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CROTON BAY SEEPAGE CONTROL WORK PLAN HARMON RAILROAD YARD

Harmon Railroad Yard
Croton-on-Hudson, New York

1 November 1995

Prepared for:

Metro-North Commuter Railroad

Prepared by:

ERM-Northeast
475 Park Avenue South
29th Floor
New York, New York 10016

ERM

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Craig A. Werle, Principal

Brian J. Jacot, Principal

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PETROLEUM HYDROCARBON SEEPAGE - CROTON BAY
SEEPAGE CONTROL WORK PLAN
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TABLE OF CONTENTS

1.0 INTRODUCTION 1

2.0 EXISTING INFORMATION 1

2.1 Existing Boom Containment 1

2.2 Discharge Pipes 2

2.3 Croton Bay Sediment Investigation 5

2.4 Proximity of Defined Product Areas and Outfall Pipes 6

3.0 SEEPAGE CONTROL APPROACH 10

3.1 Phase 1: Improved Boom Containment 11

3.2 Phase 2: Mitigation of Seeps into the Croton Bay 12
3.2.1 Conceptual Approach 12
3.2.2 Description of Proposed Product Collection and Recovery System 13
3.2.2.1 Product Barrier 13
3.2.2.2 Product Collection Trench 14
3.2.2.3 Product Recovery System 15
3.2.2.4 Sequence: Design, Construction and Operation 16

Appendices

A Cut Sheets and Installation Diagrams for the Proposed Boom Containment System

TABLE OF CONTENTS (CONTINUED)

LIST OF FIGURES

(Figures are included at the end of this report)

Figure A: ***Potential Areas of Petroleum Contamination***

Figure B: ***Assessment for Remedial Action Evaluation; Petroleum Hydrocarbon Seepage in Vicinity of Croton Bay***

Figure C: ***Possible Interconnections Between Old Outfall Pipe and Active Storm Water Discharge Line in Cross-Over Area***

Figure D: ***Construction Detail: Harmon Yard Wastewater Treatment Plant Effluent Outfall at Croton Bay (Hudson River)***

Figure E: ***Concept Design, Proposed Location of Product Barrier and Recovery System - Plan View***

Figure F: ***Proposed Barrier and Recovery System; Harmon Yard Croton Bay Outfall; Profile Views***

1.0 *INTRODUCTION*

Petroleum hydrocarbon seeps have been reported in the area where two outfalls discharge from Metro-North Railroad Company (Metro-North) Harmon Railroad Yard to Croton Bay. Typically, these seeps have been observed as petroleum-like hydrocarbon sheens which appear to originate from the sediment and spread out on the surface water in Croton Bay. Currently, these seeps are being contained by a temporary boom system comprised of an outer floating marine boom and an inner sorbent boom.

This document summarizes the existing information related to the occurrence of petroleum seeps to Croton Bay and presents a proposed work plan for control of these seeps. The proposed plan includes installation of a permanent boom containment system in Croton Bay and installation of a product barrier and collection system at a location in the Harmon Railroad Yard adjacent to the observed seeps.

2.0 *EXISTING INFORMATION*

This section briefly summarizes current containment activities for the petroleum-like hydrocarbon seeps observed in Croton Bay, available information regarding the portion of Harmon Railroad Yard closest to Croton Bay and available information regarding the area where the seeps have been observed.

2.1 *Existing Boom Containment*

Following observation of petroleum-like seeps into Croton Bay, Metro-North installed a temporary boom in the vicinity of the outfall pipes located on the southern side of the Harmon Railroad Yard. This boom, which is comprised of a floating marine boom anchored to the bay floor and augmented with an adsorbent floating boom, is currently being used to contain and collect petroleum-like seeps into Croton Bay. The inner sorbent boom collects the seep materials while the outer marine boom prevents migration of non-absorbed seeps and maintains the structure and location of the boom. The boom system is inspected daily and maintenance activities are conducted on an as-needed basis.

2.2 Discharge Pipes

The suspected pathway for seeps to Croton Bay are the two active and one inactive outfall pipes located in the area of the Harmon Railroad Yard adjacent to the observed seeps. This area, which is identified as the "Outfall Area", is a bulkhead constructed with large boulders and riprap filled and covered with soil. As shown in Figures A and B, three outfall pipes exit the southern portion of the Harmon Railroad Yard property into Croton Bay. They include:

1) **Metro-North SPDES Outfall 001 (wastewater treatment plant)** - This is an active eight-inch diameter fiberglass reinforced pipe (FRP) that conveys treated wastewater from the new wastewater treatment plant (WWTP) to Croton Bay (hereafter referred to as the "active WWTP outfall"). The eight-inch measurement refers to the initial inner diameter of this pipe. The pipe has been relined and the new inner diameter of this pipe, after relining, is now four inches.

2) **Metro-North SPDES Outfall 002 (storm water/oil water separator)** - This is an active 54-inch diameter reinforced concrete pipe (RCP), located adjacent to the active WWTP discharge pipe, that conveys treated storm water from the Harmon Railroad Yard oil water separator (OWS) to Croton Bay (hereafter referred to as the "active storm water outfall").

3) **the old outfall for the former WWTP** - This is an inactive 36-inch by 40-inch RCP, installed by a predecessor railroad, which previously served

as the outfall for the former WWTP (hereafter referred to as the "inactive WWTP outfall").

The piping associated with the inactive WWTP outfall line is not continuous. Sections have been removed during various construction projects at the Harmon Yard. For example, sections of the inactive WWTP outfall line were removed at the time the two newer active lines were installed in the area where the lines cross in the southern portion of Harmon Yard.

As shown in Figure B, the two active outfalls (i.e., the 54-inch diameter storm water outfall, "SW" on Figure B, and the eight-inch active WWTP outfall, "AW" on Figure B) are generally aligned adjacent to one another as they traverse Harmon Railroad Yard and discharge to Croton Bay. The inactive WWTP outfall line ("IW" on Figure B) is aligned with the two active outfall lines in the extreme southern portion of the Harmon Railroad Yard and is aligned with the active WWTP outfall line to the north of the Croton Point Avenue bridge. In the extreme southern portion of the Yard (i.e., the Outfall Area), the inactive WWTP outfall line crosses under, but does not interconnect with, the two active outfall lines. In fact, in the Outfall Area, the inactive WWTP line lies below the active storm water and active WWTP outfall lines (sections of the inactive line were removed in this area during the construction of the newer lines). From the area where the three lines cross, they travel a similar path to Croton Bay. In the extreme southern portion of Harmon Railroad Yard, the three outfall pipes are surrounded by rip-rap on either side. To the north of the Croton Avenue bridge, approaching the WWTP, the inactive WWTP line lies adjacent to the active WWTP discharge line and the storm water outfall trunk line lies to the east of these WWTP outfall lines.

The inactive WWTP outfall line and the bedding material for all three outfall lines, which was probably installed during construction of these pipes, may serve as a conduit for seepage of ground water and, when present, petroleum. For example, soil samples collected as part of the *Remedial Investigation and Feasibility Study Work Plan, Operable Unit II, Harmon Railroad Yard/Lagoon, Croton-on-Hudson, New York*, May 1994 (OU-II RI/FS Work Plan) have indicated the possible presence of petroleum adjacent to the inactive WWTP discharge line in select areas (Figure B). However, none of the monitoring wells installed near this line during the Yard Investigation can confirm that the inactive WWTP outfall line is a definitive source of the petroleum seeps in the area near Croton Bay. Nevertheless, based on its lower elevation at the point it exits Harmon Railroad Yard property into Croton Bay, the inactive WWTP outfall line is located below the ground water table in this area. As such, the inactive WWTP outfall line or the bedding adjacent to this pipe may serve as a preferential drain during certain times of year or during portions of the tidal cycle.

In addition, the inactive WWTP outfall line was reported in past years to have contained product, probably from ground water infiltration. This pipe was once used as a conduit for an eight-inch polyethylene pipe force main from Osborn Pond to the treatment plant area. This force main was replaced in the early 1980's, during construction of the active WWTP outfall line, with an eight-inch FRP pipe. This line, which is currently used to convey storm water from Osborn Pond to the treatment plant area, is located immediately adjacent to the active WWTP outfall line in a common pipe trench. Prior to and during replacement of this force main, petroleum product was reported to have been observed in the previous carrier line (i.e., the inactive 36-inch by 40-inch WWTP outfall pipe). This information is not documented and the location or nature of the petroleum observed in the pipe has not been defined, but the reported presence of petroleum in this carrier pipe does provide additional support to the conclusion that the inactive WWTP outfall pipe and associated bedding is a potential source of the petroleum seeps in Croton Bay.

In addition to the inactive WWTP outfall line and its surrounding bedding, the bedding for the active 54-inch diameter storm water outfall line and for the active eight-inch diameter WWTP outfall line may also serve as conduits for seepage of ground water and, when present, petroleum to Croton Bay. Neither of these lines is suspected to internally convey infiltrated ground water or petroleum to Croton Bay. The inside of the active 54-inch diameter storm water outfall pipe was recently visually inspected. No seepage of petroleum into this pipe was identified during this inspection. In addition, the active eight-inch diameter WWTP outfall pipe was recently relined. The inner diameter of this line, after relining, is approximately 4 inches.

In summary, the inactive WWTP outfall line and the bedding materials surrounding all three outfall lines (i.e., the inactive WWTP outfall line, the active storm water outfall line and the active WWTP outfall line) are potential pathways for seeps to Croton Bay. Additional discussion regarding the potential for these conduits and their associated bedding to provide a conduit for the seepage of petroleum to Croton Bay and their proximity to locations of petroleum product at the Harmon Railroad Yard is presented in Section 2.4 of this document.

2.3 Croton Bay Sediment Investigation

Metro-North conducted a preliminary study of Croton Bay outfall area in October 1992. This preliminary study focused on evaluation of sediment quality, with respect to petroleum hydrocarbons, in the vicinity of Croton Bay outfall. As part of this effort, visual inspections for petroleum seeps were performed in the transition zone between Croton Bay and Harmon Railroad Yard property.

The results of the sediment samples obtained during this preliminary study were summarized in Section 2.2.2 of the OU-II RI/FS Work Plan. Essentially, three separate sediment areas were characterized by Total Petroleum Hydrocarbon (TPH) analyses. These are shown in Figure A.

Area 1 extends approximately 40 to 45 feet radially outward from the outfall pipe. TPH results of sediment samples in this area were >1,000 parts per million (ppm). This area was also reported to exhibit sheens on the water table surface during low tide.

Area 2 was defined as the sediment area on the northwestern side of the outfalls. It comprises an area approximately 15 feet wide by 105 feet long. Although no sediment samples were collected from this area for TPH analysis, the report referenced visual observations that suggested a number of seeps of petroleum in this area.

Area 3 represents the sediment area in Croton Bay just beyond Areas 1 and 2. Sediment samples obtained in this area indicate a transition to lower TPH concentrations (approximately $\leq$ 100 ppm). There were no oil seeps or sheens observed in this area.

Although somewhat limited, Croton Bay sediment TPH data confirm that the sediments near the southern portion of the Harmon Railroad Yard contain petroleum related materials. The results of the investigation also suggest active seeps along the rip-rap land mass which comprises the southern portion of the Harmon Railroad Yard. However, the data does not distinguish whether sheens observed in the surface water are caused by potential seeps or occur as a result of the residual petroleum materials contained in sediments near the current and former outfall pipes.

2.4 *Proximity of Defined Product Areas and Outfall Pipes*

A number of subsurface pipes and structures are located in the Outfall Area. As shown on Figure B and discussed in Section 2.2, three discharge lines are located in this area. As a result, all three outfall pipes in this area and the typically more permeable soil and stone used as bedding and backfill during the installation of these outfall lines have been evaluated as potential petroleum migration pathways. This section further discusses these discharge lines, their relation to defined product areas and their role as potential pathways for petroleum migration from defined product areas to Croton Bay.

Metro-North recently completed a subsurface investigation at Harmon Railroad Yard. This investigative work was conducted on Metro-North's initiative with the intent to use appropriate information in support of the requirements of the Stipulation of Discontinuance between the New York State Department of Environmental Conservation (NYSDEC) and Metro-North. The results of this investigation were presented in the *Field Investigation Report; Harmon Railroad Yard* (ERM; April 1995).

As part of the investigation at Harmon Railroad Yard, areas of floating product referred to as non-aqueous phase liquids (NAPL) were defined. These areas were denoted on Figure 3-2 ("NAPL Thickness in Monitoring Wells - 9/19/94") in the April 1995 *Field Investigation Report*. All three outfall lines lie in close proximity to two of the NAPL areas identified during the Field Investigation. These two NAPL areas, shown in Figure B, are identified as the Former One Million Gallon Oil Storage Tank area and the Osborn Pond area. Figure B also indicates the position of the inactive 36-inch by 40-inch WWTP outfall pipe, the active 54-inch storm water outfall pipe and the active eight-inch WWTP outfall pipe in relation to these identified areas of NAPL. Specifically, the inactive WWTP outfall line traverses the Former One Million Gallon Oil Storage Tank area and both active outfall lines cross the southwestern corner of the Osborn Pond area. Since the inactive WWTP outfall line and the bedding for all three discharge lines may serve as a preferential pathway for ground water and product migration, the former Million Gallon Tank area and the Osborn Pond area may be possible sources of petroleum seeping into Croton Bay.

The NAPL identified in these two areas is currently being addressed as part of the Remediation Plan that will be submitted to the NYSDEC at the end of November 1995. Consequently, the outcome of the efforts described in this document focus on a more detailed evaluation of a separate remedial action for the three outfall lines to prevent the possible migration of petroleum in and along these lines to Croton Bay.

The exact position of the inactive WWTP outfall line is difficult to determine. Historic engineering drawings and manhole locations were used during the OU-II RI/FS Work Plan to survey in the location of the inactive outfall line so that soil samples could be collected adjacent to the pipe. The location of the inactive WWTP outfall line presented in Figure B is based on the results of this survey. Visual observations and laboratory results of soil samples collected immediately above the ground water table adjacent to this inactive outfall line indicated the possible presence of petroleum at particular locations (Figure B). The qualitative descriptions of where petroleum may be present in soil appear to confirm the two previously defined locations in which NAPL was found during the Harmon Railroad Yard investigation.

Based on a comparison of the measured ground water elevations collected during the recent investigation and the reported invert elevations of the inactive WWTP outfall pipe and the two active outfalls, all three outfalls pipes appear to lie below the ground water table in the southern portion of Harmon Railroad Yard. In the areas of defined NAPL, the inactive WWTP outfall pipe, the active WWTP outfall line and the storm water outfall line appear to lie at or below the water table. This further supports the likelihood that the inactive WWTP outfall pipe or its bedding and the bedding for the active outfall lines may be transmitting petroleum to Croton Bay, contributing to the previously reported seeps and sheen on the surface water.

In addition, interconnections between outfall line beddings may be increasing the conveyance of product by providing additional pathways. Numerous potential sites for bedding interconnections are present in the southern end of the Yard. One interconnection is between the inactive WWTP outfall pipe and the active storm water outfall pipe. The active storm water outfall pipe crosses over the inactive WWTP outfall pipe several hundred feet north of the discharge to Croton Bay. Similarly, the inactive WWTP outfall and the active storm water outfall pipes have been placed in close proximity to each other in the area immediately north (i.e., 50 to 100 feet) of the discharge to Croton Bay. In fact, in some areas the 54-inch diameter active storm water pipe has been installed directly above the inactive WWTP outfall pipe. In either of these areas, the bedding from the active WWTP outfall pipe may be hydraulically connected to the bedding and backfill around the underlying active storm water outfall pipe. As a result, product migrating along the inactive WWTP outfall pipe and/or bedding may be able to enter the bedding of the active storm water outfall pipe, as shown on Figure C.

It has also been reported that an interceptor trench constructed of crushed stone had once been installed perpendicular to the inactive WWTP outfall pipe in an area 50 to 100 feet north of the inactive WWTP outfall pipe (i.e., from Croton Bay). This interceptor trench was constructed for much the same purposes as the remedial approach discussed here: to control the migration of petroleum to Croton Bay. This interceptor trench was reported to have been installed by a predecessor railroad; it was not installed by Metro-North. Operation of the interceptor trench, however, was reported to not have been successful and this operation was subsequently abandoned. No other information is available on the location or construction of this trench. However, if this trench or a remnant of this trench still exists in this area, it could also be serving as an interconnection between the inactive WWTP outfall pipe bedding and the bedding of the two active outfall pipes. Due to the proximity of the outfall lines to areas with NAPL and the potential interconnection between pipe beddings, any remediation in the area near the outfall (i.e., near Croton Bay) must consider all of the pipes in this area to be potential petroleum migration pathways.

As previously discussed in Section 1.0, petroleum seeps in the Outfall Area appear to originate from the sediment and spread onto the surface water. In fact, during periodic monitoring of the outfall by Metro-North, petroleum has been observed on the surface of the water in Croton Bay at a distance approximately 15 feet from the shore. The petroleum has been observed as isolated releases approximately four to eight-inches in diameter. Review of the construction drawings has indicated that a possible explanation for the location of these seeps is a preferential pathway for ground water and NAPL migration along the active WWTP outfall line's spillway sub-base.

Figure D shows the construction of Croton Bay discharge end of the active WWTP outfall pipe (SPDES Outfall 001). Petroleum that may be migrating along this line would enter the bottom layer of gravel (see note on Figure D: "12 inch screen gravel") and if prevented from migrating to the surface by the engineering fabric shown in the drawing, could migrate along this gravel layer and discharge to Croton Bay some distance from the open (discharge) end of this pipe (see notes added to Figure D: "Possible Petroleum Migration Pathway" and "Possible Croton Bay Discharge Location"). The location of these isolated petroleum releases is consistent with the location of the engineering fabric installed for the new WWTP outfall (see Figure D). In addition, this spillway subbase extends some distance on either side of the active WWTP outfall and intercepts the bedding from the storm water and the inactive WWTP outfalls. Consequently, petroleum that may be migrating along the bedding of all three outfall lines may also be migrating under this spillway subbase. As a result, the seepage control approach described below should address migration of NAPL to this spillway sub-base.

3.0 SEEPAGE CONTROL APPROACH

The proposed seepage control approach would be implemented in three distinct phases. They would include:

Phase 1: improved seepage containment in Croton Bay;
Phase 2: mitigation of seeps into Croton Bay; and
Phase 3: elimination of the source of seeps.

Phase 1, improved seepage containment, is intended to serve as an interim control measure for seeps into Croton Bay. This phase of seepage control, which entails replacement of the existing temporary floating adsorbent boom with a permanent semi-flexible floating boom, is being proposed by Metro-North to address containment of sheens or product that may be dislodged during Phase 2 or Phase 3 construction activities. It also addresses containment boom durability concerns associated with severe current conditions in Croton Bay.

Phase 2, mitigation of seeps into Croton Bay, is intended to serve as a longer term seepage control measure. Information on the discharge pipes in the Outfall Area, such as piping locations and ground water elevations, strongly suggests that the inactive WWTP outfall line and the bedding for all three outfall lines are causing or contributing to the petroleum seeps to Croton Bay. A conceptual approach to mitigate seeps into Croton Bay would be to intercept and remove petroleum migrating in or along these lines. A more detailed discussion of Phase 1 and Phase 2 work is presented in Sections 3.1 and 3.2, respectively.

Finally, Phase 3, elimination of the source of seeps, is intended as a final seepage control measure. As discussed in Section 2.3, two known NAPL areas (i.e., the Former One Million Gallon Oil Storage Tank and Osborn Pond) have been identified as potential sources of seeps. The potential for continued migration of product from these areas will be addressed under a remedial plan pursuant to the

Harmon Yard Field Investigation being conducted under NYSDEC oversight. That is, the potential for these two areas to continue to be a source of petroleum to the inactive WWTP outfall pipe or the bedding of all three outfall lines and, ultimately, to Croton Bay, will be dealt with separately as part of the site-wide petroleum remediation plan to be submitted to the NYSDEC Division of Spills Managment.

3.1 *Phase 1: Improved Boom Containment*

Metro-North plans to replace the existing floating marine boom with a semi-flexible permanent floating boom. The permanent boom would be comprised of a 16" urethane coated polyester skirt with solid molded polyethylene floats. Cut sheets and installation drawings for this semi-flexible permanent boom system are presented in Appendix A.

As shown in Appendix A, Drawing No. 21D4109, "Outfall Boom. Metro North. Harmon Yd. Crot-Hudson", the boom would be connected to the shore via two bulkheads and secured to the bay floor via pilings at three distinct locations. These connections would result in a four-sided semi-flexible floating containment wall around the seep area while maintaining a navigable channel under the railroad bridge. At the bulkhead and the piling locations, the boom would be connected to a track with a floating bulkhead riser (see Appendix A, Drawing No. 15B3713, "Bulkhead Riser Illust."). These connections would allow the entire boom to rise and fall with the tide. Bulkhead riser and track illustrations are also provided in Appendix A.

Provided this work plan is approved by the end of November 1995 and all appropriate permits for construction in Croton Bay can be received within six months, construction of this semi-flexible permanent floating boom is expected to be completed by the end of August 1996. Operation of this system following initiation of Phase 2 seepage control is discussed in Section 3.2.2.4.

3.2 Phase 2: Mitigation of Seeps into Croton Bay

3.2.1 Conceptual Approach

As discussed earlier, product may be migrating to Croton Bay in the inactive WWTP outfall pipe or along the bedding of the inactive WWTP outfall line, the active WWTP outfall line or the storm water outfall line. In order to prevent this migration, product must either be collected at some point along its route, physically prevented from migrating using an impermeable barrier or a combination of both methods (collection and physical barrier) could be used. Petroleum products are less dense than water and will remain on the surface of a ground water table. Product will generally migrate in the same direction as the downward gradient (slope) of the water table.

Collection is most effective when a gradient can be imposed on the water table in all directions toward the collection area by pumping ground water to lower the water table in the collection area. The disadvantage to this approach is that the ground water pumped from the collection area would probably need to be treated prior to discharge. While ground water from the outfall area could potentially be pumped to either the storm water oil water separator (SPDES Outfall 002) or the active Metro-North wastewater treatment plant (SPDES Outfall 001), both of these options would be difficult to implement, as discussed below.

Ground water from this area, if it requires treatment, would need to be treated to remove dissolved constituents. The oil water separator does not remove dissolved constituents and would be ineffective in treating this ground water. The wastewater treatment plant is located a considerable distance from the outfall area. Construction of a force main from the outfall area to the treatment plant would be an extensive and costly project. Consequently, systems which remove only product and not ground water and a method to physically prevent continued migration of product were considered in developing this remedial approach.

The remedial approach developed by ERM to effectively deal with this situation would be to construct a product recovery system across all three pipe lines in a area as close to Croton Bay as possible. A possible location for this system is shown on Figure E. This product recovery system would be comprised of three major components:

1) a downgradient product barrier constructed of grouted sheeting or similar material and a slurry wall (for pipe penetration);
2) a product collection trench immediately upgradient of this composite barrier wall; and
3) a product-only recovery system to remove the product from the collection trench to an above ground storage tank or drum.

A plan view and a profile (cross-section) of this conceptual approach are presented in Figures E and F, respectively. Each of these components and a possible sequence of design, construction and operation activities are described in the following subsection.

3.2.2 Description of Proposed Product Barrier and Collection System

3.2.2.1 Product Barrier

This conceptual approach to remediating petroleum seeps in Croton Bay would include a product barrier to prevent the continuous migration of petroleum in and along the pipe lines in the outfall area that is assumed to be the source of the seeps in Croton Bay. As shown in Figure E, this barrier would be constructed in the shape of a "V". The pointed end of the "V" would be plugged downgradient. In this way, product on the surface of the water table would be collected and concentrated in the center of the "V". The location of the barrier should extend from as close to the adjacent railroad tracks as is feasible and continue west in a "V" path to an area close to Croton bay, as shown on Figure E.

The barrier would be constructed of impermeable material, such as a combination of a slurry wall around the pipes and sheeting (grouted or conventional) between the pipes. Although sheeting is effective in preventing the migration of floating product it may not be feasible to install sheeting around the pipes. A slurry wall would therefore be used in pipe areas to provide a physical barrier in areas around the pipe. The barrier wall would be installed in a location similar to that shown on Figure E and to a depth approximately 2 to 3 feet below the seasonal low ground water table. As shown on Figures E and F, the two foot wide trench needed to install a slurry wall would be excavated above and below the pipe to the necessary depth.

The active pipes would be supported during this excavation, if necessary. The section of the inactive WWTP outfall pipe where this pipe crosses the product barrier would be removed (see Figure F). The downgradient end would be plugged with concrete, but the upgradient end would be filled with crushed stone to enable product that may be migrating in the pipe to continue to migrate to the product collection trench, discussed below, to be constructed adjacent to and upgradient of the product barrier.

3.2.2.2 Product Collection Trench

This conceptual approach includes the installation of a product collection trench immediately upgradient of the physical barrier described in Section 3.2.2.1. As shown on Figures E and F, this collection trench would be constructed to a depth equal to the bottom of the barrier (sheeting or slurry wall), i.e., approximately 2 to 3 feet below the seasonal low ground water table. Floating product migrating in or around the pipe lines or pipe bedding would collect on the water table in the collection trench. Ground water would continue to migrate toward Croton Bay and would flow under the barrier, as shown on Figure F. The flow of ground water and the "V" shape of the barrier would also help to concentrate any floating product in this area.

Product recovery systems are most effective if a sufficient thickness of product can be collected. The shape of the barrier, then, would result in greater thickness of accumulated product in smaller areas and would enable product recovery system, described below, to collect greater quantities of product. The product that accumulates behind (i.e., upgradient of) the barrier in the collection trench would be removed using a product recovery system, described below.

3.2.2.3 Product Recovery System

A product recovery system would be installed to remove the product that accumulates in the collection trench and transfer it to above ground storage. The product recovery system would consist of several recovery wells installed within the collection trench, as shown on Figure E. The wells should be designed to accommodate either product-only recovery pumps or dual-phase (i.e., product and ground water) recovery systems. Although this conceptual remedial approach only considers the use of product-only systems for the reasons discussed earlier (see Section 3.2.1), a dual-phase capability included in the design should be considered as a contingency in the event that a more aggressive recovery system is considered in the future.

Each of the wells would be equipped with a product-only recovery system. These system monitor the thickness and elevation of the free product layer that accumulates within each well and pumps the product out of the well and to above ground storage. Depending on the amount of product recovered, drums may be used for storage of recovered product or a storage tank may be installed.

3.2.2.4 Sequence: Design, Construction and Operation

The first step in implementing this approach would be to develop a scope for and conduct pre-design work to determine if the pipes in the Outfall Area are migration pathways for petroleum in this area and if petroleum is encountered in these pipe line areas. In addition, other potential migration pathways in this area should also be evaluated. Investigative methods such as test pits, geoprobe, temporary observation wells and soil borings would be considered. The area to be investigated is limited: the distance from the railroad west to Croton Bay is less than 75 feet. Investigation activities around pipe lines are difficult, but an effort should be made to collect information from as close to each pipe line as possible. This information should also be used to determine the length of the barrier and collection trench. For example, if no product is encountered near the railroad tracks, the length of the barrier and collection trench may be shortened.

If product is encountered, samples should be collected during this pre-design phase and analyzed for barrier, collection trench and recovery system design and for disposal characteristics (e.g., viscosity, flammability, TCLP and PCBs). Other design-related information, such as depth to ground water and geotechnical parameters, may also be collected during this pre-design period. The potential effects of the high voltage from the nearby active rail lines should also be monitored and considered in the design of the barrier system (e.g., steel sheeting that may corrode) and the product recovery system (e.g., pumps, instrumentation). Ground water may also be sampled to identify possible iron and manganese problems (i.e., scaling), if dual-phase pumping is considered. An analysis of the presence of other pipe lines or utilities that may be located in the area should be performed.

In addition, the presence of boulders and large diameter rocks known to have been used in the construction of the track bed and the right-of-way in this area may preclude the use of sheeting for the barrier component of the recovery trench. Pre-design test pits and other measures, then, are also needed to define subsurface conditions in the area being considered for recovery trench installation prior to design.

Once the pre-design information has been collected, a preliminary design of the system should be prepared and the cost of constructing and operating the system should be estimated. A final design would be prepared and used to procure a contractor to construct the system. Either Metro-North or a Metro-North contractor would operate the system. The system can be operated initially using drums for storage until there is enough operating information to accurately estimate the product recovery rates. An above ground storage tank may then be designed and installed if justified by the rate of product recovery.

Finally, a system of observation wells downgradient of the system and closer to Croton Bay should be designed and installed. These wells would be used to monitor the performance of the product recovery and barrier system. In addition, a program of periodic inspections of Croton Bay should be developed and implemented to note the presence, if any, of petroleum seeps in Croton bay after the barrier and recovery system is operating.

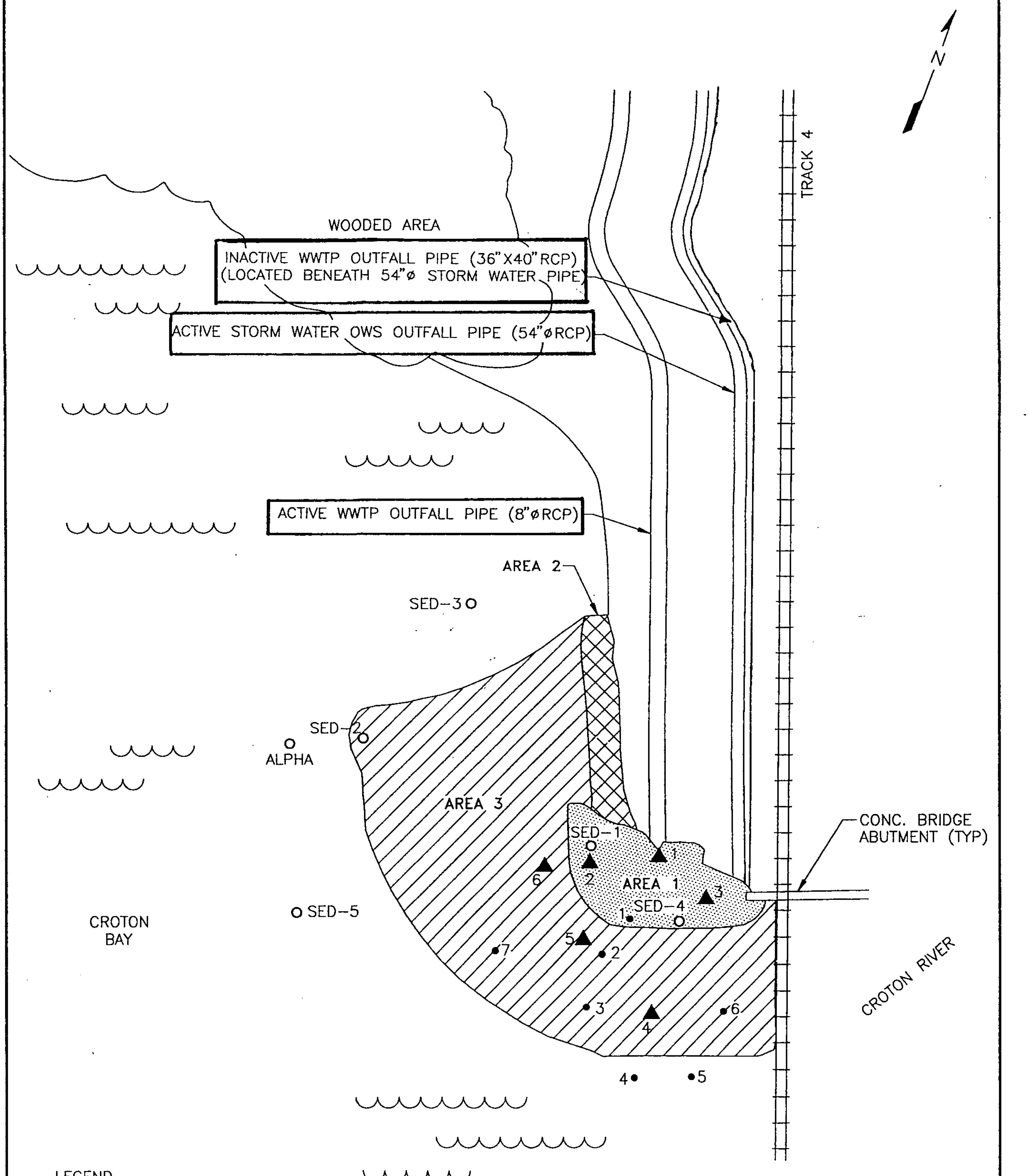
Provided regulatory approval of this work plan is received by the end of November 1995, design of the product barrier and collection system is expected to be completed by the end of May 1996. Contractor procurement would then be completed by the end of July 1996 and construction and start-up would be completed by the end of 1996.

