INSTALLATION RESTORATION PROGRAM

FINAL

SUPPLEMENTAL DATA COLLECTION WORK PLAN
SITE 6

109th AIRLIFT WING
NEW YORK AIR NATIONAL GUARD
SCHENECTADY AIR NATIONAL GUARD BASE
SCOTIA, NEW YORK

MAY 2002

Prepared For

AIR NATIONAL GUARD READINESS CENTER
ANDREWS AFB, MARYLAND 20762-5157

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LIST OF ACRONYMS

ABB	ABB Environmental Services, Inc.
AW	Airlift Wing
ANG	Air National Guard
ANGRC	Air National Guard Readiness Center
ANGSIP	Air National Guard Site Investigation Protocol
Aneptek	Aneptek Corporation
ARARs	Applicable or Relevant and Appropriate Requirements
AWQC	Ambient Water Quality Criteria
BDL	below detection limit
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	Contaminant of Concern
COR	Contracting Officer Representative
CWA	Clean Water Act
DCE	Dichloroethene
DERP	Defense Environmental Restoration Program
DOD	Department of Defense
DOT	Department of Transportation
DQO	Data Quality Objective
EM	Environmental Manager
EPA	Environmental Protection Agency
°F	degrees Fahrenheit
FS	Feasibility Study
FSC	Field Sample Custodian
ft	feet
GC	Gas Chromatograph
HASP	Health and Safety Plan
HI	Hazard Index
IDW	Investigation Derived Waste
IRIS	Integrated Risk Information System
IRP	Installation Restoration Program
MCL	Maximum Contaminant Level
MDL	Method Detection Limit
mg/kg	milligram per kilogram
MIS	Management Information System
ml	milliliter
mph	miles per hour

LIST OF ACRONYMS/ABBREVIATIONS (Cont.)

MS/MSD	Matrix Spike/Matrix Spike Duplicate
ND	Not Detected
NGB	National Guard Bureau
NYANG	New York Air National Guard
NYCRR	New York Code, Rules, Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PCB	Polychlorinated Biphynels
PID	Photoionization Detector
PPE	Personal Protective Equipment
PQL	Practical Quantitation Limit
P/S	Project/Site Manager
RI	Remedial Investigation
SARA	Superfunds Amendments and Reauthorization Act
SDC	Supplemental Data Collection
SVOC	Semivolatile Organic Compound
TAL	Target Analyte List
TCRA	Time Critical Removal Action
TBC	To Be Considered
TCE	Trichloroethene
TIC	Tentatively Identified Compounds
TM	Technical Memorandum
TPH	Total Petroleum Hydrocarbons
SOP	Standard Operating Procedure
SSO	Site Safety Officer
QA\QC	Quality Control\Quality Assurance
ug/Kg	Microgram per Kilogram
ug/L	Microgram per Liter

SECTION 1.0

1.0 INTRODUCTION

This Work Plan outlines the activities for conducting a Supplemental Data Collection (SDC) at Installation Restoration Program (IRP) Site 6 (Site 6), at the 109th Airlift Wing (AW), New York Air National Guard (NYANG) Schenectady Air National Guard Base (the Base) located at Schenectady County Airport, Scotia, New York. The SDC at Site 6 is being performed by Aneptek Corporation (Aneptek) for the Air National Guard (ANG/CEVR) pursuant to the IRP, under National Guard Bureau (NGB) Contract No. DAHA90-93-D-0003, Delivery Order No. 14. The SDC is performed under the authority of the Comprehensive Environmental Response, Compensation, and Liabilities Act (CERCLA), and the Superfund Amendments and Reauthorization Act (SARA).

The Defense Environmental Restoration Program (DERP) was established in 1984 to promote and coordinate efforts for the evaluation and cleanup of contamination at Department of Defense (DOD) installations. On January 23, 1987, Presidential Executive Order 12580 was issued which assigned the responsibility to the Secretary of Defense for carrying out DERP within the overall framework of CERCLA and SARA. The IRP was established under DERP to identify, investigate, and cleanup contamination at installations. The IRP is focused on cleanup of contamination associated with past DOD activities to ensure that threats to public health are eliminated and to restore natural resources for further use. The ANGRC manages the IRP and related activities at ANG Installations.

This SDC is being implemented based on the results of a Remedial Investigation (RI) performed by Aneptek at the 109th AW during 1998 and 1999, and on the findings of the Draft Final Feasibility Study (FS) (Draft Final Feasibility Study, Aneptek, March, 2001). The results of the RI indicated volatile organic compound (VOC) contaminated soil and groundwater and petroleum contaminated soil at Site 6. Based on the recommendations of the RI, a Feasibility Study (FS) was developed for Site 6 soils which recommended excavation and off-site disposal of the contaminated soils at Site 6. The FS stated that further investigative measures were needed to complete the FS with regards to Site 6 groundwater. These measures are detailed in this Work Plan.

The following documents are incorporated by reference:
Remedial Investigation/Feasibility Study Work Plan, 109th Airlift Wing, Schenectady Air National Guard Base, Scotia, New York, Appendix A (Health and Safety Plan) and Appendix B (Quality Assurance/Quality Control Plan) (Aneptek, April, 1998); Remedial Investigation/Feasibility Study Report, 109th Airlift Wing, Schenectady Air National Guard Base, Scotia, New York (Aneptek, September, 2000); Draft Final Feasibility Study, 109th Airlift Wing, Schenectady Air National Guard Base, Scotia, New York (Aneptek, March, 2001).

1.1 Project Objectives and Scope

The objectives and scope of this project is the performance of an SDC at Site 6 at the 109th AW. The SDC will include activities necessary to further characterize the nature and extent of soil and groundwater contamination at Site 6, and to obtain sufficient data to determine the need for possible site remediation. Results of this SDC will be reported in a Technical Memorandum (TM). Following the TM, an Action Memorandum (AM) will be developed, detailing the recommended actions to be taken at Site 6 to reduce or eliminate soil and groundwater contamination. The results of this AM will in turn be included in the Final Feasibility Study, at which point options for remedial activities, including the option of No Further Action, will be detailed and numerically rated. One option will then be rated as the most effective with regards to both cost and remedial effectiveness.

1.2 General Investigative Approach

The general investigative approach for the SDC is to conduct investigation activities sufficient for characterization of Site 6 soils and groundwater under this Work Plan. Investigations to be performed at Site 6 include collection of subsurface soil samples, groundwater samples, and groundwater elevation data necessary for site characterization. Soil and groundwater data collected during this SDC will be compared to current New York State Department of Environmental Conservation (NYSDEC) Clean-Up Objectives (soil) and Water Quality Standards and Guidance Values (groundwater), and United States Environmental Protection Agency (US EPA) soil and groundwater Maximum Contaminant Levels (MCL's). Based on these comparisons, further site remediation may or may not be warranted at Site 6.

1.3 Work Plan Structure

This Work Plan is presented in 10 sections. Section 1.0 describes the project objectives and scope. Section 2.0 presents the Project Management Approach to be used by Aneptek in performance of the SDC. Section 3.0 presents a description of the Schenectady ANG Base and of Site 6, and presents the results of the RI, including sample results, geological and hydrogeological findings, and conclusions. Section 4.0 identifies the permits required for performance of the SDC. Section 5.0 describes the investigative approach to be used during the SDC, while detailed investigation and sample collection procedures are discussed in Section 6.0 and Section 7.0, respectively. Section 8.0 presents a brief discussion of the Applicable or Relevant and Appropriate Requirements (ARARs) for the Base. Sections 9.0 outlines the SDC Completion Report. Section 10.0 provides a list of the references used in preparation of the Work Plan.

SECTION 2.0

2.0 PROJECT MANAGEMENT APPROACH

2.1 Project Management Organization

In performing this SDC under contract with the NGB, Aneptek will be addressing a variety of issues utilizing a formalized program management approach accompanied by a flexible project team structure. The Project Team is headed by a Project/Site Manager (P/S) with expertise in the primary technical area(s) or academic disciplines required for project performance. The P/S is responsible for the day-to-day operations and is supported by specialists drawn from complimentary technical disciplines on an as-needed basis.

For policy direction and guidance, the P/S reports directly to the Program Manager. Formalized quality control and quality assurance procedures for all sampling events, analyses, and product control activities will be supervised by the Quality Assurance/Quality Control (QA/QC) Officer.

Figure 2-1 presents the organizational chart for the SDC being performed at the 109 AW.

2.2 Project Procedures

The contractor has maintained a management information system (MIS) which will be utilized on this project. The system consists primarily of the Deltek Advantage accounting software along with the Microsoft Project scheduling software. Technical controls are provided through review groups within the program organization, and QA/QC procedures.

2.3 Quality Management

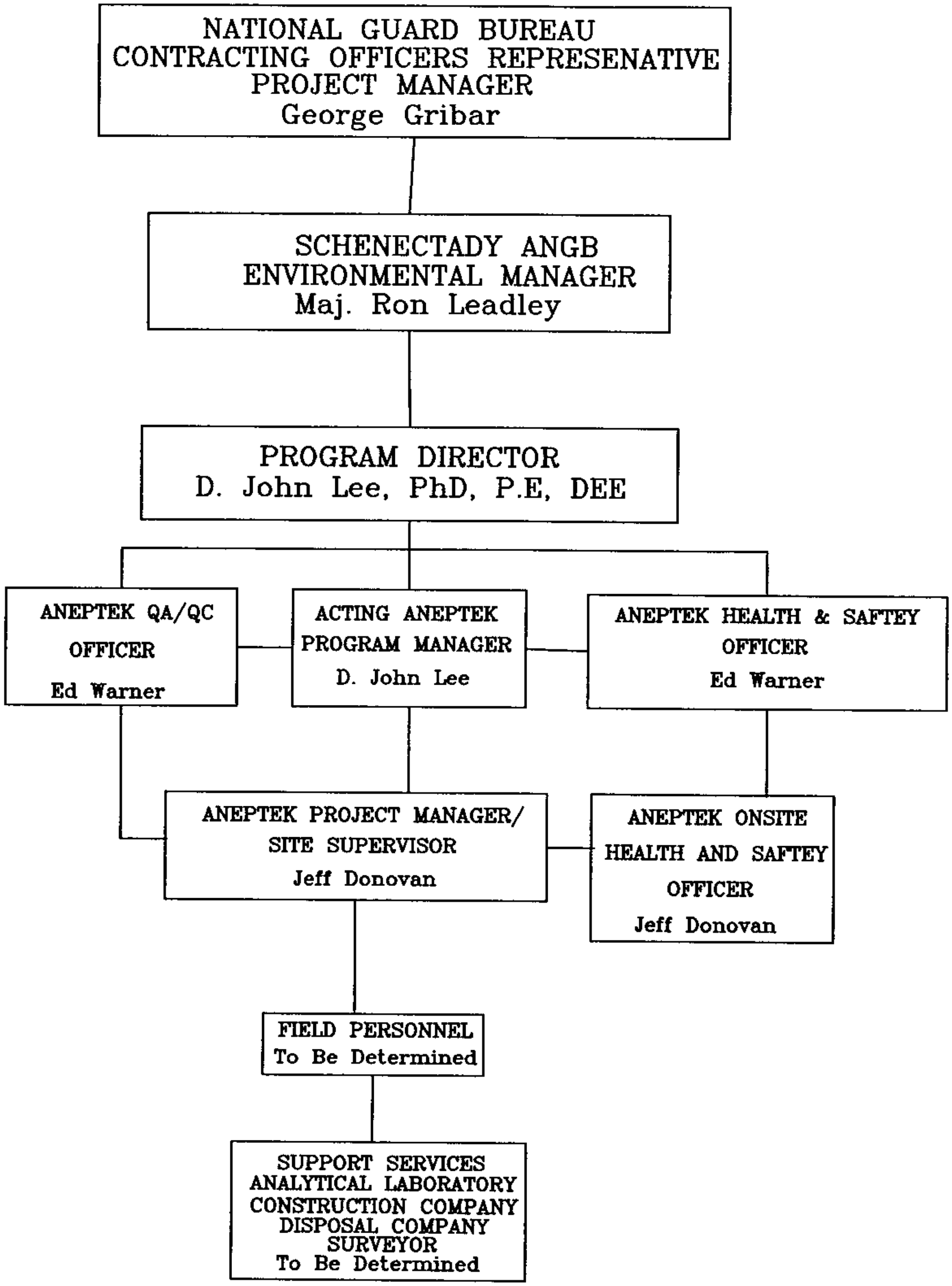
The technical management is handled by a Program Management Group which is comprised of professionals as discussed below.

Program Director

The Program Director is responsible for the overall management of the Contract, and ensuring that all work is performed in accordance with the standards and procedures promulgated by the ANG and Aneptek. The Program Director oversees Anepteks Program Manager, QA/QC officer, and on-site Health and Safety Officer.

Program Manager

The Program Manager will provide administrative supervision and will maintain oversight on progress through regular internal reviews with the Project Manager. In the event that technical issues



C:\DRAW\ORGANIZATION CHART

NEW YORK AIR NATIONAL GUARD BASE

109th AIRLIFT WING

ORGANIZATIONAL CHART

SCOTIA, NEW YORK

ANEPTEK CORPORATION
Analytic, Environmental and Process Technologies

FIGURE: 2-1

arise that cannot be resolved at the Project Manager level, the Program Manager will provide guidance to the Project Manager and, if necessary, contact the ANG Contracting Officer's Representative (COR) to address the issues.

Project/Site Manager

Specific Duties of the P/S Manager include:

- Serves as the principal point of contact for the ANG Project Manager, providing regular and routine progress reports to both the ANG and Aneptek Program Manager.
- Direct and/or supervise all project related activities.
- Identify technical concerns, develop solutions and implement corrective action as appropriate.
- Project scheduling and staff assignments.
- Ensure the correctness of the work through technical review and application of high quality standards.
- Maintain task files.
- Prepare monthly progress reports.
- Prepare amendments to the Work Plan (if needed) for approval by the ANG and the ANG Acquisition Contracting Division.
- Prepare notification of requests for scope changes, personnel changes, changes to level of effort, and schedule changes by the ANG.

Administrative Support

The managers and staff will be supported by Aneptek's administrative staff. Aneptek's administrative responsibilities, essential to the smooth performance of the contract, include:

- Maintaining overall program files.
- Preparing any special financial summaries requested by the ANG.
- Providing summary reports to the Program Manager for tracking purposes.

QA/QC Officer

The QA/QC Officer will oversee all QA/QC functions under the direction of the Program Director. The QA/QC Officer will have the following responsibilities:

- Ensure that company-wide QA/QC procedures applicable to this project are followed.
- Coordinate with the P/S Manager to review the project-specific QA/QC procedures.
- Inform the Program Director of problems and recommend corrective measures.

Health and Safety Officer

The Health and Safety Officer will be responsible for maintaining a safe working environment, ensuring that all field personnel follow the approved Health And Safety Plan (HASP). The Health and Safety Officer will coordinate with the P/S Manager and report directly to the Program Director. The Health and Safety Officer will have the following responsibilities:

- Ensure compliance with, and proper implementation of the approved site-specific HASP.
- Conduct the daily Health and Safety meeting.
- Perform and/or supervise all Health and Safety field monitoring.
- Coordinate with the P/S Manager on all Health and Safety matters.
- Inform the Program Director of problems, recommend solutions and implement corrective measures as appropriate.

2.4 Subcontract Management

The contractors MIS will be used to manage multiple subcontractors on this project. The labor charges and expenses for subcontractor(s) are entered into the system on a weekly basis, thus providing information on costs incurred by the subcontractor. Subcontractor invoices are compared against the internal printouts for concurrence and discrepancies resolved through verification of signed time sheets and expense receipts. Subcontractors will be provided with a scope of work describing the individual task(s) as they pertain to that subcontractor. Subcontractors will be chosen based on their ability to complete the task they are contracted to perform as outlined in a scope of work. All subcontractors will be requested to provide proof of all appropriate licenses, bonds, and certifications.

Change Order

Change order/modification files will be set up for this project. A Field Change Request Form is shown in Figure 2-2. Should a change order be anticipated by a subcontractor at the site, the following procedures will be employed:

a. The subcontractor shall notify, in writing, to the site coordinator, who is designated by the contractor, circumstances leading to the change/modification, and an estimate of the additional time and other costs necessary to accomplish and complete the tasks.

b. Anepteks Project Manager will review the request against the original scope of the subcontract with the ANG/CEVR Project Manager who will then determine if the request for change order should be initiated.

c. All change orders and modifications must be approved and finalized by the Contracting Officer.

Purchasing

The Purchasing Agent of the contractor will have the following responsibilities:

1. Evaluate the relativity of the supplier/subcontractors to deliver products or services that will satisfy quality requirements and utilize the evaluation results as a major factor in procurement.

2. Provide terms and conditions in procurement documents that establish supplier/subcontractor responsibility for compliance with quality requirements and that permit adequate control of supplier/subcontractor performance.

3. Administer procurement contracts and execute control of supplier/subcontractor performance adequate to assure the delivery of services or products that satisfy requirements.

4. Provide aggressive follow-up and obtain supplier/subcontractor corrective action when improvement is required.

Figure 2-2
Field Change Request Form

1. Field Change No.______
2. Page _____ of _____

3. PROJECT____
4. PROJECT NUMBER________________________________
5. APPLICABLE DOCUMENT__________________________

6. DESCRIPTION OF CHANGE:

____
____
____
____

7. REASON FOR CHANGE:

____
____
____
____

8. RECOMMENDED DISPOSITION:

____
____
____
____

9. PRESENT & COMPLETED WORK IMPACT:

____
____
____
____

10. REQUESTED BY:

____________________	______________
Field/Project Manager	Date

11. FINAL DISPOSITION:

____
____
____

12. APPROVAL:

____________________	______________
NGB Project Manager	Date

SECTION 3.0

3.0 FACILITY BACKGROUND INFORMATION

This section presents brief background summaries of the Base (Section 3.1), Site 6 (Section 3.2), results from the Remedial Investigation, including the performance of a Removal Action (Section 3.3), Summary and Conclusions of RI Report (Section 3.4), and the identification of Data Gaps (Section 3.5).

3.1 Base Description and History

The 109th Airlift Wing is located on the eastern and southern portions of the Schenectady County Airport in Scotia, New York (Figure 3-1). The Base comprises approximately 106 acres. The land to the north, east, and west of the Base is agricultural and residential. South of the Base is the Mohawk River, a railway, commercial and residential properties. Prior to construction of the Base, the property was utilized as agricultural land. The ANG authorized the formation of the 139th fighter squadron of the New York National Guard in November 1948. The unit was first located at the Scotia Naval Depot, which is about three miles to the west of the current base. The first aircraft for the new unit, the P-47 ''Thunderbolt'', arrived in 1949, along with an assortment of support aircraft including the T-6, B-26 and the C-47.

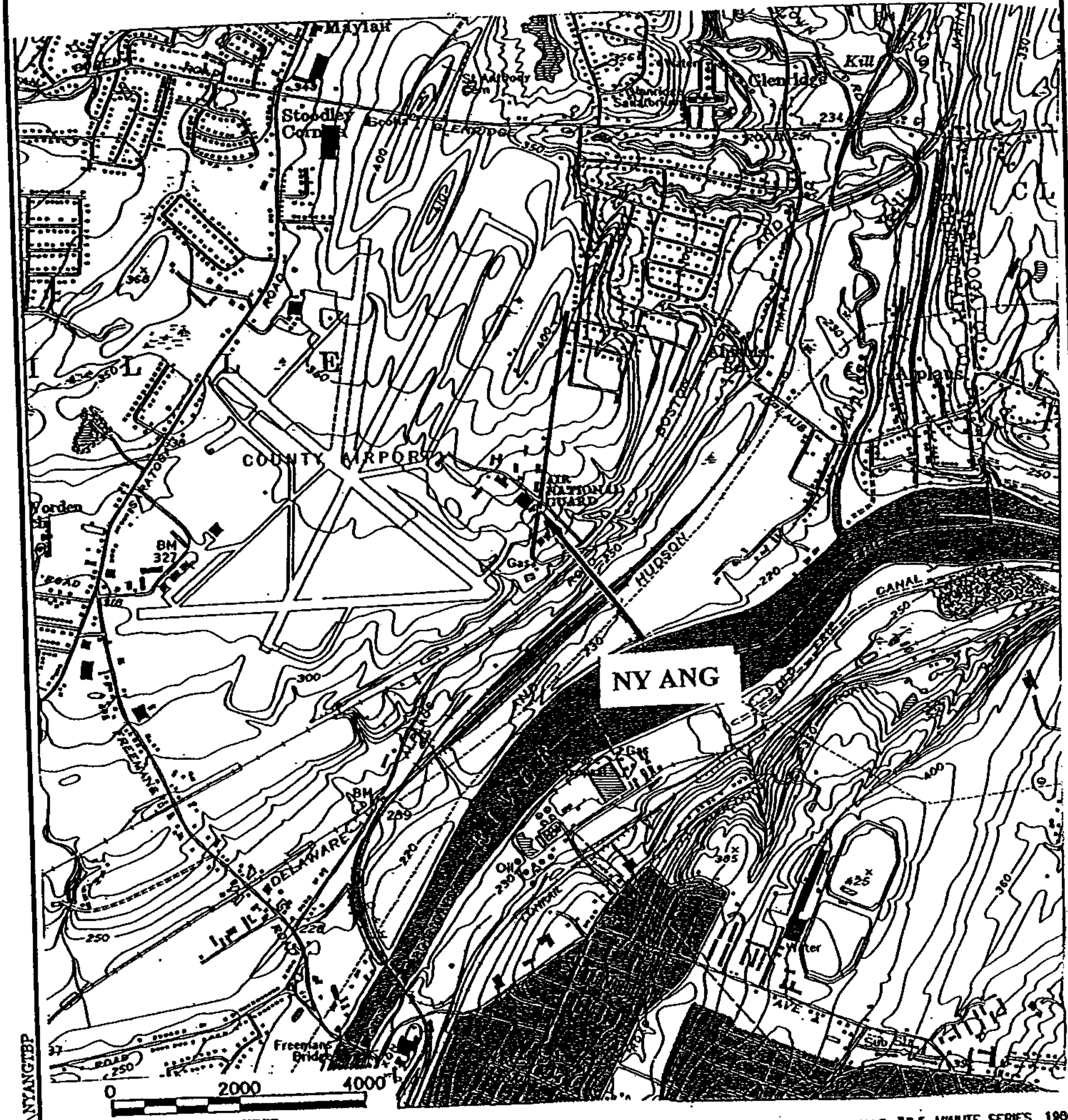
By September of 1950, the permanent facilities for the unit were completed at the Schenectady County Airport. These facilities consisted of the present administration building, aircraft hanger, vehicle maintenance, and various supply buildings. In 1951, The P-47's were replaced by the P-51 "Mustang." By 1954, the Base had received the F-94 "Starfire" jets. In order to accommodate the new aircraft, a 7,000 foot runway with overruns was constructed.

By 1960, the unit was redesignated the 109th Tactical Airlift Group and acquired the four-engine C-97A "Stratocrusier". In October 1961, the 109th Tactical Airlift Group was called to active duty in support of the Berlin Airlift. The unit was deactivated and resumed guard status on August 31, 1962. At that time, the aging C-97A aircraft were replaced with the C-97G model.

A new mission was undertaken by the unit in 1971 with the replacement to the C-97G by the C-130 "Hercules" turboprop transport. In 1972, The C-130A models were converted to the C-130D by Lockheed Aircraft Company to facilitate the use of skis on the Greenland Polar Ice Cap. In 1984, the 109th Tactical Airlift Group received its first C-130H aircraft, which replaced the older C-130D model. In 1991, the unit's name changed from the "109th Tactical Airlift Group" to the "109th Airlift Wing".

3.2 Site Description

Site 6 was added to this investigation after samples collected during the RI indicated soil and groundwater contamination from chlorinated compounds, mainly cis-1,2-Dichloroethene (cis-1,2-DCE) and vinyl chloride, and additional soil contamination from petroleum compounds, mainly xylenes.



SOURCE: USGS TOPOGRAPHIC MAP, SCENECTADY QUADRANGLE, "7.5 MINUTE SERIES, 1980"

NEW YORK AIR NATIONAL GUARD BASE
109th AIRLIFT WING
NY ANG LOCATION
SCOTIA, NEW YORK

ANEPTEK CORPORATION
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FIGURE: 3-1

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Site 6 was not originally included as part of the RI. It was included only after sample results from Site 3, which is downgradient of Site 6, indicated contamination present in this previously unknown area. Initially, given the close proximity of this area to other designated IRP sites (Site 1, investigated in 1996 [Final SI Report, ABB, October, 1996], and Site 3), it was thought this area was somehow related to either one or both of them. However, based on the nature of contamination found in this area (analytes other than at Site 1 or 3), the potential association of previous activities being conducted within the same time frame and in this same general area (but at different locations), it is evident that this area should be treated as a separate site, designated as such, and included in the IRP program. Figure 3-2 presents the location of Site 1, Site 3, and Site 6.

3.3 Previous Investigations

The following section presents a summary of the results of the RI performed at Site 6. The RI has been the only investigative activity conducted at Site 6. For more detailed information on these activities and information on the environmental setting at Site 6, including meteorology, geology, and hydrogeology, please refer to the Final RI Report (Aneptek, September, 2000).

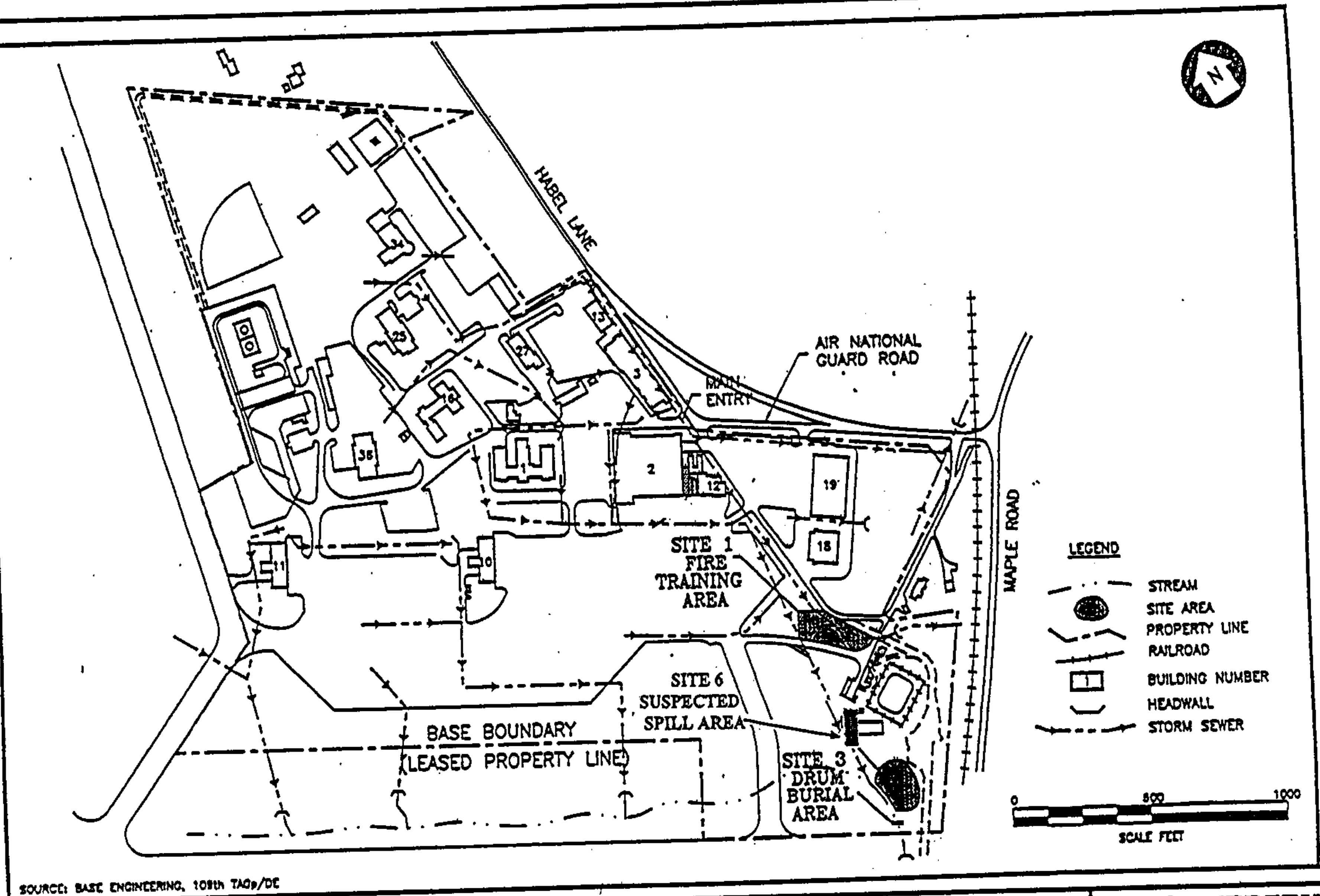
3.3.1 Remedial Investigation

The RI field program was conducted by Aneptek from July of 1998 to June of 1999. A total of three sites, Site 2, Site 3, and Site 6, were investigated during the RI. This Work Plan will only detail results from Site 6.

Field activities at Site 6 included the installation of two permanent groundwater monitoring wells, conducting in-situ hydraulic conductivity "slug" testing on the two new wells plus a previously existing well, the installation of 16 temporary wells, the advancement of 16 soil borings, and the advancement of one bedrock boring to a depth of 109 feet below ground surface (bgs), to facilitate the installation of a bedrock monitoring well. No water was evident in bedrock to this depth, and the well was not installed. Two rounds of groundwater samples were collected from the newly installed wells. One other monitoring well, which was installed earlier in the RI and is located within Site 6, was also sampled. Groundwater samples collected from the temporary wells were screened using a gas chromatograph (GC). Although 16 soil borings were advanced at Site 6, not every boring was sampled. Soil samples from selected borings were screened using the GC or sent to an off-site laboratory for full analysis. Soil boring and monitoring well locations are presented in Figure 3-3, temporary wells are presented in Figure 3-4. RI Monitoring well construction logs are presented in Appendix A, RI boring logs are presented in Appendix B, rock coring logs are presented in Appendix C. Table 3-1 presents a construction summary of the monitoring wells at Site 6. The results of the RI conducted at Site 6 are discussed below.

