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INTERIM CLOSEOUT REPORT/ FINAL CONSTRUCTION COMPLETION REPORT - GROUNDWATER REMEDY

Fulton Terminals Site
Fulton, New York

Volume I of II (Text, Tables, and Figures)

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Prepared for:

Fulton Terminals Site
Management Committee

Prepared by:

ROUX ASSOCIATES, INC.
25 Corporate Drive, Suite 230
Burlington, Massachusetts 01803

and

REMEDIAL ENGINEERING, P.C.
1377 Motor Parkway, Suite 403
Islandia, New York 11749

ROUX

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EXECUTIVE SUMMARY

This Interim Closeout Report/Final Construction Completion Report was prepared to document completion of the Groundwater Remedy at the Fulton Terminals Superfund Site (the Site) in Fulton, New York. The groundwater remediation work at the Site was performed by Clean Harbors Environmental Services, Inc. and Roux Associates, Inc., in accordance with the EPA-approved Expedited Groundwater Remediation Work Plan, Groundwater Treatment System and the EPA-approved Post-Soil Remedy Groundwater Investigation Work Plan. The remedial action was consistent with the September 1989 Record of Decision (ROD) and the EPA-approved Groundwater Remedy Final Design Submittal.

The Expedited Pumping Program was implemented between February and October 1997, and included the following work elements:

- Pumping of approximately 100 gallons per minute (gpm) from the previously-installed on-site horizontal groundwater extraction well network for a period of approximately 12 weeks;
- Treatment of approximately 8.8 million gallons of groundwater using air stripping and carbon polishing techniques;
- Reinjection or discharge (to surface water) of treated groundwater;
- Weekly sampling and monitoring of influent and effluent water; and
- Performance of a groundwater investigation to evaluate the effectiveness of the Expedited Pumping Program in achieving groundwater cleanup standards.

The groundwater investigation was implemented by Roux Associates between April and October 1997, and included the following tasks:

- monitoring well/piezometer installation;
- groundwater monitoring prior to termination of groundwater extraction; and
- groundwater monitoring following termination of groundwater extraction.

The investigation demonstrated that, by May 1997 (after about nine weeks of pumping), the ROD-identified groundwater cleanup standards had been achieved throughout the former plume core area, and VOC concentrations in downgradient areas had been significantly reduced.

Moreover, results of the initial post-pumping (i.e., June, August, and October 1997) sampling events demonstrated that VOC concentrations in the former plume core area had not rebounded following the cessation of pumping. The results of subsequent sampling events indicated that, by August 1999, only three monitoring wells - all located at the downgradient Site boundary - exhibited VOC concentrations exceeding the ROD-identified ARARs. Moreover, the concentrations of VOCs in these wells, which only marginally exceeded their respective ARARs, were generally an order of magnitude or more lower than the concentrations measured prior to implementation of the Expedited Pumping Program.

Subsequent to the August 1999 sampling event, Roux Associates performed modeling to determine an approximate time frame for natural attenuation of these residual VOCs to ARAR levels. The modeling results suggested that natural attenuation would effectively remediate the low levels of VOCs remaining in the small area of the sand and gravel groundwater unit at the downgradient boundary of the Site in a reasonable time frame. The reasonableness of the model-predicted time frame was based on Site-specific factors including the absence of human health and environmental risks associated with these residual VOCs, and the non-potable nature of the sand and gravel groundwater unit in the area of the Site. There are no risks because: 1) there are no exposure pathways for groundwater at the Site; and 2) there is no impact to the Oswego River associated with the discharge of groundwater from the Site.

Based on these findings, the USEPA authorized production of a Remedial Action Report for the Groundwater Remedy. Subsequently, the USEPA concluded in a Preliminary Site Closeout Report that the ROD requirements for the Groundwater Remedy had been substantially met, that remedial construction for the entire Site had been completed, and that no further response other than long-term groundwater monitoring was necessary. Accordingly, a Long-Term Groundwater Monitoring Program was developed to monitor groundwater quality for the three-year period prescribed in the ROD to verify continued effectiveness of the Groundwater Remedy.

1.0 INTRODUCTION

This Interim Closeout Report/Final Construction Completion Report was prepared to document completion of the Groundwater Remedy at the Fulton Terminals Superfund Site (the Site) in Fulton, New York. The report was prepared on behalf of the Fulton Terminals Site Remedial Action Trust and under the direction of the Fulton Terminal Site Management Committee (the Committee). The Committee represents the "Settling Defendants" as defined in the Remedial Design/Remedial Action (RD/RA) Consent Decree (Consent Decree) for the Site, which was approved by the U.S. District Court for the Northern District of New York on December 13, 1991. This report satisfies the requirements of Section VI, Item J(2)(d) of the Consent Decree.

The Interim Closeout Report/Final Construction Completion Report is based on the groundwater remedial action work completed at the Site by Clean Harbors Environmental Services, Inc. (Clean Harbors) and Roux Associates, Inc. (Roux Associates). The groundwater remediation work at the Site was performed in accordance with the EPA-approved Expedited Groundwater Remediation Work Plan, Groundwater Treatment System (Clean Harbors, 1997a) and the EPA-approved Post-Soil Remedy Groundwater Investigation Work Plan (Roux Associates, 1997). (Copies of these documents are provided in Attachments 1 and 2, respectively.) Together, these two documents constitute the scope of work for the Expedited Pumping Program performed to execute the Groundwater Remedy at the Site. The remedial action was consistent with the September 1989 Record of Decision (ROD) and the EPA-approved Groundwater Remedy Final Design Submittal (Blasland, Bouck & Lee, Inc. [BB&L], 1994).

2.0 SUMMARY OF SITE CONDITIONS

2.1 Site Description

The Site is located in an industrial section of the City of Fulton in Oswego County, New York (Figure 1). Residences, city and county offices, and several businesses are located within a 1,500-foot radius of the Site. The Site consists of an approximately 2-acre former storage facility that was used for the storage of raw materials used in the manufacture of asphalt roofing from the 1920s through the 1960s. The storage facility, which formerly contained several aboveground and underground storage tanks, was also used in the 1970s and early 1980s for the storage of solvents and other materials that were originally scheduled for incineration at the Pollution Abatement Services facility in Oswego, New York. The Site was listed on the National Priorities List (NPL) in 1982.

