs, PCBs, TAL Metals |
| MHW-3 | PCBs |
| MHW-5 | PCBs |
| MHW-6 | PCBs |
| MHW-7 | PCBs |
| MHW-8 | PCBs |
| MHW-29 | PCBs |
| MHW-30 | PCBs |
| MHW-40 | PCBs |
| MHW-43 | PCBs |
| MHW-52 | PCBs |
| MHW-59 | PCBs |
| MHW-69 | PCBs |
| CBW-28 | PCBs |

TCL - Target Compound List
TAL - Target Analyte List
VOCs - Volatile Organic Compounds
SVOCs - Semivolatile Organic Compounds
PCBs - Polychlorinated Biphenyls

## Table 6. Summary of Sewer-Sediment Quality Sampling, Sunnyside Yard, Queens, New York.

| Sampling Location/ Designation | Analytes |
|---|---|
| MHS-2 | PCBs |
| MHS-3 | PCBs |
| MHS-8 | PCBs |
| MHS-29 | PCBs |
| MHS-35 | PCBs |
| MHS-37 | PCBs |
| MHS-40 | PCBs |
| MHS-42 | PCBs |
| MHS-45 | PCBs |
| MHS-52 | PCBs |
| MHS-55 | PCBs |
| MHS-65 | PCBs |
| MHS-69 | PCBs |
| CBS-28 | PCBs |

PCBs - Polychlorinated Biphenyls

Table 7. Summary of Water-Level Elevations and Separate-Phase Petroleum Thickness Measurements, Sunnyside Yard, Queens, New York.

| | February 8, 1993 | | | | | February 1 and 2, 1994 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Well Designation | Measuring Point Elevation (ft above mean sea level) | Depth to Product (ft below measuring point) | Depth to Water (ft below measuring point) | Product Thickness (ft) | Water-Level Elevation (ft relative to mean sea level) | Measuring Point Elevation (ft above mean sea level) | Depth to Product (ft below measuring point) | Depth to Water (ft below measuring point) | Product Thickness (ft) | Water-Level Elevation (ft relative to mean sea level) |
| MW-13 | 17.33 | -- | 2.22 | -- | 15.11 | 17.33 | -- | 1.67 | sheen | 15.66 |
| MW-16* | 20.92 | 4.74 | 7.31 | 2.57 | 15.86 | 20.92 | NM | NM | NM | NM |
| MW-17* | 20.75 | 4.54 | 7.20 | 2.66 | 15.87 | 20.75 | 4.02 | 7.06 | 3.04 | 16.35 |
| MW-19 | 21.36 | -- | 7.31 | -- | 14.05 | 21.36 | -- | 6.77 | -- | 14.59 |
| MW-20* | 20.33 | 4.33 | 4.69 | 0.36 | 15.95 | 20.33 | 3.96 | 4.36 | 0.40 | 16.32 |
| MW-21 | 18.62 | -- | 2.42 | sheen | 16.20 | 18.62 | -- | 1.89 | sheen | 16.73 |
| MW-22* | 19.44 | 1.48 | 1.86 | 0.38 | 17.91 | 19.44 | 2.83 | 2.94 | 0.11 | 16.60 |
| MW-23D | 20.40 | -- | 4.80 | -- | 15.60 | 20.40 | -- | 4.33 | -- | 16.07 |
| MW-25 | 22.77 | -- | 5.71 | -- | 17.06 | 22.77 | NM | NM | NM | NM |
| MW-25A | 26.52 | -- | 9.59 | -- | 16.93 | 26.52 | -- | 9.13 | -- | 17.39 |
| MW-27 | 22.67 | -- | 10.71 | -- | 11.96 | 22.67 | -- | 10.26 | -- | 12.41 |
| MW-28 | 19.44 | -- | 7.97 | -- | 11.47 | 19.44 | -- | 7.45 | -- | 11.99 |
| MW-29 | 13.51 | -- | 4.60 | -- | 8.91 | 13.51 | -- | 3.87 | -- | 9.64 |
| MW-30 | 17.65 | -- | 7.97 | -- | 9.68 | 17.65 | -- | 6.37 | -- | 11.28 |
| MW-31 | 15.46 | -- | 4.24 | -- | 11.22 | 15.46 | -- | 3.72 | -- | 11.74 |
| MW-32 | 27.07 | -- | 4.61 | -- | 22.46 | 27.07 | -- | -- | -- | -- |
| MW-33 | 24.90 | -- | 8.63 | -- | 16.27 | 24.90 | -- | -- | -- | -- |
| MW-34 | 30.21 | -- | 14.68 | -- | 15.53 | 30.21 | -- | 14.72 | -- | 15.49 |
| MW-35 | 19.84 | -- | 5.74 | -- | 14.10 | 19.92 | -- | 4.84 | -- | 15.08 |
| MW-36* | 21.25 | 6.51 | 7.40 | 0.89 | 14.63 | 21.25 | 5.97 | 7.27 | 1.30 | 15.12 |
| MW-37 | NM | NM | NM | NM | NM | 19.09 | -- | 4.92 | -- | 14.17 |
| MW-38D | NM | NM | NM | NM | NM | 21.50 | -- | 5.71 | -- | 15.79 |
| MW-39D | NM | NM | NM | NM | NM | 21.35 | -- | 6.25 | -- | 15.10 |
| MW-40D | NM | NM | NM | NM | NM | 22.85 | -- | 6.15 | -- | 16.70 |
| MW-41 | 16.21 | -- | 4.35 | -- | 11.86 | 16.21 | NM | NM | NM | NM |
| MW-42 | 16.88 | -- | 5.99 | -- | 10.89 | 16.88 | -- | 5.47 | -- | 11.41 |
| MW-43 | 16.35 | -- | 5.33 | -- | 11.02 | 16.35 | -- | 4.71 | -- | 11.64 |
| MW-44D | 15.46 | -- | 4.36 | -- | 11.10 | 15.46 | -- | 3.92 | -- | 11.54 |
| MW-45 | 23.77 | -- | 12.12 | -- | 11.65 | 23.77 | -- | 11.75 | -- | 12.02 |
| MW-46 | 27.71 | -- | 10.65 | -- | 17.06 | 27.71 | -- | 11.07 | -- | 16.64 |
| MW-47 | 30.02 | -- | 9.32 | -- | 20.70 | 30.02 | -- | 7.84 | -- | 22.18 |
| MW-48D | 30.21 | -- | 11.53 | -- | 18.68 | 30.21 | -- | 10.84 | -- | 19.37 |
| MW-49 | NM | NM | NM | NM | NM | 20.39 | -- | 5.06 | -- | 15.33 |
| MW-50* | NM | NM | NM | NM | NM | 20.20 | 4.04 | 8.60 | 4.56 | 15.59 |
| MW-51 | NM | NM | NM | NM | NM | 20.42 | -- | 3.89 | -- | 16.53 |
| MW-52 | NM | NM | NM | NM | NM | 19.24 | -- | 3.14 | -- | 16.10 |
| MW-53* | NM | NM | NM | NM | NM | 21.40 | 4.71 | 6.09 | 1.38 | 16.52 |
| MW-54* | NM | NM | NM | NM | NM | 20.59 | 3.90 | 4.28 | 0.38 | 16.64 |
| MW-55 | NM | NM | NM | NM | NM | 20.45 | -- | 3.79 | -- | 16.66 |
| MW-56 | NM | NM | NM | NM | NM | 22.68 | -- | 5.90 | sheen | 16.78 |
| MW-57 | NM | NM | NM | NM | NM | 23.24 | -- | 6.52 | -- | 16.72 |
| MW-58 | NM | NM | NM | NM | NM | 19.60 | -- | 2.93 | sheen | 16.67 |
| MW-59 | NM | NM | NM | NM | NM | 22.61 | -- | 5.91 | -- | 16.70 |
| MW-60* | NM | NM | NM | NM | NM | 24.56 | 7.81 | 8.84 | 1.03 | 16.62 |
| MW-61 | NM | NM | NM | NM | NM | 32.19 | -- | 14.52 | -- | 17.67 |
| MW-62D | NM | NM | NM | NM | NM | 31.86 | -- | 14.82 | -- | 17.04 |
| MW-63 | NM | NM | NM | NM | NM | 22.10 | -- | 5.55 | -- | 16.55 |

-- - No measurable product.

* - Water-level elevations corrected for presence of separate-phase petroleum. Correction for separate-phase petroleum assumes density of 0.874 (average specific gravity of petroleum samples collected at Yard.)

NM - Not measured

Table 7. Summary of Water-Level Elevations and Separate-Phase Petroleum Thickness Measurements, Sunnyside Yard, Queens, New York.

| | | June 14, 1994 | | | |
|---|---|---|---|---|---|
| Well Designation | Measuring Point Elevation (ft above mean sea level) | Depth to Product (ft below measuring point) | Depth to Water (ft below measuring point) | Product Thickness (ft) | Water-Level Elevation (ft relative to mean sea level) |
| MW-13 | 18.52 | -- | 3.29 | sheen | 15.23 |
| MW-17* | 20.75 | 4.39 | 6.98 | 2.59 | 16.03 |
| MW-19 | 21.36 | -- | 7.26 | -- | 14.10 |
| MW-20* | 20.33 | 4.21 | 4.70 | 0.49 | 16.06 |
| MW-21 | 20.83 | -- | 4.65 | -- | 16.18 |
| MW-22* | 19.44 | 3.10 | 3.93 | 0.83 | 16.24 |
| MW-23D | 20.40 | -- | 4.68 | -- | 15.72 |
| MW-25A | 26.52 | -- | 9.28 | -- | 17.24 |
| MW-27 | 22.67 | -- | 10.69 | -- | 11.98 |
| MW-28 | 19.44 | -- | 7.97 | -- | 11.47 |
| MW-29 | 13.51 | -- | 5.05 | -- | 8.46 |
| MW-30 | 17.65 | -- | 8.13 | -- | 9.52 |
| MW-31 | 15.46 | -- | 4.28 | -- | 11.18 |
| MW-32 | 26.07 | -- | 4.00 | -- | 22.07 |
| MW-33 | 24.90 | -- | 8.31 | -- | 16.59 |
| MW-34 | 30.21 | -- | 14.58 | -- | 15.63 |
| MW-35 | 19.92 | -- | 5.63 | -- | 14.29 |
| MW-36* | 21.25 | 6.50 | 6.61 | 0.11 | 14.74 |
| MW-37 | 19.09 | -- | 5.50 | -- | 13.59 |
| MW-38D | 21.50 | -- | 6.02 | -- | 15.48 |
| MW-39D | 21.35 | -- | 6.54 | -- | 14.81 |
| MW-40D | 22.85 | -- | 6.40 | -- | 16.45 |
| MW-41 | 16.21 | -- | 3.79 | -- | 12.42 |
| MW-42 | 16.88 | -- | 6.10 | -- | 10.78 |
| MW-43 | 16.35 | -- | 5.36 | -- | 10.99 |
| MW-44D | 15.46 | -- | 4.43 | -- | 11.03 |
| MW-45 | 23.77 | -- | 12.13 | -- | 11.64 |
| MW-46 | 27.71 | -- | 11.38 | -- | 16.33 |
| MW-47 | 30.02 | -- | 7.47 | -- | 22.55 |
| MW-48D | 30.21 | -- | 10.83 | -- | 19.38 |
| MW-49 | 20.39 | -- | 5.63 | -- | 14.76 |
| MW-50* | 20.20 | 4.41 | 8.96 | 4.55 | 15.22 |
| MW-51* | 20.42 | 4.23 | 4.42 | 0.19 | 16.17 |
| MW-52 | 19.24 | -- | 3.55 | sheen | 15.69 |
| MW-53* | 21.40 | 5.03 | 6.40 | 1.37 | 16.20 |
| MW-54* | 20.59 | 4.15 | 4.85 | 0.70 | 16.35 |
| MW-55 | 20.45 | -- | 4.05 | sheen | 16.40 |
| MW-56 | 22.68 | -- | 6.25 | sheen | 16.43 |
| MW-57 | 23.24 | -- | 6.81 | -- | 16.43 |
| MW-58 | 19.60 | -- | 3.27 | sheen | 16.33 |
| MW-59 | 22.61 | -- | 6.20 | -- | 16.41 |
| MW-60* | 24.56 | 8.14 | 8.88 | 0.74 | 16.33 |
| MW-61 | 32.19 | -- | 14.85 | -- | 17.34 |
| MW-62D | 31.86 | -- | 14.55 | -- | 17.31 |
| MW-63 | 22.10 | -- | 5.85 | -- | 16.25 |

-- - No measurable product.

* - Water-level elevations corrected for presence of separate-phase petroleum. Correction for separate-phase petroleum assumes density of 0.874 (average specific gravity of petroleum samples collected at Yard.)

Table 8. Summary of Volatile Organic Compound Concentrations Detected in Soil Samples, Sunnyside Yard, Queens, New York.

| Sample Designation: | S-99 | S-100 | S-101 | S-102 | S-122 | S-129 | S-134 |
|---|---|---|---|---|---|---|---|
| Sample Depth (ft): | 0-2 | 0-2 | 0-2 | 0-2 | 7.5-8.5 | 3-5 | 2-4 |
| Sample Date: | 1/18/93 | 1/18/93 | 1/18/93 | 1/18/93 | 4/9/94 | 11/29/93 | 11/8/93 |
| Volatile Organic Compounds (Concentrations in ug/kg) | | | | | | | |
| Chloromethane | 11 U | 11 U | 12 U | 11 U | 11 UJV | 1500 U | 12 U |
| Bromomethane | 11 U | 11 U | 12 U | 11 U | 11 U | 1500 U | 12 U |
| Vinyl Chloride | 11 U | 11 U | 12 U | 11 U | 11 U | 1500 U | 12 U |
| Chloroethane | 11 U | 11 U | 12 U | 11 U | 11 U | 1500 U | 12 U |
| Methylene Chloride | 11 UV | 11 UV | 12 UV | 11 UV | 6 U | 1500 UV | 12 UV |
| Acetone | 11 U | 27 UV | 19 UV | 16 UV | 29 UV | 1500 UV | 15 UV |
| Carbon Disulfide | 11 U | 11 U | 12 U | 11 U | 6 U | 1500 UJV | 12 U |
| 1,1-Dichloroethene | 11 U | 11 U | 12 U | 11 U | 6 U | 1500 U | 12 U |
| 1,1-Dichloroethane | 11 U | 11 U | 12 U | 11 U | 6 U | 1500 U | 12 U |
| 1,2-Dichloroethene (total) | 11 U | 11 U | 12 U | 11 U | 6 U | 1500 U | 12 U |
| Chloroform | 11 U | 11 U | 12 U | 11 U | 6 U | 1500 U | 12 U |
| 1,2-Dichloroethane | 11 U | 11 U | 12 U | 11 U | 6 U | 1500 U | 12 U |
| 2-Butanone | 11 U | 11 U | 12 U | 11 U | 11 U | 1500 U | 12 UV |
| 1,1,1-Trichloroethane | 11 U | 11 U | 12 U | 11 U | 6 U | 1500 U | 12 U |
| Carbon Tetrachloride | 11 U | 11 U | 12 U | 11 U | 6 U | 1500 U | 12 U |
| Bromodichloromethane | 11 U | 11 U | 12 U | 11 U | 6 U | 1500 U | 12 U |
| 1,2-Dichloropropane | 11 U | 11 U | 12 U | 11 U | 6 U | 1500 U | 12 U |
| cis-1,3-Dichloropropene | 11 U | 11 U | 12 U | 11 U | 6 U | 1500 U | 12 U |
| Trichloroethene | 11 U | 11 U | 12 U | 11 U | 6 U | 1500 U | 12 U |
| Dibromochloromethane | 11 U | 11 U | 12 U | 11 U | 6 U | 1500 U | 12 U |
| 1,1,2-Trichloroethane | 11 U | 11 U | 12 U | 11 U | 6 U | 1500 U | 12 U |
| Benzene | 11 U | 11 U | 12 U | 11 U | 6 U | 1500 U | 12 U |
| trans-1,3-Dichloropropene | 11 U | 11 U | 12 U | 11 U | 6 U | 1500 U | 12 U |
| Bromoform | 11 U | 11 U | 12 U | 11 U | 6 U | 1500 U | 12 U |
| 4-Methyl-2-Pentanone | 11 U | 11 U | 12 U | 11 U | 11 U | 1500 U | 12 U |
| 2-Hexanone | 11 U | 11 U | 12 U | 11 U | 11 U | 1500 U | 12 U |
| Tetrachloroethene | 11 U | 11 U | 12 U | 11 U | 6 U | 1500 U | 12 U |
| 1,1,2,2-Tetrachloroethane | 11 U | 11 U | 12 U | 11 U | 6 U | 1500 U | 12 U |
| Toluene | 11 UV | 11 UV | 12 UV | 11 U | 6 U | 1500 UV | 12 U |
| Chlorobenzene | 11 U | 11 U | 12 U | 11 U | 6 U | 1500 U | 12 U |
| Ethylbenzene | 11 U | 11 U | 12 U | 11 U | 6 U | 1500 U | 12 U |
| Styrene | 11 U | 11 U | 12 U | 11 U | 6 U | 1500 U | 12 U |
| Xylenes (total) | 11 U | 11 U | 12 U | 11 U | 6 U | 1500 U | 12 U |

Table 8. Summary of Volatile Organic Compound Concentrations Detected in Soil Samples, Sunnyside Yard, Queens, New York.

| Sample Designation: | S-135 | S-139 | MW-54 | MW-58 |
|---|---|---|---|---|
| Sample Depth (ft): | 3-3.5 | 3-3.1 | 3-5 | 2-3 |
| Sample Date: | 12/7/93 | 12/7/93 | 11/29/93 | 12/7/93 |
| Volatile Organic Compounds (Concentrations in ug/kg) | | | | |
| Chloromethane | 12 U | 12 U | 1600 U | 1600 U |
| Bromomethane | 12 U | 12 U | 1600 U | 1600 U |
| Vinyl Chloride | 12 U | 12 U | 1600 U | 1600 U |
| Chloroethane | 12 U | 12 U | 1600 U | 1600 U |
| Methylene Chloride | 6 UV | 6 UV | 1600 UV | 1600 UV |
| Acetone | 24 UV | 12 UV | 2600 UV | 1600 UV |
| Carbon Disulfide | 6 U | 6 U | 1600 U | 1600 U |
| 1,1-Dichloroethene | 6 U | 6 U | 1600 U | 1600 UJV |
| 1,1-Dichloroethane | 6 U | 6 U | 1600 UJV | 1600 U |
| 1,2-Dichloroethene (total) | 6 U | 6 U | 1600 U | 1600 U |
| Chloroform | 6 U | 6 U | 1600 U | 1600 U |
| 1,2-Dichloroethane | 6 U | 6 U | 1600 U | 1600 U |
| 2-Butanone | 12 UV | 12 U | 1600 UV | 1600 U |
| 1,1,1-Trichloroethane | 6 U | 6 U | 1600 U | 1600 U |
| Carbon Tetrachloride | 6 U | 6 U | 1600 U | 1600 U |
| Bromodichloromethane | 6 U | 6 U | 1600 U | 1600 U |
| 1,2-Dichloropropane | 6 U | 6 U | 1600 U | 1600 U |
| cis-1,3-Dichloropropene | 6 U | 6 U | 1600 U | 1600 U |
| Trichloroethene | 6 U | 6 U | 1600 U | 1600 U |
| Dibromochloromethane | 6 U | 6 U | 1600 U | 1600 U |
| 1,1,2-Trichloroethane | 6 U | 6 U | 1600 U | 1600 U |
| Benzene | 6 U | 6 U | 1600 U | 1600 U |
| trans-1,3-Dichloropropene | 6 U | 6 U | 1600 U | 1600 U |
| Bromoform | 6 U | 6 U | 1600 U | 1600 U |
| 4-Methyl-2-Pentanone | 12 U | 12 U | 1600 U | 1600 U |
| 2-Hexanone | 12 U | 12 U | 1600 U | 1600 U |
| Tetrachloroethene | 6 U | 6 U | 1600 U | 1600 U |
| 1,1,2,2-Tetrachloroethane | 6 U | 6 U | 1600 U | 1600 U |
| Toluene | 6 U | 6 UV | 1600 UV | 1600 UV |
| Chlorobenzene | 6 U | 6 U | 1600 U | 1600 U |
| Ethylbenzene | 6 U | 6 U | 640 J | 1600 U |
| Styrene | 6 U | 6 U | 1600 U | 1600 U |
| Xylenes (total) | 1 J | 6 U | 1600 U | 1600 U |

ug/kg - Micrograms per kilogram.
U - Indicates that the compound was analyzed for but not detected.
V - Qualifier added and/or value altered during validation.
J - Estimated value

Table 9. Summary of Semivolatile Organic Compound Concentrations Detected in Soil Samples, Sunnyside Yard, Queens, New York.

| Sample Designation: | S-99 | S-100 | S-101 | S-101+ | S-102 | S-102+ | S-122 |
|---|---|---|---|---|---|---|---|
| Sample Depth (ft): | 0-2 | 0-2 | 0-2 | 0-2 | 0-2 | 0-2 | 7.5-8.5 |
| Sample Date: | 1/18/93 | 1/18/93 | 1/18/93 | 1/18/93 | 1/18/93 | 1/18/93 | 4/9/94 |
| Semivolatile Organic Compounds (Concentrations in ug/kg) | | | | | | | |
| Phenol | 380 U | 380 UJV | 3100 UJV | 3100 UJV | 380 UJV | 380 UJV | 370 U |
| bis(2-Chloroethyl)ether | 380 U | 380 UJV | 3100 UJV | 3100 UJV | 380 UJV | 380 UJV | 370 U |
| 2-Chlorophenol | 380 U | 380 UJV | 3100 UJV | 3100 UJV | 380 UJV | 380 UJV | 370 U |
| 1,3-Dichlorobenzene | 380 U | 380 UJV | 3100 UJV | 3100 UJV | 380 UJV | 380 UJV | 370 U |
| 1,4-Dichlorobenzene | 380 U | 380 UJV | 3100 UJV | 3100 UJV | 380 UJV | 380 UJV | 370 U |
| Benzyl alcohol | NA | NA | NA | NA | NA | NA | 370 U |
| 1,2-Dichlorobenzene | 380 U | 380 UJV | 3100 UJV | 3100 UJV | 380 UJV | 380 UJV | 370 U |
| 2-Methylphenol | 380 U | 380 UJV | 3100 UJV | 3100 UJV | 380 UJV | 380 UJV | 370 U |
| 2,2'-oxybis(1-Chloropropane) | 380 U | 380 UJV | 3100 UJV | 3100 UJV | 380 UJV | 380 UJV | 370 U |
| 4-Methylphenol | 380 U | 380 UJV | 3100 UJV | 3100 UJV | 380 UJV | 28 JV | 370 U |
| N-Nitroso-di-n-propylamine | 380 U | 380 UJV | 3100 UJV | 3100 UJV | 380 UJV | 380 UJV | 370 U |
| Hexachloroethane | 380 U | 380 UJV | 3100 UJV | 3100 UJV | 380 UJV | 380 UJV | 370 U |
| Nitrobenzene | 380 U | 380 UJV | 3100 UJV | 3100 UJV | 380 UJV | 380 UJV | 370 U |
| Isophorone | 380 U | 380 UJV | 3100 UJV | 3100 UJV | 380 UJV | 380 UJV | 370 U |
| 2-Nitrophenol | 380 U | 380 UJV | 3100 UJV | 3100 UJV | 380 UJV | 380 UJV | 370 U |
| 2,4-Dimethylphenol | 380 U | 380 UJV | 41 JV | 3100 UJV | 380 UJV | 15 JV | 370 U |
| Benzoic acid | NA | NA | NA | NA | NA | NA | 1800 U |
| bis(2-Chloroethoxy)methane | 380 U | 380 UJV | 3100 UJV | 3100 UJV | 380 UJV | 380 UJV | 370 U |
| 2,4-Dichlorophenol | 380 U | 380 UJV | 3100 UJV | 3100 UJV | 380 UJV | 380 UJV | 370 U |
| 1,2,4-Trichlorobenzene | 380 U | 380 UJV | 3100 UJV | 3100 UJV | 380 UJV | 380 UJV | 370 U |
| Naphthalene | 9 J | 85 JV | 700 JV | 660 JV | 260 JV | 280 JV | 370 U |
| 4-Chloroaniline | 380 UJ | 380 UJV | 3100 UJV | 3100 UJV | 380 UJV | 380 UJV | 370 U |
| Hexachlorobutadiene | 380 U | 380 UJV | 3100 UJV | 3100 UJV | 380 UJV | 380 UJV | 370 U |
| 4-Chloro-3-Methylphenol | 380 U | 380 UJV | 3100 UJV | 3100 UJV | 380 UJV | 380 UJV | 370 U |
| 2-Methylnaphthalene | 11 J | 81 JV | 430 JV | 440 JV | 190 JV | 230 JV | 370 U |
| Hexachlorocyclopentadiene | 380 U | 380 UJV | 3100 UJV | 3100 UJV | 380 UJV | 380 UJV | 370 U |
| 2,4,6-Trichlorophenol | 380 U | 380 UJV | 3100 UJV | 3100 UJV | 380 UJV | 380 UJV | 370 U |
| 2,4,5-Trichlorophenol | 910 U | 910 UJV | 7400 UJV | 7400 UJV | 910 UJV | 910 UJV | 1800 U |
| 2-Chloronaphthalene | 380 U | 380 UJV | 3100 UJV | 3100 UJV | 380 UJV | 380 UJV | 370 U |
| 2-Nitroaniline | 910 U | 910 UJV | 7400 UJV | 7400 UJV | 910 UJV | 910 UJV | 1800 U |
| Dimethylphthalate | 380 U | 380 UJV | 3100 UJV | 3100 UJV | 380 UJV | 380 UJV | 370 U |
| Acenaphthylene | 16 J | 380 JV | 2500 JV | 3500 JV | 600 JV | 710 JV | 370 U |
| 2,6-Dinitrotoluene | 380 U | 380 UJV | 3100 UJV | 3100 UJV | 380 UJV | 380 UJV | 370 U |
| 3-Nitroaniline | 910 UJ | 910 UJV | 7400 UJV | 7400 UJV | 910 UJV | 910 UJV | 1800 U |
| Acenaphthene | 380 U | 74 JV | 240 JV | 290 JV | 45 JV | 380 UJV | 370 U |
| 2,4-Dinitrophenol | 910 U | 910 UJV | 7400 UJV | 7400 UJV | 910 UJV | 910 UJV | 1800 UJV |
| 4-Nitrophenol | 910 U | 910 UJV | 7400 UJV | 7400 UJV | 910 UJV | 910 UJV | 1800 U |
| Dibenzofuran | 8 J | 70 JV | 500 JV | 600 JV | 210 JV | 180 JV | 370 U |
| 2,4-Dinitrotoluene | 380 U | 380 UJV | 3100 UJV | 3100 UJV | 380 UJV | 380 UJV | 370 U |
| Diethylphthalate | 380 UV | 380 UJV | 3100 UJV | 3100 UJV | 380 UV | 380 UV | 370 U |
| 4-Chlorophenyl-phenylether | 380 U | 380 UJV | 3100 UJV | 3100 UJV | 380 UJV | 380 UJV | 370 U |
| Fluorene | 380 U | 110 JV | 460 JV | 600 JV | 380 UJV | 380 UJV | 370 U |
| 4-Nitroaniline | 910 U | 910 UJV | 7400 UJV | 7400 UJV | 910 UJV | 910 UJV | 1800 U |
| 4,6-Dinitro-2-methylphenol | 910 U | 910 UJV | 7400 UJV | 7400 UJV | 910 UJV | 910 UJV | 1800 U |
| N-Nitrosodiphenylamine (1) | 380 U | 380 UJV | 3100 UJV | 3100 UJV | 380 UJV | 380 UJV | 370 U |
| 4-Bromophenyl-phenylether | 380 U | 380 UJV | 3100 UJV | 3100 UJV | 380 UJV | 380 UJV | 370 U |
| Hexachlorobenzene | 380 U | 380 UJV | 3100 UJV | 3100 UJV | 380 UJV | 380 UJV | 370 U |
| Pentachlorophenol | 910 U | 910 UJV | 7400 UJV | 7400 UJV | 910 UJV | 910 UJV | 1800 U |
| Phenanthrene | 45 J | 1000 JV | 3100 JV | 3600 JV | 680 JV | 630 JV | 15 J |
| Anthracene | 17 J | 460 JV | 3100 JV | 3200 JV | 370 JV | 340 JV | 370 U |
| Di-n-butylphthalate | 380 UV | 380 UJV | 3100 UJV | 3100 UJV | 380 UJV | 380 UJV | 15 J |
| Fluoranthene | 100 J | 1700 JV | 7000 JV | 6800 JV | 260 JV | 220 JV | 48 J |
| Pyrene | 77 J | 380 UJV | 6900 JV | 7800 JV | 380 UJV | 710 JV | 39 J |
| Butylbenzylphthalate | 380 U | 380 UJV | 3100 UJV | 3100 UJV | 380 UJV | 380 UJV | 370 U |
| 3,3'-Dichlorobenzidine | 380 U | 380 UJV | 3100 UJV | 3100 UJV | 380 UJV | 380 UJV | 750 U |
| Benzo(a)anthracene | 65 J | 1100 JV | 3900 JV | 4600 JV | 690 JV | 730 JV | 22 J |
| Chrysene | 110 J | 380 UJV | 4900 JV | 6500 JV | 1500 JV | 1100 JV | 40 J |
| Bis(2-Ethylhexyl)phthalate | 380 UV | 1600 UJV | 1900 UJV | 2400 UJV | 380 UJV | 380 UJV | 370 UV |
| Di-n-octylphthalate | 380 U | 380 UJV | 3100 UJV | 3100 UJV | 380 UJV | 380 UJV | 370 U |
| Benzo(b)fluoranthene | 100 J | 1000 JV | 3200 JV | 3500 JV | 1200 JV | 760 JV | 28 J |
| Benzo(k)fluoranthene | 110 J | 940 JV | 5100 JV | 3800 JV | 860 JV | 670 JV | 37 J |
| Benzo(a)pyrene | 88 J | 1200 JV | 5700 JV | 4000 JV | 2100 JV | 2100 JV | 370 U |
| Indeno(1,2,3-cd)pyrene | 110 J | 280 JV | 920 JV | 1200 JV | 770 JV | 670 JV | 370 U |
| Dibenz(a,h)anthracene | 13 J | 51 JV | 3100 UJV | 3100 UJV | 250 JV | 180 JV | 370 U |
| Benzo(g,h,i)perylene | 80 J | 150 JV | 700 JV | 550 JV | 670 JV | 280 JV | 370 U |

