

**SOIL VAPOR EXTRACTION AND AIR SPARGE
PERFORMANCE ANALYSIS AND DESIGN
MODIFICATION PLAN**

**Former Duralab Property
Brooklyn, New York**

September 22, 1998

Prepared for:

**Federal Express Corporation
One Century Drive
Parsippany, New Jersey**

Prepared by:

**ROUX ASSOCIATES, INC.
1377 Motor Parkway
Islandia, New York 11788**



CONTENTS

1.0 INTRODUCTION	1
1.1 Site Background And Setting	3
1.2 Remedial Objectives	4
1.3 Organization of PADMP	4
2.0 OFF-SITE AND ON-SITE GROUND-WATER INVESTIGATIONS	6
2.1 Off-Site Investigation	6
2.1.1 Monitoring Well Installation	6
2.1.2 Off-Site Investigation Results	6
2.2 On-Site Investigation	7
2.2.1 On-Site Investigation Results	8
3.0 SOIL VAPOR EXTRACTION/ AIR SPARGING PILOT STUDY	10
3.1 Pilot Study Wells and Monitoring Points	10
3.2 Baseline Monitoring	10
3.3 Summary of SVE/AS Pilot Test	10
3.4 Description of Equipment Used and Data Collected for the Pilot Study	10
3.5 Pilot Study Data Interpretation	11
3.5.1 Pneumatic SVE Vacuum Response	12
3.5.2 Air Sparge ORP and Water Level Response	12
3.5.3 Extracted Soil Vapor Sampling	12
3.5.4 Soil Vapor Extraction Flow Rate	13
3.5.5 Air Sparge Injection Rate	13
3.6 Full-Scale Design Modifications	13
3.6.1 Soil Vapor Extraction Wells	14
3.6.2 Air Sparge Wells	14
3.6.3 SVE and AS Recovery Piping	15
3.6.4 Soil Vapor Extraction Blower	15
3.6.5 Air Sparge Blower	15
3.6.6 Off-Gas Controls	15
3.7 Summary	16
4.0 PERFORMANCE ANALYSIS AND SVE/AS SYSTEM OPTIMIZATION	17
4.1 Remedial Objectives of SVE/AS System	17
4.2 SVE/AS System	17
4.3 Operation and Maintenance Manual	18
4.3.1 General Operation and Maintenance	18
4.3.2 Full-Scale SVE/AS System Operation and Maintenance	19
4.3.3 Vapor Phase Carbon Drum Operation and Maintenance	19
4.4 Operational Adjustments	19

CONTENTS (continued)

5.0 EFFECTIVENESS EVALUATION.....	21
5.1 Mechanism of Removal.....	21
5.2 Assessment and Optimization of Mass Removal	21
5.3 Record Keeping	22
6.0 SHUTDOWN EVALUATION	23
6.1 Temporary Shutdown	23
6.2 Permanent Shutdown	25
6.3 Post-Shutdown Monitoring.....	25

TABLES

1. Summary of Volatile Organic Compounds Detected in Ground Water
2. Summary of Semivolatile Organic Compounds Detected in Ground Water Off-site
3. Summary of Pesticides and Polychlorinated Biphenyls Detected in Ground Water Off-site
4. Summary of Metals Detected in Ground Water Off-site
5. Summary of Semivolatile Organic Compounds Detected in Ground Water On-Site
6. Summary of Pesticides and Polychlorinated Biphenyls Detected in Ground Water On-Site
7. Summary of Metals Detected in Ground Water On-Site
8. Monitoring Point Physical Data
9. SVE Pilot Test Study Results
10. SVE/AS Pilot Study Test Analytical Data

FIGURES

1. Site Location Map
2. Site Plan
3. Trichloroethene Concentrations Detected in Ground Water
4. Log of Vacuum Response vs. Radial Distance from SVE-1
5. Water Level Rise vs. Radial Distance from AS-1
6. Oxidation Reduction Potential vs. Radial Distance from AS-1
7. Modified SVE and AS System Well, Piping and Equipment Layout
8. Anticipated SVE Well Effective Radius of Influence for the SVE and AS System
9. Anticipated AS Well Effective Radius of Influence for the SVE and AS System
10. PADMP Decision Chart

1.0 INTRODUCTION

Roux Associates, Inc. (Roux Associates), on behalf of Federal Express Corporation (Federal Express) and Cargex Brooklyn Limited Partnership (Cargex), has prepared this Performance Analysis and Design Modification Plan (PADMP) for the former Duralab Equipment Corporation (Duralab) property in Brooklyn, New York (Site). The purpose of the PADMP is to detail the results of a pilot study and on-site/ off-site investigations performed to project full scale system performance, estimate its likely effectiveness and establish monitoring requirements and shutdown criteria for the remedial system described in the Remedial Action Work Plan (RAWP) by Roux Associates, Inc. April 21, 1998. Currently, Federal Express and Cargex are in the process of entering the New York State Department of Environmental Conservation (NYSDEC) Voluntary Cleanup Program (VCP). Federal Express has made a long-term commitment to develop this property into a major distribution facility in Brooklyn, New York. As part of the redevelopment process, Federal Express performed several environmental site assessments (ESAs) to evaluate the environmental conditions at the Site. The results of these ESAs indicated that a localized hot spot, along with lesser impacted ground-water, is present at the Site. This hot spot primarily consists of trichloroethene (TCE), which is the constituent of concern in both soil and ground water.

To address the soil and ground-water contamination at the Site, a soil vapor extraction and air sparging (SVE/AS) system (System) will be installed, operated and maintained. This System was originally described in the RAWP and is modified by this document. The full-scale SVE/AS system design modifications required, based on the results of the pilot study, are described in detail in Section 3.6. This remedial system is intended to remove the majority of the mass of soil and ground-water contamination, which would then be followed by a human health risk assessment (RA) that would demonstrate that residual contamination, if any, does not pose a risk to human health. It is anticipated, based on the pilot study results, that the remedial system will be operative for approximately 18 months which will result in the removal of the major portion of the contamination at the Site.

The PADMP is intended to achieve six objectives. These objectives are as follows:

1. document results of the pilot study;
2. document on-site/off ground water quality;
3. present a method to evaluate the performance of the individual components of the proposed full-scale remedial system to gauge whether they are operating in accordance with the design intent of the SVE/AS system;
4. present a method to evaluate the effectiveness of the proposed full-scale SVE/AS system and estimate its ability to achieve the remedial goals;
5. set forth monitoring requirements, methods analysis and decision making processes to effect operational changes or design modifications to the proposed full-scale SVE/AS system to achieve the remedial goals; and
6. propose a mechanism to implement a two-phased shutdown of the SVE/AS system.

This PADMP sets forth both performance and effectiveness criteria. While performance relates to the adequacy of the operating elements of the SVE/AS system, effectiveness pertains to the degree of success in meeting the remedial goals.

The performance aspect of the PADMP identifies the adjustable components and record-keeping procedures for each of the elements in the SVE/AS system. Based on these, specific operational adjustments are proposed which could improve the recovery rate to meet the design objectives.

The effectiveness evaluation in the PADMP espouses two concepts. The first concept relies on a comparison of the cumulative mass of chemicals removed to a baseline initial mass of chemical present in the soil and ground water. The calculation of the initial mass of chemical in the ground water is based on a number of assumptions as well as existing data. The second concept utilizes monitoring data over time to judge whether continued operation of the SVE/AS system is likely to create a condition of diminishing returns with respect to chemical mass removal.

The shutdown evaluation includes an initial, temporary shutdown followed by a permanent shutdown. The permanent shutdown phase will be followed by a period of post-shutdown monitoring.

Ground-water monitoring will be performed to determine the extent to which the SVE/AS system has removed the dissolved contamination and mitigated its off-site migration. After the temporary shutdown period, the SVE/AS system will be reactivated and monitored to determine if recovered contaminant concentrations are consistent with pre-shutdown levels. Continued operation will be dependent on the performance response of the SVE/AS system after its reactivation. The PADMP, Section 6.0, outlines the criteria which will be employed to optimize the timing of the temporary shutdown.

Additionally, the PADMP outlines criteria that will be used to determine that the SVE/AS system has, to the extent practical, achieved the remedial goals such that the project can transition to the post-shutdown monitoring phase.

1.1 Site Background And Setting

The former Duralab property is located in the Canarsie Section of Brooklyn, New York (Figure 1). The former Duralab property is bordered by Farragut Road, East 108th Street, and a commercial building across East 105th Street to the south, east and west, respectively, while the Long Island Railroad right of way borders the Site to the north (Figure 2). The property is approximately 8.5 acres in size and contains a 165,500 square foot building. The building was constructed in 1971 with an addition built in 1986.

The property is owned by the City of New York. It was leased by Duralab Equipment Corporation from 1971 to 1997 under a ground lease with the City of New York, and was utilized as a cabinet manufacturing facility. In 1997, Duralab ceased operations, and the leasehold estate under the ground lease was purchased by CARGEX Brooklyn Limited Partnership. A detailed description of the manufacturing processes and potential chemicals of concern associated with operation of the property were provided in the Phase I ESA performed by LAW Environmental Consultants, Inc., 1997.

Federal Express is currently working to redevelop the former Duralab property into a major distribution facility in Brooklyn, New York. Federal Express is subleasing the property from CARGEX Brooklyn Limited Partnership. As part of the redevelopment process, Federal Express retained several environmental consultants to determine the environmental conditions at the Site. A description of the scope and results of the ESAs performed at the Site was provided in the Roux Associates Remedial Action Work Plan (RAWP) dated April 28, 1998.

Pursuant to its sublease with CARGEX Brooklyn Limited Partnership, Federal Express has agreed to remediate certain environmental conditions at the Site through participation in the New York State Voluntary Cleanup Program.

1.2 Remedial Objectives

The following are the remedial objectives of the SVE/AS system.

- to remediate the area of contaminated ground water delineated in Figure 3, if Federal Maximum Contaminant Levels (MCLs) are not achieved, to levels determined during the human health RA; and
- mitigate off-site migration of TCE contamination.

These remedial objectives will be met through the use of a full-scale SVE/AS system. The remedial program is intended to eliminate any potential ongoing TCE sources and cause mass-reduction of TCE in ground water. Prior to the completion of these remediation efforts, a human health RA will be performed to confirm that residual contamination concentrations do not pose a threat to human health if Federal MCLs are not achieved and to determine when natural attenuation would be effective in remediation of residual, dissolved TCE in ground water.

1.3 Organization of PADMP

The remainder of this PADMP is organized into five sections.

- Section 2.0 details the results of the off-site and on-site ground water investigations performed.
- Section 3.0 discusses the pilot study performed, the results of the pilot study and the resulting modifications to the SVE/AS system design.

- Section 4.0 presents a discussion of the performance analysis of the SVE/AS system, including the record keeping procedures and available operational adjustments that can be used to improve performance.
- Section 5.0 discusses the approach to evaluating the effectiveness of the SVE/AS system. As mentioned earlier, this approach is based on two concepts to quantify how the SVE/AS system has done in removing chemical mass from the ground water. Specific data collection (record keeping) procedures as well as approaches to enhance contaminant mass removal are presented in Section 4.0.
- Section 6.0 establishes a basis for determining when to shutdown the SVE/AS system. Two phases of shutdown are considered. A temporary phase is intended to eliminate potential preferential pathways that may have been created. During this time, samples will be evaluated to determine the effect the SVE/AS system has had on TCE concentrations in ground water. A permanent phase of shutdown will commence when it is determined that remediation efforts, to the extent practical, reduced the chemical mass sufficiently such that residual impacts, if any, from the remaining chemical mass will not adversely impact human health and the environment if Federal MCLs are not achieved.

2.0 OFF-SITE AND ON-SITE GROUND-WATER INVESTIGATIONS

Ground-water monitoring investigations were performed on August 3, 1998 and August 28, 1998, to characterize off-site and on-site ground-water quality. These investigations were requested by the NYSDEC in accordance with Roux Associates letter dated July 17, 1998 to the NYSDEC. The following summarizes the scope of work and results for each investigation.

2.1 Off-Site Investigation

The purpose of this portion of the investigation was to determine the ground-water quality conditions offsite and downgradient of the Site. This effort included the installation and sampling of two off-site monitoring wells.

2.1.1 Monitoring Well Installation

Two 2-inch diameter PVC monitoring wells (MWO-1 and MWO-2) were installed offsite and downgradient of the Site to a depth of 20 feet below land surface using the hollow-stem auger method. The location of the two monitoring wells is shown in Figure 2. During the drilling, the soil cuttings were screened for volatile organic compounds using a photoionization detector. The soil cuttings were also inspected for contamination (i.e., staining and odors).

After installation of the monitoring wells, each well was developed using a submersible pump. Each well was sampled immediately after well development in order to expedite the laboratory turnaround schedule. The ground water was collected using disposable bailers, and analyzed for VOCs, SVOCs, pesticides and PCBs, and metals using the NYSDEC Analytical Services Protocol methods.

2.1.2 Off-Site Investigation Results

Several semivolatile organic compounds (SVOCs) and metals were detected in the ground water above the NYSDEC Ambient Water-Quality Standards or Guidelines (AWQSG). Please note that no sources for SVOCs were identified onsite, and the SVOCs detected offsite are typical of an urban industrial area. Additionally, the samples were not filtered and, therefore, the metal concentrations probably reflect suspended sediment, not mobile contamination. Pesticides and

polychlorinated biphenyls (PCBs) were not detected in the off-site samples. Additionally, the soil cuttings screening and inspection indicated that contaminants were not present in the soil. A summary of the ground-water quality results is provided below.

Volatile Organic Compounds

Three volatile organic compounds (cis-1,2-dichloroethene, trichloroethene and vinyl chloride) were detected above the NYSDEC AWQSG (Table 1). All three of these VOCs were detected above the NYSDEC AWQSG at MWO-1 (Figure 2), while only cis-1,2-dichloroethene was detected above the NYSDEC AWQSG at MWO-2 (Figure 2).

