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FIELD INVESTIGATION/ REMEDIATION PROJECT WORK PLAN HARMON RAILROAD YARD CROTON-ON-HUDSON, NEW YORK

3 September 1993

Prepared for:

Metro-North Commuter Railroad
347 Madison Avenue
New York, NY 10017

ERM-Northeast
475 Park Avenue South
New York, NY 10016

ERM

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TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF FIGURES

LIST OF PLATES

LIST OF TABLES

1.0 *INTRODUCTION*

1.1 *PURPOSE OF WORK PLAN*

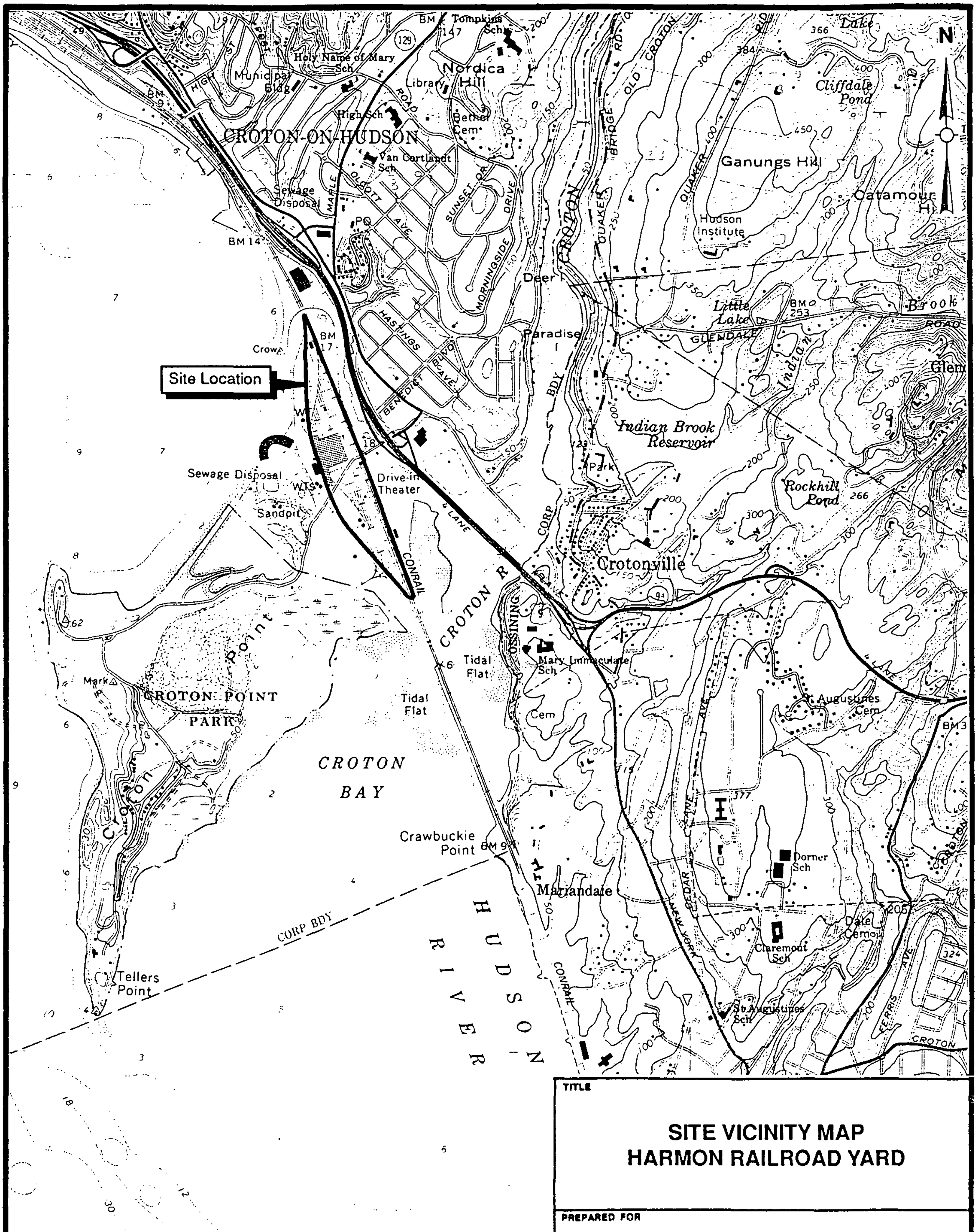
ERM-Northeast, on behalf of Metro-North Commuter Railroad, has prepared this Field Investigation/Remediation Project (FI/RP) Work Plan for the Harmon Railroad Yard in Croton-on-Hudson, New York. This work is being conducted pursuant to a Stipulation of Discontinuance between the New York State Department of Environmental Conservation (NYSDEC) and Metro-North Commuter Railroad (Metro-North).

The Harmon Railroad Yard, hereafter referred to as "the yard", has been an active rail yard for over 100 years. The yard is owned by Penn Central Corporation and/or its subsidiaries and leased by the Metropolitan Transportation Authority. The yard has been operated by Metro-North since 1983. In the process of handling large quantities of petroleum products such as fuel oil, diesel fuel and gasoline in both above and below ground storage tanks, there have been some discharges of petroleum to the subsurface. For the purposes of this investigation, the petroleum products will be referred to by the generic term non-aqueous phase liquid, or NAPL. In the context of this investigation, NAPLs are petroleum hydrocarbons with a specific gravity less than water which causes them to accumulate on the surface of the ground water table when sufficient quantities are present. The focus of this investigation will be to identify the lateral extent of NAPL at the yard as well as its chemical characteristics and the volume of soil and ground water impacted by the NAPL. Once the investigative work is complete, all of the field and bench scale/pilot test data will be reviewed to determine the most appropriate technologies for remediation of the areas of the yard where NAPL is present and/or where soils or ground water have been impacted by the NAPL.

1.2 *SITE DESCRIPTION AND HISTORY*

The yard is located in the Village of Croton-on-Hudson, New York, and is bounded by Route 9 on the east and Croton Point Park to the west (Figure 1-1). The yard is approximately 100 acres in size and is on a fairly level grade. According to the most recent United States Geological Survey (USGS) information on the area, the change in elevation from the north end of the yard to the south end of the yard near the bridge that crosses Croton Bay is approximately 11 feet. Much of the yard lies on the eastern edge of Croton Point, a peninsula that extends approximately two miles into the Hudson River and forms Croton Bay. The yard is in a fairly low lying area and is adjacent to the Croton Point Landfill, the surface of which is approximately 45 feet higher than the yard. The landfill was operated from 1927 to 1986 and is currently the focus of remediation activities which are being conducted under NYSDEC oversight. On the northwestern side of the yard is the Half Moon Bay Development. The development stretches from the northern shore of Croton Point along the Hudson River shoreline to a point north of the yard (Figure 1-1).

Based on the available records, the yard has been in existence for over 100 years. Since 1983, the yard has been the location of the Metro-North maintenance operations where repairs are made on commuter train cars and diesel and electric motors. A current plan of the yard is shown in Plate 1. The yard includes a major diesel/electric shop for maintenance of passenger cars and locomotives, a carwash, a blowshed, a railcar storage yard, a fuel pad with an above ground storage tank, a 47,500 square foot warehouse facility, an automotive fueling facility, wastewater treatment facilities, headquarters and shop facilities for various maintenance departments and approximately 300,000 square feet of outdoor paved storage and parking area. The majority of these facilities have been constructed since 1983 when Metro-North was created. Most of the maintenance activities take place on the northern side of the yard in the



SOURCE: U.S.G.S. Quadrangle Maps, Haverstraw and Ossining, NY

SCALE: 1"= 2000'

TITLE

SITE VICINITY MAP
HARMON RAILROAD YARD

PREPARED FOR

METRO NORTH COMMUTER RAILROAD

ERM–Northeast
Environmental Resources Management
ERM

SCALE Noted

DATE June 93

FIGURE 1-1

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vicinity of the Electric Shop and the Wastewater Treatment Plant (Plate 1). The refueling operations take place in the central portion of the yard and the southern end of the yard is used primarily for storage of materials and equipment (Plate 1). There are also several office buildings located throughout the yard.

According to Lawler, Matusky and Skelly Engineers (LMS), who completed the Phase II investigation at the yard, most of the NYSDEC files on the yard pertain to the Old Waste Water Treatment Plant Lagoon and the presence of polychlorinated biphenyl compounds (PCBs) in the lagoon. There is relatively little information on environmental conditions in the remainder of the yard. NYSDEC first placed the Harmon Railroad Yard on the state registry of Inactive Hazardous Waste Disposal Sites in 1985. At that time, the site was classified as a 2A, a temporary classification assigned to sites with inadequate and/or insufficient data for inclusion in any other classification. In December of 1988, at the request of Metro-North, NYSDEC split the Harmon Railroad Yard into two sites. The Old Wastewater Treatment Plant was designated as one site and was reclassified as a 2. Hart Environmental Management Corporation, on behalf of Metro-North, initiated a RI/FS project on the lagoon at that time. The RI/FS project has been completed and preparation of a remedial design is currently underway.

The remainder of the yard was grouped into another site and because of the lack of information about the yard, this site retained its classification as a 2A. In 1988, LMS was subcontracted by NYSDEC to perform a Phase II investigation and prepare a Hazard Ranking System (HRS) score for the yard. LMS released their report in 1989 and based upon the data collected during the Phase II investigation, the site received an HRS score of 28.51. As a result of the HRS score, which indicated that the site did not pose a significant threat to human health, and the fact that the environmental conditions at the site were related to the handling of petroleum products, the yard was removed from the Inactive Hazardous Waste Disposal Site registry in 1992. The site is now being managed by the Bureau of Spill Prevention and Response at NYSDEC.

1.3 *PROPOSED FIELD INVESTIGATION/REMEDIATION PROJECT TASKS*

Based upon the background information and discussions with Metro-North, NAPL has been confirmed in several areas of the yard and is suspected to be present in several other areas. Given the size of the yard and the spatial location of the potential source areas, the investigation of the yard requires a significant level of effort. Based upon these conditions, a logical manner in which to focus the field investigative efforts is on the known or suspected occurrences of NAPL in the yard. Therefore, ERM developed an investigative scope of work that is initially directed towards delineating the lateral extent of and the composition of NAPL in each area where NAPL is suspected or known to be present. Once the composition and extent of NAPL has been delineated at the yard and discrete areas of NAPL have been identified, the soils in contact with the NAPL will be characterized. The characterization will include an approximation of the volume of soils impacted as well as the chemical quality of these soils. The last task of the investigation will focus on characterizing the nature of the dissolved constituents in ground water in the vicinity of the NAPL.

The FI/RP at the yard will be comprised of eight major tasks. The first six tasks are part of the field investigation and include the following:

1) Update of Yard Map;
2) NAPL Delineation and Characterization;
3) Soil Characterization;
4) Ground Water Characterization;
5) Aquifer Testing; and
6) Field Investigation Report Preparation.

The Field Investigation Report will be submitted to NYSDEC for review and approval. In the process of completion of the Field Investigation Report, preliminary remedial technologies may be identified and the next major task of the project will be the performance of bench scale or pilot scale tests for technologies deemed appropriate for the yard. The last major task will be the preparation of a Cleanup Plan for the yard. The plan will include the results of the pilot tests and will describe the proposed remedial approach to the yard. The plan will also present the costs associated with the remedy, the manner in which the remedy will be implemented and a schedule for that implementation. NYSDEC's approval of the Cleanup Plan will be obtained prior to implementation of the design and construction of the selected remedy.

1.4 WORK PLAN ORGANIZATION

This work plan has been organized into eight major sections. The first section includes introductory information related to the yard and the performance of the FI/RP proposed by ERM for the yard. The second section contains a summary of the investigative work done in the past in the yard and includes a brief description of the scope and objectives of each investigation and a summary of the results. The second section also contains a discussion of the known and suspected areas of NAPL at the yard that have been identified for additional investigative work. The third section contains a detailed description of the objectives of the field investigative program and the procedures to be used at the yard to delineate the extent of NAPL and to characterize the soils and ground water. The fourth section of the report contains a description of the field investigative report that will be prepared upon completion of the field activities. The fifth section of the work plan briefly describes the manner in which bench and/or pilot scale tests may be conducted. The sixth section of the work plan contains a description of the cleanup plan that will be prepared upon completion of the field investigation and the bench and/or pilot scale tests. Section 7.0 contains a proposed schedule for the Field Investigation/Remediation Project and the last section of the work plan lists the references cited in this work plan. Also included in the work plan are several appendices. The Quality Assurance Project Plan for the field investigation is contained in Appendix A, the Health & Safety Plan for the field personnel is contained in Appendix B, and selected boring logs are presented in Appendix C.

2.0 SITE BACKGROUND

2.1 SUMMARY OF PREVIOUS INVESTIGATIONS

A number of investigations have been conducted at various locations throughout the Harmon Railroad Yard during the past several years. These investigations consisted of the following:

- Phase II Investigation - Lawler, Matusky & Skelly, 1989;
- RCRA Investigations - Day Engineering, 1991 and American Environmental Technologies, 1992;
- Outdoor Storage Area Investigation (Harmon Shop Recovery Well) - American Environmental Technologies/Land Tech Remedial, 1990;
- Half Moon Bay Development Investigations - C.A. Rich Consultants, Inc., 1985-1987;
- Croton Avenue Bridge Investigation - Mueser Rutledge Consulting Engineers, 1992-1993;
- Maintenance of Way Storage Building Investigation, 1989.

The purposes of these investigations have ranged from site characterization related to construction to specific concerns regarding potential areas of soil and/or ground water contamination. The findings from each of these investigations have been used as background information to identify the areas in the yard which require additional investigative work. A summary of each of these previous investigations is presented in the sections that follow.

2.1.1 Lawler, Matusky & Skelly Phase II Investigation

2.1.1.1 Objectives of Phase II Investigation

Lawler, Matusky & Skelly Engineers (LMS) was retained by the New York State Department of Environmental Conservation (NYSDEC) in 1988 to conduct a Phase II Investigation at the Harmon Railroad Yard. The main objectives of the investigation were to: 1) address specific concerns regarding past and present wastewater disposal practices and fuel spills that were not completely documented in Metro-North's records; 2) to identify the degree and extent of single or multiple contaminant plumes that may have been migrating from the site; and 3) to provide additional information to be used in the preparation of a Hazard Ranking System (HRS) score. The objectives, methodologies and findings of the investigation were presented in the Phase II Investigation Report prepared by LMS in December 1989 (LMS 1989) and are summarized below.

2.1.1.2 Phase II Investigation Scope of Work

LMS's Phase II investigation consisted of several tasks. The first task was a literature review in which information maintained by regulatory and municipal agencies and private consultants was reviewed. Next, LMS conducted a site reconnaissance to prepare for the initiation of field work and to inspect the site for "areas of concern". From that information, LMS identified several areas on which to focus their investigation: an active drum storage area; an inactive drum storage area; Osborne Pond; a refueling station; and the wastewater treatment plant.

The Phase II field investigation began with a geophysical survey of the railroad yard. The objectives of the survey were to determine the location of underground utilities, and to locate any plumes of contaminated ground water that may have been emanating from the site. The survey consisted of a terrain conductivity survey in July 1988. Both the active drum storage area and the area surrounding Osborne Pond were investigated.

The major component of the Phase II investigation was the ground water/subsurface investigation. Five monitoring wells (GW-1 through GW-5) were installed in the uppermost unconsolidated aquifer. Soil samples were collected at five-foot intervals to the water table and at two-foot intervals to the bottom of the borings. Two-inch diameter monitoring wells were installed. The well locations are shown on Plate 2. After the five LMS wells were developed, they were sampled in August 1988 along with one well (EW-7) previously installed by Metro-North. The wells were sampled again in January 1989. Slug tests were conducted on the monitoring wells to determine the permeability of the unconsolidated aquifer.

Sediment, surface water, waste water and surface soil sampling was also conducted during the Phase II investigation. The sampling locations are shown on Plate 2 and included:

- One water sample from existing well EW-7;
- One water and one sediment sample at the waste water treatment plant (WWTP) outfall;
- One sediment sample in the tidal flats south of the WWTP outfall;
- One water and one sediment sample from the concrete oil/water separator at the Old WWTP;
- Five surface soil samples at locations throughout the site.

2.1.1.3 *Site Inspection Results*

During the site inspection, access points, railway crossing areas, a decontamination zone and potable water sources were identified. The initial scope of work identified two areas for the Phase II investigation: the drum storage area and the waste treatment area including the lagoon. However, because of the separate investigation going on at the lagoon, this area was omitted from the Phase II investigation and instead Osborne Pond was added.

2.1.1.4 *Geophysical Survey Results*

A terrain conductivity survey was performed at the Harmon Railroad Yard to locate areas of potential contamination. Two areas of the site were surveyed: the new drum storage area to the north of the site and the Osborne Pond pump station to the south. Three areas of anomalous readings were obtained near the new drum storage area: two conductivity highs were interpreted by LMS to possibly represent organic contamination in the ground water; one conductivity low, in the vicinity of the C&S Headquarters building, was interpreted by LMS to possibly have been caused by nearby spools of cable wire.

In the southern region of Osborne Pond three anomalous areas were identified, two of which are conductivity highs. A conductivity low in the vicinity of the Osborne Pond pump station was interpreted by LMS as possibly related to the piping in the area.

2.1.1.5 *Summary of Geology*

According to published data cited in the LMS report (LMS 1989), the geology in the vicinity of the Harmon Yard site consists of extensive unconsolidated deposits overlying bedrock. The bedrock groups are found to trend in a northeasterly direction. Directly beneath the overburden lie the members of the Trenton Group, a middle to upper Ordovician facies consisting of schists with varied medium- to high-grade metamorphic components. A narrow band of Yonkers Gneiss (upper Proterozoic) is also reported to extend under the northern portion of the site. Evidence of the gneiss may have been observed in the metasediments taken from wells GW-3 and GW-5. The southern portion of the yard is believed to be underlain by another upper Proterozoic metamorphic unit consisting of Fordham Gneiss.

The unconsolidated deposits identified at the site by LMS include an unconsolidated aquifer composed of sand and gravel overlying the Fordham Gneiss. The saturated thickness of this sand and gravel is estimated to be more than 10 feet at the site. According to published data, transmissivity values are high in comparison to surrounding formations (LMS 1989). The southern-most tip of this unconsolidated aquifer is less than one mile from the yard. Although the elevation of the bottom of the aquifer was not reported in the literature, drilling records indicate that bedrock at the northern end of the site is at least 200 feet below grade.

Overlying the aquifer in the northern portion of the site are unconsolidated sediments composed of fluvially deposited shoreline sediments. At the southern end of the site (near GW-3 and GW-5), the unconsolidated sediments were characteristic of wetland deposits interbedded with more coarse-grained sands believed to be deposited from the Croton River outwash. Sands here contained high percentages of metamorphic parent rock.

The Croton River has created a minor deltaic condition at the junction of its mouth and Croton Bay. Several large tidal flats were observed to lie above mean low water at times during the Phase II Investigation. The sediments at the mouth of the Croton River were found to be very fine-grained and cohesive.

2.1.1.6 *Summary of Hydrogeology*

According to information summarized by LMS, the Harmon Yard is located in a hydrogeologically active area due to the influences of the Hudson and Croton rivers, which border the site to the north, southwest and extreme south. Both rivers flow toward the south and experience appreciable daily tidal incursions. Incoming tides bring with them an inflow of saline water from New York Harbor. The fresh/salt water boundary is reported to be located north of the site (LMS 1989). The tidal fluctuations serve to lessen the overall movement of ground water toward the river by increasing pressure in the pore space beneath and along the riverbed during periods of high tide. According to the LMS report, a ground water mound may be created in the area where the tidal incursions interface with the ground water. The mounding may then extend back to the monitoring wells and fluctuate with the periodic raising and lowering of the static water level, which corresponds to low and high tide periods.

Areas of more local ground water influence at the site are suggested by LMS to include the abandoned 36- by 40-inch concrete discharge pipe. This pipe was buried at a relatively shallow depth, and originated at the Old WWTP at the northern end of the site. The pipe then ran along the western portion of the site to the railroad bridge at the southern end of the site, where it discharged into Croton Bay.

Local land and water bodies, including the WWTP lagoon and the Croton Point Landfill, were also expected by LMS to alter ground water flow. The landfill rises approximately 45 feet above the site. Since runoff from the landfill was assumed to be radial any flow off its eastern side would flow toward the yard, possibly creating a ground water mound where the two fronts meet. Since no wells were installed close to the landfill, its influence on ground water conditions at the yard could not be determined by LMS.

LMS also used static water level measurements and ground elevations to determine the elevation of the water table across the site. Their data indicate that ground water flow across the site is from higher upland areas in the east toward the Hudson River, in a southwesterly direction. The horizontal gradient was found to be shallow, with well EW-7, the highest point on the water table, as the upgradient-most well.

Hydraulic conductivities were calculated by LMS using slug test data from three wells. The hydraulic conductivities ranged from 1.8 x 10^1 meters/day to 2.7 x 10^1 meters/day and averaged 2.25 x 10^1 meters/day. These results are typical for the types of saturated materials found at the site.

2.1.1.7 *Ground Water Results*

All five monitoring wells installed for the Phase II investigation were sampled along with the existing well EW-7 in August 1988. Due to QA/QC problems, the data were declared invalid. The wells were sampled again in January 1989. A summary of the ground water data is presented in Table 2-1.

Ground water beneath the site was found by LMS to flow generally from east to west across the Harmon Yard site. Non-aqueous phase liquid (NAPL) was detected in well GW-1, the proposed upgradient well. The NAPL, which measured 1.5 feet thick, had the visual appearance and odor of a fuel oil. GW-5 also contained a 0.47 foot thick layer of NAPL, which was similar in appearance to kerosene. Due to the presence of NAPL, the ground water quality in well GW-1 was thought not to be truly reflective of upgradient conditions. GW-1 contained the highest concentration of total volatile organic compounds (TVOC) and well GW-5 had the lowest TVOC concentrations. The data collected by LMS indicated that the ground water in all of the monitoring wells contained some concentrations of VOCs which were identified as evidence of gasoline or other fuel and solvent contamination.

GW-1 also contained higher concentrations of total semivolatile organic compounds (SVOCs) than any other well. Most of the SVOCs found in well GW-1 and the other wells were polynuclear aromatic hydrocarbons (PAHs). Dibenzofuran was also found in several monitoring wells. EW-7

Table 2-1 **SUMMARY OF PHASE II GROUND WATER QUALITY DATA**

PARAMETER	GW-1	GW-2	GW-3	GW-4	GW-4MS	GW-4MSD	GW-5	EW-7	GW STD.
VOLATILE ORGANICS									
Methylene chloride	5 b	ND	ND	0.5 bj	1 bj	2 bj	ND	ND	5
1,1-Dichloroethene	ND	ND	ND	0.7 bj	ND	ND	ND	ND	50
1,2-Dichloroethene (total)	ND	ND	1 j	ND	ND	ND	ND	ND	5
Benzene	2 bj	ND	1 j	0.7 bj	ND	ND	0.3 bj	0.3 bj	5
Chloroform	ND	ND	ND	0.2 bj	ND	ND	ND	ND	5
1,2-Dichloropropane	ND	ND	ND	2 j	1 j	1 j	ND	ND	5
Trichloroethene	ND	1 bj	7 b	0.7 bj	ND	ND	ND	ND	5
4-Methyl-2-pentanone	93	ND	ND	ND	ND	ND	ND	ND	50
Tetrachloroethene	0.8 bj	6 b	5 b	2 bj	1 bj	0.9 bj	0.8 bj	0.5 bj	50
Toluene	1 bj	ND	0.7 bj	0.7 bj	ND	ND	1 bj	ND	5
Chlorobenzene	ND	ND	ND	ND	ND	ND	0.3 bj	ND	5
Ethylbenzene	ND	ND	0.4 bj	0.2 bj	ND	ND	ND	ND	5
Total xylenes	27 b	ND	2 bj	0.4 bj	ND	ND	ND	ND	5
Tentatively Identified Compounds									
Trimethylbenzene Isomer	ND	ND	ND	ND	NR	NR	16 j	ND	50
Alkyl benzene compound	ND	ND	ND	ND	NR	NR	10 j	12 j	50

All data in ug/l.

Groundwater STD: Drinking water standard as promulgated by NYSDOH.

b - Found in method blank.
j - Estimated concentration; compound present below method detection level.
ND - Not detected at analytical detection level; see Appendix J for detection levels.
'R - Not run.

PARAMETER	GW-1	GW-2	GW-3	GW-4	GW-4MS	GW-4MSD	GW-5	EW-7	GW STD.
SEMIVOLATILES									
Naphthalene	870	ND	ND	ND	ND	ND	ND	ND	50
2-Methylnaphthalene	5200	ND	2 j	ND	ND	ND	ND	ND	50
Acenaphthene	ND	ND	7 j	ND	ND	ND	ND	5 j	50
Dibenzofuran	330	ND	6 j	ND	ND	ND	ND	4 j	50
Fluorene	530	ND	10 j	ND	ND	ND	5 j	5 j	50
Pentachlorophenol	ND	ND	ND	ND	ND	ND	ND	99	50
Phenanthrene	1100	ND	10 j	ND	ND	ND	6 j	5 j	50
Di-n-butylphthalate	ND	ND	ND	ND	ND	ND	ND	1 j	50
Fluoranthene	ND	ND	0.2 j	ND	ND	ND	ND	0.2 j	50
Pyrene	42 j	ND	0.5 j	ND	ND	ND	ND	ND	50
Bis(2-ethlhexyl)phthalate	ND	ND	2 j	8 bj	8 bj	11 bj	ND	12	50
Tentatively Identified Compounds									
Trimethylbenzene isomer	840 j	ND	ND	ND	NR	NR	ND	ND	50
Alkyl substituted compound	26500 j (8)	ND	59 j (2)	ND	NR	NR	509 j (7)	293 j (6)	50
Dimethyl-naphthalene isomer	11800 j (3)	ND	285 j (4)	ND	NR	NR	ND	41 j	50
Alkyl naphthalene compound	2000 j	ND	ND	ND	NR	NR	ND	ND	50
Naphthalene derivative	2800 j	ND	223 j (3)	ND	NR	NR	ND	80 j (2)	50
Phenanthrene derivative	910 j	ND	ND	ND	NR	NR	ND	ND	50
Unknown	1700 j	13 j	109.9 j (5)	109 j (4)	NR	NR	125 j (4)	14 j	50
Indene derivative	ND	ND	66 j (3)	ND	NR	NR	67 j (3)	ND	50

All data in ug/l.

Groundwater STD: Drinking water standard as promulgated by NYSDOH.

() - Number of compounds in group total.
b - Found in method blank.
j - Estimated concentration; compound present below method detection level.
ND - Not detected at analytical detection level; see Appendix J for detection levels.
NR - Not run.

PARAMETER	PARAMETER	GW-1	GW-2	GW-3	GW-4	GW-4MS	GW-4MSD	GW-5	EW-7	GW STD.
SEMIVOLATILES (con't)										
Tentatively Identified Compounds										
Dihydromethyl Indene Isomer		ND	ND	29 J	ND	NR	NR	ND	ND	50
Long chain compound		ND	ND	20 J	530 J (2)	NR	NR	ND	ND	50
Methyl-naphthaleneacetic acid Isomer		ND	ND	15 J	ND	NR	NR	ND	ND	50
Furanone derivative		ND	ND	ND	10 J	NR	NR	ND	ND	50
Atrazine derivative		ND	ND	ND	21 J	NR	NR	ND	ND	50
Unknown ester		ND	ND	ND	13 J	NR	NR	ND	14 J	50
Trimethyl naphthalene Isomer		2100 J	ND	ND	ND	NR	NR	76 J (2)	ND	50
Silicon compound		ND	ND	ND	ND	NR	NR	ND	70 J (5)	50
Unknown alcohol		ND	12 J	ND	ND	NR	NR	ND	ND	50
PESTICIDES/PCBs										
gamma-BHC (lindane)		ND	ND	0.59	ND	ND	ND	0.87	ND	50
Endrin		ND	ND	0.41 J	ND	ND	ND	1.2	0.5 J	50
gamma-chlordane		0.37 J	ND	ND	0.013 J	0.53 J	0.026 J	ND	ND	50

All data in ug/l.

Groundwater STD: Drinking water standard as promulgated by NYSDOH.

() - Number of compounds in group total.
J - Estimated concentration; compound present below method detection level.
ND - Not detected at analytical detection level; see Appendix J for detection levels.

PARAMETER	GW-1	GW-2	GW-3	GW-4	GW-4 DUP.	GW-5	EW-7	GW STD.
METALS								
Aluminum	5000 N*	30600	4370	3110 N*	2450 N*	2040 N*	900 N*	NA
Arsenic	7.2	11.3	20.4	ND	ND	19.2	ND	50
Barium	390	420	460	420	440	450	120 B	10000
Cadmium	6.0 *	ND	ND *	ND *	7 *	ND *	ND *	10
Calcium	208000	135000	128000	210000	214000	175000	184000	NA
Chromium	16 *	66	15 *	11 *	15 *	15 *	ND *	50
Cobalt	ND	ND	ND	90	70	ND	ND *	NA
Copper	48	169	41	55	57	46	22 B	1000
Iron	26600	50000	51000	6500	6300	46000	9100	300
Lead	18	137	125	566	475	755	112	50
Magnesium	55200	23700	29300	51100	51700	32200	51200	NA
Manganese	2430	1956	1430	1570	1610	1130	9750	300
Mercury	ND	0.4	ND	ND	ND	ND	48	2
Nickel	ND	60	ND	ND	ND	ND	ND	NA
Potassium	5630	9130	7560	6680	6640	9550	5530	NA
Sodium	10000	26000	107000	260000	260000	103000	21000	NA
Vanadium	ND	ND	ND N	ND N*	60 *	ND *	ND *	NA
Zinc	ND	224	112	20	11 B	68 *	311	5000
Cyanide	ND	ND	ND	ND	ND	ND	ND	NA

All data in ug/l.

Groundwater STD: Drinking water standard as promulgated by NYSDOH.

* - Indicates duplicate analysis is not within control limits.
B - Value less than CRDL but greater than IDL.
N - Spiked sample recovery not within control limits.
NA - No standard as promulgated by NYSDOH.
ND - Not detected at analytical detection level; see Appendix J for detection levels.

contained 99 micrograms per liter (ug/l) of PCP which was not found in any other well.

Pesticides were detected at wells across the site at concentrations below the ground water standards. Metals were also detected in all monitoring wells, with iron and manganese concentrations exceeding the ground water standard in every well. The mercury and chromium standards were exceeded in wells GW-7 and GW-2, respectively. The lead standard was exceeded in every well except GW-1.

In general, the area around the active drum storage area was found by LMS to have slightly lower concentrations of organics and inorganics than the area around Osborne Pond. Existing well EW-7 contained the lowest level of VOCs but the highest level of semivolatile organic compounds (SVOCs), other than GW-1.

2.1.1.8 Waste Water Results

Three waste water samples were collected by LMS, one each from the Osborne Pond pump site (PS-1), treatment plant influent (ST-1), and treatment plant effluent (SW-1). A summary of the waste water data is presented in Table 2-2. The concentrations and types of VOCs found in all three samples were generally similar to those found in the ground water samples. The highest concentration of any VOC was 990 ug/l of 4-methyl-2-pentanone, detected in sample ST-1. This compound was also detected in the ground water. Low concentrations of SVOCs, particularly PAHs were found. Sample PS-1 had the highest concentration of SVOCs. Pesticides were also found at low concentrations in PS-1 and SW-1.

Metals were also found in the waste water, with the effluent having slightly lower concentrations than the influent or pump station samples. No

SUMMARY OF PHASE II SURFACE WATER AND WASTE WATER QUALITY DATA

PARAMETER	PS-1	ST-1	ST-1DL	SW-1 a	SW-1DL a	SW-2	TRIP BLANK 1	FIELD BLANK	TRIP BLANK 2
VOLATILE ORGANICS			[Dil.:5.0]		[Dil.:2.0]				
Methylene chloride	0.7 bj	8 b	10 dbj	4 bj	3 dbj	4 bj	2 bj	6 b	ND
Acetone	ND	ND	65 d	69	8 dj	16	ND	ND	ND
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	0.5 bj	ND
1,2-Dichloroethene (total)	ND	ND	15 dj	ND	ND	ND	ND	ND	ND
Benzene	1 j	ND	ND	0.8 bj	ND	0.4 bj	ND	0.5 bj	ND
Chloroform	ND	0.7 bj	ND	7 b	ND	ND	ND	0.2 bj	ND
Bromodichloromethane	ND	ND	ND	0.6 j	ND	ND	ND	ND	ND
Trichloroethene	8 b	ND	ND	1 bj	15 db	0.3 bj	ND	0.7 bj	2 bj
4-Methyl-2-pentanone	ND	990 e	2 dj	310 e	160 d	35	ND	ND	ND
Tetrachloroethene	5 b	0.7 bj	25 db	0.8 bj	12 db	0.8 bj	1 bj	1 bj	7 b
Toluene	ND	14 b	4 dbj	6 b	ND	1 bj	0.2 bj	1 bj	0.1 bj
Chlorobenzene	ND	1 bj	ND	1 bj	ND	0.5 bj	ND	0.9 bj	ND
Ethylbenzene	ND	0.4 bj	ND	ND	ND	ND	ND	0.6 bj	ND
Total xylenes	ND	11 b	ND	3 bj	ND	ND	ND	1 bj	ND
Tentatively Identified Compounds									
Indene derivative	ND	ND	56 j	ND	25 j	ND	ND	ND	ND
Silicon compound	ND	ND	ND	ND	23 j	ND	ND	ND	ND

All data in ug/l.

a - Wastewater treatment plant discharge sample. Applicable SPDES permit levels for PCBs are a daily average of 1 ug/l and a daily maximum of 2 ug/l. Applicable action level for cadmium, chromium (total), chromium hexavalent, copper, lead, nickel, zinc and surfactants is 0.1 mg/l. The sum of benzene, toluene and xylene has an action level of 0.1 mg/l.
d - Value recovered from a diluted sample.
e - Indicates a value estimated due to the presence of interference.
j - Estimated concentration; compound present below method detection level.
ND - Not detected at analytical detection level; see Appendix J for detection levels.

SUMMARY OF PHASE II SURFACE WATER AND WASTE WATER QUALITY DATA

PARAMETER	PS-1	ST-1	ST-1DL	SW-1 a	SW-1DL a	SW-2	TRIP BLANK 1	FIELD BLANK	TRIP BLANK 2
SEMIVOLATILES			[Dil.:5.0]		[Dil.:2.0]				
Phenol	ND	6 j	NR	ND	NR	ND	NR	ND	NR
4-Methylphenol	ND	44	NR	ND	NR	ND	NR	ND	NR
Benzoic acid	ND	100	NR	ND	NR	ND	NR	ND	NR
2-Methylnaphthalene	160	18	NR	1 j	NR	ND	NR	ND	NR
Phenanthrene	ND	3 j	NR	ND	NR	ND	NR	ND	NR
Anthracene	160	ND	NR	ND	NR	ND	NR	ND	NR
Benzo (a) anthracene	7 j	ND	NR	ND	NR	ND	NR	ND	NR
Fluoranthene	46	ND	NR	ND	NR	ND	NR	ND	NR
Chrysene	13	ND	NR	ND	NR	ND	NR	ND	NR
Bis(2-ethlhexyl)phthalate	17	10 j	NR	6 j	NR	7 j	NR	8 bj	NR
Tentatively Identified Compounds									
Alkyl substituted compound	32384 j (16)	93 j (4)	NR	48 j	NR	41 j (2)	NR	ND	NR
Dimethyl-naphthalene isomer	1800 j	ND	NR	ND	NR	ND	NR	ND	NR
Naphthalene derivative	ND	12 j	NR	ND	NR	ND	NR	ND	NR
Unknown	5408 j (3)	436 j (3)	NR	18 j	NR	43 j	NR	41 j (2)	NR
Long chain compound	ND	1026 bj (3)	NR	410 j	NR	590 j	NR	420 j (2)	NR
Unsaturated hydrocarbon	ND	63 j	NR	ND	NR	ND	NR	ND	NR
Oxygenated compound	ND	10 j	NR	14 j	NR	ND	NR	ND	NR
PESTICIDES/PCBs									
gamma-BHC (lindane)	1.2	ND	NR	ND	NR	ND	NR	ND	NR
Heptachlor epoxide	2.4	ND	NR	ND	NR	ND	NR	ND	NR
4,4'-DDT	4.2	ND	NR	ND	NR	ND	NR	ND	NR
gamma-chlordane	6.9	ND	NR	0.06 j	NR	0.03 j	NR	ND	NR

All data in ug/l.

( ) - Number of compounds in group total.
a - Wastewater treatment plant discharge sample. Applicable SPDES permit levels for PCBs are a daily average of 1 ug/l and a daily maximum of 2 ug/l. Applicable action level for cadmium, chromium (total), chromium hexavalent, copper, lead, nickel, zinc and surfactants is 0.1 mg/l. The sum of benzene, toluene and xylene has an action level of 0.1 mg/l.
b - Found in method blank.
j - Estimated concentration; compound present below method detection level.
ND - Not detected at analytical detection level; see Appendix J for detection levels.
NR - Not run.

Table 2-2 *SUMMARY OF PHASE II SURFACE WATER AND WASTE WATER QUALITY DATA*

PARAMETER	ST-1	SW-1	SW-2	PS-1	FIELD BLANK
METALS					
Aluminum	270	850	640	240	ND N*
Barium	80 B	ND	ND	70 B	ND
Calcium	79400	62500	27700	47700	1710 B
Chromium	ND	ND	23	10	ND *
Cobalt	70	ND	ND	ND	ND
Copper	63	51	141	32	ND
Iron	1070	330	12900	8600	ND
Lead	34.3	22.1 +	92.5 s	65.7 +	ND
Magnesium	18700	14100	2170	5530	ND
Manganese	466	399	261	474	ND
Potassium	10800	15700	7350	4880 B	ND
Sodium	74000	53000	7000	21000	ND
Vanadium	ND	ND	ND	50	ND *
Zinc	132	29	132	83	ND
Cyanide	ND	ND	ND	ND	ND

All data in ug/l.

a - Wastewater treatment plant discharge sample. Applicable SPDES permit levels for PCBs are a daily average of 1 ug/l and a daily maximum of 2 ug/l. Applicable action level for cadmium, chromium (total), chromium hexavalent, copper, lead, nickel, zinc and surfactants is 0.1 mg/l. The sum of benzene, toluene and xylene has an action level of 0.1 mg/l.

\+ - The correlation coefficient for method of standard addition is less than 0.995.

* - Duplicate analyses not within control limits.

B - Value less than CRDL but more than IDL.

N - Spiked sample recovery not within control limits.

ND - Not detected at analytical detection level; see Appendix J for detection levels.

s - Indicates value determined by Method of Standard Addition.

violations of the SPDES permit limits occurred during the Phase II sampling.

2.1.1.9 *Surface Water and Sediment Results*

One surface water sample was taken from an old oil/water separator on the site. The surface water data is summarized in Table 2-2. The sample contained lower levels of volatiles, semivolatiles, and pesticides than found in the waste water samples. Metals found in the surface water sample were also similar in type and concentration to those found in the waste water samples.

A summary of the sediment sampling data is contained in Table 2-3. Sediment samples contained higher concentrations of volatiles and semivolatiles than those found in associated water samples. The samples from the old oil/water separator tank contained higher concentrations of chemicals than found in either of the samples taken near the treatment plant discharge. VOCs consisted mostly of benzene, toluene and xylene, and the SVOCs were primarily PAHs and naphthalene-like substances.

The suite of metals found in the sediment samples was similar to that found in the waste water samples. However, concentrations were higher in the sediment. The sediment sample from the oil/water separator tank had the highest total metal concentration.

2.1.1.10 *Soil Results*

Subsurface soil samples were collected from two monitoring well locations and were submitted for laboratory analysis. However, the data did not pass NYSDEC quality assurance/quality control (QA/QC) review and were not reported by LMS.

SUMMARY OF PHASE II SEDIMENT QUALITY DATA

PARAMETER	SED-1	SED-1RE	SED-2	SED-2RE	SED-3
VOLATILE ORGANICS					
Methylene chloride	ND	36 bj	590 bj	500 bj	ND
Acetone	580 bj	2100 b	9300 bj	9500 bj	ND
Carbon disulfide	ND	ND	5500 bj	5800 bj	180 j
Toluene	ND	ND	1800 j	ND	ND
Total xylenes	ND	ND	14000	12000	ND
Tentatively Identified Compounds					
Methyl propyl benzene isomer	60000 j	ND	ND	ND	ND
Alkyl benzene derivative	142000 j (2)	ND	ND	144000 j (2)	ND
Tetrahydronaphthalene	11000 j	6300 j	ND	ND	ND
Aromatic compound	ND	39000 j (2)	ND	ND	ND
Unknown	ND	ND	30000 j	44300 j (2)	ND
SEMIVOLATILES					
2-Methylnaphthalene	43 j	NR	79000	78000	ND
Acenaphthene	270 j	NR	ND	18000 j	ND
Dibenzofuran	100 j	NR	ND	ND	460 j
Fluorene	270 j	NR	ND	ND	ND
N-Nitrosodiphenylamine	ND	NR	ND	ND	1100 j
Phenanthrene	2500 j	NR	ND	ND	1900 j
Anthracene	450 j	NR	62000 j	77000	430 j
Fluoranthene	1900 j	NR	ND	ND	2000 j

All data in ug/kg.

( ) - Number of compounds in group total.
b - Found in method blank.
j - Estimated concentration; compound present below method detection level.
ND - Not detected at analytical detection level; see Appendix J for detection levels.
NR - Not run.

SUMMARY OF PHASE II SEDIMENT QUALITY DATA

PARAMETER	SED-1	SED-1RE	SED-2	SED-2RE	SED-3
SEMIVOLATILES (con't)					
Pyrene	2100 J	NR	ND	43000 J	2300 J
Benzo (a) anthracene	910 J	NR	2100 J	2300 J	1000 J
Bis (2-ethylhexyl) phthalate	ND	NR	10000 J	15000 J	430 J
Chrysene	950 J	NR	5700 J	6100 J	1000 J
Di-n-octyl-phthalate	ND	NR	ND	ND	14 J
Benzo (b) fluoranthene	770 J	NR	ND	ND	610 J
Benzo (k) fluoranthene	470 J	NR	ND	ND	430 J
Benzo (a) pyrene	540 J	NR	ND	ND	600 J
Indeno (1,2,3-cd) pyrene	270 J	NR	ND	ND	280 J
Benzo (g,h,i) perylene	270 J	NR	ND	ND	250 J
Tentatively Identified Compounds					
Alkyl substituted compound	ND	NR	6800000 J (8)	3450000 J (8)	103300 J (8)
Dimethyl-naphthalene derivative	ND	NR	ND	190000 J	ND
Naphthalene derivative	ND	NR	290000 J	290000 J	ND
Phenanthrene derivative	ND	NR	340000 J	ND	ND
Unknown	ND	NR	3970000 J (10)	2815000 J (10)	57400 J (7)
Indene derivative	ND	NR	ND	ND	6700 J
Long chain compound	ND	NR	ND	ND	5900 J
Trimethyl naphthalene isomer	ND	NR	ND	ND	11800 J (2)
PESTICIDES/PCBs					
gamma-BHC (lindane)	ND	NR	690 J	NR	ND
gamma-chlordane	32 J	NR	ND	NR	25 J

All data in ug/kg.

( ) - Number of compounds in group total.
J - Estimated concentration; compound present below method detection level.
ND - Not detected at analytical detection level; see Appendix J for detection levels.
NR - Not run.

PARAMETER	SED-1	SED-2	SED-3
METALS			
Aluminum	1200	21100	5720
Arsenic	ND n	ND n	6.1 n
Barium	9.0 B	459	40.0
Cadmium	ND	10.1	ND
Calcium	3650	13900	9520
Chromium	4.5 *	907 *	22.4 *
Copper	15.1 n*	867 n*	30.9 n*
Iron	4026 *	38300 *	13800 *
Lead	17.9 n*	1580 n*	80.0 n*
Magnesium	1603	2570 B	3950
Manganese	29.4 *	227 *	482 *
Mercury	ND	ND	0.17
Nickel	6.4	ND	12.9
Potassium	256 B	984 B	1160
Sodium	ND	ND	1120
Vanadium	15.4 *	ND *	12.8 *
Zinc	39.7 n	2037 n	125 n
Cyanide	ND	ND	ND

All data in mg/kg.

* - Indicates duplicate analysis is not within control limits.
B - Value less than CRDL but greater than IDL.
n - Spiked sample recovery not within control limits.
ND - Not detected at analytical detection level; see Appendix J for detection levels.

SUMMARY OF PHASE II SEDIMENT QUALITY DATA

PARAMETER	EPA MAX. CONC.	SED-1	SED-2	SED-3
EP TOXICITY				
Total arsenic	5.0	ND	ND	ND
Total barium	100.0	0.05	0.54	ND
Total cadmium	1.0	ND	ND	ND
Total chromium	5.0	0.011	0.013	ND
Total lead	5.0	ND	ND	ND
Total mercury	0.2	ND	ND	ND
Total selenium	1.0	ND	ND	ND
Total silver	5.0	ND	ND	ND

All data in mg/l.

ND - Not detected at analytical detection limit; see Appendix J for detection limit.

Surface soil samples were also collected from several areas around the site (Plate 2). These data are summarized in Table 2-4. Sample SS-3, located near well GW-1, was intended by LMS to be a background sample. SS-3 did contain the lowest concentration of TVOCs of all soil samples, and did not contain any SVOCs or pesticides. Metals detected in SS-3 were similar in type and concentration to those found on the remainder of the site. SS-1 and S-5 were collected in the vicinity of the active drum storage area. SS-1, closest to the storage pad, contained significant quantities of BTX and PAHs, naphthalene-like substances, and dibenzofuran. SS-5 contained similar compounds, at concentrations lower than SS-1 but higher than SS-3. The Osborne Pond samples, SS-2 and SS-4, contained the highest concentrations of organics of all of the soil samples; the compounds and their concentrations were interpreted by LMS to be indicative of diesel fuel. SS-6 was the only sample on the site that contained PCBs.

SS-7 and SS-8, collected near the Osborne Pond pump station, contained greater VOC concentrations than the background soil sample, but approximately the same concentrations as SS-5. The type and concentrations of SVOCs at SS-7 and SS-8 were similar to those at S-5, although SS-8 contained the highest concentrations of SVOCs among the three samples.

Metals were detected throughout the site. Concentrations were relatively consistent in all samples. The highest concentrations found were of iron, manganese, copper and zinc.