As a precautionary measure, the upgraded boom would be installed prior to construction of the barrier and recovery system. In the event that construction activities in the Outfall Area cause an acceleration in seepage from this area, the permanent boom would contain materials discharge to Croton Bay. As discussed in Section 3.1, provided approval of this work plan is received by the end of

November 1995, construction of the upgraded boom containment system could be completed by June 1996. Installation of the upgraded boom is therefore expected prior to contractor procurement. However, if acquisition of the necessary permits for construction in Croton Bay be greater than six months, construction of the product barrier and collection system may be delayed.

Although operation of the product barrier and collection system is expected to eventually eliminate the need for Phase 1 seepage control, the boom would continue to be used after Phase 2 activities commence. At that time, the boom would be used: (1) to collect seeps that are located between the product barrier and collection system and Croton Bay; and (2) as a secondary seepage control measure in the event of a product barrier and collection system upset.

Figures



LEGEND

5 • SOUNDING POINTS

SED-5 ○ SEDIMENT SAMPLING POINT

▲ PROPOSED SEDIMENT SAMPLING LOCATIONS

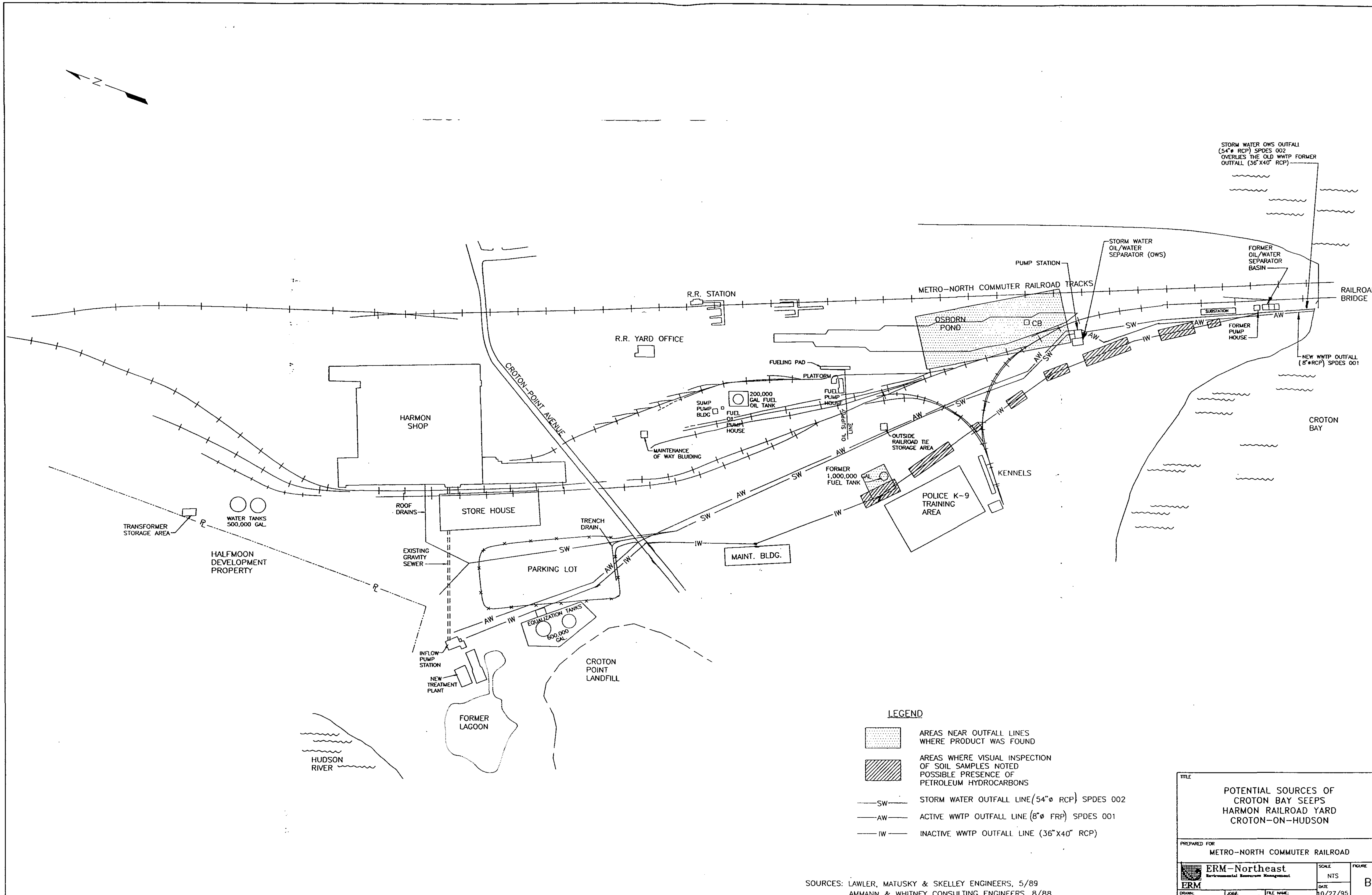
TITLE

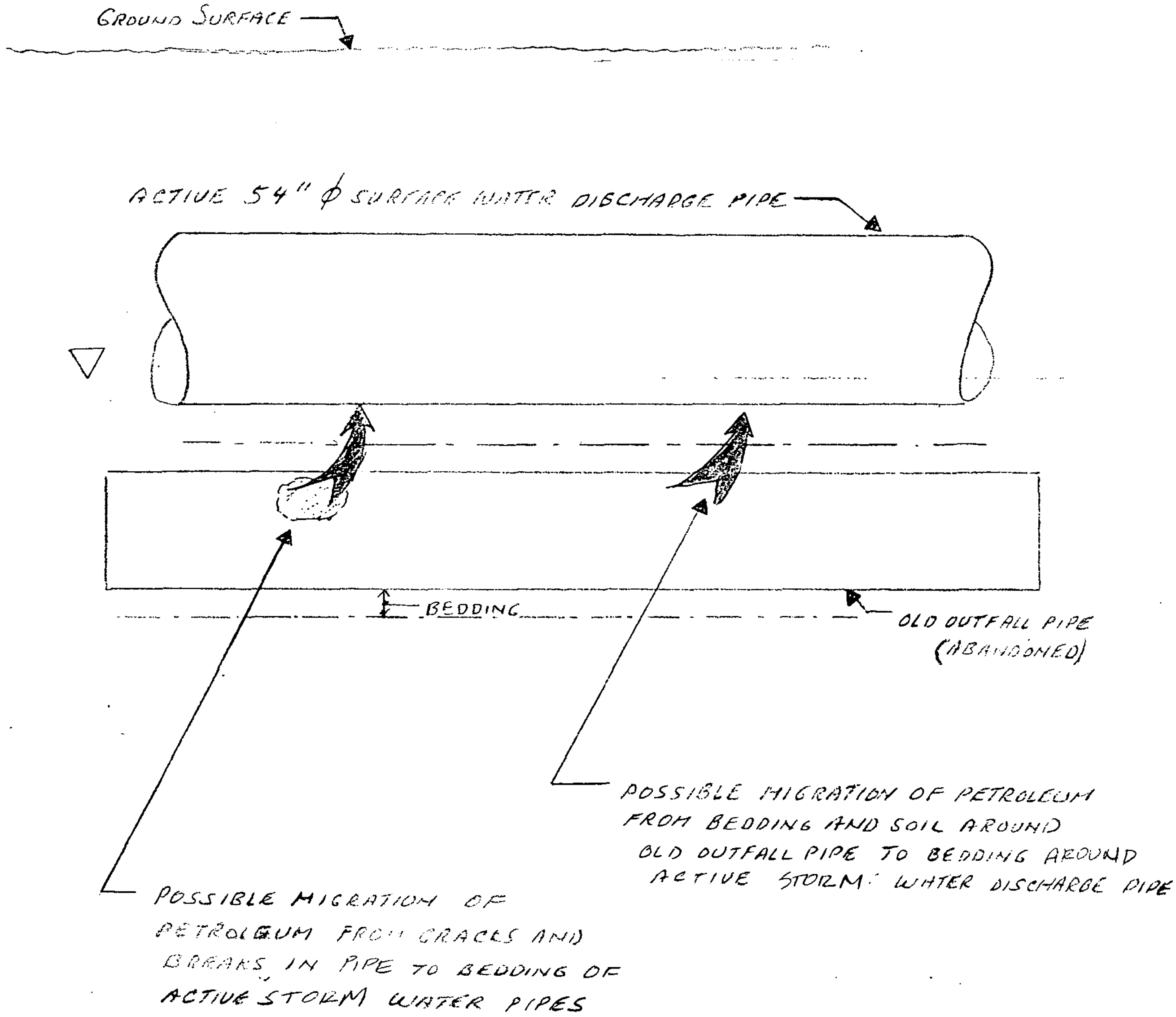
CROTON BAY
SEDIMENT SAMPLING LOCATIONS
HARMON YARD

PREPARED FOR

METRO NORTH COMMUTER RAILROAD

ERM-Northeast Environmental Resources Management ERM	SCALE NTS	FIGURE A
DRAWN:	JOB NO.:	FILE NAME:	DATE 10/27/95


N
STORM WATER OWS OUTFALL (54"ø RCP) SPDES 002 OVERLIES THE OLD WWTP FORMER OUTFALL (36"X40" RCP)
STORM WATER OIL/WATER SEPARATOR (OWS)
PUMP STATION
FORMER OIL/WATER SEPARATOR BASIN
METRO-NORTH COMMUTER RAILROAD TRACKS
RAILROAD BRIDGE
R.R. STATION
OSBORN POND
CB
SUBSTATION
FORMER PUMP HOUSE
NEW WWTP OUTFALL (8"øRCP) SPDES 001
R.R. YARD OFFICE
FUELING PAD
PLATFORM
200,000 GAL FUEL OIL TANK
SUMP PUMP BLDG
FUEL OIL PUMP HOUSE
FUEL PUMP HOUSE
OIL SUPPLY LINE
MAINTENANCE OF WAY BLUIDING
OUTSIDE RAILROAD TIE STORAGE AREA
KENNELS
FORMER 1,000,000 GAL FUEL TANK
POLICE K-9 TRAINING AREA
CROTON BAY
HARMON SHOP
CROTON POINT AVENUE
ROOF DRAINS
STORE HOUSE
TRENCH DRAIN
MAINT. BLDG.
WATER TANKS 500,000 GAL.
TRANSFORMER STORAGE AREA
HALFMOON DEVELOPMENT PROPERTY
EXISTING GRAVITY SEWER
PARKING LOT
EQUALIZATION TANKS
600,000 GAL.
INFLOW PUMP STATION
NEW TREATMENT PLANT
CROTON POINT LANDFILL
FORMER LAGOON
HUDSON RIVER
SW
AW
IW
LEGEND
AREAS NEAR OUTFALL LINES WHERE PRODUCT WAS FOUND
AREAS WHERE VISUAL INSPECTION OF SOIL SAMPLES NOTED POSSIBLE PRESENCE OF PETROLEUM HYDROCARBONS
SW — STORM WATER OUTFALL LINE (54"ø RCP) SPDES 002
AW — ACTIVE WWTP OUTFALL LINE (8"ø FRP) SPDES 001
IW — INACTIVE WWTP OUTFALL LINE (36"X40" RCP)
SOURCES: LAWLER, MATUSKY & SKELLEY ENGINEERS, 5/89
AMMANN & WHITNEY CONSULTING ENGINEERS, 8/88
TITLE
POTENTIAL SOURCES OF CROTON BAY SEEPS HARMON RAILROAD YARD CROTON-ON-HUDSON
PREPARED FOR
METRO-NORTH COMMUTER RAILROAD
ERM-Northeast
Environmental Resources Management
ERM
SCALE NTS
FIGURE B
DATE 10/27/95
DRAWN: E.M.F.
JOB#: 680.001.5
FILE NAME: METFIFB



TITLE

Possible Interconnections Between Old Outfall Pipe and Active Storm Water Discharge Line in Cross-Over Area

PREPARED FOR

Metro-North Railroad Company

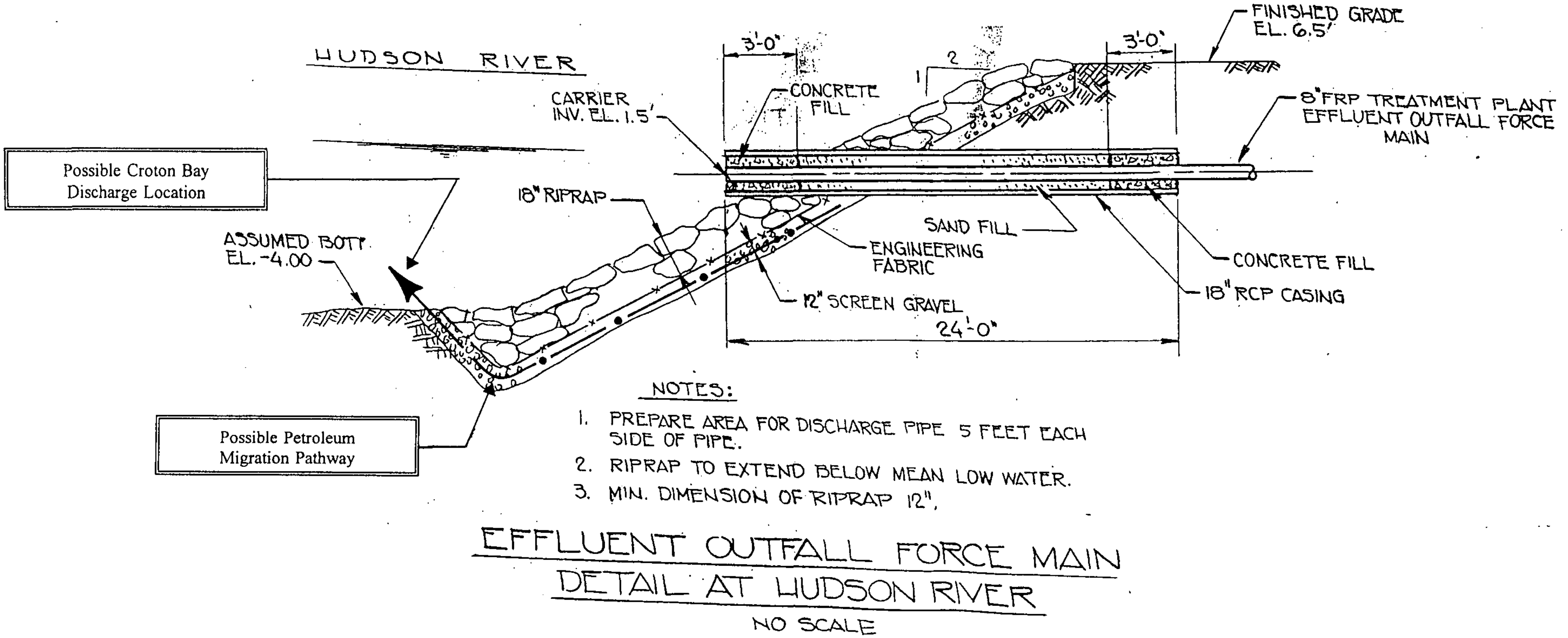
ERM–Northeast
Environmental Resources Management
ERM

SCALE

DATE

FIGURE C

167114



Source:
Construction Drawing
"Improvements to Harmon Yard Wastewater Treatment Plant"
25 May 1984
Metcalf & Eddy

Note: This outfall is referred to in text as the active eight-inch diameter waste water treatment plant (WWTP) outfall. This pipe has been relined; its inner diameter is now four inches.

TITLE

Construction Detail
Harmon Yard Waste Water Treatment Plant
Active WWTP Outfall at Croton Bay (Hudson River)

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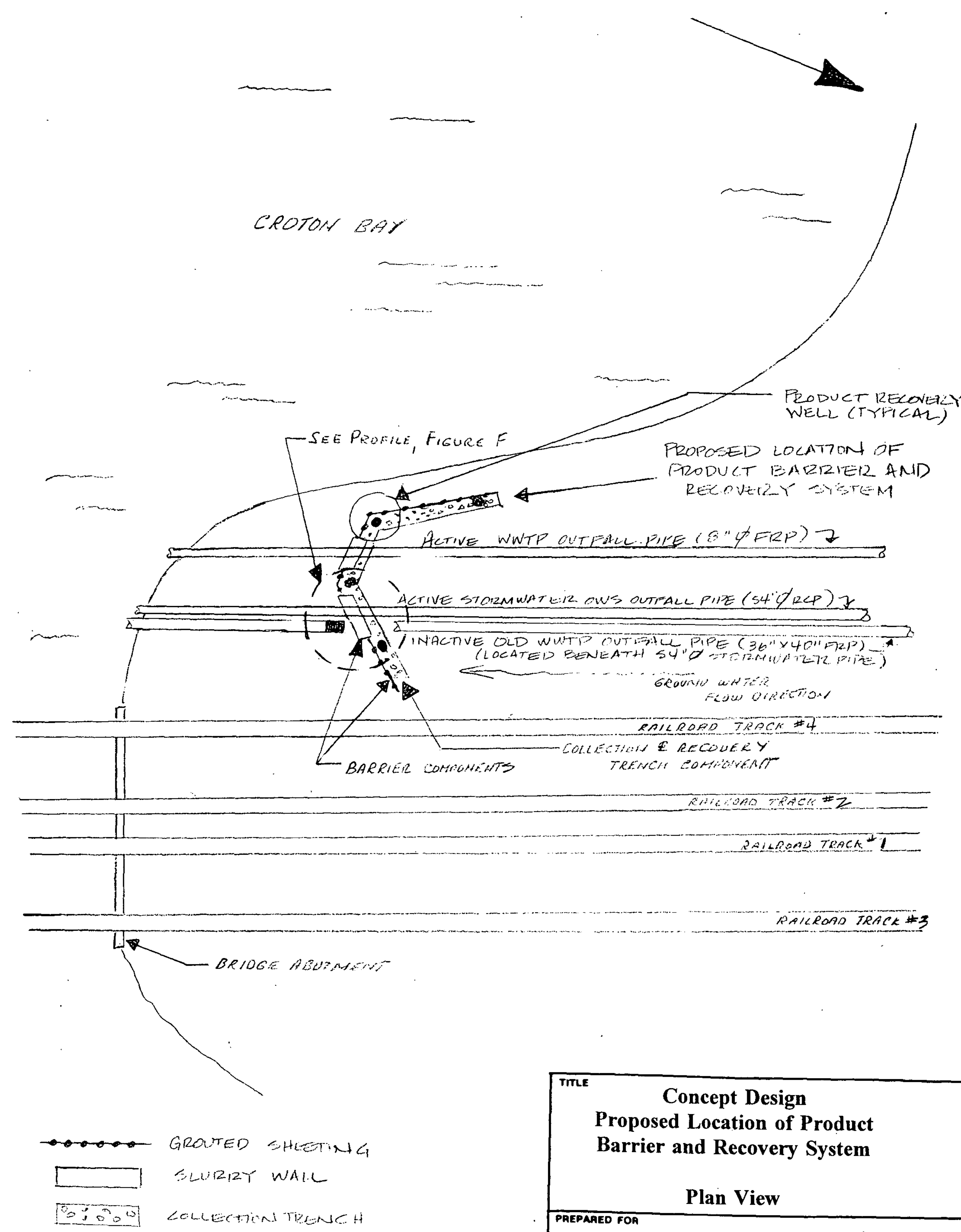
ERM

SCALE

DATE

FIGURE
D



TITLE

Concept Design
Proposed Location of Product Barrier and Recovery System

Plan View

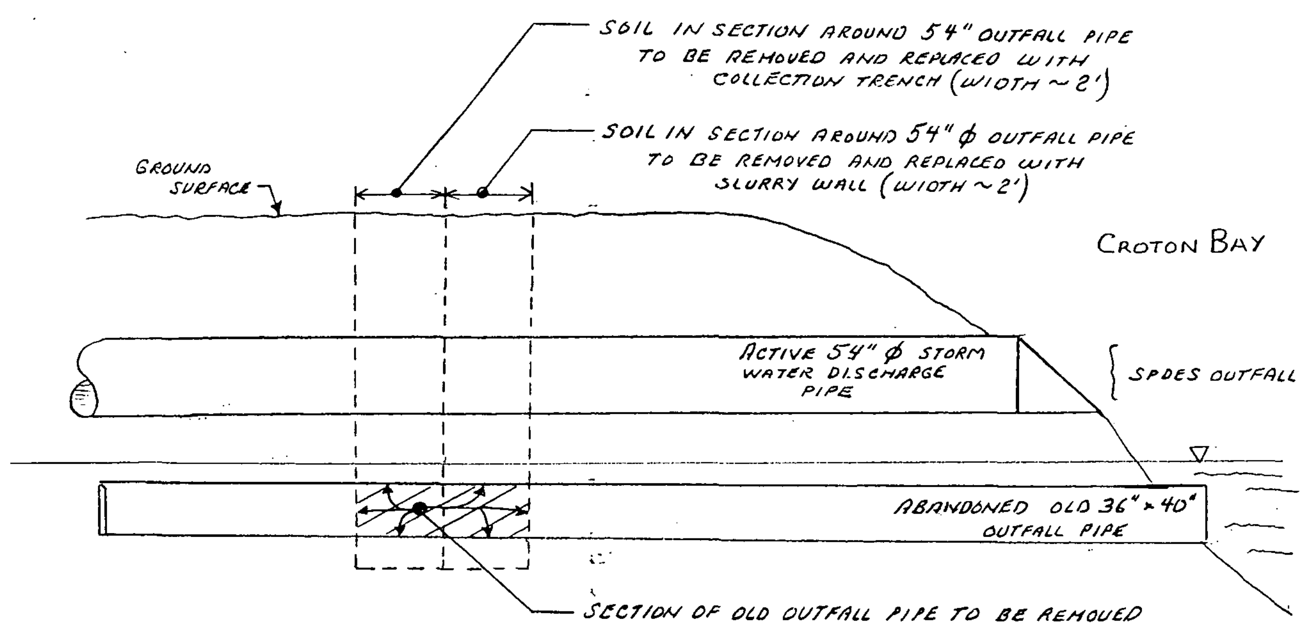
PREPARED FOR

Metro-North Railroad Company

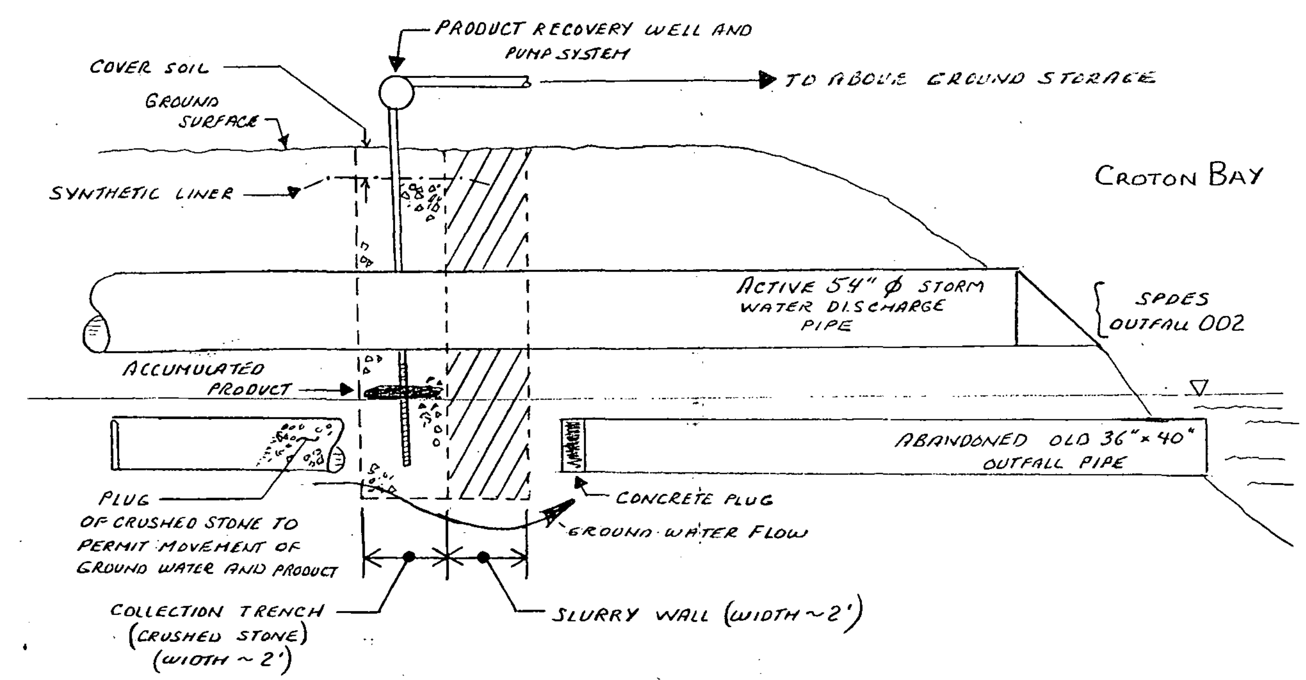
ERM ERM–Northeast
Environmental Resources Management

SCALE	FIGURE
NONE	E
DATE	

167114



PROFILE VIEW
PRIOR TO CONSTRUCTION



PROFILE VIEW
AFTER CONSTRUCTION

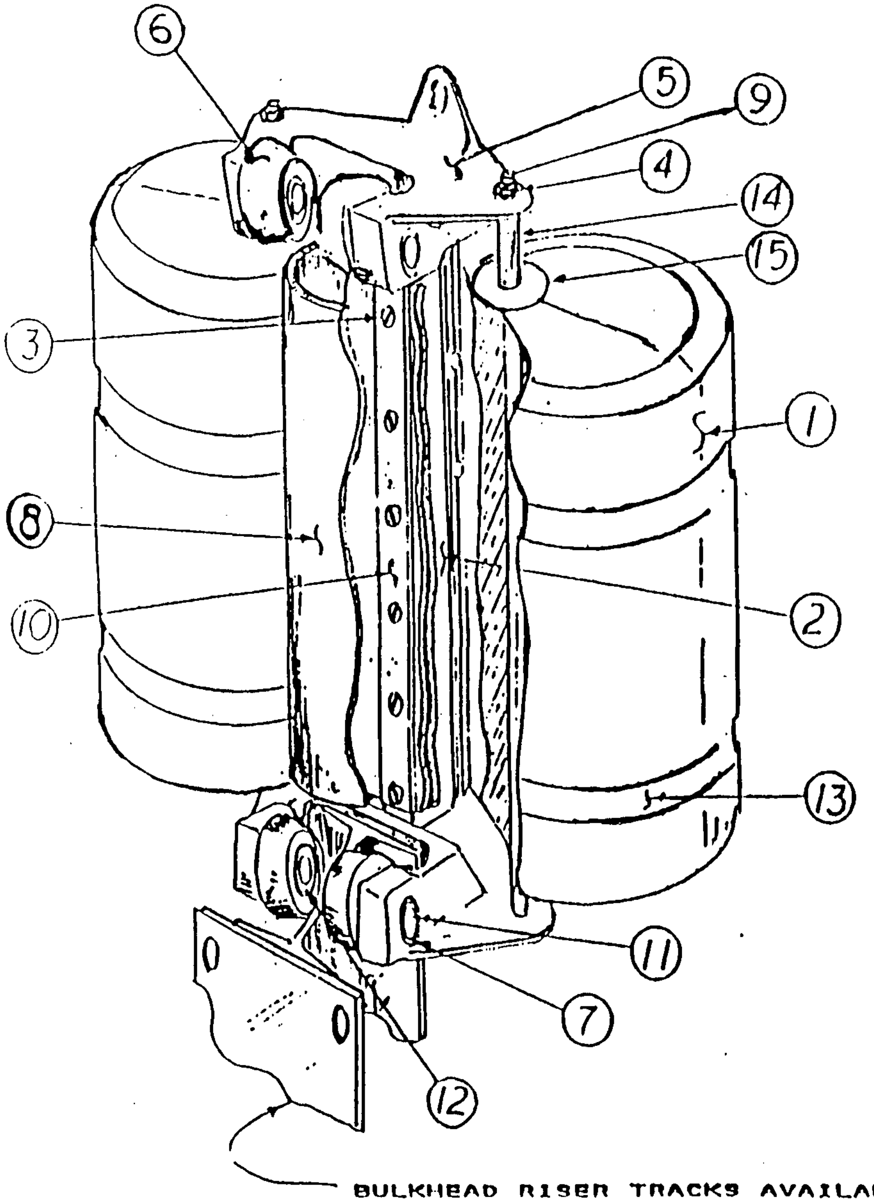
LEGEND:

▽ APPROXIMATE GROUND WATER ELEVATION AT LOW TIDE

TITLE **CONCEPT DESIGN PROPOSED BARRIER AND RECOVERY SYSTEM HARMON YARD CROTON BAY OUTFALL PROFILE VIEWS**		
PREPARED FOR **Metro-North Railroad Company**		
ERM-Northeast Environmental Resources Management ERM	SCALE DATE	FIGURE F

Appendix A

Cut Sheets and Installation Diagrams for the Proposed Boom Containment System



1. MOLDED POLYETHYLENE FLOATS.
2. MK2 EXTRU. 6063-T5
3. 10-32 X 3/4 FHMS S/S
4. 3/8 16 HH NYLOCK NUT
5. RISER CASTINGS AL.
6. 2" DIA. URETHANE WHEEL
7. EXT. IND. RETAIN. RING
8. 1/8" NITRILE RUBBER SEAL
9. 3/8" DIA. THREADED ROD S.S.
10. 3/16" X1" ALUM. STRIP
11. 1/2" RND. X 1 3/4" 303 SS AXLE
12. 1/2" ID X 7/8" OD FLAT WASH.
13. SS HOSE CLAMP
14. 1/2" ID NYLON TUBE SPACER
15. 3/8" ID X 2" OD X 1/8" POLY WASH.

