REMEDIATION SYSTEM EVALUATION

MATTIACE PETROCHEMICAL SUPERFUND SITE
GLEN COVE, NEW YORK

Report of the Remediation System Evaluation,
Site Visit Conducted at the Mattiace Petrochemical Superfund Site
March 29-30, 2001

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NOTICE

Work described herein was performed by GeoTrans, Inc. (GeoTrans) and the United States Army Corps of Engineers (USACE) for the U.S. Environmental Protection Agency (U.S. EPA). Work conducted by GeoTrans, including preparation of this report, was performed under Dynamac Contract No. 68-C-99-256, Subcontract No. 91517. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

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EXECUTIVE SUMMARY

The Mattiace Petrochemical Superfund Site, located in an industrial area near the harbor of Glen Cove, is approximately 1.9 acres and has extensive soil and groundwater contamination of volatile organic compounds stemming from the operations of a former solvent storage and distribution company. The initial remedial investigation of the site uncovered a number of buried storage tanks, drums, lagoons and truck that at one time contained solvents. Current remediation actions include operable unit three (OU3), which is a pump-and-treat system for treating groundwater, and operable unit four (OU4), which is a soil vapor extraction system for treating contaminated soils. The goals of these operable units are both containment of the contaminants and restoration of the aquifer.

Both units became operational and functional in June 1999 with one groundwater extraction well, six soil vapor extraction wells, five dual phase vapor extraction wells, and 20 nested vapor extraction wells. Since operation, two additional groundwater extraction wells have been added.

In general, the RSE team found a well-operated system. Recommendations to improve system effectiveness include the following:

- The capture zones for the groundwater extraction wells should be analyzed to ensure that additional contamination is not migrating offsite.

- The contaminant plume, especially to the north of the site, should be delineated to ensure it is not migrating toward the residential area and to help provide a more accurate target capture zone for the groundwater extraction wells.

- The hydrogeology of the site should also be investigated to determine a more effective location for discharging water from the treatment plant. The optimal discharge location would be to surface water or downgradient reinjection rather than the current reinjection wells.

These recommendations might require approximately $41,000 in capital costs and might increase annual costs by approximately $4,000 per year.

Recommendations to reduce life-cycle costs include the following:

- Replacing the thermal oxidizer with vapor-phase carbon with onsite steam regeneration would likely save approximately $23,000 per month in utilities (mainly natural gas but also electricity and water).

- The addition of a biological, fluidized-bed reactor would reduce the acetone and other ketone concentrations thereby allowing less frequent changeouts of the liquid-phase carbon units and saving approximately $15,000 per month in combined carbon purchase and disposal costs.

- With the above reductions in monthly costs, the project-management/technical support costs could also likely be scaled back from $20,000 per month to $10,500 per month or less.

- Weekly sampling of effluent and other process monitoring results in analytical costs associated with the treatment system of about $10,000 per month. Approximately 95% of the effluent parameters have met guidelines and may only need to be sampled on a monthly basis and some process monitoring is redundant and can be eliminated. Savings of approximately $5,000 per month may be possible assuming monitoring adjustments are approved by the state.

Additional recommendations for significant technical improvement include the following:

- The yield from the groundwater extraction wells is significantly compromised by biofouling. These wells should be treated to improve production rates.

- Approximately half of the 31 vapor extraction wells are not producing due to condensate/water in the piping. Repiping all of the vapor extraction wells with larger diameter piping and appropriate regrading will not only enable these wells to produce, but will reduce the head loss through the piping and therefore the electricity costs.

Implementing the recommendations to reduce costs would require initial investments, but savings from operations and maintenance could offset these initial investments and the costs associated with recommendations for enhanced system effectiveness and technical improvement.

A summary of recommendations, including estimated costs and/or savings associated with those recommendations is presented in Section 7.0 of the report.

PREFACE

This report was prepared as part of a project conducted by the United States Environmental Protection Agency (USEPA) Technology Innovation Office (TIO) and Office of Emergency and Remedial Response (OERR). The objective of this project is to conduct Remediation System Evaluations (RSEs) of pump-and-treat systems at Superfund sites that are "Fund-lead" (i.e., financed by USEPA). RSEs are to be conducted for up to two systems in each EPA Region with the exception of Regions 4 and 5, which already had similar evaluations in a pilot project.

The following organizations are implementing this project.

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The project team is grateful for the help provided by the following EPA Project Liaisons.

Region1	Darryl Luce and Larry Brill	**Region 6**	Vincent Malott
Region 2	Diana Cutt	**Region 7**	Mary Peterson
Region 3	Kathy Davies	**Region 8**	Armando Saenz and Richard Muza
Region 4	Kay Wischkaemper	**Region 9**	Herb Levine
Region 5	Dion Novak	**Region 10**	Bernie Zavala

They were vital in selecting the Fund-lead P&T systems to be evaluated and facilitating communication between the project team and the Remedial Project Managers (RPM's).

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1.0 INTRODUCTION

1.1 PURPOSE

In the *OSWER Directive No. 9200.0-33, Transmittal of Final FY00 - FY01 Superfund Reforms Strategy, dated July 7,2000*, the Office of Solid Waste and Emergency Response outlined a commitment to optimize Fund-lead pump-and-treat systems. To fulfill this commitment, the US Environmental Protection Agency (USEPA) Technology Innovation Office (TIO) and Office of Emergency and Remedial Response (OERR), through a nationwide project, is assisting the ten EPA Regions in evaluating their Fund-lead operating pump-and-treat systems. This nationwide project is a continuation of a demonstration project in which the Fund-lead pump-and-treat systems in Regions 4 and 5 were screened and two sites from each of the two Regions were evaluated. It is also part of a larger effort by TIO to provide USEPA Regions with various means for optimization, including screening tools for identifying sites likely to benefit from optimization and computer modeling optimization tools for pump and treat systems.

This nationwide project identifies all Fund-lead pump-and-treat systems in EPA Regions 1 through 3 and 6 through 10, collects and reports baseline cost and performance data, and evaluates up to two sites per Region. The site evaluations are conducted by EPA-TIO contractors, GeoTrans, Inc. and the United States Army Corps of Engineers (USACE), using a process called a Remediation System Evaluation (RSE), which was developed by USACE. The RSE process is meant to evaluate performance and effectiveness (as required under the NCP, i.e., and “five-year" review), identify cost savings through changes in operation and technology, assure clear and realistic remediation goals and an exit strategy, and verify adequate maintenance of Government owned equipment.

The Mattiace Petrochemical Superfund Site was chosen based on initial screening of the pump-and-treat systems managed by USEPA Region 2 as well as discussions with the EPA Remedal Project Manager for the site and the Superfund Reform Initiative Project Liaison for that Region. This site has high operation costs relative to the cost of an RSE and a long projected operating life. This report provides a brief background on the site and current operations, a summary of the observations made during a site visit, and recommendations for changes and additional studies. The cost impacts of the recommendations are also discussed.

A report on the overall results from the RSEs conducted for this system and other Fund-lead P&T systems throughout the nation will also be prepared and will identify lessons learned and typical costs savings.

1.2 TEAM COMPOSITION

The team conducting the RSE consisted of the following individuals:

Frank Bales, Chemical Engineer, USACE, Kansas City District
Dave Becker, Hydrogeologist, USACE HTRW CX
Peter Rich, Civil and Environmental Engineer, GeoTrans, Inc.
Doug Sutton, Water Resources Engineer, GeoTrans, Inc.

1.3 DOCUMENTS REVIEWED

Author	Date	Title/Description
US EPA	9/27/1990	Record of Decision, Mattiace Petrochemical Co., Inc., Glen Cove, Nassau County, New York, September 27, 1990
EBASCO	4/1991	Mattiace Remedial Investigation Report, selected sections and Appendix A-5
EBASCO	5/1991	Mattiace Final Feasibility Study, selected sections
US EPA	6/27/1991	Record of Decision, Mattiace Petrochemical Co., Inc., Glen Cove, Nassau County, New York, June 27, 1991
US EPA	5/1998	Li Tungsten Remedial Investigation Report monitoring data
Foster Wheeler Environmental Corp.	11/1999	Final Long Term Remedial Action Work Plan, Operable Units 3 and 4, Mattiace Petrochemical Site, Glen Cove, Nassau County, New York
Foster Wheeler Environmental Corp.	12/1999	Operations and Maintenance Manual for Long Term Remedial Action, Mattiace Petrochemical Site, Glen Cove, Nassau County, New York
US EPA	1/4/00	Memo - from Robert Alvey to Ed Als (Draft Long Term Remedial Action Plan Comments)
NYSDEC	2/01/00	Memo - from Carl Hoffman to Mike Mason
Foster Wheeler Environmental Corp.	3/2/2000	Hydrogeologic Data Letter Report from Marlene B. Lindhardt to Ed Als
US EPA	4/6/00	Memo - from Robert Alvey to Ed Als (Hydrogeologic Data Letter Comments)