2.1.1.11 *Summary of Phase II Investigation Results*

The results of the Phase II investigation indicated the presence of organic compounds in the ground water and surface soils indicative of gasoline, coal tars, fuel oils, and other petroleum products such as asphalt. Organic contaminants found on site included benzene, toluene, and xylene (BTX)

PARAMETER	SS-1	SS-2	SS-3	SS-3MS
VOLATILE ORGANICS				
Methylene chloride	39 bj	45 bj	1 bj	5 bj
Acetone	3700 b	870 bj	2 bj	4 bj
Carbon disulfide	160 bj	79 bj	0.7 bj	0.8 bj
Benzene	100 j	ND	ND	ND
Toluene	410 j	ND	ND	ND
Total xylenes	1000	ND	ND	ND
Tentatively Identified Compounds				
Alkyl benzene derivative	21800 j (2)	ND	ND	NR
Unknown	18000 j	ND	39 j (2)	NR
SEMIVOLATILES				
Naphthalene	1000 j	630 j	ND	ND
2-Methylnaphthalene	2100 j	8500	ND	ND
Acenaphthylene	100 j	ND	ND	ND
Acenaphthene	560 j	ND	ND	ND
Dibenzofuran	690 j	ND	ND	ND
Fluorene	740 j	ND	ND	ND
Phenanthrene	4000 j	ND	ND	ND
Anthracene	730 j	8000	ND	ND
Di-n-butylphthalate	84 j	ND	ND	ND
Fluoranthene	3600 j	5500 j	ND	2800 j

All data in ug/kg.

( ) - Number of compounds in group total.
b - Found in method blank.
j - Estimated concentration; compound present below method detection level.
ND - Not detected at analytical detection level; see Appendix J for detection levels.
NR - Not run.

PARAMETER	SS-1	SS-2	SS-3	SS-3MS	SS-3MSD
SEMIVOLATILES (con't)					
Pyrene	4100 J	9100	ND	ND	ND
Benzo (a) anthracene	1700 J	720 J	ND	1200 J	ND
Bis (2-ethylhexyl) phthalate	260 J	1100 J	ND	ND	ND
Chrysene	1900 J	1800 J	ND	1600 J	ND
Benzo (b) fluoranthene	1300 J	1000 J	ND	1200 J	ND
Benzo (k) fluoranthene	1500 J	750 J	ND	ND	ND
Benzo (a) pyrene	1100 J	650 J	ND	830 J	ND
Indeno (1,2,3-cd) pyrene	360 J	200 J	ND	ND	ND
Benzo (g,h,i) perylene	300 J	130 J	ND	ND	ND
Tentatively Identified Compounds					
Alkyl substituted compound	151700 J (10)	841000 J (12)	ND	NR	NR
Unknown	143200 J (10)	487000 J (8)	ND	NR	NR
PESTICIDES/PCBs					
Heptachlor epoxide	ND	33 J	ND	ND	ND
gamma-Chlordane	140 J	ND	ND	ND	ND

All data in ug/kg.

( ) - Number of compounds in group total.
J - Estimated concentration; compound present below method detection level.
ND - Not detected at analytical detection level; see Appendix J for detection levels.
NR - Not run.

PARAMETER	SS-4	SS-4RE	SS-5	SS-5RE	SS-6	SS-7	SS-7RE	SS-8	SS-8RE
VOLATILE ORGANICS									
Methylene chloride	41 bj	99 bj	3 bj	2 bj	0.7 bj	2 bj	8 b	2 bj	4 bj
Acetone	3500 b	830 bj	3 bj	2 bj	ND	2 bj	16 b	5 bj	24 b
Carbon disulfide	ND	ND	0.7 bj	ND	ND	0.8 bj	ND	1 bj	1 j
Benzene	93 j	230 j	ND	ND	ND	ND	ND	ND	ND
Toluene	1800	2300	0.6 j	ND	ND	ND	ND	ND	1 j
Ethylbenzene	6300	8500	ND	ND	ND	ND	ND	ND	ND
Total xylenes	67000 e	71000 e	ND	ND	ND	1 j	4 j	ND	0.9 j
Tentatively Identified Compounds									
Unknown	55000 j (3)	43000 j (3)	37 bj	47 j	ND	60 j	64 j	45 j	49 j (2)
Trimethyl-cyclohexane isomer	18000 j	ND	ND	ND	ND	ND	ND	ND	ND
Alkyl hydrocarbon	ND	ND	29 j	ND	ND	ND	ND	16 j	17 j
SEMIVOLATILES									
Naphthalene	14000	18000	ND	NR	150 j	270 j	NR	420 j	NR
2-Methylnaphthalene	86000	110000	160 j	NR	140 j	400 j	NR	1500 j	NR
Acenaphthylene	ND	ND	ND	NR	ND	690 j	NR	160 j	NR
Acenaphthene	ND	ND	ND	NR	ND	45 j	NR	ND	NR
Dibenzofuran	ND	ND	ND	NR	53 j	140 j	NR	150 j	NR
Phenanthrene	ND	ND	830 j	NR	140 j	1400 j	NR	420 j	NR
Anthracene	29000	58000	ND	NR	ND	340 j	NR	200 j	NR
Di-n-butylphthalate	ND	ND	ND	NR	75 j	ND	NR	ND	NR
Fluoranthene	ND	ND	ND	NR	81 j	4200 j	NR	130 j	NR

All data in ug/kg.

( ) - Number of compounds in group total.
b - Found in method blank.
e - Value estimated due to the presence of interference.
j - Estimated concentration; compound present below method detection level.
ND - Not detected at analytical detection level; see Appendix J for detection levels.
NR - Not run.

PARAMETER	SS-4	SS-4RE	SS-5	SS-5RE	SS-6	SS-7	SS-7RE	SS-8	SS-8RE
SEMIVOLATILES (con't)									
Pyrene	7800 j	13000 j	1200 j	NR	80 j	3800 j	NR	320 j	NR
Benzo (a) anthracene	610 j	900 j	560 j	NR	42 j	2300 j	NR	ND	NR
Bis (2-ethylhexyl) phthalate	ND	270 j	ND	NR	180 j	ND	NR	ND	NR
Chrysene	990 j	1900 j	960 j	NR	92 j	3000 j	NR	200 j	NR
Benzo (b) fluoranthene	360 j	800 j	750 j	NR	ND	2500 j	NR	250 j	NR
Benzo (k) fluoranthene	380 j	710 j	810 j	NR	96 j	2400 j	NR	110 j	NR
Benzo (a) pyrene	230 j	280 j	400 j	NR	30 j	1900 j	NR	110 j	NR
Indeno (1,2,3-cd) pyrene	ND	ND	ND	NR	ND	1300 j	NR	160 j	NR
Benzo (g,h,i) perylene	140 j	ND	ND	NR	21 j	1100 j	NR	150 j	NR
Tentatively Identified Compounds									
Alkyl substituted compound	1550000 j (12)	4410000 j (10)	ND	NR	1500 bj	ND	NR	188000 j (16)	NR
Dimethyl-naphthalene isomer	86000 j	210000 j	ND	NR	ND	ND	NR	ND	NR
Alkyl naphthalene derivative	100000 j	ND	ND	NR	ND	ND	NR	ND	NR
Naphthalene derivative	120000 j	250000 j	ND	NR	ND	ND	NR	ND	NR
Unknown	344000 j (3)	2040000 j (8)	ND	NR	1500 j	ND	NR	25300 j (4)	NR
Indene derivative	94000 j	ND	ND	NR	ND	ND	NR	ND	NR
Trimethyl naphthalene isomer	71000 j	ND	ND	NR	ND	ND	NR	ND	NR
PESTICIDES/PCBs									
Heptachlor epoxide	33 j	NR	ND	NR	ND	ND	NR	8.1 j	NR
Endosulfan I	ND	NR	ND	NR	ND	83	NR	34	NR
Gamma-chlordane	ND	NR	20 j	NR	ND	ND	NR	17 j	NR
Aroclor-1254	ND	NR	ND	NR	540	ND	NR	ND	NR

All data in ug/kg.

( ) - Number of compounds in group total.
b - Found in method blank.
j - Estimated concentration; compound present below method detection level.
ND - Not detected at analytical detection level; see Appendix J for detection levels.
NR - Not run.

PARAMETER	SS-1	SS-2	SS-3	SS-3D	SS-4	SS-5	SS-6	SS-7	SS-8
METALS									
Aluminum	3820	3960	5320	5310	2360	6024	3680 n*	3770	4120
Antimony	20.9	ND	ND	ND	ND	2.0 B	ND	7.2	ND
Arsenic	12.8 n	ND n	6.0 n	6.2 n	9.7 n	10.9 n+	5.1	204 n	14.6 n
Barium	176	28.9	59.9	52.5	58.8	103	ND	106	59.9
Cadmium	1.8	0.78	ND	ND	ND	0.68	ND *	ND	ND
Calcium	3430	52600	8140	8170	2098	3306	7670	5160	19700
Chromium	86.1 *	11.8 *	13.9 *	10.5 *	8.8 *	14.6 *	27.7 *	16.2 *	7.9 *
Cobalt	7.3	ND	5.6	4.6 B	ND	5.6 B	ND	8.6	5.4 B
Copper	23400 n*	38.1 n*	67.2 n*	40.9 n*	48.4 n*	721 n*	105	182 n*	50.2 n*
Iron	24010 *	10900 *	18000 *	11200 *	11800 *	19000 *	12200	43000 *	11200 *
Lead	3840 n*	87.9 n*	1660 n*	51.4 n*	66.8 n*	443 n*	55.1	487 n*	46.8 n*
Magnesium	2320	25200	4880	4910	405 B	2630	4140	1190	15700
Manganese	145 *	300 *	390 *	219 *	43.0 *	377 *	935	332 *	186 *
Mercury	ND	ND	ND	ND	ND	0.30	ND	0.32	ND
Nickel	77.6	7.8	13.5	12.5	9.4	15.8	34.1	20.8	10.9
Potassium	582 B	1902	1160	1091	274 B	538 B	754	401 B	974
Silver	9.2	ND	ND	ND	ND	ND	ND	ND	ND
Vanadium	19.4 *	8.9 *	13.6 *	8.0 *	20.0 *	24.8 *	ND *	17.2 *	9.8 *
Zinc	896 n	219 n	99.6 n	83.4 n	57.4 n	249 n	58.9	341 n	125 n
Cyanide	ND	ND	ND	ND	ND	2.8	ND	ND	ND

All data in mg/kg.

* - Duplicate analysis is not within control limits.
\+ - The correlation coefficient for method of standard addition is less than 0.995.
B - Value less than CRDL but greater than IDL.
n - Spiked sample recovery not within control limits.
ND - Not detected at analytical detection level; see Appendix J for detection levels.

PARAMETER	EPA MAX. CONC.	SS-1	SS-2	SS-3	SS-4	SS-5	SS-6	SS-7	SS-8
EP TOXICITY									
Total arsenic	5.0	ND	ND	ND	0.008	ND	ND	0.005	ND
Total barium	100.0	0.25	0.08	0.095	0.06	0.11	0.04	0.15	0.11
Total cadmium	1.0	0.008	ND	ND	ND	ND	ND	ND	ND
Total chromium	5.0	ND	0.010	ND	ND	ND	ND	0.010	ND
Total lead	5.0	0.34	ND	ND	ND	0.08	ND	ND	ND
Total mercury	0.2	ND	ND	ND	ND	ND	ND	ND	ND
Total selenium	1.0	ND	0.007	0.006	ND	ND	ND	ND	0.011
Total silver	5.0	ND	ND	ND	ND	ND	ND	ND	ND

All data in mg/l.

ND - Not detected at analytical detection limit; see Appendix J for detection limit.

commonly found in gasoline; polynuclear aromatic hydrocarbons (PAHs) and dibenzofuran commonly found in coal tars; and xylenes and higher molecular chain hydrocarbons commonly associated with fuel oils and other petroleum products. High concentrations of metals of unspecified origin were also found throughout the site. The upgradient ground water monitoring well contained the highest levels of organic compounds in the ground water. During sampling, the upgradient well was found to contain 1.5 feet of fuel oil that was not present at the time of well installation. One well near the Osborne Pond area (probably well GW-5) also contained fuel oil but only low concentrations of VOCs were detected in the ground water sample.

The soil samples from the Osborne Pond area were found to contain the highest concentrations of BTX and PAHs. These soils also showed visual evidence of oil staining. PCBs were found only in a surface soil sample northeast of the treatment plant.

Water and sediment from the old concrete oil/water separator located in the southern portion of the site was found to contain organics and showed the sediment evidence of oil. The WWTP effluent, which was also sampled, met all the State Pollutant Discharge Elimination System (SPDES) permit limits.

The data collected from the file review and the Phase II sampling and analysis program were used to evaluate the site within the context of the U.S. Environmental Protection Agency (EPA) HRS. The final HRS score for the Harmon Railroad Yard, based mainly on ground water route characteristics and toxicity/persistence characteristics, was 28.51.

2.1.2 *AET RCRA Investigation*

2.1.2.1 *Introduction*

In March 1992, American Environmental Technologies, Inc. (AET) conducted a soil sampling program at six locations at Harmon Yard where drums were currently stored or had been stored in the past. The purpose of the investigation was to determine whether past or current storage practices had resulted in any impacts to the underlying soils.

Four of the six areas investigated by AET were originally described by Day Engineering in their 1991 Report on Solid Waste Management Units at Harmon Yard (Day, 1991). In their report, Day identified a total of four container storage areas (CSA)/transfer stations (two active, two inactive), one inactive land disposal unit, and two inactive wastewater treatment/recycling units. A brief description of the four CSAs is presented below.

HAR-CSA-01

HAR-CSA-01 was located west of the electric shop at Harmon Yard (Plate 1). Complete information on the history of this unit (waste management practices and evidence of spills/releases) was not available at the time of the Day report. However, Day reported that this unit was operated by Penn Central Transportation Company, Conrail and possibly other predecessor railroads for several decades prior to commencement of operations by Metro-North.

HAR-CSA-02

HAR-CSA-02 was a 100 foot by 120 foot outdoor drum storage area located west of the electric shop at Harmon Yard (Plate 1). This area had been operated by Metro-North since 1986, and was used for less than 90-day storage of waste solvents and corrosive wastes. The wastes were stored in 55-gallon drums; approximately 25 to 50 drums were stored there at any one time. The drums were placed on absorbent pads which were in turn stored on concrete pads. This HAR-CSA-02 is no longer in use, since the new CSA was completed in 1992.

HAR-CSA-03

HAR-CSA-0.3 was located near the substation at the northern end of Harmon Yard (Plate 1). No information on the history of this unit, including type of material stored, waste management practices, or evidence of spills/releases, was available at the time of the Day report. However, Day reported that this unit was operated by Penn Central Transportation Company, Conrail and possibly other predecessor railroads for several decades prior to commencement of operations by Metro-North.

HAR-CSA-04

HAR-CSA-04 was a 225-foot by 260-foot outdoor drum storage area located just north of the Maintenance-of-Way building at Harmon Yard (Plate 1). This area was active at the time of the Day report, and was used for storage of virgin products. Day reports that this unit had been operated by Penn Central Transportation Company, Conrail and possibly other predecessor railroads for several decades prior to commencement of operations by Metro-North.

Materials stored at HAR-CSA-04 were kept in steel drums ranging in capacity from five to 55 gallons. The drums were segregated to minimize any hazards, and were found by Day to be in generally fair condition at the time of their inspection. Approximately 50 to 150 drums were stored there at any one time, with residence times varying depending on demand. Among the materials stored at this unit was pentachlorophenol (PCP).

No records of any releases of hazardous materials from HAR-CSA-04 were found during Day's investigation. However, they did note the presence of discolored asphalt in the drum storage area, and cited it as indirect evidence of a release.

2.1.2.2 *Description of AET Sampling Program*

Each of the six locations designated for sampling were initially inspected by representatives of NYSDEC, AET and Metro-North and sample locations and depths were staked out. AET subsequently installed borings at each sampling location and collected two samples from each boring: one at 2 feet and one at 4 feet. The samples were then submitted to YAL for analysis of TCLP constituents.

Site 1 was an inactive drum storage area and corresponded to HAR-CSA-01 of the Day report. The area is currently used for parking and is located off the western corner of the maintenance shop. Site 2 is also currently used for parking and is located on the northwestern side of the maintenance shop. Site 2 was thought to be an inactive drum storage area. Site 3 was located on the southern corner of the substation on the northern end of Harmon Yard. This area corresponds to HAR-CSA-03 of the Day report and was investigated for the possible presence of PCBs. Site 4 is located west of the Maintenance Shop and is also known as the active interim drum storage; this area was identified by Day as HAR-CSA-02. Site 5 was the location of the newly constructed waste accumulation building. Site 6 was an outdoor storeroom lot located north of the Maintenance-of-Way Building. This area was identified as HAR-CSA-04 by Day and was the location of drums containing virgin pentachlorophenol.

2.1.2.3 *Summary of Findings*

No pesticides, volatile organic compounds or semi-volatile compounds were detected in any of the six sampling locations. PCBs were only detected in one location, at Site 4, at a depth of 2 feet. The concentration of PCBs at

2 feet was 10.9 ppm, and was non-detect in the sample collected from a depth of 4 feet at the same location. A number of metals were detected in the soil samples from all six areas. A summary of the metals data is contained in Table 2-5. The metals detected with the greatest frequency were: barium, cadmium, chromium and lead. However, with the exception of lead, none of the metals occurred in concentrations which exceed New York State Regulatory guidelines for protection of ground water. Lead exceeded the guidelines by a fairly small amount in one or two samples at samples at Sites 1, 3 and 4. Based upon the results of AET's sampling program, no further work is required in these areas.

2.1.3 Harmon Shop Recovery Well

2.1.3.1 Hydrogeologic Investigation Report Outdoor Storage Area - September 1990

Background

American Environmental Technologies, Inc. (AET) retained Land Tech Remedial, Inc. (LTR) to conduct a subsurface investigation at Harmon Yard in August 1990. The purpose of the investigation was to address the occurrence of subsurface free phase hydrocarbons in the vicinity of the outdoor storage area adjacent to the south side of the Harmon Distribution Center Warehouse. The details of the investigation are presented in "Hydrogeologic Investigation Report, Metro North Commuter Railroad, Harmon Yard Outdoor Storage Area", November 1990 (LTR, 1990).

The specific area addressed in the AET investigation is situated immediately south of the Distribution Center Warehouse (Figure 2-1). Prior to initiating the subsurface investigation, Metro-North removed an underground storage tank (UST) adjacent to a concrete platform along the east side of the study area. The 1,000-gallon tank was formerly used to

Table 2-5 ***Summary of Inorganic Sample Results from AET Investigation***

		Sample Identification					Sample Identification				
Dilution Factor	1	1	1	1	1	1	1	1	1	1	1
Parameter	MDL[1]	Site1-001	Site1-002	Site1-003	Site1-004	Site1-005	Site1-006	Site1-007	Site1-009	Site1-010	Site1-011
Arsenic	0.5	0.92	4.64	1.75	ND[2]	ND	ND[2]	2.77	ND	ND	1.99
Barium	25	69.0	114.5	57.0	41.8	80.5	39.1	30.5	75.9	38.5	81.2
Cadmium	1.0	1.7	2.5	1.7	ND	3.5	1.7	3.3	1.1	1.1	1.7
Chromium, total	5.0	52.6	123.8	54.2	42.3	92.6	34.1	57.0	71.9	35.4	99.5
Lead	0.5	98.9	3341.5	140.7	36.9	358.9	ND	142.3	135.6	22.2	88.4
Mercury	0.02	0.249	0.693	0.089	0.521	ND[2]	0.110	0.133	0.112	0.127	ND
Selenium	0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	2.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

		Sample Identification					Sample Identification				
Dilution Factor	1	1	1	1	1	1	1	1	1	1	1
Parameter	MDL[1]	Site1-012	Site1-013	Site1-015	Site1-017	Site1-018	Site1-019	Site3-020	Site3-021	Site3-022	Site3-023
Arsenic	0.5	ND	1.74	1.19	5.57	ND	1.14	ND[2]	ND	ND	ND
Barium	25	35.0	60.2	52.0	76.6	ND	66.2	38.7	47.4	ND	69.6
Cadmium	1.0	ND	2.1	2.6	2.2	1.0	1.6	1.1	1.1	1.0	1.0
Chromium, total	5.0	45.2	62.4	52.0	57.7	25.6	75.3	38.1	35.8	26.9	26.2
Lead	0.5	27.5	108.2	97.7	201.8	ND	100.4	ND	103.2	ND	71.2
Mercury	0.02	ND	ND	ND	0.173	0.073	0.032	0.020	0.074	0.135	ND
Selenium	0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	2.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

		Sample Identification					Sample Identification				
Dilution Factor	1	1	1	1	1	1	1	1	1	1	1
Parameter	MDL[1]	Site3-022S	Site3-024	Site3-025	Site3-026	Site3-027	Site3-028	Site3-029	Site3-030	Site3-031	Site3-032
Arsenic	0.5	ND	ND	2.08	ND	0.70	ND	ND	2.30	0.94	4.79
Barium	25	37.0	26.6	39.5	27.9	33.5	35.2	41.7	26.5	55.0	56.9
Cadmium	1.0	ND	1.1	ND	ND	ND	1.1	ND	ND	1.1	1.1
Chromium, total	5.0	29.7	34.1	38.9	23.7	40.6	38.9	38.0	29.7	42.6	44.8
Lead	0.5	ND	29.8	42.7	ND	58.4	31.4	102.7	25.4	62.0	203.9
Mercury	0.02	0.188	0.117	0.171	0.127	0.206	0.171	ND	0.053	0.054	0.099
Selenium	0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	2.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table 2-5 ***Summary of Inorganic Sample Results from AET Investigation (Continued)***

	Sample Identification						Sample Identification				
Dilution Factor	1	1	1	1	1	1	1	1	1	1	1
Parameter	MDL[1]	Site3-033	Site3-035	Site2-036	Site2-037	Site2-038	Site2-039	Site2-040	Site2-041	Site2-042	Site2-043
Arsenic	0.5	ND[2]	1.49	ND	2.40	ND	ND	0.52	1.08	ND	ND
Barium	25	73.9	97.8	26.9	38.9	27.0	61.4	38.4	40.8	ND	ND
Cadmium	1.0	1.1	2.3	ND	1.0	1.5	ND	ND	1.1	1.1	1.1
Chromium, total	5.0	45.5	50.9	32.7	36.9	26.0	40.7	29.7	47.2	31.9	45.7
Lead	0.5	76.6	294.1	ND	54.0	ND	51.1	ND	413.3	ND	49.6
Mercury	0.02	0.129	0.185	0.062	0.104	0.031	ND	0.054	0.097	0.147	0.121
Selenium	0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	2.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

	Sample Identification						Sample Identification				
Dilution Factor	1	1	1	1	1	1	1	1	1	1	1
Parameter	MDL[1]	Site2-044	Site2-045	Site2-046	Site4-047	Site4-048	Site4-049	Site4-050	Site4-051	Site4-052	Site4-053
Arsenic	0.5	1.85	0.87	ND	ND	0.82	ND[2]	ND	ND	1.50	1.55
Barium	25	ND	ND	ND	38.2	ND	ND	38.3	29.8	29.6	27.8
Cadmium	1.0	1.6	ND	ND	1.1	ND	ND	ND	1.1	ND	ND
Chromium, total	5.0	39.1	33.8	35.2	36.0	29.6	36.6	51.9	28.7	30.1	32.6
Lead	0.5	154.8	32.8	16.5	126.5	ND	84.7	151.6	ND	ND	17.1
Mercury	0.02	0.055	0.042	0.032	0.065	0.032	0.031	0.063	0.032	ND	ND
Selenium	0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	2.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

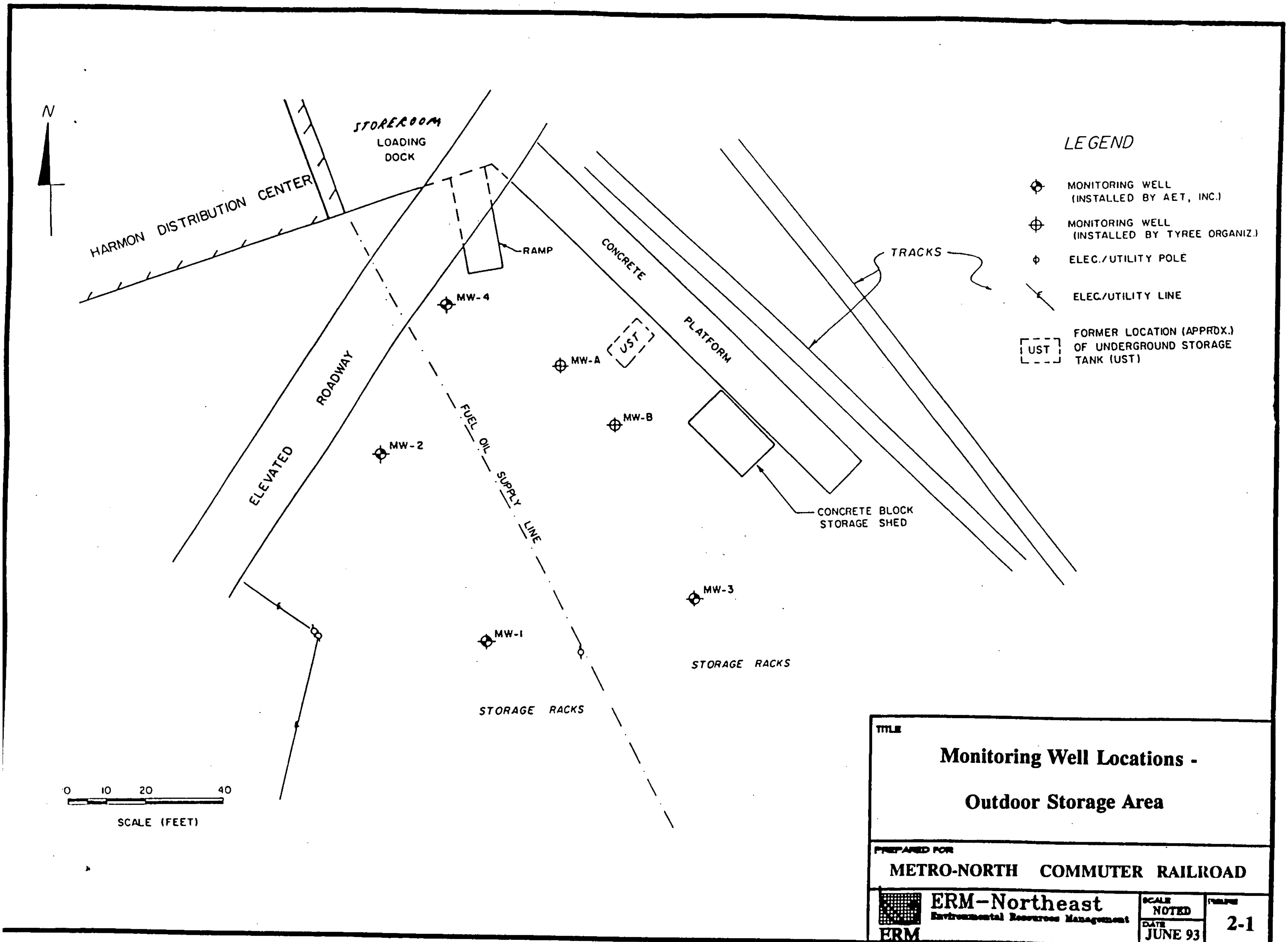
	Sample Identification						Sample Identification				
Dilution Factor	1	1	1	1	1	1	1	1	1	1	1
Parameter	MDL[1]	Site4-054	Site4-055	Site4-056	Site4-057	Site4-058	Site4-059	Site4-065	Site4-066	Site4-067	Site4-068
Arsenic	0.5	ND	ND	1.51	1.57	ND	1.63	ND	ND	5.79	ND
Barium	25	33.2	ND	31.5	75.4	87.8	183.2	ND	28.3	77.5	ND
Cadmium	1.0	ND	ND	ND	4.3	4.1	3.8	ND	ND	1.1	ND
Chromium, total	5.0	27.7	28.7	33.1	82.1	95.9	85.9	24.9	34.2	37.1	29.2
Lead	0.5	ND	ND	ND	815.0	1012.1	593.5	ND	ND	139.2	ND
Mercury	0.02	0.040	ND	ND	0.085	0.698	0.477	0.032	ND	0.120	ND
Selenium	0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	2.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table 2-5 ***Summary of Inorganic Sample Results from AET Investigation (Continued)***

				Sample Identification					Sample Identification		
Dilution Factor	1	1	1	1	1	1	1	1	1	1	1
Parameter	MDL[1]	Site4-069	Site4-071	Site4-072	Site4-073	Site4-075	Site5-077	Site5-079	Site5-080	Site5-081	Site5-082
Arsenic	0.5	4.11	3.67	4.18	1.48	1.09	0.61	5.71	0.67	3.38	1.00
Barium	25	44.0	102.8	ND[2]	51.2	33.8	44.1	50.1	31.9	51.5	42.0
Cadmium	1.0	3.9	6.3	1.1	1.7	1.6	2.7	1.7	1.1	1.1	1.1
Chromium, total	5.0	75.9	100.3	37.9	57.9	67.1	62.2	53.4	35.5	64.0	46.3
Lead	0.5	198.6	409.8	117.8	56.8	41.5	74.5	101.3	50.1	138.1	76.5
Mercury	0.02	0.110	1.354	ND	0.056	0.076	0.043	0.100	0.031	0.068	ND
Selenium	0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	2.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

				Sample Identification					Sample Identification		
Dilution Factor	1	1	1	1	1	1	1	1	1	1	1
Parameter	MDL[1]	Site5-083	Site5-085	Site5-087	Site5-089	Site5-090	Site6-091	Site6-092	Site6-093	Site6-094	Site6-095
Arsenic	0.5	4.98	4.45	2.41	ND	0.60	0.63	ND[2]	ND	0.69	ND
Barium	25	43.2	44.6	ND	31.5	45.9	29.2	ND	60.4	28.4	32.7
Cadmium	1.0	2.3	2.2	2.2	1.0	1.1	ND	1.0	ND	ND	ND
Chromium, total	5.0	66.8	59.4	64.2	38.2	39.0	52.7	28.5	114.2	33.2	32.7
Lead	0.5	85.9	80.9	68.7	ND	ND	20.0	ND	89.2	ND	ND
Mercury	0.02	ND	0.055	ND	ND	ND	ND	0.041	0.033	0.032	ND
Selenium	0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	2.5	ND	ND	ND	ND	ND	ND	ND	3.9	ND	ND

				Sample Identification				
Dilution Factor	1	1	1	1	1	1	1	1
Parameter	MDL[1]	Site6-096	Site6-097	Site6-098	Site6-099	Site6-100	Site6-101	Site6-102
Arsenic	0.5	ND	ND	ND	ND	ND	ND	ND
Barium	25	31.6	40.1	37.0	49.1	52.4	30.2	ND
Cadmium	1.0	1.0	1.5	1.1	1.1	1.1	1.6	ND
Chromium, total	5.0	48.7	45.2	38.6	48.0	45.6	39.6	29.5
Lead	0.5	ND	106.6	23.6	17.1	ND	ND	ND
Mercury	0.02	ND	ND	ND	0.033	ND	0.115	0.127
Selenium	0.5	ND	ND	ND	ND	ND	ND	ND
Silver	2.5	ND	ND	ND	ND	ND	ND	ND



TITLE

Monitoring Well Locations - Outdoor Storage Area

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ERM-Northeast
Environmental Resources Management

SCALE: NOTED

DATE: JUNE 93

FIGURE: 2-1

store fuel oil. Discoloration and an odor typical of fuel oil were observed in the annular soils at the time of the tank removal. Inspection of the tank and lines indicated no signs of corrosion or leakage.

Metro-North officials speculated that a former leak in a four-inch fuel supply line that ran north-south under this area may have been the source of the petroleum in the tank pit. The leak in the fuel supply line was discovered in the center of this area in November 1989. In response to the leak, AET uncovered the fuel oil line at the leak area, pumped out the free-phase oil with vacuum tanks, and excavated soils adjacent to the tank that contained NAPL. After inspection of the excavated area by NYSDEC, Metro-North backfilled the excavation with clean fill. Following the primary leak response, Metro-North evacuated the supply line of standing fuel oil and capped the ends.

A preliminary investigation was conducted to evaluate the possible presence of NAPL in the subsurface. Two two-inch diameter monitoring wells were installed west of the tank excavation by Tyree. These wells, labelled MW-A and MW-B, are shown in Figure 2-1. Wells MW-A and MW-B were approximately 17 feet deep, and the depth to water and depth to NAPL in both wells were approximately 12.2 feet and 8.2 feet, respectively. This data indicated that there was approximately four feet of NAPL in the subsurface.

1990 Investigation

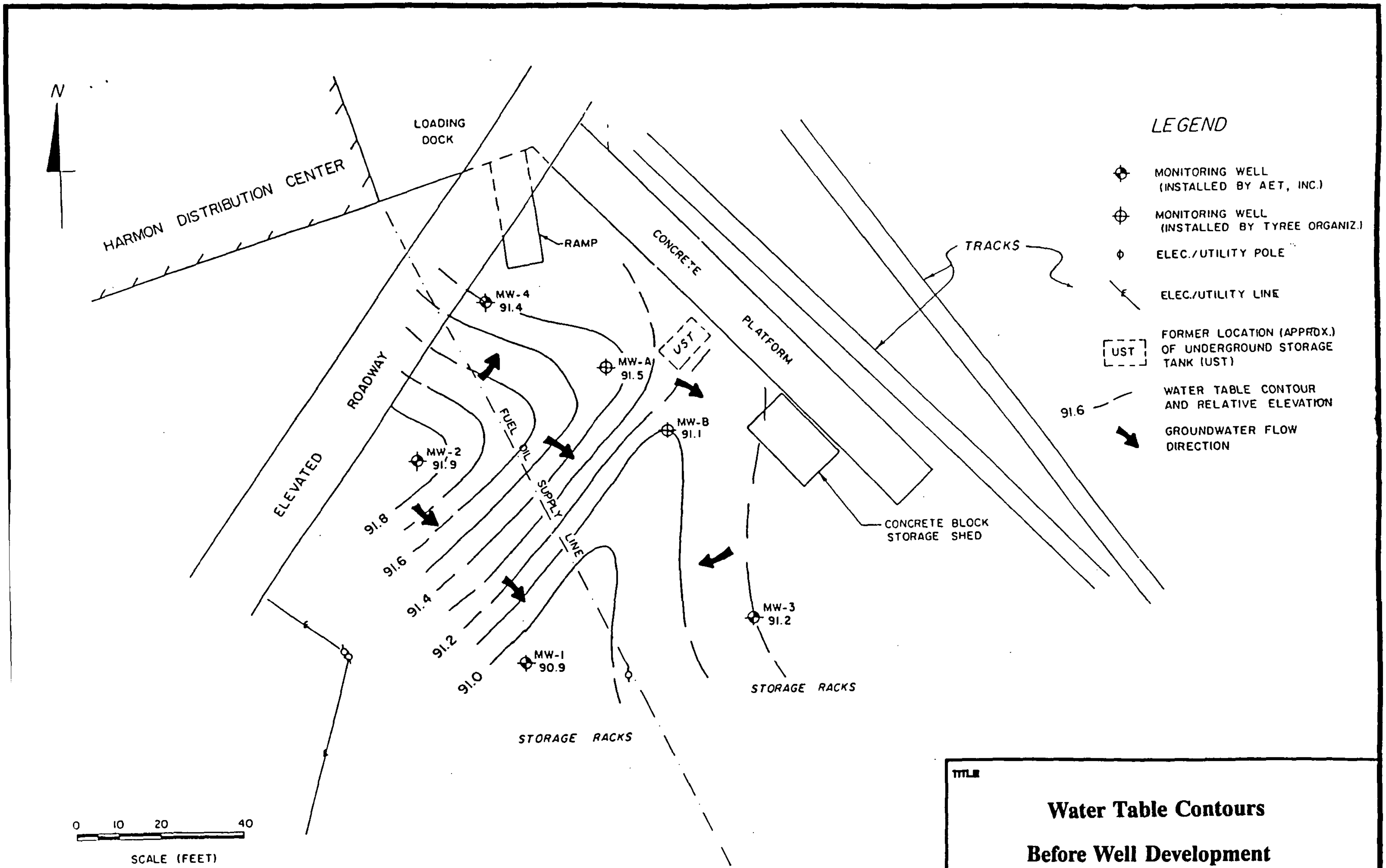
In August 1990, AET, LTR and Metro-North expanded the initial investigation with four more soil borings/monitoring wells to further define the occurrence of NAPL, determine ground water and NAPL levels and ultimately ground water flow direction, and to assess subsurface conditions on both the east and west sides of the fuel supply line.

Four additional soil borings and monitoring wells were installed on August 14 and 15, 1990. The boring logs, presented in Appendix C, indicate that the unconsolidated sediments underlying the site are relatively homogeneous fine-to medium-grained sand, with trace amounts of fine gravel, and some to little intermingled silt. The wells are constructed of four-inch diameter polyvinyl chloride (PVC) with 15 foot long, 20-slot screens.

Water level measurements were collected in the wells from August 24 to August 27, 1990. These data were used to develop shallow ground water contours over the study area. As shown in Figures 2-2 and 2-3, these contours indicate that ground water flow underlying the storage area is predominantly toward the southeast. Contours developed from monitoring data collected August 27 more clearly suggest a southeast flow direction and show a gradient of approximately 0.006 feet per foot (ft/ft).

All of the monitoring wells were developed to evaluate recharge of immiscible hydrocarbons and thereby better define floating phase thicknesses across the study area. As shown in Table 2-6, recharge of the entire free phase hydrocarbon thicknesses in wells MW-A and MW-B was nearly complete one hour after well evacuation. NAPL in wells MW-1 through MW-4 recharged to slightly less than the initial thicknesses. However, recharge after the second round of well evacuation was more than 100% in wells MW-2 and MW-3.

A comparison of the NAPL thickness measurements between August 24 and August 27 shows that the NAPL thickness increased with time in wells MW-1 through MW-4. The thickness of the NAPL in MW-1 increased from a film (August 24) to 1.70 feet, while in MW-4 it increased from 0.05 feet to 2.14 feet. These data were interpreted by LTR to indicate that the well development program was effective in flushing the well pack and enhancing communication with the formation.



TITLE

Water Table Contours

Before Well Development

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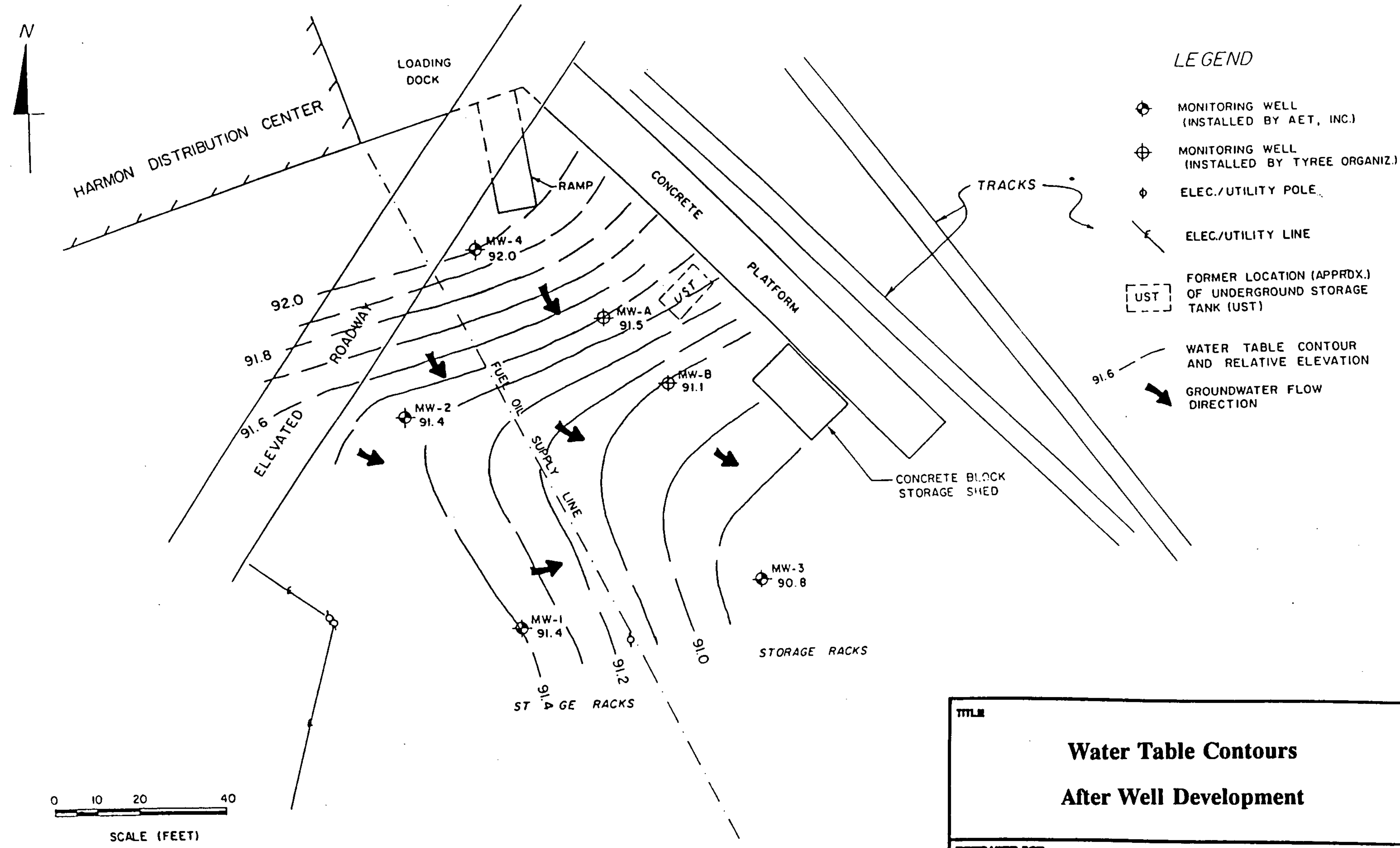
ERM–Northeast
Environmental Resources Management

SCALE: NOTED
DATE: JUNE 93
FIGURE: 2-2



TITLE

Water Table Contours

After Well Development

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Environmental Resources Management

ERM

SCALE: NOTED

DATE: JUNE 93

2-3

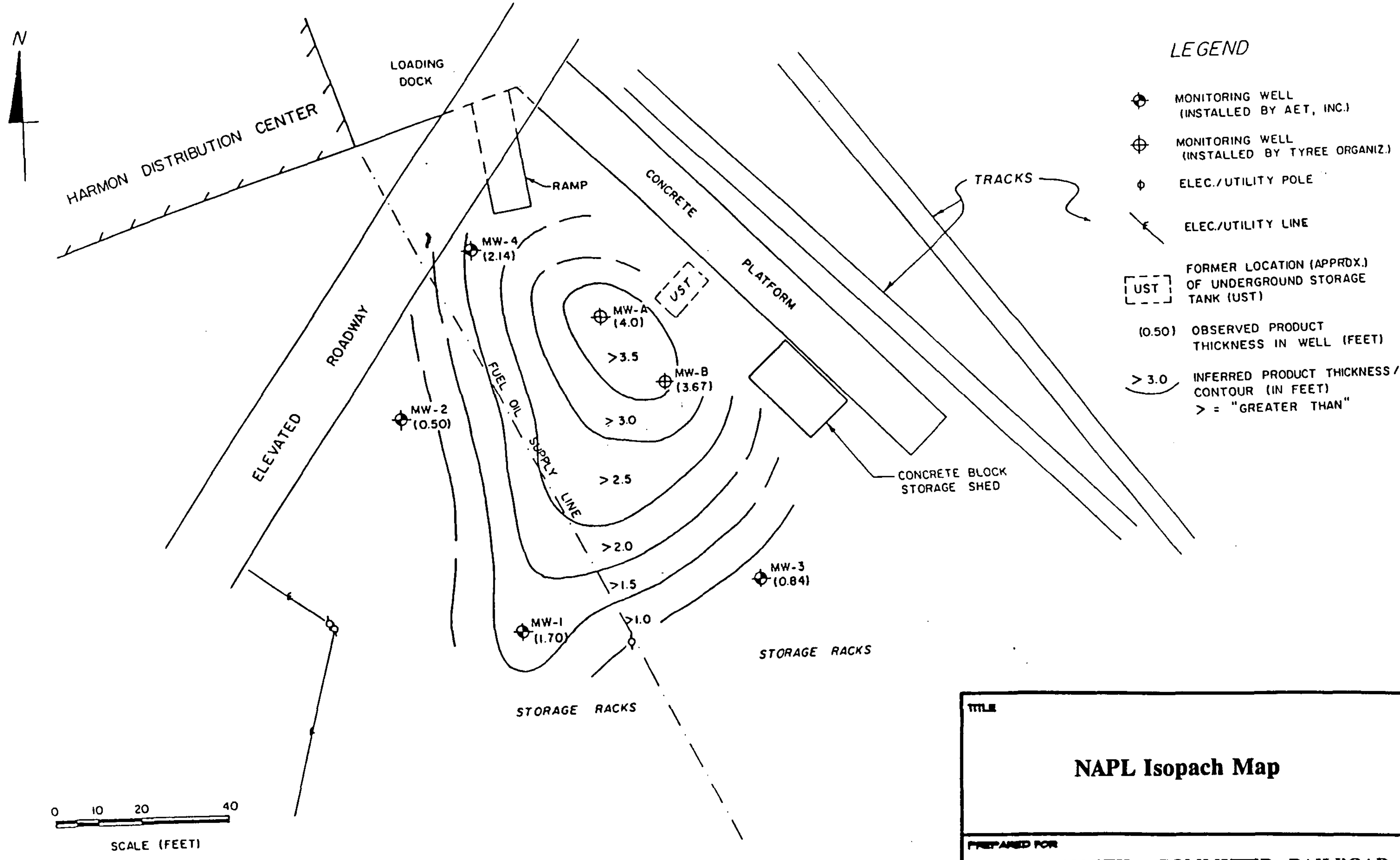
Table 2-6 Water Level Data - Outdoor Storage Area

Well Number	Well Elevation	Depth to Water	Depth to NAPL	NAPL Thickness	Corrected Water Table Elevation
August 24, 1990 - Before Development					
MW-A	99.91	12.04	7.79	4.25	91.53
MW-B	99.72	12.08	8.12	3.96	91.05
MW-1	99.03	8.25	8.17	0.08	90.85
MW-2	99.66	9.04	7.50	1.54	91.94
MW-3	99.34	8.21	8.12	0.09	91.21
MW-4	100.00	9.17	8.50	0.67	91.41
August 27, 1990 - After Development					
MW-A	99.91	11.79	7.79	4.00	91.56
MW-B	99.72	11.75	8.08	3.67	91.13
MW-1	99.03	9.12	7.42	1.70	91.37
MW-2	99.66	8.71	8.21	.050	91.38
MW-3	99.34	9.29	8.45	0.84	90.77
MW-4	100.00	9.75	7.61	2.14	92.01

Free phase hydrocarbon thicknesses observed on August 27, 1990 were used to develop a NAPL isopach map (Figure 2-4). This map shows extrapolated and inferred plume dimensions based on the thicknesses in each well, ground water flow direction and assumed location of subsurface structures/conduits (i.e., the fuel supply line). The boundaries of the floating layer could not be defined with the existing wells since there was NAPL present in all wells. The data indicate that the heaviest accumulation of immiscible hydrocarbons was in the area of MW-A and MW-B. It also suggested that the NAPL may extend to the east-southeast, toward areas underlying the concrete platform and railroad tracks. Since the fuel supply line backfill materials are similar in grain size to the native formation, the permeability of the backfill was not thought by LTR have played a substantial role in plume migration. Furthermore, the absence of a pronounced ground water gradient, coupled with the low permeability of the subsurface sediments suggested to LTR that the NAPL plume, if it did result from a relatively low-volume, one-time line loss, had probably not migrated extensively from the study area.

