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# PROPOSED REMEDIAL ACTION PLAN
# PHOTOCIRCUITS CORPORATION
## Operable Unit No. 1
### City of Glen Cove, Nassau County, New York
### Site No. 130009

September 2007

Prepared by:
Division of Environmental Remediation
New York State Department of Environmental Conservation

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### SECTION 1: SUMMARY AND PURPOSE OF THE PROPOSED PLAN

The New York State Department of Environmental Conservation (the Department), in consultation with the New York State Department of Health (NYSDOH), is proposing a remedy for the Photocircuits Corporation (Photocircuits) site, Operable Unit No. 1; on-site soils and groundwater to a depth of approximately 100 feet below ground surface (ft bgs). 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, the manufacture of printed circuit boards and related activities have resulted in the disposal of hazardous wastes, including volatile organic compounds. These wastes have contaminated the soils and groundwater at the site, and have resulted in:

- a potential significant threat to human health associated with elevated groundwater concentrations of chlorinated solvents.
- a significant environmental threat associated with contravention of groundwater standards in a sole source aquifer.

To eliminate or mitigate these threats, the Department proposes bioremediation with additional injection points coupled with a downgradient air sparging curtain.

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 September 28, 1998 "Remedial Investigation (RI) Report," the October 2006 "Focused Feasibility Study" (FFS), and other relevant documents. The public is encouraged to review the project documents, which are available at the following repositories:

NYS Dept. of Environmental Conservation
Region 1 Office
SUNY @ Stony Brook
50 Circle Rd., Stony Brook
Open: M-F, 8:30 a.m. - 4:45 p.m.
Phone: (516) 444-0240

NYS Dept. of Environmental Conservation
625 Broadway, 11th Floor
Albany, NY 12233-7015
Open: M-F, 8:30 a.m. - 4:45 p.m.
Phone: (518) 402-9621
Attn: Mr. Joseph Jones, Project Manager

The Department seeks input from the community on all PRAPs. A public comment period has been set from September 14, 2007 to October 20, 2007 to provide an opportunity for public participation in the remedy selection process. A public meeting is scheduled for September 20, 2007 at the Glen Cove High School Auditorium beginning at 7:00 p.m.

At the meeting, the results of the RI/FFS 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. Jones at the above address through October 20, 2007.

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: <u>SITE LOCATION AND DESCRIPTION</u>

The Photocircuits site is located in the City of Glen Cove, in Nassau County. Figure 1 shows the site location. The site is approximately 10 acres in areal extent. The site address is 31 Sea Cliff Avenue, Glen Cove, NY. The site is bounded by Sea Cliff Avenue to the north, the Pass and Seymour site (Site No. 130053A) to the west, the Glen Head Country Club to the south, and the Glen Cove arterial highway to the east. The Pall Corporation site (Site No. 130053B) is located across Sea Cliff Avenue to the north. The site is located in an urban/industrial area of Nassau County. The Glen Cove Creek flows to the north along the west side of the site. The main site features are several industrial buildings. Most of the site is paved. Photocircuits is one of several properties that comprise the Sea Cliff Avenue Industrial Area. Figure 2 shows the site detail.

The Photocircuits site is underlain by the following soil layers in descending order: the Upper Glacial Aquifer, the Port Washington confining unit, the Port Washington aquifer, the Lloyd Aquifer, and bedrock. The Upper Glacial aquifer is composed of stratified beds of fine to coarse sand and gravel with some interbedded lenses of silt and clay and extends to a depth of approximately 200 ft bgs. The Port Washington confining unit, which extends approximately 100 ft below the Upper Glacial aquifer, consists of silt and clay with some interbedded sand and gravel lenses. The Port Washington aquifer is composed of sand and gravel with variable amounts of interbedded clay and silt, and is approximately 50 ft thick. The Lloyd aquifer, which is approximately 200 ft thick, consists of discontinuous layers of gravel, sand, sandy clay, silt, and clay. It roughly parallels the crystalline bedrock, which is present at a depth of approximately 550 ft bgs. Groundwater is present at 4 to 10 ft bgs. Groundwater flow is generally to the north northwest. See Figure 3.

Operable Unit (OU) No. 1, which is the subject of this document, consists of on-site soil and groundwater to a depth of approximately 100 ft bgs. 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. The remaining operable unit for this site is Operable Unit (OU) No. 2, which addresses deep groundwater (greater than 100 ft bgs) on-site and downgradient of the Photocircuits site.

## SECTION 3: <u>SITE HISTORY</u>

### 3.1: <u>Operational/Disposal History</u>

The property was formerly owned by Powers Chemco (1954-1971) & Kollmorgen Corporation (1971-1986). Photocircuits has occupied the site from 1986 to the present. Kollmorgen and Photocircuits manufactured printed circuit boards. Past investigations of this area have documented high concentrations of chlorinated organics in the groundwater underlying the site. To identify the source of these contaminants, a Preliminary Site Assessment (PSA) was conducted by the Nassau County Department of Public Works

(NCDPW) through a Municipal Delegation Agreement with the Department in 1994. The investigation relied largely on the compilation and interpretation of existing raw data. The PSA report noted the presence of volatile organic compounds (VOCs), particularly 1,1,1-trichloroethane (1,1,1-TCA), in the soil and groundwater associated with these premises, and identified Photocircuits as a source of methylene chloride, 1,1,1-TCA and tetrachloroethene. The highest concentrations were found in a drum storage and tank farm area near the northeast corner of the property. Elevated groundwater concentrations of VOC contaminants evidence prior releases of chlorinated solvents to the environment in the drum storage and tank farm areas. The concentration in the aquifer is above the applicable Part 703 Groundwater Standard, and presents a significant threat to the environment.

### 3.2: Remedial History

In February of 1995, 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. The decision to list the site in the Registry was made, in part, on the basis of the March 1994 Preliminary Site Assessment which identified VOCs in groundwater at the Photocircuits site.

## 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 Department and the Photocircuits Corporation entered into a Consent Order (Index No. W1-0713-94-12) on March 31, 1997. The Order obligates the responsible parties to implement a RI/FFS remedial program. After the remedy is selected, the Department will approach the PRPs to implement the selected remedy under an Order on Consent.

## SECTION 5: SITE CONTAMINATION

A remedial investigation/focused feasibility study (RI/FFS) 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 any contamination resulting from previous activities at the site. The RI was conducted between April and September of 1998. The field activities and findings of the investigation are described in the RI report. Prior to the RI, a preliminary site investigation (PSI) was conducted on the site during August of 1996, and a Source Area Investigation for the Sea Cliff Industrial Area was performed in 1992. The field activities and findings of the PSI and the Source Area Investigation are described in the PSI and Source Area Investigation reports. These reports identified the drum storage and tank farm areas located to the east of the Photocircuits' main building as the primary areas of concern at the site (see Figure 3).