Author	Date	Title/Description
Foster Wheeler Environmental Corp.	7/2000	Long Term Remedial Action Corrective Action Plan for Operable Units 3 and 4, Mattiace Petrochemical Site, Glen Cove, Nassau County, New York
Foster Wheeler Environmental Corp.	7/2000	Operable Units 3 and 4 Effectiveness/Environmental Monitoring Data Report, Mattiace Petrochemical Site, Glen Cove, Nassau County, New York
Foster Wheeler Environmental Corp.	9/2000	Interim Remedial Action Report for Operable Units 3 and 4, Groundwater and in-situ Vacuum Extraction Treatment System, Mattiace Petrochemical Site, Glen Cove, Nassau County, New York
Woodard and Curran	10/2000	Mattiace Petrochemical Superfund Site, Validated Data, Sample Delivery Group, 10/3/2000, 10/4/2000, 10/11/2000, 10/18/2000, 10/26/2000.
Foster Wheeler Environmental Corp.	2/15/2001	Operation and Maintenance Report for the month of September 2000
Foster Wheeler Environmental Corp.	2/15/2001	Operation and Maintenance Report for the month of October 2000

1.4 PERSONS CONTACTED

The following individuals were present for the site visit:

Kathy Yager, EPA Technology Innovation Office
Edward Als,, RPM, EPA Region 2
Rob Alvey, Hydrogeologist, EPA Region 2
Diana Cutt, Project Liaison, EPA Region 2
Dave Dedian, Operations Project Manager, Woodard and Curran
Lou, Plant Operator, Woodard and Curran
Paul McCusker, Plant Operator, Woodard and Curran
Karuppenan Subburamu, Project Manager, Foster Wheeler Environmental Corp.

1.5 SITE LOCATION, HISTORY, AND CHARACTERISTICS

1.5.1 LOCATION

The Mattiace Petrochemical Superfund Site is approximately 1.9 acres and is located in an industrial area along the harbor of Glen Cove, New York. The treatment processes at the site address contamination from volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) contamination from the former Mattiace Petrochemical Company. The site is bordered on the east and south by LUND Industries and Medallion Oil Company, on the west by Circle Lubricant and other tenants, and to the north by a wooded hillside that slopes up to a residential area. The Li Tungsten Superfund Site is located upgradient to the east. Both Glen Cove Creek 500 feet to the south and Hempstead Harbor approximately 1500 feet to the west lie downgradient of the site. A redevelopment project is underway to convert industrial units along the waterfront downgradient of the site into condominiums and shops, and Garvies Point Preserve lies beyond the industrial area to the north and west. Figure 1-1 shows the location of the site and the area surrounding it.

The site currently is divided into two operable units, OU3 and OU4, which began operation in June 1999. OU3 is a pump-and-treat system that addresses groundwater contamination, and OU4 is a soil vapor extraction system that addresses contamination in the vadose zone.

1.5.2 POTENTIAL SOURCES

VOC and SVOC contamination of the soils and groundwater resulted from the daily operations of storing, blending, and repackaging solvents at the former Mattiace Petrochemical Company that operated from the mid-1960s to September 1987. Onsite sources of contamination included both unintentional spills and leaks and intentional releases of organic solvents from drums, underground storage tanks, lagoons, and a buried truck. In a removal action completed in June 1998, approximately 100,000 gallons of hazardous substances were removed from storage tanks and drums at the site. Contamination in the form of light non-aqueous phase liquid (LNAPL) was found both during the Remedial Investigation in 1991 and again in sampling conducted in January 2000. This LNAPL offers a continual source of dissolved phase contamination. A temporary extraction system (OU6) was installed to remove LNAPL from the site prior to operation of the soil vapor and groundwater extraction system in June 1999. Although all of the LNAPL was not removed by OU6, the current pump-and-treat system has not recovered any LNAPL.

1.5.3 HYDROGEOLOGIC SETTING

Groundwater contamination is limited to the Upper Glacial formation which is confined below by the Raritan Clay and Port Washington Confining Unit that extend 50 feet or more in depth. The water table is approximately 30 feet below land surface and the saturated zone of the Upper Glacial formation is approximately 30 feet deep in the northern half of the site and as possibly less than 10 feet deep in the southern half of the site. A rise in the Raritan Clay nearly separates the saturated glacial deposits on the northern half of the site from those on the southern half. Groundwater gradients at the site generally result in flow to the west, but in the southern quarter of the site groundwater flows to the south. The vertical extent of the glacial deposits and the elevation of the top of the clay are relatively unknown beyond the boundaries of the site. Boring logs from MW-8d, however, indicate the clay elevation at approximately 5 feet below mean sea level, which is approximately 10 feet higher than the clay elevation measured from the DVE-3 boring on the northern edge of the site. Local geological cross-sections indicate that the elevation of the Port Washington Confining Unit continues to rise to the north and approaches near mean sea level.

1.5.4 DESCRIPTION OF GROUND WATER PLUME

Groundwater and soil contamination occupies a majority of the subsurface underlying the 1.9 acre area of the former Mattiace Petrochemical Company property with “hot spots” occurring 1) halfway between the treatment plant building and the northern boundary of the site and 2) in the southeastern corner of the site. The northern “hot spot” includes many VOCs and SVOCs including PCE, TCE, ethylbenzene, methylene chloride, xylenes, and 1,2 dichlorobenzene. The “hot spot” in the southeastern corner is predominantly xylenes. The July-2000 report on sampling conducted in January through April of 2000 documents detectable concentrations of 29 of the 34 VOCs analyzed.

In addition to onsite contamination, contamination has migrated offsite to the west, southwest, southeast, and to the north. This migration is evident from the results of the sampling program conducted in January through April 2000 and reported in the July 2000 sampling report. To the north, MW-10 had concentrations as high as 22,000 ug/L of TCE and 23,000 ug/L of xylenes, and LNAPL was found in MW-10 and MW-7s. Also, a monitoring well associated with the Li Tungsten site to the northeast has concentrations of tetrachlorethylene and trichlorethylene, contaminants associated with the Mattiace Petrochemical Site but not associated with operations at Li Tungsten. Monitoring wells to the west of the site also show contaminant migration extending over 100 feet from the site. Another sampling program was conducted during the winter of 2000 to 2001, but this data was not available at the time of the RSE. The project manager and plant operators, however, mentioned detectable concentrations in the now-inactive reinjection wells to the north of the site.

Figure 1-2 shows the various areas of contamination at the site and the wells associated with the vapor extraction, groundwater extraction, and reinjection systems.

2.0 SYSTEM DESCRIPTION

2.1 SYSTEM OVERVIEW

The system consists of an extraction, a treatment, and a reinjection system to address VOC and SVOC contamination of the subsurface. At the time of the RSE, the plant had removed a total of 25,000 pounds of contaminants since operation began and was removing approximately 500 pounds per month. Both treated groundwater and water from the city used for quenching of a thermal oxidizer were reinjected through the reinjection system. Thus, approximately double the amount of water that is extracted from the subsurface is reinjected.

2.2 EXTRACTION SYSTEM

The extraction system includes soil vapor, dual-phase (water and vapor), and groundwater extraction wells. The soil vapor extraction system currently consists of thirty-one wells (six soil vapor extraction wells SVE 1-6, five dual phase extraction wells DVE 1-5, and 20 nested extraction wells NVE 1-20). Soil vapors are drawn into the system using a 50 hp blower for the dual phase wells and a 30 hp blower for the soil vapor wells. The system currently draws approximately 500 scfm of soil gas. At the time of the RSE, current operators estimated that over half of the soil vapor wells (especially on the south side of the site) are not producing, most likely due to condensate/water trapped in the piping. The groundwater extraction system originally consisted of a single extraction well, but over time, two additional wells were added to improve production rates including converting a reinjection well (R-4) into a groundwater extraction well (PW-4). Also, six of the vapor phase wells are used to extract groundwater, but the yields are typically around 0.1 gpm in each of these wells. As a whole, groundwater is extracted at approximately 10 gpm.

2.3 TREATMENT SYSTEM

The groundwater system is designed to treat 22 gpm with an influent solvent concentration in the high mg/l range. The system consists of a phase separator, metals removal, sand filter, bag filter, heat exchanger, tray aerator, and GAC. The process vapors from the tray aerators are mixed with the extracted soil vapors and vented to a thermal oxidizer. The operations currently require daily bag filter replacement, weekly GAC replacement, and weekly to biweekly cleaning of the system to remove a biological slime extracted from the subsurface.