Six oil and water samples were collected in October 1990 from MW-A, MW-B and MW-1 through MW-4. The oil samples were analyzed for EPA Method 8010 compounds (halogenated volatile organics) and the water samples were analyzed for EPA Method 601 compounds (purgeable halocarbons); both oil and water samples were also analyzed for PCBs. None of the oil or water samples contained any PCBs above detectable limits. No halogenated volatile organics were present in the oil samples at concentrations above the detection limits. Four purgeable halocarbons were detected in the ground water samples from MW-3 and MW-4 at concentrations ranging from four to 16 ug/l. The analytical results for the water samples are summarized in Table 2-7.

Six additional monitoring wells (MW-5 through MW-10) were installed in the area of the free-phase hydrocarbon release in late 1990/early 1991.



TITLE

NAPL Isopach Map

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Environmental Resources Management

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FIGURE 2-4

Table 2-7 ***Summary of Analytical Results for Six Water Samples - Outdoor Storage Facility October 1990***

Compound	MW-A	MW-B	MW-1	MW-2	MW-3	MW-4
1,2-Dichloroethylene	<2	<2	<2	<2	16	9
Tetrachloroethylene	<2	<2	<2	<2	8	<2
Methylene Chloride	<2	<2	<2	<2	<2	5
1,1,1-Trichloroethane	<1	<1	<1	<1	<1	4

Notes:

Units are in micrograms per liter (ug/l)

Product thicknesses in wells MW-1 through MW-10 ranged from zero inches in well MW-10 to approximately 4.5 feet in wells MW-2, MW-3, and MW-4 (AET, 1991). During this phase of the investigation, the southeast edge of the NAPL plume was thought to extend under the track yard. Since this location was not accessible to a rig, the edge of the plume could not be defined. A passive product skimmer was also installed in well MW-3 in late January, 1991. As of April 1991, the skimmer had removed 103 gallons of product.

2.1.3.2 *Ground Water Monitoring - Outdoor Storage Area - 1991 to 1993*

In April 1991, AET began construction of a pump and treat product recovery system, reinfiltration gallery and overflow relief area to address the NAPL plume in the vicinity of the Outdoor Storage Area. The installation of the recovery system was completed in June 1991 with the installation of a 24-inch diameter recovery well at 27 feet below grade. A large diameter skimmer was also installed.

In January 1992, NYSDEC approved a SPDES permit for discharge of the treated ground water to the on-site wastewater treatment plant. Ground water recovered by the system was then treated in an air stripping tower located at the site and discharged to the wastewater treatment plant. The NAPL recovered in the skimmer was discharged to a separate for transport to a fuel blending facility.

The 12 ground water monitoring wells and one recovery well located at the outdoor storage facility were monitored twice a week from April 1991 through April 1992, once a week from May 1992 through March 1993. Depth to NAPL and depth to water measurements were collected during each monitoring session using a sonic interface probe. When NAPL was encountered, it was removed and added to the recovery tank. Operational data for the recovery system, such as the volume of NAPL recovered and the volume of water treated are shown in Table 2-8.

During the monitoring period, NAPL was commonly detected in all 12 monitoring wells. Thicknesses ranged from a few hundredths of a foot to an apparent maximum of 4.09 feet in MW-2 (May 27, 1992). NAPL was typically not encountered in MW-7. The smallest amounts of NAPL were generally encountered in wells MW-4 and MW-8; and the greatest amounts of NAPL were generally encountered in well MW-6. Overall NAPL thicknesses were reported by AET to have diminished from the time of the startup of the recovery system to the time of the last available report in March 1993. One anomalous reading was obtained in February 1993 when the NAPL thickness in the recovery well RW-1 measured 5.03 feet. This reading was attributed to an electrical power surge and subsequent equipment repair and trouble shooting during January and February. Table 2-9 contains a summary of the depths to NAPL and water and measurements of NAPL thickness for the period of record.

In addition to monitoring water and NAPL levels, AET collected samples from the recovery system for laboratory analysis. Water samples were collected from the stripping tower for both influent and effluent water quality analyses on a monthly basis during 1992 and 1993. Analytical data showing monthly influent and effluent water quality during 1992 are presented in Table 2-10.

2.1.4 *Half Moon Bay Investigations*

2.1.4.1 *Introduction*

During the period between September 1985 and April 1987, several environmental sampling and analysis programs were performed by C.A. Rich Consultants, Inc. for the Croton River Club, Inc. The area of

Table 2-8 Summary of Recovery System Operating Data - Outdoor Storage Facility 1991 to 1992

	April 1991	May 1991	June 1991	July 1991	Feb 1992	March 1992	April 1992	May 1992	June 1992	July 1992
Water Flow Rates (gpm)						15	15	15	15	15
Total Water Treated to Date (gal)							393,290	393,290	635,653	857,837
NAPL Recovered this Month(1) (gal)	143	143	67	249	3,700	5,469	2,450	1,332	3,050	2,750
NAPL Recovered to Date(2) (gal)	243	461	528	767	8,171	13,640	17,120	18,560	21,610	24,360

	August 1992	September 1992	October 1992	November 1992	December 1992	January 1993	February 1993	March 1993
Water Flow Rates (gpm)	15	15	15	15	15	NA	15	15
Total Water Treated to Date (gal)	857,837	1,132,547	1,317,828	1,317,828	1,808,930	NA	NA	NA
NAPL Recovered this Month(1) (gal)	2,975	2,184	665	3,520	2,241	NA	276	637(3)
NAPL Recovered to Date(2) (gal)	27,335	29,519	30,184	33,704	36,125	NA	36,931	37,568

Notes:

gal = gallons
gpm = gallons per minute
NA = Not Available
(1) Skimmer system in conjunction with manual bailing
(2) Recovery system in conjunction with manual bailing
(3) Filter scavenger

Table 2-9 Summary of Water and NAPL Monitoring Data - Outdoor Storage Facility 1991 to 1993

Well Number	April 1, 1991			May 2, 1991			June 1, 1991			July 1, 1991			February 4, 1992			March 3, 1992		
	DTN	DTW	NT	DTN	DTW	NT	DTN	DTW	NT	DTN	DTW	NT	DTN	DTW	NT	DTN	DTW	NT
MW-A	8.74	12.00	3.26	8.78	11.98	3.20	9.00	12.55	3.55	8.22	12.03	2.81	7.66	13.70	4.04	9.76	13.02	3.26
MW-B	8.54	12.00	3.46	8.60	12.00	3.40	8.78	12.52	3.74	8.78	13.02	4.24	9.46	13.31	3.85	9.53	12.84	3.31
MW-1	7.80	11.10	3.30	7.85	11.20	3.35	8.08	11.55	3.47	8.79	11.97	3.18	8.68	12.05	3.37	8.82	11.85	3.03
MW-2	8.38	11.84	3.46	8.45	11.75	3.30	8.63	12.40	3.77	9.28	12.23	2.98	9.18	13.37	4.19	9.29	13.32	4.03
MW-3	8.60	8.85	0.25	7.65	7.90	0.25	8.85	9.10	0.55	8.61	12.98	4.37	9.06	12.26	3.20	9.26	12.18	2.92
MW-4	8.88	11.20	2.32	9.00	10.55	1.55	9.15	11.30	2.15	7.60	11.89	4.29	9.71	12.54	2.83	9.78	12.60	2.82
MW-5	8.24	11.80	3.56	8.25	11.95	3.70	8.44	12.35	3.91		8.20		9.06	13.18	4.12	9.16	13.18	4.02
MW-6	7.22	10.76	3.54	7.20	10.85	3.65	7.40	1106.	4.20	7.69	7.81	0.12	8.00	12.11	4.11	8.09	12.46	4.37
MW-7		7.65			7.53			7.76		8.89	10.86	1.97		8.58			8.58	
MW-8		7.20			7.24			7.49		9.62	11.50	1.88	8.00	8.23	0.23	8.08	8.26	0.18
MW-9	8.50	9.50	1.00	8.55	9.45	0.90	8.75	10.20	1.45	8.96	12.97	4.01	NA	NA	NA	NA	NA	NA
MW-10		9.40		9.40	9.55	0.15	9.60	9.95	0.35	9.13	12.99	3.86	9.81	13.37	3.56	9.84	13.52	3.68
RT-1			7.5"			15"			2"			8"			16.5"			10"
RW-1										10.90	13.15	2.25	12.48	12.50	0.02	16.19	16.21	0.02

Notes:

DTN = Depth to NAPL (feet below ground surface)
DTW = Depth to Water (feet below ground surface)
NT = NAPL Thickness (feet)

Well Number	April 3, 1992			May 27, 1992			June 26, 1992			July 31, 1992			August 5, 1992			September 2, 1992		
	DTN	DTW	NT	DTN	DTW	NT	DTN	DTW	NT	DTN	DTW	NT	DTN	DTW	NT	DTN	DTW	NT
MW-A	9.01	12.12	3.11	9.86	13.24	3.38	9.71	12.14	2.43	9.63	12.00	2.37	9.67	11.93	2.26	9.84	12.51	2.67
MW-B	9.41	12.11	2.70	9.74	13.11	3.37	9.53	11.84	2.31	9.51	11.75	2.24	9.44	11.78	2.34	9.74	12.21	2.47
MW-1	8.67	10.97	2.30	9.01	11.74	2.73	8.77	10.98	2.21	8.75	10.76	2.01	8.68	10.94	2.26	8.98	11.11	2.13
MW-2	9.15	12.28	3.13	9.41	13.50	4.09	9.20	12.65	3.45	9.16	12.45	3.29	9.18	12.29	3.11	9.37	12.96	3.59
MW-3	9.30	10.04	0.74	9.52	11.92	2.40	9.14	11.40	2.26	9.17	11.15	1.98	9.18	11.19	2.11	9.40	11.41	2.01
MW-4	9.82	10.30	0.48	10.12	11.17	1.05	9.79	11.36	1.57	9.67	11.45	1.78	9.68	11.45	1.77	9.94	11.64	1.70
MW-5	8.98	12.39	3.41	9.31	13.21	3.90	9.07	12.52	3.45	NA	NA	NA	9.04	12.12	3.08	9.26	12.51	3.25
MW-6	7.91	11.53	3.62	8.24	12.19	3.95	8.04	11.64	3.60	7.90	11.26	3.36	7.94	11.28	3.35	8.19	11.82	3.63
MW-7		8.21			8.69			8.26			8.02			7.94			8.46	
MW-8	7.76	8.26	0.50	8.12	8.96	0.84	7.86	8.83	0.97	7.25	8.87	1.12	7.92	8.89	0.97	8.02	9.14	1.12
MW-9	NA	NA	NA	9.36	11.51	2.15	9.11	11.22	2.11	9.15	10.90	1.75	9.16	10.98	1.82	NA	NA	NA
MW-10	9.76	12.00	2.24	9.91	13.42	3.51	9.65	12.67	3.02	9.68	12.41	2.73	9.63	12.22	2.59	9.93	13.03	3.10
RT-1			20.5"			36"			0"			8.5"			11.3			24"
RW-1	15.86	15.91	0.05	18.51	18.54	0.03	15.86	15.90	0.04	16.05	16.07	0.02	16.61	16.56	0.05	17.61	17.63	0.02

Notes:

DTN = Depth to NAPL (feet below ground surface)
DTW = Depth to Water (feet below ground surface)
NT = NAPL Thickness (feet)

Table 2-9 Summary of Water and NAPL Monitoring Data - Outdoor Storage Facility 1991 to 1993 (Continued)

Well Number	October 2, 1992			November 6, 1992			December 4, 1992			February 5, 1993			March 3, 1993		
	DTN	DTW	NT	DTN	DTW	NT	DTN	DTW	NT	DTN	DTW	NT	DTN	DTW	NT
MW-A	9.93	12.51	2.58	10.11	13.01	2.90	9.84	11.86	2.02	9.39	11.36	1.97	9.51	11.52	2.01
MW-B	9.73	12.26	2.53	9.96	12.57	2.61	9.69	11.69	2.00	8.44	10.16	1.72	9.37	11.00	1.63
MW-1	9.04	11.24	2.20	9.16	11.72	2.56	8.43	10.84	2.41	8.86	11.94	3.08	8.61	10.31	1.70
MW-2	9.46	11.24	2.20	9.31	13.64	4.33	9.34	12.40	3.06	8.83	10.59	1.76	8.96	12.41	3.45
MW-3	9.50	11.17	1.67	9.74	11.34	1.60	9.36	11.15	1.79	9.38	11.26	1.88	8.99	11.09	2.10
MW-4	10.02	11.71	1.69	10.24	11.81	1.57	9.84	11.64	1.80	8.88	11.06	2.18	9.52	11.17	1.65
MW-5	9.34	12.54	3.20	9.50	13.06	3.56	9.23	12.07	2.84	7.84	10.23	2.39	NA	NA	NA
MW-6	8.25	11.93	3.68	8.24	11.67	3.43	9.14	11.29	3.15		8.09		NA	NA	NA
MW-7		8.60			8.81			8.32			8.09			8.08	
MW-8	8.11	9.22	1.11	8.26	9.47	1.19	7.87	9.16	1.29	8.89	9.87	0.98	7.60	8.61	1.01
MW-9	9.31	11.64	2.33	NA	NA	NA	NA	NA	NA	9.51	11.35	1.84	NA	NA	NA
MW-10	9.96	13.48	3.52	10.11	13.67	3.56	9.86	12.55	2.69	9.22	11.19	1.97	9.61	11.67	2.06
RT-1												11.5"			20"
RW-1	17.64	17.82	0.18	18.11	18.14	0.03	19.63	19.81	0.18	19.81	19.86	0.05	17.64	17.67	0.03

Notes:

DTN = Depth to NAPL (feet below ground surface)
DTW = Depth to Water (feet below ground surface)
NT = NAPL Thickness (feet)

Table 2-10 ***Summary of Recovery System Treatment Data - Outdoor Storage Facility*** **1992**

	February		March		April		May		June	
Analytical Data	**Inf**	**Eff**	**Inf**	**Eff**	**Inf**	**Eff**	**Inf**	**Eff**	**Inf**	**Eff**
pH	7.13	7.51	7.17	7.72	6.94	7.28	7.11	7.53	7.10	7.87
BOD_5 (mg/l)	12	9	NA	NA	NA	NA	NA	NA	<6	<6
S-BOD (mg/l)	10	13	NA	NA	NA	NA	NA	NA	<6	<4
Total Suspended Solids (mg/l)	0.9	19.2	NA	NA	NA	NA	NA	NA	6.6	26.2
Oil & Grease (mg/l)	5.9	5.0	8.6	NA	<0.3	<0.3	<1.96	<0.85	<0.7	<0.7
COD (mg/l)	54	58	NA	NA	NA	NA	NA	NA	20	27
Benzene (ug/l)	80	3	28	0.3	53	<1	50	<1	9	<1
Toluene (ug/l)	100	4	37	<0.1	44	<1.0	46	<1	3	<1
p-,m-Xylenes (ug/l)	94	6	32	1	72	2	63	1	7	<1
o-Xylene (ug/l)	122	10	50	2	61	1	44	<1	11	<1
MTBE (ug/l)	270	69	177	29	330	25	298	18	192	23

Notes:

Inf = Influent
Eff = Effluent
$BOD_{(5)}$ = Five-Day Biological Oxygen Demand
S-BOD = ???
COD = Chemical Oxygen Demand
MTBE = Methyl Tertiary Butyl Ether
mg/l = milligrams per liter
ug/l = micrograms per liter
NA = Not Available

Analytical Parameter	July		August		September		October		November	
	Inf	Eff	Inf	Eff	Inf	Eff	Inf	Eff	Inf	Eff
pH	7.10	7.96	7.09	7.88	7.09	7.83	7.19	7.92	7.16	7.92
BOD_5 6 (mg/l)	72	25	NA	NA	4	4	NA	NA	NA	NA
S-BOD (mg/l)	72	17	NA	NA	4	4	NA	NA	NA	NA
Total Suspended Solids (mg/l)	27.2	12.3	NA	NA	25	9	NA	NA	NA	NA
Oil & Grease (mg/l)	<0.25	<0.27	1.8	1.5	<0.5	<0.5	<0.5	<0.5	<0.05	<0.05
COD (mg/l)	31	33	NA	NA	29	29	NA	NA	NA	NA
Benzene (ug/l)	1	<1	55	<1	13	2	25	<1.0	22	<0.2
Toluene (ug/l)	2	1	128	<1	5	2	24	1	16	2
p-,m-Xylenes (ug/l)	3	<1	106	1	10	2	38	2	26	<1.0
o-Xylene (ug/l)	<1	<1	60	1	13	<1	26	<1.0	17	<1.0
MTBE (ug/l)	186	7	205	30	166	4	183	22	178	25

Notes:

Inf = Influent
Eff = Effluent
$BOD_{(5)}$ = Five-Day Biological Oxygen Demand
S-BOD = ???
COD = Chemical Oxygen Demand
MTBE = Methyl Tertiary Butyl Ether
mg/l = milligrams per liter
ug/l = micrograms per liter
NA = Not Available

investigation was a 24-acre parcel of waterfront property known as Half Moon Bay, located adjacent to the Harmon Railroad Yard (Plate 1). Half Moon Bay was formerly owned by predecessor railroads and was never owned or operated by Metro-North.

The first few studies conducted by C.A. Rich were primarily for site and soil characterization and concentrated primarily on investigating the possible presence of polychlorinated biphenyl compounds (PCBs) and petroleum-related substances in the shallow, on-site soils. The last study conducted by C.A. Rich (May 1987) consisted of both a soil and ground water sampling and analysis program. These investigations were summarized in the following reports:

- "Soils Characterization at the River Club Property, Croton-on-Hudson, NY", C.A. Rich Consultants, Inc., November 1985 (C.A. Rich, 1985);
- "Summary Report - Site Characterization at the River Club Property, Croton-on-Hudson, NY", C.A. Rich Consultants, Inc., March 1986 (C.A. Rich, 1986a);
- "Report - Site Characterization at the River Club Property, Croton-on-Hudson, NY", C.A. Rich Consultants, Inc., April 1986 (C.A. Rich, 1986b);
- "Soil Sampling and Analysis Program at Half Moon Bay, Croton-on-Hudson, NY", C.A. Rich Consultants, Inc., March 1987 (C.A. Rich, 1987a);
- "Letter Report - Soil Sampling and Analysis - Half Moon Bay Plan Proposal", C.A. Rich Consultants, Inc., March 20, 1987 (C.A. Rich, 1987b); and
- "Soil and Groundwater Sampling and Analysis Program at the Half Moon Bay Site", C.A. Rich Consultants, Inc., March 1987 (C.A. Rich, 1987c).

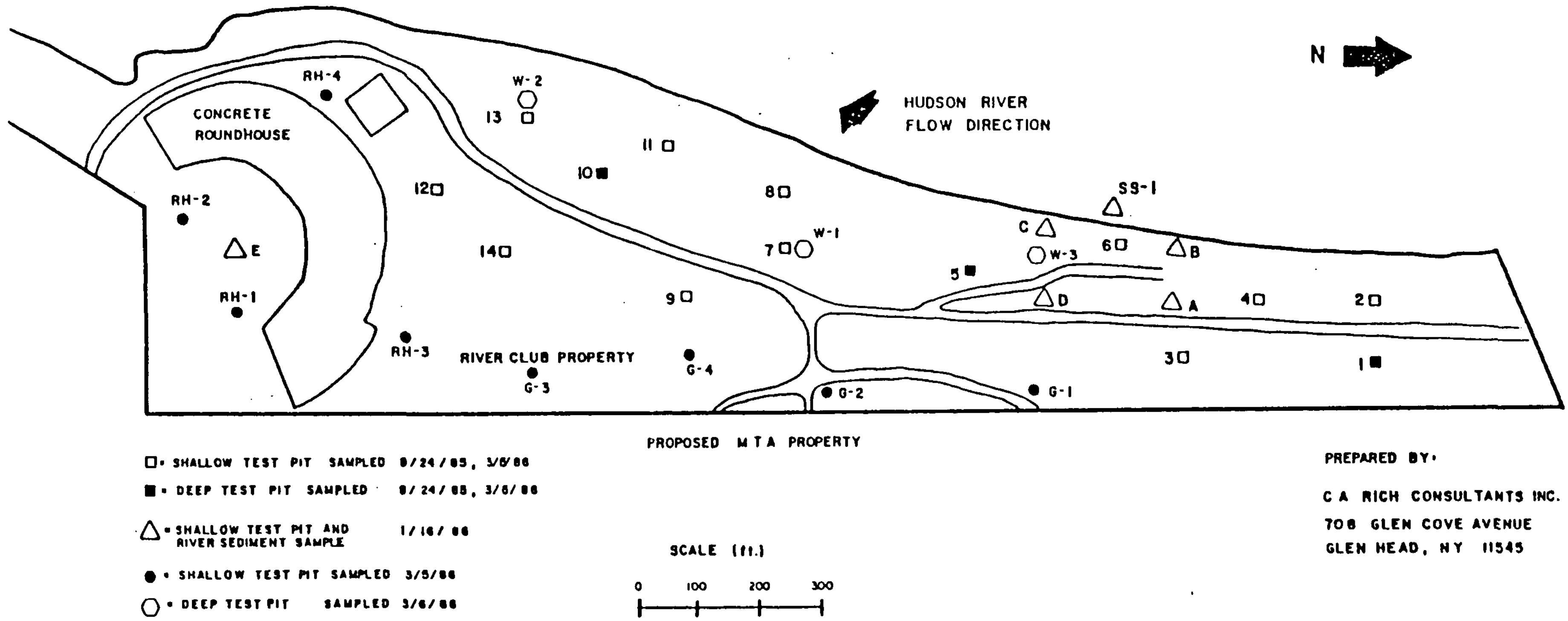
2.1.4.2 *Site and Soil Characterization Investigations*

Two of the investigations consisted solely of the collection of soil samples from numerous test pits across the site. The soil samples were analyzed for PCBs only. In 1985, 14 soil samples were collected from a depth of 12 inches at 14 test pits (Figure 2-5; C.A. Rich 1985). Only two of those samples contained PCBs, and the highest concentration detected was 0.042 milligrams per kilogram (mg/kg). In February 1987, 41 soil samples were submitted for PCB analysis from 27 test pits and only one sample contained a detectable concentration of PCBs (C.A. Rich, 1987). That sample was collected from the zero to six-inch interval and contained 2.0 mg/kg Aroclor-1248.

In a follow-up to the 1985 sampling event, soil samples from five shallow test pits, and one near-shore Hudson River sediment sample were collected (C.A. Rich, 1986b). Sample locations are shown in Figure 2-5. The samples were analyzed for EP Toxicity metals, total petroleum hydrocarbons (TPH) and PCBs. The concentrations of eight EP Toxicity metals were non-detect in all soil samples. The TPH concentrations ranged from 16 to 66 mg/kg. The highest concentration was observed in the sediment sample. None of the soil samples contained PCBs in excess of 0.01 mg/kg. Four of the six samples were collected in the vicinity of the pit at which 0.042 mg/kg PCBs were detected in 1985. One sample from this area was also selected for full priority pollutant analysis. Only one compound, bis-2-ethylhexyl phthalate, was detected at two milligrams per kilogram (mg/kg).

2.1.4.3 Site Characterization Program

Test pit excavations and surficial soil and ground water sampling were also conducted at Half Moon Bay in March, 1986 (C.A. Rich, 1986b). Eight shallow and three deep test pits were excavated. A total of 22 soil samples were collected for laboratory analysis. Ground water samples were



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TITLE

Half Moon Bay Sampling Locations

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collected from the three deep test pits. The sampling locations are shown in Figure 2-5.

Soil Sampling Results

All of the soil samples exhibited some detectable concentrations of oil and grease. The highest concentration of oil and grease, 2,700 mg/kg, was observed at pit #5. Only one soil sample had PCBs in excess of 0.01 mg/kg: Aroclor-1260 was detected at 0.03 mg/kg. In one soil/fill sample (pit #5), the EP Toxicity concentrations of lead, arsenic, and chromium exceeded their EP Toxicity standard. The soil samples generally had TPH concentrations ranging from the tens to hundreds of mg/kg, with the highest concentration detected at 1,049.2 mg/kg (G-3). One soil sample (RH-2) was analyzed for priority pollutant compounds. Thirteen of those compounds, including VOCs and metals, were detected. Organic compounds, including toluene, bis(2-ethylhexyl)phthalate, pyrene and 2-butanone, were detected at a concentrations of one mg/kg. Cyanide was present at 0.08 mg/kg and total phenols at 0.430 mg/kg. Copper, lead and zinc were also present at approximately 10 mg/kg each.

Ground Water Sampling Results

Oil and grease was detected in the W-1 water sample at 1500 ug/l. No PCBs were detected in the water samples. Among the EP Toxicity metals, selenium was detected at 210 ug/l in one water sample (W-2). TPH concentrations in the water samples ranged from 700 ug/l to 1,300 ug/l. One ground water sample (W-3) was analyzed for priority pollutant compounds. Six of those compounds were detected. The organic compounds found were methylene chloride (145 ug/l) and bis(2-ethylhexyl)phthalate (90 ug/l). The four remaining detectable constituents were total phenols (26 ug/l), selenium (21 ug/l), zinc (28 ug/l) and arsenic (two ug/l). Of these six compounds, methylene chloride, total phenols, and selenium exceeded the NYSDEC water quality standards applicable at the time.

2.1.4.4 *Soil and Ground Water Investigation*

Work completed during the last Half Moon Bay study (May 1987) included the sampling of approximately 60 separate locations on the property. The investigative tasks included:

- Excavation and sampling of six deep test pits with analysis of soil samples for PCBs and volatile organic compounds (VOCs);
- Ambient air and soil vapor screening for VOCs using an organic vapor analyzer (OVA);
- Design and installation of 10 two-inch diameter ground water monitoring wells screened at the water table;
- Measurement of water levels for determination of ground water elevation and flow direction; and
- Ground water sampling and analysis for priority pollutants, oil and grease, and petroleum hydrocarbons including a full VOC library search.

The findings of this investigation are presented in the May 1987 report. The air monitoring results included only one trace-level detection of airborne organic compounds found during OVA screening. The soil data revealed no evidence of PCB compounds in any of the locations sampled. One soil sample (DP-1) collected during the April 1987 investigation contained low concentrations of toluene and total xylenes at a depth of 12 feet below surface level. The report concluded that the extent of these compounds was limited and therefore did not pose a serious environmental problem.

The Half Moon Bay monitoring well locations are shown on Plate 3. Ground water in the unconsolidated aquifer was estimated to be flowing westward at the Half Moon Bay site at the rate of 1.5 feet per day (ft/day). The ground water sampling results, summarized in Table 2-11, indicated the presence of several organic and inorganic compounds. The only VOC detected was 1,2-dichloroethane in one monitoring well (MW-2) at 44 ug/l. Six inorganic constituents were identified: arsenic, beryllium, copper, selenium, zinc and cyanide. Petroleum hydrocarbons were detected at 3.1 milligrams per liter (mg/l) in one ground water sample (MW-8). Six of 10 water samples contained some oil and grease. The highest concentration (12 mg/l) was again detected in MW-8. Seven of 10 water samples contained phenolic compounds at concentrations ranging from nine ug/l to 75 ug/l. Two additional tentatively identified compounds (TICs) were also detected: 2-propanol and 3-penten-2-one.

2.1.5 *Croton Avenue Bridge Investigation*

A geotechnical investigation was conducted in conjunction with the replacement of the Croton Point Avenue Bridge in December 1992 and January 1993 by Mueser Rutledge Consulting Engineers (MRCE). The purpose of the investigation was to evaluate the subsurface soils and determine whether they were suitable for the construction of a replacement bridge. The investigation focused on the area immediately south of the existing bridge and consisted of drilling 28 shallow and deep test boring, collecting split-spoon and undisturbed soil samples, and installing one wellpoint piezometer for monitoring ground water levels. The boring locations are shown in Figure 2-6.

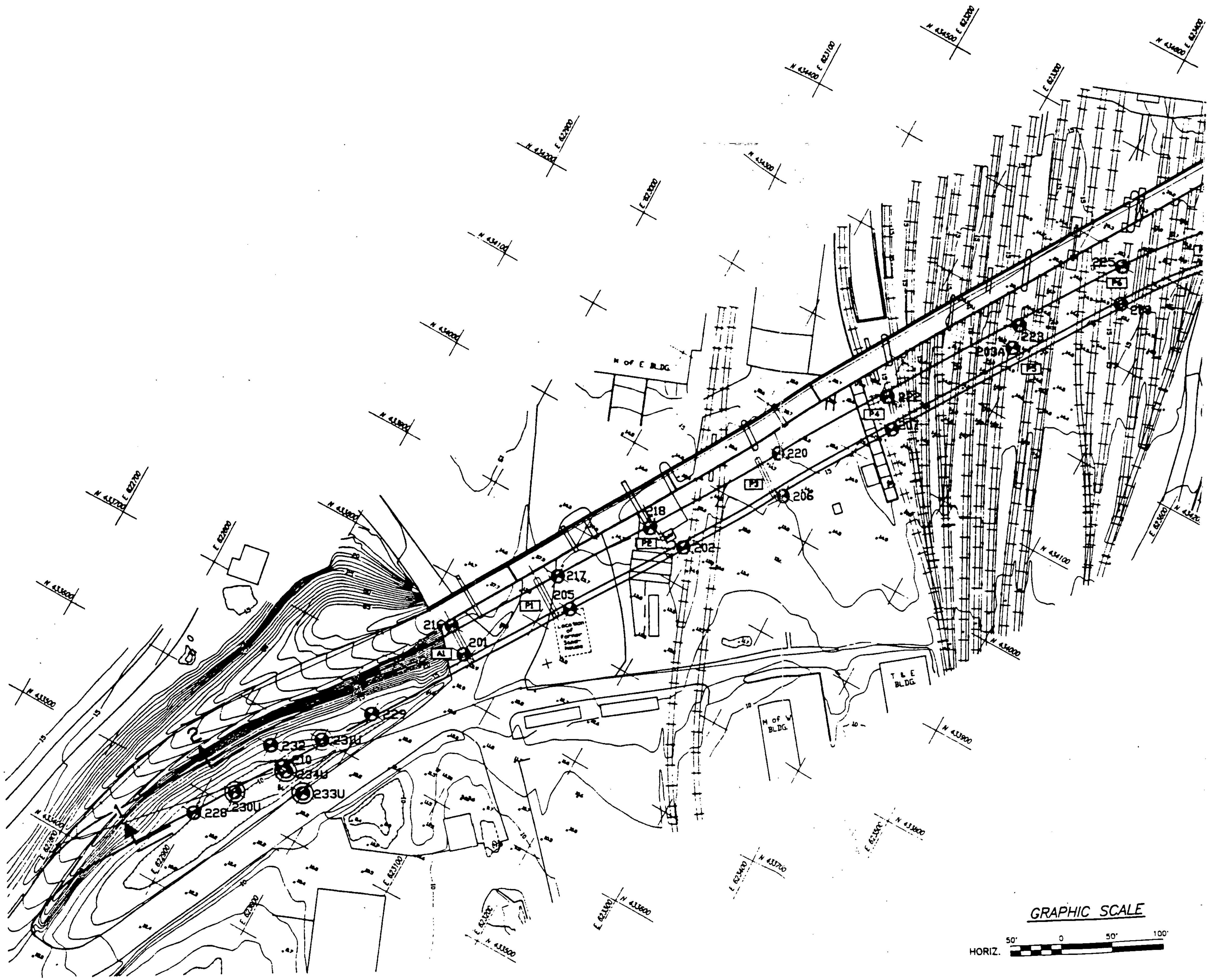
MRCE conducted the subsurface boring program in two phases. Phase I consisted of drilling five borings, each four inches in diameter. Four borings (201, 202, 203A and 204) extended to a depth of 127 feet. A fifth boring (202A) was abandoned at five feet after penetrating a water line.

Table 2-11 ***Summary of Analytical Detections for 1987 Ground Water Sampling at Half Moon Bay***

Compound	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10	NYSDEC Water Quality Standards/Guidance Values (ug/l)
Chloroform	ND	3 (T)	ND	ND	ND	ND	ND	ND	ND	ND	100
1,2-Dichloroethane	ND	44	ND	ND	ND	ND	ND	ND	ND	ND	0.8
2-Propanol	54 (T)	31 (T)	28 (T)	26 (T)	ND	24 (T)	16 (T)	22 (T)	ND	18 (T)	
3-Penten-2-one	21 (T)	21 (T)	17 (T)	22 (T)	24 (T)	16 (T)	17 (T)	26 (T)	24 (T)	16 (T)	
Arsenic	ND	ND	ND	ND	ND	ND	ND	3	8	ND	25
Beryllium	5	ND	ND	ND	6	6	ND	ND	9	6	3
Copper	ND	ND	ND	22	22	ND	29	21	65	63	1,000
Selenium	ND	9	5	ND	5	9	3	3	ND	3	20
Zinc	82	50	95	63	ND	49	76	71	97	97	5,000
Petroleum Hydrocarbons (mg/l)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	3.1	< 0.1	< 0.1	
Oil and Grease (mg/l)	< 0.1	2	6	3.8	< 0.1	< 0.1	2	12	2.4	< 0.1	
Phenols (mg/l)	0.01	< 0.002	< 0.002	0.015	0.009	< 0.002	0.07	0.075	0.075	0.068	0.001 mg/l
Cyanide (mg/l)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.05	< 0.01	< 0.01	< 0.01	0.2 mg/l

Notes:

(T) = Tentative Detection
ND = Not Detected at or above laboratory detection limit
* = NYSDEC Division of Water and Technical Operational Guidance; Series (85-W-38) Ambient Water Quality Standards and Guidance Values



LEGEND

- 234 — 4" DIAMETER SPLIT-SPOON SAMPLE BORING COMPLETED IN DECEMBER 1992 AND JANUARY 1993 BY SOIL TESTING, INC. UNDER CONTINUOUS INSPECTION OF MRCE.
- 230U — 4" DIAMETER UNDISTURBED SAMPLE BORING COMPLETED IN JANUARY 1993 BY SOIL TESTING, INC. UNDER CONTINUOUS INSPECTION OF MRCE.
- 215P — PIEZOMETER INSTALATION
- MONITORING WELL

TITLE		
Croton Avenue Bridge Boring Locations		
PREPARED FOR METRO-NORTH COMMUTER RAILROAD		
ERM–Northeast Environmental Resources Management ERM	SCALE NOTED DATE JUNE 93	FIGURE 2-6

The boring logs are shown in Appendix C. Representative soil samples were collected with a two-inch diameter split-spoon. Samples obtained in the first 10 feet of Borings 202 and 203A were reported to emit a petroleum odor. Ground water levels were obtained from an existing monitoring well near Boring 202. This well is presumed to be part of the 12-well ground water recovery network discussed in Section 2.1.3.2. Depth to water was approximately 10 feet (five feet above mean sea level (msl)). In addition, one foot of NAPL, identified in the MRCE report as diesel fuel, was observed floating on top of the water table in this well.

Phase II of the geotechnical investigation consisted of 22 additional borings. Additional split-spoon samples were recovered within the top 20 feet of the Phase II borings to provide information on shallow soil density. The boring depths ranged from 22 feet to 122 feet. Eleven undisturbed peat samples were collected from these borings. A piezometer was installed 10 feet south of Boring 215 to monitor ground water levels. Depth to water in the piezometer was recorded at 10 feet below grade (five feet above msl).

The findings of MRCE's investigation indicated that the subsurface soils along the proposed bridge alignment consisted of shallow granular fills generally less than five feet thick underlain by loose to medium compact "delta" sands that typically extend to depths of five to 43 feet. The "delta" sands were deposited where glacial streams entered glacial lakes. The delta sands are underlain by a thick deposit of medium compact to very compact glacial lake sand that typically extends to depths of 95 to 115 feet below grade. This sand is underlain by interlayered glacial lake very compact to compact silts and sands that extend to depths of greater than 125 feet below grade. The only organic materials encountered were located along the alignment for the west approach embankment (Figure 2-6). The top of that peat deposit, which was underlain by slightly organic sands, occurred at six feet below grade and extended to depths ranging from 18 to 29 feet below grade.

2.1.6 *Maintenance-of-Way Storage Building Investigation*

The current location of the Maintenance-of-Way Storage Building was the former location of an outdoor materials storage yard. In 1989, prior to construction of the foundation for the new storage building, Metro-North personnel collected soil samples for TPH analysis. As a result of the data and visual observations, Metro-North excavated approximately 225 cubic yards of soil in March of 1989. The soil was believed to be contaminated with diesel fuel and was transported to Model City for disposal. As a result of the limited records in Metro-North's files about the excavation, further work will be done in this area to evaluate the current conditions.

2.1.7 *Investigation at Fuel Pad in Southeast Area of Yard*

In December of 1985, under the supervision of NYSDEC, Metro-North undertook a remedial action at the fuel pad in the southeast area of the yard (Plate 1). This fuel pad was used for refueling locomotives. Prior to the removal of the soil, Metro-North collected six soil samples in the vicinity of the fuel pad and analyzed them for EP Toxicity, ignitability, reactivity, corrosivity and PCBs. The results of these analyses showed that the samples were not EP Toxic or otherwise characteristically hazardous and that the soils could therefore be disposed at a municipal landfill. A summary of the sampling data collected prior to the removal of the soil is shown in Table 2-12.

2.1.8 *Investigation at Fuel Supply Line*

In September of 1987, in the process of installing a fire protection water line, a contractor accidentally ruptured the fuel supply line. This line

Table 2-12 Summary of EP Toxicity Data from Southeastern Fuel Pad

Test	1	2	3	4	5	6
EP Toxicity, Metals						
Arsenic	0.050	0.016	<0.001	<0.001	0.018	<0.001
Barium	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cadmium	0.006	<0.003	<0.003	0.004	<0.003	<0.003
Chromium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Lead	<0.025	<0.025	<0.025	<0.025	0.029	<0.025
Mercury	0.0009	<0.0005	<0.0005	0.0029	0.0017	0.0007
Selenium	<0.001	<0.001	<0.001	<0.001	0.002	0.005
Silver	0.012	<0.006	<0.006	<0.006	<0.006	<0.006
Ignitability	>212°F	>212°F	>212°F	>212°F	>212°F	>212°F
Reactiviuty	Non-reactive	NR	NR	NR	NR	NR
Corrosivity	<0.01 in/yr	<0.01 in/yr	<0.01 in/yr	<0.01 in/yr	<0.01 in/yr	<0.01 in/yr
pH	7.25	7.50	7.55	7.56	7.55	7.45
Total Solids	951,405	910,140	883,030	961,304	966,024	970,962
PCBs	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

NOTES:

All units in mg/kg unless otherwise noted.
Samples 1 and 2 were collected on the southern side of the platform, on the west and east sides, respectively. Samples 3 and 4 were collected on the north sode of the platform on the east and west sides, respectively. Samples 5 and 6 were colleced further to the south of 1 and 2, on the west and east sides of the platform respectively.

was located on the west side of the fuel pump house and extended westward through the vicinity of the area that is now known as the Tie Storage Area (Plate 1). Approximately 5,000 to 6,000 gallons of diesel fuel were spilled when the line was ruptured and the spill was reported to NYSDEC (Spill number 874890). After completion of the major portion of the cleanup in March 1988, two 15 foot wells were installed adjacent to the ruptured line. One water sample was collected from each well, analyzed via Method EPA 503.1 for organics, and the results were reported to NYSDEC. The data is summarized in Table 2-13. Low concentrations of benzene, ethylbenzene, hexachlorobutadiene, toluene and xylenes were positively detected in the well closest to the supply line. These wells were subsequently removed from the area during the construction of the Tie Storage Area.

2.1.9 Underground Storage Tank Located Near Platform Extension

In April 1993, when footings for an extension to the existing platform were being constructed, Metro-North personnel identified an underground storage tank between Tracks no. 2 and no. 4. The contents of the tank were tested and the results indicated that the tank was filled with water and traces of oil. Subsequently, the contents of the tank were pumped out and discharged to the Waste Water Treatment Plant. The inside of the tank was inspected for sludge and then filled with concrete. Since a portion of the tank was located under Track no. 4, the tank was closed in place. During placement of the footings, soil was also excavated from this area and tested for Total Petroleum Hydrocarbons (TPH) and New York State Table 2 TCLP Constituents. Based upon the results of the analyses, which are summarized in Table 2-14, the concentration of four organics exceeded the TCLP regulatory levels by a minor amount. As a result of the data, some of the soils were removed from the site. However, in light of the minor exceedances of the TCLP regulatory levels, the fact that the

Table 2-13 Summary of Ground Water Sample Results from Wells Near Fuel Supply Line

Compound	Well #1	Well #2
Benzene	<10.0	4.0
2,3 Benzofuran	<20.0	<2.0
Bromobenzene	<20.0	<2.0
p-Bromofluorobenzene	<40.0	<4.0
n-Butylbenzene	<20.0	<2.0
sec-Butylbenzene	<20.0	<2.0
tert-Butylbenzene	<40.0	<4.0
Chlorobenzene	<10.0	<1.0
1-Chlorocyclohexene-1	<30.0	<3.0
m-Chlorotoluene	<30.0	<3.0
o/p-Chlorotoluene	<20.0	20.3
Cumene (Isopropylbenzene)	<20.0	<2.0
Cyclopropylbenzene	<20.0	<2.0
p-Cymene	<40.0	<4.0
m-Dichlorobenzene	<10.0	<1.0
o-Dichlorobenzene	<10.0	<1.0
p-Dichlorobenzene	<10.0	<1.0
Ethylbenzene	<10.0	1.6
Hexachlorobutadiene	<50.0	13.6
Naphthalene	<20.0	<10.0
n-Propylbenzene	<10.0	<1.0
Styrene	<20.0	<2.0
Tetrachloroethylene	<20.0	4.3*

Table 2-13 Summary of Ground Water Sample Results from Wells Near Fuel Supply Line (Cont'd)

Compound	Well #1	Well #2
Toluene	<10.0	1.8
1,2,3-Trichlorobenzene	<30.0	<10.0
1,2,4-Trichlorobenzene	<100.0	<10.0
Trichloroethylene	<20.0	<10.0
1,2,4-Trimethylbenzene	<20.0	48.7
1,3,5-Trimethylbenzene	<30.0	<3.0
o-Xylene	<20.0	4.0
m-Xylene	<20.0	7.6
p-Xylene	<20.0	9.4

NOTES:

All units in ug/l
* Laboratory indicated that confirmation of this value was needed.

Table 2-14 Summary of Soil and Water Sampling Data from Tank and Soils Collected Near Platform Extension

WATER/LIQUID SAMPLES FROM TANK		
Parameter	3.5 inch pipe	1.5 inch pipe
Oil & Grease	ND	ND
TOX	ND	ND
Flashpoint	>200 'F	194 'F
PCBs	ND	ND
TCLP Chromium	ND	ND
TCLP Lead	ND	0.30 ug/l
TCLP Benzene	ND	12 ug/l
SOIL SAMPLES FROM EXCAVATED SOIL PILES		
Parameter	Composite 1	Composite 2
TCLP Mercury	ND	1.8 ug/l
Total Toluene	1	ND
Total o-Xylene	2	ND
Total 1,3,5 Trimethylbenzene	25	5
Total 1,2,4 Trimethybenzene	45	7
n-Butylbenzene	15	ND
Anthracene	28	8
Fluorene	19	7
Napthalene	30	6
Phenanthrene	32	8
Total Petroleum Hydrocarbons	14,042	15,375

tank contents were primarily water and that no free product was observed, this area does not require any further investigative effort.

2.1.10 *Sample Collection During Installation of New Oil-Water Separator*

As part of the Waste Water Treatment Plant Improvement Program, a new oil/water separator is being installed at the south and of the T&E parking lot. The purpose of the separator is to remove oil from storm water originating at the fuel pad area prior to its being pumped to the Waste Water Treatment Plant. Prior to any excavation work in the yard, Metro-North routinely tests the soils to determine disposal options. Therefore, Metro-North collected samples from eight borings located in the proposed area of the oil/water separator. A total of eight samples were analyzed for PCBs and TCLP constituents and a summary of the data is shown in Table 2-15. No PCBs were detected in any of the samples; low concentrations of six organics were found in four samples and lead was detected in three samples. As a result of this data, the excavated soils will be disposed at an industrial waste landfill by Waste Technology Service (WTS).

Metro-North recently started the excavation for the oil/water separator and found NAPL. Therefore, further work will be done in this area.

2.2 *AREAS OF KNOWN/SUSPECTED NAPL*

Based upon a review of the available background documents and discussions with Metro-North, a number of locations at the yard have been identified as areas where non-aqueous phase liquid (NAPL) is known or suspected. In the context of this investigation, NAPLs are petroleum hydrocarbons with a specific gravity less than water which causes them to accumulate on the surface of the ground water table when sufficient quantities are present. The NAPL is expected to be either No. 2 or No. 4 fuel oil based upon the maintenance currently done in the yard. These

Table 2-15 Summary of Soil Sampling Data from Borings at New Oil/Water Separator

Constituent	Upper Boring 1	Lower Boring 1	Upper Boring 2	Lower Boring 2	Upper Boring, North	Lower Boring, North	Upper Boring, South	Lower Boring, South
TCLP ANALYSIS, all results in ug/l								
Lead	ND	ND	720	360	ND	ND	ND	ND
TOTAL ANALYSIS, all results in ug/kg								
n-Propylbenzene	ND	6	10	ND	7	ND	ND	ND
1,3,5 Trimethylbenzene	ND	8	45	15	12	ND	ND	ND
1,2,4 Trimethylbenzene	ND	11	85	24	21	ND	ND	ND
sec-Butylbenzene	ND	12	22	11	10	ND	ND	ND
n-Butlybenzene	ND	21	48	22	14	ND	ND	ND
Napthalene	ND	22	37	20	18	ND	ND	ND
Lead	ND	ND	720	360	ND	ND	ND	ND
TPH	720	31,700	10,000	30,600	44,000	10,800	18,900	4,300

areas of known or suspected NAPL are discussed in more detail below and will be the focus of the investigative activities presented in Section 3.0 of the work plan.

