003B

Pilot-Scale Air Sparging/Soil Vapor Extraction System Work Plan

OU7

for

Naval Weapons Industrial Reserve Plant

Bethpage, New York

Northern Division
Naval Facilities Engineering Command

Contract Number N62472-90-D-1298

Contract Task Order 0213

March 1997

C F BRAUN ENGINEERING CORPORATION

109501/P

PILOT-SCALE AIR SPARGING/SOIL VAPOR EXTRACTION SYSTEM
FOR
NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
BETHPAGE, NEW YORK

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

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1.0 PROJECT DESCRIPTION

1.1 AUTHORIZATION

The Northern Division of the Naval Facilities Engineering Command has issued Contract Task Order (CTO) 0213 to C F Braun Engineering Corporation under a master agreement with Halliburton NUS Corporation under Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract N62472-90-D-1298. Under CTO 213, C F Braun shall prepare a Work Plan for a Pilot Scale Air Sparging/Soil Vapor Extraction System (AS/SVE) as part of the Remedial Design, Phase II, for Site 1 at the Naval Weapons Industrial Reserve Plant (NWIRP) located in Bethpage, New York.

1.2 BACKGROUND INFORMATION

1.2.1 The Naval Weapons Industrial Reserve Plant

The Naval Weapons Industrial Reserve Plant (NWIRP) Bethpage is located in Nassau County on Long Island, New York, approximately 30 miles east of New York City. This 108 acre site is bordered on the north, west, and south by the Grumman facilities which covers approximately 605 acres, and by a residential neighborhood to the east. The NWIRP is a Government-Owned Contractor Operated (GOCO) facility operated by Northrop-Grumman Corporation. The NWIRP was established in 1933 and is still active. Since its inception, the primary mission for the facility has been the research proto-typing, testing, design engineering, fabrication, and primary assembly of military aircraft.

The facilities at NWIRP include four plants (Nos. 3, 5, and 20, used for assembly and prototype testing; and No. 10, which contains a group of quality control laboratories), two warehouse complexes (north and south), a salvage storage area, water recharge basins, an industrial wastewater treatment plant (WWTP) and several smaller support buildings.

The field activities discussed in this work plan will be performed in the area of Site 1. A brief description of Site 1 is presented below.

1.2.2 Site 1 - Former Drum Marshaling Area

Site 1 is located in the middle third of the NWIRP facility and east of Plant 3 as shown in Figure 1-1.

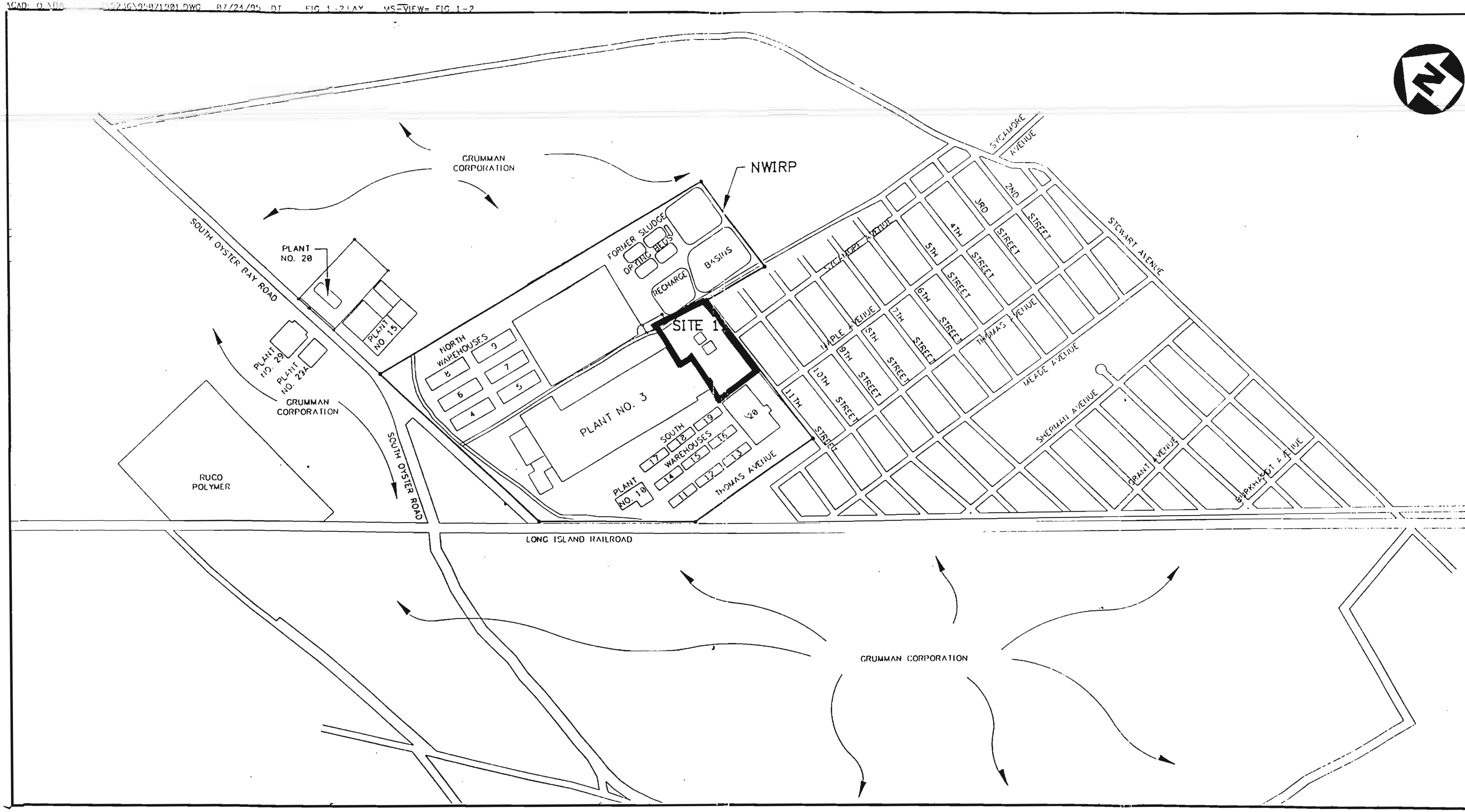

FIGURE 1-1

SITE LOCATION MAP
NWIRP, BETHPAGE, NEW YORK

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CTO 213

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Site 1 occupies an area of approximately 4 acres. It is surrounded on three sides by a fence and on the fourth side by Plant No. 3. The site is relatively flat, with the eastern portion covered with bare sandy soils, gravel, grass, and one concrete pad. The western portion of the site is predominantly covered with concrete. A vegetated wind row (pine) and fence are present along the eastern edge of the site to reduce community visibility.

1.2.3 Previous Investigations

The original basis for the work conducted at the Navy's Site 1 resulted from pubic water supply wells being impacted by VOC contamination. In response to this impact, a regional groundwater quality study was conducted in the 1980s. The results of this study indicated that the Navy's Site 1 to be one of several potential sources of a relatively large groundwater VOC plume originating near this area and extending for several thousand feet to the south (hydraulic downgradient direction).

The Navy conducted a Remedial Investigation in the early 1990s to investigate potential sources of the VOC contamination, (Halliburton NUS, May 1992 and Halliburton NUS July, 1993). Based on this investigation, the source of the groundwater contamination at Site 1 was determined to originate near the former drum marshaling areas. All shallow groundwater samples collected south of the Former Cinder Drum Marshaling Pad, and a few shallow groundwater samples collected north of the pad, exhibited VOC contamination. However, this area of groundwater contamination also coincides with the location of cesspools at the site. The cesspools could also be a source of the VOC contamination.

Soil testing during the Remedial Investigation determined that Site 1 soils contained VOC, PCB, and arsenic contamination. Subsequent soil testing at the site confirmed the presence of PCB and VOC contamination; however, the arsenic contamination could not be confirmed. In addition, testing of the cesspool contents revealed even higher concentrations of VOCs and PCBs in the cesspools then in the surrounding soils, as well as the presence of cadmium contamination.

During pre-design testing under this CTO, sampling was again conducted to confirm an appropriate location for the pilot-scale AS/SVE system. Samples results from soil borings DSB10, DSB11, DSB12, and DSB13 all exceeded the site specific action levels for VOCs. The VOC concentrations in DSB14 did not exceed site-specific action levels.

The most current estimate of VOC- and PCB-contaminated soils and cesspool content is presented in Figure 1-2. Also presented is the estimated extent of groundwater contamination at Site 1.

1.3 PURPOSE

The purpose of this Work Plan is as follows.

- Prepare design plans and installation specifications for a pilot-scale AS/SVE system at Site 1.

- Generate a Field Sampling Plan to monitor AS/SVE operating parameters and VOC concentrations in the soil and groundwater, over the duration of the pilot-scale study.

The objective of the pilot study is as follows.

- Determine the physical parameters required for a full scale system design (well spacing, extraction/injection rates, and well depths).

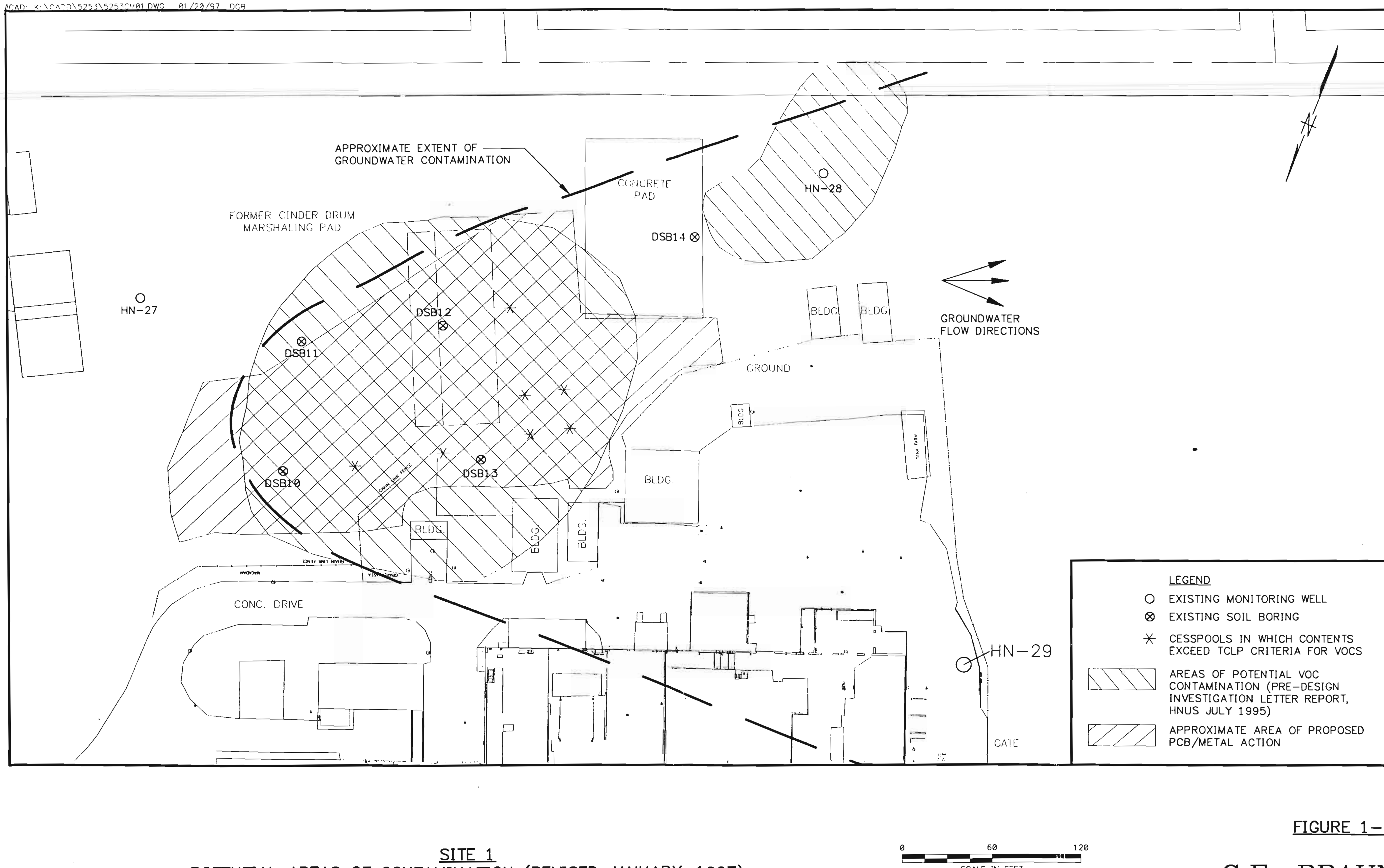
- Evaluate the effectiveness of air sparging/soil vapor extraction in removing VOCs from site soils, cesspools, and shallow groundwater.

- Estimate the time required for cleanup of soils, groundwater, and cesspool contents.

- Determine the requirements for offgas treatment.

1.4 SCOPE OF WORK

Field samples collected during a previous site investigations established the nature and extent of the soil, cesspool, and groundwater contamination at the Site 1. The system installation specifications and Field Sampling Plan contained in this Work Plan will be used to install and monitor a pilot-scale AS/SVE system for remediation of concentrations of VOCs contained in the soil, cesspools, and shallow groundwater. The estimated period of operation of the pilot-scale AS/SVE system at Site 1 is approximately 3 months.



SITE 1
POTENTIAL AREAS OF CONTAMINATION (REVISED JANUARY 1997)
NWIRP, BETHPAGE, NEW YORK

FIGURE 1-2

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1.5 SAMPLE MATRICES, PARAMETERS, AND FREQUENCY OF COLLECTION

Soil, groundwater, and air samples will be collected at specific times over the duration of the project. A detailed description of sample locations, collection frequencies and analytical methods to be applied to the collected samples is presented in the Field Activities Section 4.0 of this document.

1.6 REGULATORY REQUIREMENTS

No permitting is required for the operation of the pilot-scale AS/SVE System as stated by the New York State Department of Environmental Conservation provided in Appendix A.