3.3.1.1 RI Groundwater Sampling GC Screening Results

Groundwater samples were collected from 16 temporary wells and from one permanent well (6MW-03) for GC screening. All samples were screened using a modified EPA Method 8021 for trans-1,2,-dichloroethene (trans-1,2-DCE), cis-1,2-Dichloroethene (cis-1,2-DCE), tetrachloroethene (PCE), trichloroethene (TCE), and vinyl chloride. In the samples collected from the temporary wells, cis-1,2-DCE was the only compound which was detected above the NYSDEC drinking water



NEW YORK AIR NATIONAL GUARD BASE

109th AIRLIFT WING

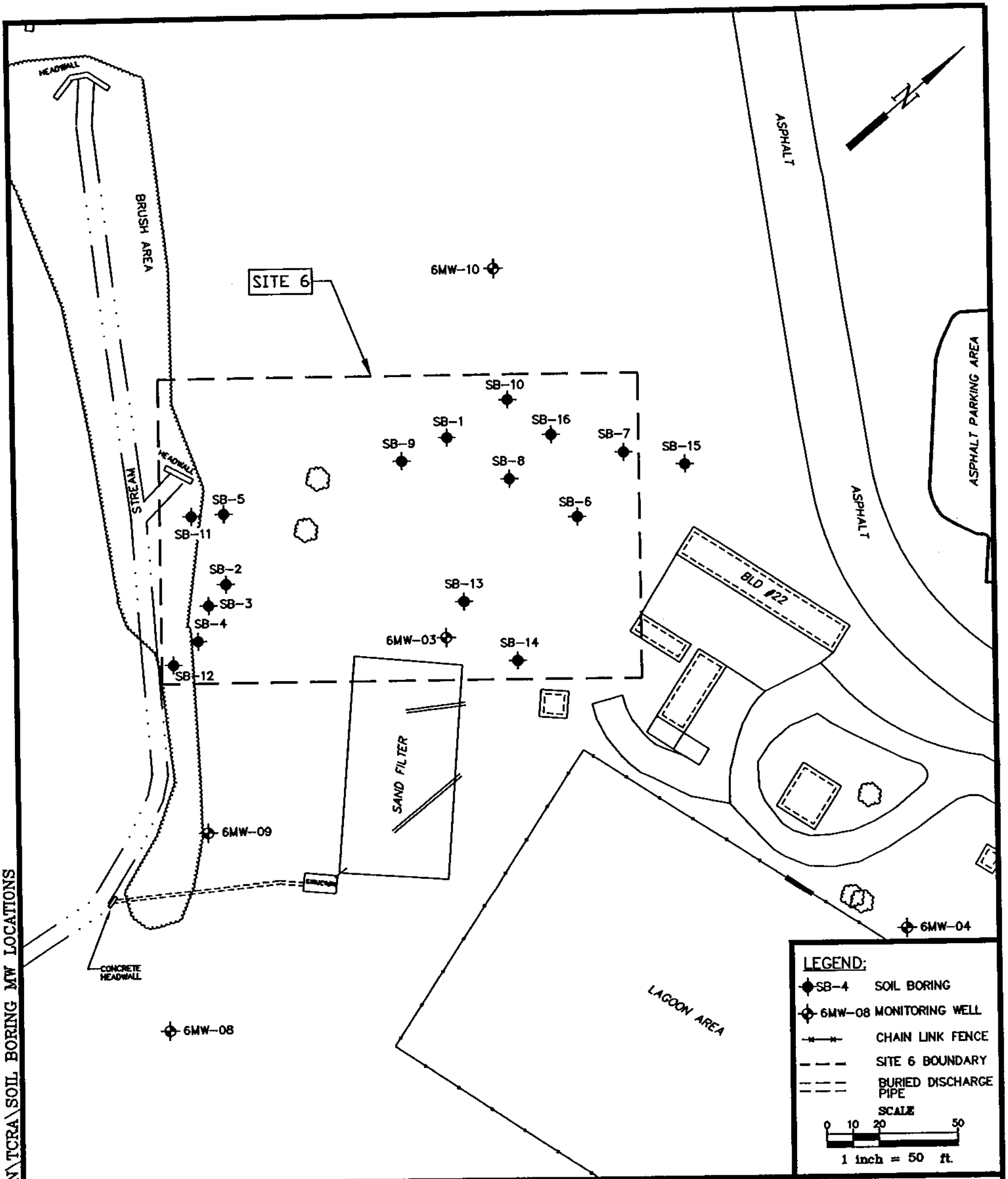
IRP SITE LOCATIONS

SCOTIA, NEW YORK

ANEPTEK CORPORATION
Analytic, Environmental and Process Technologies

FIGURE: 3-2

C:\DRAW\STRATTON\DISK1\IRP SITE LOCATIONS



NEW YORK AIR NATIONAL GUARD BASE
109th AIRLIFT WING
RI SOIL BORING/MONITORING WELL
LOCATIONS - SITE 6
SCOTIA, NEW YORK

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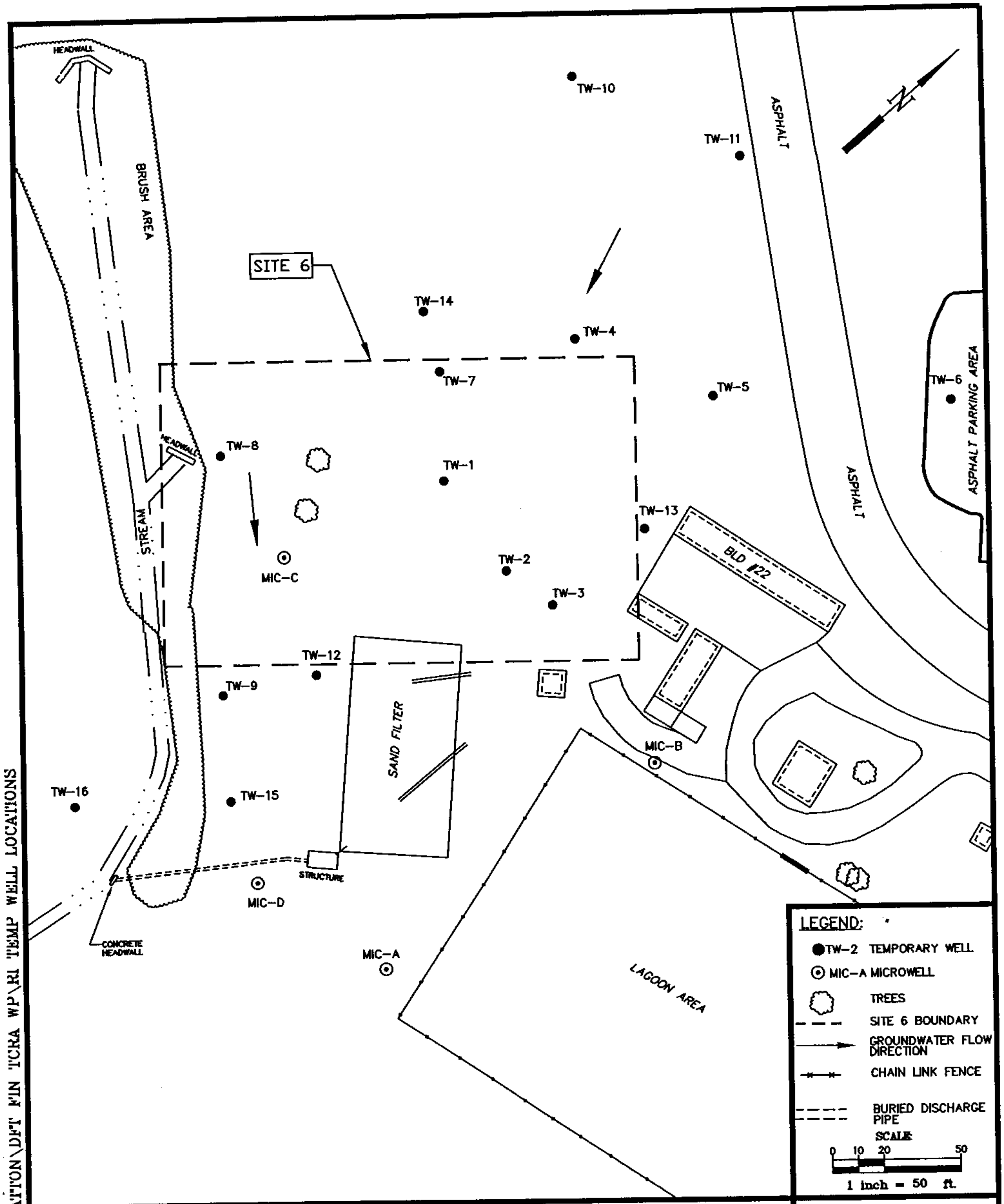
FIGURE: 3-3

C:\DRAW\STRATTON\TCRA\SOIL BORING MW LOCATIONS



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NEW YORK AIR NATIONAL GUARD BASE
109th AIRLIFT WING
RI TEMPORARY WELL/MICROWELL LOCATIONS–SITE 6
SCOTIA, NEW YORK

ANEPTEK CORPORATION
Analytic, Environmental and Process Technologies

FIGURE: 3–4

TABLE 3-1
RI MONITORING WELL CONSTRUCTION SUMMARY - SITE 6
SCHENECTADY ANGB
SCOTIA, NEW YORK

WELL DESIGNATION	REFERENCE POINT	GROUND SURFACE ELEVATION (ft msl)	REFERENCE POINT ELEVATION (ft msl)	RISER HEIGHT ABOVE GROUND SURFACE (ft)	DEPTH TO TOP OF SCREEN (bgs)	ELEVATION TOP OF SCREEN (ft msl)	DEPTH TO BOTTOM OF SCREEN (ft bgs)	ELEVATION BOTTOM OF SCREEN (ft msl)	ELEVATION CENTER OF SCREEN (ft msl)	TOTAL DEPTH OF BORING (ft bgs)	LENGTH OF SCREEN (ft)
6MW-03	Top Of PVC	306.7	305.93	Flush Mount	3.5	302.43	13.5	292.43	297.43	14.8	10
6MW-08	Top Of PVC	302.4	302.2	Flush Mount	5	297.2	15	287.2	292.2	16	10
6MW-09	Top Of PVC	304.1	304.06	Flush Mount	5	299.06	15	289.06	294.06	16	10
6MW-10	Top Of PVC	313.7	313.56	Flush Mount	5	308.56	15	298.56	303.56	16	10

ABBREVIATIONS:
bgs - below ground surface
ft - feet
msl - mean sea level

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standard of 5 µg/L. The sample collected from TW-9 had the highest concentration of cis-1,2-DCE at 50.1 µg/L. Other compounds detected in this sample were tetrachloroethene at 3.3 µg/L, trichloroethene at 1.14 µg/L, and vinyl chloride at 1.01 µg/L. NYSDEC drinking water standards for these three compounds are 5 µg/L, 5 µg/L, and 2 µg/L, respectively. TW-12 had the next highest concentration of cis-1,2-dichloroethene at 34.2 µg/L. Trichloroethene was also detected in this sample at 2.72 µg/L. In the sample from TW-7, only cis- 1,2-dichloroethene was detected at a concentration of 6.87 µg/L. In sample TW-15, cis-1,2-dichloroethene was detected at 1.14 µg/L and tetrachloroethene at 4.71 µg/L, both below NYSDEC drinking water standards. Temporary wells TW-2 and TW-10 were screened for VOCs using a full EPA Method 8021. The reported results for TW-10 were non-detect for all compounds. The sample collected from TW-2 reported only 1,3,5-trimethylbenzene at 1.33 µg/L. Results from these two temporary wells are also presented in Table 3-1.

3.3.1.2 RI Groundwater Sampling Analytical Results

Two groundwater monitoring wells installed at Site 6 were sampled in accordance with the approved RI Work Plan (Aneptek, 1998). Groundwater samples were submitted to an off-site laboratory for the following analyses: VOCs by EPA Method 8260, semi volatile organic compounds (SVOCs) by EPA Method 8270, target analyte list (TAL) metals (total and dissolved inorganics) by EPA Method 6010, chlorinated herbicides by EPA Method 8150, cyanide by EPA Method 9010, propylene glycol by EPA Method 8015, and pesticides/PCBs by EPA Method 8081.

Two rounds of groundwater sampling were performed at monitoring wells 6MW-08 and 6MW-09, in May and June, 1999. Tables 3-2 and 3-3 present the analytical results for round one and two, respectively. Additionally, the groundwater sample analytical results from monitoring well 6MW-03, collected in October and December, 1998, are included in the Site 6 data set. In summary, the analyses for pesticides, PCBs, herbicides, cyanide and propylene glycol were all reported as not detected above the laboratory reported PQL or less than the NYSDEC groundwater standards. The remaining analytical results for VOCs, SVOCs and inorganics are summarized as follows:

VOCs. Several VOCs in exceedance of the NYSDEC standards were detected in the Site 6 groundwater samples. These VOCs included cis-1,2-DCE, vinyl chloride and PCE. Cis-1,2-DCE was detected in 6MW-03 and 6MW-09 during the second round, and at it highest recorded concentration of 120 µg/L in 6MW-03 in the first round. Vinyl chloride was detected in both rounds at 6MW-03, at a concentration of 16 µg/L (first round) and 2.7 µg/L (second round). PCE was detected in 6MW-09 at a concentration of 16 µg/L in the second round. The laboratory did not report any significant VOC Tentatively Identified Compounds (TICs).

SVOCs. Several SVOCs in exceedance of the NYSDEC groundwater standards were detected in the Site 6 groundwater samples. These included the PAHs acenaphthene and 2-methylnapthalene, and the phenolic compounds 2,4-dinitrophenol, 4-nitrophenol, and phenol. Acenaphthene and 2-methylnapthalene were detected in the first round at 6MW-09 at concentrations of 40 µg/L and 35 µg/L, respectively. The phenolic compounds were detected in the second round at 6MW-08 and 6MW-09, with the highest combined concentration of 54 µg/L at 6MW-09. No significant TICs were reported by the laboratory.

TABLE 3-2

TEMPORARY WELL GROUNDWATER SAMPLE RESULTS
GC SCREENING
SCHENECTADY ANGB - SITE 6
SCOTIA, NEW YORK

ANALYTE	DETECTION LIMITS[1]	FEDERAL MCL[2]	NY STATE DWQS[3]	SAMPLE NUMBERS TW-1	TW-2	TW-3	TW-4	TW-5	TW-6	TW-7	TW-8
VOCs (µg/L)											
1,3,5-Trimethylbenzene	1	NA	5	NA	1.33	ND	ND	ND	ND	ND	ND
cis-1,2,-Dichloroethene	1	70	5	1.86	ND	ND	ND	ND	ND	[illegible]	ND
Tetrachloroethene	1	NA	5	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	1	5	5	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride	1	2	2	1.04	ND	ND	ND	ND	ND	ND	ND

ANALYTE	DETECTION LIMITS[1]	FEDERAL MCL[2]	NY STATE DWQS[3]	SAMPLE NUMBERS TW-9	TW-10	TW-12	TW-13	TW-14	TW-15	TW-16	6MW-3[4]
VOCs (µg/L)											
1,3,5-Trimethylbenzene	1	NA	5	NA	ND	ND	ND	ND	ND	ND	ND
cis-1,2,-Dichloroethene	1	70	5	[illegible]	ND	[illegible]	ND	ND	1.14	ND	[illegible]
Tetrachloroethene	1	NA	5	3.3	ND	ND	ND	ND	4.71	ND	ND
Trichloroethene	1	5	5	1.14	ND	2.72	ND	ND	ND	ND	ND
Vinyl Chloride	1	2	2	1.01	ND	ND	ND	ND	ND	ND	ND

ABBREVIATIONS:
µg/L - micrograms per liter
NA - Not Applicable
ND - Not Detected
TW - Temporary Well
MW-3 - Monitoring Well
NYSDEC - New York State Department of Environmental Conservation

NOTES:
1) Contract Required Detection Limit for Organics
2) U.S E.P.A Drinking Water Regulations and Health Advisories EPA 822-R-007, May, 1994
3) NYSDEC Water Quality Standards and guidance values, June 1998
Samples screened only for the compounds listed.
4) MW-3 is a permanent groundwater monitoring well which was sampled for GC screening.

DATA QUALIFIERS:
[illegible] Indicates concentration that exceeds State regulatory limits.

TABLE 3-3
GROUNDWATER SAMPLING RESULTS - FIRST ROUND
SITE 6
SCHENECTADY ANGB

ANALYTE	DETECTION LIMITS[1]	FEDERAL MCL[2]	NYSDEC DWQS[3]	BACKGRND CONC[4]		SAMPLE NUMBERS 6MW - 03		6MW - 08		6MW - 09		6MW - 19	
VOCs (µg/L)													
Tetrachloroethene	1	5	5	1	U	1	U	1	U	1	J	1.2	
cis-1,2-Dichloroethene	1	70	5[a]	1	U	[redacted]		1	U	1	U	1	U
trans-1,2-Dichloroethene	1	100	5[a]	1	U	0.7	J	1	U	1	U	1	U
Trichloroethene	1	5	5[a]	1	U	1.4		1	U	1	U	1	U
Vinyl Chloride	1	2	2	1	U	[redacted]		1	U	1	U	1	U
Methylene Chloride	1	NA	5[a]	1	U	1	U	1	U	1	U	1	U
Toluene	1	1,000	5[a]	1	U	1	U	1	U	1	U	1	U
SVOCs (µg/L)													
bis (2-Ethylhexyl) phthalate	10	NA	5	12		11	U	10	U	10	U	10	U
Diethylphthalate	10	NA	NA	10	U	11	U	10	U	10	J	10	U
Di-n-butylphthalate	10	NA	50	1	J	11	U	10	U	10	U	10	U
2-Methylphenol	10	NA	NA	10	U	11	U	10	U	1	J	10	U
Naphthalene	10	NA	10	10	U	11	U	10	U	3	J	10	U
2-Methylnaphthalene	10	NA	4.7[f]	10	U	11	U	10	U	[redacted]		10	UJ
Acenaphthene	10	NA	20	10	U	11	U	10	U	[redacted]		10	U
Dibenzofuran	10	NA	NA	10	U	11	U	10	U	30	J	10	U
Fluorene	10	NA	50[f]	10	U	11	U	10	U	18	J	10	UJ
Phenanthrene	10	NA	50[f]	10	U	11	U	10	U	8	J	10	U
Anthracene	10	NA	50[f]	10	U	11	U	10	U	2	J	10	U
Phenol	10	NA	1[d]	10	U	10	U	10	U	10	U	10	U
2,4-Dinitrophenol	10	NA	10[f] / 1[d]	10	U	10	U	10	U	10	U	10	U
4-Nitrophenol	10	NA	1[d]	10	U	10	U	10	U	10	U	10	U
PEST/PCBs (µg/L)													
4,4'-DDD	0.1	NA	0.3	0.1	U	0.01	J	0.01	U	0.01	U	0.01	U
4,4'-DDT	0.1	NA	0.2	0.1	U	0.01	J	0.01	U	0.01	U	0.01	U
HERBICIDES (µg/L)													
2,4,5-TP (Silvex)	0.5	50	NA	0.05	UJ	0.05	UJ	0.05	UJ	0.05	UJ	0.05	UJ
Pentachlorophenol (PCP)	0.1	1	1[d]	0.1	R	0.1		0.1	R	0.1	R	0.1	R
Dinoseb	0.1	7	1[d]	0.1	UJ	0.1		0.1	UJ	0.1	UJ	0.1	UJ
Picloram	0.04	500	50	0.04	UJ	0.05	J	0.04	UJ	0.04	UJ	0.04	UJ
2,4-D	0.05	70	50	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
CYANIDE, total (µg/L)	10	200	200	10	U	0.01	U	10	U	10	U	10	U
PROPYLENE GLYCOL (mg/L)	1	NA	NA	1	U	1	U	1	U	1	U	1	U
DISSOLVED INORGANICS (µg/L)													
Aluminum	200	NA	NA	10.2	UJ	200	U	10.2	UJ	15.9	J	10.2	UJ
Antimony	2.8	6	3	2.6	UJ	6	U	5.9	U	2.8	U	2.4	U
Arsenic	10	50	25	2.6	UJ	1.7	U	6.4	U	5	U	5.4	U
Barium	200	2,000	1,000	78.8	J	154	J	80.8	J	167	J	162	J
Beryllium	5	4	3[c]	0.4	J	0.2	U	0.1	U	0.1	U	0.1	U
Cadmium	5	5	5	0.4	J	0.3	U	0.2	U	0.2	U	0.2	U
Calcium	5,000	NA	NA	71,900		133,000	J	126,000		92,700		95,900	
Chromium	10	100	50	14		0.5	U	0.6	U	0.6	U	0.6	U
Cobalt	50	NA	5	0.6	U	0.8	U	0.7	J	0.6	U	0.6	U
Copper	25	1,300	200	0.5	UJ	2.7	U	0.5	UJ	0.5	UJ	0.5	UJ
Iron	100	NA	300	1.3	U	12.7	B	1.3	U	1.3	U	1.3	U
Lead	3	15	25	1.1	U	3	UJ	2.9	J	1.1	U	1.1	U
Magnesium	5,000	NA	35000[f]	18,600	J	32,200	J	[redacted]		[redacted]		[redacted]	
Manganese	15	NA	300	85	J	15	U	[redacted]		[redacted]		[redacted]	
Nickel	40	100	100	3.8	J	3.1	U	6	BJ	2	J	1.7	J
Potassium	5,000	NA	NA	3,360	J	10,900	J	6,830	J	9,270	J	9,590	J
Silver	10	NA	50	10	U	10	UJ	10	U	10	U	10	U
Sodium	5,000	NA	20,000	6,870	J	[redacted]		[redacted]		[redacted]		[redacted]	
Thallium	10	2	0.5[c]	1.1	U	10	U	1.1	U	1.1	U	1.1	U
Vanadium	50	NA	NA	1.2	U	50	U	1.2	U	1.2	U	1.2	U
Zinc	20	NA	2,000[f]	9.2	J	20	U	4.4	J	1	J	2.4	J

TABLE 3-3 (Cont.)

GROUNDWATER SAMPLING RESULTS - FIRST ROUND
SITE 6
SCHENECTADY ANGB

ANALYTE	DETECTION LIMITS[1]	FEDERAL MCL[2]	NYSDEC DWQS[3]	BACKGRND CONC[4]	SAMPLE NUMBERS 6MW-03	6MW - 08	6MW - 09	6MW - 19[5]
TOTAL INORGANICS (µg/L)								
Aluminum	200	NA	NA	7,050 J	107 J	3,280 J	4,620 J	6,830 J
Antimony	2.3	6	3	2.3 U	6 U	2.3 U	3.5 U	2.3 U
Arsenic	10	50	25	6.8 U	7.3 U	2.2 U	3 U	7.9 U
Barium	200	2,000	1,000	198 J	143 J	141 J	200	224
Beryllium	5	4	3[c]	0.4 J	0.2 U	0.1 U	0.2 J	0.9 J
Cadmium	5	5	5	0.4 J	0.3 U	0.1 U	0.2 J	0.9 J
Calcium	5,000	NA	NA	71,800	110,000 J	120,00	93,200	94,100
Chromium	10	100	50	14	10 U	4.3 U	8.9 J	15.5
Cobalt	50	NA	5	8.8 J	1.2 U	3 J	3.7 J	6.2 J
Copper	25	1,300	200	13.6 J	4.8 U	5.8 J	8.7 J	19.8 J
Iron	100	NA	300	15,200	386 J	5,900	9,910 J	[redacted]
Lead	3	15	25	6.7 J	3 UJ	5.2 J	7.7 J	9.7 J
Magnesium	5,000	NA	35000[f]	21,000	27,600 J	[redacted]	[redacted]	[redacted]
Manganese	15	NA	300	607	[redacted]	[redacted]	606	[redacted]
Nickel	40	100	100	20.4 J	4.1 J	10.7 J	11.3 J	16.7 J
Potassium	5,000	NA	NA	4,680 J	9,200 J	5,530 J	6,840 J	7,350 J
Silver	10	NA	50	ND	10 UJ	10 U	10 U	10 U
Sodium	5,000	NA	20,000	8,190	[redacted]	[redacted]	[redacted]	[redacted]
Thallium	10	2	0.5[c]	10 U	[redacted]	10 U	10 U	10 U
Vanadium	50	NA	NA	17.4 J	0.8 J	7.1 J	11.6 J	17.5 J
Zinc	20	NA	2,000[f]	62.1	9.9 J	66.6	29.8 J	45.9 J

ABBREVIATIONS:
µg/L - micrograms per liter
mg/L - milligrams per liter
NYSDEC - New York State Department of Environmental Conservation
VOC's - Volatile Organic Compounds
SVOC's - Semivolatile Organic Compounds
IDL- Instrument Detection Limit
NA - Not Applicable
DWQS - Drinking Water Quality Standards
MCL - Maximum Contaminant Level
PCB's - Polychlorinated Biphenyls

NOTES:
1) Contract Required Detection Limit (CRDL)
2) US EPA Drinking Water Regulations and Health Advisories EPA 822-R-007, May 1994.
3) NYSDEC Water Quality Standards and Guidance Values, June 1998. Unless otherwise noted, the value is the State promulgated standard for protection of drinking water from a groundwater source.
4) Background sample collected from 6MW-10
5) 6MW-19 is a duplicate sample of 6MW-9
a) The value listed is a guidance for the protection of drinking water from a groundwater source.
b) The listed value represents the maximum allowable concentration of phenolic compounds. Sum of all phenolic compounds may not exceed 1.0 ppb.
c) The value listed is a guidance for the protection of drinking water from a groundwater source
d) The liste value represents the maximum allowable concentration of phenolic compounds. Total phenolic compounds may not exceed 1.0 ppb.

DATA QUALIFIERS:
B - Value is less than CRDL but greater than IDL.
N - Spiked sample recovery not within control limits.
UJ - The analyte was not detected above the reported sample quantitation limit. However the reported quantitation limit is approximate and may or may not precisely measure the analyte in the sample.
J - The analyte was positively identified; the associated value is the approximate concentration of the analyte in the sample.
U - Compound was analyzed for but not detected.
[redacted] - Indicates concentration that exceeds either State or Federal regulatory limits.

TABLE 3-4

GROUNDWATER SAMPLING RESULTS - SECOND ROUND
SITE 6
SCHENECTADY ANGB

ANALYTE	DETECTION LIMITS[1]	FEDERAL MCL[2]	NYSDEC DWQS[3]	BACKGRND CONC[4]		SAMPLE NUMBERS 6MW-03		6MW-08		6MW-09		6MW-29[5]	
VOCs (µg/L)													
cis-1,2-Dichloroethene	1	70	5[e]	1	U	[redacted]		1	U	[redacted]		[redacted]	
Trans-1,2-Dichloroethene	1	100	5[e]	1	U	1	U	1	U	1	U	1	U
Trichloroethene	1	5	5[e]	1	U	0.6	J	1	U	1.8		1.6	
Vinyl Chloride	1	2	2	1	U	[redacted]		1	U	1	U	1	U
Methylene Chloride	1	NA	5[e]	1	U	1	U	1	U	1	U	1	U
Toluene	1	1,000	5[e]	1	U	1	U	1	U	1	U	1	U
Tetrachloroethene	1	5	5[e]	1	U	1	U	1	U	[redacted]		[redacted]	
SVOCs (µg/L)													
Phenol	10	NA	1[e]	10	U	10	U	[redacted]		[redacted]		10	U
2,4-Dinitrophenol	10	NA	10[f] / 1[e]	10	U	10	U	11	U	[redacted]		[redacted]	
Diethylphthalate	11	NA	NA	10	U	11	U	10	U	10	U	10	U
4-Nitrophenol	10	NA	1[e]	10	U	10	U	[redacted]		[redacted]		[redacted]	
Di-n-butylphthalate	10	NA	50	1	J	11	U	11	U	11	U	10	U
bis (2-Ethylhexyl) phthalate	10	NA	5	12		11	U	1	J	11	U	1	J
Naphthalene	10	NA	10	10	U	10	U	10	U	10	U	10	U
2-Methylnaphthalene	10	NA	4.7[f]	10	U	10	U	10	U	10	U	10	U
Acenaphthene	10	NA	20	10	U	10	U	10	U	10	U	10	U
Dibenzofuran	10	NA	NA	10	U	10	U	10	U	10	U	10	U
Fluorene	10	NA	50[f]	10	U	10	U	10	U	10	U	10	U
Phenanthrene	10	NA	50[f]	10	U	10	U	10	U	10	U	10	U
Anthracene	10	NA	50[f]	10	U	10	U	10	U	10	U	10	U
PEST/PCBs (µg/L)													
4,4'-DDD	0.1	NA	0.3	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
4,4'-DDT	0.1	NA	0.2	0.1	U	0.1	U	0.1	U	0.1	U	0.1	U
HERBICIDES (µg/L)													
2,4,5-TP (Silvex)	0.5	NA	NA	0.05	UJ	0.1	U	0.05	UJ	0.05	UJ	0.05	UJ
Pentachlorophenol (PCP)	0.1	1	1[e]	0.1	R	0.1	U	0.1	R	0.1	R	0.1	R
Dinoseb	0.1	7	1[e]	0.1	UJ	0.1	U	0.1	UJ	0.1	UJ	0.1	UJ
Picloram	0.04	500	50	0.04	UJ	0.04	U	0.04	UJ	0.04	UJ	0.04	UJ
2,4-D	0.05	70	50	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
CYANIDE, total (µg/L)	10	200	200	10	U	0.01	UJ	10	U	10	U	10	U
PROPYLENE GLYCOL (mg/L)	1	NA	NA	1	U	1	U	1	U	1	U	1	U
DISSOLVED INORGANICS (µg/L)													
Aluminum	200	NA	NA	10.2	UJ	9.5	U	40.8	J	19.2	U	56.2	J
Antimony	6	6	3	2.6	UJ	1.6	UJ	6	U	6	U	6	U
Arsenic	10	50	25	2.6	UJ	4.9	U	10	U	10	U	10	U
Barium	200	2,000	1,000	78.8	J	147	J	75.2	J	145	J	152	J
Beryllium	5	4	3[c]	0.1	U	0.2	U	0.1	U	0.1	U	0.1	U
Cadmium	5	5	5	0.2	U	0.3	U	0.3	U	0.4	U	0.3	U
Calcium	5,000	NA	NA	71,900		174,000	J	113,300		120,000		124,000	
Cobalt	50	NA	5	0.6	U	1.1	U	1.3	J	1.3	U	1.3	U
Copper	25	1,300	200	0.5	UJ	0.5	U	1.5	J	1.2	J	2.1	J
Iron	100	NA	300	1.3	U	8.9	U	ND		ND		ND	
Lead	3	15	25	1.1	U	1.5	U	ND		ND		ND	
Magnesium	5,000	NA	35,000[f]	18,600	J	[redacted]		[redacted]		[redacted]		[redacted]	
Manganese	15	NA	300	85	J	[redacted]		[redacted]		[redacted]		[redacted]	
Potassium	5,000	NA	NA	3,360	J	7820		2,470	J	6,840		6,830	
Silver	10	NA	50	10	U	3.8	UJ	ND		ND		ND	
Sodium	5,000	NA	20,000	6870	J	[redacted]		[redacted]		[redacted]		[redacted]	
Thallium	10	2	0.5[c]	1.1	U	1.5	U	[redacted]		[redacted]		[redacted]	
Vanadium	50	NA	NA	1.2	U	0.4	U	ND		ND		ND	
Zinc	20	NA	2,000[f]	9.2	J	4.6	U	7.2	J	24.5		31.7	

TABLE 3-4 Cont.)

GROUNDWATER SAMPLING RESULTS - SECOND ROUND
SITE 6
SCHENECTADY ANGB

ANALYTE	DETECTION LIMITS[1]	FEDERAL MCL[2]	NYSDEC DWQS[3]	BACKGRND CONC[4]		SAMPLE NUMBERS 6MW-03		6MW - 08		6MW - 09		6MW - 29[5]	
TOTAL INORGANICS (µg/L)													
Aluminum	200	NA	NA	7,050	UJ	927		799		96.8	J	109	J
Antimony	6	6	3	2.3	U	1.6	UJ	6	U	6	U	6	U
Arsenic	10	50	25	6.8	U	3.4	J	ND		ND		ND	
Barium	200	2,000	1,000	198	J	146	B	7.9	J	160	J	156	J
Beryllium	5	4	3[c]	0.4	J	0.2	U	5	U	5	U	5	U
Cadmium	5	5	5	0.4	J	0.3	U	5	U	5	U	5	U
Calcium	5,000	NA	NA	71,800		143,000		103,200		122,000		119,300	
Chromium	10	100	50	14		1.1		10	U	10	U	10	U
Cobalt	50	NA	5	8.8	J	1.6		2.2	J	1.3	U	1.3	U
Copper	25	1,300	200	13.6	J	3	J	3.4	J	2.4	J	3.1	J
Iron	100	NA	300	15,200		2,160		1,490		309		372	
Lead	3	15	25	6.7	J	2		3	U	3	U	3	U
Magnesium	5,000	NA	35000[c]	21,000	J	32,600		[illegible]		[illegible]		[illegible]	
Manganese	15	NA	300	607	J	[illegible]		599		[illegible]		[illegible]	
Nickel	40	100	100	20.4	J	5.1	J	3.9	U	3.1	U	3.0	U
Potassium	5,000	NA	NA	4,680	J	7,180		2,610	J	6,890		6,740	
Selenium	5	50	10	5	U	5	U	2.4	UJ	2.4	UJ	2.9	UJ
Silver	10	NA	50	10	U	3.8	UJ	10	U	10	U	10	U
Sodium	5,000	NA	20,000	8,190		[illegible]		[illegible]		[illegible]		[illegible]	
Thallium	10	2	0.5[c]	10	U	1.5	U	[illegible]		[illegible]		[illegible]	
Vanadium	50	NA	NA	17.4	J	2.9	J	1.9	J	1.1	U	1.1	U
Zinc	20	NA	2,000[c]	62.1		71	U	18.7	J	27.8	J	31.1	J

ABBREVIATIONS:
µg/L - micrograms per liter
mg/L - milligrams per liter
NYSDEC - NY State Department of Environmental Conservation
VOC's - Volatile Organic Compounds
SVOC's - Semivolatile Organic Compounds
CRDL - Contract Required Detection Limit
IDL- Instrument Detection Limit
NA - Not Applicable
DWQS - Drinking Water Quality Standards
MCL - Maximum Contaminant Level
PCB's - Polychlorinated Biphenyls

NOTES:
1) Contract Required Detection Limit (CRDL).
2) US EPA Drinking Water Regulations and Health Advisories, EPA 822-R-007, May 1994.
3) NYSDEC Water Quality Standards and guidance values, June 1998. Unless otherwise noted, the value listed is the State promulgated standard for the protection of drinking water from a groundwater source.
4) Background sample collected from 6MW-10
5)MW-29 is a duplicate sample of MW-09
a) The value listed is the NYSDEC standard for the protection of drinking water from a surface water source. The value listed is also the groundwater standard through reference as a Principal Organic Contaminant (POC).
b) The value listed is the Principal Organic Contaminant (POC) standard for the protection of drinking water from a groundwater source.
c) The value listed is a guidance for the protection of drinking water from a groundwater source.
d) The listed value represents the maximum allowable concentration of phenolic compounds. The sum of all phenolic compounds may not exceed 1.0 ppb.

DATA QUALIFIERS:
B - Value is less than CRDL but greater than IDL.
UJ - The analyte was not detected above the reported sample quantitation limit. However the reported quantitation limit is approximate and may or may not precisely measure the analyte in the sample.
J - The analyte was positively identified; the associated value is the approximate concentration of the analyte in the sample.
U - Compound was analyzed for but not detected.
R - The analyte was rejected due to inability to meet quality control criteria.
(shaded) - Indicates concentration that exceeds either State or Federal regulatory limits.

Inorganics. Several inorganic constituents were reported in exceedance of the NYSDEC groundwater standards and the Site 6 groundwater background. These inorganics included the essential nutrient elements magnesium, manganese and sodium; and thallium. The concentration of thallium detected in the Site 6 groundwater slightly exceeded the NYSDEC guidance value of 0.5 µg/L. A promulgated NYSDEC groundwater standard for thallium is not currently available.

3.3.1.3 RI Soil Sampling GC Screening Results

At soil boring locations SB-1, SB-2, SB-4, SB-5, SB-7, and SB-9, samples were collected and sent to an off-site laboratory for GC screening analysis for VOCs using EPA Method 8021. A sample was also collected from the location of TW-2. Screening results are presented in Table 3-4. A summary of the screening results are as follows:

- SB-1, collected from 8 to 8.6 feet bgs, contained the heavy-end gasoline fuel components 1,2,4-trimethylbenzene (828 µg/Kg); 1,3,5-trimethylbenzene (254 µg/Kg); 4-isopropyltoluene (2200 µg/Kg); isopropylbenzene (468 µg/Kg); n-butylbenzene (252 µg/Kg); n-propylbenzene (180 µg/Kg); sec-butylbenzene (1980 µg/Kg); and tert-butylbenzene (441 µg/Kg). Additionally, the chlorinated VOCs cis-1,2-dichloroethene (2600 µg/Kg) and trichloroethene (2940 µg/Kg) were also detected. Trichloroethene was in exceedance of the NYSDEC cleanup concentration of 700 µg/Kg.

- SB-2, collected from 4 to 6 feet bgs, contained tetrachloroethene at 140,000 µg/Kg. This exceeds the NYSDEC cleanup concentration of 1,400 µg/Kg.

- SB-4, collected from 4 to 4.7 feet bgs, contained tetrachloroethene at 8480 µg/Kg. This exceeds the NYSDEC cleanup concentration of 1,400 µg/Kg.

- SB-5, collected from 3.4 to 4 feet bgs, contained tetrachloroethene at 217 µg/Kg.

- SB-9, collected from 4 to 6 feet bgs, contained trichloroethene at 32.2 µg/Kg.

- SB-7, collected from 5 to 6 feet bgs, was nondetect for all of the previously identified contaminants, at a practical quantitation limit (PQL) of 27.7 µg/Kg.

Sample TW-2, collected from 3.5 to 4 feet bgs, contained 1,2,4-trimethylbenzene (3310 µg/Kg); 1,3,5-trimethylbenzene (2900 µg/Kg); 4-isopropyltoluene (1630 µg/Kg); ethylbenzene (622 µg/Kg); isopropylbenzene (3900 µg/Kg); n-butylbenzene (604 µg/Kg); n-propylbenzene (1220 µg/Kg); sec-butylbenzene (785 µg/Kg); tert-butylbenzene (491 µg/Kg); and total xylenes (1668 µg/Kg). The xylene result was the only VOC detected in exceedance of NYSDEC cleanup concentrations. These above listed compounds are typical heavy-end, gasoline fuel components.

3.3.1.4 RI Soil Sampling Analytical Results

A total of ten soil samples were collected from various soil borings and submitted for laboratory analysis for VOCs, SVOCs, Pest/PCBs, herbicides, total cyanide, and TAL metals. The results of the analyses for soil boring samples are presented in Table 3-5. A summary of the analytical

TABLE 3-5

SOIL BORING SAMPLE RESULTS - GC SCREENING
SCHENECTADY ANGB - SITE 6
SCOTIA, NEW YORK

ANALYTE	BKGRND. CONC.	NYSDEC CLEANUP CONC.[1]	SAMPLE NUMBERS									
			SB-1 8-8.6'	SB-2 4-6'	SB-3	TW-2 3.5-4'	SB-4 4.4-4.7'	SB-5 3.4-4'	SB-6	SB-7 5-6'	SB-9 4-5'	SB-10
VOCs (ug/kg)												
1,2,4-Trimethylbenzene	ND	NA	828	ND	NS	3,310	ND	ND	NS	ND	ND	NS
1,3,5-Trimethylbenzene	ND	NA	254	ND	NS	2,900	ND	ND	NS	ND	ND	NS
4-Isopropyltoluene	ND	NA	2,200	ND	NS	1,630	ND	ND	NS	ND	ND	NS
cis-1,2,-Dichloroethene	ND	NA	2,600	ND	NS	ND	ND	ND	NS	ND	ND	NS
Ethylbenzene	ND	5500	ND	ND	NS	622	ND	ND	NS	ND	ND	NS
Isopropyl benzene	ND	NA	468	ND	NS	3,900	ND	ND	NS	ND	ND	NS
m,p-Xylene	ND	1200	ND	ND	NS	[illegible]	ND	ND	NS	ND	ND	NS
n-Butylbenzene	ND	NA	252	ND	NS	604	ND	ND	NS	ND	ND	NS
n-Propylbenzene	ND	NA	180	ND	NS	1,220	ND	ND	NS	ND	ND	NS
O Xylene	ND	NA	ND	ND	NS	178	ND	ND	NS	ND	ND	NS
sec-Butylbenzene	ND	NA	1,980	ND	NS	785	ND	ND	NS	ND	ND	NS
tert-Butylbenzene	ND	NA	441	ND	NS	491	ND	ND	NS	ND	ND	NS
Tetrachloroethene	ND	1400	ND	[illegible]	NS	ND	[illegible]	217	NS	ND	ND	NS
Trichloroethene	ND	700	[illegible]	ND	NS	ND	ND	ND	NS	ND	32.2	NS

ABBREVIATIONS:
ug/kg - micrograms per kilogram
NA - Not Applicable
ND - Not Detected
NS - Not Sampled
SB - Soil Boring / Sample depth

NOTES:
1) NYSDEC TAGM HWR-94-4046
January 24, 1994
TW-2 represents a soil sample collected
during installation of a temporary well.
Samples screened only for compounds listed

DATA QUALIFIERS:
[illegible] Indicates concentration that exceeds State regulatory limits.

