31 & 45 SEA CLIFF AVENUE SITES
PHOTOCIRCUITS CORPORATION
GLEN COVE, NEW YORK

SITES #130009 AND #130053A

WORK PLAN 2000 FOR REMEDIAL INVESTIGATION (RI) COMPLETION, INTERIM REMEDIAL MEASURE (IRM) IMPLEMENTATION & FEASIBILITY STUDY (FS)

MARCH, 2000

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1.0 INTRODUCTION

This Work Plan has been prepared by Barton & Loguidice, P.C. on behalf of Photocircuits Corporation. This Work Plan provides the methodologies for completing subsurface investigation activities and continuing remedial activities, in compliance with the 1997 and 1998 Orders on Consent between Photocircuits and the New York State Department of Environmental Conservation (NYSDEC). The scopes of these activities were discussed with NYSDEC on February 9, 2000 and were summarized by the NYSDEC in their letter of February 11, 2000. The elements of this Work Plan are as follows:

- Presentation of the methodology for the completion of the Remedial Investigation (RI).
- Presentation of the design and strategy for the implementation of soil vapor extraction (SVE) as an Interim Remedial Measure (IRM) at the 31 Sea Cliff Avenue site.
- Presentation of the design and strategy for the implementation of soil vapor extraction/ air sparging (SVE/AS) as an IRM at the 45 Sea Cliff Avenue site.
- Presentation of the methodology for the performance of a bioremediation pilot test at the 31 Sea Cliff Avenue site.
- Presentation of the methodology for performing a Focused Feasibility Study (FFS) for both sites.
- Presentation of a schedule for the performance of these activities.

2.0 REMEDIAL INVESTIGATION COMPLETION

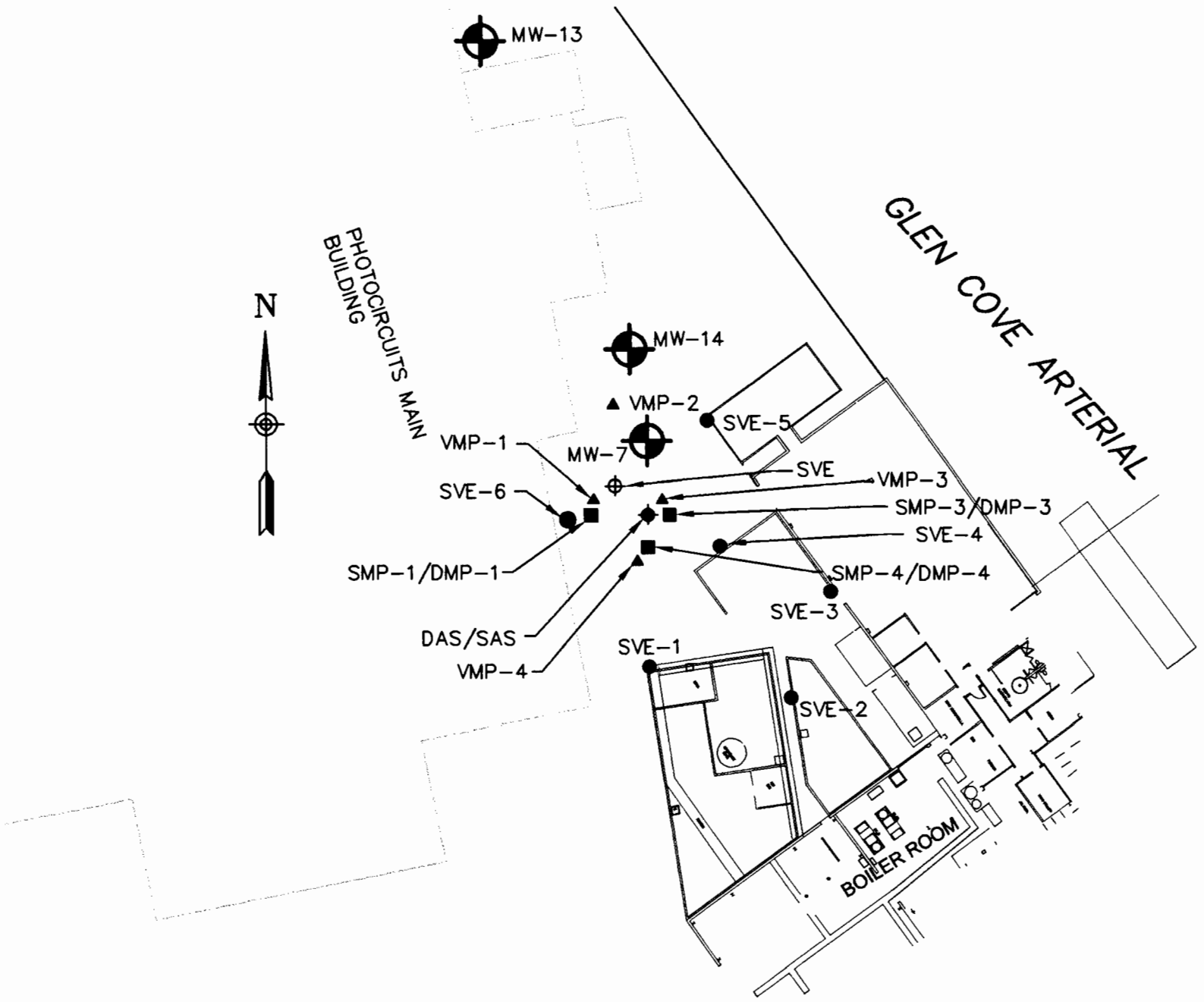
The single issue remaining for completion of the Remedial Investigation (RI) phase of work is to ensure that contamination detected in well MW-14 is sufficiently defined vertically to allow the Interim Remedial Measure (IRM) and Feasibility Study (FS) to move forward. Existing data from well MW-8 (which is roughly 170 feet in depth and located approximately 250 feet north of well MW-14) will be reviewed for this purpose. Well MW-8 has been sampled in 1996 and in 1998 and therefore can provide a meaningful perspective on the vertical extent of contamination in this area. The results of this review will be provided to NYSDEC in an addendum report to the September 1998 RI Report. The addendum will then serve as the completion of the RI phase of work.