Table 9. Summary of Semivolatile Organic Compound Concentrations Detected in Soil Samples, Sunnyside Yard, Queens, New York.

| Sample Designation: | S-129 | S-134 | S-135 | S-139 | MW-54 | MW-58 |
|---|---|---|---|---|---|---|
| Sample Depth (ft): | 3-5 | 2-4 | 3-3.5 | 3-3.1 | 3-5 | 2-3 |
| Sample Date: | 11/29/93 | 11/8/93 | 12/7/93 | 12/7/93 | 11/29/93 | 12/7/93 |
| Semivolatile Organic Compounds (Concentrations in ug/kg) | | | | | | |
| Phenol | 410 U | 790 UJV | 350 U | 330 U | 7600 U | 7300 U |
| bis(2-Chloroethyl)ether | 410 U | 790 UJV | 350 U | 330 U | 7600 U | 7300 U |
| 2-Chlorophenol | 410 U | 790 UJV | 350 U | 330 U | 7600 U | 7300 U |
| 1,3-Dichlorobenzene | 410 U | 790 UJV | 350 U | 330 U | 7600 U | 7300 U |
| 1,4-Dichlorobenzene | 410 U | 790 UJV | 350 U | 330 U | 7600 U | 7300 U |
| Benzyl alcohol | NA | 790 UJV | 350 U | 330 U | 7600 U | 7300 U |
| 1,2-Dichlorobenzene | 410 U | 790 UJV | 350 U | 330 U | 7600 U | 7300 U |
| 2-Methylphenol | 410 U | 790 UJV | 350 U | 330 U | 7600 U | 7300 U |
| 2,2'-oxybis(1-Chloropropane) | 410 U | 790 UJV | 350 U | 330 U | 7600 U | 7300 U |
| 4-Methylphenol | 410 U | 790 UJV | 350 U | 330 U | 7600 U | 7300 U |
| N-Nitroso-di-n-propylamine | 410 U | 790 UJV | 350 U | 330 U | 7600 U | 7300 U |
| Hexachloroethane | 410 U | 790 UJV | 350 U | 330 U | 7600 U | 7300 U |
| Nitrobenzene | 410 U | 790 UJV | 350 U | 330 U | 7600 U | 7300 U |
| Isophorone | 410 U | 790 UJV | 350 U | 330 U | 7600 U | 7300 U |
| 2-Nitrophenol | 410 U | 790 UJV | 350 U | 330 U | 7600 U | 7300 U |
| 2,4-Dimethylphenol | 410 U | 790 UJV | 350 U | 330 U | 7600 U | 7300 U |
| bis(2-Chloroethoxy)methane | 410 U | 790 UJV | 350 U | 330 U | 7600 U | 7300 U |
| 2,4-Dichlorophenol | 410 U | 790 UJV | 350 U | 330 U | 7600 U | 7300 U |
| Benzoic acid | 480 J | 3800 UJV | 17000 U | 1600 U | 37000 U | 35000 U |
| 1,2,4-Trichlorobenzene | 410 U | 790 UJV | 350 U | 330 U | 7600 U | 7300 U |
| Naphthalene | 410 U | 790 UJV | 350 U | 33 J | 6600 J | 20000 |
| 4-Chloroaniline | 410 U | 790 UJV | 350 U | 330 U | 7600 U | 7300 U |
| Hexachlorobutadiene | 410 U | 790 UJV | 350 U | 330 U | 7600 U | 7300 U |
| 4-Chloro-3-Methylphenol | 410 U | 790 UJV | 350 U | 330 U | 7600 U | 7300 U |
| 2-Methylnaphthalene | 410 U | 790 UJV | 350 U | 18 J | 21000 | 45000 |
| Hexachlorocyclopentadiene | 410 U | 790 UJV | 350 U | 330 U | 7600 U | 7300 U |
| 2,4,6-Trichlorophenol | 410 U | 790 UJV | 350 U | 330 U | 7600 U | 7300 U |
| 2,4,5-Trichlorophenol | 2000 U | 3800 UJV | 1700 U | 1600 U | 37000 U | 35000 U |
| 2-Chloronaphthalene | 410 U | 790 UJV | 350 U | 330 U | 7600 U | 7300 U |
| 2-Nitroaniline | 2000 U | 3800 UJV | 1700 U | 1600 U | 37000 U | 35000 U |
| Dimethylphthalate | 410 U | 790 UJV | 350 U | 330 U | 7600 U | 7300 U |
| Acenaphthylene | 40 J | 330 JV | 350 U | 330 U | 7600 U | 7300 U |
| 2,6-Dinitrotoluene | 410 U | 790 UJV | 350 U | 330 U | 7600 U | 7300 U |
| 3-Nitroaniline | 2000 U | 3800 UJV | 1700 UJV | 1600 UJV | 37000 UJV | 35000 UJV |
| Acenaphthene | 410 U | 790 UJV | 350 U | 330 U | 7600 U | 7300 U |
| 2,4-Dinitrophenol | 2000 U | 3800 UJV | 1700 U | 1600 U | 37000 U | 35000 U |
| 4-Nitrophenol | 2000 U | 3800 UJV | 1700 U | 1600 U | 37000 U | 35000 U |
| Dibenzofuran | 58 J | 790 UJV | 17 J | 330 U | 7600 U | 760 J |
| 2,4-Dinitrotoluene | 410 U | 790 UJV | 350 U | 330 U | 7600 U | 7300 U |
| Diethylphthalate | 410 U | 790 UJV | 350 U | 330 U | 7600 U | 7300 U |
| 4-Chlorophenyl-phenylether | 410 U | 790 UJV | 350 U | 330 U | 7600 U | 7300 U |
| Fluorene | 410 U | 790 UJV | 31 J | 330 U | 2600 J | 1400 J |
| 4-Nitroaniline | 2000 U | 3800 UJV | 1700 U | 1600 U | 37000 U | 35000 U |
| 4,6-Dinitro-2-methylphenol | 2000 U | 3800 UJV | 1700 U | 1600 U | 37000 U | 35000 U |
| N-Nitrosodiphenylamine (1) | 410 U | 790 UJV | 350 U | 330 U | 7600 U | 7300 U |
| 4-Bromophenyl-phenylether | 410 U | 790 UJV | 350 U | 330 U | 7600 U | 7300 U |
| Hexachlorobenzene | 410 U | 790 UJV | 350 U | 330 U | 7600 U | 7300 U |
| Pentachlorophenol | 410 U | 790 UJV | 350 U | 330 U | 7600 U | 7300 U |
| Phenanthrene | 140 J | 920 JV | 350 U | 58 J | 4200 J | 1500 J |
| Anthracene | 57 J | 210 JV | 350 U | 330 U | 7600 U | 500 J |
| Di-n-butylphthalate | 30 J | 120 J | 350 U | 18 J | 7600 U | 7300 U |
| Fluoranthene | 140 J | 500 J | 350 U | 93 J | 7600 U | 1500 J |
| Pyrene | 130 J | 2100 JV | 350 U | 100 J | 660 J | 1200 J |
| Butylbenzylphthalate | 410 U | 790 UJV | 350 U | 330 U | 7600 U | 7300 U |
| 3,3'-Dichlorobenzidine | 410 U | 1600 UJV | 350 U | 330 U | 7600 U | 7300 U |
| Benzo(a)anthracene | 410 U | 370 J | 350 U | 330 U | 7600 U | 7300 U |
| Chrysene | 81 J | 630 J | 350 U | 56 J | 7600 U | 650 J |
| Bis(2-Ethylhexyl)phthalate | 410 UV | 790 UJV | 350 UV | 330 UV | 7600 UV | 7300 U |
| Di-n-octylphthalate | 410 U | 790 UJV | 350 UJV | 330 U | 7600 U | 7300 U |
| Benzo(b)fluoranthene | 250 J | 790 UJV | 350 UJV | 89 J | 7600 U | 860 J |
| Benzo(k)fluoranthene | 37 J | 820 JV | 350 UJV | 330 U | 7600 U | 7300 U |
| Benzo(a)pyrene | 47 J | 460 J | 350 UJV | 46 J | 7600 U | 7300 U |
| Indeno(1,2,3-cd)pyrene | 63 J | 550 J | 350 UJV | 330 U | 7600 U | 7300 U |
| Dibenz(a,h)anthracene | 410 U | 790 UJV | 350 UJV | 330 U | 7600 U | 7300 U |
| Benzo(g,h,i)perylene | 43 J | 790 UJV | 350 UJV | 330 U | 7600 U | 7300 U |

## Table 9. Summary of Semivolatile Organic Compound Concentrations Detected in Soil Samples, Sunnyside Yard, Queens, New York.

ug/kg - Micrograms per kilogram
U - Indicates that the compound was analyzed for but not detected.
J - Estimated value.
V - Qualifier added and/or value altered during validation.
\+ - Reanalysis

Table 10. Summary of Metal Concentrations Detected in Soil Samples, Sunnyside Yard, Queens, New York.

| Sample Designation: | | S-99 | S-100 | S-101 | S-102 | S-122 | S-129 |
|---|---|---|---|---|---|---|---|
| Sample Depth (ft): | | 0-2 | 0-2 | 0-2 | 0-2 | 7.5-8.5 | 3-5 |
| Sample Date: | | 1/18/93 | 1/18/93 | 1/18/93 | 1/18/93 | 4/9/94 | 11/29/93 |
| Metals (Concentrations in mg/kg) | Background Range* | | | | | | |
| Aluminum | 3850N - 4770 | 9370 | 8330 | 4050 | 3020 | 7000 | 2570 |
| Antimony | <1.6JN - 2.4BN | 4.2 U | 4.3 U | 4.3 U | 10.7 B | 9.2 U | 4.8 U |
| Arsenic | <0.68W - <1.2 | 16.8 | 7.7 | 25.0 | 21.2 | 1.6 B | 4.7 |
| Barium | 14BJ - 32B | 50.6 | 84.8 | 154 | 74.5 | 65.9 B | 38.6 JV |
| Beryllium | <0.34 - <0.36 | 0.22 B | 0.20 U | 0.21 U | 0.20 U | 0.63 B | 0.23 U |
| Cadmium | <0.73* - <1.1 | 0.40 U | 1.6 | 9.2 | 1.4 | 0.72 B | 0.46 U |
| Calcium | 1400 - 6850 | 920 B | 5900 | 8680 | 1630 | 1850 | 5890 |
| Chromium | 7.5JN - 13N* | 18.8 | 23.2 | 124 | 29.4 | 16.1 | 17.0 |
| Cobalt | 3.0B - 3.2BJ | 7.5 B | 6.7 B | 12.7 | 6.5 B | 6.6 B | 4.3 B |
| Copper | 7.8 - 12 | 90.7 JV | 132 JV | 629 JV | 344 JV | 33.7 | 106 |
| Iron | 5610 - 11200 | 21300 | 21800 | 91800 | 41800 | 16900 | 17700 |
| Lead | 3.5 - 8.8N* | 61.9 | 251 | 1190 | 393 | 12.1 | 46.9 JV |
| Magnesium | 1510 - 4260J | 2180 | 2510 | 2370 | 1180 | 3660 | 3980 |
| Manganese | 165* - 224 | 321 | 318 | 667 | 233 | 624 | 327 |
| Mercury | <0.1 | 0.20 | 0.49 | 1.3 | 0.94 | 0.10 U | 0.10 U |
| Nickel | 4.7BJ - 11 | 13.8 | 20.6 | 168 | 26.1 | 13.2 B | 14.0 |
| Potassium | 567B - 861B | 762 B | 804 B | 928 B | 616 B | 1240 | 516 B |
| Selenium | <0.56N - <0.59NW | 0.40 JV | 0.52 BJV | 0.78 BJV | 1.4 JV | 0.23 U | 0.46 JV |
| Silver | <0.51 - <0.57 | 0.60 U | 0.61 U | 0.62 U | 0.59 U | 0.69 U | 0.46 U |
| Sodium | 88BJ - 456B | 96.9 B | 120 B | 260 B | 144 B | 103 B | 47.6 B |
| Thallium | <0.62 - <0.8 | 0.40 U | 0.36 U | 0.45 U | 0.40 U | 0.23 U | 0.23 JV |
| Vanadium | 11B - 13 | 30.6 | 38.0 | 41.8 | 41.7 | 26.5 | 15.2 |
| Zinc | 18J - 22 | 56.8 | 275 | 1310 | 134 | 66.0 | 50.2 |

| Sample Designation: | | S-134 | S-135 | S-139 | MW-54 | MW-58 | CS-43 |
|---|---|---|---|---|---|---|---|
| Sample Depth (ft): | | 2-4 | 3-3.5 | 3-3.1 | 3-5 | 2-3 | 0-2 |
| Sample Date: | | 11/8/93 | 12/7/93 | 12/7/93 | 11/29/93 | 12/7/93 | 1/18/93 |
| Metals (Concentrations in mg/kg) | Background Range* | | | | | | |
| Aluminum | 3850N - 4770 | 6270 | 1910 | 4430 | 1600 | 4050 | -- |
| Antimony | <1.6JN - 2.4BN | 4.9 JV | 4.5 U | 5.1 U | 4.6 U | 5.0 U | -- |
| Arsenic | <0.68W - <1.2 | 8.9 | 0.37 B | 2.5 | 1.1 B | 3.8 BS | -- |
| Barium | 14BJ - 32B | 83.5 | 30.3 JV | 52.0 JV | 34.4 JV | 68.0 JV | -- |
| Beryllium | <0.34 - <0.36 | 0.23 U | 0.21 U | 0.24 U | 0.22 U | 0.31 B | -- |
| Cadmium | <0.73* - <1.1 | 3.7 | 0.43 U | 0.49 U | 0.43 U | 2.5 | -- |
| Calcium | 1400 - 6850 | 2060 | 402 B | 549 B | 242 B | 817 B | -- |
| Chromium | 7.5JN - 13N* | 66.3 JV | 6.7 | 11.6 | 5.1 | 17.7 | -- |
| Cobalt | 3.0B - 3.2BJ | 5.7 B | 1.8 B | 3.4 B | 2.5 B | 6.4 B | -- |
| Copper | 7.8 - 12 | 168 | 21.9 | 54.2 | 22.0 | 406 | -- |
| Iron | 5610 - 11200 | 25200 | 3910 | 10400 | 6810 | 16900 | -- |
| Lead | 3.5 - 8.8N* | 591 | 5.4 JV | 27.1 JV | 18.5 JV | 529 JV | -- |
| Magnesium | 1510 - 4260J | 1760 | 957 B | 1710 | 802 B | 1390 | -- |
| Manganese | 165* - 224 | 206 | 89.3 | 121 | 148 | 112 | -- |
| Mercury | <0.1 | 0.37 JV | 0.10 U | 0.10 U | 0.11 U | 0.12 | 22.5 |
| Nickel | 4.7BJ - 11 | 23.0 | 4.5 B | 8.3 B | 6.5 B | 24.5 | -- |
| Potassium | 567B - 861B | 671 B | 398 B | 421 B | 286 B | 457 B | -- |
| Selenium | <0.56N - <0.59NW | 1.3 BJV | 0.43 JV | 0.49 JV | 0.43 JV | 0.47 JV | -- |
| Silver | <0.51 - <0.57 | 0.47 U | 0.43 U | 0.49 U | 0.43 U | 0.47 U | -- |
| Sodium | 88BJ - 456B | 244 B | 46.8 B | 149 B | 29.3 B | 107 B | -- |
| Thallium | <0.62 - <0.8 | 0.23 U | 0.21 JV | 0.24 JV | 0.22 JV | 0.24 JV | -- |
| Vanadium | 11B - 13 | 46.3 | 5.9 B | 14.9 | 10.7 B | 32.1 | -- |
| Zinc | 18J - 22 | 223 | 38.8 | 38.3 | 37.4 | 763 | -- |

mg/kg - Milligrams per kilogram
U - Indicates analyte result less than method detection limit (MDL).
B - Indicates analyte result between MDL and practical quantitation limit (PQL).
J - Estimated value.
-- - Not analyzed
* - Developed from Phase I RI metals data for soil samples S-30, S-33 and S-35.

Table 11. Summary of Polychlorinated Biphenyl Compound Concentrations Detected in Soil Samples, Sunnyside Yard, Queens, New York.

| Sample Designation: | CS-1a | CS-1DL | CS-3 | CS-5 | CS-6DL |
|---|---|---|---|---|---|
| Sample Depth (ft): | 0-2 | 0-2 | 3-5 | 0-2 | 0-2 |
| Sample Date: | 1/26/93 | 1/26/93 | 11/8/93 | 11/8/93 | 1/25/93 |
| Polychlorinated Biphenyl (PCB) Compounds (Concentrations in ug/kg) | | | | | |
| Aroclor-1016 | 390 U | 3,900 U | 210 U | 190 U | 40,000 U |
| Aroclor-1221 | 790 U | 7,900 U | 210 U | 190 U | 81,000 U |
| Aroclor-1232 | 390 U | 3,900 U | 210 U | 190 U | 40,000 U |
| Aroclor-1242 | 390 U | 3,900 U | 210 U | 190 U | 40,000 U |
| Aroclor-1248 | 700 | 3,900 U | 210 U | 190 U | 40,000 U |
| Aroclor-1254 | 390 U | 3,900 U | 850 | 440 | 40,000 U |
| Aroclor-1260 | 7,400 | 8,600 | 1,400 | 1,700 | 62,000 |

| Sample Designation: | CS-10 | CS-16 | CS-22 | CS-41A | CS-43 |
|---|---|---|---|---|---|
| Sample Depth (ft): | 0-2 | 0-2 | 0-2 | 3.5-5.5 | 0-2 |
| Sample Date: | 11/8/93 | 12/16/93 | 12/15/93 | 12/15/93 | 1/18/93 |
| Polychlorinated Biphenyl (PCB) Compounds (Concentrations in ug/kg) | | | | | |
| Aroclor-1016 | 180 U | 210 U | 170 U | 170 U | 400 U |
| Aroclor-1221 | 180 U | 210 U | 170 U | 170 U | 820 U |
| Aroclor-1232 | 180 U | 210 U | 170 U | 170 U | 400 U |
| Aroclor-1242 | 180 U | 210 U | 170 U | 170 U | 400 U |
| Aroclor-1248 | 180 U | 210 U | 170 U | 170 U | 400 U |
| Aroclor-1254 | 360 U | 790 | 7.3 J | 320 U | 400 U |
| Aroclor-1260 | 370 | 1600 | 16 J | 42 J | 1400 |

| Sample Designation: | CS-47 | CS-49DL | CS-50DL | CS-51DL | CS-53DL |
|---|---|---|---|---|---|
| Sample Depth (ft): | 2-4 | 2-4 | 0-2 | 0-2 | 0-2 |
| Sample Date: | 12/15/93 | 2/1/93 | 1/20/93 | 1/20/93 | 2/1/93 |
| Polychlorinated Biphenyl (PCB) Compounds (Concentrations in ug/kg) | | | | | |
| Aroclor-1016 | 8,600 U | 3,800 U | 380 U | 380 U | 38,000 U |
| Aroclor-1221 | 8,600 U | 7,600 U | 770 U | 770 U | 76,000 U |
| Aroclor-1232 | 8,600 U | 3,800 U | 380 U | 380 U | 38,000 U |
| Aroclor-1242 | 8,600 U | 3,800 U | 380 U | 380 U | 38,000 U |
| Aroclor-1248 | 8,600 U | 3,800 U | 380 U | 380 U | 38,000 U |
| Aroclor-1254 | 29,000 | 3,800 U | 380 U | 380 U | 38,000 U |
| Aroclor-1260 | 20,000 | 17,000 | 270 J | 1,100 J | 88,000 |

Table 11. Summary of Polychlorinated Biphenyl Compound Concentrations Detected in Soil Samples, Sunnyside Yard, Queens, New York.

| Sample Designation: | CS-59 | CS-61 | CS-64 | CS-67 | CS-75DL |
|---|---|---|---|---|---|
| Sample Depth (ft): | 0-2 | 5-7 | 2-3 | 0-2 | 0-2 |
| Sample Date: | 11/9/93 | 11/8/93 | 2/1/93 | 11/8/93 | 1/19/93 |
| Polychlorinated Biphenyl (PCB) Compounds (Concentrations in ug/kg) | | | | | |
| Aroclor-1016 | 170 U | 200 UJ | 400 U | 190 U | 3,700 U |
| Aroclor-1221 | 170 U | 200 UJ | 820 U | 190 U | 7,400 U |
| Aroclor-1232 | 170 U | 200 UJ | 400 U | 190 U | 3,700 U |
| Aroclor-1242 | 170 U | 200 UJ | 400 U | 190 U | 3,700 U |
| Aroclor-1248 | 170 U | 200 UJ | 400 U | 190 U | 3,700 U |
| Aroclor-1254 | 35 J | 400 U | 400 U | 380 U | 3,700 U |
| Aroclor-1260 | 200 J | 97 J | 1,500 J | 430 | 6,900 |

| Sample Designation: | CS-76a | CS-76DL | CS-77 | CS-82 | CS-83DL |
|---|---|---|---|---|---|
| Sample Depth (ft): | 0-0.5 | 0-0.5 | 0-2 | 0-2 | 0-2 |
| Sample Date: | 1/26/93 | 1/26/93 | 11/9/93 | 11/9/93 | 1/25/93 |
| Polychlorinated Biphenyl (PCB) Compounds (Concentrations in ug/kg) | | | | | |
| Aroclor-1016 | 3,800 U | 38,000 U | 180 U | 920 U | 3,600 U |
| Aroclor-1221 | 7,600 U | 76,000 U | 180 U | 920 U | 7,300 U |
| Aroclor-1232 | 3,800 U | 38,000 U | 180 U | 920 U | 3,600 U |
| Aroclor-1242 | 3,800 U | 38,000 U | 180 U | 920 U | 3,600 U |
| Aroclor-1248 | 2,900 J | 38,000 U | 180 U | 920 U | 3,600 U |
| Aroclor-1254 | 3,800 U | 38,000 U | 370 | 4,100 | 3,600 U |
| Aroclor-1260 | 36,000 | 73,000 | 550 | 4,600 | 4,400 |

| Sample Designation: | S-99 | S-100DL | S-101DL | S-102 | S-103DL |
|---|---|---|---|---|---|
| Sample Depth (ft): | 0-2 | 0-2 | 0-2 | 0-2 | 0-2 |
| Sample Date: | 1/18/93 | 1/18/93 | 1/18/93 | 1/18/93 | 1/19/93 |
| Polychlorinated Biphenyl (PCB) Compounds (Concentrations in ug/kg) | | | | | |
| Aroclor-1016 | 38 U | 3,800 U | 38,000 U | 380 U | 36,000 U |
| Aroclor-1221 | 76 U | 7,600 U | 78,000 U | 760 U | 74,000 U |
| Aroclor-1232 | 38 U | 3,800 U | 38,000 U | 380 U | 36,000 U |
| Aroclor-1242 | 38 U | 3,800 U | 38,000 U | 380 U | 36,000 U |
| Aroclor-1248 | 38 U | 3,800 U | 38,000 U | 380 U | 36,000 U |
| Aroclor-1254 | 38 U | 3,800 U | 38,000 U | 380 U | 36,000 U |
| Aroclor-1260 | 120 | 4,100 | 71,000 | 1,400 V | 65,000 |

Table 11. Summary of Polychlorinated Biphenyl Compound Concentrations Detected in Soil Samples, Sunnyside Yard, Queens, New York.

| Sample Designation: | S-104DL | S-105DL | S-106DL | S-107DL | S-108DL |
|---|---|---|---|---|---|
| Sample Depth (ft): | 0-2 | 0-2 | 0-2 | 0-2 | 0-2 |
| Sample Date: | 1/25/93 | 1/25/93 | 1/25/93 | 1/25/93 | 1/25/93 |
| Polychlorinated Biphenyl (PCB) Compounds (Concentrations in ug/kg) | | | | | |
| Aroclor-1016 | 370,000 U | 3,900,000 U | 3,800,000 U | 39,000 U | 3,800 U |
| Aroclor-1221 | 740,000 U | 7,900,000 U | 7,600,000 U | 80,000 U | 7,800 U |
| Aroclor-1232 | 370,000 U | 3,900,000 U | 3,800,000 U | 39,000 U | 3,800 U |
| Aroclor-1242 | 370,000 U | 3,900,000 U | 3,800,000 U | 39,000 U | 3,800 U |
| Aroclor-1248 | 370,000 U | 3,900,000 U | 3,800,000 U | 39,000 U | 3,800 U |
| Aroclor-1254 | 370,000 U | 3,900,000 U | 3,800,000 U | 39,000 U | 3,800 U |
| Aroclor-1260 | 860,000 | 15,000,000 | 20,000,000 | 63,000 | 5,600 |

| Sample Designation: | S-111DL | S-112DL | S-113 | S-114DL | S-115DL |
|---|---|---|---|---|---|
| Sample Depth (ft): | 0-2 | 0-2 | 0-2 | 0-2 | 0-2 |
| Sample Date: | 1/20/93 | 1/20/93 | 1/20/93 | 1/20/93 | 1/20/93 |
| Polychlorinated Biphenyl (PCB) Compounds (Concentrations in ug/kg) | | | | | |
| Aroclor-1016 | 390 U | 380 U | 380 U | 35,000 U | 380 U |
| Aroclor-1221 | 790 U | 780 U | 760 U | 72,000 U | 760 U |
| Aroclor-1232 | 390 U | 380 U | 380 U | 35,000 U | 380 U |
| Aroclor-1242 | 390 U | 380 U | 380 U | 35,000 U | 380 U |
| Aroclor-1248 | 390 U | 380 U | 380 U | 35,000 U | 380 U |
| Aroclor-1254 | 390 U | 380 U | 380 U | 35,000 U | 380 U |
| Aroclor-1260 | 1,500 | 1,700 | 3,100 JV | 90,000 | 590 |

| Sample Designation: | S-122 | S-129 | S-134 | S-135 | S-139 |
|---|---|---|---|---|---|
| Sample Depth (ft): | 7.5-8.5 | 3-5 | 2-4 | 3-3.5 | 3-3.1 |
| Sample Date: | 4/9/94 | 11/29/93 | 11/8/93 | 12/7/93 | 12/7/93 |
| Polychlorinated Biphenyl (PCB) Compounds (Concentrations in ug/kg) | | | | | |
| Aroclor-1016 | 91 U | 200 UJV | 100 U | 170 U | 160 U |
| Aroclor-1221 | 91 U | 200 UJV | 100 U | 170 U | 160 U |
| Aroclor-1232 | 91 U | 200 UJV | 100 U | 170 U | 160 U |
| Aroclor-1242 | 91 U | 200 UJV | 100 U | 170 U | 160 U |
| Aroclor-1248 | 91 U | 200 UJV | 100 U | 170 U | 160 U |
| Aroclor-1254 | 180 U | 400 UJV | 110 J | 12 J | 320 U |
| Aroclor-1260 | 37 J | 190 J | 390 | 340 U | 140 J |

Table 11. Summary of Polychlorinated Biphenyl Compound Concentrations Detected in Soil Samples, Sunnyside Yard, Queens, New York.

| Sample Designation: | CMW-20 | CMW-22 | CMW-30 | CMW-31DL | CMW-34 |
|---|---|---|---|---|---|
| Sample Depth (ft): | 0-2 | 0-2 | 0-2 | 0-2 | 0-2 |
| Sample Date: | 11/8/93 | 11/8/93 | 12/15/93 | 2/1/93 | 12/15/93 |
| Polychlorinated Biphenyl (PCB) Compounds (Concentrations in ug/kg) | | | | | |
| Aroclor-1016 | 200 U | 200 U | 190 U | 4,000 U | 180 U |
| Aroclor-1221 | 200 U | 200 U | 190 U | 8,200 U | 180 U |
| Aroclor-1232 | 200 U | 200 U | 190 U | 4,000 U | 180 U |
| Aroclor-1242 | 200 U | 200 U | 190 U | 4,000 U | 180 U |
| Aroclor-1248 | 200 U | 200 U | 190 U | 4,000 U | 180 U |
| Aroclor-1254 | 190 J | 400 J | 300 J | 4,000 U | 3.5 J |
| Aroclor-1260 | 360 J | 1,100 | 310 J | 10,000 | 360 U |

| Sample Designation: | MW-54 | MW-58 | T-21A* | T-21B* | T-21C* |
|---|---|---|---|---|---|
| Sample Depth (ft): | 3-5 | 2-3 | 0-0.5 | 0-0.5 | 0-0.5 |
| Sample Date: | 11/29/93 | 12/7/93 | 3/2/92 | 3/2/92 | 3/2/92 |
| Polychlorinated Biphenyl (PCB) Compounds (Concentrations in ug/kg) | | | | | |
| Aroclor-1016 | 180 UJV | 88 U | 86 U | 170 U | 85 U |
| Aroclor-1221 | 180 UJV | 88 U | 86 U | 170 U | 85 U |
| Aroclor-1232 | 180 UJV | 88 U | 86 U | 170 U | 85 U |
| Aroclor-1242 | 180 UJV | 88 U | 86 U | 170 U | 85 U |
| Aroclor-1248 | 140 J | 100 | 88 | 170 U | 85 U |
| Aroclor-1254 | 320 UJV | 340 JV | 170 U | 340 U | 170 U |
| Aroclor-1260 | 33 J | 290 JV | 130 J | 640 | 480 |

| Sample Designation: | T-21D* | T-21E* | PD-45* | PD-47* |
|---|---|---|---|---|
| Sample Depth (ft): | 0-0.5 | 0-0.5 | 3-4 | 6.5-7 |
| Sample Date: | 3/2/92 | 3/2/92 | 4/7/93 | 4/7/93 |
| Polychlorinated Biphenyl (PCB) Compounds (Concentrations in ug/kg) | | | | |
| Aroclor-1016 | 460 U | 450 U | 88 U | 88 U |
| Aroclor-1221 | 460 U | 450 U | 88 U | 88 U |
| Aroclor-1232 | 460 U | 450 U | 88 U | 88 U |
| Aroclor-1242 | 460 U | 450 U | 88 U | 140 |
| Aroclor-1248 | 460 U | 450 U | 88 U | 88 U |
| Aroclor-1254 | 920 U | 450 U | 176 U | 390 |
| Aroclor-1260 | 2,300 | 2,400 | 14 J | 270 |

Table 11. Summary of Polychlorinated Biphenyl Compound Concentrations Detected in Soil Samples, Sunnyside Yard, Queens, New York.