TABLE 3-6

SOIL SAMPLE RESULTS
SCHENECTADY ANGB - SITE 6
SCOTIA, NEW YORK

ANALYTE	DETECTION LIMIT[1]	BKGRND CONC.	NYSDEC CLEANUP CONC.[2]	SAMPLE NUMBERS									
				SB-2 4-6'		TW-2 3-4'		TW-22[3] 3-4'		SB-11 2-4'		SB-12 2-4'	
VOC's (µg/kg)													
cis-1,2,-Dichloroethene	6	ND	NA	17		6	U	6	U	1	U	200	J
tert-Butylbenzene	6	ND	NA	6	U	6	U	12		1	U	1	U
Trichloroethene	6	ND	700*	14		6	U	1	U	1	U	95	
Ethylbenzene	6	ND	5500*	6	U	10	J	17	J	1	U	1	U
Isopropyl benzene	6	ND	NA	6	U	69	J	150	J	1	U	1	U
4-Isopropyltoluene	6	ND	NA	6	U	52	J	140	J	1	U	1	U
n-Propylbenzene	6	ND	NA	6	U	84	J	220	J	1	U	1	U
1,1,1,2-Tetrachloroethane	6	ND	NA	7.1		6	U	5.6	U	1	U	1	U
1 3,5-Trimethylbenzene	6	ND	NA	6	U	110	J	380	J	1	U	1	U
1 ,2,4-Trimethylbenzene	6	ND	NA	6	U	170	J	600	J	1	U	1	U
Tetrachloroethene	6	ND	1400*	[redacted]		7	J	6	UJ	4	U	520	J
m,p-Xylene	6	ND	1200*	6	U	49	J	140	J	1	U	1	U
trans-1,2-Dichlorofluromethane	1	ND	NA	6	U	6	U	6	U	1	U	6.2	
Toluene	1	5.4	1500*	6	U	6	U	6	U	1	U	1.4	J
Trichlorofluromethane	1	ND	NA	6	U	6	U	6	U	1	UJ	1	U
SVOC's (µg/kg)													
Fluoranthene	390	340	50,000**	390	U	44	J	68	J	38	J	390	U
Benzo (b) fluoranthene	390	330	1,100	390	UJ	390	UJ	370	UJ	370	U	390	U
2,2'oxibis (1 Chloropane)	390	ND	NA	390	UJ	390	UJ	370	UJ	370	U	390	U
Pentachlorophenol	980	ND	1000 or MDL	980	R	970	R	930	R	940	U	970	U
n-Nitrosodimethylamine	390	ND	NA	390	UJ	390	UJ	370	UJ	370	U	390	U
Pyrene	390	330	50,000**	390	U	390	UJ	55	J	41	J	390	U
2-Methylnapthalene	390	ND	36,400	390	U	88	J	370	U	370	U	390	U
Naphthalene	390	ND	13,000	390	U	110	J	370	UJ	370	U	390	U
Hexachlorocyclopentadiene	390	ND	NA	390	UJ	390	UJ	370	U	370	UJ	390	UJ
2,4-Dinitrophenol	390	ND	NA	390	U	390	U	370	U	940	UJ	970	UJ
bis (2-Ethylhexyl) phthalate	390	ND	50,000**	390	U	390	U	370	U	370	U	110	J
Benzo (a) anthracene	390	180	224 or MDL	390	U	390	U	370	U	370	U	390	U
Chrysene	390	250	400	390	U	390	U	370	U	370	U	390	U
Benzo (a) pyrene	390	210	61 or MDL	390	U	390	U	370	U	370	U	390	U
PEST/PCBs (µg/kg)													
4,4'-DDT	3.9	6	2,100	3.9	U	3.9	U	3.7	U	3.8	U	3.9	U
4,4'-DDE	3.7	3	2,100	3.9	U	3.9	U	3.7	U	3.8	U	3.9	U
HERBICIDES (µg/kg)													
2,4-D	0.6	ND	500	0.58	R	0.58	R	0.56	R	0.6	R	0.6	R
2,4,5-TP (Silvex)	0.6	0.24	700	0.58	UJ	0.58	U	0.56	U	0.6	UJ	0.6	UJ
Dinonseb	1.1	ND	NA	1.2	UJ	1.2	U	1.1	U	1.1	R	1.2	R
Picloram	0.5	ND	NA	0.47	UJ	0.46	UJ	0.44	UJ	0.4	UJ	0.5	UJ
CYANIDE, Total (mg/kg)	0.5	ND	ND	ND		ND		ND		ND		ND	
INORGANICS (mg/kg)													
Aluminum	200	15,321	SB	14,200		14,200	J	[redacted]		13,100	J	10,200	J
Antimony	60	17	SB	1.1	U	0.5	U	1.0	U	2.7	U	1.4	U
Arsenic	2	8	7.5 or SB	[redacted]		7.6	J	6.8	J	[redacted]		5.4	
Barium	200	97	300 or SB	115		90.3	J	156	J	75.4	J	66.2	J
Beryllium	1	0.81	0.16 or SB	[redacted]		0.6	J	[redacted]		0.7	J	0.5	J
Cadmium	1	ND	1 or SB			0.7	J	0.7	J	0.2	J	0.3	J
Calcium	5,000	11,383	SB	2,070	J	3,360		1,840	J	2,860	J	5,060	J
Chromium	2	23	10 or SB	[redacted]		16.7		21.6		17.7		14	
Cobalt	50	16	30 or SB	25.9		11.6	J	13.8	J	14.2	J	9	J
Copper	25	42	25 or SB	[redacted]		24.5		24.0		32.2		21.1	
Iron	100	35,876	2,000 or SB			23,200		31,800		30,800	J	19,000	J
Lead	3	45	SB	25.6	J	15.9	J	10	J	20.2		12.3	
Magnesium	5,000	8,120	SB	6,690		4,420		4,990		4,600		4,480	J
Manganese	15	855	SB	[redacted]		464		363		535	J	205	J
Nickel	40	29	13 or SB			21.4		24.6		[redacted]		18.9	
Potassium	5,000	1,930	SB			1,370	J	1,910	J	1,760	J	1,590	
Silver	2	ND	SB	0.6	U	0.6	U	0.7	U	1.3	J	1.0	J
Sodium	5,000	380	SB	232	U	192	U	39.3	U	67	U	65.7	U
Thallium	10	ND	SB	0.5	U	1.1	U	0.5	U	1.8	U	0.9	U
Vanadium	50	30	150 or SB	25.2		21.9		32.8		28		20.9	
Zinc	20	116	20 or SB	[redacted]		75.2		75.4		75.35	J	56.3	J

TABLE 3-6 (Cont.)

SOIL SAMPLE RESULTS
SCHENECTADY ANGB - SITE 6
SCOTIA, NEW YORK

ANALYTE	DETECTION LIMIT[1]	BKGRND CONC.	NYSDEC CLEANUP CONC.[2]	SAMPLE NUMBERS									
				SB-13 2-4'		SB-14 2-4'		SB-15 2-4'		SB-55[4] 2-4'		SB-16 2-4'	
VOC's (µg/kg)													
cis-1,2,-Dichloroethene	6	ND	NA	1	U	1	U	1	U	1	U	1	U
tert-Butylbenzene	6	ND	NA	1	U	1	U	1	U	1	U	1	U
Trichloroethene	6	ND	700*	1	U	1	U	1	U	1	U	1	U
Ethylbenzene	6	ND	5,500*	1	U	1	U	1	U	1	U	1	U
Isopropyl benzene	6	ND	5	1	U	1	U	1	U	1	U	1	U
4-Isopropyltoluene	6	ND	NA	1	U	1	U	1	U	1	U	1	U
n-Propylbenzene	6	ND	NA	1	U	1	U	1	U	1	U	1	U
1,1,1,2-Tetrachloroethane	6	ND	NA	1	U	1	U	1	U	1	U	1	U
1,3,5-Trimethylbenzene	6	ND	NA	1	U	1	U	1	U	1	U	1	U
1,2,4-Trimethylbenzene	6	ND	NA	1	U	1	U	1	U	1	U	1	U
Tetrachloroethene	6	ND	1400*	1	U	1	U	1	U	1	U	1	U
m,p-Xylene	6	ND	1200*	1	U	1	U	1	U	1	U	1	U
trans-1,2-Dichloroethene	1	ND	NA	1	U	1	U	1	U	1	U	1	U
Toluene	1	5.4	1500*	1	U	1	U	1	U	0.8	J	1	U
Trichlorofluoromethane	1	ND	NA	1	U	1	U	1	U	1	U	1	U
SVOC's (µg/kg)													
Fluoranthene	390	340	50,000*	410	U	390	U	60	J	410	U	94	J
Benzo (b) fluoranthene	390	330	1,100	410	U	390	U	55	J	410	U	78	J
2,2'oxibis (I Chloropane)	390	ND	NA	410	U	390	U	370	U	410	U	390	U
Pentachlorophenol	980	ND	1000 or MDL	1,000	U	970	U	920	U	1,000	U	970	U
n-Nitrosodimethylamine	390	ND	NA	410	U	390	U	370	U	410	U	390	U
Pyrene	390	330	50,000**	410	U	48	J	70	J	410	U	98	J
Fluorene	390	ND	50,000**	410	U	390	U	370	U	410	U	390	U
2-Methylnaphthalene	390	ND	36,400	410	U	390	U	370	U	410	U	390	U
Napthalene	390	ND	13,000	410	U	390	U	370	U	410	U	390	U
Hexachlorocyclopentadiene	390	ND	NA	410	UJ	390	U	370	U	410	U	390	U
2,4-Dinitrophenol	390	ND	NA	1,000	U	390	U	920	UJ	1,000	UJ	390	U
bis (2-Ethylhexyl) phthalate	390	ND	50,000**	410	U	390	U	370	U	410	U	390	U
Benzo (a) anthracene	390	180	224 or MDL	410	U	54	J	370	U	410	U	45	J
Chrysene	390	250	400	410	U	390	U	370	U	410	U	47	J
Benzo (a) pyrene	390	210	61 or MDL	410	U	39	J	40	J	410	U	52	J
PEST/PCBs (µg/kg)													
4,4'-DDT	3.9	6	2,100	4	U	0.7	U	2.8	J	2.1	U	3.9	U
4,4'-DDE	3.7	3	2,100	4	U	3.9	U	0.9	J	4.1	U	3.9	U
HERBICIDES (µg/kg)													
2,4-D	0.6	ND	500	0.6	R	0.6	R	0.5	R	0.6	R	0.6	R
2,4,5-TP (Silvex)	0.6	0.24	700	0.6	UJ	0.6	UJ	0.5	UJ	0.6	R	0.6	UJ
Pentachlorophenol (PCP)	1.1	ND	1000 or MDL	1.2	R	1.2	R	1.1	R	1.2	R	1.2	R
Dinoseb	1.1	ND	NA	1.2	R	1.2	R	1.1	R	1.2	R	1.2	R
Picloram	0.5	ND	NA	0.5	UJ	0.5	UJ	0.4	UJ	0.5	UJ	0.5	UJ
CYANIDE, Total (mg/kg)	0.5	ND	ND	ND		ND		ND		ND		ND	
INORGANICS (mg/kg)													
Aluminum	200	15,321	SB	14,600	J	14,000	J	[illegible]		[illegible]		11,000	J
Antimony	60	17	SB	2.9	U	2.8	U	2.6	U	2.9	U	1.4	U
Arsenic	2	8	7.5 or SB	8	J	[illegible]		[illegible]		[illegible]		6.2	
Barium	200	97	300 or SB	93.6	J	65.5	J	116	J	124	J	80	J
Beryllium	1	0.81	0.16 or SB	.8	J	0.7	J	[illegible]		[illegible]		[illegible]	
Cadmium	1	ND	1 or SB	0.1	U	0.2	J	0.5	J	0.9	J	0.2	J
Calcium	5,000	11,383	SB	2,250	J	1,590	J	7,020	J	6,010	J	5,210	J
Chromium	2	23	10 or SB	17.4		21.8		19.4		22.5		13.5	
Cobalt	50	16	30 or SB	9.5	J	15.6	J	9.4	J	10.6	J	10.2	J
Copper	25	42	25 or SB	24		31.7		22.8		24.2		20	
Iron	100	35,876	2,000 or SB	27,900	J	24,000	J	32,100	J	33,600	J	22,200	J
Lead	3	45	SB	16	J	18.4	J	18.4	J	22.3		14.1	
Magnesium	5,000	8,120	SB	3,940	J	5,930	J	6,440	J	5,610	J	3,870	J
Manganese	15	855	SB	421	J	661	J	418	J	551	J	522	J
Nickel	40	29	13 or SB	23		[illegible]		21.5		23.5	J	15.6	
Potassium	5,000	1,930	SB	1,710	J	[illegible]		1,520	J	1,890	J	1,380	
Silver	2	ND	SB	1.4	U	1.3	U	1.6	J	1.7	J	1.0	J
Sodium	5,000	380	SB	72.2	U	69.2	U	64	U	72	U	33.8	U
Thallium	10	ND	SB	1.9	U	1.8	U	1.7	U	1.9	U	0.9	U
Vanadium	50	30	150 or SB	29.8		25.7		35		38		24	
Zinc	20	116	20 or SB	78.2	J	76.3	J	56	J	64.9	J	48	J

ABBREVIATIONS:

ug/kg - micrograms per kilogram
mg/kg - milligrams per kilogram
DWQS - Drinking Water Quality Standards
MDL - Method Detection Limit
NYSDEC - New York State Department of Environmental Conservation
ND - Not Detected
NA - Not Applicable
PCB's - Ploy Chlorinated Biphenyls
SVOC's - Semivolatile Organic Compounds
SB - Soil Boring
TAGM - Technical and Administrative Guidance Memorandum
VOC's - Volatile Organic Compounds

NOTES:

1) Contract Required Detection Limit (CDRL)

2) NYSDEC TAGM HWR-94-4046, January 24, 1994. Where applicable, the soil cleanup objectives were corrected for TOC levels. Where the GW based Soil Cleanup Objectives differed from the Recommended Soil Cleanup Objectives, the more stringent value was used.

3) TW-22 is duplicate sample of TW-2.
4)SB-55 is a duplicate sample of SB-15.
*) As per TAGM #4046, total VOCs < 10 ppm.
**) As per TAGM #4046, total VOCs < 10 ppm, total SVOCs < 500 ppm, and individual SVOCs < 50 ppm must be maintained for the listed NYSDEC concentrations to apply.

DATA QUALIFIERS:

R - Sample result was rejected. Presence or absence of analyte cannot be verified.
B - Value is less than the CRDL but greater than the IDL.
UJ - The analyte was not detected above the reported sample quantitation limit. However the reported quantitation limit is approximate and may or may not precisely measure the analyte in the sample.
J - The analyte was positively identified; the associated value is the approximate concentration of the analyte in the sample.
U - Compound was analyzed for but not detected.
- Indicates concentration that exceeds either State or Federal regulatory limits.

findings, including significant tentatively identified compounds (TICs) reported by the laboratory, is presented below.

- SB-2. Sample collected from 4 to 6 feet bgs. VOCs detected included cis-1,2-dichloroethene (17 µg/Kg); trichloroethene (14 µg/Kg); 1,1,1,2-tetrachloroethane (7.1 µg/Kg); and tetrachloroethene (8,600 µg/Kg), of which only tetrachloroethene was in excess of the NYSDEC cleanup standard (1,400 µg/Kg). No significant VOC TICs were reported by the laboratory. No significant SVOCs were reported by the laboratory. Trace amounts of several polynuclear aromatic hydrocarbons (PAH), near the practical quantitation limit (PQL) were recorded. The laboratory did not report the presence of any pesticides, herbicides, PCBs or cyanides. Significant inorganics detected above the NYSDEC cleanup criteria included arsenic (16.4 mg/Kg), beryllium (0.9 mg/Kg), cadmium (1.1 mg/Kg), chromium (24.5 mg/Kg), cobalt (25.9 mg/Kg), copper (48.8 mg/Kg), nickel (59.7 mg/Kg) and zinc (132 mg/Kg). Iron (40,500 mg/Kg), manganese (888 mg/Kg), and potassium , (2,280 mg/Kg) were also detected above NYSDEC cleanup criteria.

- TW-2. Sample was collected from a depth of 3 to 4 feet bgs. A duplicate sample of TW-2, TW-22, was also collected from this same depth. Although no VOCs were detected above available background or NYSDEC cleanup standards, several heavy end petroleum related compounds were detected in TW-2 and TW-22 at elevated levels relative to the other sample results. N-propylbenzene (84 to 220 µg/Kg), 1,3,5-trimethylbenzene (110 to 380 µg/Kg) and 1,2,4-trimethylbenzene (170 to 600 µg/Kg) had the highest concentrations. Only two inorganics, aluminum, detected at 18,000 µg/Kg, and beryllium, detected at 1.0 µg/Kg, exceeded NYSDEC cleanup standards (15,321 µg/Kg and 0.81 µg/Kg, respectively). These were detected in the duplicate sample, TW-22.

Although the sample results for the same compounds from TW-2 were comparable, they did not exceed either of these standards. The laboratory did not report the presence of any pesticides, herbicides, PCBs or cyanides.

- SB-11. Sample collected from 2 to 4 feet bgs. was found to be relatively free of organic contamination. No significant VOCs, SVOCs, pesticides, herbicides, PCBs, or cyanide were reported. Two inorganic compounds which only slightly exceeded NYSDEC cleanup criteria were arsenic at 11.2 mg/Kg and nickel at 30 mg/Kg. The cleanup standards for these two compounds are 8 mg/Kg and 29 mg/Kg, respectively.

- SB-12. Sample collected from 2 to 4 feet bgs. VOCs detected in this sample included cis-1,2-dichloroethene (200 µg/Kg); trans-1,2-dichlorofluromethane (6.2 µg/Kg); trichloroethene (95 µg/Kg); tetrachloroethene (520 µg/Kg); and toluene (1.4 µg/Kg), all of which are less than the NYSDEC cleanup standards. No significant VOCs TICs were reported by the laboratory, nor were there any SVOCs, pesticides, herbicides, PCBs, or cyanide reported. No inorganic compounds were detected above NYSDEC cleanup criteria.

- SB-13. Sample collected from 2 to 4 feet bgs. No significant VOCs, SVOCs, pesticides, herbicides, PCBs, or cyanide were reported. No inorganic compounds were detected above NYSDEC cleanup criteria.

- SB-14. Sample collected from 2 to 4 feet bgs. No significant VOCs, SVOCs, pesticides, herbicides, PCBs or cyanides were reported. Inorganics detected at concentrations slightly above the NYSDEC cleanup criteria included arsenic (10.4 mg/Kg), nickel (35 mg/Kg), and potassium (2,150 mg/Kg).

- SB-15. Sample collected from 2 to 4 feet bgs. No significant VOCs, SVOCs, pesticides, herbicides, PCBs or cyanides were reported. A duplicate sample of SB-15, SB-55, was also collected from this same depth. Inorganics detected at concentrations slightly above the NYSDEC cleanup criteria included aluminum (17,400 mg/Kg), arsenic (8.7 mg/Kg), barium (116 mg/Kg), beryllium (1 mg/Kg), and vanadium (35 mg/Kg). Sample results from the duplicate sample, SB-55, were almost identical to the results from the original sample.

- SB-16. Sample collected from 2 to 4 feet bgs. No significant VOCs, SVOCs, pesticides, herbicides, PCBs or cyanides were reported. Of the inorganic compounds analyzed for, only beryllium , at 1.0 mg/Kg, was detected above the NYSDEC cleanup criteria of 0.81 mg/Kg.

3.3.1.5 Surficial Geology

The overburden material at Site 6 consists mainly of a brownish to dark gray inorganic clayey silt with some fine to medium sand. The material was dry and fairly loose but could be rolled into 1/4-inch threads when wet. The thickness of the overburden ranged from between four and eight feet bgs throughout the majority of the northern section of Site 6. Following surficial topography, the overburden becomes increasingly shallower towards the southern edge of the site.

3.3.1.6 Bedrock Geology

During the advancement of soil borings to facilitate the installation of groundwater monitoring wells at Site 6, bedrock was encountered at between four and eight feet bgs. Split spoon samples recovered from the point of refusal typically had 3 to 7 inches of fractured, weathered shale in the nose of the sampler. This shale was typically dark gray to bluish black and highly fractured. Due to the fact that the bedrock was highly fractured, rock coring or the use of a roller bit was not required. The borings were advanced with the use of hollow stem augers (HSA). The fractured shale was pulverized into a fine powder and brought to the surface as a fine powder. Boring logs are presented in Appendix D.

During the initial field program for the RI, a boring was advanced to a depth of 100.5 feet bgs for the purpose of installing a bedrock groundwater monitoring well. The location of this boring was approximately fifty feet north of Site 6. A total of seventeen rock cores were collected during the borehole advancement. Evaluation of the core samples revealed an average Rock Quality Designation (RQD) of 94.2%. The bedrock was dark gray, moderately hard thinly-bedded shale. Observed fractures were closely spaced with an orientation ranging from horizontal to 20 degrees from horizontal. No evidence of staining, oxidation, or calcification were observed along the fractures. Rock cores recovered from this boring were consistently homogenous in nature. The rock coring log is presented in Appendix C, the location of the borehole is shown in Figure 3-3.

3.3.1.7 Hydrogeology

Groundwater at Site 6 was consistently encountered at depths ranging from 5 to 7 feet bgs. Groundwater flows along the overburden/bedrock interface and within the first few feet of the fractured, weathered bedrock. Hydraulic gradients were calculated for Site 6 using groundwater elevation data obtained from monitoring wells 6MW-08, 6MW-09, and 6MW-10 measured on May 17, 1999. Hydraulic gradients ranged from 0.03 ft/ft (measured between 6MW-08 and 6MW-09) to 0..42 ft/ft (measured between 6MW-09 and 6MW-10), with an average gradient of 0.037 ft/ft.

Hydraulic conductivity (K) was estimated from in-situ hydraulic conductivity tests performed on monitoring wells 6MW-03, 6MW-08, 6MW-09, and 6MW-10. Hydraulic conductivity values ranged from $8.46X10^{-6}$ cm/sec measured at 6MW-08 to $2.72x10^{-4}$ measured at 6MW-10. Groundwater flow velocity at Site 6 was calculated using a lower hydraulic gradient (I) of 0.03 ft/ft (measured between 6MW-08 and 6MW-09) and an upper gradient of 0.42 ft/ft (measured between 6MW-09 and 6MW-10), a K value of $2.12x10^{-3}$ cm/sec, and an estimated effective porosity of 15%. A groundwater flow velocity of 0.015 ft/day (5.5 ft/yr) was calculated using the shallower gradient of 0.03 ft/ft. A flow velocity of 0.022 ft/day (7.9 ft/yr) was calculated using the steeper gradient of 0.042 ft/ft. General groundwater flow direction at Site 6 is shown in Figure 3-5.

3.3.1.8 Removal Action

Three AOCs were identified during the RI which required soil excavation and off-site disposal. The areas of excavation are between SB-4 and SB-5 (centering on SB-2), between SB-1 and SB-10, and centering on TW-2, areas to be excavated are shown in Figure 3-6. At the time this Work Plan was being written, the soil removal had not yet been performed. The soil removal action is expected to occur in the spring of 2002. Soils will be excavated from the ground surface to a depth of approximately 8 feet bgs. Approximately 150 cubic yards of soil are slated to be removed. Soils are to be transported to EMSI in Hudson Falls, New York, for disposal by incineration. Confirmatory soil samples will be collected from the sidewalls and floor of each excavation and submitted to an off-site laboratory for VOC analysis by EPA Method 8021, analysis to be expanded to include chlorinated organic compounds.

3.4 Summary and Conclusions

Within Site 6, the RI revealed three apparently separate and distinct soil contaminant locations. The dominant Contaminants of Concern (COCs) within these three areas are inorganics and volatile organic compounds. These areas, identified by their specific soil contaminant in reference to a soil boring location, are as follows:

- Tetrachloroethene (a.k.a. perchloroethene, PCE): This soil contaminant is centered near soil boring location SB-2, with diminished levels extending northwest to SB-5 and southeast to SB-4. The concentration of PCE is above the NYSDEC criteria for soil based on laboratory analytical results.

- Trichloroethene (TCE): This location is approximately 100 feet north (up gradient) from the PCE location. This area is approximately centered near the soil borings SB-1. The concentration of TCE is above the NYSDEC criteria for soil based on laboratory screening data.

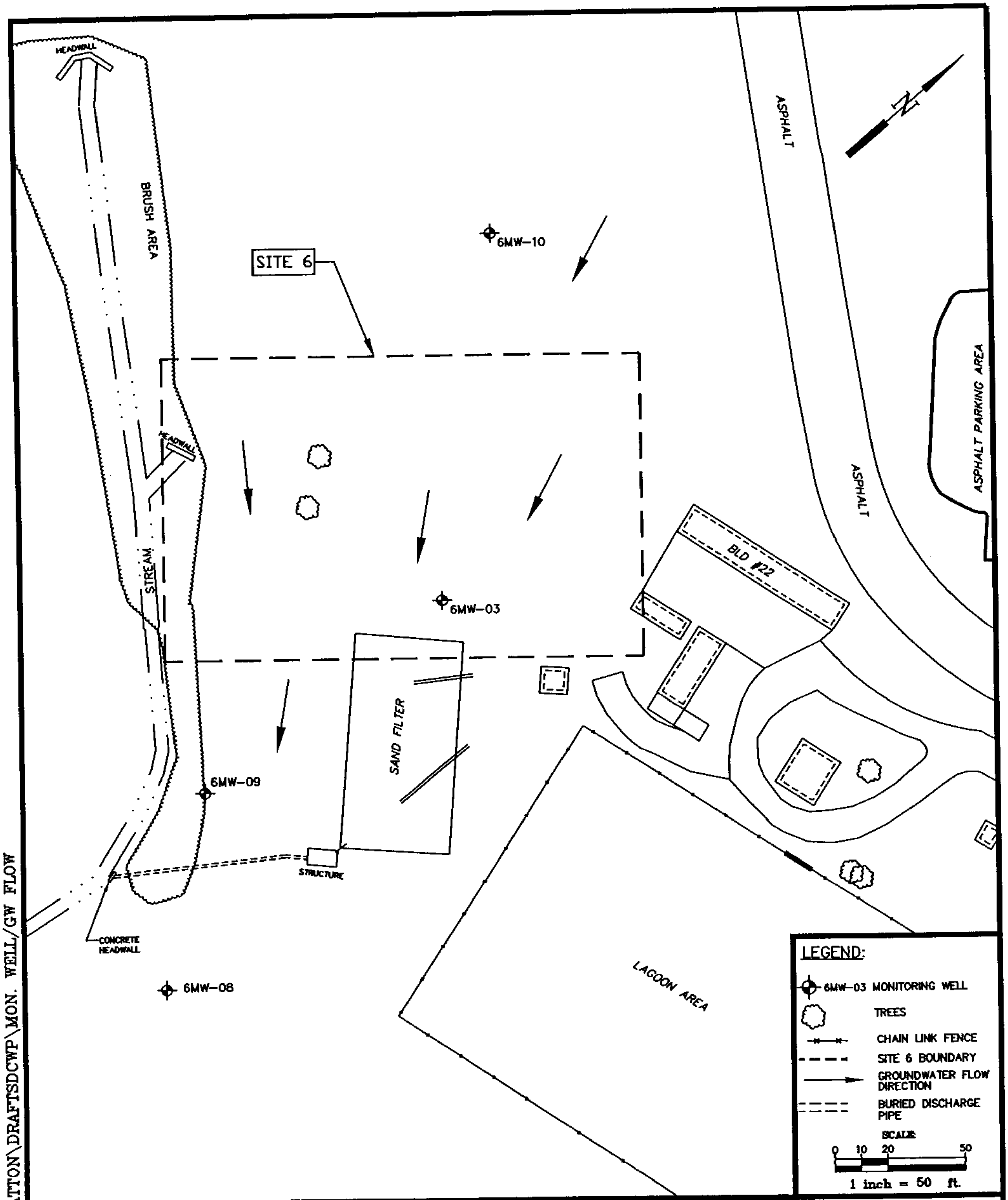

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FIGURE: 3-5

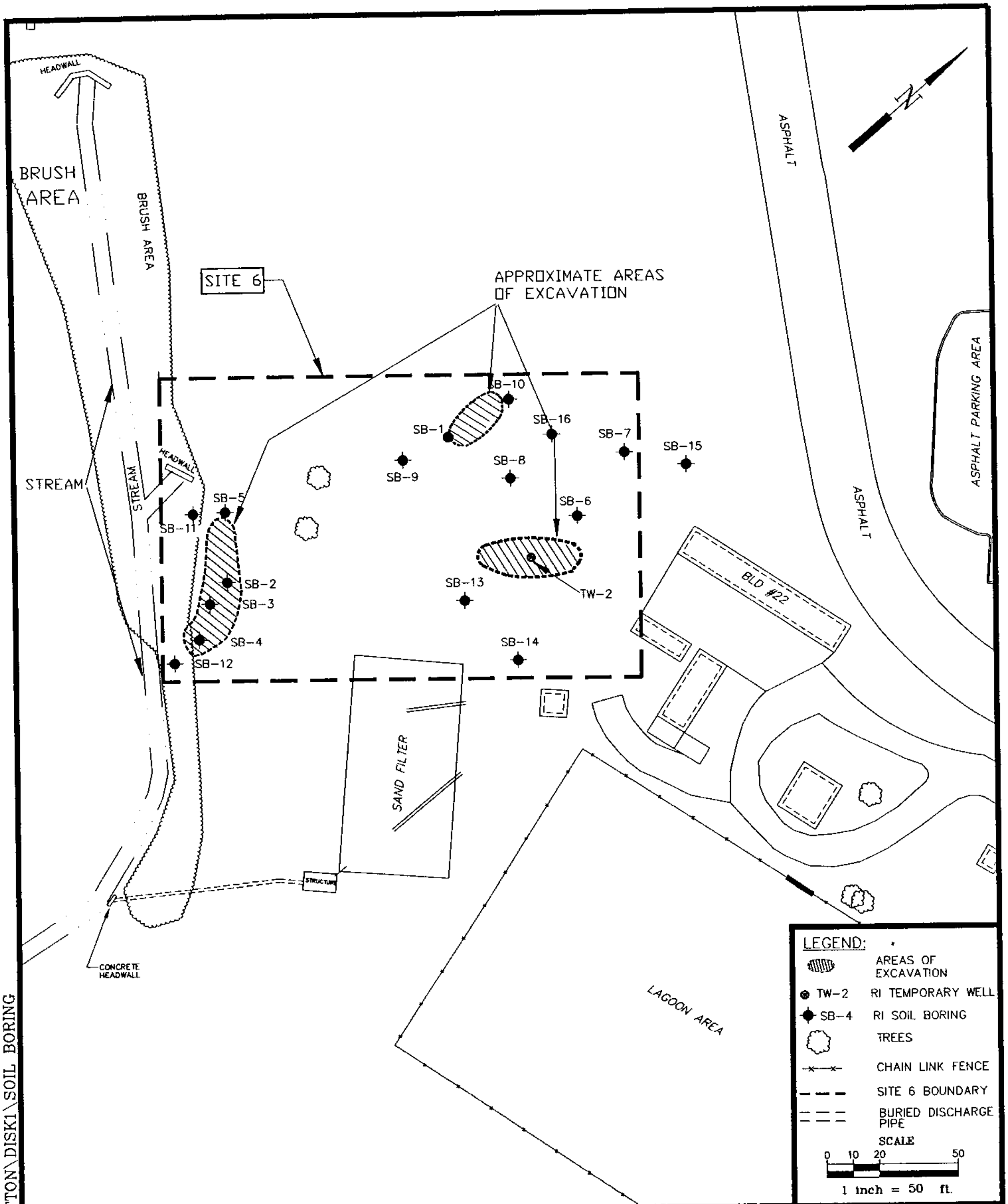

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FIGURE: 3-6

- Weathered Fuel Constituents (heavy-end residual): This contaminant location is centered near TW-2, and possesses trace amounts (7 ug/kg, estimated) of PCE. The fuel is significantly weathered and is void of its lighter-end components, including benzene, ethylbenzene, and toluene. With the exception of a single laboratory screening result for xylenes, all soil contaminants were detected below the NYSDEC soil criteria at this location.

Downgradient of the above referenced locations, where PCE and TCE were detected in soil, the more mobile and soluble degradation product, cis-1,2-DCE, was detected in groundwater. In (down gradient) monitoring well 6MW-09, both cis-1,2-DCE and PCE were detected above the NYSDEC criteria for groundwater. In two (down gradient) temporary wells, (near the Site 6/3 boundary), TW-9 and TW-12, cis-1,2-DCE was also detected above the NYSDEC criteria for groundwater. Vinyl chloride was also detected in TW-9 and TW-12, but at a levels slightly below the NYSDEC criteria. In temporary monitoring well TW-1, cis-1,2-DCE was detected in the groundwater at a concentration below the NYSDEC criteria. Monitoring well 6MW-08 and microwells MIC-A and MIC-D (located down gradient from Site 6) did not possess any chlorinated VOC contaminants. Cis-1,2-DCE and vinyl chloride were detected in 6MW-03 at concentrations that exceeded the NYSDEC criteria for groundwater quality. The presence of cis-1,2-DCE and vinyl chloride at 6MW-03 may have resulted from the degradation of the PCE and TCE in soils situated upgradient.

In summary, groundwater contamination at Site 6 extends approximately 190 feet in a north /south direction from TW-7 to 6MW-09, and approximately 70 feet in a east/ west direction from 6MW-03 to MIC-C, with the width of the plume diminishing as it approaches 6MW-09.

The soil contamination detected near TW-2 does not appear to be impacting the groundwater. A groundwater sample collected from TW-2 possessed 1,3,5-Trimethylbenzene at a concentration of 1.33µg/L, below the NYSDEC drinking water standard of 5µg/L. In monitoring well 6MW-03 (located directly down gradient from TW-2) gasoline fuel constituents were not detected during the RI.

3.5 Data Gaps

As stated in Section 3.2 of this Work Plan, Site 6 was not originally identified as an IRP Site to be investigated during the RI. Based on results from the RI activities conducted at IRP Site 3, it became apparent that groundwater at Site 3 was being impacted from point sources located upgradient and adjacent to Site 3. As this was realized near the end of the RI field program, the scope of work conducted at Site 6 was limited in nature. This resulted in a limited number of soil and groundwater sampling points with corresponding limited information about site contamination, contributing to a number of data gaps relating the to the vertical and horizontal extent of soil and groundwater contamination. The objective of this SDC is to address existing data gaps to facilitate the completion of the FS at Site 6. The data gaps to be addressed and the field activities being performed to address them are presented in Table 3-7.