The Remedial Investigation was conducted from March 1997 to September 1998 and included the following tasks:

- Soil and groundwater sampling using a Geoprobe® to delineate impacts detected during the PSI in the tank farm and drum storage areas
- Sampling of on-site monitoring wells
- Slug testing of on-site monitoring wells

Additional groundwater sampling was carried out at the site in conjunction with the Soil Vapor Extraction Interim Remedial Measure and the Bioremediation Pilot study. The information acquired is contained in the Quarterly Progress Reports for the Photocircuits site for 2000 to 2004.

### 5.1.1: Standards, Criteria, and Guidance (SCGs)

To determine whether the on-site soils and groundwater 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.
- Soil SCGs are based on the Department's Cleanup Objectives ("Technical and Administrative Guidance Memorandum [TAGM] 4046; Determination of Soil Cleanup Objectives and Cleanup Levels" and 6 NYCRR Subpart 375.6 - Remedial Program Soil Cleanup Objectives)

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.

### 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 RI report, many soil and groundwater samples were collected to characterize the nature and extent of contamination. As seen in Figure 3 and summarized in Table 1 and Table 2, the main categories of contaminants that exceed their SCGs are volatile organic compounds (VOCs).

Chemical concentrations are reported in parts per billion (ppb) for water and parts per million (ppm) for soil.

Table 1 summarizes the degree of contamination for the contaminants of concern in groundwater 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.

**Subsurface Soil**

The August 1996 PSI report indicated the presence of VOCs at five locations on the Photocircuits site, with the highest concentrations being found in the drum storage and tank farm areas. For the RI, soil samples were collected at six locations on the Photocircuits site. Total VOC concentrations ranged from non-detect to 48 ppm. Tetrachloroethene (PCE) and trichloroethene (TCE) were the VOCs most frequently detected. Concentrations of individual VOC contaminants in soils did not exceed Department soil cleanup objectives (see Figure 3).

No site-related subsurface soil contamination of concern was identified during the RI/FFS. Therefore, no remedial alternatives need to be evaluated for subsurface soil. It should be noted, however, that the air sparge/soil vapor extraction (AS/SVE) system operated as an interim remedial measure (IRM) in the drum storage/tank farm area would have reduced any soil-bound VOC contamination in this area.

**Groundwater**

During the August 1996 PSI, VOCs were detected in four of the eleven monitoring wells on the Photocircuits site. The groundwater sample from MW-7 in the vicinity of the tank farm and the drum storage area indicated the presence of the following compounds in excess of groundwater standards: vinyl chloride, chloroethane, 1,1-dichloroethene, methylene chloride, 1,1-dichloroethane, 1,2-dichloroethane, 2-butanone, 1,1,1-trichloroethane, TCE, toluene, and PCE. Well locations are shown in Figure 3. During the 1998 RI, eight locations were sampled by Geoprobe®, and eleven groundwater monitoring wells were sampled. VOC contamination in excess of SCGs was detected at six of the eight Geoprobe® locations, with concentrations as high as 8,020 ppb of total VOCs. VOC contamination in excess of SCGs was detected in nine monitoring wells with total VOC concentrations as high as 3,402 ppb. Groundwater monitoring beginning in August 2000 carried out in the drum storage/tank farm as part of the SVE IRM and the bioremediation pilot study showed elevated levels of VOC contamination in groundwater with the highest level (282,800 ppb of total VOCs) being reached in September 2000 in Monitoring Well SMP-3. The dominant contaminants in the drum storage/tank farm area during this time period were 1,1,1-trichloroethane and 1,1-dichloroethane. The increase in observed contaminant levels between 1998 and 2000 events is likely due to the installation of additional sampling points (as part of the Bioremediation pilot study) which were placed closer to the original contaminant sources than the sampling points used in 1998. Additionally, injection of substrate during the Bioremediation pilot study may have caused increased contaminant migration in the drum storage/tank farm area. See Table 2 and Figure 3.

Groundwater contamination identified during the RI/FFS will be addressed in the remedy selection process.

## 5.2: Interim Remedial Measures

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/FFS.

In the Spring of 1999, an AS/SVE system pilot test was conducted in the vicinity of MW-7, located in the drum storage/tank farm area of the site. The system included one shallow air sparge well (screened 10-12 ft bgs), one deep air sparge well (screened 30-32 ft bgs), and one shallow horizontal SVE well. See Figure 3 for MW-7 location. The results of the pilot test were satisfactory, and the system was run until May 9, 2000, achieving VOC removal rates of approximately 6 pounds per day. In May 2000, a catalytic oxidizer/scrubber was added to the system, and the system was restarted in July of 2000. Removal rates gradually declined, and the system was decommissioned in November 2002. Significant mass removal of VOC contaminants was accomplished, however, levels of VOC contamination in groundwater in the treatment area remained high (see Table 2).

In August of 2000, an Accelerated Anaerobic Bioremediation pilot test was begun on the site in the drum storage/tank farm area. See Figure 3. Substrate (emulsified soybean oil) was injected in seven locations to a depth of 50 ft bgs. In February 2002, an additional 12 points were injected. In total, approximately 9,000 gallons of emulsified soybean oil were injected. Based on monitoring before and after the pilot test (see Table 2), the PRP's consultants calculated a first order degradation half-life of 578 days for VOCs within the pilot test area. First order degradation is the removal of one chlorine atom from a chlorinated VOC. Results, however, were not evenly distributed throughout the pilot test area. In general, the results show progressive dechlorinization of the contaminants and large quantities of methane were generated. In some monitoring points, elevated levels of vinyl chloride were generated, and in some monitoring points, total VOCs actually increased. See Table 2 for groundwater monitoring results of VOC contamination in the pilot study area.

In January of 2002, a hydraulic restraint system operating between the Photocircuits' main building and Sea Cliff Avenue was pilot tested. Four groundwater extraction wells were installed at depths up to 60 ft bgs. Groundwater extraction was carried out at a rate of 3 gallons per minute per well during the pilot test. The results of the pilot test were consistent with effective hydraulic restraint and the system began full time operation in January 2003. The operation of the hydraulic restraint system has not resulted in significant decrease in downgradient (north of Sea Cliff Avenue) contaminant concentrations, particularly in groundwater samples taken from 60-100 ft bgs. It is likely that the hydraulic restraint system does not have a sufficient effective depth to prevent contaminated groundwater from migrating beneath the system.

## 5.3: Summary of Human Exposure Pathways:

This section describes the types of potential exposures from environmental contaminants to human health. 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.

Pathways which are known to or may exist include:

- Ingestion of contaminated groundwater.

Since the Carney Street well field located downgradient from the site is not in use, no known completed exposure pathways exist for groundwater at this time.