Semivolatile Organic Compounds

Six semivolatile organic compounds (benzo[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, chrysene and indeno[1,2,3-cd]pyrene) were detected above the NYSDEC AWQSG (Table 2). These SVOCs were detected above the NYSDEC AWQSG at MWO-1 (Figure 2), while no SVOCs were detected above the NYSDEC AWQSG at MWO-2 (Figure 2).

Pesticides and Polychlorinated Biphenyls

Neither pesticides nor polychlorinated biphenyls were detected in ground water offsite at Monitoring Wells MWO-1 and MWO-2 (Table 3).

Metals

Ten of the 23 Target Analyte List metals (antimony, arsenic, chromium, copper, iron, lead, manganese, sodium, thallium and zinc) were detected in unfiltered ground water offsite above the NYSDEC AWQSG at Monitoring Wells MWO-1 and MWO-2 (Table 4). The concentrations of all metals detected in unfiltered ground water offsite at each downgradient monitoring well location are consistent.

2.2 On-Site Investigation

Previous investigations have revealed TCE to be the primary on-site contaminant of concern based on the sampling of on-site ground water for VOCs. The purpose of this portion of the

investigation was to determine additional on-site ground-water quality conditions for SVOCs, pesticides, polychlorinated biphenyls and metals. As part of this on-site investigation, ground-water sampling from five monitoring wells (MW-1, MW-2, LMW-13, LMW-17 and LMW-25) was originally proposed to be performed; however, only four monitoring wells were sampled since the exact location of LMW-17 was unable to be determined (Figure 2).

2.2.1 On-Site Investigation Results

Based on a review of the on-site investigation results, it appears that no additional on-site contamination exists other than TCE. Specifically, SVOCs, pesticides and polychlorinated biphenyls (PCBs) were not detected in the on-site ground water samples. Although metals were detected in the ground water above the NYSDEC AWQSG, the metals detected were typical of an urban industrial area and were comparable to background conditions. Additionally, the samples were not filtered and; therefore, the metal concentrations may reflect suspended sediment, not contamination. A summary of the ground-water quality results is provided below.

Semivolatile Organic Compounds

No SVOCs were detected in ground water on-site at monitoring wells MW-1, MW-2, LMW-13 and LMW-25 (Table 5).

Pesticides and Polychlorinated Biphenyls

No pesticides and polychlorinated biphenyls were detected in ground water on-site at monitoring wells MW-1, MW-2, LMW-13 and LMW-25 (Table 6).

Metals

Six of the 23 target analyte list metals (antimony, chromium, iron, lead, manganese and sodium) were detected in unfiltered ground water on-site above the NYSDEC AWQSG (Table 7).

The specific analytes detected above the NYSDEC AWQSG in each well are summarized below.

- MW-1: antimony, chromium, iron, lead, manganese and sodium
- MW-2: antimony, iron, manganese and sodium

- LMW-13: iron and manganese
- LMW-25: iron

3.0 SOIL VAPOR EXTRACTION/ AIR SPARGING PILOT STUDY

The pilot study was performed during July 28, 1998 in accordance with the RAWP. The pilot study included installation of SVE/AS test wells and monitoring points, baseline monitoring and performance of an SVE/AS pilot test. A description of the SVE/AS Pilot Study, data interpretation and resulting full-scale design modifications are presented below.

3.1 Pilot Study Wells and Monitoring Points

Two pilot study wells (AS well AS-1 and SVE well SVE-1) along with four monitoring points (MP-1 through MP-4) were constructed to conduct and evaluate the effectiveness of the pilot test. A summary of the test well monitoring point construction data is provided in Table 8. Locations of each monitoring point are shown in Figure 7.

3.2 Baseline Monitoring

Pre-pilot test baseline data, including collection of ground-water elevations, dissolved oxygen (DO) concentrations and oxidation reduction potentials (ORPs) were collected following the installation of the pilot test wells and monitoring points to evaluate the results of the pilot tests. A summary of this baseline data is provided in Table 9.

3.3 Summary of SVE/AS Pilot Test

Following the completion of initial pre-pilot baseline testing, a pilot test was performed in accordance with RAWP.

3.4 Description of Equipment Used and Data Collected for the Pilot Study

The SVE/AS pilot system equipment consisted of a skid mounted SVE blower, AS blower, air filter, moisture separator and manual ambient air valve. A water level indicator, pocket digital manometer (PDM), in-line air flow meters, and photoionization detector (PID) were utilized to monitor water levels, pressures, air flow rates, and volatile organic vapor concentrations, respectively.

For the SVE/AS pilot test, raw data was collected after steady-state conditions had been achieved which was confirmed by stable air flow rates and respective extraction vacuum/ injection pressures. The raw data collected during the pilot test are presented in Table 9.

At approximately 30 to 60 minute intervals, various measurements were taken at various air flow rates during both the SVE and AS testing phases. These results are summarized in Table 9.

The following test data was obtained, where applicable, for each phase:

- soil vapor extraction flow rate at SVE well SVE-1;
- air sparge flow rate at air sparge well AS-1;
- applied vacuum at the SVE blower;
- applied pressure at the AS blower;
- vacuum or pressure response at the monitoring points;
- water-level elevations at the monitoring points;
- dissolved oxygen in ground water at each monitoring point; and
- oxidation reduction potential (ORP) at each monitoring point.

In addition, one soil vapor sample was collected during the pilot test using a tedlar bag and analyzed for VOCs using USEPA Method TO-14. The analytical data from the pilot test is summarized in Table 10.

3.5 Pilot Study Data Interpretation

The pilot study data interpretation includes SVE/AS system evaluation of the pneumatic response, the water-table response, the ORP response and vapor characteristics in relation to varying SVE extraction and AS injection rates. This information is presented in the following sections.

3.5.1 Pneumatic SVE Vacuum Response

To determine the potential SVE effective radius of influence (EROI) at the source area, the pneumatic response data gathered during the pilot tests was extrapolated by plotting the vacuum response versus distance from the respective extraction well. (Vacuum decrease with distance may be approximated as a logarithmic relationship. Based on this, the plot of the logarithm of vacuum versus distance will yield a straight line which can be extrapolated to distances beyond the monitoring network.) API (1985c) supports this statement by listing a minimum observed logarithmic vacuum of -0.1 to -0.2 inches of W.C. that should be used to obtain the EROI.

The pneumatic vapor extraction response observed during the pilot test is summarized in Table 9. Figure 4 shows the plots of the vacuum response versus distance for the pilot test using the logarithmic relationship described above. These figures indicate that the EROI is approximately 45 feet at a flow rate of 25 CFM.

3.5.2 Air Sparge ORP and Water Level Response

To determine the potential air sparge EROI at the area of remediation, the ORP and water-level rise pilot study data was reviewed.

The pilot study data gathered is summarized in Table 9. Figures 5 and 6 respectively, show the plot of the water level rise and ORP response versus distance. The ORP response results show an EROI of 80 to 100 feet. However, based on the water level rise response data observed, an EROI of 35 feet will be used for the full-scale SVE/AS system.

3.5.3 Extracted Soil Vapor Sampling

During the course of performing the SVE/AS pilot test, one soil vapor sample was collected for laboratory analysis for total VOCs and compared to PID data collected during each sampling event. A summary of the data collected is provided in Table 10.

It should be noted that the characteristics of the extracted soil vapor are critical in selection of an emission control technology and determining whether controls are required during the design of the full-scale system. In this case, granular activated carbon (GAC) is the preferred method of off-gas control to treat TCE.

3.5.4 Soil Vapor Extraction Flow Rate

Results of the SVE flow rates documented during the pilot test are presented in Table 9. Analysis of the flow rates measured prior to dilution indicate an increase from 25 cubic feet per minute (cfm) to 50 cfm as the extraction blower inlet vacuum was increased from 22 inches water column (W.C.) to 53 inches W.C. Based on the information discussed in Section 3.4.1, this vapor extraction flow rate will produce a minimum EROI of 45 feet.

3.5.5 Air Sparge Injection Rate

The AS injection flow rates measured during the pilot test are presented in Table 9. Analysis of the flow rate data indicates an increase from 3 cfm to 5 cfm as the air sparge blower outlet pressure was increased from 10 pounds per square inch (psi) to 11 psi. Based on this air sparge response, it can be assumed that a minimum air injection rate of 6 cfm can be achieved by applying a blower outlet pressure of 12 psi.

3.6 Full-Scale Design Modifications

Based on the results of the pilot study, the full-scale SVE/AS proposed for the remediation will include five additional SVE wells and five additional AS wells than were originally proposed in the RAWP. This increase in wells is necessary to compensate for the reduced estimated EROI determined during the pilot study. The proposed final well layout is shown in Figure 7.

Due to the off-gas concentrations observed during the SVE pilot study tests, off-gas controls consisting of air phase granular activated carbon (GAC) will be installed on the effluent of the SVE blower to treat the off-gas of the full-scale system prior to discharge to the atmosphere. Off-gas controls will be utilized on the SVE/AS system until contaminant concentrations are reduced sufficiently to allow direct discharge without air controls.

The specific recommendations for the construction of SVE wells, AS wells and the associated SVE/AS system equipment are provided below.

3.6.1 Soil Vapor Extraction Wells

The full-scale SVE/AS system proposed for the source area consists of a total of eight SVE wells. The locations of the proposed SVE wells are presented in Figure 7. Based on the results of the SVE pilot study, an applied vacuum of 22 inches W.C. at each SVE well head will achieve an EROI of 45 feet, providing an effective contaminant removal rate from delineated remediation area. A maximum EROI of 45 feet will be used for the full-scale SVE/AS system based on the average of EROI trends that provide a log of the vacuum response of at least -0.1 inches of water column, as shown in Figure 4. The EROI around each SVE well overlaps with that of adjacent SVE wells, providing adequate coverage of the plume area as depicted in Figure 8. The anticipated combined EROI expected when the SVE wells are operating together is also depicted in Figure 8. This anticipated coverage is based on the inferred additive effect of SVE from multiple SVE well locations. The cumulative EROI, or anticipated coverage, was determined by combining the effect of vacuum response at adjacent monitoring points during the pilot test. The SVE wells will be constructed as detailed in the RAWP.

3.6.2 Air Sparge Wells

The full-scale AS injection system proposed for the remediation area consists of a total of 17 AS wells. The locations of the proposed AS wells are presented in Figures 7 and 9, which depicts a 35-foot EROI around each of 17 proposed AS wells.

The EROI for the AS wells is expected to be 35 feet based on the pilot test results and will be adjusted based on data collected during the startup of the full-scale SVE/AS system. Based upon the evaluation described in Section 3.5.2, an AS injection pressure of approximately 12 psi and a maximum injection rate of 6 cfm is proposed at each AS well for the full-scale SVE/AS system.

3.6.3 SVE and AS Recovery Piping

Individual recovery piping from each SVE and AS well will consist of Schedule 40 PVC piping and will include throttling valves to independently control the extraction/sparge rates from each well and assist in balancing the system.

Individual polyvinyl chloride (PVC) pipe branches will be used to convey the soil vapor to the SVE blower unit and off-gas control system and to convey sparge air to the AS wells. System piping will also be constructed of steel at the outlet of the extraction blower and outlet of the AS blower due to the high temperatures associated with the blower discharges. The piping layout is shown in Figure 7 for the entire SVE/AS system.

3.6.4 Soil Vapor Extraction Blower

Based on the results of the SVE pilot study, a minimum flow rate of 25 cfm per SVE well is expected, not including the use of dilution air. This will be achieved by use of a 15 horsepower SVE blower capable of extracting up to 600 cfm and capable of vacuums up to 100 inches W.C. The skid mounted SVE blower system will also include an inlet particulate filter and a 55-gallon moisture separator.

3.6.5 Air Sparge Blower

Based on the results of the SVE/AS pilot study, a minimum AS flow rate of 6 cfm per AS well is expected. This will be achieved by use of a 7.5 horsepower air sparge blower capable of injecting a minimum of 50 cfm at up to 15 psi. The skid-mounted AS blower system will also include an inlet particulate filter.

3.6.6 Off-Gas Controls

Based on the results of the SVE/AS pilot Study, two 350 pound GAC drums will be used to control the off-gas recovered through the SVE blower. The drums will be connected on the discharge side of the SVE blower.

3.7 Summary

The pneumatic results of the SVE/AS pilot study of the source area and the recommendations described above for the full-scale SVE/AS system are summarized below.

Observed Pilot Test Responses:

- Applied SVE Blower Vacuum 22 to 53 inches W.C.
- SVE Flow Rate 25 to 50 cfm
- SVE EROI 45 feet
- Applied AS Pressure 12 psi
- AS Flow Rate 3 to 5 cfm

Design Parameters for Full-Scale SVE/AS System:

- Applied Vacuum at Well Head 25 inches W.C.
- SVE Flow Rate per Well 25 to 50 cfm
- SVE EROI 45 feet
- Maximum SVE Blower Flow Rate 600 cfm
- AS Flow Rate per Well 3 to 6 cfm
- AS EROI 35 feet
- Maximum AS Blower Flow Rate 50 cfm

4.0 PERFORMANCE ANALYSIS AND SVE/AS SYSTEM OPTIMIZATION

This section presents the remedial objectives of the SVE/AS system, describes its specific components and provides a basis for monitoring the mechanical performance of the SVE/AS system as well as a discussion of operational and design modifications that can be made to optimize its performance.

4.1 Remedial Objectives of SVE/AS System

The purpose of the SVE/AS system is to induce a mass transfer of TCE contamination throughout the plume area from both the liquid phase in soil and the dissolved phase in ground water to the vapor phase, recover (extract) the contaminated vapor and treat the vapor prior to discharge to the atmosphere.

The remedial objectives of the remedial effort are to:

- reduce and minimize the contaminant concentrations in soil and ground water within the plume area; and
- to mitigate off-site plume migration.

4.2 SVE/AS System

The following are the components of the full-scale SVE/AS system:

- eight 2-inch SVE wells;
- seventeen 2-inch AS wells;
- one 600 cfm, SVE blower with thermal overload protection;
- one 50 cfm, AS blower with thermal overload protection;
- one NEMA 4 common SVE/AS control panel;
- two manual dilution air/blow-off valves;
- two particulate filters;
- one high vacuum switch;
- one high pressure switch;
- four vacuum/two pressure indicators;

- one 55-gallon capacity moisture separator with high liquid level switch and manual drain; and
- two 350-pound carbon adsorption drums for off-gas control.