2.4 REINJECTION SYSTEM

The reinjection system originally consisted of 10 reinjection wells located on the hill north of the facility; however, one of the reinjection wells was converted to a groundwater extraction well to improve capture to the northwest of the site. To reduce reinjection near this new extraction well, three of the reinjection wells (R-1 through R-3) were taken off line. Currently, only R-5 through R-10 reinject water. Because city water is used to quench the thermal oxidizer, the plant discharges approximately double the amount of water that is extracted. City water is used to provide cooling to the thermal oxidizer at a rate of 6-10 gpm.

3.0 SYSTEM OBJECTIVES, PERFORMANCE AND CLOSURE CRITERIA

3.1 CURRENT SYSTEM OBJECTIVES AND CLOSURE CRITERIA

The ROD stipulates that the pump-and-treat system will "restore groundwater under the Site to its most beneficial use, which is as a potential supply of potable water". However, the ROD also mentions that if contaminant levels cease to decline and remain above the cleanup levels, the cleanup goals can be reevaluated. The remedy is to continue for an estimated period of 30 years. Goals for the soil vapor extraction system are similar with cleanup levels at or below the target risk level of 10^{-6}. The ROD also stipulates a sampling program is to continue during the remedy and for a year after the remedy is complete to ensure that contaminant levels remain below cleanup levels.

3.2 TREATMENT PLANT OPERATION GOALS

The current contract for operations calls for the plant to operate 24 hours per day, seven days a week while treating water from the three extraction wells. Two plant operator attend the site for approximately 50 hours per week including weekends.

3.3 ACTION LEVELS

The air effluent from treatment plant must meet the requirements of the Clean Air Act and State laws and the water effluent must meet the requirements of the Safe Drinking Water Act and State laws. The plant has two discharge criteria for water detailed in the State Pollution Discharge Elimination System (SPDES) Equivalency Permit issued by the New York State Department of Environmental Conservation (NYSDEC), one for discharging to reinjection wells to the north of the site (Outfall 001) and another to discharge into Glen Cove Creek (Outfall 002). Now that the plant has reached the levels for outfall 001, discharge to the creek (Outfall 002) is no longer allowed under the current permit.

Tables 3-1, 3-2, and 3-3 provide some of the discharge limits for water to Outfall 001 and Outfall 002 and for air to the atmosphere. The discharge permit for the water effluent expires in April 2002.

The plant operators and site managers report that the state requires monitoring of all air and groundwater effluent parameters on a weekly frequency if one or more of the parameters is beyond the limit. Thus, although the facility has met discharge requirements since operation for over 95% of the parameters sampling is still required for all parameters on a weekly basis rather than on a semi-monthly or monthly basis.

Table 3-1. Sample Discharge limits for Outfall 001 (reinjection wells)

Constituent	Sampling Frequency	Daily Max. Limit
Total suspended solids (TSS)	Weekly	20 mg/L
Total dissolved solids (TDS)	Weekly	1200 mg/L
5-day carbon biological oxygen demand ($CBOD_5$)	Monthly	20 mg/L
Benzene	semi-monthly	0.7 ug/L
2-Butanone	semi-monthly	50 ug/L
1,1-Dichlorethylene	semi-monthly	5 ug/L
Methylene chloride	semi-monthly	5 ug/L
1,1-Dichlorethane	semi-monthly	5 ug/L
1,2-Dichlorethylene (cis)	semi-monthly	5 ug/L
1,1,1-Trichlorethane	semi-monthly	5 ug/L
1,2-Dichlorethane	semi-monthly	5 ug/L
Trichlorethylene	semi-monthly	10 ug/L
Toluene	semi-monthly	5 ug/L
Tetrachloroethene	semi-monthly	5 ug/L
Ethylbenzene	semi-monthly	5 ug/L
M+P-Xylene	semi-monthly	10 ug/L
O-Xylene	semi-monthly	5 ug/L
Napthalene	semi-monthly	10 ug/L
Acetone	semi-monthly	
4-Methyl-2-Pentanone	semi-monthly	140 ug/L
2-Hexanone	semi-monthly	50 ug/L
Vinyl chloride	semi-monthly	5 ug/L

Table 3-2. Sample Discharge limits for Outfall 002 (Glen Cove Creek)

Constituent	Sampling Frequency	Daily Max. Limit
Total suspended solids (TSS)	Weekly	20 mg/L
Total dissolved solids (TDS)	Weekly	Monitor
5-day carbon biological oxygen demand ($CBOD_5$)	Monthly	20 mg/L
Individual Base/Neutral Acid Extractable compounds (BNAs)	semi-monthly	10 ug/L
Individual Volatile Organic Compounds (VOCs)	semi-monthly	10 ug/L

Table 3-3. Sample air emission limits to atmosphere.

Constituent	Daily Max. Limit (lbs per year)
Benzene	1
2-Butanone	197
1,1-Dichlorethylene	187
Methylene chloride	769
1,1-Dichlorethane	319
1,1,1-Trichlorethane	2,173
1,2-Dichlorethane	11
Trichlorethylene (TCE)	994
Toluene	105
Tetrachloroethene (PCE)	1,279
Ethylbenzene	365
Xylenes	1,642
Napthalene	79
Isophorone	56
Methyl Isobutyl Ketone (MIBK)	92
1,1,2,2-Tetrachlorethane	99
Vinyl Chloride	153
O-Dichlorobenzene	5
1,2-Dichlorethylene (total)	700
2-Propanone	214
Di-n-butylthalate	6.8
Particulates	263
Sulfur dioxide	13
Nitrogen oxides	2,190
Carbon Monoxide	460
Carbon tetrachloride	86
Chlorethane	12
Chloroform	80

4.0 FINDINGS AND OBSERVATIONS FROM THE RSE SITE VISIT

4.1 FINDINGS

The RSE team found a well-operated site and continuing efforts by the operators to improve the design of the treatment plant. At the time of the RSE over 25,000 pounds of contaminants had been removed from the subsurface with groundwater and soil vapor extraction systems. Approximately 500 pounds are recovered each month, with much higher rates of removal having occurred in the first months of operation. The observations and recommendations given below are not intended to imply a deficiency in the work of the designers, operators, or site managers but are offered as constructive suggestions in the best interest of the EPA and the public. These recommendations obviously have the benefit of the operational data unavailable to the original designers.

4.2 SUBSURFACE PERFORMANCE AND RESPONSE

The groundwater and soil vapor extraction system are operating significantly below design parameters. NVE wells 2, 3, and 4 located along the southern boundary of the site, DVE wells 1 and 2 located in the northern half of the site, and DVE well 5 located along the western edge of the site are all pumping a small fraction of a gallon per minute. Extraction from these wells is meant to drawdown the water level adjacent to the wells to increase the effectiveness of vapor extraction. This extraction is not adding significantly to removal of contaminants from the groundwater or containment of those contaminants. Groundwater extraction wells PW-1, PW-2, and PW-4 (the converted reinjection well) cumulatively extract approximately 9 gpm. Given a plant treatment capacity of approximately 30 gpm, this extraction is less than optimal.

The performance of the groundwater extraction wells (PW-1, PW-2, and PW-4) and of the reinjection wells (R-5 through R-10) has been reduced by a biological/organic slime that has contributed to the fouling of these wells. While efforts will be made in the Spring of 2001 to remove the slime from the pumps, the slime is pervasive and will likely repeatedly foul the wells in the future.

Approximately half of the SVE, NVE, and DVE wells have no established vacuum. This is likely due to condensate/water collecting in low points of the relatively small (1.5 inch diameter) extraction lines.

4.2.1 WATER LEVELS

Water levels are currently gaged semi-annually and typically demonstrate groundwater from the northern three-quarters of the site is funneled to the west whereas groundwater in the southern quarter of the site flows to the south. It should be noted that LNAPL originally discovered midway between the location of the treatment plant and the northern boundary of the site has apparently migrated further north and west, seemingly against a groundwater gradient established by the reinjection gallery to the north of the site.

The RSE team reviewed potentiometric surfaces generated from water levels measured in October 1999 and January 2000. The October potentiometric surfaces reflected two different pumping conditions and used water-level data from the groundwater extraction wells in generating the surfaces. The potentiometric surfaces generated from the January 2000 data did not reflect pumping. The October 1999 data and the January 2000 data were compared to determine the effect of pumping; however, given the lag of two to three months and seasonal variations in recharge, this comparison may not be valid.

4.2.2 CAPTURE ZONES

The contractor estimates that the contaminants are 95% contained. However, clear and accurate capture zones of the groundwater extraction wells (PW-1, PW-2, and PW-4) have not been generated. Those that have been generated used water level data from the extraction wells which may overestimate capture. Thus, the potentiometric surfaces analyzed by the contracted engineers and hydrogeologists likely overestimate capture of these wells. NVE 2, 3, 4 and DVE 1,2, 5 also extract water. The capture zones of these wells have not been analyzed, but due to the low hydraulic conductivity surrounding these wells and the low yield, the capture zones are expected to be minimal. Also, reinjection into wells R-5 through R-10 of both the treated water and the city water used for quenching likely reduces the capture zone of PW-4 and possibly spreads the contamination further north of the site.