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ug/kg - Micrograms per kilogram.
U - Indicates that the compound was analyzed for but not detected.
J - Estimated value.
V - Qualifier added and/or value altered during validation.
* - Non-ASP analyses
a - Aroclor-1248 is considered more representative at the primary dilution.

NOTE: Some samples were analyzed at a secondary (higher) dilution and are designated DL. Based upon data validation, either the primary or secondary results of some Aroclor species are considered to be more representative of actual conditions.

Table 12. Summary of Petroleum Hydrocarbon Compounds Detected in Soil Samples, Sunnyside Yard, Queens, New York.

| Sample Designation: | S-122 | S-129 | S-134 | S-135 | S-139 | MW-54 |
|---|---|---|---|---|---|---|
| Sample Depth (ft): | 8.5-9.5 | 3-5 | 2-4 | 3-3.5 | 3-3.1 | 3-5 |
| Sample Date: | 4/9/94 | 11/29/93 | 11/8/93 | 12/7/93 | 12/7/93 | 11/29/93 |
| Petroleum Hydrocarbon Compounds (Concentrations in mg/kg) | | | | | | |
| Gasoline | U | U | U | U | U | U |
| Kerosene | U | U | U | U | U | U |
| Diesel | U | U | U | U | U | U |
| Residual Oil | U | U | U | U | U | U |
| #2 Fuel Oil | U | 770 | 1,350 | U | U | 11,300 |
| #4 Fuel Oil | U | U | U | U | U | U |
| #6 Fuel Oil | U | U | U | U | U | U |

| Sample Designation: | MW-58 |
|---|---|
| Sample Depth (ft): | 2-3 |
| Sample Date: | 12/7/93 |
| Petroleum Hydrocarbon Compounds (Concentrations in mg/kg) | |
| Gasoline | U |
| Kerosene | U |
| Diesel | U |
| Residual Oil | U |
| #2 Fuel Oil | 13,900 |
| #4 Fuel Oil | U |
| #6 Fuel Oil | U |

mg/kg - Milligrams per kilogram
U - Indicates that the compound was analyzed for but not detected.

Table 13. Summary of Polychlorinated Biphenyl Compound Concentrations Detected in Separate-Phase Petroleum Samples, Sunnyside Yard, Queens, New York.

| Sample Designation:<br>Sample Date:<br>PCB Compounds (Concentrations in ug/kg) | MW-36DL<br>2/8/93 | MW-50<br>2/17/94 | MW-53<br>2/17/94 | MW-54<br>2/17/94 | MW-60<br>2/17/94 |
|---|---|---|---|---|---|
| Aroclor-1016 | 10,000 U | 2,400 U | 2,400 U | 2,400 U | 2,400 U |
| Aroclor-1221 | 20,000 U | 2,400 U | 2,400 U | 2,400 U | 2,400 U |
| Aroclor-1232 | 10,000 U | 2,400 U | 2,400 U | 2,400 U | 2,400 U |
| Aroclor-1242 | 10,000 U | 2,400 U | 2,400 U | 2,400 U | 2,400 U |
| Aroclor-1248 | 10,000 U | 2,400 U | 2,400 U | 2,400 U | 2,400 U |
| Aroclor-1254 | 10,000 U | 4,800 U | 5,300 JV | 5,200 JV | 4,800 UJV |
| Aroclor-1260 | 14,000 | 18,000 | 3,100 JV | 2,200 JV | 830 |

ug/kg - Micrograms per kilogram
U - Indicates that the compound was analyzed for but not detected.
J - Estimated value.
V - Qualifier added and/or value altered during validation.

NOTE: Some samples were analyzed at a secondary (higher) dilution and are designated DL. Based upon data validation, either the primary or secondary results of some Aroclor species are considered to be more representative of actual conditions.

Table 14. Summary of Petroleum Characteristics and Hydrocarbon Compounds Detected in Separate-Phase Petroleum Samples, Sunnyside Yard, Queens, New York.

| Sample Designation:<br>Sample Date: | MW-50<br>2/17/94 | MW-53<br>2/17/94 | MW-54<br>2/17/94 | MW-60<br>2/17/94 |
|---|---|---|---|---|
| **Petroleum Hydrocarbon Compounds (Concentrations in mg/kg)** | | | | |
| Gasoline | U | U | U | U |
| Kerosene | U | U | U | U |
| Diesel | U | U | U | U |
| Residual Oil | U | U | U | U |
| #2 Fuel Oil | 1,090,000 | 961,000 | 1,550,000 | 920,000 |
| #4 Fuel Oil | U | U | U | U |
| #6 Fuel Oil | U | U | U | U |
| **Characteristics** | | | | |
| Specific Gravity @ 60 degrees F (unitless) | 0.8799 | 0.8739 | 0.8704 | 0.8709 |
| Kinematic Viscosity @ 60 degrees F (cSt) | 7.70 | 5.35 | 6.14 | 7.00 |

mg/kg - Milligrams per kilogram
U - Indicates that the compound was analyzed for but not detected.
F - Fahrenheit
cSt - Centistokes

Table 15. Summary of Volatile Organic Compound Concentrations Detected in Ground-Water Samples, Sunnyside Yard, Queens, New York.

| Sample Designation: | | MW-23D | MW-35 | MW-37 | MW-38D | MW-39D | MW-40D |
|---|---|---|---|---|---|---|---|
| Sample Date: | | 2/9/93 | 2/9/93 | 2/17/94 | 2/17/94 | 2/17/94 | 2/17/94 |
| Volatile Organic Compounds (Concentrations in ug/L) | NYS Standard** | | | | | | |
| Chloromethane | -- | 10 U | 10 U | 10 UJV | 10 U | 10 U | 10 U |
| Bromomethane | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Vinyl Chloride | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Chloroethane | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Methylene Chloride | -- | 10 U | 10 U | 5 U | 5 U | 5 U | 5 U |
| Acetone | -- | 10 UV | 10 UV | 10 UV | 10 UV | 10 UV | 10 UV |
| Carbon Disulfide | -- | 10 U | 10 U | 5 U | 5 U | 5 U | 5 U |
| 1,1-Dichloroethene | -- | 10 U | 10 U | 5 U | 5 U | 5 U | 5 U |
| 1,1-Dichloroethane | 5 | 2 J | 10 U | 5 U | 3 J | 5 U | 5 U |
| 1,2-Dichloroethene (total) | 5 | 10 U | 10 U | 5 U | 5 U | 5 U | 5 U |
| Chloroform | -- | 10 U | 10 U | 5 U | 5 U | 5 U | 5 U |
| 1,2-Dichloroethane | -- | 10 U | 10 U | 5 U | 5 U | 5 U | 5 U |
| 2-Butanone | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 1,1,1-Trichloroethane | 5 | 10 U | 10 U | 5 U | 5 U | 5 U | 5 U |
| Carbon Tetrachloride | -- | 10 U | 10 U | 5 U | 5 U | 5 U | 5 U |
| Bromodichloromethane | -- | 10 U | 10 U | 5 U | 5 U | 5 U | 5 U |
| 1,2-Dichloropropane | -- | 10 U | 10 U | 5 U | 5 U | 5 U | 5 U |
| cis-1,3-Dichloropropene | -- | 10 U | 10 U | 5 U | 5 U | 5 U | 5 U |
| Trichloroethene | 5 | 10 U | 10 U | 5 U | 5 U | 5 U | 5 U |
| Dibromochloromethane | -- | 10 U | 10 U | 5 U | 5 U | 5 U | 5 U |
| 1,1,2-Trichloroethane | -- | 10 U | 10 U | 5 U | 5 U | 5 U | 5 U |
| Benzene | -- | 10 U | 10 U | 5 U | 5 U | 5 U | 5 U |
| trans-1,3-Dichloropropene | -- | 10 U | 10 U | 5 U | 5 U | 5 U | 5 U |
| Bromoform | -- | 10 U | 10 U | 5 U | 5 U | 5 U | 5 U |
| 4-Methyl-2-Pentanone | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2-Hexanone | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Tetrachloroethene | 5 | 10 U | 10 U | 5 U | 5 U | 5 U | 5 |
| 1,1,2,2-Tetrachloroethane | 5 | 10 U | 10 U | 5 U | 5 U | 5 U | 5 U |
| Toluene | -- | 10 U | 10 U | 5 U | 5 U | 5 U | 5 U |
| Chlorobenzene | -- | 10 U | 10 U | 5 U | 5 U | 5 U | 5 U |
| Ethylbenzene | 5 | 10 U | 10 U | 5 U | 5 U | 5 U | 5 U |
| Styrene | -- | 10 U | 10 U | 5 U | 5 U | 5 U | 5 U |
| Xylenes (total) | 15 | 1 J | 10 U | 5 U | 5 U | 5 U | 5 U |

Table 15. Summary of Volatile Organic Compound Concentrations Detected in Ground-Water Samples, Sunnyside Yard, Queens, New York.

| Sample Designation:<br>Sample Date: | | MW-41<br>2/9/93 | MW-42<br>2/9/93 | MW-43<br>2/9/93 | MW-44D<br>2/9/93 | MW-45<br>2/9/93 | MW-45*<br>2/9/93 |
|---|---|---|---|---|---|---|---|
| Volatile Organic Compounds (Concentrations in ug/L) | NYS Standard** | | | | | | |
| Chloromethane | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Bromomethane | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Vinyl Chloride | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Chloroethane | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Methylene Chloride | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Acetone | -- | 10 U | 10 U | 10 UV | 10 UV | 10 UV | 10 U |
| Carbon Disulfide | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 1,1-Dichloroethene | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 1,1-Dichloroethane | 5 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 1,2-Dichloroethene (total) | 5 | 10 U | 10 U | 2 J | 46 | 10 U | 10 U |
| Chloroform | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 1,2-Dichloroethane | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2-Butanone | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 1,1,1-Trichloroethane | 5 | 10 U | 10 U | 10 U | 10 U | 2 J | 1 J |
| Carbon Tetrachloride | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Bromodichloromethane | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 1,2-Dichloropropane | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| cis-1,3-Dichloropropene | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Trichloroethene | 5 | 10 U | 10 U | 11 | 75 | 10 U | 10 U |
| Dibromochloromethane | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 1,1,2-Trichloroethane | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Benzene | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| trans-1,3-Dichloropropene | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Bromoform | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Methyl-2-Pentanone | -- | 10 U | 10 U | 10 U | 10 UV | 10 U | 10 U |
| 2-Hexanone | -- | 10 U | 10 U | 10 U | 10 UV | 10 U | 10 U |
| Tetrachloroethene | 5 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 1,1,2,2-Tetrachloroethane | 5 | 10 U | 10 U | 10 U | 2 J | 10 U | 10 U |
| Toluene | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Chlorobenzene | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Ethylbenzene | 5 | 2 J | 10 U | 10 U | 10 U | 10 U | 10 U |
| Styrene | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Xylenes (total) | 15 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |

Table 15. Summary of Volatile Organic Compound Concentrations Detected in Ground-Water Samples, Sunnyside Yard, Queens, New York.

| Sample Designation:<br>Sample Date: | | MW-46<br>2/9/93 | MW-47<br>2/9/93 | MW-48D<br>2/9/93 | MW-49<br>2/17/94 | MW-57<br>2/17/94 | MW-57*<br>2/17/94 |
|---|---|---|---|---|---|---|---|
| Volatile Organic Compounds (Concentrations in ug/L) | NYS Standard** | | | | | | |
| Chloromethane | -- | 10 U | 10 U | 10 U | 10 UJV | 10 U | 10 UJV |
| Bromomethane | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Vinyl Chloride | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Chloroethane | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Methylene Chloride | -- | 10 U | 10 U | 10 U | 5 U | 5 U | 5 U |
| Acetone | -- | 10 UV | 10 UV | 10 UV | 10 U | 10 U | 10 UV |
| Carbon Disulfide | -- | 10 U | 10 U | 10 U | 5 U | 5 U | 5 U |
| 1,1-Dichloroethene | -- | 10 U | 10 U | 10 U | 5 U | 5 U | 5 U |
| 1,1-Dichloroethane | 5 | 10 U | 10 U | 10 U | 5 U | 5 U | 5 U |
| 1,2-Dichloroethene (total) | 5 | 10 U | 10 U | 10 U | 5 U | 5 U | 5 U |
| Chloroform | -- | 10 U | 10 U | 10 U | 5 U | 5 U | 5 U |
| 1,2-Dichloroethane | -- | 10 U | 10 U | 10 U | 5 U | 5 U | 5 U |
| 2-Butanone | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 1,1,1-Trichloroethane | 5 | 10 U | 10 U | 10 U | 5 U | 5 U | 5 U |
| Carbon Tetrachloride | -- | 10 U | 10 U | 10 U | 5 U | 5 U | 5 U |
| Bromodichloromethane | -- | 10 U | 10 U | 10 U | 5 U | 5 U | 5 U |
| 1,2-Dichloropropane | -- | 10 U | 10 U | 10 U | 5 U | 5 U | 5 U |
| cis-1,3-Dichloropropene | -- | 10 U | 10 U | 10 U | 5 U | 5 U | 5 U |
| Trichloroethene | 5 | 10 U | 10 U | 10 U | 5 U | 5 U | 5 U |
| Dibromochloromethane | -- | 10 U | 10 U | 10 U | 5 U | 5 U | 5 U |
| 1,1,2-Trichloroethane | -- | 10 U | 10 U | 10 U | 5 U | 5 U | 5 U |
| Benzene | -- | 10 U | 10 U | 10 U | 5 U | 5 U | 5 U |
| trans-1,3-Dichloropropene | -- | 10 U | 10 U | 10 U | 5 U | 5 U | 5 U |
| Bromoform | -- | 10 U | 10 U | 10 U | 5 U | 5 U | 5 U |
| 4-Methyl-2-Pentanone | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2-Hexanone | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Tetrachloroethene | 5 | 10 U | 10 U | 10 U | 5 U | 5 U | 5 U |
| 1,1,2,2-Tetrachloroethane | 5 | 10 U | 10 U | 10 U | 5 U | 5 U | 5 U |
| Toluene | -- | 10 U | 10 U | 10 U | 5 U | 5 U | 5 U |
| Chlorobenzene | -- | 10 U | 10 U | 10 U | 5 U | 5 U | 5 U |
| Ethylbenzene | 5 | 10 U | 10 U | 10 U | 5 U | 5 U | 5 U |
| Styrene | -- | 10 U | 10 U | 10 U | 5 U | 5 U | 5 U |
| Xylenes (total) | 15 | 10 U | 10 U | 10 U | 5 U | 5 U | 5 U |

Table 15. Summary of Volatile Organic Compound Concentrations Detected in Ground-Water Samples, Sunnyside Yard, Queens, New York.

| Sample Designation: | | MW-59 | MW-61 | MW-62D | MW-63 | TW-1 | TW-2 |
|---|---|---|---|---|---|---|---|
| Sample Date: | | 2/17/94 | 2/17/94 | 2/17/94 | 2/17/94 | 1/26/93 | 1/26/93 |
| Volatile Organic Compounds (Concentrations in ug/L) | NYS Standard** | | | | | | |
| Chloromethane | -- | 10 U | 10 UJV | 10 UJV | 10 U | 10 U | 10 U |
| Bromomethane | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Vinyl Chloride | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Chloroethane | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Methylene Chloride | -- | 5 U | 5 U | 5 U | 5 U | 10 U | 10 U |
| Acetone | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 13 UV |
| Carbon Disulfide | -- | 5 U | 5 U | 5 U | 5 U | 10 U | 10 UV |
| 1,1-Dichloroethene | -- | 5 U | 5 U | 5 U | 5 U | 10 U | 10 U |
| 1,1-Dichloroethane | 5 | 5 U | 5 U | 5 U | 3 J | 10 U | 10 U |
| 1,2-Dichloroethene (total) | 5 | 5 U | 5 U | 5 U | 14 | 10 U | 10 U |
| Chloroform | -- | 5 U | 5 U | 5 U | 5 U | 10 U | 10 U |
| 1,2-Dichloroethane | -- | 5 U | 5 U | 5 U | 5 U | 10 U | 10 U |
| 2-Butanone | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 1,1,1-Trichloroethane | 5 | 5 U | 5 U | 5 U | 5 U | 10 U | 10 U |
| Carbon Tetrachloride | -- | 5 U | 5 U | 5 U | 5 U | 10 U | 10 U |
| Bromodichloromethane | -- | 5 U | 5 U | 5 U | 5 U | 10 U | 10 U |
| 1,2-Dichloropropane | -- | 5 U | 5 U | 5 U | 5 U | 10 U | 10 U |
| cis-1,3-Dichloropropene | -- | 5 U | 5 U | 5 U | 5 U | 10 U | 10 U |
| Trichloroethene | 5 | 5 U | 5 U | 5 U | 24 | 10 U | 10 U |
| Dibromochloromethane | -- | 5 U | 5 U | 5 U | 5 U | 10 U | 10 U |
| 1,1,2-Trichloroethane | -- | 5 U | 5 U | 5 U | 5 U | 10 U | 10 U |
| Benzene | -- | 5 U | 5 U | 5 U | 5 U | 10 U | 10 U |
| trans-1,3-Dichloropropene | -- | 5 U | 5 U | 5 U | 5 U | 10 U | 10 U |
| Bromoform | -- | 5 U | 5 U | 5 U | 5 U | 10 U | 10 U |
| 4-Methyl-2-Pentanone | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2-Hexanone | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Tetrachloroethene | 5 | 5 U | 9 | 3 J | 23 | 10 U | 10 U |
| 1,1,2,2-Tetrachloroethane | 5 | 5 U | 5 U | 5 U | 5 U | 10 U | 10 U |
| Toluene | -- | 5 U | 5 U | 5 U | 5 U | 10 U | 10 UV |
| Chlorobenzene | -- | 5 U | 5 U | 5 U | 5 U | 10 U | 10 U |
| Ethylbenzene | 5 | 5 U | 5 U | 5 U | 5 U | 10 U | 10 U |
| Styrene | -- | 5 U | 5 U | 5 U | 5 U | 10 U | 10 U |
| Xylenes (total) | 15 | 5 U | 5 U | 5 U | 5 U | 10 U | 10 U |

ug/L - Micrograms per liter
U - Indicates that the compound was analyzed for but not detected.
J - Estimated value.
V - Qualifier added and/or value altered during validation.
* - Indicates blind replicate sample.
** - NYS Standards taken from October, 1993 New York State Department of Environmental Conservation Division of Water Technical and Operational Guidance Series (1.1.1.), Ambient Water Quality Standards and Guidance Values. Standards are only for those compounds for which concentrations were detected.

Table 16. Summary of Semivolatile Organic Compound Concentrations Detected in Ground-Water Samples, Sunnyside Yard, Queens, New York.

| Sample Designation:<br>Sample Date: | | MW-23D<br>2/9/93 | MW-35<br>2/9/93 | MW-37<br>2/17/94 | MW-38D<br>2/17/94 | MW-39D<br>2/17/94 | MW-40D<br>2/17/94 |
|---|---|---|---|---|---|---|---|
| Semivolatile Organic Compounds (Concentrations in ug/L) | NYS Standard** | | | | | | |
| Phenol | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 URV |
| bis(2-Chloroethyl)ether | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 U |
| 2-Chlorophenol | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 URV |
| 1,3-Dichlorobenzene | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 U |
| 1,4-Dichlorobenzene | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 U |
| Benzyl alcohol | -- | NA | NA | 11 U | 11 U | 11 U | 11 U |
| 1,2-Dichlorobenzene | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 U |
| 2-Methylphenol | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 U |
| 2,2'-oxybis(1-Chloropropane) | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 U |
| 4-Methylphenol | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 U |
| N-Nitroso-di-n-propylamine | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 U |
| Hexachloroethane | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 U |
| Nitrobenzene | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 U |
| Isophorone | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 U |
| 2-Nitrophenol | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 URV |
| 2,4-Dimethylphenol | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 URV |
| Benzoic acid | NS | NA | NA | 53 U | 53 U | 53 U | 54 U |
| bis(2-Chloroethoxy)methane | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 U |
| 2,4-Dichlorophenol | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 URV |
| 1,2,4-Trichlorobenzene | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 U |
| Naphthalene | 10 | 10 U | 10 U | 0.4 J | 11 U | 1 J | 11 U |
| 4-Chloroaniline | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 U |
| Hexachlorobutadiene | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 U |
| 4-Chloro-3-Methylphenol | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 URV |
| 2-Methylnaphthalene | NS | 23 | 5 J | 11 U | 11 U | 11 U | 11 U |
| Hexachlorocyclopentadiene | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 U |
| 2,4,6-Trichlorophenol | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 URV |
| 2,4,5-Trichlorophenol | -- | 25 U | 25 U | 53 U | 53 U | 53 U | 54 URV |
| 2-Chloronaphthalene | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 U |
| 2-Nitroaniline | -- | 25 U | 25 U | 53 U | 53 U | 53 U | 54 U |
| Dimethyl Phthalate | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 U |
| Acenaphthylene | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 U |
| 2,6-Dinitrotoluene | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 U |
| 3-Nitroaniline | -- | 25 U | 25 U | 53 U | 53 U | 53 U | 54 U |
| Acenaphthene | (20) | 4 J | 2 J | 11 U | 11 U | 11 U | 11 U |
| 2,4-Dinitrophenol | -- | 25 U | 25 U | 53 U | 53 U | 53 U | 54 URV |
| 4-Nitrophenol | -- | 25 U | 25 U | 53 U | 53 U | 53 U | 54 URV |
| Dibenzofuran | NS | 4 J | 10 U | 1 J | 11 U | 11 U | 11 U |
| 2,4-Dinitrotoluene | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 U |
| Diethylphthalate | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 U |
| 4-Chlorophenyl-phenylether | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 U |
| Fluorene | (50) | 10 U | 10 U | 11 U | 11 U | 11 U | 11 U |
| 4-Nitroaniline | -- | 25 U | 25 U | 53 U | 53 U | 53 U | 54 U |
| 4,6-Dinitro-2-methylphenol | -- | 25 U | 25 U | 53 U | 53 U | 53 U | 54 U |
| N-Nitrosodiphenylamine (1) | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 U |
| 4-Bromophenyl-phenylether | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 U |
| Hexachlorobenzene | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 U |
| Pentachlorophenol | -- | 25 U | 25 U | 53 U | 53 U | 53 U | 54 URV |
| Phenanthrene | (50) | 2 J | 10 U | 11 U | 11 U | 11 U | 11 U |
| Anthracene | (50) | 10 U | 1 J | 11 U | 11 U | 11 U | 11 U |
| Di-n-butylphthalate | -- | 10 U | 10 UV | 11 UV | 11 UV | 11 U | 11 UV |
| Fluoranthene | (50) | 10 U | 1 J | 11 U | 11 U | 11 U | 11 U |
| Pyrene | (50) | 10 U | 0.9 J | 0.4 J | 11 U | 11 U | 11 U |
| Butylbenzylphthalate | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 U |
| 3,3'-Dichlorobenzidine | -- | 10 U | 10 U | 21 U | 21 U | 21 U | 22 U |
| Benzo(a)anthracene | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 U |
| Chrysene | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 U |
| Bis(2-Ethylhexyl)phthalate | -- | 10 UV | 10 UV | 11 UV | 11 UV | 11 UV | 11 UV |
| Di-n-octylphthalate | (50) | 10 U | 10 U | 11 U | 11 U | 11 U | 11 U |
| Benzo(b)fluoranthene | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 U |
| Benzo(k)fluoranthene | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 U |
| Benzo(a)pyrene | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 U |
| Indeno(1,2,3-cd)pyrene | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 U |
| Dibenzo(a,h)anthracene | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 U |
| Benzo(g,h,i)perylene | -- | 10 U | 10 U | 11 U | 11 U | 11 U | 11 U |

Table 16. Summary of Semivolatile Organic Compound Concentrations Detected in Ground-Water Samples, Sunnyside Yard, Queens, New York.

| Sample Designation:<br>Sample Date: | | MW-42<br>2/9/93 | MW-43<br>2/9/93 | MW-44D<br>2/9/93 | MW-45<br>2/9/93 | MW-45*<br>2/9/93 | MW-46<br>2/9/93 |
|---|---|---|---|---|---|---|---|
| Semivolatile Organic Compounds (Concentrations in ug/L) | NYS Standard** | | | | | | |
| Phenol | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| bis(2-Chloroethyl)ether | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2-Chlorophenol | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 1,3-Dichlorobenzene | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 1,4-Dichlorobenzene | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Benzyl alcohol | -- | NA | NA | NA | NA | NA | NA |
| 1,2-Dichlorobenzene | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2-Methylphenol | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,2'-oxybis(1-Chloropropane) | -- | 10 U | 10 UJV | 10 UJV | 10 UJV | 10 UJV | 10 UJV |
| 4-Methylphenol | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| N-Nitroso-di-n-propylamine | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Hexachloroethane | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Nitrobenzene | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Isophorone | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2-Nitrophenol | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,4-Dimethylphenol | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Benzoic acid | NS | NA | NA | NA | NA | NA | NA |
| bis(2-Chloroethoxy)methane | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,4-Dichlorophenol | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 1,2,4-Trichlorobenzene | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Naphthalene | 10 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Chloroaniline | -- | 10 U | 10 UJV | 10 UJV | 10 UJV | 10 UJV | 10 UJV |
| Hexachlorobutadiene | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Chloro-3-Methylphenol | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2-Methylnaphthalene | NS | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Hexachlorocyclopentadiene | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,4,6-Trichlorophenol | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,4,5-Trichlorophenol | -- | 25 U | 26 U | 26 U | 26 U | 26 U | 26 U |
| 2-Chloronaphthalene | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2-Nitroaniline | -- | 25 U | 26 U | 26 U | 26 U | 26 U | 26 U |
| Dimethyl Phthalate | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Acenaphthylene | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,6-Dinitrotoluene | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 3-Nitroaniline | -- | 25 U | 26 U | 26 U | 26 U | 26 U | 26 U |
| Acenaphthene | (20) | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,4-Dinitrophenol | -- | 25 U | 26 UJV | 26 UJV | 26 UJV | 26 UJV | 26 UJV |
| 4-Nitrophenol | -- | 25 U | 26 U | 26 U | 26 U | 26 U | 26 U |
| Dibenzofuran | NS | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2,4-Dinitrotoluene | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Diethylphthalate | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Chlorophenyl-phenylether | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Fluorene | (50) | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Nitroaniline | -- | 25 U | 26 U | 26 U | 26 U | 26 U | 26 U |
| 4,6-Dinitro-2-methylphenol | -- | 25 U | 26 U | 26 U | 26 U | 26 U | 26 U |
| N-Nitrosodiphenylamine (1) | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Bromophenyl-phenylether | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Hexachlorobenzene | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Pentachlorophenol | -- | 25 U | 26 U | 26 U | 26 U | 26 U | 26 U |
| Phenanthrene | (50) | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Anthracene | (50) | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Di-n-butylphthalate | -- | 10 U | 10 UV | 10 UV | 10 U | 10 UV | 10 UV |
| Fluoranthene | (50) | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Pyrene | (50) | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Butylbenzylphthalate | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 3,3'-Dichlorobenzidine | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Benzo(a)anthracene | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Chrysene | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Bis(2-Ethylhexyl)phthalate | -- | 10 UV | 10 UV | 10 UV | 10 UV | 10 UV | 10 U |
| Di-n-octylphthalate | (50) | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Benzo(b)fluoranthene | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Benzo(k)fluoranthene | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Benzo(a)pyrene | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Indeno(1,2,3-cd)pyrene | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Dibenzo(a,h)anthracene | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Benzo(g,h,i)perylene | -- | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |

Table 16. Summary of Semivolatile Organic Compound Concentrations Detected in Ground-Water Samples, Sunnyside Yard, Queens, New York.

| Sample Designation:<br>Sample Date: | | MW-47<br>2/9/93 | MW-48D<br>2/9/93 | MW-49<br>2/17/94 | MW-57<br>2/17/94 | MW-57*<br>2/17/94 | MW-59<br>2/17/94 |
|---|---|---|---|---|---|---|---|
| Semivolatile Organic Compounds (Concentrations in ug/L) | NYS Standard** | | | | | | |
| Phenol | -- | 10 U | 10 U | 10 URV | 10 U | 11 U | 10 U |
| bis(2-Chloroethyl)ether | -- | 10 U | 10 U | 10 U | 10 U | 11 U | 10 U |
| 2-Chlorophenol | -- | 10 U | 10 U | 10 URV | 10 U | 11 U | 10 U |
| 1,3-Dichlorobenzene | -- | 10 U | 10 U | 10 U | 10 U | 11 U | 10 U |
| 1,4-Dichlorobenzene | -- | 10 U | 10 U | 10 U | 10 U | 11 U | 10 U |
| Benzyl alcohol | -- | NA | NA | 10 U | 10 U | 11 U | 10 U |
| 1,2-Dichlorobenzene | -- | 10 U | 10 U | 10 U | 10 U | 11 U | 10 U |
| 2-Methylphenol | -- | 10 U | 10 U | 10 URV | 10 U | 11 U | 10 U |
| 2,2'-oxybis(1-Chloropropane) | -- | 10 UJV | 10 U | 10 U | 10 U | 11 U | 10 U |
| 4-Methylphenol | -- | 10 U | 10 U | 10 URV | 10 U | 11 U | 10 U |
| N-Nitroso-di-n-propylamine | -- | 10 U | 10 U | 10 U | 10 U | 11 U | 10 U |
| Hexachloroethane | -- | 10 U | 10 U | 10 U | 10 U | 11 U | 10 U |
| Nitrobenzene | -- | 10 U | 10 U | 10 U | 10 U | 11 U | 10 U |
| Isophorone | -- | 10 U | 10 U | 10 U | 10 U | 11 U | 10 U |
| 2-Nitrophenol | -- | 10 U | 10 U | 10 URV | 10 U | 11 U | 10 U |
| 2,4-Dimethylphenol | -- | 10 U | 10 U | 10 URV | 10 U | 11 U | 10 U |
| Benzoic acid | NS | NA | NA | 51 U | 50 U | 53 U | 50 U |
| bis(2-Chloroethoxy)methane | -- | 10 U | 10 U | 10 U | 10 U | 11 U | 10 U |
| 2,4-Dichlorophenol | -- | 10 U | 10 U | 10 URV | 10 U | 11 U | 10 U |
| 1,2,4-Trichlorobenzene | -- | 10 U | 10 U | 10 U | 10 U | 11 U | 10 U |
| Naphthalene | 10 | 10 U | 10 U | 2 J | 10 U | 11 U | 10 U |
| 4-Chloroaniline | -- | 10 UJV | 10 U | 10 UJV | 10 UJV | 11 UJV | 10 U |
| Hexachlorobutadiene | -- | 10 U | 10 U | 10 U | 10 U | 11 U | 10 U |
| 4-Chloro-3-Methylphenol | -- | 10 U | 10 U | 10 URV | 10 U | 11 U | 10 U |
| 2-Methylnaphthalene | NS | 10 U | 10 U | 0.4 J | 10 U | 11 U | 10 U |
| Hexachlorocyclopentadiene | -- | 10 U | 10 U | 10 U | 10 U | 11 U | 10 U |
| 2,4,6-Trichlorophenol | -- | 10 U | 10 U | 10 URV | 10 U | 11 U | 10 U |
| 2,4,5-Trichlorophenol | -- | 26 U | 26 U | 51 URV | 50 U | 53 U | 50 U |
| 2-Chloronaphthalene | -- | 10 U | 10 U | 10 U | 10 U | 11 U | 10 U |
| 2-Nitroaniline | -- | 26 U | 26 U | 51 U | 50 U | 53 U | 50 U |
| Dimethyl Phthalate | -- | 10 U | 10 U | 10 U | 10 U | 11 U | 10 U |
| Acenaphthylene | -- | 10 U | 10 U | 10 U | 10 U | 11 U | 10 U |
| 2,6-Dinitrotoluene | -- | 10 U | 10 U | 10 U | 10 U | 11 U | 10 U |
| 3-Nitroaniline | -- | 26 U | 26 U | 51 U | 50 U | 53 U | 50 U |
| Acenaphthene | (20) | 10 U | 10 U | 3 J | 10 U | 11 U | 10 U |
| 2,4-Dinitrophenol | -- | 26 UJV | 26 U | 51 URV | 50 U | 53 U | 50 U |
| 4-Nitrophenol | -- | 26 U | 26 U | 51 URV | 50 U | 53 U | 50 U |
| Dibenzofuran | NS | 10 U | 10 U | 0.8 J | 10 U | 11 U | 10 U |
| 2,4-Dinitrotoluene | -- | 10 U | 10 U | 10 U | 10 U | 11 U | 10 U |
| Diethylphthalate | -- | 10 U | 10 U | 10 U | 10 U | 11 U | 10 U |
| 4-Chlorophenyl-phenylether | -- | 10 U | 10 U | 10 U | 10 U | 11 U | 10 U |
| Fluorene | (50) | 10 U | 10 U | 3 J | 10 U | 11 U | 10 U |
| 4-Nitroaniline | -- | 26 U | 26 U | 51 U | 50 U | 53 U | 50 U |
| 4,6-Dinitro-2-methylphenol | -- | 26 U | 26 U | 51 URV | 50 UJV | 53 UJV | 50 U |
| N-Nitrosodiphenylamine (1) | -- | 10 U | 10 U | 10 U | 10 U | 11 U | 10 U |
| 4-Bromophenyl-phenylether | -- | 10 U | 10 U | 10 U | 10 U | 11 U | 10 U |
| Hexachlorobenzene | -- | 10 U | 10 U | 10 U | 10 U | 11 U | 10 U |
| Pentachlorophenol | -- | 26 U | 26 U | 51 URV | 50 U | 53 U | 50 U |
| Phenanthrene | (50) | 10 U | 10 U | 0.5 J | 10 U | 11 U | 10 U |
| Anthracene | (50) | 10 U | 10 U | 0.2 J | 10 U | 11 U | 10 U |
| Di-n-butylphthalate | -- | 10 U | 10 UV | 10 UV | 10 UV | 11 UV | 10 UV |
| Fluoranthene | (50) | 10 U | 10 U | 0.2 J | 10 U | 11 U | 10 U |
| Pyrene | (50) | 10 U | 10 U | 0.4 J | 10 U | 11 U | 10 U |
| Butylbenzylphthalate | -- | 10 U | 10 U | 10 U | 10 U | 11 U | 10 U |
| 3,3'-Dichlorobenzidine | -- | 10 U | 10 U | 20 U | 20 U | 21 U | 20 U |
| Benzo(a)anthracene | -- | 10 U | 10 U | 10 U | 10 U | 11 U | 10 U |
| Chrysene | -- | 10 U | 10 U | 10 U | 10 U | 11 U | 10 U |
| Bis(2-Ethylhexyl)phthalate | -- | 10 UV | 10 U | 10 UV | 10 UV | 11 UV | 10 UV |
| Di-n-octylphthalate | (50) | 10 U | 10 U | 10 UJV | 10 UJV | 11 U | 10 U |
| Benzo(b)fluoranthene | -- | 10 U | 10 U | 10 UJV | 10 UJV | 11 U | 10 U |
| Benzo(k)fluoranthene | -- | 10 U | 10 U | 10 UJV | 10 UJV | 11 U | 10 U |
| Benzo(a)pyrene | -- | 10 U | 10 U | 10 UJV | 10 UJV | 11 U | 10 U |
| Indeno(1,2,3-cd)pyrene | -- | 10 U | 10 U | 10 UJV | 10 UJV | 11 U | 10 U |
| Dibenzo(a,h)anthracene | -- | 10 U | 10 U | 10 UJV | 10 UJV | 11 U | 10 U |
| Benzo(g,h,i)perylene | -- | 10 U | 10 U | 10 UJV | 10 UJV | 11 U | 10 U |

Table 16. Summary of Semivolatile Organic Compound Concentrations Detected in Ground-Water Samples, Sunnyside Yard, Queens, New York.

| Sample Designation:<br>Sample Date: | | MW-61<br>2/17/94 | MW-62D<br>2/17/94 | MW-63<br>2/17/94 | TW-3<br>12/6/93 |
|---|---|---|---|---|---|
| Semivolatile Organic Compounds (Concentrations in ug/L) | NYS Standard** | | | | |
| Phenol | -- | 11 U | 11 U | 11 URV | 11 U |
| bis(2-Chloroethyl)ether | -- | 11 U | 11 U | 11 U | 11 U |
| 2-Chlorophenol | -- | 11 U | 11 U | 11 URV | 11 U |
| 1,3-Dichlorobenzene | -- | 11 U | 11 U | 11 U | 11 U |
| 1,4-Dichlorobenzene | -- | 11 U | 11 U | 11 U | 11 U |
| Benzyl alcohol | -- | 11 U | 11 U | 11 U | 11 U |
| 1,2-Dichlorobenzene | -- | 11 U | 11 U | 11 U | 11 U |
| 2-Methylphenol | -- | 11 U | 11 U | 11 URV | 11 U |
| 2,2'-oxybis(1-Chloropropane) | -- | 11 U | 11 U | 11 U | 11 U |
| 4-Methylphenol | -- | 11 U | 11 U | 11 URV | 11 U |
| N-Nitroso-di-n-propylamine | -- | 11 U | 11 U | 11 U | 11 U |
| Hexachloroethane | -- | 11 U | 11 U | 11 U | 11 U |
| Nitrobenzene | -- | 11 U | 11 U | 11 U | 11 U |
| Isophorone | -- | 11 U | 11 U | 11 U | 11 U |
| 2-Nitrophenol | -- | 11 U | 11 U | 11 URV | 11 U |
| 2,4-Dimethylphenol | -- | 11 U | 11 U | 11 U | 11 U |
| Benzoic acid | NS | 56 U | 53 U | 56 U | 10 J |
| bis(2-Chloroethoxy)methane | -- | 11 U | 11 U | 11 U | 11 U |
| 2,4-Dichlorophenol | -- | 11 U | 11 U | 11 URV | 11 U |
| 1,2,4-Trichlorobenzene | -- | 11 U | 11 U | 11 U | 11 U |
| Naphthalene | 10 | 11 U | 0.4 J | 0.1 J | 1 J |
| 4-Chloroaniline | -- | 11 UJV | 11 UJV | 11 U | 11 U |
| Hexachlorobutadiene | -- | 11 U | 11 U | 11 U | 11 U |
| 4-Chloro-3-Methylphenol | -- | 11 U | 11 U | 11 U | 11 U |
| 2-Methylnaphthalene | NS | 11 U | 11 U | 11 U | 11 U |
| Hexachlorocyclopentadiene | -- | 11 U | 11 U | 11 U | 11 U |
| 2,4,6-Trichlorophenol | -- | 11 U | 11 U | 11 URV | 11 U |
| 2,4,5-Trichlorophenol | -- | 56 U | 53 U | 56 URV | 56 U |
| 2-Chloronaphthalene | -- | 11 U | 11 U | 11 U | 11 U |
| 2-Nitroaniline | -- | 56 U | 53 U | 56 U | 56 U |
| Dimethyl Phthalate | -- | 11 U | 11 U | 11 U | 11 U |
| Acenaphthylene | -- | 11 U | 11 U | 11 U | 11 U |
| 2,6-Dinitrotoluene | -- | 11 U | 11 U | 11 U | 11 U |
| 3-Nitroaniline | -- | 56 U | 53 U | 56 U | 56 U |
| Acenaphthene | (20) | 11 U | 11 U | 11 U | 11 U |
| 2,4-Dinitrophenol | -- | 56 U | 53 U | 56 URV | 56 U |
| 4-Nitrophenol | -- | 56 U | 53 U | 56 URV | 56 U |
| Dibenzofuran | NS | 11 U | 11 U | 11 U | 11 U |
| 2,4-Dinitrotoluene | -- | 11 U | 11 U | 11 U | 11 U |
| Diethylphthalate | -- | 11 U | 11 U | 0.5 J | 11 U |
| 4-Chlorophenyl-phenylether | -- | 11 U | 11 U | 11 U | 11 U |
| Fluorene | (50) | 11 U | 11 U | 11 U | 11 U |
| 4-Nitroaniline | -- | 56 U | 53 U | 56 U | 56 U |
| 4,6-Dinitro-2-methylphenol | -- | 56 UJV | 53 UJV | 56 UJV | 56 U |
| N-Nitrosodiphenylamine (1) | -- | 11 U | 11 U | 11 U | 11 U |
| 4-Bromophenyl-phenylether | -- | 11 U | 11 U | 11 U | 11 U |
| Hexachlorobenzene | -- | 11 U | 11 U | 11 U | 11 U |
| Pentachlorophenol | -- | 56 U | 53 U | 56 URV | 56 U |
| Phenanthrene | (50) | 11 U | 11 U | 11 U | 11 U |
| Anthracene | (50) | 11 U | 11 U | 11 U | 11 U |
| Di-n-butylphthalate | -- | 11 UV | 11 U | 11 UV | 11 U |
| Fluoranthene | (50) | 11 U | 11 U | 11 U | 11 U |
| Pyrene | (50) | 11 U | 11 U | 11 U | 0.7 J |
| Butylbenzylphthalate | -- | 11 U | 11 U | 11 U | 11 U |
| 3,3'-Dichlorobenzidine | -- | 22 U | 22 U | 22 U | 20 U |
| Benzo(a)anthracene | -- | 11 U | 11 U | 11 U | 11 U |
| Chrysene | -- | 11 U | 11 U | 11 U | 11 U |
| Bis(2-Ethylhexyl)phthalate | -- | 11 UV | 11 UV | 11 UV | 10 UV |
| Di-n-octylphthalate | (50) | 11 U | 11 U | 11 UV | 0.8 J |
| Benzo(b)fluoranthene | -- | 11 U | 11 U | 11 U | 11 U |
| Benzo(k)fluoranthene | -- | 11 U | 11 U | 11 U | 11 U |
| Benzo(a)pyrene | -- | 11 U | 11 U | 11 U | 11 U |
| Indeno(1,2,3-cd)pyrene | -- | 11 U | 11 U | 11 U | 11 U |
| Dibenzo(a,h)anthracene | -- | 11 U | 11 U | 11 U | 11 U |
| Benzo(g,h,i)perylene | -- | 11 U | 11 U | 11 U | 11 U |

Table 16. Summary of Semivolatile Organic Compound Concentrations Detected in Ground-Water Samples, Sunnyside Yard, Queens, New York.

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ug/L - Micrograms per liter
U - Indicates that the compound was analyzed for but not detected.
J - Estimated value.
V - Qualifier added and/or value altered during validation.
R - Data unusable
* - Indicates blind replicate sample.
** - NYS Standards and Guidance Values taken from October, 1993 New York State Department of Environmental Conservation Division of Water Technical and Operational Guidance Series (1.1.1.), Ambient Water Quality Standards and Guidance Values. Guidance Values (in parentheses) and Standards are only for those compounds for which concentrations were detected.
NS - No Standard or Guidance Value available.
NA - Not analyzed

Table 17. Summary of Metal Concentrations Detected in Ground-Water Samples, Sunnyside Yard, Queens, New York.

| Sample Designation: | | | MW-1 | MW-25 | MW-29 | MW-35 |
|---|---|---|---|---|---|---|
| Sample Date: | | | 2/9/93 | 1/15/93 | 2/9/93 | 2/9/93 |
| Metals (Concentrations in ug/L) | Background Range** | NYS Standard*** | | | | |
| Aluminum | 174B - 11,900 | NS | 12,100 | 18,000 | 5,800 | 9,210 |
| Antimony | 21.0U - 46.9B | (3) | 21.0 U | 21 U | 21.0 U | 21.0 U |
| Arsenic | 1.0U - 3.6B | 25 | 2.7 B | 1.0 U | 5.4 B | 16.5 |
| Barium | 64.1B - 199B | 1,000 | 246 | 191 B | 168 B | 696 |
| Beryllium | 1.0U | (3) | 1.0 U | 1.1 B | 1.0 U | 1.0 U |
| Cadmium | 2.0U - 2.2B | 10 | 2.0 U | 2.0 U | 2.0 U | 2.0 U |
| Calcium | 79,800 - 108,000 | NS | 127,000 | 28,100 | 63,600 | 65,300 |
| Chromium | 8.0U - 39.1 | 50 | 18.5 | 42.0 | 4.9 B | 27.8 |
| Cobalt | 3.0U - 11.3B | NS | 11.1 B | 26.1 B | 4.3 B | 6.2 B |
| Copper | 8.1B - 62.0 | 200 | 63.0 | 98.1 | 40.3 | 114 |
| Iron | 377 - 28,500 | 300 | 22,900 | 50,000 JV | 32,600 | 45,200 |
| Lead | 1.0J - 19.0 | 25 | 17.2 | 37.8 | 43.7 | 207 |
| Magnesium | 21,100 - 42,900 | (35,000) | 51,900 | 13,400 | 21,700 | 15,100 |
| Manganese | 97 - 721 | 300 | 914 | 2,550 | 2,380 | 1,280 |
| Mercury | 0.20U | 2 | 0.20 U | 0.20 U | 0.20 U | 0.49 |
| Nickel | 11.0U - 24.5B | NS | 38.6 B | 56.3 | 21.0 U | 22.6 B |
| Potassium | 2,220B - 11,900 | NS | 8,060 | 4,870 B | 7,030 | 6,180 |
| Selenium | 2.0U - 4.7B | 10 | 2.0 U | 1.0 U | 2.0 U | 2.0 U |
| Silver | 3.0U | 50 | 3.0 U | 3.0 U | 3.0 U | 3.0 U |
| Sodium | 19,300 - 130,000 | 20,000 | 6,680 | 16,700 | 132,000 | 131,000 |
| Thallium | 1.0U - 2.0U | (4) | 2.0 U | 2.0 U | 2.0 U | 2.0 U |
| Vanadium | 7.0U - 53.5 | NS | 28.5 B | 61.6 | 24.8 B | 51.4 |
| Zinc | 13.7B - 67.4 | 300 | 98.0 | 234 UV | 35.8 | 153 |

| Sample Designation: | | | MW-37 | MW-43 | MW-44D | MW-45 |
|---|---|---|---|---|---|---|
| Sample Date: | | | 2/17/94 | 2/9/93 | 2/9/93 | 2/9/93 |
| Metals (Concentrations in ug/L) | Background Range** | NYS Standard*** | | | | |
| Aluminum | 174B - 11,900 | NS | 297 | 4,420 | 3,260 | 1,030 |
| Antimony | 21.0U - 46.9B | (3) | 29.0 U | 21.0 U | 21.0 U | 21.0 U |
| Arsenic | 1.0U - 3.6B | 25 | 3.4 BJV | 1.2 B | 2.0 B | 1.0 U |
| Barium | 64.1B - 199B | 1,000 | 59.8 B | 142 B | 207 | 67.5 B |
| Beryllium | 1.0U | (3) | 1.0 U | 1.0 U | 1.0 U | 1.0 U |
| Cadmium | 2.0U - 2.2B | 10 | 2.0 U | 2.0 U | 2.0 U | 2.0 U |
| Calcium | 79,800 - 108,000 | NS | 9,950 | 29,800 | 148,000 | 47,600 |
| Chromium | 8.0U - 39.1 | 50 | 8.0 U | 3.0 U | 9.3 B | 3.0 U |
| Cobalt | 3.0U - 11.3B | NS | 3.0 U | 5.6 B | 3.4 B | 3.0 U |
| Copper | 8.1B - 62.0 | 200 | 6.5 B | 46.2 | 43.0 | 31.2 |
| Iron | 377 - 28,500 | 300 | 749 | 8,410 | 8,930 | 1,760 |
| Lead | 1.0J - 19.0 | 25 | 1.3 BJV | 5.4 | 5.7 | 2.2 B |
| Magnesium | 21,100 - 42,900 | (35,000) | 1,540 B | 15,000 | 49,800 | 12,500 |
| Manganese | 97 - 721 | 300 | 803 | 3,470 | 1,750 | 142 |
| Mercury | 0.20U | 2 | 0.20 U | 0.20 U | 0.20 U | 0.20 U |
| Nickel | 11.0U - 24.5B | NS | 11.0 U | 21.0 U | 21.0 U | 21.0 U |
| Potassium | 2,220B - 11,900 | NS | 1,220 B | 1,590 B | 7,470 | 2,950 B |
| Selenium | 2.0U - 4.7B | 10 | 1.2 B | 2.0 U | 2.0 U | 2.0 U |
| Silver | 3.0U | 50 | 3.0 U | 3.0 U | 3.0 U | 3.0 U |
| Sodium | 19,300 - 130,000 | 20,000 | 176,000 | 213,000 | 91,900 | 14,700 |
| Thallium | 1.0U - 2.0U | (4) | 1.0 | 2.0 U | 2.0 U | 2.0 U |
| Vanadium | 7.0U - 53.5 | NS | 9.4 B | 6.0 U | 9.2 B | 6.0 U |
| Zinc | 13.7B - 67.4 | 300 | 19.1 B | 55.1 | 36.3 | 27.8 |

Table 17. Summary of Metal Concentrations Detected in Ground-Water Samples, Sunnyside Yard, Queens, New York.

| Sample Designation:<br>Sample Date: | | | MW-45*<br>2/9/93 | MW-46<br>2/9/93 | MW-47<br>2/9/93<br>(Background Well) | MW-48D<br>2/9/93<br>(Background Well) |
|---|---|---|---|---|---|---|
| Metals (Concentrations in ug/L) | Background Range** | NYS Standard*** | | | | |
| Aluminum | 174B - 11,900 | NS | 872 | 80,000 | 7,660 | 11,900 |
| Antimony | 21.0U - 46.9B | (3) | 21.0 U | 21.0 U | 21.0 U | 21.0 U |
| Arsenic | 1.0U - 3.6B | 25 | 1.2 B | 10.9 | 2.1 B | 3.6 B |
| Barium | 64.1B - 199B | 1,000 | 66.0 B | 1030 | 87.6 B | 199 B |
| Beryllium | 1.0U | (3) | 1.0 U | 3.7 B | 1.0 U | 1.0 U |
| Cadmium | 2.0U - 2.2B | 10 | 2.0 U | 4.4 B | 2.2 B | 2.0 U |
| Calcium | 79,800 - 108,000 | NS | 47,700 | 57,000 | 83,800 | 95,300 |
| Chromium | 8.0U - 39.1 | 50 | 3.0 U | 146 | 17.4 | 39.1 |
| Cobalt | 3.0U - 11.3B | NS | 3.0 U | 111 | 5.8 B | 11.3 B |
| Copper | 8.1B - 62.0 | 200 | 19.1 B | 421 | 38.8 | 62.0 |
| Iron | 377 - 28,500 | 300 | 1,570 | 152,000 | 9,890 | 28,500 |
| Lead | 1.0J - 19.0 | 25 | 2.2 B | 165 | 10.8 | 19.0 |
| Magnesium | 21,100 - 42,900 | (35,000) | 12,400 | 47,200 | 28,000 | 42,200 |
| Manganese | 97 - 721 | 300 | 126 | 9,410 | 135 | 721 |
| Mercury | 0.20U | 2 | 0.20 U | 0.40 | 0.20 U | 0.20 U |
| Nickel | 11.0U - 24.5B | NS | 21.0 U | 186 | 21.1 B | 24.5 B |
| Potassium | 2,220B - 11,900 | NS | 3,040 B | 19,800 | 7,160 | 11,900 |
| Selenium | 2.0U - 4.7B | 10 | 2.0 U | 2.0 U | 2.0 U | 2.0 U |
| Silver | 3.0U | 50 | 3.0 U | 3.0 U | 3.0 U | 3.0 U |
| Sodium | 19,300 - 130,000 | 20,000 | 14,700 | 41,400 | 61,900 | 19,300 |
| Thallium | 1.0U - 2.0U | (4) | 2.0 U | 2.0 U | 2.0 U | 2.0 U |
| Vanadium | 7.0U - 53.5 | NS | 6.0 U | 205 | 47.0 B | 53.5 |
| Zinc | 13.7B - 67.4 | 300 | 20.3 | 696 | 53.0 | 67.4 |

| Sample Designation:<br>Sample Date: | | | MW-49<br>2/17/94 | MW-57<br>2/17/94 | MW-57*<br>2/17/94 | MW-59<br>2/17/94 |
|---|---|---|---|---|---|---|
| Metals (Concentrations in ug/L) | Background Range** | NYS Standard*** | | | | |
| Aluminum | 174B - 11,900 | NS | 86.2 B | 470 | 371 | 614 |
| Antimony | 21.0U - 46.9B | (3) | 29.0 U | 29.0 U | 45.5 B | 29.0 U |
| Arsenic | 1.0U - 3.6B | 25 | 7.4 B | 1.0 B | 1.0 U | 3.0 B |
| Barium | 64.1B - 199B | 1,000 | 330 | 47.0 B | 34.7 B | 18.1 B |
| Beryllium | 1.0U | (3) | 1.0 U | 1.0 U | 1.0 U | 1.0 U |
| Cadmium | 2.0U - 2.2B | 10 | 2.0 U | 2.0 U | 2.0 U | 2.0 U |
| Calcium | 79,800 - 108,000 | NS | 24,400 | 27,300 | 27,500 | 26,800 |
| Chromium | 8.0U - 39.1 | 50 | 8.0 U | 8.0 U | 8.0 U | 8.0 U |
| Cobalt | 3.0U - 11.3B | NS | 15.5 B | 3.0 U | 3.5 B | 3.0 U |
| Copper | 8.1B - 62.0 | 200 | 13.8 B | 31.2 | 28.7 | 9.6 B |
| Iron | 377 - 28,500 | 300 | 118,000 | 874 | 689 | 966 |
| Lead | 1.0J - 19.0 | 25 | 1.0 BJV | 5.7 | 4.9 | 3.2 JV |
| Magnesium | 21,100 - 42,900 | (35,000) | 5,340 | 5,760 | 5,760 | 1,750 B |
| Manganese | 97 - 721 | 300 | 3,030 | 1,700 | 1,700 | 85 |
| Mercury | 0.20U | 2 | 0.20 U | 0.20 U | 0.20 U | 0.20 U |
| Nickel | 11.0U - 24.5B | NS | 11.0 U | 11.0 U | 11.0 U | 11.0 U |
| Potassium | 2,220B - 11,900 | NS | 2,630 B | 2,890 B | 2,980 B | 4,370 B |
| Selenium | 2.0U - 4.7B | 10 | 1.0 JV | 1.1 BJV | 1.9 B | 3.0 BJV |
| Silver | 3.0U | 50 | 3.0 U | 3.0 U | 3.0 U | 3.0 U |
| Sodium | 19,300 - 130,000 | 20,000 | 13,700 | 71,500 | 71,400 | 54,300 |
| Thallium | 1.0U - 2.0U | (4) | 1.0 U | 1.0 U | 1.0 U | 1.0 U |
| Vanadium | 7.0U - 53.5 | NS | 7.0 U | 7.0 U | 7.0 U | 10.9 B |
| Zinc | 13.7B - 67.4 | 300 | 76.5 | 41.5 | 39.8 | 25.2 |

Table 17. Summary of Metal Concentrations Detected in Ground-Water Samples, Sunnyside Yard, Queens, New York.

| Sample Designation:<br>Sample Date:<br>Metals (Concentrations in ug/L) | Background Range** | NYS Standard*** | MW-61 2/17/94 (Background Well) | MW-62D 2/17/94 (Background Well) | MW-63 2/17/94 |
|---|---|---|---|---|---|
| Aluminum | 174B - 11,900 | NS | 174 B | 264 | 823 |
| Antimony | 21.0U - 46.9B | (3) | 29.0 U | 46.9 B | 29.0 U |
| Arsenic | 1.0U - 3.6B | 25 | 1.0 U | 1.0 U | 1.0 U |
| Barium | 64.1B - 199B | 1,000 | 64.1 B | 102 B | 176 B |
| Beryllium | 1.0U | (3) | 1.0 U | 1.0 U | 1.0 U |
| Cadmium | 2.0U - 2.2B | 10 | 2.0 U | 2.0 U | 2.0 U |
| Calcium | 79,800 - 108,000 | NS | 79,800 | 108,000 | 128,000 |
| Chromium | 8.0U - 39.1 | 50 | 8.0 U | 8.0 U | 8.0 U |
| Cobalt | 3.0U - 11.3B | NS | 3.0 U | 3.0 U | 3.4 B |
| Copper | 8.1B - 62.0 | 200 | 8.1 B | 11.8 B | 10.5 B |
| Iron | 377 - 28,500 | 300 | 377 | 679 | 1,900 |
| Lead | 1.0J - 19.0 | 25 | 1.0 J | 1.0 UJV | 1.4 BJV |
| Magnesium | 21,100 - 42,900 | (35,000) | 21,100 | 42,900 | 30,900 |
| Manganese | 97 - 721 | 300 | 97 | 130 | 2,120 |
| Mercury | 0.20U | 2 | 0.20 U | 0.20 U | 0.20 U |
| Nickel | 11.0U - 24.5B | NS | 11.0 U | 11.0 U | 11.0 U |
| Potassium | 2,220B - 11,900 | NS | 2,220 B | 2,860 B | 5,140 |
| Selenium | 2.0U - 4.7B | 10 | 4.7 B | 2.7 BJV | 1.4 BJV |
| Silver | 3.0U | 50 | 3.0 U | 3.0 U | 3.0 U |
| Sodium | 19,300 - 130,000 | 20,000 | 26,800 | 130,000 | 77,200 |
| Thallium | 1.0U - 2.0U | (4) | 1.0 U | 1.0 U | 1.0 U |
| Vanadium | 7.0U - 53.5 | NS | 7.0 U | 7.0 U | 7.0 U |
| Zinc | 13.7B - 67.4 | 300 | 13.7 B | 14.6 B | 25.9 |

ug/L - Micrograms per liter
U - Indicates analyte result less than method detection limit (MDL).
B - Indicates analyte result between MDL and practical quantitation limit (PQL).
S - The reported value was determined by the method of standard additions (MSA).
J - Estimated value.
V - Qualifier added and/or value altered during validation.
W - Post digest spike recovery out of range.
* - Indicates blind replicate sample
** - Background ranges for metals were determined from analytical results for upgradient Monitoring Wells MW-47, MW-48D, MW-61 and MW-62D.
*** - NYS Standards and Guidance Values taken from October, 1993 New York State Department of Environmental Conservation Division of Water Technical and Operational Guidance Series (1.1.1.), Ambient Water Quality Standards and Guidance Values. Guidance Values (in parentheses) and Standards are only for those compounds for which concentrations were detected.
NS - No Standard or Guidance Value available.