4.3 Operation and Maintenance Manual

As part of the full-scale remedial design, an Operation and Maintenance (O&M) Manual will be compiled for the SVE/AS system. The O&M Manual will consist of a descriptive system narrative and the specific literature provided by the individual equipment manufacturers to document the requirements for operating and maintaining all components of the SVE/AS system. In addition, the O&M manual will consist of a detailed operating log which will be updated weekly by the O&M operator. The operating log will be prepared to provide a standard format for detailing pertinent operations information which will include at a minimum:

- SVE/AS system performance monitoring;
- records of sampling and analysis performed; and
- inspection comments.

The operating logs will be maintained at the Site during the operation of the remedial system. Operation and maintenance activities for the components of the full-scale SVE/AS system are discussed below.

4.3.1 General Operation and Maintenance

General O&M will include the following:

- check operating status and power;
- check the integrity of all equipment, hoses, fittings and piping;
- check the security of equipment and wells; and
- coordinate and perform condensate disposal as required.

4.3.2 Full-Scale SVE/AS System Operation and Maintenance

The O&M for both the SVE and AS components of the full-scale SVE/AS system will include the following:

- recording blower vacuum and pressure;
- recording air flow rate;
- draining moisture separator and record volume;
- performing mechanical check on blowers; and
- making flow adjustments to SVE blower and AS well head flow valves as necessary.

4.3.3 Vapor Phase Carbon Drum Operation and Maintenance

The O&M for the carbon system will include:

- performing effluent air sampling as required;
- measuring organics concentrations using a PID at the influent and effluent to the system; and
- performing manufacturer recommended maintenance on mechanical equipment.

4.4 Operational Adjustments

As the SVE/AS system operates over time, it is expected that a variety of operational adjustments will be needed to enhance its ability to recover contamination. The decisions for making adjustments will be based on the operational data obtained.

When starting up the SVE system, SVE valves for each SVE well would be 100 percent open, the SVE valve for the header pipe would be closed and the dilution air valve would be 100 percent open. The header pipe valve would then be gradually opened and the dilution air valve gradually closed. Closing the dilution air valve would cause the SVE flow from the SVE wells to increase. The operational intent of the SVE system will be to maximize the flow of soil vapor from the SVE wells in areas where AS wells would be in operation. The SVE system valves will be adjusted and

the system's response monitored so that it can treat the soil vapor recovered without resulting in a condition where the vapor's lower explosive limit, as measured in the SVE system inlet, is above acceptable levels.

As the VOC concentrations reduce, the SVE system would be capable of handling a greater flow of soil vapor. This may allow more wells to be on-line at a given time.

5.0 EFFECTIVENESS EVALUATION

The effectiveness evaluation is a measure of the SVE/AS system's ability to meet, to the extent practical, the remedial objectives. The remedial objectives stated in Section 4 are to reduce and minimize the contaminant concentration within the plume area and mitigate off-site plume migration. The means by which the SVE/AS system's effectiveness will be measured is discussed below.

5.1 Mechanism of Removal

Recovery of TCE will occur primarily through volatilization of dissolved phase contamination in conjunction with SVE recovery. The TCE removal rate and the total mass of TCE removed will be obtained as part of SVE/AS operational data collected. Mass removals will be calculated based on PID readings of extracted soil vapor, flow rate data, and the vapor density of TCE (0.739 lbs/ft³). TCE removal will be determined by the following formula:

$$\text{Mass (lbs)} = \text{Flow (ft}^3\text{)} * \text{conc. (ppm)} * 10^{-6} * 0.739 \text{ lbs / ft}^3$$

In addition to the mechanical removal described above, it is expected that biodegradation will occur to reduce residual TCE concentrations. It is likely that TCE reduction will be enhanced through biodegradation as a result of oxygen injection by the AS system. Once AS system operations commence, it is expected that any biological activity occurrence will change from anaerobic to aerobic and enhance the biodegradation rate of the TCE.

5.2 Assessment and Optimization of Mass Removal

The monthly mass removal in the SVE/AS system will be compared to previous monthly removals to evaluate the effects of any operational changes, to determine if there are trends toward declining removal rates, and to assess the benefits of continued operation.

On a monthly basis, the operational data will be evaluated to optimize the SVE/AS wells utilized. Particular SVE wells which have shown a sharp decline in TCE concentration would be evaluated and temporarily taken off-line to allow the contamination in that area to increase as a result of diffusion, while allowing other SVE wells to be on-line and possibly have their flow rates increased.

There may be beneficial effects in altering the soil vapor flow patterns. To assess these potential benefits, field testing will be done by adjusting the flow control valves to the vapor extraction wells, thereby increasing vapor flow through more contaminated areas. These field tests will be done after TCE mass removal rates have decreased to about 20 percent of the maximum monthly removal. Additionally, the soil vapor extraction wells will be pulsed to determine if this action increases removal rates while lowering energy costs. If flow rate adjustment and pulsing are found to be beneficial, they will be implemented and testing will be repeated periodically after TCE removal rates have declined.

5.3 Record Keeping

On a monthly basis, data pertinent to mass removal, will be evaluated and compiled to determine a monthly TCE mass removal rate. This data will be provided in the monthly operation and maintenance report described in the RAWP.

6.0 SHUTDOWN EVALUATION

As discussed in Section 1.0, there will be two phases of shutdown of the SVE/AS system. The first phase, termed a temporary shutdown, will be initiated to eliminate preferential pathways caused by operating the SVE/AS system. The second phase, termed a permanent shutdown, will occur if the remedial objectives have been met.

The following subsections describe the decision making process for the implementation of temporary and permanent shutdown. These descriptions highlight criteria which will be used to evaluate the data and assist the decision making process, which is also presented in the decision chart in Figure 10.

6.1 Temporary Shutdown

The following rationale will be utilized to determine the optimum time to temporarily shut down the SVE/AS system.

After the SVE/AS system has been operated for a period of time, the following two criteria will be used to assist in determining the optimum time of temporary shutdown:

- chemical mass removal rate reduction; and
- off-site ground-water monitoring well contaminant concentrations.

The first criterion relies upon a comparison of the chemical mass removal rate described in Section 5.1. Basically, the mass of TCE which is removed from the ground water will be determined on a monthly basis. If, in any three consecutive months of operation, the mass of TCE which has been removed in those months is less than or equal to 10 percent of the maximum mass of TCE removed in any one prior month, the SVE/AS system will be temporarily shut down for one month. For example, suppose the mass of TCE removed in months 10, 11 and 12 is 15 lbs., 11 lbs. and 13 lbs., respectively; furthermore, suppose that in the highest month of removal, the amount of TCE mass which was removed was 200 lbs. Since the monthly mass of TCE removed in consecutive months 10, 11 and 12 is less than 20 lbs. (10 percent of 200 lbs.), the SVE/AS system would enter a temporary shutdown.

A reduction in the mass of TCE removed in one month to 10 percent of the maximum mass previously removed in a single month is indicative of a significant decline in effectiveness of the SVE/AS system. Essentially, when this criterion is reached, it would take a minimum of nine months of continued operation at the reduced mass of TCE removal rate (<10 percent) to extract an amount equal to the maximum mass of TCE that had been removed in the maximum prior month. For instance, in the example described above, it would take an additional 18 months of operation to remove 200 lbs. of TCE if the rates of removal in months 10, 11 and 12 were repeated over an 18-month period. Hence, this criterion illustrates that the operation of the SVE/AS system has reached a point of diminishing returns.

After a period of one month of a temporary shutdown, the on-site ground-water monitoring wells will be sampled. The analytical results of the ground-water samples will be compared to the Federal MCLs. Since Federal MCLs are also health-based concentration limits, they offer an objective review of whether the residual chemical mass in the subsurface at the Site poses a future potential risk. If the analytical data from the ground-water sampling indicates TCE concentrations below the Federal MCL, the SVE/AS system will be permanently shut down. However, if the results are in excess of the MCL, the SVE/AS system will be re-activated.

If the SVE/AS system is re-activated, the aforementioned criteria will again be applied to determine when it will once again enter a temporary shutdown. The SVE/AS system will again be temporarily shut down when the 10 percent TCE mass criterion is met, and an additional round of on-site ground water samples will be collected from the ground-water monitoring wells after one month.

The analytical results of the on-site ground-water samples will be evaluated after the second temporary shutdown. If the results are equal to or less than the MCLs, the SVE/AS system will be permanently shut down.

If, after two years of operation or two system shutdowns, the on-site ground-water sample results exceed the MCL, a focused quantitative human health RA will be performed to determine if the residual chemical mass poses an unacceptable risk to human health and the environment. The RA approach is an option because the shallow ground water being remediated is not used for drinking water. The outcome of the focused human health RA will dictate either continued operation or permanent shut down of the SVE/AS system.

The second criteria required to be met to allow permanent shutdown of the SVE/AS system relies on comparisons of the off-site ground-water samples. Quarterly sampling and analysis of the off-site ground-water monitoring wells will be performed to determine whether the TCE concentrations are increasing. If, during the period that the SVE/AS system is in the temporary shutdown phase, it is determined that the TCE concentration from the off-site monitoring wells has not increased, the SVE/AS system will be permitted to be permanently shut down, assuming the requirements of the first criteria have been met.

6.2 Permanent Shutdown

If the criteria for temporary shutdown are met, and agreement is reached with the NYSDEC project manager, the SVE/AS system will enter into a period of permanent shutdown. During this period, two rounds of ground-water samples will be collected. The first will be collected immediately after shutdown. The second will be collected approximately three months later to confirm the result of the first sampling round. If the results of the second set of ground-water samples indicate that the SVE/AS system is to remain in a state of permanent shutdown, then the period of post-shutdown monitoring will begin.

6.3 Post-Shutdown Monitoring

Post-shutdown monitoring will involve three subsequent quarters of samples collected from the on-site monitoring wells for the TCE with remedial goals. The average specific TCE concentration, based on the three quarters of measurement, will be reviewed to determine whether the ambient ground-water concentrations have increased above the levels which were present at the time of permanent shutdown.

If the average TCE concentrations in the on-site wells, based on three quarters of monitoring, indicate levels at or below Federal MCL or the value determined during the focused human health RA (Remedial goal), the remedial action will be deemed complete.

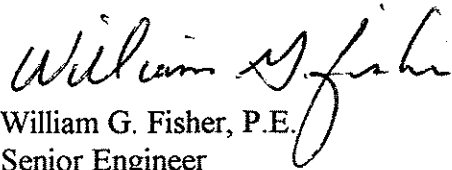
A comparison of the average specific TCE concentration, based on three quarters of monitoring, will either dictate a restart of the SVE/AS system or will allow the remedial action to be considered complete.

Respectfully submitted,

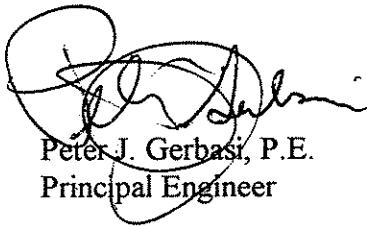
ROUX ASSOCIATES, INC.

Handwritten signature of Scott Glash in cursive script, followed by a circled 'R'.

Scott Glash, C.P.G.
Senior Hydrogeologist

Handwritten signature of William G. Fisher in cursive script.

William G. Fisher, P.E.
Senior Engineer

Handwritten signature of Peter J. Gerbasi in cursive script, with a large circular flourish.

Peter J. Gerbasi, P.E.
Principal Engineer

Table 1. Summary of Volatile Organic Compounds Detected in Ground Water Offsite, Former Duralab Property, Brooklyn, New York.

Parameter (Concentrations in µg/L)	Sample Designation:		Sample Date:	
	MWO-1		MWO-2	
	8/3/98		8/3/98	
	NYSDEC AWQSGs ⁽¹⁾ (µg/L)			
Chloromethane		5 U		5 U
Bromomethane		5 U		5 U
Vinyl Chloride	2	3.1 J		1.8 J
Chloroethane		5 U		5 U
Methylene Chloride		5 U		5 U
Acetone		20 U		20 U
Carbon Disulfide		5 U		5 U
1,1-Dichloroethene		5 U		5 U
1,1-Dichloroethane		5 U		5 U
trans-1,2-Dichloroethene		5 U		5 U
cis-1,2-Dichloroethene	5	40		23
Chloroform		5 U		5 U
1,2-Dichloroethane		5 U		5 U
2-Butanone		20 U		20 U
1,1,1-Trichloroethane		5 U		5 U
Carbon Tetrachloride		5 U		5 U
Bromodichloromethane		5 U		5 U
1,2-Dichloropropane		5 U		5 U
cis-1,3-Dichloropropene		5 U		5 U
Trichloroethene	5	35		5 U
Dibromochloromethane		5 U		5 U
1,1,2-Trichloroethane		5 U		5 U
Benzene		5 U		5 U
trans-1,3-Dichloropropene		5 U		5 U
Bromoform		5 U		5 U
4-Methyl-2-Pentanone		20 U		20 U
2-Hexanone		20 U		20 U
Tetrachloroethene		5 U		5 U
1,1,2,2-Tetrachloroethane		5 U		5 U
Toluene		5 U		5 U
Chlorobenzene		5 U		5 U
Ethylbenzene		5 U		5 U
Styrene		5 U		5 U
p+m-Xylene		5 U		5 U
o-Xylene		5 U		5 U
total Xylenes		5 U		5 U

µg/L - Micrograms per liter

U - Compound was analyzed for but not detected

J - Estimated value

⁽¹⁾ - New York State Department of Environmental Conservation Ambient-Water
Quality Standards or Guidelines

Bold - Data highlighted in Bold represent detections that exceed the NYSDEC AWQSGs.

Table 2. Summary of Semivolatile Organic Compounds Detected in Ground Water Offsite, Former Duralab Property, Brooklyn, New York.