The contaminated groundwater at and downgradient of the site presents a potential route of exposure to humans. The area is served by public water, however, the underlying aquifer is the source of the water for the Glen Cove Water District customers. Water supply wells in the Glen Cove Water District are routinely sampled for VOCs and other contaminants. As of this date, no site specific contaminants exceeding groundwater or drinking water standards have been detected in water distributed to the public. Ingestion of groundwater from the public supply wellfield is not considered to be a completed exposure pathway. However, as the groundwater is in use for water supply, with routine monitoring, it is still considered to be a potential exposure pathway for the future.

### 5.4: <u>Summary of Environmental Assessment</u>

This section summarizes the assessment of existing and potential future environmental impacts presented by the site. Environmental impacts include existing and potential future exposure pathways to fish and wildlife receptors, as well as damage to natural resources such as aquifers and wetlands.

The following environmental exposure pathways and ecological risks have been identified:

- The Glen Cove Creek runs along the western edge of the Photocircuits property. The creek is located approximately 200 ft cross-gradient from the contaminated area on the site. Sampling results from shallow groundwater monitoring wells located adjacent to the stream (MW-4 and MW-9 - see Figure 2) indicate total VOC levels of 38 ppb or less. Therefore, it is unlikely that recharge of the creek from on-site groundwater would result in significant VOC contamination in the stream.

Samples from the creek receiving drainage from the site did not contain elevated levels of contaminants, therefore, a viable exposure pathway to fish and wildlife receptors is not present.

Site-related contamination has impacted the groundwater resource in the Upper Glacial Aquifer. This aquifer is a sole source aquifer, providing virtually all the groundwater used for private, public and industrial use in the area. The contaminated groundwater at the site presents a potential route of exposure to the environment. There are no known exposure pathways of concern between the contaminated groundwater and environmental receptors. The potential for plants or animal species being exposed to site-related contaminants is highly unlikely.

## SECTION 6: <u>SUMMARY OF THE REMEDIATION GOALS</u>

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 this site are to eliminate or reduce to the extent practicable:

- the release of contaminants from soil into groundwater that may exceed groundwater quality standards;
- soil vapor intrusion into residential and/or commercial facilities both onsite and offsite;
- ingestion of groundwater impacted by the site that does not attain New York State drinking water standards as outlined in 10 NYCRR Part 5, Subpart 5-1; and
- off-site migration of groundwater that does not attain Department Class GA Ambient Water Quality Standards.

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 Photocircuits site were identified, screened and evaluated in the FFS report which is available at the document repositories established for this site.

The 2006 Focused Feasibility Study was restricted in scope due to the history of IRMs undertaken at the site. Contaminated groundwater deeper than 100 ft bgs will be addressed under a remedial investigation for OU2.

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 at the site.

**Alternative 1: No Further Action**

The No Further Action alternative recognizes remediation of the site conducted under previously completed IRMs. To evaluate the effectiveness of the remediation completed under the IRMs, only continued monitoring and continued operation of the hydraulic restraint system is necessary. 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:* ........ *$251,000*
*Capital Cost:* ........ *$0*
*Annual Costs:*
*(Years 1-5):* ........ *$16,400*
*(Years 5-30):* ........ *$16,400*

### Alternative 2: Bioremediation of the Drum Storage/tank Farm Area by the Addition of Substrate, Coupled with Hydraulic Restraint

| | |
|---|---|
| *Present Worth:* | *$326,000* |
| *Capital Cost:* | *$75,000* |
| *Annual Costs:* | |
| *(Years 1-5):* | *$16,400* |
| *(Years 5-30):* | *$16,400* |

Under this alternative, substrate would be injected in the subsurface in the drum storage/tank farm area, i.e., the area covered by the Bioremediation Pilot Study (See Figure 3). The substrate injection would be conducted in the same manner as the 2002 substrate injection events. The injection would employ approximately 10-12 injection points and roughly 5000 gallons of substrate mixture. This alternative would be a continuation of both the Bioremediation Pilot Study and operation of the hydraulic restraint system described in the Interim Remedial Action section. This remedy would have a design period of approximately 6 months, an initial implementation period of approximately 6 months (assuming one injection event), and would meet remediation goals in 6 to 10 years. A long term groundwater monitoring program would be carried out until groundwater standards are met, and institutional controls limiting the future use of groundwater at the site would be implemented.

### Alternative 3: In-situ Destruction of Contaminants in the Drum Storage/tank Farm Area by Chemical Oxidation, Coupled with Hydraulic Restraint

| | |
|---|---|
| *Present Worth:* | *$999,000* |
| *Capital Cost:* | *$748,000* |
| *Annual Costs:* | |
| *(Years 1-5):* | *$16,400* |
| *(Years 5-30):* | *$16,400* |

Groundwater, and subsurface soils would be treated under this alternative via in-situ chemical oxidation. Several chemical oxidants are commercially available for use with this technology. For the purpose of this discussion Fenton's Reagent, which consists of hydrogen peroxide with an iron catalyst, potassium (or sodium) permanganate, potassium (or sodium) persulfate, or ozone will be oxidants evaluated. When this chemical oxidant comes into contact with organic compounds such as VOCs, an oxidation reaction occurs breaking down the organic compounds to relatively benign compounds such as carbon dioxide and water.

The chemical oxidant would be applied through injection wells to at least 80 ft deep to treat contaminated groundwater and saturated soils in the drum storage/tank farm area. This is to target groundwater with VOC concentrations in excess of SCGs.

Prior to the full implementation of this technology, laboratory and on-site pilot scale studies would be conducted to more clearly define design parameters. Between the pilot and the full scale implementations, it is estimated that a minimum of 10 injection points would be installed. It is estimated that the chemical oxidant would be injected during approximately 3 separate events over several months. During implementation, groundwater VOC concentrations would be monitored.

This remedy also includes continued operation of the hydraulic restraint system described in the Interim Remedial Actions section of this PRAP. This remedy would have a design period of approximately six months, an implementation period of approximately three years, and require approximately 6 years to achieve the remedial goals. A long term groundwater monitoring program would be carried out until groundwater standards are met, and institutional controls limiting the future use of groundwater at the site would be implemented.

**Alternative 4: Extraction and Treatment of Groundwater in the Drum Storage/tank Farm Area, Coupled with Hydraulic Restraint**

*Present Worth:* .......... $680,000
*Capital Cost:* .......... $305,000
*Annual Costs:*
*(Years 1-5):* .......... $24,600
*(Years 5-30):* .......... $24,600

Under this alternative, six extraction wells would be installed in the Drum Storage/Tank Farm Area. The wells would be equipped with electric or pneumatic groundwater recovery pumps. Underground piping would be installed to bring compressed air or electric supply to each well and to convey recovered groundwater to a centralized air stripping and vapor treatment facility. Treated water would then be discharged to sanitary sewer. This remedy also includes continued operation of the hydraulic restraint system described in the Interim Remedial Actions section. This remedy would have a design period of approximately 6 months, an operation period of 5 years, and an estimated time to achieve remedial goals of 6 years. A long term groundwater monitoring program would be carried out until groundwater standards are met, and institutional controls limiting the future use of groundwater at the site would be implemented.