2.2 Initial and Supplemental Remedial Investigation/Feasibility Studies

The initial Remedial Investigation/Feasibility Study (RI/FS) activities were conducted by New York State Department of Environmental Conservation (NYSDEC) contractors between 1985 and 1987. The results of the initial RI/FS activities were declared invalid by NYSDEC due to problems associated with the laboratory analyses. A revised RI/FS was prepared by a NYSDEC contractor based on additional sampling performed in 1988. The EPA concluded that the revised RI/FS did not fully characterize the Site, so an EPA contractor conducted a Supplemental RI/FS. The Supplemental RI/FS was completed in 1989 and indicated that various volatile organic compounds (VOCs) were detected in unsaturated fill soil samples and in groundwater samples from the Site. In 1989, an EPA contractor completed an Endangerment Assessment for the Site and concluded that minimal risks were associated with site conditions at that time based on the Supplemental RI data. However, the Site VOC groundwater concentrations exceeded New York State standards for Class GA groundwater and the Supplemental RI/FS identified that the on-site soils were a potential future source of VOCs leaching into groundwater.

2.3 Record of Decision

The EPA issued the ROD in September 1989 following completion of the Supplemental RI/FS. The ROD specified a remedial action consisting of both soil and groundwater remedies to address VOCs detected in the respective media. The Soil Remedy required excavation and low

temperature thermal desorption (LTTD) of unsaturated soil located above the water table (also referred to as "fill soil") within two localized areas of the Site, in the vicinity of the former location of a 1,000,000-gallon tank used for storage of solvents. (These areas were later identified as Areas 1 and 2.) The goal of the Soil Remedy was to reduce concentrations of VOCs in the fill soils to levels which would not cause an exceedance of applicable or relevant and appropriate requirements (ARARs) for groundwater via percolation of precipitation through the unsaturated soils. The soil cleanup levels in the ROD were based on New York State groundwater standards and site-specific criteria.

The Groundwater Remedy specified in the ROD required the reduction of VOC concentrations in the groundwater to ARAR levels. This was to be accomplished by pumping from the saturated sand and gravel groundwater unit underlying the Site (hereinafter, "sand and gravel groundwater unit"), treating the groundwater by air stripping and carbon adsorption, and reinjecting the water into the saturated sand and gravel groundwater unit.

2.4 Consent Decree

The United States subsequently entered into a Consent Decree with the Settling Defendants, that was approved by the U.S. District Court on December 13, 1991. The Consent Decree required the implementation of the remedial action described in the ROD, and specified that a number of work plans, design documents, and other deliverables be prepared by the Settling Defendants prior to Site remediation.

2.5 Pre-Remedial Site Investigations

Pre-remedial Site investigations conducted during the period December 1992 to January 1993 resulted in the identification of VOC-impacted soil in a layer of saturated silt and clay below the impacted fill soils in one of the areas noted earlier (Area 1). The VOCs detected in the silt and clay layer, which were not identified during previous RI/FS activities, represented a potential continuing source of VOCs to the sand and gravel groundwater unit. During this period, a pre-remedial groundwater investigation was also conducted, including the installation of additional monitoring wells, monitoring well sampling, and an aquifer pump test. Pump testing of the sand and gravel groundwater unit indicated that the permeability of the sand and gravel unit was

significantly higher than anticipated in the Supplemental RI/FS. The groundwater sampling confirmed that VOC-impacted groundwater in the sand and gravel groundwater unit correlated with the same general area of VOC soil impacts in the silt and clay layer.

Additional field activities were conducted in July 1993 to complete the delineation of VOC impacts in the Area 1 silt and clay soils, as well as to further characterize groundwater impacts in the sand and gravel unit. Subsequent groundwater investigations were conducted during the period August 1994 to May 1995. These investigations confirmed that the upper portion of the sand and gravel groundwater unit was being impacted by VOCs contained in the silt and clay layer.

2.6 Focused Feasibility Study

Remedial alternatives to address the area of impacted soils contained in the silt and clay layer were evaluated in a focused feasibility study (FFS). The FFS results provided the basis for the EPA to conclude that the Soil Remedy should be expanded beyond the area of fill soils identified for remediation in the ROD to include the impacted silt and clay soils located beneath the fill soils in Area 1. The FFS also determined that specialized methods for stabilizing the deeper excavation would be required for removal of the impacted silt and clay soils because of the excavation depth, the need for control of groundwater infiltration into the excavation area, and the close proximity to the Oswego River. Ultimately the use of a temporary ground-freezing system was selected to control groundwater infiltration during excavation.

2.7 EPA Explanation of Significant Differences

Based on the results of the pre-remedial investigations at the Site and the FFS described above, the EPA modified the Soil Remedy in an Explanation of Significant Differences (ESD) dated June 1994. This ESD required the excavation and treatment by LTTD technology of soils impacted by VOCs, including the impacted silt and clay soils located beneath the fill soils in Area 1.

2.8 Soil Remedy Completion Summary

The Soil Remedy was implemented between April 1995 and August 1996, and included the excavation, removal and treatment of 10,200 cubic yards of unsaturated and saturated soils. A temporary ground-freezing system, or "freezewall," was used to control groundwater infiltration during excavation. The implemented Soil Remedy exceeded the original ROD design criteria by excavating saturated zone soils as incorporated through the ESD. Moreover, treated soils analyses indicate that VOC concentrations in backfilled soils were significantly below the cleanup levels specified in the ROD. As a result, approximately 99 percent of the VOC mass contributing to groundwater impacts at the Site were successfully removed. In addition, a temporary groundwater treatment system was used to treat over 100,000 gallons of impacted groundwater during dewatering of the excavation. Following the removal of all contaminated soils, a horizontal extraction well system consisting of a gallery of perforated piping and a collection manhole was installed at the base of the Area 1 excavation to facilitate performance of the Groundwater Remedy.

A detailed overview of the Soil Remedy was provided by BBL Environmental Services, Inc., (BBLES) in their October 1996 Project Closeout Report, Fulton Terminals Site, Soil Remedy (BBLES, 1996).