NOTE: NYS Standard for Iron and Manganese combined is 500 ug/L.

Table 18. Summary of Polychlorinated Biphenyl Compound Concentrations Detected in Ground-Water Samples, Sunnyside Yard, Queens, New York.

| Sample Designation:<br>Sample Date:<br>Polychlorinated Biphenyl (PCB) Compounds (Concentrations in ug/L) | NYS Standard** | MW-1<br>2/9/93 | MW-23D<br>2/9/93 | MW-25A<br>1/22/93 | MW-27<br>2/8/93 | MW-35<br>2/9/93 | MW-35<br>2/17/94 |
|---|---|---|---|---|---|---|---|
| Aroclor-1016 | -- | 0.067 U | 0.066 U | 0.066 U | 0.067 U | 0.066 U | 0.065 UJV |
| Aroclor-1221 | -- | 0.067 U | 0.066 UJV | 0.066 U | 0.067 U | 0.066 U | 0.065 UJV |
| Aroclor-1232 | -- | 0.067 U | 0.066 U | 0.066 U | 0.067 U | 0.066 U | 0.065 UJV |
| Aroclor-1242 | -- | 0.067 U | 0.066 U | 0.066 U | 0.067 U | 0.066 U | 0.065 UJV |
| Aroclor-1248 | -- | 0.067 U | 0.066 U | 0.066 U | 0.067 U | 0.066 U | 0.065 UJV |
| Aroclor-1254 | -- | 0.067 U | 0.066 U | 0.066 U | 0.067 U | 0.089 | 0.065 UJV |
| Aroclor-1260 | -- | 0.29 | 0.066 U | 0.067 | 0.067 U | 0.066 U | 0.065 UJV |
| Total Aroclors | 0.1 | 0.29 | -- | 0.067 | -- | 0.089 | -- |

| Sample Designation:<br>Sample Date:<br>Polychlorinated Biphenyl (PCB) Compounds (Concentrations in ug/L) | NYS Standard** | MW-37<br>2/17/94 | MW-38D<br>2/17/94 | MW-39D<br>2/17/94 | MW-40D<br>2/17/94 | MW-43<br>2/9/93 | MW-44D<br>2/9/93 |
|---|---|---|---|---|---|---|---|
| Aroclor-1016 | -- | 0.065 U | 0.065 U | 0.065 U | 0.065 U | 0.066 U | 0.066 U |
| Aroclor-1221 | -- | 0.065 U | 0.065 U | 0.065 U | 0.065 U | 0.066 U | 0.066 U |
| Aroclor-1232 | -- | 0.065 U | 0.065 U | 0.065 U | 0.065 U | 0.066 U | 0.066 U |
| Aroclor-1242 | -- | 0.065 U | 0.065 U | 0.065 U | 0.065 U | 0.066 U | 0.066 U |
| Aroclor-1248 | -- | 0.065 U | 0.065 U | 0.065 U | 0.065 U | 0.066 U | 0.066 U |
| Aroclor-1254 | -- | 0.065 U | 0.065 U | 0.065 U | 0.065 UJV | 0.066 U | 0.066 U |
| Aroclor-1260 | -- | 0.065 U | 0.065 UJV | 0.065 U | 0.065 U | 0.066 U | 0.066 U |
| Total Aroclors | 0.1 | -- | -- | -- | -- | -- | -- |

| Sample Designation:<br>Sample Date:<br>Polychlorinated Biphenyl (PCB) Compounds (Concentrations in ug/L) | NYS Standard** | MW-45<br>2/9/93 | MW-45*<br>2/9/93 | MW-46<br>2/9/93 | MW-46<br>2/17/94 | MW-47<br>1/22/93 | MW-47<br>2/9/93 |
|---|---|---|---|---|---|---|---|
| Aroclor-1016 | -- | 0.067 U | 0.065 U | 0.065 U | 0.065 U | 0.067 U | 0.066 U |
| Aroclor-1221 | -- | 0.067 U | 0.065 U | 0.065 U | 0.065 U | 0.067 U | 0.066 U |
| Aroclor-1232 | -- | 0.067 U | 0.065 U | 0.065 U | 0.065 U | 0.067 U | 0.066 U |
| Aroclor-1242 | -- | 0.067 U | 0.065 U | 0.065 U | 0.065 U | 0.067 U | 0.066 U |
| Aroclor-1248 | -- | 0.067 U | 0.065 U | 0.065 U | 0.065 U | 0.067 U | 0.066 U |
| Aroclor-1254 | -- | 0.067 U | 0.065 U | 0.59 | 0.065 U | 0.067 U | 0.066 U |
| Aroclor-1260 | -- | 0.067 U | 0.065 U | 1.7 JV | 0.065 U | 0.067 U | 0.066 U |
| Total Aroclors | 0.1 | -- | -- | 2.29 JV | -- | -- | -- |

Table 18. Summary of Polychlorinated Biphenyl Compound Concentrations Detected in Ground-Water Samples, Sunnyside Yard, Queens, New York.

| Sample Designation:<br>Sample Date: | | MW-48D<br>2/9/93 | MW-49<br>2/17/94 | MW-57<br>2/17/94 | MW-57*<br>2/17/94 | MW-59<br>2/17/94 | MW-61<br>2/17/94 |
|---|---|---|---|---|---|---|---|
| Polychlorinated Biphenyl (PCB) Compounds (Concentrations in ug/L) | NYS Standard** | | | | | | |
| Aroclor-1016 | -- | 0.066 U | 0.065 U | 0.065 U | 0.065 U | 0.065 U | 0.065 U |
| Aroclor-1221 | -- | 0.066 U | 0.065 U | 0.065 U | 0.065 U | 0.065 U | 0.065 U |
| Aroclor-1232 | -- | 0.066 U | 0.065 U | 0.065 U | 0.065 U | 0.065 U | 0.065 U |
| Aroclor-1242 | -- | 0.066 U | 0.065 U | 0.065 U | 0.065 U | 0.065 U | 0.065 U |
| Aroclor-1248 | -- | 0.066 U | 0.065 U | 0.065 U | 0.065 U | 0.065 U | 0.065 U |
| Aroclor-1254 | -- | 0.066 U | 0.065 U | 0.065 U | 0.065 U | 0.065 U | 0.065 U |
| Aroclor-1260 | -- | 0.066 U | 0.065 U | 0.065 U | 0.065 U | 0.065 U | 0.065 U |
| Total Aroclors | 0.1 | -- | -- | -- | -- | -- | -- |

| Sample Designation:<br>Sample Date: | | MW-62D<br>2/17/94 | MW-63<br>2/17/94 | TW-3<br>12/6/93 |
|---|---|---|---|---|
| Polychlorinated Biphenyl (PCB) Compounds (Concentrations in ug/L) | NYS Standard** | | | |
| Aroclor-1016 | -- | 0.065 U | 0.065 U | 0.072 U |
| Aroclor-1221 | -- | 0.065 U | 0.065 U | 0.072 U |
| Aroclor-1232 | -- | 0.065 U | 0.065 U | 0.072 U |
| Aroclor-1242 | -- | 0.065 U | 0.065 U | 0.072 U |
| Aroclor-1248 | -- | 0.065 U | 0.065 U | 0.072 U |
| Aroclor-1254 | -- | 0.065 U | 0.065 U | 2.4 |
| Aroclor-1260 | -- | 0.065 U | 0.065 U | 1.9 |
| Total Aroclors | 0.1 | -- | -- | 4.3 |

ug/L - Micrograms per liter
U - Indicates that the compound was analyzed for but not detected.
J - Estimated value.
V - Qualifier added and/or value altered during validation.
* - Indicates blind replicate sample.
** - NYS Standards taken from October, 1993 New York State Department of Environmental Conservation Division of Water Technical and Operational Guidance Series (1.1.1.), Ambient Water Quality Standards and Guidance Values.

NOTE: Total aroclors represents the sum of the total of all aroclors detected above the listed practical quantitation limits (PQL). NYS Standard listed applies to the sum of these substances.

Table 19. Summary of Soil Quality Sampling and Field Observations During Additional Delineation Investigation, Sunnyside Yard, Queens, New York.

| Soil Boring Number | Sampled Interval(s) | Test Kit Analyses | Confirmatory Lab Analyses | Field Observations Regarding Evidence of Petroleum Hydrocarbons |
|---|---|---|---|---|
| SB-1 | 0-1 | X | | dark brown soil and ballast to 1 ft |
| | 1-2 | X | | |
| | 2-3 | | | |
| SB-2 | 0-1 | X | | dark brown soil, trace cinders to 0.5 ft |
| | 1-2 | X | | |
| | 2-3 | XX | | |
| | 3-4 | X | | |
| | 4-5 | X | | |
| | 5-6 | X | | |
| SB-3 | 0-1 | X | | dark brown soil and cinders to 1 ft |
| | 1-2 | XX | | |
| | 2-3 | X | | |
| | 3-4 | X | | |
| | 4-5 | X | | |
| | 5-6 | X | | |
| SB-4 | 0-1 | X | X | dark gray soil and ballast to 1.25 ft |
| | 1-2 | | | |
| | 2-3 | | | |
| SB-5 | 0-1 | XX | X | dark brown soil, trace cinders to 1 ft |
| | 1-2 | X | | |
| | 2-3 | | | |
| SB-6 | 0-1 | X | | dark gray-brown soil and ballast to 0.9 ft |
| | 1-2 | | | |
| | 2-3 | | | |
| SB-7 | 0-1 | X | | dark gray-brown soil and ballast to 1 ft |
| | 1-2 | | | gray-brown soil 1 to 2 ft |
| | 2-3 | | | |
| SB-8 | 0-1 | XX | | dark brown soil, trace cinders to 1 ft |
| | 1-2 | | | |
| | 2-3 | | | |
| SB-9 | 0-1 | X | | dark brown soil, trace cinders to 1 ft |
| | 1-2 | | | |
| | 2-3 | | | |
| SB-10 | 0-1 | XX | | dark brown to black soil to 1.2 ft |
| | 1-2 | | | cinders 1.2 to 1.3 ft |
| | 2-3 | | | |
| SB-11 | 0-1 | X | | dark gray-brown soil and ballast to 1.2 ft |
| | 1-2 | X | | |
| | 2-3 | XX | | |
| | 3-4 | X | | |
| | 4-5 | X | | |
| | 5-6 | X | | |
| SB-12 | 0-1 | X | | dark brown to black soil, ballast and debris to 2 ft |
| | 1-2 | XX | | dark brown soil 2 to 3 ft |
| | 2-3 | X | | oily staining and 0.2 PPM on PID 3.5 to 4 ft |
| | 3-4 | X | | |
| | 4-5 | X | | |
| | 5-6 | X | | |
| | 6-7 | X | X | |
| SB-13 | 0-1 | XX | | black soil and ballast to 1.2 ft |
| | 1-2 | | | 0.4 to 0.5 PPM on PID to 3 ft |
| | 2-3 | | | |
| | 3-4 | X | | |
| SB-14 | 0-1 | X | | dark brown to black soil and ballast to 1.8 ft |
| | 1-2 | X | | |
| | 2-3 | X | | |

Table 19. Summary of Soil Quality Sampling and Field Observations During Additional Delineation Investigation, Sunnyside Yard, Queens, New York.

| Soil Boring Number | Sampled Interval(s) | Test Kit Analyses | Confirmatory Lab Analyses | Field Observations Regarding Evidence of Petroleum Hydrocarbons |
|---|---|---|---|---|
| SB-15 | 0-1 | X | | dark brown to black soil, ballast and cinders to 1.25 ft |
| | 1-2 | XX | | |
| | 2-3 | X | | |
| | 3-4 | X | | |
| | 4-5 | X | X | |
| | 5-6 | X | | |
| SB-16 | 0-1 | XX | | dark brown to black soil and ballast, trace fly ash to 1.5 ft |
| | 1-2 | X | | |
| | 2-3 | X | | |
| | 3-4 | XX | | |
| | 4-5 | X | | |
| | 5-6 | XX | | |
| | 6-7 | X | X | |
| | 7-8 | X | | |
| | 8-9 | X | | |
| SB-17 | 0-1 | X | | dark brown soil, trace cinders to 1.8 ft |
| | 1-2 | X | | |
| | 2-3 | X | | |
| | 3-4 | X | | |
| | 4-5 | XXX | | |
| | 5-6 | X | | |
| | 6-7 | X | | |
| SB-18 | 0-1 | X | X | dark brown soil and ballast, trace cinders to 1.8 ft |
| | 1-2 | XX | | |
| | 2-3 | XX | | |
| SB-19 | 0-1 | XX | | dark brown soil and ballast to 0.5 ft |
| | 1-2 | | | |
| SB-20 | 0-1 | X | | dark brown soil and ballast to 0.25 ft |
| | 1-2 | | | |
| | 2-3 | | | |
| SB-21 | 0-1 | X | | dark brown soil to 1 ft |
| | 1-2 | | | |
| SB-22 | 0-1 | XX | | dark brown to gray-brown soil to 1.9 ft |
| | 1-2 | | | petroleum-like odor 1 to 2 ft |
| SB-23 | 0-1 | X | | black to dark brown soil to 1.9 ft |
| | 1-2 | | | |
| | 2-3 | | | |
| SB-24 | 0-1 | XX | | black soil and ballast to 1 ft |
| | 1-2 | | | |
| SB-25 | 0-1 | X | | black soil to 1.5 ft |
| | 1-2 | | | 0.1 PPM on PID, petroleum-like odor |
| | 2-2.5 | | | |
| SB-26 | 0-1 | X | | black to dark gray-brown soil to 2 ft |
| | 1-2 | | | petroleum-like odor |
| SB-27 | 0-1 | X | | dark brown to black soil to 1 ft |
| | 1-2 | | | |
| SB-28 | 0-1 | X | | dark brown soil and ballast 2.5 ft |
| | 1-2 | | | trace cinders 2 to 2.5 ft |
| | 2-3 | | | |
| SB-29 | 0-1 | XX | | dark brown soil and cobbles to 1.5 ft |
| | 1-2 | | | |
| SB-30 | 0-1 | X | | dark brown soil and ballast to 2 ft |
| | 1-2 | XX | | trace cinders 1 to 2 ft |
| | 2-3 | X | X | |
| SB-31 | 0-1 | XX | | dark brown soil and ballast to 1.2 ft |
| | 1-2 | XXX | | |
| | 2-3 | X | | |
| | 3-4 | X | | |

Table 19. Summary of Soil Quality Sampling and Field Observations During Additional Delineation Investigation, Sunnyside Yard, Queens, New York.

| Soil Boring Number | Sampled Interval(s) | Test Kit Analyses | Confirmatory Lab Analyses | Field Observations Regarding Evidence of Petroleum Hydrocarbons |
|---|---|---|---|---|
| SB-32 | 0-1 | XX | | dark gray-brown soil to 1 ft |
| | 1-2 | | | |
| | 2-3 | | | |
| SB-33 | 0-1 | X | X | no evidence of petroleum hydrocarbons |
| | 1-2 | | | |
| | 2-3 | | | |
| SB-34 | 0-1 | XX | X | dark brown soil and ballast to 1.5 ft |
| | 1-2 | | | |
| SB-35 | 0-1 | X | | dark brown soil and ballast to 1.5 ft |
| | 1-2 | | | |
| | 2-3 | | | |
| SB-36 | 0-1 | X | X | dark brown soil and ballast to 2 ft |
| | 1-2 | | | |
| | 2-3 | | | |
| SB-37 | 0-1 | X | | dark brown soil and ballast to 2 ft |
| | 1-2 | X | | |
| | 2-3 | XX | | |
| SB-38 | 0-1 | X | | dark brown soil and ballast to 1.5 ft |
| | 1-2 | X | | |
| | 2-3 | | | |
| SB-39 | 0-1 | X | | dark brown to brown soil to 2 ft |
| | 1-2 | | | cinders 1.5 to 2 ft |
| | 2-3 | | | |
| SB-40 | 0-1 | X | | dark brown soil, ballast and cinders to 1.5 ft |
| | 1-2 | | | |
| SB-41 | 0-1 | XX | | dark brown soil and ballast to 1 ft |
| SB-42 | 0-1 | X | | dark gray-brown soil and ballast to 2 ft |
| | 1-2 | X | | trace cinders, 0.9 to 0.3 PPM on PID |
| | 2-3 | X | | |
| SB-43 | 0-1 | X | | dark brown to black soil and ballast to 2 ft |
| | 1-2 | XX | | trace cinders |
| | 2-3 | | | |
| SB-44 | 0-1 | X | | dark brown soil and ballast to 1.5 ft |
| | 1-2 | | | |
| | 2-3 | | | |
| SB-45 | 0-1 | X | X | dark brown soil and ballast to 1 ft |
| | 1-2 | X | | |
| | 2-3 | X | | |
| | 3-4 | X | | |
| | 4-5 | X | | |
| SB-46 | 0-1 | XX | | dark brown soil and ballast to 1.5 ft |
| | 1-2 | X | | |
| | 2-3 | | | |
| SB-47 | 0-1 | XX | | dark brown soil and ballast to 1 ft |
| | 1-2 | X | | cinders 1 to 2 ft |
| | 2-3 | | | |
| SB-48 | 0-1 | X | X | dark brown soil and ballast to 1.5 ft |
| | 1-2 | XX | X | |
| | 2-3 | X | X | |
| SB-49 | 0-1 | X | | dark brown soil and ballast to 2 ft |
| | 1-2 | X | | |
| | 2-3 | XX | | |
| | 3-4 | XX | | |
| | 4-5 | X | | |
| | 5-6 | X | | |

Table 19. Summary of Soil Quality Sampling and Field Observations During Additional Delineation Investigation, Sunnyside Yard, Queens, New York.

| Soil Boring Number | Sampled Interval(s) | Test Kit Analyses | Confirmatory Lab Analyses | Field Observations Regarding Evidence of Petroleum Hydrocarbons |
|---|---|---|---|---|
| SB-50 | 0-1 | XX | | dark brown soil and ballast to 2 ft |
| | 1-2 | XX | | |
| | 2-3 | XXX | | |
| | 3-4 | X | | |
| | 4-5 | | | |
| SB-51 | 0-1 | X | | dark brown soil to 1.5 ft |
| | 1-2 | | | faint odor, 2.3 PPM on PID 1 to 1.5 ft |
| SB-52 | 0-1 | X | | dark brown soil and ballast to 2 ft |
| | 1-2 | | | |
| SB-53 | 0-1 | X | | dark brown soil to 3 ft |
| | 1-2 | | | 1.7 and 0.1 PPM on PID to 2 ft |
| | 2-3 | | | |
| SB-54 | 0-1 | XX | | dark brown soil and cinders to 2 ft |
| | 1-2 | | | staining 2 to 2.1 ft |
| | 2-3 | | | |
| SB-55 | 0-1 | X | | dark brown soil and ballast to 2 ft |
| | 1-2 | X | | |
| SB-56 | 0-1 | XX | | brown soil, trace cinders and ballast to 2 ft bls |
| | 1-2 | | | |
| | 2-3 | | | |
| SB-57 | 0-1 | XX | X | brown soil, trace cinders and ballast to 1 ft bls |
| | 1-2 | | | |
| | 2-3 | | | |
| SB-58 | 0-1 | X | | brown soil, trace cinders and ballast to 1 ft bls |
| | 1-2 | | | brown soil to 3 ft bls |
| | 2-3 | | | |
| SB-59 | 0-1 | X | | brown soil, trace cinders and ballast to 1 ft bls |
| | 1-2 | | | brown soil to 3 ft bls |
| | 2-3 | | | |
| SB-60 | 0-1 | X | | dark brown soil and ballast to 1 ft bls |
| | 1-2 | | | |
| | 2-3 | | | |
| SB-61 | 0-1 | X | X | dark brown soil, trace cinders and ballast to 1 ft bls |
| | 1-2 | | | brown soil, trace cinders 1-2 ft bls |
| | 2-3 | | | |
| SB-62 | 0-1 | X | | dark brown soil, trace cinders and ballast to 2 ft bls |
| | 1-2 | X | | brown soil 2-3 ft bls |
| | 2-3 | X | | |
| SB-63 | 0-1 | X | | dark brown soil, trace cinders and ballast to 1 ft bls |
| | 1-2 | | | brown soil, trace cinders 1-2 ft bls |
| | 2-3 | | | |
| SB-64 | 0-1 | X | X | dark brown to brown soil, trace cinders to 3 ft bls |
| | 1-2 | | | |
| | 2-3 | | | |
| SB-65 | 0-1 | X | | dark brown soil and cinders to 1 ft bls |
| | 1-2 | | | brown soil 1-2 ft bls |
| | 2-3 | | | |
| SB-66 | 0-1 | X | | dark brown soil and cinders to 1 ft bls |
| | 1-2 | X | | brown soil 1-2 ft bls |
| | 2-3 | X | | |
| SB-67 | 0-1 | X | X | dark brown soil, trace cinders and ballast to 1 ft bls |
| | 1-2 | X | | brown soil 1-2 ft bls |
| | 2-3 | X | | |
| SB-68 | 0-1 | X | X | dark brown soil, trace cinders and ballast to 1 ft bls |
| | 1-2 | X | | brown soil, trace cinders 1-2 ft bls |
| | 2-3 | X | | |

Table 19. Summary of Soil Quality Sampling and Field Observations During Additional Delineation Investigation, Sunnyside Yard, Queens, New York.

| Soil Boring Number | Sampled Interval(s) | Test Kit Analyses | Confirmatory Lab Analyses | Field Observations Regarding Evidence of Petroleum Hydrocarbons |
|---|---|---|---|---|
| SB-69 | 0-1 | XX | | dark brown soil, trace cinders and ballast to 1 ft bls |
| | 1-2 | XX | | |
| | 2-3 | X | | |
| SB-70 | 0-1 | X | | dark brown soil, trace cinders and ballast to 1 ft bls |
| | 1-2 | X | | brown soil, trace cinders 1-2 ft bls |
| | 2-3 | X | | |
| SB-71 | 0-1 | X | X | dark brown soil, trace cinders and ballast to 1 ft bls |
| | 1-2 | X | | brown soil, trace cinders 1-3 ft bls |
| | 2-3 | | | |
| SB-72 | 0-1 | X | | dark brown soil, trace ballast to 1 ft bls |
| | 1-2 | | | black/brown soil, trace ballast 1-2 ft bls |
| | 2-3 | | | black/brown soil, 2-3 ft bls |
| SB-73 | 0-1 | X | | dark brown soil, trace ballast to 1 ft bls |
| | 1-2 | | | brown soil, 1-3 ft bls |
| | 2-3 | | | |
| SB-74 | 0-1 | XX | | black/brown soil, trace ballast to 2 ft bls |
| | 1-2 | | | |
| | 2-3 | | | |
| SB-75 | 0-1 | X | | black/brown soil, trace ballast to 2 ft bls |
| | 1-2 | | | |
| | 2-3 | | | |
| SB-76 | 0-1 | XX | | dark brown soil with ballast, trace cinders to 1.5 ft bls |
| | 1-2 | X | | |
| | 2-3 | | | |
| SB-77 | 0-1 | X | | dark brown soil with ballast to 1 ft bls |
| | 1-2 | X | | |
| | 2-3 | | | |
| SB-78 | 0-1 | X | | dark brown soil with ballast to 1 ft bls |
| | 1-2 | X | | dark brown soil, trace cinders 1-2 ft bls |
| | 2-3 | | | |
| SB-79 | 0-1 | X | | dark brown soil with ballast, trace cinders to 1.5 ft bls |
| | 1-2 | X | | |
| | 2-3 | | | |
| SB-80 | 0-1 | XX | | dark brown soil, trace ballast to 1 ft bls |
| | 1-2 | XX | | black soil, trace cinders 1-2 ft bls |
| | 2-3 | | | brown soil, trace cinders 2-3 ft bls |
| SB-81 | 0-1 | X | | dark brown soil, trace ballast to 1 ft bls |
| | 1-2 | | | black/brown soil, trace cinders 1-2 ft bls |
| | 2-3 | | | |
| SB-82 | 0-1 | XX | | dark brown soil, trace cinders and ballast to 1 ft bls |
| | 1-2 | X | | grey/brown |
| | 2-3 | | | |
| SB-83 | 0-1 | X | | dark brown soil, trace ballast to 1 ft bls |
| | 1-2 | X | | brown soil, trace cinders 1-2 ft bls |
| | 2-3 | | | |
| SB-84 | 0-1 | X | | dark brown soil, trace ballast to 1.5 ft bls |
| | 1-2 | X | | |
| | 2-3 | | | |
| SB-85 | 0-1 | X | | dark brown soil, trace ballast to 1 ft bls |
| | 1-2 | | | brown soil, trace cinders 1-2 ft bls |
| | 2-3 | | | |
| SB-86 | 0-1 | X | | black/dark brown soil, trace cinders and ballast to 2 ft bls |
| | 1-2 | | | |
| | 2-3 | | | |
| SB-87 | 0-1 | XX | | black/dark brown soil, trace cinders and ballast to 2 ft bls |
| | 1-2 | | | |
| | 2-3 | | | |

Table 20. Summary of Laboratory Confirmation Data for Polychlorinated Biphenyl Concentrations Detected in Soil Samples During Additional Delineation Investigation, Sunnyside Yard, Queens, New York.

| Area of Concern | Sample Designation | Sample Depth (ft bls) | Sample Date | PCB Concentration Immunoassay Analysis (ppm) | PCB Concentration Laboratory Analysis (ppm) |
|---|---|---|---|---|---|
| A-8A | SB-4 | 0 - 1 | 3/23/94 | 15.8 | 22 |
| | SB-57 | 0 - 1 | 8/9/94 | 1.6 | 6.4 |
| A-8B | SB-5 | 0 - 1 | 3/23/94 | 3 | 2.3 |
| A-8C | SB-12 | 6 - 7 | 8/9/94 | 14.9 | 29 |
| | SB-15 | 4 - 5 | 3/24/94 | <0.75 | 0.1 J |
| | SB-16 | 6 - 7 | 8/9/94 | 85 | 380 |
| | SB-18 | 0 - 1 | 3/24/94 | >48 | 2,400 |
| | SB-61 | 0 - 1 | 8/9/94 | 18 | 200 |
| | SB-64 | 0 - 1 | 8/9/94 | 14.9 | 130 |
| | SB-67 | 0 - 1 | 8/9/94 | >100 | 9,700 |
| | SB-68 | 0 - 1 | 8/9/94 | >100 | 25,000 |
| | SB-71 | 0 - 1 | 8/9/94 | 77 | 680 |
| A-17 | SB-30 | 2 - 3 | 3/21/94 | 2 | 0.52 |
| | SB-33 | 0 - 1 | 3/23/94 | 6 | 2.4 |
| | SB-34 | 0 - 1 | 3/24/94 | 3 | 4.4 |
| | SB-35 | 0 - 1 | 3/24/94 | 5 | 3.1 |
| | SB-45 | 0 - 1 | 3/22/94 | >48 | 790 |
| | SB-48 | 0 - 1 | 3/22/94 | 10 | 21 |
| | SB-48 | 1 - 2 | 3/22/94 | 10 | 8.7 |
| | SB-48 | 2 - 3 | 3/22/94 | 3 | 3.1 |