Table 3-7 Site 6 Data Gaps

Data Gap	Field Activity to Address Data Gap
Further define groundwater flow direction at Site 6.	Conduct groundwater elevation survey utilizing existing monitoring wells, microwells, and temporary wells installed during the RI. Also install three staff gauges to be used in survey. Gauges to be placed in stream located next to Site 6.
Define extent of groundwater contamination.	Install up to 20 temporary well points to facilitate the collection of groundwater samples for GC screening. Based on GC results, install up to 10 groundwater monitoring wells, conduct two rounds of sampling. Samples to be analyzed for VOC's, SVOC's, and metals.
Confirm extent of soil contamination was delineated during RI field investigation.	Advance up to ten soil borings in previously un-sampled areas. Collect one soil sample from each boring. Samples to be analyzed for VOC's, SVOC's, and metals.

SECTION 4.0

4.0 REQUIRED PERMITS

Aneptek does not anticipate that any permits will be required for work at this site. However, if permits are identified that need to be obtained, Aneptek will be responsible for all permits required by any subcontractors used during this project. Coordination for any other required permits will be made with the 109th AW of the New York Air National Guard for application and obtaining.

SECTION 5.0

5.0 INVESTIGATIVE APPROACH

This section outlines the methods to be used to obtain contaminant information and data relevant to Site 6.

5.1 Supplemental Data Collection Objectives

The objectives of this SDC are to further define the vertical and horizontal extent of contaminated soil and groundwater at Site 6, and to collect sufficient soil and groundwater data in order to complete an FS in support of future remedial activities at Site 6, if warranted.

5.2 General Approach - Sampling Strategy and Rationale

The information gathered during the SDC will be reported in a Technical Memorandum (TM). Upon the completion of the TM, an Action Memorandum (AM) will be prepared documenting, if warranted, the need for a removal action, the proposed action, and the rationale for the removal action. The AM may also propose that "No Further Action" be conducted at Site 6. The results of the TM will in turn be incorporated in the completion of the Final Feasibility Study for Site 6. The rationale for the sampling plan is dictated by the following goals:

- Collect sufficient soil and groundwater data to fully define the vertical and horizontal extent of contamination at Site 6.

- Preparation of a Decision Document (DD) which supports "No Further Action" for Site 6 in the event that media concentrations do not exceed current NYSDEC soil clean-up objectives and groundwater standards.

- Use collected soil and groundwater data to support completion of an FS that meets applicable regulatory requirements, and to develop remedial alternatives for Site 6 in the event that media concentrations exceed current NYSDEC soil clean-up objectives and groundwater standards.

The sampling strategy for the SDC is outlined in Table 5-1.

5.3 SDC Investigative Activities

The following sections outline the investigative activities to be performed during the SDC.

5.3.1 Soil Borings

At Site 6, soil borings will be advanced using two methods, one for the collection of soil samples and the installation of temporary well points, and one for the installation of permanent groundwater monitoring wells. Soil borings advanced for the purpose of soil sample collection will use direct push, Geoprobe® methods. Samples collected from these borings will be used to characterize the nature and extent of soil contamination at Site 6. Soil borings advanced for the purpose of installing temporary well points and groundwater monitoring wells will use a combination of hollow stem augers (HSA) and air rotary drilling methods to advance to the desired depth.

Table 5-1
Sampling and Analysis Plan - Site 6

Location	Planned Activities	Rationale
Site 6	Advance up to 20 soil borings to bedrock using HSA/ air rotary methods. Install temporary well-points to facilitate the collection of groundwater samples for GC screening for VOC's. Collect up to thirteen groundwater samples from existing sampling points for GC screening for VOC's.	Further define groundwater plume at Site 6.
	Advance up to 10 soil borings to collect confirmatory soil samples. Perform analysis for VOC's, SVOC's, and TAL Metals	Collect soil samples at Site 6 in previously un-sampled areas.
	Install 3 stream staff gauges, conduct groundwater elevation survey using existing monitoring wells, microwells, temporary wells, and stream gauges.	Further define groundwater flow direction at Site 6.
	Install up to 10 overburden groundwater monitoring wells. Conduct 2 rounds of groundwater sampling (new wells plus four previously installed wells). Perform analysis for VOC's, SVOC's, and TAL Metals.	Define nature and extent of groundwater contamination at Site 6.

5.3.2. Screening Sampling

Both soil and groundwater samples will be collected for screening analysis. Soil samples will be screened in the field using a PID, groundwater samples will be collected for off-site laboratory GC screening. Each phase of sample screening is discussed below.

5.3.2.1 Field Screening - Soil

Soil samples collected during the advancement of soil borings will be screened in the field using a PID equipped with a 11.7 eV lamp. Samples will be screened immediately upon opening of the sampler. Samples indicating contamination based on PID readings and/or physical observations (soil discoloration, odors, etc..) will be further field screened using headspace screening techniques.

During the advancement of soil borings for the purpose of monitoring well installation, soil samples will be collected continuously from the ground surface to refusal (bedrock) and field screened using a PID to ensure monitoring wells are not installed in areas of contamination.

5.3.2.2 Laboratory Screening - Groundwater

Up to 33 groundwater samples will be collected and submitted to an off-site laboratory for GC screening per EPA Method 8021, expanded to include chlorinated VOC's. Sample locations to be comprised of up to twenty temporary well points to be installed during this SDC, and thirteen sample locations (four groundwater monitoring wells, seven temporary wells, and two microwells), which were previously installed as part of the field program during the RI. These locations were selected based on the location of the sampling point relative to Site 6, groundwater flow direction, and the analytical results from the RI.

5.3.3 Groundwater Elevation Survey

Prior to the installation of permanent monitoring wells, a groundwater elevation survey will be conducted at Site 6. All locations to be used in the survey were previously surveyed by a registered New York land surveyor during the RI. Each point of reference (top of PVC riser) has a known elevation. In addition, three staff gauges will be installed in a stream which runs along the western edge of Site 6. One gauge will be installed upstream of Site 6, one at the mid-point of Site 6, and one downstream of Site 6. These gauges will be surveyed and elevations at the top of the gauges established. Gauges will be graduated to provide water level readings accurate to 0.01 feet. All groundwater elevation data will be used to further define groundwater flow direction at the site.

5.3.4 Confirmatory Sampling

Both confirmatory soil and groundwater samples will be collected and submitted to an off-site laboratory for analysis for Target Compound List (TCL) VOCs (EPA Method 8260), SVOCs (EPA Method 8270), and Target Analyte List (TAL) metals (EPA Method 6010). Up to ten confirmatory soil samples will be collected. In addition to soil samples, two rounds of confirmatory groundwater samples will be collected from up to ten monitoring wells to be installed during this SDC, plus four monitoring wells installed during the RI. Quality control (QC) samples that will be incorporated in addition to the confirmatory samples will include equipment decontamination rinsates, field blanks, and duplicate and matrix spike/matrix spike duplicate (MS/MSD) samples. Duplicate and MS/MSD samples will be collected in accordance with SOPs No.10 and No. 12 in Appendix D. Soil and groundwater confirmatory sampling is discussed below.

5.3.4.1 Confirmatory Sampling - Soil

Based on the results of the field screening, up to ten confirmatory soil samples will be collected. Samples will be collected from those soil boring intervals which exhibited the highest concentration of contamination based on PID readings. If no one sample interval indicates contamination based on PID readings, one sample will be collected from the interval directly above the water table, regardless of the presence of contamination or not. The samples will be submitted to an off-site laboratory for full analysis for VOC's, SVOC's, and TAL metals.

5.3.4.2 Confirmatory Sampling - Groundwater

Two rounds of confirmatory groundwater samples will be collected from the newly installed monitoring wells (to be installed during this SDC), plus four monitoring wells installed during the RI . Prior to sampling, all wells will be developed and purged in accordance with NYSDEC and ANG protocols and in accordance with SOP No. 6 in Appendix D. Wells will be sampled in accordance with SOP No. 16 in Appendix D. Samples will be analyzed for VOC's, SVOC's, and TAL metals (total).

5.4 Monitoring Well Installation

Based on the results of the soil screening and analysis, groundwater screening results, and the groundwater elevation survey, up to ten groundwater monitoring wells will be installed at Site 6. The wells to be screened to intersect the water table. Based on the results of the RI, groundwater is typically found at the overburden/bedrock interface at a depth of between 4 to 6 feet bgs. Depth of the wells are expected to be approximately 16 to 20 feet bgs. All wells will be constructed in accordance with applicable NYSDEC and ANG protocols and in accordance with SOP No. 5 in Appendix D.

5.5 Surveying

Prior to the groundwater elevation survey, the elevation of each newly installed stream gauge will be determined by a registered New York land surveyor. Following the field program at Site 6, all new soil boring and monitoring well locations and elevations will be surveyed by a registered New York land surveyor. A topographical map of Site 6 will be developed showing all monitoring wells, boring locations, stream gauges, and elevations, as well as other pertinent structures within Site 6.

SECTION 6.0

6.0 FIELD INVESTIGATION PROCEDURES

This section details the investigative procedures to be used during the SDC field program.

6.1 Underground Structures

Prior to the start of any intrusive activities, the Base Civil Engineer will be contacted to ascertain the location of all pipes, cables, water lines, gas lines, electric and communications lines, and other underground features within Site 6. The local "Dig Safe", or other appropriate public utilities companies, will be contacted a minimum of one week prior to the initiation of field activities to ensure all public utilities at Site 6 are identified. Buried features will be physically located and marked in the field by the Base Civil Engineer and representatives from local utilities. Verification of the absence or presence of underground utilities will be verified in writing. If it is determined that the proposed location of a soil boring or monitoring well may interfere with or damage an underground utility or structure, the location of the boring or well will be adjusted. Any adjustments to proposed soil boring or monitoring well locations must be approved by the ANG/CEVR.

6.2 Groundwater Elevation Survey

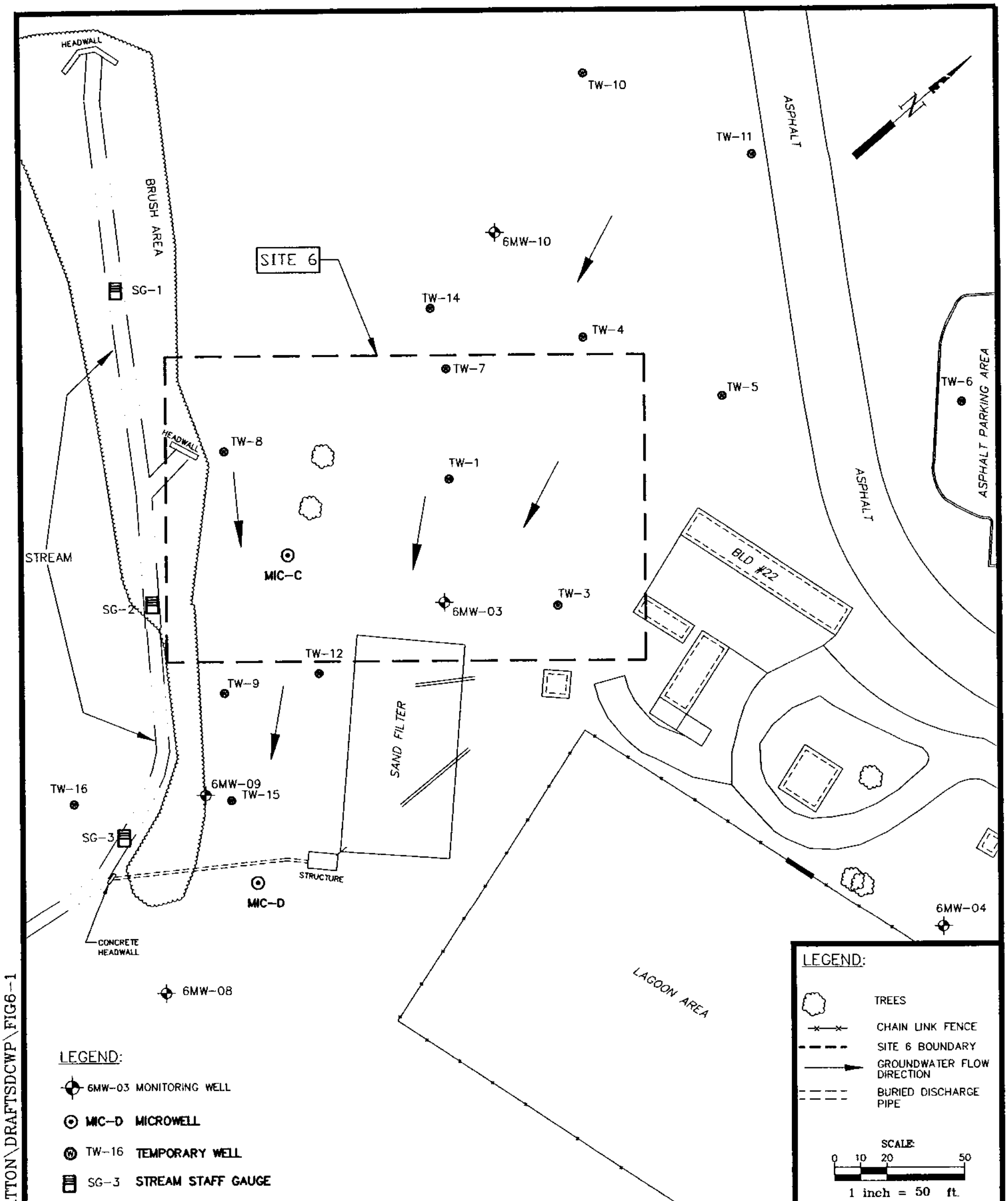
Groundwater elevations will be measured at all existing Site 6 permanent wells (6MW-03, 6MW-04, 6MW-08, 6MW-09, and 6MW-10), temporary wells (TW-1, TW-3 throughTW-12, TW-14 through TW-16), microwells (MIC-C and MIC-D), and the newly installed staff stream gauges (SG-1, SG-2, and SG-3). All measurements will be logged in the field logbook. Groundwater elevations at all data points will be recorded within the same 8 hour period. All wells to be measured will be opened and allowed to equilibrate for approximately 30 minutes prior to measurements being recorded. Unless previously marked, a measurement location point on the top of the PVC riser will be marked. All groundwater elevations will then be measured to this point. Measurements will be taken by lowering an electronic water level indicator into the well until contact with water is achieved. The depth of water will then be measured from the top of the PVC riser pipe. Groundwater elevations will be measured to the nearest 0.01 feet.

Staff stream gauge readings will be measured to the nearest 0.01 feet. The distance from the top of the gauge to the marked gradient closest to, but not in contact with, the stream surface will be noted. A measurement will then be taken from this gradient to the surface of the water. This measurement will be added to the total length of the staff gauge and then subtracted from the known elevation at the top of the gauge. The calculated number will be the elevation of the stream surface.

All groundwater elevation data points, including proposed staff stream gauge locations, are shown in Figure 6-1. For further information with regards to water level measurements, refer to SOP No.14 in Appendix D in this work plan, and Appendix B, QA/QC Plan, RI/FS Investigation Final Work Plan (Aneptek, 1998).

6.3 Soil Borings

Up to thirty soil borings will be advanced for the purpose of temporary well point installation, soil sample field screening, and soil sample collection. Up to ten borings will also be advanced



C:\DRAW\STRATTON\DRAFTSDCWP\FIG6-1

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SDC GROUNDWATER ELEVATION DATA POINTS
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FIGURE: 6-1

to facilitate the installation of groundwater monitoring wells. Borings advanced for the purpose of soil sample collection will be performed using Geoprobe direct push drilling methods. Soil borings advanced for the purpose of installing temporary well points and groundwater monitoring wells will be performed using hollow stem augers (HSA) and air rotary drilling methods to advance to the desired depth.

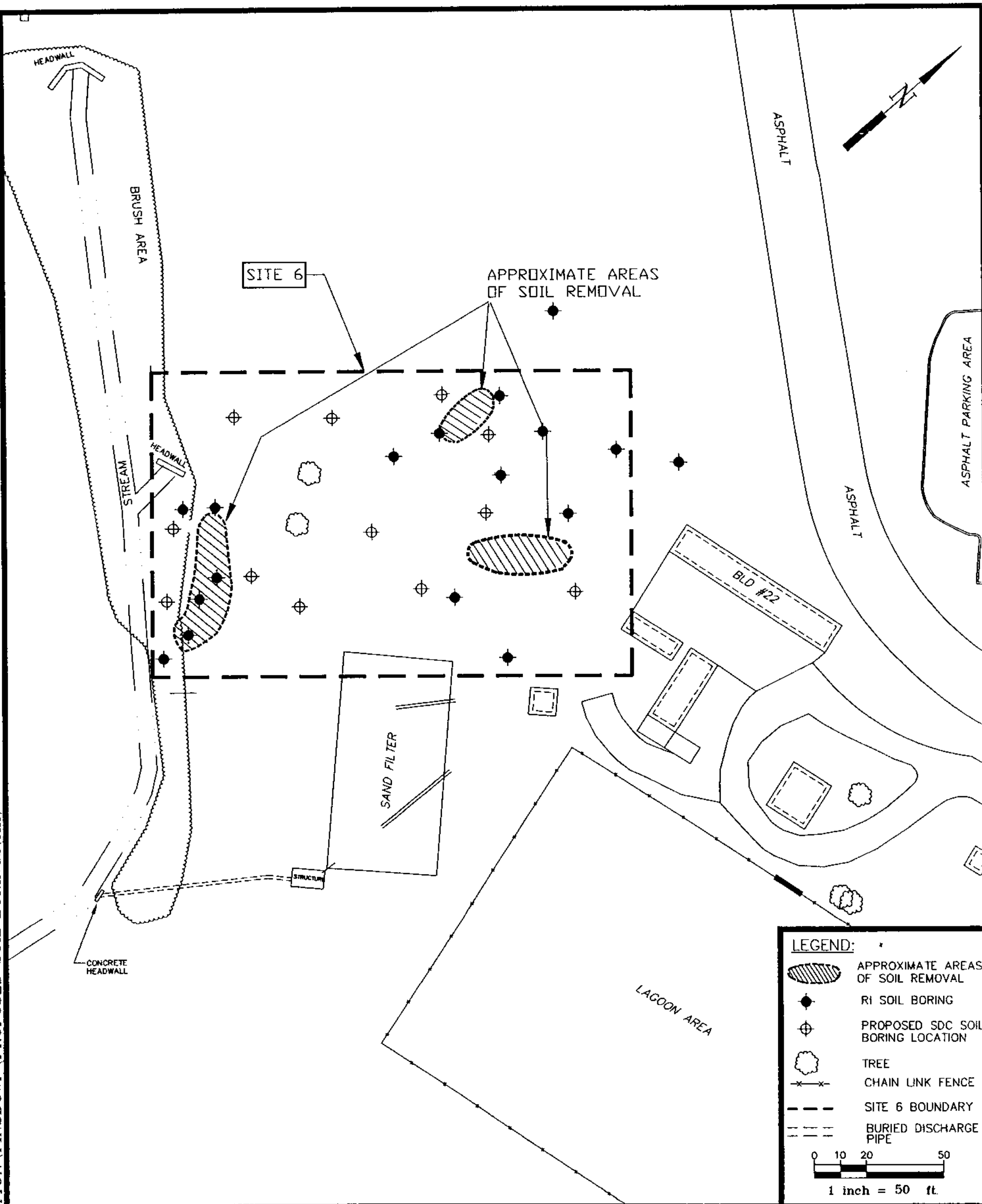
Prior to initiating the soil boring program, all down-hole equipment will be thoroughly decontaminated using steam cleaning (i.e., pressurized water with a temperature of 180^{0}F or greater). Down-hole equipment will be steam-cleaned prior to the advancement of each new borehole. Decontamination procedures are detailed in Section 7.1.2 of this Work Plan. All decontamination will be conducted in accordance with SOP No. 13 in Appendix D of this Work Plan, and Appendix B, QA/QC Plan, RI/FS Final Work Plan (Aneptek, 1998).

Prior to the advancement of soil borings for soil sample collection, and after decontamination, the direct push sampler will be assembled in preparation for soil sampling. A 4-foot long, 2-inch ID stainless steel sampler will be used for sample collection. The sampler will be fitted with a clear disposable acetate liner seated into the drive shoe which screws into the end of the sampler tube. The assembled sampler is then attached to hollow drill rods which extend to the ground surface and aid in sampler advancement. The sampler will then be advanced through the desired sampling interval. Once the sampler is advanced through the desired sample interval, it is retracted from the borehole. Samples will be collected continuously from the ground surface to the terminus of the boring (refusal).

Upon recovery, the disposable liner is cut open, exposing the sampled interval. The recovered soils are immediately screened using a PID. Soils are inspected and lithologic and physical descriptions are recorded on field boring logs. Prior to advancement to the next sample interval, the sampler will be decontaminated (see Section 7.12). Following decontamination, the sampler is fitted with a new disposable liner, assembled, attached to the drill rods, and advanced through the next sample interval. This procedure is continued until the terminus of the borehole is reached. Between borehole locations, downhole sampling equipment will be decontaminated using steam cleaning. Borings will be advanced from the ground surface to refusal. Following completion of the borehole and any subsequent sample collection, the soil boring will be grouted to the surface with bentonite chips, hydrated with potable water, and the location marked with a pin flag or wooden stake. All proposed soil boring locations are shown in Figure 6-2

6.4 Field Screening

Soil samples collected during the advancement of soil borings will be field screened for VOCs using a PID equipped with a 11.7 eV lamp. The PID will be calibrated at the beginning of each work day according to manufacturers specifications and noted as such in the field logbook. Upon retrieval of the sample interval, the sampler will be opened and the acetate liner will be cut lengthwise from one end to the other. After the soil is exposed, the tip of the PID probe will immediately be passed slowly over the length of the sample. If winds are above 10 miles per hour (mph) during field screening, the acetate liner will be moved to an enclosed area prior to opening. This will lessen the winds effect to disperse VOC's prior to screening. The tip of the probe should be held as close to the sample surface as possible without coming into contact with the sample. PID readings will be noted in the logbook along with that portion of the sample interval which produced the readings.



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PROPOSED SDC SOIL BORING LOCATIONS–SITE 6
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FIGURE: 6–2

If any readings of 10 parts ppm or greater are recorded by the PID, a sample will be collected and screened using headspace methods. The headspace sample to consist of a small amount (approximately 4 oz) of soil from the interval to be screened which will be collected and placed in an 8 oz jar. The jar is then tightly covered with clean aluminum foil. The soil is then agitated by vigorously shaking the container for approximately one minute. The tip of the PID is then inserted into the jar through the aluminum foil, and the headspace reading recorded. If ambient air temperature is below 60^0F, the soils will be warmed to approximately 60^0F before being screened.

6.5 Laboratory Screening

During this SDC, only groundwater samples will be collected and submitted to an off-site laboratory for GC screening. Samples will be screened for VOC's by EPA Method 8021, expanded to include chlorinated VOC's.

6.5.1 Laboratory Screening - Groundwater

Up to thirty three groundwater samples will be collected for laboratory GC screening. Up to twenty of these samples will be collected from temporary well points to be installed during this SDC. The remaining samples will be collected from sampling points which were installed as part of the field program during the RI. These locations include four groundwater monitoring wells, 6MW-3, 6MW-8, 6MW-9 and 6MW-10, seven temporary wells, TW-1, TW-3, TW-7, TW-9, TW-12, TW-15, and TW-16, and two microwells, MIC-C and MIC-D. Groundwater samples will be submitted to an off-site laboratory for GC screening for VOC's per EPA Method 8021, expanded to include chlorinated compounds. All proposed groundwater GC screening sample locations are shown in Figure 6-3.

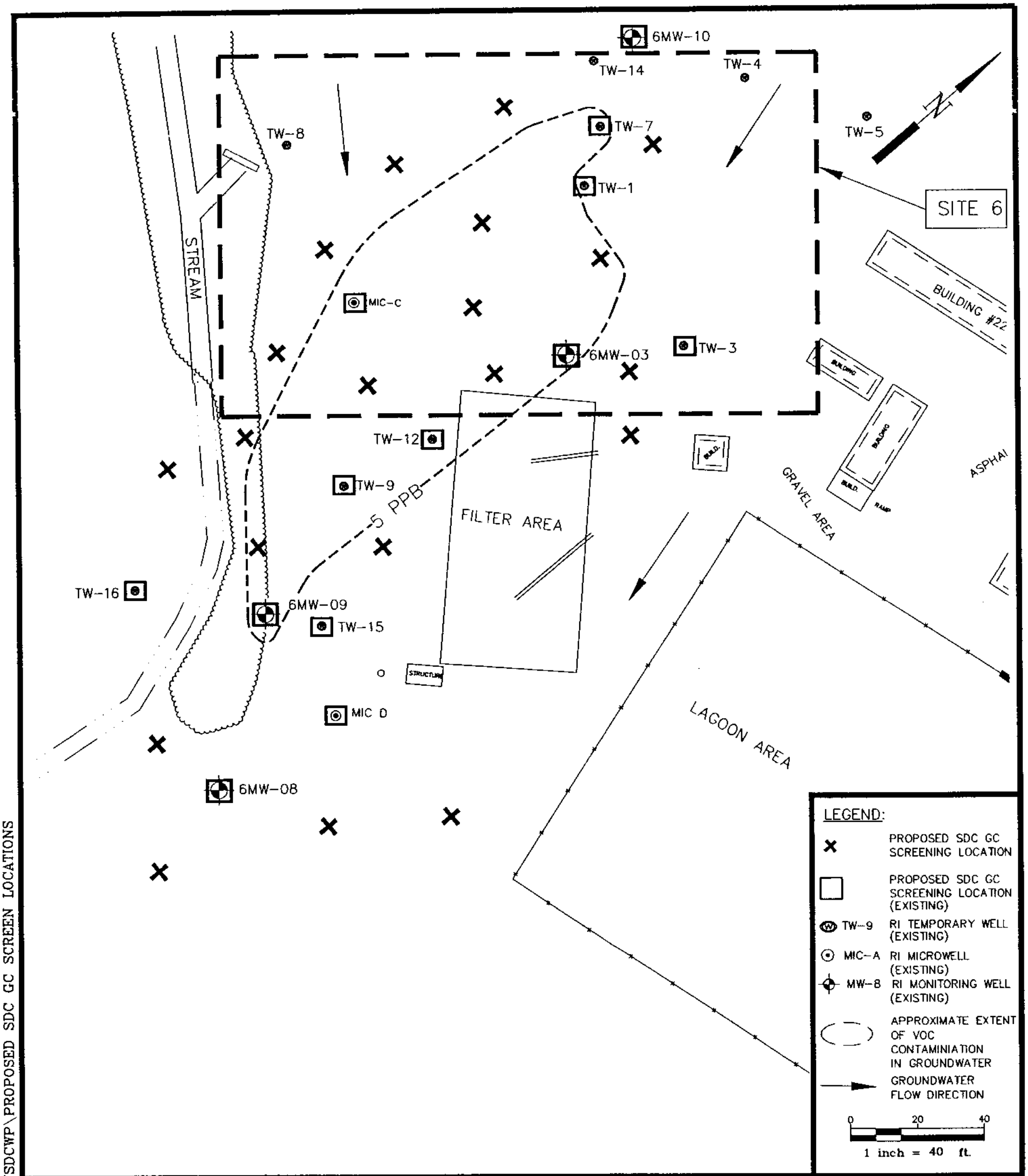
NOTE: During a site visit prior to the initiation of the SDC fieldwork, it was discovered that four groundwater data points installed during the RI (TW-2, TW-13, MIC-A, and MIC-B) had been destroyed. Therefore, although they are shown in Figure 3-3 of this Work Plan for reference purposes, they are not included in Figures 6-1and 6-3, which present the proposed groundwater elevation survey points and the proposed SDC groundwater screening locations, respectively.

6.5.2 Temporary Well Point Installation

Temporary well points will be installed to facilitate the collection of groundwater samples for GC screening. No soil samples will be collected from any of the soil borings advanced to install the temporary well points. Temporary well points will be installed using HSA's and air rotary drilling methods. The drill rig will be positioned over a pre-determined location. The bore hole will be advanced using 8 inch ID HSA flights. The augers will be advanced to refusal (at the bedrock/overburden interface). At the point of refusal, drilling methods will switch to air rotary. Based on the depth of refusal, the boring will be advanced to a depth which will allow the temporary well to be screened across the bedrock/overburden interface. Temporary well material to be constructed of 2-inch I.D., Schedule 40 poly-vinyl chloride (PVC) pipe containing a 5-foot screen at the base. Screen slot size to be 0.01 inches. Connections will be threaded and no PVC glue will be used.

6.6 Monitoring Well Installation

Up to ten 2-inch inside diameter (I.D) monitoring wells will be installed to facilitate the collection



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PROPOSED SDC GC GROUNDWATER SCREENING LOCATIONS

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FIGURE: 6-3

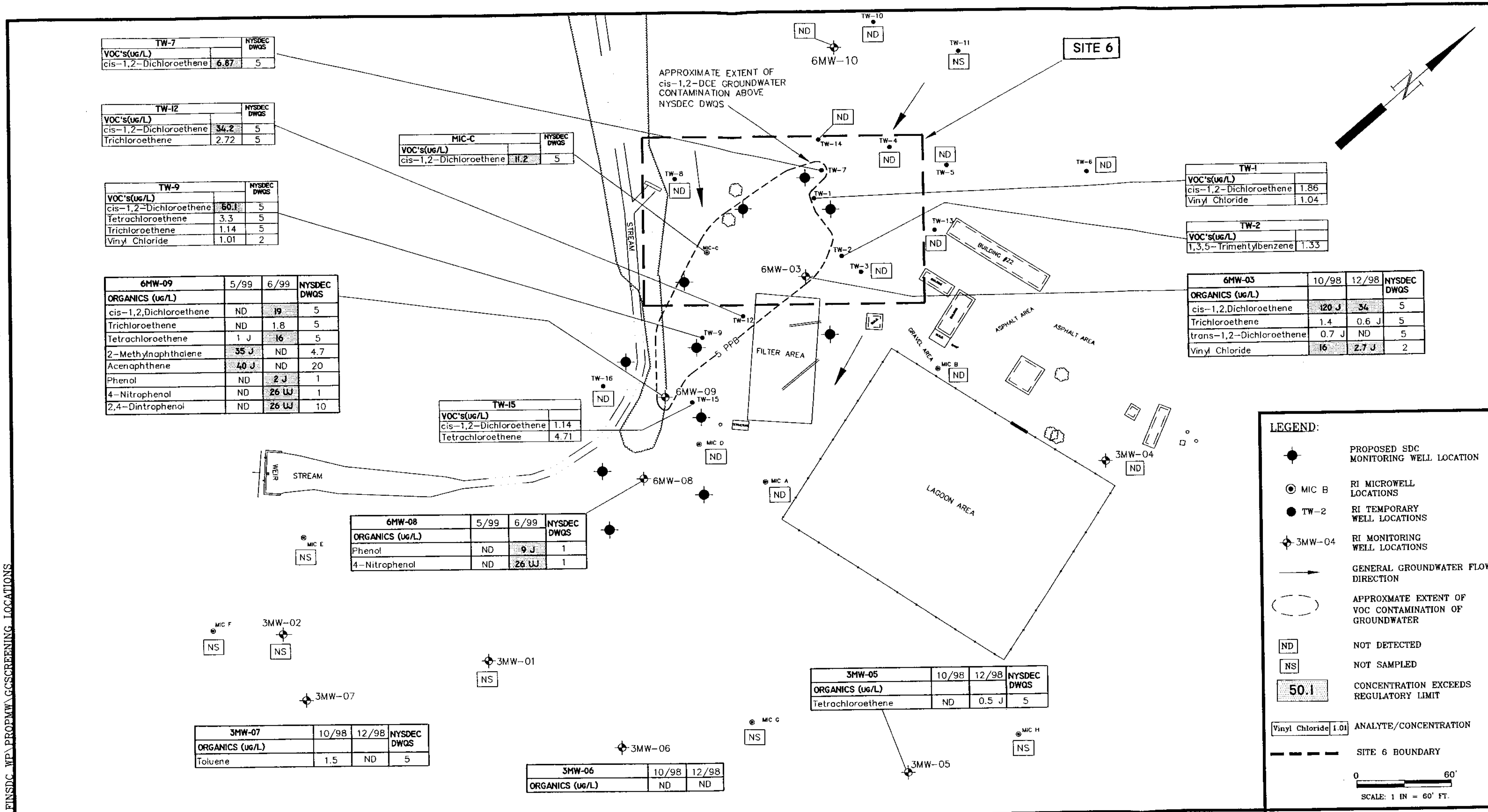
C:\DRAW\SCHENECT\FINSDCWP\PROPOSED SDC GC SCREEN LOCATIONS and laboratory analyses of groundwater samples. Wells will be installed at the bedrock/overburden interface. To ensure monitoring wells will not be installed in areas of contamination, soil borings advanced for the purpose of installing monitoring wells will initially be drilled using 8-inch I.D HSA's. Split spoon samples will be collected continuously from the ground surface to refusal and screened with a PID. Soils will be considered contaminated if readings of 10 ppm above background are obtained on the PID. Should readings be found to be 10 ppm or greater on any of the sample intervals, the borehole will be abandoned and the location of the monitoring well moved to an area suspected to be outside of any areas containing contaminated soils. Visual observations will also be used to ensure monitoring wells are not installed in areas of soil contamination. When visual evidence of soil contamination is encountered, the location will be considered to be contaminated and the location of the monitoring well will be moved. Any boreholes not used for monitoring wells will be abandoned in accordance with NYSDEC and ANG protocols. Upon encountering refusal (at the bedrock/overburden interface), drilling methods will be switched from HSA's to air rotary drilling methods. Based on results from the RI, groundwater was encountered at the bedrock/overburden interface. Drilling will continue until a depth is reached that will allow the screened interval to straddle the watertable, allowing for seasonal fluctuations. The monitoring wells are expected to be installed at depths of approximately 16 to 20 feet bgs. When handling PVC well materials (screen, riser, etc..) personnel will wear clean latex gloves.

All monitoring wells will be finished with a concrete pad and a protective, flush mounted road box installed at the ground surface. All monitoring wells will be installed in accordance with SOP No. 5 in Appendix D. The monitoring wells will be constructed of 2-inch I.D., Schedule 40 poly-vinyl chloride (PVC) pipe containing a 10-foot screen at the base. Screen slot size to be 0.01 inches. Connections will be threaded and no PVC glue will be used. The monitoring wells will be installed through 8-inch ID augers. Clean, 30/40 mesh silica sand will be placed in the annular space around the screen section and extend two feet above the top of the screen. Immediately on top of the silica sand, a one-foot layer of 70 mesh silica sand will be added. Next, a 2-foot layer of bentonite chips will be added to seal the sand layers, the bentonite layer will be hydrated with potable water. Grout, a mixture of cement and bentonite, will then be added above the bentonite layer and extend to two feet below the ground surface. The flush mount road box will then be placed around the top of the PVC riser and a concrete pad poured to surface level. The monitoring well will be equipped with a locking, vented well cap. Proposed monitoring well locations are shown in Figure 6-4. Typical monitoring well construction details are shown on Figure 6-5.

If, during monitoring well installation, it becomes necessary to alter the well construction procedure due to site conditions, any changes must be first approved by the ANG. Within 24 to 48 hours after monitoring well construction is complete, the wells will be developed using a surge block in conjunction with either disposable bailers or a submersible pump. Wells will be surged then bailed or pumped until water is clear and a minimum of at least 3 well volumes have been withdrawn. Refer to SOP No. 6 in Appendix D for well development and purging details. Monitoring well construction logs are included in SOP No. 9 in Appendix D.