2.2.1 *Out-of-Service Fuel Oil Tanks/Pump House/Refueling Area*

On the eastern side of the yard, near the train platform, there are two fueling stations. The fueling locations on the southern side of this area are used to fuel trucks at the yard. There is a fuel pump house, a fueling station and a fuel oil supply line associated with the truck fuel deliveryoperation. On the other side of the truck fueling area is a fueling pad consisting of another set of pumps and a platform that was used for fueling locomotives. There was also a fuel oil tank associated with these operations that has since been removed. Based upon information provided by Metro-North, there is thought to be NAPL present in the vicinity of the fueling pad. The presence of NAPL in the excavation for the new oil/water separator confirms that there is product in at least a portion of the area. To the north of the locomotive fueling area there is a 200,000 gallon above ground storage tank that was rehabilitated and conforms to bulk storage tanks regulations. This tank formerly supplied fuel oil to the Electric Shop. The original pipe that ran from the pump house to the Electric Shop is thought to have leaked at one time and NAPL has been found to the north of the fuel oil pump house as detailed in Section 2.1.3. There were originally two 200,000 gallon tanks and a 40,000 gallon tank in this location (Plate 1). The southern 200,000 gallon tank and the 40,000 gallon tank were demolished in 1990.

2.2.2 *1,000,000-Gallon Above Ground Storage Tank*

This tank was located on an old site map and was used in the past to store diesel fuel. The tank was constructed of steel and rested directly on the ground surface within an earthen berm. The tank was removed in 1988.

Although there are no records of leaks or spills in this area, it is possible that they occurred. Therefore, this area was designated as an area where further investigative work would be prudent.

2.2.3 *Osborne Pond*

This area was identified by LMS in the Phase II investigation and by Metro-North as an area of possible concern. Osborne Pond is located on the southeastern side of the yard and is a low area formed by the natural depression between mainline and yard tracks. As a result of its elevation, Osborne Pond floods during prolonged periods of rain or following a heavy rain as a result of poor drainage. The surface of the pond is heavily stained. LMS speculated that the staining was the result of spillage from the refueling area located 100 feet west of the pond. NAPL has also been identified in the vicinity of Osborne Pond. No storage tanks were ever constructed in this area, therefore the source of any petroleum is likely to be runoff or direct spillage from the fueling area.

2.2.4 *Maintenance-of-Way Storage Building*

Discussions with Metro-North indicate that 100 cubic yards of soil were removed from this location prior to construction of the building. An underground gasoline storage tank was also present in this area, although little is known about the condition of the tank at the time of removal. It was suggested that some impacted soils may still be present in the vicinity of the building and additional investigative work was warranted in this area. NAPL in this area is believed to have been caused by overflows of the gravity sewer line which runs north from the fuel pad wet well to the treatment plant.

2.2.5 *Electric Shop*

In the past, train car maintenance and cleaning took place in the electric shop. The work on the train cars was done over drop pits located within the shop. While the pits are constructed of concrete and equipped with floor drains, the integrity of the underground floor drains is not known. Therefore, any material in the pits may have impacted the soils and ground water in the vicinity of the shop.

2.2.6 *Recovery Well System*

As a result of a possible former leak in a fuel supply line in the vicinity of the Distribution Center Warehouse, a ground water and NAPL recovery system was installed in this area. The system is comprised of twelve monitoring wells, one recovery well and a NAPL skimmer. Based upon available monitoring data, NAPL has been detected in all twelve of the monitoring wells. Additional investigative work is required in this area to completely delineate the extent of NAPL in the subsurface and to determine whether there is a connection between this area and the fueling pad area just to the south.

2.2.7 *Oil/Water Separator at Outfall*

According to the LMS report, the water and the sediments within the former concrete oil/water separator tank located in the far southern portion of the yard contained volatile and semi-volatile organics and several inorganics. In addition, there was visual evidence of oil in the sediments remaining in the tank. It is possible, therefore, that the contents of the tanks may have impacted the soils in the vicinity of the tank. Consequently, some additional investigative work will be done in this area.

Adjacent to the former oil/water separator tank is a 54 inch outfall pipe that discharges treated water from the Waste Water Treatment Plant to outfall pipe 002. In the past, a sheen has been observed at the outfall. Originally, it was believed that the source of the oil was the oil/water separator. However, subsequent work suggests that the source of the sheen may be Harmon Yard. Therefore, ERM proposes some additional investigative work around the 54 inch outfall pipe adjacent to the oil/water separator tank.

2.2.8 LMS Well GW-1

LMS installed five wells during their Phase II investigation. Well GW-1 was located on the northern side of the site and was originally considered to be an upgradient well. However, during the course of the investigation, LMS found that GW-1 contained NAPL. The NAPL, which apparently resembled fuel oil, was present at thicknesses of up to 1.5 feet. Based upon discussions with Metro-North, there is no apparent source for the NAPL in this well. Therefore, additional investigative work is needed in this area to determine the source of the NAPL as well as its areal extent.

2.2.9 LMS Well GW-5

LMS Well GW-5 was located adjacent to the southern end of Osborne Pond on the opposite side of the yard from GW-1. NAPL was also detected in this well by LMS, but apparently resembled kerosene, not fuel oil. The source of NAPL in this well is not apparent at this time and this area also requires further study.

2.2.10 Distribution Center Warehouse Wells

Two underground storage tanks were formerly located in the vicinity of the Distribution Center Warehouse. One tank contained diesel fuel and one tank contained gasoline. After the tanks were removed, four wells were installed and monitored to determine whether any NAPL remained in the ground. Based upon conversations with Metro-North, there may have been some NAPL in these wells. The wells were removed when the Distribution Center Warehouse was built and it is not possible to evaluate the current conditions in this area. Therefore, additional work will be conducted to determine whether or nor NAPL is still present in this area.

2.2.11 *Croton Point Avenue Bridge*

Mueser Rutledge Consulting Engineers (MRCE) conducted a geotechnical investigation at the Croton Point Avenue Bridge in January of 1993 (MRCE, 1993). The purpose of the geotechnical investigation was to evaluate the soils at the base of the bridge for construction of a replacement bridge. During the investigation, MRCE encountered stained soils at two boring locations and reported that the soils emitted a petroleum odor. Therefore, this area of the site requires additional investigation to determine the source of petroleum and horizontal and vertical extent of impacted soils.

3.0 FIELD INVESTIGATION

The purpose of this section is to provide a detailed description of the objectives and procedures for the proposed field investigative activities. The overall focus of the field investigation will be on the identification of the lateral extent of NAPL in the yard and on a characterization of the soils and ground water that have been impacted by the NAPL. This information will be used both to evaluate areas in need of remediation and to evaluate appropriate remedial technologies for addressing the NAPL and impacts to the soil and ground water at the yard.

The field investigative activities will consist of the following tasks:

1) Update Yard Map
2) NAPL Delineation and Characterization
3) Soil Characterization
4) Ground Water Characterization
5) Aquifer Testing

The purpose of each task and the procedures to be followed in completing each task are discussed in the sections that follow. At the conclusion of the field investigation, a Field Investigation Report documenting the findings of the field activities will be prepared. The Field Investigation Report, possible bench and/or pilot scale testing and the preparation of the Cleanup Plan are discussed in Sections 4.0, 5.0 and 6.0.

3.1 UPDATE YARD MAP

3.1.1 Purpose

The purpose of this task is to update the existing map of the yard that was completed in 1985. The updated map can be used to accurately locate proposed sample locations with reference to current surface features. Additionally, the updated map, in conjunction with existing underground drawings of the yard, can be used to more accurately identify likely source areas and potential migration pathways.

3.1.2 *Procedures*

ERM will subcontract the services of Larsen Engineers, a licensed New York surveyor, to update the map. Larsen will obtain new aerial photos suitable for 40/50 scale mapping with one foot contours. The information on the aerials will be verified in the field with 14 horizontal control points and 16 vertical control points. The revised map will have a scale of one inch equal to 50 feet and a one foot contour interval. The map will show all existing buildings, tracks, storage tanks and to the extent possible, underground utilities. The underground utilities will be added to the map based upon existing as-built yard utility drawings supplied by Metro-North. The map will be completed on Autocadd Version 12 for use by ERM and Metro-North. A partially completed version of the updated yard map is included in this work plan on Plate 1; the map is missing the underground utility lines. The map will be completed prior to submission of the Field Investigation Report to NYSDEC so that it can be used for any remedial design work that is required.

3.2 *NAPL DELINEATION AND CHARACTERIZATION*

3.2.1 *Purpose*

The purpose of this task is to delineate the extent of NAPL at each individual area of known or suspected NAPL. ERM will install a series of temporary well casings at pre-determined locations and based upon the data collected in the first round of temporary well casings, will continue to install temporary wells until the extent of NAPL in each area is fully delineated. The result of this task will be the identification of a number of discrete areas in the yard where product is present. For the purposes of this investigative effort, the yard boundaries will not include any part of the Harmon Lagoon Operable Unit I or Operable Unit II. The delineation of the discrete areas in the yard where NAPL is present will then form the basis for the selection of locations for the remainder of the field investigative activities.

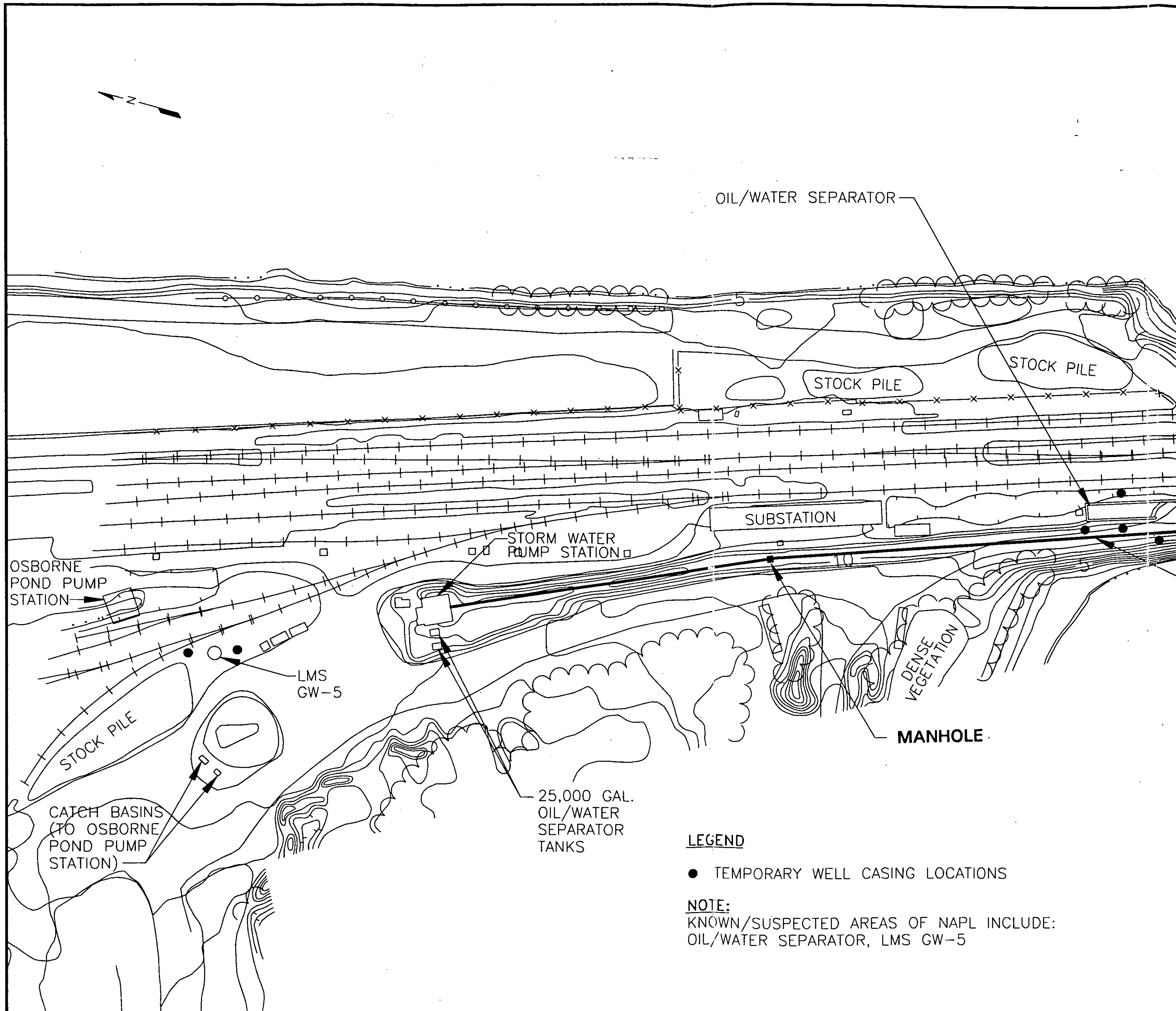
3.2.2 *Procedures*

ERM has reviewed the available background information and evaluated the size of each area of known or suspected NAPL. Based on that information, locations for between two and seven temporary well casings were identified for each area. A summary of the number of temporary well casings proposed for each area of known/suspected NAPL is shown in Table 3-1. The locations of these temporary well casings are shown on Figures 3-1 through 3-5. Generally, the larger the area, or the more likely that NAPL is to be present, the more locations proposed for temporary wells. Therefore, ERM proposed five to seven temporary wells for Osborne Pond and the refueling areas (Figures 3-2 and 3-3) and only two temporary wells in the vicinity of the 1,000,000 gallon above ground storage tank (Figure 3-3). ERM proposes to install all of the temporary well casings in one area at one time. Areas where there are only two temporary wells may be grouped together with other areas of similar size. The idea will be to install the temporary well casings in as short a time frame as possible so that this initial screening step can be completed relatively quickly.

At each temporary well location, continuous split spoon samples will be collected from the ground surface to the top of the water table with a hollow stem auger rig. The samples will be collected with decontaminated

TABLE 3-1 SUMMARY OF INITIAL TEMPORARY WELL CASING LOCATIONS FOR NAPL DELINEATION

Area of Known/Suspected NAPL	Number of Temporary Well Casings
Refueling Area	7
1,000,000 Gallon Above Ground Storage Tank	2
Osborne Pond	5
Maintenance of Way Storage Building	2
Outfall Pipe 002	2
Electric Shop	3
Product Recovery Well	4
Oil/Water Separator Tanks	2
LMS Well GW-1	2
LMS Well GW-5	2
Store House	4
Croton Point Avenue Bridge	4
Total	38

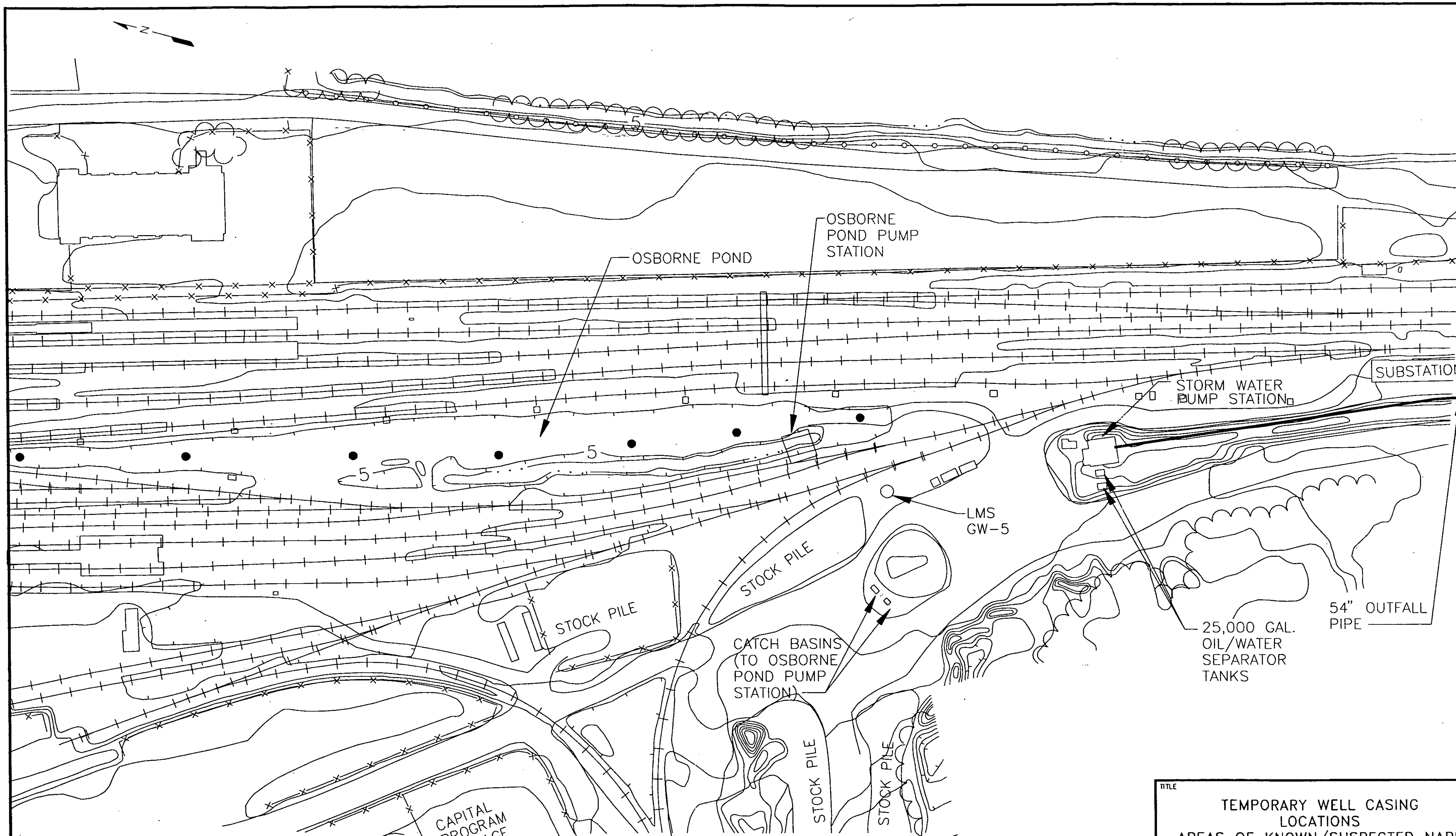


LEGEND

● TEMPORARY WELL CASING LOCATIONS

NOTE:
KNOWN/SUSPECTED AREAS OF NAPL INCLUDE:
OIL/WATER SEPARATOR, LMS GW-5

TITLE: TEMPORARY WELL CASING LOCATIONS AREAS OF KNOWN/SUSPECTED NAPL HARMON YARD				
PREPARED FOR: METRO NORTH COMMUTER RAILROAD				
ERM-Northeast Environmental Resources Management			SCALE: 1"=100'	FIGURE: 3-1
			DATE: 7/23/93	
DRAWN: S.G.	JOB NO.: 680.001	FILE NAME: DWG1		



LEGEND

● TEMPORARY WELL CASING LOCATIONS

NOTE:
KNOWN/SUSPECTED AREAS OF NAPL INCLUDE:
OSBORNE POND

TITLE

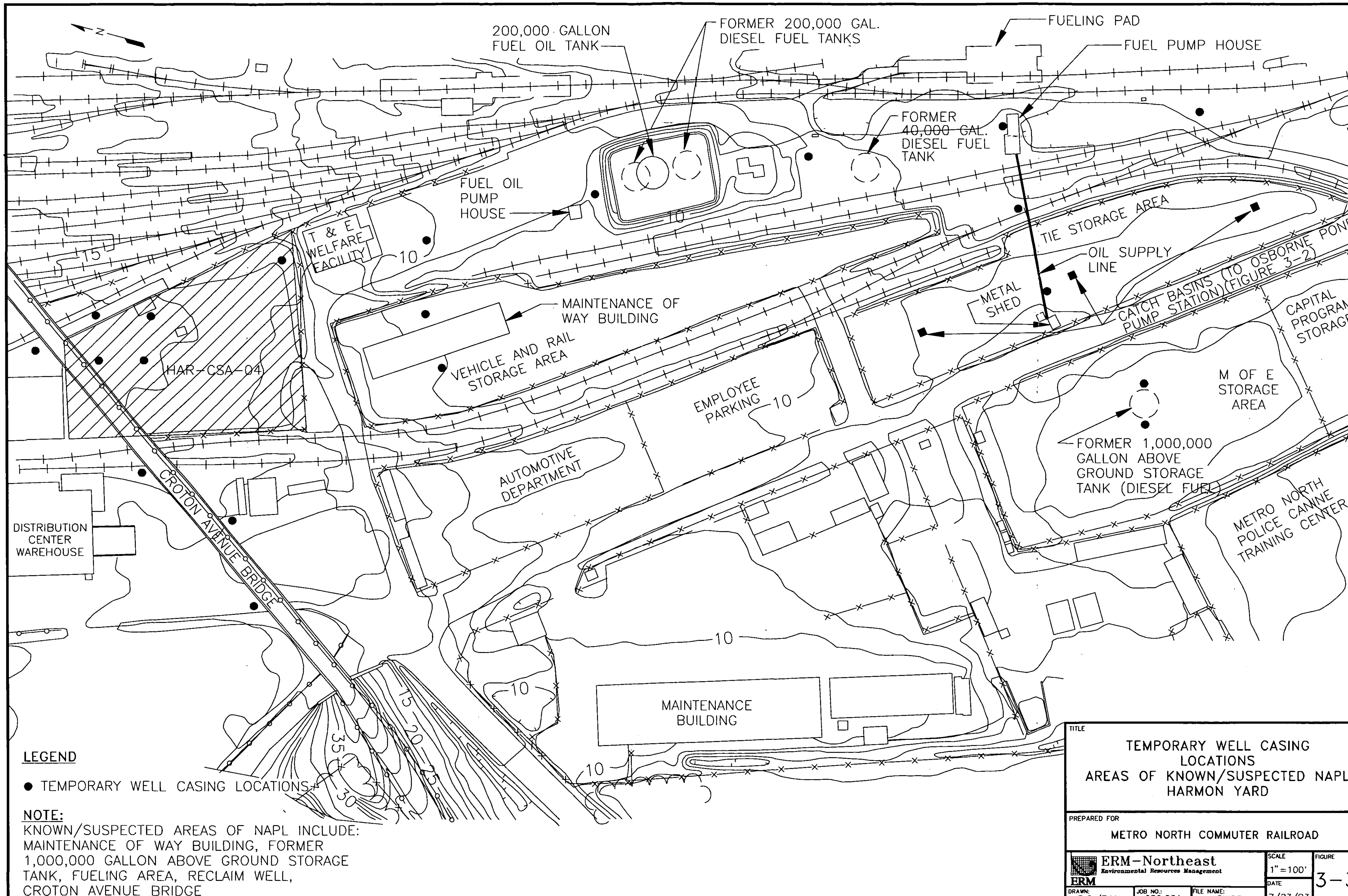
TEMPORARY WELL CASING LOCATIONS
AREAS OF KNOWN/SUSPECTED NAPL
HARMON YARD

PREPARED FOR

METRO NORTH COMMUTER RAILROAD

ERM–Northeast
Environmental Resources Management
ERM

DRAWN:	JOB NO.:	FILE NAME:	SCALE / DATE	FIGURE
S.G./E.M.	680.001	DWG2	1" = 100' / 7/15/93	3–2



TITLE

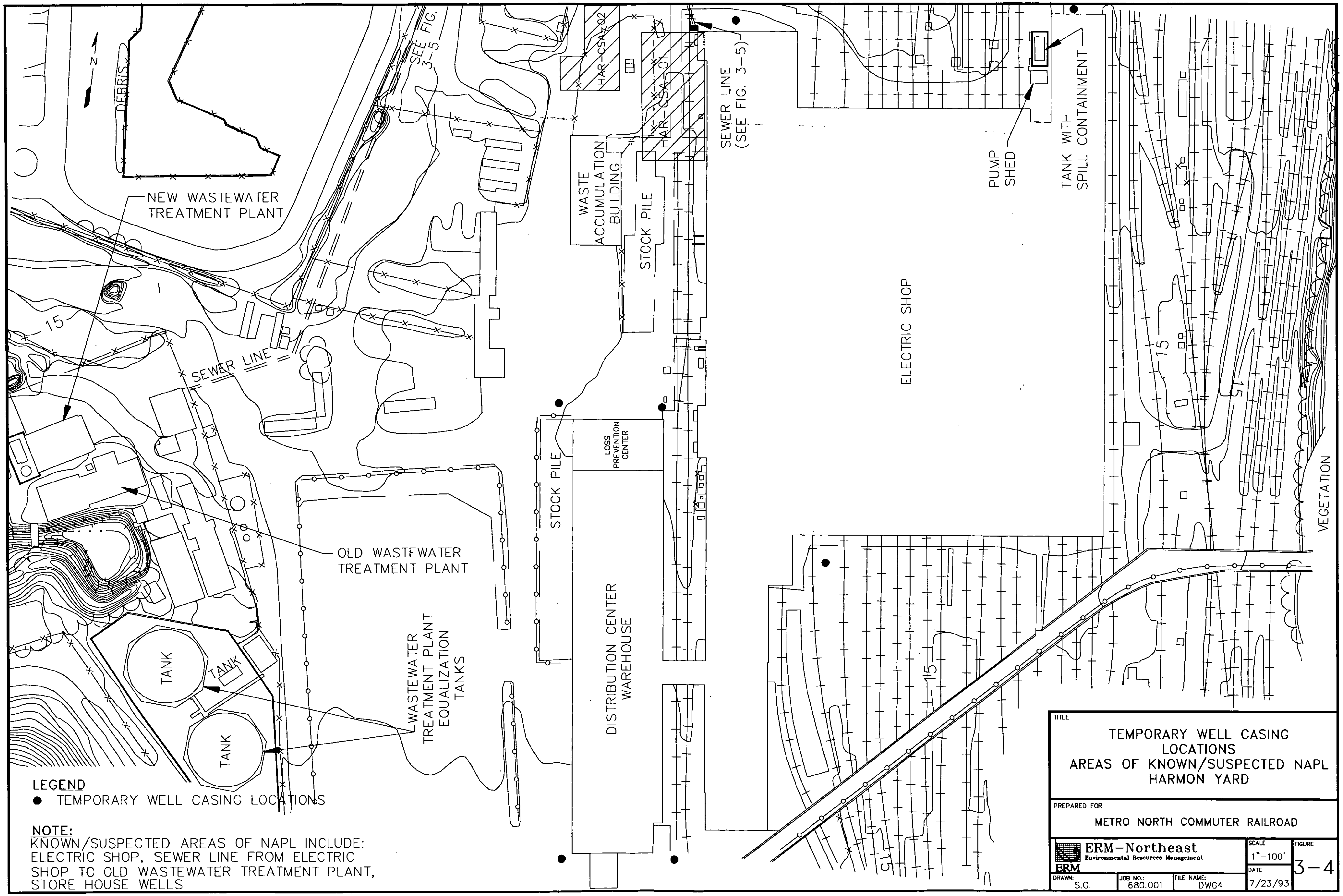
TEMPORARY WELL CASING LOCATIONS
AREAS OF KNOWN/SUSPECTED NAPL
HARMON YARD

PREPARED FOR

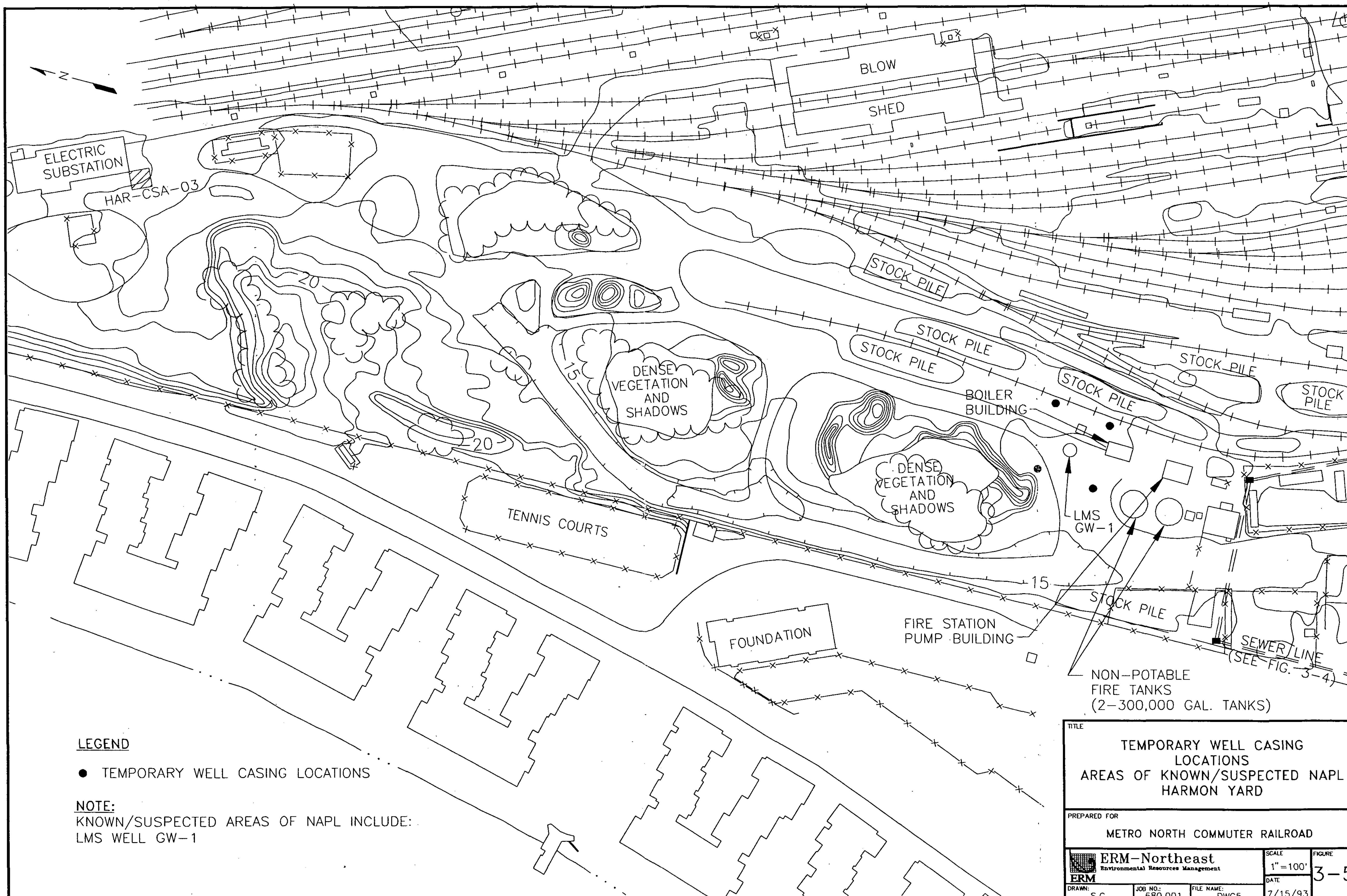
METRO NORTH COMMUTER RAILROAD

ERM-Northeast
Environmental Resources Management

DRAWN:	JOB NO.:	FILE NAME:	SCALE	DATE	FIGURE
S.G./E.M.	680.001	DWG3	1"=100'	7/23/93	3-3



N
DEBRIS
SEE FIG. 3-5
HAR-CSA-02
HAR-CSA-01
SEWER LINE (SEE FIG. 3-5)
WASTE ACCUMULATION BUILDING
STOCK PILE
PUMP SHED
TANK WITH SPILL CONTAINMENT
NEW WASTEWATER TREATMENT PLANT
ELECTRIC SHOP
15
SEWER LINE
LOSS PREVENTION CENTER
STOCK PILE
OLD WASTEWATER TREATMENT PLANT
VEGETATION
WASTEWATER TREATMENT PLANT EQUALIZATION TANKS
DISTRIBUTION CENTER WAREHOUSE
TANK
TANK
TANK
LEGEND
● TEMPORARY WELL CASING LOCATIONS
NOTE:
KNOWN/SUSPECTED AREAS OF NAPL INCLUDE: ELECTRIC SHOP, SEWER LINE FROM ELECTRIC SHOP TO OLD WASTEWATER TREATMENT PLANT, STORE HOUSE WELLS
TITLE
TEMPORARY WELL CASING LOCATIONS
AREAS OF KNOWN/SUSPECTED NAPL
HARMON YARD
PREPARED FOR
METRO NORTH COMMUTER RAILROAD
ERM-Northeast
Environmental Resources Management
ERM
SCALE 1"=100'
FIGURE 3-4
DATE 7/23/93
DRAWN: S.G.
JOB NO.: 680.001
FILE NAME: DWG4



N
ELECTRIC SUBSTATION
HAR-CSA-03
BLOW
SHED
20
STOCK PILE
STOCK PILE
STOCK PILE
STOCK PILE
STOCK PILE
STOCK PILE
DENSE VEGETATION AND SHADOWS
15
20
DENSE VEGETATION AND SHADOWS
BOILER BUILDING
LMS GW-1
TENNIS COURTS
15
FOUNDATION
FIRE STATION PUMP BUILDING
STOCK PILE
SEWER LINE (SEE FIG. 3-4)
NON-POTABLE FIRE TANKS (2-300,000 GAL. TANKS)
LEGEND
● TEMPORARY WELL CASING LOCATIONS
NOTE:
KNOWN/SUSPECTED AREAS OF NAPL INCLUDE:
LMS WELL GW-1
TITLE
TEMPORARY WELL CASING LOCATIONS
AREAS OF KNOWN/SUSPECTED NAPL
HARMON YARD
PREPARED FOR
METRO NORTH COMMUTER RAILROAD
ERM-Northeast
Environmental Resources Management
ERM
SCALE
1" = 100'
FIGURE
3-5
DATE
7/15/93
DRAWN:
S.G.
JOB NO.:
680.001
FILE NAME:
DWG5

standard two-inch split spoons driven in accordance with ASTM standards for Penetration Test and Split-Barrel Sampling of Soils (ASTM D-1586-67, reapproved 1974). Upon retrieval and opening of the split spoons, ambient volatile organic measurements will be collected with an OVA or an HNu and the samples will be logged. The sample logs will include descriptions of volatile organic readings, odor, penetration resistance, recovery, grain size, color, staining or visible presence of NAPL and moisture content. In addition, a representative number of soil samples from each boring will be analyzed in the field for Total Petroleum Hydrocarbons (TPH) with and HNU-Hanby Field Test Kit. It is estimated that between five and eight samples will be tested from each boring and the samples will be selected based upon visual observation.

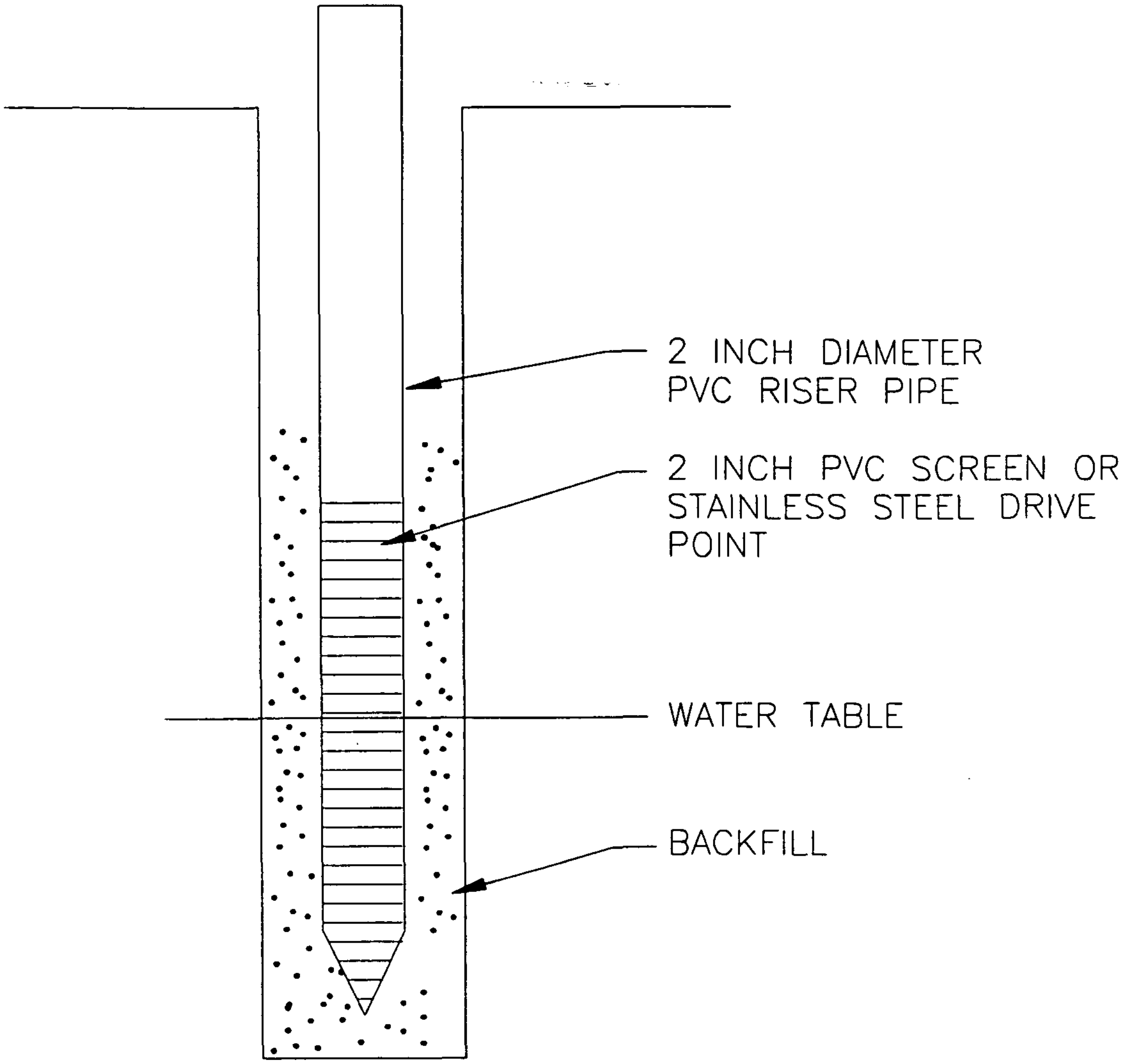
The HNU-Hanby system for TPH analysis is a self-contained test kit. The Hanby Method was documented in a recent EPA report on field measurement techniques (EPA, 1990). In this report, EPA found that the method provided quantitative results with high levels of precision and accuracy. Typical minimum detection limits are one part per million each for BTEX, unleaded gasoline, diesel fuel and crude oil. The on-site test is completed in approximately 10 minutes.

The test procedure is as follows: first, a five-gram soil sample (approximately two milliliters (ml)) is placed in a beaker. A 10-ml ampule of solvent is added to the soil which is agitated for three minutes. After allowing the soil to settle, the solvent is poured into a screw-top test tube to the 4.2 ml mark. One 10-ml vial of color development catalyst is added and the test tube is vigorously shaken for three minutes. Lastly, the hue and intensity of the resulting product are compared to color standards to determine the contaminant type and concentration. If a mixture of components exist in the soil, the resulting color will reflect their presence.

After sampling, two-inch PVC temporary well casings will be installed in the borings. The temporary well casings will be constructed of 10 feet of slotted PVC and five to 10 feet of riser pipe and will be installed such that the screened interval straddles the water table. A sufficient amount of the annular space surrounding the casing will be backfilled with drill cuttings to ensure that the casing is stable inside the boring (Figure 3-6). The casings will be left in place for eight to 12 hours.

After eight to 12 hours of equilibration, water level and NAPL thickness measurements will be collected from each well. Water level measurements in the temporary well casings will be obtained with an electronic interface probe accurate to 0.01 feet. All water level measurements will be taken from the top of each temporary casing and the time each measurement is taken will be recorded in a bound field notebook. Product thickness measurements will be collected with a clean acrylic bailer or an oil/water interface probe. All measuring equipment will be decontaminated between wells using an Alconox and water solution and a tap water rinse.

A representative sample of NAPL, if present, will be then be collected and analyzed by Worldwide Geosciences, Inc. to determine pertinent signature characteristics via a gas chromatographic analysis, type of petroleum hydrocarbon, and physical properties (eg. specific gravity and viscosity). A summary of the proposed analytical parameters is shown in Table 3-2. The purpose of this analysis is to determine the type of product present in each area, and if the NAPL plumes are laterally extensive, determine whether the composition of the NAPL changes within the plume. If for example, NAPL from two different source areas merge, the composition of the NAPL would change accordingly. The data may also be used to show that two seemingly discrete areas of NAPL have the same characteristics and are actually part of one plume. After the presence or absence of NAPL is confirmed and the NAPL is sampled, the temporary well casings will be removed and the remainder of the borehole will be backfilled with drill



TITLE

TEMPORARY WELL CASING
CONSTRUCTION
HARMON YARD

PREPARED FOR

METRO-NORTH COMMUTER RAILROAD

ERM–Northeast Environmental Resources Management ERM			SCALE NTS	FIGURE 3-6
DRAWN: S.C.	JOB NO.: 680.001	FILE NAME: FIG3-7	DATE 6/21/93	

TABLE 3-2 COMPONENTS OF PRODUCT CHARACTERIZATION ANALYSIS

Test	Method
API Gravity	D287
Density at 15°C	D4052
Visc. Kin at 100°F CST	D445
Cloud Point, °C	D97
Pour Point, °C	D97
CCR Percent by Mass	D189
Ash Percent by Mass	D482
Water Percent by Volume	D95
Flash Point, °C	D93
Sed by Filtration, Percent	Exxon
Sulfur, Percent by Mass	D4294
Hydrocarbon Scan and comparison of chromatograph to #2 oil, #4 oil, residual oil, diesel fuel, gasoline, and kerosene.	

cuttings. Any annular space not filled by the cuttings will be backfilled with a bentonite cement grout. This practice is in accordance with NYSDEC TAGM 4032 regarding the disposal of drill cuttings.

The NAPL thickness measurements from the first set of temporary wells will be plotted on a map of each area. In areas where NAPL exceeds six inches in thickness, another set of temporary well casings will be installed at a distance of 50 to 100 feet radiating outward from the first set. The appropriate distance will be selected based upon the thickness of the NAPL in the first set of wells and field judgement. Water level and NAPL measurements will be obtained from each subsequent set of temporary well casings. At any location where the temporary well casing is 100 feet or more from the first set of wells, continuous split spoon samples will be collected for detailed lithological logging, soil samples will be collected for TPH analysis and another representative sample of NAPL, if present, will be obtained. Similarly, these boring will be abandoned after the temporary casings are removed and will be backfilled with drill cuttings and bentonite cement grout.

This iterative process of temporary well installation will be continued in each area until the extent of each NAPL plume is defined in all directions within the yard boundaries. As previously mentioned, the yard boundaries do not include any areas that are part of Harmon Lagoon Operable Unit I or Operable Unit II. At the conclusion of the delineation task in each area, a final map will be prepared that shows the location and extent of the NAPL plume in each area.

3.3 SOIL CHARACTERIZATION

3.3.1 Purpose

The purpose of the soil characterization task is to determine the quality of the soil in the areas impacted by NAPL and to evaluate any changes in soil quality within the area impacted by the NAPL plume. Accordingly, soil samples will be collected from borings located within the central portion of the NAPL plume and from locations on the perimeter of the plume. Additionally, this task will provide data to determine whether soil remediation is necessary and, if so, what engineering options are most applicable.

3.3.2 *Procedures*

As the extent of the NAPL plume is identified in each area, the size and configuration of the plume will be analyzed and locations for soil borings will be selected. One soil boring will be placed in the central portion of the plume and a minimum of two soil borings will be placed on the outer edge of the plume. In addition, based upon the lithological logs developed during the NAPL characterization phase, sampling intervals in each boring will be selected. Depending upon the location of the boring, the sampling interval will either be within the zone of water table fluctuation or above that zone. The depth of these sampling intervals will vary across the site based upon topography and the proximity of the locations to the Hudson River. The depth of the interval in each boring will be carefully noted in the boring logs since this data may also provide an indication of the potential for chemicals in the unsaturated zone to migrate or leach into the ground water. This analysis of boring location and sampling interval should be relatively simple and should take place in the field after the final round of temporary well casings have been installed and the outer boundaries of the discrete NAPL plumes have been identified.

In each discrete area of product, one soil boring will be installed in the central portion of the NAPL plume to characterize soils directly impacted by surface or subsurface spills. The soil boring will be installed with a hollow stem auger rig and three-inch decontaminated split spoons will be used for sampling to ensure sufficient sample volume for the laboratory analysis. Since adequate information regarding the lithology of the subsurface will have been collected during the installation of the temporary well casings, only two soil samples will be collected from each boring installed in the central portion of the NAPL plume. Unless field observations suggest otherwise, one soil sample will be collected from above the interval impacted by fluctuations of the water table and one soil sample will be collected from the water table. Upon completion of sampling, this boring location will be used for the installation of a permanent NAPL/ground water monitoring well.

In order to characterize the quality of the soil on the outer boundary of the plume, a minimum of two additional soil borings will be installed at the outer edge of the plume. An estimate of the number of borings to be installed in each area is shown in Table 3-3. However, the final number of borings required to obtain a representative set of soil samples will be determined once the NAPL plumes are delineated. Since the soils at the outer edge of the plume have only been impacted by the migration of the plume and not by surface spills, only one sample will be collected from these borings. The soil sample will be collected with a three inch split spoon sampler from within the zone of soil impacted by water table fluctuations. These soil borings will not be used for monitoring wells and will therefore be backfilled with the drill cuttings.

Soil samples for laboratory analysis will be collected from the three-inch spilt spoon with a stainless steel trowel and the samples will be placed in laboratory supplied glassware. The bottles will be stored on ice and shipped by overnight courier to E3I. E3I is part of the New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program and has been approved by NYSDOH for the analysis of soil and ground water samples via NYSDEC Analytical Services Program (ASP)

TABLE 3-3 ESTIMATED NUMBER OF BORINGS FOR SOIL CHARACTERIZATION SAMPLING PROGRAM

Area of Known/Suspected NAPL	Number of Soil Borings	Number of Soil Samples
Refueling Area	7	8
1,000,000 Gallon Above Ground Storage Tank	3	4
Osborne Pond	7	8
Maintenance of Way Storage Building	3	4
Outfall Pipe 002	3	4
Electric Shop	3	4
Product Recovery Well	3	4
Oil/Water Separator Tanks	3	4
LMS Well GW-1	3	4
LMS Well GW-5	3	4
Store House	3	4
Croton Point Avenue Bridge	3	4
Totals	44	56[A]

[A] These soil samples will be accompanied by the following quality control samples:

duplicates (1/20) = 3
field blanks (1/20 or 1 per day of sampling) = 5
matrix spikes (1/20) = 3
matrix spike duplicates (1/20) = 3

The frequency of the quality control sample collection is given in parentheses because in the event that the total number of soil samples changes, the number of quality control samples will change according to the frequencies noted.

protocols. The soil samples will be analyzed for Target Compound List/Target Analyte List (TCL/TAL) parameters by NYSDEC 1991 ASP analytical methods. Quality control samples, including matrix spikes, matrix spike duplicates, duplicate samples and field blanks will also be collected during this program. Based upon the estimated number of 56 soil samples, three duplicates samples, three matrix spike, three matrix spike duplicates and approximately five field blanks will also be collected. A summary of these sampling program is shown in Table 3-3. The numbers of samples shown in this table are estimates since the actual number of samples will depend upon the final number and the size of the discrete areas of product as well as the number of borings needed to provide representative data.

