PROPOSED REMEDIAL ACTION PLAN
KLIEGMAN BROTHERS
Operable Unit No. 2
Glendale, New York City, Queens County, New York
Site No. 2-41-031

February 2008

Prepared by:

Division of Environmental Remediation
New York State Department of Environmental Conservation

PROPOSED REMEDIAL ACTION PLAN

Kliegman Brothers Site

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SECTION 1: SUMMARY AND PURPOSE OF THE PROPOSED PLAN

The New York State Department of Environmental Conservation (the Department, or NYSDEC), in consultation with the New York State Department of Health (NYSDOH), is proposing a remedy for the Kliegman Brothers Site Operable Unit No. 2, which consists of contaminated groundwater and off-site soil vapor contamination. The presence of hazardous waste has created significant threats to human health and/or the environment that are addressed by this proposed remedy. As more fully described in Sections 3 and 5 of this document, operations of a dry cleaning supply company have resulted in the disposal of hazardous wastes, including tetrachloroethene. These wastes have contaminated the groundwater and soil vapor at the site, and have resulted in:

- a significant threat to human health associated with potential exposure to contaminated groundwater and indoor air;
- a significant environmental threat associated with the current and potential impacts of contaminants to groundwater.

To eliminate or mitigate these threats, the Department proposes in situ chemical treatment of the concentrated plume area with continued soil vapor monitoring, and installation of residential soil vapor intrusion mitigation systems as needed. Installation and operation of an extraction well to induce a hydraulic gradient to enhance the effectiveness of the in situ chemical treatment is planned, yet may not be implementable due to the density of land use in the area. The feasibility of this option will be examined during the remedial design.

The proposed remedy, discussed in detail in Section 8, is intended to attain the remediation goals identified for this site in Section 6. The remedy must conform with officially promulgated standards and criteria that are directly applicable, or that are relevant and appropriate. The selection of a remedy must also take into consideration guidance, as appropriate. Standards, criteria and guidance are hereafter called SCGs.

This Proposed Remedial Action Plan (PRAP) identifies the preferred remedy, summarizes the other alternatives considered, and discusses the reasons for this preference. The Department will select a final remedy for the site only after careful consideration of all comments received during the public comment period.

The Department has issued this PRAP as a component of the Citizen Participation Plan developed pursuant to the New York State Environmental Conservation Law and Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York (6 NYCRR) Part 375. This document is a summary of the information that can be found in greater detail in the "February 2004 Remedial Investigation (RI) Report," "September 2005 RI Addendum Report", "July 2006 Soil Vapor Investigation Report", and the "November 2006 Feasibility Study Report," and other relevant documents. The public is encouraged to review the project documents, which are available at the following repositories:

Queens Borough Public Library
Glendale Branch
78-60 73rd Place
Glendale, NY 11385
Phone: (718) 821-4980
hours: M 1-8, T 1-6, W 10-6, Th 1-8, F 1-6
Sat. and Sun. closed

New York State Department of Environmental Conservation - Central Office
625 Broadway, Floor 12
Albany, NY 12233-7015
Attn: Jim Quinn
(518) 402-9774
1-800-342-9296
M - F 8:00 - 4:45

The Department seeks input from the community on all PRAPs. A public comment period has been set from February 15 through March 17 to provide an opportunity for public participation in the remedy selection process. A public meeting is scheduled for February 27th at the Glendale Public School 119 beginning at 7:00 PM.

At the meeting, the results of the RI/FS will be presented along with a summary of the proposed remedy. After the presentation, a question-and-answer period will be held, during which verbal or written comments may be submitted on the PRAP. Written comments may also be sent to Mr. Quinn at the above address through March 17, 2008.

The Department may modify the proposed remedy or select another of the alternatives presented in this PRAP, based on new information or public comments. Therefore, the public is encouraged to review and comment on all of the alternatives identified here.

Comments will be summarized and addressed in the responsiveness summary section of the Record of Decision (ROD). The ROD is the Department's final selection of the remedy for this site.

SECTION 2: SITE LOCATION AND DESCRIPTION

The Kliegman Brothers Site is located in an urban setting at 76-01 77th Avenue in Queens County, New York City (Figure 1). The site is bordered to the north by the Long Island Railroad. The off-site area is generally residential, and residences border the site to the east, west and south; Public School 119 is located to the west.

The geology of the area consists of concrete or asphalt underlain by reworked native materials to a depth of approximate 2 feet below ground surface (bgs.) Beneath this material is silty sand with localized sandy clay seams to a depth of approximately 10 feet bgs. From 10 feet bgs to approximately 150 feet bgs, sand with variable amounts of gravel was encountered. Beneath the eastern portion of the Kliegman property, a brown silty clay layer, with variable amounts of sand was present. This silty clay layer occurs at approximately 10 to 15 feet bgs and is approximately 5 feet thick until it appears to pinch out. Perched groundwater was observed above this silty clay layer at a depth of 10 to 12 feet bgs.

The groundwater table occurs at the site at approximately 70 feet bgs within the upper glacial aquifer. No public water supplies draw water from this source. Horizontal hydraulic gradients in shallow groundwater are very gentle. Groundwater flow direction varies from northerly to southerly and therefore, in general, the groundwater flow direction in shallow groundwater was determined to be variable, possibly due to the very gentle horizontal hydraulic gradients and seasonal fluctuations in the water table. There is little to no discernible vertical hydraulic gradient observed between the deep and shallow groundwater wells.

Operable Unit (OU) No. 2 which is the subject of this document, consists of a portion of the remedy and will address the groundwater both on-site and off-site as well as the soil vapor impact off-site. An operable unit represents a portion of the site remedy that for technical or administrative reasons can be addressed separately to eliminate or mitigate a release, threat of release or exposure pathway resulting from the site contamination.

OU No.1 of the Kliegman Brothers project addresses on-site contaminated soils, which are the source of the contaminated groundwater and soil gas being addressed by OU No.2. The remedy for OU No.1 was selected in a March 2006 Record of Decision (ROD). The OU No.1 ROD calls for an expansion and enhancement of the soil vapor extraction (SVE) system previously installed at the site as an interim remedial measure (IRM). The expanded SVE system has been installed at the site and has begun operation.

SECTION 3: SITE HISTORY

3.1: Operational/Disposal History

The site was formerly owned by Kliegman Brothers, Inc, and was used as a warehouse and distribution center for laundry and dry-cleaning supplies from the 1950s through the 1990s. The site contained two 6,000 gallon above ground storage tanks (ASTs) which were used to store tetrachloroethene (PCE) (Figure 2). The tanks have since been removed from the property. Although these tanks are the presumed source of contamination, it is unknown if, and when, product was released, or whether contamination was due to a single release or a chronic leak problem. Kliegman Brothers ceased operation in 1999. The property was purchased in 2000 and is currently being used as a warehouse.

3.2: Remedial History

In June 2000, the Department first listed the site as a Class 2a site in the Registry of Inactive Hazardous Waste Disposal Sites in New York (the Registry). Class 2a was a temporary classification assigned to a site that had inadequate and/or insufficient data for inclusion in any of the other classifications. In November 2000, the Department listed the site as a Class 2 site in the Registry of Inactive Hazardous Waste Disposal Sites in New York. A Class 2 site is a site where hazardous waste presents a significant threat to the public health or the environment and action is required.

Initial investigations were performed at the site in 1997 and 1998. These investigations were comprised of soil vapor collection and analysis in the area between the building and the railroad, where the PCE storage tanks were located. Additional soil vapor sampling was later performed for a prospective site owner and the NYSDEC in 2000. All of these investigations revealed the presence of PCE, often at high concentrations.