3.0 REMEDIAL ACTIVITIES FOR GROUNDWATER

As stated earlier, the Groundwater Remedy specified in the September 1989 ROD required the reduction of VOC concentrations in the sand and gravel groundwater unit beneath the Site to levels established by ARARs. This was to be accomplished by pumping from the sand and gravel groundwater unit, treating the groundwater by air stripping and carbon adsorption, and reinjecting the water into the saturated sand and gravel groundwater unit. The ARARs for groundwater cleanup identified in the ROD include EPA Maximum Contaminant Levels (MCLs) and New York State groundwater quality standards promulgated or proposed at the time the ROD was issued. The action level established (in accordance with ARARs) for all VOCs found at the Site is 5 µg/L, with the exception of vinyl chloride, which has an action level of 2 µg/L.

The ROD initially estimated that the groundwater pumping/treatment would have required operation for approximately four years. However, given the overall effectiveness of the Soil Remedy (i.e., the Soil Remedy achieved greater source removal than originally anticipated) and the favorable hydrogeologic and geochemical conditions in the sand and gravel groundwater unit identified during the pre-design investigations previously mentioned, the Committee believed that the groundwater cleanup standards could be achieved within a much shorter time frame than that identified in the ROD. Accordingly, the Committee proposed to implement an Expedited Pumping Program which would include the use of mobile treatment components which were consistent with the ROD and the Groundwater Remedy Final Design Submittal (BB&L, 1994), and which would greatly reduce the timeframe needed to actually begin pumping groundwater. The proposed Expedited Pumping Program was discussed with the EPA during an October 22, 1996 meeting in New York City, and the EPA (with NYSDEC concurrence) subsequently gave approval for performance of the Expedited Pumping Program.

The Expedited Pumping Program was implemented between February and October 1997, and included the following work elements:

- Pumping of approximately 100 gallons per minute (gpm) from the previously-installed on-site horizontal groundwater extraction well network for a period of approximately 12 weeks;
- Treatment of approximately 8.8 million gallons of groundwater using air stripping and carbon polishing techniques;

- Reinjection or discharge (to surface water) of treated groundwater;
- Weekly sampling and monitoring of influent and effluent water; and
- Performance of a groundwater investigation to evaluate the effectiveness of the Expedited Pumping Program in achieving groundwater cleanup standards in the sand and gravel groundwater unit.

The operation of the groundwater extraction/treatment system (including groundwater reinjection/surface water discharge) and the weekly influent/effluent monitoring were performed by Clean Harbors. These elements were performed in accordance with the EPA-approved Expedited Groundwater Remediation Work Plan, Groundwater Treatment System (Clean Harbors, 1997a). Roux Associates conducted the groundwater investigation element of the Expedited Pumping Program. The groundwater investigation was performed in accordance with the EPA-approved Post-Soil Remedy Groundwater Investigation Work Plan (Roux Associates, 1997).

3.1 Groundwater Extraction and Treatment

A mobile groundwater treatment system was mobilized to the Site in February 1997, activated on February 11, 1997, and operated intermittently during an initial 3-week test period to ensure that the system could meet the performance standards. The system was activated on a continuous basis on March 7, 1997. Influent/effluent sampling was performed weekly from March 13 through May 26, 1997, and monthly progress reports (Clean Harbors, 1997b; 1997c; 1997d) (Attachment 3) detailing the quality and quantity of extracted groundwater were submitted to the EPA and NYSDEC by Clean Harbors. The system was shut down on May 30, 1997, once influent data indicated that the objectives of the Expedited Pumping Program had been achieved and it was determined that pumping would no longer provide an efficient means of VOC mass removal. All treatment equipment was drained, decontaminated, secured and demobilized from the Site during the period of May 30 through June 4, 1997.

3.2 Groundwater Investigation

The Expedited Pumping Program groundwater investigation was implemented by Roux Associates between April and October 1997, and included the following tasks:

- monitoring well/piezometer installation;

- groundwater monitoring prior to termination of groundwater extraction; and
- groundwater monitoring following termination of groundwater extraction.

Monitoring Well/Piezometer Installation

Seven new monitoring wells were installed to monitor water levels and groundwater quality in the sand and gravel groundwater unit beneath the Site. Each new monitoring well installed during the groundwater investigation was constructed of stainless steel casing and screen, and was set to screen the entire thickness of the sand and gravel groundwater unit. Two piezometer clusters were also installed at the Site: one adjacent to monitoring well RX-3 and one at a location approximately halfway between monitoring well RX-3 and the Oswego River. Each piezometer cluster consists of three 1-inch diameter piezometers screening two feet of the uppermost, middle and lowermost portions of the sand and gravel groundwater unit. Monitoring well and piezometer logs are presented in Attachment 4. A stream gauge was installed in the Oswego River immediately adjacent to the Site so that water level fluctuations in the river could be appropriately considered in the evaluation of observed groundwater level changes in the sand and gravel groundwater unit beneath the Site. Figure 2 shows the location of all current monitoring wells at the Site.

Groundwater Monitoring Prior to Termination of Groundwater Extraction

Following installation and development of the seven new wells and two piezometer clusters, but prior to termination of pumping, a groundwater sampling event was conducted to evaluate groundwater quality in the sand and gravel groundwater unit. Groundwater samples were collected on May 7, 1997 from each new well, existing downgradient well FBW-3, and existing upgradient wells FBW-1S, EBMW-6S, and EBMW-6D.

Immediately following the May 7 sampling event, pressure transducers were installed in selected wells and at the stream gauge to monitor water levels in the sand and gravel groundwater unit prior to and following a temporary shutdown of the pumping system. On May 23, 1997, after pumping resumed and equilibrium pumping conditions were re-established, water levels were again measured at the new wells and piezometers, at the stream gauge, and at all existing Site

wells screened in the sand and gravel groundwater unit that were determined to be useable, in order to verify the horizontal and vertical groundwater flow directions under pumping conditions.