**Alternative 5: Bioremediation with Additional Injection Points Coupled with Downgradient Air Sparging Curtain and Provision for Contingent Soil Vapor Extraction and Catalytic Oxidation**

*Present Worth:* .......... $547,000
*Capital Cost:* .......... $265,000
*Annual Costs:*
*(Years 1-5):* .......... $18,400
*(Years 5-30):* .......... $18,400

Under this alternative, bioremediation activities would be undertaken as in Alternative 2 above. In addition, the area remediated would be extended to the south of the original bioremediation area, and additional substrate injection points would be utilized. Substrate would be injected to support the existing microbial degradation of chlorinated VOCs. The substrate injection would be conducted in the same manner as the 2002 substrate injection events. The injection would employ approximately 20 injection points at depths varying from 10 to 80 ft bgs and roughly 10,000 gallons of substrate mixture. In addition, the current hydraulic restraint system would be replaced by an air sparging curtain that would oxidize aid in the oxidation of residual contaminants in shallow groundwater migrating from the site. The air sparging curtain would have a minimum effective depth of 100 ft bgs, and employ approximately 12 sparge points, covering an area just south of Sea Cliff Avenue extending from the eastern site boundary to a point approximately 120 ft to the west. In order to be effective to a depth of 100 ft bgs, sparge points should be installed to a minimum depth of at least 110 ft bgs. The sparging curtain's main task would be oxidation of contaminants, however, provision would be made for sufficient air volume to enable stripping of contaminants migrating through the sparging curtain area if monitoring results show that this is necessary. Provision would be made for operation of a shallow, horizontally installed SVE system in the air sparging curtain area, with catalytic oxidation of effluent if contamination levels warrant. See Figure 4 for locations of the remedial systems specified in this alternative. System monitoring would include groundwater monitoring in the drum storage/tank farm area for VOCs, organics and breakdown products such as methane, groundwater monitoring downgradient of the air sparging curtain for VOCs, breakdown products and oxygen levels in groundwater, soil vapor monitoring in the air sparge curtain area, and effluent monitoring for the SVE system if the system is activated. This remedy would have a design period of approximately six months, require approximately 6 months for implementation, and require approximately 6 years to meet the remediation goals. A long term groundwater monitoring program would be carried out until groundwater standards are met, and institutional controls limiting future use of groundwater at the site would be implemented.

## 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 disposal sites in New York State. For each criterion, a brief description is provided, followed by an evaluation of the alternatives against that criterion. The rationale for the remedy appears in Section 8.

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.

Institutional control measures included in all Alternatives (1, 2, 3, 4 and 5) would protect human health by preventing human contact with any contaminants that would remain in the site groundwater. While the potential for human exposure to the contaminants in the groundwater would remain, the Carney Street Well Field, located downgradient of the site, is not currently in use, and would not be used for drinking water unless either the raw water met drinking water standards or suitable treatment was applied to the water prior to delivery. Alternatives 2, 3, 4 and 5 would all offer varying degrees of protection of human health and the environment through active remediation of the groundwater contamination, coupled with various forms of hydraulic restraint. Alternative 1 would offer minimal protection of human health and the environment by continued operation of the existing hydraulic restraint system.

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.

Since Alternative 1 does not include an active remedial measure for groundwater, it is unlikely that Department Class GA groundwater standards would be achieved. Alternatives 2, 3, 4 and 5 all provide for active groundwater treatment and would therefore comply with Department Class GA groundwater standards within a reasonable time frame. Alternatives 3, 4 and 5 would comply with Department Class GA groundwater standards earlier than Alternative 2.

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.

Alternative 1 would not provide active groundwater remediation, and therefore would not promote the rapid attainment of remedial goals. Alternative 2 has an estimated implementation time of 6 to 10 years, while Alternatives 3, 4 and 5 would require approximately 6 years. The technology used in Alternative 3 sometimes requires extended times (longer than estimated) to achieve groundwater standards. Alternatives 4 and 5 would provide enhanced short term effectiveness relative to Alternatives 2 and 3 because the groundwater extraction specified in Alternative 4 and the air sparging curtain specified in Alternative 5 would provide better control of downgradient contaminant transport than the hydraulic restraint system specified in Alternatives 2 and 3.

Alternative 1 would have no impact on workers or the community since there would be no construction required. Alternatives 2, 3, 4 and 5 would have some impact on workers during construction. Since all the structures required for these alternatives would be built on-site, impact on the community would be minimal.

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.

Alternative 1 would rely on institutional controls and presumed natural attenuation for long term effectiveness, and would therefore provide poor long term effectiveness. Alternatives 2, 3, 4 and 5 would all provide enhanced long term effectiveness through active groundwater remediation. Based on the results of the Bioremediation pilot study, Alternative 2, which is principally a continuation of the pilot study without significant enhancement, may not deliver maximum long term effectiveness due to potential rebound in contaminant levels and the vinyl chloride breakdown product. Alternative 3, due to the limited area of influence for each oxidant injection point, requires a very detailed knowledge of high concentration areas of contaminant in order to be reliably effective. The level of knowledge required is currently unavailable for this site. Alternatives 4 and 5 promise the best long term effectiveness. Although short term rebound is possible for Alternatives 2, 3, 4 and 5, all provide a good degree of permanence if provision for continued treatment, based on monitoring results, is provided.

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.

Alternative 1 would not reduce the toxicity, mobility or volume of contaminants. Alternative 2 would reduce the toxicity of contaminants by enhancing the microbial degradation of chlorinated VOCs, eventually reduce the volume of groundwater not meeting SCGs for substantial areas within the contaminated zone, and impede the mobility of contaminants by hydraulic restraint. Alternative 3 would reduce the toxicity by the oxidation of chlorinated VOCs, eventually reduce the volume of groundwater not meeting SCGs for substantial areas within the contaminated zone, and impede the mobility of contaminants by hydraulic restraint. Alternative 4 would reduce the toxicity of groundwater in the contaminated area by removing VOCs, reduce volume by directly removing contaminated groundwater, and impede the mobility of contamination by both the hydraulic restraint increased by the effects of the extraction wells. Alternative 5 would reduce the toxicity of groundwater both by enhancing microbial degradation of chlorinated VOCs and by removing VOCs through air sparging and contingent soil vapor extraction, reduce the volume of groundwater not meeting SCGs for substantial areas within the contaminated zone, and reduce mobility by providing a downgradient air sparging curtain barrier.

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.