An investigation was performed in 2001 as part of a Voluntary Cleanup Program (VCP) agreement with NYSDEC, and included soil and groundwater sampling as part of a Focused Remedial Investigation/Interim Remedial Measure (FRI/IRM). As part of the study, nine borings and 26 soil samples were collected from beneath the subfloor of the building, approximately 0 - 12 inches below the concrete floor/soil interface.

Between October 2000 and August 2001, the New York State Department of Health (NYSDOH) conducted air sampling in 17 residences east, west, and south of the facility. PCE vapors were detected in 16 of the 17 residences tested.

In September 2002, the site owner discontinued his participation in the VCP, and the NYSDEC initiated a remedial investigation using the state superfund.

SECTION 4: ENFORCEMENT STATUS

Potentially Responsible Parties (PRPs) are those who may be legally liable for contamination at a site. This may include past or present owners and operators, waste generators, and haulers.

The PRPs for the site, documented to date, include: the Kliegman Brothers, Inc. and, the current property owner, Arimax Realty, LLC.

The PRPs declined to implement the RI/FS at the site when requested by the Department. After the remedy is selected, the PRPs will again be contacted to assume responsibility for the remedial program. If an agreement cannot be reached with the PRPs, the Department will evaluate the site for further action under the State Superfund. The PRPs are subject to legal actions by the state for recovery of all response costs the state has incurred.

SECTION 5: SITE CONTAMINATION

A remedial investigation/feasibility study (RI/FS) has been conducted to evaluate the alternatives for addressing the significant threats to human health and the environment.

5.1: Summary of the Remedial Investigation

The purpose of the RI was to define the nature and extent of contamination resulting from previous activities at the site. The RI was conducted between April 2002 to April 2006. The field activities and findings of the investigation are described in the RI report dated February 2004, the RI Addendum dated September 2005 and the Soil Vapor Investigation Report dated July 2006.

The following activities were conducted during the first phase of the RI from April 2002 to August 2002:

- Research of historical information;
- Geophysical survey to determine depth to bedrock;
- Installation of 9 soil borings, finished as monitoring wells, for analysis of soils and groundwater as well as physical properties of soil and hydrogeologic conditions;
- Sampling of the new monitoring wells;
- A survey of public and private water supply wells in the area around the site;
- Collection of 35 indoor air samples from 17 different residences using PCE badge testing method.

The second phase of the RI field activities were conducted between February 2003 to April 2003 and included:

- Installation of 8 soil borings, finished as monitoring wells, for analysis of soils and groundwater as well as physical properties of soil and hydrogeologic conditions;
- Sampling of 8 new plus 9 existing monitoring wells.

The third phase of the RI field activities were conducted between May 2005 to June 2005 and included:

- Installation of 8 soil borings, finished as monitoring wells, for analysis of soils and groundwater as well as hydrogeologic conditions;
- Sampling of 8 new plus 16 existing monitoring wells (two wells could not be sampled.).

The indoor air investigation activities were conducted between February 2005 to April 2006 and included:

- Conducting an inventory of household chemicals present in residences and evaluating their potential to affect air sample results;
- Sampling 47 residential locations and 1 school location;
- Installation of 7 sub-slab depressurization systems.

5.1.1: Standards, Criteria, and Guidance (SCGs)

To determine whether the groundwater, and soil vapor contain contamination at levels of concern, data from the investigation were compared to the following SCGs:

- Groundwater, drinking water, and surface water SCGs are based on the Department's "Ambient Water Quality Standards and Guidance Values" and Part 5 of the New York State Sanitary Code.

- Concentrations of PCE in air were evaluated using the NYSDOH guidance document "Guidance for Evaluating Soil Vapor Intrusion in the State of New York, dated October 2006."

Based on the RI results, in comparison to the SCGs and potential public health and environmental exposure routes, certain media and areas of the site require remediation. These are summarized in Section 5.1.2. More complete information can be found in the RI report, RI Addendum and Soil Vapor Intrusion Investigation Report.

5.1.2: Nature and Extent of Contamination

This section describes the findings of the investigation for all environmental media that were investigated.

As described in the reports, many soil, groundwater and vapor samples were collected to characterize the nature and extent of contamination. As summarized in Table 1, the main categories of contaminants that exceed their SCGs are volatile organic compounds (VOCs). For comparison purposes, where applicable, SCGs are provided for each medium.

Chemical concentrations are reported in parts per billion (ppb) for water and parts per million (ppm) for soil. Air samples are reported in micrograms per cubic meter ($\mu g/m^3$).

Figure 3, Figure 4, and Table 1 summarize the degree of contamination for the contaminants of concern in groundwater and soil vapor and compares the data with the SCGs for the site. The following are the media which were investigated and a summary of the findings of the investigation.

On-site Groundwater

Although most of the site is covered by asphalt, on-site groundwater has been adversely impacted by the soil contamination being addressed through OU No.1. The contaminated soils near the building represent a continuing source of groundwater and soil vapor contamination. PCE has been detected in the groundwater on-site at levels up to 55,000 ppb, and this contamination has migrated off-site. The applicable SCG (Class GA groundwater criteria) is 5 ppb.

Off-Site Impacts

Contaminants have been found off the Kliegman Brothers site as well. Both groundwater and soil vapor/indoor air were found to be impacted.

Figure 3 summarizes the areal extent of PCE contamination in groundwater. Groundwater sampling results indicate that contamination has migrated off-site in all directions. The results for PCE in groundwater off-site ranged from "not detected" (ND) to 75,000 ppb.

Soil vapor samples taken from off-site were also found to be contaminated with PCE. Samples were taken at 10, 18, and 20 feet bgs. Similar to the on-site soil vapor results, the highest concentrations were found at 18 feet bgs.

Detected concentrations of PCE in soil vapor prompted the NYSDEC to conduct indoor air and sub-slab air sampling in residences around the Kliegman Brothers site. A soil vapor intrusion investigation of 47 residences and Public School 119 between February 2005 through April 2006 consisted of seven separate sampling events. In response to the sampling results, owners of 12 properties located south and west of the former Kliegman Brothers facility were offered sub-slab depressurization systems; results from beneath PS119 indicated no action was necessary for that structure. Five property owners declined the offer of a system, but seven such systems were installed during this effort, bringing the total to date for the project to eight. These systems (similar to radon removal systems) reduce the air pressure under a building relative to the building's interior, and thereby prevent vapors from migrating upward into the building. Analysis of the soil vapor quality in this area will be a continuing effort, and future sampling results will be used to determine whether additional homes may be sampled to determine if more properties may benefit from mitigation systems.

Unlike many sites, off-site soil vapor contamination at this site is not caused by volatilization and upward migration of contamination released from the groundwater. The depth to groundwater and the area's geology combine to prevent impacts to structures overlying the groundwater plume. Rather, impacts to surrounding structures are the result of vapor-phase contamination migrating from the source area, located on the Kliegman site.

The extent of vapor phase migration has been defined, and will continue to be monitored, through a vapor mitigation program. In this program, structures are investigated in a radial fashion away from the source area until the limit of contaminant migration is determined. Because vapor phase contaminant migration can be temporally variable, analysis of the soil vapor quality in this area will be a continuing effort, and future sampling results will be used to determine whether additional structures should be sampled and to determine if more properties may benefit from mitigation systems.

5.2: Interim Remedial Measure

An interim remedial measure (IRM) is conducted at a site when a source of contamination or exposure pathway can be effectively addressed before completion of the RI/FS.