3.0 IRM IMPLEMENTATION AT THE 31 SEA CLIFF AVENUE SITE

This section describes the implementation of the IRM at the 31 Sea Cliff Avenue site. The IRM will consist of applying SVE technology to the vadose zone and upper water table zone to remove VOCs. Because the area in which the IRM is to be conducted is congested, SVE operations will be conducted in phases. The remedial system will be moved from location to location within the IRM area, which is shown on Figure 1.

3.1 SVE Equipment

The remedial system will be skid-mounted and will consist of a regenerative blower (5 horsepower, 230 volts), moisture separator, instrumentation, metering, controls and activated carbon treatment for extracted vapors. A process and instrumentation diagram (P&ID) for the remedial system is shown on Figure 2. The system will be connected to



LEGEND

- PROPERTY LINE
- RIGHT-OF-WAY
- MONITORING WELL LOCATION
- VAPOR MONITORING POINT
- SOIL VAPOR EXTRACTION WELL
- SHALLOW/DEEP AIR SPARGING WELL
- HORIZONTAL SOIL VAPOR EXTRACTION WELL
- DEEP AIR SPARGE MONITORING POINT
- SVE WELL

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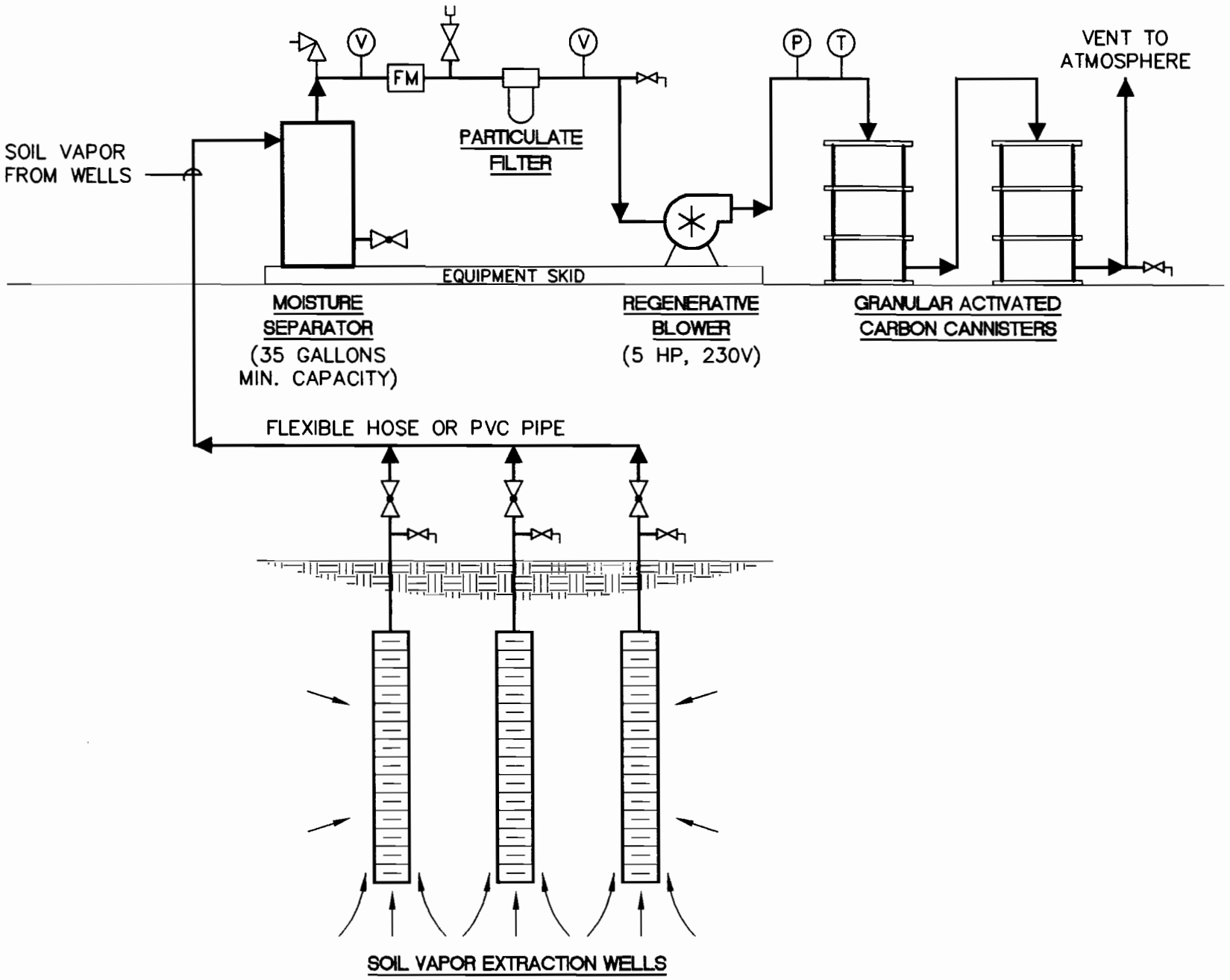
PROPOSED SVE WELL LOCATIONS