Groundwater Monitoring Following Termination of Groundwater Extraction

On June 20, 1997, three weeks after Expedited Pumping Program groundwater extraction was terminated (sufficient time for the groundwater levels to stabilize), a second groundwater sampling/water level gauging event was conducted to evaluate post-pumping groundwater quality and flow directions. Roux Associates subsequently conducted two additional groundwater sampling rounds, one in August 1997 and one in October 1997. These sampling events were also used to confirm that VOC concentrations in the former VOC plume core area (i.e., in the vicinity of well RX-3) had not rebounded and to continue to assess post-pumping conditions in the sand and gravel groundwater unit.

The results of the groundwater investigation were presented by Roux Associates in a draft report, and were discussed with EPA and NYSDEC during a November 12, 1997 meeting at EPA headquarters in New York City. However, this report was not finalized, since remnants of the freezewall installed during the Soil Remedy were still present within the sand and gravel groundwater unit in the downgradient portion of the Site, and the residual subsurface ice from the former freezewall precluded an accurate evaluation of the groundwater remedy performance at that time. The groundwater quality data (including data validation) developed during the groundwater investigation are provided in Attachment 5.

3.3 Additional Groundwater Investigation Activities

A geophysical investigation was performed by Hyd-Eng Geophysics, Inc. in February 1998 in an effort to delineate the extent of residual subsurface ice in the downgradient area of the Site. Although the results of the survey were inconclusive, physical observations made during performance of the geophysical survey indicated that significant thawing had occurred in some of the downgradient wells. Hyd-Eng Geophysics' report (Hyd-Eng Geophysics, 1998) is provided in Attachment 6.

Following the geophysical investigation, Roux Associates performed an interim scope of work that included:

- temporary thawing of the downgradient monitoring wells using high pressure steam;
- monthly groundwater temperature monitoring for four months; and
- two groundwater sampling events (May and August 1998).

The results of these interim monitoring activities were presented in an October 29, 1998 letter report (Roux Associates, 1998) a copy of which is provided in Attachment 7.

Following this interim scope of work, at EPA's request, temperature and water quality monitoring were continued for four more quarters (through August 1999). Quarterly reports dated January 1999 (Roux Associates, 1999a) and April 1999 (Roux Associates, 1999b) are provided in Attachment 8. The results of the last two quarterly events are presented in Roux Associates' September 1999 report titled Modeling the Natural Attenuation of Residual VOCs at the Fulton Terminals Site (Roux Associates, 1999c), a copy of which is provided in Attachment 9. Modeling activities are discussed further in Section 4.3.

4.0 PERFORMANCE STANDARDS AND CONSTRUCTION QUALITY ASSURANCE

Appendix C of the Groundwater Remedy Final Design Submittal (BB&L, 1994) identified the construction quality assurance (QA) provisions envisioned for the groundwater pumping and treatment system proposed for implementation at the Site. When the Expedited Pumping Program was approved, the Expedited Groundwater Remediation Work Plan, Groundwater Treatment System (Clean Harbors, 1997a) became the working QA document for the Groundwater Remedy. Due to the accelerated time frame of the Expedited Pumping Program, construction QA focused upon the extraction system installation, the treatment system mobilization and operation, and the post treatment monitoring. The following discussion details the construction QA associated with these elements.

4.1 Extraction/Injection System Installation

The extraction system was proposed (BB&L, 1994) as three horizontal extraction wells (8-inch perforated drain pipe, installed in trenches backfilled with crushed stone, protected by geotextile) approximately 120 to 130 feet in length, with valving for each line to allow independent operation. The system was proposed to be manifolded to a common pumping manhole, equipped with two submersible 100 gpm pumps operating in a lead/lag mode. As discussed earlier, the horizontal well groundwater extraction system was installed during the 1996 Soil Remedy construction. Available documentation concerning the actual construction of the extraction system is found in the Project Closeout Report, Fulton Terminals Site, Soil Remedy (BBLES, 1996), and includes a table and an unstamped record drawing showing plan and profile views of the final horizontal well placement (Attachment D, Item 3) and a stamped record drawing titled "Horizontal Collection System As Builts" (Attachment J). (Copies of these drawings are provided in Attachment 10 of this report.) The Project Close-Out Report, Fulton Terminals Site, Soil Remedy (BBLES, 1996) notes that, because the Soil Remedy excavation was deeper than planned, the horizontal wells were installed at a depth greater than planned. This field change did not impact the purpose or operation of the system during the Expedited Pumping Program. Specifically, monitoring performed prior to the cessation of pumping indicated that pumping of the horizontal extraction well system influenced water levels throughout the entire thickness of the sand and gravel groundwater unit, and propagated a capture zone that encompassed entire the lateral extent of the VOC plume.

The vertical reinjection wells proposed in the Ground-Water Remedy Final Design Submittal (BB&L, 1994) included two 8-inch stainless steel wells with filter packs and screened intervals of approximately 40 feet (i.e., the full thickness of the sand and gravel groundwater unit underlying the site). Existing well PW-1 (see figure 2) was also identified as a back-up for the two reinjection wells. Documentation regarding the construction of PW-1, included in Appendix B of the Ground-Water Remedy Final Design Submittal (BB&L, 1994), indicates that PW-1 is an 8-inch diameter well, screening most of the sand and gravel groundwater unit. The BB&L design was modified in the Expedited Groundwater Remediation Work Plan, Groundwater Treatment System (Clean Harbors, 1997a) to include recharge through existing well PW-1 only, with excess treated groundwater discharged to a stormwater catch basin which drains into the Oswego River (see Figure 2). A stamped record drawing included in Attachment J of the Project Close-Out Report for the Soil Remedy (BBLES, 1996), a copy of which is provided in Attachment 11 of this report, shows the construction of the stormwater catch basin.

Clean Harbors requested and received permission to discharge treatment system effluent to the Oswego River subject to limitations and monitoring requirements imposed by the NYSDEC under cover of a January 7, 1997 letter to Clean Harbors. A copy of this letter was included in Appendix A of Clean Harbors' Expedited Groundwater Remediation Work Plan, Groundwater Treatment System (Clean Harbors, 1997a).