A soil vapor extraction (SVE) system was installed at the Kliegman Bros. Site as an IRM in 2004. The system utilizes three extraction wells screened at various depths between 5 and 65 feet bgs. The three wells are connected through a subsurface trench to a treatment system consisting of a moisture separator, an extraction blower, and vapor phase carbon vessels. Operation of the system began in August 2004 and is estimated to have removed to date over 35,800 pounds of PCE from the vadose zone.

5.3: Summary of Human Exposure Pathways:

This section describes the types of human exposures that may present added health risks to persons at or around the site. A more detailed discussion of the human exposure pathways can be found in Section 6 of the RI report. An exposure pathway describes the means by which an individual may be exposed to contaminants originating from a site. An exposure pathway has five elements: [1] a contaminant source, [2] contaminant release and transport mechanisms, [3] a point of exposure, [4] a route of exposure, and [5] a receptor population.

The source of contamination is the location where contaminants were released to the environment (any waste disposal area or point of discharge). Contaminant release and transport mechanisms carry contaminants from the source to a point where people may be exposed. The exposure point is a location where actual or potential human contact with a contaminated medium may occur. The route of exposure is the manner in which a contaminant actually enters or contacts the body (e.g., ingestion, inhalation, or direct contact). The receptor population is the people who are, or may be, exposed to contaminants at a point of exposure.

An exposure pathway is complete when all five elements of an exposure pathway exist. An exposure pathway is considered a potential pathway when one or more of the elements currently does not exist, but could in the future. There is a potential exposure pathway associated with contaminated groundwater. An exposure pathway exists with contaminated indoor air via soil vapor migrating from the site.

Elevated concentrations of tetrachloroethene (PCE) exist in groundwater and soil vapor. The area is served by public water, therefore it is unlikely that community exposure to contaminated groundwater will occur. The state has conducted indoor air sampling at homes in the neighborhood surrounding the site. Corrective measures have been taken to minimize the intrusion of contaminated soil vapor into nearby homes and to reduce the concentration of PCE in the indoor air. Additional residential indoor air and sub-slab soil vapor sampling will be conducted to further evaluate potential indoor air impacts to homes surrounding the site and the effectiveness of the on-site SVE system at controlling off-site migration of contaminated soil vapor. Mitigation systems will continue to be offered to off-site properties as warranted.

5.4: Summary of Environmental Assessment

Site contamination has impacted the groundwater resource in the overburden aquifer, however, groundwater near this site is not used as a source of drinking water. The surrounding land use is residential, and there are no environmental resources affected other then the groundwater.

SECTION 6: SUMMARY OF THE REMEDIATION GOALS

Goals for the remedial program have been established through the remedy selection process stated in 6 NYCRR Part 375. At a minimum, the remedy selected must eliminate or mitigate all significant threats to public health and/or the environment presented by the hazardous waste disposed at the site through the proper application of scientific and engineering principles.

The remediation goals for OU No.2 are to eliminate or reduce to the extent practicable:

- exposures of persons around the site to PCE and its degradation products (trichloroethene (TCE), dichloroethene (DCE), and vinyl chloride) in contaminated groundwater;

- the release of contaminants from soil vapor into indoor air through vapor intrusion.

Further, the remediation goals for the site include attaining to the extent practicable:

- ambient groundwater quality standards

SECTION 7: SUMMARY OF THE EVALUATION OF ALTERNATIVES

The selected remedy must be protective of human health and the environment, be cost-effective, comply with other statutory requirements, and utilize permanent solutions, alternative technologies or resource recovery technologies to the maximum extent practicable. Potential remedial alternatives for the Kliegman Brothers Site Operable Unit No. 2 were identified and evaluated in the FS report which is available at the document repositories established for this site.

A summary of the remedial alternatives that were considered for this site is discussed below. The present worth represents the amount of money invested in the current year that would be sufficient to cover all present and future costs associated with the alternative. This enables the costs of remedial alternatives to be compared on a common basis. As a convention, a time frame of 30 years is used to evaluate present worth costs for alternatives with an indefinite duration. This does not imply that operation, maintenance, or monitoring would cease after 30 years if remediation goals are not achieved.

7.1: Description of Remedial Alternatives

The following potential remedies were considered to address the contaminated groundwater and off-site soil vapor at the site.

For each alternative other than the No Action Alternative, the ongoing vapor intrusion mitigation program would continue to monitor soil gas levels at area residences and assess the need for additional system sub-slab depressurization installations. Additional system installations would be conducted as necessary in the future to provide mitigation. For remedial cost estimating purposes, it is assumed that three such installations would be performed each year following indoor air sampling during the heating season.

In addition, the OU No.1 remedial system would continue to operate under each of the alternatives, as would the individual sub-slab depressurization systems which have been installed to date.

Alternative 1: No Action

The No Action Alternative is evaluated as a procedural requirement and as a basis for comparison. It requires continued monitoring only, allowing the site to remain in an unremediated state. This alternative would leave the site in its present condition and would not provide any additional protection to human health or the environment.

Present Worth: . . . . $ 0
Capital Cost: . . . . $ 0
Annual Cost: . . . . $ 0

Alternative 2A - Groundwater Extraction from Concentrated Plume Area with Above-ground Water Treatment

Present Worth: $6,200,000
Capital Cost: $1,200,000
Annual OM&M (30 years): . . . . $ 330,000

Alternative 2A is a groundwater extraction and treatment alternative that would address the most contaminated portion of the plume. Alternative 2A would include a groundwater extraction well in the concentrated plume area (PCE concentrations >10,000 ppb) with subsequent above-ground treatment. Components of this alternative include:

1. Installation of a single groundwater extraction well withdrawing 150 gallons per minute (gpm) from within the concentrated plume area.

2. Construction of a treatment system utilizing, at least, an air stripper for the removal of VOCs, and vapor phase carbon units to remove contaminants in off-gas from the air stripper.

3. Conveyance of treated water to the local sewer system.

4. Operation and maintenance of the well and treatment system.

It is expected to take between 6 months to one year to implement this alternative. Concentrations of contaminants within the concentrated plume area would be reduced over the 30-year operation period of this alternative.

Alternative 2B – Groundwater Extraction from Expanded Plume Area with Above-Ground Water Treatment

Present Worth: $6,300,000
Capital Cost: $1,100,000
Annual Cost: (30 years) . . . . $ 340,000

Alternative 2B is a groundwater extraction and treatment alternative that would address an expanded area of the groundwater plume. Alternative 2B would include groundwater extraction from the plume area including PCE concentrations > 1,000 ppb, with subsequent above-ground treatment. Components of this alternative include:

1. Installation of two groundwater extraction wells withdrawing 300 gpm from within the plume area.

2. Construction of a treatment system utilizing, at least, an air stripper for the removal of VOCs and vapor phase carbon units to remove contaminants in off-gas from the air stripper.

3. Conveyance of treated water to the local sewer system.

4. Operation and maintenance of the wells and treatment system.

It is expected to take less than one year to implement this alternative. Concentrations of contaminants within the plume area would be reduced over the 30-year operation period of this alternative.

Alternative 3A – In Situ Chemical Oxidation Treatment of Concentrated Plume Area

Present Worth: $8,000,000
Capital Cost: $7,700,000
Annual Cost:
(Years 1-3): . . . . $ 64,000
(Years 3-5): . . . . $ 43,000

Alternative 3A is an In Situ Chemical Oxidation (ISCO) treatment alternative that would address the source area (i.e., groundwater directly beneath the soil being addressed by the OU No.1 project) and the most contaminated portion of the plume. Alternative 3A would include injection of chemical oxidants (modified Fenton's reagent and/or permanganate) into the groundwater to oxidize organic contaminants (e.g., PCE) to non-toxic compounds. Components of this alternative include:

1. Focused injection of chemical oxidants to reduce contaminant mass within the source area and concentrated plume area. For the purposes of the PRAP, it is assumed that three ISCO applications utilizing modified Fenton's reagent followed by one ISCO application utilizing permanganate would be required for initial treatment.