NASSAU COUNTY GLEN COVE, N.Y.

Figure 1

Project Number 643.001



LEGEND:

- BALL VALVE
- AMBIENT AIR INLET VALVE
- CLEAN AIR INLET VALVE
- PRESSURE RELIEF VALVE
- SAMPLE PORT VALVE
- FM — FLOW METER
- H — HIGH LEVEL SHUT-OFF SWITCH
- P — PRESSURE GAUGE
- T — TEMPERATURE VALVE
- V — VACUUM GAUGE

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PRELIMINARY PROCESS AND INSTRUMENTATION DIAGRAM

SOIL VAPOR EXTRACTION SYSTEM FOR 31 SEA CLIFF AVENUE SITE

NASSAU COUNTY GLEN COVE, N.Y.

Figure 2

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facility power, and will be piped to the appropriate extraction wells using rigid PVC pipe or flexible pressure hose. The system will be moved within the site area to provide remediation in phases.

3.2 SVE Wells

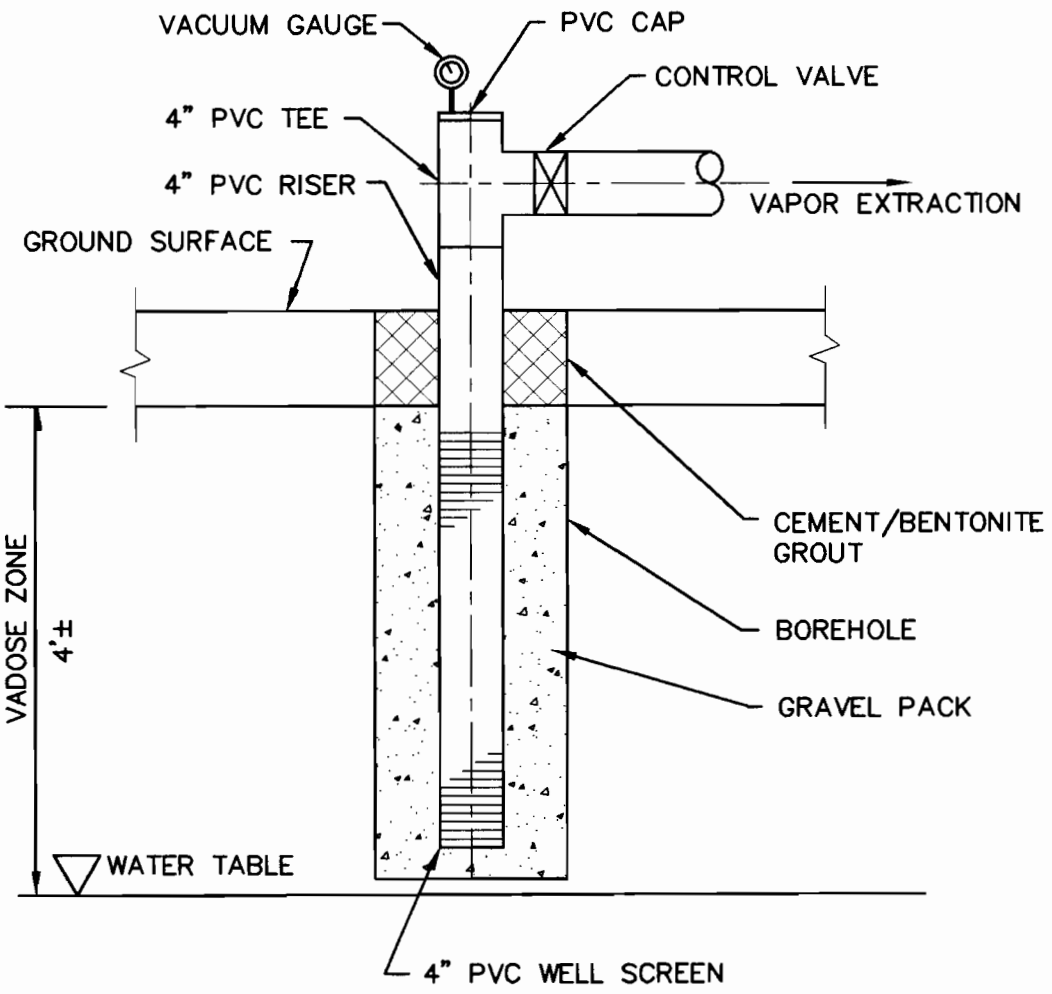
Six SVE wells will be installed at the 31 Sea Cliff Avenue site, as shown on Figure 1. The wells will be constructed as shown on Figure 3.