4.2 Treatment System Mobilization, Construction and Operation

The treatment train specified in the EPA-approved Groundwater Remedy Final Design Submittal (BB&L, 1994) called for metals removal (employing caustic and polymer addition followed by sedimentation/sludge removal), followed by pH adjustment, low profile air stripping and granular activated carbon polishing to remove volatile organics. A process flow diagram for this treatment train is provided in Attachment 12. The treatment train proposed in the EPA-approved Expedited Groundwater Remediation Work Plan, Groundwater Treatment System (Clean Harbors, 1997a) was slightly different, however, in that it called for the addition of hydrogen peroxide (rather than caustic and polymer) to enhance sedimentation/solids removal, and did not require any pH adjustment. Clean Harbors' proposed treatment train also included filtration

prior to and following air stripping. A Piping and Instrumentation Diagram (P&ID) for Clean Harbors' proposed treatment train is shown in Figure 3 of the Expedited Groundwater Remediation Work Plan, Groundwater Treatment System (Attachment 1).

A mobile treatment system containing the components identified in the Expedited Groundwater Remediation Work Plan, Groundwater Treatment System was mobilized to the Site by Clean Harbors in February 1997. System start-up tests were performed between February 11 and March 3, 1997 to verify that the system effluent met the performance standards for groundwater re-injection (1989 ROD) and surface water discharge (SPDES permit). Based upon initial testing runs conducted February 11 and 14, 1997 (where discharge was to two on-site storage tanks), the system was not meeting the groundwater reinjection standards for magnesium and manganese. Clean Harbors modified the design based upon bench testing results to mimic the treatment train specified in the Groundwater Remedy Final Design Submittal (i.e. caustic/polymer addition replaced the hydrogen peroxide oxidation, and acid metering was added for pH adjustment). These modifications were discussed in a February 20, 1997 letter from Clean Harbors to *de maximis, inc.*, Project Coordinator for the Committee (Clean Harbors, 1997e), a copy of which is provided in Attachment 13.

Following the implementation of system modifications noted above, the contents of the two system storage tanks (approximately 34,000 gallons) were discharged to the stormwater catch basin on March 3, 1997. (Note: Although the groundwater reinjection standards were not achieved for this water, all surface-water discharge standards were met.) During the period from March 3 to March 5, 1997, the treatment system configuration was modified slightly further, with one storage tank being employed as a primary settling tank, and the clarifier used for secondary settling. The chemical metering pumps initially supplied were also replaced in order to increase the chemical feed rates and thereby maintain the desired pH levels. The second storage tank was demobilized from the site on March 5, 1997. These final modifications were discussed in Clean Harbors' March 1997 progress report (Attachment 3). A copy of the final P&ID for the Expedited Pumping Program groundwater treatment system is provided in Attachment 14.

Upon completion of the above-noted modification activities, and verification that the groundwater reinjection standards were met, the system was reactivated on March 7, 1997. The treatment system remained active from that point forward, with occasional brief shutdowns to perform maintenance activities and to permit certain groundwater monitoring activities. The treatment system was operated and maintained in accordance with the Expedited Groundwater Remediation Work Plan, Groundwater Treatment System (Clean Harbors, 1997a). Weekly effluent and continuous flow monitoring was performed by Clean Harbors in accordance with the SPDES permit requirements outlined in a January 7, 1997 letter from NYSDEC. Clean Harbors also provided monthly reporting to EPA and NYSDEC regarding operation, maintenance and effluent sampling results for the system (Clean Harbors, 1997b; 1997c; 1997d). Copies of those monitoring reports are provided in Attachment 3.

The following chronicles key treatment system operation milestones that occurred during the three months of continuous operation based upon reporting provided in the Clean Harbor Monthly monitoring reports:

- March 7, 1997 – continuous operation of the treatment system resumed with discharge to the storm water catch basin.
- March 10, 1997 – the pH for metals precipitation was adjusted to 10.0 with permission from EPA. No negative impact on metals removal performance was observed.
- March 12, 1997 – the flow indicator/totalizer was replaced.
- March 27, 1997 – discharge to injection well PW-1 commenced.
- March 27 through March 29, 1997 – the totalizer was determined to be inaccurate.
- April 24, 1997 – discharge to PW-1 was discontinued.
- May 9, 1997 – system was shut down during well installation/sampling activities.
- May 19,1997 – system operation was resumed with discharge to the storm water catch basin.
- May 30, 1997 – treatment system was shut down.

As noted above, operation was terminated on May 30, 1997 once VOC concentrations in the sand and gravel groundwater unit had been substantially reduced and pumping was no longer providing an effective means of contaminant mass removal.

According to Clean Harbors' monthly reports (Attachment 3), a total of approximately 8,780,648 gallons of groundwater was treated by the system during the period of March 3 through May 30, 1997. Of this amount, 1,212,700 gallons was reinjected into the sand and gravel groundwater unit via well PW-1, with the remaining 7,567,948 gallons discharged to the catch basin.

All equipment was drained, decontaminated, secured and demobilized from the Site during the period of May 30 through June 4, 1997. Decontamination liquids, treatment sludges, and spent carbon generated by Clean Harbors were appropriately labeled, manifested and disposed in accordance with applicable state federal and local laws and regulations. Copies of waste disposal manifests are included in Attachment 15.

4.3 Groundwater Investigation

All well installations, groundwater sampling/monitoring and analytical work were performed in accordance with the Post-Soil Remedy Groundwater Investigation Work Plan (Roux Associates, 1997) and subsequent plans approved by EPA. Well construction logs are provided in Attachment 4, while field sampling forms for all groundwater sampling events are provided in Attachment 16. Groundwater quality data for the first four (1997) sampling events are provided in Attachment 5, while the data for the subsequent four events are included with the letter reports contained in Attachments 7 and 8. Data for the last two sampling events are provided in Attachment 17. Data validation was performed by Trillium, Inc., in accordance with the EPA Region II guidelines, during the first four (1997) sampling events. (Validation reports are included with the lab data in Attachment 5.) Purge water and drill cuttings generated during the field investigation were appropriately labeled, manifested and disposed of by Clean Harbors and Safety Kleen in accordance with applicable federal, state and local laws and regulations. Manifests and bills of lading for these materials are provided in Attachment 18.