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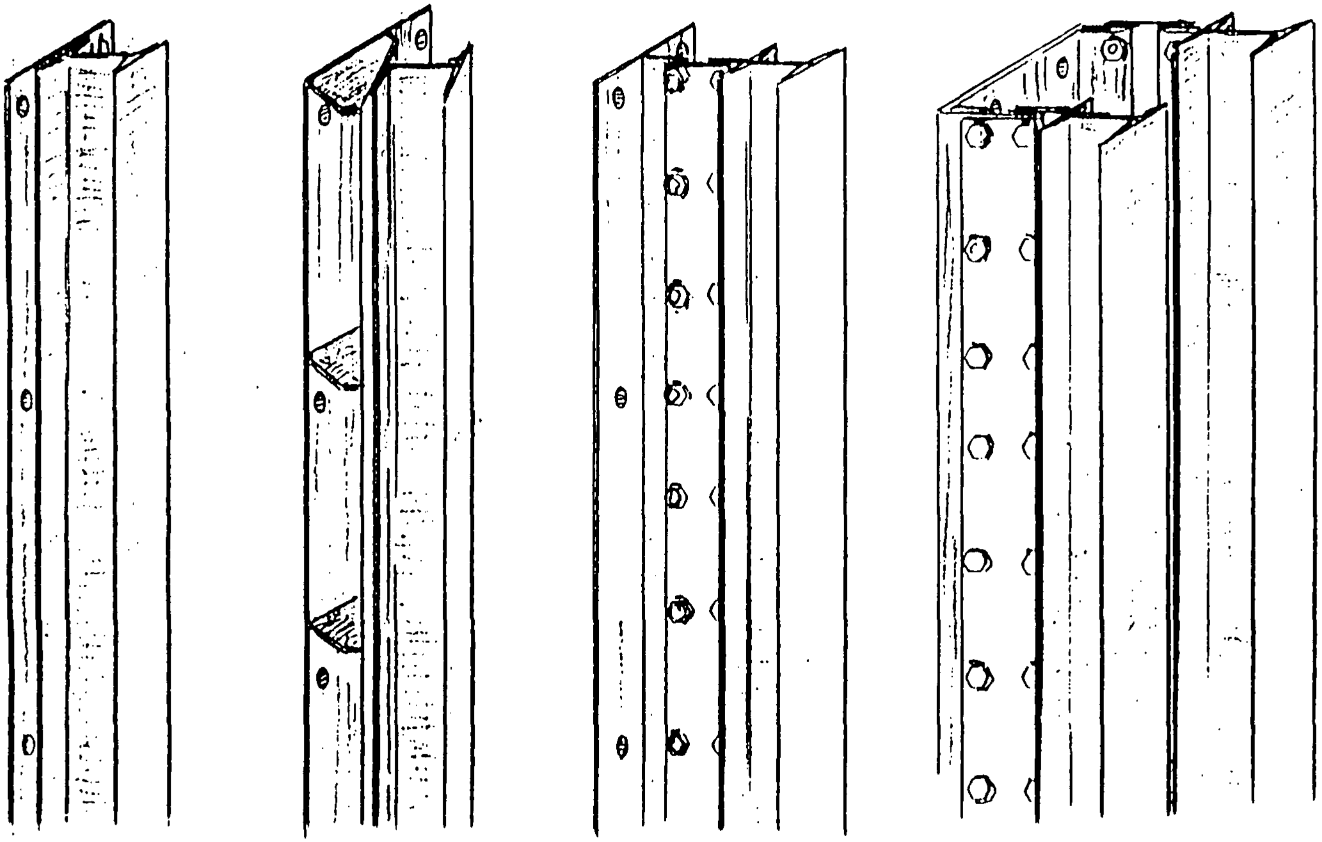

STRAIGHT

ANGLED

FLEXIBLE
± 60°

DOUBLE FLEXIBLE
± 60° x 2

SLICKBAR

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Seymour, CT 06483
Tel. (203) 888-7700

B.R. TRACK ILLUSTRATION

SCALE: NONE	DRAWN BY: [illegible]	DRAWING NUMBER
DATE: 3/15/93	APPROVED BY:	SKA3818

Environmental
Resources
Management

475 Park Avenue South
29th Floor
New York, NY 10016
(212) 447-1900
(212) 447-1904 (Fax)

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REGION 3-NEW PALTZ

April 30, 1998

ERM

Mr. James Hardy
Environmental Engineer I
New York State Department of Environmental Conservation
21 South Putt Corners Road
New Paltz, NY 12561-1696

RE: *REVIEW OF THE HARMON RAILROAD YARD*
PHASE I REMEDIATION PROJECT
THE CROTON BAY SEEPAGE CONTROL PLAN

Dear Mr. Hardy,

At the request of the Metro-North Commuter Railroad (Metro-North), Environmental Resources Management (ERM) has reviewed the data collected before and during the operation of the Croton Bay Seepage Control Plan, also referred to as Phase I of the Harmon Yard Remediation Plan. The results of ERM's review of this information, an analysis of the environmental conditions in the southern area of Harmon Yard near Croton Bay and recommendations for future actions are contained in the enclosed report, entitled "Review of the Harmon Railroad Yard, Phase I Remediation Project; The Croton Bay Seepage Control Plan".

The information provided in this report describes the investigations performed that demonstrate that although non-aqueous phase liquid (NAPL) may have been present as a liquid phase in the southern end of Harmon Yard in the past, NAPL is not present in subsurface soil or above the water table in this area at the present time. This information is presented to explain how minor amounts of NAPL may continue to seep into Croton Bay and be collected by the containment boom over the short term but that the migration of additional NAPL from other areas within Harmon Yard to Croton Bay will be prevented from occurring in the future by the barrier wall and NAPL recovery trench installed as part of the Harmon Yard Phase I remediation project.

{JI}C:\WP51\DOCS\MNNAPL\NAPL006F.DOC

Environmental
Resources
Management

The barrier wall and NAPL recovery trench were installed as a precautionary measure to prevent the migration of NAPL to Croton Bay in the future. As a result, the fact that NAPL has not yet accumulated in the NAPL recovery trench is not in any way an indication that the recovery trench is not operating as designed. The absence of NAPL in the recovery trench simply indicates that NAPL is not migrating from Harmon Yard to Croton Bay at the present time.

ERM recommends that to address NYSDEC concerns regarding this system, the NAPL recovery pumps that have been installed in the wells placed within the NAPL recovery trench be removed and replaced with absorbent material designed to remove small amounts of NAPL from recovery wells. ERM recommends that these passive hydrocarbon recovery systems be installed in each of the three NAPL recovery wells and used to recover NAPL, if any, for a period of six months. The use of these systems will provide Metro-North and the NYSDEC with the information needed to determine whether even a small amount of NAPL is accumulating in this recovery trench.

This information should confirm that NAPL is not migrating to the southern end of Harmon Yard at the present time and that the primary function of the Harmon Yard barrier wall and recovery trench near Croton Bay is as a precautionary measure to address the possible but unlikely migration of NAPL to this area of Harmon Yard in the future.

If you have any questions, please do not hesitate to call me at (212) 447-1900.

Sincerely,
ERM-Northeast

John Iannone, P.E.
Project Director

Attachments

cc: Mr. Albert Klauss, P.E. - NYSDEC *(with attachment)*
Mr. Thomas Lee, P.E. - NYSDEC *(with attachment)*
Karen L. Timko, Esq. - MTA *(with attachment)*
Mukesh L. Mehta, P.E. - Metro-North *(with attachment)*
Kenneth J. McHale Metro-North *(with attachment)*

(JI)C:\WP51\DOCS\MNNAPL\NAPL006F.DOC

REVIEW OF THE HARMON RAILROAD YARD PHASE I REMEDIATION PLAN PROJECT THE CROTON BAY SEEPAGE CONTROL PLAN

APRIL 29, 1998

Prepared for:
METRO-NORTH COMMUTER RAILROAD
420 LEXINGTON AVENUE
NEW YORK, NY 10017

Prepared by:
ENVIRONMENTAL RESOURCES MANAGEMENT
475 PARK AVENUE SOUTH
NEW YORK, NY 10016

TABLE OF CONTENTS

1.0 INTRODUCTION 1

2.0 SUMMARY OF EXISTING INFORMATION 3

2.1 APRIL 1, 1998 SITE VISIT OBSERVATIONS 3

2.2 CROTON BAY OUTFALL CONSTRUCTION METHODS 4

2.3 OUTFALL AREA REMEDIAL INVESTIGATION DATA 6
2.3.1 1994 Field Investigation Data 7
2.3.2 1995 OU-II Remedial Investigation Data 8

2.4 OIL/WATER SEPARATOR DEWATERING 10

2.5 RECOVERY TRENCH OPERATION 11

3.0 ANALYSIS 14

4.0 RECOMMENDATIONS 17

LIST OF ATTACHMENTS

Attachment I: Sections of the "Field Investigation Report" (ERM; April 1995) Related to the Harmon Yard Outfall Area

Attachment II: Section of the Operable Unit II "Remedial Investigation Report" (ERM; January 24, 1997) Related to the Southern End of Harmon Yard Near Croton Bay

Attachment III: The Croton Bay Seepage Control Plan Barrier Wall and NAPL Recovery Trench; Construction Details and Location

Attachment IV: Manufacturers Information - Peatwick Passive Hydrocarbon Recovery System

1.0 *INTRODUCTION*

At the request of the Metro-North Commuter Railroad (Metro-North), Environmental Resources Management (ERM) has reviewed the data collected before and during the operation of the Croton Bay Seepage Control Plan, also referred to as Phase I of the Harmon Yard Remediation Plan. The Croton Bay Seepage Control Plan (i.e., the "Plan") was approved by the New York State Department of Environmental Conservation (NYSDEC) and consists of:

1. a semi-flexible containment boom installed in Croton Bay; and
2. a combined non-aqueous phase liquids (NAPL) barrier wall and recovery trench.

This report contains the following:

- a summary of the information that is known regarding the southern area of Harmon Yard near Croton Bay (see Section 2.0);
- an analysis of this information (see Section 3.0); and
- recommendations regarding modifications to the Croton Bay Seepage Control Plan to address NYSDEC concerns (see Section 4.0).

Additional information is provided in Attachments I and II, which are included with this report. The information provided in this report describes the investigations performed that demonstrate that although NAPL may have been present as a liquid phase in the southern end of Harmon Yard in the past, NAPL is not present in subsurface soil or above the water table in this area at the present time. The construction of the sewer pipes and the Croton Bay outfall area, the previous NAPL removal efforts by Metro-North and the age of the NAPL that is present at Harmon Yard are described in this report. This information is presented to explain how minor amounts of NAPL may continue to seep into Croton Bay and be collected by the containment boom over the short term but that the migration of additional NAPL from other areas within Harmon Yard to Croton Bay will be prevented from occurring in the future by the barrier wall and NAPL recovery trench installed as part of the Harmon Yard Phase I remediation project.

The barrier wall and NAPL recovery trench were installed as a precautionary measure to prevent the migration of NAPL to Croton Bay in the future. As a result, the fact that NAPL has not yet accumulated in the NAPL recovery trench is not in any way an indication that the recovery trench is not operating as designed. The absence of NAPL in the recovery trench simply indicates that NAPL is <u>not</u> migrating from Harmon Yard to Croton Bay at the present time.

It was understood at the time that the *Croton Bay Seepage Control Plan* (ERM; November 1, 1995) was prepared that the possibility that NAPL would migrate to this area in the future was not definite. Nevertheless, to satisfy the NYSDEC's desire for a system that would ensure that future releases of NAPL to Croton Bay would be minimized and eventually eliminated, Metro-North proposed and constructed the Phase I remediation program. Similarly, Metro-North has undertaken the Phase II remediation program to remove NAPL from areas within Harmon Yard to ensure that this material does not migrate off-site in the future.

2.0 *SUMMARY OF EXISTING INFORMATION*

This section presents information on environmental conditions at Harmon Yard that may be related to the potential migration of free product to Croton Bay. The following information is discussed:

- the April 1, 1998 site visit observations;
- the methods used to construct the outfall at Croton Bay;
- outfall area remedial investigation data;
- the dewatering performed during construction of the Harmon Yard storm water oil/water separator; and
- recovery trench operation.

This information is discussed in the following subsections.

2.1 *APRIL 1, 1998 SITE VISIT OBSERVATIONS*

The NYSDEC has recently surveyed the components of the Croton Bay Seepage Control Plan and has requested information regarding whether the components of the Plan are achieving the goals for which they were designed. Metro-North accompanied staff from the New York State Department of Environmental Conservation (NYSDEC) during a visit to the southern part of Harmon Yard near Croton Bay on April 1, 1998. An area of Croton Bay near Harmon Yard that is located north of and beyond the limits of the Croton Bay containment boom was surveyed during the visit.

The containment boom was installed by Metro-North in an area of Croton Bay around the southern tip of Harmon Yard, where the storm and sanitary sewer pipes from Harmon Yard discharge to Croton Bay. The NYSDEC wanted to survey this general area in response to an unconfirmed report that a material similar in appearance to petroleum was observed on the surface of the shore (beach) area on Westchester

County property adjacent to Croton Bay. The Westchester County shore area where this material was observed is located beyond the containment boom.

A sample will of the material that was observed on the Westchester County shore of Croton bay during the April 1, 1998 site visit will be collected by Metro-North as soon as tidal conditions allow. *{Note: This sample was collected by Metro-North during the week of April 27, 1998.}*. This material was observed at the time of the site visit to have a glossy or reflective appearance.

Although petroleum seeps can have a similar appearance, examination by the NYSDEC personnel found that this material did not readily reconstitute when disturbed, as opposed to petroleum, which readily reconstitutes after disturbance. This material appeared to those present during the site visit to be natural in origin (e.g., decomposing leaves, brush and other natural vegetative organic material). In any case, the sample of this material that is to be collected by Metro-North will determine whether the material observed on the Westchester County shore near Croton Bay contains petroleum or whether it is a result of the decomposing leaves and other natural material in this area.

Material floating on the Hudson River tends to accumulate in Croton Bay and on this Westchester County shore area, If petroleum is present in the material observed during the April 1, 1998 site visit, sources related to the Hudson River, such as boats in Croton Bay using outboard motors, need to be evaluated before it can be concluded that this material is related to Harmon Yard.

2.2 *CROTON BAY OUTFALL CONSTRUCTION METHODS*

Petroleum hydrocarbon seeps have been reported in the area of Croton Bay where the storm water and sanitary sewer pipes from Harmon Yard discharge to Croton Bay. Typically, these seeps have been observed as petroleum-like hydrocarbon sheens which appear to originate from the sediment and spread out on the surface water in Croton Bay. This petroleum appears as small seeps on the surface of Croton Bay about 10 to 20 feet from the end of the discharge line.

As shown on Figure D of the *Croton Bay Seepage Control Plan* (ERM; November 1, 1995), this petroleum probably originated from Harmon Yard at some time in the past and migrated to Croton Bay as NAPL in the stone bedding used to install the wastewater and storm water sewer pipes that terminate at Croton Bay. As shown on Figure D, a copy of which has been attached to this letter report, this remnant of a past release is probably trapped within the stone bedding beneath the sewer pipes at the southern end of Harmon Yard.

This pipe bedding leads directly into the crushed stone layer installed beyond the Croton Bay shoreline, as shown on Figure D. The Croton Bay outfall shown on Figure D was installed in 1984 during the construction of the active wastewater sewer line. As a result, NAPL in this sewer pipe bedding is probably also trapped within the 12 inch layer of screened gravel that was installed 10 to 20 feet beyond the Croton Bay shoreline. An 18 inch layer of large stones (rip rap) and an engineering fabric were placed over this layer of screened gravel. This screened gravel and geotextile layer extends approximately 10 to 20 feet from the end of the discharge pipe into Croton Bay. As the tide recedes in this area, water and NAPL trapped in the pipe bedding immediately adjacent to the outfall point may be drawn into this layer of screened gravel. This trapped water and NAPL would then appear on the surface of Croton Bay, approximately 20 feet from the end of the shoreline. See notes on Figure D.

This matches what is being observed in Croton Bay and is most likely the explanation for the appearance of petroleum-like hydrocarbon sheens in Croton Bay about 10 to 20 feet beyond the discharge end of the sewer pipes and within the containment boom presently in place in this area.

2.3 *OUTFALL AREA REMEDIAL INVESTIGATION DATA*

Two separate investigations of environmental media at Harmon Yard have generated information on soil and ground water quality in the southern end of Harmon Yard near Croton Bay. In 1994, ERM conducted an investigation to define soil and ground water quality in this area and to investigate the potential presence of free product. This work, which is defined in the *Field Investigation Report* for Harmon Yard (ERM; April 1995), was performed under the direction of the NYSDEC Division of Spills Management, now the Division of Environmental Remediation.

In 1995, samples of soil adjacent to the inactive wastewater discharge line throughout Harmon Yard were collected as part of the Operable Unit II (OU-II) remedial investigation. This data, which is described in the OU-II *Remedial Investigation Report* (ERM; January 24, 1997), was performed under the direction of the NYSDEC Division of Hazardous Waste Remediation, now the Division of Environmental Remediation.

The data collected by these investigations, discussed in more detail below, demonstrates that although free product may have once been present in this area, only residual amounts of petroleum compounds are present in subsurface soil in this area at this time. Free product was not observed in this area and ground water quality in this area and throughout Harmon Yard has not been significantly affected by petroleum or other substances.

2.3.1 *1994 Field Investigation Data*

Sections of the *Field Investigation Report* (ERM; April 1995) that describe the petroleum-related field investigation performed at the southern end of Harmon Yard near Croton Bay have been included with this report as Attachment I. This area of Harmon Yard is referred to in the *Field Investigation Report* as the Outfall Area. As part of the 1994 petroleum-related Harmon Yard field investigation, two permanent and nine temporary NAPL monitoring wells were installed in this Outfall Area. In addition, three soil samples were collected and analyzed for Target Compound List and Target Analyte List constituents, including PCBs. Refer to Drawing 3-1 (see Attachment I to this report) for well and soil sampling locations.

As shown on Table 3-4 from the *Field Investigation Report* (see Attachment I to this report), NAPL has not been observed in the two permanent NAPL monitoring wells installed in this area (i.e., ERM-17 and ERM-19). These wells were monitored at least once a month from April 1994 until January 1995. NAPL has not been observed in any of the seven temporary NAPL monitoring wells installed within the boundaries of Harmon Yard. The on-site wells are: OF-B3, OF-B4, OF-TP1, OF-TP2, OF-TP3, OWS-B1 and OWS-B2. Very low levels of NAPL were observed during one of the two monitoring events conducted at the two off-site NAPL monitoring wells. Approximately 0.13 feet and 0.03 feet of NAPL, respectively, were observed on April 1, 1994 in temporary off-site NAPL monitoring wells OF-B1 and OF-B2.

The three soil samples collected from this area (i.e., OF-TP1, OF-TP2 and OF-TP3) contained relatively low levels of petroleum-related organic compounds. No volatile organic compounds (VOCs) were detected in any sample. The concentrations of semi-volatile organic compounds (SVOCs) detected in these samples were relatively low. The SVOCs detected were naphthalene and polycyclic aromatic hydrocarbon (PAH) compounds. The concentrations of these compounds were generally below 1.0 part per million (ppm). One sample (i.e., OF-TP3) contained a total PAH concentration of 4.2 ppm. All PCB concentrations were below 0.02 ppm. Refer to Figure 4-4 (see Attachment I to this report) for a summary of soil concentration data and soil sampling locations.

The absence of VOCs, the fact that NAPL has not accumulated in the on-site NAPL monitoring wells and the relatively low concentrations of SVOCs detected in soil clearly indicates that NAPL may have been present in this area at one time but that petroleum substances are not present as a liquid phase in this area at the present. This information is consistent with the results of the OU-II remedial investigation, described below in Section 2.3.2.

2.3.2 *1995 Operable Unit II (OU-II) Remedial Investigation Data*

As part of the Operable Unit II (OU-II) remedial investigation, Metro-North investigated the soil around the inactive wastewater discharge line. The purpose of the OU-II remedial investigation was to determine whether the operation of the old wastewater treatment plant and the former wastewater equalization lagoon, the old (now inactive) wastewater sewer line from the plant to Croton Bay or the Croton Bay outfall area were adversely affected by the operation of the plant. Sections of the OU-II *Remedial Investigation Report* (ERM; January 24, 1997) that describe the components of this investigation that were performed at the southern end of Harmon Yard near Croton Bay have been included with this report at Attachment II.

As part of the OU-II remedial investigation work, a total of 62 soil borings were installed along the full length of the inactive wastewater sewer line, from the treatment plant to Croton Bay. One soil sample was collected from each of these 62 soil boring locations. These samples were analyzed for Target Compound List constituents and for Total Organic Carbon. The inactive wastewater sewer line is present in generally the same location as the new wastewater discharge line that replaced it. In the narrow land area at the southern tip of Harmon Yard near Croton bay, all three sewer pipes (the inactive wastewater line, the active wastewater line that replaced it and the storm water sewer line) were all constructed in close proximity to one another.

The line of OU-II soil borings installed adjacent to the discharge line extended to the southern part of Harmon Yard, near Croton Bay. Staining and odors were observed in about one-third of these samples but NAPL or petroleum saturated soil was not encountered in any of these samples. The staining, odors and the presence of a number of petroleum-related SVOCs in these soil samples that are similar to those detected in soil samples collected during the 1994 field investigation discussed in Section 2.3.1, all indicate that NAPL was probably present in this area at one time.

As discussed in the Harmon Yard *Remediation Plan* (ERM; April 10, 1996), the NAPL present as a liquid phase at Harmon Yard is about 20 years old. The most likely explanation is that NAPL present as a liquid phase within Harmon Yard migrated along the bedding of these sewer pipes to Croton Bay sometime over the past 20 years since this material was first released into the environment. The current data indicate that this migration is not occurring at the present time and may never occur in the future. The removal of a significant amount of NAPL and ground water during the dewatering performed as part of the construction of the new oil\water separator, discussed below in Section 2.4, may be responsible for the absence of NAPL in this area at the present time. The recovery trench and barrier wall were installed at the southern end of Harmon Yard to address the possibility, however remote, that NAPL present as a liquid phase in areas located within Harmon Yard could migrate along the bedding of these sewer pipes in the future.

2.4 *OIL/WATER SEPARATOR DEWATERING*

In the mid-1980's, Metro-North installed a new storm water oil/water separator at the southern end of Harmon Yard approximately 500 feet north of the Croton Bay outfall area. As shown on Figure 2-4 of the OU-II *Remedial Investigation Report* (see Attachment II to this report), this is a substantial structure and includes two 25,000 gallon oil/water separator tanks. The installation of this structure required that a significant amount of ground water be removed during dewatering to prepare the area for construction. This new storm water oil/water separator was installed within 50 to 100 feet of the wastewater and storm water sewer lines that are located in the southern end of Harmon Yard.

At that time, little information was available on the presence of NAPL at Harmon Yard. Although there was no indication that NAPL was present in this area prior to construction, dewatering was stopped shortly after dewatering began because of the presence of NAPL in the ground water in the excavation areas. A temporary treatment system was installed to separate the NAPL from the ground water removed during dewatering. The treated ground water was discharged to the new Harmon Yard wastewater treatment plant with permission from the NYSDEC. Recovered NAPL was transported off-site for disposal.

This project required that the water table in this area be lowered substantially. Since the size of the excavation area was extensive, this action induced NAPL located within a reasonable distance (i.e., at least within 100 feet) from this area to flow toward the excavation. The result is that much of the NAPL that may have been present in this area of Harmon Yard was probably removed during this dewatering program. Since the sewer lines are located relatively close to the area that was dewatered, any NAPL that may have been present in the bedding for the sewer lines would probably also have been removed during dewatering.

In fact, dewatering would have had a greater effect on NAPL in the bedding for the sewer lines than on NAPL in adjacent soil because of the higher permeability of the stone used to construct the bedding for these sewer lines. Consequently, this dewatering project probably removed most of the NAPL that may have been present in the sewer pipe bedding both upgradient and for a significant distance downgradient of the oil/water separator. The extensive ground water and NAPL removal that occurred during the dewatering phase of the construction of the oil/water separator in the mid-1980's probably explains the following: (1) NAPL is no longer found as a liquid phase in the southern end of Harmon Yard; and (2) residual amounts of NAPL are seeping into Croton Bay at the outfall end of these sewer lines.

2.5 *RECOVERY TRENCH OPERATION*

The Croton Bay containment boom component of the Croton Bay Seepage Control Plan was installed in August 1996. The location of the boom was designed to contain the small amounts of petroleum that has been observed in Croton Bay near (i.e., within 10 to 20 feet from) the discharge end of the Harmon Yard outfall pipes. This boom has been successful in containing the small amount of petroleum that has been observed occasionally seeping into Croton Bay at the outfall end of the Harmon Yard sewer pipes.

The barrier wall and NAPL recovery trench component of the Croton Bay Seepage Control Plan was installed in 1997 and began start-up operations in September 1997. The system was fully operational and all installation was completed by December 1997. The methods used to construct this system were defined by the design engineer in a drawing entitled "Cut-Off Wall; Harmon Yard Groundwater Remediation; Phase I - Details". The details presented in this design drawing have been included with this report as Attachment III. Attachment III also contains a drawing developed as part of the design that shows the location of the barrier wall and recovery trench with respect to Croton Bay. As shown on this figure, the trench was installed approximately 250 feet north of Croton Bay.

The operation of the product removal pumps (i.e., the scavenger pumps) and the condition of the NAPL recovery trench are generally surveyed at least once per week by Metro-North staff. The following items are inspected and the results are recorded on "Equipment History" forms by Metro-North:

- the amount of NAPL (if any) that has accumulated in the above ground storage tank, which was installed to store the NAPL removed from the NAPL recovery trench;
- the operational status of the air compressor used to operate the NAPL removal pumps;
- the condition of the NAPL removal pumps, also referred to as the Selective Oil Skimmers *{Note: This form is also used to record the results of the inspection of the recovery wells for the presence of product, which is included as part of this phase of the inspection.}*; and
- the conditions of the desiccant dryer used in the air lines for the NAPL removal pump compressor *{Note: These air lines were heat traced in November 1997. As a result, the desiccant dryer is no longer used.}*.

The inspection of the NAPL recovery trench operation during the initial start-up period (i.e., from September 1997 through December 1997) and during the first two months of operation (i.e., January and February 1998) reported that no product had been recovered since the barrier wall and NAPL recovery trench were installed in September 1997. This is consistent with the following: (1) NAPL was not found in subsurface soil in the southern end of Harmon Yard during two separate remedial investigation efforts; and (2) most, if not all, of the NAPL present in this area was probably removed during the dewatering performed as part of the construction of the new oil/water separator.

As discussed in Section 1.0 of this report, the barrier wall and NAPL recovery trench were installed as a precautionary measure to prevent the migration of NAPL to Croton Bay in the future. As a result, the fact that NAPL has not yet accumulated in the NAPL recovery trench is not in any way an indication that the recovery trench is not operating as designed. The absence of NAPL in the recovery trench simply indicates that NAPL is not migrating from Harmon Yard to Croton Bay at the present time.

3.0 *ANALYSIS*

The following information is known with respect to the operation of the Croton Bay Seepage Control Plan:

- The material that was observed on the shore (beach) area of the Westchester County property adjacent to Croton Bay during the April 1, 1998 site visit is probably natural in origin and not related to the NAPL found in certain areas of Harmon Yard.
- Small amounts of NAPL are probably trapped in the last sections of the bedding for the Harmon Yard sewer pipes, near Croton Bay. This NAPL is probably a remnant of NAPL that entered the pipe bedding from Harmon Yard many years ago. The NAPL in this bedding at the discharge end of these sewer pipes is probably migrating to the layer of crushed stone and geotextile that was installed in 1984 during construction of the active wastewater sewer line. The layer of crushed stone and geotextile extends from the end of the pipe into Croton Bay approximately 10 to 20 feet and terminates in an area of Croton Bay where the petroleum seeps have been observed. This is the only reasonable explanation for why petroleum is not seeping out from the shore of Croton Bay but is only seen 10 to 20 feet from shore.
- Two separate investigations of environmental media at Harmon Yard have generated information on soil and ground water quality in the southern end of Harmon Yard near Croton Bay: (1) the 1994 Field Investigation for petroleum; and (2) the 1995 OU-II Remedial Investigation. The data collected by these investigations demonstrates that although free product may have once been present in this area, only residual amounts of petroleum compounds are present in subsurface soil in this area at this time.
- In the mid-1980's, Metro-North removed a significant quantity of ground water and NAPL during an excavation project to install the new storm water oil/water separator. Since the size of the excavation area was extensive, this action induced NAPL in this area to flow toward the excavation and be removed during dewatering. The result is that any NAPL that may have been present in this area of Harmon Yard was probably removed during this dewatering project.
- The inspection of the NAPL recovery trench operation reports that no product has been recovered since the barrier wall and NAPL recovery trench were installed in September 1997. This is consistent with the following: (1) NAPL was not found in subsurface soil in the southern end of Harmon Yard during two separate remedial investigation efforts; and (2) most, if not all, of the NAPL present in this area was probably removed during the dewatering performed as part of the construction of the new oil/water separator.

To summarize, NAPL or free product has not been found at the southern end of Harmon Yard. The soil borings and NAPL monitoring wells installed in the southern end of Harmon Yard up to and as far south as the location of the NAPL recovery trench did not encounter NAPL. NAPL was also not encountered in subsurface soil during the installation of the Croton Bay Seepage Control Plan NAPL recovery trench.

It is likely that NAPL once migrated to Croton Bay from Harmon Yard through the stone bedding used to construct the various Harmon Yard sewer pipes. This migration probably occurred years ago, since most of the NAPL present at Harmon Yard is over 20 years old.