3.3 Startup

The system will be started and personnel will be on-site to monitor the system and collect vacuum, air flow and total VOC measurements for the initial days of operation from existing vapor monitoring well and new extraction wells. Vapor samples will be collected for laboratory analysis for specific VOCs.

3.4 Monitoring

The system will be checked on a biweekly basis and vacuum, air flow and total VOC concentration measurements will be collected. Two vapor samples will be collected for laboratory analysis for specific VOCs each month. VOC concentration data (both total and specific) will be plotted versus time on a running basis. In a typical SVE application, the plot of concentration versus time follows an asymptotic relationship, with the majority of the contaminant mass removal being achieved in the early stages of system operation. Within each of the phases, the SVE system will be operated in a pulsed mode as the concentration versus time relationship becomes asymptotic. System operation within a



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SOIL VAPOR EXTRACTION WELL CONSTRUCTION

NASSAU COUNTY GLEN COVE, N.Y.

Figure
3
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143.001

particular phase will be discontinued when it can be demonstrated that further system operation will not result in appreciable additional contaminant mass removal. The system will then be moved to the next phased area; the SVE wells in that area will be connected to the system and SVE operation started.

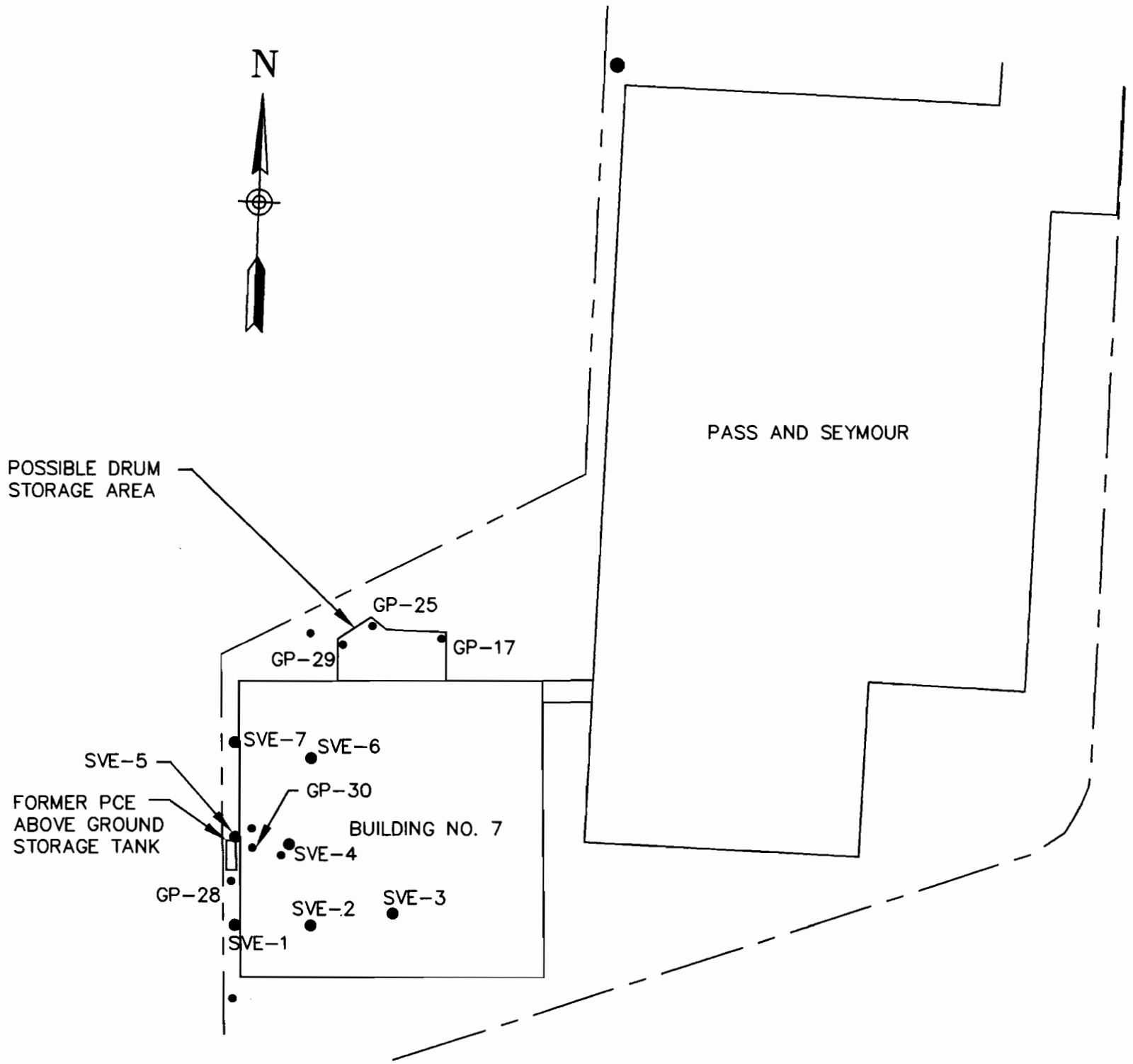
4.0 IRM AT 45 SEA CLIFF AVENUE

This section describes the implementation of the IRM at the 45 Sea Cliff Avenue site. The IRM will consist of applying SVE/AS technology to the vadose zone and upper water table zone to remove VOCs. The IRM implementation area is covered by a building, therefore SVE/AS operations will be conducted in phases. The remedial system will be located on the west side of Building 7, with pipes/hoses running to the well locations shown on Figure 4.