Parameter (Concentrations in µg/L)	Sample Designation: MWO-1 MWO-2	
	Sample Date: 8/3/98 8/3/98	
	NYSDEC AWQSGs ⁽¹⁾ (µg/L)	
Phenol	10 U	10 U
bis-(2-Chloroethyl)ether	10 U	10 U
2-Chlorophenol	10 U	10 U
1,3-Dichlorobenzene	10 U	10 U
1,4-Dichlorobenzene	10 U	10 U
1,2-Dichlorobenzene	10 U	10 U
2-Methylphenol	10 U	10 U
2-2'-oxybis(1-Chloropropane)	10 U	10 U
4-Methylphenol	10 U	10 U
N-Nitroso-di-n-propylamine	10 U	10 U
Hexachloroethane	10 U	10 U
Nitrobenzene	10 U	10 U
Isophorone	10 U	10 U
2-Nitrophenol	10 U	10 U
2,4-Dimethylphenol	10 U	10 U
bis(2-Chloroethoxy)methane	10 U	10 U
2,4-Dichlorophenol	10 U	10 U
1,2,4-Trichlorobenzene	10 U	10 U
Naphthalene	10 0.6 J	2 J
4-Chloroaniline	10 U	10 U
Hexachlorobutadiene	10 U	10 U
4-Chloro-3-Methylphenol	10 U	10 U
2-Methylnaphthalene	10 U	10 U
Hexachlorocyclopentadiene	10 U	10 U
2,4,6-Trichlorophenol	10 U	10 U
2,4,5-Trichlorophenol	25 U	25 U
2-Chloronaphthalene	10 U	10 U
2-Nitroaniline	25 U	25 U
Dimethylphthalate	10 U	10 U
Acenaphthylene	20 0.6 J	10 U
2,6-Dinitrotoluene	10 U	10 U
3-Nitroaniline	25 U	25 U
Acenaphthene	20 6 J	10 U
2,4-Dinitrophenol	25 U	25 U
4-Nitrophenol	25 U	25 U
Dibenzofuran	-- 5 J	10 U
2,4-Dinitrotoluene	10 U	10 U
Diethylphthalate	10 U	10 U
4-Chlorophenyl-phenylether	10 U	10 U
Fluorene	50 7 J	10 U
4-Nitroaniline	25 U	25 U
4,6-Dinitro-2-methylphenol	25 U	25 U
n-Nitrosodiphenylamine (1)	10 U	10 U
4-Bromophenyl-phenylether	10 U	10 U
Hexachlorobenzene	10 U	10 U

Table 2. Summary of Semivolatile Organic Compounds Detected in Ground Water Offsite, Former Duralab Property, Brooklyn, New York.

Parameter (Concentrations in µg/L)	Sample Designation: MWO-1 MWO-2	
	Sample Date: 8/3/98 8/3/98	
	NYSDEC AWQSGs ⁽¹⁾ (µg/L)	
Pentachlorophenol		25 U
Phenanthrene	50	19
Anthracene	50	4 J
Carbazole	--	10
Di-n-butylphthalate		10 U
Fluoranthene	50	7 J
Pyrene	50	6 J
Butylbenzylphthalate		10 U
3,3'-Dichlorobenzidine		10 U
Benzo(a)anthracene	0.002	2 J
Chrysene	0.002	2 J
bis(2-Ethylhexyl)phthalate		10 U
Di-n-octylphthalate		10 U
Benzo(b)fluoranthene	0.002	2 J
Benzo(k)fluoranthene	0.002	1 J
Benzo(a)pyrene	*	2 J
Indeno(1,2,3-cd)pyrene	0.002	0.7 J
Dibenz(a,h)anthracene		10 U
Benzo(g,h,i)perylene	--	0.7 J

µg/L - Micrograms per liter

U - Compound was analyzed for but not detected

J - Estimated value

⁽¹⁾ - New York State Department of Environmental Conservation Ambient-Water Quality Standards or Guidelines

* - Based on method detection limit for analytical method used

-- - No NYSDEC AWQSG available

Bold - Data highlighted in Bold represent detections that exceed the NYSDEC AWQSGs.

Table 3. Summary of Pesticides and Polychlorinated Biphenyls Detected in Ground Water Offsite, Former Duralab Property, Brooklyn, New York.

Sample Designation:	MWO-1	MWO-2
Sample Date:	8/3/98	8/3/98
Parameter (Concentrations in µg/L)		
Aroclor-1016	0.50 U	0.50 U
Aroclor-1221	1.4 U	1.4 U
Aroclor-1232	0.81 U	0.81 U
Aroclor-1242	0.50 U	0.50 U
Aroclor-1248	0.61 U	0.61 U
Aroclor-1254	0.71 U	0.71 U
Aroclor-1260	0.81 U	0.81 U
Alpha-BHC	0.01 U	0.01 U
Beta-BHC	0.02 U	0.02 U
Delta-BHC	0.02 U	0.02 U
Gamma-BHC (Lindane)	0.01 U	0.01 U
Heptachlor	0.01 U	0.01 U
Aldrin	0.01 U	0.01 U
Heptachlor Epoxide	5.0 U	5.0 U
Endosulfan I	0.03 U	0.03 U
Dieldrin	0.02 U	0.02 U
4,4-DDE	0.02 U	0.02 U
Endrin	0.03 U	0.03 U
Endosulfan II	0.02 U	0.02 U
4,4-DDD	0.02 U	0.02 U
Endosulfan Sulfate	0.1 U	0.1 U
4,4-DDT	0.03 U	0.03 U
Endrin Aldehyde	5.0 U	5.0 U
Toxaphene	1.3 U	1.3 U
Alpha-Chlordane	0.02 U	0.02 U
Gamma-Chlordane	0.02 U	0.02 U
Methoxychlor	0.2 U	0.2 U
Endrin Ketone	5.0 U	5.0 U

µg/L - Micrograms per liter

U - Compound was analyzed for but not detected

Table 4. Summary of Metals Detected in Ground Water Offsite, Former Duralab Property, Brooklyn, New York.

Parameter (Concentrations in µg/L)	Sample Designation: MWO-1 MWO-2	
	Sample Date: 8/3/98 8/3/98	
	NYSDEC AWQSGs ⁽¹⁾ (µg/L)	
Aluminum	--	52,400
Antimony	3	7.2 J
Arsenic	25	23.8
Barium	1,000	571
Beryllium	3	3.0 J
Cadmium	10	3.6 J
Calcium	--	65,700
Chromium	50	107
Cobalt	--	47.6 J
Copper	200	258
Iron	300	74,900
Lead	25	252
Magnesium	35,000	18,500
Manganese	300	7,510
Mercury	2	0.42
Nickel	--	131
Potassium	--	10,200
Selenium	10	6.5
Silver	50	1.0 U
Sodium	20,000	59,900
Thallium	4	9.3 J
Vanadium	--	114
Zinc	300	792

U - Compound was analyzed for but not detected

J - Estimated value

-- - No NYSDEC AWQSG available

⁽¹⁾ - New York State Department of Environmental Conservation Ambient-Water
Quality Standards or Guidelines

Bold - Data highlighted in Bold represent detections that exceed the NYSDEC AWQSGs.

Table 5. Summary of Semivolatile Organic Compounds Detected in Ground Water Onsite, Former Duralab Property, Brooklyn, New York.

Sample Designation:	MW-1	MW-2	LMW-13	LMW-25
Sample Date:	8/28/98	8/28/98	8/28/98	8/28/98
Parameter (Concentrations in µg/L)				
Phenol	1.8 U	1.8 U	1.8 U	1.8 U
2-Chlorophenol	1 U	1 U	1 U	1 U
2-Methylphenol	1 U	1 U	1 U	1 U
3+4-Methylphenol	1 U	1 U	1 U	1 U
2-Nitrophenol	1 U	1 U	1 U	1 U
2,4-Dimethylphenol	1 U	1 U	1 U	1 U
2,4-Dichlorophenol	1 U	1 U	1 U	1 U
4-Chloro-3-Methylphenol	1 U	1 U	1 U	1 U
2,4,6-Trichlorophenol	1 U	1 U	1 U	1 U
2,4,5-Trichlorophenol	1 U	1 U	1 U	1 U
2,4-Dinitrophenol	3.6 U	3.6 U	3.6 U	3.6 U
4-Nitrophenol	1 U	1 U	1 U	1 U
4,6-Dinitro-2-methylphenol	1 U	1 U	1 U	1 U
Pentachlorophenol	1 U	1 U	1 U	1 U
bis(2-Chloroethyl)ether	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	2.4 U	2.4 U	2.4 U	2.4 U
1,4-Dichlorobenzene	2.3 U	2.3 U	2.3 U	2.3 U
1,2-Dichlorobenzene	2.4 U	2.4 U	2.4 U	2.4 U
bis(2-Chloroisopropyl)ether	1.2 U	1.2 U	1.2 U	1.2 U
N-Nitroso-di-n-propylamine	1 U	1 U	1 U	1 U
Hexachloroethane	2.9 U	2.9 U	2.9 U	2.9 U
Nitrobenzene	1 U	1 U	1 U	1 U
Isophorone	1 U	1 U	1 U	1 U
bis(2-Chloroethoxy)methane	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	2.3 U	2.3 U	2.3 U	2.3 U
Naphthalene	2 U	2 U	2 U	2 U
4-Chloroaniline	1 U	1 U	1 U	1 U
Hexachlorobutadiene	1 U	1 U	1 U	1 U
2-Methylnaphthalene	2.1 U	2.1 U	2.1 U	2.1 U
Hexachlorocyclopentadiene	1.5 U	1.5 U	1.5 U	1.5 U
2-Chloronaphthalene	2 U	2 U	2 U	2 U
2-Nitroaniline	1 U	1 U	1 U	1 U
Dimethylphthalate	4.6 U	4.6 U	4.6 U	4.6 U
Acenaphthylene	1.5 U	1.5 U	1.5 U	1.5 U
2,6-Dinitrotoluene	1 U	1 U	1 U	1 U
3-Nitroaniline	1 U	1 U	1 U	1 U
Acenaphthene	1.9 U	1.9 U	1.9 U	1.9 U
Dibenzofuran	1.5 U	1.5 U	1.5 U	1.5 U
2,4-Dinitrotoluene	1 U	1 U	1 U	1 U
Diethylphthalate	2.3 U	2.3 U	2.3 U	2.3 U
4-Chlorophenyl-phenylether	2 U	2 U	2 U	2 U
Fluorene	1.7 U	1.7 U	1.7 U	1.7 U
4-Nitroaniline	1 U	1 U	1 U	1 U
n-Nitrosodiphenylamine (1)	1 U	1 U	1 U	1 U
4-Bromophenyl-phenylether	1.9 U	1.9 U	1.9 U	1.9 U

Table 5. Summary of Semivolatile Organic Compounds Detected in Ground Water Onsite, Former Duralab Property, Brooklyn, New York.

Sample Designation:	MW-1	MW-2	LMW-13	LMW-25
Sample Date:	8/28/98	8/28/98	8/28/98	8/28/98
Parameter (Concentrations in µg/L)				
Hexachlorobenzene	1.9 U	1.9 U	1.9 U	1.9 U
Phenanthrene	0.9 U	0.9 U	0.9 U	0.9 U
Anthracene	0.8 U	0.8 U	0.8 U	0.8 U
Di-n-butylphthalate	2.5 U	2.5 U	2.5 U	2.5 U
Fluoranthene	0.6 U	0.6 U	0.6 U	0.6 U
Pyrene	0.5 U	0.5 U	0.5 U	0.5 U
Butylbenzylphthalate	1.2 U	1.2 U	1.2 U	1.2 U
3,3'-Dichlorobenzidine	1 U	1 U	1 U	1 U
Benzo(a)anthracene	0.5 U	0.5 U	0.5 U	0.5 U
Chrysene	0.5 U	0.5 U	0.5 U	0.5 U
bis(2-Ethylhexyl)phthalate	3 U	3 U	3 U	3 U
Di-n-octylphthalate	1 U	1 U	1 U	1 U
Benzo(b)fluoranthene	0.7 U	0.7 U	0.7 U	0.7 U
Benzo(k)fluoranthene	0.7 U	0.7 U	0.7 U	0.7 U
Benzo(a)pyrene	0.5 U	0.5 U	0.5 U	0.5 U
Indeno(1,2,3-cd)pyrene	1.1 U	1.1 U	1.1 U	1.1 U
Dibenz(a,h)anthracene	0.5 U	0.5 U	0.5 U	0.5 U
Benzo(g,h,i)perylene	0.5 U	0.5 U	0.5 U	0.5 U
Carbazole	1 U	1 U	1 U	1 U

µg/L - Micrograms per liter

U - Compound was analyzed for but not detected

Table 6. Summary of Pesticides and Polychlorinated Biphenyls Detected in Ground Water Onsite, Former Duralab Property, Brooklyn, New York.

Sample Designation:	MW-1	MW-2	LMW-13	LMW-25
Sample Date:	8/28/98	8/28/98	8/28/98	8/28/98
Parameter (Concentrations in µg/L)				
Aroclor-1016	0.50 U	0.50 U	0.50 U	0.50 U
Aroclor-1221	1.4 U	1.4 U	1.4 U	1.4 U
Aroclor-1232	0.8 U	0.8 U	0.8 U	0.8 U
Aroclor-1242	0.5 U	0.5 U	0.5 U	0.5 U
Aroclor-1248	0.6 U	0.6 U	0.6 U	0.6 U
Aroclor-1254	0.7 U	0.7 U	0.7 U	0.7 U
Aroclor-1260	0.8 U	0.8 U	0.8 U	0.8 U
Alpha-BHC	0.01 U	0.01 U	0.01 U	0.01 U
Beta-BHC	0.02 U	0.02 U	0.02 U	0.02 U
Delta-BHC	0.02 U	0.02 U	0.02 U	0.02 U
Gamma-BHC (Lindane)	0.01 U	0.01 U	0.01 U	0.01 U
Heptachlor	0.01 U	0.01 U	0.01 U	0.01 U
Aldrin	0.01 U	0.01 U	0.01 U	0.01 U
Heptachlor Epoxide	0.05 U	0.05 U	0.05 U	0.05 U
Endosulfan I	0.03 U	0.03 U	0.03 U	0.03 U
Dieldrin	0.02 U	0.02 U	0.02 U	0.02 U
4,4-DDE	0.02 U	0.02 U	0.02 U	0.02 U
Endrin	0.03 U	0.03 U	0.03 U	0.03 U
Endosulfan II	0.02 U	0.02 U	0.02 U	0.02 U
4,4-DDD	0.02 U	0.02 U	0.02 U	0.02 U
Endosulfan Sulfate	0.1 U	0.1 U	0.1 U	0.1 U
4,4-DDT	0.03 U	0.03 U	0.03 U	0.03 U
Endrin Aldehyde	0.05 U	0.05 U	0.05 U	0.05 U
Toxaphene	1.2 U	1.2 U	1.2 U	1.2 U
Alpha-Chlordane	0.02 U	0.02 U	0.02 U	0.02 U
Gamma-Chlordane	0.02 U	0.02 U	0.02 U	0.02 U
Methoxychlor	0.2 U	0.2 U	0.2 U	0.2 U
Endrin Ketone	0.05 U	0.05 U	0.05 U	0.05 U

µg/L - Micrograms per liter

U - Compound was analyzed for but not detected

Table 7. Summary of Metals Detected in Ground Water Onsite, Former Duralab Property, Brooklyn, New York.