All of the soil samples will also be analyzed for total organic carbon (TOC) and approximately 30 % of the samples will be analyzed for grain size distribution. The samples will be analyzed for TOC by EPA Method 9060 and the grain size analysis will be conducted via dry sieve according to ASTM D422 (Standard Method for Particle Size Analysis of Soils).

Upon completion of the borings, any boreholes that are not subsequently to be used for monitoring wells will be backfilled as described in Section 3.2.2. All drilling and sampling equipment will be cleaned in accordance with the procedures described in Section 3.6.

3.4 GROUND WATER CHARACTERIZATION

3.4.1 Purpose

The purpose of the ground water characterization task is to evaluate the quality of ground water in the vicinity of the NAPL plume and to delineate ground water flow paths at the yard. These objectives will be achieved by installing monitoring wells within and adjacent to each discrete NAPL plume and collecting water level measurements and ground water samples for analysis.

3.4.2 *Procedures*

As the extent of the NAPL plume is identified in each area, the size and configuration of the plume will be analyzed and the locations for the permanent monitoring wells will be selected. The monitoring well network at each area of NAPL will include a minimum of four permanent four-inch PVC monitoring wells. One well will be installed in the central portion of the plume where the initial soil boring was drilled. This well will be used solely for monitoring the thickness of the NAPL plume. A minimum of three additional wells will be installed outside of the NAPL plume area to evaluate dissolved ground water quality and ground water flow directions. The final number of monitoring wells installed in each area will be dependent upon the size of the plume, access to the proposed drilling locations and the proximity of the plume boundary to other plumes. An estimate of the number of monitoring wells to be installed in each area is shown in Table 3-4. In selecting locations for the wells, the water level measurements obtained during the NAPL Delineation and Characterization task will be analyzed to determine upgradient and downgradient directions. One of the three wells will be located in the area thought to be hydraulically upgradient of the NAPL plume and two of the wells will be located on the downgradient side of the plume.

The permanent ground water monitoring wells will be constructed of four-inch flush joint, threaded, schedule 40 PVC casing and five-foot long, 20-slot PVC screens. The depth of the wells will vary across the yard, but each well will be constructed so that the screen straddles the water table. After drilling to the appropriate depth in the borehole, the screen and riser pipe will be set in the borehole. A gravel pack will be placed in the annulus around the screen and up to two to four feet above the screen. A

TABLE 3-4 ESTIMATED NUMBER OF MONITORING WELLS TO BE INSTALLED DURING GROUND WATER CHARACTERIZATION

Area of Known/Suspected NAPL	Number of Permanent Monitoring Wells	Number of Ground Water Samples
Refueling Area	5	4
1,000,000 Gallon Above Ground Storage Tank	4	3
Osborne Pond	5	4
Maintenance of Way Storage Building	4	3
Outfall Pipe 002	4	3
Electric Shop	4	3
Product Recovery Well	3	3
Oil/Water Separator Tanks	4	3
LMS Well GW-1	4	3
LMS Well GW-5	4	3
Store House	4	3
Croton Point Avenue Bridge	4	3
Estimated Total	49	37[A]

[A] These ground water samples will be accompanied by the following quality control samples:

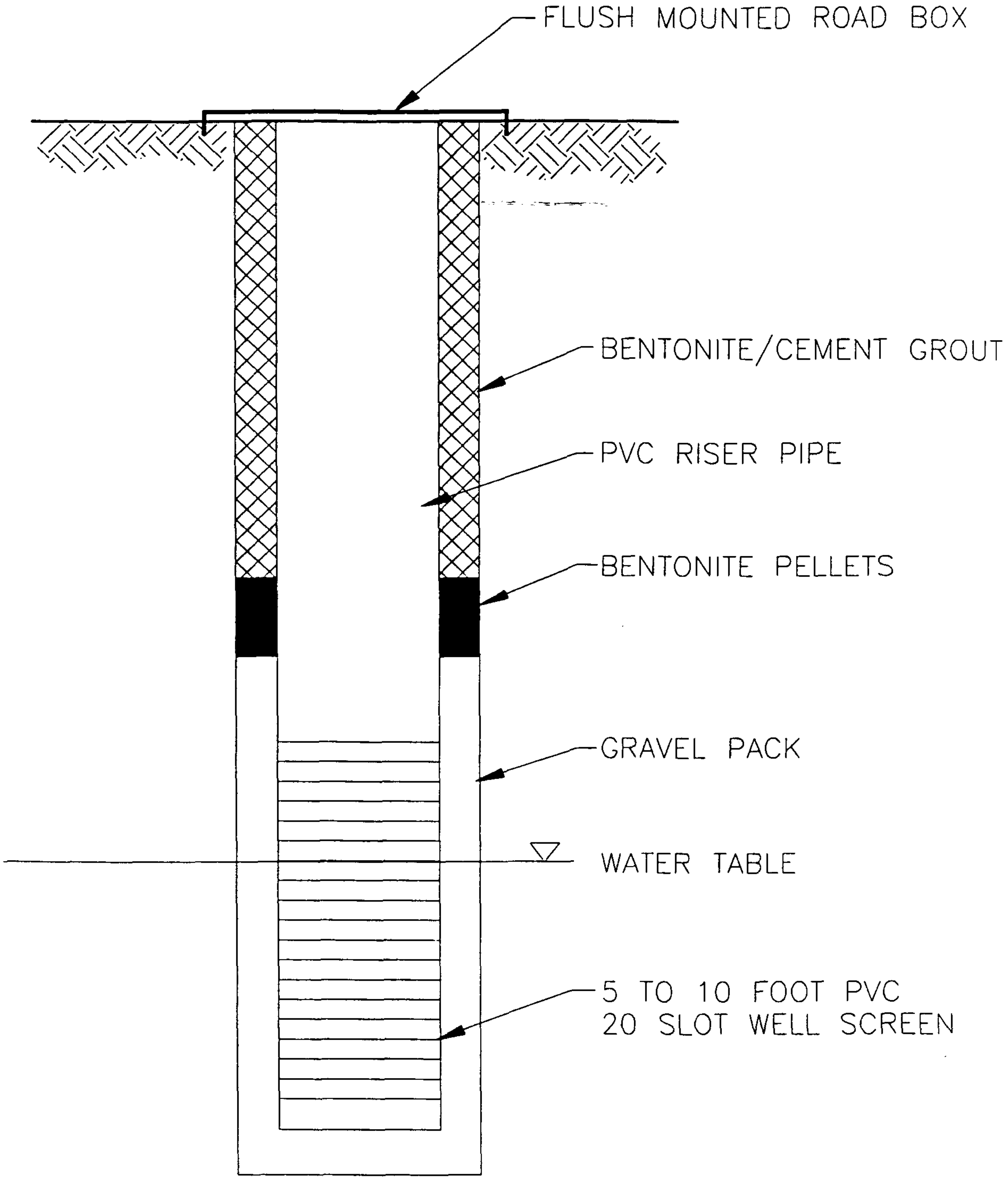
duplicates (1/20) = 2
field blanks (1/20 or 1 per day of sampling) = 3
matrix spikes (1/20) = 2
matrix spike duplicates (1/20) = 2
trip blanks (1/20) = 2

The frequency of the quality control sample collection is given in parentheses because in the event that the total number of soil samples changes, the number of quality control samples will change according to the frequencies noted.

two-foot bentonite pellet layer will be installed above the gravel pack and the remaining annular space will be grouted with a bentonite/cement grout. Depending upon the location, the PVC riser may be finished at or above grade. Wells finished at ground surface will be fitted with a locking flush-mounted road box. Wells finished above grade will be fitted with a locking two-foot protective casing. A schematic of the proposed well construction specifications is shown in Figure 3-7.

The cuttings generated during the drilling of the boreholes for the monitoring wells in the central portion of the plume will be stored in roll-off containers in the fenced area north of the hazardous waste storage building. These cuttings may be saturated with product and the roll-offs will be lined with plastic sheeting. A plastic sheet will also be laid over the cuttings and the roll-offs will be monitored regularly with an OVA or an HNu for volatile organic vapors. Upon completion of the project, the soils will be tested to determine appropriate handling procedures. The cuttings generated during the drilling of the borings outside of the NAPL plume will be regraded into the site surface in the vicinity of the monitoring well. These cuttings will not contain any NAPL and therefore will not require any special handling procedures.

All permanent monitoring wells will be developed by either air lift or submersible pump to ensure the removal of fine material and to restore the hydraulic properties of the surrounding water-bearing zone. The equipment used to develop the wells will be decontaminated prior to use and between each well. The development of wells inside the NAPL plume will only be undertaken if product thicknesses in the wells do not match product thicknesses measured during the NAPL Delineation task. In the event it is necessary to develop these wells, the water will be drummed and stored at a central location at the yard. The development of wells outside of the NAPL plume will continue until the turbidity of the well water is equivalent to 50 Nephelometric Turbidity Units (NTUs). A portable



TITLE

MONITORING WELL
CONSTRUCTION SPECIFICATIONS
HARMON YARD

PREPARED FOR

METRO-NORTH COMMUTER RAILROAD

ERM-Northeast
Environmental Resources Management
ERM

SCALE	FIGURE
NTS	3-7
DATE 6/21/93	

DRAWN:	JOB NO.:	FILE NAME:
S.G.	680.001	FIG3-8

turbidity meter will be brought to the site to measure the turbidity of the ground water. If the turbidity of the ground water cannot be reduced to 50 NTUs, the field team leader, in consultation with NYSDEC will document the problem, record the turbidity measurement achieved and will consider the well developed. All development water will be allowed to percolate into the site surface at a distance of approximately 25 feet from the well. Following development, the wells will be allowed to equilibrate for a minimum of one week prior to sample collection.

After the monitoring wells are developed, several rounds of water level measurements and NAPL thickness measurements will be collected from the permanent monitoring well network. The horizontal and vertical locations of the permanent monitoring wells, including the LMS wells and the recovery well, will also be surveyed by Larsen Engineers. This information will allow the accurate location of the wells on the base map and the measurement of vertical elevations of the wells from which water table elevations may also be calculated. Additionally, two rounds of ground water samples will be collected from the wells installed outside of NAPL plume area.

Prior to the collection of ground water samples, a round of water level measurements will be collected so that the aqueous volume in each well may be calculated. A total of five well casing volumes will be removed from each well prior to the acquisition of the ground water samples. The purge water will be discharged to the surface of the yard. The ground water samples will either be collected with stainless steel bottom loading bailers or alternatively, with disposable high density polyethylene bottom-loading bailers, suspended by a polypropylene cord. The samples will be poured from the bailer into laboratory-prepared sample bottles and the bottles will be stored in a cooler on ice. The coolers will be shipped to the E3I within 24 hours of sample collection via overnight courier. The samples will be analyzed for TCL/TAL parameters and will be accompanied by the appropriate quality control samples including matrix spikes, matrix spike duplicates, duplicates, field blanks and trip blanks. Based upon an estimated number of 37 ground water samples, two duplicate samples, two matrix spike, two matrix spike duplicates and approximately three field blanks will also be collected. A summary of the sampling program is shown in Table 3-4. The numbers of samples shown in this table are estimates since the actual number of samples will depend upon the final number and the size of the discrete areas of product as well as the number of borings needed to provide representative data. All samples shall be properly identified, logged and shipped under full chain-of-custody procedures. All sampling equipment shall be properly decontaminated prior to use according to the procedures outlined in Section 3.6.

A second round of ground water samples will be collected at least three months after the first round of samples. The data from the first round of samples will be used to determine the most appropriate analytical parameters and analytical protocols for the second round of sampling. ERM may consider selecting a representative subset of analytical parameters for the second round of samples or may consider using alternate analytical procedures for the sample analyses.

3.5 AQUIFER TESTING

3.5.1 Purpose

The purpose of aquifer testing is to determine the hydraulic characteristics of the aquifer in the area immediately surrounding a well. Water level and drawdown data generated during an aquifer test can be used to calculate the hydraulic conductivity, transmissivity and the storage coefficient of an aquifer. These parameters can be used in evaluating aquifer characteristics, plume delineation, and the potential for contaminant migration.

3.5.2 *Procedures*

A single borehole hydraulic conductivity test, known as the slug test, will be completed in 15 ground water monitoring wells that do not contain product. The 15 wells will be selected to ensure that representative hydraulic conductivity measurements are collected.

Prior to initiation of the test, the static water level will be measured and recorded using an electronic water level indicator. Then, a properly decontaminated slug will be instantaneously introduced into the monitoring well. Water level measurements will be measured and stored at frequent time intervals using an electronic programmable data logger equipped with a pressure-sensitive water level probe. After the water level in the well has equilibrated, the test will be repeated by instantaneously removing the slug and observing the rate of recharge to the screened interval. In this way, "slug in" and "slug out" tests will be performed on all fifteen monitoring wells. Data reduction for the slug test will follow the methods set forth by Bouwer and Rice (1976).

3.6 *DECONTAMINATION PROCEDURES*

3.6.1 *Heavy Equipment*

All drilling equipment will be cleaned with a high pressure steam cleaner prior to being brought on-site and after the completion of drilling at each boring location. Decontamination rinseate will be discharged to the site surface.

3.6.2 *Sampling Equipment*

All sampling equipment, including spilt-spoon samplers, sampling trowels and mixing bowls, will be decontaminated using the following procedures: soap and water wash using either Alconox or Liquinox, steam cleaning, tap water rinse and wrap in aluminum foil until use. NYSDEC has approved this decontamination procedure at other sites. By leaving out solvent and acid rinses, Metro-North and ERM are attempting to avoid sample contamination by decontamination solvents and to minimize waste management problems. However, if grossly contaminated zones, such as product zones, are encountered, more aggressive decontamination procedures may be warranted. Any solvent or acid-free waste fluids generated during decontamination may be discharged to the ground surface. Otherwise, decontamination fluids must be drummed and stored along with the drill cuttings.

4.0 FIELD INVESTIGATION REPORT

4.1 PURPOSE

The objective of this task is to organize and evaluate all of the hydrogeological, geological and chemical data collected during the field investigation. The data will be reviewed to ensure that no data gaps exist and to identify preliminary remedial alternatives for soil, ground water and NAPL at the yard.

4.2 PROCEDURES

Upon completion of the field investigation activities, all analytical data shall be reviewed, analyzed and summarized. The analytical data will be audited by an experienced data validator to determine whether or not the data are consistent and whether or not there are either noticeable trends or grossly divergent results. The data will be tabulated by sampling media and by area for ease of review. If sufficient data is available, soil and/or ground water data may be plotted on maps and contoured to evaluate the distribution of compounds at the yard.

The soil boring logs and hydrogeological data will all be collected, reviewed, analyzed and summarized for presentation in the Field Investigation Report. Geological cross-sections will be constructed from the boring logs obtained during the NAPL Characterization task and final NAPL plume maps will be constructed from the NAPL measurements collected during this task. Ground water flow maps shall be constructed from different sets of ground water elevation data. Site specific ground water flow directions will also be compared with regional ground water flow information for verification. "As-built" construction diagrams will be completed for all of the on-site ground water monitoring wells.

The final section of the report will present preliminary remedial alternatives along with specific bench scale or pilot tests that may be needed prior to the final selection of remedial alternatives.

5.0 BENCH SCALE/PILOT TESTS

5.1 Purpose

The purpose of this task is to conduct the necessary tests to support evaluation of different engineering alternatives for remediation at the yard.

5.2 Procedures

Any bench scale or pilot tests that may be required at the yard will be identified in the Field Investigation Report. These tests may include aquifer pump tests, and/or bench scale or pilot scale tests for remedial technologies such as bioventing, bioremediation, or sparging. Short work plans will be prepared prior to the implementation of the bench scale/pilot tests for review by Metro-North. The work plans will contain a brief description of the following: the objectives of the test, the manner in which the test will be conducted, and the way in which the results will be evaluated. Upon completion of the tests, the data will be reviewed and used to screen the various technologies. The results of the testing will be incorporated into the Cleanup Plan.

6.0 CLEANUP PLAN

6.1 Purpose

The purpose of the cleanup plan is to present a proposed remedy(ies) for the yard, along with associated costs, and describe the manner and schedule in which the remedy(ies) will be implemented. This description will be of sufficient detail to permit progression to a remedial design.

6.2 Procedures

A Cleanup Plan will be prepared which presents the results of the bench and pilot scale studies and a description of the proposed remedy for the yard. The Cleanup Plan will contain an evaluation of remedial technologies which may be used to address the presence of NAPL and any soil and/or ground water impacted by NAPL at the yard. The Cleanup Plan will be developed in accordance with the guidelines presented in the NYSDEC Spill Technology and Remediation Series (STARS) Memo #1 Petroleum-Contaminated Soil Guidance Policy. Remedial action goals for soil, NAPL and ground water will be developed and will be used to define appropriate cleanup goals for soil and ground water. Section IV and Appendix B of the STARS Memo will be used as guidance in developing these cleanup levels. Although not applicable to the evaluation of remedial approaches for the yard, the recently published NYSDEC TAGM Determination of Soil Cleanup Objectives and Cleanup Levels will be reviewed for potential use as relevant and appropriate guidance. Cleanup levels will then be used to define the extent, if any, of soil and ground water to be remediated. Qualitative remedial action goals will also be developed for NAPL.

Remediation technologies identified in the Field Investigation Report will be evaluated for use at the yard. The results of the bench and pilot scale tests will be used to evaluate the feasibility of these technologies. In addition, the information presented in Section VII (Management of Excavated Contaminated Soil) and in Section VIII (Management of Non-excavated Soil) of the STARS Memo will be used as guidance in evaluating potential remedial approaches.

The results of this work will be contained in the Cleanup Plan. Because of the nature of the potential problems expected to be identified during the field investigation (i.e., petroleum hydrocarbons and related chemicals), the type of remedy evaluation conducted for inactive hazardous waste sites will not be applicable. This approach is consistent with the remedy evaluation process outlined in the NYSDEC STARS Memo which pertains to petroleum contaminated soil. This approach is also consistent with the remedy evaluation approach defined as Category 2 in the NYSDEC Draft Cleanup Policy and Guidelines (Volume I; October 1991). This document applies to all NYSDEC programs involved in the selection of cleanup levels and cleanup activities.

The Cleanup Plan will define the remedial technologies, implementation issues and regulatory requirements associated with the remedy selected for the yard. The Cleanup Plan will also present a schedule for the design and construction phases of the project. In addition, the Cleanup Plan will contain a description of the manner in which the remedial design will be completed, the deliverables that will be submitted to the NYSDEC for review and approval and, once the design is complete, the manner in which the remedy will be implemented. The document will be submitted to Metro-North for review and approval and will subsequently be submitted to NYSDEC for approval. NYSDEC's approval of this document will be required prior to implementation of the design and construction of the selected remedy.

7.0 SCHEDULE

A schedule for the Field Investigation/Remediation Project at the Harmon Railroad Yard is shown in Figure 7-1. The schedule is broken down by tasks which correspond to the tasks outlined in the work plan. The overall schedule is anticipated to be 14 months, exclusive of NYSDEC review time. The actual length of time for some of these tasks is estimated since the exact conditions at the yard are unknown and the field investigative approach is designed to be an iterative process. It is likely that the time frames shown in the schedule are conservative and that some of these tasks can be completed in a shorter time frame than noted.

FIGURE 7-1

ESTIMATED SCHEDULE IN MONTHS FOR FIELD INVESTIGATION/REMEDIATION PROJECT AT HARMON RAIL YARD

TASK	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Update Yard Map	■	■	■	■										
NAPL Delineation and Characterization		■												
Soil Characterization			■											
Ground Water Characterization				■										
Aquifer Testing					■									
Field Investigation Report						■	■	■						
Bench Scale/Pilot Scale Tests									■	■	■			
Cleanup Plan												■	■	■

NOTE: The start date for the Field Investigation/Remediation Project is the date that NYSDEC approves this work plan.

8.0 REFERENCES

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EPA, 1990	*Field Measurements: Dependable Data When You Need It.* Report Number 530/UST-90/003, September 1990.

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Mueser Rutledge Consulting Engineers, 1993	*Geotechnical Data Report - Croton Point Avenue Bridge Replacement*, Croton on-Hudson, New York. March 1, MRCE1993

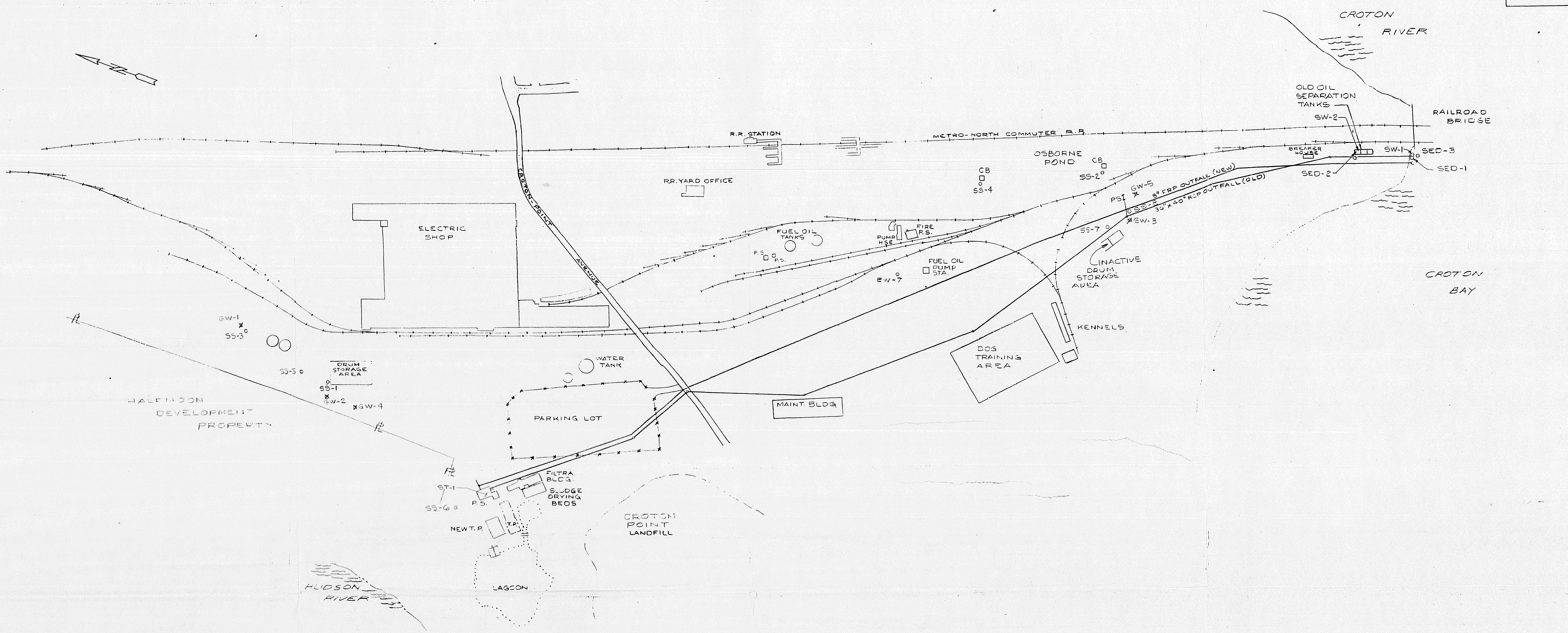
PLATE: 1

CUMULATIVE SAMPLING LOCATIONS
HALF MOON BAY, CROTON-ON-HUDSON, N.Y.
1985-1987

PREPARED BY C A RICH CONSULTANTS, INC.

NOTE:
ENLARGEMENTS OF AREAS SHOWN IN OUTLINE ARE PRESENTED IN SECTION 3.0

TITLE	SITE PLAN	
PREPARED FOR	METRO NORTH COMMUTER RAILROAD	
ERM-Northeast Environmental Resources Management	SCALE 1" = 180'	FIGURE
DRAWN: S.G	JOB#: 680.001	FILE NAME: HARMYARD
	DATE 7/16/93	



SAMPLING LOCATIONS LEGEND:

EW	EXISTING MONITORING WELL
GW	GROUND WATER MONITORING WELL
SED	SEDIMENT SAMPLE
SS	SURFACE SOIL SAMPLE
ST	TP INFLUENT
SW	SURFACE WATER SAMPLE

0 150 300 450
SCALE - FEET

NO.	ZONE	REVISIONS	DATE	BY	APP'D

DESIGNED ______ DATE ______
DRAWN PRT DATE 5/89
CHECKED ______ DATE ______
APPROVED ______ DATE ______
______ DATE ______

Lawler, Matusky & Skelly Engineers
Environmental Science & Engineering Consultants
One Blue Hill Plaza
Pearl River, New York 10965

HARMON RAILROAD YARD–
METRO NORTH RAILROAD
NYSDEC I.D. No. 360019
1988 NYSDEC
PHASE II INVESTIGATION

SAMPLING LOCATIONS

SCALE: AS SHOWN

DATE: JUNE 1989

DWG. NO.: PLATE 2

Appendix A

Quality Assurance Project Plan

QUALITY ASSURANCE PROJECT PLAN FOR THE FIELD INVESTIGATION/ REMEDIATION PROJECT HARMON RAILROAD YARD CROTON-ON-HUDSON, NEW YORK

3 September 1993

Prepared for:

Metro-North Commuter Railroad
347 Madison Avenue
New York, NY 10017

ERM-Northeast
475 Park Avenue South
New York, NY 10016

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

LIST OF FIGURES

LIST OF TABLES

1.0 *QUALITY ASSURANCE PROJECT PLAN*

1.1 *INTRODUCTION*

This Quality Assurance Project Plan (QAPP) was prepared by ERM-Northeast (ERM) for the Field Investigation/Remediation Project (FI/RP) to be implemented at the Harmon Railroad Yard in Croton-on-Hudson, New York. The Harmon Railroad Yard (hereinafter referred to as the "yard" or the "Site") is a maintenance and repair facility which occupies approximately 100 acres along the eastern shore of the Hudson River. This QAPP was developed based upon data collected during previous investigations, particularly the 1988 Phase II Investigation conducted by Lawler, Matusky & Skelly (LMS), and contains a detailed discussion of the quality assurance protocols to be used by ERM personnel and the laboratory as well as project responsibilities and a project description.

1.2 *PROJECT DESCRIPTION*

The FI/RP field activities are described in detail in Section 3.0 of the FI/RP Work Plan and only a brief overview of the activities is presented here.

The field investigative activities will focus on the characterization of soil and ground water at known/suspected NAPL areas and the delineation of the extent of any NAPL plumes.

The primary objectives of the field investigation are to: 1) delineate the extent of NAPLs at each individual area of known or suspected NAPL and to collect lithological data for each of the areas; 2) characterize the chemical quality of the soil within and outside of the area of the NAPL plume; and 3) characterize the chemical quality of ground water within and outside of the NAPL plume and delineate ground water flow paths at the yard. These activities will allow for the identification of preliminary remedial alternatives for soil, ground water and NAPL at the yard.

The field investigation will consist of four tasks:

- Task 1 - Update Yard Map
- Task 2 - NAPL Delineation and Characterization
- Task 3 - Soil Characterization
- Task 4 - Ground Water Characterization
- Task 5 - Aquifer Testing

The purpose of Task 1 is to update the 1985 yard map. This map will assist in referencing proposed sample locations to current surface features and will aid in identification of potential source areas and migration pathways. The purpose of Task 2 is to delineate the extent of non-aqueous phase liquids (NAPLs) at each individual area of known or suspected NAPL and collect detailed lithological data for each of the areas. The purpose of Task 3 is to characterize the chemical quality of the soil within and outside of the area of the NAPL plume and to determine whether soil remediation is necessary. The purpose of Task 4 is to characterize the chemical quality of ground water within and outside of the NAPL plume and to delineate ground water flow paths at the yard.

Detailed sampling methods are discussed in the FI/RP Work Plan. The following paragraphs briefly describe the sampling rationale and methods.

<u>*NAPL Delineation and Characterization*</u>

The first step in NAPL delineation will be the installation of two to seven borings/temporary well casings at each of the areas of known/suspected NAPL in the locations noted in Figures 3-1 through 3-5. At each location, soil samples will be collected and the samples will be logged for lithology, water content, OVA or HNu measurements and visual identification of

NAPL. Select soil samples may also be analyzed in the field for total petroleum hydrocarbons (TPH). After sampling, temporary polyvinyl chloride (PVC) well casings will be installed in the boring to straddle the water table. After several hours of equilibration, water level and NAPL thickness measurements will be collected. A representative NAPL sample, if present, will then be collected and analyzed to determine pertinent signature characteristics, type of petroleum hydrocarbon, chemical composition and physical properties. After any NAPL is measured and/or sampled, the temporary well casings will be removed and the borehole backfilled with drill cuttings. This iterative process of temporary well installation will be continued in each area until the extent of the NAPL plume is defined in all directions.

Soil Characterization

A sufficient number of soil borings will be installed and sampled to characterize each known/suspected NAPL area. These samples will be submitted to a laboratory for analysis of Target Compound List/Target Analyte List (TCL/TAL) compounds pursuant to New York State Department of Environmental Conservation (NYSDEC) Analytical Services Protocol (ASP). The analyte list for select soil samples may be reduced based on the prior characterization of NAPL from the area. The laboratory reports will contain results of field duplicates, matrix spike (MS) and matrix spike duplicates (MSD) for the organic fraction, and laboratory duplicates and spike sample recoveries for the inorganic fraction. The soil samples will also be analyzed for total organic carbon (TOC), grain size and parameters aimed at evaluating bioremediation options.

Ground Water Characterization

A monitoring well network consisting of at least four permanent four-inch diameter PVC wells will be installed at each NAPL area. After the wells are developed, several rounds of water level and NAPL thickness measurements will be collected. Additionally, one complete round of ground water samples will be collected from wells outside of NAPL plume areas. The ground water samples will be analyzed for TCL/TAL parameters pursuant to NYSDEC ASP protocols. The laboratory reports will contain results of field duplicates, MS and MSDs for the organic fraction, and laboratory duplicates and spike sample recoveries for the inorganic fraction. The first round of ground water sampling data will be reviewed to determine what analytical parameters/methods are appropriate for the second round of samples.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITY

While all personnel involved in an investigation and in the generation of data are implicitly a part of the overall project and quality assurance program, certain individuals have specifically designated responsibilities. Persons with specific quality assurance roles in the FI/RP are the Project Manager, the Field Team Leader and the Quality Assurance Officer. These roles will be filled by ERM-Northeast employees from the Woodbury and New York offices.

2.1 PROJECT MANAGER

The Project Manager approved by ERM is responsible for the overall direction of the project. The responsibilities of the Project Manager generally include technical review, resolution of technical issues and client and agency interactions. The Project Manager is also responsible for overseeing the field investigation and remediation activities, schedule and budget maintenance, reports to regulatory agencies and review of the project deliverables. The Project Manager will serve as ERM's main contact with Metro-North and NYSDEC and ensure that the field investigation is conducted according to the FI/RP work plan.

2.2 ERM FIELD TEAM LEADER

The Field Team Leader (FTL) is the person appointed by ERM to act in a supervisory capacity over all ERM employees and activities during the investigation. The FTL is responsible for ensuring that ERM quality assurance responsibilities are carried out during the FI/RP field activities. As part of these responsibilities, the FTL will distribute the QAPP to all field team personnel and discuss the plan prior to the start of field activities.

2.3 *QUALITY ASSURANCE OFFICER*

The Quality Assurance Officer (QAO) appointed by ERM will report to the Project Manager and will be responsible for the implementation of this QAPP. The QAO will also be responsible for maintaining quality control on all aspects of the project from sampling to report preparation. The QAO will also oversee the data validator who will be responsible for auditing and validating all analytical data generated during the field investigation.

3.0 *QUALITY ASSURANCE OBJECTIVES*

3.1 *OVERALL PROJECT OBJECTIVES*

Data Quality Objectives (DQO) are quantitative and qualitative statements specifying the quality of the environmental data required to support the decision-making process. DQO define the total uncertainty in the data that is acceptable for each specific activity during the project. This uncertainty includes both sampling error and analytical error. Ideally, the prospect of zero uncertainty is the intent; however, the very process by which data is collected in the field and analyzed in the laboratory contribute to the uncertainty of the data. It is the overall objective to keep the total uncertainty to an acceptable level that will not hinder the intended use of the data.

In order to achieve the project DQO, specific data quality requirements such as detection limits, criteria for accuracy and precision, sample representativeness, data comparability and data completeness must be specified. The overall objectives and requirements are established such that there is a high degree of confidence in the measurements. The data collected during the course of the FI/RP at the Harmon Yard site will be used to determine the presence and concentration of certain compounds and elements in the soils and ground water at specific locations described in the FI/RP Work Plan. Specific analyses and analytical methodologies for the soil and ground water samples are as follows:

1. Target Compound List (TCL) organics including volatile, semi-volatile, pesticide and PCB compounds using the 1991 NYSDEC ASP methodologies. The data packages will conform to the ASP Superfund deliverables requirements.

2. Target Analyte List (TAL) metals using the 1991 NYSDEC ASP methodologies with Superfund deliverables.

3. Total Petroleum Hydrocarbons (TPH) in the field using the Hanby test kit.

4. Total Organic Carbon (TOC) using U.S. Environmental Protection Agency (EPA) Method 9060.

5. Grain Size Analysis via dry sieve according to ASTM D422 (Standard Method for Particle-Size Analysis of Soils).

Samples of soil and ground water will be collected and analyzed for the constituents listed above according to the laboratory protocols noted. Sampling and analysis will qualitatively determine the presence or absence of these constituents at sampled locations and will quantitatively determine the concentration of these constituents at areas of detection.

The parameters that will be used to specify data quality requirements and to evaluate the analytical system performance for soil samples are precision, accuracy, representativeness, completeness and comparability (PARCC). Table 3-1 presents definitions for these parameters.

3.2 *FIELD INVESTIGATION QUALITY OBJECTIVES*

The objective of the soil and ground water sampling program is to maximize the confidence in the data in terms of PARCC.

In terms of precision and accuracy for the soil and ground water samples, Section 7.0 of the QAPP presents the frequency with which field duplicates, travel blanks, and field blanks will be collected such that a specific degree

Table 3-1 Definitions of Data Quality Parameters

- Precision - a measure of the reproducibility of measurements under a given set of conditions.

- Accuracy - a measure of the bias that exists in a measurement system.

- Representativeness - the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition.

- Completeness - a measure of the amount of the valid data obtained from the measurement system compared to the amount that was expected to be obtained under anticipated normal conditions.

- Comparability - a measure of confidence with which one data set can be compared with another.

of precision and accuracy can be calculated. The data quality objective for soil sample duplicates is to achieve precision equal to or greater than the laboratory duplicate precision requirements established in the New York State's 1991 Analytical Services Protocol (ASP) Statement of Work (SOW).

Precision will be calculated as relative percent difference (RPD) if there are only two analytical points and percent relative standard deviation (%RSD) if there are more than two analytical points. Accuracy can best be assessed by the analysis of samples spiked with a known concentration of the analytes of interest. Accuracy can be calculated as the percent recovery (%R) of the analyte.

The submission of blanks will provide a means to monitor contaminants introduced during sampling, preservation, handling, shipping and analysis. The data quality objective for equipment rinsate blanks for soil and water samples is to meet or exceed the Contract Required Quantitation Limits (CRQLs) and/or the Contract Required Detection Limits (CRDLs) stated in Section 5.0 of this QAPP. In the event that the blanks are contaminated and/or poor precision is obtained, the associated data will be qualified as described in Section 9.4. Through the submission of field QC samples, the distinction can be made between laboratory problems, sampling technique considerations, and sample matrix variability.

To assure soil and ground water sample representativeness, all sample collection will be performed in strict accordance with the EPA-recommended procedures for sample collection. Sample preservation and holding times will conform to the NYSDEC 1991 ASP.

The data quality objective for the completeness of soil and ground water data to be collected during the field investigation is 100%. In other words, the objective is to collect samples from all of the locations noted in the FI/RP Work Plan. In the event 100% is not obtained, due to inaccessibility of sampling points or other field conditions, the effect that the missing data will have on the project objectives will be evaluated by the Project Manager. If necessary, corrective action will be initiated to resolve any data gaps that develop as a result of less than 100% data completeness.

Every effort will be made to obtain valid data for all soil and ground water sampling points, particularly those classified as critical points. In this regard, the sampling points identified as critical will be selected for QC sampling (duplicate sample collection) at the frequency specified in Section 7.0.

In order to establish a degree of comparability for both soil and ground water samples such that observations and conclusions can be directly compared with all historical or future data, ERM will use standardized methods of field analysis, sample collection, holding times and preservation. In addition, field conditions will be documented and considered when evaluating data to determine the effects of sample characteristics on analytical results. Whenever possible, the same sampling team will obtain all samples on consecutive days to reduce inconsistencies which may be caused by technique and time variables.

3.3 *LABORATORY DATA QUALITY OBJECTIVES*

The laboratory selected for the project, Energy and Environmental Engineering, Inc. (E3I) of East Cambridge, Massachusetts, will demonstrate analytical precision and accuracy by the analysis of laboratory duplicates and matrix spike duplicates. Precision, as well as instrument stability, will also be demonstrated by comparison of response factors for calibration standards. Laboratory accuracy will be evaluated by the addition of surrogate and matrix spikes compounds, and will be presented as percent recovery. Precision will be presented as relative percent difference (RPD), percent relative standard deviation (%RSD), or percent difference (%D), whichever is appropriate for the number of QC samples analyzed. Laboratory blanks can also be used to demonstrate the accuracy of the analyses. The frequency of laboratory duplicates, matrix spikes and laboratory blanks is specified in Section 7.0.

3.4 CRITERIA OBJECTIVES

The quantitative criteria that ERM has established for both field and laboratory accuracy and precision are summarized in Table 3-2.

E3I will be expected to report the CRQLs and CRDLs for all soil and ground water samples in the appropriate statistical reporting units for all analyses as stated in the 1991 NYSDEC ASP. However, it should be noted that actual quantitation and detection limits are sample specific and depend upon variables such as dilution factors, percent moisture, sample matrices and the specific analyte. The handling of data reported at or near the CRQL or the CRDL will be done cautiously since the stated data quality objectives for accuracy and precision may not "translate" well in some situations.

3.5 DATA MANAGEMENT OBJECTIVES

One of ERM's data management objectives is that all aspects of the investigation from sample design, collection, shipment, analysis, use/decisions, etc., be performed in conjunction with rigorous QA/QC documentation. The specific details of this documentation can be found throughout this QAPP and the associated FI/RP Work Plan.

ERM's sampling and analysis program is designed with separate data quality requirements for field sampling and laboratory analysis; thus the cause of any problems found in the system will be isolated and evaluated.

Table 3-2 Criteria Objectives

	Aqueous	Solid/Other
Precision Objectives		
Field Duplicate/Replicates (Blind or labeled)	Within 20% RPD	Within 30% RPD
Laboratory Duplicate	As specified in 1991 ASP	As specified in 1991 ASP
Accuracy Objectives		
Equipment Rinsate, Field, or Trip Blanks	Less than the CRDL or CRQL	Less than the CRDL or CRQL
Laboratory Blanks	As specified in 1991 ASP	As specified in 1991 ASP

Conversely, the data quality requirements are also designed to provide an indication of the variability inherit to the overall system.

Through the use of a phased approach of sampling, analysis, data assessment (data review), data qualification and feedback, the overall data management objective is to provide a complete data base with a high degree of confidence.

4.0 *SAMPLE CUSTODY PROCEDURES*

The primary objective of the sample custody procedures is to create an accurate written record which can be used to trace the possession and handling of all samples from the moment of their collection, through analysis, until their final disposition. Sample custody for samples collected during this investigation will be maintained by the Field Team Leader (FTL) or the field personnel collecting the samples. The FTL or field personnel are responsible for documenting each sample transfer and maintaining custody of all samples until they are shipped to the laboratory.

ERM will place a sufficient volume of sample in the appropriate laboratory-grade bottles for use as sample containers. All necessary chemical preservatives will be added to the bottles prior to the sampling event or immediately upon collection. Custody of the sample bottles will be maintained by the FTL. Sample bottles needed for a specific sampling task will then be relinquished by the FTL to the sampling team after the FTL has verified the integrity of the bottles and that the proper bottles have been assigned for the task.

A self-adhesive sample label will be affixed to each container before sample collection. The sample label will contain the following information:

- Laboratory Name
- Sample ID Number
- Sample Location
- Sample Matrix
- Date and Time of Sample Collection
- Parameters to be Tested for
- Preservative Added and Resulting pH
- Signature of Sampler

Within 24 hours of collection, samples will be placed in an insulated cooler for overnight shipment to the laboratory. ERM field Chain-of Custody records (Figure 4-1) completed at the time of sample collection will accompany the samples inside the cooler for shipment to the laboratory. These record forms will be sealed in a ziplock plastic bag to protect them against moisture. Each cooler will contain sufficient ice packs to insure that a 4°C temperature is maintained, and will be packed in a manner to prevent damage to sample containers. Sample coolers will be sealed with nylon strapping tape and the FTL will sign and date a custody seal and place it on the cooler in such a way that any tampering during shipment will be detected. A sample of the custody seal is shown in Figure 4-2.

All coolers will be shipped by an overnight courier according to current US DOT regulations. Upon receiving the samples, the Sample Custodian at E3I will inspect the condition of the samples, compare the information on the sample labels against the field Chain-of-Custody record, assign a laboratory control number, and log the control number into the computer sample inventory system. The Sample Custodian will then store the sample in a secure sample storage cooler maintained at 4°C and maintain custody until the sample is assigned to an analyst for analysis. Custody will be maintained until disposal of the analyzed samples.

The Sample Custodian at E3I will note any damaged sample vials, void space within the vials, or discrepancies between the sample label and information on the field Chain-of-Custody record when logging the sample. This information will also be communicated to the FTL or field personnel so proper action can be taken. The Chain-of-Custody form will be signed by both the relinquishing and receiving parties and the reason for transfer indicated each time the sample changes hands.

An internal Chain-of-Custody form will be used by E3I to document sample possession from laboratory Sample Custodian to Analysts and final

ERM-Northeast
Environmental Resources Management

Chain Of Custody Record

175 Froehlich Farm Boulevard • Woodbury • New York 11797 ☎ (516) 921-4300

Project No. / I.D. ________________ Sheet No. ________________

Sampler(s) ________________ Bottles Supplied By ________________

Date Sampled ________________ Bottle Batch No. ________________

Sample I.D.	Sample Description	Sample Type	Sampling Method	Time	No. Of Containers	Analysis Requested	Remarks

Relinquished By (Signature)	Received By (Signature)	Date/Time	Reason For Transfer

Copies: White - Sampler; Yellow - Lab

TITLE

CHAIN OF CUSTODY RECORD

PREPARED FOR

Metro-North Commuter Railroad

ERM-Northeast
Environmental Resources Management

SCALE None

DATE

FIGURE 4-1

The ERM Group

OFFICAL
CUSTODY SEAL

Name ______________________

Date ______________________

TITLE

Custody Seal

PREPARED FOR

Metro-North Commuter Railroad

ERM-Northeast
Environmental Resources Management

SCALE	FIGURE
	4-2
DATE 6-6-91	

disposition. All Chain-of-Custody information will be supplied with the data packages for inclusion in the document control file.

5.0 *ANALYTICAL PROCEDURES*

The soil and ground water samples collected during the Harmon Yard FI/RP will be analyzed for the Target Compound List/Target Analyte List (TCL/TAL) compounds pursuant to NYSDEC ASP protocols. The analyte list for select soil samples may be reduced based on the prior characterization of NAPL from the area. Select soil samples will also be analyzed in the field for TPH. The soil samples will also be analyzed for TOC and grain size, and parameters aimed at evaluating possible soil remediation options.

The volatile analysis will be performed in accordance with NYSDEC Method 91-1; semi-volatile analysis will be performed in accordance with NYSDEC Method 91-2 and the metals will be analyzed in accordance with NYSDEC 1991 ASP TAL metal methodologies.

The laboratory reports will contain results of field duplicates, matrix spike (MS) and matrix spike duplicates (MSDs) for the organic fraction and laboratory duplicates and spiked sample recoveries for the inorganic fraction.

A summary of the analytical parameters and the contract required quantitation and detection limits is presented in Tables 5-1 and 5-2. Summaries of the soil and ground water sampling programs, analytical methods, preservatives, holding times and containers are shown in Tables 5-3 and 5-4.