Capture zones or radii of influence in the vadose zone of the soil vapor extraction wells have not been measured or analyzed.

4.2.3 CONTAMINANT LEVELS

Sampling in January through April of 2000 suggest contaminant concentrations at the site have generally decreased by an order of magnitude since the Remedial Investigation almost a decade before system operation. At the time of the sampling period in early 2000, high concentrations were detected in the groundwater extraction wells, which are located on the northwestern edge of the site, and in many monitoring wells throughout the site. Concentrations of PCE and TCE in the groundwater extraction wells range from 350 ug/L to 14,000 ug/L for PCE and 150 ug/L to 29,000 ug/L for TCE. Concentrations of *cis*-dichlorethylene (DCE) are also very high in the groundwater extraction wells, 32,000 ug/L to 85,000 ug/L, suggesting the possibility of reductive dechlorination of PCE and TCE. Extraction well concentrations of other non-chlorinated VOCs, such as toluene and total xylenes are as high as 64,000 ug/L and 30,000 ug/L, respectively. The same sampling program showed that MW-10, located among the reinjection wells to the north of the site boundary, had TCE concentrations of 22,000 ug/L and xylene concentrations of 22,000 ug/L. In addition, LNAPL was found in MW-10 and MW-7s, which are both located in the injection gallery. Wells PW-085-9-15 in the southeastern corner of the site had a total xylene concentration of 12,000 ug/L. MW-5S, directly west of the site, had a TCE concentration of 8,200 ug/L, a total xylene concentration of 6,600 ug/L, and an estimated acetone concentration of 64,000 ug/L. Additionally, MW-RD-02, located approximately 100 feet west beyond the southwestern corner of the site had an ethylbenzene concentration of 130 ug/L and a total xylene concentration of 39 ug/L, which further suggests that contamination has migrated from the site.

Thus, high concentrations exist throughout the site, and substantial evidence exists that contaminants have migrated from the site to the north and west. Given the absence of capture to the southeast, contaminant migration has likely occurred in this direction as well. Although the general aim of the groundwater remedy was plume capture and treatment, the remedy was designed to address the capture and treatment of the highly contaminated groundwater in the immediate vicinity of the Mattiace property, and not the less contaminated groundwater on the leading edge of the plume. The primary reason for this approach to implementing the Mattiace ROD was the existence of several other plumes of contaminated groundwater in the Garvies Point area that were unrelated to Mattiace, as well as the generally degraded condition of the Upper Glacial Aquifer in the area of the creek, due to generations of industrial usage.

Contaminant migration in a northerly direction from the site is unexpected given the topography, measured water levels, and injection of clean water to the north of the site. However, high contaminant concentrations exist to the north of the site, and while other industrial facilities exist in the area, groundwater sampling on those facilities does not indicate concentrations as high as those measured to the north of the Mattiace site.

4.3 COMPONENT PERFORMANCE

4.3.1 WELL PUMPS AND TRANSDUCERS

Grundfos submersible pumps capable of extracting 5 to 10 gpm each are used to extract groundwater from a total of nine wells (three groundwater extraction wells and six vapor extraction wells). Pressure transducers are used in conjunction with a programmable logic controller to control the rate of pumping. The transducers used at the site are subject to failure due to chemical attack of flexible seals where the cables attach to the transducer body.

4.3.2 AIR COMPRESSORS/BLOWERS

Two blowers are used for soil vapor extraction. Both are Roots rotary-lobe blowers with variable frequency drives. One is a 50-horsepower blower that operates at 35 hertz and 7 inches of mercury and the other is a 30-horsepower blower that operates at 65 hertz and 13 inches of mercury. Together, these blowers extract a maximum of approximately 800 scfm from the soil.

Another 50-horsepower blower is used for the thermal oxidizer, and a 15-horsepower blower is used for the tray aerator.

4.3.3 PHASE SEPARATOR

The phase separator was originally installed to remove LNAPL from the influent. Although LNAPL was has been detected onsite as late as January 2000, no LNAPL has been removed by the extraction system and the phase separator.

4.3.4 EQUALIZATION TANKS

The equalization tank stores extracted water that enters at approximately 10 gpm and stores this water so that the treatment plant can operate in a semi-batch mode at approximately 22 gpm. The equalization tanks must be cleaned weekly to remove slime extracted from the groundwater.

4.3.5 SLUDGE REMOVAL SYSTEMS

Water from the equalization tank is adjusted to pH between 10 and 11. Then, a solution containing 0.025% polymer is added at one gallon per day to remove iron from the extracted water. The resulting sludge is removed and processed in an onsite filter press. The solids are reclaimed and an estimated 1500 pounds per month is recovered. This sludge, with a water content of approximately 50%, is disposed as non hazardous waste. The decanted water is returned to the influent sump tank for reprocessing. After the sludge removal system, sulfuric acid is added to bring the pH to 7.

4.3.6 BAG FILTERS AND TRAY AERATOR

After pH neutralization, the water is filtered with a sand filter and then with two bag filters of 25 and 10 microns each. These bags are replaced on a daily basis. The water is then heated to approximately 120 F before entering the tray aerator, which consists of five trays and operates at an air to water ratio of over 175. This ratio and the temperature of the influent water to the aerator were increased to improve removal efficiency of ketones (acetone, 2-butanone, and others) and methylene chloride. The current aerator does not meet discharge criteria for many semivolatiles and the ketones.

4.3.7 GAC UNITS

The water exiting the aerators enters two liquid phase granular activated carbon units (GAC). These carbon units contain 1650 pounds of carbon each and are the primary means of removal for several semivolatile compounds and the ketones. The presence of acetone requires that the GAC be replaced on a weekly basis. The operators have noticed that if the GAC is not replaced on a weekly basis that the pressure drop through the system increases dramatically, possibly due to biological slime from the groundwater that passes through the previous treatment system components. The temperature of entering water is approximately 105 F, which is higher than ideal. The system should reclaim heat from entering water to reduce the temperature to below 65 F.

4.3.8 THERMAL OXIDIZER

The thermal oxidizer operates at 1500 F to destroy contaminants in the off gas of the air stripper and the air from the vapor extraction system. The thermal oxidizer was designed for significantly higher contamination loads. The current loading is less than 1.5 pounds per hour versus the design loading of 160 pounds per hour. Natural gas is used at significant cost to accommodate this difference between design and actual loading. A flow rate of approximately 10 gpm from the public water supply is used to quench the effluent from 1500 F to 400 F and the pH is neutralized.

4.3.9 CONTROLS

The control system was redone during the startup phase; however, there are several non-conventional items that should be noted.

- The color convention for the control panel is unconventional (green means off and red means on).

- The valves in the compressor room for control of the SVE wells have handles that are incorrectly installed (open/closed position of handles are reversed) and could cause a problem when switching operators or during a process excursion.

- The flowmeters on the individual vapor extraction wells are inaccurate and/or out of range and do not sum to equal the total extracted flow rate.

4.4 COMPONENTS OR PROCESSES THAT ACCOUNT FOR MAJORITY OF MONTHLY COSTS

Subcontractor operator labor (50 hours per week) × 2	$20,000
Contractor project management (for O&M only)	$8,000
Contractor technical support (for O&M only)	$12,000
Analytical (process water and air)	$10,500
Analytical (monitoring wells)	$2,500
GAC (replacement and disposal)	$20,000
Chemicals	$1,500
Sludge disposal (nonhazardous)	$850
Electric	$8,000
Gas	$25,000
Water	$2,200
Phone and cell phones	$300
	$110,850

4.4.1 UTILITIES

Natural gas accounts for over 70% of the utility costs. The monthly natural gas bill is approximately $25,000 with $2,000 for preheating water before it enters the air strippers, $1,000 heating the building, and $22,000 for the thermal oxidizer. Electric costs account for approximately 22% of the total utility costs. The monthly bill is approximately $8,000 with $4,000 for the SVE blowers, $3,000 for the thermal oxidizer, and $1,000 for the air stripper fans and remaining pumps.

4.4.2 NON-UTILITY CONSUMABLES AND DISPOSAL COSTS

Non-utility consumables include granular activated carbon (GAC) and chemicals for metal precipitation. The GAC, which is replaced on a weekly basis due to rapid acetone breakthrough, accounts for over 90% of the non-utility consumable costs at $20,000 per month including disposal of spent carbon.