Table 1 presents a summary of analytical data collected at the six source-area and downgradient monitoring wells sampled between May 1997 and August 1999. As shown in Table 1, by May 1997 (after about nine weeks of pumping), the ROD-identified groundwater cleanup standards had been achieved throughout the former plume core area (as monitored by well RX-3), and VOC concentrations in downgradient areas (as monitored by well FBW-3) had been significantly reduced. Moreover, the results of the initial post-pumping (i.e., June, August, and October 1997) sampling events demonstrated that VOC concentrations in the former plume core area had not rebounded following the cessation of pumping. The results of subsequent (i.e., 1998 and 1999) sampling events indicated that, as equilibrium conditions returned to the sand and gravel groundwater unit, VOC concentrations in those wells more distant from the residual ice decreased to near or below ARAR levels. During the last of these sampling events (August 1999), only three monitoring wells (RX-5, RX-7, and FBW-3), all located at the downgradient Site boundary (Figure 2), exhibited VOC concentrations exceeding the ROD-identified ARARs. Moreover, the concentrations of VOCs in these wells, which only marginally exceeded their respective ARARs, were generally an order of magnitude or more lower than the concentrations measured prior to the Expedited Pumping Program.

Subsequent to the August 1999 sampling event, Roux Associates performed modeling (Attachment 9) to determine an approximate time frame for natural attenuation of the residual VOCs to ARAR levels. Roux Associates selected BIOSCREEN, a USEPA-approved model designed to simulate the processes of advection, dispersion, dilution, adsorption, and decay of organic compounds in groundwater, as the most appropriate model for estimating a time frame for natural attenuation of the residual VOCs in the sand and gravel groundwater unit. The BIOSCREEN model predicted that the low concentrations of VOCs in the sand and gravel groundwater unit near the downgradient boundary of the Site would naturally attenuate to ARAR levels in approximately 7 to 14 more years.

The modeling results suggested that natural attenuation would effectively remediate the low levels of VOCs remaining in the small area of the sand and gravel groundwater unit at the downgradient boundary of the Site in a reasonable time frame. The reasonableness of the model-predicted time frame was based on Site-specific factors including the absence of human health

and environmental risks associated with these residual VOCs, and the non-potable nature of the sand and gravel groundwater unit in the area of the Site. There are no risks because: 1) there are no exposure pathways for groundwater at the Site; and 2) there is no impact to the Oswego River associated with the discharge of groundwater from the Site.

Based on these findings, and in accordance with the Consent Decree, the USEPA authorized *de maximis* to prepare a Remedial Action Report for the Groundwater Remedy. *de maximis* submitted this report (*de maximis*, 1999), a copy of which is provided in Attachment 19, on September 24, 1999. Subsequently, in a September 1999 Preliminary Site Closeout Report (USEPA, 1999), the USEPA concluded that the ROD requirements for the Groundwater Remedy had been substantially met, that remedial construction for the entire Site had been completed, and that no further action other than long-term groundwater monitoring was necessary. Accordingly, a Long-Term Groundwater Monitoring Program (LTMP) was developed to monitor groundwater quality for the three-year period prescribed in the ROD to verify continued effectiveness of the Groundwater Remedy. Long-term groundwater monitoring is discussed in the following section.

5.0 LONG-TERM MONITORING

A plan for sampling and analysis to assess the effectiveness of the Groundwater Remedy was proposed in Roux Associates' February 16, 2000 Long-Term Groundwater Monitoring Plan (Roux Associates, 2000) (Attachment 20). The Long-Term Groundwater Monitoring Program, which includes three years of post-remedy groundwater monitoring to verify successful performance of the Groundwater Remedy, was approved by the EPA. The integrity of the groundwater monitoring wells and other site controls and the general condition of the property will be assessed during each LTMP monitoring event.

6.0 FINAL INSPECTION DOCUMENTATION

The activities associated with the Groundwater Remedy did not require earth moving or regrading of the Site. Therefore, Site conditions are similar to those observed during the 1996 final inspection of the Soil Remedy. The Expedited Pumping Program involved temporary pumping/treatment and discharge of treated groundwater. Routine inspections were performed by *de maximis* as part of the oversight activities during the three-month pumping program and following the completion of field activities by Clean Harbors. Site inspections have also been performed by Roux Associates during performance of groundwater monitoring events. The most recent Site inspection was performed on September 6, 2000, during the third LTMP monitoring event. Based upon these inspections, no conditions are evident that would lead to significant human health or environmental exposures. In addition, no conditions are evident that would compromise the natural attenuation of the residual contaminant levels at the Site. One minor corrective action was taken during the first LTMP monitoring event (March 2000) to ensure the integrity of LTMP data. Specifically, the uppermost 5 feet in well RX-4 was replaced after a crimp developed in the well casing. After well repairs were completed, the measuring point was re-established and documented.

Additional inspections will be performed over the next three years as part of the LTMP discussed in Section 5.0. Once the goals of the Groundwater Remedy have been achieved, all Site monitoring wells will be abandoned in accordance with applicable guidelines.

7.0 ENGINEER'S CERTIFICATION

Roux Associates and its associated engineering design firm, Remedial Engineering, P.C., have completed this report describing completion of the Groundwater Remedy at the Fulton Terminals Superfund Site in Fulton, New York. This engineering certification is being submitted to the EPA in accordance with Section VI, Item J (2)(d) of the Consent Decree entered into by the EPA and the "Settling Defendants" on December 31, 1991.

Remedial Engineering, P.C., hereby certifies that the Groundwater Remedy was implemented and construction activities were completed in accordance with the EPA-approved Expedited Groundwater Remediation Work Plan, Groundwater Treatment System, (Clean Harbors, 1997a) which was, in turn, consistent with the September 1989 Record of Decision for the Site and the EPA-approved Groundwater Remedy Final Design Submittal (BB&L, 1994).

Respectfully submitted,

REMEDIAL ENGINEERING, P.C.

Peter J. Gerbasi, P.E.
Principal Engineer

ROUX ASSOCIATES, INC.