There are two reasons why the migration of NAPL to the southern end of Harmon Yard has ceased:

- the extent of the NAPL in the Harmon Yard source areas has stabilized and is no longer migrating beyond the source areas; and

- the dewatering project conducted during the construction of the oil/water separator removed the majority of the NAPL that had already migrated to the southern end of Harmon Yard.

Small amounts of NAPL are probably still present in the stone sewer pipe bedding at the end of the sewer pipes, immediately adjacent to Croton Bay. A layer of crushed stone and geotextile that extends from the end of the sewer pipes approximately 10 to 20 feet into Croton Bay is the most likely explanation for why NAPL is migrating from this section of pipe bedding 10 to 20 feet into Croton Bay.

The result is that the small amount of NAPL that is believed to be present in the bedding beneath the length of sewer pipes between the recovery trench and Croton Bay will continue to release NAPL into Croton Bay at the outfall point, where it will be contained by the Croton Bay semi-flexible containment boom. The recovery trench is a precautionary measure and NAPL will probably not accumulate in the trench for some time, if ever. However, if NAPL from Harmon Yard migrates along these sewer lines toward the southern end of Harmon Yard in the future, it will accumulate behind the barrier wall and in the NAPL recovery trench, where it will be removed for off-site disposal.

4.0 *RECOMMENDATIONS*

The previous sections described the conditions at the southern end of Harmon Yard. These sections also described the information that supports the conclusion that the only NAPL present at the southern end of Harmon Yard is the small amount of NAPL trapped in the bedding of the sewer pipes between the recovery trench and Croton Bay. The NAPL recovery trench was installed as close as possible to Croton Bay, i.e., approximately 250 feet north of the Croton Bay shore line. Harmon Yard is very narrow near Croton Bay and the limited distance between the trench and Croton Bay prevented the installation of the recovery trench any closer to the end of the sewer pipes. ERM believes that the small amount of NAPL that is believed to be present beneath the pipe bedding between the recovery trench and Croton Bay will be addressed by the containment boom that has been installed in Croton Bay.

The primary concern identified by the NYSDEC during the April 1, 1998 site visit is the possibility that NAPL is accumulating in the recovery trench in quantities that are too small to be removed by the NAPL recovery pumps. The NYSDEC is concerned that it may be possible that NAPL can accumulate in the trench at levels that are too small to remove but large enough to migrate past the end of the barrier wall and recovery trench. ERM believes that the length of the recovery trench (refer to site plan, Attachment III), in particular, the north-south arm of the trench that parallels the shore line of Croton Bay, makes this potential NAPL migration pathway virtually impossible. In addition, periodic monitoring of the recovery wells that were installed in the recovery trench has not reported the accumulation of any quantity of NAPL in this trench.

In order to address NYSDEC concerns that small amounts of NAPL may be accumulating in and migrating past the NAPL recovery trench, ERM recommends that the NAPL recovery pumps that have been installed in the wells placed within the NAPL recovery trench be removed and replaced with absorbent material designed to remove small amounts of NAPL from recovery wells. Attachment IV contains information on one type of absorbent material. ERM recommends that these passive hydrocarbon recovery systems be installed in each of the three NAPL recovery wells and used to recover NAPL, if any, for a period of six months. The advantage of these systems over the recovery pumps is that they will recover even very small amounts of NAPL. The use of these systems will provide Metro-North and the NYSDEC with the information needed to determine whether even a small amount of NAPL is accumulating in this recovery trench. Metro-North and the NYSDEC would then review the results of the temporary use of this absorbent material to determine whether the recovery pumps should be permanently removed and replaced with absorbent material. However, even if a small amount of NAPL is removed by this absorbent material, it is very unlikely that NAPL can migrate beyond the end of the barrier wall and recovery trench.

These passive hydrocarbon absorbent recovery systems provide continuous recovery of NAPL. The absorbent, a hydrophobic organic material, is placed within a canister and the canister and absorbent material are lowered into the recovery well so that part of the container is below the water table. Capillary action draws hydrocarbons into the absorbent material until the it reaches saturation. The spent absorbent is then removed from the canister and disposed of off-site. The Peatwick system described in Attachment IV uses a dehydrated peat moss that creates a porous structure with an affinity for absorbing hydrocarbons but which repels water. That system absorbs approximately one gallon of hydrocarbon per pound of absorbent material, which is roughly the weight of an absorbent wick for a 2 inch diameter well. The spent material can either be landfilled or incinerated.

ERM believes that the temporary use of these absorbent systems will provide the information needed to determine the amount of NAPL that accumulates in the recovery trench, if any. This information should confirm the analysis and conclusions presented in Section 3.0. That is, NAPL is not migrating to the southern end of Harmon Yard at the present time and the primary function of the Harmon Yard barrier wall and recovery trench near Croton Bay is as a precautionary measure to address the possible but unlikely migration of NAPL to this area of Harmon Yard in the future.

REVIEW OF THE HARMON RAILROAD YARD
PHASE I REMEDIATION PLAN PROJECT
THE CROTON BAY SEEPAGE CONTROL PLAN

ATTACHMENT I

SECTIONS OF THE HARMON YARD (PETROLEUM-RELATED) "FIELD INVESTIGATION REPORT" {ERM; APRIL 1995}

Related to:

Work performed at the southern end of Harmon Yard, near Croton Bay

FIELD INVESTIGATION REPORT
HARMON RAILROAD YARD

April 1995

Prepared For:
Metro-North Railroad Company

Prepared By:

ERM-NORTHEAST
175 Froehlich Farm Boulevard
Woodbury, New York 11797

indicated that the tank was filled with water containing traces of oil. The contents of the tank were pumped out and discharged to the WWTP. The inside of the tank was inspected for sludge. Since a portion of the tank was located under Track 4, NYSDEC approved closure place by filling with concrete.

Soil excavated from the platform footings was analyzed for TPH and New York State Table 2 TCLP Constituents. The concentrations of four organics exceeded their TCLP regulatory levels by a minor amount. As a result of these data, some of the soils were removed from the Yard. However, in light of the minor exceedances of the TCLP regulatory levels, the fact that the tank contents were primarily water, and that no free NAPL was observed, no further investigative effort was performed in this area.

1.3.9 Sample Collection During Installation of New Oil-Water Separator

As part of the WWTP Improvement Program, a new oil/water separator was installed at the south end of the T&E parking lot (Figure 1-2). The purpose of this separator is to remove oil from storm water originating at the fuel pad area before it is pumped to the treatment plant. Prior to any excavation work in the Yard, soils are routinely tested by Metro-North to determine disposal options. Samples were therefore collected from eight borings in the proposed location of the new separator. A total of eight samples were analyzed for PCBs and TCLP constituents. 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 these data, the excavated soils were disposed at an industrial waste landfill.

During construction of the new oil-water separator, NAPL was discovered. Additional investigative work was therefore performed in this area, as part of the Locomotive Fueling Pad and Maintenance-of-Way Building areas of concern.

Alconox and water solution wash followed by tap water rinse, or steam cleaning.

Upon retrieval and opening of each split spoon, total VOCs were measured using a organic vapor analyzer equipped with a photoionization detector (PID). The sample was then described, and a representative portion was collected in a jar, which was immediately covered with aluminum foil and capped, for later headspace analysis.

Due to the nature of the material underlying the road at the south end of the Yard, three test pits were installed to investigate the outfall pipe area. These test pits were excavated to the water table, using a backhoe. The test pit stratigraphy was described, and a sample of each separate lithologic unit was collected, as above, for later headspace analysis. A stratigraphic description for each test pit is included in Appendix A. The backhoe bucket was decontaminated before each test pit using high pressure steam. The decontamination fluids were discharged to the WWTP.

The headspace was measured for each jarred sample, using a PID. After the jar's cover had been removed, the PID probe was inserted through the aluminum foil covering the jar. The total VOC concentration of the headspace was recorded in the field notebook, after the equilibration of the PID reading. The worst-case sample from each boring or test pit, based on sensory and headspace analysis, was analyzed in the field for fuel components using the HNu-Hanby field test kit. If there was no obvious worst-case sample, then the soil sample collected directly above the water table from that boring or test pit was analyzed. The procedures and results of the HNu-Hanby analyses are presented in Section 4.3.1.

After soil sampling had been completed, a temporary well was installed in each boring or test pit. Each temporary well was constructed using 10 feet of two-inch diameter screen and enough two-inch diameter riser pipe so that the

TABLE 3-3
NAPL THICKNESS MEASUREMENTS IN TEMPORARY MONITORING WELLS
METRO-NORTH HARMON YARD

AREA OF CONCERN	TEMPORARY WELL	NAPL THICKNESS (feet)					
		Round 1		Round 2		Round 3	
		Date	Thickness	Date	Thickness	Date	Thickness
LMS-GW1	LMS-GW1-B1	3/24/94	0.00	3/25/94	0.00		
	LMS-GW1-B2	3/24/94	0.00	3/25/94	0.00		
Electric Shop	ES-B1	4/1/94	0.00				
	ES-B2	4/1/94	0.00				
	ES-B3	4/11/94	0.00				
Distribution Center	DC-B1	3/30/94	0.00	4/1/94	0.00		
	DC-B2	3/25/94	0.00				
	DC-B3	3/25/94	0.00				
	DC-B4	3/30/94	0.47	3/31/94	0.51	4/1/94	0.38
Croton Point Ave. Bridge	CAB-1	3/25/94	0.00				
	CAB-2	3/25/94	0.00				
	CAB-3	4/1/94	0.00				
Recovery Well Area	EQ-B1	3/25/94	1.37				
	RW-B101	3/30/94	0.10	4/1/94	0.14		
	RW-B102	4/11/94	0.00				
Maintenance of Way Bldg.	MOW-B1	3/25/94	0.00	3/28/94	0.00	4/1/94	0.00
	MOW-B2	3/25/94	0.00	3/28/94	0.00		
Million Gallon Tank	MGT-B1	4/5/94	0.00				
	MGT-B2	4/5/94	0.00				
Osborne Pond	OP-B1	3/25/94	0.12	3/28/94	0.03		
	OP-B2	3/25/94	0.90	3/28/94	1.17		
	OP-B3	3/25/94	0.09	3/28/94	0.07		
	OP-B4	3/25/94	0.04	3/28/94	0.02		
	OP-B5	3/25/94	0.00	3/28/94	0.00		
	OP-B7	4/13/94	0.00	4/19/94	0.00		
	OP-B8	4/19/94	0.00				
	OP-B9	4/27/94	0.00	4/29/94	0.00	5/5/94	0.00
LMS-GW5	LMS-GW5-B1	3/24/94	0.00	3/25/94	0.00		
	LMS-GW5-B2	3/24/94	0.00	3/25/94	0.00		
	LMS-GW5-B3	4/19/94	0.00				
Outfall	OF-B1	4/1/94	0.00	4/5/94	0.13		
	OF-B2	4/1/94	0.00	4/5/94	0.03		
	OF-B3	4/1/94	0.00	4/5/94	0.00		
	OF-B4	4/1/94	0.00	4/5/94	0.00		
	OF-TP1	4/19/94	0.00	5/5/94	0.00	6/8/94	0.00
	OF-TP2	4/19/94	0.00	5/5/94	0.00	6/8/94	0.00
	OF-TP3	4/19/94	0.00	5/5/94	0.00	6/8/94	0.00
Old Oil/Water Separator	OWS-B1	3/31/94	0.00	4/1/94	0.00		
	OWS-B2	3/31/94	0.01	4/1/94	0.00		

NOTES: In addition, temporary wells OF-TP1 and OF-TP3 were measured on 7/8/94, 8/8/94, and 9/19/94, and OF-TP2 was measured on 7/8/94. NAPL was not detected on any of these occasions.

TABLE 3-4
DEPTH TO WATER, DEPTH TO NAPL, AND NAPL THICKNESS MEASUREMENTS
METRO-NORTH HARMON YARD

WELL	DATE	DEPTH TO NAPL (feet)	DEPTH TO WATER (feet)	NAPL THICKNESS (feet)	DATE	DEPTH TO NAPL (feet)	DEPTH TO WATER (feet)	NAPL THICKNESS (feet)	DATE	DEPTH TO NAPL (feet)	DEPTH TO WATER (feet)	NAPL THICKNESS (feet)
MW-1	4/29/94		NOT MEASURED		5/5/94		NOT MEASURED		6/8/94	7.86	9.78	1.92
MW-2	4/29/94		NOT MEASURED		5/5/94	8.23	10.64	2.41	6/8/94	8.35	11.00	2.65
MW-3	4/29/94		NOT MEASURED		5/5/94	8.12	9.32	1.20	6/8/94	8.26	9.49	1.23
MW-4	4/29/94		NOT MEASURED		5/5/94	8.61	10.58	1.97	6/8/94	8.77	10.63	1.86
MW-5	4/29/94		NOT MEASURED		5/5/94	8.19	9.79	1.60	6/8/94	8.29	10.10	1.81
MW-6	4/29/94		NOT MEASURED		5/5/94	7.20	8.56	1.36	6/8/94	7.30	8.89	1.59
MW-7	4/29/94		NOT MEASURED		5/5/94	---	7.34	0.00	6/8/94	---	7.52	0.00
MW-8	4/29/94		NOT MEASURED		5/5/94	6.85	7.20	0.35	6/8/94	7.04	7.29	0.25
MW-9	4/29/94		NOT MEASURED		5/5/94	8.23	8.89	0.66	6/8/94		NOT MEASURED	
MW-10	4/29/94		NOT MEASURED		5/5/94	8.85	9.99	1.14	6/8/94	8.98	10.35	1.37
MW-A	4/29/94		NOT MEASURED		5/5/94	8.63	10.28	1.65	6/8/94	8.72	10.64	1.92
MW-B	4/29/94		NOT MEASURED		5/5/94	8.45	10.19	1.74	6/8/94	8.58	10.44	1.86
SMW-1	4/29/94		NOT MEASURED		5/5/94	---	5.04	0.00	6/8/94	---	5.18	0.00
SMW-2	4/29/94		NOT MEASURED		5/5/94	---	4.76	0.00	6/8/94	---	4.91	0.00
SMW-3	4/29/94		NOT MEASURED		5/5/94	---	2.65	0.00	6/8/94	---	2.81	0.00
SMW-4	4/29/94		NOT MEASURED		5/5/94		NOT MEASURED		6/8/94		NOT MEASURED	
SMW-5	4/29/94		NOT MEASURED		5/5/94	---	1.53	0.00	6/8/94	1.68	1.82	0.14
SMW-6	4/29/94		NOT MEASURED		5/5/94	3.35	4.57	1.22	6/8/94	3.49	4.66	1.17
SMW-7	4/29/94		NOT MEASURED		5/5/94	---	2.45	0.00	6/8/94	---	2.59	0.00
SMW-8	4/29/94		NOT MEASURED		5/5/94	---	3.28	0.00	6/8/94	---	3.41	0.00
SMW-9	4/29/94		NOT MEASURED		5/5/94	---	6.56	0.00	6/8/94	---	6.67	0.00
SMW-10	4/29/94		NOT MEASURED		5/5/94	5.26	5.77	0.51	6/8/94	5.42	5.68	0.26
SMW-11	4/29/94		NOT MEASURED		5/5/94	---	3.86	0.00	6/8/94	---	3.98	0.00
LMS-GW1	4/29/94		NOT MEASURED		5/5/94	8.62	10.79	2.17	6/8/94		NOT MEASURED	
LMS-GW5	4/29/94		NOT MEASURED		5/5/94	5.60	5.97	0.37	6/8/94		NOT MEASURED	
ERM-1	4/29/94	---	14.64	0.00	5/5/94	---	14.82	0.00	6/8/94	---	14.99	0.00
ERM-2	4/29/94		NOT INSTALLED		5/5/94		NOT INSTALLED		6/8/94		NOT INSTALLED	
ERM-3	4/29/94		NOT INSTALLED		5/5/94		NOT INSTALLED		6/8/94		NOT INSTALLED	
ERM-4	4/29/94	---	8.43	0.00	5/5/94	---	8.51	0.00	6/8/94	---	8.68	0.00
ERM-5	4/29/94	---	7.66	0.00	5/5/94	---	7.80	0.00	6/8/94	---	7.97	0.00
ERM-6	4/29/94	---	4.41	0.00	5/5/94	---	4.52	0.00	6/8/94	---	4.72	0.00
ERM-7	4/29/94	---	3.09	0.00	5/5/94	---	3.26	0.00	6/8/94	---	3.56	0.00
ERM-8	4/29/94	---	3.37	0.00	5/5/94	---	3.45	0.00	6/8/94	---	3.64	0.00
ERM-9	4/29/94	---	4.85	0.00	5/5/94	---	4.64	0.00	6/8/94	4.84	5.17	0.33
ERM-10	4/29/94	---	7.25 *	0.00	5/5/94	4.18	4.19	0.01	6/8/94	4.44	5.17	0.73
ERM-11	4/29/94	---	3.33	0.00	5/5/94	---	3.35	0.00	6/8/94		NOT MEASURED	
ERM-12	4/29/94	3.28	5.21	1.93	5/5/94	3.32	5.52	2.20	6/8/94	3.70	5.62	1.92
ERM-13	4/29/94	---	3.82	0.00	5/5/94	3.93	3.96	0.03	6/8/94	4.16	5.04	0.88
ERM-14	4/29/94	5.79	8.75	2.96	5/5/94	5.80	9.29	3.49	6/8/94	6.07	10.44	4.37
ERM-15	4/29/94	---	3.25	0.00	5/5/94	---	6.37	0.00	6/8/94	---	3.70	0.00
ERM-16	4/29/94	---	6.97	0.00	5/5/94	---	7.09	0.00	6/8/94	---	7.42	0.00
ERM-17	4/29/94	---	6.25	0.00	5/5/94	---	3.38	0.00	6/8/94	---	6.70	0.00
ERM-18	4/29/94		NOT INSTALLED		5/5/94		NOT INSTALLED		6/8/94		NOT INSTALLED	
ERM-19	4/29/94		NOT INSTALLED		5/5/94		NOT INSTALLED		6/8/94		NOT INSTALLED	
ERM-20	4/29/94		NOT INSTALLED		5/5/94		NOT INSTALLED		6/8/94		NOT INSTALLED	
ERM-21	4/29/94		NOT INSTALLED		5/5/94		NOT INSTALLED		6/8/94		NOT INSTALLED	
ERM-22	4/29/94		NOT INSTALLED		5/5/94		NOT INSTALLED		6/8/94		NOT INSTALLED	
ERM-23	4/29/94		NOT INSTALLED		5/5/94		NOT INSTALLED		6/8/94		NOT INSTALLED	
ERM-24	4/29/94		NOT INSTALLED		5/5/94		NOT INSTALLED		6/8/94		NOT INSTALLED	
ERM-25	4/29/94		NOT INSTALLED		5/5/94		NOT INSTALLED		6/8/94		NOT INSTALLED	

NOTES: Depth to NAPL and depth to water are feet below top of casing.
"MW-" wells are located in Recovery Well area.
"SMW-" wells are located in Fueling Pad area.
*: Measured immediately after development.

TABLE 3-4
DEPTH TO WATER, DEPTH TO NAPL, AND NAPL THICKNESS MEASUREMENTS
METRO-NORTH HARMON YARD

WELL	DATE	DEPTH TO NAPL (feet)	DEPTH TO WATER (feet)	NAPL THICKNESS (feet)	DATE	DEPTH TO NAPL (feet)	DEPTH TO NAPL (feet)	DEPTH TO WATER (feet)	~~NAPL HICKNES~~ DATE	DEPTH TO NAPL (feet)	DEPTH TO WATER (feet)	NAPL THICKNESS (feet)
MW-1	7/8/94	7.54	8.39	0.85	8/8/94	7.59	9.29	1.70	9/19/94		NOT MEASURED	
MW-2	7/8/94	7.69	11.38	3.69	8/8/94	8.01	10.85	2.84	9/19/94	8.42	11.95	3.53
MW-3	7/8/94	7.90	8.82	0.92	8/8/94	8.00	9.01	1.01	9/19/94	8.41	9.85	1.44
MW-4	7/8/94	8.33	9.53	1.20	8/8/94	8.34	11.03	2.69	9/19/94	8.89	11.27	2.38
MW-5	7/8/94	7.87	9.39	1.52	8/8/94	8.01	9.75	1.74	9/19/94	8.42	10.57	2.15
MW-6	7/8/94	6.84	7.41	0.57	8/8/94	6.98	8.66	1.68	9/19/94	7.46	9.08	1.62
MW-7	7/8/94	---	6.87	0.00	8/8/94	---	7.12	0.00	9/19/94	---	7.65	0.00
MW-8	7/8/94	6.51	7.14	0.63	8/8/94	6.68	7.50	0.82	9/19/94	7.21	7.40	0.19
MW-9	7/8/94	7.92	8.74	0.82	8/8/94	8.09	9.09	1.00	9/19/94	8.54	9.75	1.21
MW-10	7/8/94	8.30	9.44	1.14	8/8/94	8.65	9.94	1.29	9/19/94	9.12	10.82	1.70
MW-A	7/8/94	8.31	9.59	1.28	8/8/94	8.44	10.15	1.71	9/19/94	8.90	11.05	2.15
MW-B	7/8/94	8.16	9.68	1.52	8/8/94	8.30	10.08	1.78	9/19/94	8.72	10.80	2.08
SMW-1	7/8/94	4.23	4.24	0.01	8/8/94	---	4.80	0.00	9/19/94	---	5.37	0.00
SMW-2	7/8/94	3.99	4.00	0.01	8/8/94	---	4.51	0.00	9/19/94	---	5.09	0.00
SMW-3	7/8/94	---	1.78	0.00	8/8/94	---	2.40	0.00	9/19/94	---	2.89	0.00
SMW-4	7/8/94		NOT MEASURED		8/8/94		NOT MEASURED		9/19/94		NOT MEASURED	
SMW-5	7/8/94		NOT MEASURED		8/8/94	1.20	1.98	0.78	9/19/94	1.87	2.46	0.59
SMW-6	7/8/94	2.43	3.18	0.75	8/8/94	3.04	4.75	1.71	9/19/94	3.46	5.00	1.54
SMW-7	7/8/94	---	1.64	0.00	8/8/94	---	2.15	0.00	9/19/94	---	2.64	0.00
SMW-8	7/8/94	---	2.47	0.00	8/8/94	---	3.06	0.00	9/19/94	---	3.40	0.00
SMW-9	7/8/94	---	5.84	0.00	8/8/94	---	6.32	0.00	9/19/94	---	6.63	0.00
SMW-10	7/8/94	4.49	5.46	0.97	8/8/94	5.03	5.81	0.78	9/19/94	5.36	6.09	0.73
SMW-11	7/8/94	---	3.03	0.00	8/8/94	---	3.56	0.00	9/19/94		DESTROYED	
LMS-GW1	7/8/94		NOT MEASURED		8/8/94		NOT MEASURED		9/19/94		ABANDONED	
LMS-GW5	7/8/94	4.54	4.92	0.38	8/8/94		NOT MEASURED		9/19/94		ABANDONED	
ERM-1	7/8/94	---	14.38	0.00	8/8/94	---	14.53	0.00	9/19/94	---	14.97	0.00
ERM-2	7/8/94		NOT INSTALLED		8/8/94	---	8.61	0.00	9/19/94	---	9.32	0.00
ERM-3	7/8/94		NOT INSTALLED		8/8/94	---	9.43	0.00	9/19/94	---	10.21	0.00
ERM-4	7/8/94	---	8.19	0.00	8/8/94	---	8.38	0.00	9/19/94	---	8.88	0.00
ERM-5	7/8/94	7.32	7.86	0.54	8/8/94	7.53	7.82	0.29	9/19/94	8.04	8.99	0.95
ERM-6	7/8/94	---	3.99	0.00	8/8/94	---	4.31	0.00	9/19/94	---	4.92	0.00
ERM-7	7/8/94	---	2.55	0.00	8/8/94	---	2.94	0.00	9/19/94	---	3.70	0.00
ERM-8	7/8/94	---	2.73	0.00	8/8/94	3.15	3.50	0.35	9/19/94	3.74	4.04	0.30
ERM-9	7/8/94	3.82	3.96	0.14	8/8/94	4.42	4.84	0.42	9/19/94	5.04	5.44	0.40
ERM-10	7/8/94	3.16	3.38	0.22	8/8/94	3.96	4.87	0.91	9/19/94	4.68	5.54	0.86
ERM-11	7/8/94		NOT MEASURED		8/8/94	---	4.10	0.00	9/19/94	---	4.65	0.00
ERM-12	7/8/94	1.55	1.88	0.33	8/8/94	3.19	5.57	2.38	9/19/94	3.84	6.21	2.37
ERM-13	7/8/94	2.15	7.25	5.10	8/8/94	3.32	7.40	4.08	9/19/94	3.97	7.94	3.97
ERM-14	7/8/94	4.81	8.29	3.48	8/8/94	5.64	10.52	4.88	9/19/94	6.24	10.58	4.34
ERM-15	7/8/94	---	2.36	0.00	8/8/94	---	3.22	0.00	9/19/94	---	3.96	0.00
ERM-16	7/8/94	---	6.12	0.00	8/8/94	---	7.01	0.00	9/19/94	---	7.69	0.00
ERM-17	7/8/94	---	5.38	0.00	8/8/94	---	6.31	0.00	9/19/94	---	6.97	0.00
ERM-18	7/8/94		NOT INSTALLED		8/8/94	---	1.40	0.00	9/19/94	---	2.01	0.00
ERM-19	7/8/94		NOT INSTALLED		8/8/94	---	6.50	0.00	9/19/94	---	7.00	0.00
ERM-20	7/8/94		NOT INSTALLED		8/8/94	---	5.19	0.00	9/19/94	---	5.85	0.00
ERM-21	7/8/94		NOT INSTALLED		8/8/94	---	8.92	0.00	9/19/94	---	9.76	0.00
ERM-22	7/8/94		NOT INSTALLED		8/8/94	---	16.17	0.00	9/19/94	---	16.64	0.00
ERM-23	7/8/94		NOT INSTALLED		8/8/94	---	10.44	0.00	9/19/94	---	11.15	0.00
ERM-24	7/8/94		NOT INSTALLED		8/8/94	---	7.34	0.00	9/19/94	---	8.08	0.00
ERM-25	7/8/94		NOT INSTALLED		8/8/94	---	10.00	0.00	9/19/94	---	10.72	0.00

NOTES: Depth to NAPL and depth to water are feet below top of casing.
"MW-" wells are located in Recovery Well area.
"SMW-" wells are located in Fueling Pad area.

TABLE 3-4
DEPTH TO WATER, DEPTH TO NAPL, AND NAPL THICKNESS MEASUREMENTS
METRO-NORTH HARMON YARD

WELL	DATE	DEPTH TO NAPL (feet)	DEPTH TO WATER (feet)	NAPL THICKNESS (feet)	DATE	DEPTH TO NAPL (feet)	DEPTH TO WATER (feet)	NAPL THICKNESS (feet)
MW-1	10/13/94	8.15	10.79	2.64	11/1/94	INACCESSIBLE		
MW-2	10/13/94	8.64	12.28	3.64	11/1/94	8.73	12.50	3.77
MW-3	10/13/94	8.58	10.55	1.97	11/1/94	8.75	10.85	2.10
MW-4	10/13/94	9.12	11.30	2.18	11/1/94	9.28	11.28	2.00
MW-5	10/13/94	8.62	10.88	2.26	11/1/94	8.75	11.21	2.46
MW-6	10/13/94	7.66	9.56	1.90	11/1/94	7.89	9.13	1.24
MW-7	10/13/94	---	7.91	0.00	11/1/94	--	8.06	0.00
MW-8	10/13/94	7.46	7.49	0.03	11/1/94	7.60	7.61	0.01
MW-9	10/13/94	8.79	9.94	1.15	11/1/94	DESTROYED		
MW-10	10/13/94	9.36	11.19	1.83	11/1/94	9.44	11.31	1.87
MW-A	10/13/94	9.08	11.43	2.35	11/1/94	9.25	11.55	2.30
MW-B	10/13/94	8.94	11.00	2.06	11/1/94	INACCESSIBLE		
SMW-1	10/13/94	---	5.53	0.00	11/1/94	INACCESSIBLE		
SMW-2	10/13/94	---	5.24	0.00	11/1/94	INACCESSIBLE		
SMW-3	10/13/94	NOT MEASURED			11/1/94	--	3.02	0.00
SMW-4	10/13/94	---	9.15	0.00	11/1/94	INACCESSIBLE		
SMW-5	10/13/94	1.87	2.91	1.04	11/1/94	INACCESSIBLE		
SMW-6	10/13/94	NOT MEASURED			11/1/94	3.62	4.74	1.12
SMW-7	10/13/94	NOT MEASURED			11/1/94	--	2.84	0.00
SMW-8	10/13/94	NOT MEASURED			11/1/94	--	3.54	0.00
SMW-9	10/13/94	NOT MEASURED			11/1/94	--	6.80	0.00
SMW-10	10/13/94	NOT MEASURED			11/1/94	5.54	5.89	0.35
SMW-11	10/13/94	DESTROYED			11/1/94	DESTROYED		
LMS-GW1	10/13/94	ABANDONED			11/1/94	ABANDONED		
LMS-GW5	10/13/94	ABANDONED			11/1/94	ABANDONED		
ERM-1	10/13/94	---	15.31	0.00	11/1/94	--	15.55	0.00
ERM-2	10/13/94	---	9.78	0.00	11/1/94	--	10.11	0.00
ERM-3	10/13/94	---	10.65	0.00	11/1/94	--	10.97	0.00
ERM-4	10/13/94	---	9.15	0.00	11/1/94	--	9.29	0.00
ERM-5	10/13/94	8.29	9.22	0.93	11/1/94	8.43	9.37	0.94
ERM-6	10/13/94	---	5.17	0.00	11/1/94	--	5.28	0.00
ERM-7	10/13/94	---	3.94	0.00	11/1/94	--	4.06	0.00
ERM-8	10/13/94	3.97	4.24	0.27	11/1/94	INACCESSIBLE		
ERM-9	10/13/94	5.17	5.48	0.31	11/1/94	5.17	5.41	0.24
ERM-10	10/13/94	4.80	5.56	0.76	11/1/94	4.80	5.50	0.70
ERM-11	10/13/94	---	4.87	0.00	11/1/94	--	4.77	0.00
ERM-12	10/13/94	4.06	6.09	2.03	11/1/94	3.93	6.20	2.27
ERM-13	10/13/94	4.18	8.07	3.89	11/1/94	4.13	7.30	3.17
ERM-14	10/13/94	6.42	10.91	4.49	11/1/94	6.36	9.87	3.51
ERM-15	10/13/94	---	4.10	0.00	11/1/94	DESTROYED		
ERM-16	10/13/94	---	7.82	0.00	11/1/94	--	7.74	0.00
ERM-17	10/13/94	---	7.09	0.00	11/1/94	--	9.71	0.00
ERM-18	10/13/94	---	2.18	0.00	11/1/94	--	2.16	0.00
ERM-19	10/13/94	---	7.20	0.00	11/1/94	--	7.01	0.00
ERM-20	10/13/94	---	5.99	0.00	11/1/94	--	5.89	0.00
ERM-21	10/13/94	---	10.26	0.00	11/1/94	--	10.63	0.00
ERM-22	10/13/94	---	17.12	0.00	11/1/94	--	17.45	0.00
ERM-23	10/13/94	---	11.70	0.00	11/1/94	--	12.13	0.00
ERM-24	10/13/94	DESTROYED			11/1/94	DESTROYED		
ERM-25	10/13/94	---	11.08	0.00	11/1/94	--	11.32	0.00

NOTES: Depth to NAPL and depth to water are feet below top of casing. "SMW-" wells are located in Fueling Pad area.
"MW-" wells are located in Recovery Well area.