NOTES:

PCB - Polychlorinated biphenyls
ppm - Parts per million
J - Denotes an estimated concentration
ft bls - Feet below land surface

## Table 21. Summary of Polychlorinated Biphenyl Concentrations Detected in Area 8 Soil Samples During Additional Delineation Investigation, Sunnyside Yard, Queens, New York.

| Area of Concern | Sample Designation | Sample Depth (ft bls) | Sample Date | Total PCB Concentration (based on Immunoassay Analysis) (ppm) |
|---|---|---|---|---|
| **Area A-8A** | SB-1 | 0 - 1 | 3/23/94 | >48 |
| | | 1 - 2 | 3/23/94 | 3 |
| | SB-2 | 0 - 1 | 3/23/94 | >48 |
| | | 1 - 2 | 3/23/94 | 2 |
| | | 2 - 3 | 3/23/94 | 2 |
| | | 3 - 4 | 3/23/94 | 3 |
| | | 4 - 5 | 3/23/94 | 1 |
| | | 5 - 6 | 3/23/94 | 1 |
| | SB-3 | 0 - 1 | 3/23/94 | >48 |
| | | 1 - 2 | 3/23/94 | 1 |
| | | 2 - 3 | 3/23/94 | 2 |
| | | 3 - 4 | 3/23/94 | 2 |
| | | 4 - 5 | 3/23/94 | 5 |
| | | 5 - 6 | 3/23/94 | 2 |
| | SB-4 | 0 - 1 | 3/23/94 | 15.8 |
| | SB-56 | 0 - 1 | 8/9/94 | 24.5 |
| | SB-57 | 0 - 1 | 8/9/94 | 1.6 |
| | SB-58 | 0 - 1 | 8/9/94 | 0.9 |
| | SB-59 | 0 - 1 | 8/9/94 | 0.3 |
| **Area A-8B** | SB-5 | 0 - 1 | 3/23/94 | 3 |
| | | 1 - 2 | 3/23/94 | 1 |
| | SB-6 | 0 - 1 | 3/23/94 | 2 |
| | SB-7 | 0 - 1 | 3/23/94 | 3 |
| | SB-8 | 0 - 1 | 3/23/94 | 2 |
| | SB-9 | 0 - 1 | 3/23/94 | 4 |
| **Area A-8C** | SB-10 | 0 - 1 | 3/24/94 | 11 |
| | SB-11 | 0 - 1 | 3/24/94 | 48 |
| | | 1 - 2 | 3/24/94 | 10 |
| | | 2 - 3 | 3/24/94 | >48 |
| | | 3 - 4 | 3/24/94 | 5 |
| | | 4 - 5 | 3/24/94 | 3 |
| | | 5 - 6 | 3/24/94 | 2 |
| | SB-12 | 0 - 1 | 3/24/94 | >48 |
| | | 1 - 2 | 3/24/94 | >48 |
| | | 2 - 3 | 3/24/94 | >48 |
| | | 3 - 4 | 3/24/94 | >48 |
| | | 4 - 5 | 3/24/94 | >48 |
| | | 5 - 6 | 3/24/94 | >48 |
| | | 6 - 7 | 8/9/94 | 14.9 |
| | SB-13 | 0 - 1 | 3/24/94 | >48 |
| | | 3 - 4 | 8/9/94 | 5.8 |
| | SB-14 | 0 - 1 | 3/24/94 | >48 |
| | | 1 - 2 | 3/24/94 | 48 |
| | | 2 - 3 | 3/24/94 | 8 |
| | SB-15 | 0 - 1 | 3/24/94 | >48 |
| | | 1 - 2 | 3/24/94 | >48 |
| | | 2 - 3 | 3/24/94 | >48 |
| | | 3 - 4 | 3/24/94 | 9 |
| | | 4 - 5 | 3/24/94 | <0.75 |
| | | 5 - 6 | 3/24/94 | <0.75 |

Table 21. Summary of Polychlorinated Biphenyl Concentrations Detected in Area 8 Soil Samples During Additional Delineation Investigation, Sunnyside Yard, Queens, New York.

| Area of Concern | Sample Designation | Sample Depth (ft bls) | Sample Date | Total PCB Concentration (based on Immunoassay Analysis) (ppm) |
|---|---|---|---|---|
| **Area A-8C** | SB-16 | 0 - 1 | 3/24/94 | >48 |
| | | 1 - 2 | 3/24/94 | >48 |
| | | 2 - 3 | 3/24/94 | >48 |
| | | 3 - 4 | 3/24/94 | 15.7 |
| | | 4 - 5 | 3/24/94 | >48 |
| | | 5 - 6 | 3/24/94 | >48 |
| | | 6 - 7 | 8/9/94 | 85 |
| | | 7 - 8 | 8/9/94 | 3.7 |
| | | 8 - 9 | 8/9/94 | 0 |
| | SB-17 | 0 - 1 | 3/24/94 | >48 |
| | | 1 - 2 | 3/24/94 | >48 |
| | | 2 - 3 | 3/24/94 | >48 |
| | | 3 - 4 | 3/24/94 | >48 |
| | | 4 - 5 | 3/24/94 | >48 |
| | | 5 - 6 | 3/24/94 | >48 |
| | | 6 - 7 | 8/9/94 | 4.8 |
| | SB-18 | 0 - 1 | 3/24/94 | >48 |
| | | 1 - 2 | 3/24/94 | 72 |
| | | 2 - 3 | 3/24/94 | 14.4 |
| | SB-60 | 0 - 1 | 8/9/94 | 5.3 |
| | SB-61 | 0 - 1 | 8/9/94 | 18 |
| | SB-62 | 0 - 1 | 8/9/94 | >100 |
| | | 1 - 2 | 8/9/94 | >100 |
| | | 2 - 3 | 8/9/94 | 16 |
| | SB-63 | 0 - 1 | 8/9/94 | 14 |
| | SB-64 | 0 - 1 | 8/9/94 | 14.9 |
| | SB-65 | 0 - 1 | 8/9/94 | 9.7 |
| | SB-66 | 0 - 1 | 8/9/94 | >100 |
| | | 1 - 2 | 8/9/94 | >100 |
| | | 2 - 3 | 8/9/94 | >100 |
| | SB-67 | 0 - 1 | 8/9/94 | >100 |
| | | 1 - 2 | 8/9/94 | >100 |
| | | 2 - 3 | 8/9/94 | >100 |
| | SB-68 | 0 - 1 | 8/9/94 | >100 |
| | | 1 - 2 | 8/9/94 | >100 |
| | | 2 - 3 | 8/9/94 | >100 |
| | SB-69 | 0 - 1 | 8/9/94 | >100 |
| | | 1 - 2 | 8/9/94 | >100 |
| | | 2 - 3 | 8/9/94 | 90 |
| | SB-70 | 0 - 1 | 8/9/94 | >100 |
| | | 1 - 2 | 8/9/94 | >100 |
| | | 2 - 3 | 8/9/94 | >100 |
| | SB-71 | 0 - 1 | 8/9/94 | 77 |
| | | 1 - 2 | 8/9/94 | 5.8 |

PCB - Polychlorinated biphenyls
ppm - Parts per million
ft bls - Feet below land surface

Table 22. Summary of Polychlorinated Biphenyl Concentrations Detected in Area 9 Soil Samples During Additional Delineation Investigation, Sunnyside Yard, Queens, New York.

| Sample Designation | Sample Depth (ft bls) | Sample Date | Total PCB Concentration (based on Immunoassay Analysis) (ppm) |
|---|---|---|---|
| SB-19 | 0 - 1 | 3/21/94 | 2.5 |
| SB-20 | 0 - 1 | 3/21/94 | 3 |
| SB-21 | 0 - 1 | 3/21/94 | 5 |
| SB-22 | 0 - 1 | 3/21/94 | 7.7 |
| SB-23 | 0 - 1 | 3/21/94 | 4 |
| SB-24 | 0 - 1 | 3/21/94 | 2 |
| SB-25 | 0 - 1 | 3/21/94 | 4 |
| SB-26 | 0 - 1 | 3/21/94 | 6 |
| SB-27 | 0 - 1 | 3/21/94 | 3 |

PCB - Polychlorinated biphenyls
ppm - Parts per million
ft bls - Feet below land surface

Table 23. Summary of Polychlorinated Biphenyl Concentrations Detected in Area 17 Soil Samples During Additional Delineation Investigation, Sunnyside Yard, Queens, New York.

| Sample Designation | Sample Depth (ft bls) | Sample Date | Total PCB Concentration (based on Immunoassay Analysis) (ppm) |
|---|---|---|---|
| SB-28 | 0 - 1 | 3/21/94 | 2 |
| SB-29 | 0 - 1 | 3/21/94 | 4.5 |
| SB-30 | 0 - 1 | 3/21/94 | >48 |
|  | 1 - 2 | 3/21/94 | 22.9 |
|  | 2 - 3 | 3/23/94 | 2 |
| SB-31 | 0 - 1 | 3/21/94 | 17.8 |
|  | 1 - 2 | 3/21/94 | 14.1 |
|  | 2 - 3 | 3/23/94 | 5 |
|  | 3 - 4 | 3/23/94 | 1 |
| SB-32 | 0 - 1 | 3/23/94 | 11.7 |
| SB-33 | 0 - 1 | 3/24/94 | 6 |
| SB-34 | 0 - 1 | 3/21/94 | 3 |
| SB-35 | 0 - 1 | 3/22/94 | 5 |
| SB-36 | 0 - 1 | 3/22/94 | 4 |
| SB-37 | 0 - 1 | 3/22/94 | 10 |
|  | 1 - 2 | 3/22/94 | 6 |
|  | 2 - 3 | 3/22/94 | 1.5 |
| SB-38 | 0 - 1 | 3/22/94 | 6 |
|  | 1 - 2 | 3/22/94 | 2 |
| SB-39 | 0 - 1 | 3/22/94 | 2 |
| SB-40 | 0 - 1 | 3/21/94 | 2 |
| SB-41 | 0 - 1 | 3/22/94 | 5.5 |
| SB-42 | 0 - 1 | 3/22/94 | 7 |
|  | 1 - 2 | 3/22/94 | 4 |
|  | 2 - 3 | 3/22/94 | 1 |
| SB-43 | 0 - 1 | 3/22/94 | 10 |
|  | 1 - 2 | 3/22/94 | 3 |
| SB-44 | 0 - 1 | 3/22/94 | 7 |
| SB-45 | 0 - 1 | 3/22/94 | >48 |
|  | 1 - 2 | 3/22/94 | >48 |
|  | 2 - 3 | 3/22/94 | >48 |
|  | 3 - 4 | 8/25/94 | 1.3 |
|  | 4 - 5 | 8/25/94 | 1.5 |
| SB-46 | 0 - 1 | 3/22/94 | 9 |
|  | 1 - 2 | 3/22/94 | 1 |
| SB-47 | 0 - 1 | 3/22/94 | 29.1 |
|  | 1 - 2 | 3/22/94 | 5 |
| SB-48 | 0 - 1 | 3/22/94 | 10 |
|  | 1 - 2 | 3/22/94 | 10 |
|  | 2 - 3 | 3/22/94 | 3 |
| SB-49 | 0 - 1 | 3/22/94 | >48 |
|  | 1 - 2 | 3/22/94 | >48 |
|  | 2 - 3 | 3/22/94 | 13.5 |
|  | 3 - 4 | 3/22/94 | 9.5 |
|  | 4 - 5 | 3/22/94 | <0.75 |
|  | 5 - 6 | 3/22/94 | 3 |
| SB-50 | 0 - 1 | 3/22/94 | 67.8 |
|  | 1 - 2 | 3/22/94 | 11.7 |
|  | 2 - 3 | 3/22/94 | 6.1 |
|  | 3 - 4 | 3/22/94 | <0.75 |
| SB-51 | 0 - 1 | 3/21/94 | <0.75 |
| SB-52 | 0 - 1 | 3/21/94 | 3 |
| SB-53 | 0 - 1 | 3/23/94 | 6 |

Table 23. Summary of Polychlorinated Biphenyl Concentrations Detected in Area 17 Soil Samples During Additional Delineation Investigation, Sunnyside Yard, Queens, New York.

| Sample Designation | Sample Depth (ft bls) | Sample Date | Total PCB Concentration (based on Immunoassay Analysis) (ppm) |
|---|---|---|---|
| SB-54 | 0 - 1 | 3/22/94 | 3 |
| SB-55 | 0 - 1 | 3/24/94 | 6 |
| | 1 - 2 | 3/24/94 | 8 |
| SB-72 | 0 - 1 | 8/10/94 | 4.9 |
| SB-73 | 0 - 1 | 8/10/94 | 10.2 |
| SB-74 | 0 - 1 | 8/10/94 | 23.8 |
| SB-75 | 0 - 1 | 8/10/94 | 17 |
| SB-76 | 0 - 1 | 8/25/94 | 4.5 |
| | 1 - 2 | 8/25/94 | 1.7 |
| SB-77 | 0 - 1 | 8/25/94 | 6.8 |
| | 1 - 2 | 8/25/94 | 1.1 |
| SB-78 | 0 - 1 | 8/25/94 | 5 |
| | 1 - 2 | 8/25/94 | 1.8 |
| SB-79 | 0 - 1 | 8/25/94 | 7 |
| | 1 - 2 | 8/25/94 | 3.7 |
| SB-80 | 0 - 1 | 8/10/94 | 70 |
| | 1 - 2 | 8/10/94 | 5 |
| SB-81 | 0 - 1 | 8/10/94 | 16 |
| SB-82 | 0 - 1 | 8/25/94 | 18 |
| SB-83 | 0 - 1 | 8/25/94 | 65 |
| | 1 - 2 | 8/25/94 | 2.1 |
| SB-84 | 0 - 1 | 8/10/94 | 43 |
| | 1 - 2 | 8/10/94 | 3.4 |
| SB-85 | 0 - 1 | 8/10/94 | 4 |
| SB-86 | 0 - 1 | 8/10/94 | 0 |
| SB-87 | 0 - 1 | 8/10/94 | 0.6 |

PCB - Polychlorinated biphenyls
ppm - Parts per million
ft bls - Feet below land surface

Table 24. Summary of Volatile Organic Compound Concentrations Detected in Sewer-Water Samples, Sunnyside Yard, Queens, New York.

| Sample Designation:<br>Sample Date:<br>Volatile Organic Compounds (Concentrations in ug/L) | MHW-1<br>2/9/93 | MHW-2<br>2/9/93 |
|---|---|---|
| Chloromethane | 10 U | 10 U |
| Bromomethane | 10 U | 10 U |
| Vinyl Chloride | 10 U | 10 U |
| Chloroethane | 10 U | 10 U |
| Methylene Chloride | 10 U | 10 U |
| Acetone | 10 UV | 10 UV |
| Carbon Disulfide | 10 U | 10 U |
| 1,1-Dichloroethene | 10 U | 10 U |
| 1,1-Dichloroethane | 10 U | 10 U |
| 1,2-Dichloroethene (total) | 10 U | 10 U |
| Chloroform | 1 J | 5 J |
| 1,2-Dichloroethane | 10 U | 10 U |
| 2-Butanone | 10 U | 10 U |
| 1,1,1-Trichloroethane | 6 J | 10 U |
| Carbon Tetrachloride | 10 U | 10 U |
| Bromodichloromethane | 10 U | 10 U |
| 1,2-Dichloropropane | 10 U | 10 U |
| cis-1,3-Dichloropropene | 10 U | 10 U |
| Trichloroethene | 10 U | 10 U |
| Dibromochloromethane | 10 U | 10 U |
| 1,1,2-Trichloroethane | 10 U | 10 U |
| Benzene | 6 J | 10 U |
| trans-1,3-Dichloropropene | 10 U | 10 U |
| Bromoform | 10 U | 10 U |
| 4-Methyl-2-Pentanone | 10 UV | 10 U |
| 2-Hexanone | 10 U | 10 U |
| Tetrachloroethene | 10 U | 10 U |
| 1,1,2,2-Tetrachloroethane | 10 U | 10 U |
| Toluene | 8 J | 10 U |
| Chlorobenzene | 10 U | 10 U |
| Ethylbenzene | 3 J | 10 U |
| Styrene | 10 U | 10 U |
| Xylenes (total) | 51 | 10 U |

ug/L - Micrograms per liter
U - Indicates that the compound was analyzed for but not detected.
J - Estimated value.
V - Qualifier added and/or value altered during validation.

## Table 25. Summary of Semivolatile Organic Compound Concentrations Detected in Sewer-Water Samples, Sunnyside Yard, Queens, New York.

| Sample Designation:<br>Sample Date: | MHW-1<br>2/9/93 | MHW-2<br>2/9/93 |
|---|---|---|
| Semivolatile Organic Compounds (Concentrations in ug/L) | | |
| Phenol | 10 U | 10 U |
| bis(2-Chloroethyl)ether | 10 U | 10 U |
| 2-Chlorophenol | 10 U | 10 U |
| 1,3-Dichlorobenzene | 10 U | 10 U |
| 1,4-Dichlorobenzene | 10 U | 10 U |
| Benzyl alcohol | NA | NA |
| 1,2-Dichlorobenzene | 10 U | 10 U |
| 2-Methylphenol | 10 U | 10 U |
| 2,2'-oxybis(1-Chloropropane) | 10 UJV | 10 U |
| 4-Methylphenol | 10 U | 10 U |
| N-Nitroso-di-n-propylamine | 10 U | 10 U |
| Hexachloroethane | 10 U | 10 U |
| Nitrobenzene | 10 U | 10 U |
| Isophorone | 10 U | 10 U |
| 2-Nitrophenol | 10 U | 10 U |
| 2,4-Dimethylphenol | 10 U | 10 U |
| Benzoic acid | NA | NA |
| bis(2-Chloroethoxy)methane | 10 U | 10 U |
| 2,4-Dichlorophenol | 10 U | 10 U |
| 1,2,4-Trichlorobenzene | 10 U | 1 J |
| Naphthalene | 2 J | 0.7 J |
| 4-Chloroaniline | 10 UJV | 10 U |
| Hexachlorobutadiene | 10 U | 10 U |
| 4-Chloro-3-Methylphenol | 10 U | 10 U |
| 2-Methylnaphthalene | 1 J | 10 U |
| Hexachlorocyclopentadiene | 10 U | 10 U |
| 2,4,6-Trichlorophenol | 10 U | 10 U |
| 2,4,5-Trichlorophenol | 25 U | 26 U |
| 2-Chloronaphthalene | 10 U | 10 U |
| 2-Nitroaniline | 25 U | 26 U |
| Dimethylphthalate | 10 U | 10 U |
| Acenaphthylene | 10 U | 10 U |
| 2,6-Dinitrotoluene | 10 U | 10 U |
| 3-Nitroaniline | 25 U | 26 U |
| Acenaphthene | 10 U | 10 U |
| 2,4-Dinitrophenol | 25 UJV | 26 U |
| 4-Nitrophenol | 25 U | 26 U |
| Dibenzofuran | 10 U | 0.9 J |
| 2,4-Dinitrotoluene | 10 U | 10 U |
| Diethylphthalate | 10 U | 10 UV |
| 4-Chlorophenyl-phenylether | 10 U | 10 U |
| Fluorene | 10 U | 10 U |
| 4-Nitroaniline | 25 U | 26 U |
| 4,6-Dinitro-2-methylphenol | 25 U | 26 U |
| N-Nitrosodiphenylamine (1) | 10 U | 10 U |
| 4-Bromophenyl-phenylether | 10 U | 10 U |
| Hexachlorobenzene | 10 U | 10 U |
| Pentachlorophenol | 25 U | 26 U |
| Phenanthrene | 10 U | 7 J |
| Anthracene | 10 U | 2 J |
| Di-n-butylphthalate | 10 U | 10 UV |
| Fluoranthene | 10 U | 16 |
| Pyrene | 10 U | 10 J |
| Butylbenzylphthalate | 10 U | 10 UV |
| 3,3'-Dichlorobenzidine | 10 U | 10 U |
| Benzo(a)anthracene | 10 U | 3 J |
| Chrysene | 10 U | 7 J |
| Bis(2-Ethylhexyl)phthalate | 10 UV | 10 UV |
| Di-n-octylphthalate | 10 U | 10 U |
| Benzo(b)fluoranthene | 10 U | 4 J |
| Benzo(k)fluoranthene | 10 U | 10 U |
| Benzo(a)pyrene | 10 U | 10 U |
| Indeno(1,2,3-cd)pyrene | 10 U | 10 U |
| Dibenz(a,h)anthracene | 10 U | 10 U |
| Benzo(g,h,i)perylene | 10 U | 10 U |

Table 25. Summary of Semivolatile Organic Compound Concentrations Detected in Sewer-Water Samples, Sunnyside Yard, Queens, New York.

ug/L - Micrograms per liter
U - Indicates that the compound was analyzed for but not detected.
J - Estimated value.
V - Qualifier added and/or value altered during validation.

Table 26. Summary of Metal Concentrations Detected in Sewer-Water Samples, Sunnyside Yard, Queens, New York.

| Sample Designation: | MHW-1 | MHW-2 |
|---|---|---|
| Sample Date: | 2/9/93 | 2/9/93 |
| Metals<br>(Concentrations in ug/L) | | |
| Aluminum | 131 B | 501 |
| Antimony | 21.0 U | 21.0 U |
| Arsenic | 5.0 B | 2.8 B |
| Barium | 150 B | 154 B |
| Beryllium | 1.0 U | 1.0 U |
| Cadmium | 2.0 U | 7.8 |
| Calcium | 52300 | 8380 |
| Chromium | 7.6 B | 34 |
| Cobalt | 3.0 U | 3.0 U |
| Copper | 50.6 | 94.5 |
| Iron | 33000 | 15300 |
| Lead | 15.1 | 21.6 S |
| Magnesium | 16000 | 2010 B |
| Manganese | 1670 | 175 |
| Mercury | 1.6 UV | 2.0 UV |
| Nickel | 21.0 U | 21.0 U |
| Potassium | 4940 B | 2660 B |
| Selenium | 2.0 U | 2.0 U |
| Silver | 3.0 U | 3.0 U |
| Sodium | 90000 | 12800 |
| Thallium | 2.0 U | 2.0 U |
| Vanadium | 6.0 U | 6.0 U |
| Zinc | 75.5 | 130 |

ug/L - Micrograms per liter
U - Indicates analyte result less than method detection limit (MDL).
B - Indicates analyte result between MDL and practical quantitation limit (PQL).
S - The reported value was determined by the method of standard additions (MSA).
V - Qualifier added and/or value altered during validation.

Table 27. Summary of Polychlorinated Biphenyl Compound Concentrations Detected in Sewer-Water Samples
Sunnyside Yard, Queens, New York.

| Sample Designation: | MHW-1 | MHW-1 | MHWF-1 | MHW-2 | MHW-2 | MHWF-2 |
|---|---|---|---|---|---|---|
| | | (Bottom) | (Bottom) | | (4x8)N | (4x8)N |
| Sample Date: | 2/9/93 | 4/28/94 | 4/28/94 | 2/9/93 | 4/26/94 | 4/26/94 |
| (PCB) Compounds (Concentrations in ug/L) | | | | | | |
| Aroclor-1016 | 0.066 U | 0.065 U | 0.065 U | 0.065 U | 0.065 UJ | 0.065 UJ |
| Aroclor-1221 | 0.066 U | 0.065 U | 0.065 U | 0.065 U | 0.065 UJ | 0.065 UJ |
| Aroclor-1232 | 0.066 U | 0.065 U | 0.065 U | 0.065 U | 0.065 UJ | 0.065 UJ |
| Aroclor-1242 | 0.066 U | 0.065 U | 0.065 U | 0.065 U | 0.065 UJ | 0.065 UJ |
| Aroclor-1248 | 0.066 U | 0.065 U | 0.065 U | 0.065 U | 0.065 UJ | 0.065 UJ |
| Aroclor-1254 | 0.33 UV | 0.065 U | 0.065 U | 1.1 JV | 0.23 J | 0.065 UJ |
| Aroclor-1260 | 0.13 UV | 0.065 U | 0.065 U | 1.2 JV | 0.43 J | 0.065 UJ |

| Sample Designation: | MHW-3 | MHW-5 | MHW-6 | MHW-7 | MHW-8 | MHW-29 |
|---|---|---|---|---|---|---|
| | | | | | | (Bottom) |
| Sample Date: | 2/8/93 | 2/8/93 | 2/8/93 | 2/8/93 | 2/9/93 | 4/27/94 |
| (PCB) Compounds (Concentrations in ug/L) | | | | | | |
| Aroclor-1016 | 0.065 U | 0.065 U | 0.067 U | 0.32 U | 0.33 U | 0.50 U |
| Aroclor-1221 | 0.065 U | 0.065 U | 0.067 U | 0.32 U | 0.33 U | 0.50 U |
| Aroclor-1232 | 0.065 U | 0.065 U | 0.067 U | 0.32 U | 0.33 U | 0.50 U |
| Aroclor-1242 | 0.065 U | 0.065 U | 0.067 U | 0.32 U | 0.33 U | 0.50 U |
| Aroclor-1248 | 0.065 U | 0.065 U | 0.067 U | 2.6 | 0.33 U | 0.50 U |
| Aroclor-1254 | 0.32 UV | 0.065 U | 0.48 UV | 5.9 | 9.6 JV | 1.0 U |
| Aroclor-1260 | 0.31 UV | 0.065 U | 0.33 UV | 6.3 | 11 JV | 1.0 U |

| Sample Designation: | MHW-39 | MHW-39 | MHW-40 | MHW-40 | MHWF-40 | MHW-43 |
|---|---|---|---|---|---|---|
| | (Bottom) | (24)S | (4x8)S | (48)E | (48)E | (Bottom) |
| Sample Date: | 4/26/94 | 4/26/94 | 4/25/94 | 4/25/94 | 4/25/94 | 4/27/94 |
| (PCB) Compounds (Concentrations in ug/L) | | | | | | |
| Aroclor-1016 | 0.065 UJ | 0.065 U | 0.065 U | 0.065 U | 0.065 U | 0.065 UJ |
| Aroclor-1221 | 0.065 UJ | 0.065 U | 0.065 U | 0.065 U | 0.065 U | 0.065 UJ |
| Aroclor-1232 | 0.065 UJ | 0.065 U | 0.065 U | 0.065 U | 0.065 U | 0.065 UJ |
| Aroclor-1242 | 0.065 UJ | 0.065 U | 0.065 U | 0.065 U | 0.065 U | 0.065 UJ |
| Aroclor-1248 | 0.065 UJ | 0.065 U | 0.065 U | 0.065 U | 0.065 U | 0.065 UJ |
| Aroclor-1254 | 0.065 UJ | 0.065 U | 0.065 U | 0.24 J | 0.065 U | 0.065 UJ |
| Aroclor-1260 | 0.20 J | 0.065 U | 0.065 U | 0.27 J | 0.065 U | 0.065 UJ |

Table 27. Summary of Polychlorinated Biphenyl Compound Concentrations Detected in Sewer-Water Samples Sunnyside Yard, Queens, New York.

| Sample Designation: | MHW-43 DUP<br>(Bottom) | MHW-52<br>(10)N | MHW-52<br>(18)SE | MHW-52<br>(42)SW | MHWF-52<br>(42)SW | MHW-59<br>(Bottom) |
|---|---|---|---|---|---|---|
| Sample Date: | 4/27/94 | 4/26/94 | 4/26/94 | 4/26/94 | 4/26/94 | 4/28/94 |
| (PCB) Compounds<br>(Concentrations in ug/L) | | | | | | |
| Aroclor-1016 | 0.065 U | 0.065 U | 0.065 U | 0.065 U | 0.065 UJ | 0.065 U |
| Aroclor-1221 | 0.065 U | 0.065 U | 0.065 U | 0.065 U | 0.065 UJ | 0.065 U |
| Aroclor-1232 | 0.065 U | 0.065 U | 0.065 U | 0.065 U | 0.065 UJ | 0.065 U |
| Aroclor-1242 | 0.065 U | 0.065 U | 0.065 U | 0.065 U | 0.065 UJ | 0.065 U |
| Aroclor-1248 | 0.065 U | 0.065 U | 0.065 U | 0.065 U | 0.065 UJ | 0.065 U |
| Aroclor-1254 | 0.22 J | 0.065 U | 0.065 U | 0.065 U | 0.065 UJ | 0.065 U |
| Aroclor-1260 | 0.56 J | 0.065 U | 0.065 U | 0.065 U | 0.065 UJ | 0.065 U |

| Sample Designation: | MHW-69<br>(Bottom) | CBW-28<br>(Bottom) |
|---|---|---|
| Sample Date: | 4/28/94 | 4/28/94 |
| (PCB) Compounds<br>(Concentrations in ug/L) | | |
| Aroclor-1016 | 0.50 U | 0.065 UJ |
| Aroclor-1221 | 0.50 U | 0.065 UJ |
| Aroclor-1232 | 0.50 U | 0.065 UJ |
| Aroclor-1242 | 0.50 U | 0.065 UJ |
| Aroclor-1248 | 0.50 U | 0.065 UJ |
| Aroclor-1254 | 1.0 U | 0.065 UJ |
| Aroclor-1260 | 4.4 | 0.065 UJ |

ug/L - Micrograms per liter
U - Indicates that the compound was analyzed for but not detected.
DUP - Duplicate sample
F - Filtered sample
J - Indicates the compound was analyzed for and determined to be present in the sample. The concentration listed is an estimated value, which is less than the specified minimum detection limit but is greater than zero.
B - This flag is used when the analyte is found in the blanks as well as the sample. It indicates possible sample contamination and warns the data user to use caution when applying the results of this analyte.
V - Qualifier added and/or value altered during data validation.