Table 5-1 ***Summary of Organic Analytical Parameters and Contract Required Quantitation Limits***

Volatiles		Quantitation Limits	
		Low Water (ug/l)	Low Soil/Sediments[a] (ug/kg)
1.	Chloromethane	10	10
2.	Bromomethane	10	10
3.	Vinyl Chloride	10	10
4.	Chloroethane	10	10
5.	Methylene Chloride	10	10
6.	Acetone	10	10
7.	Carbon Disulfide	10	10
8.	1,1-Dichloroethene	10	10
9.	1,1-Dichloroethane	10	10
10.	1,2-Dichloroethene (total)	10	10
11.	Chloroform	10	10
12.	1,2-Dichloroethane	10	10
13.	2-Butanone	10	10
14.	1,1,1-Trichloroethane	10	10
15.	Carbon Tetrachloride	10	10
16.	Bromodichloromethane	10	10
17.	1,2-Dichloropropane	10	10
18.	cis-1,3-Dichloropropene	10	10
19.	Trichloroethene	10	10
20.	Dibromochloromethane	10	10
21.	1,1,2-Trichloroethane	10	10
22.	Benzene	10	10
23.	trans-1,3-Dichloropropene	10	10
24.	Bromoform	10	10
25.	4-Methyl-2-pentanone	10	10
26.	2-Hexanone	10	10
27.	Tetrachloroethene	10	10
28.	Toluene	10	10
29.	1,1,2,2-Tetrachloroethane	10	10
30.	Chlorobenzene	10	10
31.	Ethyl Benzene	10	10
32.	Styrene	10	10
33.	Total Xylenes	10	10

Table 5-1 ***Summary of Organic Analytical Parameters and Contract Required Quantitation Limits (Continued)***

Semi-Volatiles		Quantitation Limits	
		Low Water (ug/l)	Low Soil/Sediments[b] (ug/kg)
34.	Phenol	10	330
35.	bis(2-Chloroethyl) ether	10	330
36.	2-Chlorophenol	10	330
37.	1,3-Dichlorobenzene	10	330
38.	1,4-Dichlorobenzene	10	330
39.	1,2-Dichlorobenzene	10	330
40.	2-Methylphenol	10	330
41.	2,2'-oxybis(1-Chloropropane)	10	330
42.	4-Methylphenol	10	330
43.	N-Nitroso-di-n-propylamine	10	330
44.	Hexachloroethane	10	330
45.	Nitrobenzene	10	330
46.	Isophorone	10	330
47.	2-Nitrophenol	10	330
48.	2,4-Dimethylphenol	10	330
49.	bis(2-Chloroethoxy) methane	10	330
50.	2,4-Dichlorophenol	10	330
51.	1,2,4-Trichlorobenzene	10	330
52.	Naphthalene	10	330
53.	4-Chloroaniline	10	330
54.	Hexachlorobutadiene	10	330
55.	4-Chloro-3-methylphenol (para-chloro-meta-cresol)	10	330
56.	2-Methylnaphthalene	10	330
57.	Hexachlorocyclopentadiene	10	330
58.	2,4,6-Trichlorophenol	10	330
59.	2,4,5-Trichlorophenol	25	800
60.	2-Chloronaphthalene	10	330
61.	2-Nitroaniline	25	800
62.	Dimethyl Phthalate	10	330
63.	Acenaphthylene	10	330
64.	2,6-Dinitrotoluene	10	330
65.	3-Nitroaniline	25	800
66.	Acenaphthene	10	330

Table 5-1 ***Summary of Organic Analytical Parameters and Contract Required Quantitation Limits (Continued)***

Semi-Volatiles		Quantitation Limits	
		Low Water (ug/l)	Low Soil/Sediments[b] (ug/kg)
67.	2,4-Dinitrophenol	25	800
68.	4-Nitrophenol	25	800
69.	Dibenzofuran	10	330
70.	2,4-Dinitrotoluene	10	330
71.	Diethylphthalate	10	330
72.	4-Chlorophenyl phenyl ether	10	330
73.	Fluorene	10	330
74.	4-Nitroaniline	25	800
75.	4,6-Dinitro-2-methylphenol	25	800
76.	N-nitrosodiphenylamine	10	330
77.	4-Bromophenyl phenyl ether	10	330
78.	Hexachlorobenzene	10	330
79.	Pentachlorophenol	25	800
80.	Phenanthrene	10	330
81.	Anthracene	10	330
82.	Carbazole	10	330
83.	Di-n-butyl phthalate	10	330
84.	Fluoranthene	10	330
85.	Pyrene	10	330
86.	Butyl benzyl phthalate	10	330
87.	3,3'-Dichlorobenzidine	10	330
88.	Benz(a)anthracene	10	330
89.	Chrysene	10	330
90.	bis(2-Ethylhexyl)phthalate	10	330
91.	Di-n-octyl phthalate	10	330
92.	Benzo(b)fluoranthene	10	330
93.	Benzo(k)fluoranthene	10	330
94.	Benzo(a)pyrene	10	330
95.	Indeno(1,2,3-cd)pyrene	10	330
98.	Dibenz(a,h)anthracene	10	330
97.	Benzo(g,h,i)perylene	10	330

Table 5-1 ***Summary of Organic Analytical Parameters and Contract Required Quantitation Limits (Continued)***

Pesticides/PCBs		Quantitation Limits	
		Low Water (ug/l)	Low Soil/Sediments[c] (ug/kg)
98.	alpha-BHC	0.05	1.7
99.	beta-BHC	0.05	1.7
100.	delta-BHC	0.05	1.7
101.	gamma-BHC (Lindane)	0.05	1.7
102.	Heptachlor	0.05	1.7
103.	Aldrin	0.05	1.7
104.	Heptachlor Epoxide	0.05	1.7
105.	Endosulfan I	0.05	1.7
106.	Dieldrin	0.10	3.3
107.	4,4'-DDE	0.10	3.3
108.	Endrin	0.10	3.3
109.	Endosulfan II	0.10	3.3
110.	4,4'-DDD	0.10	3.3
111.	Endosulfan Sulfate	0.10	3.3
112.	4,4'-DDT	0.10	3.3
113.	Methoxychlor	0.50	17.0
114.	Endrin Ketone	0.10	3.3
115.	Endrin aldehyde	0.10	3.3
116.	alpha Chlordane	0.05	1.7
117.	gamma Chlordane	0.05	1.7
118.	Toxaphene	5.0	170.0
119.	AROCLOR-1016	1.0	33.0
120.	AROCLOR-1221	1.0	67.0
121.	AROCLOR-1232	1.0	33.0
122.	AROCLOR-1242	1.0	33.0
123.	AROCLOR-1248	1.0	33.0
124.	AROCLOR-1254	1.0	33.0
125.	AROCLOR-1260	1.0	33.0

a. Volatile medium soil/sediment CRQLS are 120 times volatile low soil/sediment CRQLS.

b. Semi-volatile medium soil/sediment CRQLS are 15 times semi-volatile low soil/sediment CRQLS.

c. Pesticide medium soil/sediment CRQLS are 15 times low pesticide soil/sediment CRQLS.

Table 5-2 *Summary of Inorganic Analytical Parameters and Contract Required Detection Limits*

Inorganics		Detection Limits
		Low Water and Low Soil/Sediments (ug/l)
1.	Aluminum	200
2.	Antimony	60
3.	Arsenic	10
4.	Barium	200
5.	Beryllium	5
6.	Cadmium	5
7.	Calcium	5000
8.	Chromium	10
9.	Cobalt	50
10.	Copper	25
11.	Iron	100
12.	Lead	3
13.	Magnesium	5000
14.	Manganese	15
15.	Mercury	0.2
16.	Nickel	40
17.	Potassium	5000
18.	Selenium	5
19.	Silver	10
20.	Sodium	5000
21.	Thallium	10
22.	Vanadium	50
23.	Zinc	20
24.	Cyanide	10

ABLE 5-3 SUMMARY OF SOIL SAMPLING PROGRAM, PRESERVATIVES, HOLDING TIMES AND CONTAINERS

Parameter	Number of Samples	Sample Matrix	Analytical Method Reference	Sample Preservation	Holding Times	Containers
TCL Volatile Organics	65	Soil	NYSDEC 91-1	Cool, 4°C	7 days after receipt of sample	2 x 40 ml vials, w/ teflon-lined septum
TCL Semi-Volatile Organics	65	Soil	NYSDEC 91-2	Cool, 4°C	Extraction must start within 5 days and be complete within 7 days of receipt, 40 days after extraction to analyze	1 x 8 oz. glass jar w/ teflon-lined cap
TCL Pesticides/PCBs	65	Soil	NYSDEC 91-3	Cool, 4°C	Extraction must start within 5 days and be complete within 7 days of receipt, 40 days after extraction to analyze	1 x 8 oz. glass jar w/ teflon-lined cap
TAL Metals	65	Soil	NYSDEC 1991 ASP TAL Metals Methodologies	Cool, 4°C	6 months, except mercury - 26 days	1 x 8 oz. glass bottle
Total Organic Carbon	65	Soil	EPA Method 9060	Cool, 4°C	28 days	1 x 8 oz. glass jar w/ teflon-lined cap

TABLE 5-4 SUMMARY OF GROUND WATER SAMPLING PROGRAM, PRESERVATIVES, HOLDING TIMES AND CONTAINERS

Parameter	Number of Samples	Sample Matrix	Analytical Method Reference	Sample Preservation	Holding Times	Containers
TCL Volatile Organics	53	Water	NYSDEC 91-1	Cool, 4°C	7 days after receipt	2 x 40 ml vials, w/ teflon-lined septum
TCL Semi-Volatile Organics	51	Water	NYSDEC 91-2	Cool, 4°C	Extractions must start within 5 days and be complete within 7 days of receipt, 40 days after extraction to analyze	3 x 1000 ml amber glass bottles
TCL Pesticides/PCBs	51	Water	NYSDEC 91-3	Cool, 4°C	Extractions must start within 5 days and be complete within 7 days of receipt, 40 days after extraction to analyze	2 x 1000 ml amber glass bottle w/ teflon-lined cap
TAL Metals	51	Water	NYSDEC 1991 ASP TAL Metal Methodologies	HNO_3 to pH < 2	6 months, except mercury - 26 days	1 x 1000 ml plastic bottle

6.0 DATA REPORTING, VALIDATION, AND REDUCTION

Data validation practices will be followed to insure that raw data are not altered and that an audit trail is developed for those data which require reduction. All the field data, such as those generated during field measurements, observations and field instrument calibrations, will be entered directly into a bound field notebook. Each project team member will be responsible for proofing all data transfers made, and the Field Team Leader will proof at least 10% of all data transfers.

One or more bound books will be maintained for the site; each book will be consecutively numbered. The book(s) will remain with the site evidence file. Copies will be made for the Project Manager and for the person who made the entries if requested.

All entries in the Logbook will be made in ink. Logbook entries will include but not be limited to the following:

First Page:

- Site Name and number
- Date and time started
- Personnel on site

Subsequent Pages:

- Detailed description of investigative activities including drilling, well construction, sampling, on-site meetings and any problems encountered along with the duration of these activities
- Documentation of all personnel monitoring results (e.g. PID readings)

- List of all samples obtained and sample appearance (referenced to field logs if necessary)
- List of personal protection used and documentation procedure
- All other pertinent daily activities

Each new day will contain:

- Date and time started
- Weather
- Personnel on-site (including any non-ERM personnel)
- Activity information
- Initials of notekeeper

*Note: When a mistake is made in the log, it will be crossed out with a single ink line and will be initialed and dated.

Special care will be taken in the description and documentation of sampling procedures. Sampling information to be documented in the field notebook and/or associated forms are as follows:

- Sample #
- Date and Time Sample collected
- Source of Sample (well, stream, domestic well, borehole, etc.)
- Purged Well - type of equipment, purge volume, rate of purge, and decontamination procedures
- Location of Sample - document with a site sketch and/or written description of the sampling location so that accurate resampling can be conducted if necessary
- Sampling equipment (bailer, trowel, split spoon, thief, etc.)
- Analysis and QA/QC required
- Chemical preservation used (HNO_3, H_2SO_4, NaOH, etc.)

- Field instrument calibration including date of calibration, standards used and their source, results of calibration and any corrective actions taken.
- Field data (pH, temperature, conductivity, etc.)
- Field observations - all significant observations will be documented
- Sample condition (color, odor, turbidity, oil, sheen, etc.)
- Site condition (stressed vegetation, exposure of buried wastes, erosion problems, etc.)
- Sample shipping procedure, date, time, destination and if legal seals were attached to transport container(s)
- Comments - Any observation or event that occurred that would be relevant to the site; for example: weather changes and effect on sampling, conversations with the client, public official or private citizen; and instrument calibration, equipment problems, and field changes.

Upon receipt of the sample data packages, the laboratory data will be quantitatively and qualitatively validated by ERM's Data Validator. The laboratory will supply all required data deliverables to enable ERM to validate the data. Data validation is discussed in detail in Section 9.4.

ERM's data reduction for this investigation will consist primarily of tabulating analytical results from Form I of the analytical reports on summary tables. Data will be reduced and flagged with the appropriate data qualifiers based on the QA/QC data validation review. Data will be designated as quantitative, semi-quantitative, qualitative or invalid. Accompanying documentation will give the rationale for each designation. All reduced data will be placed in the central file maintained by the Project Manager.

7.0 *INTERNAL QUALITY CONTROL CHECKS*

7.1 *LABORATORY INTERNAL QUALITY CONTROL CHECKS*

The Internal Quality Control Checks used by E3I are provided in their Quality Assurance Plan (QAP) which is contained in Attachment A to this QAPP. The checks conducted by the laboratory will be a continuation of ERM's Field Internal Quality Control Checks presented below.

7.2 *FIELD INTERNAL QUALITY CONTROL CHECKS*

Field Internal Quality Control Checks will be utilized during this investigation through the use of the following:

- Trip Blanks - These blanks of distilled, deionized water will be prepared by the laboratory and will be shipped to the Site in the sample-pack coolers. These blanks will accompany the sample bottles during the sampling process and will be returned to the laboratory with the sample shipment. They will serve as a QC check on container cleanliness, external contamination and the analytical method. One trip blank will be submitted to the laboratory for every day of ground water sampling.

- Equipment Rinsate Blank - Equipment rinsate blanks will be collected during soil and ground water sampling to ensure that the sampling equipment is clean and that the potential for cross-contamination has been minimized by the equipment decontamination procedures. These blanks will be prepared by decontaminating the sampling device and then pouring distilled, deionized water over the device. The distilled deionized water will be supplied by the laboratory. The rinsate water will be collected in the appropriate sample containers. One equipment rinsate blank will be collected for each day of sampling. The equipment rinsate blank will be analyzed for the same parameters as the samples.

- Field Duplicates - One of every twenty soil and ground water samples collected in the field will be accompanied by a duplicate sample. Soil samples for volatile organics will be collected first, as grab samples from the same location and depth interval. The primary and duplicate samples for all remaining parameters will then be collected from one homogenized grab sample and placed in the appropriate bottles. The duplicate ground water samples will be prepared by alternately filling each sample bottle with water until all of the bottles are filled. The duplicate samples will be assigned a fictitious sample number which will be recorded in the field notebook and submitted blind to the laboratory. Analysis of duplicate samples will determine the precision of the field sampling techniques.

- Laboratory Samples for Quality Control (spike and duplicates) - One sample out of each soil and water Sample Delivery Group (SDG) will be designated as the laboratory spike and duplicate sample. All laboratory samples will be labeled with the sample number and a notation will be made on the chain-of-custody form which sample is also to be used for laboratory quality control. The purpose of these samples is to evaluate the effect of possible matrix interferences on the sample results.

8.0 PREVENTIVE MAINTENANCE

8.1 LABORATORY MAINTENANCE

A copy of E3I's QAP is included in Attachment A to this QAPP and it contains a description of their standard operating procedures for maintenance, including specific routine and preventive procedures, and maintenance logs for the gas chromatograph/mass spectrometer.

8.2 FIELD MAINTENANCE

Field equipment will be maintained through the use of a tracking system. Each piece of equipment will carry a tag which identifies the date of the most recent maintenance, and/or battery charge, and the condition. When equipment is damaged or in need of repair it will be immediately and appropriately flagged for the required maintenance to be performed. This process ensures that only operable and maintained equipment enters the field. Routine daily maintenance procedures conducted in the field will include:

- Removal of surface dirt and debris from exposed surfaces of the sampling equipment and measurement systems.
- Protection of equipment from adverse weather conditions.
- Daily inspections of sampling equipment and measurement systems for possible problems such as cracked or clogged lines or tubing or weak batteries.
- Daily checks of instrument calibration as described in Attachment B to this QAPP.
- Charge battery packs for equipment that is not in use.

Spare and replacement parts that are required to be stored in the field to minimize downtime include:

- Appropriately sized batteries.
- Locks.
- Extra sample containers and preservatives.
- Extra sample coolers, packing material, and sample location stakes.
- Additional supply of health and safety equipment (e.g., respirator cartridges, boots, gloves, tyvek, etc.).
- Additional equipment as necessary for the field tasks.

9.0 *SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY AND COMPLETENESS*

9.1 *OVERALL PROJECT ASSESSMENT*

Overall data quality will be maintained by careful adherence to the data quality objectives. By maintaining thorough documentation of all decisions made during each phase of sampling, performing field and laboratory audits, thoroughly reviewing and validating the analytical data as it is generated by the laboratory, and providing appropriate feedback as problems arise in the field or at the laboratory, ERM will closely monitor data accuracy, precision and completeness.

9.2 *FIELD QUALITY ASSESSMENT*

To ensure that all field data are collected accurately and correctly, specific written instructions will be issued to all personnel involved in field data acquisition by the Project Manager. The Quality Assurance Officer will also perform a field audit during an initial round of sampling to document that the appropriate procedures are being followed with respect to sample and blank collection. These audits will include a thorough review of the field books used by the project personnel to ensure that all tasks were performed as specified in the instructions. The field audits will necessarily enable the data quality to be assessed with regard to the field operations.

The evaluation of field blanks, and other field QC samples will provide definitive indications of the data quality. If a problem arises, corrective actions can be instituted for future field efforts.

9.3 *LABORATORY DATA QUALITY ASSESSMENT*

The specific measures to be taken by E3I to assess data quality are described in the their Quality Assurance Plan (Attachment A).

9.4 *ERM DATA VALIDATION*

All analytical data generated during the investigation will undergo a rigorous data review by the ERM Data Validator. A preliminary review will be performed to verify that all necessary paperwork, such as chain-of-custodies, traffic reports, analytical reports, laboratory personnel signatures and deliverables (as stated in the 1991 ASP), are present. A detailed quality assurance review will be then performed by the ERM Data Validator to verify the qualitative and quantitative reliability of the data as it is presented. This review will include a detailed evaluation and interpretation of all data generated by the laboratory. The primary tools which will be used by the experienced data review chemist will be guidance documents, established (contractual) criteria, and professional judgement.

Based upon the review of the soil and ground water sampling data, a data quality assurance report will be prepared which will describe the qualitative and quantitative reliability of the analytical data. The report will consist of an introduction section followed by a section which describes the analytical results and any qualifications that should be taken into account when using the data. A support documentation package will be prepared which will provide the backup information for all qualifying statements presented in the quality assurance report. Based upon the quality assurance review, qualifier codes will be placed next to specific sample results on the sample data summary table. These qualifier codes will serve as an indication of the qualitative and quantitative reliability of the data.

Once the review has been completed, the Data Validator will submit the findings to the Quality Assurance Officer and the Project Manager. The approved data tables and quality assurance reports will be signed and dated by the Data Validator. Upon completion of the review, a copy of the signed tables and reports will be submitted to NYSDEC.

9.5 DATA MANAGEMENT QUALITY ASSESSMENT

As the analytical data are validated and qualified, the quality of the data can be assessed by direct comparison to analytical results obtained from previous sampling. Information that can be obtained includes comparison of results obtained from samples taken at the same location, and the identification of missing data points. By examination of the data at the "back-end" of the process, the data quality can be assessed with respect to representativeness, precision, compatibility and completeness.

10.0 *CORRECTIVE ACTION*

10.1 *LABORATORY CORRECTIVE ACTION*

The Corrective Action Program to be followed by E3I is outlined in their QAP (Attachment A). The laboratory will provide documentation as to what, if any, corrective actions were initiated during this project and report them to ERM's Quality Assurance Officer.

10.2 *ERM's CORRECTIVE ACTION*

Field quality assurance activities will be reported to ERM's Project Manager. Problems encountered during the study that may affect quality assurance will be reported on the Corrective Action form shown in Figure 10-1. The Field Team Leader will be responsible for initiating the corrective actions and for insuring that the actions are taken in a timely manner, and that the desired results are produced. The Field Team leader will report to the Quality Assurance Officer and the Project Manager on all necessary corrective actions taken, the outcome of these actions, and their affect on data produced. All corrective action taken will be reported to the respondents.

Figure 10-1 ERM's CORRECTIVE ACTION FORM

Date: ______________

Job Name: ____________

Initiator's Name and Title: ____________________

Problem Description: ______________________________________

____

____

____

____

Reported To: ____

Corrective Action: ____

____

____

____

____

____

____

Reviewed and Implemented By: ____________________

cc: Field Investigation manager - ______________
QA Manager - ______________________
Project Manager - ____________________

Appendix B

Health and Safety Plan

HEALTH AND SAFETY PLAN FOR THE FIELD INVESTIGATION/ REMEDIATION PROJECT HARMON RAILROAD YARD CROTON-ON-HUDSON, NEW YORK

3 September 1993

Prepared for:

Metro-North Commuter Railroad
347 Madison Avenue
New York, NY 10017

ERM-Northeast
475 Park Avenue South
New York, NY 10016

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION

This Health and Safety Plan (HASP) was developed by ERM-Northeast (ERM) for the Field Investigation/Remediation Project (FI/RP) to be implemented at the Harmon Railroad Yard in Croton-on-Hudson, New York. The Harmon Railroad Yard (hereinafter referred to as the "yard" or the "Site") is a maintenance and repair facility which occupies approximately 100 acres along the eastern shore of the Hudson River. This plan was developed based upon data collected during previous investigations, particularly the 1988 Phase II Investigation conducted by Lawler, Matusky & Skelly (LMS), and describes the recommended health and safety procedures for the field personnel on-Site during the field investigation activities.

The field investigation will consist of four tasks:

- Task 1 - Update Yard Map
- Task 2 - NAPL Delineation and Characterization
- Task 3 - Soil Characterization
- Task 4 - NAPL and Ground Water Characterization
- Task 5 - Aquifer Testing

The purpose of Task 1 is to update the 1985 yard map. This map will assist in referencing proposed sample locations to current surface features and will aid in identification of likely source areas and potential migration pathways. The purpose of Task 2 is to delineate the extent of non-aqueous phase liquids (NAPLs) at each individual area of known or suspected NAPL and collect detailed lithological data for each of the areas. The purpose of Task 3 is to characterize the chemical quality of the soil within and outside of the area of the NAPL plume and to determine whether soil remediation is necessary. The purpose of Task 4 is to characterize the chemical quality of ground water within and outside of the NAPL plume and to delineate ground water flow paths at the yard.

The procedures set forth in this Health and Safety plan are designed to reduce the risk of exposure to chemical substances and physical or other hazards which may be present in the soil, water and air associated with the investigation at the Site. The procedures described herein were developed in accordance with the provisions of the Occupational Safety and Health Administration (OSHA) rule 29 CFR 1910.120 and in accordance with ERM's experience in similar field investigations. ERM shall be responsible solely for the compliance of ERM employees with the provisions of this Health and Safety Plan unless otherwise specified and agreed to in writing by a Principal of ERM.

The recommended health and safety guidelines suggested within this document may be modified as further information is made available through sample analyses, on-Site characterization, and exposure monitoring performed during intrusive activities. The intrusive activities to be performed during the investigation include drilling and sampling of soil borings and the installation and sampling of ground water monitoring wells.

1.2 SITE BACKGROUND

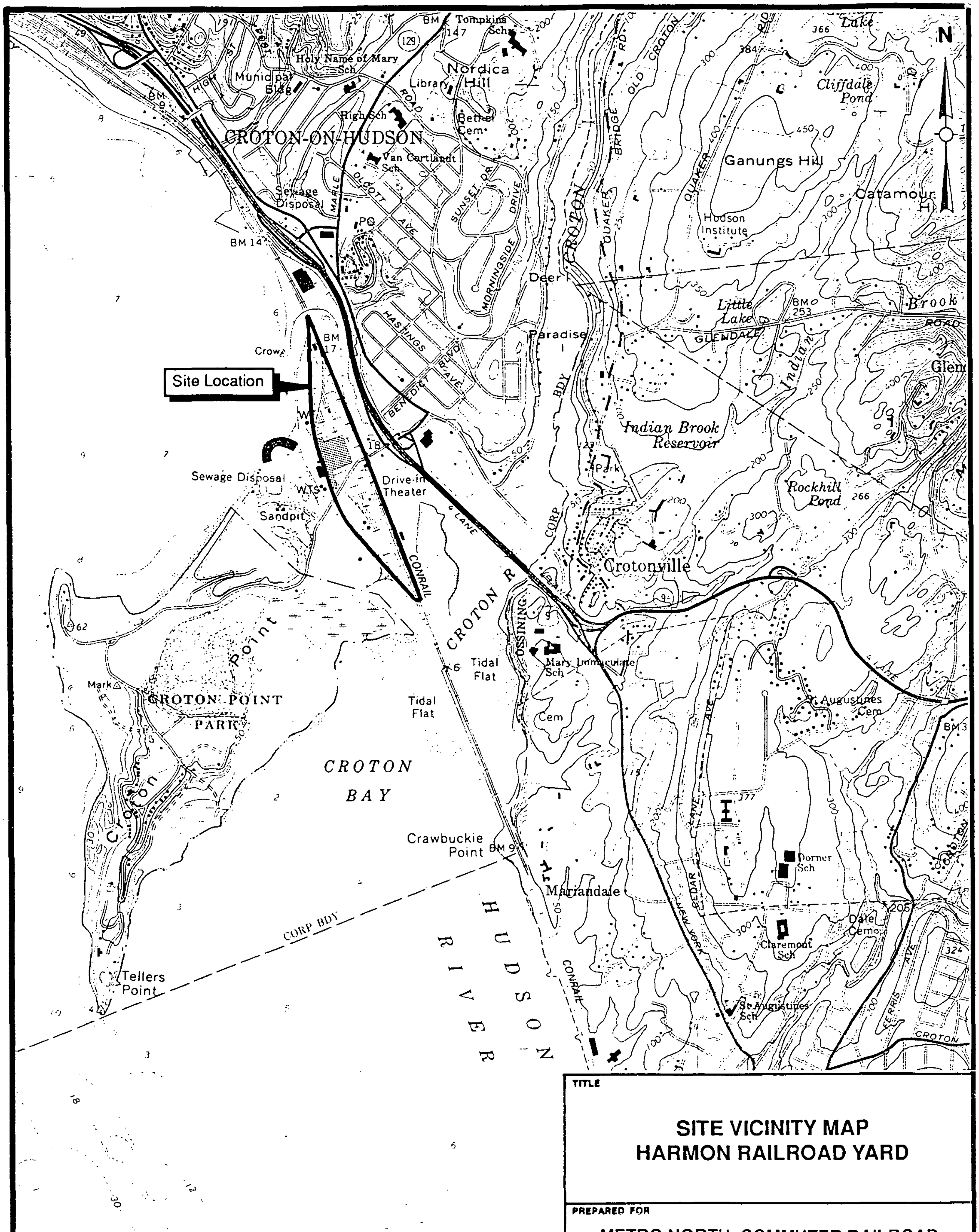
A detailed description of the history of this project is provided in Section 1.2 of the FI/RP Work Plan and only a brief summary of the Site history will be presented here.

The Harmon Railroad Yard is a railroad maintenance and repair yard located in Croton-on-Hudson, Westchester County, New York. The Harmon Railroad Yard has been operated by Metro-North Commuter Railroad Company (MNCR) since 1983. The yard consists of approximately 100 acres of land located east of Haverstraw Bay and west of Croton Bay, as shown on Figure 1-1.

The Harmon Railroad Yard was first placed on the New York State Department of Environmental Conservation's (NYSDEC) state registry of Inactive Hazardous Waste Disposal Sites in 1985. The Site was classified at the time as a category 2a site because insufficient data were available to fully characterize the Site. In 1988, NYSDEC divided the Site into two portions, the wastewater treatment portion which included a 1.3-acre lagoon and pond, and the remainder of the yard. The lagoon has been the subject of investigations independent of the remainder of the yard and will not be addressed in this HASP.

The remainder of the yard was grouped into another site and because of the lack of information about the yard, this site retained its classification as a 2A. In 1988, LMS was subcontracted by NYSDEC to perform a Phase II investigation and prepare a Hazard Ranking System (HRS) score for the yard. LMS released their report in 1989 and based upon the data collected during the Phase II investigation, the site received an HRS score of 28.51. As a result of the HRS score, which indicated that the site did not pose a significant threat to human health, and the fact that the environmental conditions at the site were related to the handling of petroleum products, the yard was removed from the Inactive Hazardous Waste Disposal Site registry in 1992. The site is now being managed by the Bureau of Spill Prevention and Response at NYSDEC.

A number of investigations have previously been conducted at the Harmon Railroad Yard. These investigations are discussed in detail in Section 2.0 of the FI/RP Work Plan. The investigation most pertinent to this FI/RP was conducted by LMS in 1988 and 1989. Under the direction of the NYSDEC, LMS conducted a Phase II investigation to determine the nature and extent of any contaminants that may have been emanating from the



SOURCE: U.S.G.S. Quadrangle Maps, Haverstraw and Ossining, NY

SCALE: 1"= 2000'

TITLE

SITE VICINITY MAP
HARMON RAILROAD YARD

PREPARED FOR

METRO NORTH COMMUTER RAILROAD

ERM–Northeast
Environmental Resources Management
ERM

SCALE	FIGURE
Noted	1-1
DATE June 93	

67114

Site. The investigation focused primarily on the active drum storage area and Osborne Pond and consisted of sampling and analysis of surface and subsurface soil, surface water and sediment, and ground water.

During the Phase II investigation, surface soil samples (zero to two-foot interval) were found to contain detectable concentrations of four volatile organic compounds (VOCs; benzene, toluene, ethylbenzene, and total xylenes) and several semivolatile organic compounds (SVOCs), including polynuclear aromatic hydrocarbons (PAHs), PAEs, dibenzofuran and napthalene-like compounds. Polychlorinated biphenyl compounds (PCBs) were detected in only one surface soil sample; three pesticides were detected in several samples. None of the metals detected exceeded the EP Toxicity allowable concentrations. Data from the deeper subsurface soil samples were discounted by LMS due to quality assurance/quality control problems.

The ground water sampling data indicated that five VOCs (benzene, total xylenes, trichloroethene, tetrachloroethene, and 4-methyl-2-pentanone), eight SVOCs (PAHs and dibenzofuran), one pesticide and no PCBs were detected in the ground water. In the six monitoring wells sampled, at least two metals were detected at concentrations above the New York State ground water standards, with iron, lead and manganese occurring with the greatest frequency. NAPL was detected in two of the six ground water monitoring wells. Although the product was not identified, it was found to be RCRA non-hazardous.

Samples of the drill cuttings were also collected for analysis of PCBs, EP Toxicity metals and organics, corrosivity, ignitability and reactivity to define disposal options. PCBs were not detected in any of the samples and none of the RCRA parameters exceeded EPA limits for definition of a hazardous waste.

This HASP will be followed during the FI/RP soil boring and ground water monitoring well activities.

1.3 *PLANNED FIELD ACTIVITIES*

The FI/RP field activities are described in detail in Section 3.0 of the FI/RP Work Plan and only a brief overview of the activities is presented here.

The field investigative activities will focus on the characterization of soil and ground water at known/suspected NAPL areas and the delineation of the extent of any NAPL plumes.

The primary objectives of the field investigation are to: 1) delineate the extent of NAPLs at each individual area of known or suspected NAPL and to collect lithological data for each of the areas; 2) characterize the chemical quality of the soil within and outside of the area of the NAPL plume; and 3) characterize the chemical quality of ground water within and outside of the NAPL plume and delineate ground water flow paths at the yard. These activities will allow for the identification of preliminary remedial alternatives for soil, ground water and NAPL at the yard.

Detailed sampling methods are discussed in the Pre-Design Test Boring Work Plan. The following paragraphs briefly describe the sampling rationale and methods.

NAPL Delineation and Characterization

The first step in NAPL delineation will be the installation of two to seven borings/temporary well casings at each of the areas of known/suspected NAPL in the locations noted in Figures 3-1 through 3-5. At each location, soil samples will be collected and the samples will be logged for lithology, water content, OVA or HNu measurements and visual identification of NAPL. Select soil samples may also be analyzed in the field for total petroleum hydrocarbons (TPH). After sampling, temporary polyvinyl chloride (PVC) well casings will be installed in the boring to straddle the water table. After several hours of equilibration, water level and NAPL thickness measurements will be collected. A representative NAPL sample, if present, will then be collected and analyzed to determine pertinent signature characteristics, type of petroleum hydrocarbon, chemical composition and physical properties. After any NAPL is measured and/or sampled, the temporary well casings will be removed and the borehole backfilled with drill cuttings. This iterative process of temporary well installation will be continued in each area until the extent of the NAPL plume is defined in all directions.

Soil Characterization

A sufficient number of soil borings will be installed and sampled to characterize each known/suspected NAPL area. These samples will be submitted to a laboratory for analysis of Target Compound List/Target Analyte List (TCL/TAL) compounds via SW-846 methods pursuant to NYSDEC Contract Laboratory Procedures (CLP) protocols. The analyte list for select soil samples may be reduced based on the prior characterization of NAPL from the area. The laboratory reports will contain results of sample duplicates, matrix spike (MS) and matrix spike duplicates (MSD) for the organic fraction, and spike sample recoveries for the inorganic fraction. The soil samples will also be analyzed for total organic carbon (TOC), grain size and parameters aimed at evaluating bioremediation options.

Ground Water Characterization

A monitoring well network consisting of at least four permanent four-inch diameter PVC wells will be installed at each NAPL area. After the wells are developed, several rounds of water level and NAPL thickness measurements will be collected. Additionally, one complete round of ground water samples will be collected from wells outside of NAPL plume areas. The ground water samples will be analyzed for TCL/TAL parameters via SW-846 methods pursuant to NYSDEC CLP protocols. The laboratory reports will contain results of sample duplicates, MS and MSDS for the organic fraction, and spike sample recoveries for the inorganic fraction. The first round of ground water sampling data will be reviewed to determine what additional investigations are necessary.

1.4 POTENTIAL CHEMICAL AND PHYSICAL HAZARDS

1.4.1 Potential Chemical Hazards

Table 1-1 lists the chemicals which may be encountered during the field investigation. This data is a summary of the soil and ground water data collected during the LMS Phase II investigation. The table includes the media in which each constituent was detected and its maximum concentration. A summary of the exposure limits and physical properties of the volatile organics of potential concern is shown in Table 1-2. The risk of chemical exposure can be through inhalation, ingestion, skin contact, and possibly injection or puncture, depending on the type of compound and intrusive activity. This information was used to develop action levels for the field investigation team.

Table 1-1 List of Chemicals of Concern

Constituent	Maximum Concentration (ug/kg or ug/l)	Medium	Location On-Site
Volatile Organics			
Benzene	230	soil	SS-4RE
Toluene	2,300	soil	SS-4RE
Ethylbenzene	8,500	soil	SS-4RE
Xylenes	71,000	soil	SS-4RE
Trichloroethene	7 B	water	GW-3
4-Methyl-2-pentanone	93	water	GW-1
Tetrachloroethene	6 B	water	GW-2
Semivolatile Organics			
Naphthalene	18,000	soil	SS-4RE
2-Methylnaphthalene	110,000	soil	SS-4RE
Acenaphthlyene	690	soil	SS-7
Acenaphthene	560	soil	SS-1
Dibenzofuran	690	soil	SS-1
Fluorene	740	soil	SS-1
Pentachlorophenol	99	water	EW-7
Phenanthrene	4,000	soil	SS-1
Di-n-butylphthalate	84	soil	SS-1
Fluroanthene	5,500	soil	SS-2
Pyrene	13,000	soil	SS-4RE
Bis(2-ethylhexyl)phthalate	1,100	soil	SS-2
Benzo(a)anthracene	2,300	soil	SS-7
Chrysene	3,000	soil	SS-7
Benzo(b)fluoranthene	2,500	soil	SS-7
Benzo(k)fluoranthene	2,400	soil	SS-7
Benzo(a)pyrene	1,900	soil	SS-7
Indeno(1,2,3-cd)pyrene	1,300	soil	SS-7
Benzo(g,h,i)perylene	1,100	soil	SS-7
Pesticides/PCBs			

Table 1-1 List of Chemicals of Concern (Cont'd)

Constituent	Maximum Concentration (ug/kg or ug/l)	Medium	Location On-Site
Heptachlor epoxide	33	soil	SS-2, SS-4
Endosulfan	83	soil	SS-7
Endrin	0.5	water	EW-7
Gamma-BHC (Lindane)	0.87	water	GW-5
Gamma-Chlordane	140	soil	SS-1
Aroclor-1254	540	soil	SS-6
Metals			
Aluminum	30,600	water	GW-2
Antimony	20.9	soil	SS-1
Arsenic	204	soil	SS-7
Barium	460	water	GW-3
Cadmium	6.0	water	GW-1
Calcium	208,000	water	GW-1
Chromium	66	water	GW-2
Cobalt	90	water	GW-4
Copper	23,400	soil	SS-1
Iron	51,000	water	GW-3
Lead	3,840	soil	SS-1
Magnesium	55,200	water	GW-1
Manganese	9,750	water	EW-7
Mercury	48	water	EW-7
Nickel	77.6	soil	SS-1
Potassium	9,550	water	GW-5
Sodium	260,000	water	GW-4
Vanadium	60	water	GW-4
Zinc	896	soil	SS-1

Notes:
ug/kg = micrograms per kilogram, soils
ug/l = micrograms per liter, water
B = Found in method blank

able 1-2 Exposure Limits and Physical Properties of Compounds of Potential Concern

Compound	Exposure Limits	IDHL Level	Physical Description	Chemical and Physical Properties
Benzene	PEL: 1 ppm REL: 0.1 ppm TLV: 10 ppm	Ca [1,000 ppm]	Colorless to light-yellow liquid with an aromatic odor. [Note: solid below 42°F	MW: 78.1 UEL: 7.9% BP: 176°F Sol: 0.07% LEL: 1.3% FL.P.: 12°F
Naphthalene	PEL: 10 ppm REL: 10 ppm TLV: NA	500 ppm	White crystalline flakes with an aromatic odor resembling coal tar	MW: 128.18 UEL: 5.9% BP: 218°C LEL: 0.9% Sol: 30 mg/L FL.P.: 79°C
Ethylbenzene	PEL: 100 ppm REL: 100 ppm TLV: 100 ppm	2,000 ppm	Colorless liquid with an aromatic odor	MW: 106.2 UEL 6.7% BP: 227°F LEL: 1.0% Sol: 0.01% FL.P.: 55°F
Xylenes	PEL: 100 ppm REL: 100 ppm TLV: 100 ppm	1,000 ppm	Colorless liquids with an aromatic odor	MW: 106.2 UEL: 7% BP: 269-29°F LEL: 1.1% Sol: insoluble FL.P.: 63-84°F
Trichloroethene	PEL: 50 ppm REL: 25 ppm TLV: 50 ppm	Ca [1,000 ppm]	Colorless liquid (unless dyed blue) with a chloroform-like odor	MW: 131.4 UEL: 10.5% BP: 189°F LEL: 8% Sol: 0.1% FL.P.: 90°F
Tetrachloroethylene	PEL: 100 ppm REL: 50 ppm TLV: 50 ppm	Ca [500 ppm]	Colorless liquid with an odor like ether or chloroform	MW: 166 UEL: NA BP: 250°F LEL: NA Sol: 0.015% FL.P.: none
Arsenic	PEL: 0.010 mg/m^3 REl: 0.002 mg/m^3 TLV: NA	Ca [20 mg/m^3]	Metal: silver-gray or tin-white, brittle, odorless, solid	MW: 74.9 UEL: NA BP: Sublimes°F LEL: NA Sol: Insoluble FL.P.: NA

Table 1-2 Exposure Limits and Physical Properties of Compounds of Potential Concern (Cont'd)

Compound	Exposure Limits	IDHL Level	Physical Description	Chemical and Physical Properties
Lead	PEL: 0.050 mg/m^3 REL: 0.100 mg/m^3 TLV: NA	100 mg/m^3	Metal: Heavy, ductile, soft gray solid	MW: 207.2 UEL: NA BP: 3164°F LEL: NA Sol: Insoluble FL.P.: NA
Mercury (vapor)	PEL: 0.1 mg/m^3 REL: NA TLV: NA	28 mg/m^3	Silver-white heavy odorless liquid	MW: 200.6 UEL: NA BP: 674°F LEL: NA Sol: Insoluble FL.P.: NA
Cobalt (metal dust, and fume)	PEL: 0.1 mg/m^3 REL: NA TLV: NA	20 mg/m^3	Metal: odorless, silver-gray to black solid	MW: 58.9 UEL: NA BP: 5612°F LEL: NA Sol: Insoluble FL.P.: NA
Nickel (metal)	PEL: 0.1 mg/m^3 (sol. compounds) 1 mg/m^3 (insol. compounds) REL: 0.015 mg/m^3 TLV: NA	Ca [N.E.]	Metal: Lustrous, silvery solid	MW: 58.7 UEL: NA BP: 5139°F LEL: NA Sol: Insoluble FL.P.: NA
Endosulfan	PEL: NA REL: NA TLV: NA	NA	NA	MW: NA UEL: NA BP: NA LEL: NA Sol: NA FL.P.: NA
Endrin	PEL: 0.1 mg/m^3 REL: 0.1 mg/m^3 TLV: NA	200 mg/m^3	Colorless to tan crystallikne solid, with a mild chemical odor	MW: 380.9 UEL: NA BP: Decomposes LEL: NA Sol: Insoluble FL.P.: NA
Cadmium (dust)	PEL: 0.2 mg/m^3 REL: L.P.C. TLV: NA	Ca [50 mg/m^3]	Metal: silver-white, blue-tinged, lustrous, odorless solid	MW: 112.4 UEL: NA BP: 1409°F LEL: NA Sol: Insoluble FL.P.: NA

Table 1-2 Exposure Limits and Physical Properties of Compounds of Potential Concern (Cont'd)

Compound	Exposure Limits	IDHL Level	Physical Description	Chemical and Physical Properties
Cadmium (fume)	PEL: 0.1 mg/m³ REL: L.P.C. TLV: NA	Ca [9 mg/m³]	Odorless, yellow-brown, finely divided particulates dispersed in air	MW: 128.4 UEL: NA BP: Decomposes LEL: NA Sol: Insoluble FL.P.: NA
Pyrene	PEL: NA REL: NA TLV: NA	NA	Colorless solid, solutions have a slight blue color	MW: 202.26 UEL: NA BP: 156°F LEL: NA Sol: Insol. in water Sol. in organics FL.P.: NA
Chrysene	PEL: NA REL: NA TLV: NA	NA	NA	MW: NA UEL: NA BP: NA LEL: NA Sol: NA FL.P.: NA
Benzo(a)pyrene	PEL: NA REL: NA TLV: NA	NA	Yellow crystals	MW: 252.32 UEL: NA BP: 312°F LEL: NA Sol: Insol. in water Sol. in BTX FL.P.: NA
Antimony	PEL: 0.5 mg/m³ REL: 0.5 mg/m³ TLV: NA	80 mg/m³	Metal: Silver-white, lustrous, hard, brittle solid; scale-like crystals; or a dark gray, lustrous powder	MW: 121.8 UEL: NA BP: 2975°F LEL: NA Sol: Insoluble FL.P.: NA
Barium (Barium nitrate/ Barium chloride)	PEL: 0.5 mg/m³ REL: 0.5 mg/m³ TLV: NA	1100 mg/m³	Both are white odorless solids	MW: 261.4/208.3 UEL: NA/? BP: Decomposes/ 2840°F LEL: NA/? Sol: 9/38% FL.P.: NA/?
Chromium	PEL: 1 mg/m³ REL: 0.5 mg/m³ TLV: NA	NA	Blue-white to steel gray, lustrous, brittle, hard solid	MW: 52.0 UEL: NA BP: 4788°F LEL: NA Sol: Insoluble FL.P.: NA

able 1-2 *Exposure Limits and Physical Properties of Compounds of Potential Concern (Cont'd)*

Compound	Exposure Limits	IDHL Level	Physical Description	Chemical and Physical Properties	
Vanadium (vanadium pentoxide - respirable dust and fume)	PEL: 0.05 mg/m^3 REL: 0.05 mg/m^3 TLV: NA	70 mg/m^3	Yellow-orange powder or dark gray, odorless flakes dispersed in air	MW: 181.9 BP: 3182°F Sol: 0.8% FL.P.: NA	UEL: NA LEL: NA
Heptachlor Epoxide	PEL: 0.5 mg/m^3 REL: 0.5 mg/m^3 TLV: NA	Ca [700 mg/m^3]	White to light tan crystals with a camphor-like odor	MW: 373.4 BP: 293°F Sol: Insoluble FL.P.: NA	UEL: NA LEL: NA
Lindane	PEL: 0.5 mg/m^3 REL: 0.5 mg/m^3 TLV: NA	1000 mg/m^3	White to yellow crystalline powder with a slightly musty odor	MW: 290.8 BP: 614°F Sol: 0.001% FL.P.: NA	UEL: NA LEL: NA
Chlordane	PEL: 0.5 mg/m^3 REL: 0.5 mg/m^3 TLV: NA	Ca [500 mg/m^3]	Amber-colored viscous liquid with pungent chlorine-like odor	MW: 409.8 BP: Decomposes Sol: Insoluble FL.P.: NA	UEL: NA LEL: NA
Aroclor-1254	PEL: 500 ug/m^3 REL: NAppm TLV: 0.5 mg/m^3	5 mg/m^3	NA	MW: NA BP: NA Sol: NA FL.P.: NA	UEL: NA LEL: NA
Copper (dusts and mists)	PEL: 1 mg/m^3 REL: 1 mg/m^3 TLV: NA	NE	Metal: reddish, lustrous, malleable, odorless solid	MW: 63.5 BP: 4703°F Sol: Insoluble FL.P.: NA	UEL: NA LEL: NA
Copper (fume)	PEL: 0.1 mg/m^3 REL: 0.1 mg/m^3 TLV: NA	NE	Finely divided black particulate dispersed in air	MW: 79.5 BP: Decomposes Sol: Insoluble FL.P.: NA	UEL: NA LEL: NA

able 1-2 Exposure Limits and Physical Properties of Compounds of Potential Concern (Cont'd)

otes:

EL - OSHA Permissible Exposure Limit, based on 1992 Transitional limits in 29 CFR 1910.100.
.EL - NIOSH Recommended Exposure Limit
LV - ACGIH Threshold Limit Value (Listed only when it is more restrictive than the PEL or REL)
pm - parts per million
ıg/m^3 - milligrams per cubic meter
g/m^3 - micrograms per cubic meter
:a - Potential Occupational Carcinogen
IA - Not Available
IE - None Established
.P.C. - Carcinogen - Reduce exposure to Lowest Possible Concentration

) Proposed Final Rule Permissible Exposure Limit
) No REL established; NIOSH questions whether the PEL for this substance is adequate to protect workers from recognized health hazards.

eferences:

merican Conference of Governmental Industrial Hygienists, 1992-1993. Threshold Limit Values and Biological Exposure Indices for 1992-1993.
J.S. Department of Health and Human Services, 1990. NIOSH Pocket Guide to Chemical Hazards. June 1990.
Montgomery, John H., and Welkom, Linda M., 1990. Groundwater Chemicals Desk Reference.
Sax, N. Irving, 1984. Dangerous Properties of Industrial Materials.

The major compounds present in the soils at the yard are VOCs including benzene, toluene, ethylbenzene, and xylenes, and SVOCs, consisting mainly of PAHs, PAEs, dibenzofuran and naphthalene-like compounds. PCBs were detected in only one surface soil sample. Three pesticides were also detected. Inorganic contaminants were also detected in the surface soils but none exceede the EP Toxicity allowable levels.

The compounds detected in the ground water include: five VOCs (benzene, total xylenes, trichloroethene, tetrachloroethene, and 4-methyl-2-pentanone), eight SVOCs (PAHs and dibenzofuran), one pesticide and no PCBs were detected in the ground water. In the six monitoring wells sampled, at least two metals were detected at concentrations above the New York State ground water standards, with iron, lead and manganese occurring with the greatest frequency. NAPL was detected in two of the six ground water monitoring wells.