4.1 SVE/AS Equipment

The remedial system will consist of the following components:

- Trailer or skid-mounted with enclosure for system
- 5-8 hp rotary screw compressor
- 5 hp regenerative blower
- Moisture separator
- 230V 3-Phase power
- Standard instrumentation, metering and controls
- Standard system interlocks – sparging module is shut off in the event of a shutdown of the vacuum extraction module



LEGEND

PROPERTY LINE

RIGHT-OF WAY

GEOPROBE SAMPLING LOCATION

SVE WELL

AS WELL

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PROPOSED SVE AND AS WELL LOCATIONS

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Figure
4
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- Carbon treatment for extracted vapors

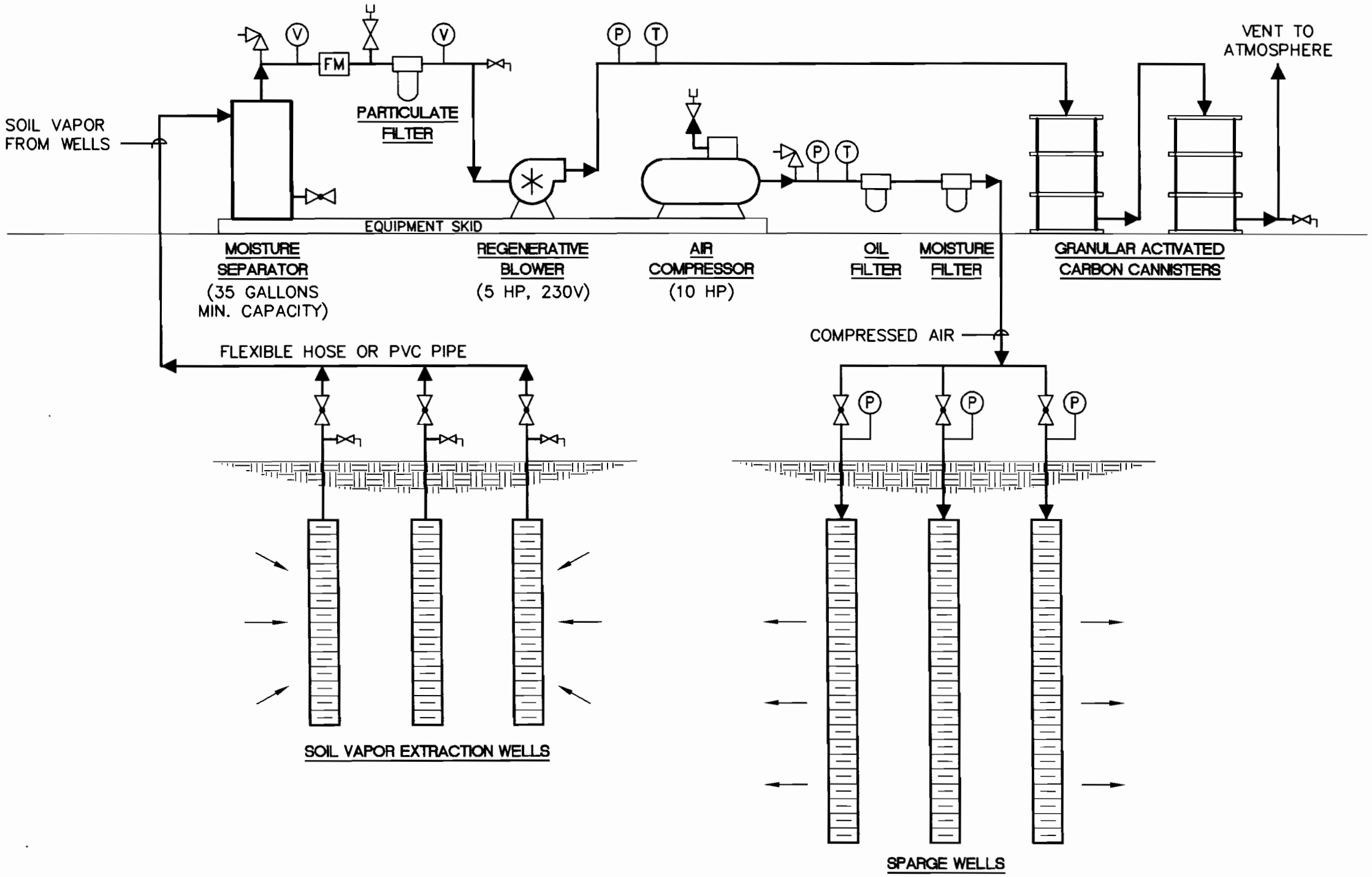
A process and instrumentation diagram (P&ID) for the remedial system is shown on Figure 5. The system will be connected to facility power, and will be piped to the appropriate extraction wells using rigid PVC pipe or flexible pressure hose for the extraction lines and flexible pressure hose for the sparging supply lines. The system will be moved within the site area to provide remediation in phases.