4.4.3 LABOR

Labor costs are associated with both plant operation (subcontractor), project management (contractor), and technical support (contractor). The complexity of the system justifies the presence of two operators each at 50 hours per week and a monthly cost of $20,000. Project management costs approximately $8,000 per month and consists of one site visit per month, daily phone calls to the site, and submission of required reports. Technical support costs approximately $12,000, and the details of technical support were not disclosed during the RSE visit. The RSE team has typically found lower costs for project management and technical support for similar systems.

4.4.4 CHEMICAL ANALYSIS

Chemical analysis, for both aquifer sampling and process water, accounts for approximately 10% of the monthly costs.

4.5 RECURRING PROBLEMS OR ISSUES

The following list identifies a number of recurring problems that affect the treatment and extraction systems.

- Condensate gathers in the low points of the vapor extraction wells preventing them from producing vapor. At the time of the RSE, approximately half of the 31 vapor extraction wells produced were not functioning due to this problem.

- A biological slime, mostly in the northern portion of the site, is fouling the groundwater extraction and reinjection wells causing the groundwater extraction wells to perform well below design levels. This slime also repeatedly clogs the treatment system requiring the operators to clean it every few weeks.

- Transducers in the reinjection and groundwater extraction wells are damaged as the interface between the cable and the transducer disintegrates when in contact with the groundwater. The operators have been salvaging extra transducers from reinjection wells to use for the more crucial purpose of controlling pumping in the groundwater extraction wells.

- BOD and ketone levels are high in water exiting the air stripper. Because the efficiency of carbon to remove these components is low, the carbon must be replaced on a weekly basis, a much higher frequency than would otherwise be necessary.

- A number of other issues have arisen due to original design and installation flaws in the plant. Although these items alone are not recurring issues, problems arising from design and installation are recurring. The operators have replaced piping in multiple areas of the plant that was melting or disintegrating due to high water temperatures or chemical compositions. In addition, they have identified a number of wiring problems, some of which could have led to injuries.

4.6 REGULATORY COMPLIANCE

Before officially becoming operational and functional, the plant had difficulty meeting discharge criteria for total dissolved solids (TDS); biological oxygen demand (BOD), and various VOCs. The plant became operational and functional in September 1999 and initially discharged into the creek via Outfall 002. By September 2000 the TDS level in the influent had dropped below the discharge criteria for Outfall 001. The plant is now discharging according to the more stringent criteria associated with the discharge wells (Outfall 001). Now that the more stringent TDS criteria are being met, discharge to the creek is no longer permitted.

The plant continues to have problems meeting the BOD requirements. Acetone, other ketones, and possibly the biological/organic slime are likely contributing to the high BOD. To accommodate these levels, especially the acetone and ketones, the plant operators are changing the carbon units once per week. These more frequent change outs help meet the discharge criteria but at a high cost due to the low efficiency of carbon to remove ketones.

4.7 TREATMENT PROCESS EXCURSIONS AND UPSETS, ACCIDENTAL CONTAMINANT/REAGENT RELEASES

The plant has difficulty meeting the discharge limits for acetone and other ketones. The RSE team found no record of accidental contaminant or reagent releases.

4.8 SAFETY RECORD

There have been no documented accidents, but the plant operators mentioned many safety hazards associated with the original design that have since been addressed. Such hazards included wiring problems and thermally or chemically inadequate piping for water.

5.0 EFFECTIVENESS OF THE SYSTEM TO PROTECT HUMAN HEALTH AND THE ENVIRONMENT

5.1 GROUND WATER

The area surrounding the site is an industrial and commercial area that borders a residential community. Given contamination of surficial aquifer and topography that slopes down from the residential community to the site, it is unlikely that site-related groundwater contamination is or will adversely affect that community. There is, however, a $300,000,000 redevelopment project along the harbor that will result in condominiums downgradient of the site. Site-related groundwater contamination, if not contained, could adversely affect this development.

Public water supply wells are located one to two miles north (upgradient) of the site beyond the current residential area and are not affected by the contamination.

5.2 SURFACE WATER

Both Glen Cove Creek and Hempstead Harbor are downgradient of the site. While the creek once served as a discharge point for the treatment plant, the water is now discharged to the subsurface through reinjection wells. Given that contamination has migrated from the site, it is possible that in the future, without sufficient containment, both the creek and the harbor could be affected by site-related contaminants.

5.3 AIR

Site related contaminants are not a threat to the air. The thermal oxidizer does discharge to the atmosphere but currently meets all discharge criteria.

5.4 SOILS

Surface soils likely do not serve as a significant avenue of exposure to contaminants. However, gaps in the fencing do allow access to the site where there are other hazards, such as steep topography.

5.5 WETLANDS AND SEDIMENTS

Wetlands or sediments associated with Glen Cove Creek or Hemstead Harbor are not currently affected by site-related contaminants, but these areas are downgradient of the site. Garvies Point Nature Preserve is located north and northwest of the site and may be impacted by the plume observed near the injection wells.

6.0 RECOMMENDATIONS

6.1 RECOMMENDED STUDIES TO ENSURE EFFECTIVENESS

Aquifer sampling data collected between January and April of 2000 and the 1998 Remedial Investigation for the neighboring Li Tungsten Superfund site show high concentrations of VOCs throughout the Mattiace site and beyond the site boundaries to the west and north. Additionally, based on the potentiometric surface and contaminant concentrations, it is possible that contaminants have migrated offsite to the south.

Although multiple wells throughout the site extract groundwater in an attempt to remove contaminants and prevent migration, it is unlikely that these wells are containing the contaminants. The cumulative pumping rate for all groundwater extraction wells is less than 10 gpm. It should be noted that due to well fouling the actual cumulative extraction rate of 10 gpm is significantly lower than the designed extraction rate and the plant treatment capacity of 30 gpm.

Despite extraction from PW-1, PW-2, and PW-4 capture in the northwestern corner of the site is questionable. Furthermore, capture is compromised by the injection of water through reinjection wells R-5 through R-10. Approximately twice the amount of water that is extracted and treated is reinjected through these wells (the city water used for quenching is also reinjected). Although the contractors have analyze potentiometric surfaces on a semiannual basis to determine capture, these surfaces were generated using water level data from the groundwater extraction wells, and capture was likely overestimated.

Capture in the southern half of the site is also likely limited due to the tight formation and the low pumping rates. NVE wells 2, 3, and 4 are each extracting approximately 0.1 gpm from the relatively shallow and tight formation. Although new piezometers (PZ-2 through PZ-4) are adjacent to these wells and may show capture a few feet from these wells the wells are located in a straight line along the southern boundary in 50-foot intervals. Therefore, capture along this southern boundary is likely incomplete. No groundwater extraction is occurring in the southeastern corner.

6.1.1 ANALYZE CAPTURE OF SITE-RELATED CONTAMINANTS

To determine capture, water levels should be measured monthly or more frequently from monitoring wells and piezometers and not from groundwater extraction or reinjection wells. Furthermore, additional piezometers, monitoring wells, and subsurface characterization are required to determine capture along the site boundaries. The optimal locations of new piezometers, monitoring wells, and characterization should be determined after further review of previous water level data and aquifer hydraulic conductivities; however, a list of suggestions is provided below.

- To the north of the site, the Port Washington Confining Unit may rise in elevation and may provide a natural barrier to groundwater flow and contaminant transport to the north. The subsurface to the north of the site, however, has not been characterized to verify this potential barrier. A truck-mounted geoprobe could be used to characterize the confining unit in the area that extends approximately 100 feet to the north of R-5 through R-10. To provide information about the potentiometric surface in this area, two piezometers should be installed that screen the contaminated formation, one of them approximately 50 feet north of MW-8s and other approximately 50 feet north of MW-10. The optimal depths of these piezometers should be determined based on the geoprobe results. It should be noted that access to this area may be limited as it is heavily wooded and may be part of the nature preserve. For approximately $5,000 a small geoprobe can be hired for two to three days and provide 12 to 15 samples. The two piezometers can be installed for approximately $2,000 a piece.

In addition, semi-annual sampling should continue in monitoring wells MW-8s, MW-8d, and MW-10, and semi-annual sampling for VOCs should commence in monitoring wells MW-7s and MW-7d. If concentrations increase, especially in MW-7s and MW-7d, then capture is not adequate. The analytical work for the additional sampling should cost approximately $1,000 per year.

- To the west of the site, one piezometer could be added approximately 20 feet to the north MW-5s. This new piezometer, in addition to MW-5s and PZ-7, would provide a cluster of three monitoring points in the same formation for determining the local horizontal hydraulic gradient. Hydraulic gradients from water-level measurements of PW-OBS-50 and PW-OBS-20 should also be analyzed. These gradient should indicate flow toward DVE-5 or PW-1 and PW-2 if capture is adequate, and an additional groundwater extraction well may be necessary in this area if capture is not adequate. The recommended piezometer would cost approximately $2,000.