Table 28. Summary of Polychlorinated Biphenyl Compound Concentrations Detected in Sewer-Sediment Samples, Sunnyside Yard, Queens, New York.

| Sample Designation: | MHS-1<br>(Bottom) | MHS-2 | MHS-2<br>(Bottom) | MHS-3 | MHS-8DL | MHS-29<br>(Bottom) | MHS-35<br>(Bottom) |
|---|---|---|---|---|---|---|---|
| Sample Date: | 4/28/94 | 2/9/93 | 4/26/94 | 2/8/93 | 2/9/93 | 4/27/94 | 4/28/94 |
| (PCB) Compounds<br>(Concentrations in ug/kg) | | | | | | | |
| Aroclor-1016 | 530 U | 5,400 U | 1,200 U | 4,100 U | 430 U | 100 U | 170 U |
| Aroclor-1221 | 530 U | 11,000 U | 1,200 U | 8,400 U | 870 U | 100 U | 170 U |
| Aroclor-1232 | 530 U | 5,400 U | 1,200 U | 4,100 U | 430 U | 100 U | 170 U |
| Aroclor-1242 | 530 U | 5,400 U | 1,200 U | 3,000 JV | 430 U | 100 U | 700 |
| Aroclor-1248 | 530 U | 5,400 U | 2,000 J | 4,100 U | 430 U | 100 U | 170 U |
| Aroclor-1254 | 1,800 | 24,000 V | 2,400 U | 29,000 V | 1,300 JV | 200 U | 340 U |
| Aroclor-1260 | 1,700 | 58,000 V | 9,900 J | 22,000 V | 2,900 V | 170 J | 250 J |

| Sample Designation: | MHS-37<br>(Bottom) | MHS-40<br>(4x8)S | MHS-40<br>(48)E | MHS-42<br>(Bottom) | MHS-45<br>(Bottom) | MHS-52<br>(Bottom) | MHS-55<br>(Bottom) |
|---|---|---|---|---|---|---|---|
| Sample Date: | 4/28/94 | 4/25/94 | 4/25/94 | 4/26/94 | 4/28/94 | 4/26/94 | 4/26/94 |
| (PCB) Compounds<br>(Concentrations in ug/kg) | | | | | | | |
| Aroclor-1016 | 510 U | 1,000 U | 1,000 U | 2,100 U | 110 U | 110 U | 1,000 U |
| Aroclor-1221 | 510 U | 1,000 U | 1,000 U | 2,100 U | 110 U | 110 U | 1,000 U |
| Aroclor-1232 | 510 U | 1,000 U | 1,000 U | 2,100 U | 110 U | 110 U | 1,000 U |
| Aroclor-1242 | 510 U | 1,000 U | 1,000 U | 2,100 U | 110 U | 110 U | 1,000 U |
| Aroclor-1248 | 510 U | 2,100 J | 5,200 J | 13,000 J | 53 J | 110 U | 1,000 U |
| Aroclor-1254 | 1,000 U | 2,000 U | 2,000 U | 4,300 U | 700 J | 1,600 J | 13,000 J |
| Aroclor-1260 | 9,400 | 13,000 J | 11,000 J | 38,000 J | 750 J | 1,300 J | 12,000 J |

| Sample Designation: | MHS-65<br>(Bottom) | MHS-69<br>(18)NE | MHS-69<br>(36)E | CBS-28<br>(Bottom) |
|---|---|---|---|---|
| Sample Date: | 4/28/94 | 4/28/94 | 4/28/94 | 4/28/94 |
| (PCB) Compounds<br>(Concentrations in ug/kg) | | | | |
| Aroclor-1016 | 150 U | 1,100 U | 2,000 U | 96 U |
| Aroclor-1221 | 150 U | 1,100 U | 2,000 U | 96 U |
| Aroclor-1232 | 150 U | 1,100 U | 2,000 U | 96 U |
| Aroclor-1242 | 150 U | 1,100 U | 2,000 U | 96 U |
| Aroclor-1248 | 220 | 1,100 U | 2,000 U | 96 U |
| Aroclor-1254 | 300 U | 2,100 U | 4,100 U | 230 |
| Aroclor-1260 | 440 | 4,700 | 29,000 J | 260 |

ug/kg - Micrograms per liter
U - Indicates that the compound was analyzed for but not detected.
J - Estimated value.
V - Qualifier added and/or value altered during validation.

NOTE: Some samples were analyzed at a secondary (higher) dilution and are designated DL. Based upon data validation, either the primary or secondary results of some Aroclor species are considered to be more representative of actual conditions.

**Table 29. Summary of Preliminary Survey Observations of the Primary Sewer System, Sunnyside Yard, Queens, New York**

| Manhole/Catch Basin Designation | Description | Observations |
|---|---|---|
| MH-2 | Solid Cover Manhole | (2) 48" and 36" pipes entering, 4'x8' pipe leaving, high velocity, sediment present |
| MH-3 | Solid Cover Manhole | 42" pipe entering, 42" pipe leaving, medium velocity, sediment present |
| MH-4 | Not Located | Buried under soil pile |
| MH-5 | Solid Cover Manhole | 36" and 18" pipes entering, 36" pipe leaving, moderate velocity, sediment present |
| MH-6 | Solid Cover Manhole | (1) 6" and (3) 4" pipes entering, 12" pipe leaving, high velocity, no sediment |
| MH-7 | Solid Cover Manhole | (2) 4" and 8" pipes entering, 8" pipe leaving, low velocity, no sediment |
| MH-8 | Solid Cover Manhole | 6" and 18" pipes entering, 18" pipe leaving, low velocity, sediment present |
| MH-9 | Solid Cover Manhole | 6" and 18" pipes entering, 18" pipe leaving, low velocity, sediment present |
| MH-10 | Not Located | Buried under soil pile |
| MH-11 | Not Located | Buried under soil pile |
| MH-12 | Not Located | Buried under soil pile |
| MH-13 | Not Located | Buried under soil pile |
| MH-14 | Not Located | Buried under soil pile |
| MH-15 | Not Located | Section of sewer presumed not built |
| MH-16 | Not Located | Section of sewer presumed not built |
| MH-17 | Not Located | Section of sewer presumed not built |

**Table 29. Summary of Preliminary Survey Observations of the Primary Sewer System, Sunnyside Yard, Queens, New York**

| Manhole/Catch Basin Designation | Description | Observations |
|---|---|---|
| MH-18 | Solid Cover Manhole | Unknown entering, 10" pipe leaving, no water, sediment present |
| MH-19 | Solid Cover Manhole | 10" pipe entering, 10" pipe leaving, no water, sediment present |
| MH-20 | Solid Cover Manhole | 8" and 10" pipes entering, 10" pipe leaving, no water, sediment present |
| MH-21 | Solid Cover Manhole | 10" pipe entering, 10" pipe leaving, no water, sediment present |
| MH-22 | Grated Cover Manhole | 10" and 18" pipes entering, unknown leaving, low velocity, sediment present |
| MH-23 | Not Located | Buried by construction activities |
| MH-24 | Not Located | Buried by construction activities |
| MH-25 | Not Located | Buried by construction activities |
| MH-26 | Not Located | Buried by construction activities |
| MH-27 | Not Located | Buried by construction activities |
| MH-28 | Solid Cover Manhole | 8" pipe entering, 12" pipe leaving, low velocity, no sediment |
| MH-29 | Solid Cover Manhole | Possible drywell, 3 feet of water |
| MH-30 | Solid Cover Manhole | 6" and 12" pipes entering, 12" pipe leaving, low velocity, no sediment |
| MH-31 | Not Located | Buried under soil pile |
| MH-32 | Solid Cover Manhole | 12" pipe entering, 12" pipe leaving, low velocity, no sediment |
| MH-33 | Solid Cover Manhole | 12" pipe entering, 12" pipe leaving, low velocity, no sediment |
| MH-34 | Solid Cover Manhole | (2) 8" and 12" pipes entering, 12" pipe leaving, low velocity, no sediment |

**Table 29. Summary of Preliminary Survey Observations of the Primary Sewer System, Sunnyside Yard, Queens, New York**

| Manhole/Catch Basin Designation | Description | Observations |
|---|---|---|
| MH-35 | Solid Cover Manhole | 12" pipe entering, 18" pipe leaving, low velocity, no sediment |
| MH-36 | Not Located | Paved over |
| MH-37 | Solid Cover Manhole | 18" pipe entering, 18" pipe leaving, medium velocity, no sediment |
| MH-38 | Solid Cover Manhole | 18" pipe entering, 24" pipe leaving, medium velocity, no sediment |
| MH-39 | Solid Cover Manhole | 18" and (2) 24" pipes entering, 36" pipe leaving, medium velocity, sediment present |
| MH-40 | Not Located | Buried under soil pile |
| MH-41 | Not Located | Paved over |
| MH-42 | Solid Cover Manhole | 12" and 42" pipes entering, 48" pipe leaving, low velocity |
| MH-43 | Open Grate Manhole | 36" and 42" pipes entering, 42" pipe leaving, low velocity, sediment present |
| MH-44 | Not Located | Manhole located inside Substation 1a, building locked |
| MH-45 | Solid Cover Manhole | 12" and 24" pipes entering, 42" pipe leaving, medium velocity, sediment present |
| MH-46 | Solid Cover Manhole | 12" and 18" pipes entering, 24" pipe leaving, medium velocity, sediment present |
| MH-47 | Not Located | Paved over |
| MH-48 | Not Located | Paved over |
| MH-49 | Solid Cover Manhole | 12" pipe entering, 12" pipe leaving, low velocity, sediment present |
| MH-50 | Not Located | Paved over |
| MH-51 | Open Grate Manhole | 15" pipe entering, 18" pipe leaving, medium velocity, sediment present |

**Table 29. Summary of Preliminary Survey Observations of the Primary Sewer System, Sunnyside Yard, Queens, New York**

| Manhole/Catch Basin Designation | Description | Observations |
|---|---|---|
| MH-52 | Solid Cover Manhole | 18" and 42" pipes entering, 48" pipe leaving, medium velocity, sediment present |
| MH-53 | Solid Cover Manhole | 6", 18" and 48" pipes entering, 48" pipe leaving, medium velocity, sediment present |
| MH-54 | Unknown | 12" and 18" pipes entering, possible drywell |
| MH-55 | Solid Cover Manhole | 4", 8" and 48" pipes entering, 48" pipe leaving, medium velocity, sediment present |
| MH-56 | Not Located | Buried under soil pile |
| MH-57 | Solid Cover Manhole | 24" pipe entering, 42" pipe leaving, standing water, unable to determine presence of sediment |
| MH-66 | Not Located | Buried under soil pile |
| MH-67 | Open Grate Manhole | Dry, filled with sediment |
| MH-68 | Not Located | Buried under soil pile |
| MH-69 | Open Grate Manhole | 18" and 36" pipes entering, 36" pipe leaving, low velocity and volume from 36" pipe |
| MH-70 | Open Grate Manhole | 36" pipe entering, 36" pipe leaving, low velocity, sediment present |
| MH-71 | Open Grate Manhole | 36" pipe entering, 36" pipe leaving, low velocity, sediment present |
| MH-72 | Open Grate Manhole | 36" pipe entering, 36" pipe leaving, low velocity, sediment present |
| MH-73 | Not Located | Buried by construction activities |
| MH-74 | Not Located | Buried by construction activities |
| CB-1 | Catch Basin | Flowing water, sediment present |
| CB-2 | Catch Basin | Flowing water, sediment present |
| CB-3 | Catch Basin | Flowing water, sediment present |

**Table 29. Summary of Preliminary Survey Observations of the Primary Sewer System, Sunnyside Yard, Queens, New York**

| Manhole/Catch Basin Designation | Description | Observations |
|---|---|---|
| CB-4 | Catch Basin | Flowing water, sediment present |
| CB-5 | Not Located | Buried |
| CB-6 | Catch Basin | Standing water, sediment present |
| CB-7 | Catch Basin | Standing water, sediment present |
| CB-8 | Catch Basin | Standing water, unable to determine presence of sediment |
| CB-9 | Catch Basin | Standing water, unable to determine presence of sediment |
| CB-10 | Catch Basin | Flowing water, sediment present |
| CB-11 | Catch Basin | Flowing water, sediment present |
| CB-12 | Catch Basin | Flowing water, sediment present |
| CB-13 | Catch Basin | Standing water, sediment present |
| CB-14 | Not Located | Possibly buried |
| CB-15 | Not Located | Buried by soil pile |
| CB-16 | Not Located | Buried by soil pile |
| CB-17 | Catch Basin | Standing water, sediment present |
| CB-19 | Catch Basin | Standing water, unable to determine presence of sediment |
| CB-29 | Catch Basin | Standing water, unable to determine presence of sediment |
| CB-30 | Catch Basin | Standing water, unable to determine presence of sediment |
| CB-31 | Catch Basin | Standing water, unable to determine presence of sediment |

## Table 30. Summary of Preliminary Survey Observations of the Secondary Sewer System, Sunnyside Yard, Queens, New York

| Manhole/Catch Basin Designation | Description | Observations |
|---|---|---|
| MH-1 | Solid Cover Manhole | 12", 24" and 48" pipes entering, 48" pipe leaving, large volume of water, low velocity, presence of sediment unable to be determined |
| MH-58 | Solid Cover Manhole | 24" pipe entering, 24" pipe leaving, low velocity, sediment present |
| MH-59 | Solid Cover Manhole | 12" and 24" pipes entering, 24" pipe leaving, low velocity, sediment present |
| MH-60 | Solid Cover Manhole | 24" pipe entering, 24" pipe leaving, low velocity, sediment present |
| MH-61 | Not Located | Buried |
| MH-62 | Not Located | Buried |
| MH-63 | Solid Cover Manhole | 24" pipe entering, 24" pipe leaving, large volume of water, low velocity, unable to determine presence of sediment |
| MH-64 | Not Located | Presumed buried by construction activities |
| MH-65 | Solid Cover Manhole | Unknown entering, 48" pipe leaving, large volume of water, low velocity, unable to determine presence of sediment |
| CB-18 | Not Located | Possibly buried |
| CB-20 | Catch Basin | Flowing water, sediment present |
| CB-21 | Catch Basin | Standing water, unable to determine presence of sediment |
| CB-22 | Catch Basin | Standing water, unable to determine presence of sediment |
| CB-23 | Catch Basin | Standing water, unable to determine presence of sediment |

**Table 30. Summary of Preliminary Survey Observations of the Secondary Sewer System, Sunnyside Yard, Queens, New York**

| | | |
|---|---|---|
| CB-24 | Catch Basin | Standing water, unable to determine presence of sediment |
| CB-25 | Catch Basin | Standing water, unable to determine presence of sediment |
| CB-26 | Catch Basin | Standing water, unable to determine presence of sediment |
| CB-27 | Catch Basin | Standing water, unable to determine presence of sediment |
| CB-28 | Catch Basin | Standing water, unable to determine presence of sediment |
| CB-32 | Not Located | Possibly Buried |

**Table 31. Available Physical and Chemical Properties of Organic Compounds Detected, Sunnyside Yard, Queens, New York**

| Compound | Solubility in Water(1) (mg/L) | Vapor Pressure(1) (mm Hg) | Specific Gravity(1) | Henry's Law Constant (atm•m$^3$/ mole) | Log Organic Carbon Distribution Coefficient (Log Koc) | Log Octanol/Water Partition Coefficient (Log Kow) |
|---|---|---|---|---|---|---|
| **Aromatics** | | | | | | |
| Benzene | 1780 | 76 | 0.8786 | --(3) | -- | 2.13 |
| Ethylbenzene | 152 | 7 | 0.867 | -- | -- | 3.15 |
| Styrene | 300 | 5 | 0.90 (25°) | -- | -- | -- |
| Toluene | 515 | 22.0 | 0.867 | -- | 1.90 | 2.60 |
| 1,2,4-Trichlorobenzene | 19 (22°) | 0.45 (25°) | 1.574 (10°) | -- | -- | 4.30 |
| o-Xylene(2) | 175 | 5.0 | 0.88 | -- | -- | 2.77 |
| m-Xylene(2) | -- | 6.0 | 0.864 | -- | -- | 3.20 |
| p-Xylene(2) | 198 (25°) | 6.5 | 0.86 | -- | -- | 3.15 |
| **Chlorinated Volatile Organic Compounds** | | | | | | |
| Chloroform | 8000 | 160 | 1.489 | 3.67E-03 (24.8°) | -- | 1.97 |
| 1,1-Dichloroethane | 5500 | 180 | 1.174 | 3.89E-3 (24.8°) | -- | 1.79 |
| cis-1,2-Dichloroethene | 800 | 200 (25°) | 1.28 | 4.08E-03 (24.8°) | -- | 0.70 |
| trans-1,2-Dichloroethene | 600 | 200 (14°) | 1.26 | 9.38E-03 (24.8°) | -- | 0.48 |
| Methylene Chloride (Dichloromethane) | 20000 | 349 | 1.366 | 2.19E-03 (24.8°) | -- | 1.28 |
| Tetrachloroethene | 150 (25°) | 14 | 1.626 | 1.77E-02 (24.8°) | -- | 2.60 |
| 1,1,1-Trichloroethane | 4400 | 100 | 1.35 | 1.72E-02 (24.8°) | -- | 2.51 |
| 1,1,2,2-Tetrachloroethane | 2900 | 5 | 1.60 | -- | -- | 2.42 |
| Trichloroethene | 1100 (25°) | 60 | 1.46 | 9.58E-03 (24.8°) | -- | 2.38 |
| **Ketones** | | | | | | |
| Acetone | miscible | 270 (30°) | 0.791 | -- | -- | -0.22 |
| **Other Volatiles** | | | | | | |
| Carbon disulfide | 2300 (22°) | 260 | 1.263 | -- | -- | 1.84 |
| **Phenols** | | | | | | |
| 4-Chloro-3-methylphenol | -- | -- | -- | -- | -- | 3.10 |
| 2,4-Dichlorophenol | 4600 | -- | 1.383 (60°) | -- | -- | -- |
| 2,4-Dimethylphenol | -- | -- | 1.036 | -- | -- | -- |
| 4-Methylphenol | 24000 (40°) | 0.04 | 1.035 | -- | -- | 1.92 |

Table 31. Available Physical and Chemical Properties of Organic Compounds Detected, Sunnyside Yard, Queens, New York

| Compound | Solubility in Water$^{(1)}$ (mg/L) | Vapor Pressure$^{(1)}$ (mm Hg) | Specific Gravity$^{(1)}$ | Henry's Law Constant (atm•m$^3$/ mole) | Log Organic Carbon Distribution Coefficient (Log Koc) | Log Octanol/Water Partition Coefficient (Log Kow) |
|---|---|---|---|---|---|---|
| **Phthalate Esters** | | | | | | |
| Bis(2-ethylhexyl)phthalate | 0.285 | -- | 0.9843 | -- | -- | 3.98 |
| Butyl benzyl phthalate | 2.9 | 8.6E-6 | 1.1 (25°) | -- | -- | 4.78 |
| Di-n-butyl phthalate | 400 (25°) | 0.1 (115°) | 1.0465 | -- | -- | -- |
| Di-n-octyl phthalate | 0.285 (24°) | 1.2 (200°) | 0.99 | -- | -- | -- |
| Diethylphthalate | 210 | -- | 1.12 (25°) | -- | -- | -- |
| **Polycyclic Aromatics** | | | | | | |
| Acenaphthene | 3.47 | 0.00447 (25°) | 1.069 (95°) | -- | -- | 4.00 |
| Acenaphthylene | 3.93 (25°) | -- | 0.899 | -- | -- | -- |
| Anthracene | 1.29 (25°) | 0.0196 | 1.25 | -- | -- | 4.45 |
| Benzo(a)anthracene | 0.010 | -- | -- | -- | -- | 5.61 |
| Benzo(b)fluoranthene | 0.0012 | 5E-7 | -- | -- | -- | 6.57 |
| Benzo(b+k)fluoranthenes | -- | -- | -- | -- | -- | -- |
| Benzo(k)fluoranthene | 0.00055 | 5E-7 | -- | -- | -- | 6.84 |
| Benzo(g,h,i)perylene | 0.00026 (25°) | -- | -- | -- | -- | 6.51 |
| Benzo(a)pyrene | 0.003 | 6.85E-7 | 1.35 (25°) | -- | -- | 6.04 |
| Chrysene | 0.0015 (15°) | 6.3E-7 | 1.274 | -- | -- | 5.61 |
| Dibenz(a,h)anthracene | -- | -- | -- | -- | -- | -- |
| Dibenzofuran | -- | -- | -- | -- | -- | 4.12 |
| Fluoranthene | 0.265 (25°) | 6E-6 | -- | -- | -- | 5.33 |
| Fluorene | 1.9 (25°) | 0.000664 (25°) | -- | -- | -- | 4.38 |
| Indeno(1,2,3-cd)pyrene | 0.062 | 1E-10 | -- | -- | -- | 7.66 |
| Naphthalene | 30 | 0.0492 | 1.152 | -- | 3.11 | 3.01 |
| 2-Methylnaphthalene | 26-28 (25°) | 0.0543 (25°) | 1.025 | -- | -- | 4.11 |
| Phenanthrene | 1.6 (15°) | 0.00068 | 1.025 | -- | 4.36 | 4.46 |
| Pyrene | 0.16 (26°) | 6.85E-7 | -- | -- | 4.89 | 4.88 |
| **Polychlorinated Biphenyls and Pesticides** | | | | | | |
| Aroclor 1016 | 0.25 | 4E-4 (25°) | -- | -- | -- | 5.88 |
| Aroclor 1242 | 0.10 (24°) | 4E-4 (25°) | 1.41 (15.5°) | 5.73E-4 | -- | -- |
| Aroclor 1248 | -- | 5E-4 (25°) | 1.445 | 3.51E-3 | -- | 6.11 |
| Aroclor 1254 | 0.057 (24°) | 7E-5 (25°) | 1.5 (25°) | 8.37E-3 | -- | 6.47 |
| Aroclor 1260 | 0.080 (24°) | 4E-5 (25°) | 1.62 | 7.13E-3 | -- | 6.91 |
| Dieldrin | 0.1 | 1.8E-7 (25°) | 1.75 | -- | -- | 5.48 |

**Table 31. Available Physical and Chemical Properties of Organic Compounds Detected, Sunnyside Yard, Queens, New York**

| Compound | Solubility in Water$^{(1)}$ (mg/L) | Vapor Pressure$^{(1)}$ (mm Hg) | Specific Gravity$^{(1)}$ | Henry's Law Constant (atm•m$^3$/ mole) | Log Organic Carbon Distribution Coefficient (Log Koc) | Log Octanol/Water Partition Coefficient (Log Kow) |
|---|---|---|---|---|---|---|
| Endrin | -- | 2E-7 (25° ) | -- | -- | -- | 5.6 |
| Heptachlor | 0.18 | 3E-4 (25° ) | 1.58 | -- | -- | 5.44 |
| Other Organics | | | | | | |
| Benzoic Acid | 2900 | -- | 1.27 | -- | -- | 1.87 |
| N-Nitrosodiphenylamine | -- | -- | -- | -- | -- | -- |

mg/L - milligrams per liter
mm - millimeters Hg
atm•m$^3$/mole - atmosphere-cubic meters per mole

(1) Solubility, Vapor Pressure, and Specific Gravity values reported at 20° C, except as noted by values in parentheses.

(2) Because xylene analysis was often done for total xylenes, the most stringent isomer chemical property will be used as appropriate in the modeling performed in the assessment.

(3) No information available in the reference sources consulted.

Sources:

Verschueren, 1983. Mackay et al., 1982. Mackay, 1982. Gossett, 1987. Nyer et al., 1991. Sims et al., 1984. Federal Register, Vol. 55, No. 61, p. 11816-11817, March 29, 1990. Hutzinger et al., 1974. Monsanto Chemical Co., undated. Mackay and Leiononen, 1975. Hwang, 1982. U.S. EPA, 1980.

## Table 32. Estimated Retardation Factors of Organic Compounds Detected, Sunnyside Yard, Queens, New York

| Compound | Log Octanol/Water Partition Coefficient (Log Kow) | Retardation Factor (R)(1) | Relative Mobility(2) |
|---|---|---|---|
| Aromatics | | | |
| Benzene | 2.13 | 7.0 | Medium |
| Ethylbenzene | 3.15 | 64 | Immobile |
| Styrene | --(3) | -- | -- |
| Toluene | 2.60 | 19 | Medium |
| 1,2,4-Trichlorobenzene | 4.30 | 890 | Immobile |
| o-Xylene | 2.77 | 27 | Low |
| m-Xylene | 3.20 | 71 | Immobile |
| p-Xylene | 3.15 | 64 | Immobile |
| Halogenated Aliphatics | | | |
| Chloroform | 1.97 | 5.1 | Medium |
| 1,1-Dichloroethane | 1.79 | 3.7 | Medium |
| cis-1,2-Dichloroethene | 0.70 | 1.2 | High |
| trans-1,2-Dichloroethene | 0.48 | 1.1 | High |
| Methylene Chloride (Dichloromethane) | 1.28 | 1.8 | High |
| Tetrachloroethene | 2.60 | 19 | Medium |
| 1,1,1-Trichloroethane | 2.51 | 15 | Medium |
| 1,1,2,2-Tetrachloroethane | 2.42 | 13 | Medium |
| Trichloroethene | 2.38 | 12 | Medium |
| Ketones | | | |
| Acetone | -0.22 | 1.0 | High |
| Other Volatiles | | | |
| Carbon disulfide | 1.84 | 4.1 | Medium |
| Phenols | | | |
| 4-Chloro-3-methylphenol | 3.10 | 57 | Immobile |
| 2,4-Dichlorophenol | -- | -- | -- |
| 2,4-Dimethylphenol | -- | -- | -- |
| 4-Methylphenol | 1.92 | 4.7 | Medium |

**Table 32. Estimated Retardation Factors of Organic Compounds Detected, Sunnyside Yard, Queens, New York**

| Compound | Log Octanol/Water Partition Coefficient (Log Kow) | Retardation Factor (R)(1) | Relative Mobility(2) |
|---|---|---|---|
| **Phthalate Esters** | | | |
| Bis(2-ethylhexyl)phthalate | 3.98 | 420 | Immobile |
| Butyl benzyl phthalate | 4.78 | 2700 | Immobile |
| Di-n-butyl phthalate | -- | -- | -- |
| Di-*n*-octyl phthalate | -- | -- | -- |
| Diethylphthalate | -- | -- | -- |
| **Polycyclic Aromatics** | | | |
| Acenaphthene | 4.00 | 440 | Immobile |
| Acenaphthylene | -- | -- | -- |
| Anthracene | 4.45 | 1,300 | Immobile |
| Benzo(a)anthracene | 5.61 | 18,000 | Immobile |
| Benzo(b)fluoranthene | 6.57 | 160,000 | Immobile |
| Benzo(b+k)fluoranthenes | -- | -- | -- |
| Benzo(k)fluoranthene | 6.84 | 310,000 | Immobile |
| Benzo(g,h,i)perylene | 6.51 | 140,000 | Immobile |
| Benzo(a)pyrene | 6.04 | 49,000 | Immobile |
| Chrysene | 5.61 | 18,000 | Immobile |
| Dibenz(a,h)anthracene | -- | -- | -- |
| Dibenzofuran | 4.12 | 590 | Immobile |
| Fluoranthene | 5.33 | 9,500 | Immobile |
| Fluorene | 4.38 | 1,100 | Immobile |
| Indeno(1,2,3-cd)pyrene | 7.66 | 2,000,000 | Immobile |
| Naphthalene | 3.01 | 46 | Low |
| 2-Methylnaphthalene | 4.11 | 570 | Immobile |
| Phenanthrene | 4.46 | 1,300 | Immobile |
| Pyrene | 4.88 | 3,400 | Immobile |

**Table 32. Estimated Retardation Factors of Organic Compounds Detected, Sunnyside Yard, Queens, New York**

| Compound | Log Octanol/Water Partition Coefficient (Log Kow) | Retardation Factor (R)(1) | Relative Mobility(2) |
|---|---|---|---|
| **Polychlorinated Biphenyls and Pesticides** | | | |
| Aroclor 1016 | 5.88 | 34,000 | Immobile |
| Aroclor 1242 | -- | -- | -- |
| Aroclor 1248 | 6.11 | 57,000 | Immobile |
| Aroclor 1254 | 6.47 | 130,000 | Immobile |
| Aroclor 1260 | 6.91 | 360,000 | Immobile |
| Dieldrin | 5.48 | 13,000 | Immobile |
| Endrin | 5.6 | 18,000 | Immobile |
| Heptachlor | 5.44 | 12,000 | Immobile |
| **Other Organics** | | | |
| Benzoic Acid | 1.87 | 4.3 | Medium |
| N-Nitrosodiphenylamine | -- | -- | -- |

(1) Estimates based on octanol/water partition coefficients, according to the following steps.