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1.7 REPORT FORMAT

This Work Plan presents the operating procedures and performance standards required to perform the work identified in this report. Section 1.0 identifies the facility and work required. Section 2.0 provides a description of the key personnel and their responsibility on this project. Section 3.0 identifies the Quality Assurance procedures for the data generated during the implementation of the work. Section 4.0 provides a detailed description of the field work to be performed. Section 5.0 provides the chain-of-custody procedures. Section 6.0 identifies calibration procedures. Section 7.0 provides sample preparation and analytical procedures. Section 8.0 provides information of the procedures for presenting data. Section 9.0 identifies quality control checks. Section 10.0 identifies system audit procedures. Section 11.0 identifies preventive maintenance. Section 12.0 identifies data assessment procedures. Section 13.0 identifies the corrective action procedures and Section 14.0 identifies the procedures for providing Quality Assurance Reports to management. Supplemental information identified in these sections is provided in Appendices A through F.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITY

C F Braun will be responsible for the overall management of the project, including the field inspection and conduct of all drilling, excavation, and sampling activities. Personnel from the Navy will be actively involved in the investigation and will coordinate with personnel from C F Braun in a number of areas.

2.1 PROJECT ORGANIZATION

The key firms and personnel involved in the investigation, as well as the chain-of-communication and responsibility of the project personnel are as follows. The Navy Remedial Project Manager is responsible for the overall management of the IR Program for the NWIRP Bethpage.

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The Project Manager has the primary responsibility for project and technical management of this project. He is responsible for the coordination of all onsite personnel, and for providing technical assistance for all activities that are directly related to the determination of the environmental quality of the site. If quality assurance problems or deficiencies requiring specific action are identified, the project and QA/QC managers will identify the appropriate corrective action.

2.2 FIELD ORGANIZATION

The C F Braun field investigation team will be organized according to the activity planned. For onsite sampling, the sampling team members will be selected based upon the type and extent of effort required. The team will consist of a combination of the following personnel.

- Field Operation Leader (FOL)
- Field Geologist
- Quality Assurance/Quality Control (QA/QC) Advisor

The FOL will be responsible for the coordination of all onsite personnel and for providing technical assistance when required. The FOL, or designee, will coordinate and be present during all sampling activities and will assure the availability and maintenance of all sampling materials and equipment. The FOL will be responsible for completing all sampling and chain-of-custody documentation, state custody of all samples, and ensuring that the samples are properly handled and shipped. The FOL will also be responsible for providing technical supervision of the drilling subcontractor and for maintaining a geologic log of all borings drilled. Copies of the forms to be used in this investigation are provided in Appendix B.

One field team member will be assigned QA/QC Advisor responsibilities. The QA/QC Advisor will assure that all QA/QC guidelines defined in this Work Plan are followed during installation and operation of this pilot-scale AS/SVE system and interface with the QA/QC Manager as needed. Strict adherence to these procedures is critical to the collection of acceptable and representative data.

One designated field team member will function as the Site Health and Safety Specialist. The Site Health and Safety Specialist will be responsible for assuring that all team members adhere to the site health and safety requirements. Additional responsibilities of the Site Health and Safety Specialist are as follows:

- Updating equipment or procedures based upon new information gathered during the site operation.

- Modifying the levels of protection based upon site observations.

- Determining and posting locations and routes to medical facilities, including poison control centers, and arranging for emergency transportation to medical facilities.

- Notifying local public emergency officers, including police and fire departments, of the nature or the team's operations and for posting these department's telephone numbers.

- Examining work-party members for symptoms of exposure of stress.

- Providing emergency medical care and first aid as necessary on site. The site health and safety manager also has the responsibility to stop any field operation that threatens the health or safety of the team or the surrounding populace.

- Interfacing with the Health and Safety Manager as necessary.

3.0 QUALITY ASSURANCE OBJECTIVES FOR DATA MANAGEMENT

The overall QA objective is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting that will provide environmental monitoring data of known and acceptable quality. Specific procedures to be used for sampling, chain-of-custody, calibration of field instruments, laboratory analysis, reporting, internal quality control, audits, preventative maintenance, and corrective actions are described in later sections of this Work Plan. The purpose of this section is to address the data quality objectives in terms of the (PARCC) parameters, quantitation and detection limits, field duplicates, field blanks, trip blanks, rinsate blanks, and bottleware cleanliness.

3.1 DATA QUALITY OBJECTIVES

Data Quality Objectives (DQOs) are qualitative and/or quantitative statements regarding the quality of data needed to support the Work Plan activities. The sampling rationale provided in Section 4.0 explains the choice of sample locations and media which will supply information needed for installation and operation of the pilot-scale AS/SVE system. The data to be collected will be used to evaluate changes in soil, waste, groundwater, and air VOC concentrations during the course of the pilot study.

The site is known to be contaminated with several specific VOCs. If other VOCs are detected (from cross contamination), the relevance of the other VOCs would be evaluated based on previous site data, and non-site related data may be eliminated. Each of these media are expected to be contaminated with VOCs at concentrations of one or more orders of magnitude greater than the chemical-specific MDLs. Therefore, trace concentrations of unexpected compounds (from cross contamination), could also be evaluated for relevance. Also, during the pilot study, a VOC reduction of approximately 90% will be targeted for the soils and groundwater. Overall, based on this use of the data, a reduced QA/QC sample effort will be conducted.

3.2 QUANTITATION AND DETECTION LIMITS

The analytical laboratory will report sample values as Practical Quantitation Limits (PQLs), with allowances for dilutions and dry weight conversions. PQLs are an expression of an analytical methods capability, with consideration given to the matrix characteristics of the samples analyzed. PQLs levels for each analytical method are defined within the method. The laboratory also reports Method Detection Limits (MDLs - for organics) and Instrument Detection Limits (IDLs - for inorganics). These limits, by contract, must be equal to or less than the PQLs.

3.3 PARCC PARAMETERS

The quality of the data set is measured by certain characteristics of the data, namely the PARCC (precision, accuracy, representativeness, comparability, and completeness) parameters. Some of the parameters are expressed quantitatively, while others are expressed qualitatively. The objectives of this project and the intended use of the data define the PARCC goals.

3.3.1 <u>Precision</u>

Precision characterizes the amount of variability and bias inherent in a data set. Precision describes the reproducibility of measurements of the same parameter for a sample under the same or similar conditions. Precision is expressed as a range (the difference between two measurements of the same parameter) or as a relative percent difference (the range relative to the mean, expressed as a percent). Range and Relative Percent Difference (RPD) values are calculated as follows:

$$\text{Range} = OR - DR$$

$$RPD = (OR - DR)/[(1/2)(OR + DR)] \times 100\%$$

where: OR = original sample result

DR = duplicate sample result

The internal laboratory control limits for precision are three times the standard deviation of a series of RPD or range values. RPD values may be calculated for both laboratory and field duplicates, and can be compared to the control limits as a QA check. Because of the relatively high reduction targeted (90%) and the use of replicate samples for groundwater and air, laboratory only limited field duplicates will be analyzed during this program.

3.3.2 Accuracy

Accuracy is the comparison between experimental and known or calculated values expressed as a percent recovery (%R). Percent recoveries are derived from analysis of standards spiked into deionized water (blank spike recovery) or into actual samples (matrix spike or surrogate spike recovery). Recovery is calculated as follows:

$$\%R = E/T \times 100\%$$

where: E = experimental result
T = true value (theoretical result)

and

T = [(sample aliq.)(sample conc.) + (spike aliq.)(spike conc.)]/(sample aliq. + spike aliq)

Control limits for accuracy are set at the mean plus or minus three times the standard deviation of a series or %R values. Organic control limits are set at the mean plus or minus two times the standard deviation of a series of %R values. Because of the projected use of the data, accuracy estimates for aqueous and solid samples will not be evaluated during this program.

3.3.3 Representativeness

All data obtained should be representative of actual conditions at the sampling location. The Work Plan is designed so that the samples taken will present an accurate representation of actual site conditions, by providing for use of standardized sampling and analysis protocols. All sampling activities will conform to the protocols described in Section 4.0 of this Work Plan. The use of EPA-approved analytical protocols and data deliverables will ensure that analytical results and deliverables are representative, and both consistently performed and reported.

3.3.4 Comparability

Use of standardized sampling and analysis methods and data reporting format will also ensure comparability of the data obtained. These measures will also maximize the comparability of this new data to previous data. Additionally, consideration will be given to seasonal conditions and other environmental conditions that could influence analytical results.

3.3.5 Completeness

Completeness is a measure of the amount of valid data obtained from the measurement program, compared to the total amount collected. For relatively clean, homogeneous matrices, 100-percent completeness is expected. However, as matrix complexity and heterogeneous increase, completeness may decrease. Where analysis is precluded or where DQOs are compromised, effects on the overall investigation must be considered. Whether any particular sample is critical to the investigation will be evaluated in terms of the sample location, the parameter in question, the intended data use, and the risk associated with the error.

Critical data points may not be evaluated until all the analytical results are evaluated. If in the evaluation of results it becomes apparent that the data for a specific medium are of insufficient quality (95 percent), either with respect to the number of samples or an individual analysis, re-sampling of the deficient data points may be necessary.

3.4 VALIDATION SAMPLES

Validation samples typically include Field Duplicates, Field Blanks, Trip Blanks, and Rinsate Blanks. As identified in Section 8.0 - Data Reduction, Validation, and Reporting; Field Duplicates and Trip Blanks will be collected, but field blanks and rinsate blanks will not be collected during this field activity.

3.4.1 Field Duplicates

Field duplicates are two samples typically collected either: (1) independently at a sampling location in the case of groundwater or surface water; or (2) a single sample split into two portions in the case of soil or sediment. Duplicates are obtained during a single act of sampling and are used to assess the overall precision of the sampling and analysis program. Duplicates will be collected at a rate of approximately one in ten for soils and groundwater samples.

3.4.2 Field Blanks

Field blanks consist of the source waters used in decontamination processes (steam cleaning and field equipment decontamination). Field blanks are typically obtained at the rate of one per source per sampling event, and are analyzed to determine if these source waters could be introducing contaminants to the collected samples. Field blanks are analyzed for all parameters investigated to support project goals. Field blanks will not be collected during this program.

3.4.3 Trip Blanks

To determine whether contamination of samples has occurred during transit or storage, trip blanks will be used. Trip blanks consist of analyte-free water taken from the laboratory to the site, and returned. Trip blanks are taken at the rate of one per cooler of volatile organic samples for groundwater samples and will be analyzed for TCL VOCs only.

3.4.4 Rinsate Blanks

An equipment rinsate blank consists of the final analyte-free water rinse from equipment decontamination procedures. Typically, one rinsate blank is collected each day per each type of sampling device, however, only rinsate blanks from every other day are analyzed. Rinsate blanks are analyzed for the same parameters as the associated samples. Rinsate samples will not be collected during this field program. ?

Check decon methods.

3.5 BOTTLEWARE

The NEESA guidelines require specific bottleware. Bottles will be provided by the laboratory. The required certification will be provided. Table 3-1 provides a summary of the analysis, bottle requirements, presentation requirements and associated holding times for the samples to be collected.

TABLE 3-1

SUMMARY OF ANALYSIS, BOTTLE REQUIREMENTS, PRESERVATION REQUIREMENTS AND HOLDING TIMES
SUBSURFACE SOIL AND GROUNDWATER SAMPLES
SITE 1
NWIRP, BETHPAGE, NEW YORK

Analysis Parameter	Analytical Method	Total No. of Samples	No. of Containers per Sample	Container Type	Preservation Requirements	Holding Times
SOIL						
Soil Classification	ASTM-2487	3	1	32 oz. clear, wide-mouth jars	None required	None required
Volatile Organic Compounds	SW-846-8240	20	1	4 oz. clear, wide-mouth jar, full and packed.	Cool to 4°C, dark	14 days (10 days within receipt by laboratory)
GROUNDWATER						
Volatile Organic Compounds	SW-846-8240	28	2	60 ml, VOC vial	HCL to pH <2, Cool to 4°C, dark	14 days (10 days within receipt by laboratory
AIR						
VOC	TO-14	8	1	Tedlar Bag	None	3 days

4.0 FIELD ACTIVITIES

4.1 STATEMENT OF WORK

A pilot-scale Air Sparging/Soil Vapor Extraction (AS/SVE) system will be installed at the NWIRP, Bethpage, New York. The system will inject air into the ground via an injection well and extract soil vapor via extraction wells to remove the volatile organic compounds (VOCs) trapped in the soil and groundwater. The VOCs will be removed from the vapor stream by passing the vapor through a carbon adsorption off-gas treatment system before release into the atmosphere. The spent carbon in the off-gas treatment system can be reactivated for later use. The pilot-scale system to be installed for this project and associated sampling and analysis activities are intended to provide information regarding removal and treatment of chlorinated volatile organic compounds (chlorinated VOCs) identified at Site 1.

The results of the pilot-scale test will be used to determine final design parameters for a full scale system including effective radii of influence, off-gas treatment requirements, subsurface soil conditions, well location and depth requirements, flow rate requirements, vacuum and injection pressures, and removal efficiencies.

The air sparging and soil vapor extraction design includes consideration of the cover soil texture, soil permeability, structure, and for relatively tight soils (clays and silts), moisture content. Since air leakage through the cover soils ultimately provides the net air requirement for a vapor extraction system, the cover soil texture directly affects the radius of influence for an individual well. Low permeable cover soils would decrease air leakage into the nearby soils and thereby increase the radius of influence. As a result, low permeability covers are often placed over a site to increase the area affected by each well. Even though the surface soils at this site are relatively permeable, because the relatively deep unsaturated zone (approximately 60 feet) and associated placement of the screens, surface covering was not considered for the pilot study. If the pilot study results indicate that excessive surface leakage is occurring, then the full scale design would include provisions for adding a surface cover.

The coarse native sands at the site should provide a relatively good soil texture and permeability for this technology. For typical fine sands, at moderate pressures, common individual well air injection and extraction rates for this technology are 8 to 12 CFM and 6 to 10 CFM, respectively. For tight, clayey and silty soils, relatively high vacuums or pressures may be required to obtain these rates; or these rates may not be obtainable. Whereas for coarse sandy soils such as those present at the site, these rates may be obtainable with relatively low vacuums and pressures. In addition, at higher vacuums or pressures, much higher air injection and extraction rates can be considered.