Parameter (Concentrations in mg/L)	Sample Designation:		MW-1	MW-2	LMW-13	LMW-25
	Sample Date:		8/28/98	8/28/98	8/28/98	8/28/98
	NYSDEC AWQSGs ⁽¹⁾ (mg/L)					
Aluminum	--		20.4	1.580	11.8	2.98
Antimony	0.003		0.0031	0.0031	0.0030 U	0.0030 U
Arsenic	0.025		0.0164	0.0035 U	0.0035 U	0.0035 U
Barium	1.0		0.932	0.081	0.1270	0.0591
Beryllium	0.003		0.0014	0.0002 U	0.0008	0.0002 U
Cadmium	0.01		0.0023	0.0031	0.0093	0.0038
Calcium	--		155	67.0	38.0	34.7
Chromium	0.05		0.0646	0.0060	0.0442	0.0086
Cobalt	--		0.0183	0.0037	0.0098	0.0028
Copper	0.2		0.0826	0.0139	0.0439	0.0224
Iron	0.3		32.0	3.18	19.2	5.22
Lead	0.025		2.84	0.0066	0.0121	0.0091
Magnesium	35		24.4	10.3	14.6	8.31
Manganese	0.3		5.11	6.81	27.9	2.43
Mercury	0.002		0.0006	0.0001	0.0001	0.0001
Nickel	--		0.0824	0.0115	0.0424	0.0110
Potassium	--		9.09	5.70	5.85	5.37
Selenium	0.01		0.0042	0.0036 U	0.0077	0.0036 U
Silver	0.05		0.0010 U	0.0010 U	0.0016	0.0010 U
Sodium	20		36.0	29.9	18.0	13.9
Thallium	0.004		0.0037 U	0.0037 U	0.0037 U	0.0037 U
Vanadium	--		0.0499	0.0049	0.0288	0.0089
Zinc	0.3		0.688	0.0175	0.0568	0.0262

U - Compound was analyzed for but not detected

-- No NYSDEC AWQSG available

⁽¹⁾ - New York State Department of Environmental Conservation Ambient-Water
Quality Standards or Guidelines

Bold - Data highlighted in Bold represent detections that exceed the NYSDEC AWQSGs.

Table 8. Monitoring Point Physical and Analytical Data, Former Duralab Property, Brooklyn, New York.

Physical Data			
Monitoring Point Designation	Screen Length (feet)	Depth to Ground Water (feet bls)	Top of Screen (feet bls)
SVE-1	10	10	5
AS-1	5	10	16
MP-1	10	10	5
MP-2	10	10	5
MP-3	10	10	5
MP-4	10	10	5

Note:

bls - Below land surface

Table 9. SVE Pilot Test Study Results, Former Duralab Property, Brooklyn, New York.

Test Performed on July 28, 1998

Time	Elapsed Time (minutes)	SVE Flow Rate (CFM)	Vacuum @ SVE Extraction Well (in. w.c.)	AS Flow Rate (CFM)	Pressure @ AS Well (p.s.i.)	Monitoring Point Designation	Distance From SVE Extraction Well (feet)	Depth to Water (feet)	Dissolved Oxygen Conc. (ppm)	Oxidation Reduction Potential (mV)	Monitoring Point Vacuum Response (in. w.c.)	SVE Discharge PID Conc. (ppm)	SVE Discharge PID Conc. after Dilution (ppm)	Analytical Tedlar Bag Total VOC Conc. (ppm)	Log of Vacuum Response
10:15 (base line)	0	0	0	0	0	SVE-1	0.0	NM	NM	NM	NM	0	0	NA	NC
						AS-1	5.0	NM	NM	NM	NM				NC
						MP-1	5.0	13.32	0.1	-179	0.0				NC
						MP-2	9.8	13.19	0.1	-175	0.0				NC
						MP-3	15.2	13.29	0.1	-185	0.0				NC
						MP-4	20.8	13.63	0.1	-177	0.0				NC
11:15	60	25	22	0	0	SVE-1	0.0	NM	NM	NM	-13	NM	NM	NA	1.11
						AS-1	5.0	NM	NM	NM	0.0				NC
						MP-1	5.0	NM	NM	NM	-4.5				0.65
						MP-2	9.8	NM	NM	NM	-2.7				0.43
						MP-3	15.2	NM	NM	NM	-1.7				0.23
						MP-4	20.8	NM	NM	NM	-1.1				0.04
11:30	75	25	22	0	0	SVE-1	0.0	NM	NM	NM	-13	NM	NM	NA	1.11
						AS-1	5.0	NM	NM	NM	0.0				NC
						MP-1	5.0	NM	NM	NM	-4.6				0.66
						MP-2	9.8	NM	NM	NM	-2.6				0.41
						MP-3	15.2	NM	NM	NM	-1.6				0.20
						MP-4	20.8	NM	NM	NM	-1.1				0.04
12:00	105	25	22	0	0	SVE-1	0.0	NM	NM	NM	-13	7.5	1.3	NA	1.11
						AS-1	5.0	NM	NM	NM	0.0				NC
						MP-1	5.0	NM	NM	NM	-4.6				0.66
						MP-2	9.8	NM	NM	NM	-2.6				0.41
						MP-3	15.2	NM	NM	NM	-1.6				0.20
						MP-4	20.8	NM	NM	NM	-1.1				0.04
12:30	135	50	53	0	0	SVE-1	0.0	NM	NM	NM	-50	4.5	1.0	NA	1.70
						AS-1	5.0	NM	NM	NM	0.0				NC
						MP-1	5.0	NM	NM	NM	-8.9				0.95
						MP-2	9.8	NM	NM	NM	-4.7				0.67
						MP-3	15.2	NM	NM	NM	-3.5				0.34
						MP-4	20.8	NM	NM	NM	-2.4				0.38
13:30	195	30	23	3	11	SVE-1	0.0	NM	NM	NM	-20	5.9	2.0	NA	1.30
						AS-1	5.0	NM	NM	NM	57.1 p.s.i.				NC
						MP-1	5.0	13.27	0.1	-242	-4.9				0.69
						MP-2	9.8	13.19	0.1	-242	-2.5				0.40
						MP-3	15.2	13.30	0.1	-239	-1.9				0.28
						MP-4	20.8	13.63	0.1	-224	-0.9				-0.05
14:00	225	30	23	3	11	SVE-1	0.0	NM	NM	NM	-20	5.7	2.0	7072 (VOCs) 6500 (TCE)	1.30
						AS-1	5.0	NM	NM	NM	57.1 p.s.i.				NC
						MP-1	5.0	13.27	0.1	-242	-4.9				0.69
						MP-2	9.8	13.19	0.1	-242	-2.5				0.40
						MP-3	15.2	13.30	0.1	-239	-1.9				0.28
						MP-4	20.8	13.63	0.1	-224	-0.9				-0.05
14:30	255	30	23	5	11	SVE-1	0.0	NM	NM	NM	-21	4.9	1.8	NA	1.32
						AS-1	5.0	NM	NM	NM	60.3 p.s.i.				NC
						MP-1	5.0	13.27	0.1	-302	-4.7				0.67
						MP-2	9.8	13.16	0.1	-295	-2.8				0.45
						MP-3	15.2	13.22	0.1	-294	-1.7				0.23
						MP-4	20.8	13.62	0.1	-286	-1.2				0.08

Legend:

in. w.c. - Inches of water column
 ppm - Parts per million
 NM - Not measured
 NA - Not analyzed
 NC - Not calculated

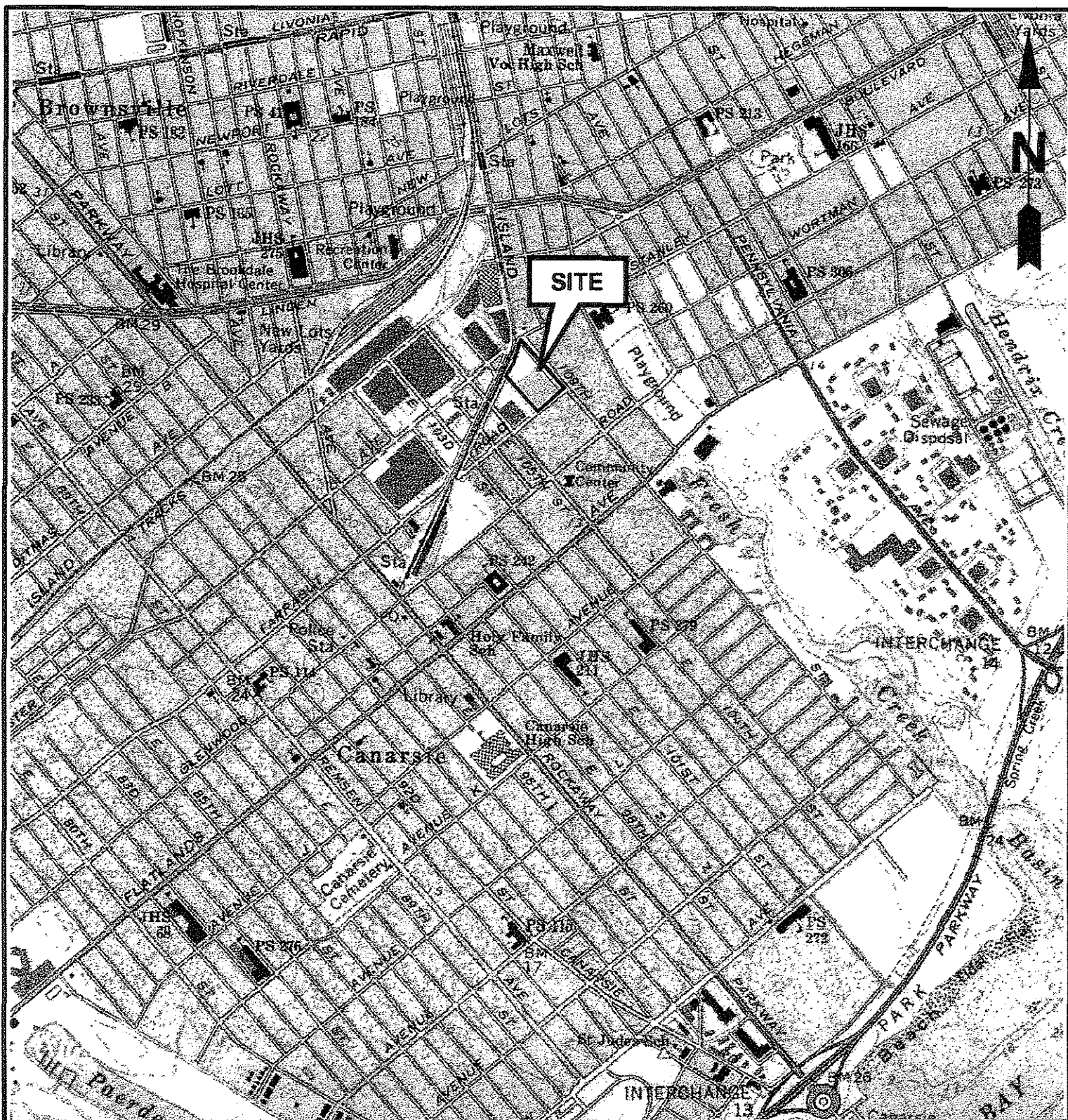
Table 10. SVE/AS Pilot Study Test Analytical Data, Former Duralab Property, Brooklyn, New York.