  Semi-annual sampling of monitoring wells MW-5s, MW-5d, and MW-RD-2 should continue, and semi-annual sampling of VOCs in MW-RD-1s and MW-RD-1d should commence. The analytical work for this additional sampling should cost approximately $1,000 per year.

- To the south of the site, two monitoring wells could be added to verify capture from NVE-2, NVE-3. These two monitoring wells should be located along the southern boundary of the site or preferably 10 feet further south (if permission is granted) and 30 feet on either side of NVE-2. These two new wells should be sampled semi-annually for VOCs, and the semi-annual sampling of MW-1 and MW-7 should continue. If concentrations in these wells increase over time, it is likely that adequate capture is not provided. In this case, additional wells, or perhaps a collection trench and sump should be installed to provide additional capture. Installation for each of the two new monitoring wells should cost $10,000. The analytical work for semi-annual sampling of the two new wells should cost approximately $1,000 per year.

- Even with the addition of these piezometers, a significant gap exists between groundwater extraction through NVE-4 and DVE-5. Piezometers or monitoring wells may be required to verify capture of contaminants between these two wells.

Water levels in the existing and recommended piezometers should be analyzed, along with sampling data, on a monthly basis to verify capture. After careful analysis of the capture zones as determined from the increased number water-level and concentration monitoring points, if the capture is still incomplete, additional groundwater extraction wells or trenches may be required to provide thorough capture.

6.1.2 DELINEATE CONTAMINANT PLUME TO THE NORTH

Sampling from January through April 2000 and the 1998 Remedial Investigation for the neighboring Li Tungsten site demonstrate that contamination has moved offsite to the north and to the west from the Mattiace Petrochemical site. Given the proximity of a residential area to the north of the site, additional plume delineation is needed. A sentinel monitoring well should be installed 50 to 100 feet north of MW-8s and sampled quarterly for VOCs to warn the site managers if contaminants have migrated or will migrate further toward the residential area. The depth of this monitoring well should be based on the results of the geoprobe work recommended in 6.1.1. The monitoring well should cost approximately $10,000 to install and $1,000 per year for analytical work.

6.1.3 FURTHER EVALUATE SITE HYDROGEOLOGY, IMPROVE CAPTURE, AND OPTIMIZE EXTRACTION AND REINJECTION SYSTEMS

Further evaluation of the site hydrogeology and pumping strategies should be done to optimize the contaminant containment and cleanup. Currently, treated water and water used for quenching of the effluent from the thermal oxidizer are both reinjected into the subsurface near groundwater extraction well PW-4. For the month of October 2000, over 600,000 gallons of water were reinjected through R-4 through R-10 while approximately 326,000 gallons of water were extracted (mostly from PW-1, PW-2, and PW-4). This proximity of the reinjection to the groundwater extraction wells likely decreases their capture. In addition, high levels of contamination have been found in the reinjection area, and the reinjected water is likely spreading some of that contamination further from the site boundaries. A more optimal reinjection strategy should be considered such as discharge through Outfall 002, which is Glen Cove Creek. While discharging water to surface water rather than groundwater may reduce the water levels in the area, this will increase the portion of the subsurface addressed by the SVE system. This alternate discharge location would require an adjustment to the permit which is up for renewal in April 2002.

As mentioned in Recommendation 6.1.1, additional groundwater extraction wells may be required to enhance capture of the contaminant plumes. These extraction wells should be strategically placed based on improved water level data collected from some of the recommended piezometers.

6.2 RECOMMENDED CHANGES TO REDUCE COSTS

6.2.1 REPLACE THERMAL OXIDIZER

The thermal oxidizer requires approximately $25,000 per month to operate ($22,000 for the natural gas and $3,000 for the electricity). It is currently destroying less than 1.5 pounds of contaminant per hour rather than the design rate of 160 pounds per hour, and this difference in vapor concentration translates to about $6,000 per month in additional natural gas costs to operate it. The lower operating concentrations and the high cost of operating the thermal oxidizer (partly due to increased gas prices) indicate that alternative vapor treatment options should be reevaluated. At the current VOC mass, vapor granular activated carbon (GAC) usage without onsite regeneration would likely offer only slight cost savings versus the oxidizer; however, these cost savings would increase as concentrations continue to decline. At this point, the use of vapor GAC with an onsite steam regeneration system would offer considerable operating cost savings even if the contaminant mass loading increased by a factor of two or more. The capital cost for an appropriate unit is about $300,000; however, EPA may have units available from other sites that no longer need them. Installation of the system would require about $70,000. Operating costs for the unit are mainly labor, gas, and maintenance. Labor and maintenance costs would be similar to the thermal oxidizer and gas costs for the required steam would be about $2,000 per month assuming daily regeneration. The electric and water costs would also be significantly less than with the thermal oxidizer. A savings of about $23,000 per month is likely, which in the worst case, would pay for the capital expenditure within three years.

6.2.2 USE ALTERNATIVE TREATMENT PROCESS TO REMOVE KETONES AND REDUCE GAC CHANGE OUT

The liquid GAC costs are very high, $20,000 per month, due to levels of acetone and to a lesser extent 2-butanone and other ketones in groundwater well above design estimates. These ketones breakthrough the GAC beds very quickly resulting in necessary change outs at a frequency of once per week or more. The solubility of the ketones makes air stripping of them relatively ineffective, even with preheating of the influent water. To remove these ketones, a different technology is necessary. Either a biological fluidized bed reactor (FBR) or a UV/oxidation unit are possible alternatives. A proposal from Envirogen for a 15 gpm (25 gpm maximum) FBR unit was submitted in March. The capital cost of the unit is $170,000 with about $30,000 installation cost; the operating cost was quoted at less than $1,000/year. Use of this unit would eliminate or significantly reduce liquid GAC costs and likely eliminate the need for heating of the air stripper influent, thereby saving at least $15,000 per month. This savings would pay for the capital investment in just over 1 year. Another potential alternative is to discharge the air stripper effluent to the POTW; however, this is not likely to produce the same savings as using the FBR, especially if the influent flow rate is increased to about 15 gpm and this is likely if the biofouling of the wells is solved.

6.2.3 REDUCE SAMPLING OF PROCESS WATER

Analytical costs associated with the treatment system are about $10,000 per month. Most of the analysis is based on NYSDEC requirements. They reportedly still require monitoring of all air and groundwater effluent parameters on a weekly frequency even though over 95% of the parameters have met the guidelines to be reduced to a monthly frequency. Discussions should be held with NYSDEC to reasonably reduce sampling frequency of certain parameters. The plant operators analyze several air influent (NVE, SVE/DVE, and total) samples on a more frequent basis than is useful. Analyzing certain process water parameters such as SVOCs on a regular basis also does not seem to be useful (removal appears to take place in the GAC only) and the frequency should be reduced. At the lower end, approximately $2,000 per month can be saved; with some cooperation of the state, a savings of approximately $5,000 per month may be possible.

6.2.4 SCALE BACK PROJECT-MANAGEMENT/TECHNICAL-SUPPORT COSTS ACCORDING TO COST SAVINGS AFFORDED BY RECOMMENDATIONS

With the simplification and cost reductions mentioned in the previous three recommendations, a reduction in project management and technical support is also expected. Currently, the project management and technical support costs account for approximately 18% of the total monthly cost. The above recommendations suggest a savings of approximately $43,000 per month which reduces the non-management/technical-support costs to approximately $47,850. For the project management/technical support costs to equal approximately 18% of the monthly costs of the optimized system, the these costs likely should be scaled back from $20,000 per month ($8,000 for project management and $12,000 for technical support) to $10,500 per month ($4,200 for project management and $6,300 for technical support).

6.3 MODIFICATIONS INTENDED FOR TECHNICAL IMPROVEMENT

6.3.1 REHABILITATE FOULED WELLS

A biological slime is fouling the groundwater extraction and reinjection wells. The fouling of the extraction wells is significantly reducing the extraction rates and possibly compromising their capture. Hach BART tests can be used to identify the biological problem, and a rehabilitation method can be chosen that reflects the results. The approximate cost for rehabilitation of each of the nine groundwater extraction wells may range from $1,300 to $3,000 but could be as low as $400 to $600 if the plant operators perform the work. As fouling issues may continue to arise in the future, it is reasonable to assume that preventative maintenance on the groundwater extraction wells could result in additional annual costs of up to $10,000 per year.

6.3.2 REPIPE SVE WELLS AND REPLACE SVE BLOWERS WITH SMALLER UNITS

Approximately half of the 31 vapor extraction wells do not produce vapor, likely due to condensate gathering in low points of the piping between the well and the treatment plant. In addition, the piping is has a 1.5" inner diameter which creates significant head loss as air travels from the wells to the treatment plant. This piping on all vapor extraction wells should be replaced with 3-inch inner diameter piping and an adequate grade should be established to allow condensate to flow back into the well or a sump. Other non-functioning wells may need to be replaced, especially if they are located in areas with high contaminant concentrations.