Based on the pilot testing conducted at NWIRP Calverton, which has a similar soil type, individual well air injection rates of 13 CFM were achieved at a pressure within 0.5 psi of the pressure needed to displace the water column. Similarly, for individual extraction wells, flow rates of 12 CFM could be achieved with a vacuum pressure of only 0.12 inches of mercury. Based on the relatively low pressure and vacuum requirements experienced during the Calverton pilot study, higher air injection and extraction rates can be considered during the NWIRP Bethpage pilot study.

One potential concern at the NWIRP Bethpage, and in particular for the testing within a cesspool, is that oil contamination at select locations and thin silt lenses could affect the system performance. The data collected during the pilot study can be used to evaluate these affects. Because the site materials are primarily sand, soil moisture is not a primary concern at this site.

4.2 INSTALLATION OF PILOT SCALE SYSTEM

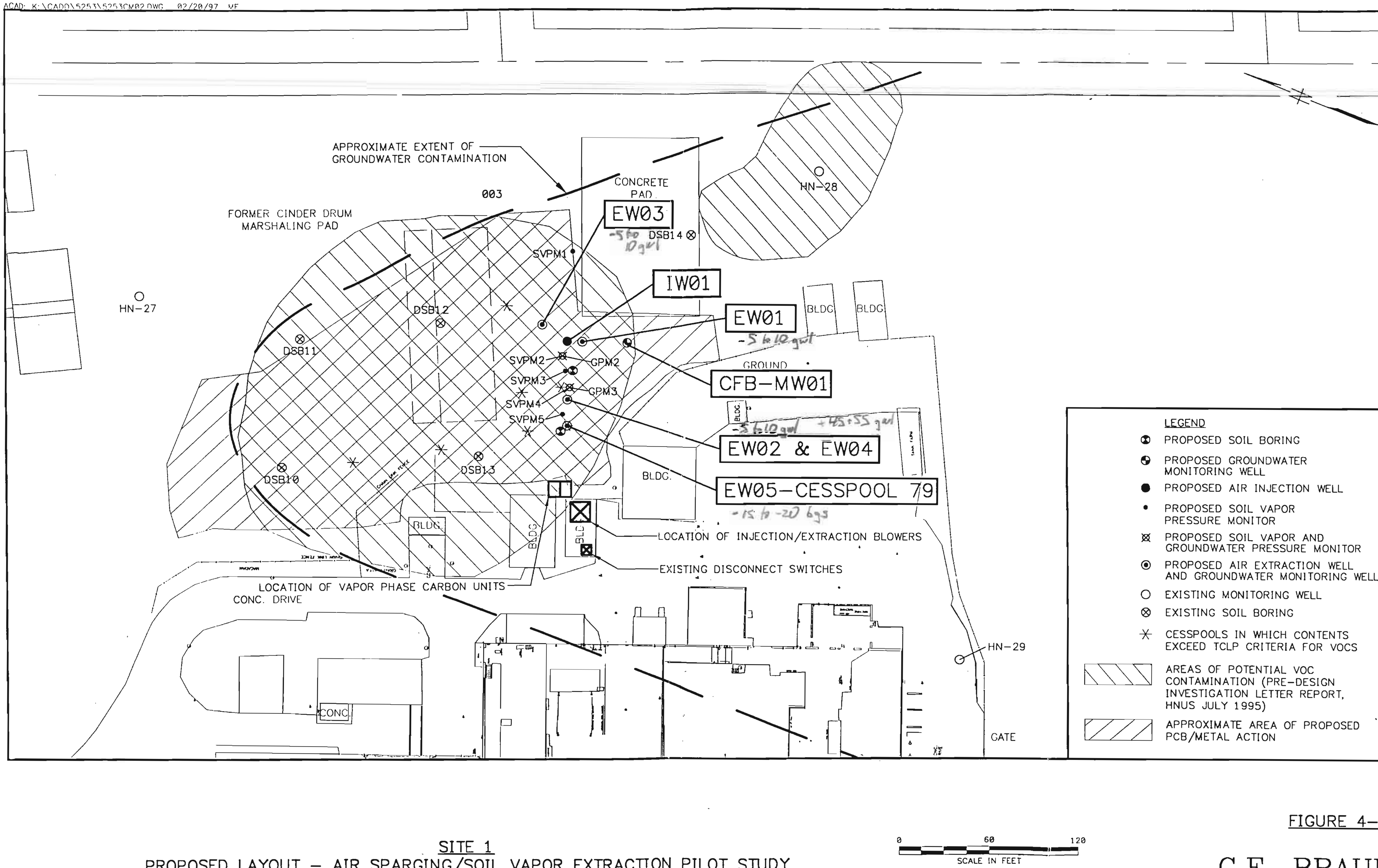
The pilot scale system consists of an air injection system, a soil vapor extraction system, and soil vapor/groundwater monitoring points. Prior to, during, and after the pilot study operation, samples of soil, groundwater, and/or soil gas will be collected and analyzed. The planned location for the major components are presented in Figure 4-1. Details on the installation of the air injection system and soil vapor extraction system are presented in Appendix C and are summarized below. Planned testing and sampling activities are detailed in this section.

Air Injection System - Summary

The air injection system consists of a positive displacement blower and an air injection well (IW01). The blower will be rated for 35 to 60 cubic feet per minute (CFM) at a pressure of 6 pounds per square inch (PSI). The air will be injected at 8 to 10 feet below the water table, (approximate total depth of 70 feet below ground surface (bgs)). The injection well will be located 60 feet east-northeast of Cesspool 79. Sample taps will be installed to allow measurement of pressure and flowrate.

Air Extraction System - Summary

The air extraction system consists of five air extraction wells, a positive displacement soil vapor extraction blower, and vapor phase carbon. The blower will be rated for 100 to 150 CFM at a vacuum of 5 inches of mercury column. The soil vapor extraction wells will be screened at the following depths.



SITE 1
PROPOSED LAYOUT – AIR SPARGING/SOIL VAPOR EXTRACTION PILOT STUDY
NWIRP, BETHPAGE, NEW YORK

FIGURE 4-1

C.F. BRAUN

Extraction Well	Screened Interval	Location
EW01	10 feet above water table to 5 feet below water table (approximately 55 to 70 feet bgs).	Well to be located 10 feet south-southwest of IW01.
EW02	10 feet above water table to 5 feet below water table (approximately 55 to 70 feet bgs).	Well to be located 40 feet west-northwest of IW01, in line with Cesspool 79. Well to be nested with EW04.
EW03	10 feet above water table to 5 feet below water table (approximately 55 to 70 feet bgs).	Well to be located 20 feet north-northeast of IW01.
EW04	20 to 30 feet bgs.	Well to be nested with EW02.
EW05	15 to 20 feet bgs.	Well to located in the center of Cesspool 79.

Two 2000-pound vapor phase carbon units will be used to treat the offgas during the course of the pilot study. Sample taps will be provided on the vacuum header and each individual extraction line to measure flowrate, vacuum, and allow the collection of soil gas samples. Sample taps will be provided prior to, between, and after the carbon units to measure flowrate and allow collection of soil gas.

Monitoring Points - Summary

Monitoring points will be used to determine effective radius of influence distances for the extraction and injection system. These monitor points consist of both dedicated soil vapor, water table, and groundwater monitoring points, as well as the extraction wells.

Four dedicated soil vapor points will be located on the line between the air injection well (IW01) and extraction well EW05. A fifth soil vapor point will be located east of the injection well to confirm that all injected air is being captured. Four of the soil vapor points (SVPM 1, 2, 3, and 4) will be installed with a screened depth of 25 to 30 feet below ground surface. Soil vapor point SVPM 5 will be installed with a screened depth of 15 to 20 feet below ground surface. These points will be installed using the same procedure as the soil vapor extraction wells, (see Appendix C).

A dedicated water table monitoring well (CFB-MW01) will be installed 30 feet downgradient of the air injection well (IW01). The well will be installed across the water table, with 2 feet of screen above the water table and 8 feet of screen below the water table. This well, in conjunction with the air extraction wells, will be used to evaluate groundwater remediation time requirements. Installation techniques will be the same as the air injection well, and include a bentonite seal, (see Appendix C).

Two dedicated groundwater pressure monitors (GPM-2 and GPM-3) will be installed with a screened depth of 4 to 6 feet below the water table. Installation techniques will be the same as for the air injection well and will include a bentonite seal, (see Appendix C).

4.3 FIELD SAMPLING OBJECTIVES

The objectives to be achieved by these field sampling activities are as follows.

- Determine pre-, interim-, and/or post-treatment concentrations of the identified parameters in subsurface soil, groundwater, and extracted soil gas at select points within the proposed area of operation of the AS/SVE system to evaluate the effectiveness of the technology.

- Measure the effective radius-of-influence for the soil vapor extraction wells and air injection well to serve as the basis for a full scale system.

4.4 FIELD SAMPLING ACTIVITIES

The following types of field samples will be collected for fixed-base analytical testing at specified times during installation and operation of the pilot-scale AS/SVE system:

- Soil samples.

- Groundwater samples collected from a permanent groundwater monitoring well, an injection well, and extraction wells.

- Air samples collected from pre- and post-air treatment locations along the vapor-phase air treatment system. Note that addition air samples will be collected for field analysis (Draeger tube and PID analysis).

Each of these sample types are discussed below. The collection frequency and analysis methods are listed in Table 4-1. A schedule for collecting these samples is presented Figure 4-2. A daily/weekly checklist for recording the operation of the pilot study is provided in Figure 4-3.

TABLE 4-1

FIELD SAMPLING ACTIVITIES
PILOT-SCALE AS/SVE SYSTEM - SITE 1
NWIRP, BETHPAGE, NEW YORK

Task	Description of Activities	Sample Event	Sample Depth	Number of Samples	Analysis
Subsurface Soil Boring	Collect soil samples from borings prior to, and after operation of pilot study.	Prior to AS/SVE operation	2 to 3 depths per boring, locations to be determined.	6 to 9, plus one duplicate	VOCs
				3	Geotechnical parameters(1) — Shelby Tube?
		End of AS/SVE operation	Locations to correspond to pre-study locations.	6 to 9, plus one duplicate	VOCs
Groundwater Sample	Collect water samples from air injection well, vapor extraction wells, and new groundwater monitoring wells. ↳ Any existing MW's?	Prior to AS/SVE operation	Water Table	5, plus trip blank and duplicate	VOCs
		End of first and second month of operation	Water Table	10, plus trip blanks and duplicates	VOCs
		End of AS/SVE operation	Water Table	5, plus trip blank and duplicate	VOCs
Air Samples	Collect air samples from pre- and post-air treatment locations on the vapor-phase treatment system.	One week after AS/SVE start-up	Water Table	2	VOCs
		Following each month of operation	Water Table	4	VOCs
		End of AS/SVE operation	Water Table	2	VOCs

VOC = Volatile organic compounds

(1) Geotechnical Parameters to be taken at three boring locations.

FIGURE 4-2

PROPOSED ANALYTICAL TESTING DURING OPERATION
AIR SPARGING/SOIL VAPOR EXTRACTION PILOT STUDY
NWIRP BETHPAGE, NEW YORK

Activity	Pretrial	Week 1 (04/21/97)	Week 2	Week 3	Week 4	Weeks 5 - 7	Week 8	Week 9 - 11	Week 12
Overview	Collect pre-trial samples	Allow system to stablize	Conduct ROI Testing	Conplete ROI Testing	Normal operation	Normal Operation	Normal Operation	Normal Operation	Last week of operation.
Soil Testing	6 - 9 VOCs 3 Geotech.								6 to 9 VOCs
Groundwater Testing	5 samples - VOCs				5 samples - VOCs				5 samples - VOCs
Stratification Testing	3 wells, 3 depths		If necessary						
Soil Vapor - PID[1]		3 rounds, 8 points-VOCs	3 rounds, 8 points-VOCs	8 points-VOCs	8 points - total VOCs	8 points - total VOCs	8 points - total VOCs	8 points - total VOCs	8 points - total VOCs
Soil Vapor - Draeger Tubes,[1,2]		3 rounds, 8 points	3 rounds, 8 points	8 points	8 points	8 points	8 points	8 points	8 points - VOCs
Soil Vapor - Fixed Base[3]	2 samples VOCs	2 samples - VOCs			2 samples - VOCs		2 samples - VOCs		2 samples - VOCs
Radius of Influence - Vapor Extraction			EW01, EW05, EW02, EW04						1 -2 extraction rates ?
Radius of Influence - Air Sparge				IW01					1 - 2 injection rates ?
Blower Maintenance					Change oil and filter, grease		Change oil and filter, grease		Change oil and filter, grease

1) Sample points are: each extraction well (5); pre-carbon unit header; between carbon units; and after carbon units.
2) Initial draeger tubes will consist of carbon dioxide, trichloroethane, trichloroethene, and vinyl chloride. Draeger tube testing may be modified in the field based on initial results.
3) Samples to be collected pre- and post-carbon units.

FIGURE 4-3

CHECK LIST - NORMAL OPERATION
AIR SPARGING/SOIL VAPOR EXTRACTION PILOT STUDY
NWIRP CALVERTON, NEW YORK

1. Extraction Wells

Well	Vacuum inch water	Water Level	PID Reading	Flowrate (ft/min)	TCA	TCE	CO2	Vinyl chloride
EW01								
EW02								
EW03								
EW04		-						
EW05		-						

2. Injection Wells

Well	Pressure (PSI)	Flowrate (ft/min)
IW01		

4.1 Carbon System

Location	Pressure	Flowrate	PID
Pre-carbon			
Between Carbon			
Post Carbon			

3. Monitoring Points

Well	Pressure/Vacuum (inches of water)	Water Level
SVPM1		
SVPM2		
SVPM3		
SVPM4		
SVPM5		
GPM 2		
GPM 3		
CFB-MW01		
HN-29S		

Drilling and Sampling Procedures

Drilling and sampling will be performed in accordance with Halliburton NUS SOPs GH-1.3 and GH-1.5 provided in Appendix D. Requirements of the drilling subcontractor are outlined in Solicitation No. 1298-95-279 procurement of drilling services for CTO 213.