2. Monitoring of the PCE concentrations throughout the extent of the treatment area.

3. Based upon performance monitoring, additional ISCO applications may be required to continue treatment of contaminant mass within the saturated zone. For the purposes of the PRAP, it is assumed that two permanganate injection events may be required for additional polishing, or finishing treatment.

It is expected to take less than 1 year for well installation and pilot-scale testing. The four injection events would be followed by performance monitoring. Remediation is anticipated to be accomplished within 1 year; however, based on the results of the monitoring, additional injection events could be performed. For this analysis, while groundwater monitoring would continue for a period of 5 years, the operating phase would cease and remediation would be complete within 1 year.

Alternative 3B – In Situ Chemical Oxidation Treatment of Expanded Plume Area

Present Worth:	$13,900,000
Capital Cost:	$13,700,000
Annual Cost:	
(Years 1-3)	$ 64,000
(Years 3-5)	$ 43,000

Alternative 3B is an ISCO alternative that would address the expanded groundwater plume area defined in Alternative 2B. Alternative 3B would include all components of Alternative 3A and additionally include injection of chemical oxidants into the groundwater within the expanded plume area to oxidize organic contaminants to non-toxic compounds. Components of this alternative include:

1. Focused injection of chemical oxidants to reduce contaminant mass in the source area, the concentrated plume area, and additionally within the remaining portions of the plume. For the purposes of the PRAP, it is assumed that three ISCO applications utilizing modified Fenton's reagent followed by one ISCO application utilizing permanganate would be required for initial treatment.

2. Monitoring of the PCE concentrations throughout the extent of the treatment area.

3. Based upon performance monitoring, additional ISCO applications may be required to continue treatment of contaminant mass within the saturated zone. For the purposes of the PRAP, it is assumed that two permanganate injection events may be required for additional polishing, or finishing treatment.

It is expected to take less than 1 year for well installation and pilot-scale testing. The four injection events would be followed by performance monitoring. Remediation is anticipated to be accomplished within 1 year; however, based on the results of the monitoring, additional injection events could be performed. For this analysis, while groundwater monitoring would continue for a period of 5 years, the operating phase would cease and remediation would be complete within 1 year.

Alternative 4 - In Situ Chemical Oxidation Treatment of Concentrated Plume Area with Induced Groundwater Gradient

Present Worth:	$7,600,000
Capital Cost:	$7,300,000
Annual Cost:	
(Years 1-3)	$ 64,000
(Years 3-5)	$ 43,000

Alternative 4 combines a similar ISCO approach as presented in Alternative 3A but coupled with a groundwater extraction well to induce a gradient within the saturated zone. This alternative includes injection of chemical oxidants (modified Fenton's reagent and/or permanganate) at the source area (i.e., groundwater associated with OU1) and the most contaminated portion of the plume to oxidize organic contaminants to non-toxic compounds. In addition to the ISCO component, Alternative 4 incorporates an extraction well to generate a groundwater gradient that would promote migration of the injected regent over a larger portion of the plume, including beneath existing structures where access for injection may not be feasible. Components of this alternative include:

1. Focused injection of chemical oxidants to reduce contaminant mass in the source area and portions of the concentrated plume area. For the purposes of this analysis, it is assumed that three ISCO applications utilizing modified Fenton's reagent followed by one ISCO application utilizing permanganate would be required for initial treatment.

2. Monitoring of the PCE concentrations throughout the extent of the treatment area.

3. Based upon performance monitoring, additional ISCO applications may be required to continue treatment of contaminant mass within the saturated zone. For the purposes of this analysis, it is assumed that two permanganate injection events may be required for additional polishing, or finishing treatment.

4. A single groundwater extraction well withdrawing 150 gpm located within the concentrated plume area to generate an increased hydraulic gradient in the water table. The increased hydraulic gradient from groundwater flow to the extraction well would potentially increase the area of the plume addressed by the ISCO injection wells.

5. Although groundwater extraction is included principally to generate an hydraulic gradient rather than serve as an extraction and treatment system, the extracted groundwater would have to be treated. Therefore this alternative includes construction of a treatment system utilizing, at a minimum, an air stripper for the removal of VOCs and vapor phase carbon units to remove contaminants in off-gas from the air stripper.

6. Conveyance of treated water to the local combined sanitary/storm sewer system.

Note the groundwater extraction and treatment costs for Alt. 4 were considered a capital cost (above) since they would be of a short duration compared to a long term pump and treat approach.

It is expected to take approximately 1 year to implement this alternative. For this analysis, the operating phase would be complete after 3 years.

7.2 Evaluation of Remedial Alternatives

The criteria to which potential remedial alternatives are compared are defined in 6 NYCRR Part 375, which governs the remediation of inactive hazardous waste disposal sites in New York A detailed discussion of the evaluation criteria and comparative analysis is included in the FS report.

The first two evaluation criteria are termed "threshold criteria" and must be satisfied in order for an alternative to be considered for selection.

1. Protection of Human Health and the Environment. This criterion is an overall evaluation of each alternative's ability to protect public health and the environment.

2. Compliance with New York State Standards, Criteria, and Guidance (SCGs). Compliance with SCGs addresses whether a remedy will meet environmental laws, regulations, and other standards and criteria. In addition, this criterion includes the consideration of guidance which the Department has determined to be applicable on a case-specific basis.

The next five "primary balancing criteria" are used to compare the positive and negative aspects of each of the remedial strategies.

3. Short-term Effectiveness. The potential short-term adverse impacts of the remedial action upon the community, the workers, and the environment during the construction and/or implementation are evaluated. The length of time needed to achieve the remedial objectives is also estimated and compared against the other alternatives.

4. Long-term Effectiveness and Permanence. This criterion evaluates the long-term effectiveness of the remedial alternatives after implementation. If wastes or treated residuals remain on-site after the selected remedy has been implemented, the following items are evaluated: 1) the magnitude of the remaining risks, 2) the adequacy of the engineering and/or institutional controls intended to limit the risk, and 3) the reliability of these controls.

5. Reduction of Toxicity, Mobility or Volume. Preference is given to alternatives that permanently and significantly reduce the toxicity, mobility or volume of the wastes at the site.

6. Implementability. The technical and administrative feasibility of implementing each alternative are evaluated. Technical feasibility includes the difficulties associated with the construction of the remedy and the ability to monitor its effectiveness. For administrative feasibility, the availability of the necessary personnel and materials is evaluated along with potential difficulties in obtaining specific operating approvals, access for construction, institutional controls, and so forth.

7. Cost-Effectiveness. Capital costs and annual operation, maintenance, and monitoring costs are estimated for each alternative and compared on a present worth basis. Although cost-effectiveness is the last balancing criterion evaluated, where two or more alternatives have met the requirements of the other criteria, it can be used as the basis for the final decision. The costs for each alternative are presented in Table 2.

This final criterion is considered a "modifying criterion" and is taken into account after evaluating those above. It is evaluated after public comments on the Proposed Remedial Action Plan have been received.

8. Community Acceptance - Concerns of the community regarding the RI/FS reports and the PRAP are evaluated. A responsiveness summary will be prepared that describes public comments received and the manner in which the Department will address the concerns raised. If the selected remedy differs significantly from the proposed remedy, notices to the public will be issued describing the differences and reasons for the changes.