Retardation Factor (R) = the ratio (velocity of ground water/velocity of dissolved compound).

$R = 1 + \frac{\rho_b}{n} \cdot K_d$ (Freeze and Cherry, 1979), where

$\rho_b$ = the bulk density of the soil, estimated to be 1.8 g/cm$^3$;
n = the soil porosity, estimated to be 0.25; and
$K_d$ = the distribution coefficient for the contaminant.

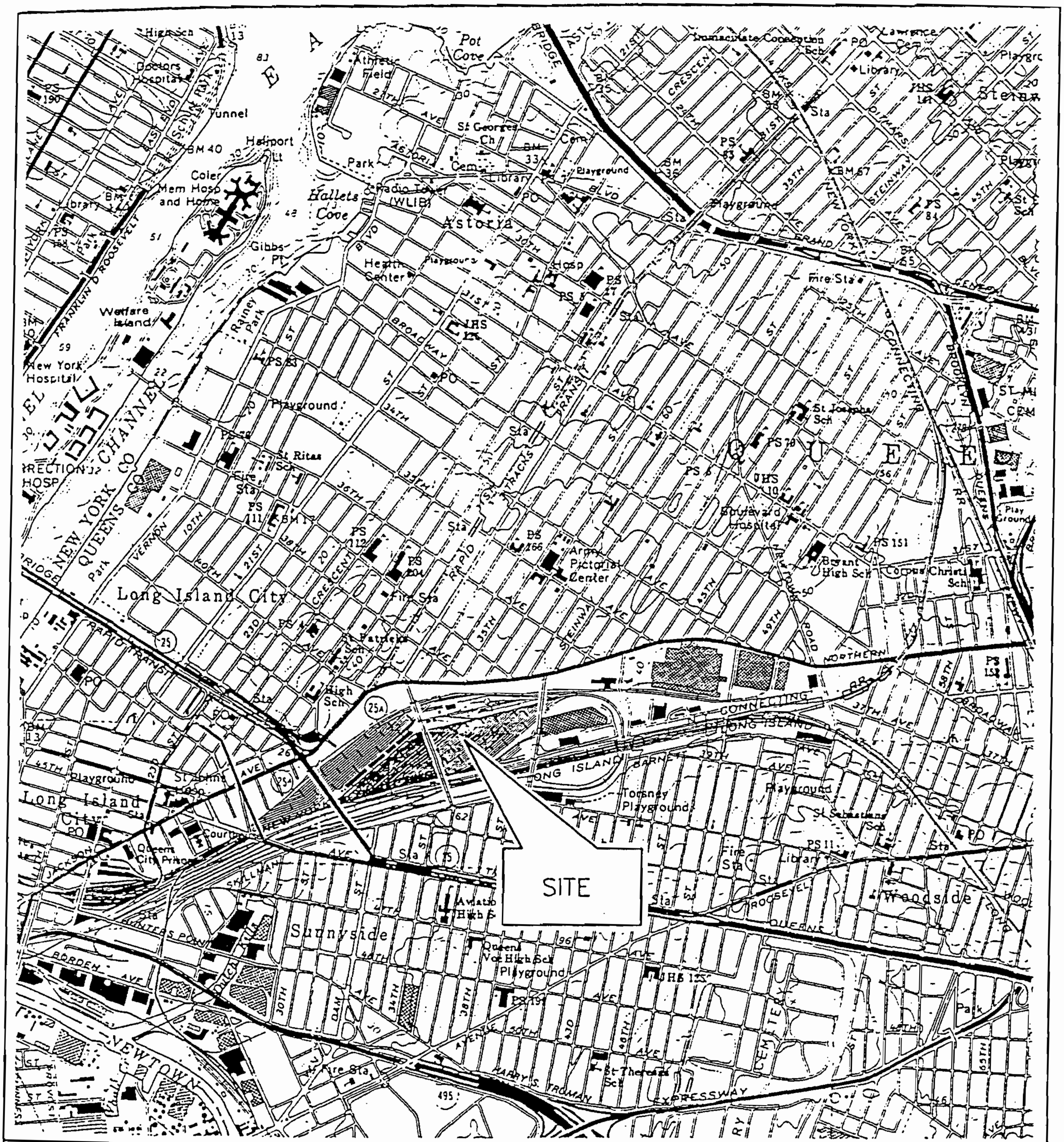
$K_d$ was estimated from the log Kow using the relationship (Lyman et al., 1982)

$\log K_d = 1.00 \log K_{ow} + \log f_{oc} - 0.21$, where $f_{oc}$ is the fraction of organic content in soil.

In the absence of valid analytical data on the total organic carbon (TOC) of the aquifer at the Yard, a default value of 0.01 (1%) was taken as the value of $f_{oc}$ for the natural aquifer matrix in these calculations.

(2) Characterizations used: High (R = 1.0-2.0); Medium (R between 2.1 and 20); Low (R between 21 and 50); and Immobile (R greater than 50).

(3) No information available in the reference sources consulted; calculation of R not possible.



SOURCE: USGS CENTRAL PARK QUADRANGLE
NEW YORK–NEW JERSEY AND
BROOKLYN QUADRANGLE, NEW YORK
7.5 MINUTE SERIES (TOPOGRAPHIC)

N

Title:

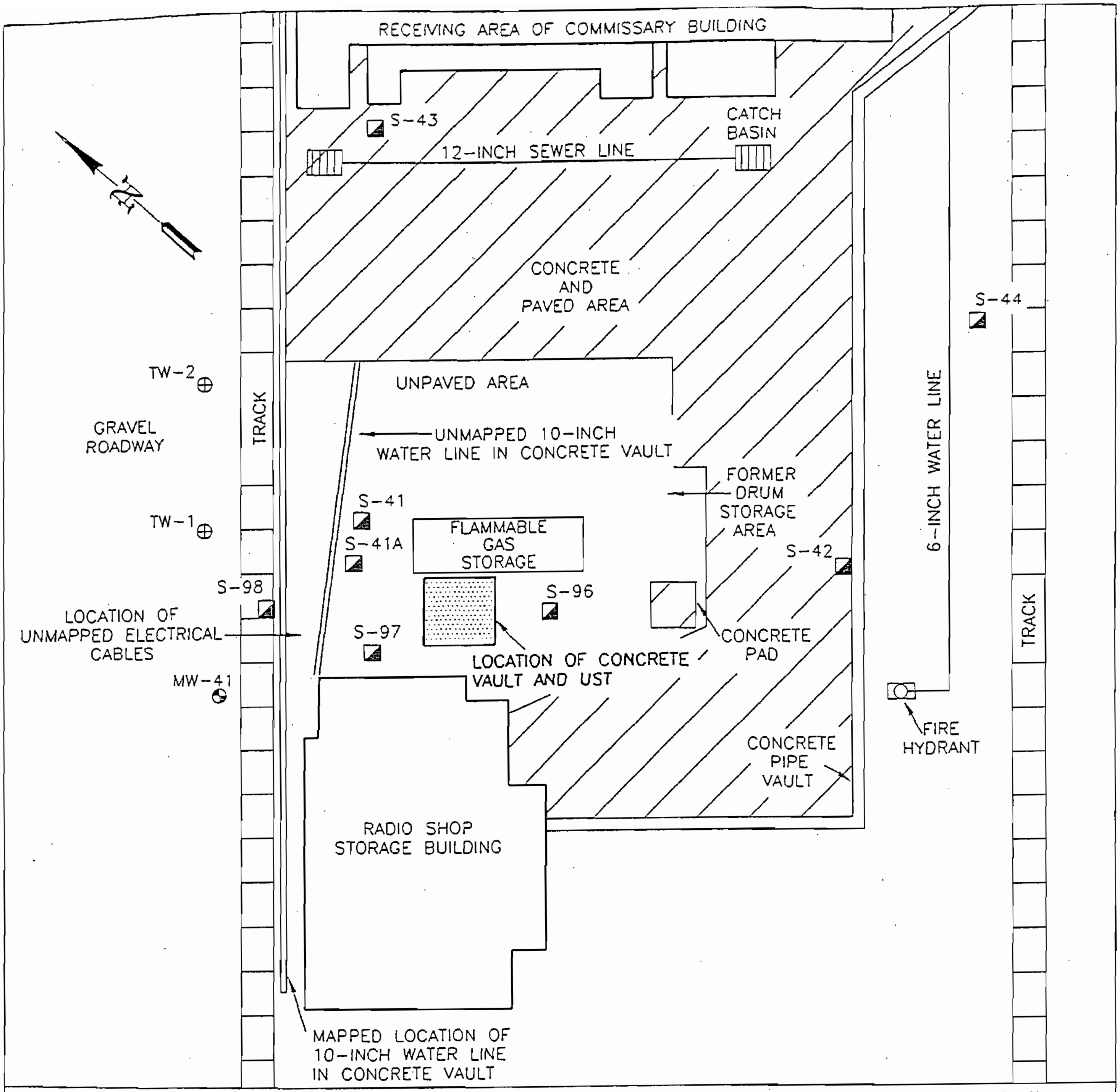
## LOCATION OF SITE

Prepared For:

SUNNYSIDE YARD, QUEENS, NEW YORK

**ROUX**
ROUX ASSOCIATES INC
*Environmental Consulting & Management*

| | | |
|---|---|---|
| Compiled by: H.G. | Date: 4/94 | FIGURE |
| Prepared by: J.R. | Scale: 1" = 2000' | |
| Project Mgr: J.D.D. | Revision: | 1 |
| File No: 05526Y | Project: 05526/45 | |



S-43 ◪ LOCATION AND DESIGNATION OF SOIL BORING

MW-41 ● LOCATION AND DESIGNATION OF MONITORING WELL

TW-1 ⊕ LOCATION AND DESIGNATION OF TEMPORARY WELLPOINT

Title:

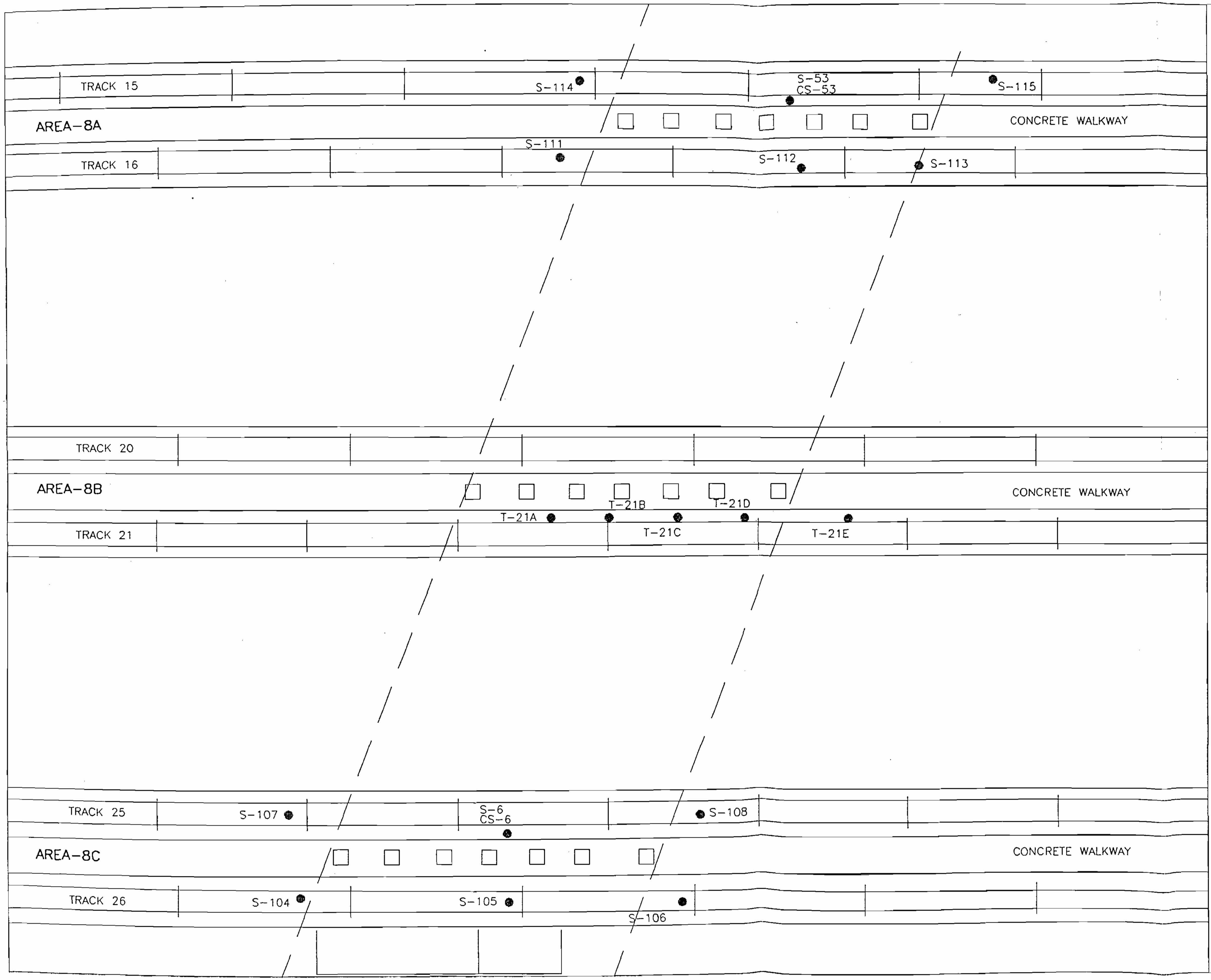
# AREA 2

# GROUND-WATER AND SOIL SAMPLING LOCATIONS FOR UNDERGROUND STORAGE TANK INVESTIGATION

Prepared For:

SUNNYSIDE YARD, QUEENS, NEW YORK

| | | | |
|---|---|---|---|
| ROUX<br>ROUX ASSOCIATES INC<br>*Environmental Consulting & Management* | Compiled by: H.G. | Date: 9/94 | FIGURE |
| | Prepared by: J.R. | Scale: SHOWN | 2 |
| | Project Mgr: J.D.D. | Revision: | |
| | File No: AM526F16 | Project: 05526/45 | |



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EXPLANATION

S-53
CS-53 ● EXISTING SOIL BORING LOCATION AND DESIGNATION

☐ HONEYWELL STREET BRIDGE SUPPORT

— — EXTENT OF HONEYWELL STREET BRIDGE

0 20 40 FT.

Title:

## AREAS 8A, 8B AND 8C

## SOIL SAMPLING LOCATIONS

Prepared For:

SUNNYSIDE YARD, QUEENS, NEW YORK

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ROUX ASSOCIATES INC
*Environmental Consulting & Management*

| | | |
|---|---|---|
| Compiled by: H.G. | Date: 12/94 | FIGURE<br>3 |
| Prepared by: J.R. | Scale: SHOWN | |
| Project Mgr: J.D.D. | Revision: | |
| File No: 05526013 | Project: 05526/45 | |

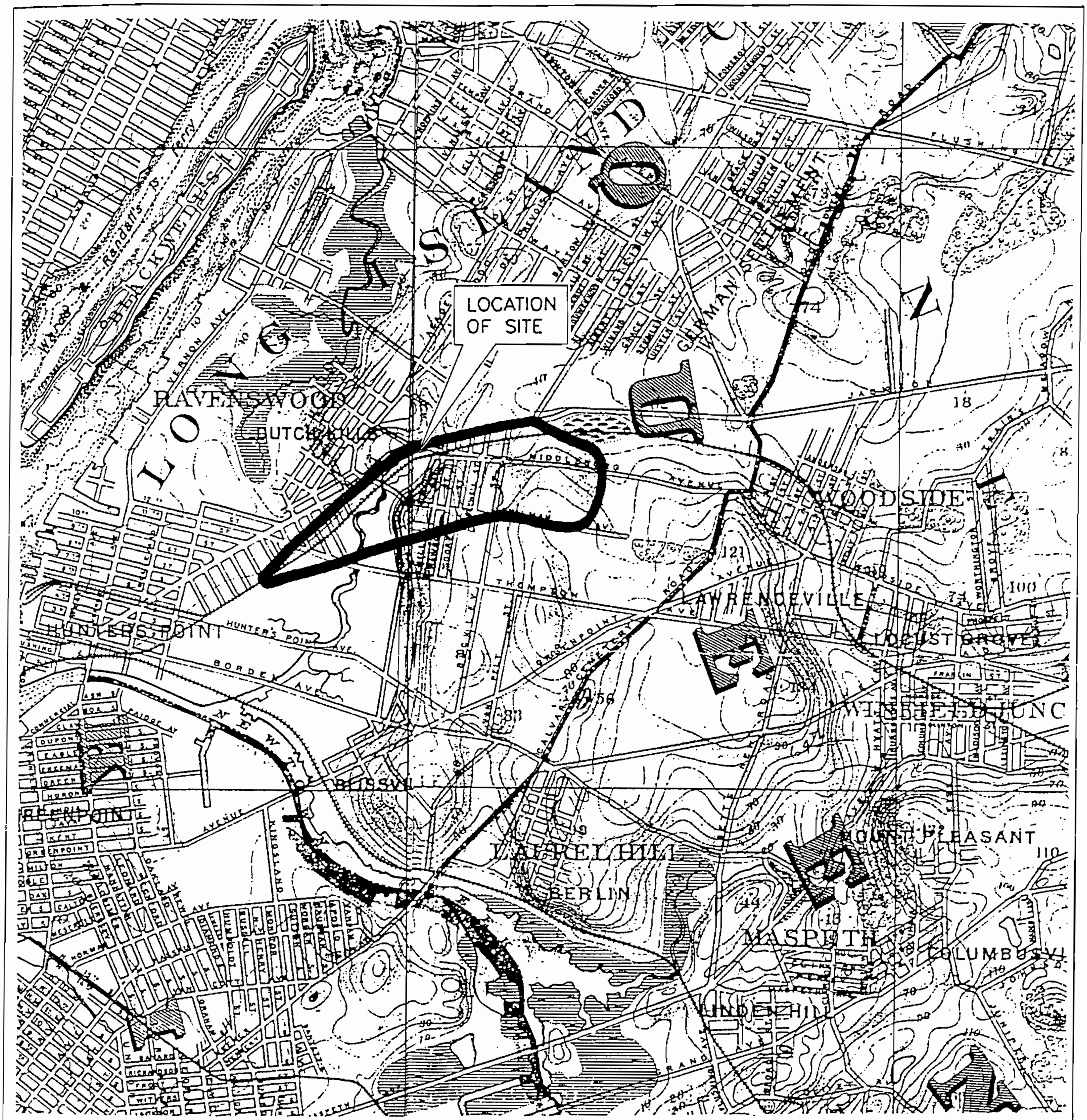
## Figure 4. Schedule for Implementation of Sediment Removal and Sewer System Monitoring Program

| Task Name | 0M | 1M | 2M | 3M | 4M | 5M | 6M | 7M | 8M | 9M | 10M | 11M | 12M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TASK 2: SEDIMENT REMOVAL | | | | | | | | | | | | | |
| Contract Procurement | █ | | | | | | | | | | | | |
| Sediment Removal | █ | | | | | | | | | | | | |
| TASK 4: SEWER SYSTEM MONITORING | | | | | | | | | | | | | |
| Sediment Build-up Inspections | I I | I I I I | I I I I | I I I | | | | | | | | | |
| | | | | | I I | I I | I I | | | | | | |
| | | | | | | | | I | I | I | I | I | I |
| Initial Sewer-Water Sampling† | I | I | | I | | | | | | | | | |
| Modified Sewer-Water Sampling (if PCBs detected) | | | | | I | I | I | I | I | I | I | I | I |
| Modified Sewer-Water Sampling (if PCBs NOT detected) | | | | | | | I | | | I | | | I |
| Letter Report Submittals‡ | | I | I | I | | | I | | | I | | | I |

Notes:

† An additional inspection (not shown on chart) will take place following the first precipitation event after sediment removal.

‡ If PCBs are detected in the sediment or water samples, the NYSDEC will be notified immediately.



Title:

# 1890 TOPOGRAPHIC MAP

Prepared For:

SUNNYSIDE YARD, QUEENS, NEW YORK

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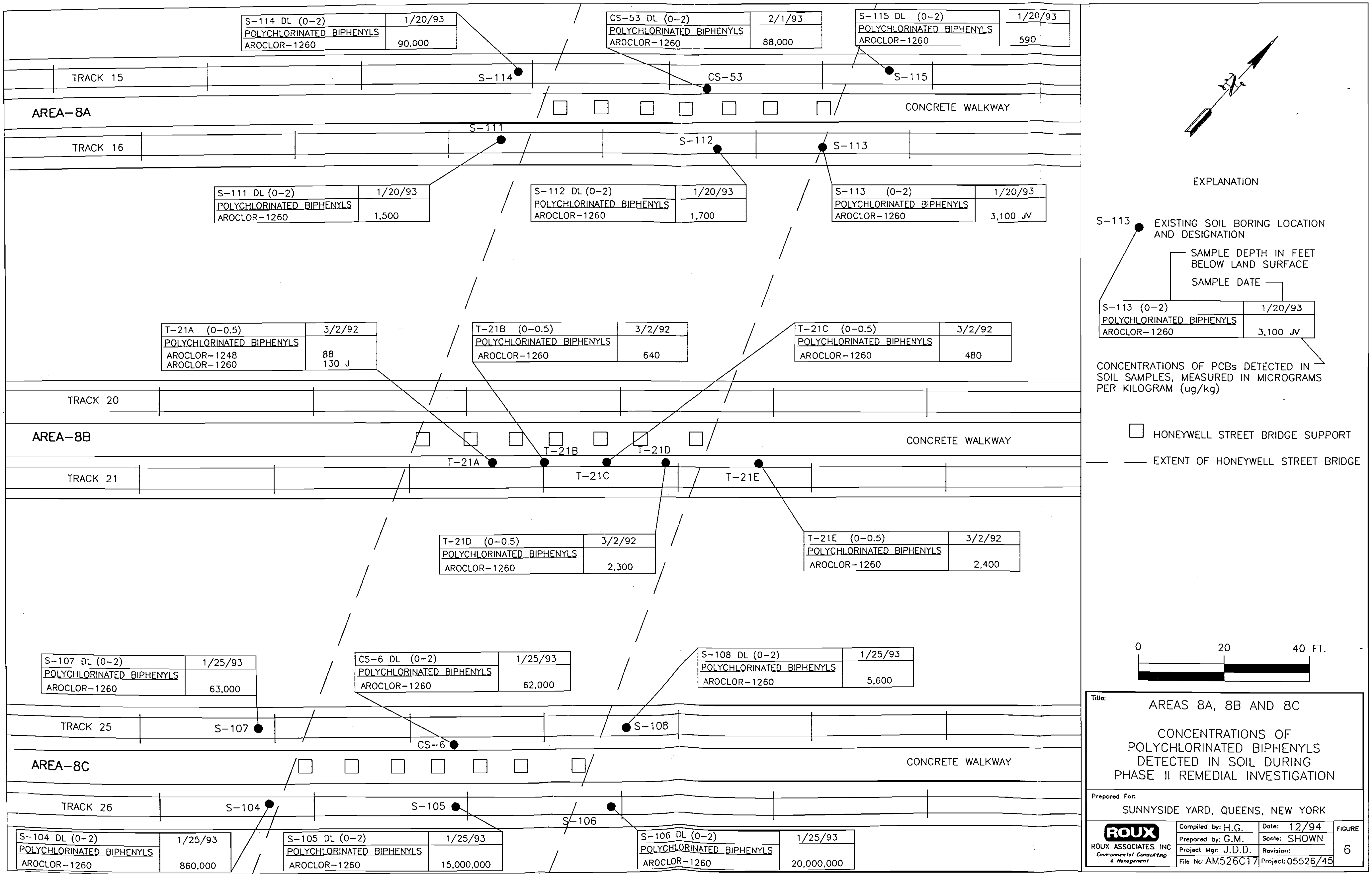
ROUX ASSOCIATES INC
*Environmental Consulting & Management*

| | | |
|---|---|---|
| Compiled by: H.G. | Date: 12/94 | FIGURE |
| Prepared by: R.R. | Scale: 1" = 2000' | 5 |
| Project Mgr: J.D.D. | Revision: | |
| Project: 05526/45 | | |



Title:

AREAS 8A, 8B AND 8C

CONCENTRATIONS OF POLYCHLORINATED BIPHENYLS DETECTED IN SOIL DURING PHASE II REMEDIAL INVESTIGATION

Prepared For:

SUNNYSIDE YARD, QUEENS, NEW YORK

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ROUX ASSOCIATES INC
Environmental Consulting & Management

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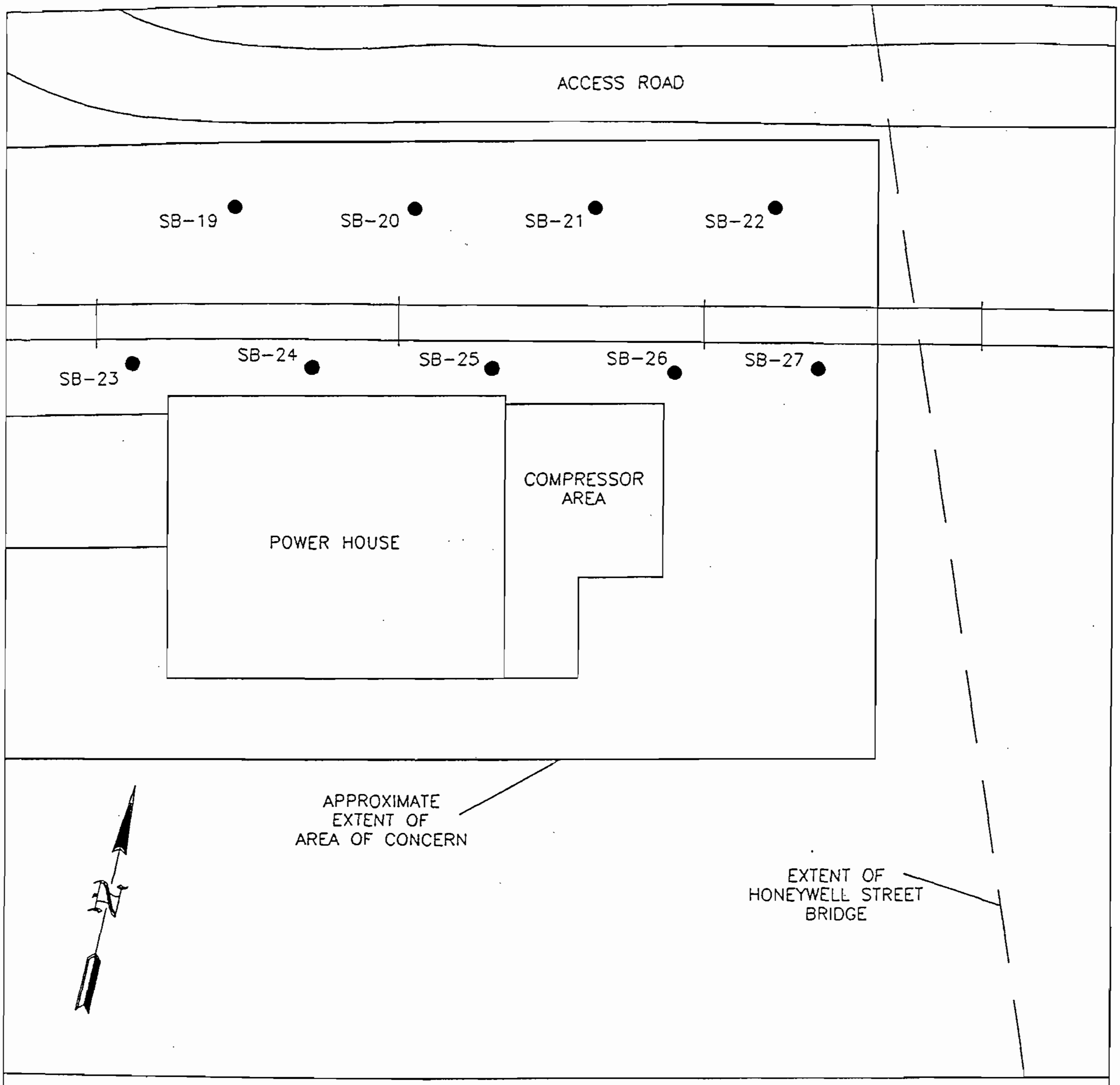
|---|---|---|
| Compiled by: H.G. | Date: 12/94 | FIGURE |
| Prepared by: G.M. | Scale: SHOWN | 6 |
| Project Mgr: J.D.D. | Revision: | |
| File No: AM526C17 | Project: 05526/45 | |



EXPLANATION

SB-19 ● SOIL BORING LOCATION AND DESIGNATION. NO PCBs DETECTED AT CONCENTRATIONS GREATER THAN 25 ppm (PARTS PER MILLION)

Title:

## AREA 9

## RESULTS OF ADDITIONAL DELINEATION OF PCBs IN SOIL

Prepared For:
SUNNYSIDE YARD, QUEENS, NEW YORK

**ROUX**
ROUX ASSOCIATES INC
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| | | |
|---|---|---|
| Compiled by: H.G. | Date: 1/95 | FIGURE |
| Prepared by: G.M. | Scale: AS SHOWN | 7 |
| Project Mgr: J.D.D. | Revision: | |
| File No: 05526009 | Project: 05526/45 | |