Sample Designation: SVE-EFF	
Sample Date: 7/28/98	
Parameter (Concentrations in ppbv)	
Dichlorodifluoromethane	3 U
Freon 114	3 U
Chloromethane	3 U
Vinyl Chloride	4 D
Bromomethane	3 U
Chloroethane	3 U
Trichlorofluoromethane	3 U
1,1-Dichloroethene	3 U
Freon 113	3 U
3-Chloropropene	3 U
Methylene Chloride	3 U
1,1-Dichloroethane	3 U
cis-1,2-Dichloroethene	540 D
Chloroform	3 U
1,1,1-Trichloroethane	3 U
Carbon Tetrachloride	3 U
1,2-Dichloroethane	3 U
Benzene	3 U
Trichloroethene	6500 D
1,2-Dichloropropane	3 U
cis-1,3-Dichloropropene	3 U
Toluene	15 D
trans-1,3-Dichloropropene	3 U
1,1,2-Trichloroethane	3 U
Tetrachloroethene	13 D
1,2-Dibromoethane	3 U
Chlorobenzene	3 U
Ethylbenzene	3 U
p+m-Xylene	3 U
o-Xylene	3 U
Styrene	3 U
1,1,2,2-Tetrachloroethane	3 U
4-Ethyltoluene	3 U
1,3,5-Trimethylbenzene	3 U
1,2,4-Trimethylbenzene	3 U
1,3-Dichlorobenzene	3 U
1,4-Dichlorobenzene	3 U
Benzyl chloride	3 U
1,2-Dichlorobenzene	3 U
1,2,4-Trichlorobenzene	3 U
Hexachlorobutadiene	3 U

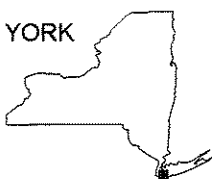
ppbv - Parts per billion by volume

U - Compound was analyzed for but not detected

D - Dilution



NEW YORK



QUADRANGLE LOCATION

Title:

SITE LOCATION MAP

FORMER DURALAB PROPERTY
BROOKLYN, NEW YORK

Prepared For:

FEDERAL EXPRESS CORPORATION

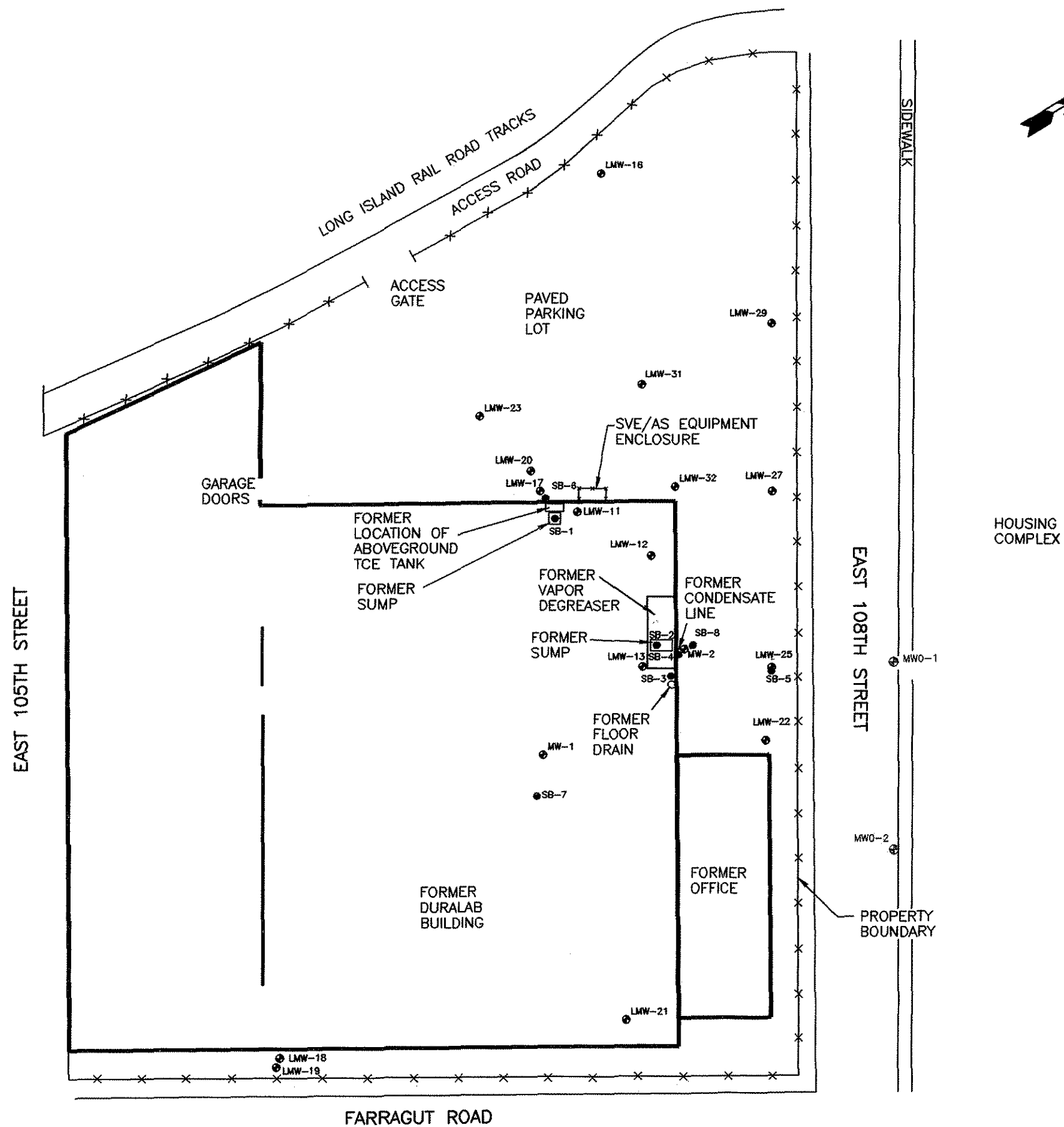
ROUX

ROUX ASSOCIATES INC
Environmental Consulting
& Management

Compiled by:	SG	Date:	3/98
Prepared by:	RK	Scale:	1"=2000'
Project Mgr:	S.G.	Status:	Final
File No:	F0213208	Project:	44402Y

FIGURE

1



LEGEND:

- x — x — CHAIN LINK FENCE
- MW-1 LOCATION AND DESIGNATION OF MONITORING WELL
- SB-1 LOCATION AND DESIGNATION OF SOIL BORING
- TCE TRICHLOROETHENE
- ⊕ MWO-1 LOCATION OF OFFSITE MONITORING WELL



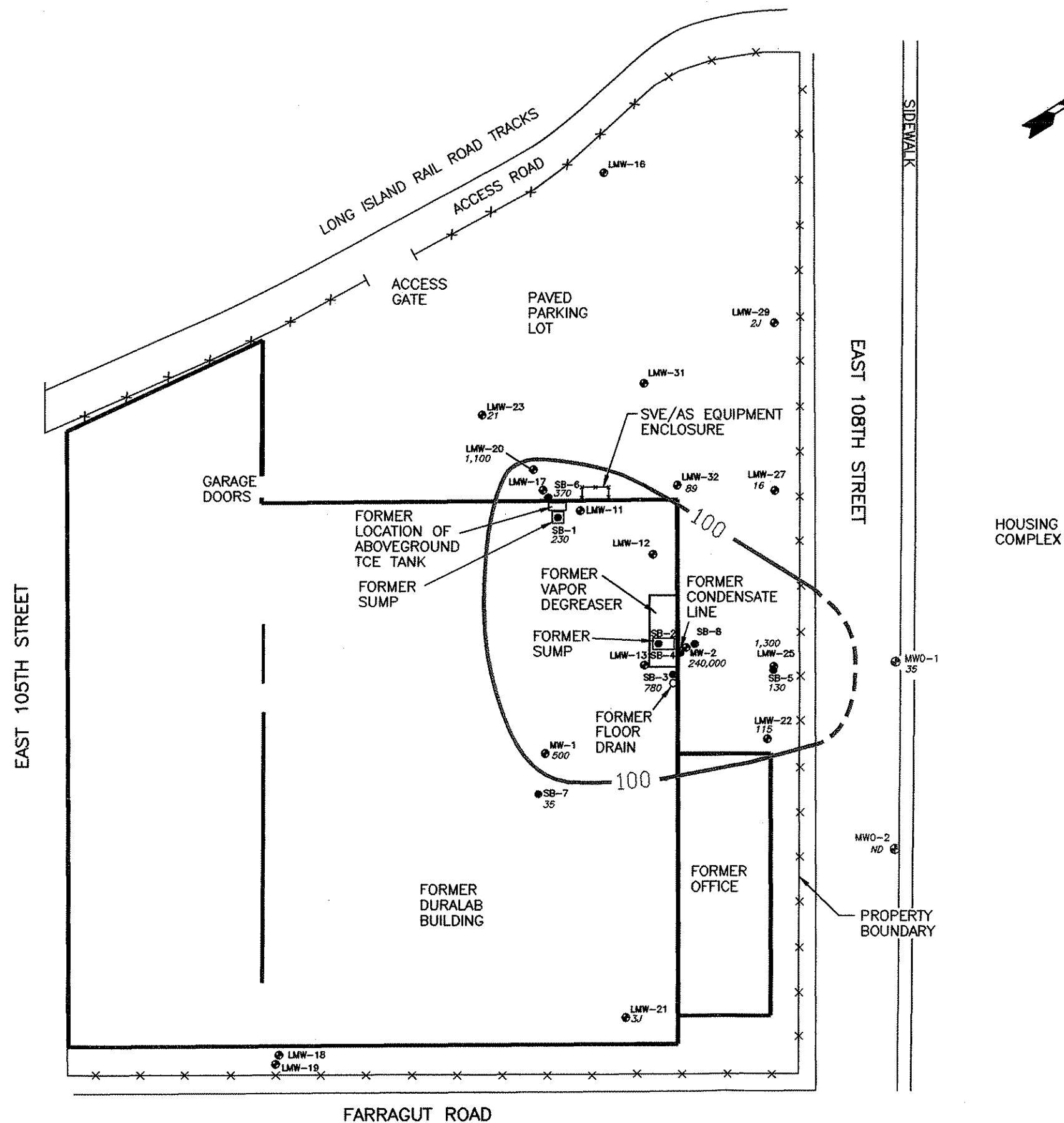
SITE PLAN

PERFORMANCE ANALYSIS AND
DESIGN MODIFICATION PLAN
FORMER DURALAB PROPERTY
BROOKLYN, NEW YORK

Prepared For: FEDERAL EXPRESS CORPORATION
ONE CENTURY DRIVE
PARSIPPANY, NEW JERSEY

ROUX
ROUX ASSOCIATES INC
Environmental Consulting
& Management

Compiled by: S.J.G.	Date: 8/98	FIGURE 2
Prepared by: B.H.C.	Scale: As Shown	
Project Mgr: S.J.G.	Status: Final	
File No: F0213204	Project: 44402Y	



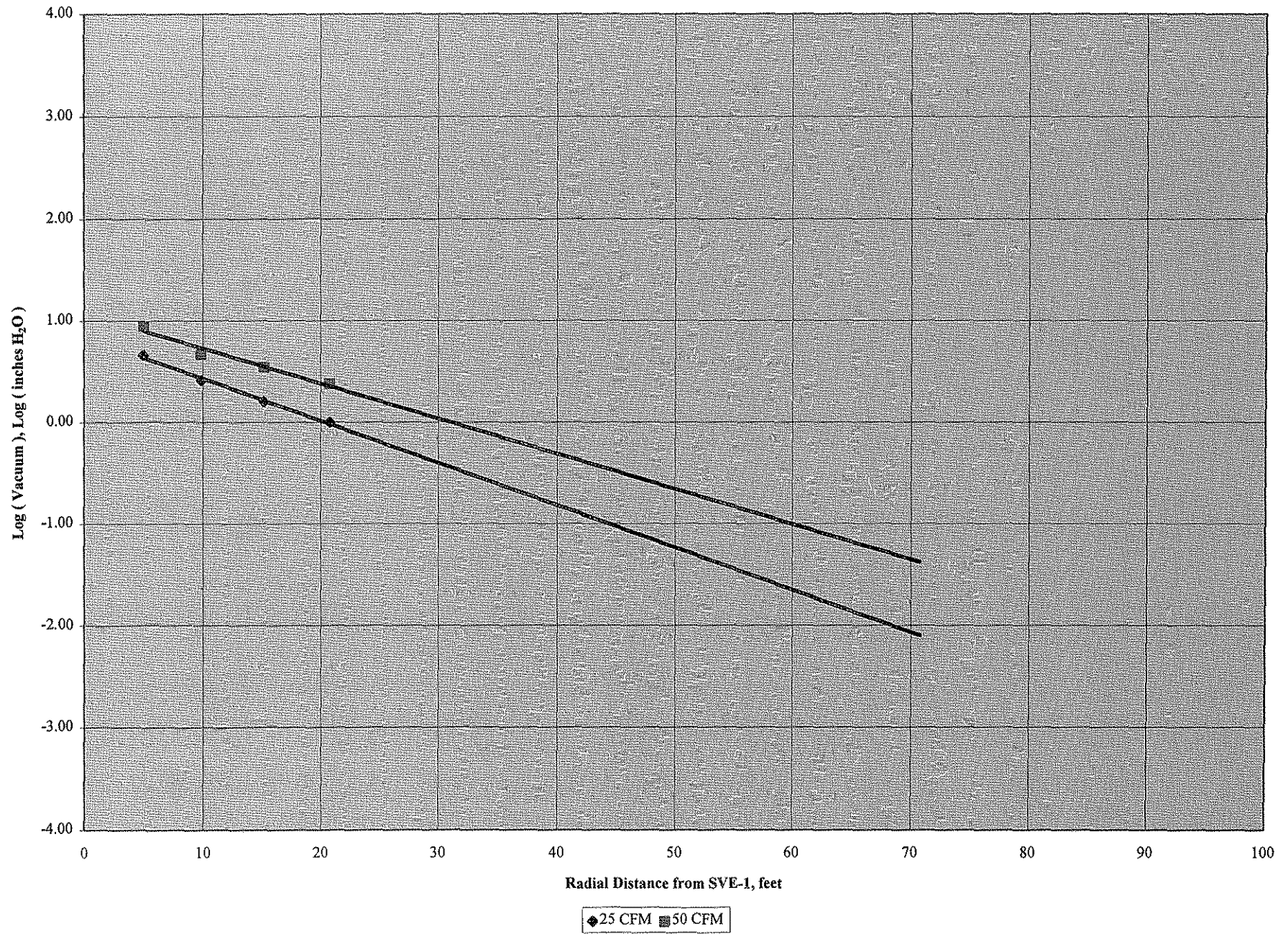
LEGEND:

- x—x— CHAIN LINK FENCE
- MW-1 LOCATION AND DESIGNATION OF MONITORING WELL
- SB-1 LOCATION AND DESIGNATION OF SOIL BORING
- TCE TRICHLOROETHENE
- 35 TCE CONCENTRATIONS IN MICROGRAMS PER LITER (ug/L)
- 100— LINE OF EQUAL TCE CONCENTRATIONS IN ug/L
- ✓ ESTIMATED VALUE
- MWO-1 LOCATION OF OFFSITE MONITORING WELL



Title:			
TRICHLOROETHENE CONCENTRATIONS DETECTED IN GROUND WATER			
PERFORMANCE ANALYSIS AND DESIGN MODIFICATION PLAN FORMER DURALAB PROPERTY BROOKLYN, NEW YORK			
Prepared For: FEDERAL EXPRESS CORPORATION ONE CENTURY DRIVE PARSIPPANY, NEW JERSEY			
ROUX ROUX ASSOCIATES INC Environmental Consulting & Management	Compiled by: S.J.G.	Date: 9/98	FIGURE 3
	Prepared by: B.H.C.	Scale: As Shown	
	Project Mgr: S.J.G.	Status: Final	
	File No: F0213205	Project: 44402Y	