Replacing piping as discussed above will allow the use of smaller, more efficient blowers thereby reducing electrical costs. Cost savings associated with the smaller blowers will help offset the cost of repiping the wells. In addition, there is $150,000 set aside for regrading of the site. Although the site grounds are uneven, it is not apparent to the RSE team why they need regrading except for the steep topography along the western edge of the site. After addressing this steep topography, this money could potentially be used for regrading the tracks of the new piping for the vapor extraction wells.

Once the vapor extraction wells have been repaired, an evaluation should be conducted to determine the capture zones and air throughput for these wells in the vadose zone and to determine the optimal extraction rates for each vapor extraction well. Determining the capture zones may involve measuring vacuums in adjacent monitoring wells that have screened intervals above the water level or the installation of small-diameter probes. Determining the optimal extraction rates for each well would involve sampling VOC concentrations in each of the well headers to determine which wells are extracting the most contamination. Flow rates in wells with low concentrations can be reduced to accommodate higher flow rates in wells with high concentrations.

The purchase and installation of two 15-horsepower regenerative blowers with drivers and the repiping and regrading should cost approximately $100,000, and the optimization of the SVE system may cost as much as $25,000. However, these costs likely would be offset by savings in electricity of more than $2,000 per month.

6.3.3 REPLACE DAMAGED OR INEFFECTIVE EQUIPMENT

A number items have been damaged or are ineffective at the Mattiace site, and they should be replaced. The following is a list of some of those items:

- For wells that pump less than 6 gpm (after well rehabilitation), the Grundfos submersible pumps can be replaced with pneumatic submersible pumps. Because these pumps only discharge when full, installing such pumps will eliminate the need for transducers to control pumping with the Grundos pumps. This would reduce the effect of fouling on the Grundfos pumps and reduce the need for transducers, which have been failing due to disintegration at the cable-transducer interface. Furthermore, these pumps would provide much more regular flow to the treatment plant. As each pump or associated transducer fails, the pump should be replaced by a pneumatic submersible one. In addition, if additional wells are used for extracting groundwater at less than 6 gpm, submersible pneumatic pumps should be installed.

  There are currently a total of nine groundwater extraction wells extracting a total of 10 gpm. A 7.5-horsepower compressor will provide 25 cubic feet per minute of air and will be sufficient for operating the new pumps. The compressor and the interior piping would cost approximately $5,000 and each pump would cost approximately $1,000. The current discharge pipes for each well can be used, but airlines to each well are required and could cost as much as $4,000 per well if the airlines cannot be run through the current electrical conduit. Thus, the total cost for replacing all pumps should be lower than $50,000. Given that the pumps will be replaced as they fail, this cost will likely be distributed over a couple of years.

- If the pumps are not replaced, as mentioned in the previous bullet, the current pressure transducers should be replaced with another type that does not fail as frequently. The approximate cost of each transducer is $1,500.

- The current program to replace the steel drop tubes in the vapor extraction wells with HDPE drop tubes should be continued as it will reduce the need for heavy machinery for well maintenance. Drop tubes in the SVE wells should be eliminated since their use does little to focus the extraction, but the tubing contributes to the overall system pressure drop and thus electricity usage. The approximate cost of the supplies for this recommendation is approximately $500.

- If reinjection is to continue through the reinjection wells (and not the surface water as recommended in Recommendation 6.1.3) then flowmeters for individual recharge wells should be installed. This could likely be done for $3,000 if the plant operators do the labor.

- The flow meters for many of the vapor extraction wells are currently reading out of range. In addition, the sum of the individual flow meters does not add up to the total flow of the SVE system. Measurement of the flow through these wells will be necessary when optimizing the SVE extraction system as mentioned in Recommendation 6.3.2. This could likely be accomplished for approximately $1,000.

- The security fencing around the site has a gap on the northern side, which faces the residential area. This gap should be eliminated by installing a gate. This gate could likely be installed for under $1,000 and would allow plant operators to visit the reinjection and monitoring wells offsite to the north but would prevent trespassers from entering.

- The steep drop on the western side of the site should be eliminated as it is a hazard. A small portion, perhaps $5,000, of the $150,000 set aside for regrading could be used to this end.

6.4 MODIFICATIONS INTENDED TO GAIN SITE CLOSE-OUT

6.4.1 ESTABLISH DATA NEEDS FOR ANALYZING PROGRESS AND PERFORMANCE

There should be periodic analysis of progress keeping in mind site goals. The project team should sit down and identify clearly the objectives of the system and the data they need to assess performance and progress for each goal including capture, soil remediation, and groundwater remediation. The use of simple geographic information system would facilitate aquifer sampling analysis and the progress toward cleanup.

6.4.2 CONSIDER AGGRESSIVE MASS REMOVAL

Given the small size of the site and shallow contaminant depths, aggressive mass removal may be warranted. Once the vapor extraction wells are operating as designed and the extraction rates have been optimized, the site managers should review the cost-benefit of six-phase heating and air sparging. Six-phase heating would likely reduce remediation time for the vadose zone if significant concentrations of VOCs are trapped in tight silt or clay lenses or if moisture levels prevent adequate air flow through the soil. In-situ thermal treatment may be appropriate for the saturated zone as well. Air sparging would likely help groundwater remediation especially in the northern portion of the site where the saturated thickness is more substantial and there are fewer lateral barriers to displace the injected air. The SVE system, once repaired, would collect the contaminant-laden air from the sparging. Although air sparging would increase dissolved oxygen, which would reduce the potential for biological reductive dechlorination, concentrations at the site are currently too high for natural biological processes to effectively remediate the site. Note that periodic sampling for monitored natural attenuation (MNA) parameters would be useful to determine the potential for MNA at the site after further remediation progress. An initial feasibility study without bench or pilot testing could be done for approximately $25,000.

6.5 DONATE UNUSED EQUIPMENT

A continuous emissions monitor has been purchased but is not used at the site due to maintenance costs of nearly $80,000 multiple times per year. This instrument may be useful at other government sites or may be sold to recover some of the original cost.

7.0 SUMMARY

In general, the RSE team found a well-operated treatment system. The observations and recommendations mentioned are not intended to imply a deficiency in the work of either the designers or operators but are offered as constructive suggestions in the best interest of the EPA and the public. These recommendations have the obvious benefit of the operational data unavailable to the original designers.

Several recommendations are made to enhance system effectiveness, reduce future operations and maintenance costs, improve technical operation, and gain site close out. The recommendations to enhance effectiveness include the installation of additional piezometers and monitoring wells as well as more frequent sampling of groundwater quality and water levels to better define extraction-well capture zones and plume extents. Recommendations to reduce costs include replacing a thermal oxidizer with vapor phase carbon, using a biological fixed-bed reactor to help reduce the use of liquid phase carbon, and reducing the amount of process-water sampling. Finally, recommendations regarding site closure include identifying the data necessary to evaluate the system performance and the progress of restoration and the further investigation of more aggressive mass removal. The table below itemizes all of the recommendations as well as the cost (or cost savings) and reason for each one.