While many of these chemicals may pose primarily acute hazards such as irritation and narcosis, others may cause chronic systemic illness with repeated and prolonged exposure. Such effects may be manifested in the hematopoietic system (lead), in the liver and kidneys (chlorinated hydrocarbons, lead, PCBs), or in the gastrointestinal system (lead). A number of the identified chemicals are carcinogenic or suspected of being so (benzene, TCE, PCE, arsenic) or cause dermatitis or allergic skin responses (PCBs).

In addition to the potential health hazards described above, many of the volatile hydrocarbons ar flammable, exhibiting low flash points and low explosive limits (ethylbenzene, xylene and naphthalene).

1.4.2 Potential Physical Hazards

The yard and the planned investigative activities have associated physical hazards. Physical hazards range from the danger of tripping and falling on uneven ground to those associated with the operation of heavy equipment such as backhoes. The Harmon Yard may have debris materials such as empty drums, plastic, concrete forms, domestic refuse, wire, railroad ties, wood products, and other construction type wastes present. A list of the potential physical hazards that may be encountered during the FI/RP field activities is shown in Table 1-3.

Table 1-3 ***List of Potential Physical Hazards***

Concern	Task	Procedures Used to Monitor/Reduce Hazard
1. Drilling in areas of buried utilities	Borings/Temporary Wells, Permanent Wells	Conduct utility markouts
2. Working around active tracks	Borings/Temporary Wells, Permanent Wells	Notify Metro-North and procure flag person
3. Facility traffic	General sampling	Position personnel and equipment once traffic patterns known; use "caution" tape and safety cones appropriately
4. Working around heavy machinery	Borings/Temporary Wells, Permanent Wells	Focus attention on machinery, wear hard hats

2.0 PERSONNEL RESPONSIBILITIES

ERM has developed a Health and Safety Management Team to ensure that the project is implemented safely. The following responsibilities have been or, will be, assigned to designated project personnel for RI field activities.

2.1 ERM FIELD TEAM LEADER

The Field Team Leader (FTL) is the person appointed by ERM to act in a supervisory capacity over all ERM employees and activities during the investigation. The FTL is responsible for ensuring that ERM Health and Safety responsibilities are carried out during the FI/RP field activities. As part of these responsibilities, the FTL will distribute the HASP to all field team personnel and discuss the plan prior to the start of field activities. A Health and Safety Plan Review Record is shown in Figure 2-1 for such documentation. The field personnel will sign a document verifying that they have read and are familiar with the contents of this HASP.

2.2 SITE HEALTH AND SAFETY OFFICER

The Site Health and Safety Officer appointed by ERM will be responsible solely for ERM employees unless otherwise specified in an appropriate agreement between a Principal of ERM and Metro-North. The Site Health and Safety Officer will have received the appropriate level of training required to perform these duties. The Site Health and Safety Officer will have the following authority and responsibilities:

- responsibility for the review of, and any necessary field modifications to, this HASP;

HEALTH AND SAFETY PLAN REVIEW RECORD

Harmon Railroad Yard
Croton-on-Hudson, New York

I have read the Health and Safety Plan for the Harmon Railroad Yard site and have been briefed on the nature, level, and degree of exposure likely as a result of participation in this project. I agree to follow all the requirements in the Health and Safety Plan.

____________________________ ________________________

Employee Signature Date

____

Name

____________________________ ________________________

Project Manager Signature Date

____

Name

- responsibility for maintaining adequate supplies of all personal protective equipment as well as calibration and maintenance of all monitoring instruments;

- in conjunction with ERM's Director of Environmental Health and Safety, authority to suspend Site operation due to any ineffectiveness of this HASP;

- responsibility to coordinate emergency response activities;

- implementation and documentation of pre-task field briefings.

2.3 ERM SUBCONTRACTORS

ERM subcontractors who will be working at the Harmon Railroad Yard will be provided a copy of this HASP. It will be supplied to the subcontractors for information purposes only. Subcontractors will be informed of the health and safety concerns and the monitoring data presented in this plan and will be responsible, at a minimum, for maintaining the health and safety requirements presented in this plan. Information, such as air monitoring and analytical results, will be shared with the subcontractors to assist them in addressing the health and safety recommendations.

ERM will ensure that subcontractors have met the training, respirator certification and medical examination requirements of the OSHA Hazardous Waste Operations Standard (29 CFR 1910.120). Subcontractors are required to provide ERM with completed certification forms for this purpose (Figure 2-2).

Figure 2-2 Subcontractor Occupational Safety and Health Certification

SUBCONTRACTOR OCCUPATIONAL SAFETY AND HEALTH CERTIFICATION

Project: ______________________

Contractor: ____________________

1. Contractor certifies that the following personnel to be employed during field activities at the Harmon Railroady Yard site have met the following requirements of the OSHA Hazardous Waste Operations Standard (29 CFR 1910.120) and other applicable OSHA standards.

2.

Contractor Personnel	Training	Respirator Certification	Medical Examination
________	_____	________	_______
________	_____	________	_______
________	_____	________	_______
________	_____	________	_______
________	_____	________	_______

3. Contractor certifies that it has received a copy of the Health and Safety Plan and will ensure that its employees are informed and will comply with its requirements.

4. Contractor further certifies that it has read and understands and will comply with all provisions of its contractual agreement with ERM.

Signed______________________ Date__________

Title ______________________

To the Subcontractor:

This HASP has been prepared for ERM personnel use. It is supplied to you for informational purposes only. As noted in the subcontract, you are responsible for your own health and safety program. However, field operations will be halted by ERM if subcontractors do not use appropriate protective measures warranted by site conditions.

3.0 *MEDICAL MONITORING AND PERSONNEL TRAINING REQUIREMENTS*

OSHA has established requirements for a medical surveillance program designed to monitor and reduce health risks for employees who may potentially be exposed to hazardous materials. This program has been designed to provide baseline medical data for each employee involved in hazardous waste operations and includes a determination of their ability to wear personal protective equipment, such as chemical resistant clothing and respirators. The medical examinations are administered on a pre-employment, annual basis and as warranted by symptoms of exposure or specialized activities. Symptoms or exposures, related to the field activities, will be reported to the Site Safety Officer and Corporate Health and Safety Director as soon as possible and the individual will be examined by a physician.

All personnel involved in the FI/RP field activities at the Harmon Railroad Yard will be required to participate in a medical monitoring program that meets the specifications of 29 CFR 1910.120. The examining physician is required to make a report to the employer of any medical condition which would place employees required to wear a respirator or other personal protection equipment at increased risk. Each employer engaged in Site work shall assume the responsibility of maintaining Site personnel medical records as regulated by 29 CFR 1910.120, where applicable.

A respiratory protection program is required for all those employees who wear or may wear respiratory protection as regulated by 29 CFR 1910.134. This program is included in ERM's Health and Safety Management Manual and includes cartridge selection and use, and respiratory training.

3.1 PERSONNEL TRAINING

Site personnel associated with those field activities in which the potential for exposure to hazardous substances exists will be required to participate in a health and safety training program that complies with the OSHA standard 29 CFR 1910.120. This program instructs employees on general health and safety principles and procedures, proper operation of monitoring instruments, and use of personal protective equipment.

4.0 SITE MONITORING AND PERSONAL PROTECTIVE EQUIPMENT

4.1 INTRODUCTION

The organic compounds that have been found in the surface soils and ground water at the Site are listed in Table 1-1. The chemical and physical properties of these compounds are provided in Table 1-2. To provide safeguards for exposures to these compounds, a monitoring and protection program has been designed based upon the three compounds with the lowest permissible exposure limits (PELs). To minimize the potential exposure to these and less threatening compounds, engineering controls, Site monitoring, protective ensembles and good work practices will be used during the project.

4.2 SITE MONITORING

The primary compounds of concern at the Harmon Railroad Yard are volatile organics, semivolatile organics, inorganics, and PCBs. Field personnel may be exposed to volatile organic compounds and inorganics in the breathing space during the field investigative activities. Volatiles may be in the form of mists or vapors, and inorganics may be in the form of dust; these can enter the body through ingestion, inhalation and absorption. Air monitoring and good Site work practices will be used during the field activities to ensure that appropriate personal protection is selected which would minimize potential exposures. All instruments to be used during Site activities have been selected based on their ability to detect the hazards present.

Organic vapor concentrations will be monitored routinely in the breathing space with an organic vapor meter utilizing either flame or photo-ionization detection (FID/PID). Additionally, colorimetric tubes will be used for those materials which are difficult to detect with these devices. Monitoring for particulates will be performed with a direct reading particulate monitor. Minimally, monitoring will be conducted during each boring location change. Organic vapor concentrations may be used as action level criteria for upgrading or downgrading protective equipment and implementing additional precautions or procedures.

The potential for explosive atmosphere and oxygen content will be monitored by a combustible gas indicator/oxygen meter (CGI/O_2). This monitoring will be conducted in conjunction with the organic vapor monitoring.

All Site monitoring will be conducted by or under the supervision of the Site Safety Officer. Average readings during intrusive activities will be recorded in a dedicated Site notebook or on the Air Monitoring/Observation Form in Figure 4-1. The Site Safety Officer will maintain all monitoring instruments throughout the Site investigation to ensure their reliability and proper operation.

4.3 ACTION LEVELS

Based upon the exposure limits of the chemicals identified in Table 1-2, action levels were developed for upgrading or downgrading the level of protection for Site workers and for activity cessation. The action levels are summarized in Table 4-1 and are specifically applicable to the breathing zone. These levels were based on the suspected presence of benzene, which has a very low PEL.

Based upon these levels, the Site Safety Officer will be responsible for determining when activity cessation, Site evacuation, emergency response,

Figure 4-1 Air Monitoring/Observation Record

Date:_______________ Location:_______________

Air Monitoring Results Activity:_______________

Instrument	Reading/Time	Interpretation	Observation/Action

Conducted By:_______________

Note Atmospheric Conditions:_______________

Compounds[1]	Monitoring	Action Level [2]	Respiratory Protection
I. Vapors[2]			
A. Benzene[3]	General screening: PID Specific screening: colorimetric detector tubes	(IDLH = 3,000 ppm) 0 to 1 ppm 1 to 5 ppm 5 to 25 ppm 25 to 50 ppm 50 to 100 ppm > 100 ppm	 None Required Half-Face with benzene-approved OV canister[4] Full-Face with benzene-approved OV canister[4] PAPR with benzene-approved OV canister[4] PDSAR SCBA or PDSAR with escape
B. Naphthalene	General screening: PID Specific screening: colorimetric detector tubes	(IDLH = 500 ppm) 0 to 5 ppm 5 to 25 ppm 25 to 50 ppm 50 to 100 ppm 100 to 200 ppm > 200 ppm	 None Required Half-Face with benzene-approved OV canister[4] Full-Face with benzene-approved OV canister[4] PAPR with benzene-approved OV canister[4] PDSAR SCBA or PDSAR with escape
C. Xylene[5], Ethylbenzene, Trichloroethene, Tetrachloroethene	General screening: PID Specific screening: not applicable	(IDLH = 500 ppm for tetrachloroethylene) 0 to 50 ppm 50 to 100 ppm 100 to 150 ppm 150 to 250 ppm 250 to 350 ppm > 350 ppm	 None Required Half-Face with benzene-approved OV canister[4] Full-Face with benzene-approved OV canister[4] PAPR with benzene-approved OV canister[4] PDSAR SCBA or PDSAR with escape
II. Particulates			
A. Inorganic Arsenic	General screening: real time particulate monitor Specific screening: personal exposure assessment	(IDLH = 20 mg/m³) Background to 0.01 mg/m³ above background 0.01 to 0.10 mg/m³ above background 0.10 to 1.0 mg/m³ above background 1.0 to 5.0 mg/m³ above background 5.0 to 10.0 mg/m³ above background > 10 mg/m³ above background	 None Required Half-Face with HEPA filter Full-Face with HEPA filter PAPR with HEPA filter PDSAR SCBA or PDSAR with escape

Compounds[1]	Monitoring	Action Level [2]	Respiratory Protection
B. Lead[5,7]	General screening: real time particulate monitor Specific screening: personal exposure assessment	(IDLH = 100 mg/m^3) Background to 0.05 mg/m^3 above background 0.05 to 0.5 mg/m^3 above background 0.5 to 1.25 mg/m^3 above background 1.25 to 12.5 mg/m^3 above background 12.5 to 20.0 mg/m^3 above background > 20 mg/m^3 above background	 None Required Half-Face with HEPA filter Full-Face with HEPA filter PAPR with HEPA filter PDSAR SCBA or PDSAR with escape
C. Mercury[8], Cobalt, Nickel, Endosulfan, and Endrin	General screening: real time particulate monitor Specific screening: personal exposure assessment	(IDLH = 20 mg/m^3 for cobalt) Background to 0.1 mg/m^3 above background 0.1 to 1.0 mg/m^3 above background 1.0 to 2.5 mg/m^3 above background 2.5 to 12.5 mg/m^3 above background 12.5 to 20 mg/m^3 above background > 20 mg/m^3 above background	 None Required Half-Face with HEPA filter Full-Face with HEPA filter PAPR with HEPA filter PDSAR SCBA or PDSAR with escape
D. Cadmium, Pyrene, Chrysene, and Benzo(a)pyrene	General screening: real time particulate monitor Specific screening: personal exposure assessment	(IDLH = 50 mg/m^3 for cadmium) Background to 0.2 mg/m^3 above background 0.2 to 2.0 mg/m^3 above background 2.0 to 5.0 mg/m^3 above background 5.0 to 15 mg/m^3 above background 15 to 20 mg/m^3 above background > 20 mg/m^3 above background	 None Required Half-Face with HEPA filter Full-Face with HEPA filter PAPR with HEPA filter PDSAR SCBA or PDSAR with escape
E. Antimony, Barium, Chromium, Vanadium, Heptachlor Epoxide, Lindane, and Chlordane,	General screening: real time particulate monitor Specific screening: personal exposure assessment	(IDLH = 70 mg/m^3 for vanadium) Background to 0.5 mg/m^3 above background 0.5 to 5.0 mg/m^3 above background 5.0 to 10 mg/m^3 above background 10 to 20 mg/m^3 above background 20 to 35 mg/m^3 above background > 35 mg/m^3 above background	 None Required Half-Face with HEPA filter Full-Face with HEPA filter PAPR with HEPA filter PDSAR SCBA or PDSAR with escape
F. Copper[5]	General screening: real time particulate monitor Specific screening: personal exposure assessment	(IDLH = N.E.) Background to 1.0 mg/m^3 above background 1.0 to 5.0 mg/m^3 above background 5.0 to 10 mg/m^3 above background 10 to 20 mg/m^3 above background 20 to 40 mg/m^3 above background > 40 mg/m^3 above background	 None Required Half-Face with HEPA filter Full-Face with HEPA filter PAPR with HEPA filter PDSAR SCBA or PDSAR with escape

Notes:

PAPR - Powered Air Purifying Respirator
PDSAR -Pressure Demand Supplied Air Respirator
HEPA - High Efficiency Particulate Air
SCBA - Self-Contained Breathing Apparatus
PID - Photo-Ionization Detector
OV - Organic Vapor
N.E. - None Established
ppm - parts per million
mg/m^3- milligrams per cubic meter

(1) Compounds selected on a highest hazard basis in order to protect against a worst case scenario; therefore, action levels based on these compounds are overprotective for less hazardous compounds.

(2) This table is to be used making the initial assumption that the readings obtained using the screening device are completely attributable to the material present with the lowest permissible exposure limit (PEL). This assumption is used until such time that the individual material indicator test determines the material is not present in the workers' breathing zone. At that point, general screening will be considered indicative of the material with the next higher PEL and specific screening will be performed to determine its presence as well as to reaffirm the absence of the first material. This continues iteratively until the maximum set of action levels are achieved.

(3) The action levels for benzene have been adjusted to account for the possible undetected IDLH conditions of naphthalene.

(4) The OV cartridges used must meet the requirements of 29 CFR 1910.1028. In order to prevent potential overexposure within the respirator facepiece, the cartridges will have to be replaced after every four hours of use. Additionally, their use has been required whenever vapors are present in the event that exposure to benzene recurs.

(5) Expected as a primary hazard because of the level detected in the soil and ground water at the site.

(6) Since no "real time" monitoring technology exists for detection of individual metal species, pesticides, or polychlorinated biphenyls (PCBs), levels for inorganic arsenic will be utilized until such time that representative standard industrial hygiene exposure assessments have been performed for specific site activities to determine which set of action levels apply based upon the materials present. The determination of the action levels to use will be made by the Site Health and Safety Officer based upon the results of the assessments and observations made during field operations.

(7) The action level for lead "Without Aroclor-1254" have been adjusted to account for potential undetected IDLH conditions involving cobalt.

(8) If the presence of liquid mercury metal is confirmed by visual inspection, then a gold film mercury vapor analyzer will be obtained and screening for mercury vapor performed. If mercury vapors are present, then cartridges rated for use with mercury vapor will be required and the action levels for lead utilized because the PEL for mercury vapor is 0.05 mg/m^3. This requirement would be modified based upon the presence or absence of Aroclor-1254. Additionally, the protective gloves and clothing used would be reviewed for their ability to resist metallic mercury.

Changes to the action levels (for vapors or particulates) and use of any personal protective equipment are allowed according to the professional discretion of the Site Health and Safety Officer based upon the nature of the field operations, observations, and their previous experience during other similar activities at other similar site.

Based upon feasibility and provision of equipment, levels of protection against exposure the Site Health and Safety Officer may allow the substitution of administrative or engineering controls in place of personal protective equipment.

and the upgrade or downgrade in the level of personal protective equipment are appropriate. In order to prevent unnecessary upgrading or downgrading, when the total volatile organic concentration in the breathing zone is close to an action level, the zone should be continuously monitored for several minutes to determine whether or not the exceedance is a temporary fluctuation.

4.4 PERSONAL PROTECTIVE EQUIPMENT

The types of protective clothing and equipment to be used during the Site activities are discussed in this section. Personal protective equipment will be in conformance with EPA criteria for Level C and D protection. All respiratory protective equipment used at the Site will be approved by NIOSH/MSHA.

Level C protection, as described in this plan, will be worn during FI/RP field activities at the Site since drilling activities involve surface soil disturbance and may involve release of volatiles to the air and contact with the soil. Conditions during drilling may warrant backing away a short distance from the drilling location and allowing vapors to vent as an extra safety precaution. Vapors from the borehole are expected to disperse to below detectable levels within a short distance from the borehole. Therefore, backing away from the boring along with level C protection would provide adequate personal protection. The Site Safety Officer will determine whether or not a level protection can be upgraded or downgraded. Changes in the level of protection will be recorded in the dedicated Site logbook along with the rationale for the changes. In atmospheres that potentially contain toluene and xylenes, the protective ensemble should include chemical resistent clothing since the two compounds have skin absorption potential. Consistent with OSHA training, during the use of Level C, oxygen percent must be continuously monitored.

The following describes the personnel protective equipment requirements of the various levels of protection.

4.4.1 *Level C Protection*

a. Full-face or half-face air purifying respirator equipped with appropriate organic vapor canisters or cartridges. HEPA dust filters will be available and utilized as warranted by Site conditions.

b. Tyvek coveralls. Chemical resistant clothing such as Poly-coated Tyvek or Saranex at areas suspected of containing toluene or xylenes.

c. Outer nitrile gloves and inner latex surgical gloves.

d. Leather boots with rubber overboots.

e. Options as required:

    1. Coveralls
    2. Disposable outer boots
    3. Escape mask
    4. Hard hat
    5. Face shield
    6. Ear protection
    7. Safety glasses
    8. Chemical-resistant tape

4.4.2 Level D Protection

a. Coveralls or sleeved shirts and long pants.

b. Outer nitrile gloves at a minimum. Inner latex surgical gloves are recommended where practical.

c. Rubber boots.

d. Level C protection readily available.

e. Options as required:
   1. Disposable outer boots
   2. Hard hat
   3. Safety glasses
   4. Ear protection

5.0 DECONTAMINATION AND WORK ZONE CATEGORIES

5.1 PERSONAL DECONTAMINATION

Personnel involved with the field activities may be exposed to compounds in several ways despite the most stringent protective procedures. Site personnel may come in contact with vapors, gases, mists, or particulates in the air, or other Site media while performing Site duties. Use of monitoring instruments, Site equipment and protective clothing can also result in transmittal and exposure of hazardous substances. As a result of this potential exposure, personal decontamination procedures must be carefully practiced.

In general, decontamination involves scrubbing with a detergent water solution followed by clean water rinses. All disposable items shall be disposed of in a dry container. Certain parts of contaminated respirators, such as harness assemblies and leather or cloth components, are difficult to decontaminate. If grossly contaminated, they may have to be discarded. Rubber components can be soaked in detergent and water and scrubbed with a brush. In addition to being decontaminated, all respirators, non-disposable protective clothing, and other personal articles must be sanitized before further use if they become soiled from exhalation, body oils, and perspiration. The manufacturer's instructions should be followed in sanitizing the respirator masks. The Site Safety Officer will be responsible to oversee the proper maintenance, decontamination, and sanitizing of all respirator equipment.

5.2 *HEAVY EQUIPMENT DECONTAMINATION*

The drill rigs and backhoes will be decontaminated on-Site. This decontamination will be done in a designated area near the area in which field work is on-going. This area will be used to completely decontaminate the heavy machines between and prior to exiting the Site. Additionally, the hollow stem augers for drilling will be decontaminated between boring locations and this designated area. Decontamination will involve the use of high pressure steam. All decontamination rinseate will be discharged to the surface.

5.3 *DECONTAMINATION ZONES AND WORK ZONES*

The decontamination zone layout and procedures should match the prescribed levels of personal protection. A detailed discussion of the decontamination zones and the procedures required for the various levels of personnel protection is provided in the following paragraphs.

<u>Exclusion Zone (EZ):</u> This is the zone in which the field activities are actually being conducted and only persons with the appropriate personal protection equipment are permitted within this zone. The EZ for Site activities will be the area immediately surrounding the known/suspected NAPL areas where work is being conducted. In addition, traffic cones will be placed around the perimeter of the work area.

<u>Contaminant Reduction Zone (CRZ):</u> It is within this zone that the decontamination process is undertaken. Personnel and their equipment must be adequately decontaminated before leaving this zone for the support zone. This zone will be set up along the perimeter of the EZ.

<u>Support Zone (SZ):</u> The support zone is considered to be uncontaminated; as such, protective clothing and equipment are not required but should be available for use in emergencies. All equipment and materials are stored and maintained within this zone. Protective clothing is put on in the support zone before entering the contaminant reduction zone.

The procedures described in the following paragraphs have been established to provide Site personnel with minimum guidelines for proper decontamination. These minimum procedures must be followed by personnel leaving the point of operations designated as the EZ. The decontamination process shall take place at a reasonable distance away from any area of potential contamination. Prior to leaving the EZ, personnel will remove all visible contamination from heavy machinery. The machinery will be completely decontaminated at the decontamination pad.

5.4 *MINIMUM DECONTAMINATION PROCEDURE*

Personnel leaving the point of operations should wash outer gloves and boots. At a minimum, the outer boots shall be removed first and stored in an appropriate area or disposed of properly. Outer boots must be properly washed where gross contamination is evident. Personnel shall then remove and dispose of the Tyvek coveralls. Personnel should remove the Tyvek coveralls so that inner clothing does not come in contact with any contaminated surfaces. After Tyvek removal, personnel shall remove and discard outer nitrile gloves. Personnel shall then remove the respirator, where applicable. Respirators shall be disinfected between use with towelettes or other sanitizing methods. Potable water, at a minimum, will be present so that Site personnel can thoroughly wash hands and face after leaving the contamination reduction zone.

Portable wash stations shall be utilized for easy and efficient access. The wash station shall consist of a potable water supply, hand soap and clean towels. Portable sprayer units filled with Alconox solution and potable water should also be available to wash and rinse off grossly contaminated boots, gloves and equipment. The Site Safety Officer will monitor decontamination procedures to ensure their effectiveness. Modifications of the decontamination procedure may be necessary as determined by the Site Safety Officer's observations.

5.5 *STANDARD DECONTAMINATION PROCEDURE*

The following paragraphs describe decontamination procedures for each level of protection. During the RI activities, decontamination procedures appropriate for the task and the level of protection will be followed.

Level C - Personal Protection Decontamination Procedure

Step 1 - Segregated Equipment Drop

Deposit equipment (tools, sampling devices, notes, monitoring instruments, radios, etc.) used on the Site onto plastic drop cloths.

Step 2 - Boot Covers and Glove Wash

Outer boot covers and outer gloves should be scrubbed with a decontamination solution of detergent and water.

Step 3 - Rinse Off Boot Covers and Gloves

Decontamination solution should be rinsed off boot covers and gloves using generous amounts of water. Repeat as many times as necessary.

Step 4 - Tape Removal (if used)

Remove tape from around boots and gloves and place into container with plastic liner.

Step 5 - Boot Cover Removal

Remove disposable boot covers and place into container with plastic liner.

Step 6 - Outer Glove Removal

Remove outer gloves and deposit in container with plastic liner.

Step 7 - Suit/Safety Boot Wash

Completely wash Tyvek, gloves, and safety boots.

Step 8 - Suit/Safety Boot Rinse

Thoroughly rinse off all decontamination solution from protective clothing.

Step 9 - Respirator Cartridge Changes

This is the last step in the decontamination process for those workers wishing to change respirator cartridges and return to the exclusion zone. The worker's cartridge is exchanged, new outer glove and boot covers are donned and if desired, joints are taped.

Step 10 - Removal of Safety Boots

Remove safety boots and deposit in container with a plastic liner.

Step 11 - Respirator Removal

Remove the respirator with care, and clean the inside.

Step 12 - Splash or Tyvek Suit Removal

With care, remove splash or Tyvek suit. The exterior of the splash or Tyvek should not come in contact with any inner layers of clothing.

Step 13 - Inner Glove Wash

The inner gloves should be washed with a mild decontamination solution (detergent/water).

Step 14 - Inner Glove Rinse

Generously rinse inner gloves with water.

Step 15 - Face Piece Removal [?]

Remove face piece without allowing gloves to touch face. Face piece should be deposited into a container with a plastic liner.

Step 16 - Inner Glove Removal

Remove inner glove and deposit in container with plastic liner.

Step 17 - Field Wash

Wash hands and face thoroughly. If highly toxic, skin corrosive, or skin-absorbent materials are known or suspected to be present, a shower should be taken.

Level D Personal Protection Decontamination Procedure

The decontamination procedure for Level D personal protection will follow the applicable steps outlined for the Level C decontamination process.

5.6 *SAMPLING EQUIPMENT AND SAMPLE CONTAINER DECONTAMINATION*

All non-disposable sampling equipment will be decontaminated in the following manner:

- wash with a non-phosphate detergent solution (Alconox/water);
- steam clean;
- potable water rinse;
- distilled water rinse.

Before leaving the Site, all sample containers will be thoroughly decontaminated using a detergent and water solution followed by a clean water rinse. The decontamination procedure should include a complete scrubbing of the container's surface to remove possible contamination. Care must be exercised to prevent damage to sample container identification labels.

6.0 EMERGENCY RESPONSE

6.1 NOTIFICATION OF SITE EMERGENCIES

Prior to the commencement of field activities, workers at the Site, local police, local rescue personnel and Mr. David Cohen, President of the Halfmoon Bay Condominiums Association will be notified that an environmental investigation is being conducted at the facility.

In the event of an emergency, the Site Safety Officer will coordinate response activities. Appropriate authorities will then be immediately notified of the nature and extent of the emergency. Table 6-1 provides emergency telephone numbers that will be posted within the support zone or any other visible location. A map showing the most direct route to the hospital is shown in Figure 6-1.

6.2 RESPONSIBILITIES

The Site Safety Officer will be responsible for coordinating response to all emergencies. The Site Safety Officer will:

1. In the event of an emergency, notify appropriate authorities and/or health care facilities of the activities and hazards of the investigation.

2. Ensure that the following safety equipment is available at the Site: fire extinguisher, eyewash station and first aid supplies.

3. Have working knowledge of all safety equipment available at the Site.

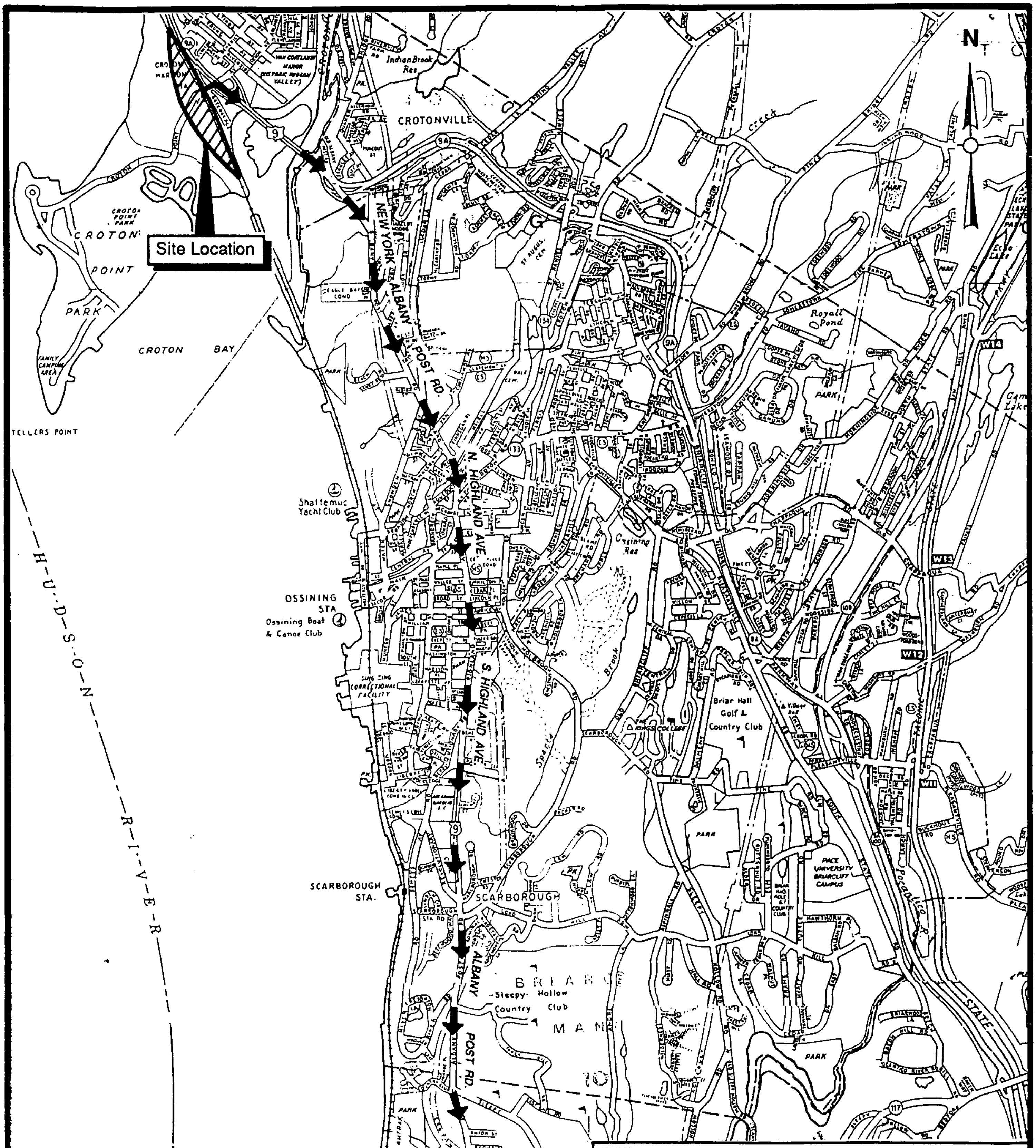
Table 6-1 Emergency Contacts and Routes

Agency	Contact	City	Tel. Number
Fire Department		Croton-on-Hudson	(914) 271-5177
Police Department		Croton-on-Hudson	(914) 271-5177
Ambulance			(914) 271-5177
Consulting Physician	Dr. Schoenfeld	Plainview, NY	(516) 822-2541
ERM Contact	Jim Perazzo	New York City	(212) 447-1900
Metro-North	Chris Bennett	New York City	(212) 340-2243
NYSDEC	Chittibabu Vasudevan	Albany, NY	(518) 457-1708
NYSDOH	Mark VanValkenberg		(518) 458-6305
WCDOH	Elizabeth Hendricks		(914) 593-5044

Medical Emergency

Name of Hospital	Phelps Memorial Hospital North Broadway North Tarrytown, NY 10591 (914) 366-3000
Route to Hospital (route map attached)	Follow Route 9 south through the Town of Ossinning and past Sleepy Hollow Country Club. Continue to Junction Route 117. Hospital is on the right side after Route 117. See attached map.

Location of Nearest Telephone - Wastewater Treatment Plant



SOURCE: Hagstrom Map

APPROX. SCALE: 0 1000 2000 3000 4000 5000 Feet; 1 Mile

TITLE

ROUTE TO HOSPITAL
HARMON RAILROAD YARD

PREPARED FOR

METRO NORTH COMMUTER RAILROAD

ERM–Northeast
Environmental Resources Management
ERM

SCALE	FIGURE
Noted	6-1
DATE June 93	

167114

4. Ensure that a map which details the most direct route to the nearest hospital shall be present with the emergency telephone numbers.

5. For a release incident, determine and communicate safe distances and places of refuge.

6.3 ACCIDENTS AND INJURIES

In the event of a safety or health emergency at the Site, appropriate emergency measures must immediately be taken to assist those who have been injured or exposed and to protect others from hazards. The Site Safety Officer will be immediately notified and will respond according to the seriousness of the injury. A Field Medical Data Sheet shown in Figure 6-2, will be completed for all field personnel prior to field work and will accompany the individual to the hospital, if warranted. The Incident/Accident Reporting Form in Figure 6-3 will be filled out by the Site Safety Officer and submitted to ERM's Health and Safety Coordinator.

6.4 SITE COMMUNICATIONS

A telephone is located at the Wastewater Treatment Plant office. It will be used as the primary off-Site communication network.

FIELD MEDICAL DATA SHEET

Name:______________________________________ Phone:________________

Address:____

Date of Birth:______________________ Height:_____ Weight:__________

Allergies:____

Particular Sensitivities:____

Do you wear contact lenses: Note: Contact lenses are not permitted on-site

List exposures to hazardous chemicals if any and resultant illness or symptoms.

____

____

____

List Medications you presently use:__________________________________

____

____

List any other Medical Restrictions:_________________________________

____

____

Special Medical or Incident Response Training:_______________________

____

Name, Address and phone number of personal physician:

____

____

____

Nearest Relative:__________________________ Phone:_____________________

___________________________________ ______________________

Employee Signature Date

Figure 6-3 Accident/Incident Report

Project______________ Project #______________

Date__________ Location____________ Manager_______________

Description of incident, including injuries, property damage and emergency action taken and personnel involved (use additional sheets if needed):

Witness of incident:

Possible or known causes:

What actions are needed to prevent a similar incident?

Reporter

Site Safety Officer

Project Manger

Health & Safety Officer

7.0 SITE-SPECIFIC HAZARD ASSESSMENT WORKING AROUND RAIL LINES

7.1 POTENTIAL RISKS

During implementation of the FI/RP field activities at the Harmon Railroad Yard, workers may be exposed to both chemical substances and physical hazards. The chemical risks have been explained in detail in the previous sections. The potential for worker exposure to hazardous substances will be significantly reduced through the use of personal protective clothing, engineering controls and implementation of safe work practices.

Potential hazards that are associated with the Site activities include injury from heavy equipment, heat stress/cold exposure, Site refuse, traffic, and overhead or underground utilities. Precautionary measures have been established to reduce these risks to a minimum during Site activities.

7.2 TRIPPING HAZARDS

An area of potential risk at the Site is the uneven ground surface which is somewhat difficult to walk on, and may pose a potential tripping hazard. Debris on the surface of the Site adds to this difficulty as do holes and crevices.

7.3 CUTS AND LACERATIONS

Field activities that involve drum handling, excavation, and sampling usually involve contact with various types of machinery. Each supervisor on Site will have up-to-date training in first aid and CPR. Personnel trained and in first aid should be prepared to take care of cuts and bruises as well as other minor injuries. A first aid kit approved by the American Red Cross will be present on-Site and available during all field activities.

7.4 *BIOLOGICAL HAZARDS*

All field team members should be aware of potentially dangerous plants, snakes, insects (bees, ticks, etc.) and animals. Snakes, animals and some insects will bite. Anyone bitten should be given immediate first aid as necessary and shall be transported to the nearest medical facility. A snake bite kit will be available in the command office. Members of the field team will be properly briefed regarding the potential for encountering wildlife and poisonous plants.

7.5 *LIFTING HAZARDS*

Improper lifting by workers is one of the leading causes of injuries. Field workers may often be required to lift heavy objects (drums, soils, equipment, etc.). Therefore, all members of the field crew will be trained in the proper methods of lifting heavy objects. All workers should be cautioned against lifting objects too heavy for one person.

7.6 *HEAVY MACHINERY/EQUIPMENT*

All Site employees must be aware of those Site activities that involve the use of heavy equipment and machinery particularly when wearing protective equipment. Respiratory protection and protective eyewear may be worn frequently during Site activities. This protective equipment significantly reduces the peripheral vision of the wearer. Therefore, it is essential that all employees at the Site exercise extreme caution during operation of equipment and machinery to avoid physical injury to themselves or others.

7.7 *BURIED HAZARDS*

Before conducting any boring work, the field team will evaluate the area for possible buried utility lines (gas and electrical). The ERM-Northeast FTL will discuss utilities with the appropriate MNCR personnel.

7.8 *SPECIAL INSTRUCTIONS FOR WORKING ON METRO-NORTH PROPERTY*

The following rules and instructions are to assist contractors in thoroughly understanding the inherent dangers of the railroad environment. Failure to follow these safety instructions could result in equipment or property damage, serious injury, or death.

All contractor employees must receive the prescribed safety instructions prior to working on Metro-North property. The contractor shall designate an individual who will be responsible at all work location to insure compliance with the Railroad Safety Rules.

7.8.1 *Glossary*

The list below defines railroad terminology that should be studied and understood. These terms are being used in subsequent sections and in the field.

1) Horizontal Clearance Point - A point 10 feet from the centerline of adjacent track.

2) Vertical Clearance Point - A point 22 feet and 6 inches above the top of a running rail unless otherwise authorized by Metro-North.

3) Conductor/Flagman - A Metro-North employee qualified on Rules of the Operating Department and qualified on the physical characteristics of the portion of the railroad involved. He is the employee qualified to protect contractor employees against the movement of trains and obtain the use of track. Each flagman will have the proper flagging equipment, up-to-date Metro-North Book of Rules, and Metro-North timetables.

4) 3rd Railman - An employee of Metro-North Power Department authorized to de-energize 3rd rail power.

5) Qualified Metro-North Employees - For the purpose of these instructions, a qualified employee is a Metro-North employee (M/W foreman, conductor/flagman. etc.), qualified to remove track or tracks from service.

6) Traffic Envelope - The area encompassed by the vertical and horizontal clearance points.

7) Obstruction - An entering of the traffic envelope, also referred to as fouling.

8) Occupancy - Any use of track other than direct crossing.

9) Operating (LIVE) Track - Any track is to be considered an operating (LIVE) track unless otherwise notified by qualified Railroad employee.

10) Right-of-Way - The limits of railroad property ownership on either side of tracks.

11) Use of Track - Obtaining permission from the proper authority at Metro-North for track occupancy.

7.8.2 *Personal Protection Devices*

Hard hats and florescent orange vests will be worn at all times when on Metro-North property. Other protective equipment such as goggles, face shields, safety belts and respirators shall be issued when required. Protective devices for hearing conversation shall be used when determined necessary.

7.8.3 *Surveying Equipment*

Measuring tape must be non-metallic to avoid shunting the signal system electric circuits. Shunting will occur when a metallic object is laid across the top of two rails of any track.

7.8.4 *Protection Against Moving Trains*

Prior to the beginning of work, it must be determined by an authorized Railroad personnel whether the tracks near the work area must be taken out of service.

1) The following conditions normally require track to be taken out-of-service:

a) Any machinery, equipment, or personnel which occupies the traffic envelope or is standing within 10 feet of the centerline of an adjacent track.

b) Any unsecured materials stored closer than 15 feet of the centerline of any track.

c) Boom-equipped construction machinery where the boom, loads, leads for pile driving, etc. may be accidentally swung into the traffic envelope or affect electrical transmission systems, electrification wires, signal-systems powers lines, electrical equipment, or communication wires.

d) Excavations under or adjacent to operating tracks, where in the opinion, of a qualified Railroad employee, the stability of tracks may be affected.

e) Any other conditions, circumstance, or situation that may present in the opinion of a qualified Railroad employee danger to the safe movement of trains.

2) When it is necessary to walk on track (only when accompanied by an appropriate Railroad employee):

a) Do not walk, step, rest foot on, or sit on rail, frog, switch, guard rail, pipe, interlocking apparatus or connection except when necessary in the performance of duty.

b) Walk through steam, smoke or other such vapor or substance only when it does not obscure the view of the walking area. Do not cross track closer than 10 feet from a standing train or standing self-propelled equipment. Never pass under, over or between it.

c) Make frequent observations in both directions.

3) When required by a conductor flagman or other qualified Metro-North employee to vacate tracks, the conductor and his employees must comply immediately.

7.8.5 *Under Running Third Rail*

1) <u>On or About 3rd Rail</u>
All 3rd rail must be considered energized (LIVE) at all times except when it is known that is has been de-energized.

2) Before any work is started, the 3rd Railman must indicate to the contractor foreman, the structure or portion of the structure on which work may be performed.

7.9 *HEAT STRESS*

Heat stress is the aggregate of environmental and physical work factors that constitute the total heat load imposed on the body. Heat strain is the series of physiological responses to heat stress. When the strain is excessive for the exposed individual, a feeling of discomfort or distress may result, and finally, a heat disorder may ensue. The severity of strain will depend not only on the magnitude of the prevailing stress, but also on the age, physical fitness, degree of acclimatization, and dehydration of the worker.

Heat disorder is a general term used to describe one or more of the following heat-related disabilities or illnesses:

- Heat cramps - painful intermittent spasms of the voluntary muscles following hard physical work in a hot environment. Cramps usually occur after heavy sweating, and often begin at the end of a work shift.

- Heat exhaustion - profuse sweating, weakness, rapid pulse, dizziness, nausea, and headache. The skin is cool and sometimes pale and clammy with sweat. Body temperature is normal or subnormal. Nausea, vomiting, and unconsciousness may occur.

- Heat stroke - sweating is diminished or absent. The skin is hot, dry, and flushed. Increased body temperature, which if uncontrolled, may lead to delirium, convulsions, coma, and even death. Medical care is urgently needed.

As many of the following control measures as are appropriate to Site conditions should be utilized to aid in controlling heat stress:

- Provide for adequate liquids to replace lost body fluids and replace water and salt lost from sweating. Encourage personnel to drink more than the amount required to satisfy thirst. Thirst satisfaction is not an accurate indicator of adequate fluid replacement.

- Replace fluids with water, commercial mixes such as Gatorade or Quick Kick, or a combination of these.

- Establish a work regiment that will provide adequate rest periods for cooling down. This may require additional shifts of works.

- Wear cooling devices such as vortex tubes or cooling vests beneath protective garments.

- Take all breaks in a cool rest area (77°F is best).

- Remove impermeable protective garments during rest periods.

- Do not assign other tasks to personnel during rest periods.

- Inform personnel of the importance of adequate rest, acclimation, and proper diet in the prevention of heat stress.

7.10 COLD STRESS

Exposure to cold weather, wet conditions and extreme wind-chill factors may result in excessive loss of body heat (hypothermia) and/or frost bite. In general, when actual or equivalent temperatures fall below 0°F, work regiments need to be modified to protect workers from cold stress. To guard against cold exposure and to prevent cold injuries, appropriate warm clothing should be worn, warm shelter must be readily available, rest periods should be adjusted as needed, and the physical conditions of on-Site field personnel should be closely monitored. Personnel and supervisors working at the Harmon Site will be made aware of the signs and symptoms of frost bite and hypothermia such as shivering, reduced blood pressure, reduced coordination, drowsiness, impaired judgement, fatigue, pupils dilated but reactive to light, and numbing of the fingers and toes.

To best prepare for working outdoors in cold weather, the following measures should be taken:

- Wear insulated cold weather clothing (i.e., long underwear, coats, gloves, hats, hard hat liners, thermal vests, etc.);
- Wear clothing in layers and loosely to create "dead air" spaces. Avoid tight-fitting garments;
- Outer garments should be "windproof" made of close weave of film-like materials;
- Cover all exposed skin. Wind chill will rapidly promote tissue freezing (frostbite);
- Protect the extremities. At the first signs of a pricking sensation or numbness, move to a location where hands and feet can be warmed;

- Keep clothing or exposed skin dry. Change garments if they become wet. This is especially true of socks and gloves;
- Keep out of the wind. Work behind wind breaks and provide them if necessary; and
- Avoid handling cold objects.

7.10.1 Signs and Symptoms

Frostbite

Early signs include a pricking sensation and/or numbness. Superficial frostbite will result in reddening of the skin and numbness possibly with water blisters. Deep freezing of tissue will result in poor to non-existent blood circulation, an initial whitening of the skin followed by cyanosis and eventually gangrene.

Trenchfoot

Caused by continuous exposure to wet or dampness without freezing. Feet swell, tingle, itch, and become painful and may be followed by blisters, superficial skin death and open sores.

Hypothermia

Caused by prolonged cold exposure and heat loss. This can be rapidly accelerated by wet skin, use of sedatives or alcohol, and inadequate clothing. Early signs are shivering and chills. This progresses to loss of manual dexterity, slurred speech, mental confusion and drowsiness. Eventually unconsciousness and death occur.

7.10.2 *Treatment*

Frostbite

In mild cases, warm the skin gradually. Do not rub with snow or expose the skin to high temperatures. Warm water (<100°F) may be suitable. In extreme cases, seek professional medical attention.

Trenchfoot

Dry feet and keep dry with dry socks and shoes. See a physician for further treatment.

Hypothermia

Move victim to warm, dry location. Remove wet garments and put on dry, warm clothing. Give the victim warm fluids or food. Do not give alcoholic beverages. Help the victim walk or move around to build up body heat.

7.11 *ADDITIONAL SAFETY PRACTICES*

The following are important safety precautions which will be enforced during this investigation:

1. Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases that probability of hand-to-mouth transfer and ingestion of material is prohibited in any area designated as contaminated.

2. Hands and face must be thoroughly washed upon leaving the work area and before eating, drinking, or any other activity.

3. Whenever decontamination procedures for outer garments are in effect, the entire body should be thoroughly washed as soon as possible after the protective garment is removed.

4. No excessive facial hair which may interfere with the effectiveness of a respirator will be permitted on personnel required to wear respiratory protection equipment. The respirator must seal against the face so that the wearer receives air only through the air purifying cartridges attached to the respirator. Fit-testing shall be performed prior to respirator use to ensure a proper seal is obtained by the wearer.