All of the options considered would be technically and administratively feasible. Of the alternatives providing active remediation, Alternative 2 would be readily feasible, as no additional permanent installations are required (the hydraulic restraint system is in place, and the emulsified soybean oil can be injected using temporary geoprobe injection points as already demonstrated in the Bioremediation pilot study. Alternative 3 would be more technically and administratively difficult, as large numbers of permanent injection wells would be required, and current lack of detailed knowledge of subsurface geology and contaminant distribution would require additional exploration efforts. The injection wells required for Alternative 3 are more expensive and more difficult to construct than those required in Alternatives 2 and 5. Alternative 4 would be readily feasible, but would require a long term commitment to waste treatment. Alternative 5 would be readily feasible. The substrate injection process is not technically difficult, and an air sparging curtain is more easily installed and operated than extraction wells.

7. Cost-Effectivness. 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 3.

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/FFS 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 5: Bioremediation with Additional Injection Points Coupled with Downgradient Air Sparging Curtain and Provision for Contingent Soil Vapor Extraction and Catalytic Oxidation as the remedy for this site. The elements of this remedy are described at the end of this section.

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

Alternative 5 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 supporting microbial degradation of chlorinated VOCs in the drum storage/tank farm area and adjacent areas of the site, and providing an air sparging curtain downgradient of the primary contaminated area to ensure further oxidation of any contaminants not fully degraded in the primary treatment area. This will greatly reduce the levels of VOC contamination in the drum storage/tank farm area, and create the conditions necessary to restore groundwater quality to the extent practicable. Alternatives 2, 3 and 4 would also comply with the threshold criteria but with potentially longer time frames or lesser reliability and certainty.

Because Alternatives 2, 3, 4, and 5 satisfy the threshold criteria, the five balancing criteria are particularly important in selecting a final remedy for the site.

Alternatives 2 (bioremediation), 3 (chemical oxidation), 4 (groundwater extraction) and 5 (bioremediation/air sparge/contingent sve) all have short-term impacts which can easily be controlled. The time needed to achieve the remediation goals would be longest (six to ten years) for Alternative 2 and similar (approximately 6 years) for Alternatives 3, 4, and 5.

Achieving long-term effectiveness is best accomplished by Alternatives 4 and 5, which provide a wide area of remedial coverage with the best methods of restricting groundwater transport of contaminants downgradient of the site. Alternatives 2 may not cover a wide enough area to effectively treat all the contamination, as indicated by the insufficient results obtained in the Bioremediation Pilot Study. Alternative 3 may leave untreated areas within the primary treatment area.

Implementation of all alternatives is feasible. Of the alternatives meeting the threshold criteria, Alternative 2 is the most readily implemented, followed by Alternatives 5, 4 and 3.

Alternative 5 would offer the most reduction in waste volume by comprehensively treating VOC contamination in the drum storage/tank farm and offering additional treatment for residual contamination present in groundwater migrating from the site. Alternative 4 would also achieve good waste volume reduction, and Alternatives 2 and 3 would offer reasonable volume reduction.

All alternatives would offer reduced contaminant mobility. Alternatives 1, 2 and 3 would use a hydraulic restraint system to reduce mobility, whereas Alternative 4 would use hydraulic restraint coupled with the extraction wells. Alternative 5 would rely on a downgradient air sparging curtain to reduce contaminant mobility. Alternative 2 would reduce toxicity by biodegradation. Alternative 3 would reduce toxicity by oxidation of contaminants. Alternative 4 would not reduce toxicity unless secondary treatment was applied. Alternative 5 would reduce toxicity by biodegradation and oxidation.

The cost of the alternatives varies significantly. The preferred alternative (Alternative 5) is more expensive than Alternatives 2 and 4, which also meet the threshold criteria. Because Alternative 5 is estimated to be the most comprehensive and time efficient remedial alternative, the present worth cost may be less than those projected since operation and monitoring may actually be necessary for less than the 30 years provided for in the cost estimates.

The estimated present worth cost to implement the remedy is $547,000. The cost to construct the remedy is estimated to be $265,000 and the estimated average annual costs for 30 years is $18,400.

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.

2. A pilot study would be conducted, including the installation of at least one air sparging curtain well for the purpose of determining the radius of influence. Based on the pilot study data, the remainder of the air sparging curtain will be installed, and operated until the remedial goals are attained, or the Department determines that it is no longer effective to operate.

3. One substrate injection event, utilizing approximately 20 injection points covering the drum storage/tank farm area and the adjacent area immediately to the south will be conducted. Additional injection events would be carried out as required over a period of up to 5 years.

4. Continued groundwater monitoring at locations established during the bioremediation pilot study, at a minimum of two additional points located south of the pilot study area, and at a minimum of two downgradient points. Groundwater would be monitored for VOCs, dissolved oxygen, organic content and methane at a minimum. Additional groundwater monitoring well installations may be required.

5. Imposition of an institutional control in the form of an environmental easement that would require (a) limiting the use and development of the property to commercial/industrial use; (b) compliance with the approved site management plan; (c) restricting the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by NYSDOH; and (d) the property owner to complete and submit to the Department a periodic certification of institutional and engineering controls.

6. Development of a site management plan which would include the following institutional and engineering controls: (a) continued evaluation of the potential for vapor intrusion for any buildings developed on the site, including provision for mitigation of any impacts identified both on-site and off-site; (b) monitoring of groundwater; (c) identification of any use restrictions on the site; and (d) provisions for the continued proper operation and maintenance of the components of the remedy.

7. The property owner would provide a periodic certification of institutional and engineering controls, prepared and submitted by a professional engineer or such other expert acceptable to the Department, until the Department notifies the property owner in writing that this certification is no longer needed. This submittal would: (a) contain certification that the institutional controls and engineering controls put in place are still in place and are either unchanged from the previous certification or are compliant with Department-approved modifications; (b) allow the Department access to the site; and (c) state that nothing has occurred that would impair the ability of the control to protect public health or the environment, or constitute a violation or failure to comply with the site management plan unless otherwise approved by the Department.

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

Since the remedy results in untreated hazardous waste remaining at the site, a long-term monitoring program would be instituted. Groundwater at and downgradient of the treatment area would be monitored. The monitoring program would allow the effectiveness of the bioremediation and air sparging curtain to be monitored and would be a component of the long-term management for the site.