4.2 SVE, AS and Vapor Monitoring Wells

The preliminary number of SVE, AS and vapor monitoring wells on the 45 Sea Cliff Avenue site are shown on Figure 4 along with their approximate locations. The wells will be constructed as shown on Figure 6. Final well locations will be selected based on field reconnaissance and will submitted to NYSDEC prior to well installation.

4.3 Startup

The system will be started and personnel will be on-site to monitor the system and collect vacuum, pressure, air flow and total VOC measurements for the initial days of operation from existing vapor monitoring well and new extraction wells. Vapor samples will be collected for laboratory analysis for specific VOCs.



LEGEND:

- BALL VALVE
- AMBIENT AIR INLET VALVE
- CLEAN AIR INLET VALVE
- PRESSURE RELIEF VALVE
- SAMPLE PORT VALVE
- FM FLOW METER
- (H) HIGH LEVEL SHUT-OFF SWITCH
- (P) PRESSURE GAUGE
- (T) TEMPERATURE VALVE
- (V) VACUUM GAUGE

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PRELIMINARY PROCESS AND INSTRUMENTATION DIAGRAM
SOIL VAPOR EXTRACTION SYSTEM FOR 45 SEA CLIFF AVENUE SITE
NASSAU COUNTY GLEN COVE, N.Y.

Figure 5
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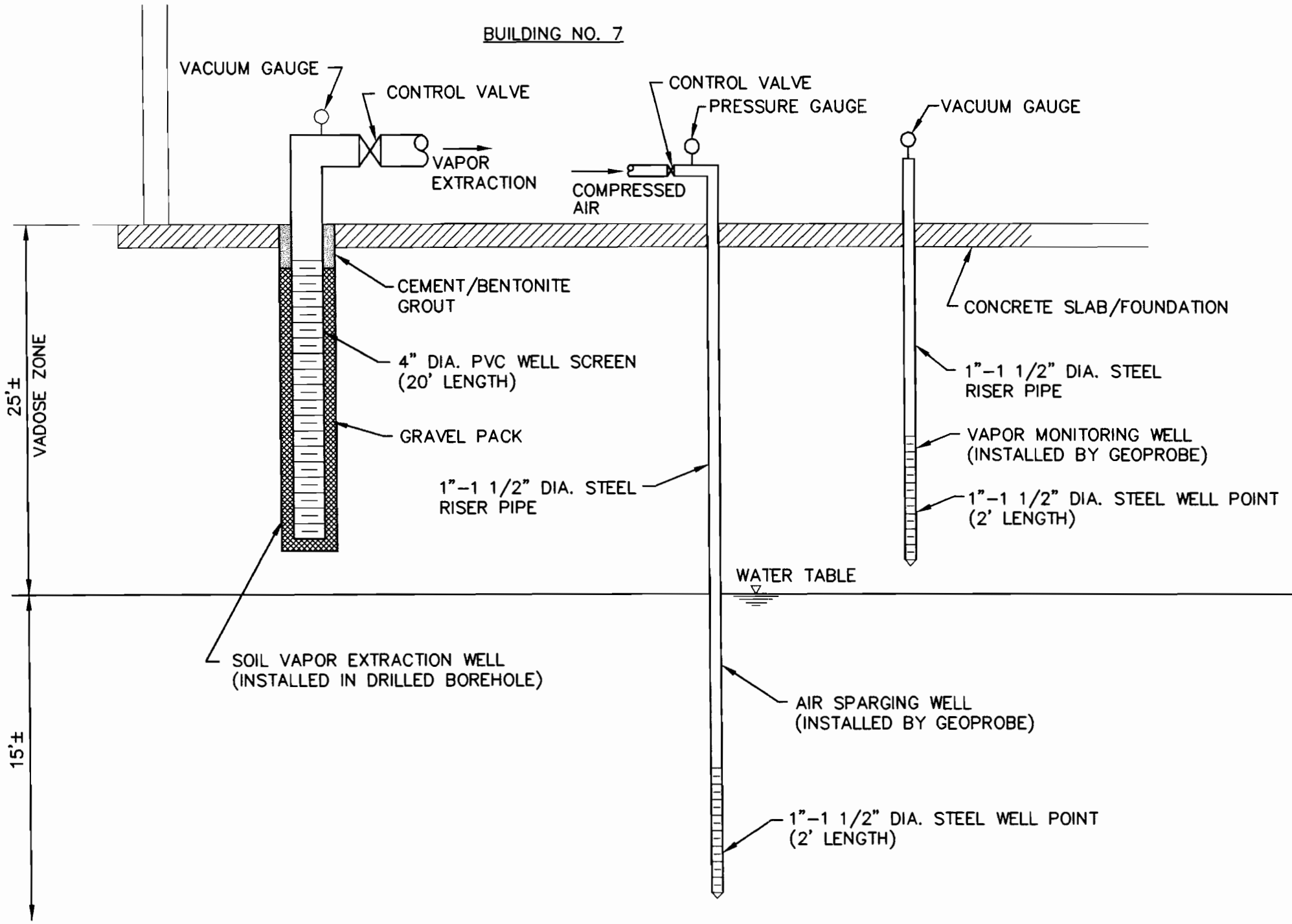

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WELL CONSTRUCTION FOR INTERIM REMEDIAL MEASURE AT 45 SEA CLIFF AVENUE SITE

NASSAU COUNTY GLEN COVE, N.Y.