SECTION 8: SUMMARY OF THE PROPOSED REMEDY

The Department is proposing Alternative 4, In Situ Chemical Oxidation Treatment of Concentrated Plume Area with Induced Groundwater Gradient, as the remedy for this site. The elements of this remedy are shown on Figure 5 and described at the end of this section. If construction of the extraction well, force main piping, and groundwater treatment plant were determined to not be feasible during the remedial design due to density of land use in the area, Alternative 3, In Situ Chemical Oxidation Treatment of Concentrated Plume Area, would be implemented.

The proposed remedy is based on the results of the RI and the evaluation of alternatives presented in the FS.

Alternative 4 is being proposed because, as described below, it satisfies the threshold criteria and provides the best balance of the primary balancing criteria described in Section 7.2. It would achieve the remediation goals for the site by addressing the highest concentrations of contamination within the plume and source areas. By doing so, it would create the conditions needed to restore groundwater quality to the extent practicable. The ongoing vapor intrusion mitigation program included as part of this alternative would continue to monitor soil vapor contaminant levels at area residences during the groundwater remediation period and assess the need for additional sub-slab depressurization system installations. Alternatives 3A and 4 also comply with the threshold selection criteria.

Alternatives 2A and 2B would comply with the threshold selection criteria to a lesser degree or with lower certainty because they would not provide a reduction in toxicity of contaminants, as would be accomplished through the ISCO process.

Alternative 1 would not meet the remedial action objectives for soil gas or groundwater, but would leave the groundwater and off-site soil vapor in its present condition. Alternative 1 would not provide any additional protection to human health or the environment and would not meet the threshold criteria.

Because Alternatives 2A, 2B, 3A, 3B and 4 satisfy the threshold criteria, the five balancing criteria are particularly important in selecting a final remedy for the site.

Alternatives 3A, 3B, and 4 would be more effective and provide more protection than Alternatives 2A and 2B due to the reduction in toxicity of contaminants from the ISCO process. Further, Alternatives 3A, 3B, and 4 would improve groundwater quality in a more rapid time frame than Alternatives 2A and 2B. Therefore, Alternatives 3A, 3B, and 4 are preferred over Alternatives 2A and 2B. Alternative 4 has the potential to be more effective than Alternatives 3A or 3B because the creation of a hydraulic gradient may increase the movement of the chemicals applied in situ and result in a greater volume of treated groundwater.

Compared to Alternatives 3A and 3B, Alternative 4 would have difficulties involving short-term effectiveness and implementability. A groundwater extraction well and a force main to the proposed location of the groundwater treatment facility would require construction of the force main through the residential neighborhood. Also, there would be limited locations for the proposed treatment facility.

Alternatives 3A, 3B and 4 would all provide remediation within the source and concentrated plume areas. Alternative 3B additionally would provide remediation within the remaining plume area. Concentrations of contaminants outside the treatment zones for each alternative would be reduced over time by dispersion.

Alternative 3B would treat a larger area than Alternatives 3A or 4, and there would therefore be a greater amount of contaminant destruction. Based on the dissolved concentrations (and assuming 95% treatment), 3B would destroy about 1,200 pounds of PCE currently in the groundwater while 3A would destroy about 1,000 pounds. However, the majority of the contaminant mass resides in the source and concentrated plume areas, areas that would be addressed by Alternatives 3A and 4. It is known that the SVE IRM has removed tens of thousands of pounds of PCE present in the vadose zone. This suggests that non-aqueous phase PCE may be present in the saturated zone to the extent of thousands of pounds as well. Both 3A and 3B would treat this source area equally effectively, reducing the significance of the estimated additional 200-pound destruction potentially achievable with 3B compared to 3A.

The additional injections proposed in Alternative 3B would provide limited overall benefit due to the lower concentrations present outside the source and concentrated plume areas. The additional injection area included in Alternative 3B would increase impacts to the community during construction and ISCO implementation due to the increased number of injection wells distributed throughout the residential neighborhood. This would result in much greater short-term impacts when compared to Alternative 3A.

The cost analysis for all alternatives is presented in Table 2, which details the capital cost, annual OM&M cost and total present worth of OM&M costs for each alternative (based on a 5% discount rate). With the exception of Alternative 3B, the costs of the alternatives which meet the threshold criteria would not vary greatly. Alternative 2A and Alternative 2B have similar estimated costs, and Alternative 3A and 4 would be somewhat more expensive. Alternative 3B would be significantly more expensive than any other alternative.

On the basis of the rationale outlined in this section, In Situ Chemical Oxidation Treatment of the Concentrated Plume Area with Induced Groundwater Gradient (Alternative 4) is recommended. However, as detailed above, the density of the surrounding land use may ultimately result in a finding that installation of the extraction well, force main, and treatment facility included in Alternative 4 is not feasible. If this were found to be the case, then the Department proposes to implement Alternative 3A - In Situ Chemical Oxidation Treatment of the Concentrated Plume Area. The feasibility determination would be made during the remedial design process.

The estimated present worth cost to implement Alternative 4 is $ 7,600,000. The cost to construct the remedy is estimated to be $ 7,300,000, the estimated average annual costs for system operation (three years total) is $21,000, and the estimated average annual costs for monitoring (five years total) is $43,000. Note the groundwater extraction and treatment costs for Alt. 4 are considered a capital cost since they would be of a short duration compared to a long term pump and treat approach. The present worth estimate includes sampling and construction costs associated with the ongoing vapor mitigation program.

The estimated present worth cost to implement Alternative 3A is $ 8,000,000. The cost to construct the remedy is estimated to be $ 7,700,000, the estimated average annual costs for system operation (three years total) is $21,000, and the estimated average annual costs for monitoring (five years total) is $43,000. The present worth estimate includes sampling and construction costs associated with the ongoing vapor mitigation program

The elements of the proposed remedy are as follows:

1. A remedial design program would be implemented to provide the details necessary for the construction, operation, maintenance, and monitoring of the remedial program. During this design, the feasibility of constructing an extraction well and water treatment plant (items 3 and 4, below) would be determined;

2. Approximately 60 oxidant injection locations would be installed within the concentrated plume area. Several modified Fenton's reagent or permanganate In Situ Chemical Oxidation injection events would occur, each expected to last a few weeks to one month. Performance monitoring events would be performed four to eight weeks after completion of injection activities to determine contaminant mass reduction in comparison to baseline groundwater concentrations and subsurface distribution of injection oxidant material;

3. A ground water extraction well would be constructed on 76th St. Groundwater would be extracted from this well to create a hydraulic gradient to increase the area reached by the injected oxidants. This system would not be constructed if it was determined to be not feasible during the remedial design process. In such a case, the number and density of oxidant injection locations would be increased;

4. A groundwater treatment system would be constructed on or near Edsall Ave. to treat extracted groundwater. The treatment system is anticipated to include at a minimum: an air stripper for the removal of VOCs and vapor phase carbon units to remove contaminants in off-gas from the air stripper. A force main would be constructed to carry water from the extraction well to the treatment plant. This system would not be constructed if it was determined to be not feasible during the remedial design process;

5. The ongoing vapor intrusion mitigation program would continue to monitor soil gas levels at adjacent residences and assess the need for additional sub-slab depressurization system installations. Additional system installations would be conducted as necessary in the future to provide mitigation;

6. Development of a site management plan which would include the following engineering controls: (a) continued evaluation of the potential for vapor intrusion in the area; (b) monitoring of groundwater and soil vapor; (c) provisions for the continued proper operation and maintenance of the components of the remedy.