Subsurface soil borings will be drilled to the specified depth depending on the type of well to be installed using hollow stem auger drilling techniques. During drilling operations, Standard Penetration Tests and split-spoon sampling for lithologic description will be performed every 10 feet continuously to the bottom of each soil boring. All split-spoon samples will be screened with an Organic Vapor Analyzer (OVA) or Photoionization Detector (PID) and visually inspected for lithologic description. Split spoon samplers will have a minimum outside diameter of 2 inches and be at least 2 feet long to fulfill the sample volume requirements for chemical analysis. The use of drilling fluids is prohibited during soil boring activities. Drill cuttings will be containerized onsite in 55-gallon drums provided by the drilling subcontractor.

A complete log of each boring will be maintained by the field geologist. Appendix B contains an example of the boring log form and other field forms necessary for recording field activities. At a minimum, the boring log will contain the following information, when applicable, for each overburden boring:

- Sample numbers and types
- Sample depths
- Standard Penetration Test data
- Sample recovery/sample interval
- Soil density or cohesiveness
- Soil color
- Unified Soil Classification System (USCS) material description and symbol

In addition, depths of changes in lithology, sample moisture observations, depth to water, OVA readings, drilling method, and total depth of each borehole should be included on each boring log, as well as any other pertinent observations.

Soil Samples

Subsurface soil testing at the site will consist of preliminary screening of the soils, chemical testing of the soils prior to the start of the pilot study, and chemical testing of the soils at the end of the pilot study. The pilot-scale system includes the installation of one injection well, five soil vapor extraction wells, several monitoring wells, and soil borings. During the installation of each of the wells, split spoon samples will be collected to define lithology, as well as to better define potential VOC contamination of the soils via PID field screening. The PID data will be used to select locations and depths for subsequent soil boring samples and fixed-base VOC analysis.

Based on this data, CF Braun will select three soil boring locations to conduct pre- and post-trial soil testing. These locations will in general represent the three high VOC concentrations detected during the field screening. However, at least one of these soil borings will be within Cesspool 79. The other two soil borings will be within an area affected by the pilot study.

For each soil boring, two or three samples will be collected for chemical analysis (6 to 9 samples) and submitted to a fixed-base laboratory for Volatile Organics Compound (VOC) analysis. Exact sample intervals will be based on the results of the preliminary screening. However, once a location is selected, the same location and depth will be used for both the initial and final sample events. One field duplicate will collected during each sample event. Since all of the soil samples will be collected in areas of known and environmentally significant concentrations of VOCs (greater than the action levels) and the potential for cross contamination is minimal, other QA/QC samples will not be collected during the soil sampling program.

Samples for chemical analysis will be collected by splitting the split spoon open longitudinally and extracting soil from the entire length of the interior of the split spoon. Portions of the sample submitted for volatile organic analysis will be placed directly into the required containers. A stainless steel or dedicated plastic trowel will be used to place the sample into the required containers. The analytical methods to be used for each collected sample is provided in Tables 3-1. Decontamination of drilling and sampling equipment will be performed as described in Section 4-11.

In addition, one soil sample will be collected during the installation of the injection well and two samples will be collected during the installation of two of the extraction well soil borings for geotechnical parameters (Soil Classification - ASTM D2487). The borings to be sampled for geotechnical parameters will be determined in the field, but as a minimum, will be located so as to provide representative data throughout the site.

The pilot-scale system is currently scheduled to operate for a total of 3 months. At the end of the of system operation borings will be placed directly next to the borings sampled during the installation of the pilot-scale system. The same sample collection and procedures will be followed for this round of sampling except Lithology and Geotechnical samples do not need to be collected or submitted for analysis. These samples will be analyzed according to the matrix outlined in Table 4-1.

Groundwater Samples Collected from the Air Injection Well, Vapor Extraction Wells, and Groundwater Monitoring Well

The location of the air injection well, vapor extraction wells, and groundwater monitoring well for groundwater sampling are identified in Figure 4-1. Each of these wells will be sampled prior to start up of the pilot-scale system; after each month of operation (two events), and immediately following the close of operations of the pilot-scale system. A field duplicate and trip blank will be collected during each sample event. No other QA/QC samples are planned. Sampling of the wells shall be performed in accordance with SOP SA-1.1 provided in Appendix D. The analytical methods to be used for each sampling event are listed in Table 3-1. The number of samples to be collected, schedule for the sample events, and analysis to be performed are provided in Table 4-1 and Figure 4-2.

Fixed Base - VOC Air Monitoring Samples

Air samples will be collected from two (2) locations along the exhaust line from the air extraction blower for fixed base chemical testing. One air sample will be collected from the air line that enters the vapor-phase GAC air treatment system, and one air sample will be collected from the air line that exits the GAC treatment system. Air samples for laboratory analysis will be collected from the two locations at the end of the first week of operation, at end of the first and second months of operation, and finally at the end of the pilot-scale study (approximately 3 months after start up). These samples will be used to monitor the overall quality of extracted and treated air discharge and will be used in conjunction with additional field PID readings to calibrate PID results from individual well results and results from between the carbon units . QA/QC samples will not be collected. The analytical methods to be used for each sampling event are listed in Table 3-1. The following procedure will be followed to collect air samples for laboratory analysis:

1. Attach one end of an unused section of Tygon tubing to the hose barb on the vacuum port of the portable vacuum sampling pump. Attach the other end of the tubing to the in-line sample port.

2. Attach one end of another unused section of Tygon tubing to the hose barb on the pressure port of the vacuum sample pump.

3. Turn on the pump and purge the pump and lines for approximately 2 minutes.

4. After the purge is complete, attach the sample pump pressure port line to the tedlar bag, open the fill valve, and allow the sample bag to fill. Once the bag has been inflated to approximately two-thirds of its full capacity (e.g., fully inflated), close the fill valve and the ball valve, and then remove the tubing from the fill valve.

5. While keeping the sample bag under pressure, open the fill valve and deflate the sample bag.

6. Reconnect the fill valve to the teflon tubing.

7. Allow the bag to fill twice by repeating Steps 1 through 6, deflating the bag after each fill to purge the sample bag.

8. After repeating the sample purge procedure, follow Steps 1 through 6 to fill the bag once again to collect the sample, making sure the fill valve is securely closed once the bag is filled.

9. Prepare the air sample for shipping to the lab.

10. Field measurements of VOCs will also be collected by inserting the sample tip of the PID into a separate Tedlar bag fill tube and opening the fill valve.

Soil Gas Stratification Testing

Prior to the start of the test, at a minimum one week after the extraction wells have been installed, soil gas stratification test will be conducted. This test will evaluate the potential for VOCs to stratify within an extraction well and adjacent monitoring well prior to, and during soil vapor extraction. Discrete samples will be collected within the screen zone of the three deep extraction wells (EW01, EW02, and EW03). A personal diaphragm air pump will be used to collect the samples. A length-calibrated suction hose will be placed within the well at depths corresponding to the top of the well screen, the mid-point of the well screen, and just above water table. PID readings will be obtained from the pump discharge.

The testing will be conducted first at the top of the well screen, then at the mid point, and finally at the water table. The time required for each test will be based on sample tube purge times, (determined in the field). At the time equivalent to three suction tube purge volumes, a tedlar sample will be collected as described for the fixed-base VOC air monitoring samples. For each depth, two consecutive air samples will be collected to evaluate variability.

If soil gas stratification is noted in the extraction wells prior to the operation of the soil vapor extraction wells, then additional soil gas stratification tests will be conducted during the operation of the trial. In particular, during the radius of influence testing described below, the stratification testing would be conducted to determine under which soil vapor extraction conditions stratification occurs and what steps can be taken to minimize it.

Field VOC Analysis/Real Time Monitoring

The performance of the AS/SVE system will be monitored in the field using an PID to measure VOC concentrations at each of the extraction wells, prior to the carbon units, between the carbon units, and after the carbon units. At a minimum, each extraction well will be tested during each fixed-base soil vapor sample event. The same tedlar bag may be used at more than one location, with a preference for moving from less contaminated to more contaminated locations. Ambient air will be used to purge the bag in between samples and the PID will be used to document displacement of residual VOCs. The standard to be applied to document adequate purging is less than 1 ppm or less than 10 percent of the following location to be sampled. In the event that this standard is exceeded, then the sample must be collected again.

4.5 RADIUS OF INFLUENCE TESTING

In order to allow the system wells to stabilize, radius of influence testing will be conducted one week after system startup. The testing will consist of operating only one extraction or injection well at a time. Variable extraction and injection rates will be tested. The soil vapor extraction rates will be evaluated over a range of 5 to 80 CFM (if achievable). The injection well will be evaluated over a range of 10 to 60 SCM (if achievable). During the course of the tests, the soil vapor pressures will be allow to stabilize at each flow rate. The soil vapor pressures will be considered stable, when the readings change less then 10% over three consecutive readings. During the tests, Figure 4-4 will be completed for each well tested. The wells and flow rates to be tested (in order) are as follows.

EW01:	5, 10, 20, 40, and 80 CFM.
EW05:	5, 10, 20, 40, and 80 CFM.
EW02:	5, 10, 20, 40, and 80 CFM.
EW04:	5, 10, 20, 40, and 80 CFM.
IW01:	10, 20, 30, 45, and 60 CFM.
IW01/EW02:	Injection rate to be fixed based on previous testing. Extraction rate to vary from 1.0, 1.5, 2.0, and 3.0 times the injection rate.

FIGURE 4-4
RADIUS OF INFLUENCE TESTING - SCHEDULE
AIR SPARGING/SOIL VAPOR EXTRACTION PILOT STUDY
NWIRP BETHPAGE, NEW YORK

Test:____________________ Date:________________

Start Time:__________________ Well (s) Operating:________

Target Flow rate:________________

Initial Header Pressure/Vacuum:____________

Time (hrs)	Flow Rate	SVPM 1	SVPM 2	SVPM 3	SVPM 4	SVPM 5	EW01 Press	EW01 Level	EW02 Press	EW02 Level	EW03 Press	EW03 Level	EW04 Press	EW05 Press	GPM2 Level	GPM3 Level	HN29 Level
0.0																	
0.5																	
1.0																	
2.0																	
4.0																	
6.0																	
8.0																	

Time 0.0 hours is recorded prior to the start of the test.
The criteria for completing the test is to have three consecutive readings with less than a 10% difference for each of the wells.

The test for each well is expected to require one to two days to perform. When switching the test from one well to another, the extraction system must be shutdown and the soil vapor pressures allowed to return to normal prior to testing the next well.

4.6 HEALTH AND SAFETY

Work conducted in conjunction with this field effort shall be performed in a manner which follows the guidelines provided in the site-specific Health and Safety Plan provided in Appendix E.

4.7 SURVEYING

The horizontal and vertical locations of each well and boring will be surveyed following complete installation of the pilot-scale system. Existing survey monuments located near Site 1 at the NWIRP, Bethpage facility will be used as reference points. Horizontal locations will be referenced to the New York state Plane Coordinate System. The horizontal locations of all surveyed points shall be completed to the nearest 0.10 foot. The vertical locations of all surveyed points shall be completed to the nearest 0.01 foot.

4.8 SAMPLE IDENTIFICATION SYSTEM

Each sample submitted to a fixed base laboratory for chemical analysis will be assigned a unique sample tracking number. The sample tracking number will consist of a four-segment, alpha-numeric code that identifies the site, sample medium and number, and sample identification. Any other pertinent information regarding sample identification will be recorded in the field log books and sample log sheets.

The alpha-numeric coding to be used in the sample system is explained below.

<u>Field Samples</u>

(AA) -	(AANNN) -	(NN)
(Site name)	(Sample Medium & Number)	(Sample identifier)

Character Type:

A = Alpha
N = Numeric

Project name:

PS =Pilot-scale

Sample Medium:

GW = Groundwater from the pressure monitoring well (PS-MW-01)
IW = Groundwater from an air injection well
EW = Groundwater from an air extraction well
SB = Subsurface soil from a soil boring
AS = Air sample from the air exhaust system

Sample Number:

A running total of samples collected - Independent of medium

Sample Identifier:

Permanent Monitoring Well = Sample identifier not used
Air Injection Well = Sample identifier not used
Subsurface Soil = Start depth of interval at which sample is collected.
Air = 01 Pre-carbon treatment sample
02 Post-carbon treatment sample

For example, a subsurface soil sample which was the fifth sample collected during this field event was collected from the soil boring to install air injection well at a depth of 10 to 12 feet would be:

PS-SB01-10

4.9 SAMPLING EQUIPMENT AND PROTOCOLS

The protocols to be used during field sampling at Site 1 are presented in Appendix D of this Work Plan and consist of Halliburton NUS Standard Operating Procedures (SOPs).

4.10 SAMPLE HANDLING

Sample handling includes the field-related considerations regarding the selection of sample containers, preservatives, allowable holding times and analyses requested. The EPA User's Guide to the Contract Laboratory Program (EPA, December 1988), and the Federal Register (EPA, October 26, 1984) address the topics of containers and sample preservations.

4.10.1 Sample Packaging and Shipping

Samples will be packaged and shipped in accordance with Halliburton NUS SOP SA-6.2 provided in Appendix D. The FOL will be responsible for completion of the following forms:

- Sample Labels
- Chain-of-Custody Forms
- Appropriate labels applied to shipping coolers
- Chain-of-Custody Labels
- Federal Express Air Bills

4.10.2 Sample Custody

Custody of samples must be maintained and documented at all times. Chain-of-custody begins with the collection of the samples in the field. Section 5.3 of Halliburton NUS SOP SA-6.1 provided in Appendix D provides a description of the chain-of-custody procedures to be followed. A sample chain-of-custody form is attached in Appendix C.

4.11 EQUIPMENT DECONTAMINATION

The equipment involved in field sampling activities will be decontaminated prior to and during drilling and sampling activities. This equipment includes drilling rigs, downhole tools, augers, well casing and screens, and all sampling equipment.

4.11.1 Major Equipment

Downhole drilling and sampling tools shall be steam cleaned prior to beginning work, between well borings, any time the drilling rig leaves the site prior to completing a boring, and at the completion of the drilling program.

These decontamination operations will consist of washing the equipment using a high-pressure steam wash. All decontamination activities will take place on a decontamination pad at a location determined during mobilization. It is assumed that the facility will provide a suitable location for decontamination operations along with potable water and electricity. Additional requirements for drilling equipment decontamination can be found in Halliburton NUS SOP SA-7.1 provided in Appendix D.