Thomas J. Nunno, P.E., LSP
Principal Engineer

STATE OF NEW YORK
THOMAS J. NUNNO
No. 068551
LICENSED PROFESSIONAL ENGINEER

Lawrence McTiernan
Principal Hydrogeologist/
Project Manager

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Roux Associates, Inc., 2000. Long-Term Groundwater Monitoring Plan. Fulton Terminals Site.

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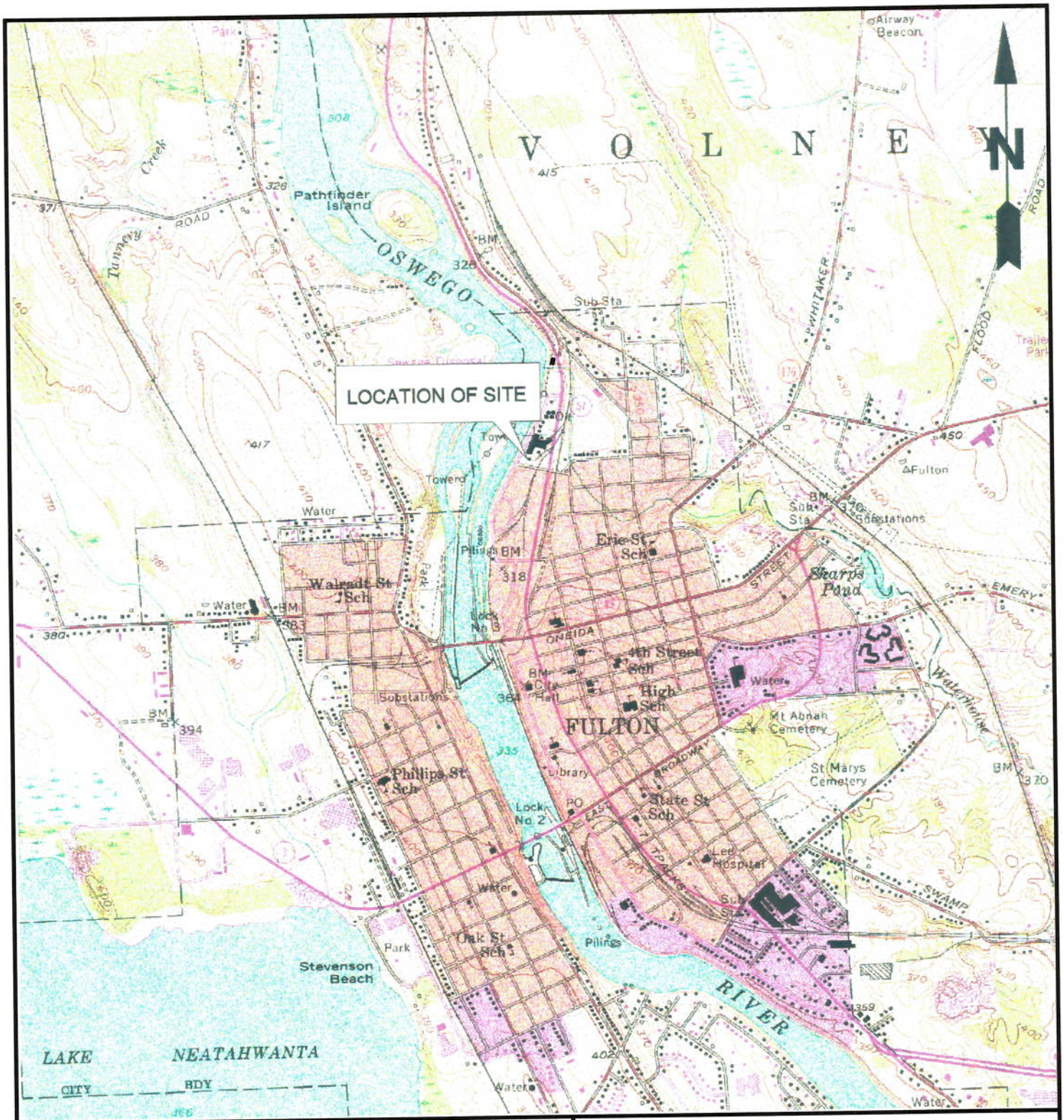
Table 1. Summary of Groundwater Quality Data for Source-Area and Downgradient Monitoring Wells, 1995 - 1999
Fulton Terminals Site, Fulton, New York

WELL	ANALYTE	ARARs	SAMPLING DATES										
			5/1/95	5/7/97	6/20/97	8/15/97	10/17/97	5/27/98	8/28/98	12/9/98	3/2/99	6/15/99	8/27/99
RX-3	cis-1,2-Dichloroethylene	5	20,000*	5	ND	ND	1 J	2	ND	ND	ND	ND	ND
	Tricholorethylene	5	2,300*	ND	ND	ND	1 J	7	ND	ND	ND	ND	ND
	Vinyl Chloride	2	1,000*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
RX-4	cis-1,2-Dichloroethylene	5	NS	10 J	NS	NS	NS	53	160	34	11	8	2
	Tricholorethylene	5	NS	ND	NS	NS	NS	14	22	14	8	4	3
	Vinyl Chloride	2	NS	ND	NS	NS	NS	5	11	2	ND	ND	ND
RX-5	cis-1,2-Dichloroethylene	5	NS	1900	45	340	300 J	120	410	450	410	250	45
	Tricholorethylene	5	NS	ND	ND	ND	31 J	ND	30	29	24	13	3
	Vinyl Chloride	2	NS	ND	ND	ND	ND	ND	10	20	20	ND	ND
RX-6	cis-1,2-Dichloroethylene	5	NS	1400	1400	1600	620 J	63	4	100	42	13	ND
	Tricholorethylene	5	NS	380	ND	290	430	16	15	ND	7	7	ND
	Vinyl Chloride	2	NS	630	1100	640	ND	9	ND	ND	3	ND	ND
RX-7	cis-1,2-Dichloroethylene	5	NS	ND	40	14	2 J	6	ND	ND	ND	ND	ND
	Tricholorethylene	5	NS	5 J	16	15	8 J	8	4	ND	4	3	8
	Vinyl Chloride	2	NS	ND	ND	1 J	ND	ND	ND	ND	ND	ND	ND
FBW-3	cis-1,2-Dichloroethylene	5	280	8 J	40	54	45 J	NS	110	41	25	24	13
	Tricholorethylene	5	ND	3 J	ND	12 J	19 J	NS	2	ND	ND	ND	ND
	Vinyl Chloride	2	410	11 J	12	8 J	10 J	NS	16	33	16	27	27