7. The institutional controls imposed by the OU No.1 ROD would remain in effect. These controls, in the form of an environmental easement: (a) require compliance with the approved site management plan; (b) limit the use and development of the property to commercial, industrial and/or restricted residential only; (c) restrict the use of groundwater as a source of potable water, without necessary water quality treatment as determined by NYSDOH and/or the New York City Department of Environmental Protection; and. (d) require the property owner to complete and submit to the NYSDEC a periodic certification.

8. The operation of the components of the remedy would continue until the remedial objectives have been achieved, or until the Department determines that further remediation is technically impracticable or not feasible.

TABLE 1
Nature and Extent of Contamination - OU2

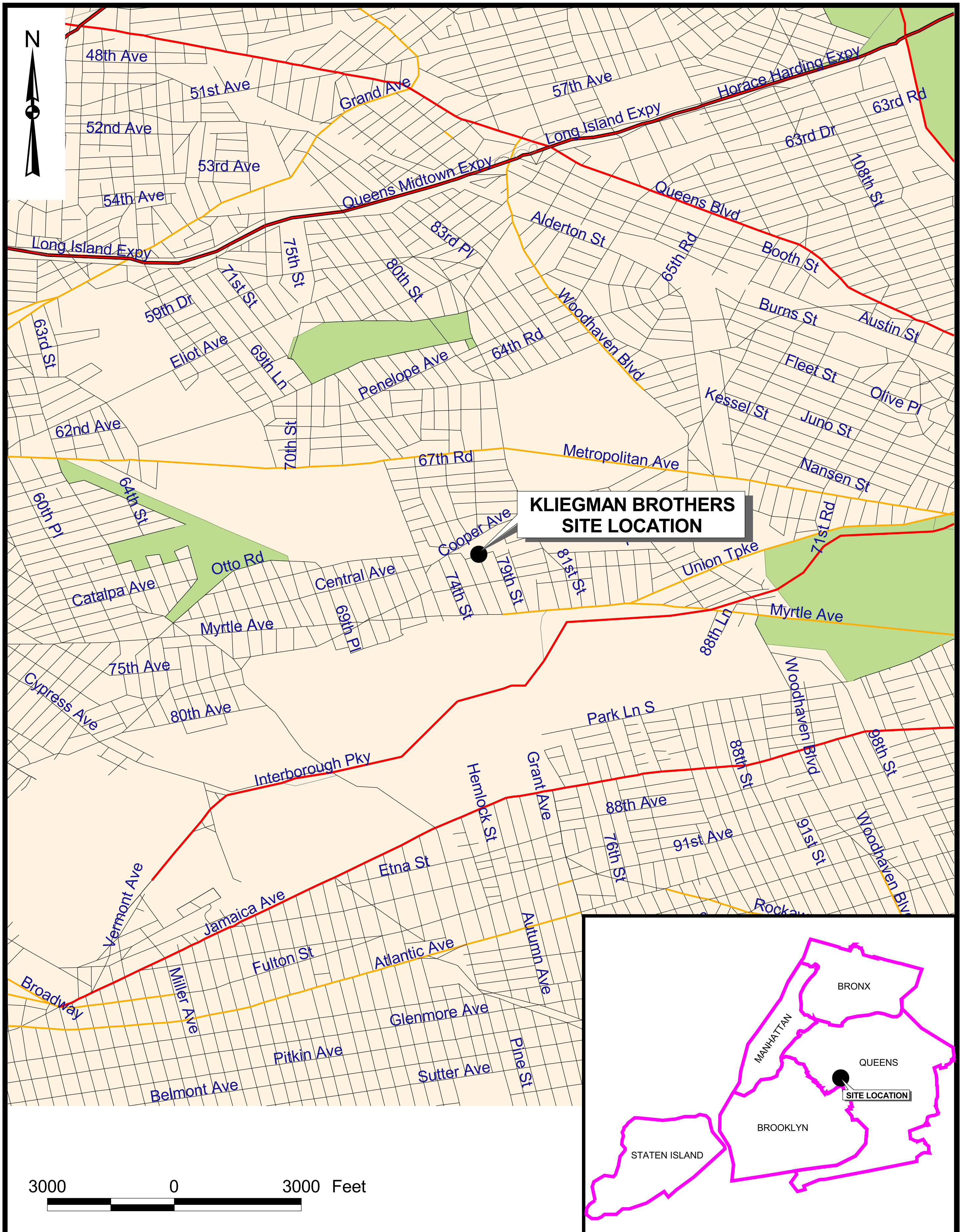
GROUNDWATER	Contaminants of Concern	Concentration Range Detected (ppb)[a]	SCG[b] (ppb)[a]	Frequency of Exceeding SCG
Volatile Organic Compounds (VOCs)	benzene	ND-28J	1	3 of 31
	n-butylbenzene	ND-17J	5	1 of 31
	carbon tetrachloride	ND-140J	5	12 of 31
	2-chlorotoluene	ND-160J	5	3 of 31
	1,1-dichloroethene	ND-280	5	11 of 31
	1,2-dichloroethene	ND-47J	5	2 of 31
	methylene chloride	ND-1,600	5	5 of 31
	n-propylbenzene	ND-110J	5	3 of 31
	tetrachloroethene	ND-75,000	5	27 of 31
	toluene	ND-50J	5	2 of 31
	trichloroethane	ND-75J	5	1 of 31
	trichloroethene	ND-640	5	16 of 31
	xylenes (total)	ND-11J	5	1 of 31

SOIL VAPOR (on- and off-site)	Contaminants of Concern	Concentration Range Detected (µg/m³)[a]	SCG[b] (µg/m³)[a]	Frequency of Exceeding SCG
Compounds (VOCs)	1,1-dichloroethene	ND-25,000	NA	NA
	cis-1,2-dichloroethene	ND-26,200	NA	NA
	trans-1,2-dichloroethene	ND-887,000	NA	NA
	tetrachloroethene	ND-165,000,000	NA	NA
	trichloroethene	ND-618,000	NA	NA
	vinyl chloride	ND-2,1800	NA	NA

[a] ppb = parts per billion, which is equivalent to micrograms per liter, µg/L, in water;
ppm = parts per million, which is equivalent to milligrams per kilogram, mg/kg, in soil;
µg/m³ = micrograms per cubic meter
[b] SCG = standards, criteria, and guidance values
ND = not detected
NA = none available
J = estimated concentration detected below quantitation limit

Table 2
Remedial Alternative Costs

Remedial Alternative	Capital Cost ($)	Annual Costs ($)	Total Present Worth ($)
Alternative 1 - No Action	0	0	0
Alternative 2A - Groundwater Extraction from Concentrated Plume Area with Above-ground Water Treatment	1,200,000	330,000	6,200,000
Alternative 2B - Groundwater Extraction from Expanded Plume Area with Above-Ground Water Treatment	1,100,000	340,000	6,300,000
Alternative 3A - Insitu Chemical Treatment of Concentrated Plume Area	7,700,000	64,000	8,000,000
Alternative 3B - In situ Chemical Treatment of Expanded Plume Area	13,700,000	64,000	13,900,000
Alternative 4 - In situ Chemical Treatment of Concentrated Plume Area with Induced Groundwater Gradient	7,300,000	64,000	7,600,000