## TABLE 1
## Nature and Extent of Contamination
April 1998 to May 1998

| Groundwater | Contaminants of Concern | Concentration Range Detected (ppb)[a] | SCG[b] (ppb)[a] | Frequency of Exceeding SCG |
|---|---|---|---|---|
| **Volatile Organic Compounds (VOCs)** | 1,1,1-Trichloroethane | ND to 6,000 | 5 | 4 of 18 |
| | 1,1-Dichloroethane | ND to 3,200 | 5 | 7 of 18 |
| | Vinyl Chloride | ND to 640 | 2 | 5 of 18 |
| | 1,1-Dichloroethene | ND to 570 | 5 | 4 of 18 |
| | cis-1,2-Dichloroethene | ND to 520 | 5 | 6 of 18 |
| | Chloroethane | ND to 180 | 5 | 3 of 18 |
| | Tetrachloroethene | ND to 150 | 5 | 4 of 18 |
| | Trichloroethene | ND to 50 | 5 | 5 of 18 |
| | Toluene | ND to 26 | 5 | 1 of 18 |
| | Benzene | ND to 1.1 | 0.7 | 2 of 1 |

[a] ppb = parts per billion, which is equivalent to micrograms per liter, ug/L, in water;

[b] SCG = standards, criteria, and guidance values; for groundwater samples: New York State Ambient Water Quality Standards

[c]ND = non-detect

## TABLE 2
## IRM TREATMENT AREA MONITORING RESULTS
## VOLATILE ORGANIC COMPOUNDS

| Contaminants of Concern | Concentration Range Detected (ppb)[a] by Year | | | | | SCG[b] (ppb)[a] |
|---|---|---|---|---|---|---|
| | 2000 | 2001 | 2002 | 2003 | 2004 | |
| 1,1,1-Trichloroethane | ND-178000 | 28-24000 | ND-56600 | ND-3610 | ND-6600 | 5 |
| 1,1-Dichloroethane | ND-38200 | ND-18800 | ND-7620 | ND-91 | ND-11000 | 5 |
| Vinyl Chloride | ND-4710 | ND-4320 | ND-180 | ND-342 | ND-1500 | 2 |
| 1,1-Dichloroethene | ND-210 | ND-6630 | ND-227 | ND-91 | ND-330 | 5 |
| cis-1,2-Dichloroethene | ND-24900 | ND-12300 | ND-680 | ND-43 | ND-180 | 5 |
| Chloroethane | ND-5370 | ND-6630 | 16-8640 | 261-9290 | 340-18000 | 5 |
| Tetrachloroethene | ND-13 | ND-72 | ND-37 | ND-65 | ND-9 | 5 |
| Trichloroethene | ND | ND-25 | ND-3 | ND | ND | 5 |
| Toluene | ND-232 | ND-140 | ND-59 | ND-81 | 4-250 | 5 |
| Benzene | ND | ND-20 | ND-48 | ND-40 | ND-3 | 0.7 |

[a] ppb = parts per billion, which is equivalent to micrograms per liter, ug/L, in water

[b] SCG = standards, criteria, and guidance values; for groundwater samples: New York State Ambient Water Quality Standard

[c] ND = non-detect

## Table 3
## Remedial Alternative Costs

| Remedial Alternative | Capital Cost ($) | Annual Costs ($) | Total Present Worth ($) |
|---|---|---|---|
| No. 1: No Further Action | $0 | $16,400 | $251,000 |
| No. 2: Bioremediation of the Drum Storage/tank Farm Area by the Addition of Substrate, Coupled with Hydraulic Restraint | $75,000 | $16,400 | $326,000 |
| No. 3: In-situ Destruction of Contaminants in the Drum Storage/tank Farm Area by Chemical Oxidation, Coupled with Hydraulic Restraint | $748,000 | $16,400 | $949,000 |
| No. 4: Extraction and Treatment of Groundwater in the Drum Storage/tank Farm Area, Coupled with Hydraulic Restraint | $305,000 | $24,600 | $680,000 |
| No. 5: Bioremediation with Additional Injection Points Coupled with Downgradient Air Sparging Curtain and Provision for Contingent Soil Vapor Extraction and Catalytic Oxidation | $265,000 | $18,400 | $547,000 |