TABLE 3-4
DEPTH TO WATER, DEPTH TO NAPL, AND NAPL THICKNESS MEASUREMENTS
METRO-NORTH HARMON YARD

WELL	DATE	DEPTH TO NAPL (feet)	DEPTH TO WATER (feet)	NAPL THICKNESS (feet)	DATE	DEPTH TO NAPL (feet)	DEPTH TO WATER (feet)	NAPL THICKNESS (feet)
MW-1	12/5/94	8.11	9.33	1.22	1/4/95	8.22	10.00	1.78
MW-2	12/5/94	8.55	11.05	2.50	1/4/95	8.53	12.62	4.09
MW-3	12/5/94	8.39	9.98	1.59	1/4/95		INACCESSIBLE	
MW-4	12/5/94	8.93	10.72	1.79	1/4/95		INACCESSIBLE	
MW-5	12/5/94		NOT MEASURED		1/4/95		INACCESSIBLE	
MW-6	12/5/94	7.49	7.77	0.28	1/4/95	7.65	9.21	1.56
MW-7	12/5/94	---	7.63	0.00	1/4/95	---	7.79	0.00
MW-8	12/5/94	---	7.21	0.00	1/4/95	---	7.37	0.00
MW-9	12/5/94		DESTROYED		1/4/95		DESTROYED	
MW-10	12/5/94	9.18	10.25	1.07	1/4/95		INACCESSIBLE	
MW-A	12/5/94	9.02	10.20	1.18	1/4/95		INACCESSIBLE	
MW-B	12/5/94	8.84	10.26	1.42	1/4/95	8.98	10.65	1.67
SMW-1	12/5/94	---	4.56	0.00	1/4/95		INACCESSIBLE	
SMW-2	12/5/94		INACCESSIBLE		1/4/95	---	4.52	0.00
SMW-3	12/5/94	---	2.06	0.00	1/4/95	---	2.26	0.00
SMW-4	12/5/94		INACCESSIBLE		1/4/95		INACCESSIBLE	
SMW-5	12/5/94		INACCESSIBLE		1/4/95		INACCESSIBLE	
SMW-6	12/5/94	2.73	2.85	0.12	1/4/95	2.73	4.50	1.77
SMW-7	12/5/94	---	1.93	0.00	1/4/95	---	1.87	0.00
SMW-8	12/5/94	---	2.64	0.00	1/4/95	---	2.89	0.00
SMW-9	12/5/94	---	6.01	0.00	1/4/95	---	6.15	0.00
SMW-10	12/5/94	4.76	5.03	0.27	1/4/95	4.91	5.30	0.39
SMW-11	12/5/94		DESTROYED		1/4/95		DESTROYED	
LMS-GW1	12/5/94		ABANDONED		1/4/95		ABANDONED	
LMS-GW5	12/5/94		ABANDONED		1/4/95		ABANDONED	
ERM-1	12/5/94	---	15.46	0.00	1/4/95	---	15.43	0.00
ERM-2	12/5/94	---	9.49	0.00	1/4/95	---	9.49	0.00
ERM-3	12/5/94	---	10.27	0.00	1/4/95	---	10.32	0.00
ERM-4	12/5/94	---	8.92	0.00	1/4/95	---	8.99	0.00
ERM-5	12/5/94	8.08	8.83	0.75	1/4/95		INACCESSIBLE	
ERM-6	12/5/94	---	3.46	0.00	1/4/95	---	4.83	0.00
ERM-7	12/5/94	---	3.32	0.00	1/4/95	---	3.41	0.00
ERM-8	12/5/94	---	3.31	0.00	1/4/95	---	3.45	0.00
ERM-9	12/5/94		NOT MEASURED		1/4/95		INACCESSIBLE	
ERM-10	12/5/94		NOT MEASURED		1/4/95		INACCESSIBLE	
ERM-11	12/5/94	---	3.32	0.00	1/4/95	---	3.91	0.00
ERM-12	12/5/94	2.21	4.33	2.12	1/4/95	2.97	5.34	2.37
ERM-13	12/5/94	3.21	4.87	1.66	1/4/95	3.43	5.81	2.38
ERM-14	12/5/94	5.25	11.12	5.87	1/4/95	5.51	11.23	5.72
ERM-15	12/5/94	---	2.95	0.00	1/4/95	---	3.38	0.00
ERM-16	12/5/94	---	6.58	0.00	1/4/95	---	6.87	0.00
ERM-17	12/5/94	---	5.87	0.00	1/4/95	---	6.15	0.00
ERM-18	12/5/94	---	0.96	0.00	1/4/95	---	1.25	0.00
ERM-19	12/5/94	---	6.22	0.00	1/4/95	---	6.50	0.00
ERM-20	12/5/94	---	4.88	0.00	1/4/95	---	5.05	0.00
ERM-21	12/5/94	---	10.00	0.00	1/4/95	---	10.02	0.00
ERM-22	12/5/94	---	17.42	0.00	1/4/95	---	17.32	0.00
ERM-23	12/5/94	---	77.90	0.00	1/4/95	---	11.91	0.00
ERM-24	12/5/94		DESTROYED		1/4/95		DESTROYED	
ERM-25	12/5/94	---	10.58	0.00	1/4/95	---	10.72	0.00

NOTES: Depth to NAPL and depth to water are feet below top of casing. "SMW-" wells are located in Fueling Pad area.
"MW-" wells are located in Recovery Well area.

TABLE 3-6
SUMMARY OF ANALYTICAL RESULTS FOR NAPL SAMPLES
METRO NORTH HARMON YARD
CROTON-ON-HUDSON, NEW YORK

SAMPLE	AREA OF CONCERN	SAMPLE DATE	SAMPLE TYPE	SEDIMENT BY EXTRACTION (weight %)	VISCOSITY (centistokes)	POUR POINT (degrees F)	SULFUR CONTENT (weight %)	CARBON RESIDUE (weight %)	FLASH POINT (degrees F)
LMS-GW1	LMS-GW1	3/25/94	Diesel	< 0.01	3.03	< -35	0.349	0.19	177
LMS-GW5	LMS-GW5	3/25/94	Diesel	< 0.01	4.08	< -35	0.335	0.17	195
Osbourne	Osborne Pond	3/25/94	Diesel	< 0.01	4.18	< -35	0.316	0.21	182
EQ-B1	Recovery Well Area	3/25/94	Diesel	< 0.01	2.70	< -35	0.208	0.04	155
DC-B4	Distribution Center	3/25/94	Diesel	< 0.01	2.50	< -35	0.144	0.04	162
SMW-6	Fueling Pad	6/7/94	Diesel	< 0.01	3.03	< -50	0.27	0.07	147
MET-0	Million Gallon Tank	7/29/94	Diesel	0.0033	3.42	< -50	0.302	0.04	145

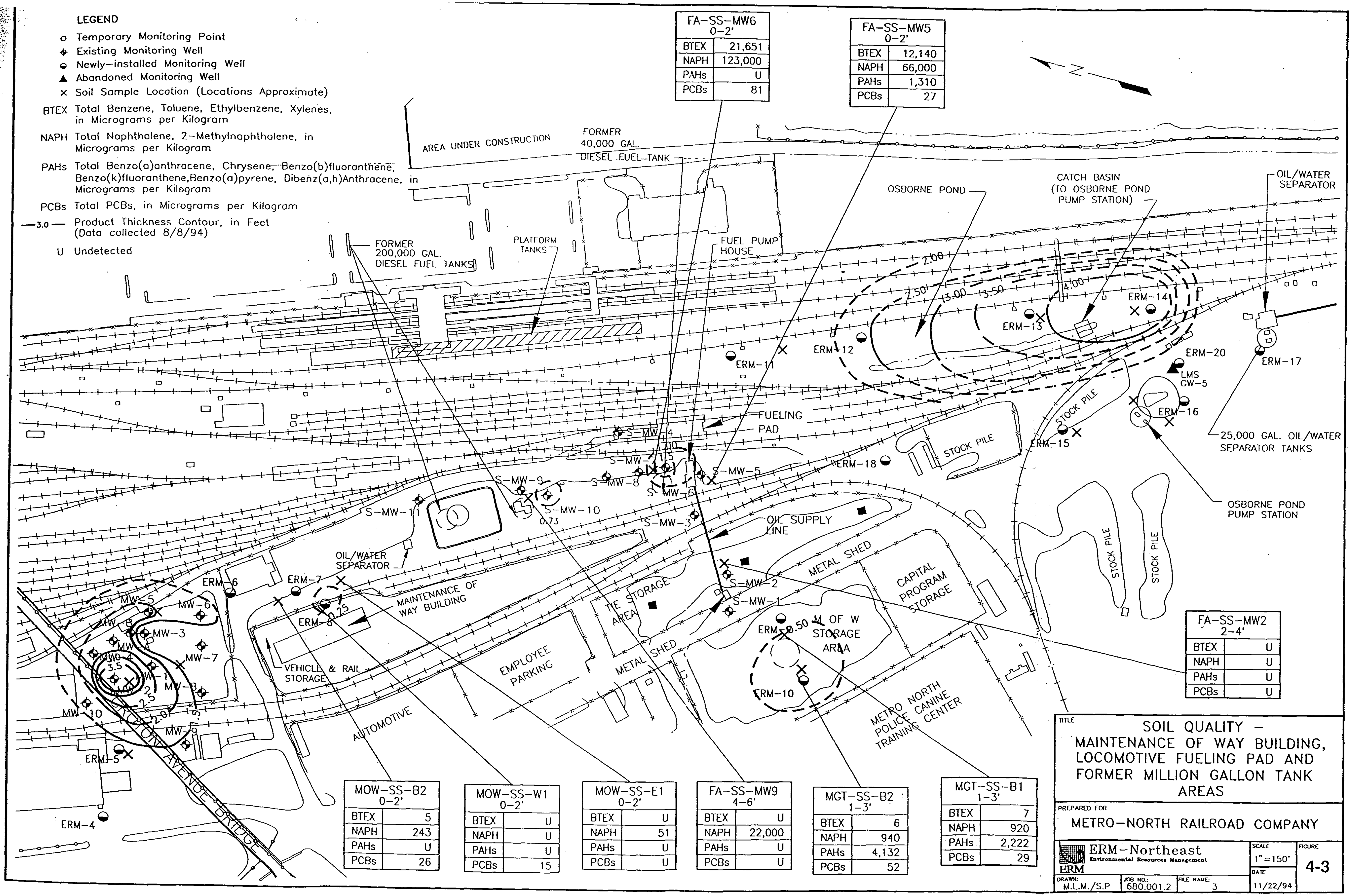
SAMPLE	AREA OF CONCERN	SAMPLE DATE	SAMPLE TYPE	ASH CONTENT (weight %)	SPECIFIC GRAVITY (grams/cc)	API GRAVITY (degrees API)	WATER CONTENT (weight %)	LEVEL OF DEGRADATION	ESTIMATED EXPOSURE TIME (years)
LMS-GW1	LMS-GW1	3/25/94	Diesel	0.0208	0.8693	31.3	NA	Severe	> 20
LMS-GW5	LMS-GW5	3/25/94	Diesel	0.0036	0.8664	31.8	NA	Severe	> 20
Osbourne	Osborne Pond	3/25/94	Diesel	0.0167	0.8695	31.2	NA	Severe	> 20
EQ-B1	Recovery Well Area	3/25/94	Diesel	0.0011	0.8560	33.8	NA	Moderate	13-17
DC-B4	Distribution Center	3/25/94	Diesel	0.0022	0.8540	34.2	NA	Minimal	8-11
SMW-6	Fueling Pad	6/7/94	Diesel	0.0042	0.8722	30.7	0.66	Significant	17-22
MET-0	Million Gallon Tank	7/29/94	Diesel	< 0.002	0.8819	29.0	0.38	Severe	> 20

NOTES

Analyses and exposure estimates performed by Worldwide Geosciences.

NA: Not analyzed, due to insufficient sample volume.

No PCBs were detected in any of these product samples.



FA-SS-MW6 0-2'	
BTEX	21,651
NAPH	123,000
PAHs	U
PCBs	81

FA-SS-MW5 0-2'	
BTEX	12,140
NAPH	66,000
PAHs	1,310
PCBs	27

FA-SS-MW2 2-4'	
BTEX	U
NAPH	U
PAHs	U
PCBs	U

MOW-SS-B2 0-2'	
BTEX	5
NAPH	243
PAHs	U
PCBs	26

MOW-SS-W1 0-2'	
BTEX	U
NAPH	U
PAHs	U
PCBs	15

MOW-SS-E1 0-2'	
BTEX	U
NAPH	51
PAHs	U
PCBs	U

FA-SS-MW9 4-6'	
BTEX	U
NAPH	22,000
PAHs	U
PCBs	U

MGT-SS-B2 1-3'	
BTEX	6
NAPH	940
PAHs	4,132
PCBs	52

MGT-SS-B1 1-3'	
BTEX	7
NAPH	920
PAHs	2,222
PCBs	29

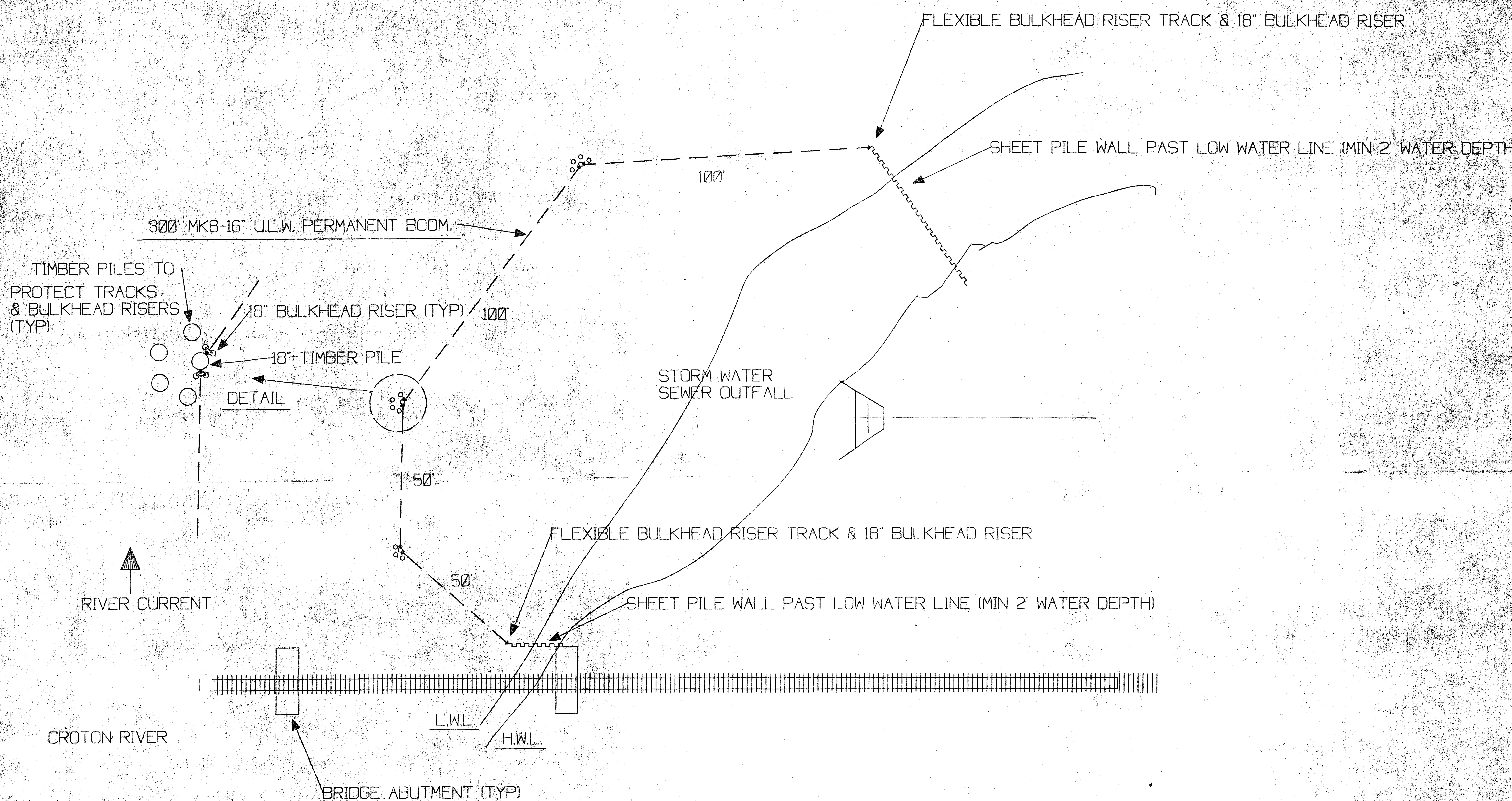
TITLE
SOIL QUALITY – MAINTENANCE OF WAY BUILDING, LOCOMOTIVE FUELING PAD AND FORMER MILLION GALLON TANK AREAS

PREPARED FOR
METRO-NORTH RAILROAD COMPANY

ERM-Northeast
Environmental Resources Management
ERM

SCALE	FIGURE
1" = 150'	4-3
DATE 11/22/94	

DRAWN:	JOB NO.:	FILE NAME:
M.L.M./S.P.	680.001.2	3



ISSUED FOR DATE OCT 25 1995

- [ ] APPROVAL
- [ ] CERTIFIED PRINT
- [ ] RECORD
- [ ] OTHER
- [X] QUOTATION
- [ ] PRELIMINARY

BY J. Stobiecki

ORDER NO. Q95-199

FOR E.R.R. INC.

QUANTITY	ITEM / PART NO.	DESCRIPTION: PARTS LIST
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS +/- DECIMALS +/- ANGLES +/-	CONTRACT NO.	SLICKBAR PRODUCTS CORPORATION, 18 BEACH STREET, SEYMOUR, CT 06483 USA
MATERIAL	DRAWN JJS DATE 5/2/95; CHECKED SJR DATE 24 OCT 95; APPROVED DATE; APPROVED DATE	TITLE: OUTFALL BOOM, METRO NORTH HARMON YD. CROT-HUDSON
HEAT TREAT	DESIGN ACTIVITY	FSCM NO. 56494 · DWG NO. 21D4109 · REV A
FINISH	APPROVAL	SCALE 1" = 20' · SHEET

	Q95-199
	USED ON
APPLICATION	

4.13 *MONITORING WELL LMS-GW5*

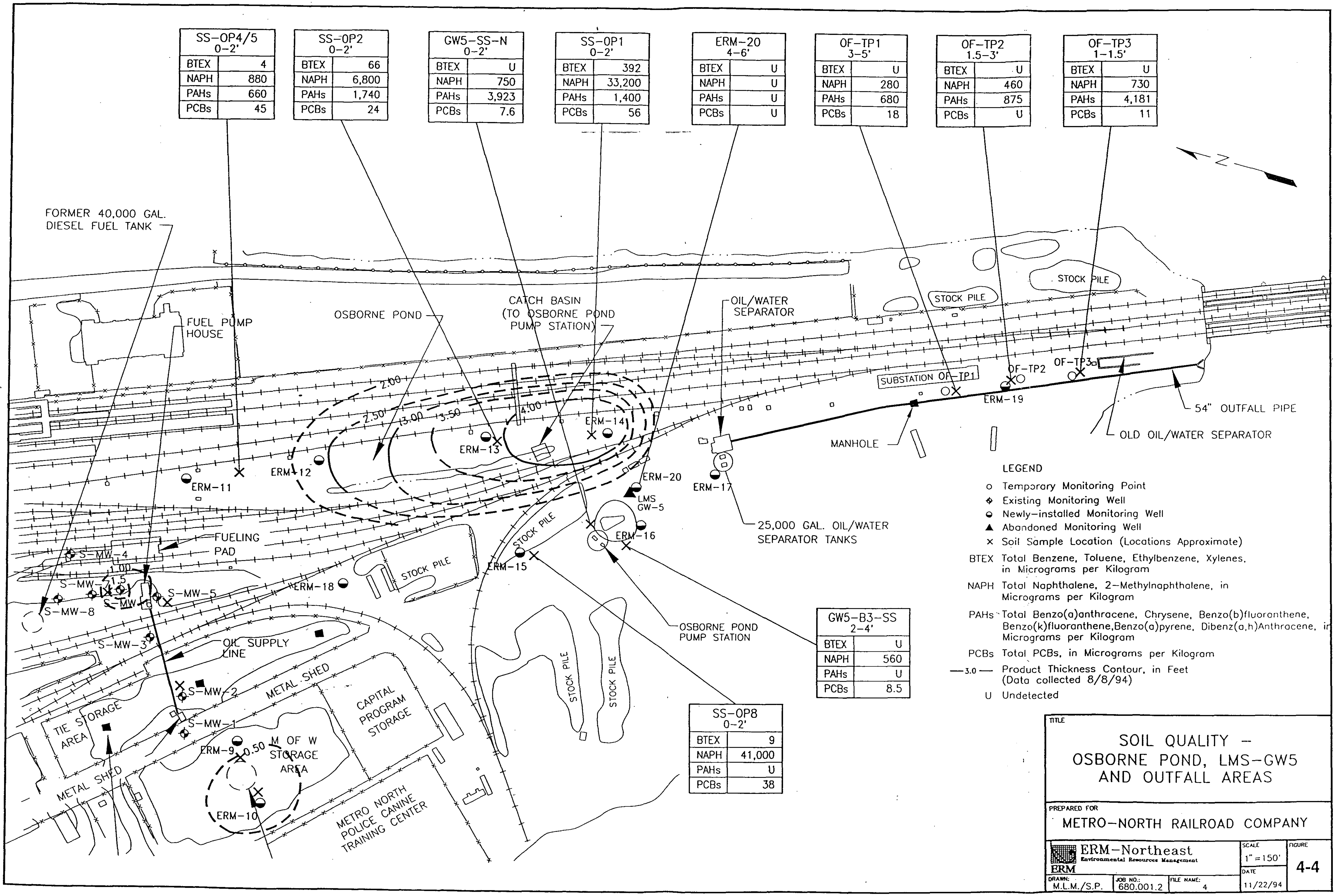
Three samples were collected to characterize the soil around the former location of monitoring well LMS-GW5. As shown on Figure 4-4, the samples were collected from depths of zero to two feet (GW5-SS-N), two to four feet (GW5-B3-SS), and four to six feet (ERM-20).

All indicator parameters were undetected in the sample from ERM-20. BTEX was also undetected in each of the other two samples. In GW5-B3-SS, naphthalenes were found at a concentration of 560 ug/kg and PCBs were detected at 8.5 ug/kg. PAHs were not detected in this sample. Sample GW5-SS-N contained naphthalenes at 750 ug/kg, PAHs at 3,923 ug/kg, and PCBs at 7.6 ug/kg.

4.14 *OUTFALL*

One soil sample was collected from each of the three test pits, installed along the 54-inch diameter outfall pipe at the south end of the Yard. The sample locations are shown on Figure 4-4. Sampled depths were three to five feet in OF-TP1, 1.5 to three feet in OF-TP2, and one to 1.5 feet in OF-TP3.

No BTEX was detected in any of the samples. The concentrations of naphthalenes and PAHs increased from the north at OF-TP1 to the south at OF-TP3. Respective concentrations of napthalenes and PAHs were 280 ug/kg and 680 ug/kg in OF-TP1, 460 ug/kg and 875 ug/kg in OF-TP2, and 730 ug/kg and 4,181 ug/kg in OF-TP3. Trace concentrations of PCBs were detected in two of the samples, at 18 ug/kg in OF-TP1 and 11 ug/kg in OF-TP3.


SS-OP4/5 0-2'
BTEX 4
NAPH 880
PAHs 660
PCBs 45
SS-OP2 0-2'
BTEX 66
NAPH 6,800
PAHs 1,740
PCBs 24
GW5-SS-N 0-2'
BTEX U
NAPH 750
PAHs 3,923
PCBs 7.6
SS-OP1 0-2'
BTEX 392
NAPH 33,200
PAHs 1,400
PCBs 56
ERM-20 4-6'
BTEX U
NAPH U
PAHs U
PCBs U
OF-TP1 3-5'
BTEX U
NAPH 280
PAHs 680
PCBs 18
OF-TP2 1.5-3'
BTEX U
NAPH 460
PAHs 875
PCBs U
OF-TP3 1-1.5'
BTEX U
NAPH 730
PAHs 4,181
PCBs 11
N
FORMER 40,000 GAL. DIESEL FUEL TANK
FUEL PUMP HOUSE
OSBORNE POND
CATCH BASIN (TO OSBORNE POND PUMP STATION)
OIL/WATER SEPARATOR
STOCK PILE
SUBSTATION
OF-TP1
OF-TP2
OF-TP3
ERM-19
54" OUTFALL PIPE
OLD OIL/WATER SEPARATOR
MANHOLE
2.00
2.50
3.00
3.50
4.00
ERM-11
ERM-12
ERM-13
ERM-14
ERM-20
ERM-17
LMS GW-5
25,000 GAL. OIL/WATER SEPARATOR TANKS
ERM-16
ERM-15
ERM-18
FUELING PAD
S-MW-4
S-MW-7
S-MW-5
S-MW-6
S-MW-8
S-MW-3
S-MW-2
S-MW-1
1.00
1.5
OIL SUPPLY LINE
OSBORNE POND PUMP STATION
GW5-B3-SS 2-4'
BTEX U
NAPH 560
PAHs U
PCBs 8.5
SS-OP8 0-2'
BTEX 9
NAPH 41,000
PAHs U
PCBs 38
METAL SHED
CAPITAL PROGRAM STORAGE
TIE STORAGE AREA
M OF W STORAGE AREA
0.50
ERM-9
ERM-10
METRO NORTH POLICE CANINE TRAINING CENTER
LEGEND
○ Temporary Monitoring Point
Existing Monitoring Well
Newly-installed Monitoring Well
▲ Abandoned Monitoring Well
× Soil Sample Location (Locations Approximate)
BTEX Total Benzene, Toluene, Ethylbenzene, Xylenes, in Micrograms per Kilogram
NAPH Total Naphthalene, 2-Methylnaphthalene, in Micrograms per Kilogram
PAHs Total Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)Anthracene, in Micrograms per Kilogram
PCBs Total PCBs, in Micrograms per Kilogram
—3.0— Product Thickness Contour, in Feet (Data collected 8/8/94)
U Undetected
TITLE
SOIL QUALITY - OSBORNE POND, LMS-GW5 AND OUTFALL AREAS
PREPARED FOR
METRO-NORTH RAILROAD COMPANY
ERM-Northeast
Environmental Resources Management
SCALE 1" = 150'
FIGURE 4-4
DATE 11/22/94
DRAWN: M.L.M./S.P.
JOB NO.: 680.001.2
FILE NAME: 4

No VOCs were detected in any of these wells during either round of sampling. The total SVOC concentrations showed a minimal increase in each well from the first to the second sampling event. In ERM-16, the total went from 62.40 ug/l to 76 ug/l, and in ERM-17, total SVOCs increased from 6 ug/l to 8.7 ug/l. The total SVOC concentrations in ERM-20 showed the greatest increase, from 8 ug/l to 45 ug/l.

5.5.12 *Old Oil/Water Separator*

No permanent monitoring wells were installed in this area. Therefore, no ground water samples were collected.

5.5.13 *Outfall*

One well, ERM-19, was installed along the outfall pipe. No VOCs were detected in either ground water sample from this well. The total SVOC concentrations showed a small increase between the sampling rounds; from 15.40 ug/l in August to 35.0 ug/l in November.

5.5.14 *Summary of Ground Water Quality*

In general, the ground water sampling results indicate that neither the operations at the Yard nor the NAPL present in some areas of the Yard have had a significant impact on the ground water at the Yard. Petroleum-related compounds were found with the most frequency, and included benzene, toluene, ethylbenzene, xylenes, naphthalene, 2-methylnaphthalene, phenanthrene, iron, and manganese. With the exception of iron and manganese, which are present in most wells at concentrations above the NYSDOH Part 5 Drinking Water Standards (the Part 5 Standards), there were only a few locations where the concentrations of the petroleum-related compounds exceeded the Part 5 Standards. A few non-petroleum related compounds were also found; they tended to be found in only one or two of the

6.11 *MONITORING WELL LMS-GW5*

Three temporary wells were installed in the vicinity of LMS-GW5. No NAPL was found in any of them. Since NAPL had been found in LMS-GW5, the decision was made to install two permanent wells in this area. In addition, in order to have one set of wells that was installed at the same time and in the same manner, LMS-GW5 was replaced. None of the permanent wells installed in this area have shown any evidence of NAPL.

Soil samples collected from the locations of the permanent monitoring wells showed trace levels of VOCs and pesticides and more significant levels of SVOCs. However, with the exception of iron and manganese, the ground water samples collected from the three wells show no evidence of impacts. Since there is no NAPL in this area and the SVOCs are not migrating to ground water, it is unlikely that remediation will be proposed for this area.

6.12 *OLD OIL/WATER SEPARATOR*

NAPL was detected at a thickness of 0.01 feet on one occasion in one of the two temporary wells installed around the old separator. The NAPL had disappeared by the next day. All material in the separator tank was later removed by a Metro-North contractor, and the separator body was filled. Therefore, no soil samples were collected for laboratory analysis and no permanent monitoring wells were installed in this area. It is unlikely that any further investigation or additional remediation will be required here. Additional data may be collected in the vicinity of the old oil/water separator and outfall as part of the OU II investigation.

6.13 *OUTFALL*

Seven temporary wells were installed in this area. Four of these were located southwest of well LMS-GW5. NAPL was detected in the two southernmost of these wells, at thicknesses up to 0.13 feet. It was subsequently learned that this property is owned by Westchester County, and therefore, no additional work was performed at these locations.

The other three temporary wells were installed in test pits at the south end of the Yard, along the 54-inch diameter outfall pipe. Permanent well ERM-19 was subsequently installed at one of these locations. No NAPL was detected in any of these wells.