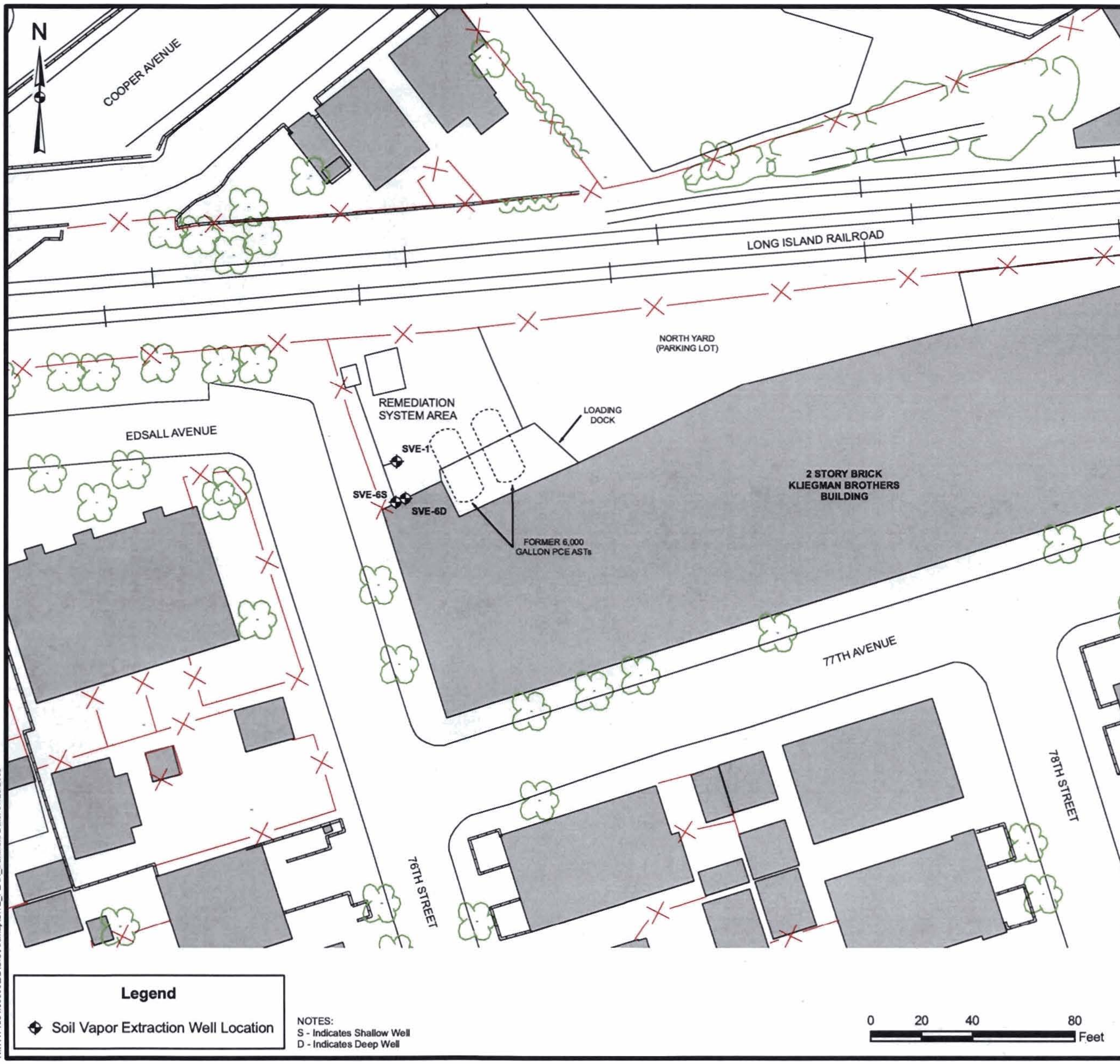


URS

KLIEGMAN BROTHERS
SITE LOCATION MAP

Figure 1

N:\11171964.00000\DB\GIS\site.apr SITE LOCATION
10/7/2005



KLIEGMAN BROTHERS
IRM SITE PLAN

URS

Figure 2

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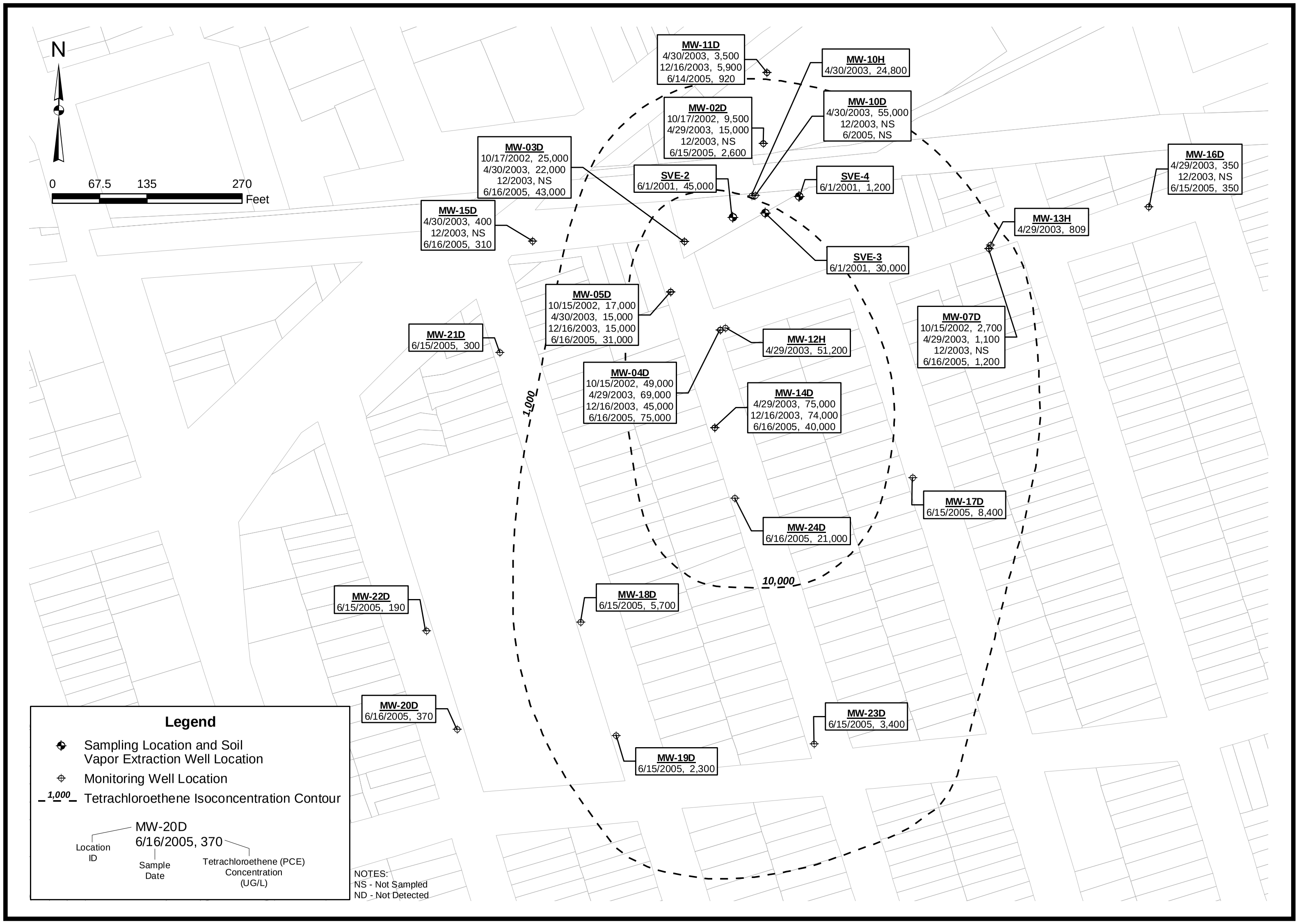
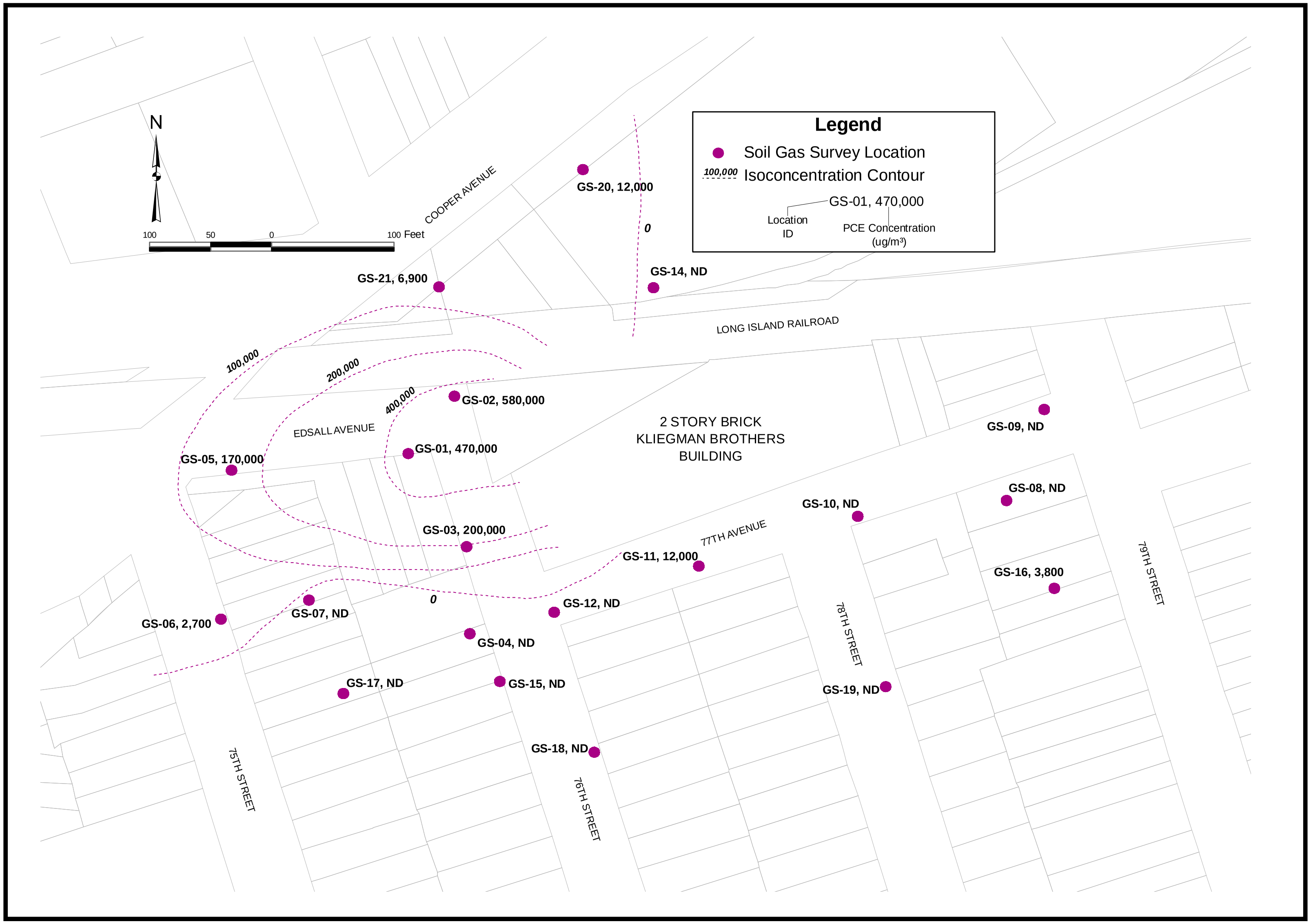