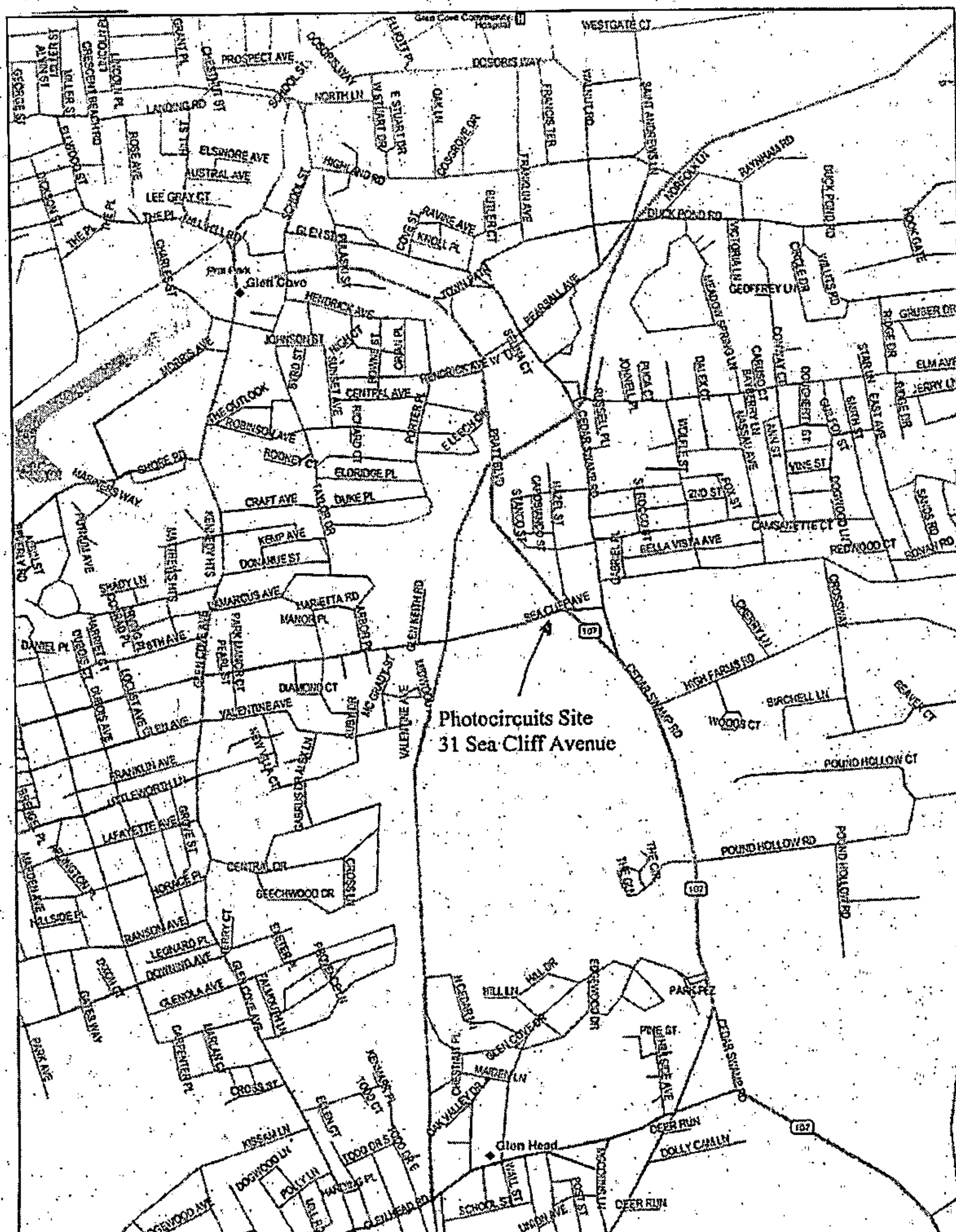



**Figure 1**

Scale 1 : 17,600

1" = 1,466.7 ft    Data Zoom 13-5

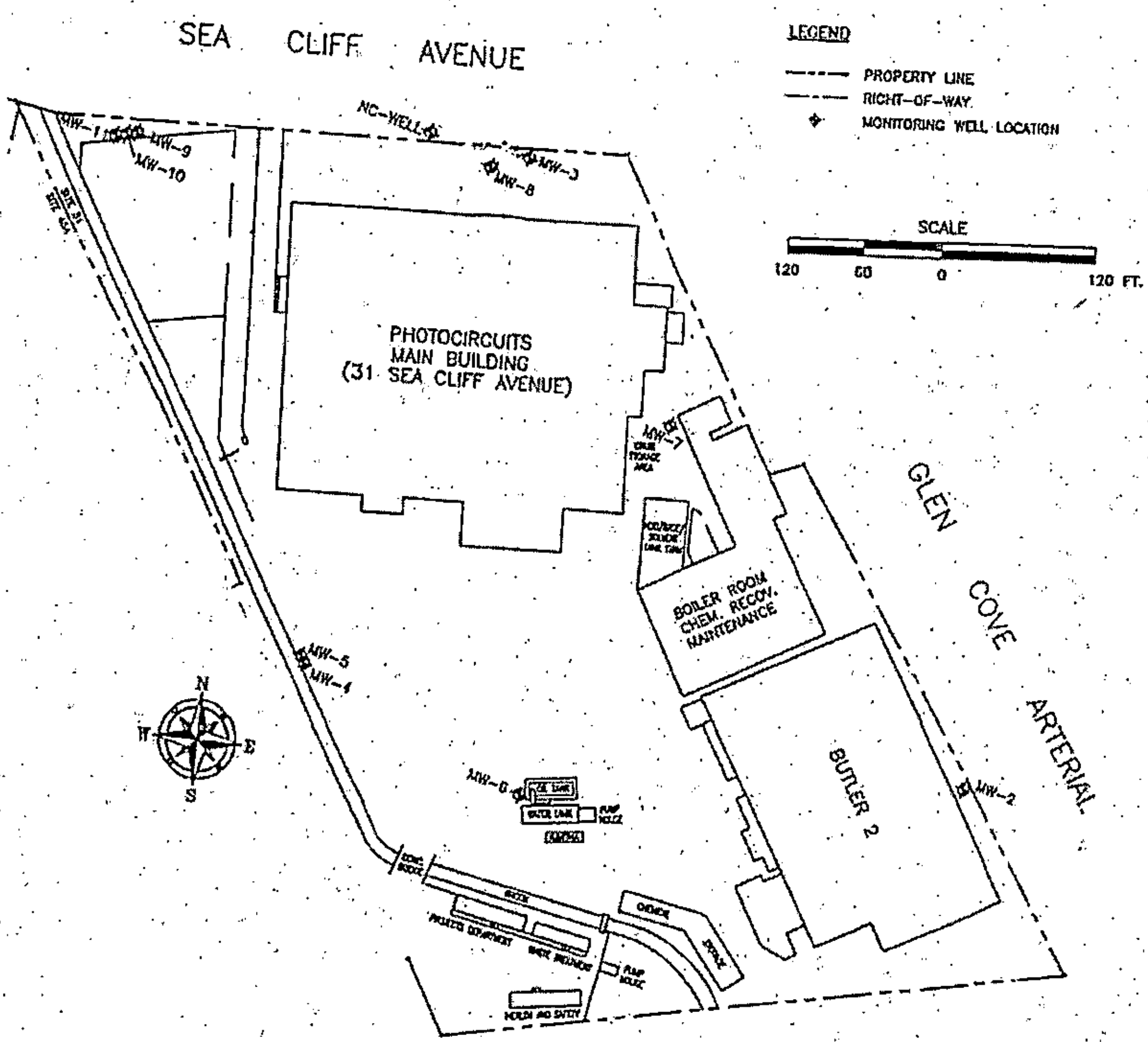
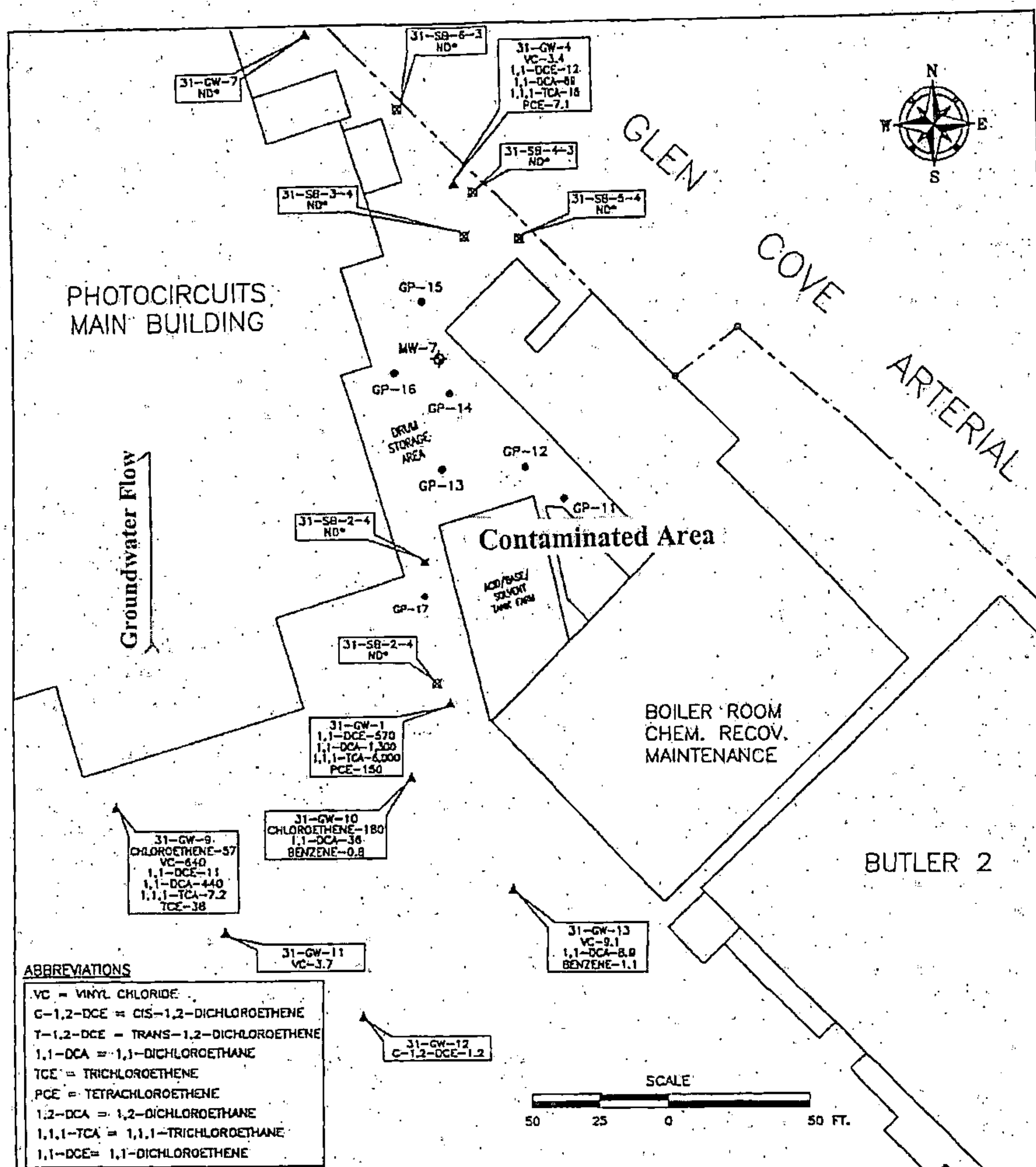