4.11.2 Sampling Equipment

All sampling equipment used for collecting samples will be decontaminated both prior to beginning field sampling and between samples. The following decontamination steps will be taken:

- Potable water rinse
- Alconox or liquinox detergent wash
- Potable water rinse
- Methanol rinse
- Hexane rinse (pesticide grade) (only necessary for equipment used on pesticide/PCB samples)
- Steam distilled water rinse
- Air dry
- Wrap in aluminum foil for transport.

4.12 RESIDUE MANAGEMENT

Five types of potentially contaminated residues are expected to be generated during this field investigation, namely Personal Protection Equipment (PPE), drill rig decontamination fluids, sampling equipment decontamination fluids, auger soil cuttings, and purge waters. Based on the activities and types of contaminants present, none of these residues are expected to represent a significant risk to human health or the environment if properly managed. Planned management of each of these residues is provided below.

PPE - PPE will be placed in the trash receptacles at the facility.

Drill Rig Decontamination Fluids - Drill rig decontamination fluids will be containerized in a 55 gallon drums and stored at the site for disposal at the WWTP.

Sampling Equipment Decontamination Fluids - Equipment decontamination fluids will be containerized in 55 gallon drums and handled with the drill rig decontamination fluids.

Auger Soil Cuttings - With the exception of soil cuttings from the upper 30 feet in the PCB hotspot area (EW-02 and EW-04), auger soil cuttings will be spread neatly around the borings at Site 1 to fill in existing dips in the topography. Based on previous testing, the deeper soils at each of these locations are less contaminated than in the surface soils. The upper 30 feet of auger cuttings from EW-02 and EW-04 will be containerized and labeled for ultimate disposal during the full scale, Site 1, PCB remediation.

Purge Water - Groundwater generated during the initial purging of the wells and subsequent sampling of these wells will be screened with an OVA (or PID). Fluids with elevated OVA readings (greater than 1 ppm) will be containerized with the drill rig decontamination fluids. Fluids without elevated OVA readings will be discharged to the ground surface at the site. Runoff will not be allowed.

5.0 DOCUMENTATION AND CHAIN-OF-CUSTODY

Sample custody procedures are designed to provide documentation of preparation, handling, storage, and shipping of all samples collected. An example of the chain-of-custody form, which will be used during this investigation, is included in Appendix B.

Samples collected during the site investigation will be the responsibility of identified persons from the time they are collected until they are appropriately transferred. Stringent chain-of-custody procedures will be followed to document sample possession.

5.1 FIELD CUSTODY

- The FOL, or his or her designee, is responsible for the care and custody of the samples collected until they are delivered to the analytical laboratory or entrusted to a carrier.
- Sample logs or other records will always be signed and dated.
- Chain-of-custody sample forms will be completed to the fullest extent possible prior to sample shipment. They will include the following information: project name, sample number, time collected, source of sample and location, description of sample location, matrix, type of sample, grab or composite designation, preservative, number and size of bottle, analysis, and name of sampler.

These forms will be filled out in a legible manner, using waterproof ink, and will be signed by the sampler. Similar information will be provided on the sample label which will be securely attached to the sample bottle. The label will also include the general analyses to be conducted. In addition, sampling forms will be used to document collection, filtration, and preparation procedures. Copies of all field documentation forms are provided in Appendix B.

5.2 TRANSFER OF CUSTODY AND SHIPMENT

The following procedures will be used when transferring custody of samples:

- Samples will always be accompanied by a chain-of-custody record. When transferring samples, the individuals relinquishing and receiving them will sign, date, and note the time of the chain-of-custody record. This record documents the sample custody transfer from the sampler to the laboratory, often through another person or agency (common carrier). Upon arrival at the laboratory, internal sample custody procedures will be followed.

- Prior to shipment to the laboratory for analysis, samples will be properly packaged. Individual custody records will accompany each shipment. Shipping containers will then be sealed for shipment to the laboratory. The methods of shipment, courier name, and other pertinent information, will be entered in the remarks section of the custody record.

- All shipments will be accompanied by the chain-of-custody record identifying the contents. The original record will accompany the shipment; and a copy will be retained by the field sampler.

- Proper documentation will be maintained for shipments by common carrier.

5.3 SAMPLE SHIPMENT PROCEDURES

The following procedures will be followed when shipping samples for laboratory analysis:

- Samples requiring refrigeration will be promptly chilled with ice or Blue Ice to a temperature of 4°C and will be packaged in an insulated cooler for transport to the laboratory. Ice will be sealed in containers to prevent leakage of water. Samples will not be frozen.

- Only shipping containers that meet all applicable state and Federal standards for safe shipment will be used.

- Shipping containers will be sealed with nylon strapping tape, custody seals will be signed, dated, and affixed, in a manner that will allow the receiver to quickly identify any tampering that may have occurred during transport to the laboratory.

- Shipment will be made by overnight courier. After samples have been taken, they must be sent to the laboratory within 24 hours.

5.4 FIELD DOCUMENTATION RESPONSIBILITIES

It will be the responsibility of the FOL to secure all documents produced in the field (geologist's daily logs, lithologic and sampling logs, communications) at the end of each work day.

The possession of all records will be documented; however, only the project FOL or designee may remove field data from the site for reduction and evaluation.

The data generated by the laboratory will be sent to C F Braun and stored by C F Braun until completion of the pilot-scale AS/SVE project.

6.0 CALIBRATION PROCEDURES

Field equipment such as the Photoionization Detector (PID) and any geophysical equipment used during this project will be calibrated and operated in accordance with the manufacturer's instructions and manuals. A log will be kept documenting the calibration results for each field instrument. The log will include the date, standards, personnel, and results of the calibration.

Calibration procedures for laboratory equipment used in the analysis of environmental samples will be performed in accordance with method-specific requirements.

7.0 SAMPLE PREPARATION AND ANALYTICAL PROCEDURES

Environmental samples collected during the field investigation for chemical analyses will be analyzed using the appropriate analytical procedures as outlined in Table 4-1 of this work plan. All methods to be used are EPA-approved or other guidance..

8.0 DATA REDUCTION, VALIDATION, AND REPORTING

Data validation is the stringent review of an analytical chemical data package with respect to sample receipt and handling, analytical methods, data reporting and deliverables, and document control. To complete a data validation, the full range of QA/QA samples are required. Typically, data validation is used to support potential litigation and is normally conducted during the Remedial Investigation to confirm the presence of contamination and during the Remedial Action to confirm the extent of contamination and final compliance with objectives. Data validation can sometimes be performed during the Feasibility Study and Remedial Design phases. However, it use is limited to cases where relatively small uncertainties in the data can affect the conclusions of the work.

The goal of this sampling event is to determine the effectiveness of the pilot-scale remediation system in support of the design efforts. The area is already identified as contaminated, and VOC reductions in excess of 90% are targeted. Since no additional human or ecological risk assessments will be performed and no litigation involving this work is anticipated, data validation will not be performed for the data generated under this RD task order. Furthermore, information establishing the extent and levels of contamination were already established in the Remedial Investigation.

9.0 EXTERNAL/INTERNAL QUALITY CONTROL CHECKS

There are two types of quality assurance mechanisms used to ensure the production of analytical data of known and documented quality. The internal laboratory quality control procedures for the analytical services are specified in the analytical methodology. These specifications include the types of control samples required (sample spikes, surrogate spikes, controls, and blanks), the frequency of each control, the compounds to be used for sample spikes and surrogate spikes, and the quality control acceptance criteria. It will be the laboratory's responsibility to document, in each data package, that both initial and on-going instrument and analytical QC criteria are met. Only limited external quality control samples (i.e., trip blanks and field duplicates) will be generated by C F Braun.

Analytical results will also be compared to acceptance criteria, and documentation will be performed showing that criteria have been met. Any samples in nonconformance with the QC criteria will be identified and reanalyzed by the laboratory, as required. The following procedures will be employed for the processing of NWIRP Bethpage samples:

- Proper storage of samples.
- Use of qualified and/or certified technicians.
- Use of calibrated equipment.
- Use of standardized test procedures.

10.0 PERFORMANCE AND SYSTEM AUDITS

The following measures have been established to assure that the work is being implemented in accordance with the approved project SOPs and in an overall satisfactory manner:

- The FOL will supervise and check on a daily basis that the soil borings are installed correctly, field measurements are made accurately, equipment is thoroughly decontaminated, samples are collected and handled properly, and the field work is accurately and neatly documented.

- The project manager will oversee the FOL, and check that management of the acquired data proceeds in an organized and expeditious manner.

- System audits for the laboratory are performed on a regular basis.

A formal audit of the field sampling procedures may be conducted in addition to the auditing that is an inherent part of the daily project activities. If so conducted, the auditors will check that sample collection, sample handling, decontamination protocols, and instrument calibration and use are in accordance with the approved project SOPs. The auditors will also check that the field documentation logs and chain-of-custody forms are being filled out properly.

11.0 PREVENTATIVE MAINTENANCE

C F Braun has established a program for the maintenance of field equipment to ensure the availability of equipment in good working order when and where it is needed. This program consists of the following elements:

- The equipment manager keeps an inventory of the equipment in terms of items (model and serial number) quantity and condition. Each item of equipment is signed out when in use, and its operating condition and cleanliness checked upon return.

- The equipment manager conducts routine checks on the status of equipment and is responsible for the stocking of spare parts and equipment readiness.

- The equipment manager maintains the equipment manual library and trains field personnel in the proper use and care of equipment.

- The FOL is responsible for working with the equipment manager to make sure that the equipment is tested, cleaned, charged, and calibrated in accordance with the manufacturer's instructions before being taken to the job site.

The laboratory follows a well-defined program to prevent the failure of laboratory equipment and instrumentation. This preventative program, includes the periodic inspection, lubrication, cleaning, and replacement of parts of the equipment, and is detailed in the laboratory quality assurance plan.

12.0 DATA ASSESSMENT PROCEDURES

12.1 REPRESENTATIVENESS, ACCURACY, AND PRECISION

All data generated in the investigation will be assessed for its representativeness, accuracy, and precision, as feasible. The completeness of the data will also be assessed by comparing the valid acquired data to the project objectives to see that these objectives are being addressed and met. The specific procedures used to determine data precision, accuracy, and completeness will be provided in the analytical reports.

The representativeness of the data will be assessed by determining if the data are consistent with known or anticipated hydrogeologic or chemical conditions and accepted principles. Field measurements will be checked for completeness of procedures and documentation of procedures and results.

Precision and accuracy will be evaluated using replicate and duplicate samples and trip blank samples, respectively. The specific procedures for determining PARCC parameters are outlined in Section 3.0.

12.2 VALIDATION

As discussed in Section 8.0, data validation is not being performed for this RD project, because the information observed is for basic design purposes only and does not require validation. However, a data review will be conducted. This review will compare the results obtained with previous data sets and expected trends, (e.g. decrease in concentration with treatment).

13.0 CORRECTIVE ACTIONS

The Brown & Root Environmental QA program will enable problems to be identified, controlled, and corrected. Potential problems may involve nonconformance with the SOPs and/or analytical procedures established for the project or other unforeseen difficulties. Any person identifying an unacceptable condition will notify the project manager. The project manager, with the assistance of the project QA/QC advisor, will be responsible for developing and initiating appropriate corrective action and verifying that the correction action has been effective. Corrective actions may include the following: resampling and/or reanalysis of sample, amending or adjusting project procedures. If warranted by the severity of the problem (for example, if a change in the approved work plan is required), the Navy will be notified in writing and their approval will be obtained prior to implementing any change. Additional work that is dependent on a nonconforming activity will not be performed until the problem has been eliminated.

The laboratory maintains an internal closed-loop corrective action system that operates under the direction of the laboratory QA coordinator.

14.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

The QA/QC manager will review all aspects of the implementation of the FSAP on a regular basis and with the use of designated support personnel, will prepare a summary report. Reviews will be performed at the completion of each field activity and reports will be completed at this time. These reports will include an assessment of data quality and the results of system and/or performance audits. Any significant QA deficiencies will be reported and identified, and corrective action possibilities discussed. The laboratory will issue monthly progress reports.

REFERENCES

ASTM, March 1988. Annual Book of Standards - Soil and Rock, Building Stones; Geotextiles. Section 4, Volume 04.08.

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U.S. EPA, 1986. Test Methods for Evaluating Solid Waste - SW846.

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APPENDIX A

AIR PERMIT WAIVER LETTER

New York State Department of Environmental Conservation
50 Wolf Road, Albany, New York 12233-7010

Michael D. Zagata
Commissioner

April 5, 1995

Mr. David Brayack, P.E.
Halliburton NUS Environmental Corporation
661 Anderson Drive
Pittsburgh, PA 11501-4250

RE: <u>NWIRP-Bethpage</u>
<u>Calverton-NWIRP</u>
Site Numbers: 130003B 152136

Dear Mr. Brayack:

Enclosed please find three (3) copies of the permit form for a Process, Exhaust or Ventilation System along with a copy of the instruction manual.

A permit application need not be submitted for the soil vapor extraction pilot test programs at the above-referenced sites as long as there is a treatment system in place (such as a vapor phase granular activated carbon system) at each site. A permit application will be required for each site as part of the design reports for the full-scale soil vapor extraction systems.

If you have any questions regarding this matter, please feel free to contact me at (518) 457-3395 or Jeff McCullough at (518) 457-3976.