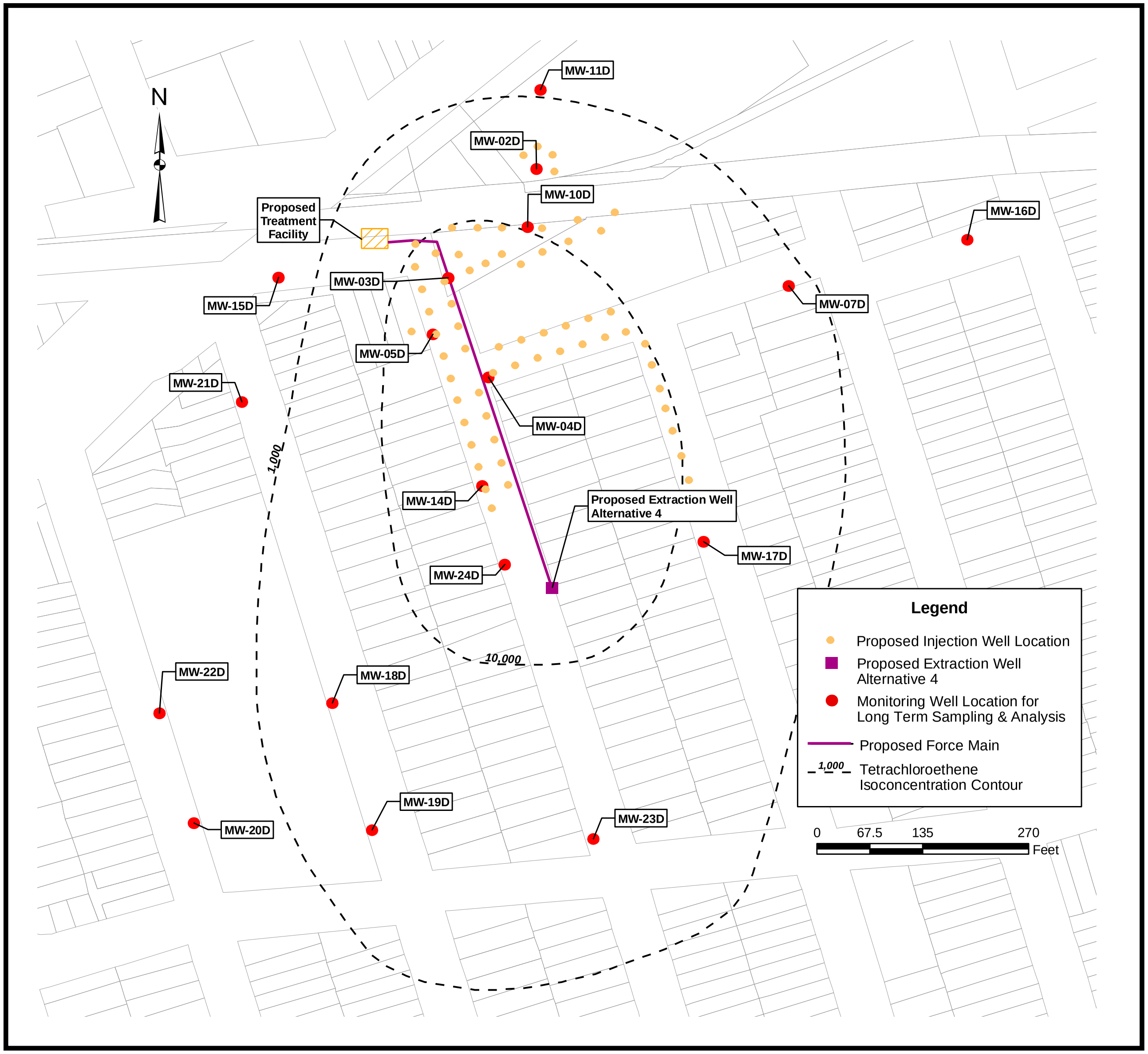
PCE in Groundwater

Figure 3



PCE in Shallow Soil Gas

Figure 4



Proposed Remedy - Alternative 4

Figure 5