**Figure 2 - Site Map**




LEGEND

- ------ PROPERTY LINE
- –·–·– RIGHT-OF-WAY
- ● SOIL SAMPLE LOCATION (1996)
- ▲ GROUNDWATER GRAB SAMPLE
- ◆ MONITORING WELL LOCATION
- ⊠ SOIL SAMPLE LOCATION (1998)

ND* NO ANALYTES DETECTED IN EXCESS OF NYSDEC CRITERIA

NOTE: ALL RESULTS REPORTED IN PARTS PER BILLION (ppb)

# Figure 3 - RI Groundwater Sampling

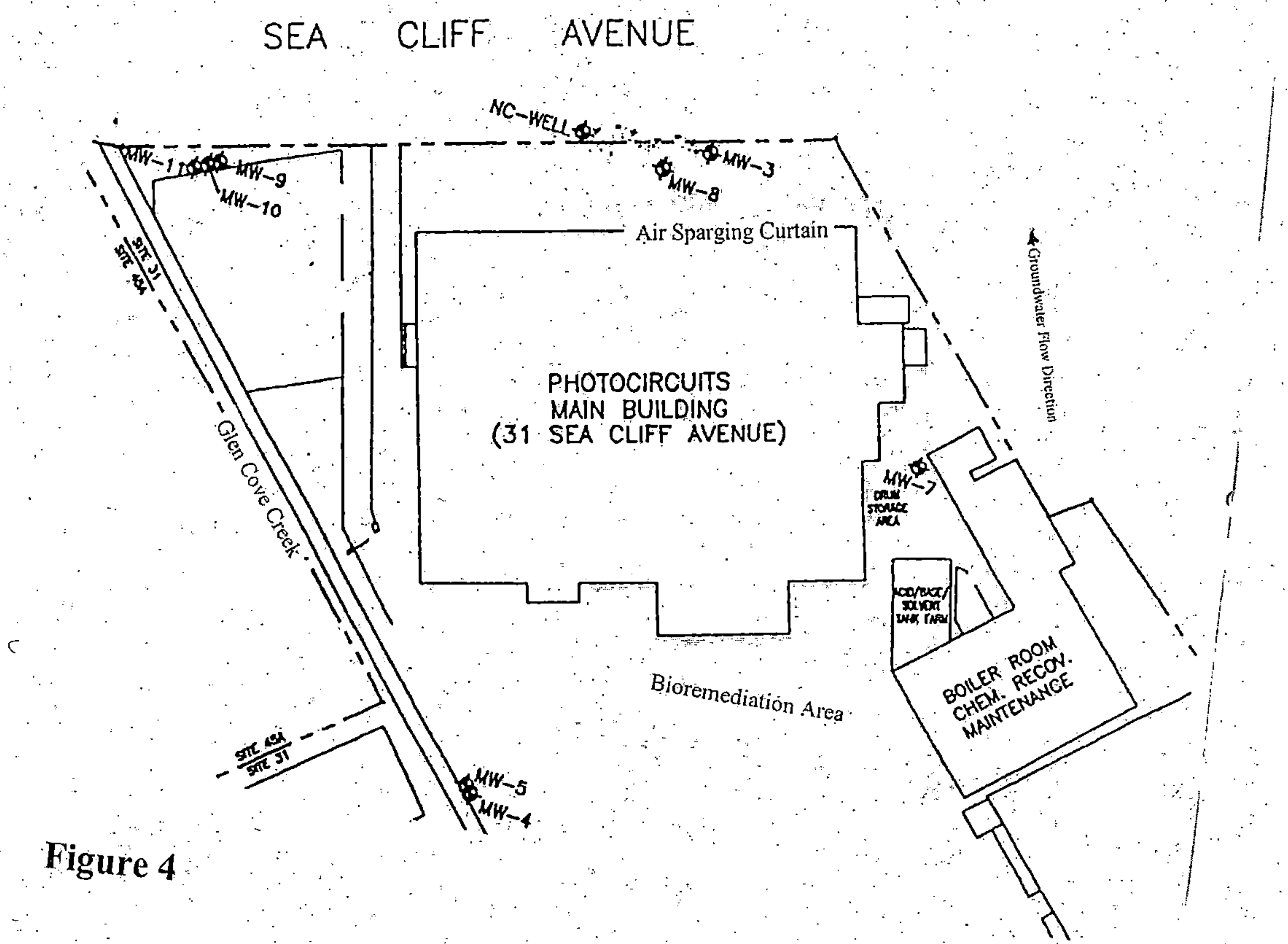

SEA CLIFF AVENUE
NC-WELL
MW-11
MW-9
MW-10
MW-3
MW-8
Air Sparging Curtain
Groundwater Flow Direction
SITE 31
SITE 45A
PHOTOCIRCUITS
MAIN BUILDING
(31 SEA CLIFF AVENUE)
MW-7
DRUM STORAGE AREA
ACID/BASE/SOLVENT TANK FARM
Glen Cove Creek
BOILER ROOM
CHEM. RECOV.
MAINTENANCE
Bioremediation Area
SITE 45A
SITE 31
MW-5
MW-4

**Figure 4**