6.7 Confirmatory Sampling

Confirmatory samples collected during this SDC will include both subsurface soil and groundwater samples. Up to ten confirmatory soil samples will be collected from the soil boring intervals which, based on GC screening data, exhibit the highest concentrations of contamination. Two rounds of confirmatory groundwater samples will be collected from each of the monitoring wells installed



TW-7		NYSDEC DWQS
VOC'S(UG/L)		
cis-1,2-Dichloroethene	6.87	5

TW-12		NYSDEC DWQS
VOC'S(UG/L)		
cis-1,2-Dichloroethene	34.2	5
Trichloroethene	2.72	5

TW-9		NYSDEC DWQS
VOC'S(UG/L)		
cis-1,2-Dichloroethene	60.1	5
Tetrachloroethene	3.3	5
Trichloroethene	1.14	5
Vinyl Chloride	1.01	2

MIC-C		NYSDEC DWQS
VOC'S(UG/L)		
cis-1,2-Dichloroethene	11.2	5

6MW-09	5/99	6/99	NYSDEC DWQS
ORGANICS (UG/L)			
cis-1,2,Dichloroethene	ND	19	5
Trichloroethene	ND	1.8	5
Tetrachloroethene	1 J	16	5
2-Methylnaphthalene	35 J	ND	4.7
Acenaphthene	40 J	ND	20
Phenol	ND	2 J	1
4-Nitrophenol	ND	26 UJ	1
2,4-Dintrophenol	ND	26 UJ	10

TW-15	
VOC'S(UG/L)	
cis-1,2-Dichloroethene	1.14
Tetrachloroethene	4.71

6MW-08	5/99	6/99	NYSDEC DWQS
ORGANICS (UG/L)			
Phenol	ND	9 J	1
4-Nitrophenol	ND	26 UJ	1

TW-1	
VOC'S(UG/L)	
cis-1,2-Dichloroethene	1.86
Vinyl Chloride	1.04

TW-2	
VOC'S(UG/L)	
1,3,5-Trimehtylbenzene	1.33

6MW-03	10/98	12/98	NYSDEC DWQS
ORGANICS (UG/L)			
cis-1,2,Dichloroethene	120 J	34	5
Trichloroethene	1.4	0.6 J	5
trans-1,2-Dichloroethene	0.7 J	ND	5
Vinyl Chloride	16	2.7 J	2

3MW-05	10/98	12/98	NYSDEC DWQS
ORGANICS (UG/L)			
Tetrachloroethene	ND	0.5 J	5

3MW-07	10/98	12/98	NYSDEC DWQS
ORGANICS (UG/L)			
Toluene	1.5	ND	5

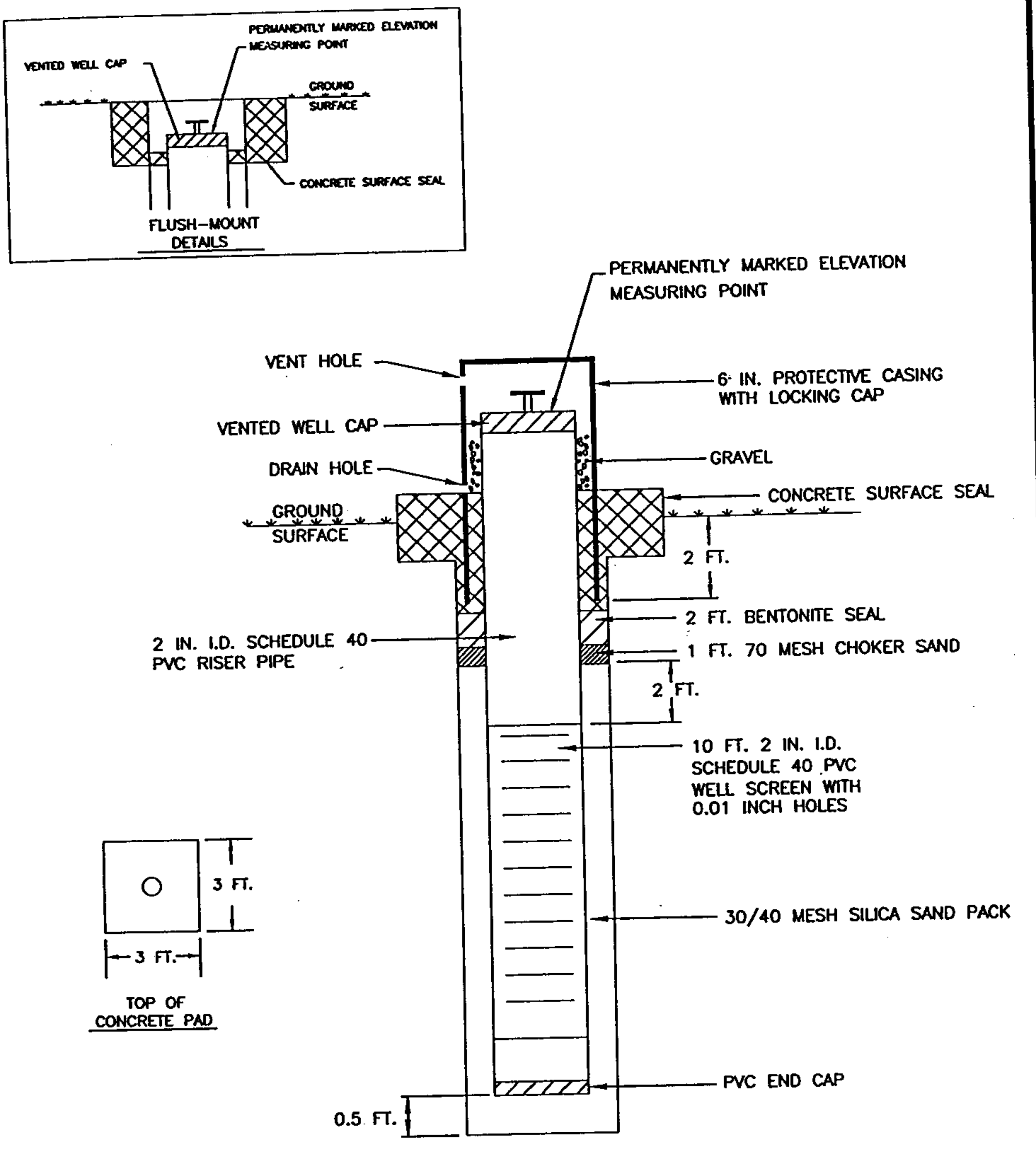
3MW-06	10/98	12/98
ORGANICS (UG/L)	ND	ND

NEW YORK AIR NATIONAL GUARD BASE
RI GROUNDWATER ANALYTICAL SUMMARY-ORGANIC COMPOUNDS
PROPOSED SDC MONITORING WELL LOCATIONS-SITE 6
SCOTIA, NEW YORK

ANEPTEK CORPORATION
Analytic, Environmental and Process Technologies

FIGURE: 6-4

C:\DRAW\STRATTON\FINSDC WP\PROPMW\GCSCREENING LOCATIONS



C:\DRAW\SCHENECT\DFTSDCWP\FIG 6-5

NEW YORK AIR NATIONAL GUARD BASE
109th AIRLIFT WING

GENERAL GROUNDWATER MONITORING WELL CONSTRUCTION DETAILS

SCOTIA, NEW YORK

ANEPTEK CORPORATION
Analytic, Environmental and Process Technologies

FIGURE: 6-5

during this field program, as well as four monitoring wells previously installed during the RI. All confirmatory soil and groundwater samples will be submitted for laboratory analysis for VOC's, SVOC's, and TAL metals (total), in accordance with Appendix B, QA/QC Plan, Final RI/FS Work Plan (Aneptek, 1998). Results will be reported in accordance with ASP Category B reporting contingencies. All confirmatory sampling data will be submitted for third party data validation. Soil and groundwater confirmatory sampling is discussed below.

6.7.1 Confirmatory Sampling - Soil

During this SDC, up to ten confirmatory subsurface soil samples will be collected and submitted for laboratory analysis. Samples will be collected during the advancement of soil borings, and will be collected continuously from ground surface to refusal. Samples will be screened in the field using a PID. Based on the field screening results, the sample interval from each boring which exhibited the highest probability of contamination will be submitted for laboratory analysis. One sample from each boring will be submitted for laboratory analysis, regardless if the field screening indicates the presence of contamination or not. If, during the advancement of any soil boring, no sample interval indicates the presence of contamination, the sample interval which was collected directly above the water table will be submitted for laboratory analysis.

6.7.2 Confirmatory Sampling - Groundwater

A minimum of 7 days after monitoring well installation and development, one round of groundwater samples will be collected from each well and submitted to an off-site laboratory for analysis. In addition, four existing Site 6 monitoring wells (6MW-03, 6MW-08, 6MW-09, and 6MW-10), will also be sampled. Prior to sampling, wells will be purged by bailing/pumping until parameters have stabilized in accordance with SOP No. 6 in Appendix D. Groundwater samples will be collected using small diameter single-use disposable bailers and/or a peristaltic pump. The bailer and peristaltic pump tubing will be disposed of upon completion of sampling at each location. A new bailer/peristaltic pump tubing will be used at each sampling location. Since disposable sampling equipment will be used, no equipment decontamination will be conducted. A second round of groundwater samples will be collected approximately 6 to 8 weeks after the first round.

6.8 Air Monitoring

During the advancement of soil borings, the ambient air in the breathing zone and at the top of the borehole will be monitored for VOC's using a PID in accordance with procedures outlined in Appendix A, Health and Safety Plan, RI/FS Final Work Plan (Aneptek, 1998). If a sustained reading of 10 ppm or greater is indicated on the PID, work will stop and the area cleared. Work will not resume until the Site Health and Safety Officer has evaluated the situation and deemed the area safe.

6.9 Land Surveying

The locations and elevations of all new monitoring wells, soil borings, and staff stream gauges will be surveyed by a surveyor registered in the State of New York. All pertinent structures within Site 6 will also be surveyed. Surveying of horizontal control will be within an accuracy of 0.10 feet. Vertical elevations will be surveyed to an accuracy of 0.01 feet and tied to mean sea level. Measurements will be recorded from the (marked) high point on the riser pipe of each monitoring well. A benchmark will be surveyed and marked using an accessible permanent existing structure so that future surveys will be conducted using the same reference point.

SECTION 7.0

7.0 SAMPLE COLLECTION PROCEDURES

This section presents details regarding procedures to be followed in collecting media samples for chemical analysis. Table 7-1 presents a summary of the media samples to be collected along with sample bottle and preservation requirements.

All confirmatory soil and groundwater samples will be submitted to an off-site, state certified laboratory for analysis for TCL VOCs (EPA Method 8260), SVOCs (EPA Method 8270), and TAL metals (total, water only) (EPA Method 6010), using NYSDEC ASP Category B protocols. All Health and Safety and QA/QC requirements for media sampling will be conducted in accordance with Appendix A and B, respectively, as included in the Final RI/FS Work Plan (Aneptek, 1998), as well as appropriate SOP's located in Appendix D in this Work Plan.

7.1 Subsurface Soil Sampling

Up to ten subsurface soil samples will be collected during this SDC for field screening and full laboratory analysis. As stated in Section 6.7.1, subsurface soil samples will be first collected for field screening using a PID. Based on screening results, one sample from each boring will be submitted for laboratory analysis. As previously stated, if during the advancement of any soil boring, no one sample interval indicates the presence of contamination, the sample collected from the interval directly above the groundwater table will be submitted for laboratory analysis.

Prior to initiating the soil sampling program, all down-hole equipment will be thoroughly decontaminated using steam cleaning (i.e., pressurized water with a temperature of 180^{0}F or greater). Downhole equipment will be steam-cleaned prior to the advancement of each new borehole.

Soil borings advanced for the purpose of sample collection will be facilitated using Geoprobe direct push drilling methods. Soil samples will be collected continuously from the ground surface to refusal. Based on field screening results, the sample interval which indicates the highest concentration of contamination will selected for laboratory analysis. Soil samples will be collected as follows:

Immediately after the sampler is opened, the acetate liner will be removed and the liner will be cut along its entire length and opened. The sample interval will be immediately screened using a PID as described in Section 6.4. The portion of the sample interval which records the highest reading on the PID will be immediately collected for VOC analysis. The sample will be placed in the appropriate laboratory supplied container, ensuring there is no headspace. Following this, the remaining sample material will be placed in a stainless steel bowl and composited using stainless steel sampling utensils in accordance with SOP No. 11 in Appendix D. The remaining sample fractions will then be collected from the bowl and placed in the appropriate laboratory supplied containers. The samples collected from that interval will then be placed on ice, the sampler de-contaminated, and a new acetate liner placed in the sampler. Sampling will continue until refusal is encountered. After the boring is completed, the field screening results will be compared. The

TABLE 7-1
SUMMARY OF SAMPLE CONTAINERS, SAMPLE PRESERVATION METHODS AND HOLDING TIMES

PARAMETERS	ANALYTICAL METHOD	PRESERVATION METHOD	CONTAINER REQUIREMENTS	HOLDING TIME[1]
Soil				
TCL Volatiles	ASP EPA 8260B	Cool to 4°C	2-40mL glass	10 days to analysis
TCL Semi-Volatiles	ASP EPA 8270	Cool to 4°C	1-8 oz. wide mouth jar	10 days to extraction, analysis within 40 days
TAL Metals	ASP EPA 6010B	Cool to 4°C	1-8 oz. wide mouth jar	180 days[2]
TCLP (for disposal purposes only)	Federal Register Vol. 57 No. 227 11/92, Vol. 55 No. 126 6/90	Cool to 4°C	1-8 oz. wide mouth jar 2-40 mL glass vials	14 days to TCLP extraction analysis. Analysis within 14 days of extraction.
Water				
TCL Volatiles	ASP EPA 8260B	HCL to pH<2 Cool to 4°C	2-40 mL glass vials	10 days for VOA analysis
TCL Semi-Volatiles	ASP EPA 8270	Cool to 4°C	2-1 liter amber bottles	5 days to extraction, analysis within 40 days
TAL Metals (total)	ASP EPA 6010B	HNO_3 to pH <2 Cool to 4°C	2-1 liter polyethylene bottles	180 days[2]

1. All holding times are determined from date of laboratory sample recaipt.

C:\MyDocsDfr SDC WP Table 7-1 Sample Pres_Holding times sample interval which recorded the highest readings on the PID will be submitted for laboratory analysis. At least one sample will be collected from each sample interval, regardless if field screening indicates the presence of contamination or not. The remaining samples will be disposed of in accordance with Section 7.7.1 in this Work Plan.

Soil samples will be collected in accordance with Section 6.7.1 and SOP No. 4 in Appendix D. Soils will be composited in accordance with SOP No. 11 in Appendix D. QA/QC samples (duplicates and MS/MSD) will be collected in accordance with SOP. No. 10 in Appendix D. Immediately after sample collection, the sample containers will be labeled in accordance with Section 7.4, placed in a cooler, and preserved with ice. Lithologic information will be recorded in accordance with SOP No. 17 in Appendix D. Following decontamination, the sampler will be fitted with a new disposable liner, assembled, attached to the drill rods, and advanced through the next sample interval. This procedure will be continued until the borehole is advanced to the desired depth. Downhole sampling equipment will be decontaminated between each borehole location using steam cleaning in accordance with Section 7.6 of this Work Plan.

7.2 Groundwater Sampling

A minimum of 7 days after the installation and development of the groundwater monitoring wells, one round of groundwater samples will be collected. Samples will be collected from each of the newly installed groundwater monitoring wells as well as four monitoring wells previously installed during the RI (6MW-03, 6MW-08, 6MW-09, and 6-MW-10). Groundwater samples will be collected in accordance with SOP No. 16 in Appendix D. Samples will be collected as follows:

The monitoring well will be unlocked and opened. Immediately upon opening the well, the tip of a PID will be inserted into the top of the well riser and any readings recorded in the log book. The well will then be allowed to vent for 3 to 5 minutes. The monitoring well PVC riser (not the outer protective casing) will be used for measuring. The static water level within the monitoring well and the total depth of the monitoring well will be measured to the highest point on the PVC riser using appropriate equipment.

The height of the static water column of the monitoring well will be calculated by subtracting the depth to the static water level from the total depth of the monitoring well. The volume of the static water column will be calculated using the following equation:

$$V=d^2h(0.0408)$$

Where:

V= volume of static water column (gallons)
d= diameter of the monitoring well (inches)
h= height of the static water column (feet)
(0.0408)= a conversion factor for units

Prior to sampling, each well will be purged in accordance with SOP No. 6 in Appendix D, until stabilization of pH, temperature, turbidity, dissolved oxygen, and specific conductivity have been achieved. Stabilization of these parameters will be achieved when three consecutive sets of readings fall within the following guidelines:

- pH readings within 0.2 standard units;
- turbidity less than 50 Nephlometric Turbidity Units (NTUs) or until stability within 10%;
- specific conductivity readings within 10%; and
- temperature readings within 1 degree Celsius.

All water withdrawn from the monitoring wells during well development and purging will be containerized in 55-gallon drums and handled as described in Section 7.7.2 of this Work Plan.

Water to be analyzed for the VOC analytical fraction is to be placed in two 40-ml glass vials which will be pre-preserved with a set amount of hydrochloric acid (HCL). Aneptek will coordinate with the analytical laboratory to ensure a given number of drops of HCL are placed into each pre-preserved bottle (approx. 2 or 3 drops per bottle). To ensure the water in these bottles is adequately preserved (i.e., pH<2 standard units), a third pre-preserved bottle (40-ml glass vial) will first be filled with water collected from the well. The bottle will be capped, lightly shaken to mix the preservative, and the pH will be tested using pH sensitive paper. Should the bottle require additional HCL to bring the pH below 2 standard units, a given number of drops will be added, mixed and the pH re-tested until an acceptable pH is achieved. The required, additional number of drops of HCL will then be added to the remainder of the pre-preserved bottles received from the laboratory. A similar procedure will be followed, using appropriate preservative analytes, when collecting water samples for each respective analytical fraction which require preservation.

Groundwater to be analyzed will be transferred directly from the bailer to the sample bottle. The 40-ml glass vials will be filled completely, leaving no air bubbles. After being filled, each bottle will be capped with a Teflon-lined cap, labeled, and immediately placed in a cooler containing ice. The volume of groundwater required for analytical fractions other than VOCs will then be collected. The order in which groundwater for each analytical fraction will be collected will be as follows:

1. VOCs
2. SVOCs
3. TAL Metals (total)

In order to minimize turbidity in the inorganic (metals) sample fractions, the inorganics will be collected approximately two hours following the collection of the remaining parameters. This will allow sufficient time for particulates to settle from the top of the water column. After the two hour period, the bailer/pump tubing will be lowered slowly into the top of the water column and a sample will be retrieved and measured for turbidity. If the turbidity of the sample is less than 50 NTU's, the sample will be collected. If the turbidity is greater than 50 NTU's, additional time will be given for the settling of particulates, and the turbidity will be re-evaluated. All sample fractions will be collected within the same 24 hour period.

A second round of groundwater sampling and analysis will be performed approximately 6 to 8 weeks after the first round.

Refer to SOP No.16 provided in Appendix D for groundwater sampling procedures.

7.3 Monitoring Well/Soil Boring and Sample Designations

The groundwater monitoring wells will be numbered numerically in the order in which they are installed. Each monitoring well location will be prefixed with "6MW-", followed by the well number . As there are already existing monitoring wells at Site 6 (6MW-03, 6MW-04, 6MW-08, 6MW-09, and 6MW-10), wells installed during this SDC will begin with the number 11(i.e., the first well installed at Site 6 during the SDC will be designated "6MW-11").

Groundwater samples will be designated by the well from which they were obtained followed by a four-digit number corresponding to the date the sample was collected. Therefore, the groundwater sample collected from well 6MW-11 on July 1, 2002, will be designated 6MW-11-0702.

Subsurface soil boring samples will be prefixed with "SB-", followed by the number of the boring, followed by the depth of the sample interval. Therefore, a sample collected from soil boring number 15 at a depth of 10 to 12 feet will be designated SB-15-10 to12 After the unique identifying number has been assigned to each sample, pertinent information will be included in the logbook. Information recorded in the logbook for all soil samples collected for analysis will include:

- Sample number
- Date and time sampled
- Sample identification number
- Depth below ground surface
- Analyses to be performed
- Sample description
- Readings of pH, temperature, specific conductivity, turbidity, and dissolved oxygen (groundwater samples)
- Name of person collecting sample.

7.4 Identification of Field Quality Control Samples

The types of quality control (QC) samples to be collected during field activities include trip blanks, equipment rinsates, field blanks, and duplicates.

7.4.1 Trip Blanks

Trip blanks are used to detect contamination by VOCs during sample shipping and handling. Trip blanks are 40-ml glass vials containing demonstrated analyte-free deionized water that are filled in the laboratory, transported to the sampling site, and returned to the laboratory with VOC samples. Trip blanks are not to be opened in the field. One trip blank is to accompany each cooler containing aqueous VOC samples. Each trip blank is to be stored at the laboratory with associated samples and analyzed with those samples. Trip blanks are only analyzed for VOCs. The trip blanks will be identified by date, with the prefix TB. For example, a trip blank collected on May 1 would be identified as "TB-05-01" on the chain-of-custody form.

7.4.2 Equipment Rinsates

Equipment rinsates are samples of demonstrated analyte-free deionized water passed through decontaminated sampling equipment. They are used as a measure of decontamination process effectiveness. Equipment rinsates will be collected at a rate of approximately one rinsate per seven soil samples collected. Groundwater samples will be collected using dedicated, disposable bailers or peristaltic pumps (new tubing to be used for each sampling event), therefore no rinsate samples will be required on groundwater sampling equipment. Equipment rinsates are analyzed for the same analytes as samples collected that day. As with the trip blanks, equipment rinsates will be identified by the prefix "RB" along with a reference to the media sampling equipment ("SB" for soil boring rinsates), followed by the date of collection.

7.4.3 Field Blanks

Field blanks are samples of source water used for decontamination and steam cleaning. At a minimum, one sample for each source of water for a given event will be collected for analyses. Normally, there will be two field blanks per event: a sample of the potable water used for steam cleaning and a sample of the American Society for Testing and Materials (ASTM) Type II or equivalent water used for decontamination. If more than one lot number of ASTM Type II or equivalent water is used or if potable water is taken from more than one location, then additional field blanks must be taken since these constitute different sources. As with trip blanks, field blanks will be designated by the prefix "FB" along with a reference to the media being sampled ("PW" for potable water).

7.4.4 Field Duplicates-MS\MSD Samples

For each analytical parameter, field duplicates for soil and water samples will be collected immediately after the original sample (i.e., first the 40-ml vials for the sample will be filled followed by the 40-ml vials for the duplicate etc.). Samples submitted for VOC analyses will not be combined or split. Field duplicates will be collected at a frequency of 10% of the samples collected per matrix per event (i.e., 1 to 10 samples collected equals 1 field duplicate; 11 to 20 samples collected equals 2 field duplicates). Duplicate samples will bear the same designation as the original sample, however a "D" will be placed after the of the numerical identification of the sample date. For example, a duplicate of the sample collected from 6MW-08 on July 1 will be designated 6MW-08-0701D.

Matrix spike and matrix spike duplicate (MS/MSD) samples will be collected at a frequency of one per twenty samples per matrix sampled for all parameters. These samples are used by the laboratory to check QC. Extra volume of sample must be collected to ensure that sufficient sample is available for analyses. QC samples will normally be used as a duplicate/matrix spike (MS) combination or a MS/MSD by the laboratory.

7.5 Sample Preservation, Packaging and Shipment

All sample containers will be pre-preserved by the laboratory or bottle vendor. Sample containers will be packed in coolers for shipment. Bottles will be packed using Styrofoam, vermiculite, and/or "bubble pack" so that no motion is possible. Ice will be placed in double "ziplock" bags and added to the cooler along with all paperwork in a separate "ziplock" bag. Sealed containers of heat transfer fluids (e.g., "Blue Ice") may be used in lieu of ice. Solid carbon dioxide (dry ice) will not be used. The cooler top will then be taped shut and custody seals will be placed on opposite edges of the cooler lid. The cooler will be securely taped shut prior to shipment. Specific preservation requirements for each sample type/analytical parameter are provided in Table B4-2 in Appendix B in the Final RI/FS Work Plan (Aneptek, 1998).

All shipping of environmental samples collected will be done through overnight delivery service or laboratory courier. All samples will leave the Base within 24 hours of sample collection under Chain of Custody protocol.

7.5.1 Sample Transport and Custody

All samples will be transported from the Base within 24 hours of collection, via courier or overnight express service. All sample coolers will be sealed with chain of custody seals at opposite corners of the cooler cover. Chain-of-custody records, identifying the samples in the cooler, date and time collected, containers, sample type, condition of the sample upon receipt, and disposal record for each sample will accompany all sample coolers. Every time custody of a sample cooler is transferred, the persons relinquishing and receiving custody of the cooler must sign and date the record on the appropriate line(s). An example Chain-of-Custody form is provided in Figure B5-6 in Appendix B in the Final RI/FS Work Plan (Aneptek, 1998).

7.6 Decontamination

The drilling subcontractor will provide a truck equipped with a steam cleaner, water tank, portable wash racks, and other necessary equipment and supplies to decontaminate drilling equipment. All drill rigs, construction equipment, and tools will be cleaned before beginning the field programs and at the conclusion of each drilling activity. If not supplied decontaminated (and in polyethylene sheaths) by the manufacturer, a metal rack (or wood, if the rack is wrapped with plastic sheeting) will be used to keep augers, well casings, and well screens off the ground. Cleaning will consist of scraping, brushing, washing with potable water, and steam-cleaning until exposed surfaces are visibly free of soil buildup. All decontamination water will be captured on a decontamination pad and containerized in 55-gallon drums. Adequate supplies of potable water required for decontamination activities will be obtained from a source at the Base. Any tank used for transporting potable water will be flushed prior to filling. Field Blank samples will be collected by the Field Supervisor to confirm water quality.

Sampling equipment will be decontaminated according to the following procedure:

- Wash and scrub with laboratory-grade detergent (Liquinox® or equal)
- Rinse with potable water
- Rinse with methanol
- Rinse with potable water
- Rinse with nitric acid (10% solution for stainless steel, 1% solution for other metals)
- Rinse with ASTM Type II or equivalent water
- Air dry and wrap equipment in aluminum foil, shiny-side away from equipment.

Decontamination of reusable protective equipment and clothing (gloves, boots, hardhat, etc.) will be accomplished by the following procedure:

- Rinse with potable water
- Wash with laboratory grade detergent (Liquinox® or equal)
- Rinse with deionized water
- Place in polyethylene bag (as necessary) to prevent contamination during storage or transit.

Refer to SOP No.13 provided in Appendix D for field equipment decontamination procedures.

7.7 Investigation Derived Waste

During the investigative activities of this project, wastes generated will include drill cuttings, water generated during well development and purging, waste liquids used in the decontamination process, sample bottles not submitted to the laboratory, and used personal protective equipment (PPE). The following describes the appropriate handling of each of these waste streams.

7.7.1 Handling of Soils

Soils will be removed from the subsurface during the advancement of soil borings and monitoring well installation. During these activities, soils will be monitored by personnel with a PID to determine the presence of volatile organics. Soils registering less than 5 ppm will be spread on the ground surface as directed by the Field Supervisor. Soils registering greater than 5 ppm will be containerized in DOT-approved, open-end sealed 55-gallon steel drums. All drums will be labeled with a unique identifying number, point of origin (soil boring/well designation), and content, to allow for tracking and accountability. Liquids and solids will not be placed into the same drum. Additionally, materials from borings advanced in one location cannot be combined in the same drum with wastes obtained from borings advanced in another location.

All drums containing soils determined to be potentially contaminated by PID screening will be transported to a central staging area for storage until they can be sampled, analyzed, and an appropriate disposal method can be determined. The staging area will be determined by the Field Supervisor. A forklift or properly equipped truck must be provided by the drilling subcontractor for drum transport. Pallets large enough to accommodate four drums will be provided by the drilling subcontractor.

7.7.2 Handling of Water

Water evacuated from monitoring wells during development and purging will be segregated by well and containerized in 55-gallon drums. Waste fluids generated during the decontamination process will be stored in separate drums. All drums containing liquids will be transported to a central staging area, as determined by the Field Supervisor.

7.7.3 Handling of PPE and Sample Bottles

During the field activities, all used PPE and sample bottles will be segregated based on whether they are suspected to contain residual hazardous wastes. Materials suspected to contain residual hazardous materials will be stored in the same central staging area as the drummed soils and water until appropriate disposal of these materials is arranged. Materials not suspected to contain residual hazardous wastes will be disposed of as general trash.

7.7.4 Sampling and Disposal of Wastes

Those drums suspected of containing contaminated wastes will be sampled by Aneptek personnel and subsequently shipped to an approved analytical laboratory. If the contamination is substantiated by TCLP and Hazardous Waste Characterization analyses, the drums will be manifested by Aneptek personnel for Base signature for disposal at an appropriate facility. The NYANG representative will be responsible for arranging transportation and disposal, and for signing shipping manifests.

SECTION 8.0

8.1 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

This section presents a preliminary analysis of Federal and State ARARs and additional criteria To-Be-Considered (TBC). Applicable requirements are those clean-up standards, standards of control, or other substantive environmental protection requirements, criteria or limitation promulgated under Federal or State law which specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstances at a CERCLA site. Relevant and appropriate requirements are those Federal and/or State requirements that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at a CERCLA site that their use is well suited to the particular site. TBC criteria are non-promulgated advisories or guidance issued by federal or state agencies that, although not legally binding, can be used in determining the level of clean-up for protection of health and the environment.

8.1 Methodology

The determination of ARARs/TBCs for the SDC is based on a review of: (1) the types, quantities and extent of contaminants potentially present at the site, (2) local considerations of the site, and (3) the types of actions being considered to mitigate the public health and environmental threats posed by the release of contaminants from the site. Following this, the universe of Federal and State requirements is examined and all chemical-specific, location-specific and action-specific ARARs pertinent to current or potential future conditions at the site are determined. Also identified are the additional State or Federal criteria and guidance (TBCs) which may be used during the CERCLA remedial response process. This analysis gives consideration to the requirements of the "CERCLA Compliance with other Laws Manual" (EPA, 1988b) as well as the "Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA" (EPA, 1988a).

The Chemical-specific ARARs for the SDC are presented in Table 8-1. The Location-specific ARARs pertinent to the SDC are initially evaluated in Table 8-2. Other criteria, advisories, and guidance to-be-considered are presented in Table 8-3. A general listing of chemical-specific ARAR and TBC concentration values are provided in Table 8-4 soils/sediment.

TABLE 8-1
POTENTIAL CHEMICAL-SPECIFIC ARARS FOR SITE 6

ARARS	SYNOPSIS
Federal ARARs	
1. Clean Water Act (CWA) Ambient Water Quality Criteria (AWQC); CWA Section 304	Federal AWQC are health-based criteria that have been developed for 95 carcinogenic and non-carcinogenic compounds. AWQC for the protection of human health provides levels for exposure both from drinking the water and consumption of aquatic organisms (i.e. fish), and from consumption of fish alone. AWQC for the protection of aquatic life includes acute and chronic levels for freshwater and marine organisms. Remedial actions involving contaminated surface water or groundwater must consider water uses and the circumstances of the release or threatened release.
2. Safe Drinking Water Act (SDWA) National Drinking Water Regulation (40 CFR 141)	Local wells use groundwater for drinking water supplies; therefore, the SDWA MCLs and Maximum Contaminant Level Goals (MCLGs) are potential ARARs for the aquifer. MCLs are legally enforceable federal drinking water standards, and MCLGs are nonenforceable health goals established by USEPA.
3. Clean Air Act	Any remedial action at the PPBA may generate air emissions. If so, the Clean Air Act requirements for emissions must be met. Clean Air Act standards include both Ambient Air Quality Standards (AAQS) and National Emissions Standards for Hazardous Air Pollutants (NESHAPS).

TABLE 8-1 (Cont.)
POTENTIAL CHEMICAL-SPECIFIC ARARS FOR SITE 6

ARARS	SYNOPSIS
State ARARs	
1. New York State Rules for Inactive Hazardous Waste Sites 6 NYCRR Subpart 375	This regulation includes the New York State regulations for inactive hazardous waste sites.
2. New York State water quality regulations 6 NYCRR Chapter X	This regulation establishes the requirements for the State Pollutant Discharge Elimination System (SPDES) program. This program provides the standards for surface water and drinking water to protect human health and the environment. 6 NYCRR Parts 701 and 702 include surface water standards and 6 NYCRR Part 703 includes groundwater standards.
3. New York State Hazardous Waste Regulations 6 NYCRR Part 373	This regulation includes the standards for groundwater monitoring for releases from solid waste management units.
4. New York State Drinking Water Regulations 10 NYCRR Part 5; NYSDEC TOGS 1.1.1	This regulation provides the New York State Department of Health drinking water quality standards. These regulations would apply to groundwaters used as drinking water supplies. Specific standards and guideline values are included in the guidance document TOGS 1.1.1.
5. New York Air Quality Regulations 6 NYCRR Parts 256 and 257	These regulations include the New York State requirements for air quality. 6 NYCRR Part 256 describes the State Air Quality Classification System. 6 NYCRR Part 257 includes ambient air quality standards. These requirements would be ARARs if a remedial action is implemented.

TABLE 8-2
POTENTIAL LOCATION-SPECIFIC ARARS FOR SITE 6

ARARS	SYNOPSIS
Federal ARARs	
1. National Environmental Policy Act (NEPA) (40 CFR 6, Appendix A); Protection of Wetlands, (EO 11990), Executive Order	Appendix A of 40 CFR 6 sets forth policy for carring out provisions of Protection of Wetlands Executive Order. Under this order, federal agencies are required to minimize the degredation, loss, or destruction of wetlands, and to preserve the natural and beneficial values of wetlands. Appendix A requires that no remedial alternative adversely affect a wetland if another practicable alternative is available. If no alternative is available, impacts from implementing the chosen alternative must be mitigated. During the FS process, the identification and evaluation of alternatives for the site will include an evaluation of each alternative's impact on any wetlands identified at or near the PPBA.
2. Endangered Species Act of 1973, 16 USC 1531 et seq. (50 CFR 81, 225, 402)	Directs the state to establish programs for the protection of endangered or protected species in the state's jurisdiction. The states can apply for federal assistance by filing an application with the Federal Government and entering into a cooperative agreement. In complying with the requirements of Section 404, the New York Department of Fish and Wildlife should be contacted to determine if any threatened or endangered species exist in the vicinity of the work area.
3. Migratory Bird Treaty Act of 1972	The Migratory Bird Treaty Act of 1972 implements many treaties involving migratory birds. This statute protects almost all species of native birds in the U.S. from unregulated "take" which can include poisoning at hazardous waste sites. The Act is a primary tool of the U.S. Fish and Wildlife Service and other Federal agencies in managing migratory birds.