Figure 4. Log of Vacuum Response vs. Radial Distance from SVE-1



**Figure 5. Water Level Rise vs.
Radial Distance From AS-1**

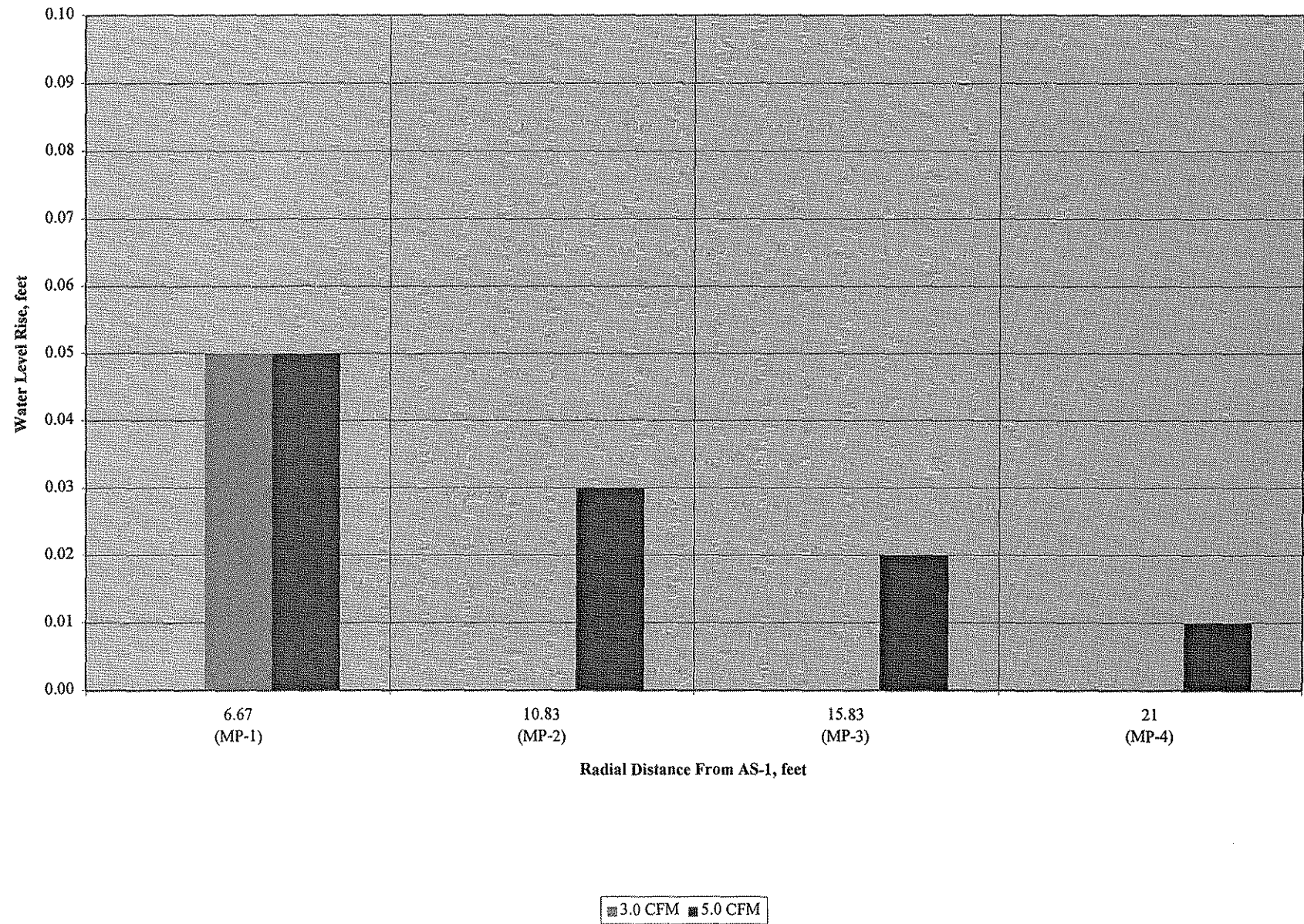
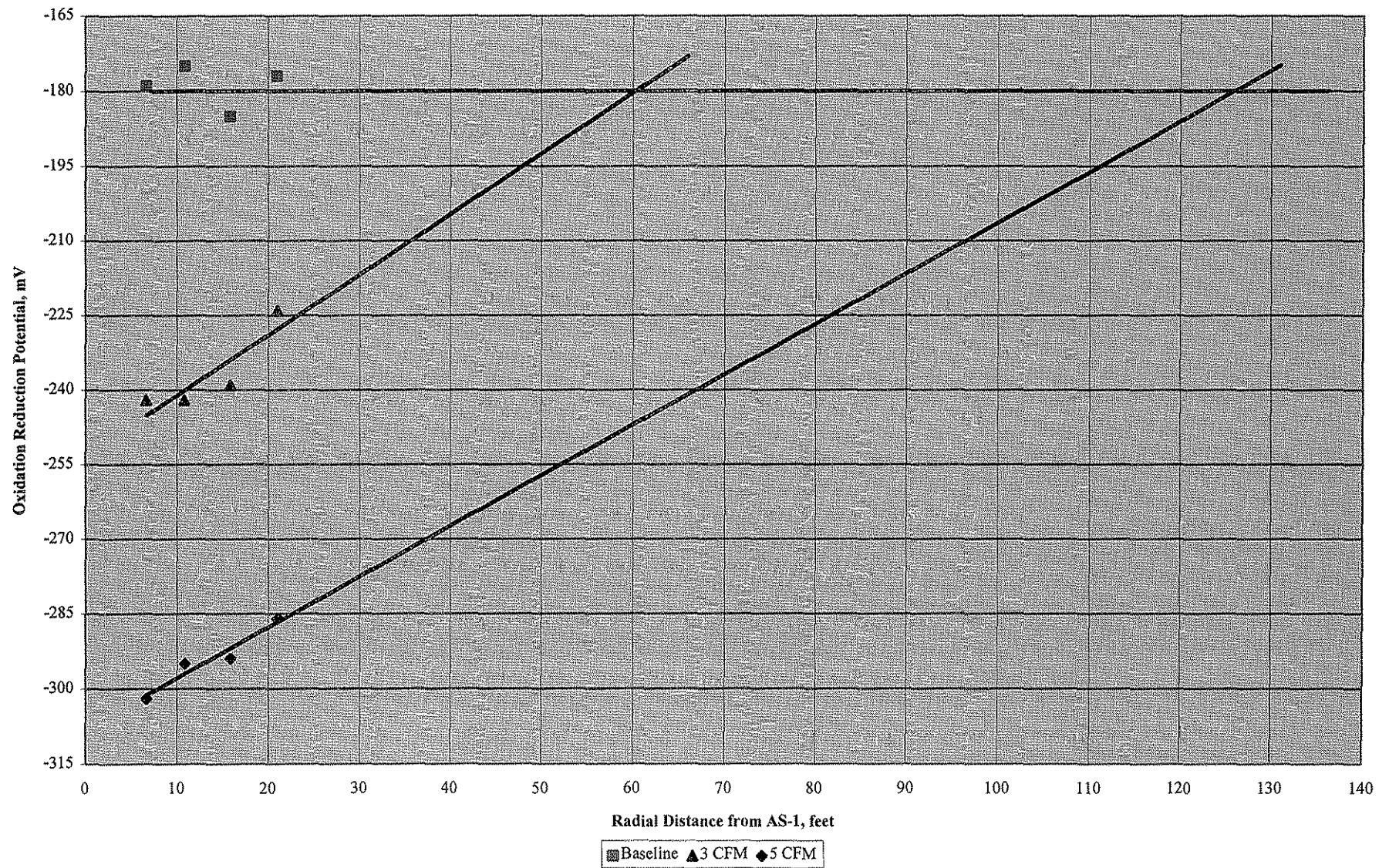
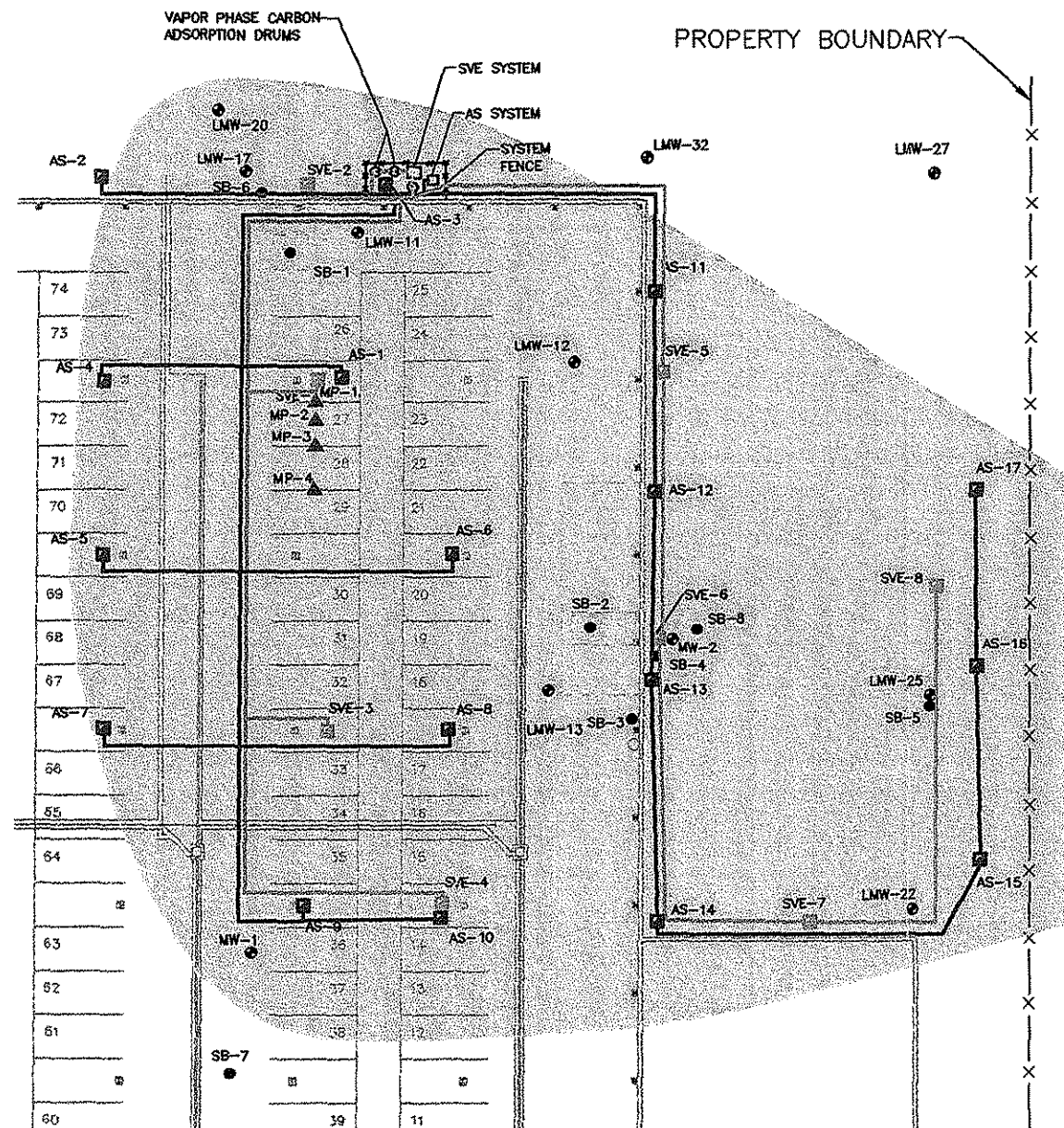


Figure 6. Oxidation Reduction Potential vs. Radial Distance from AS-1





EAST 108TH STREET

LEGEND:

- X—X— CHAIN LINK FENCE
- FORMER BUILDING STRUCTURE
- MW-1 LOCATION AND DESIGNATION OF EXISTING MONITORING WELL
- SB-1 LOCATION AND DESIGNATION OF FORMER SOIL BORING
- APPROXIMATE EXTENT OF SOURCE AREA
- SVE-1 LOCATION AND DESIGNATION OF PROPOSED SVE WELL
- AS-1 LOCATION AND DESIGNATION OF PROPOSED AIR SPARGE WELL
- MP-1 LOCATION AND DESIGNATION OF PILOT MONITORING POINT
- SOIL VAPOR EXTRACTION PIPING
- AIR SPARGE PIPING

NOTES:

1. SITE PLAN ADAPTED FROM "NEW (PARTIAL FLOOR PLAN ONE," ENGINEERING DESIGN ASSOCIATES, JUNE 1997. REVISED NOVEMBER 1997 AS PART OF THE PROPOSED RENOVATION FOR THE FEDERAL EXPRESS CITY STATION FACILITY (FORMER DURALAB PROPERTY).