Soil samples collected from the test pits contained low concentrations of SVOCs, and the concentrations increased from north to south. With the exception of the concentrations of iron and manganese, the ground water from the well at the outfall showed no impact in petroleum. Therefore, it is unlikely that remediation will be required in this AEC.

6.14 CONCLUSIONS

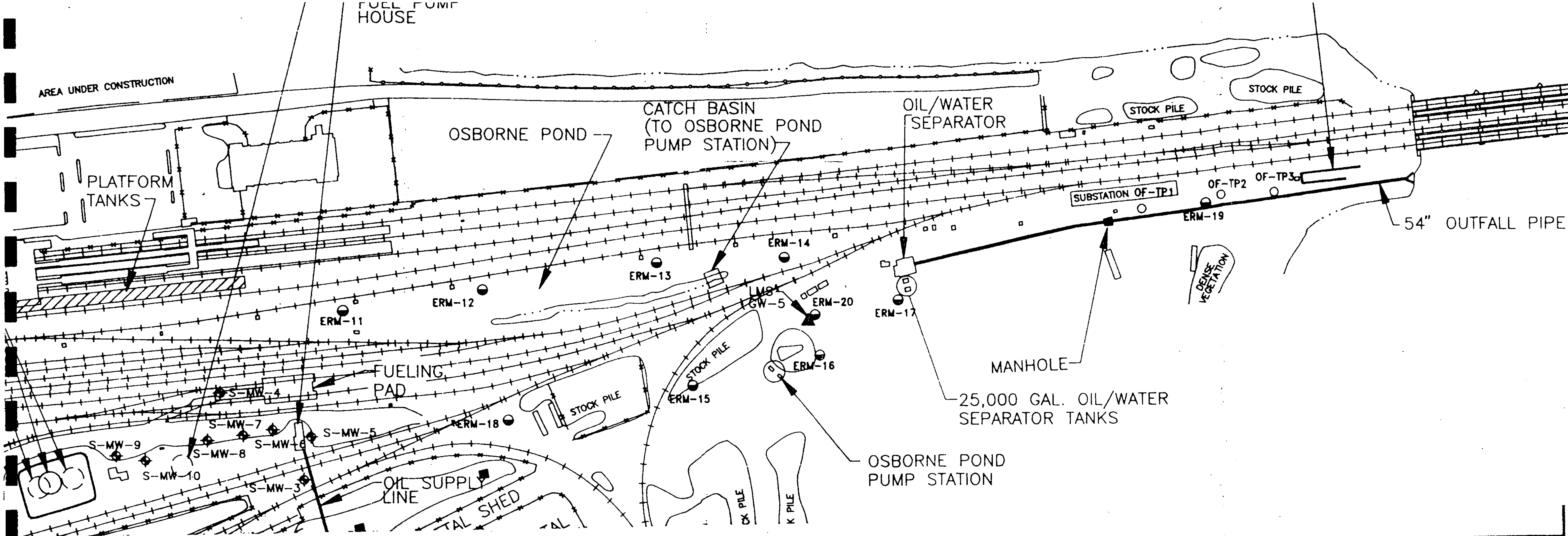
This Field Investigation was conducted by ERM at Harmon Yard between March 1994 and January 1995. Activities included the installation and monitoring of 39 temporary wells, collection of 35 soil samples for laboratory analysis, collection of 43 additional soil samples for field analysis, installation of 25 permanent monitoring wells, regular gauging of the monitoring well network, and two rounds of ground water sampling. In addition, slug tests were performed on 20 permanent wells, to estimate hydraulic conductivities, and a tidal study was performed, to evaluate tidal effects on ground water flow at the Yard.

Data from the regular well gauging program showed that ground water flow is toward the north (toward the Hudson River) at the north end of the Yard and toward the south (toward Croton Bay) at the south end of the Yard. There is a ground water divide located in the vicinity of the fire tanks at the Yard's north end. Hydraulic conductivity estimates, determined from the slug testing, generally range from 0.07 to 4.62 meters per day. Results of the tidal study indicate that there is no significant tidal influence on the ground water flow system at the Yard.

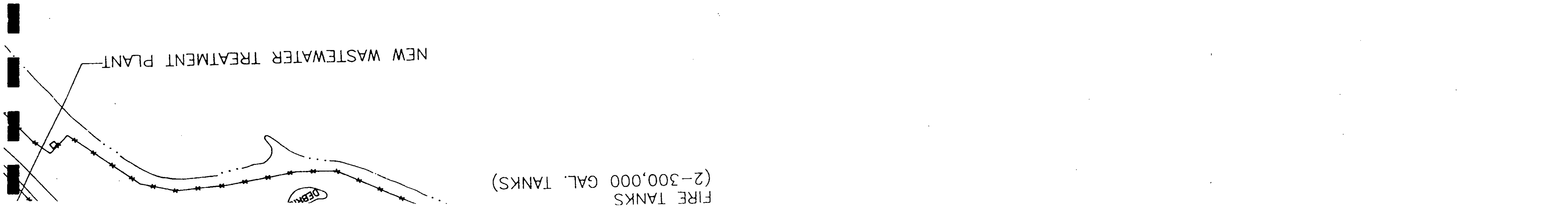
NAPL was detected on the ground water in the following six areas examined during this investigation: Distribution Center Warehouse, Recovery Well Area, Maintenance-of-Way Building, Locomotive Fueling Pad, Former Million Gallon Tank, and Osborne Pond. The presence of NAPL has also impacted the soils at several of the AECs. In addition, at the Locomotive Fueling Pad, VOCs and SVOCs in the soils have leached into the ground water. At a minimum, product recovery will be necessary in those areas where NAPL was found. Various options and recommendations for NAPL recovery will be presented in the Remediation Plan. The need for soil remediation will be evaluated, based on impacts to ground water, and, if necessary, remedial alternatives will also be addressed in the Remediation Plan.

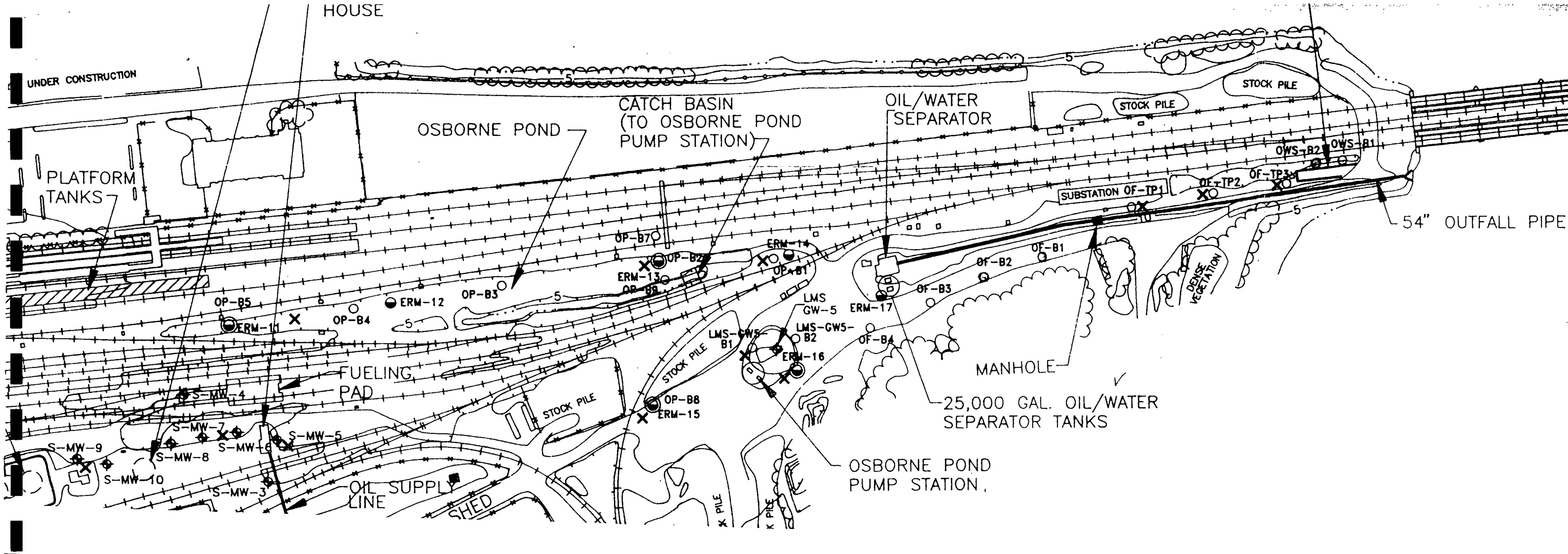
Based on the absence of NAPL and/or impacts to soil or ground water, the remaining AECs will probably not require any additional investigation or remediation. These areas include the Background, Monitoring Well LMS-GW1, Croton Point Avenue Bridge, Monitoring Well LMS-GW5, Old Oil/Water Separator, and Outfall AECs. Some additional monitoring may be implemented in these areas, to evaluate any potential accumulation of NAPL over time.

In spite of the presence of NAPL and the impacts to soil, ground water quality across the Yard shows little impact. The primary compounds found at the AECs, SVOCs, are not leaching into the ground water at the Yard. Since the ground water shows only minor impacts, there is minimal potential for any compounds found in the soils at the Yard to reach either Croton Bay or the Hudson River. Remediation of ground water at the Yard is therefore unlikely to be required. However, in order to confirm that SVOCs are not leaching



		CHECKED	DATE	SITE PLAN AND MONITORING WELL LOCATIONS			DRAWING NO. 1-2
		DESIGN ENGINEER					
		PROJECT ENGINEER					REV. NO.
		PROJECT MANAGER					
		APPROVED		DRAWN S.G./E.M.F.	DATE OCT. 20, 1994	REVISED DATE	
		APPROVED		SCALE 1"=150'	JOB NO. 680.001.5	FILE NAME 94METRO	SHEET OF

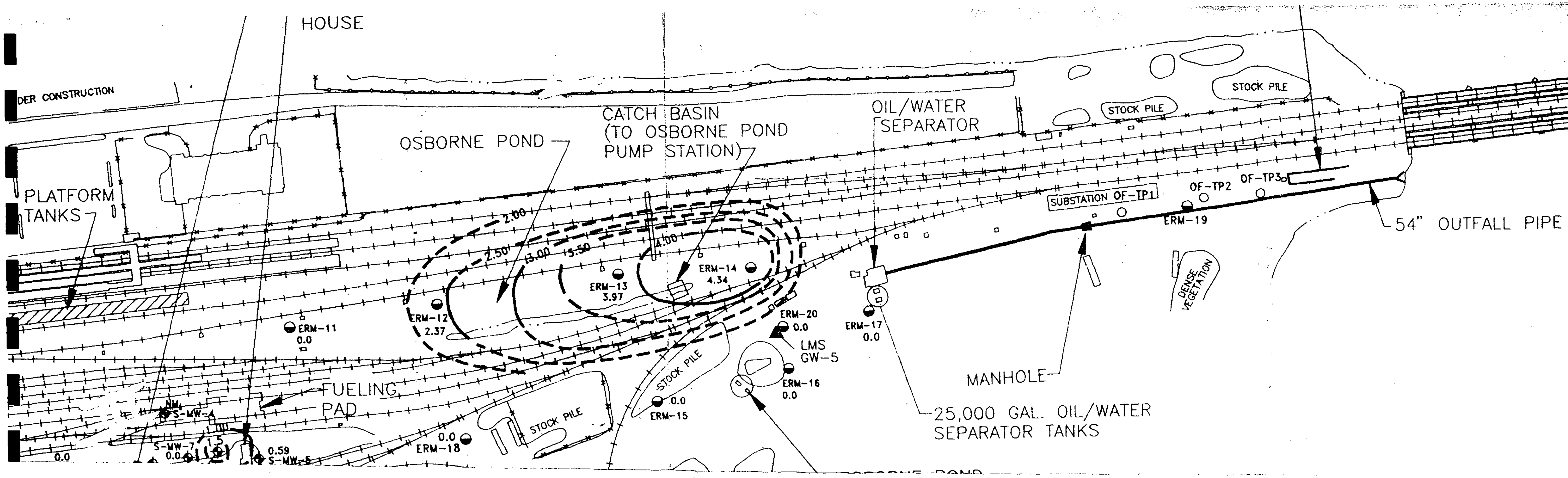




CHECKED	DATE	
DESIGN ENGINEER		
PROJECT ENGINEER		
PROJECT MANAGER		
APPROVED		
APPROVED		

SOIL SAMPLE AND TEMPORARY NAPL WELL LOCATIONS

DRAWN: S.G./S.P./D.S.	DATE: MARCH 2, 1995	REVISED DATE	DRAWING NO. 3-1
SCALE: 1"=150'	JOB NO. 680.001.5	FILE NAME: YARDSOIL	REV. NO.
			SHEET OF



CHECKED	DATE	PRODUCT THICKNESS IN MONITORING WELLS - 9/19/94			DRAWING NO. 3-2
DESIGN ENGINEER					
PROJECT ENGINEER					
PROJECT MANAGER					REV. NO.
APPROVED		DRAWN E.M.F./S.P.	DATE NOV.1, 1994	REVISED DATE	
APPROVED		SCALE 1"=150'	JOB NO. 680.001.2	FILE NAME OIL-CONT	SHEET OF

REVIEW OF THE HARMON RAILROAD YARD
PHASE I REMEDIATION PLAN PROJECT
THE CROTON BAY SEEPAGE CONTROL PLAN

ATTACHMENT II

SECTIONS OF THE

HARMON YARD OPERABLE UNIT II
"REMEDIAL INVESTIGATION REPORT"
{ERM; JANUARY 24, 1997}

Related to:

Work performed at the southern end of Harmon Yard, near Croton Bay

REMEDIAL INVESTIGATION/ FEASIBILITY STUDY REPORT

VOLUME I - REMEDIAL INVESTIGATION

Harmon Railroad Yard Wastewater Treatment Area
Operable Unit II
NYSDEC Site No.: 3-60-010

24 January 1997

Prepared for:

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

Prepared by:

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

ERM

23 milligrams per kilogram (mg/kg) (parts per million (ppm)). The laboratory data and data validation reports are provided in Appendix B.

Baildown tests were conducted on the six selected monitoring wells on January 11, 12 and 17, 1995. These data are used in the FS to determine NAPL percent recovery to illustrate the magnitude of recoverable NAPL. The data and analysis are discussed in Section 5.2.1. The associated data and data plots are included in Appendix C.

2.2 *SOIL INVESTIGATION ALONG FORMER DISCHARGE LINE*

2.2.1 *Purpose*

The purpose of the soil characterization task was to determine the quality of the soil in the area adjacent to the former discharge line which conveyed wastewater from the Old Treatment Plant to the outfall point at Croton Bay. These soil samples were collected from borings installed adjacent to the former discharge line.

2.2.2 *Procedures*

Soil sampling adjacent to the former discharge line was conducted from January 26, 1995 through February 6, 1995. Soil borings were installed on either side of the discharge pipe and spaced at approximately 100 foot intervals (Figure 2-4). The soil borings were installed with a Geoprobe drive point sampling device. One soil sample was collected from just above the water table at the capillary fringe. The approximate depth to ground water along the alignment of the discharge line was ascertained from the existing monitoring wells in the Yard as well as any other relevant investigations that were completed at the time the OU-II RI was implemented.

Multiple Geoprobe samples were driven at several locations to obtain a sufficient volume of sample. Soil samples were placed in laboratory supplied glassware and the bottles were stored on ice prior to shipment by courier to NEI. NEI is part of the New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program and was approved by NYSDOH for the analysis of soil and ground water samples via NYSDEC Analytical Services Program (ASP) protocols.

The soil samples were analyzed for Target Compound List (TCL) parameters by NYSDEC 1991 ASP analytical methods. Quality control samples, including matrix spikes (MS), matrix spike duplicates (MSD), duplicate samples and field blanks were also collected during this program. A total of 62 soil samples, along with four matrix spike (MS) and matrix spike duplicates (MSD), four duplicate samples and seven field blanks were collected. All duplicate samples were homogenized prior to sampling.

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

Upon completion, the borings were backfilled as described in Section 2.1.2.2. All Geoprobe and sampling equipment was cleaned between each boring using an Alconox and water solution and a tap water rinse.

2.2.3 *Results*

A summary of the physical descriptions of each of the soil samples collected along the former discharge line, along with the respective intervals, is provided in Table 2-5. The occurrence of coarse materials in many of these samples suggests the presence of backfill and hence, shows that the Geoprobe technique was successful in reaching along side the discharge line.

The analytical results of the soil samples are contained in Table 2-6. Only those constituents which were identified in at least one sample are summarized on this table. The laboratory data and data validation reports are contained in Appendix D.

2.3 *SEDIMENT AND SURFACE WATER INVESTIGATION*

2.3.1 *Purpose*

Croton Bay sediments were sampled to ascertain whether any discharges from the former discharge line resulted in residual organic compounds or inorganic constituents in this medium. At the same time, surface water samples were also collected to determine if any correlation existed between the sediment chemistry and surface water.

2.3.2 *Procedures*

The sediment sampling approach sought to determine whether organic compounds or inorganic constituents were present in areas of Croton Bay previously determined to have elevated TPH levels in sediment. As described in the RI Work Plan, previous data suggested a particular pattern of elevated TPH in sediment in the vicinity of the former

According to Worldwide Geosciences, the four NAPL samples collected as part of OU-II in 1995 and two NAPL samples collected in 1996 are unrelated to the 1994 NAPL Harmon Yard samples. The gas chromatographic signatures of the 1994 Harmon Yard NAPL samples did not match those of the 1995 or 1996 OU-II Site NAPL samples. Differences between NAPL samples collected in 1995 and 1996, as part of OU-II, and those collected in 1994 from areas within Harmon Yard establish that the yard is not a source of NAPL in the four areas around the former lagoon.

3.2 *SOIL ALONG THE FORMER DISCHARGE LINE*

The soil along the former discharge line that connected the old treatment plant to the outfall at Croton Bay was investigated to ascertain whether chemicals in treated wastewater were discharged to surrounding soil. In accordance with the Stipulation of Discontinuance (NYSDEC, 1994a) and the ROD for OU-I (NYSDEC, 1992), any PCB-contaminated soils around the former discharge line would be presumed to originate from the former lagoon.

As shown in Table 2-6 and Table 3-2, the only PCB compound detected in the soils along the former discharge line was Aroclor-1260. Therefore, "PCBs" and "total PCBs", as used in this discussion, refers to Aroclor-1260 only.

PCBs were detected in seven of the 62 soil samples collected along the former discharge line. The concentrations of PCBs ranged from 15 micrograms per kilogram (µg/kg) to 68 µg/kg. All of the detected concentrations are below the OU-I remedial goal of 10 mg/kg. As such, the soil along the former discharge line does not require remediation.

The quality of soil collected along the former discharge line for parameters other than PCBs were compared to soil data obtained during the Harmon Yard investigation. The purpose of that investigation was to evaluate the impacts of NAPL on soil and ground water at Harmon Yard. Toward that end, the Harmon Yard investigation focused on known NAPL areas and other areas of concern. A summary of the OU-II and Harmon Yard soil data, including the number of samples collected, frequency of detection for each parameter and the range of concentrations detected, is presented in Table 3-2.

All the volatile organic compounds (VOCs) detected in soil along the former discharge line during the OU-II investigation, with the exception of 4-methyl-2-pentanone, were present in soil characterized as part of the Harmon Yard investigation. This one exception was found in only one soil sample along the former discharge line. Moreover, its reported concentration was even below the NYSDEC Recommended Soil Cleanup Objective (HWR-94-4046, Revised April 1995) for this constituent.

The semi-volatile organic compounds (SVOCs) detected in the soils along the former discharge line during the OU-II investigation are the same as those identified during the Harmon Yard investigation. The range in SVOC concentrations detected in both investigations was also similar. Among the compounds with the highest frequency of detection during both studies were 2-methylnaphthalene, phenanthrene, and pyrene. These three compounds are related to fuel oil.

There were 19 pesticides detected in the soils along the former discharge line during the OU-II investigation. All but two of them were among the 18 pesticides detected during the Harmon Yard investigation. One of the two, delta-BHC, was detected in only one of the 62 OU-II soil samples. Methoxychlor, however, was detected in 13 of the 62 samples. In any event, all the reported pesticide concentrations in soil along the former discharge line were below their respective NYSDEC Recommended Soil Cleanup Objectives.

Total organic carbon (TOC) was measured in all of the samples collected for OU-II and the Harmon Yard investigation. The range of TOC concentrations among soils along the former discharge line was 2073 mg/kg to 282,481 mg/kg. These concentrations are consistent with the 640 mg/kg to 630,000 mg/kg range detected during the Harmon Yard investigation. This indicates a carbon content of 0.2 percent to 28 percent.

In summary, there were no PCBs in soil from around the former discharge line at concentrations which exceeded the OU-I ROD remedial goal of 10 mg/kg. The suite of organic compounds in soil samples from along the former discharge line were similar to those found in soils during the Harmon Yard investigation. Many of these compounds can be associated with fuel oil. Based on the above, the soil along the former discharge line can be eliminated from the OU-II RI/FS and addressed along with the remainder of Harmon Yard under the jurisdiction of the former NYSDEC Division of Spills Management, now the Division of Environmental Remediation.

3.3 *SEDIMENT AND SURFACE WATER IN CROTON BAY*

ERM collected sediment samples from six locations in Croton Bay. Samples SD-1, SD-2 and SD-3 were collected closest to the outfall pipe, in an area where elevated total petroleum hydrocarbons (TPH) in sediment along with occasional oil sheens and seeps have been previously observed. Samples SD-4, SD-5 (and SEDDUP, a duplicate of SD-5) and SD-6 were collected further from the outfall in a transition zone between

Table 2-5
Former Discharge Line Soil Sampling Log
Harmon Railroad Yard Wastewater Treatment Area Operable Unit II
Croton-on-Hudson, NY

Sample Number	Date Sampled	Depth Sampled	Description
E-1	1/26/95	7-9'	Brown very fine SAND
W-2	1/26/95	7-9'	Brown, grey very fine SAND, ODOR
E-3	1/26/95	7-9'	Brown very fine SAND and GRAVEL
W-4	1/26/95	9.5-11.5'	Brown very fine SAND and GRAVEL
E-5	1/27/95	7-9'	Brown very fine SAND and GRAVEL
E-6	1/26/95	7-9'	Brown very fine SAND and GRAVEL
W-6A	1/27/95	7-9'	Brown fine SAND and GRAVEL, trace silt
W-7	1/26/95	7-9'	Brown fine SAND and GRAVEL
E-8	1/27/95	7-9'	Brown fine SAND and SILT
W-9	1/27/95	7-9'	Brown very fine SAND and SILT
E-10	1/27/95	7-9'	Very fine SAND and GRAVEL
W-11	1/27/95	7-9'	Brown fine SAND, trace silt
E-12	1/27/95		Location abandoned due to repeated refusals
W-13	1/27/95	7-9'	Brown fine SAND
E-14	1/30/95	7-9'	Brown fine to medium SAND
E-15	1/30/95	7-9'	Brown medium to coarse SAND and GRAVEL
W-16	1/30/95	7-8'	Medium to coarse brown SAND
E-17	1/30/95	7-9'	Brown medium to coarse SAND
W-18			Inaccessible
W-19	1/30/95	5-7'	Brown medium to coarse SAND
W-20	1/30/95	6-8'	Brown medium to coarse SAND
E-21	1/31/95	5-7'	Brown medium to coarse SAND
W-22	1/31/95	5-7'	Brown medium to coarse SAND
E-23	1/31/95	5-7'	Brown medium to coarse SAND
W-24	1/31/95	5-7'	Dark brown to black medium to coarse SAND and GRAVEL (fill material)
E-25	1/31/95	5-7'	Black and brown medium to coarse SAND and GRAVEL
W-26	1/31/95	4-6'	Black and brown medium to coarse SAND and GRAVEL
E-27	1/31/95	4-6'	4-5' - Black med. - coarse SAND and GRAVEL; 5-6' - Brown fine to medium SAND
W-28	1/31/95	4-6'	Medium to coarse brown SAND, trace gravel
E-29	1/31/95	4-6'	Brown coarse SAND and GRAVEL
E-30	2/1/95	2-4'	Brown and black coarse SAND and GRAVEL, STAINED and ODOR
W-31	2/1/95	2-4'	Brown and black coarse SAND and GRAVEL, STAINED and ODOR
E-32	2/1/95	2-4'	Black coarse SAND and GRAVEL, trace clay, STAINED and ODOR
W-33	2/1/95	2-4'	Coarse black SAND and GRAVEL
E-34	2/1/95	2-4'	Black coarse SAND and GRAVEL, STAINED and ODOR
W-35	2/1/95	2-4'	Black coarse SAND and GRAVEL, STAINED and ODOR
E-36	2/1/95	2-4'	Black coarse SAND and GRAVEL, and tan clay, STAINED and ODOR
W-37	2/1/95	2-4'	Black coarse SAND and CLAY, STAINED and ODOR
E-38	2/2/95	2-4'	Black coarse SAND and GRAVEL
W-39	2/1/95	2-4'	Black coarse SAND and GRAVEL
E-40	2/1/95	4-7'	Black coarse SAND and GRAVEL, STAINED and ODOR
W-41	2/2/95	2-4'	Medium to coarse orange SAND
E-42	2/2/95	1-3'	Medium to coarse orange SAND
W-43	2/2/95	1-3'	Medium to coarse orange SAND

Table 2-5
Former Discharge Line Soil Sampling Log
Harmon Railroad Yard Wastewater Treatment Area Operable Unit II
Croton-on-Hudson, NY

Sample Number	Date Sampled	Depth Sampled	Description
E-44	2/2/95	1-3'	Black coarse SAND and GRAVEL, STAINED and ODOR
W-45	2/2/95	1-3'	Black coarse SAND and GRAVEL, STAINED and ODOR
E-46	2/2/95	1-3'	Black coarse SAND and GRAVEL
W-47	2/2/95	1-3'	Black coarse SAND and GRAVEL, STAINED and ODOR
E-48	2/2/95	1-3'	Black coarse SAND and GRAVEL, STAINED and ODOR
W-49	2/2/95	1-3'	Black coarse SAND and GRAVEL
E-50	2/2/95	1-3'	Black coarse SAND and GRAVEL
W-51	2/2/95	1-3'	Black coarse SAND and GRAVEL
E-52	2/3/95	2-4'	Black coarse SAND and GRAVEL, STAINED and ODOR
W-53	2/3/95	2-4'	Black coarse SAND and GRAVEL, STAINED and ODOR
E-54	2/3/95	2-4'	Black coarse SAND and GRAVEL, STAINED and ODOR
W-55	2/3/95	2-4'	Black coarse SAND and GRAVEL, some STAINING, no odor
E-56	2/3/95	2-4'	Black coarse GRAVEL and SAND
W-57	2/3/95	2-4'	Black coarse SAND and GRAVEL
E-58	2/3/95	2-4'	Black coarse SAND and GRAVEL, STAINED, no odor
W-59	2/3/95	3-5'	Black coarse SAND and GRAVEL, STAINED and ODOR
W-60	2/3/95	3-5'	Black, brown fine to coarse SAND, trace gravel, some Stain, no odor
W-61	2/6/95	2-4'	Brown fine to medium SAND, no stain, no odor
W-62	2/6/95	2-4'	Brown medium to coarse SAND, ODOR
W-63	2/6/95	2-4'	Brown medium to coarse SAND
W-64	2/6/95		Abandoned due to refusal

Table 2

Summary of Soil Sampling Results

Harmon Railroad Yard Wastewater Treatment Area Operable Unit II

Croton-on-Hudson, NY

Sample Number	Recommended Soil Cleanup Objectives	E-1	W-2	E-3	W-4	DUP 1 (Dup. of W-4)	E-5	E-6	W-6A	W-7	E-8
Depth		7-9'	7-9'	7-9'	9.5-11.5'		7-9'	7-9'	7-9'	7-9'	7-9'
Date Collected		1/26/95	1/26/95	1/26/95	1/26/95		1/27/95	1/26/95	1/27/95	1/26/95	1/27/95
Volatile Organic Compounds, in µg/kg											
Acetone	200										
4-Methyl-2-Pentanone	1,000										
Toluene	1,500	2 J			10 J	4 J		6 J		1 J	
Ethylbenzene	5,500										
Xylene (total)	1,200				1 J						
Total TICs			19600 J						26 J		43 J
Semi-Volatile Organics, in µg/kg											
4-Methylphenol	900										
2,4-Dimethylphenol	NA										
Naphthalene	13,000			71 J							
2-Methylnaphthalene	36,400		6811 J	60 J							
Acenaphthylene	41,000										
Acenaphthene	50,000		1500 J								
Dibenzofuran	6,200										
Fluorene	50,000		2100 J	41 J							
Phenanthrene	50,000		5600 J	120 J				62 J			
Anthracene	50,000			39 J							
Carbazole	NA										
Di-n-butylphthalate	8,100										
Fluoranthene	50,000	70 J		40 J				91 J			
Pyrene	50,000	69 J		63 J				77 J			
Benzo (a) anthracene	224 or MDL							42 J			
Chrysene	400	47 J						50 J			
bis (2-Ethylhexyl) phthalate	50,000							54 J	37 J		
Benzo (b) fluoranthene	224 or MDL										
Benzo (k) fluoranthene	224 or MDL										
Benzo (a) pyrene	61 or MDL										
Indeno (1,2,3-cd) pyrene	3,200										
Benzo (g,h,i) perylene	50,000										

Table 2
Summary of Soil Sampling Results
Harmon Railroad Yard Wastewater Treatment Area Operable Unit II
Croton-on-Hudson, NY

Sample Number	Recommended Soil Cleanup Objectives	E-1		W-2		E-3		W-4		DUP 1 (Dup. of W-4)		E-5		E-6		W-6A		W-7		E-8	
Depth		7-9'		7-9'		7-9'		9.5-11.5'				7-9'		7-9'		7-9'		7-9'		7-9'	
Date Collected		1/26/95		1/26/95		1/26/95		1/26/95				1/27/95		1/26/95		1/27/95		1/26/95		1/27/95	
Total TICs		220	J	252400	J	894	J	1017	J	1059	J	1260	J	14508	J	722	J	2289	J	2224	J
Pesticides (in µg/kg)																					
alpha-BHC	110			3.1	PJ																
beta-BHC	200																				
delta-BHC	300																				
Heptachlor	100			2.7	PJ																
Aldrin	41																				
Heptachlor epoxide	20																				
Endosulfan I	900																				
Dieldrin	44																				
4,4'-DDE	2,100																				
Endrin	100			4.1	PJ																
Endosulfan II	900																				
4,4'-DDD	2,900																				
Endosulfan sulfate	1,000																				
4,4'-DDT	2,100																				
Methoxychlor	< 10,000																				
Endrin ketone	NA	5.4																			
Endrin aldehyde	NA																				
alpha-Chlordane	Total = 540																				
gamma-Chlordane	Total = 540																				
PCB COMPOUNDS (in µg/kg)																					
Aroclor-1260								37	J	15	PJ			22	J			29	J		
Total (surface)	1,000																				
Total (subsurface)	10,000																				
Total Organic Carbon (in mg/kg)		2909		8613		5393		9098		4370		5875		6521		5546		6114		7055	
Grain Size																					