NOTES: All concentrations are in micrograms per liter (parts per billion).
Where replicate samples were collected, the higher of the two concentrations reported for each sample is shown.
* - Data shown are for well EBMW-3S, which was formerly located in the current location of well RX-3.
NS - Not sampled
ND - Not detected
J - Indicates estimated concentration detected below the quantitation limit



■ QUADRANGLE LOCATION

SOURCE:
USGS FULTON, NEW YORK QUADRANGLE
7.5 MINUTE SERIES (TOPOGRAPHIC)

Title:

SITE LOCATION MAP

FULTON TERMINAL SITE
FULTON, N.Y.

Prepared for:

de maximis, inc.

ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: L.M.		Date: 22DEC2000	FIGURE
Prepared by: R.F.		Scale: 1"=2000'	1
Project Mgr.: L.M.		Office: MA	
File No.: DM0218102.CDR		Project No.: 32702M	

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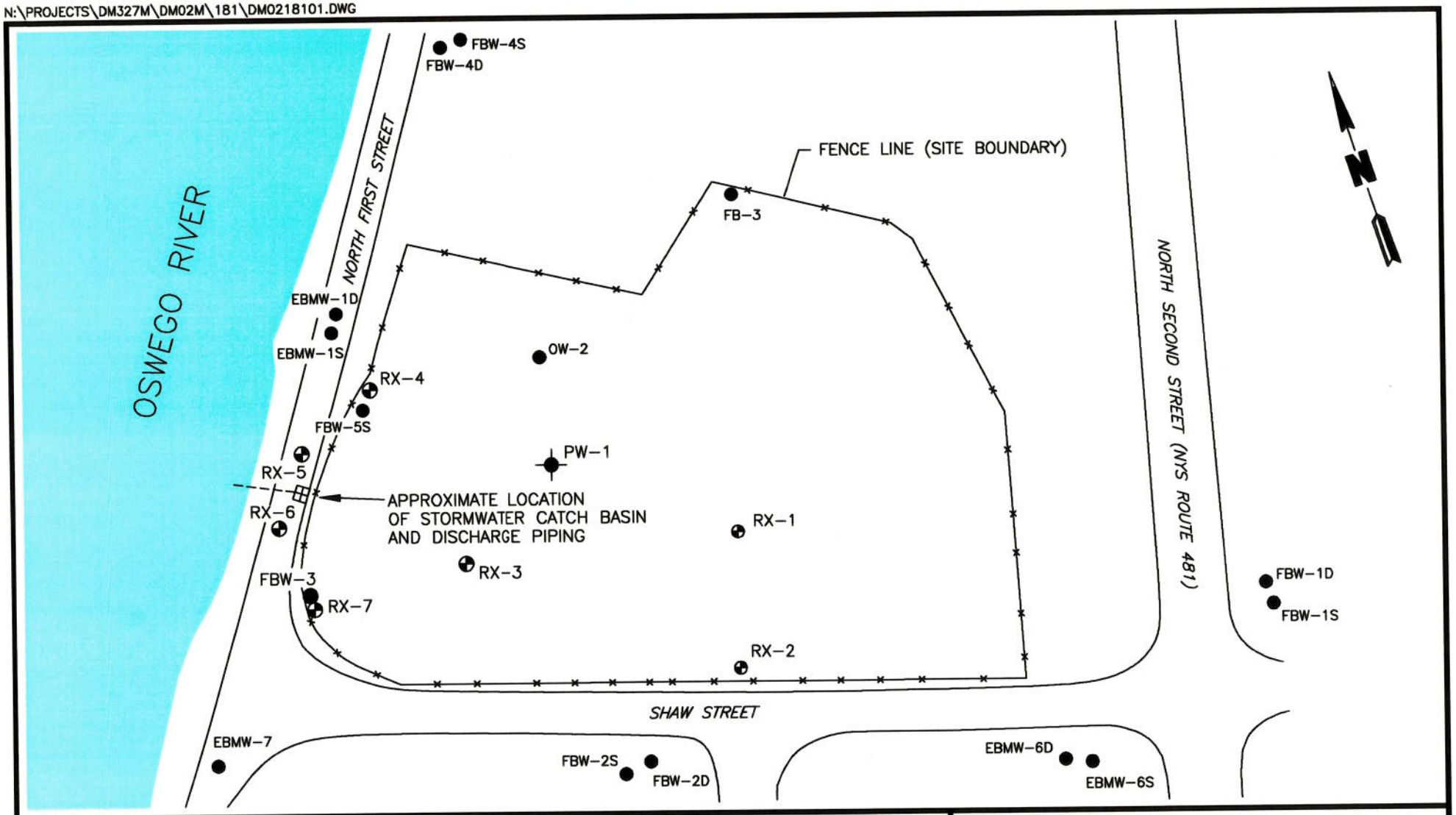
N:\PROJECTS\DM327M\DM02M\181\DM0218101.DWG



LEGEND

RX-3 ⊕ APPROXIMATE LOCATION AND DESIGNATION OF MONITORING WELL INSTALLED DURING EXPEDITED PUMPING PROGRAM

EBMW-7 ● APPROXIMATE LOCATION AND DESIGNATION OF MONITORING WELL INSTALLED DURING PREVIOUS INVESTIGATION

PW-1 ✛ APPROXIMATE LOCATION AND DESIGNATION OF PUMPING WELL

80' 0 80'

Title:

SITE PLAN

FULTON TERMINALS SITE
FULTON, N.Y.

Prepared For:

de maximis

ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: L.M.	Date: 22DEC2000	FIGURE
Prepared by: R.F.	Scale: AS SHOWN	2
Project Mgr: L.M.	Office: MA	
File No: DM0218101	Project: 32702M	