Very truly yours,

John D. Barnes, P.E.
Environmental Engineer 2
Bureau of Eastern Remedial Action
Div. of Hazardous Waste Remediation

cc: S. Ervolina
S. McCormick
M. Chen
J. McCullough
J. Colter (Navy)

APPENDIX B

FIELD FORMS

Brown & Root Environmental

BORING LOG

PROJECT: ______________________ BORING NO.: ______________

PROJECT NO.: ______________ DATE: ______________ DRILLER: ______________

ELEVATION: ______________ FIELD GEOLOGIST: ______________

WATER LEVEL DATA: ______________________________

(Date, Time & Conditions) ______________________________

					MATERIAL DESCRIPTION*				
SAMPLE NO. & TYPE	DEPTH (Ft.) OR RUN NO.	BLOWS/6" OR RQD (%)	SAMPLE RECOVERY/SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, Ft.)	SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS

REMARKS ______________________________

BORING ______________

PAGE _____ OF _____

* See Legend on Back

SOIL TERMS

UNIFIED SOIL CLASSIFICATION (USCS)

COARSE GRAINED SOILS

More than half of material is LARGER than No. 200 sieve size

		FIELD IDENTIFICATION PROCEDURES (Excluding particles larger than 3" & basing fractions on estimated weights)	GROUP SYMBOL	TYPICAL NAMES
GRAVELS 50%(+) > ¼" Ø	CLEAN GRAVELS (Low % fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes	GW	Well graded gravels, gravel sand mixtures, little or no fines
		Predominantly one size or a range of sizes with some intermediate sizes missing	GP	Poorly graded gravels, gravel-sand mixtures, little or no fines
	GRAVELS W/FINES (High % fines)	Non plastic fines (for identification procedures see ML)	GM	Silty gravels, poorly graded gravel sand silt mixtures.
		Plastic fines (for identification procedures see CL)	GC	Clayey gravels, poorly graded gravel sand clay mixtures
SANDS 50%(+) < ¼" Ø	CLEAN SANDS (Low % fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes	SW	Well graded sand, gravelly sands, little or no fines
		Predominantly one size or a range of sizes with some intermediate sizes missing	SP	Poorly graded sands, gravelly sands, little or no fines
	SANDS W/FINES (High % fines)	Non plastic fines (for identification procedures see ML)	SM	Silty sands, poorly graded sand silt mixtures
		Plastic fines (for identification procedures see CL)	SC	Clayey sands, poorly graded sand clay mixtures

FINE GRAINED SOILS

More than half of material is SMALLER than No. 200 sieve size

FIELD IDENTIFICATION PROCEDURES (Excluding particles larger than 3" & basing fractions on estimated weights)

Identification procedures on fraction smaller than No. 40 sieve size

	DRY STRENGTH (Crushing Characteristics)	DILATANCY (Reaction to Shaking)	TOUGHNESS (Consistency Near Plastic Limit)	GROUP SYMBOL	TYPICAL NAMES
SILTS & CLAYS Liquid limit < 50	None to slight	Quick to slow	None	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity
	Medium to high	None to very slow	Medium	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
	Slight to medium	Slow	Slight	OL	Organic silts and organic silt clays of low plasticity
SILTS & CLAYS Liquid limit > 50	Slight to medium	Slow to none	Slight to medium	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
	High to very high	None	High	CH	Inorganic clays of high plasticity, fat clays
	Medium to high	None to very slow	Slight to medium	OH	Organic clays of medium to high plasticity
HIGHLY ORGANIC SOILS	Readily identified by color, odor, spongy feel and frequently by fibrous texture.			PT	Peat and other organic soils

Boundary classifications: Soils possessing characteristics of two groups are designated by combining group symbols. For example GW-GC, well graded gravel sand mixture with clay binder.
All sieve sizes on this chart are U.S. standard.

LEGEND

SOIL SAMPLES - TYPES

S - 2" O.D. Split Barrel Sample
ST - 3" O.D. Undisturbed Sample
O - Other Samples, Specify in Remarks

ROCK SAMPLES - TYPES

X - NX (Conventional) Core (~2-1/8" O.D.
Q - NQ (Wireline) Core (~1-7/8" O.D.)
Z - Other Core Sizes, Specify in Remarks

WATER LEVELS

12/18
▼12.6' Initial Level w/Date & Depth

12/18
▼12.6' Stabilized Level w/Date & Dept

DENSITY OF GRANULAR SOILS

DESIGNATION	STANDARD PENETRATION RESISTANCE - BLOWS/FOOT
Very loose	0-4
Loose	5-10
Medium dense	11-30
Dense	31-50
Very dense	Over 50

CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNC. COMPRESSIVE STR. TONS/SQ. FT.	STANDARD PENETRATION RESISTANCE - BLOWS/FOOT	FIELD IDENTIFICATION METHODS
Very soft	Less than 0.25	0 to 2	Easily penetrated several inches by fist
Soft	0.25 to 0.50	2 to 4	Easily penetrated several inches by thumb
Medium stiff	0.50 to 1.0	4 to 8	Can be penetrated several inches by thumb
Stiff	1.0 to 2.0	8 to 15	Readily indented by thumb
Very stiff	2.0 to 4.0	15 to 30	Readily indented by thumbnail
Hard	More than 4.0	Over 30	Indented with difficulty by thumbnail

ROCK TERMS

ROCK HARDNESS (FROM CORE SAMPLES)

DESCRIPTIVE TERMS	SCREWDRIVER OR KNIFE EFFECTS	HAMMER EFFECTS
Soft	Easily gouged	Crushes when pressed with hammer
Medium soft	Can be gouged	Breaks (one blow) Crumbly edges
Medium hard	Can be scratched	Breaks (one blow) Sharp edges
Hard	Cannot be scratched	Breaks conchoidally (several blows) Sharp edges

ROCK BROKENNESS

DESCRIPTIVE TERMS	ABBREVIATION	SPACING
Very broken	(V. Br.)	0 - 2"
Broken	(Br.)	2" - 1'
Blocky	(Bl.)	1' - 3'
Massive	(M.)	3' - 10'

Brown & Root Environmental

SAMPLE LOG SHEET

PAGE____ OF____

[ ] SURFACE SOIL
[ ] SUBSURFACE SOIL
[ ] SEDIMENT
[ ] LAGOON/POND
[ ] OTHER

SAMPLERS SIGNATURE____________________

SITE NAME____________________

SITE NUMBER____________________

SAMPLE No.	SAMPLE METHOD	DEPTH (FT)	DATE	TIME	SAMPLED BY	CONCENTRATION (L)LOW (H)HIGH	(G)GRAB (C)COMPOSITE	ANALYSES							No. OF CONT TOTAL	SOIL DESCRIPTION

REMARKS:

LAB:

Brown & Root Environmental

SAMPLE LOG SHEET

☐ Monitoring Well Data
☐ Domestic Well Data
☐ Other ___________

Page _____ of _____

Case # ___________

By ___________

Project Site Name ______________________ Project Site Number ______________________

NUS Source No. ______________________ Source Location ______________________

	Purge Data						
Total Well Depth:	Volume	pH	S.C.	Temp. (°C)	TURB	DO	SAL
Well Casing Size & Depth:							
Static Water Level:							
One Casing Volume:							
Start Purge (hrs.):							
End Purge (hrs.):							
Total Purge Time (min.):							
Total Amount Purged (gal.):							
Monitor Reading:							
Purge Method:							
Sample Method:							
Depth Sampled:							

	Sample Data					
Sample Date & Time:	pH	S.C.	Temp. (°C)	TURB	DO	SAL
Sampled By:						

Signature(s):	Observations / Notes:

Type of Sample

☐ Low Concentration
☐ High Concentration
☐ Grab
☐ Composite
☐ Grab - Composite

Analysis:	Preservative				

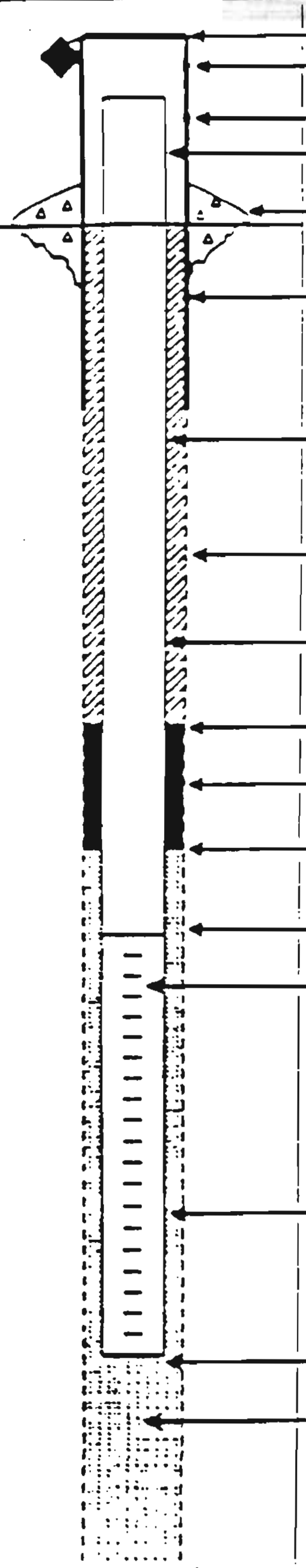
BORING NO. ____________

Brown & Root Environmental

MONITORING WELL SHEET

PROJECT ____________ LOCATION ____________ DRILLER ____________
PROJECT NO. ____________ BORING ____________ DRILLING METHOD ____________
ELEVATION ____________ DATE ____________ DEVELOPMENT METHOD ____________
FIELD GEOLOGIST ____________

GROUND ELEVATION



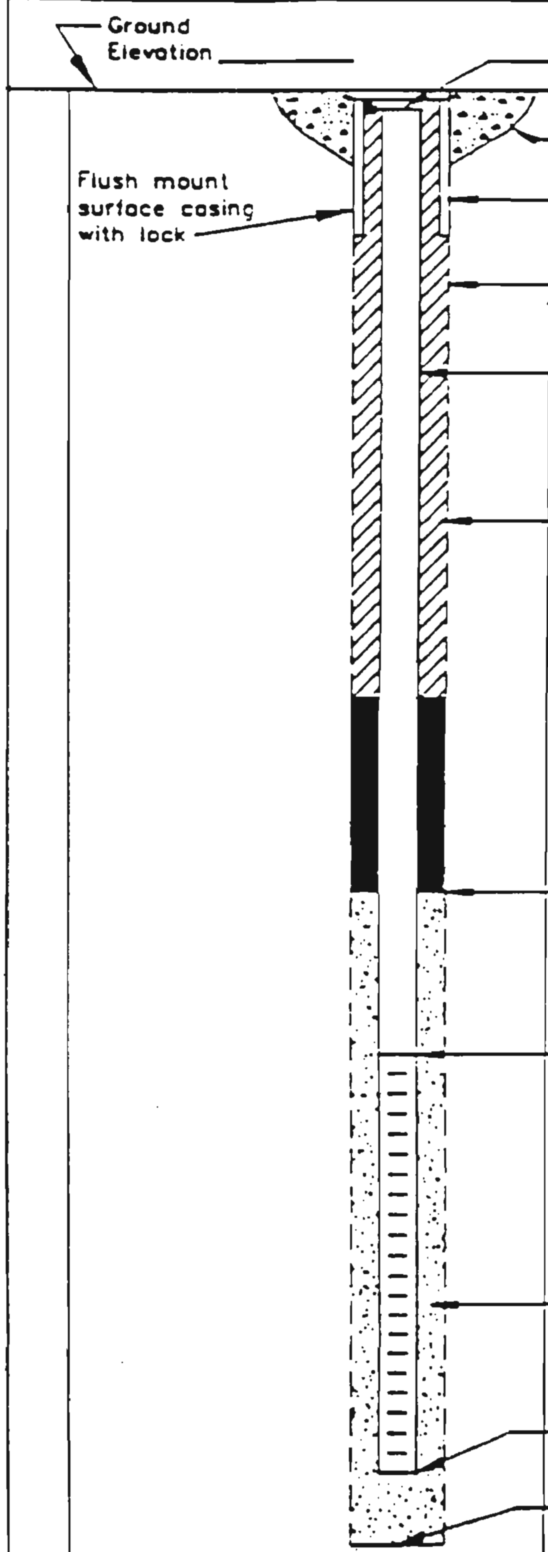
ELEVATION OF TOP OF SURFACE CASING: ____________
ELEVATION OF TOP OF RISER PIPE: ____________
STICK - UP TOP OF SURFACE CASING: ____________
STICK - UP RISER PIPE: ____________
TYPE OF SURFACE SEAL: ____________
I.D. OF SURFACE CASING: ____________
TYPE OF SURFACE CASING ____________
RISER PIPE I.D. ____________
TYPE OF RISER PIPE: ____________
BOREHOLE DIAMETER: ____________
TYPE OF BACKFILL: ____________
ELEVATION / DEPTH TOP OF SEAL ____________
TYPE OF SEAL: ____________
DEPTH TOP OF SAND PACK: ____________
ELEVATION / DEPTH TOP OF SCREEN ____________
TYPE OF SCREEN: ____________
SLOT SIZE x LENGTH: ____________
I.D. OF SCREEN: ____________
TYPE OF SAND PACK: ____________
ELEVATION / DEPTH BOTTOM OF SCREEN: ____________
ELEVATION / DEPTH BOTTOM OF SAND PACK: ____________
TYPE OF BACKFILL BELOW OBSERVATION WELL: ____________
ELEVATION / DEPTH OF HOLE ____________

Brown & Root Environmental

WELL NO.: ______________

MONITORING WELL SHEET

PROJECT: ____________	LOCATION: ____________	DRILLER: ____________
PROJECT NO.: ____________	BORING: ____________	DRILLING METHOD: ____________
ELEVATION: ____________	DATE: ____________	DEVELOPMENT METHOD: ____________
FIELD GEOLOGIST: ____________		