Table 2

Summary of Soil Sampling Results

Harmon Railroad Yard Wastewater Treatment Area Operable Unit II

Croton-on-Hudson, NY

Sample Number	Recommended Soil Cleanup Objectives	W-9	E-10	W-11	W-13	E-14	E-15	W-16	E-17	E-19	W-20
Depth		7-9'	7-9'	7-9'	7-9'	7-9'	7-9'	7-8'	7-9'	5-7'	6-8'
Date Collected		1/27/95	1/27/95	1/27/95	1/27/95	1/30/95	1/30/95	1/30/95	1/30/95	1/30/95	1/30/95
Volatile Organic Compounds, in µg/kg											
Acetone	200										
4-Methyl-2-Pentanone	1,000										
Toluene	1,500										
Ethylbenzene	5,500						27				
Xylene (total)	1,200						150				
Total TICs		20 J	8 J	15 J	21 J	6 J	1100 J	5250 J	198 J	18 J	
Semi-Volatile Organics, in µg/kg											
4-Methylphenol	900										
2,4-Dimethylphenol	NA										
Naphthalene	13,000						800 J				
2-Methylnaphthalene	36,400						4200		57 J		
Acenaphthylene	41,000										
Acenaphthene	50,000						510 J				
Dibenzofuran	6,200										
Fluorene	50,000						840 J				
Phenanthrene	50,000		52 J				1200 J		54 J		
Anthracene	50,000										
Carbazole	NA										
Di-n-butylphthalate	8,100										
Fluoranthene	50,000								72 J		
Pyrene	50,000								76 J		
Benzo (a) anthracene	224 or MDL		40 J						46 J		
Chrysene	400		58 J						61 J		
bis (2-Ethylhexyl) phthalate	50,000	37 J	39 J								
Benzo (b) fluoranthene	224 or MDL										
Benzo (k) fluoranthene	224 or MDL										
Benzo (a) pyrene	61 or MDL										
Indeno (1,2,3-cd) pyrene	3,200										
Benzo (g,h,i) perylene	50,000										

Table 2
Summary of Soil Sampling Results
Harmon Railroad Yard Wastewater Treatment Area Operable Unit II
Croton-on-Hudson, NY

Sample Number	Recommended Soil Cleanup Objectives	W-9		E-10		W-11		W-13		E-14		E-15		W-16		E-17		E-19		W-20	
Depth		7-9'		7-9'		7-9'		7-9'		7-9'		7-9'		7-8'		7-9'		5-7'		6-8'	
Date Collected		1/27/95		1/27/95		1/27/95		1/27/95		1/30/95		1/30/95		1/30/95		1/30/95		1/30/95		1/30/95	
Total TICs		1661	J	2166	J	1753	J	1170	J	2960	J	147000	J			83	J	500	J	92	J
Pesticides (in µg/kg)																					
alpha-BHC	110																				
beta-BHC	200																				
delta-BHC	300																				
Heptachlor	100																				
Aldrin	41																				
Heptachlor epoxide	20																				
Endosulfan I	900																				
Dieldrin	44											2.1	JP								
4,4'-DDE	2,100											2.4	JP								
Endrin	100																				
Endosulfan II	900																				
4,4'-DDD	2,900																				
Endosulfan sulfate	1,000																				
4,4'-DDT	2,100																				
Methoxychlor	< 10,000																				
Endrin ketone	NA																				
Endrin aldehyde	NA																				
alpha-Chlordane	Total = 540																				
gamma-Chlordane	Total = 540																				
PCB COMPOUNDS (in µg/kg)																					
Aroclor-1260																		21	J		
Total (surface)	1,000																				
Total (subsurface)	10,000																				
Total Organic Carbon (in mg/kg)		4227		3600		5244		4926		2819		6350		3084		9674		8879		8638	
Grain Size																					

Table 2

Summary of Soil Sampling Results

Harmon Railroad Yard Wastewater Treatment Area Operable Unit II

Croton-on-Hudson, NY

Sample Number	Recommended Soil Cleanup Objectives	E-21		W-22		DUP 2 (Dup. of W-22)		E-23		W-24		E-25		W-26		E-27		W-28		E-29	
Depth		5-7'		5-7'				5-7'		5-7'		5-7'		4-6'		4-6'		4-6'		4-6'	
Date Collected		1/31/95		1/31/95				1/31/95		1/31/95		1/31/95		1/31/95		1/31/95		1/31/95		1/31/95	
Volatile Organic Compounds, in µg/kg																					
Acetone	200																				
4-Methyl-2-Pentanone	1,000																				
Toluene	1,500*									2	J			4	J						
Ethylbenzene	5,500																				
Xylene (total)	1,200											2	J	10	J						
Total TICs		118	J							7	J	10	J	21	J	308	J			1323	J
Semi-Volatile Organics, in µg/kg																					
4-Methylphenol	900									38	J										
2,4-Dimethylphenol	NA									44	J			190	J						
Naphthalene	13,000									720		930		2700		1000		300	J	85	J
2-Methylnaphthalene	36,400									1000		1400		4300		1600		500		110	
Acenaphthylene	41,000									140	J										
Acenaphthene	50,000																				
Dibenzofuran	6,200									260	J	340	J	1200	J	460		140	J		
Fluorene	50,000									50	J										
Phenanthrene	50,000									520		540		2100		670		260	J	160	J
Anthracene	50,000									120	J										
Carbazole	NA									95	J	51	J	200	J	65	J				
Di-n-butylphthalate	8,100																				
Fluoranthene	50,000									700		81	J	900	J	170	J	170	J		
Pyrene	50,000									690		120	J	870	J	210	J	190	J		
Benzo (a) anthracene	224 or MDL									360	J	72	J	470	J	120	J	99	J		
Chrysene	400									570		120	J	740	J	200	J	140	J		
bis (2-Ethylhexyl) phthalate	50,000																				
Benzo (b) fluoranthene	224 or MDL									580		55	J	530	J	120	J	130	J		
Benzo (k) fluoranthene	224 or MDL									400		40	J	380	J	99	J	94	J		
Benzo (a) pyrene	61 or MDL									340	J	48	J	290	J	79	J	71	J		
Indeno (1,2,3-cd) pyrene	3,200									200	J							43	J		
Benzo (g,h,i) perylene	50,000									170	J							44	J		

Table .
Summary of Soil Sampling Results
Harmon Railroad Yard Wastewater Treatment Area Operable Unit II
Croton-on-Hudson, NY

Sample Number	Recommended Soil Cleanup Objectives	E-21		W-22		DUP 2 (Dup. of W-22)		E-23		W-24		E-25		W-26		E-27		W-28		E-29	
Depth		5-7'		5-7'				5-7'		5-7'		5-7'		4-6'		4-6'		4-6'		4-6'	
Date Collected		1/31/95		1/31/95				1/31/95		1/31/95		1/31/95		1/31/95		1/31/95		1/31/95		1/31/95	
Total TICs		962	J	1223	J	1511	J	650	J	6530	J	8150	J	29460	J	10560	J	4290	J	13200	J
Pesticides (in µg/kg)																					
alpha-BHC	110																				
beta-BHC	200																				
delta-BHC	300																				
Heptachlor	100									1.9	PJ	2.8	PJ	4.4	PJ	2.9	PJ	1.6	J		
Aldrin	41																			3.3	
Heptachlor epoxide	20									2.3	PJ	2.5	PJ								
Endosulfan I	900																				
Dieldrin	44																				
4,4'-DDE	2,100																				
Endrin	100									7.7	YJ	5.3	PJ	15	PJ	8.9				4.5	PJ
Endosulfan II	900													9.3	PJ						
4,4'-DDD	2,900																				
Endosulfan sulfate	1,000																				
4,4'-DDT	2,100									7.2	PYJ					10		3.9	YJ		
Methoxychlor	< 10,000									13	JP	18	JP	65	J	25	PJ				
Endrin ketone	NA															7.2	PJ				
Endrin aldehyde	NA																				
alpha-Chlordane	Total = 540																				
gamma-Chlordane	Total = 540																				
PCB COMPOUNDS (in µg/kg)																					
Aroclor-1260										51								17	JP		
Total (surface)	1,000																				
Total (subsurface)	10,000																				
Total Organic Carbon (in mg/kg)		5846		5589		5477		10757		79790		42605		216024		92785		26130		4242	
Grain Size																					

Table

Summary of Soil Sampling Results

Harmon Railroad Yard Wastewater Treatment Area Operable Unit II

Croton-on-Hudson, NY

Sample Number	Recommended Soil Cleanup Objectives	E-30		W-31		E-32		W-33		E-34		W-35		E-36		W-37		E-38		W-39	
Depth		2-4'		2-4'		2-4'		2-4'		2-4'		2-4'		2-4'		2-4'		2-4'		2-4'	
Date Collected		2/1/95		2/1/95		2/1/95		2/1/95		2/1/95		2/1/95		2/1/95		2/1/95		2/2/95		2/1/95	
Volatile Organic Compounds, in µg/kg																					
Acetone	200											37	B								
4-Methyl-2-Pentanone	1,000																				
Toluene	1,500					13	J														
Ethylbenzene	5,500																				
Xylene (total)	1,200					83	J					9 J	J	17							
Total TICs		3110	J	1429	J	1964	J	2520	J	7870	J	1580	J	1631	J	7720	J	38500	J	16	J
Semi-Volatile Organics, in µg/kg																					
4-Methylphenol	900																				
2,4-Dimethylphenol	NA																				
Naphthalene	13,000			1700	J											870	J			520	J
2-Methylnaphthalene	36,400	2500	J	2900	J	19000		2800	J	77000	D	32000		14000		1100	J	6800		980	J
Acenaphthylene	41,000																				
Acenaphthene	50,000																				
Dibenzofuran	6,200			820	J											620	J				
Fluorene	50,000									7500						500	J	4700		810	J
Phenanthrene	50,000	3200	J	3800	J	5100		9500		13000		9200		3700	J	2300	J	6500		1000	J
Anthracene	50,000			630	J			1100	J	1400	J	1200	J			660	J				
Carbazole	NA																				
Di-n-butylphthalate	8,100																				
Fluoranthene	50,000	2100	J	3600	J	930	J	5000		4200		11000		580	J	4800		1500	J	1100	J
Pyrene	50,000	2900	J	3900		1200	J	5200		4200		13000		700	J	5200	J	1900	J	1400	J
Benzo (a) anthracene	224 or MDL			1700	J			2200	J	1800	J	5800				2200	J	600	J	580	J
Chrysene	400			1900	J	540	J	2400	J	1800	J	6500				2500	J	710	J	710	J
bis (2-Ethylhexyl) phthalate	50,000																				
Benzo (b) fluoranthene	224 or MDL			1700	J	490	J	2000	J	1100	J	5300				2600	J	480	J	680	J
Benzo (k) fluoranthene	224 or MDL			770	J			1400	J	1100	J	2800	J			1000	J	570	J		
Benzo (a) pyrene	61 or MDL			1300	J			1600	J	910	J	3000	J			1500	J	400	J	400	J
Indeno (1,2,3-cd) pyrene	3,200			760	J			1000	J	590	J	1600	J			980	J				
Benzo (g,h,i) perylene	50,000			870	J			1100	J	630	J	1500	J			980	J				

Table .
Summary of Soil Sampling Results
Harmon Railroad Yard Wastewater Treatment Area Operable Unit II
Croton-on-Hudson, NY

Sample Number	Recommended Soil Cleanup Objectives	E-30		W-31		E-32		W-33		E-34		W-35		E-36		W-37		E-38		W-39	
Depth		2-4'		2-4'		2-4'		2-4'		2-4'		2-4'		2-4'		2-4'		2-4'		2-4'	
Date Collected		2/1/95		2/1/95		2/1/95		2/1/95		2/1/95		2/1/95		2/1/95		2/1/95		2/2/95		2/1/95	
Total TICs		272700	J	37840	J	822000	J	609000	J	454000	J	524000	J	322900	J	28360	J	421600	J	94900	J
Pesticides (in µg/kg)																					
alpha-BHC	110					4.3	PJ														
beta-BHC	200					5.3	PJ														
delta-BHC	300																				
Heptachlor	100							3.2	PJ	7										4.4	
Aldrin	41	3.9	JP					4	JP									10	PJ		
Heptachlor epoxide	20			3.5	JP													6.1	PJ		
Endosulfan I	900																				
Dieldrin	44																				
4,4'-DDE	2,100																				
Endrin	100							12	PJ			19	PJ					22	PJ		
Endosulfan II	900																	5.6	JP		
4,4'-DDD	2,900					6.3	JP														
Endosulfan sulfate	1,000																				
4,4'-DDT	2,100	25				9.6	PJ	6.2	JP	9.6	PJ	6.6	JP					13	PJ		
Methoxychlor	< 10,000	23	JP	33	JP	28	JP					34	JP								
Endrin ketone	NA	10		18	PJ	6.9	JP	9.9		9.8	PJ										
Endrin aldehyde	NA																				
alpha-Chlordane	Total = 540																				
gamma-Chlordane	Total = 540																				
PCB COMPOUNDS (in µg/kg)																					
Aroclor-1260																					
Total (surface)	1,000																				
Total (subsurface)	10,000																				
Total Organic Carbon (in mg/kg)		40611		39440		48885		51051		282481		46941		43317		24929		38799		23977	
Grain Size																					

Table

Summary of Soil Sampling Results

Harmon Railroad Yard Wastewater Treatment Area Operable Unit II

Croton-on-Hudson, NY

Sample Number	Recommended Soil Cleanup Objectives	E-40		W-41		E-42		W-43		DUP 3 (Dup. of W-43)		E-44		W-45		E-46		W-47	
Depth		4-7'		2-4'		1-3'		1-3'		1-3'		1-3'		1-3'		1-3'		1-3'	
Date Collected		2/1/95		2/2/95		2/2/95		2/2/95		2/2/95		2/2/95		2/2/95		2/2/95		2/2/95	
Volatile Organic Compounds, in µg/kg																			
Acetone	200											1	J						
4-Methyl-2-Pentanone	1,000																		
Toluene	1,500							1	J					1	J				
Ethylbenzene	5,500																		
Xylene (total)	1,200							11	J	31	J								
Total TICs		1434	J					7590	J	31900	J	1110	J	7150	J	1094	J	909	J
Semi-Volatile Organics, in µg/kg																			
4-Methylphenol	900																		
2,4-Dimethylphenol	NA																		
Naphthalene	13,000	500	J																
2-Methylnaphthalene	36,400	850	J					1900	J	1700	J			1100	J	440	J	1000	J
Acenaphthylene	41,000													670	J				
Acenaphthene	50,000	480	J					1700	J	1500	J	3900		740	J				
Dibenzofuran	6,200																		
Fluorene	50,000							2600	J	2300	J	6600		1400	J				
Phenanthrene	50,000	1100	J					9700		6200		9600		3800	J			470	J
Anthracene	50,000							1100	J					420	J				
Carbazole	NA																		
Di-n-butylphthalate	8,100																		
Fluoranthene	50,000	1600	J					9600		3400	J	2400	J	2500	J			670	J
Pyrene	50,000	1800	J					9700		3900	J	5000		2900	J			770	J
Benzo (a) anthracene	224 or MDL	870	J					3800	J	1400	J	880	J	1400	J			470	J
Chrysene	400	1100	J					4000		1500	J	1100	J	1600	J			580	J
bis (2-Ethylhexyl) phthalate	50,000		J	260	J	56	J												
Benzo (b) fluoranthene	224 or MDL	1100	J					3100	J	1100	J	860	J	1200	J			710	J
Benzo (k) fluoranthene	224 or MDL	560	J					2700	J	1400	J	560	J	1700	J				
Benzo (a) pyrene	61 or MDL	620	J					2400	J	870	J	610	J	1100	J			380	J
Indeno (1,2,3-cd) pyrene	3,200	430	J					1700	J	700	J	560	J	890	J				
Benzo (g,h,i) perylene	50,000	440	J					1700	J	710	J	580	J	880	J			390	J

Table 5
Summary of Soil Sampling Results
Harmon Railroad Yard Wastewater Treatment Area Operable Unit II
Croton-on-Hudson, NY

Sample Number	Recommended Soil Cleanup Objectives	E-40		W-41		E-42		W-43		DUP 3 (Dup. of W-43)		E-44		W-45		E-46		W-47	
Depth		4-7'		2-4'		1-3'		1-3'		1-3'		1-3'		1-3'		1-3'		1-3'	
Date Collected		2/1/95		2/2/95		2/2/95		2/2/95		2/2/95		2/2/95		2/2/95		2/2/95		2/2/95	
Total TICs		98700	J	120	J	760	J	193500	J	183600	J	278000	J	152800	J			10990	J
Pesticides (in µg/kg)																			
alpha-BHC	110																		
beta-BHC	200																		
delta-BHC	300																		
Heptachlor	100																		
Aldrin	41							10	PJ	7.6	PJ							5.2	PJ
Heptachlor epoxide	20															2.9	J		
Endosulfan I	900																		
Dieldrin	44																		
4,4'-DDE	2,100																		
Endrin	100																		
Endosulfan II	900									9.5	PJ	11	PJ	24	J	7.7	PJ	5.9	JP
4,4'-DDD	2,900																		
Endosulfan sulfate	1,000									8.7	PJ								
4,4'-DDT	2,100							22	J	37	PJ	14	PJ	48	PJ				
Methoxychlor	< 10,000																		
Endrin ketone	NA							53	J	20	PJ	20	PJ						
Endrin aldehyde	NA																		
alpha-Chlordane	Total = 540							8.9	J										
gamma-Chlordane	Total = 540																		
PCB COMPOUNDS (in µg/kg)																			
Aroclor-1260																		68	JP
Total (surface)	1,000																		
Total (subsurface)	10,000																		
Total Organic Carbon (in mg/kg)		39862		6146		3371		9947		35098		54504		172764		18985		39505	
Grain Size																			

Table 2-6

Summary of Soil Sampling Results

Harmon Railroad Yard Wastewater Treatment Area Operable Unit II

Croton-on-Hudson, NY

Sample Number	Recommended Soil Cleanup Objectives	E-48		W-49		E-50		W-51		E-52		W-53		E-54		W-55		E-56	
Depth		1-3'		1-3'		1-3'		1-3'		2-4'		2-4'		2-4'		2-4'		2-4'	
Date Collected		2/2/95		2/2/95		2/2/95		2/2/95		2/3/95		2/3/95		2/3/95		2/3/95		2/3/95	
Volatile Organic Compounds, in µg/kg																			
Acetone	200			17	J							6	J						
4-Methyl-2-Pentanone	1,000	130	J																
Toluene	1,500	88	J																
Ethylbenzene	5,500																		
Xylene (total)	1,200	140	J																
Total TICs		48300	J	6300	J			51100	J	80500	J	77	J	15060	J				
Semi-Volatile Organics, in µg/kg																			
4-Methylphenol	900																		
2,4-Dimethylphenol	NA																		
Naphthalene	13,000			160	J							200	J	220	J	150	J	190	J
2-Methylnaphthalene	36,400			290	J	43	J	6800	J	980	J	280	J	360	J	330	J	420	J
Acenaphthylene	41,000											340	J	200	J	76	J	140	J
Acenaphthene	50,000			310	J			10000		690	J			240	J				
Dibenzofuran	6,200			210	J			5800	J	370	J	190	J					120	J
Fluorene	50,000			410	J			13000		900	J			260	J			120	J
Phenanthrene	50,000			1000	J			34000		2300		660	J	680	J	160	J	1500	
Anthracene	50,000			230	J			6900	J	530	J	220	J	300	J			210	J
Carbazole	NA																		
Di-n-butylphthalate	8,100			200	J														
Fluoranthene	50,000	3600	J	220	J			3800	J	500	J	1600	J	1400	J	240	J	2100	
Pyrene	50,000	7000		240	J			3200	J	630	J	1300	J	1300	J	250	J	1400	
Benzo (a) anthracene	224 or MDL	1400	J					980	J	230	J	840	J	690	J	150	J	680	J
Chrysene	400	1600	J					1400	J	280	J	1000	J	810	J	210	J	820	
bis (2-Ethylhexyl) phthalate	50,000																		
Benzo (b) fluoranthene	224 or MDL	1700	J					960	J	280	J	810	J	580	J	210	J	490	J
Benzo (k) fluoranthene	224 or MDL	950	J					1100	J	250	J	1000	J	800	J	180	J	490	J
Benzo (a) pyrene	61 or MDL	880	J					840	J	230	J	720	J	670	J	170	J	390	J
Indeno (1,2,3-cd) pyrene	3,200	800	J							190	J	490	J	390	J	120	J	170	J
Benzo (g,h,i) perylene	50,000	840	J							190	J	200	J	280	J	110	J	140	J

Table 2-6
Summary of Soil Sampling Results
Harmon Railroad Yard Wastewater Treatment Area Operable Unit II
Croton-on-Hudson, NY

Sample Number	Recommended Soil Cleanup Objectives	E-48		W-49		E-50		W-51		E-52		W-53		E-54		W-55		E-56	
Depth		1-3'		1-3'		1-3'		1-3'		2-4'		2-4'		2-4'		2-4'		2-4'	
Date Collected		2/2/95		2/2/95		2/2/95		2/2/95		2/3/95		2/3/95		2/3/95		2/3/95		2/3/95	
Total TICs		625000	J	44370	J			400300	J	87300	J	16120	J	65300	J	4420	J	5340	J
Pesticides (in µg/kg)																			
alpha-BHC	110																		
beta-BHC	200							2.2	PJ										
delta-BHC	300																		
Heptachlor	100			2.3						3.8	PJ			2.8	PJ			1.7	JP
Aldrin	41	8.4	PJ																
Heptachlor epoxide	20									1	JP								
Endosulfan I	900	2.4	PJ																
Dieldrin	44																		
4,4'-DDE	2,100			4.9	PJ														
Endrin	100			7.3	PJ	7.3	PJ											5.9	PJ
Endosulfan II	900					4.8	PJ												
4,4'-DDD	2,900			4.3															
Endosulfan sulfate	1,000	5.1	PJ																
4,4'-DDT	2,100	6.2	J							3.7	PJ			3.7	JP	2.2	JP		
Methoxychlor	< 10,000					23	PJ					20	JP	25	PJ	12	JP	15	JP
Endrin ketone	NA	5.5	JP			3.4	JP	3.9	J										
Endrin aldehyde	NA																	3.9	PJ
alpha-Chlordane	Total = 540																		
gamma-Chlordane	Total = 540																		
PCB COMPOUNDS (in µg/kg)																			
Aroclor-1260																			
Total (surface)	1,000																		
Total (subsurface)	10,000																		
Total Organic Carbon (in mg/kg)		44329		9898		85598		115647		47073		54038		86576		24373		18904	
Grain Size																			

Table 2-6
Summary of Soil Sampling Results
Harmon Railroad Yard Wastewater Treatment Area Operable Unit II
Croton-on-Hudson, NY

Sample Number	Recommended Soil Cleanup Objectives	W-57		E-58		W-59		W-60		W-61		W-62		DUP-4 (Dup. of W-62)		W-63	
Depth		2-4'		2-4'		3-5'		3-5'		2-4'		2-4'		2-4'		2-4'	
Date Collected		2/3/95		2/3/95		2/3/95		2/3/95		2/6/95		2/6/95		2/6/95		2/6/95	
Volatile Organic Compounds, in μg/kg																	
Acetone	200											20	J	29	J	8	J
4-Methyl-2-Pentanone	1,000																
Toluene	1,500																
Ethylbenzene	5,500																
Xylene (total)	1,200																
Total TICs		31700	J	50500	J	60133	J	8430	J	2037	J	16000	J	22600	J	4050	J
Semi-Volatile Organics, in μg/kg																	
4-Methylphenol	900																
2,4-Dimethylphenol	NA																
Naphthalene	13,000																
2-Methylnaphthalene	36,400			8200		2700	J					3900	J	3100	J	450	J
Acenaphthylene	41,000																
Acenaphthene	50,000	1900	J	2500	J	3000	J					5200	J	4400	J	590	J
Dibenzofuran	6,200	1100	J	1500	J							3200	J	2700	J		
Fluorene	50,000	2600	J	3300	J	3300	J					6800	J	6700	J	710	J
Phenanthrene	50,000	6700	J	9000		7700	J					15000		15000		1600	J
Anthracene	50,000	900	J	1000	J							1800	J	1600	J		
Carbazole	NA																
Di-n-butylphthalate	8,100																
Fluoranthene	50,000									86	J	910	J	860	J	710	J
Pyrene	50,000							1400	J	80	J	1200	J	1300	J	670	J
Benzo (a) anthracene	224 or MDL																
Chrysene	400															390	J
bis (2-Ethylhexyl) phthalate	50,000																
Benzo (b) fluoranthene	224 or MDL																
Benzo (k) fluoranthene	224 or MDL															400	J
Benzo (a) pyrene	61 or MDL																
Indeno (1,2,3-cd) pyrene	3,200																
Benzo (g,h,i) perylene	50,000																

Table 2-
Summary of Soil Sampling Results
Harmon Railroad Yard Wastewater Treatment Area Operable Unit II
Croton-on-Hudson, NY

Sample Number	Recommended Soil Cleanup Objectives	W-57		E-58		W-59		W-60		W-61		W-62		DUP-4 (Dup. of W-62)		W-63	
Depth		2-4'		2-4'		3-5'		3-5'		2-4'		2-4'		2-4'		2-4'	
Date Collected		2/3/95		2/3/95		2/3/95		2/3/95		2/6/95		2/6/95		2/6/95		2/6/95	
Total TICs		316100	J	375900	J	472200	J	190100	J	5950	J	503000	J	441100	J	99600	J
Pesticides (in μg/kg)																	
alpha-BHC	110																
beta-BHC	200											2.1	PJ	2.1	PJ		
delta-BHC	300											1.3	JP	1.8	JP		
Heptachlor	100															1.6	JP
Aldrin	41																
Heptachlor epoxide	20																
Endosulfan I	900																
Dieldrin	44			2.7	JP												
4,4'-DDE	2,100																
Endrin	100																
Endosulfan II	900																
4,4'-DDD	2,900											4.1	PJ				
Endosulfan sulfate	1,000							7.2	J			2.9	JP				
4,4'-DDT	2,100			7								4.7	PJ				
Methoxychlor	< 10,000																
Endrin ketone	NA																
Endrin aldehyde	NA																
alpha-Chlordane	Total = 540																
gamma-Chlordane	Total = 540							3.5	JP			2.1	PJ	1.5	JP		
PCB COMPOUNDS (in μg/kg)																	
Aroclor-1260																	
Total (surface)	1,000																
Total (subsurface)	10,000																
Total Organic Carbon (in mg/kg)		11972		29766		20833		20704		2073		48387		122902		19254	
Grain Size																	

Table 2-6
Summary of Soil Sampling Results
Harmon Railroad Yard Wastewater Treatment Area Operable Unit II
Croton-on-Hudson, NY

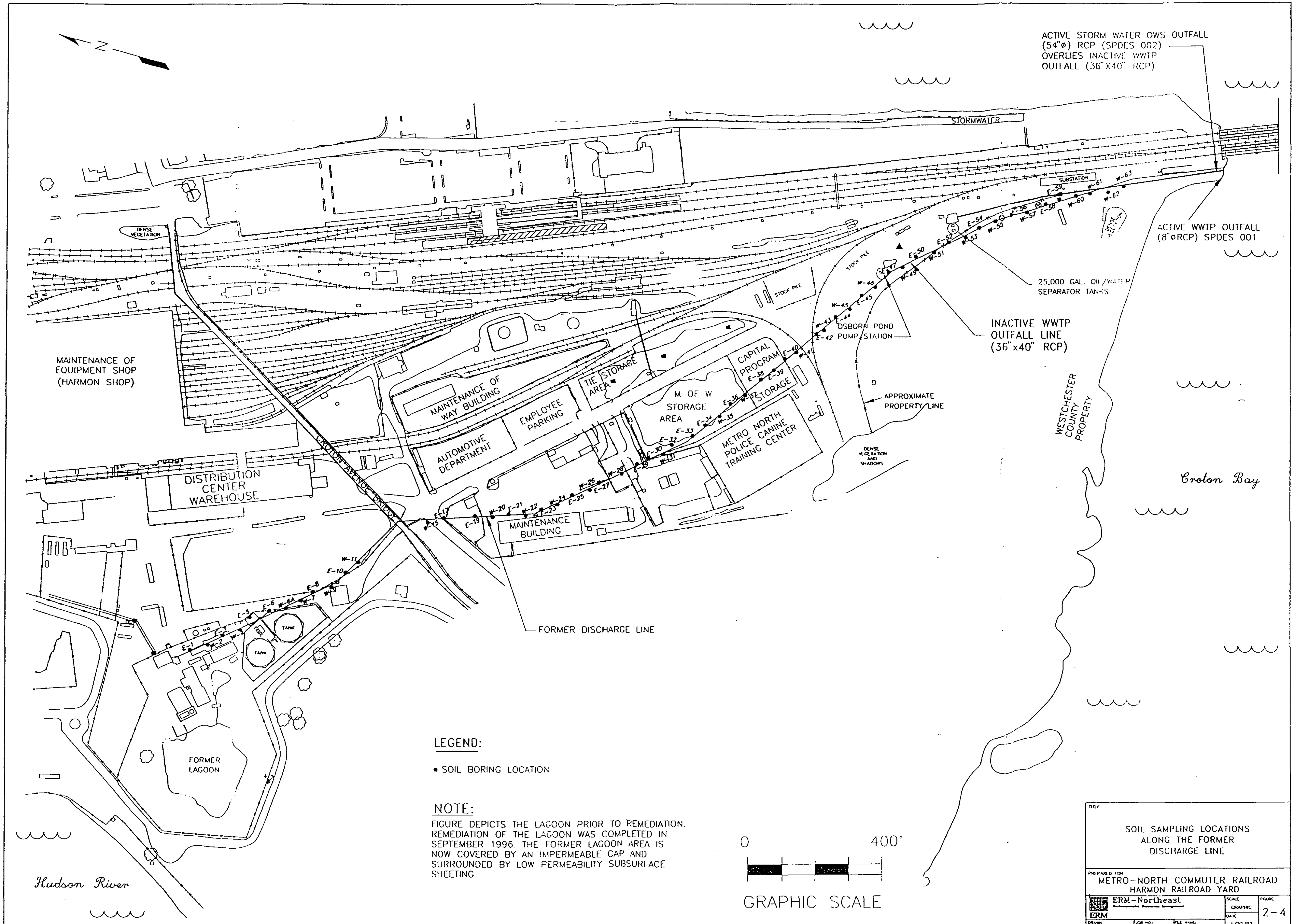
NOTES:

Detection limits are provided in Appendix D.