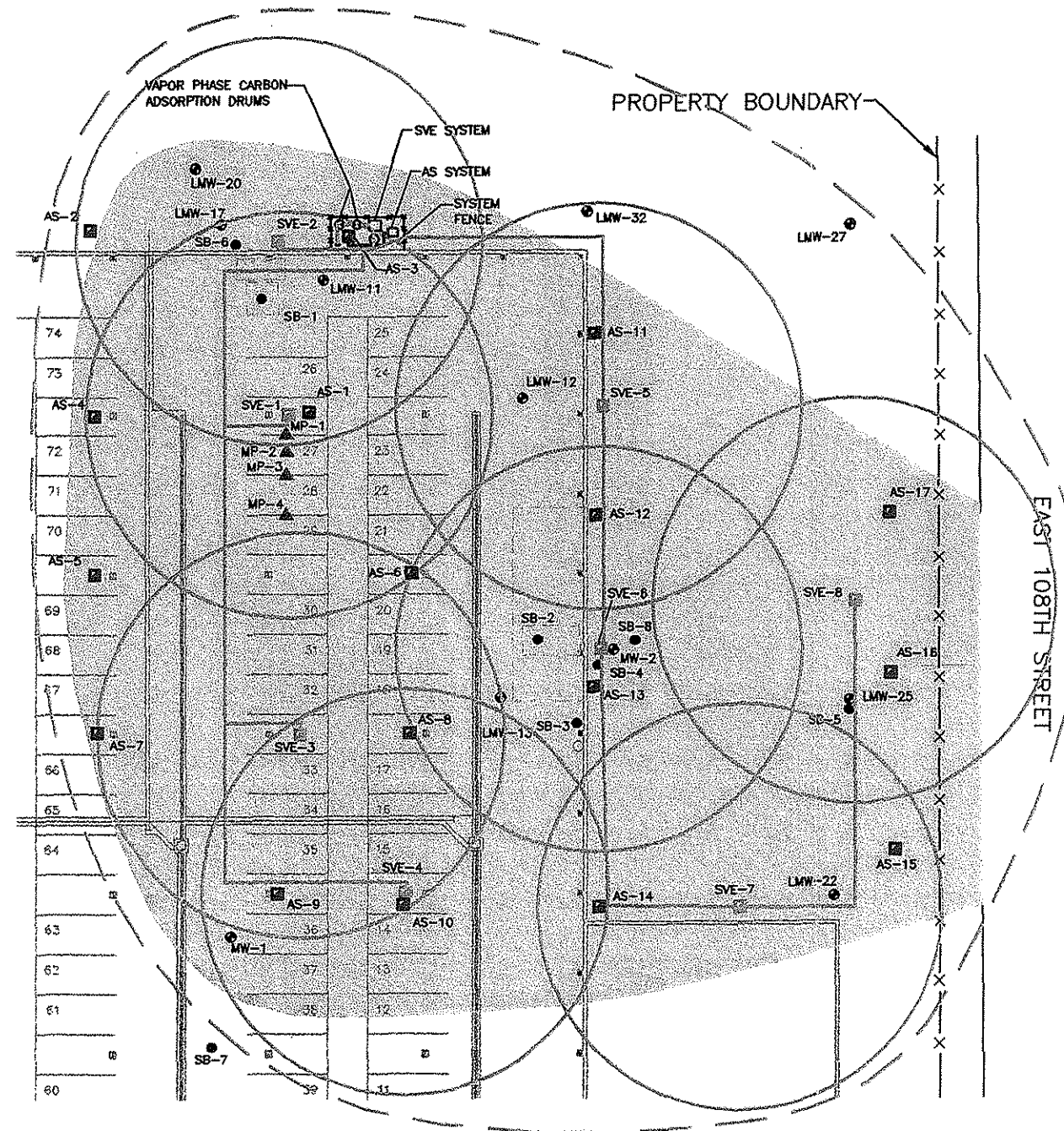
Title:

MODIFIED SVE AND AS SYSTEM WELL, PIPING AND EQUIPMENT LAYOUT

PERFORMANCE ANALYSIS AND
DESIGN MODIFICATION PLAN
FORMER DURALAB PROPERTY
BROOKLYN, NEW YORK

Prepared For: FEDERAL EXPRESS CORPORATION
ONE CENTURY DRIVE
PARSIPPANY, NEW JERSEY

ROUX ROUX ASSOCIATES INC Environmental Consulting & Management	Compiled by: O.R.	Date: 9/98	FIGURE 7
	Prepared by: O.R.	Scale: As Shown	
	Project Mgr: S.J.G.	Status: FINAL	
	File No: F0213201	Project: 44402Y	



LEGEND:

- x—x— CHAIN LINK FENCE
- — — — — FORMER BUILDING STRUCTURE
- MW-1 LOCATION AND DESIGNATION OF EXISTING MONITORING WELL
- SB-1 LOCATION AND DESIGNATION OF FORMER SOIL BORING
- APPROXIMATE EXTENT OF SOURCE AREA
- SVE-1 LOCATION AND DESIGNATION OF PROPOSED SVE WELL
- AS-1 LOCATION AND DESIGNATION OF PROPOSED AIR SPARGE WELL
- MP-1 LOCATION AND DESIGNATION OF PILOT MONITORING POINT
- SOIL VAPOR EXTRACTION PIPING
- ANTICIPATED SVE WELL EROI
- COMBINED ANTICIPATED SVE WELL EROI

NOTES:

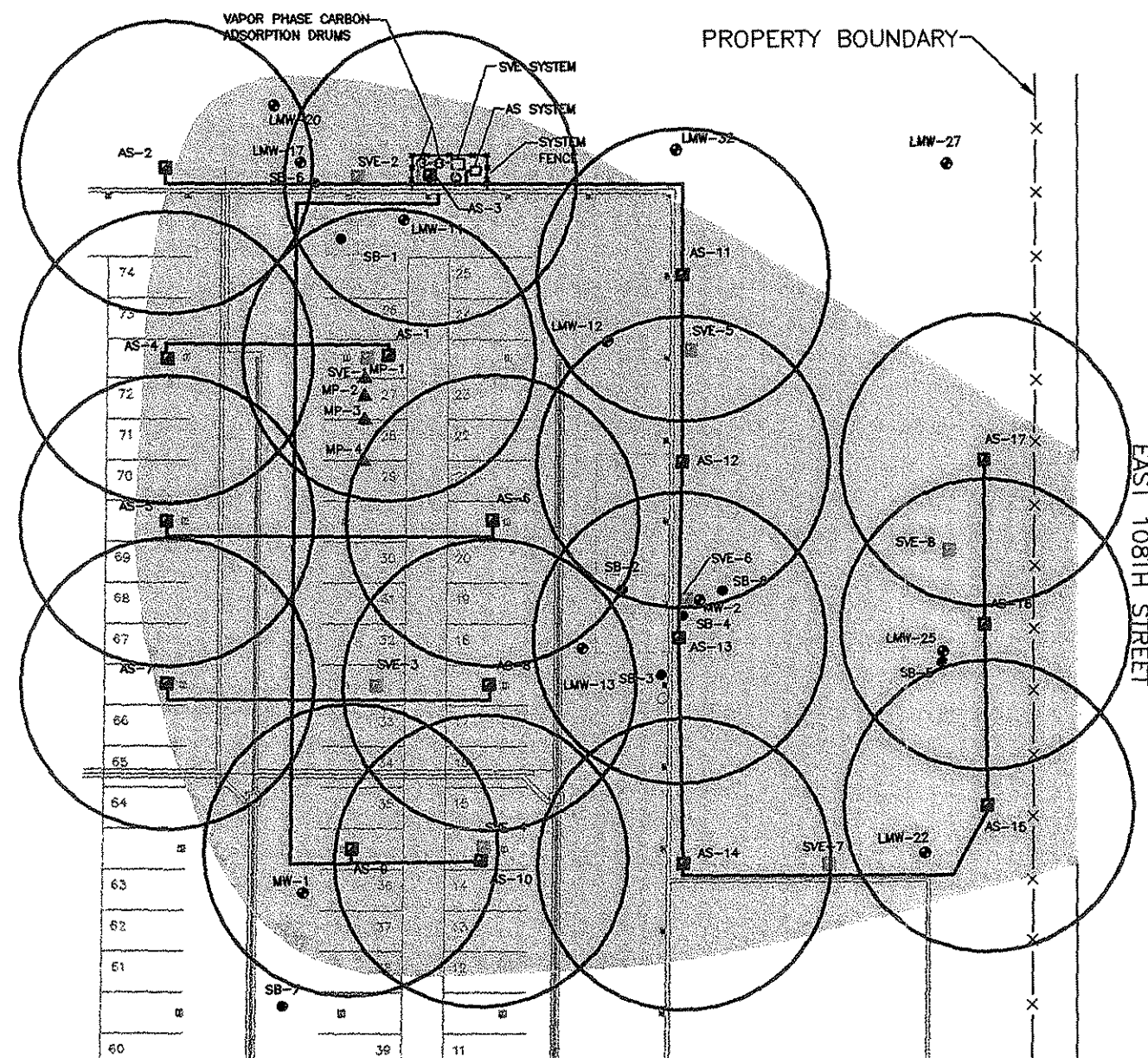
1. SITE PLAN ADAPTED FROM "NEW (PARTIAL FLOOR PLAN ONE," ENGINEERING DESIGN ASSOCIATES, JUNE 1997. REVISED NOVEMBER 1997 AS PART OF THE PROPOSED RENOVATION FOR THE FEDERAL EXPRESS CITY STATION FACILITY (FORMER DURALAB PROPERTY).



Title: ANTICIPATED SVE WELL EFFECTIVE RADIUS OF INFLUENCE FOR THE SVE AND AS SYSTEM
 PERFORMANCE ANALYSIS AND DESIGN MODIFICATION PLAN
 FORMER DURALAB PROPERTY
 BROOKLYN, NEW YORK

Prepared For: FEDERAL EXPRESS CORPORATION
 ONE CENTURY DRIVE
 PARSIPPANY, NEW JERSEY

ROUX	Compiled by: O.R.	Date: 9/98	FIGURE
ROUX ASSOCIATES INC.	Prepared by: O.R.	Scale: As Shown	0



LEGEND:

- X—X— CHAIN LINK FENCE
- FORMER BUILDING STRUCTURE
- MW-1 LOCATION AND DESIGNATION OF EXISTING MONITORING WELL
- SB-1 LOCATION AND DESIGNATION OF FORMER SOIL BORING
- APPROXIMATE EXTENT OF SOURCE AREA
- SVE-1 LOCATION AND DESIGNATION OF PROPOSED SVE WELL
- AS-1 LOCATION AND DESIGNATION OF PROPOSED AIR SPARGE WELL
- MP-1 LOCATION AND DESIGNATION OF PILOT MONITORING POINT
- AIR SPARGE PIPING
- AS ANTICIPATED WELL EROI

NOTES:

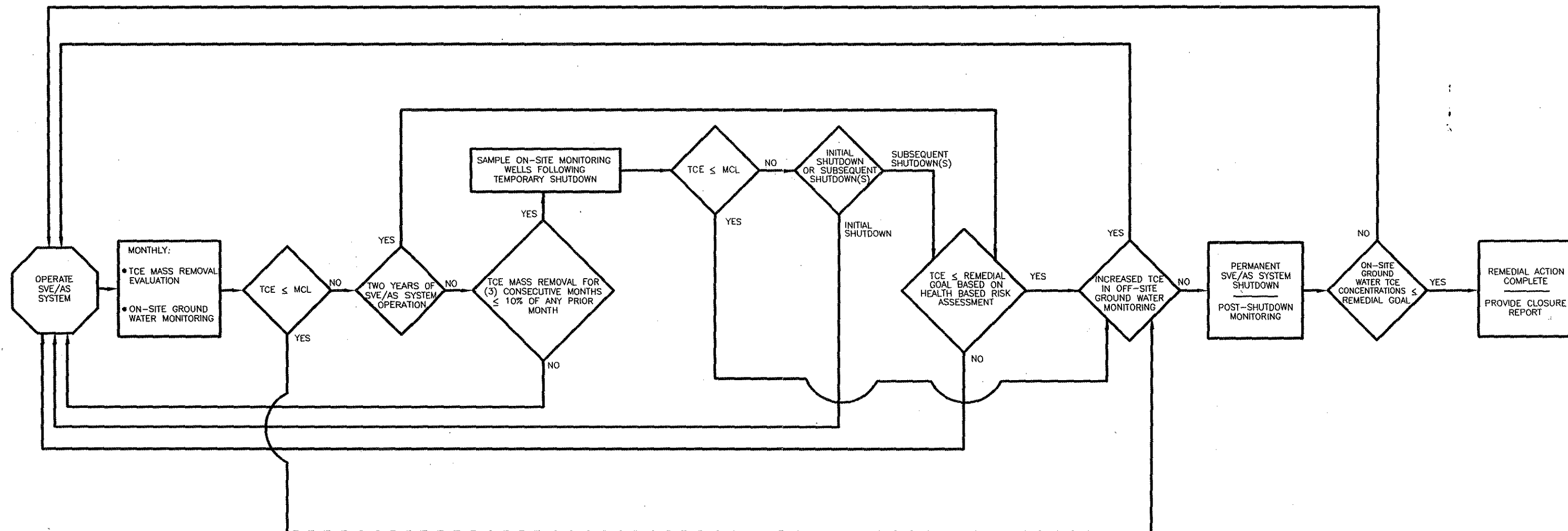
1. SITE PLAN ADAPTED FROM "NEW (PARTIAL FLO PLAN ONE," ENGINEERING DESIGN ASSOCIATES, JUNE 1997. REVISED NOVEMBER 1997 AS PART OF THE PROPOSED RENOVATION FOR THE FEDI EXPRESS CITY STATION FACILITY (FORMER DUR PROPERTY).



Title: ANTICIPATED AS WELL EFFECTIVE RADIUS OF INFLUENCE FOR THE SVE AND AS SYSTEM
PERFORMANCE ANALYSIS AND DESIGN MODIFICATION PLAN
FORMER DURALAB PROPERTY
BROOKLYN, NEW YORK

Prepared For: FEDERAL EXPRESS CORPORATION
ONE CENTURY DRIVE
PARSIPPANY, NEW JERSEY

ROUX ROUX ASSOCIATES INC Environmental Consulting & Management	Compiled by: O.R.	Date: 9/98
	Prepared by: O.R.	Scale: As Shown
	Project Mgr: S.J.G.	Status: FINAL
	File No: F0213203	Project: 44402Y



Title:			
PADMP DECISION CHART			
PERFORMANCE ANALYSIS AND DESIGN MODIFICATION PLAN FORMER DURALAB PROPERTY BROOKLYN, NEW YORK			
Prepared For: FEDERAL EXPRESS CORPORATION ONE CENTURY DRIVE PARSIPPANY, NEW JERSEY			
ROUX ROUX ASSOCIATES INC Environmental Consulting & Management	Compiled by: S.J.G.	Date:	9/98
	Prepared by: R.K.	Scale:	As Shown
	Project Mgr: S.J.G.	Status:	Final
	File No: F0213206	Project:	44402Y