ELEVATION TOP OF RISER: ____________

TYPE OF SURFACE SEAL: ____________

TYPE OF PROTECTIVE CASING: ____________

I.D. OF PROTECTIVE CASING: ____________

BOREHOLE DIAMETER: ____________

TYPE OF RISER PIPE: ____________

RISER PIPE I.D.: ____________

TYPE OF BACKFILL/SEAL: ____________

____

DEPTH/ELEVATION TOP OF SAND: ______/______

DEPTH/ELEVATION TOP OF SCREEN: ______/______

TYPE OF SCREEN: ____________

SLOT SIZE x LENGTH: ____________

TYPE OF SAND PACK: ____________

DEPTH/ELEVATION BOTTOM OF SCREEN: ______/______

DEPTH/ELEVATION BOTTOM OF SAND: ______/______

DEPTH/ELEVATION BOTTOM OF HOLE: ______/______

BACKFILL MATERIAL BELOW SAND: ____________

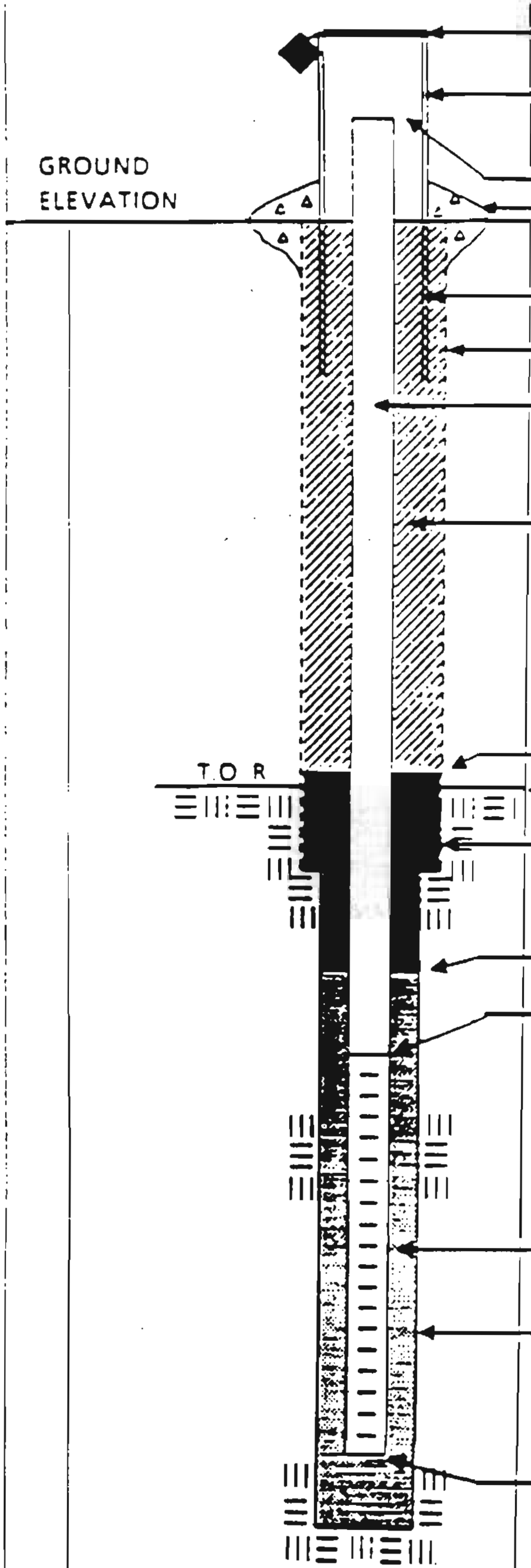
Brown & Root Environmental

BORING NO : ______________

BEDROCK
MONITORING WELL SHEET
WELL INSTALLED IN BEDROCK

PROJECT ______________ LOCATION ______________
PROJECT NO. ______________ BORING ______________
ELEVATION ______________ DATE ______________
FIELD GEOLOGIST ______________

DRILLER ______________
DRILLING METHOD ______________
DEVELOPMENT METHOD ______________



ELEVATION OF TOP OF SURFACE CASING ______________

STICK UP OF CASING ABOVE GROUND SURFACE: ______________

ELEVATION TOP OF RISER: ______________

TYPE OF SURFACE SEAL: ______________
____

I.D. OF SURFACE CASING: ______________

DIAMETER OF HOLE: ______________

RISER PIPE I.D.: ______________

TYPE OF RISER PIPE: ______________
____

TYPE OF BACKFILL: ______________
____
____

ELEVATION / DEPTH TOP OF SEAL: ______________

ELEVATION / DEPTH TOP OF BEDROCK ______________

TYPE OF SEAL: ______________
____

ELEVATION / DEPTH TOP OF SAND: ______________

ELEVATION / DEPTH TOP OF SCREEN: ______________

TYPE OF SCREEN: ______________

SLOT SIZE x LENGTH: ______________

I.D. SCREEN: ______________

TYPE OF SAND PACK: ______________
____

DIAMETER OF HOLE IN BEDROCK:

CORE / REAM: ______________
____

ELEVATION / DEPTH BOTTOM SCREEN: ______________

ELEVATION / DEPTH BOTTOM OF HOLE ______________

Brown & Root Environmental

WELL NO.: ______

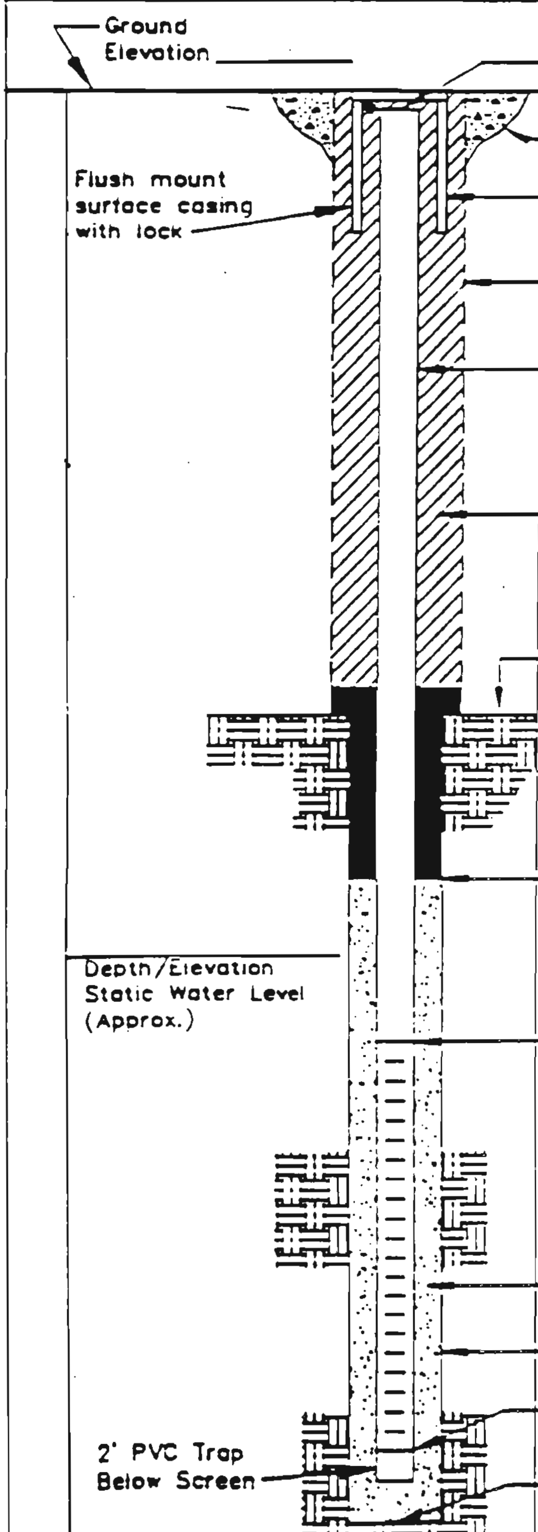
BEDROCK
MONITORING WELL SHEET
WELL INSTALLED IN BEDROCK

PROJECT: ______ LOCATION: ______ DRILLER: ______

PROJECT NO.: ______ BORING: ______ DRILLING METHOD: ______

ELEVATION: ______ DATE: ______ DEVELOPMENT METHOD: ______

FIELD GEOLOGIST: ______



ELEVATION TOP OF RISER: ______

TYPE OF SURFACE SEAL: ______

TYPE OF PROTECTIVE CASING: ______

I.D. OF PROTECTIVE CASING: ______

DIAMETER OF HOLE: ______

TYPE OF RISER PIPE: ______

RISER PIPE I.D.: ______

TYPE OF BACKFILL/SEAL: ______

______

DEPTH/ELEVATION TOP OF BEDROCK: ______ / ______

DEPTH/ELEVATION TOP OF SAND: ______ / ______

DEPTH/ELEVATION TOP OF SCREEN: ______ / ______

TYPE OF SCREEN: ______

SLOT SIZE x LENGTH: ______

TYPE OF SAND PACK: ______

DIAMETER OF HOLE IN BEDROCK: ______

DEPTH/ELEVATION BOTTOM OF SCREEN: ______ / ______

DEPTH/ELEVATION BOTTOM OF SAND: ______ / ______

DEPTH/ELEVATION BOTTOM OF HOLE: ______ / ______

BACKFILL MATERIAL BELOW SAND: ______

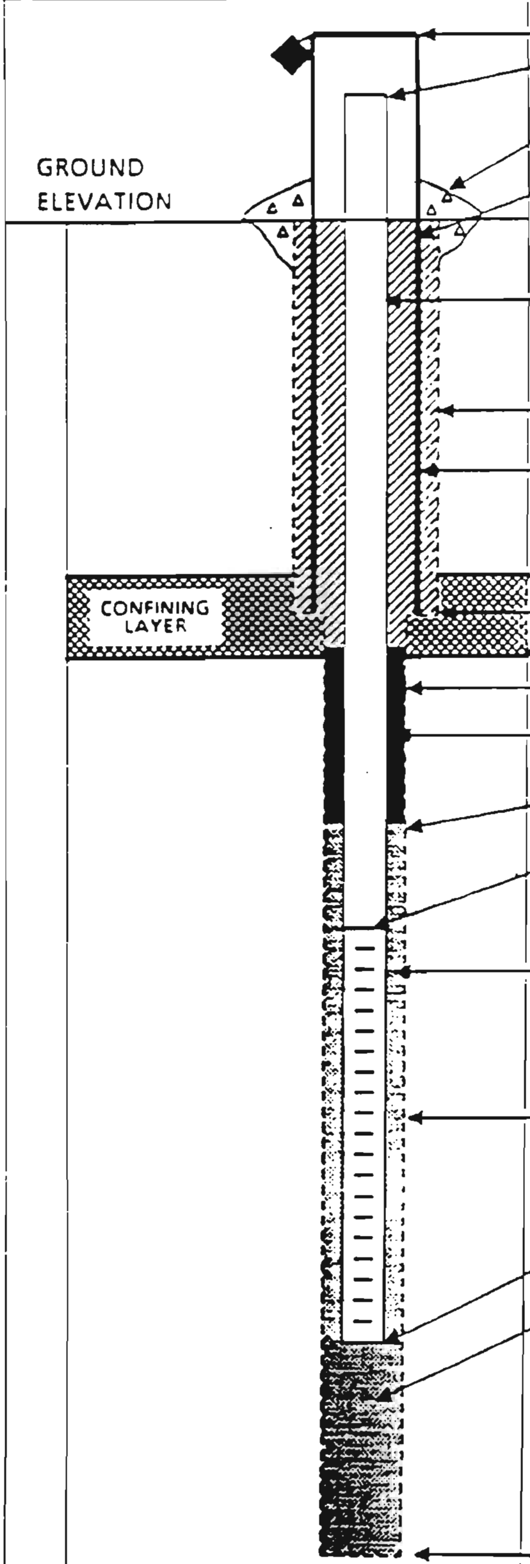
Brown & Root Environmental

BORING NO ____________

CONFINING LAYER
MONITORING WELL SHEET

PROJECT ____________ LOCATION ____________
PROJECT NO. ____________ BORING ____________
ELEVATION ____________ DATE ____________
FIELD GEOLOGIST ____________

DRILLER ____________
DRILLING METHOD ____________
DEVELOPMENT METHOD ____________



ELEVATION OF TOP OF PERM. CASING: ____________
ELEVATION OF TOP OF RISER PIPE: ____________

TYPE OF SURFACE SEAL: ____________
____

I.D. OF PERM. CASING: ____________
TYPE OF SURFACE CASING: ____________
____

RISER PIPE I.D. ____________
TYPE OF RISER PIPE: ____________
____

BOREHOLE DIAMETER: ____________

PERM. CASING I.D ____________
TYPE OF CASING & BACKFILL: ____________
____

ELEVATION / DEPTH TOP CONFINING LAYER: ____________
ELEVATION / DEPTH BOTTOM OF CASING: ____________
ELEVATION / DEPTH BOT. CONFINING LAYER: ____________

ELEVATION / DEPTH TOP OF SEAL: ____________
TYPE OF SEAL: ____________
____

DEPTH TOP OF SAND PACK: ____________

ELEVATION/DEPTH TOP OF SCREEN: ____________
TYPE OF SCREEN: ____________
____

TYPE OF SAND PACK: ____________
____

BOREHOLE DIA. BELOW CASING: ____________

ELEVATION / DEPTH BOTTOM OF SCREEN: ____________

ELEVATION / DEPTH BOTTOM OF SAND PACK: ____________
TYPE OF BACKFILL BELOW OBSERVATION WELL: ____________
____

ELEVATION / DEPTH OF HOLE: ____________

DAILY ACTIVITIES RECORD

Brown & Root Environmental

PROJECT ____________________ LOCATION ____________________

CLIENT ____________________ ARRIVAL TIME ________ JOB NO. ____________

DATE ____________________ DEPARTURE TIME ____________

CONTRACTOR ____________________ DRILLER ____________________

BORING NO. ____________________ HNUS REPRESENTATIVE ____________

ITEM	QUANTITY ESTIMATE	QUANTITY TODAY	PREVIOUS TOTAL QUANTITY	CUMULATIVE QUANTITY TO DATE

COMMENTS: ____________________

APPROVED BY:

HNUS FIELD REPRESENTATIVE

DRILLER OR REPRESENTATIVE

Brown & Root Environmental

EQUIPMENT CALIBRATION LOG

Instrument (Name/Model No./Serial No.): ______________________________

Manufacturer ______________________________ Date Purchased ____________________

Calibration Date	Initial Settings	Standard/Gas Used	Procedure	Adjustments Made	Final Settings	Signature	Comments

TECHNICAL SPECIFICATION FOR CONSTRUCTION OF PILOT SCALE REMEDIATION SYSTEM

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
BETHPAGE, NEW YORK
CONTRACT NUMBER N62472-90-D-1298, CTO-0213

1.0 INTRODUCTION

A pilot-scale remediation system will be installed at the NWIRP, Bethpage, New York. The remediation system will consist of an air sparging/vapor soil extraction system (AS/SVE) in which air is injected into the ground via an injection well and extracted through contaminated soil via extraction wells to remove the volatile organic compound (VOC) trapped in the soil and groundwater. The VOCs are removed from the vapor in a carbon adsorption off-gas treatment system before release into the atmosphere. The spent carbon in the off-gas treatment system can then be reactivated for later use. The pilot-scale system to be installed for this project is intended to provide information regarding removal and treatment of chlorinated volatile organic compounds (chlorinated VOCs).

The work required to install the pilot-scale system includes placement of injection, extraction, and monitoring wells, blowers, piping, electrical hookup and emissions control equipment. All wells will be installed by a drilling subcontractor procured by C F Braun.