ORGANIC QUALIFIERS

[ ]	Blanks indicate that the compound was analyzed for but was not detected, and detection limit is not specified.
U	Indicates that the compound was analyzed for but was not detected.
J	Indicates an estimated value. The compound meets the identification criteria but the result is less than the sample quantitiation limit but greater than zero.
P	Indicates a pesticide/Aroclor target analyte where there is greater than 25% difference for detected concetrations between the two GC columns.
B	Indicates that the compound is found in the associated blank as well as the sample.
Y	Indicates that the pesticide is suspect due to possible interference from PCB compounds.
--	Indicates no guideline available for that compound.
D	Indicates that the compound was identified in an analysis at a secondary dilution factor.

NYSDEC recommended soil cleanup objective as provided in *NYSDEC Technical and Administrative Guidance Memorandum: Determination of Soil Cleanup Objectives and Cleanup Levels,* HWR-90-4046, NYSDEC, 24 January 1994 (a revised TAGM was proposed in April 1995 - when applicable, these revised soil cleanup objectives were cited and used).



ACTIVE STORM WATER OWS OUTFALL (54"Ø) RCP (SPDES 002) OVERLIES INACTIVE WWTP OUTFALL (36"X40" RCP)
STORMWATER
SUBSTATION
ACTIVE WWTP OUTFALL (8"ØRCP) SPDES 001
25,000 GAL. OIL/WATER SEPARATOR TANKS
INACTIVE WWTP OUTFALL LINE (36"x40" RCP)
OSBORN POND PUMP STATION
STOCK PILE
MAINTENANCE OF EQUIPMENT SHOP (HARMON SHOP)
DENSE VEGETATION
MAINTENANCE OF WAY BUILDING
EMPLOYEE PARKING
TIE STORAGE AREA
CAPITAL PROGRAM STORAGE
M OF W STORAGE AREA
METRO NORTH POLICE CANINE TRAINING CENTER
AUTOMOTIVE DEPARTMENT
DISTRIBUTION CENTER WAREHOUSE
CROTON AVENUE BRIDGE
MAINTENANCE BUILDING
APPROXIMATE PROPERTY LINE
WESTCHESTER COUNTY PROPERTY
DENSE VEGETATION AND SHADOWS
Croton Bay
FORMER DISCHARGE LINE
TANK
TANK
FORMER LAGOON
Hudson River
LEGEND:
• SOIL BORING LOCATION
NOTE:
FIGURE DEPICTS THE LAGOON PRIOR TO REMEDIATION. REMEDIATION OF THE LAGOON WAS COMPLETED IN SEPTEMBER 1996. THE FORMER LAGOON AREA IS NOW COVERED BY AN IMPERMEABLE CAP AND SURROUNDED BY LOW PERMEABILITY SUBSURFACE SHEETING.
0
400'
GRAPHIC SCALE
SOIL SAMPLING LOCATIONS ALONG THE FORMER DISCHARGE LINE
PREPARED FOR
METRO-NORTH COMMUTER RAILROAD HARMON RAILROAD YARD
ERM-Northeast
SCALE GRAPHIC
FIGURE 2-4
DATE 1/22/97

REVIEW OF THE HARMON RAILROAD YARD
PHASE I REMEDIATION PLAN PROJECT
THE CROTON BAY SEEPAGE CONTROL PLAN

ATTACHMENT III

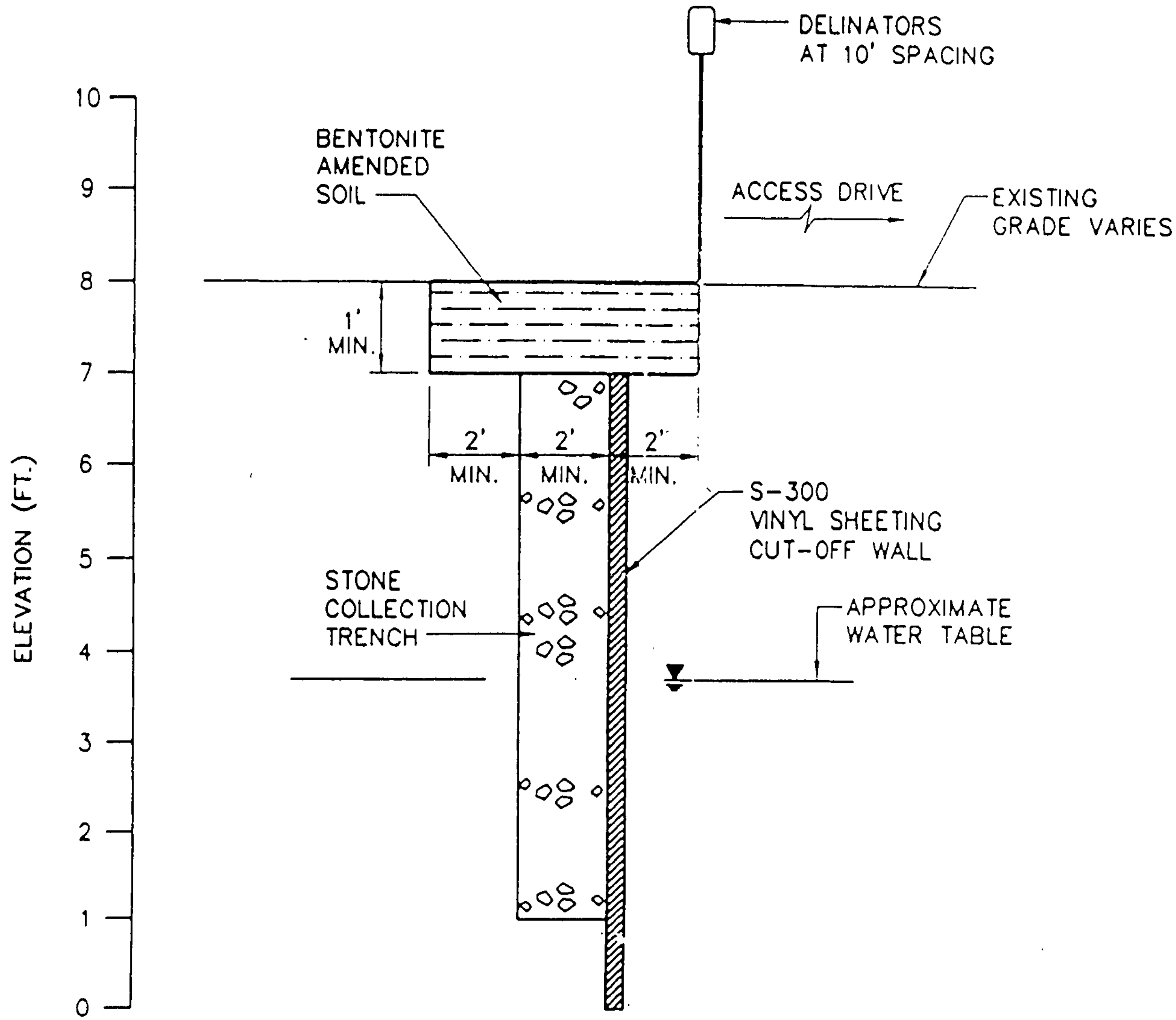
THE CROTON BAY SEEPAGE CONTROL PLAN

BARRIER WALL AND NAPL RECOVERY TRENCH

CONSTRUCTION DETAILS

AND

LOCATION



VINYL SHEET PILING/STONE COLLECTION TRENCH DETAIL

NO SCALE

CROTON BAY SEEPAGE CONTROL PLAN
Barrier Wall and NAPL Recovery Trench Details
Source: Drawing -
"Cut-Off Wall
Harmon Yard Groundwater Remediation
Phase I; Details; Submittal 25.0"
The Tyree Organization, Inc.
Clough, Harbour & Associates, LLP
February 1997

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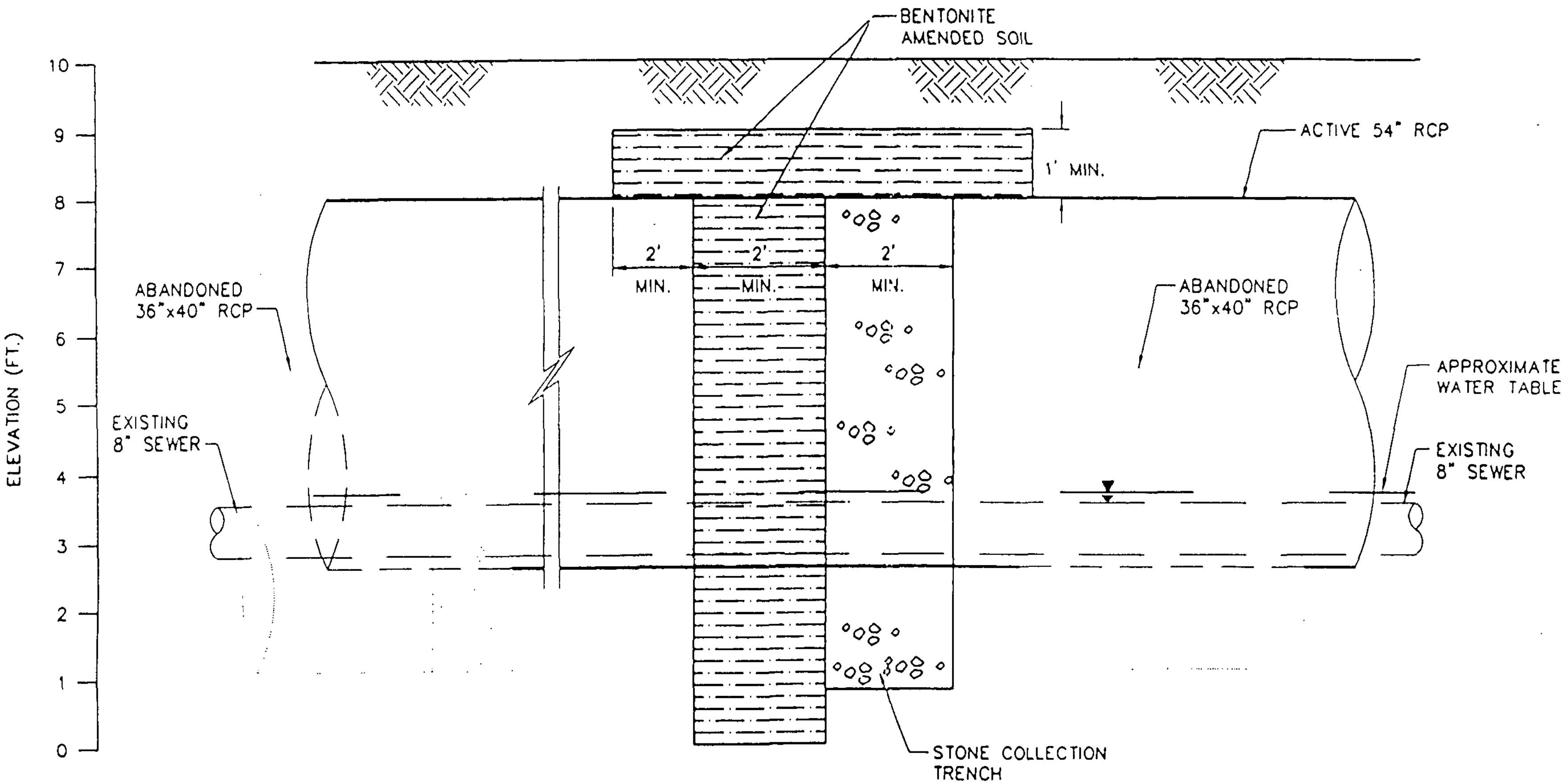

BENTONITE AMENDED SOIL/STONE COLLECTION TRENCH
DETAIL AT PIPE CROSSING

NO SCALE

CROTON BAY SEEPAGE CONTROL PLAN
Barrier Wall and NAPL Recovery Trench
Details
Source: Drawing -
"Cut-Off Wall
Harmon Yard Groundwater Remediation
Phase I; Details; Submittal 25.0"
The Tyree Organization, Inc.
Clough, Harbour & Associates, LLP
February 1997

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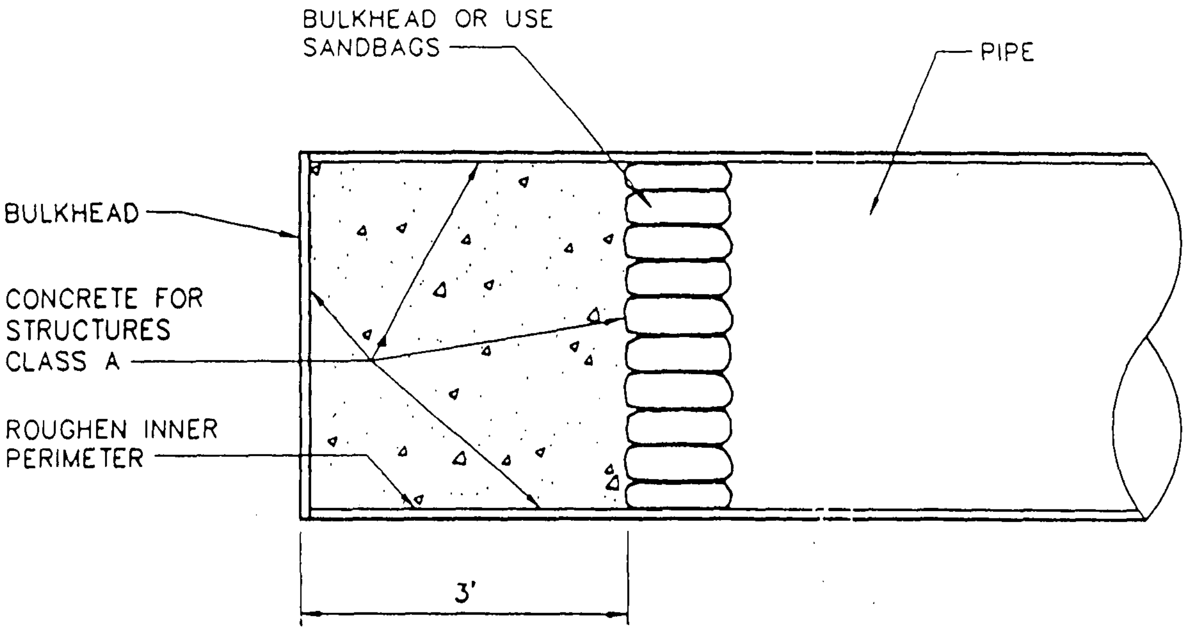
VINYL SHEET PILING/STONE COLLECTION TRENCH DETAIL

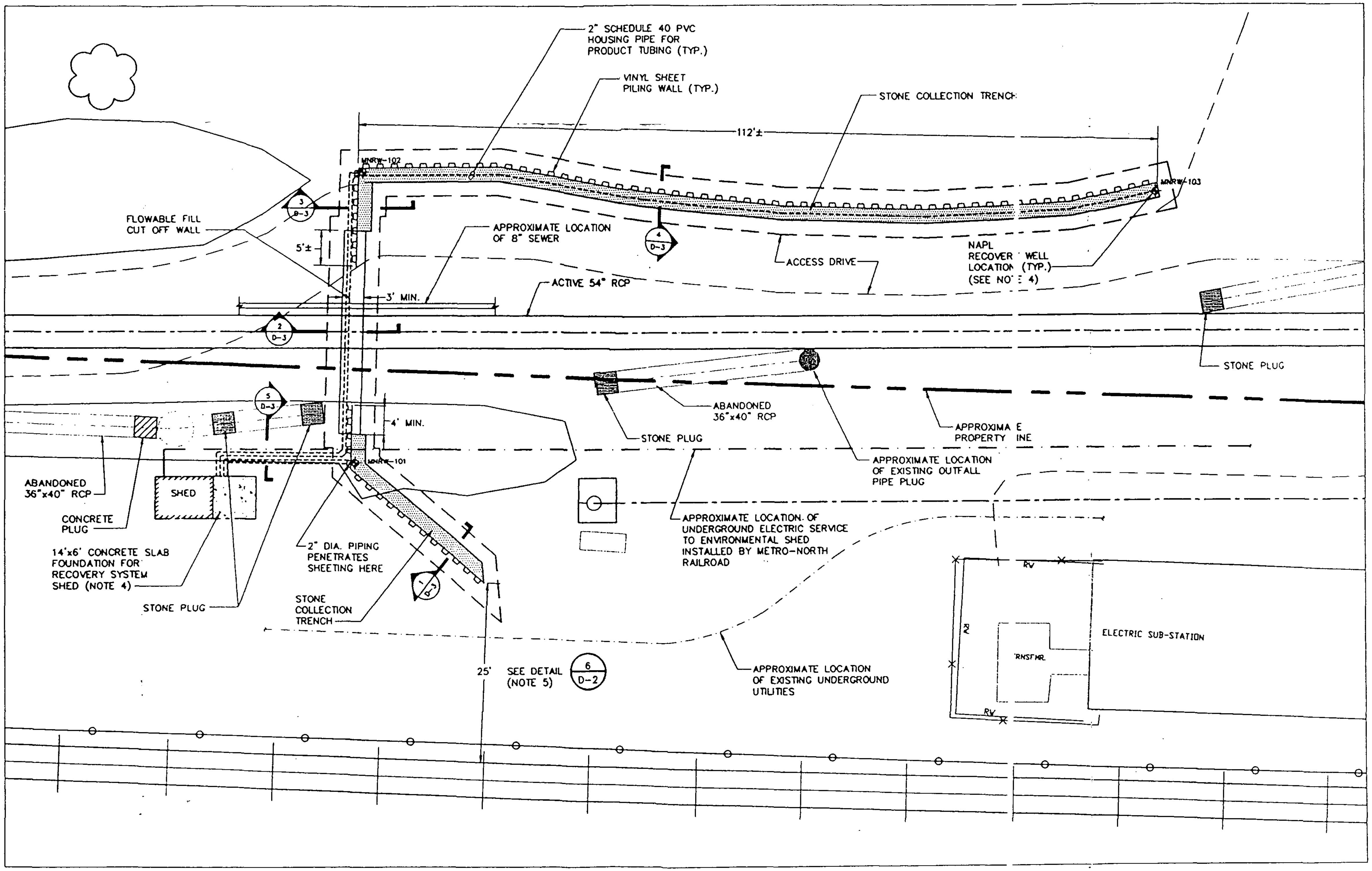
NO SCALE



EXISTING 36"x40" PIPE ABANDONMENT DETAIL

NO SCALE

CROTON BAY SEEPAGE CONTROL PLAN
Barrier Wall and NAPL Recovery Trench Details
Source: Drawing -
"Cut-Off Wall
Harmon Yard Groundwater Remediation
Phase I; Details; Submittal 25.0"
The Tyree Organization, Inc.
Clough, Harbour & Associates, LLP
February 1997



SHEET PILING WALL – STONE COLLECTION TRENCH
PLAN VIEW

CROTON BAY SEEPAGE CONTROL PLAN
Location of Barrier Wall, NAPL Recovery Trench and NAPL Recovery Wells
Construction Record (As-Built) Drawing
Source: Record Drawing, June 1997
Drawing No. 2A
"Cut-Off Wall Harmon Yard Groundwater Remediation Phase I"
Phase I Harmon Yard Remediation
The Tyree Organization, Inc.
and
Clough, Harbour & Associates, LLP

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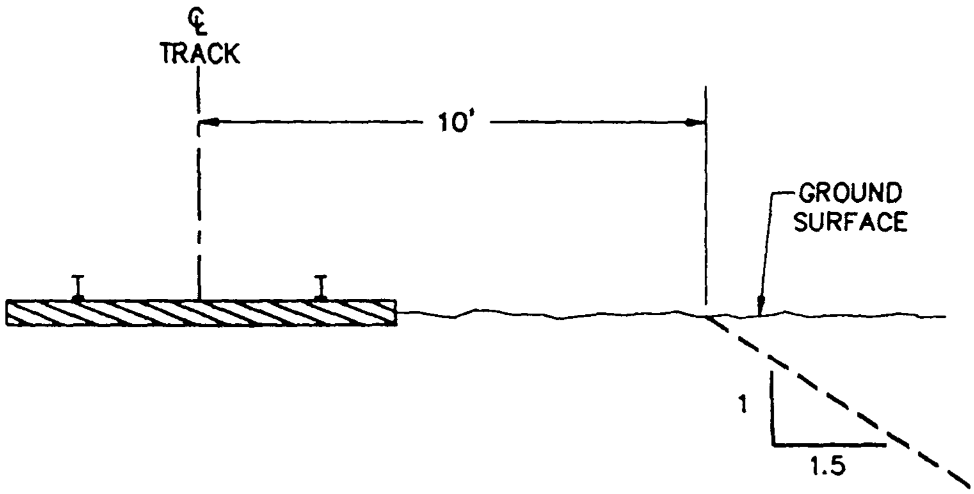

6
D-2

RAIL ROAD SHEET PILING DETAIL

NO SCALE

CROTON BAY SEEPAGE CONTROL PLAN
Detail: Railroad Sheet Piling Detail (Minimum Excavation Distance)
Construction Record (As-Built) Drawing
Source: Record Drawing, June 1997
Drawing No. 2A
"Cut-Off Wall Harmon Yard Groundwater Remediation Phase I"
Phase I Harmon Yard Remediation
The Tyree Organization, Inc.
and
Clough, Harbour & Associates, LLP

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NOTES:

1.) DEPTH OF CUT-OFF WALL AND COLLECTION TRENCH SHOWN ON CROSS SECTIONS IS BASED ON HISTORIC SEASONAL LOW GROUNDWATER LEVEL AT LOW TIDE. THE BASE OF CUT-OFF WALL IS +/- 3 FT. BELOW THIS GROUND WATER LEVEL PER PROJECT REQUIREMENTS.

2.) CUT-OFF WALL TO BE CONSTRUCTED USING IMPERMEABLE BARRIER (LESS THAN 1.0 X 10-6 CM/SEC). VINYL SHEET PILING WILL BE USED ALONG THE TRENCH ACCORDING TO THE LIMITS SHOWN. A CEMENT BENTONITE BASED FLOWABLE FILL WILL BE USED TO CREATE THE CUT-OFF WALL AROUND THE OPERATIONAL SANITARY SEWER DISCHARGE AND STORM WATER OUTFALL PIPES.

3.) STONE COLLECTION TRENCH WILL NOT BE INSTALLED AROUND FLOWABLE FILL CUT-OFF WALL SEGMENT. STONE FOR COLLECTION TRENCH SHALL CONFORM TO PEA GRAVEL, NATURALLY-ROUNDED PARTICLES WITH A MINIMUM DIAMETER OF 1/8 INCH AND A MAXIMUM SIZE OF 3/4 INCH, OR CRUSHED ROCK OR GRAVEL WASHED AND FREE FLOWING ANGULAR PARTICLES BETWEEN 1/8 INCH AND 1/2 INCH SIZE.

4.) RECOVERY WELL DETAIL AND RECOVERY SYSTEM SHOWN ON DRAWING NO. D-3.

5.) ADJUST LOCATION OF CUT-OFF WALL IN FIELD AS REQUIRED.

CROTON BAY SEEPAGE CONTROL PLAN
Drawing Notes
Construction Record (As-Built) Drawing
Source: Record Drawing, June 1997
Drawing No. 2A
"Cut-Off Wall Harmon Yard Groundwater Remediation Phase I"
Phase I Harmon Yard Remediation
The Tyree Organization, Inc.
and
Clough, Harbour & Associates, LLP

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REVIEW OF THE HARMON RAILROAD YARD
PHASE I REMEDIATION PLAN PROJECT
THE CROTON BAY SEEPAGE CONTROL PLAN

ATTACHMENT IV

MANUFACTURERS INFORMATION

PEATWICK

PASSIVE HYDROCARBON

RECOVERY SYSTEM

PEATWICK™

Passive Hydrocarbon Recovery System

The **Peatwick**™ is a passive recovery system designed to provide continuous recovery of floating hydrocarbons from groundwater monitoring wells at a fraction of the cost of standard mechanical or manual bailing systems.

The **Peatwick** absorbs floating hydrocarbons with a hydrophobic organic material and provides continuous recovery through a capillary action which draws hydrocarbons into the "wick" until the "wick" reaches saturation.

Applications:

Interim Response

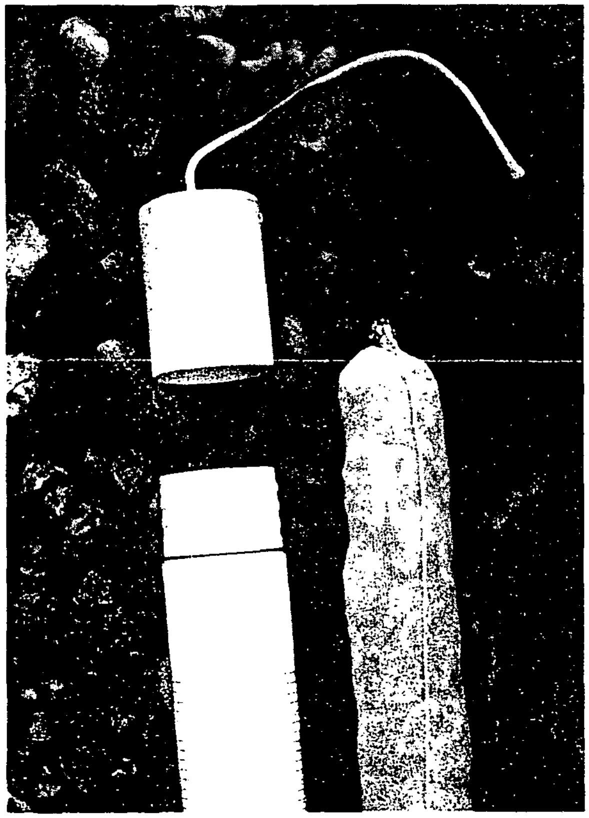
The **Peatwick** is ideal as an interim response measure when floating hydrocarbons are encountered during groundwater investigations. By simply installing a **Peatwick** in the contaminated well, product recovery can commence while a permanent remedial system is designed.

Remote Locations

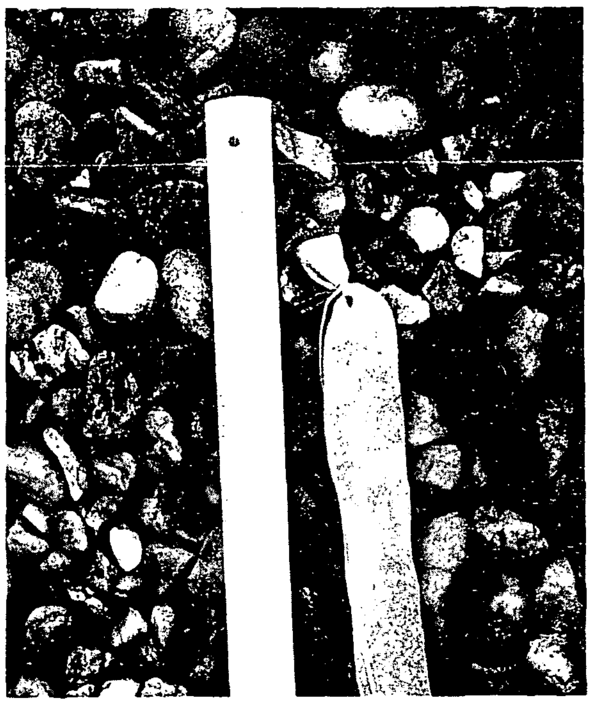
The **Peatwick** has also been successfully used for product recovery at remote locations. Sites that either lack on-site utilities or require considerable travel to access have been found to be suited for the **Peatwick** system.

Marginal Product Thickness

The **Peatwick** is also used when floating hydrocarbon thicknesses are less than 1 inch. In these situations both manual and mechanical recovery methods are not practical but regulatory response requires some action.



4" WELL

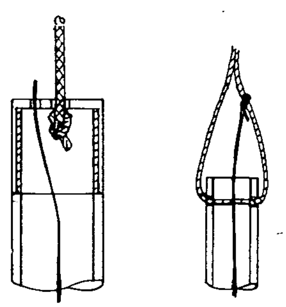


2" WELL

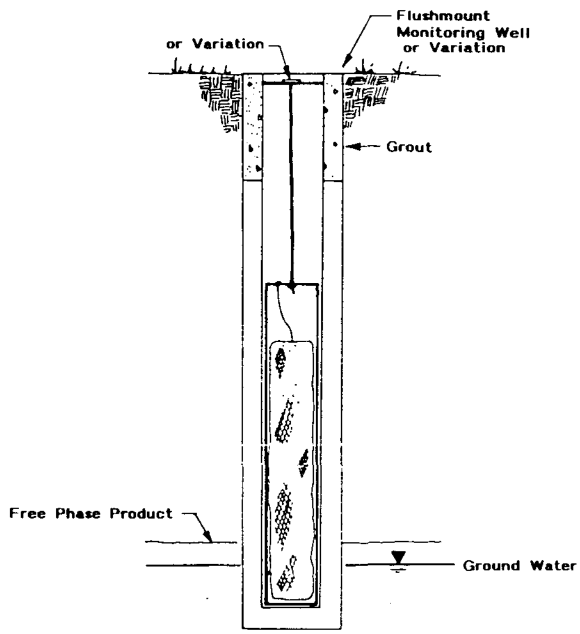
Peatwick™ Specifications

Absorbent Material - **Peatwick**™ systems utilize a dehydrated peatmoss. The dehydration process creates a porous structure with an affinity for hydrocarbon absorption while repelling water. This process also creates a natural capillary action which draws hydrocarbons into the "wick" and provides continuous recovery until the "wick" becomes saturated. The **Peatwick** absorbs approximately one gallon of hydrocarbons per pound of absorbent material.

Disposal Options - (1) The **Peatwick** absorbent material has passed the TCLP test with hydrocarbons and other liquids, so it is compatible with landfilling, when regulations permit. (2) Used peatwicks can also be incinerated. The absorbent material has an original heating value of about 9000 BTUs per pound (excluding hydrocarbons) and an ash residue of less than 5%. (3) Used peatwicks have also been incorporated as a medium in ex-situ bioremediation systems.



HANGER DETAIL



DETAIL OF 'PEATWICK'™ INSTALLATION

Peatwick	2" Wells Unit Price	4" Wells Unit Price
Canisters **Part No.**	$ 30.00 **001**	$ 60.00 **002**
Wicks **Part No.**	$ 15.00 **003**	$ 25.00 **004**
Absorbtion Capaciity **(maximum)**	**1 GAL.**	**3 GAL.**

For Information, contact:

ENVIRONMENTAL BASICS COMPANY
P.O. Box 453 Shillington, PA 19607
PHONE: 610-796-9102