Figure
6
Project No.
643.001

4.4 Monitoring

The system will be checked on a biweekly basis, and vacuum, pressure, air flow and total VOC concentration measurements will be collected. Two vapor samples will be collected for laboratory analysis for specific VOCs each month. VOC concentration data (both total and specific) will be plotted versus time on a running basis. In a typical SVE/AS application, the plot of concentration versus time follows an asymptotic relationship, with the majority of the contaminant mass removal being achieved in the early stages of system operation. Within each of the phases, the SVE/AS system will be operated in a pulsed mode as the concentration versus time relationship becomes asymptotic. System operation within a particular phase will be discontinued when it can be demonstrated that further system operation will not result in appreciable additional contaminant mass removal. The system will then be moved to the next phased area; the SVE and AS wells in that area will be connected to the system and SVE/AS operations started.

5.0 FOCUSED FEASIBILITY STUDY

A focused Feasibility Study (FFS) will be performed, in accordance with the Order on Consent. The FFS will be performed consistent with USEPA and NYSDEC guidance documents. It is anticipated that the IRMs (previously described) will address contaminant source areas and groundwater contamination at the 45 Sea Cliff Avenue site. The FFS will therefore focus largely on alternatives for addressing groundwater contamination at the 31 Sea Cliff Avenue site. A key element of the FFS will be the performance of a pilot test to evaluate the effectiveness of enhancing existing biologic degradation of VOCs in groundwater.

5.1 Bioremediation Pilot Test

Current and historic site data indicate that chlorinated VOCs are being biologically degraded in the subsurface at the 31 Sea Cliff Avenue site. The strongest evidence is the presence of reductive dechlorination products such as 1,1-dichloroethane and chloroethane. The reductive dechlorination process takes place under anaerobic conditions and can be supplemented to ensure that complete dechlorination takes place. To demonstrate the effectiveness of the technology at this site and to develop the strategy for optimizing biological degradation of the subsurface contaminants, a bioremediation pilot test will be conducted as part of the FS. A completion report on the pilot test will be prepared following receipt of the final round of analytical results.

5.1.1 Groundwater Sampling

To conduct the pilot test, it is necessary to conduct a microecologic profile. The first part of the profile will consist of chemical analyses to characterize the subsurface environment for optimal biodegradation. Groundwater samples will be collected from the following wells:

Upgradient	Impacted Area	Downgradient
MW-6	MW-7, MW-14, SMP-3, DMP-3	MW-12, MW-13

The analytical parameters include parameters such as dissolved nitrogen species (ammonia, nitrate, nitrite), phosphorus, iron, manganese, total organic carbon, sulfate and alkalinity; the samples will also be analyzed for VOCs (USEPA Method 8260B) and non-chlorinated organic end products (ethane, ethene and

methane). In-situ measurements of dissolved oxygen (DO), oxidation/reduction (redox) potential, pH and specific conductance will also be made in each well sampled. These parameters define the existing geochemical conditions and will be used to develop the best means of augmenting the existing biodegradation processes.

5.1.2 Microecologic Analysis

The second part of the microecological profile will be to identify the microbes that are present in the subsurface. Microbial analysis will be conducted on soil; and groundwater samples to assess whether bacteria are already present in the subsurface at the site that are actively degrading the compounds of concern. Groundwater samples will be collected from the monitoring wells identified in the previous section. Soil samples will be collected in the proximity of the monitoring wells, encompassing three general areas on the site - an upgradient location, within the impacted area and downgradient of the heavily impacted area at depths of approximately 15-25 feet and 40-50 feet below grade. Soil samples will be collected using geoprobe equipment. Soil and groundwater samples will also shipped to Lambda Bioremediation Systems, Inc. (Lambda) of Columbus, Ohio for microbial analysis.