The purpose of the pilot-scale system is to determine final design parameters including effective radii of influence, off-gas treatment requirements, subsurface soil conditions, well location and depth requirements, flow rate requirements, vacuum and injection pressures, and removal efficiencies.

2.0 SCOPE OF WORK

The scope of work for the installation of the pilot-scale AS/SVE system is defined as follows:

- Mobilization/demobilization.
- Installation of injection, extraction, and monitoring wells.
- Procurement and installation of blowers, piping, and vapor phase carbon units.
- Collection of soil, groundwater, and air samples prior to, during, and/or after system operation.
- An existing building located at Site 1 will be used to house the unit.

2.1 MOBILIZATION/DEMOBILIZATION

Mobilization/demobilization includes the following:

- Mobilization to the site.
- Securing any necessary permits.
- Initial Health and Safety meeting of approximately 2 hours (presented by C F Braun).
- All decontamination of excavation and transportation equipment, including hauling of potable water for high-pressure water cleaning and decontamination purposes.
- Miscellaneous supplies (crew PPE, air monitoring equipment, hand tools, etc.)
- Incidental site clearing and site access.
- General site clean-up.
- Demobilization from the site.

Decontamination operations will consist of washing large equipment (excavation buckets, tires, etc.) using a high pressure potable wash prior to demobilizing equipment from the site. All decontamination water will be collected and transported to the Industrial Wastewater Treatment plant located near the Navy's recharge basin.

2.2 AIR INJECTION SYSTEM

The air injection system will consist of a positive displacement air injection blower, conveyance piping, and one injection well. A piping schematic is provided as Attachment C-1. The air injection well will be located approximately 60 feet from the center of Cesspool 79, see Figure 4-1.

The positive displacement air injection blower will be a rotary lobe-type blower, rated for 35 CFM and 60 CFM at 6 psi. Multiple sheaves will be used to provide this range of flowrates. The blower will be equipped with a high temperature cutoff switch and a pressure switch interlock to the vapor extraction system piping, where a lack of vacuum on the extraction system will cause the injection blower to shut down. The blower will be equipped with inlet and outlet air silencers to reduce noise levels and an inlet air filter to remove ambient dust. The blower and associated control panel will be pre-assembled and mounted on a skid. This skid will be placed within an existing building at Site 1. The skid will be anchored to the existing concrete slab via four 3/4-inch cinch bolts. A 5 to 7.5 HP (based on blower efficiency), three-phase, 480 volt motor will be used.

The conveyance piping will consist of 10 feet of 2-inch carbon steel pipe immediately adjacent to the blower to dissipate heat, a flexible rubber coupling for vibration control, 2-inch schedule 40 PVC pipe, two 2-inch ball valves to control air flow to the sparge well and provide a pressure bleed off, and a 4-inch noise suppresser on the pressure bleed off. Expansion joints will be installed on each straight run of pipe greater than 100 feet. Sample taps and plugs will be installed on the injection line to allow measurement of air velocity and line pressure. Line size calculations are provided as Appendix F.

The air injection well (IW01) will consist of a 2-inch PVC riser pipe, with a 2-foot long 0.020 inch slot size well screen located 10 feet below the water table. Total depth of well will be approximately 70 feet below ground surface. The well will be installed using a 4-inch diameter hollow stem auger. During installation of the well, split spoon samples will be collected every 10 feet. These samples will be classified in the field for lithology. In addition, PID readings will be taken from the split spoon head space.

Well construction details are as follows.

- Auger to 10 feet below the water table.
- Collect split spoons sample every 10 feet during augering. The last split spoon sample will be collected at 8 to 10 feet below the water table (screened interval).
- Place the injection well at depth.
- Install No. 1 Sand around the well screen to a height of two feet above the well screen.
- Install a 2 foot thick bentonite seal.
- Complete the well with a cement/bentonite grout.
- The well will be developed by pumping and/or surging methods to obtain a final water turbidity of 50 NTUs.

2.3 VAPOR EXTRACTION SYSTEM

The vapor extraction system will consist of a positive displacement soil vapor extraction blower, moisture separator, conveyance piping, five vapor extraction wells, and two vapor phase carbon units. A piping schematic is provided as Attachment C-2. The locations of the extraction wells are presented in Figure 4-1. Extraction Wells EW01 to EW04 are to located based on IW01 as a reference point. EW05 is to be located in Cesspool 79.

The positive displacement vapor extraction blower will be rated for 100 cfm and 150 cfm at +1 psi/-5 inches of mercury. Multiple sheaves will be used to provide this range of flowrates. The blower will be equipped with a high temperature and high water level (moisture separator) cut off switch. In addition, an inlet air filter will be used to remove potential dust and sand in the extraction system. The blower, moisture separator, and associated control panel will be pre-assembled on a skid. The skid will be placed within an existing building at Site 1. The skid will be anchored to the existing concrete slab via 3/4-inch cinch bolts. A 5 to 7.5 HP (based on blower efficiency), three-phase 480 volt motor will be used.

The moisture separator will consist of a 55-gallon tank, complete with a high water level switch and drain tap. The moisture separator will mounted on the blower skid.

The conveyance system will consist of a vacuum component to the extraction wells and a pressure component to the vapor phase carbon. The vacuum piping will consist of a flexible rubber coupling for vibration control, a 4-inch PVC header, five 2-inch schedule 40 PVC lines, (one to each well), and five 2-inch ball valves to control air flow to each extraction well, plus one vacuum bleed valve. Expansion joints will be installed on each straight run of pipe greater than 100 feet. Sample taps will be installed in the header, and on each extraction well line to allow measurement of flow rate and pressure, as well as to allow samples of the soil vapor to be collected. A manual and automatic vacuum relief valve will be provided on the vacuum piping to prevent excessive line vacuums.

The pressure piping will consist of 10 feet of 3-inch carbon steel at the blower outlet to dissipate heat, a rubber coupling for vibration control, and 4-inch PVC pipe leading to, between, and after the carbon units. Sample taps will be installed on this line prior to, between, and after the carbon unit to allow measurement of flow rate and pressure, as well as to allow soil vapor samples to be collected. Line size calculations are provided as Appendix F.

The soil vapor extraction wells will be five 2-inch PVC riser pipes, with screened intervals at location-specific depths. Three of the extraction wells (EW01, EW02, and EW03) will be installed to a depth of 5 feet below the water table (approximately 65 feet) and include a 15 foot long screen with a 0.020 slot size. The fourth extraction well (EW04) will be installed to a depth of 30 feet below ground surface and include a 10 foot long screen, with a 0.020 slot size. The fifth extraction well (EW05) will be located within an existing cesspool (Cesspool 79) to a depth of 20 feet and include a 5 foot long well screen, with a 0.020 slot size. This well will be installed through an existing opening in the cesspool.

The wells will be installed using a 4-inch hollow stem auger. During installation of the well, split spoon samples will be collected every 10 feet. In addition, one split spoon sample will be collected in the middle of each screened interval. These samples will be classified in the field for lithology. In addition, PID readings will be taken from the split spoon head space.

Well construction details are as follows.

- Auger to the depth of each well, collecting a split spoon sample every 10 feet. In addition, collect one split spoon sample in the middle of the screened interval.
- Place the extraction well at depth.
- Install No. 1 Sand around the well screen to a height of one foot above the well screen.
- Install a 2 foot thick bentonite seal.
- Complete the well with a cement/bentonite grout.
- The wells which are installed below the water table will be developed by pumping and/or surging methods to obtain a final water turbidity of 50 NTUs.

The moisture knockout drum will be a 55-gallon tank, with a high moisture level switch and drain. This tank will be mounted on the same skid as the blower.

Two 2000-pound vapor phase activated carbon units will be used to treat the extracted air prior to discharge. The vapor phase carbon units will be used in series. The carbon units will be located outside the blower building.

2.4 SOIL VAPOR PRESSURE MONITORS

Four soil vapor pressure monitors (SVPM 1 to 4) will be located at a distance of 10, 20, 30, and 60 feet from the air injection well, as shown in Figure 4-1. The screened depth of each monitor will be 25 to 30 feet below ground surface. A fifth monitor (SVPM 5) will be located at a distance of 10 feet from the center of Cesspool - CP79 and have a screened depth of 15 to 20 feet below ground surface. The fifth monitor should also be located at a distance of approximately 40 feet from the air injection well. The location of these four soil vapor pressure monitors coincides with distances of approximately 10, 20, 30, 40, 50, 60, 80, 100, and 120 feet from one or more air extraction wells.

The soil vapor monitors are to be installed as described for the soil vapor extraction wells.

Also, air extraction wells will be used to supplement these soil vapor pressure monitors during the air injection and extraction system testing. As previously indicated, three of the air extraction wells will be screened at the water table (60 to 70 feet below ground surface), one well will be screened at 20 to 30 feet below ground surface, and one well will be screened at 15 to 20 feet below ground surface.

2.5 GROUNDWATER PRESSURE MONITORS AND MONITORING WELL

Two 2-inch groundwater pressure monitors (GPM 2 and GPM 3) will be located a distance of 10 and 30 feet from the air injection well. These wells will be used to assess groundwater flow at these depths and distances. The screened interval on these monitors will be 4 to 6 feet below the water table. Total depth of the two monitors is approximately 66 feet below ground surface.

One new groundwater monitoring well (CFB-01) will be located 30 feet south (hydraulically downgradient) of the air injection well. The screened interval on this monitoring well will be from 2 feet above the water table to 8 feet below the water table.

In addition to the groundwater pressure monitors and monitoring well, the three air extraction wells located into the water table, will be used to monitor groundwater table elevation fluctuations during the trial. Groundwater table monitors will be available at distances of 10, 20, 30, and 40 feet from the air injection wells.

2.6 POWER SUPPLY

Two existing 440 volt, 30 amp, three-phase disconnect switches, located in the proposed blower building, will be used to supply power to the two blowers. Two existing, but unused building heaters will be temporary disconnected. A certified New York State electrician will be subcontracted to perform the work.

2.7 UTILITY CLEARANCE

Each of the soil boring and well locations will be cleared for utilities prior to construction by reviewing facility drawings, interviewing local personnel, toning by the local phone company, and confirming in the field with a pipe and cable locator. In addition, over 100 abandoned cesspools are present at the site. Cesspools are reportedly 8 feet in diameter and are located on 30 foot centers. Except for EW05 and associated soil borings, these cesspools should be avoided. Reportedly, each cesspool is covered with a several inch-thick concrete cap at a depth of 1 to 3 feet below ground surface. If encountered during drilling, the drilling location should be moved north or south to avoid them.

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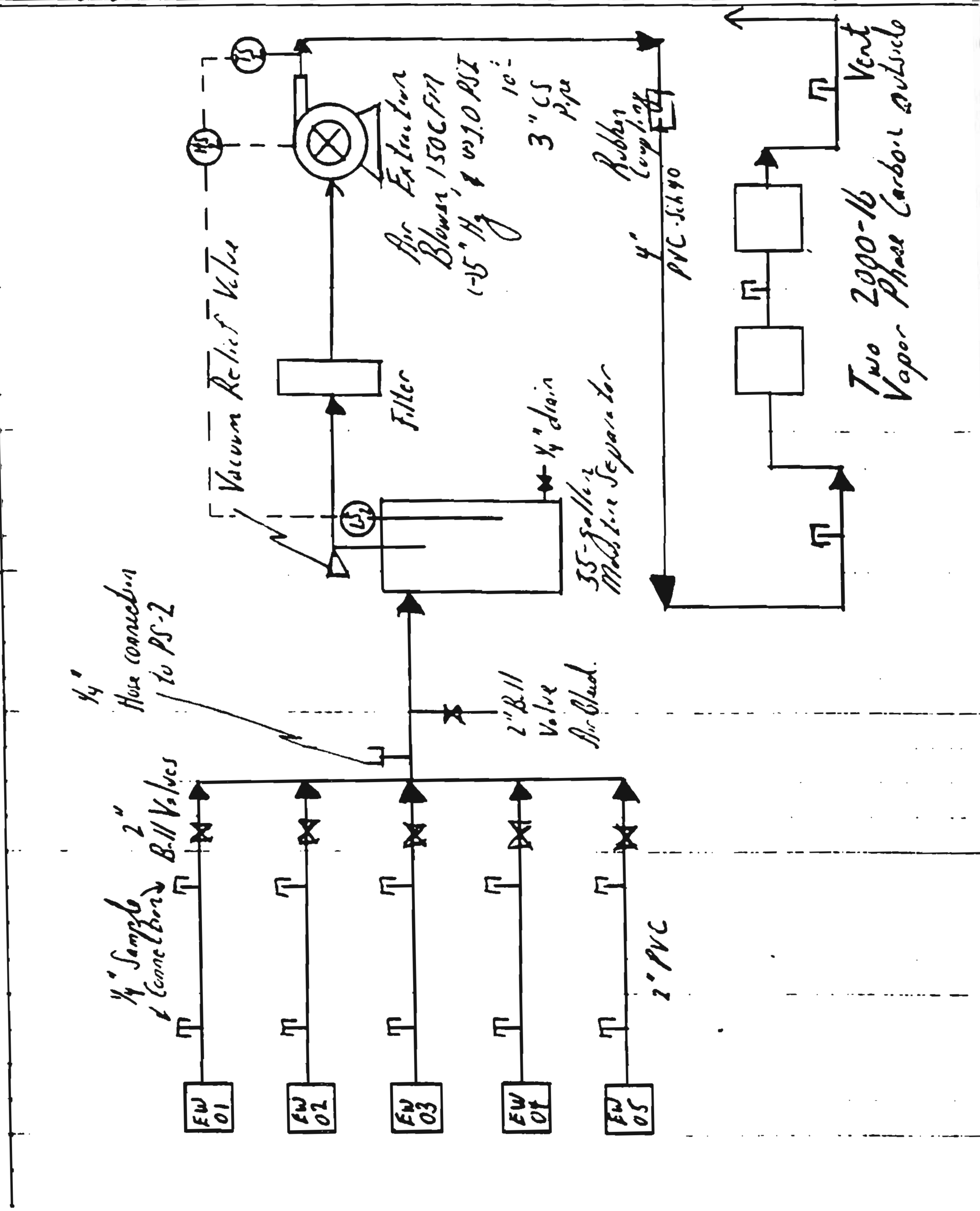

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