5. Contact with potentially contaminated surfaces should be avoided whenever possible. One should not walk through puddles, mud, or other discolored surfaces; kneel on ground; lean, sit or place equipment on drums, containers, vehicles, or the ground.

6. Medicine and alcohol can enhance the effect from exposure to certain compounds. Prescribed drugs and alcoholic beverages should not be consumed by personnel involved in the project.

7. Personnel and equipment in the work areas should be minimized, consistent with effective Site operations.

8. Work areas for various operational activities should be established.

9. Procedures for leaving the work area must be planned and implemented prior to going to the Site. Work areas and decontamination procedures must be established on the basis of prevailing Site conditions.

10. Respirators will be issued for the exclusive use of one worker and will be cleaned and disinfected after each use.

11. Safety gloves and boots shall be taped to the disposable, chemical-protective suits as necessary.

12. All unsafe equipment left unattended will be identified by a "DANGER, DO NOT OPERATE" tag.

13. Noise mufflers or ear plugs may be required for all Site personnel working around heavy equipment. This requirement will be at the discretion of the Site Safety Officer. Disposable, form-fitting plugs are preferred.

14. Cartridges on air-purifying respirators that are in active use will be changed daily at a minimum.

8.0 PROCEDURES FOR PROTECTING THIRD PARTIES

8.1 ERM EMPLOYEES AND SUBCONTRACTORS

ERM will be responsible for monitoring the health and safety practices of ERM employees. ERM employs subcontractors that are trained and competent to perform the scheduled tasks. ERM subcontractors are required to provide documentation regarding applicable regulatory compliance as discussed in Section 3.0 of this document. The subcontractors will be presented with a copy of this plan, and certification of receipt and understanding of its content will be procured by ERM prior to the start of the field program.

ERM will require additional contractual agreements with MNCR to monitor the activities of personnel other than ERM employees.

8.2 PUBLIC AND OTHER PERSONNEL

ERM will perform periodic and routine monitoring during Site operations to determine the concentration of compounds in the breathing zone. If warranted, ERM will monitor the perimeter of the work Site to determine contaminant levels in the ambient air that may affect off-Site personnel. ERM will evaluate appropriate measures to reduce the risk of hazard to off-site personnel whenever Level C personal protective equipment is employed during Site operations. ERM will evaluate and affect appropriate corrective measures as necessary to reduce the risk of chemical hazard to off-Site personnel.

Site control procedures are reuired to protect those persons unaware of on-Site hazards. However, since the Harmon Railroad Yard is an active facility, Site control procedures will enforced only on the area immediately surrounding the ongoing drilling or sampling activities. Such site controls will consist of traffic cones to guide Site traffic and restrict access by unauthorized personnel.

Appendix C

Boring Logs

LAND TECH REMEDIAL, INC.

SOIL BORING/WELL LOG NO. MW-1

PROJECT NAME: AET/Metro North Harmon Yard PROJECT NO: 10247 PAGE 1

PROJECT LOCATION: Outdoor Storage Area PERMIT NO: N/A

BORING LOCATION: Just N. of west side storage racks DATE COMPLETED: 8/14/90

DRILLING EQUIPMENT: Mobil B-51 DRILLMASTER: K. McSherry COMPLETED DEPTH: 21 ft. (boring) 17 ft. (well)

DRILLING METHOD: Rotary Auger STAFF GEOLOGIST: Jeff Brown

SAMPLE & TYPE	DEPTH/FT	SOIL DESCRIPTION	BLOWS PER 6"	PID
	0 - 1	asphalt overlying grey medium grey angular gravel		
	1 - 2	d. brown medium-coarse SAND, little f. gravel		
	2 - 3.5	brown fine-medium, SAND, trace fine gravel, trace silt		
	3.5 - 5	grey fine SAND, little silt		
	5 - 13	lt. brown fine SAND, trace (-) silt		
Split-spoon (MW-1-5'	5' - 7'	fine micaceous SAND		
Split-spoon MW-1=10'	10' - 12'	grey fine-medium SAND	2/2/3/3	
	13 - 21	grey fine-medium SAND		

MONITORING WELL CONSTRUCTION

TYPE:
Flush to grade overburden well

WELL ELEVATION:

REFERENCE POINT:
North side top of PVC casing

DIAMETER:
4-inch

SCREEN:
15' of .020 slot threaded PVC

CASING:
2' solid PVC riser

WELL PACK:
#2 coefficient was filter gravel

Type of Sample:

REMARKS:

1) Hydrocarbon (fuel) odor first noted in samples from 2'
2) Odor noted at 7' internal in split spoon sample
3) Moist with fuel at 9'
4) Lost approx. 3.5 feet of boring to collapse of fine sands

GROUNDWATER OBSERVATIONS

Ground water observed at 10 -11' below grade

LAND TECH REMEDIAL, INC.

SOIL BORING/WELL LOG NO. MW-2

PROJECT NAME: AET/Metro North Harmon Yard — PROJECT NO: 10247 — PAGE 1

PROJECT LOCATION: outdoor storage area — PERMIT NO: N/A

BORING LOCATION: west of fuel line just south of elevated road — DATE COMPLETED: 8/14/90

DRILLING EQUIPMENT: Mobil B-51 — DRILLMASTER: K. McSherry — COMPLETED DEPTH: 20 ft. (boring) 17 ft. (well)

DRILLING METHOD: Rotary Auger — STAFF GEOLOGIST: J. Brown

SAMPLE & TYPE	DEPTH/FT	SOIL DESCRIPTION	BLOWS PER 6"	PID	MONITORING WELL CONSTRUCTION
					TYPE:
	0 - 4"	asphalt			Flush to grade overburden well
					WELL ELEVATION:
	4" - 1'	angular medium GRAVEL			
	1' - 2.5	dark brown, fine-coar. SAND, some f-m sbrnd gravel			**REFERENCE POINT:** North side top of PVC casing
	2.5 - 4	light brown, fine-medium SAND, trace fine gravel			
					DIAMETER: 4-inch
	4 - 5.5	fine-coarse light brown SAND, little f-m gravel			
	5.5 - 20	fine (some medium) grey/brown SAND, trace (-) fine gravel			**SCREEN:** 15' of .020 slot threaded PVC
					CASING:
					2' of solid PVC ri
					WELL PACK: #2 coefficient washed filter gra

Type of Sample:

REMARKS:

1) slight product odor at 2 feet

2) continuous fuel odor from 5'

3) moist with fuel at 9'

GROUNDWATER OBSERVATIONS

Ground water observed at approx. 9.5 - 1- feet below grade.

LAND TECH REMEDIAL, INC.

SOIL BORING/WELL LOG NO. MW-3

PROJECT NAME: AET/Metro North Harmon Yard
PROJECT NO: 10247
PAGE /
PROJECT LOCATION: outdoor storage area
PERMIT NO: N/A
BORING LOCATION: just N. of past side storage racks
DATE COMPLETED: 8/14/90
DRILLING EQUIPMENT: Mobil B-51
DRILLMASTER: K. McSherry
COMPLETED DEPTH: 20 ft. (boring) 20 ft. (well)
DRILLING METHOD: Rotary Auger
STAFF GEOLOGIST: J. Brown

SAMPLE & TYPE	DEPTH/FT	SOIL DESCRIPTION	BLOWS PER 6"	PID
	0 - 1'	asphalt overlying angular medium gravel		
	1' - 2'	d. brown/black f-c SAND, some (-) f gravel		
	2 - 7'	brown/lt brown f-c SAND, trace f gravel		
	7 - 12'	grey f-med SAND, trace f. gravel		
	12 - 20'	grey f-med SAND, little coarse SAND		

MONITORING WELL CONSTRUCTION

TYPE:
Flush to grade overburden well

WELL ELEVATION:

REFERENCE POINT:
North side top of PVC casing

DIAMETER:
4- inch

SCREEN:
15' of .020 slot threaded PVC

CASING:
5' of solid PVC ri

WELL PACK:
#2 coefficient was filter gravel

Type of Sample:

REMARKS:
1) product odor from 4 feet
2) moist with fuel at 9'

GROUNDWATER OBSERVATIONS
Approx. 9 - 10 feet below grade

LAND TECH REMEDIAL, INC.

SOIL BORING/WELL LOG NO. MW-4

PROJECT NAME: AET/Metro North Harmon Yard | PROJECT NO: 10247 | PAGE /

PROJECT LOCATION: outdoor storage area | PERMIT NO:

BORING LOCATION: E. of supply line, just W. of ramp | DATE COMPLETED: 8/15/90

DRILLING EQUIPMENT: Mobile B-51 | DRILLMASTER: K. McSherry | COMPLETED DEPTH: 20 ft. (boring) 20 ft. (well)

DRILLING METHOD: Rotary Auger | STAFF GEOLOGIST: J. Brown

SAMPLE & TYPE	DEPTH/FT	SOIL DESCRIPTION	BLOWS PER 6"	PID	MONITORING WELL CONSTRUCTION
					TYPE:
	0 - 1'	asphalt and grey angular medium gravel			Flush to grade overburden well
					WELL ELEVATION:
	1 - 2'	d. brown/black f-c SAND, little f. gravel			
	2 - 14'	light brown f-m SAND, trace (+) f. gravel			REFERENCE POINT: North side top of PVC casing
	8'	color change to grey			DIAMETER: 4-inch
	14 - 20'	(slight coarsening) grey f-m SAND, some (-) coar. SAND			SCREEN: 15' of .020 slot threaded PVC
					CASING: 5' of solid PVC ri
					WELL PACK: #2 coefficient wash filter gravel

Type of Sample:

REMARKS:

1) Fuel odor noted at 6'
2) Moist with fuel at 9'

GROUNDWATER OBSERVATIONS

Approx. 10 feet below grade

MUESER RUTLEDGE CONSULTING ENGINEERS

BORING LOG

BORING NO. 201
SHEET 1 OF 4
FILE NO. 7860
SURFACE ELEV. 13.4
RES. ENGR. DAN SELIGMANN

PROJECT: CROTON PT. AVENUE BRIDGE REPLACEMENT
LOCATION: CROTON-ON-HUDSON, NEW YORK

DAILY PROGRESS	SAMPLE NO.	SAMPLE DEPTH	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION	STRATA	DEPTH	CASING BLOWS	REMARKS
13:00	1D	0.5	12-9	Brown fine to coarse sand, some gravel,				0-5": Asphalt
11-30-92 Monday		2.5	10-11	silt, tr wood, asphalt, cinders (Fill) (SM)				pavement.
Sunny	2D	2.5	8-7	Light brown fine to coarse sand, some				Augered 0-10.0'.
50°F		4.5	2-3	cinders, silt, trace gravel (Fill) (SM)	F			
13:30						5		
08:30	3D	5.0	4-4	Brown fine to coarse sand, some gravel,				3D: Petroleum
12-01-92		7.0	3-2	silt, trace cinders (Fill) (SM)		7		odor.
Tuesday	4D	7.0	5-4	Brown fine to coarse sand, trace gravel, silt				
Sunny		9.0	6-5	(SP-SM)				Placed casing
40°F						10		to 10.0'.
	5D	10.0	5-5	Brown fine to coarse sand, some gravel,				5D: Saturated
		12.0	4-5	trace silt (SP)				sample.
						15		
	6D	15.0	12-4	Gray fine to coarse sand, some gravel,	S2			
		17.0	4-4	trace silt (SP)				Drilled with
								mud 10.0'-125.0'.
	7D	19.0	13-11	Do 6D (SP)		20		
		21.0	10-11					
	8D	24.0	19-15	Do 6D (SP)		25		
		26.0	15-17					
						27.5		
	9D	29.0	19-17	Gray brown fine sand, trace silt, mica		30		
		31.0	17-20	(SP-SM)				
	10D	34.0	17-20	Gray brown fine sand, some silt, trace		35		
		36.0	31-34	mica (SM)				
	11D	39.0	18-29	Do 10D (SM)		40		
		41.0	32-37		S3			
						45		
	12D	45.0	15-19	Gray brown silty fine sand, some clay layers				
16:30		47.0	23-27	(SM)&(CL)				
08:30								
12-02-92								
Wednesday						50		
Cloudy								
40°F								

BORING LOG

BORING NO.	201
SHEET 2 OF	4
FILE NO.	7860
SURFACE ELEV.	13.4
RES. ENGR.	DAN SELIGMANN

PROJECT: CROTON PT. AVENUE BRIDGE REPLACEMENT
LOCATION : CROTON-ON-HUDSON, NEW YORK

DAILY PROGRESS	SAMPLE NO.	SAMPLE DEPTH	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION	STRATA	DEPTH	CASING BLOWS	REMARKS
Cont'd	13D	50.0	23-24	Gray brown fine sand, some silt, trace mica				
12-02-92		52.0	31-34	(SM)				
Wednesday								
Cloudy								
40°F						55		
	14D	55.0	28-37	Gray brown silty fine sand, trace mica (SM)				
		57.0	49-52					
						60		
	15D	60.0	32-61	Gray brown fine sandy silt, interlayered with				
		62.0	75-100	fine sand, some silt (ML)&(SM)				
						65		
	16D	65.0	35-52	Gray brown fine sand, some silt, trace clay				
		67.0	61-77	layers, mica (SM)				
						70		
	17D	70.0	41-57	Gray brown fine sand, some silt,				
		71.8	65-100/3"	interlayered with fine sandy silt, trace clay	S3			
				layers, mica (SM)&(ML)				
						75		
	18D	75.0	32-54	Gray brown silty fine sand varved with silt				
		77.0	69-88	(SM)&(ML)				
						80		
	19D	80.0	25-41	Gray brown silty fine sand. varved with				
		82.0	53-60	trace silt (SM)				
						85		
	20D	85.0	30-39	Gray brown fine sand, some silt, trace silt				
		87.0	49-61	layers (SM)				
						90		
	21D	90.0	45-59	Gray brown silt, some fine sand, trace clay				
		92.0	62-72	layers, mica (ML)				
						95		
	22D	95.0	39-50	Gray brown fine sandy silt, trace clay				
		97.0	57-69	layers, mica (ML)				
						100		

BORING LOG

BORING NO.	201
SHEET 3 OF	4
FILE NO.	7860
SURFACE ELEV.	13.4
RES. ENGR.	DAN SELIGMANN

PROJECT: CROTON PT. AVENUE BRIDGE REPLACEMENT

LOCATION : CROTON-ON-HUDSON, NEW YORK

DAILY PROGRESS	SAMPLE NO.	SAMPLE DEPTH	BLOWS/6"	SAMPLE DESCRIPTION	STRATA	DEPTH	CASING BLOWS	REMARKS
Cont'd	23D	100.0	49-56	Gray brown fine sand, trace silt, gravel, silt				
12-02-92		102.0	58-72	seams (SP-SM)				
Wednesday								
Cloudy								
40°F						105		
	24D	105.0	46-49	Gray brown fine sand, trace silt, silt seams				
		107.0	59-68	(SP-SM)	S3			
						110		
	25D	110.0	35-51	Do 24D, trace clay seams (SP-SM)				
		112.0	62-77					
						113		
						115		
	26D	115.0	30-42	Gray silt, some fine sand, trace clay layers				
		117.0	55-61	(ML)				
						120		
	27D	120.0	20-29	Do 26D (ML)	M			
		122.0	43-50					
						125		
	28D	125.0	25-31	Do 26D (ML)				End of Boring at
15 00		127.0	39-53			127		127.0'.
					127			Grouted upon
								completion.
						130		
						135		
						140		
						145		
						150		

BORING NO. 201

BORING NO. 201
SHEET 4 OF 4
FILE NO. 7860
SURFACE ELEV. 13.4
DATUM U.S.G.S. (MSL)

PROJECT CROTON PT. AVENUE BRIDGE REPLACEMENT
LOCATION CROTON-ON-HUDSON, NEW YORK
BORING LOCATION N 433738, E 623054

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG
TRUCK ACKER SOIL MAX
SKID
BARGE
OTHER

TYPE OF FEED DURING CORING
MECHANICAL
HYDRAULIC
OTHER

CASING USED [X] YES [ ] NO
DIA., IN. 5 DEPTH, FT. FROM 0 TO 10
DIA., IN. DEPTH, FT. FROM TO
DIA., IN. DEPTH, FT. FROM TO

DRILLING MUD USED [X] YES [ ] NO
DIAMETER OF ROTARY BIT, IN. 3-7/8" ROLLER BIT
TYPE OF DRILLING MUD QUIK GEL
AUGER USED [X] YES [ ] NO
TYPE AND DIAMETER, IN. 4" 1D HOLLOW STEM

TYPE AND SIZE OF:
D-SAMPLER 2" O.D. SPLIT SPOON
U-SAMPLER
S-SAMPLER
CORE BARREL
CORE BIT
DRILL RODS NW

CASING HAMMER, LBS. 300 AVERAGE FALL, IN. 24
SAMPLER HAMMER, LBS. 140 AVERAGE FALL, IN. 30

WATER LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO WATER	CONDITIONS OF OBSERVATION
					NOT RECORDED

PIEZOMETER INSTALLED [ ] YES [X] NO SKETCH SHOWN ON

STANDPIPE: TYPE ID, IN. LENGTH, FT. TOP ELEV.
INTAKE ELEMENT: TYPE OD, IN. LENGTH, FT. TIP ELEV.
FILTER: MATERIAL OD, IN. LENGTH, FT. BOT. ELEV.

PAY QUANTITIES

2.5" DIA. DRY SAMPLE BORING LIN. FT. 127
3.5" DIA. U-SAMPLE BORING LIN. FT.
CORE DRILLING IN ROCK LIN. FT.
NO. OF 2" SHELBY TUBE SAMPLES
NO. OF 3" UNDISTURBED SAMPLES
OTHER:

BORING CONTRACTOR SOIL TESTING INC.
DRILLER KEVIN BONACUM HELPERS ERIK DELPRIORE
REMARKS BORING GROUTED UPON COMPLETION.
RESIDENT ENGINEER DAN SELIGMANN DATE 12-2-92

BORING LOG

PROJECT:	CROTON PT. AVENUE BRIDGE REPLACEMENT
LOCATION :	CROTON-ON-HUDSON, NEW YORK

BORING NO.	202
SHEET 1 OF	4
FILE NO.	7860
SURFACE ELEV.	15.0
RES. ENGR.	DAN SELIGMANN

DAILY PROGRESS	SAMPLE NO.	SAMPLE DEPTH	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION	STRATA	DEPTH	CASING BLOWS	REMARKS
09:30								Hand augered
12-03-92					F			0-5.0'.
Thursday						3		0-3.0': Fill - Brown
Sunny								fine to coarse sand,
30°F						5		trace gravel, silt
	1D	5.0	7-8	Light brown medium to fine sand, trace silt,	S1			(SP-SM)
		7.0	7-7	gravel, coarse sand (SP-SM)		7		Augered from
	2D	7.0	6-8	Gray fine to coarse sand, trace gravel, silt				5.0'-10.0'
		9.0	8-7	(SP-SM)				Drilled ahead of
						10		casing 10-15.0'.
	3D	10.0	10-12	Gray fine to coarse sand, some gravel,	S2			3D: Strong
11:00		12.0	15-15	trace silt (SP)				petroleum odor.
08:00						13		
12-04-92								
Friday						15		
Sunny	4D	15.0	25-27	Gray brown fine sand, some silt, trace fine				4D-10D: Petroleum
30°F		17.0	18-17	sandy silt seams, mica (SM)				odor.
								Drilled with mud
								15.0'-125.0'.
						20		
	5D	20.0	8-9	Gray brown fine to medium sand, trace silt,				
		22.0	7-7	mica (SP-SM)				
						25		
	6D	25.0	7-9	Gray brown fine sand, trace silt, mica				
		27.0	7-8	(SP-SM)				
						30		
	7D	30.0	23-25	Do 6D, trace silt pockets (SP-SM)				
		32.0	27-25		S3			
						35		
	8D	35.0	12-15	Do 7D (SP-SM)				
		37.0	24-29					
						40		
	9D	40.0	15-17	Do 7D (SP-SM)				
		42.0	23-31					
						45		
	10D	45.0	19-24	Do 7D (SP-SM)				
		47.0	29-35					
						50		

BORING LOG

BORING NO.	202
SHEET 2 OF	4
FILE NO.	7860
SURFACE ELEV.	15.0
RES. ENGR.	DAN SELIGMANN

PROJECT: CROTON PT. AVENUE BRIDGE REPLACEMENT
LOCATION : CROTON-ON-HUDSON, NEW YORK

DAILY PROGRESS	SAMPLE NO.	SAMPLE DEPTH	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION	STRATA	DEPTH	CASING BLOWS	REMARKS
Cont'd	11D	50.0	12-18	Do 7D (SP-SM)				
12-04-92		52.0	22-25					
Friday								
Sunny								
30°F						55		
	12D	55.0	16-21	Gray brown fine sand, trace silt, mica with				
		57.0	29-32	some silty fine sand layers (SP-SM) & (SM)				
						60		
	13D	60.0	14-24	Gray brown fine sand, some silt, trace silt				
		62.0	29-38	seams, mica (SM)				
						65		
	14D	65.0	18-29	Gray brown fine sand, some silt, trace silt				
		67.0	30-31	seams (SM)				
						70		
	15D	70.0	20-31	Gray brown fine sand, trace silt, silt seams				
		72.0	44-29	(SP-SM)				
					S3	75		
	16D	75.0	19-28	Gray brown silty fine sand, trace silt seams				
		77.0	37-45	(SM)				
						80		
	17D	80.0	25-36	Do 16D, trace clay layers (SM)				
		82.0	39-48					
						85		
	18D	85.0	20-31	Gray brown fine sand, some silt, trace silt				
		87.0	43-37	seams, clay seams (SM)				
						90		
	19D	90.0	30-38	Gray brown silty fine sand, some silt layers,				
		92.0	42-30	trace clay layers (SM)&(ML)				
						95		
	20D	95.0	29-36	Gray brown silty fine sand (SM)				
		97.0	40-41					
						100		
16:00								

BORING NO. 202

BORING LOG

PROJECT: CROTON PT. AVENUE BRIDGE REPLACEMENT
LOCATION : CROTON-ON-HUDSON, NEW YORK

BORING NO. 202
SHEET 3 OF 4
FILE NO. 7860
SURFACE ELEV. 15.0
RES. ENGR. DAN SELIGMANN

DAILY PROGRESS	SAMPLE NO.	SAMPLE DEPTH	BLOWS/6"	SAMPLE DESCRIPTION	STRATA	DEPTH	CASING BLOWS	REMARKS
08:30 12-07-92 Monday Sunny and Windy 30°F	21D	100.0 102.0	32-36 40-45	Gray brown fine sand, trace silt, clay layers, silt seams (SP-SM)	S3	105		
	22D	105.0 107.0	28-36 40-43	Gray brown fine sand, trace silt, clay pockets, silt pockets (SP-SM)		108 110		
	23D	110.0 112.0	32-34 36-39	Gray silt, some micaceous fine sand, clay layers (ML)&(CL)	M	115		PP=Pocket Penetrometer Compressive Strength.
	24D	115.0 117.0	31-36 39-42	Gray silt, some micaceous fine sand, interlayered with fine sand, some silt, trace mica (ML)&(SM)		120		
	25D	120.0 122.0	15-19 21-26	Stiff gray silty clay varved with clayey silt, trace fine sand (CL)&(ML)		125		PP=2.0 TSF
12.30	26D	125.0 127.0	16-23 25-27	Do 25D (CL)&(ML)	127	127		End of Boring at 127.0'. Grouted upon completion.
						130		
						135		
						140		
						145		
						150		

BORING NO. 202

MUESER RUTLEDGE CONSULTING ENGINEERS

PROJECT	CROTON PT. AVENUE BRIDGE REPLACEMENT	BORING NO.	202
LOCATION	CROTON-ON-HUDSON, NEW YORK	SHEET	4 OF 4
BORING LOCATION	N. 433935, E. 623191	FILE NO.	7860
		SURFACE ELEV.	15.0
		DATUM	U.S.G.S. (MSL)

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG
- TRUCK: ACKER SOIL MAX
- SKID:
- BARGE:
- OTHER:

TYPE OF FEED DURING CORING
- MECHANICAL:
- HYDRAULIC:
- OTHER:

CASING USED [X] YES [ ] NO

DIA., IN.	DEPTH, FT. FROM	TO
5	0	15

DRILLING MUD USED [X] YES [ ] NO
DIAMETER OF ROTARY BIT, IN. 4-3/4" ROLLER BIT
TYPE OF DRILLING MUD QUIK GEL
AUGER USED [X] YES [ ] NO
TYPE AND DIAMETER, IN. 4" ID HOLLOW STEM

TYPE AND SIZE OF:
- D-SAMPLER: 2" O.D. SPLIT SPOON
- U-SAMPLER:
- S-SAMPLER:
- CORE BARREL:
- CORE BIT:
- DRILL RODS: NW

CASING HAMMER, LBS. 300 AVERAGE FALL, IN. 24
SAMPLER HAMMER, LBS. 140 AVERAGE FALL, IN. 30

WATER LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO WATER	CONDITIONS OF OBSERVATION
					NOT RECORDED

PIEZOMETER INSTALLED [ ] YES [X] NO SKETCH SHOWN ON

STANDPIPE:	TYPE		ID, IN.		LENGTH, FT.		TOP ELEV.	
INTAKE ELEMENT:	TYPE		OD, IN.		LENGTH, FT.		TIP ELEV.	
FILTER:	MATERIAL		OD, IN.		LENGTH, FT.		BOT. ELEV.	

PAY QUANTITIES

2.5" DIA. DRY SAMPLE BORING	LIN. FT.	127	NO. OF 2" SHELBY TUBE SAMPLES	
2.5" DIA. U-SAMPLE BORING	LIN. FT.		NO. OF 3" UNDISTURBED SAMPLES	
CORE DRILLING IN ROCK	LIN. FT.		OTHER: HAND AUGER 5'	1/2 HOUR

BORING CONTRACTOR SOIL TESTING INC.
DRILLER KEVIN BONACUM HELPERS ERIK DELPRIORE / RALPH DESTEFANO
REMARKS BORING GROUTED UPON COMPLETION.
RESIDENT ENGINEER DAN SELIGMANN DATE 12-7-92

BORING NO. 202

MUESER RUTLEDGE CONSULTING ENGINEERS
BORING LOG

BORING NO. 202A
SHEET 1 OF 2
FILE NO. 7860
SURFACE ELEV. 15.0
RES. ENGR. DAN SELIGMANN

PROJECT: CROTON PT. AVENUE BRIDGE REPLACEMENT
LOCATION : CROTON-ON-HUDSON, NEW YORK

DAILY PROGRESS	SAMPLE NO.	SAMPLE DEPTH	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION	STRATA	DEPTH	CASING BLOWS	REMARKS
10:00								Drilled with augers
11-30-92								0-5.0'.
Monday					F			
Sun., 50°F								
10:30						5		Hit water line at
					5			5.0' and abandoned
								boring.
						10		
						15		
						20		
						25		
						30		
						35		
						40		
						45		
						50		

MUESER RUTLEDGE CONSULTING ENGINEERS

BORING NO. 202A
SHEET 2 **OF** 2
FILE NO. 7860
SURFACE ELEV. 15.0
DATUM U.S.G.S. (MSL)

PROJECT CROTON PT. AVENUE BRIDGE REPLACEMENT
LOCATION CROTON-ON-HUDSON, NEW YORK
BORING LOCATION AS PER BORING LOCATION PLAN

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG
TRUCK CME-75
SKID
BARGE
OTHER

TYPE OF FEED DURING CORING
MECHANICAL
HYDRAULIC
OTHER

CASING USED [ ] YES [X] NO
DIA., IN. ____ DEPTH, FT. FROM ____ TO ____
DIA., IN. ____ DEPTH, FT. FROM ____ TO ____
DIA., IN. ____ DEPTH, FT. FROM ____ TO ____

DRILLING MUD USED [ ] YES [X] NO
DIAMETER OF ROTARY BIT, IN.
TYPE OF DRILLING MUD

TYPE AND SIZE OF:
D-SAMPLER 2" O.D. SPLIT SPOON
U-SAMPLER
S-SAMPLER
CORE BARREL
CORE BIT
DRILL RODS N

AUGER USED [X] YES [ ] NO
TYPE AND DIAMETER, IN. 2-1/2" ID HOLLOW STEM

CASING HAMMER, LBS. ____ AVERAGE FALL, IN. ____
SAMPLER HAMMER, LBS. 140 AVERAGE FALL, IN. 30

WATER LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO WATER	CONDITIONS OF OBSERVATION
					NOT RECORDED

PIEZOMETER INSTALLED [ ] YES [X] NO SKETCH SHOWN ON

STANDPIPE: TYPE ____ ID, IN. ____ LENGTH, FT. ____ TOP ELEV. ____
INTAKE ELEMENT: TYPE ____ OD, IN. ____ LENGTH, FT. ____ TIP ELEV. ____
FILTER: MATERIAL ____ OD, IN. ____ LENGTH, FT. ____ BOT. ELEV. ____

PAY QUANTITIES

2.5" DIA. DRY SAMPLE BORING LIN. FT. ____
3.0" DIA. U-SAMPLE BORING LIN. FT. ____
CORE DRILLING IN ROCK LIN. FT. ____

NO. OF 2" SHELBY TUBE SAMPLES ____
NO. OF 3" UNDISTURBED SAMPLES ____
OTHER: ____

BORING CONTRACTOR SOIL TESTING INC.
DRILLER DAVE DEANGELIS HELPERS RALPH DESTEFANO
REMARKS ABANDONED ON WATER LINE AT 5.0'.
RESIDENT ENGINEER DAN SELIGMANN DATE 11-30-92

MUESER RUTLEDGE CONSULTING ENGINEERS
BORING LOG

BORING NO. 203A
SHEET 1 OF 4
FILE NO. 7860
SURFACE ELEV. 15.0
RES. ENGR. DAN SELIGMANN

PROJECT: CROTON PT. AVENUE BRIDGE REPLACEMENT
LOCATION : CROTON-ON-HUDSON, NEW YORK

DAILY PROGRESS	SAMPLE NO.	SAMPLE DEPTH	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION	STRATA	DEPTH	CASING BLOWS	REMARKS
09:15								Hand augered
12-03-92					F			0-6.0'.
Thursday	1D	2.0	Auger	Light brown fine to medium sand, trace silt		3		0-2.0': Fill - Brown
Sunny		3.0	Sample	(Fill) (SP-SM)				fine to medium sand,
30°F						5		some gravel, silt,
								cinders (SM)
	2D	6.0	4-3	Light brown fine to medium sand, trace silt,				Drilled ahead of
		8.0	3-4	gravel, coarse sand (SP-SM)	S1			casing 6.0'-15.0'.
	3D	8.0	5-4	Gray and light brown fine to medium sand,				2D & 3D: Strong
		10.0	3-4	trace silt, gravel, coarse sand (SP-SM)		10		petroleum odor.
	4D	10.0	5-7	Gray fine to medium sand, trace silt, coarse				4D-6D: Slight
		12.0	6-9	sand (SP-SM)				petroleum odor.
						13		
						15		Drilled with mud
	5D	15.0	8-7	Gray fine to coarse sand, some gravel,				15.0'-125.0'.
		17.0	7-6	trace silt (SP)				
						20		
	6D	20.0	10-8	Gray brown fine to coarse sand, trace silt,				
13:00		22.0	9-7	gravel (SP)				
08:30								
2-04-92								
Friday					S2	25		
Sunny	7D	25.0	8-12	Gray brown fine to medium sand, trace silt,				
30°F		27.0	14-13	coarse sand (SP)				
						30		
	8D	30.0	10-11	Gray brown fine to medium sand, trace silt,				
		32.0	15-13	mica (SP-SM)				
						35		
	9D	35.0	10-9	Do 8D (SP-SM)				
		37.0	11-10					
						40		
	10D	40.0	8-10	Do 8D, trace coarse sand (SP-SM)				
		42.0	9-10					
						43		
						45		
	11D	45.0	11-13	Gray brown fine sand, some silt, trace mica				
		47.0	12-14	and fine sandy silt (SM)&(ML)	S3			
						50		

MUESER RUTLEDGE CONSULTING ENGINEERS

BORING LOG

BORING NO. 203A
SHEET 2 OF 4
FILE NO. 7860
SURFACE ELEV. 15.0
RES. ENGR. DAN SELIGMANN

PROJECT: CROTON PT. AVENUE BRIDGE REPLACEMENT
LOCATION : CROTON-ON-HUDSON, NEW YORK

DAILY PROGRESS	SAMPLE NO.	SAMPLE DEPTH	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION	STRATA	DEPTH	CASING BLOWS	REMARKS
Cont'd	12D	50.0	12-15	Gray brown silty fine sand, some clay layers, silt layers (SM)&(CL)				
12-04-92		52.0	14-18					
Friday								
Sunny								
30°F						55		
	13D	55.0	10-10	Gray brown fine sand, trace silt varved with some silt, trace mica (SP-SM) & (ML)				
		57.0	14-16					
						60		
	14D	60.0	11-12	Gray brown fine sand, some silt, trace silt layers, mica (SM)				
		62.0	14-15					
						65		
	15D	65.0	12-14	Gray brown fine sand, some silt, silty fine sand pockets, mica (SM)				
		67.0	19-19					
						70		
	16D	70.0	13-13	Gray brown fine sand, some silt (SM)				
		72.0	18-21					
					S3			
						75		
	17D	75.0	16-18	Gray brown fine sand, some silt varved with fine sandy silt (SM)&(ML)				
		77.0	22-22					
						80		
	18D	80.0	18-20	Gray brown silty fine sand interlayered with silt, some fine sand, trace mica (SM)&(ML)				
		82.0	21-23					
						85		
	19D	85.0	14-21	Gray brown silty fine sand varved with clayey silt (SM)&(ML)				
		87.0	25-25					
						90		
	20D	90.0	17-20	Do 19D (SM)&(ML)				
		92.0	24-29					
						93.5		
						95		
	21D	95.0	4-6	Stiff gray silty clay varved with some silt, trace fine sand (CL)&(ML)				
		97.0	20-24					
					M			Hard drilling at 98.0'.
						100		

BORING NO. 203A

BORING LOG

BORING NO. 203A
SHEET 3 OF 4
FILE NO. 7860
SURFACE ELEV. 15.0
RES. ENGR. DAN SELIGMANN

PROJECT: CROTON PT. AVENUE BRIDGE REPLACEMENT
LOCATION : CROTON-ON-HUDSON, NEW YORK

DAILY PROGRESS	SAMPLE NO.	SAMPLE DEPTH	BLOWS/6"	SAMPLE DESCRIPTION	STRATA	DEPTH	CASING BLOWS	REMARKS
Cont'd	22D	100.0	27-36	Gray fine sand, some silt, trace silt pockets,				
12-04-92		102.0	31-29	mica (SM)				
Friday								
Sunny								
30°F						105		
	23D	105.0	22-34	Gray fine sand, some silt, trace fine sandy				
		107.0	41-50	silt pockets, mica (SM)				
						110		
	24D	110.0	28-32	Gray fine sand, some silt varved with silty				
		112.0	43-47	clay (SM)&(CL)				
					M			
						115		
	25D	115.0	25-31	Gray silty fine sand, trace clay layers (SM)				
		117.0	39-38					
						120		
	26D	120.0	19-25	Gray brown fine sandy silt varved with				
		122.0	31-40	some silty clay (ML)&(CL)				
						125		
	27D	125.0	24-31	Gray brown fine sandy silt varved with silty				End of Boring at
15:30		127.0	36-39	clay (ML)&(CL)		127		127.0'.
					127			Grouted upon
								completion.
						130		
						135		
						140		
						145		
						150		

BORING NO. 203A
SHEET 4 OF 4
FILE NO. 7860
SURFACE ELEV. 15.0
DATUM U.S.G.S. (MSL)

PROJECT CROTON PT. AVENUE BRIDGE REPLACEMENT
LOCATION CROTON-ON-HUDSON, NEW YORK
BORING LOCATION N. 434265, E. 623388

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG
TRUCK DIETRICH D120
SKID
BARGE
OTHER

TYPE OF FEED DURING CORING
MECHANICAL
HYDRAULIC
OTHER

CASING USED [X] YES [ ] NO
DIA., IN. 5 DEPTH, FT. FROM 0 TO 15
DIA., IN. DEPTH, FT. FROM TO
DIA., IN. DEPTH, FT. FROM TO

DRILLING MUD USED [X] YES [ ] NO
DIAMETER OF ROTARY BIT, IN. 4-7/8" AND 3-3/8" ROLLER BITS
TYPE OF DRILLING MUD E-Z MUD
AUGER USED [ ] YES [X] NO
TYPE AND DIAMETER, IN.

TYPE AND SIZE OF:
D-SAMPLER 2" O.D. SPLIT SPOON
U-SAMPLER
S-SAMPLER
CORE BARREL
CORE BIT
DRILL RODS NW

CASING HAMMER, LBS. 300 AVERAGE FALL, IN. 24
SAMPLER HAMMER, LBS. 140 AVERAGE FALL, IN. 30

WATER LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO WATER	CONDITIONS OF OBSERVATION
					NOT RECORDED

PIEZOMETER INSTALLED [ ] YES [X] NO SKETCH SHOWN ON

STANDPIPE: TYPE ID, IN. LENGTH, FT. TOP ELEV.
INTAKE ELEMENT: TYPE OD, IN. LENGTH, FT. TIP ELEV.
FILTER: MATERIAL OD, IN. LENGTH, FT. BOT. ELEV.

PAY QUANTITIES

2.5" DIA. DRY SAMPLE BORING LIN. FT. 127
3.5" DIA. U-SAMPLE BORING LIN. FT.
CORE DRILLING IN ROCK LIN. FT.

NO. OF 2" SHELBY TUBE SAMPLES
NO. OF 3" UNDISTURBED SAMPLES
OTHER: HAND AUGERED 6' 1 HOUR

BORING CONTRACTOR SOIL TESTING INC.
DRILLER DAVE DEANGELIS HELPERS RALPH DESTEFANO
REMARKS BORING GROUTED UPON COMPLETION.
RESIDENT ENGINEER DAN SELIGMANN DATE 12-4-92

BORING LOG

BORING NO.	204
SHEET 1 OF	4
FILE NO.	7860
SURFACE ELEV.	15.3
RES. ENGR.	DAN SELIGMANN

PROJECT: CROTON PT. AVENUE BRIDGE REPLACEMENT
LOCATION : CROTON-ON-HUDSON, NEW YORK

DAILY PROGRESS	SAMPLE NO.	SAMPLE DEPTH	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION	STRATA	DEPTH	CASING BLOWS	REMARKS
08:30								Hand excavated
12-01-92					F			0-5.0'.
Tuesday						3		0-3.0': Fill - Brown
Sunny								fine to coarse sand,
40°F						5		some gravel, trace
	1D	5.0	6-6	Light & dark brown f-m sand, tr silt, gvl,				silt, brick, glass
		7.0	6-6	coarse sand, decomposed wood (SP-SM)				(SP-SM)
	2D	7.0	7-6	Tan fine to medium sand, trace silt, coarse				1D: Petroleum odor.
		9.0	4-4	sand, gravel (SP-SM)				Augered from
					S1	10		5.0'-10.0'.
	3D	10.0	3-2	Light brown fine to medium sand, some silt,				Saturated sample.
		12.0	2-2	trace gravel, coarse sand (SM)				
						15		
	4D	15.0	3-2	Light brown fine to coarse sand, trace silt				
		17.0	3-2	(SP-SM)		17		Drill bit chattering at
								17.0'.
						20		
	5D	20.0	10-9	Gray fine to coarse sandy gravel, trace silt				
		22.0	10-11	(GP)				
					S2			
						25		
	6D	25.0	11-10	Do 5D (GP)				Drilled ahead of
		27.0	11-9					casing 10.0'-28.0'.
						28.5		Borehole collapsed
						30		to 30.0'.
	7D	30.0	10-14	Gray brown fine sand, trace silt, silt				
		32.0	15-12	pockets, mica (SP-SM)				Drilled with mud
								28.0'-35.0'.
						35		
	8D	35.0	10-12	Do 7D (SP-SM)				
		37.0	14-14					
					S3	40		
	9D	40.0	11-13	Gray brown fine sand, some silt pockets,				
		42.0	12-13	trace silt, mica (SP-SM)				
						45		
	10D	45.0	15-20	Gray brown fine sand, some silt, silt layers,				
		47.0	25-23	clay layers (SM)&(ML)				
						50		

BORING LOG

FILE NO. 7860
SURFACE ELEV. 15.3
RES. ENGR. DAN SELIGMANN

PROJECT: CROTON PT. AVENUE BRIDGE REPLACEMENT
LOCATION: CROTON-ON-HUDSON, NEW YORK

DAILY PROGRESS	SAMPLE NO.	SAMPLE DEPTH	BLOWS/6"	SAMPLE DESCRIPTION	STRATA	DEPTH	CASING BLOWS	REMARKS
Cont'd	11D	50.0	14-17	Gray fine sand, some silt varved with some				
12-01-92		52.0	21-24	silt (SM)&(ML)				
Tuesday								
Sunny								
40°F						55		
	12D	55.0	26-30	Gray brown fine to medium sand, trace silt,				
		57.0	30-38	silt pockets, mica (SP-SM)				
						60		
	13D	60.0	27-32	Gray brown fine sand, some silt, trace silt				
		62.0	35-40	seams, clay seams (SM)				
						65		
	14D	65.0	26-28	Gray brown fine sand, some silt, trace silt				
		67.0	31-40	seams (SM)				
						70		
	15D	70.0	21-27	Gray brown fine to medium sand, some silt				
		72.0	29-36	(SM)	S3			
						75		
	16D	75.0	25-27	Do 15D, trace clay seams (SM)				
		77.0	29-31					
						80		
	17D	80.0	24-29	Do 15D, trace silt layers, clay seams (SM)				
16:30		82.0	30-34					
08:30								
12-02-92								
Wednesday						85		
Cloudy	18D	85.0	25-24	Gray brown silty fine sand, some silt layers,				
40°F		87.0	22-23	trace clay layers (SM)&(ML)				
						90		
	19D	90.0	23-26	Gray brown fine sandy silt with silty fine				
		92.0	25-22	sand layers (ML)&(SM)				
						95		
	20D	95.0	25-46	Gray brown fine sand, some silt, trace mica				
		97.0	40-39	(SM)				
						100		

BORING LOG

PROJECT: CROTON PT. AVENUE BRIDGE REPLACEMENT
LOCATION : CROTON-ON-HUDSON, NEW YORK

BORING NO. 204
SHEET 3 OF 4
FILE NO. 7860
SURFACE ELEV. 15.3
RES. ENGR. DAN SELIGMANN

DAILY PROGRESS	SAMPLE NO.	SAMPLE DEPTH	SAMPLE BLOWS/6"	SAMPLE DESCRIPTION	STRATA	DEPTH	CASING BLOWS	REMARKS
Cont'd	21D	100.0	28-43	Gray brown fine sand, some silt, trace mica				
12-02-92		102.0	41-36	(SM)	S3			
Wednesday						103		
Cloudy								
40°F						105		
	22D	105.0	26-25	Gray silt varved with silty fine sand, some				
		107.0	38-40	clay seams (ML)&(SM)				
					M	110		
	23D	110.0	28-26	Gray silty clay varved with silty fine sand				
		112.0	34-39	(CL)&(SM)				
						115		
	NR	115.0	25-26	No recovery				
		117.0	36-40					
						120		
	24D	120.0	28-36	Gray silty fine sand varved with some clay				
		122.0	38-44	and silt (SM)&(CL)				
						125		
	25D	125.0	30-40	Gray silty fine sand, trace silt seams, clay				
13 00		127.0	48-46	seams (SM)		127		End of Boring at
					127			127.0'.
								Grouted upon
						130		completion.
						135		
						140		
						145		
						150		

PROJECT: CROTON PT. AVENUE BRIDGE REPLACEMENT
LOCATION: CROTON-ON-HUDSON, NEW YORK
BORING LOCATION: N. 434458, E. 623519

BORING NO. 204
SHEET 4 OF 4
FILE NO. 7860
SURFACE ELEV. 15.3
DATUM U.S.G.S. (MSL)

BORING EQUIPMENT AND METHODS OF STABILIZING BOREHOLE

TYPE OF BORING RIG
TRUCK: DIETRICH D120
SKID:
BARGE:
OTHER:

TYPE OF FEED DURING CORING
MECHANICAL:
HYDRAULIC:
OTHER:

CASING USED [X] YES [ ] NO
DIA., IN. 5 DEPTH, FT. FROM 0 TO 28
DIA., IN. ___ DEPTH, FT. FROM ___ TO ___
DIA., IN. ___ DEPTH, FT. FROM ___ TO ___

DRILLING MUD USED [X] YES [ ] NO
DIAMETER OF ROTARY BIT, IN. 3-7/8" ROLLER BIT
TYPE OF DRILLING MUD: E-Z MUD

AUGER USED [X] YES [ ] NO
TYPE AND DIAMETER, IN. 8" ID HOLLOW STEM

TYPE AND SIZE OF:
D-SAMPLER: 2" O.D. SPLIT SPOON
U-SAMPLER:
S-SAMPLER:
CORE BARREL:
CORE BIT:
DRILL RODS: NW

CASING HAMMER, LBS. 300 AVERAGE FALL, IN. 24
SAMPLER HAMMER, LBS. 140 AVERAGE FALL, IN. 30

WATER LEVEL OBSERVATIONS IN BOREHOLE

DATE	TIME	DEPTH OF HOLE	DEPTH OF CASING	DEPTH TO WATER	CONDITIONS OF OBSERVATION
					NOT RECORDED

PIEZOMETER INSTALLED [ ] YES [X] NO SKETCH SHOWN ON ___

STANDPIPE: TYPE ___ ID, IN. ___ LENGTH, FT. ___ TOP ELEV. ___
INTAKE ELEMENT: TYPE ___ OD, IN. ___ LENGTH, FT. ___ TIP ELEV. ___
FILTER: MATERIAL ___ OD, IN. ___ LENGTH, FT. ___ BOT. ELEV. ___

PAY QUANTITIES

2.5" DIA. DRY SAMPLE BORING LIN. FT. 127
3.5" DIA. U-SAMPLE BORING LIN. FT. ___
CORE DRILLING IN ROCK LIN. FT. ___

NO. OF 2" SHELBY TUBE SAMPLES ___
NO. OF 3" UNDISTURBED SAMPLES ___
OTHER: HAND AUGERED 5' 1/2 HOUR
STAND-BY 1/2 HOUR

BORING CONTRACTOR: SOIL TESTING INC.
DRILLER: DAVE DEANGELIS HELPERS: RALPH DESTEFANO
REMARKS: BORING GROUTED UPON COMPLETION.
RESIDENT ENGINEER: DAN SELIGMANN DATE 12-2-92