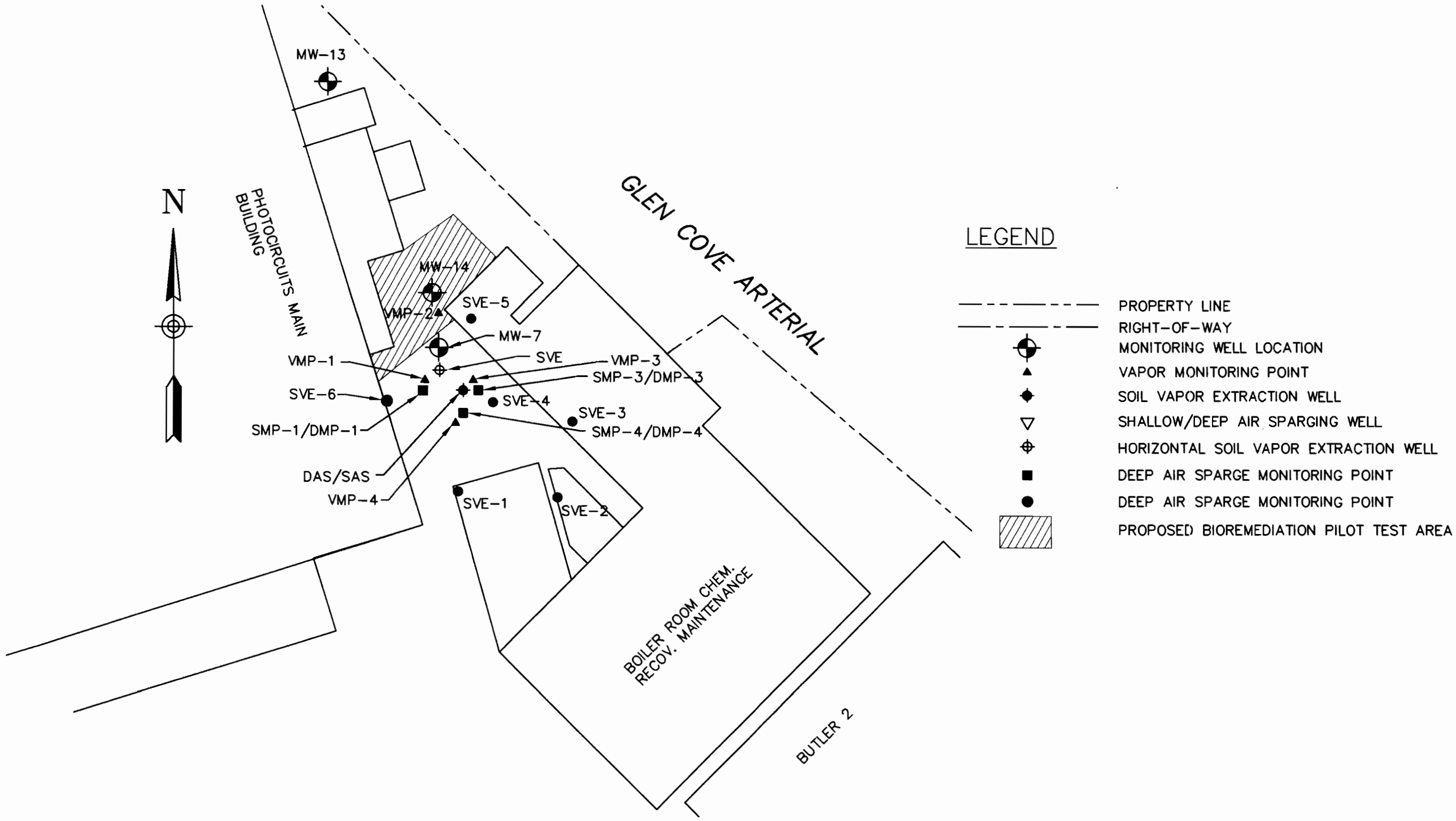
Once Lambda has identified the micro-organisms present at the site, the soil collected from the site will be amended with the appropriate nutrients, sugars, yeasts, etc. and used to promote growth of indigenous micro-organisms which are acclimated to a higher level of degradation activity. The acclimated microbes and nutrients will then be injected back into the ground during the pilot testing activities discussed in the following sections.

5.1.3 Pilot Test

The pilot test will consist of injection of a mixture of nutrients, sugars, yeasts, electron acceptors, and microbes cultured from the soil and groundwater samples which have been acclimated to a higher level of degradation activity. We propose to conduct the injection at three depths: 1) just above the water table (2-3 ft depth), into the groundwater table at a depth of approximately 25 feet below grade, and 3) into the groundwater table at a depth of approximately 50 feet below grade. For the deeper injections, four injection wells will be installed (two each at the 25-foot and 50-foot depths) rather than injection through Geoprobe rods. The injection wells will allow for changes in subsurface chemistry to be detected more quickly, and will be re-used if the full-scale bioremediation is implemented. The wells will be drilled by hollow-stem auger and constructed of two-inch diameter PVC screen and casing, with a 20 foot length of screen. The approximate area for the pilot test is shown on Figure 7.

5.1.4 Monitoring

The pilot test will be monitored in two ways: 1) using in-situ using indicator parameters, and 2) by laboratory analysis of groundwater samples. The indicator parameter monitoring will initially be conducted on a biweekly basis and will consist of measuring dissolved oxygen (DO), temperature, oxidation/reduction (Redox) potential, specific conductance and pH in monitoring wells, injection wells and sparge points located in and around the pilot test area. Groundwater samples will be collected from the four injection wells and from four existing wells (to be designated



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BIOREMEDIATION PILOT TEST AREA

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Figure 7

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following the bioaugmentation injection) three times during the pilot test period. Samples will be analyzed for VOCs and the inorganic suite of parameters previously identified.

5.2 Alternatives Development and Analysis

In addition to bioremediation, a suitable range of alternatives for addressing groundwater contamination will be developed. These alternatives may include individual technologies or approaches, or combinations of technologies and approaches. The alternatives will be compared for their performance against the nine criteria identified by USEPA, which include implementability, short- and long-term effectiveness and cost. The results of this analysis will be presented in tabular form, and a recommended alternative will be presented.

6.0 SCHEDULE

The schedule for implementation of the activities described in this work plan is shown on Figure 8.

7.0 REPORTING

Quarterly reports will be submitted to NYSDEC to document remedial progress of the IRMs and present data collected or generated during the covered period.

Figure 8 - Interim Remedial Measure Scedule

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