Table 7-1. Cost Summary Table

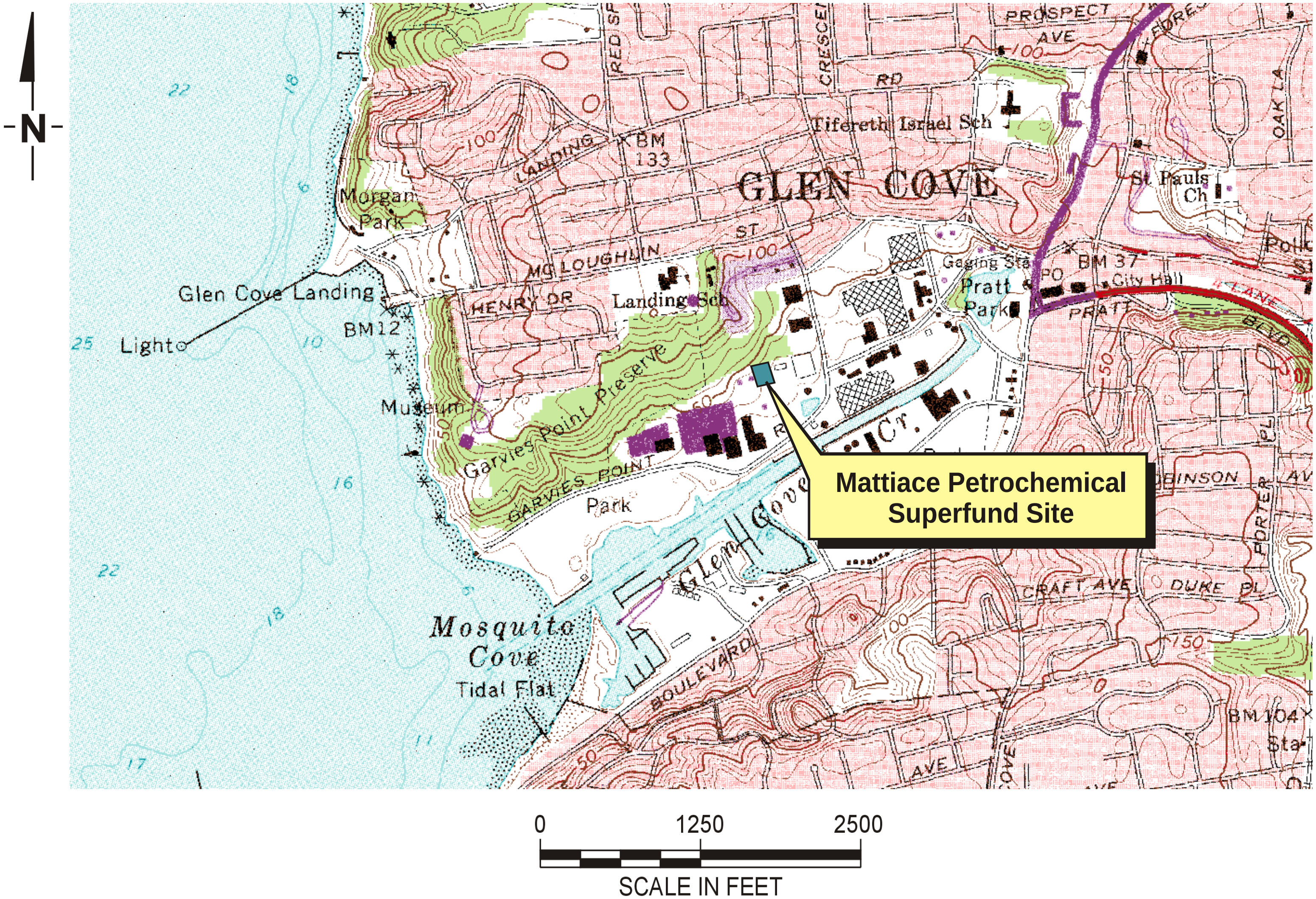
		Estimated Change in			
Recommendation	**Reason**	**Capital Costs**	**Annual Costs**	**Lifecycle Costs ***	**Lifecycle Costs ****
Analyze capture zones	Effectiveness	$31,000	$3,000	$121,000	$79,000
Delineate plume to the north	Effectiveness	$10,000	$1,000	$40,000	$26,000
Reconsider reinjection strategy	Effectiveness	$0	$0	$0	$0
Replace thermal oxidizer	Cost reduction	$370,000	($276,000)	($7,910,000)	($4,077,000)
Use alternate process to remove ketones	Cost reduction	$200,000	($179,000)	($5,170,000)	($2,684,000)
Reduce process monitoring	Cost reduction	$0	($5,000)	($150,000)	($81,000)
Scale back project management	Cost reduction	$0	($114,000)	($3,420,000)	($1,837,000)
Rehabilitate fouled wells	Technical improvement	$5,400	$10,000	$305,400	$167,000
Repipe SVE wells and optimize SVE system	Technical improvement	$125,000	($2,000)	$65,000	$93,000

Recommendation	Reason	Estimated Change in Capital Costs	Annual Costs	Lifecycle Costs *	Lifecycle Costs **
Replace damaged or ineffective equipment	Technical improvement	$60,500	$0	$60,500	$60,500
Establish data needs to evaluate progress and performance	Gain site close out	$0	$0	$0	$0
Consider aggressive mass removal	Gain site close out	$25,000	$0	$25,000	$25,000
Donate unused equipment to other EPA sites	EPA cost effectiveness	$0	$0	$0	$0
	Total	$826,900	($562,000)	($16,033,100)	($8,229,000)

Costs in parentheses imply cost reductions.
* assumes 30 years of operation with a discount rate of 0% (i.e., no discounting)
** assumes 30 years of operation with a discount rate of 5% and no discounting in the first year

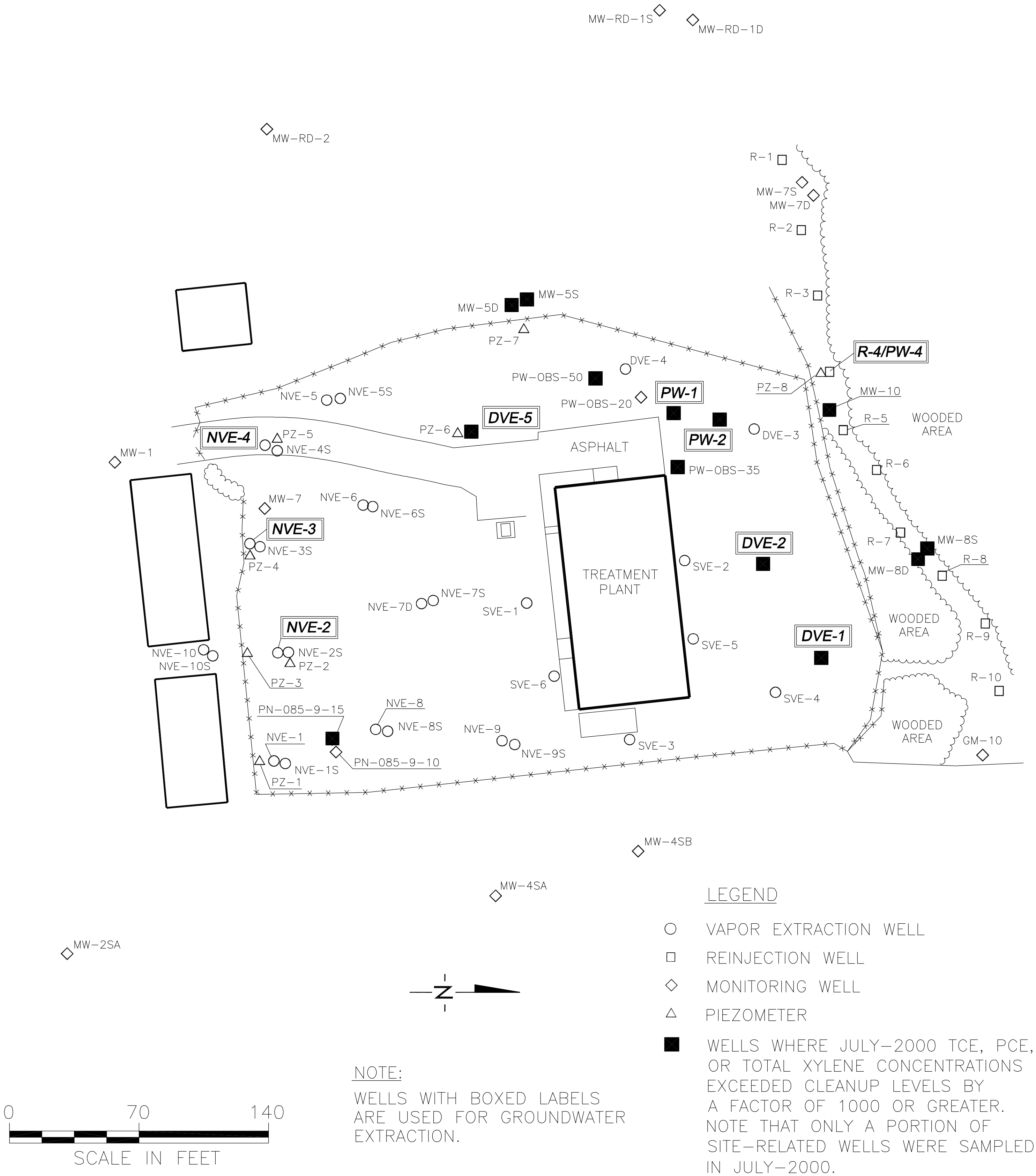
FIGURES

FIGURE 1-1. GLEN COVE, NASSAU COUNTY, NEW YORK AND THE AREA SURROUNDING THE MATTIACE PETROCHEMICAL SUPERFUND SITE



(Figure taken from the 1988 USGS topographical map, Sea Cliff quadrangle.)

FIGURE 1-1. SITE LAYOUT SHOWING SELECT MONITORING POINTS AND THE WELLS ASSOCIATED WITH THE VAPOR EXTRACTION, GROUNDWATER EXTRACTION, AND WATER REINJECTION SYSTEMS. WELLS WITH SIGNIFICANT CONTAMINANT CONCENTRATIONS ARE INDICATED



(Figure compiled from figures of the Mattiace Petrochemical Site Remedial Design, Glen Cove, New York, prepared by Foster Wheeler Environmental Corporation for USEPA, 2000).

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