TABLE 8-3
OTHER CRITERIA, ADVISORIES, AND GUIDANCE TO-BE-CONSIDERED

CRITERIA	SYNOPSIS
Federal TBC's	
1. Environmental Protection Agency (EPA) Reference Doses (RfDs)	EPA RfDs are dose levels developed for non-carcinogenic effects. They are considered levels unlikely to cause significant adverse health effects associated with a threshold mechanism of action in human exposure for a lifetime. RfDs are used to characterize risks of groundwater contaminant exposure.
2. EPA Carcinogen Assessment Group - Potency Factors (CAGs)	EPA CAGs were developed from Health Effects Assessments (HEAs), or evaluations by the Carcinogen Assessment Group, and present the most up-to date cancer risk potency information. CAGs complete the individual incremental cancer risk resulting from exposure to contaminants.
3. Acceptable Intake-Chronic (AIC) and Subchronic (AIS) - EPA Health Assessment Documents	EPA developed these two guidance documents for assessing risks and determining contaminant transport and fate. The AIC and AIS EPA Health Assessment Documents provide values developed for the RfDs and HEAs for non-carcinogenic compounds. AIC and AIS values characterize the risks from these contaminants.
4. EPA Health Advisories (Office of Drinking Water)	EPA Health Advisories are estimates of risks due to consumption of contaminated drinking water. The advisories consider non-carcinogenic effects only, and should be considered for contaminants in groundwater used for drinking water.
State TBCs	
1. NYSDEC TAGM HWR-94-4046	This guidance document provides cleanup standards for soils in New York State. These criteria are not promulgated standards but may be used to establish site-specific cleanup goals.
2. NYSDEC Air Guide 1	This document provides guidance for the control of toxic ambient air concentrations in New York State, and would be useful in establishing the allowable air emissions from a remedial action.

TABLE 8-4
POTENTIAL CHEMICAL-SPECIFIC ARARS AND TBC's AT SITE 6
SOILS/SEDIMENT

Parameters	Soil Criteria (a)		Sediment Criteria (b)					
			Aquatic Toxicity		Human Health		Wildlife Residue	
Metals (mg/kg)								
Aluminum	SB							
Antimony	SB							
Arsenic	7.5 or SB		5					
Barium	300 or SB							
Beryllium	0.16 or SB							
Cadmium	1 or SB		0.8					
Chromium	10 or SB		26					
Copper	25 or SB		19					
Iron	2000 or SB		2.4 %					
Lead	SB		27					
Manganese	SB		428					
Mercury	0.1		0.11					
Nickel	13 or SB		22					
Selenium	2 or SB							
Silver	SB							
Thallium	SB							
Vanadium	150 or SB							
Zinc	20 or SB		85					
Semivolatile Organics (mg/kg)								
Acenaphthene	50	c,e	7.3	c				
Anthracene	50	c,e						
Benz(a)anthracene	0.224 or MDL	c,e			0.007	c		
Benzo(b)fluoranthene	1.1	c,e			0.007	c		
Benzo(k)fluoranthene	1.1	c,e			0.007	c		
Benzo(g,h,i)perylene	50	c,e						
Benzo(a)pyrene	0.061 or MDL	c,e			0.007	c		
Chrysene	0.4	c,e			0.007	c		
Dibenz(a,h)anthracene	0.014 or MDL	c,e						
Dibenzofuran	6.2	c,e						
Fluoranthene	50	c,e						
Fluorene	50	c,e						
Indeno(1,2,3-c,d)pyrene	3.2	c,e			0.007	c		
2-Methylnaphthalene	36.4	c,e						
Naphthalene	13	c,e						
Phenanthrene	50	c,e	1.39	c				
Pyrene	50	c,e						

TABLE 8-4 (Cont.)
POTENTIAL CHEMICAL-SPECIFIC ARARS AND TBC's AT SITE 6
SOILS/SEDIMENT

Parameters	Soil Criteria (a)		Sediment Criteria (b)					
			Aquatic Toxicity		Human Health		Wildlife Residue	
Volatile Organics (mg/kg)								
Benzene	0.06	c,d			0.006	c		
Chlorobenzene	1.7	c,d	0.035	c				
Ethylbenzene	5.5	c,d						
Toluene	1.5	c,d						
Xylenes (total)	1.2	c,d						
1,2-Dichlorobenzene	7.9	c,d	0.12	c				
1,3-Dichlorobenzene	1.6	c,d	0.12	c				
1,4-Dichlorobenzene	8.5	c,d	0.12	c				
1,2,4-Trichlorobenzene	3.4	c,d	0.91	c				

Notes:

SB = Site Background
MDL = Method Detection Limit
mg/kg = milligrams per kilogram
ug/L = micrograms per liter.

(a) NYSDEC TAGM HWR-94-4046, January 24, 1994.
(b) NYSDEC Sediment Criteria, December, 1989.
(c) Values are TOC dependent. Values presented in this table assume a TOC of 1%.
(d) Total VOCs in soil should not exceed 10 mg/kg.
(e) Total SVOCs in soil should not exceed 500 mg/kg.

SECTION 9.0

9.0 SDC COMPLETION REPORT

Following the completion of the field program at Site 6, a SDC Completion Report will be prepared detailing the results of the SDC along with any additional investigative data collected during the soil removal. The report will include an evaluation of the performance of the SDC and the effectiveness of the removal action. The report shall include applicable figures depicting relevant analytical, engineering and hydrogeologic data. The report shall also include the following information:

- All comfirmatory soil sample analytical results from the recently conducted (April, 2002) TCRA soil removal conducted at Site 6.

- All analytical method detection limits (MDL) used during sample analysis for samples collected during this SDC. All confirmatory sample analysis to be conducted by an ELAP approved laboratory.

- A comparison of sample results from the laboratory and screening analysis of samples collected during this SDC.

- A table which will contain all analytical results for soils remaining on-site after the TCRA.

10.0 REFERENCES

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New York State Division of Environmental Conservation (NYSDEC) 1998a. *Technical and Administrative Guidance Memorandum # 4046: Determination of Soil Cleanup Objectives and Cleanup Levels* July 1998.

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APPENDIX A

RI MONITORING MONITORING WELL CONSTRUCTION DIAGRAMS

ANEPTEK CORPORATION
Well Completion Log

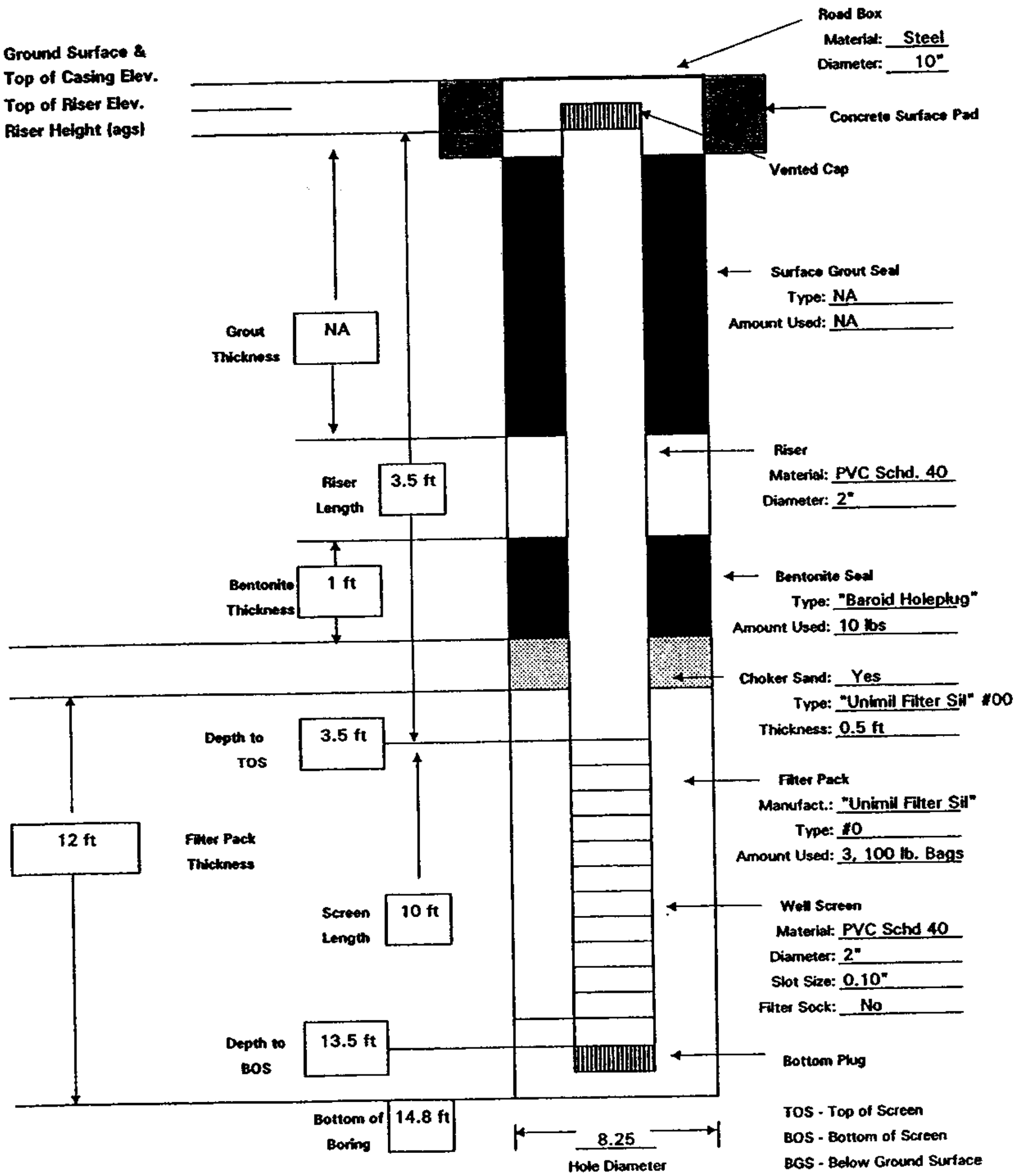
Client/Project/Contract No.:		Well/Boring No.
ANGRC/Stratton ANGB/DAHA-90-93-D-0003		Site 6 6MW-03
Logged By: J. Donovan/T. Markham	Date/Time Started: 10/15/98 0851	Date/Time Finished: 10/15/1998 1000
Drilling Contractor: Maxim Technologies	Drilling Rig Make/Model: Acker "Soil Max"	Drilling Method: Hollow Stem Auger

Survey Coordinates

Northing (Y): ____________

Easting (X): ____________

All Depths in feet below ground surface



TOS - Top of Screen
BOS - Bottom of Screen
BGS - Below Ground Surface

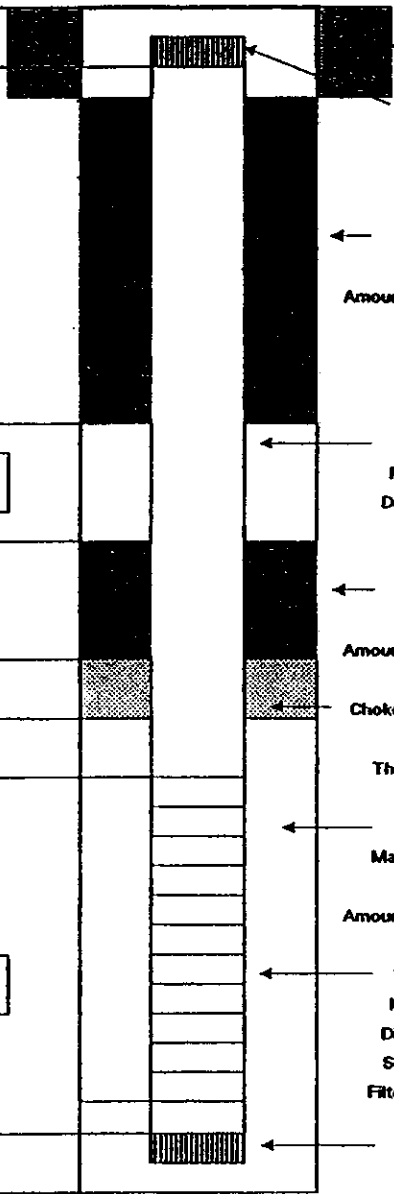
ANEPTEK CORPORATION Well Completion Log	Client/Project/Contract No.: ANGRC/Stratton ANGB/DAHA-90-93-D-0003		Well/Boring No. Site 6 6MW-8
	Logged By: J. Donovan/T. Markham	Date/Time Started 5/13/99 1448	Date/Time Finished 5/13/99 1555

Drilling Contractor:	Drilling Rig Make/Model:	Drilling Method:
Maxim Technologies	Acker "Soil Max"	Hollow Stem Auger

All Depths in feet below ground surface

Survey Coordinates
Northing (Y): ____
Easting (X): ____

Ground Surface & Top of Casing Elev. ____
Top of Riser Elev. ____
Riser Height (ags) ____



Road Box
Material: Steel
Diameter: 10"

Concrete Surface Pad

Vented Cap

Surface Grout Seal
Type: NA
Amount Used: NA

Grout Thickness: NA

Riser Length: 5 ft

Riser
Material: PVC Schd. 40
Diameter: 2"

Bentonite Thickness: 1 ft

Bentonite Seal
Type: 3/8"
Amount Used: 1 ft

Choker Sand: Yes
Type: #00
Thickness: 1 ft

Depth to TOS: 5 ft

Filter Pack Thickness: 13 ft

Filter Pack
Manufact.: "Unimil Filter Sil"
Type: #0
Amount Used: 100 lbs

Screen Length: 10 ft

Well Screen
Material: PVC Schd 40
Diameter: 2"
Slot Size: 0.10"
Filter Sock: No

Depth to BOS: 15 ft

Bottom Plug

Bottom of Boring: 16 ft

8.25 Hole Diameter

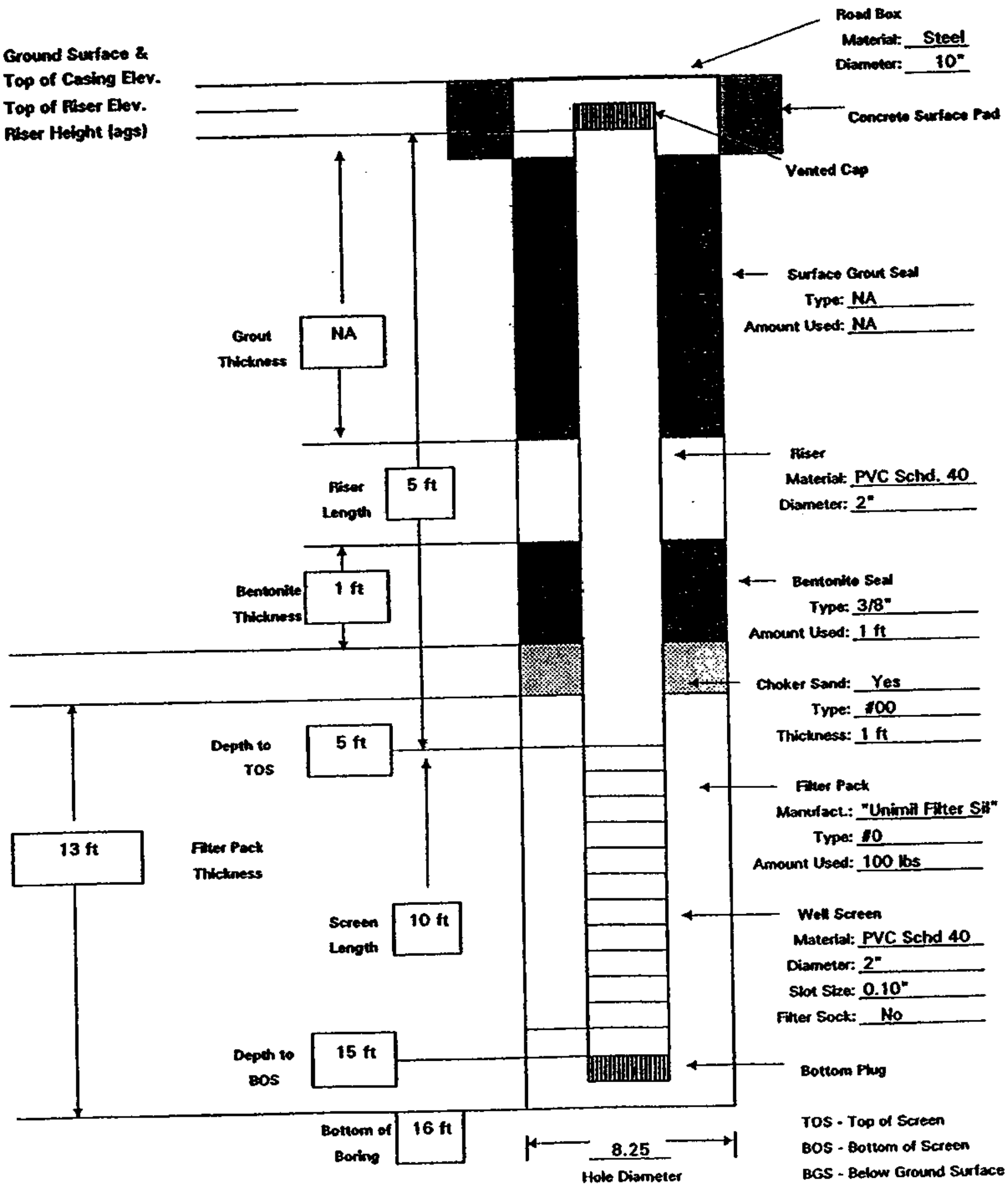
TOS - Top of Screen
BOS - Bottom of Screen
BGS - Below Ground Surface

ANEPTEK CORPORATION
Well Completion Log

Client/Project/Contract No.: ANGRC/Stratton ANGB/DAHA-90-93-D-0003			Well/Boring No.: Site 6 6MW-9
Logged By: J. Donovan/T. Markham		Date/Time Started: 5/14/99 0815	Date/Time Finished: 5/14/99 0845
Drilling Contractor: Maxim Technologies	Drilling Rig Make/Model: Acker "Soil Max"	Drilling Method: Hollow Stem Auger	

Survey Coordinates
Northing (Y): ____
Easting (X): ____

All Depths in feet below ground surface

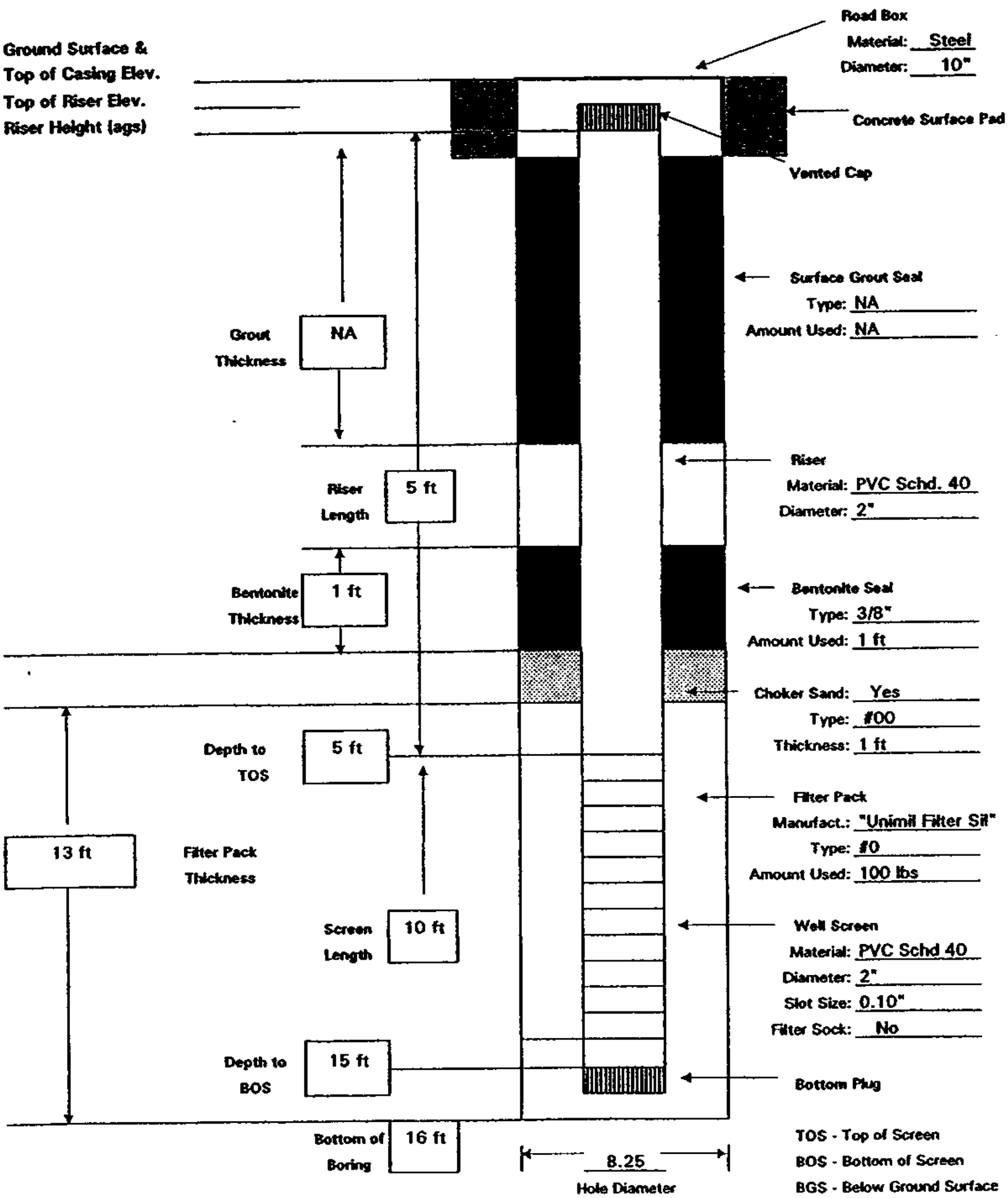


TOS - Top of Screen
BOS - Bottom of Screen
BGS - Below Ground Surface

ANEPTEK CORPORATION Well Completion Log	Client/Project/Contract No.: ANGRC/Stratton ANGB/DAHA-90-93-D-0003		Well/Boring No. Site 6 6MW-10
	Logged By: J. Donovan/T. Markham	Date/Time Started 5/13/99 1115	Date/Time Finished 5/13/99 1210
Drilling Contractor: Maxim Technologies	Drilling Rig Make/Model: Acker "Soil Max"	Drilling Method: Hollow Stem Auger	

All Depths in feet below ground surface

Survey Coordinates
Northing (Y): ______
Easting (X): ______



APPENDIX B

RI BORING LOGS

ANEPTEK CORPORATION
Boring Log

Client/Project/Contract No.: ANGRC/Stratton ANGB/ DAHA-90-93-D-003		Page 1 of 1
Sampler Type/Size: 2' Split Spoon		Boring/Well No.: Site 6 6MW-03

Drilling Contractor:	Drilling Rig Make/Model:			Date/Time Started	Date/Time Finished
Maxim Technologies	Acker "Soil Max"			10/14/98 1000	10/14/98 1500
Logged By:	**Drilling Method:**			**Screening Device (Type, make, model):**	
J. Donovan / T. Markham	HSA			HNU 101 PID 10.2eV	
Location (survey coord):	**Ground. El:**	**Total Depth:**	**Bedrock Depth:**	**Water Table Depth:**	**Borehole Diameter:**
		18.2 ft	3.30 ft	NA	8.25"(0-9')/3"(9-72.5)

Depth (ft)	Sample Interval (ft)	Sample Number	Blows/ 6-in.	Rec. (in.)	Lithologic Description	USCS Class.	FID (ppm)
0–2	0-2		2,10 11,14	12	0-3" Brown topsoil. 3-9" brown/grey silt, some clay, trace sand, loose density, trace bits of shale in nose.	ML	ϕ
2–4	2-4		10,15 15,50	8	Brown/grey silt, some clay, fractured /weatherd shale in nose. Soil more dense.	ML	ϕ
4–6	4-4'.7"		45,70 100/0.2"	8	Fractured shale at 4'. Refusal at 4'.7"	ML	ϕ

Penetration Resistance

Granular Soils Blows/ft	Granular Soils Density	Cohesive Soils Blows/ft	Cohesive Soils Density
<4	V. Loose	<2	V. Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	m. Dense	4 - 8	m. Stiff
30 - 50	Dense	8 - 15	Stiff
>50	V. Dense	15 - 30	V. Stiff
		>50	Hard

Proportions

Trace: 0 - 10%
Little: 10 - 20%
Some: 20 - 35%
And: 35 - 50%

Water Content

D - Dry
M - Moist
W - Wet

Notes and Comments:

Augered from 4' to 6', tried split spoon, refusal, no evidence of moisture in borehole up to this point. Augered to 18'.2", pull up augers to 16.0' and let sit overnite. Pulled augers up to 9.0' at 0751 on 10/15/98. Augers wet at 4-5' interval. Installed well. ~~121-1364~~

ANEPTEK CORPORATION
Boring Log

Client/Project/Contract No.: Stratton ANGB/97030.31 Site 6			Page 1 of 1
Sampler Type/Size: 2 ft Split Spoon			Boring/Well No.: 6MW-08
Drilling Contractor: Maxim Technologies	Drilling Rig Make/Model: CME 75	Date/Time Started: 5/13/1999 1448	Date/Time Finished:
Logged By: J. Donovan, T Markham	Drilling Method: Air Rotary/Split Spoon to Refusal	Screening Device (Type, make, model): HNU 101 PID 10.2 eV	
Location (survey coord):	Ground El.: / Total Depth: / Bedrock Depth: 9.3 ft	Water Table Depth:	Borehole Diameter: 8 inches

Depth (ft)	Sample Interval	Sample Number	Blows/ 6-in.	Rec. (in.)	Lithologic Description	USCS Class.	PID/FID (ppm)
4	4.0-6.0		4 6 8 5	17	Brown clay/silt, mottled brown color	CL	0
6.0	6.0-8.0		8 10 12 2	20	Top 2" brown clay/ silt, 2-7" brown w/dark grey section Headspace = 0 on 6.8 band section	CL	0
8.0			7 10 100/3	19	Top 3" grey/brown silt clay 3"-5" brown silt clay 15-19" fractured shale	CL SH	0
9.3							

Penetration Resistance				Proportions
Granular Soils		Cohesive Soils		Trace: 0 - 10%
Blows/ft	Density	Blows/ft	Density	Little: 10 - 20%
<4	V. Loose	<2	V. Soft	Some: 20 - 35%
4 - 10	Loose	2 - 4	Soft	And: 35 - 50%
10 - 30	M. Dense	4 - 8	M. Stiff	**Water Content**
30 - 50	Dense	8 - 15	Stiff	D - Dry
>50	V. Dense	15 - 30	V. Stiff	M - Moist
		>50	Hard	W - Wet

Notes and Comments:

ANEPTEK CORPORATION

Boring Log

Client/Project/Contract No.: Stratton ANGB/97030.31 Site 6		Page 1 of 1
Sampler Type/Size: 2 ft Split Spoon		Boring/Well No.: 6MW-09

Drilling Contractor:	Drilling Rig Make/Model:		Date/Time Started	Date/Time Finished
Maxim Technologies	CME 75		5/13/1999 @0825	
Logged By: J. Donovan, T Markham	Drilling Method: Air Rotary/Split Spoon to Refusal		Screening Device (Type, make, model): HNU 101 PID 10.2 eV	
Location (survey coord):	Ground El.:	Total Depth:	Bedrock Depth: 7.9 ft	Water Table Depth:	Borehole Diameter: 8 inches

Depth (ft)	Sample Interval	Sample Number	Blows/ 6-in.	Rec. (in.)	Lithologic Description	USCS Class.	PID/FID (ppm)
4	4.0-6.0		4 5 8 4	10	Brown topsoil, slightly moist, little gravel		1
6.0	6.0-7.9		5 17 18 100/3	20	4" brown topsoil w/ little gravel. 9" brown silty clay 7" fractured shale, dry	CL SH	0
7.9							

Penetration Resistance				Proportions	Notes and Comments:
Granular Soils		Cohesive Soils			
Blows/ft	Density	Blows/ft	Density		
<4	V. Loose	<2	V. Soft	Trace: 0 - 10%	
4 - 10	Loose	2 - 4	Soft	Little: 10 - 20%	
10 - 30	M. Dense	4 - 8	M. Stiff	Some: 20 - 35%	
30 - 50	Dense	8 - 15	Stiff	And: 35 - 50%	
>50	V. Dense	15 - 30	V. Stiff	Water Content	
		>50	Hard	D - Dry M - Moist W - Wet	

ANEPTEK CORPORATION

Boring Log

Client/Project/Contract No.:	Stratton ANGB/97030.31 Site 6
Page	1 of 1
Sampler Type/Size:	2 ft Split Spoon
Boring/Well No.:	6MW-10
Drilling Contractor:	Maxim Technologies
Drilling Rig Make/Model:	CME 75
Date/Time Started	5/13/1999 @1115
Date/Time Finished	
Logged By:	J. Donovan, T Markham
Drilling Method:	Air Rotary/Split Spoon to Refusal
Screening Device (Type, make, model):	HNU 101 PID 10.2 eV
Location (survey coord):	
Ground El.:	
Total Depth:	
Bedrock Depth:	7.4 ft
Water Table Depth:	
Borehole Diameter:	8 inches

Depth (ft)	Sample Interval	Sample Number	Blows/ 6-in.	Rec. (in.)	Lithologic Description	USCS Class.	PID/FID (ppm)
4	4.0-6.0		8 9 10 10	19	Top 4", topsoil, 4-15" brown clay/silt, bits fractured shale nose wet	CL	0
6.0	6.0-7.9		10 12 100/4	17	Top 3" coarse sand, 3-8" clay/silt wet Bottom 5" brown clay/silt Fractured shale in bottom	CL SH	0
7.4							

Penetration Resistance

Granular Soils Blows/ft	Granular Soils Density	Cohesive Soils Blows/ft	Cohesive Soils Density
<4	V. Loose	<2	V. Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	M. Dense	4 - 8	M. Stiff
30 - 50	Dense	8 - 15	Stiff
>50	V. Dense	15 - 30	V. Stiff
		>50	Hard

Proportions

Trace: 0 - 10%
Little: 10 - 20%
Some: 20 - 35%
And: 35 - 50%

Water Content

D - Dry
M - Moist
W - Wet

Notes and Comments:

ANEPTEK CORPORATION
Boring Log

Client/Project/Contract No.: Stratton ANGB/97030.31 Site 6		Page 1 of 1
Sampler Type/Size: 2 ft Split Spoon		Boring/Well No.: SB-1

Drilling Contractor: Maxim Technologies	Drilling Rig Make/Model: CME 75			Date/Time Started: 4/16/99 1418	Date/Time Finished:	
Logged By: J. Donovan, T Markham	Drilling Method: HSA			Screening Device (Type, make, model): HNU 101 PID 10.2 eV		
Location (survey coord):	Ground El.:	Total Depth:	Bedrock Depth: 10.7 ft	Water Table Depth:	Borehole Diameter: 8 inches	

Depth (ft)	Sample Interval	Sample Number	Blows/ 6-in.	Rec. (in.)	Lithologic Description	USCS Class.	PID/FID (ppm)
	0-2		3 6 8 9	0	No recovery		
2	2-4		5 6 15 21	8	Brown Clay, Silt Moist Bottom 3 grey fractured shale	CL	40ppm on headspace
4	6-8		16 25 22 28	12	Top 2" Light Brown 4" Brown silty clay to 6 " Fractured shale, little gravel	CL SH	18ppm on headspace
8	8-8.7		65 100/1	6	Brown Clayey silt Sweet smell	CL	50ppm on spoon 80ppm on headspace
10.7							

Penetration Resistance				Proportions	Notes and Comments:
Granular Soils		Cohesive Soils		Trace: 0 - 10%	
Blows/ft	Density	Blows/ft	Density	Little: 10 - 20%	
<4	V. Loose	<2	V. Soft	Some: 20 - 35%	
4 - 10	Loose	2 - 4	Soft	And: 35 - 50%	
10 - 30	M. Dense	4 - 8	M. Stiff	Water Content	
30 - 50	Dense	8 - 15	Stiff	D - Dry	
>50	V. Dense	15 - 30	V. Stiff	M - Moist	
		>50	Hard	W - Wet	

ANEPTEK CORPORATION
Boring Log

Client/Project/Contract No.: Stratton ANGB/97030.31 Site 6			Page 1 of 1Page 1 of 1
Sampler Type/Size: 2 ft Split Spoon			Boring/Well No.: SB-2
Drilling Contractor: Maxim Technologies	Drilling Rig Make/Model: CME 75	Date/Time Started: 4/20/99 0914	Date/Time Finished:
Logged By: J. Donovan, T Markham	Drilling Method: HSA	Screening Device (Type, make, model): HNU 101 PID 10.2 eV	
Location (survey coord):	Ground El.: / Total Depth: / Bedrock Depth: 6.8 ft	Water Table Depth:	Borehole Diameter: 8 inches

Depth (ft)	Sample Interval	Sample Number	Blows/ 6-in.	Rec. (in.)	Lithologic Description	USCS Class.	PID/FID (ppm)
	4-6		5 12 16 38	18	Will auger down to 4 ft. Take spoon @ 4-6 ft 14" Brown silty clay to 4" weathered shale	CL	350ppm in nose, 5ppm above the nose
6	6-6.8		42 100/2	8	Grey weathered shale. Tip of the nose is wet Refusal	CL SH	100ppm
6.8							

Penetration Resistance				Proportions	Notes and Comments:
Granular Soils		Cohesive Soils			
Blows/ft	Density	Blows/ft	Density		
<4	V. Loose	<2	V. Soft	Trace: 0 - 10%	
4 - 10	Loose	2 - 4	Soft	Little: 10 - 20%	
10 - 30	M. Dense	4 - 8	M. Stiff	Some: 20 - 35%	
30 - 50	Dense	8 - 15	Stiff	And: 35 - 50%	
>50	V. Dense	15 - 30	V. Stiff	Water Content	
		>50	Hard	D - Dry M - Moist W - Wet	

ANEPTEK CORPORATION

Boring Log

Client/Project/Contract No.:	Page 1 of 1
Stratton ANGB/97030.31 Site 6	
Sampler Type/Size: 2 ft Split Spoon	Boring/Well No.: SB-3

Drilling Contractor:	Drilling Rig Make/Model:	Date/Time Started	Date/Time Finished
Maxim Technologies	CME 75	5/12/99 0845	
Logged By: J. Donovan, T Markham	Drilling Method: HSA	Screening Device (Type, make, model): HNU 101 PID 10.2 eV	
Location (survey coord):	Ground El.:	Total Depth:	Bedrock Depth:
		Water Table Depth:	Borehole Diameter: 8 inches

Depth (ft)	Sample Interval	Sample Number	Blows/ 6-in.	Rec. (in.)	Lithologic Description	USCS Class.	PID/FID (ppm)
	0-2		4 9 8 6	8	Top 2.5" top soil. Bottom 5.5" brown clay/silt	CL	0
2	2-4		9 10 15 13	14	Brown clay/silt Stop drilling and moved rig.	CL	10ppm
4							

Penetration Resistance			
Granular Soils		Cohesive Soils	
Blows/ft	Density	Blows/ft	Density
<4	V. Loose	<2	V. Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	M. Dense	4 - 8	M. Stiff
30 - 50	Dense	8 - 15	Stiff
>50	V. Dense	15 - 30	V. Stiff
		>50	Hard

Proportions
Trace: 0 - 10%
Little: 10 - 20%
Some: 20 - 35%
And: 35 - 50%

Water Content
D - Dry
M - Moist
W - Wet

Notes and Comments:

ANEPTEK CORPORATION
Boring Log

Client/Project/Contract No.: Stratton ANGB/97030.31 Site 6			Page 1 of 1
Sampler Type/Size: 2 ft Split Spoon			Boring/Well No.: SB-4
Drilling Contractor: Maxim Technologies	Drilling Rig Make/Model: CME 75	Date/Time Started: 5/12/99 0930	Date/Time Finished:
Logged By: J. Donovan, T Markham	Drilling Method: HSA	Screening Device (Type, make, model): HNU 101 PID 10.2 eV	
Location (survey coord):	Ground El.: / Total Depth: / Bedrock Depth: 4.9 ft	Water Table Depth:	Borehole Diameter: 8 inches

Depth (ft)	Sample Interval	Sample Number	Blows/ 6-in.	Rec. (in.)	Lithologic Description	USCS Class.	PID/FID (ppm)
	0-2		14 6 7 6	14	Top 2." top soil. Bottom 12" brown clay/silt	CL	1ppm at top of hole
2	2-4		6 12 14 18	13	Clay/silt	CL	4.5
4	4-4.9		16 100/4	10	Top 2" fluff 6" brown clay/silt Bottom 4" fractured shale	CL SH	4.5
4.9					Will sample 4.4-4.7		

Penetration Resistance

Granular Soils Blows/ft	Granular Soils Density	Cohesive Soils Blows/ft	Cohesive Soils Density
<4	V. Loose	<2	V. Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	M. Dense	4 - 8	M. Stiff
30 - 50	Dense	8 - 15	Stiff
>50	V. Dense	15 - 30	V. Stiff
		>50	Hard

Proportions

Trace: 0 - 10%
Little: 10 - 20%
Some: 20 - 35%
And: 35 - 50%

Water Content

D - Dry
M - Moist
W - Wet

Notes and Comments:

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ANEPTEK CORPORATION

Boring Log

Client/Project/Contract No.: Stratton ANGB/97030.31 Site 6		Page 1 of 1
Sampler Type/Size: 2 ft Split Spoon		Boring/Well No.: SB-5

Drilling Contractor: Maxim Technologies	Drilling Rig Make/Model: CME 75			Date/Time Started: 5/12/99 0945		Date/Time Finished:
Logged By: J. Donovan, T Markham	Drilling Method: HSA			Screening Device (Type, make, model): HNU 101 PID 10.2 eV		
Location (survey coord):	Ground El.:	Total Depth:	Bedrock Depth: 6.8 ft	Water Table Depth:		Borehole Diameter: 8 inches

Depth (ft)	Sample Interval	Sample Number	Blows/ 6-in.	Rec. (in.)	Lithologic Description	USCS Class.	PID/FID (ppm)
0–2	0-2		3 8 7 7	16	Top 2." top soil. Bottom 14" brown clay/silt	CL	2
2–4	2-4		7 10 12 11	6	Clay/silt	CL	2
4–6	4-6		6 8 12 16	0	No recovery		0
6–6.8	6-6.8		25 100/2	8	6" wet silty clay with little fractured shale to 2" fractured shale		0

Penetration Resistance				Proportions
Granular Soils		Cohesive Soils		Trace: 0 - 10%
Blows/ft	Density	Blows/ft	Density	Little: 10 - 20%
<4	V. Loose	<2	V. Soft	Some: 20 - 35%
4 - 10	Loose	2 - 4	Soft	And: 35 - 50%
10 - 30	M. Dense	4 - 8	M. Stiff	Water Content
30 - 50	Dense	8 - 15	Stiff	D - Dry
>50	V. Dense	15 - 30	V. Stiff	M - Moist
		>50	Hard	W - Wet

Notes and Comments:

ANEPTEK CORPORATION

Boring Log

Client/Project/Contract No.: Stratton ANGB/97030.31 Site 6			Page 1 of 1	
Sampler Type/Size: 2 ft Split Spoon			Boring/Well No.: SB-6	
Drilling Contractor: Maxim Technologies	Drilling Rig Make/Model: CME 75		Date/Time Started: 5/12/99 1101	Date/Time Finished:
Logged By: J. Donovan, T Markham	Drilling Method: HSA		Screening Device (Type, make, model): HNU 101 PID 10.2 eV	
Location (survey coord):	Ground El.:	Total Depth:	Bedrock Depth: 6.8 ft	Water Table Depth:	Borehole Diameter: 8 inches

Depth (ft)	Sample Interval	Sample Number	Blows/ 6-in.	Rec. (in.)	Lithologic Description	USCS Class.	PID/FID (ppm)
0	0-2		3 10 9 6	6	Top 3" brown clay/silt	CL	1
2	2-4		8 7 8 15	20	18" brown silty clay. Top 2." brown soil with trace fractured shale.	CL	0
4	4-6		14 15 16 12	16	8" brown soil with trace fractured shale. 8" fractured shale.	CL SH	40ppm in nose 200ppm on headspace
6	6-6.8		20 100/2	8	8" wet silty clay with little fractured shale.	CL SH	2ppm in nose 100ppm on headspace
6.8							

Penetration Resistance			
Granular Soils		Cohesive Soils	
Blows/ft	Density	Blows/ft	Density
<4	V. Loose	<2	V. Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	M. Dense	4 - 8	M. Stiff
30 - 50	Dense	8 - 15	Stiff
>50	V. Dense	15 - 30	V. Stiff
		>50	Hard

Proportions
Trace: 0 - 10%
Little: 10 - 20%
Some: 20 - 35%
And: 35 - 50%

Water Content
D - Dry
M - Moist
W - Wet

Notes and Comments:

ANEPTEK CORPORATION

Boring Log

Client/Project/Contract No.: Stratton ANGB/97030.31 Site 6			Page 1 of 1
Sampler Type/Size: 2 ft Split Spoon			Boring/Well No.: SB-7
Drilling Contractor: Maxim Technologies	Drilling Rig Make/Model: CME 75	Date/Time Started: 5/12/99 1256	Date/Time Finished:
Logged By: J. Donovan, T Markham	Drilling Method: HSA	Screening Device (Type, make, model): HNU 101 PID 10.2 eV	
Location (survey coord):	Ground El.: / Total Depth: / Bedrock Depth: 7.2 ft	Water Table Depth:	Borehole Diameter: 8 inches

Depth (ft)	Sample Interval	Sample Number	Blows/ 6-in.	Rec. (in.)	Lithologic Description	USCS Class.	PID/FID (ppm)
0–2	0-2		4 6 6 5	12	8" brown top soil with trace gravel. 4" brown clay/silt soil.	CL	1
2–4	2-4		6 7 10 12	18	6" brown top soil. 12" brown silty/clay soil.	CL	0 4ppm on headspace
4–6	4-6		9 11 17 30	20	8" brown soil with trace gravel. 6" wet clay/silty soil with trace fractured shale. 6" fractured shale.	CL SH	0
6–7.2	6-7.2		19 30 100/2	8	6" wet silty clay with little fractured shale. 2" fractured shale, wet.	CL SH	0

Penetration Resistance

Granular Soils Blows/ft	Granular Soils Density	Cohesive Soils Blows/ft	Cohesive Soils Density
<4	V. Loose	<2	V. Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	M. Dense	4 - 8	M. Stiff
30 - 50	Dense	8 - 15	Stiff
>50	V. Dense	15 - 30	V. Stiff
		>50	Hard

Proportions

Trace: 0 - 10%
Little: 10 - 20%
Some: 20 - 35%
And: 35 - 50%

Water Content

D - Dry
M - Moist
W - Wet

Notes and Comments:

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Boring Log

Client/Project/Contract No.:	Stratton ANGB/97030.31 Site 6
Page	1 of 1
Sampler Type/Size:	2 ft Split Spoon
Boring/Well No.:	Site 6 SB-8
Drilling Contractor:	Maxim Technologies
Drilling Rig Make/Model:	CME 75
Date/Time Started	5/12/99 1325
Date/Time Finished	
Logged By:	J. Donovan, T Markham
Drilling Method:	HSA
Screening Device (Type, make, model):	HNU 101 PID 10.2 eV
Location (survey coord):	
Ground El.:	
Total Depth:	
Bedrock Depth:	6 ft
Water Table Depth:	
Borehole Diameter:	8 inches

Depth (ft)	Sample Interval	Sample Number	Blows/ 6-in.	Rec. (in.)	Lithologic Description	USCS Class.	PID/FID (ppm)
0–2	0-2		5 14 10 8	12	12" brown top soil with trace gravel.	CL	2
2–4	2-4		8 10 10 15	14	2" brown top soil. 12" brown silty/clay soil with trace shale.	CL	0
4–6	4-6		12 15 13 19	10	2" clay/silty soil. with trace gravel. 8" clay/silty soil with 40% fractured shale, wet. Odor evident	CL SH	250ppm on nose 300ppm on headspace

Penetration Resistance

Granular Soils Blows/ft	Granular Soils Density	Cohesive Soils Blows/ft	Cohesive Soils Density
<4	V. Loose	<2	V. Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	M. Dense	4 - 8	M. Stiff
30 - 50	Dense	8 - 15	Stiff
>50	V. Dense	15 - 30	V. Stiff
		>50	Hard

Proportions

Trace: 0 - 10%
Little: 10 - 20%
Some: 20 - 35%
And: 35 - 50%

Water Content

D - Dry
M - Moist
W - Wet

Notes and Comments:

ANEPTEK CORPORATION
Boring Log

Client/Project/Contract No.: Stratton ANGB/97030.31 Site 6				Page 1 of 1Page 1 of 1
Sampler Type/Size: 2 ft Split Spoon				Boring/Well No.: SB-9
Drilling Contractor: Maxim Technologies	Drilling Rig Make/Model: CME 75		Date/Time Started: 5/12/99 1358	Date/Time Finished:
Logged By: J. Donovan, T Markham	Drilling Method: HSA		Screening Device (Type, make, model): HNU 101 PID 10.2 eV	
Location (survey coord):	Ground El.:	Total Depth:	Bedrock Depth: 7.9 ft	Water Table Depth:	Borehole Diameter: 8 inches

Depth (ft)	Sample Interval	Sample Number	Blows/ 6-in.	Rec. (in.)	Lithologic Description	USCS Class.	PID/FID (ppm)
	0-2		3 8 11 7	8	8" brown top soil with trace gravel.		0
2	2-4		5 4 5 4	0	No recovery		0
4	4-6		5 2 2 1	0	No recovery		
6	6-7.9		7 12 15 100/4	22	6" brown clay/silty soil with 40% fractured shale with some sand wet.	CL SH	
7.9							

Penetration Resistance

Granular Soils Blows/ft	Density	Cohesive Soils Blows/ft	Density
<4	V. Loose	<2	V. Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	M. Dense	4 - 8	M. Stiff
30 - 50	Dense	8 - 15	Stiff
>50	V. Dense	15 - 30	V. Stiff
		>50	Hard

Proportions
Trace: 0 - 10%
Little: 10 - 20%
Some: 20 - 35%
And: 35 - 50%

Water Content
D - Dry
M - Moist
W - Wet

Notes and Comments:

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ANEPTEK CORPORATION

Boring Log

Client/Project/Contract No.:	Stratton ANGB/97030.31 Site 6
Page	1 of 1
Sampler Type/Size:	2 ft Split Spoon
Boring/Well No.:	Site 6 SB-10
Drilling Contractor:	Maxim Technologies
Drilling Rig Make/Model:	CME 75
Date/Time Started	5/12/99 1500
Date/Time Finished	
Logged By:	J. Donovan, T Markham
Drilling Method:	HSA
Screening Device (Type, make, model):	HNU 101 PID 10.2 eV
Location (survey coord):	
Ground El.:	
Total Depth:	
Bedrock Depth:	7.4 ft
Water Table Depth:	
Borehole Diameter:	8 inches

Depth (ft)	Sample Interval	Sample Number	Blows/ 6-in.	Rec. (in.)	Lithologic Description	USCS Class.	PID/FID (ppm)
0–2	0-2		7 8 8 9	13	4" brown silty/clay soil with bits of crushed brick. 9" brown clay/silty soil.	CL	0
2–4	2-4		7 10 9 14	12	12" brown silty/clay soil with trace gravel.	CL	2
4–6	4-6		12 13 14 9	8	2" clay/silty soil with 1" cobble. 3" brown clay/silty soil with trace gravel. 3' Gray soil with strong petro odor.	CL	70
6–7.4	6-7.4		9 10 100/4	12	Top 3" top soil with cobble. 4" clay/silty soil, damp. Soil from 6.4-7.4 is dry.	CL	150ppm on damp soil

Penetration Resistance

Granular Soils Blows/ft	Granular Soils Density	Cohesive Soils Blows/ft	Cohesive Soils Density
<4	V. Loose	<2	V. Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	M. Dense	4 - 8	M. Stiff
30 - 50	Dense	8 - 15	Stiff
>50	V. Dense	15 - 30	V. Stiff
		>50	Hard

Proportions

Trace: 0 - 10%
Little: 10 - 20%
Some: 20 - 35%
And: 35 - 50%

Water Content

D - Dry
M - Moist
W - Wet

Notes and Comments:

ANEPTEK CORPORATION

Boring Log

Client/Project/Contract No.: Stratton ANGB/97030.31 Site 6		Page 1 of 1
Sampler Type/Size: 2 ft Split Spoon		Boring/Well No.: SB-11

Drilling Contractor: Maxim Technologies	Drilling Rig Make/Model: CME 75	Date/Time Started: 6/15/99 0900	Date/Time Finished:
Logged By: J. Donovan, T Markham	Drilling Method: HSA	Screening Device (Type, make, model): HNU 101 PID 10.2 eV	
Location (survey coord):	Ground El.: / Total Depth: / Bedrock Depth:	Water Table Depth:	Borehole Diameter: 8 inches

Depth (ft)	Sample Interval	Sample Number	Blows/ 6-in.	Rec. (in.)	Lithologic Description	USCS Class.	PID/FID (ppm)
	2-4		9 9 5 8	10	Top 4" brown clay/silty soil. 4.8" gray clay. 2" fractured shale.	CL SH	1
4							

Penetration Resistance

Granular Soils Blows/ft	Granular Soils Density	Cohesive Soils Blows/ft	Cohesive Soils Density
<4	V. Loose	<2	V. Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	M. Dense	4 - 8	M. Stiff
30 - 50	Dense	8 - 15	Stiff
>50	V. Dense	15 - 30	V. Stiff
		>50	Hard

Proportions

Trace: 0 - 10%
Little: 10 - 20%
Some: 20 - 35%
And: 35 - 50%

Water Content

D - Dry
M - Moist
W - Wet

Notes and Comments:

ANEPTEK CORPORATION Boring Log		Client/Project/Contract No.: Stratton ANGB/97030.31 Site 6	Page 1 of 1
		Sampler Type/Size: 2 ft Split Spoon	Boring/Well No.: SB-12

Drilling Contractor: Maxim Technologies	Drilling Rig Make/Model: CME 75	Date/Time Started: 6/15/99 0835	Date/Time Finished:
Logged By: J. Donovan, T Markham	Drilling Method: HSA	Screening Device (Type, make, model): HNU 101 PID 10.2 eV	
Location (survey coord):	Ground El.: / Total Depth: / Bedrock Depth:	Water Table Depth:	Borehole Diameter: 8 inches

Depth (ft)	Sample Interval	Sample Number	Blows/ 6-in.	Rec. (in.)	Lithologic Description	USCS Class.	PID/FID (ppm)
	2-4		8 8 12 10	36	Clay/silty soil with some sand. Gray fractured shale, wet.	CL SH	1
4							

Penetration Resistance				Proportions
Granular Soils		Cohesive Soils		Trace: 0 - 10%
Blows/ft	Density	Blows/ft	Density	Little: 10 - 20%
<4	V. Loose	<2	V. Soft	Some: 20 - 35%
4 - 10	Loose	2 - 4	Soft	And: 35 - 50%
10 - 30	M. Dense	4 - 8	M. Stiff	Water Content
30 - 50	Dense	8 - 15	Stiff	D - Dry
>50	V. Dense	15 - 30	V. Stiff	M - Moist
		>50	Hard	W - Wet

Notes and Comments:

ANEPTEK CORPORATION

Boring Log

Client/Project/Contract No.:	Stratton ANGB/97030.31 Site 6
Page	1 of 1
Sampler Type/Size:	2 ft Split Spoon
Boring/Well No.:	SB-13
Drilling Contractor:	Maxim Technologies
Drilling Rig Make/Model:	CME 75
Date/Time Started	6/15/99 1045
Date/Time Finished	
Logged By:	J. Donovan, T Markham
Drilling Method:	HSA
Screening Device (Type, make, model):	HNU 101 PID 10.2 eV
Location (survey coord):	
Ground El.:	
Total Depth:	
Bedrock Depth:	
Water Table Depth:	
Borehole Diameter:	8 inches

Depth (ft)	Sample Interval	Sample Number	Blows/ 6-in.	Rec. (in.)	Lithologic Description	USCS Class.	PID/FID (ppm)
	2-4		6 5 12 11	48	12" brown top soil. 36" Lt. Brown clay/silty soil.	CL	0
4							

Penetration Resistance

Granular Soils Blows/ft	Granular Soils Density	Cohesive Soils Blows/ft	Cohesive Soils Density
<4	V. Loose	<2	V. Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	M. Dense	4 - 8	M. Stiff
30 - 50	Dense	8 - 15	Stiff
>50	V. Dense	15 - 30	V. Stiff
		>50	Hard

Proportions

Trace: 0 - 10%
Little: 10 - 20%
Some: 20 - 35%
And: 35 - 50%

Water Content

D - Dry
M - Moist
W - Wet

Notes and Comments:

ANEPTEK CORPORATION
Boring Log

Client/Project/Contract No.: Stratton ANGB/97030.31 Site 6		Page 1 of 1
Sampler Type/Size: 2 ft Split Spoon		Boring/Well No.: SB-14
Drilling Contractor: Maxim Technologies	Drilling Rig Make/Model: CME 75	Date/Time Started: 6/15/99 1110
		Date/Time Finished:
Logged By: J. Donovan, T Markham	Drilling Method: HSA	Screening Device (Type, make, model): HNU 101 PID 10.2 eV
Location (survey coord):	Ground El.:	Total Depth:
Bedrock Depth:	Water Table Depth:	Borehole Diameter: 8 inches

Depth (ft)	Sample Interval	Sample Number	Blows/ 6-in.	Rec. (in.)	Lithologic Description	USCS Class.	PID/FID (ppm)
	2-4		8 8 7 12	24	2" top soil. 22" gray silty/clay with trace sand, dry.	CL	0
4							

Penetration Resistance

Granular Soils Blows/ft	Granular Soils Density	Cohesive Soils Blows/ft	Cohesive Soils Density
<4	V. Loose	<2	V. Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	M. Dense	4 - 8	M. Stiff
30 - 50	Dense	8 - 15	Stiff
>50	V. Dense	15 - 30	V. Stiff
		>50	Hard

Proportions
Trace: 0 - 10%
Little: 10 - 20%
Some: 20 - 35%
And: 35 - 50%

Water Content
D - Dry
M - Moist
W - Wet

Notes and Comments:

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Boring Log

Client/Project/Contract No.:	Page 1 of 1
Stratton ANGB/97030.31 Site 6	
Sampler Type/Size: 2 ft Split Spoon	Boring/Well No.: SB-15

Drilling Contractor:	Drilling Rig Make/Model:		Date/Time Started	Date/Time Finished
Maxim Technologies	CME 75		6/15/99 1128	
Logged By: J. Donovan, T Markham	Drilling Method: HSA		Screening Device (Type, make, model): HNU 101 PID 10.2 eV	
Location (survey coord):	Ground El.:	Total Depth:	Bedrock Depth:	Water Table Depth:	Borehole Diameter: 8 inches

Depth (ft)	Sample Interval	Sample Number	Blows/ 6-in.	Rec. (in.)	Lithologic Description	USCS Class.	PID/FID (ppm)
	2-4		11 15 11 8	12	2" top soil. 10" gray silty/clay with trace sand, dry.	CL	0
4							

Penetration Resistance

Granular Soils Blows/ft	Granular Soils Density	Cohesive Soils Blows/ft	Cohesive Soils Density
<4	V. Loose	<2	V. Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	M. Dense	4 - 8	M. Stiff
30 - 50	Dense	8 - 15	Stiff
>50	V. Dense	15 - 30	V. Stiff
		>50	Hard

Proportions

Trace: 0 - 10%
Little: 10 - 20%
Some: 20 - 35%
And: 35 - 50%

Water Content

D - Dry
M - Moist
W - Wet

Notes and Comments:

ANEPTEK CORPORATION
Boring Log

Client/Project/Contract No.: Stratton ANGB/97030.31 Site 6			Page 1 of 1
Sampler Type/Size: 2 ft Split Spoon			Boring/Well No.: SB-16
Drilling Contractor: Maxim Technologies	Drilling Rig Make/Model: CME 75	Date/Time Started: 6/15/99 0940	Date/Time Finished:
Logged By: J. Donovan, T Markham	Drilling Method: HSA	Screening Device (Type, make, model): HNU 101 PID 10.2 eV	
Location (survey coord):	Ground El.: / Total Depth: / Bedrock Depth:	Water Table Depth:	Borehole Diameter: 8 inches

Depth (ft)	Sample Interval	Sample Number	Blows/ 6-in.	Rec. (in.)	Lithologic Description	USCS Class.	PID/FID (ppm)
	2-4		6 8 6 12	20	6" top soil. 14" gray silty/clay with trace sand, dry.	CL	0
4							

Penetration Resistance

Granular Soils Blows/ft	Granular Soils Density	Cohesive Soils Blows/ft	Cohesive Soils Density
<4	V. Loose	<2	V. Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	M. Dense	4 - 8	M. Stiff
30 - 50	Dense	8 - 15	Stiff
>50	V. Dense	15 - 30	V. Stiff
		>50	Hard

Proportions
Trace: 0 - 10%
Little: 10 - 20%
Some: 20 - 35%
And: 35 - 50%

Water Content
D - Dry
M - Moist
W - Wet

Notes and Comments:

ANEPTEK CORPORATION

Boring Log

Client/Project/Contract No.:	Stratton ANGB/97030.31 Site 6	Page 1 of 1
Sampler Type/Size:	2 ft Split Spoon	Boring/Well No.: TW-1

Drilling Contractor:	Drilling Rig Make/Model:	Date/Time Started	Date/Time Finished
Maxim Technologies	CME 75	4/13/1999 1444	

Logged By:	Drilling Method:	Screening Device (Type, make, model):
J. Donovan, T Markham	Air Rotary/Split Spoon to Refusal	HNU 101 PID 10.2 eV

Location (survey coord):	Ground El.:	Total Depth:	Bedrock Depth:	Water Table Depth:	Borehole Diameter:
			7.8ft		8 inches

Depth (ft)	Sample Interval	Sample Number	Blows/ 6-in.	Rec. (in.)	Lithologic Description	USCS Class.	PID/FID (ppm)
5	5-7		6 8 15 25	13	2" moist clay 6" silty clay 5" weathered shale in nose	CL	0
7	7-7.8		60 100/3	4	Brown silty clay Refusal at 7.8 ft	CL	0
7.8							

Penetration Resistance				Proportions	Notes and Comments:
Granular Soils		Cohesive Soils		Trace: 0 - 10%	
Blows/ft	Density	Blows/ft	Density	Little: 10 - 20%	
<4	V. Loose	<2	V. Soft	Some: 20 - 35%	
4 - 10	Loose	2 - 4	Soft	And: 35 - 50%	
10 - 30	M. Dense	4 - 8	M. Stiff	Water Content	
30 - 50	Dense	8 - 15	Stiff	D - Dry	
>50	V. Dense	15 - 30	V. Stiff	M - Moist	
		>50	Hard	W - Wet	

ANEPTEK CORPORATION

Boring Log

Client/Project/Contract No.: Stratton ANGB/97030.31 Site 6		Page 1 of 1
Sampler Type/Size: 2 ft Split Spoon		Boring/Well No.: TW-2
Drilling Contractor: Maxim Technologies	Drilling Rig Make/Model: CME 75	Date/Time Started: 4/15/1999 1203
		Date/Time Finished:
Logged By: J. Donovan, T Markham	Drilling Method: HSA/Split Spoon to Refusal	Screening Device (Type, make, model): HNU 101 PID 10.2 eV
Location (survey coord):	Ground El.: / Total Depth: / Bedrock Depth: 7.6 ft	Water Table Depth: / Borehole Diameter: 8 inches

Depth (ft)	Sample Interval	Sample Number	Blows/ 6-in.	Rec. (in.)	Lithologic Description	USCS Class.	PID/FID (ppm)
4	4-6		4 5 7 4	12	10" light brown soil mixed with light grey sand, dry and hard 2" weathered shale in nose Petroleum odor	CL SH	110ppm on soil 50ppm at top of hole
6	6-7.6		7 20 35 100/1	18	8" Brown soil, slightly moist 8" highly fractured light grey shale, wet 2" fractured shale in nose	CL SH	180ppm on shale
7.6							

Penetration Resistance

Granular Soils Blows/ft	Granular Soils Density	Cohesive Soils Blows/ft	Cohesive Soils Density
<4	V. Loose	<2	V. Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	M. Dense	4 - 8	M. Stiff
30 - 50	Dense	8 - 15	Stiff
>50	V. Dense	15 - 30	V. Stiff
		>50	Hard

Proportions

Trace: 0 - 10%
Little: 10 - 20%
Some: 20 - 35%
And: 35 - 50%

Water Content

D - Dry
M - Moist
W - Wet

Notes and Comments:

ANEPTEK CORPORATION
Boring Log

Client/Project/Contract No.: Stratton ANGB/97030.31 Site 6			Page 1 of 1
Sampler Type/Size: 2 ft Split Spoon			Boring/Well No.: TW-3
Drilling Contractor: Maxim Technologies	Drilling Rig Make/Model: CME 75	Date/Time Started: 4/15/1999 0931	Date/Time Finished:
Logged By: J. Donovan, T Markham	Drilling Method: Air Rotary/Split Spoon to Refusal	Screening Device (Type, make, model): HNU 101 PID 10.2 eV	
Location (survey coord):	Ground El.: / Total Depth: / Bedrock Depth: 7.4ft	Water Table Depth:	Borehole Diameter: 8 inches

Depth (ft)	Sample Interval	Sample Number	Blows/ 6-in.	Rec. (in.)	Lithologic Description	USCS Class.	PID/FID (ppm)
5	5-7		7 4 9 19	20	5" light brown soil 4" moist clay 6" silty clay 5" weathered shale in nose	CL SH	0
7	7-7.4		100/4	4	Brown silty clay Refusal at 7.4 ft	CL SH	0
7.4							

Penetration Resistance				Proportions	Notes and Comments:
Granular Soils		Cohesive Soils		Trace: 0 - 10%	
Blows/ft	Density	Blows/ft	Density	Little: 10 - 20%	
<4	V. Loose	<2	V. Soft	Some: 20 - 35%	
4 - 10	Loose	2 - 4	Soft	And: 35 - 50%	
10 - 30	M. Dense	4 - 8	M. Stiff	Water Content	
30 - 50	Dense	8 - 15	Stiff	D - Dry	
>50	V. Dense	15 - 30	V. Stiff	M - Moist	
		>50	Hard	W - Wet	

ANEPTEK CORPORATION

Boring Log

Client/Project/Contract No.: Stratton ANGB/97030.31 Site 6		Page 1 of 1
Sampler Type/Size: 2 ft Split Spoon		Boring/Well No.: TW-4
Drilling Contractor: Maxim Technologies	Drilling Rig Make/Model: CME 75	Date/Time Started: 4/13/99
		Date/Time Finished:
Logged By: J. Donovan, T Markham	Drilling Method: Air Rotary/Split Spoon to Refusal	Screening Device (Type, make, model): HNU 101 PID 10.2 eV
Location (survey coord):	Ground El.: / Total Depth: / Bedrock Depth: 7.6 ft	Water Table Depth: / Borehole Diameter: 8 inches

Depth (ft)	Sample Interval	Sample Number	Blows/ 6-in.	Rec. (in.)	Lithologic Description	USCS Class.	PID/FID (ppm)
4	4-6		3 8 7 7	8	Brown Clay, Silt Moist	CL	0
6	6-7.6		7 14 50 100/1	13	Weathered Shale (saturated) Refusal at 7.6 ft	SH	0
7.6							

Penetration Resistance			
Granular Soils		Cohesive Soils	
Blows/ft	Density	Blows/ft	Density
<4	V. Loose	<2	V. Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	M. Dense	4 - 8	M. Stiff
30 - 50	Dense	8 - 15	Stiff
>50	V. Dense	15 - 30	V. Stiff
		>50	Hard

Proportions
- Trace: 0 - 10%
- Little: 10 - 20%
- Some: 20 - 35%
- And: 35 - 50%

Water Content
- D - Dry
- M - Moist
- W - Wet

Notes and Comments:

ANEPTEK CORPORATION

Boring Log

Client/Project/Contract No.: Stratton ANGB/97030.31 Site 6			Page 1 of 1
Sampler Type/Size: 2 ft Split Spoon			Boring/Well No.: TW-5
Drilling Contractor: Maxim Technologies	Drilling Rig Make/Model: CME 75	Date/Time Started: 4/12/1999 1628	Date/Time Finished:
Logged By: J. Donovan, T Markham	Drilling Method: Air Rotary/Split Spoon to Refusal	Screening Device (Type, make, model): HNU 101 PID 10.2 eV	
Location (survey coord):	Ground El.: / Total Depth: / Bedrock Depth: 8.0 ft	Water Table Depth:	Borehole Diameter: 8 inches

Depth (ft)	Sample Interval	Sample Number	Blows/ 6-in.	Rec. (in.)	Lithologic Description	USCS Class.	PID/FID (ppm)
4	4.0-6.0		4 6 12 22	10	4"Top brown clay/silt 3" grey silty clay Bottom 3 grey fractured shale	CL	0
6	6.0-8.0		15 18 25 100/6	11	10" Brown clayey silt, wet Bottom 1" fractured shale. Refusal @ 8.0 ft	CL SH	0
8.0							

Penetration Resistance

Granular Soils Blows/ft	Granular Soils Density	Cohesive Soils Blows/ft	Cohesive Soils Density
<4	V. Loose	<2	V. Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	M. Dense	4 - 8	M. Stiff
30 - 50	Dense	8 - 15	Stiff
>50	V. Dense	15 - 30	V. Stiff
		>50	Hard

Proportions

Trace: 0 - 10%
Little: 10 - 20%
Some: 20 - 35%
And: 35 - 50%

Water Content

D - Dry
M - Moist
W - Wet

Notes and Comments:

ANEPTEK CORPORATION
Boring Log

Client/Project/Contract No.:	Stratton ANGB/97030.31 Site 6
Sampler Type/Size:	2 ft Split Spoon
Boring/Well No.:	TW-6
Drilling Contractor:	Maxim Technologies
Drilling Rig Make/Model:	CME 75
Date/Time Started	4/14/1999 1620
Date/Time Finished	
Logged By:	J. Donovan, T Markham
Drilling Method:	Air Rotary/Split Spoon to Refusal
Screening Device (Type, make, model):	HNU 101 PID 10.2 eV
Location (survey coord):	
Ground El.:	
Total Depth:	
Bedrock Depth:	6.6 ft
Water Table Depth:	
Borehole Diameter:	8 inches

Depth (ft)	Sample Interval	Sample Number	Blows/ 6-in.	Rec. (in.)	Lithologic Description	USCS Class.	PID/FID (ppm)
5	5.0-6.6		4 4 30 100/1	13	5"brown clay/silt Bottom 5" highly fractured shale, wet Refusal @ 6.6 ft	CL SH	0
7							

Penetration Resistance

Granular Soils Blows/ft	Granular Soils Density	Cohesive Soils Blows/ft	Cohesive Soils Density
<4	V. Loose	<2	V. Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	M. Dense	4 - 8	M. Stiff
30 - 50	Dense	8 - 15	Stiff
>50	V. Dense	15 - 30	V. Stiff
		>50	Hard

Proportions

Trace: 0 - 10%
Little: 10 - 20%
Some: 20 - 35%
And: 35 - 50%

Water Content

D - Dry
M - Moist
W - Wet

Notes and Comments:

ANEPTEK CORPORATION

Boring Log

Client/Project/Contract No.: Stratton ANGB/97030.31 Site 6			Page 1 of 1
Sampler Type/Size: 2 ft Split Spoon			Boring/Well No.: TW-7
Drilling Contractor: Maxim Technologies	Drilling Rig Make/Model: CME 75	Date/Time Started: 4/16/1999 1237	Date/Time Finished:
Logged By: J. Donovan, T Markham	Drilling Method: Air Rotary/Split Spoon to Refusal	Screening Device (Type, make, model): HNU 101 PID 10.2 eV	
Location (survey coord):	Ground El.: / Total Depth: / Bedrock Depth: 8.0 ft	Water Table Depth:	Borehole Diameter: 8 inches

Depth (ft)	Sample Interval	Sample Number	Blows/ 6-in.	Rec. (in.)	Lithologic Description	USCS Class.	PID/FID (ppm)
0			8 7 7 7	0			0
2			6 6 11 13	16	Brown Clayey silt	CL	0
4			5 8 9 10	18	Same as above	CL	0
6			10 12 13 20	24	19" Brown, clayey soil to 5". Fractured weathered shale, wet. No odor, refusal	CL SH	1
8							

Penetration Resistance

Granular Soils Blows/ft	Granular Soils Density	Cohesive Soils Blows/ft	Cohesive Soils Density
<4	V. Loose	<2	V. Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	M. Dense	4 - 8	M. Stiff
30 - 50	Dense	8 - 15	Stiff
>50	V. Dense	15 - 30	V. Stiff
		>50	Hard

Proportions
Trace: 0 - 10%
Little: 10 - 20%
Some: 20 - 35%
And: 35 - 50%

Water Content
D - Dry
M - Moist
W - Wet

Notes and Comments:

ANEPTEK CORPORATION

Boring Log

Client/Project/Contract No.:	Stratton ANGB/97030.31 Site 6
Page	1 of 1
Sampler Type/Size:	2 ft Split Spoon
Boring/Well No.:	TW-8
Drilling Contractor:	Maxim Technologies
Drilling Rig Make/Model:	CME 75
Date/Time Started	4/20/1999 0953
Date/Time Finished	
Logged By:	J. Donovan, T Markham
Drilling Method:	Air Rotary/Split Spoon to Refusal
Screening Device (Type, make, model):	HNU 101 PID 10.2 eV
Location (survey coord):	
Ground El.:	
Total Depth:	
Bedrock Depth:	7.7 ft
Water Table Depth:	
Borehole Diameter:	8 inches

Depth (ft)	Sample Interval	Sample Number	Blows/ 6-in.	Rec. (in.)	Lithologic Description	USCS Class.	PID/FID (ppm)
4	4.0-6.0		3 8 10 11	12	Top brown clay/silt Bottom 3 grey fractured shale 1 ppm on shale	CL SH	1
6	6.0-7.7		13 25 100/1	13	Some weathered shale 2". 2" - 10" Brown clayey silt, wet Bottom 2" fractured shale. Refusal @ 7.7 ft	CL SH	1
7.7							

Penetration Resistance

Granular Soils		Cohesive Soils	
Blows/ft	Density	Blows/ft	Density
<4	V. Loose	<2	V. Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	M. Dense	4 - 8	M. Stiff
30 - 50	Dense	8 - 15	Stiff
>50	V. Dense	15 - 30	V. Stiff
		>50	Hard

Proportions

Trace: 0 - 10%
Little: 10 - 20%
Some: 20 - 35%
And: 35 - 50%

Water Content

D - Dry
M - Moist
W - Wet

Notes and Comments:

ANEPTEK CORPORATION

Boring Log

Client/Project/Contract No.:	Stratton ANGB/97030.31 Site 6
Page	1 of 1
Sampler Type/Size:	2 ft Split Spoon
Boring/Well No.:	TW-9
Drilling Contractor:	Maxim Technologies
Drilling Rig Make/Model:	CME 75
Date/Time Started	4/20/1999 1224
Date/Time Finished	
Logged By:	J. Donovan, T Markham
Drilling Method:	Air Rotary/Split Spoon to Refusal
Screening Device (Type, make, model):	HNU 101 PID 10.2 eV
Location (survey coord):	
Ground El.:	
Total Depth:	
Bedrock Depth:	6.8 ft
Water Table Depth:	
Borehole Diameter:	8 inches

Depth (ft)	Sample Interval	Sample Number	Blows/ 6-in.	Rec. (in.)	Lithologic Description	USCS Class.	PID/FID (ppm)
4	4.0-6		3 4 3 2	6	Brown sandy soil, 1/2" fractured, snale in nose, wet	SC	0
6	6.0-6.8		2 100/3	10	4" Brown silty clay to 6 " Fractured shale, little gravel	CL	1
##					Refusal @ 6.8 ft		

Penetration Resistance

Granular Soils Blows/ft	Granular Soils Density	Cohesive Soils Blows/ft	Cohesive Soils Density
<4	V. Loose	<2	V. Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	M. Dense	4 - 8	M. Stiff
30 - 50	Dense	8 - 15	Stiff
>50	V. Dense	15 - 30	V. Stiff
		>50	Hard

Proportions

Trace: 0 - 10%
Little: 10 - 20%
Some: 20 - 35%
And: 35 - 50%

Water Content

D - Dry
M - Moist
W - Wet

Notes and Comments:

ANEPTEK CORPORATION

Boring Log

Client/Project/Contract No.: Stratton ANGB/97030.31 Site 6		Page 1 of 1
Sampler Type/Size: 2 ft Split Spoon		Boring/Well No.: TW-10
Drilling Contractor: Maxim Technologies	Drilling Rig Make/Model: CME 75	Date/Time Started: 4/14/1999 0837
Date/Time Finished:		
Logged By: J. Donovan, T Markham	Drilling Method: HSA/Split Spoon to Refusal	Screening Device (Type, make, model): HNU 101 PID 10.2 eV
Location (survey coord):	Ground El.:	Total Depth:
Bedrock Depth: 9.6 ft	Water Table Depth:	Borehole Diameter: 8 inches

Depth (ft)	Sample Interval	Sample Number	Blows/ 6-in.	Rec. (in.)	Lithologic Description	USCS Class.	PID/FID (ppm)
5	5.0-7.0		6 7 10 6	8	Brown clayey silt Bottom 2" damp	CL	0
7	7.0-9.0		2 100/3	12	Same as above Bottom 4" moist, bits of fractured shale	CL SH	1
9.0 9.6	9.0-11.0		33	10	Top 2" light brown clay/silt Bottom 8" grey shale, No moisture	CL SH	

Penetration Resistance

Granular Soils Blows/ft	Granular Soils Density	Cohesive Soils Blows/ft	Cohesive Soils Density
<4	V. Loose	<2	V. Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	M. Dense	4 - 8	M. Stiff
30 - 50	Dense	8 - 15	Stiff
>50	V. Dense	15 - 30	V. Stiff
		>50	Hard

Proportions

Trace: 0 - 10%
Little: 10 - 20%
Some: 20 - 35%
And: 35 - 50%

Water Content

D - Dry
M - Moist
W - Wet

Notes and Comments:

ANEPTEK CORPORATION

Boring Log

Client/Project/Contract No.:	Stratton ANGB/97030.31 Site 6
Page	1 of 1
Sampler Type/Size:	2 ft Split Spoon
Boring/Well No.:	TW-11
Drilling Contractor:	Maxim Technologies
Drilling Rig Make/Model:	CME 75
Date/Time Started	4/14/1999 1122
Date/Time Finished	
Logged By:	J. Donovan, T Markham
Drilling Method:	HSA/Split Spoon to Refusal
Screening Device (Type, make, model):	HNU 101 PID 10.2 eV
Location (survey coord):	
Ground El.:	
Total Depth:	
Bedrock Depth:	10.3 ft
Water Table Depth:	
Borehole Diameter:	8 inches

Depth (ft)	Sample Interval	Sample Number	Blows/ 6-in.	Rec. (in.)	Lithologic Description	USCS Class.	PID/FID (ppm)
9.5			13 100/3	8	8" weathered shale, trace of moisture Refusal at 10.3 ft	SH	0
10.3							

Penetration Resistance

Granular Soils Blows/ft	Granular Soils Density	Cohesive Soils Blows/ft	Cohesive Soils Density
<4	V. Loose	<2	V. Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	M. Dense	4 - 8	M. Stiff
30 - 50	Dense	8 - 15	Stiff
>50	V. Dense	15 - 30	V. Stiff
		>50	Hard

Proportions

Trace: 0 - 10%
Little: 10 - 20%
Some: 20 - 35%
And: 35 - 50%

Water Content

D - Dry
M - Moist
W - Wet

Notes and Comments:

ANEPTEK CORPORATION
Boring Log

Client/Project/Contract No.: Stratton ANGB/97030.31 Site 6			Page 1 of 1
Sampler Type/Size: 2 ft Split Spoon			**Boring/Well No.:** TW-12
Drilling Contractor: Maxim Technologies	**Drilling Rig Make/Model:** CME 75	**Date/Time Started** 4/21/1999 0836	**Date/Time Finished**
Logged By: J. Donovan, T Markham	**Drilling Method:** HSA/Split Spoon to Refusal	**Screening Device (Type, make, model):** HNU 101 PID 10.2 eV	
Location (survey coord):	**Ground El.:** / **Total Depth:** / **Bedrock Depth:** 6.8 ft	**Water Table Depth:**	**Borehole Diameter:** 8 inches

Depth (ft)	Sample Interval	Sample Number	Blows/ 6-in.	Rec. (in.)	Lithologic Description	USCS Class.	PID/FID (ppm)
4	4.0-6.0		2 1 1 5	8	6" Brown sandy soil to 2", fractured shale, wet, in nose	CL	0
6.0 6.8	6.0-6.8		16 100/2	6	4" brown sandy soil, wet w/ trace of gravel to 2 " Fractured shale in nose	CL SH	

Penetration Resistance

Granular Soils Blows/ft	Density	Cohesive Soils Blows/ft	Density
<4	V. Loose	<2	V. Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	M. Dense	4 - 8	M. Stiff
30 - 50	Dense	8 - 15	Stiff
>50	V. Dense	15 - 30	V. Stiff
		>50	Hard

Proportions

Trace: 0 - 10%
Little: 10 - 20%
Some: 20 - 35%
And: 35 - 50%

Water Content

D - Dry
M - Moist
W - Wet

Notes and Comments:

ANEPTEK CORPORATION
Boring Log

Client/Project/Contract No.:	Stratton ANGB/97030.31 Site 6
Sampler Type/Size:	2 ft Split Spoon
Boring/Well No.:	TW-13
Drilling Contractor:	Maxim Technologies
Drilling Rig Make/Model:	CME 75
Date/Time Started	4/21/1999 0836
Date/Time Finished	
Logged By:	J. Donovan, T Markham
Drilling Method:	HSA/Split Spoon to Refusal
Screening Device (Type, make, model):	HNU 101 PID 10.2 eV
Location (survey coord):	
Ground El.:	
Total Depth:	
Bedrock Depth:	6.3 ft
Water Table Depth:	
Borehole Diameter:	8 inches

Depth (ft)	Sample Interval	Sample Number	Blows/ 6-in.	Rec. (in.)	Lithologic Description	USCS Class.	PID/FID (ppm)
4	4.0-6.0		4 7 20 34	8	Top 12" Brown clayey silt, bottom 6" grey fractured shale top 5" moist	CL SH	1
6.0 6.3	6.0-6.3		100/3	6	Saturated grey clayey silt Refusal @ 6.3 ft	CL	0

Penetration Resistance				Proportions
Granular Soils		Cohesive Soils		Trace: 0 - 10%
Blows/ft	Density	Blows/ft	Density	Little: 10 - 20%
<4	V. Loose	<2	V. Soft	Some: 20 - 35%
4 - 10	Loose	2 - 4	Soft	And: 35 - 50%
10 - 30	M. Dense	4 - 8	M. Stiff	Water Content
30 - 50	Dense	8 - 15	Stiff	D - Dry
>50	V. Dense	15 - 30	V. Stiff	M - Moist
		>50	Hard	W - Wet

Notes and Comments:

ANEPTEK CORPORATION

Boring Log

Client/Project/Contract No.: Stratton ANGB/97030.31 Site 6		
Sampler Type/Size: 2 ft Split Spoon		Boring/Well No.: TW-14

Drilling Contractor: Maxim Technologies	Drilling Rig Make/Model: CME 75	Date/Time Started: 5/11/1999 1006	Date/Time Finished:
Logged By: J. Donovan, T Markham	Drilling Method: HSA/Split Spoon to Refusal	Screening Device (Type, make, model): HNU 101 PID 10.2 eV	
Location (survey coord):	Ground El.: / Total Depth: / Bedrock Depth: 8.8 ft	Water Table Depth:	Borehole Diameter: 8 inches

Depth (ft)	Sample Interval	Sample Number	Blows/ 6-in.	Rec. (in.)	Lithologic Description	USCS Class.	PID/FID (ppm)
4	4.0-6.0		4 10 11 9	20	Light brown silty clay to nose	CL	0
6.0	6.0-8.0		10 12 23 22	6	4" fractured shale to 2" brown silty clay w/ trace of fractured shale	SH CL	0
8.0	8.8-8.8		15 100/2	4	Silty brown clay w/trace of fractured shale. 2" fractured shale in nose	CL SH	0
8.8							

Penetration Resistance				Proportions	Notes and Comments:
Granular Soils		Cohesive Soils		Trace: 0 - 10%	
Blows/ft	Density	Blows/ft	Density	Little: 10 - 20%	
<4	V. Loose	<2	V. Soft	Some: 20 - 35%	
4 - 10	Loose	2 - 4	Soft	And: 35 - 50%	
10 - 30	M. Dense	4 - 8	M. Stiff	Water Content	
30 - 50	Dense	8 - 15	Stiff	D - Dry	
>50	V. Dense	15 - 30	V. Stiff	M - Moist	
		>50	Hard	W - Wet	

ANEPTEK CORPORATION

Boring Log

Client/Project/Contract No.: Stratton ANGB/97030.31 Site 6		Page 1 of 1
Sampler Type/Size: 2 ft Split Spoon		Boring/Well No.: TW-15

Drilling Contractor:	Drilling Rig Make/Model:			Date/Time Started	Date/Time Finished
Maxim Technologies	CME 75			5/11/1999 1220	
Logged By:	**Drilling Method:**			**Screening Device (Type, make, model):**	
J. Donovan, T Markham	Air Rotary/Split Spoon to Refusal			HNU 101 PID 10.2 eV	
Location (survey coord):	**Ground El.:**	**Total Depth:**	**Bedrock Depth:**	**Water Table Depth:**	**Borehole Diameter:**
			8.1 ft		8 inches

Depth (ft)	Sample Interval	Sample Number	Blows/ 6-in.	Rec. (in.)	Lithologic Description	USCS Class.	PID/FID (ppm)
4	4.0-6.0		2 4 7 4	10	6" brown sandy soil to 4" fractured shale	CL SH	0
6.0	6.0-8.0		5 8 17 23	20	18" light grey clay (fine) 2" fractured shale (highly fractured)	CL SH	0
8.0	8.0-8.1		30 100/4	8	1" light grey clay - 7" fractured shale, dry no odors	CL SH	0
8.1							

Penetration Resistance				Proportions
Granular Soils		Cohesive Soils		
Blows/ft	Density	Blows/ft	Density	
<4	V. Loose	<2	V. Soft	Trace: 0 - 10%
4 - 10	Loose	2 - 4	Soft	Little: 10 - 20%
10 - 30	M. Dense	4 - 8	M. Stiff	Some: 20 - 35%
30 - 50	Dense	8 - 15	Stiff	And: 35 - 50%
>50	V. Dense	15 - 30	V. Stiff	**Water Content**
		>50	Hard	D - Dry M - Moist W - Wet

Notes and Comments:

ANEPTEK CORPORATION

Boring Log

Client/Project/Contract No.: Stratton ANGB/97030.31 Site 6			Page 1 of 1
Sampler Type/Size: 2 ft Split Spoon			**Boring/Well No.:** TW-16
Drilling Contractor: Maxim Technologies	**Drilling Rig Make/Model:** CME 75	**Date/Time Started** 5/11/1999 1456	**Date/Time Finished**
Logged By: J. Donovan, T Markham	**Drilling Method:** Air Rotary/Split Spoon to Refusal	**Screening Device (Type, make, model):** HNU 101 PID 10.2 eV	
Location (survey coord):	**Ground El.:** **Total Depth:** **Bedrock Depth:** 6.9 ft	**Water Table Depth:**	**Borehole Diameter:** 8 inches

Depth (ft)	Sample Interval	Sample Number	Blows/ 6-in.	Rec. (in.)	Lithologic Description	USCS Class.	PID/FID (ppm)
4	4.0-6.0		4 5 10 18	14	Nose wet, top 6" clay brown/silt, bottom 8" fractured shale	CL	1
6.0	6.0-6.9		30 100/3	6	Saturated fractured shale	SH	0
6.9							

Penetration Resistance

Granular Soils Blows/ft	Granular Soils Density	Cohesive Soils Blows/ft	Cohesive Soils Density
<4	V. Loose	<2	V. Soft
4 - 10	Loose	2 - 4	Soft
10 - 30	M. Dense	4 - 8	M. Stiff
30 - 50	Dense	8 - 15	Stiff
>50	V. Dense	15 - 30	V. Stiff
		>50	Hard

Proportions
Trace: 0 - 10%
Little: 10 - 20%
Some: 20 - 35%
And: 35 - 50%

Water Content
D - Dry
M - Moist
W - Wet

Notes and Comments:

APPENDIX C

RI ROCK CORE LOGS

ANEPTEK Corporation	Project: Stratton ANGB	Project No.: 97030.31	Date/ Start Time: 10/8/98 @ 0800	Sheet 1 of 2
Rock Core Log	Contractor Personnel: J. Hammond, J. Vincent		Aneptek Personnel: J. Donovan, T. Markham	

Boring/Well Number:	Driller/Equipment:	Surface Elevation:	
Site 3/MW-3 Abandoned and Grouted	HQ Diamond Bit Casing Seated at 22.6 ft bgs	Depth to Bedrock:	8 ft bgs
		Date/Time Start:	10/8/98 @ 0800
		Date/Time Finish:	10/13/98 @ 1540

Depth	Comments: Coring Rate and Coring Fluid Loss	Core Run Length & Rec.(%)	Box No.	Discontinuities: RQD (%)	Discontinuities: Frac-tures per foot	Discontinuities: Description Tightness, Planarity Smoothness Filling, Staining Orientation	Lithology: Classification Minerology Color, Grain Size Hardness, Weathering	Graphic Log
22.6 ft 25 ft	1 ft = 8.5 min 2 ft = 7.5 min 3.5 = 10.7 min	3 ft 5 in 70%	1	92.5	3	Tight smooth, no staining No solutioning No calcification	Gray color, no evidence of weathering	No crack or irregular fractures. All fractures straight.
26 ft 31 ft	1 ft=7 min 2 ft = 7 min 3 ft = 6 min 4 ft = 6.04 pumped 5 ft = 6.1 pumped		1	89.2	1	Same as above	Same as above	Same as above
31 ft 36 ft	1 ft = 5 min 2 ft = 6 min 3 ft = 6 min 4 ft = 5.5 min 5 ft = 6 min	4.87 in 97%	2	90.6	1.6	Same as above	Same as above	4 inch fracture 180° @ 32 ft
36 ft 41 ft	1 ft = 6 min 2 ft = 6 min 3 ft = 7 min 4 ft = 7 min 5 ft = 6 min	4.91 ft 98.20%	2	100	1.6	Same as above	Same as above	3 fractures. All straight
41 ft 46 ft	1 ft = 5.5 min 2 ft = 6 min 3 ft = 6.5 min 4 ft = 7 min 5 ft = 6 min	5.12 ft 97.60%	3	94	0.85	Same as above	Same as above	At 42 ft 180° Fracture 5 in long At 42.5 180° Fracture 7.5 in long
46 ft 51 ft	1 ft = 6 min 2 ft = 5 min 3 ft = 5.5 min 4 ft = 6 min 5 ft = 5 min	5 ft 100%	3	93	1	Same as above	Same as above	
51 ft 56 ft	1 ft = 5 min 2 ft = 5 min 3 ft = 4 min 4 ft = 4.5 min 5 ft = 4 min	4.75 ft 95%	4	92.9	1.1	Same as above	Same as above	
56 ft 61 ft	1 ft = 4 min 2 ft = 4.5 min 3 ft = 4 min 4 ft = 4 min 5 ft = 4 min	5.12 ft 100%	4	100	1	Same as above	Same as above	
61 ft 66 ft	1 = 4 min 2 = 4 min 3 = 3.5 min 4 = 4 min 5 = 4 min	4.91 ft 98.20%	5	93.2	0.7	Same as above	Same as above	Straight 90° Fracture @ 64.15 ft 64.85 ft, 63.25 ft, 65.7 ft, 65.8 ft 65.9 ft
66 ft 71 ft	1 = 6 min 2 = 5min 3 = 5 min 4 = 5 min 5 = 5 min	5.2 ft 100%	5	91	1.04	Same as above	Same as above	

$$RQD = \frac{\text{length of all naturally fractured core} \geq 4 \text{ in. (10 cm.)}}{\text{length of the cored interval}}$$

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APPENDIX D

STANDARD OPERATING PROCEDURES

STANDARD OPERATING PROCEDURE No. 4
SUBSURFACE-SOIL SAMPLING

1.0 OBJECTIVE

The objective of this procedure is to define the requirements for the collection of soil samples with hand augers, Shelby tubes, split-spoon samplers or geoprobe direct-push type samplers.

2.0 BACKGROUND

For the purpose of this procedure, subsurface soil samples are considered to be those collected below a depth of 1 ft using a split-spoon, Shelby-tube or geoprobe soil sampler. Samples collected from the surface to a depth of 1 ft are addressed in Standard Operating Procedure (SOP) No. 3, "Surface Soil Sampling".

Shallow soil samples (to depths of 10 ft) may be collected using hand augers. However, soil samples collected with a hand auger are commonly of poorer quality than those collected by split-spoon or Shelby-tube samplers. Hand-augered samples should not be used for projects requiring Data Quality Objective (DQO) Level III or IV quality assurance/quality control.

Split-spoon and Shelby-tube samplers are driven into undisturbed soil by percussion or hydraulically pushed through hollow-stem augers. Split-spoon and Shelby-tube samplers collect the sample in an enclosed tube, which prevents mixing and contamination by soils uphole. Geoprobe samplers are pushed by percussion hammering into soils in a borehole created by the geoprobe. Geoprobes are used at sites where conditions permit use of direct push samplers and generation of waste should be minimized. When collecting samples at U.S. Environmental Protection Agency (EPA) Superfund regulated sites for volatile organic compounds (VOCs) at EPA DQO Level III or IV, liners must be used.

3.0 RESPONSIBILITIES

Site Manager: The Site Manager is responsible for ensuring that field personnel are trained in the use of this procedure and for verifying that subsurface soil samples are collected in accordance with this procedure.

Project Field Geologist/Engineer: The Project Field Geologist/Engineer is responsible for complying with this procedure.

4.0 REQUIRED EQUIPMENT

4.1 GENERAL

- Site-specific sampling plan.
- Field logbook.
- Indelible black-ink pens and markers.
- Sample tags/labels and appropriate forms/documentation.
- Appropriate sample containers.
- Insulated cooler(s).
- Latex gloves.
- Plastic zip-top bags and waterproof sealing tape.
- Rinse bottles and deionized or distilled water.
- Decontamination equipment and supplies.
- Personnel protective equipment as required by the site-specific health and safety plan.
- Plastic sheeting.
- Chain-of-custody and security seals.
- Appropriate equipment and meters for obtaining field measurements specified in the site-specific sampling plan.

4.2 MANUAL (HAND) AUGERING

- Hand auger: flighted-, bucket-, or tube-type auger as required by the site-specific work plan.
- Extension rods, as needed.
- Wrench(es), plier(s).

4.3 SPLIT-SPOON AND SHELBY-TUBE SAMPLING

- Drill rig equipped with a 140-lb drop hammer and sufficient hollow-stem augers to drill to the depths required by the site-specific work plan.
- Sufficient numbers of split-spoon or Shelby-tube samplers so that at least one is always decontaminated and available for sampling.
- Sample containers, labels or tags, and required chain-of-custody forms.
- Decontamination supplies.
- Personnel protective equipment as required by the site-specific health and safety plan.

4.4 GEOPROBE DIRECT PUSH SAMPLING

- Geoprobe rig equipped with a percussion driving system of sufficient power and sufficient drive rods to advance the sampler to the depths required by the site-specific work plan.
- Sufficient numbers of geoprobe soil samplers so that at least one is always decontaminated and available for sampling.
- Sample containers, labels or tags, and required chain-of-custody forms.
- Decontamination supplies.
- Personnel protective equipment as required by the site-specific health and safety plan.

5.0 PROCEDURES

The following steps must be followed when collecting hand-augered samples:

1. Survey and stake the location(s) to be sampled. The survey should include horizontal location and elevation relative to mean sea level or other specified data. Horizontal and vertical measurements by surveying may occur before or after the sampling event, if applicable.
2. Clear vegetation and other debris from the surface around the boring location.
3. Put on personnel protective clothing and equipment as required by the site-specific health and safety plan.
4. Prepare an area next to the sample collection location by laying plastic sheeting on the ground or over the work area.
5. Set up the decontamination line.
6. Begin augering to the depth required for sampling. Place cuttings as specified in the Field Sampling and Analysis Plan (FSAP) or Quality Assurance Project Plan (QAPP). If possible, lay out cuttings in stratigraphic order.
7. While augering, make detailed notes concerning the geologic features of the soil or sediments in the field logbook.
8. Stop drilling at the top of the specified or selected sampling depth. Remove the auger from the hole and decontaminate according to SOP 13. Then either use a fresh auger or the decontaminated original auger to obtain a sample.
9. Place the sample in the appropriate container, label it, and store it in a cooler. Note the sample identification number, depth from which sample was taken, and analyses requested in the field logbook and on the appropriate forms.
10. Proceed with further sampling, as required by the site-specific FSAP or QAPP.
11. When all sampling is completed, dispose of cuttings as specified in the FSAP or QAPP.
12. Decontaminate all equipment according to SOP 13.
13. Remove plastic sheeting and place in the designated receptacle.
14. Complete the field logbook entry and soil boring log per SOPs 8 and 9.

(Note: The above is a DQO Level B sampling methodology for VOCs and Level C and D for all other analytes.)

5.1 SPLIT-SPOON SAMPLING

The following steps must be followed when collecting samples with the split spoon:

1. Survey and stake the location(s) to be sampled. The survey should include horizontal location and elevation relative to mean sea level or other specified data.
2. Clear vegetation and debris from the ground surface. Remove any pavement and subbase material from an area of twice the bit diameter, if necessary.
3. Set up the decontamination line for split spoons and other small sampling equipment. The drilling rig will be decontaminated according to SOP 13 at a separate location.
4. Attach the hollow-stem auger with the cutting head and center rod(s).
5. Put on personnel protective clothing and equipment as required by the site-specific health and safety plan.
6. Begin drilling and proceed to the first sample depth.
7. Slightly raise the auger flight(s) to disengage the cutting head and rotate without advancement to clean cuttings from the bottom of the hole.
8. Remove the plug and center rods.
9. Install a decontaminated split spoon on the center rod(s) and insert into the hollow-stem auger. Connect the hammer assembly and lightly tap the rods to seat the drive shoe at the top of undisturbed soil or sediment.
10. Mark the center rod in 6-in. increments from the top of the auger flight(s).
11. Drive the spoon using the hammer. Use a full 30-in. drop as specified by the American Society for Testing and Materials (ASTM) Method D-1586. Record the number of blows required to drive the spoon or tube through each 6-in. increment.
12. Cease driving when the full length of the spoon has been driven or upon refusal. Refusal occurs when little (<3 in.) or no progress is made for 100 blows of the hammer.
13. Pull the spoon or tube free by using upswings of the hammer to loosen the sampler. Pull out the center rod and spoon.
14. Unscrew the split-spoon assembly from the center rod and place it on the sampling table.
15. Remove the drive shoe and head assembly. If necessary, tap the split-spoon assembly with a hammer to loosen threaded couplings.
16. With the drive shoe and head assembly off, split the spoons, being careful not to disturb the sample.
17. Describe the sample in detail in the field logbook and on the boring log form

per SOPs 8 and 9, then remove enough soil to fill the required sample containers. Seal, label, and store samples as required by the site-specific work plan. (Note: if volatile organic analyses are to be conducted on the soil sample, place the sample in the sample container first, then describe it in the field logbook and on the boring log form.)

18. Continue to advance the borehole to the next sampling point. Collect samples as outlined above.
19. When sampling is complete, remove the drilling rig to the heavy equipment decontamination site.
20. Dispose of cuttings as specified in the FSAP or QAPP.
21. Decontaminate split spoons and other small sampling equipment according to SOP 13.
22. Note all relevant information in the field logbook before leaving the site.

5.2 SPLIT-SPOON SAMPLING USING LINERS

The following steps must be followed when collecting samples with a split spoon with liners:

1. Survey and stake the location(s) to be sampled. The survey should include horizontal location and elevation relative to mean sea level or other specified data.
2. Clear vegetation and debris from the ground surface. Remove any pavement and subbase material from an area of twice the bit diameter, if necessary.
3. Set up the decontamination line for split spoons and other small sampling equipment. The drilling rig will be decontaminated according to SOP 13 at a separate location.
4. Attach the hollow-stem auger with the cutting head and center rod(s).
5. Put on personnel protective clothing and equipment as required by the site-specific health and safety plan.
6. Begin drilling and proceed to the first sample depth.
7. Slightly raise the auger flight(s) to disengage the cutting head and rotate without advancement to clean the bottom of the hole of cuttings.
8. Remove the plug and center rods.
9. Install a decontaminated Teflon or stainless steel liner in the split-spoon barrel.
10. Install a decontaminated split spoon on the center rod(s) and insert into the hollow-stem auger. Connect the hammer assembly and lightly tap the rods to seat the drive shoe at the top of undisturbed soil or sediment.
11. Mark the center rod in 6-in. increments from the top of the auger flight(s).
12. Drive the spoon using the hammer. Use a full 30-in. drop as specified by ASTM Method D-1586. Record the number of blows required to drive the spoon or tube through each 6-in. increment.
13. Cease driving when the full length of the spoon has been driven or upon refusal.

Refusal occurs when little (<3 in.) or no progress is made after 100 blows of the hammer.

14. Pull the spoon or tube free by using upswings of the hammer to loosen the sampler. Pull out center rod and spoon or tube.
15. Unscrew the split-spoon assembly from the center road and place it on the sampling table.
16. Remove the drive shoe and head assembly. If necessary, tap the split-spoon assembly with a hammer to loosen threaded couplings.
17. With the drive shoe and head assembly off, split the spoons and remove the liners without disturbing the sample. For a normal 2-in.-O.D. split spoon, four 6-in. liners are installed.
18. Immediately seal the ends of the liner with Teflon tape and install a Teflon septa over the ends of the liners and with waterproof tape so as to minimize loss of VOCs. Label and store samples as required by the site-specific work plan. Mark the top and bottom of the sample on the outside of the liner. Screen the remaining recovered material with a PID to identify any gross VOC contamination.
19. Describe sample lithology from cuttings and from observation of the bottom end of the sample in the liner.
20. Continue to advance the borehole to the next sampling point. Collect samples as outlined above.
21. When sampling is complete, remove the drilling rig to the heavy equipment decontamination site.
22. Dispose of cuttings as specified in the FSAP or QAPP.
23. Decontaminate split spoons and other small sampling equipment according to SOP 13.
24. Note all relevant information in the field logbook before leaving the site. (Note: The above represents DQO Level C and D sampling methodologies for all analytes.)

5.3 SHELBY-TUBE SAMPLING

The following steps must be followed when collecting samples with Shelby tube:

1. Survey and stake the location(s) to be sampled. The survey should include horizontal location and elevation relative to mean sea level or other specified datum.
2. Clear vegetation and debris from the ground surface. Remove any pavement and subbase material from an area of twice the bit diameter, if necessary.
3. Set up the decontamination line for split spoons and other small sampling equipment. The drilling rig will be decontaminated according to SOP 13 at a separate location.

4. Attach the hollow-stem auger with the cutting head and center rod(s).
5. Put on personnel protective clothing and equipment as required by the site-specific health and safety plan.
6. Begin drilling and proceed to the first sample depth.
7. Slightly raise the auger flight(s) to disengage the cutting head and rotate without advancement to clean the bottom of the hole of cuttings.
8. Remove the plug and center rods.
9. Attach a head assembly to a decontaminated Shelby tube. Attach the Shelby-tube assembly to the center rods.
10. Lower the Shelby tube and center rods into the hollow-stem augers until seated at bottom. Be sure to leave 30 in. or more of center rod above the lowest point of the hydraulic piston's extension.
11. Use the rig's hydraulic drive to push the Shelby tube into undisturbed soil. The tube should be pushed with a steady force.
12. When the Shelby tube has been advanced its full length or to refusal, back off the hydraulic pistons. Attach a hoisting plug to the upper end of the center rod, twist to break off the sample, and pull it out of the hole with the rig winch.
13. Retrieve the Shelby tube to the surface, detach it from the center rod, and remove the head assembly.
14. Use a hydraulic extruder to extrude the sample from the tube onto a clean piece of plastic sheeting.
15. Describe the sample in detail in the field logbook and on the boring log per SOPs 8 and 9, then remove enough soil to fill the required sample containers. Seal, label, and store samples as required by the site-specific work plan. (Note: if volatile organic analyses are to be conducted on the soil sample, place the sample in the sample container first, then describe it in the field logbook and on the boring log form.) However, this method of sampling for volatile organic analytes in subsurface soils can only be considered a screening data quality level.
16. If the intent of the Shelby-tube sampling is for engineering purposes and an undisturbed sample is required, the ends should be sealed immediately, the top or "up" end of the tube marked, and the tube should be transported to the laboratory in an upright position.
17. Continue to advance the borehole to the next sampling point. Collect samples as outline above.
18. When sampling is complete, remove the drilling rig to the heavy equipment decontamination site.
19. Dispose of cuttings as specified in the FSAP and QAPP.
20. Decontaminate Shelby tubes and other small sampling equipment according to SOP 13.
21. Note all relevant information in the field logbook before leaving the site. (Note: This sampling procedure satisfies sampling requirements for DQO Level A or B methodologies for VOCs.)

5.4 GEOPROBE SAMPLING

The following steps must be followed when collecting samples with a geoprobe:

1. Survey and stake the location(s) to be sampled. The survey should include horizontal location and elevation relative to mean sea level or other specified data.
2. Clear vegetation and debris from the ground surface. Remove any pavement and subbase material from an area of twice the bit diameter, if necessary.
3. Set up the decontamination line for geoprobe samplers and other small sampling equipment. The drilling rig will be decontaminated according to SOP 13 at a separate location.
4. Attach the geoprobe sampler to the drive rods.
5. Put on personnel protective clothing and equipment as required by the site-specific health and safety plan.
6. Begin sampler advancement and proceed to the first sample depth.
7. Advance the sampler through the first sampling interval (3 or 4 feet, depending upon the sampler model used).
8. Cease driving when the full length of the sampler has been driven or upon refusal. Refusal occurs when little (<3 in.) or no progress is made after applying pressure on the sampler.
9. Pull the sampler by lifting the drive rods with back pressure of the geoprobe drive system.
10. Unscrew the sampler assembly from the drive rod and place it on the sampling table.
11. Remove the drive shoe and head assembly. If necessary, tap the sampler assembly with a hammer to loosen threaded couplings.
12. With the drive shoe and head assembly off, push the sample out of the sampling tube, being careful not to disturb the sample.
13. Describe the sample in detail in the field logbook and on the boring log form per SOPs 8, 9 and 17, then remove enough soil to fill the required sample containers. Seal, label, and store samples as required by the site-specific work plan. (Note: if volatile organic analyses are to be conducted on the soil sample, place the sample in the sample container first, then describe it in the field logbook and on the boring log form.)
14. Continue to advance the borehole to the next sampling point. Collect samples as outlined above.
15. When sampling is complete, remove the geoprobe rig to the heavy equipment decontamination site.
16. Dispose of excess soil samples as specified in the FSAP or QAPP.
17. Decontaminate samplers and other small sampling equipment according to SOP 13.
18. Note all relevant information in the field logbook before leaving the site.

6.0 RESTRICTIONS/LIMITATIONS

Basket or spring retainers may be needed for sampling in loose, sandy soils. Shelby tubes may not retain the sample in loose, sandy soils. Geoprobe samplers are not suited to dense soils or soils with high fines content.

7.0 REFERENCES

American Society for Testing and Materials, *Penetration Test and Split Barrel Sampling of Soils*, Standard Method D-1586-84, 1984.

U.S. Environmental Protection Agency, *A Compendium of Superfund Field Operations Methods*, EPA/540/P-87/001, 1987.

STANDARD OPERATING PROCEDURE No. 5
MONITORING WELL INSTALLATION

1.0 OBJECTIVE

The objective of this procedure is to define the requirements for the installation of monitoring wells.

2.0 BACKGROUND

Monitoring wells are installed to provide access to groundwater for collecting samples, as well as for obtaining water-level and other data. Because the monitoring wells are used to collect samples, it is important that construction materials not interfere with sample quality either by contributing contaminants or by sorbing contaminants already present. Further, construction materials must be compatible with (i.e., not degraded by) contaminants present in soils or groundwater.

Monitoring wells are potential contaminant migration routes between aquifers or from the surface to the subsurface. Construction procedures and standards must ensure that neither passive nor active introduction of contaminants can occur. Properly installed hydraulic seals and locking well covers reduce the potential for cross-contamination of monitoring wells.

3.0 RESPONSIBILITIES

Site Manager: The Site Manager is responsible for ensuring that field personnel are properly trained in monitoring well installation and for verifying that monitoring wells are installed in accordance with this procedure.

Project Field Geologist/Engineer: The Project Field Geologist/Engineer is responsible for complying with this procedure, including recording all information relevant to the construction and materials used in monitoring well installation.

4.0 REQUIRED EQUIPMENT

- Drilling or augering equipment appropriate to site conditions, drilling depth, and other project requirements.
- Drill bits appropriate for the expected rock type(s) to be encountered.

- Sufficient threaded flush-joint riser pipe of an approved material [stainless steel, polyvinyl chloride (PVC), Teflon] to meet design criteria. (Note: No glues are permitted.)
- Properly sized and washed filter pack material (quartz sand or glass beads) in sufficient volume to meet well design criteria, if required.
- Bentonite or polymer-bentonite pellets, chips or granules.
- Powdered bentonite.
- Portland cement [American Society for Testing and Materials(ASTM) Types I or II].
- Concrete mix.
- Tremie pump/box and pipe.

5.0 PROCEDURES

5.1 MONITOR WELL DESIGN CONSIDERATIONS

American National Standards Institute Schedule 5, Type 304, stainless steel or Schedule 40 PVC has sufficient tensile and compressive strength for most monitoring well installations. Schedule 80 PVC should be used for wells deeper than 125 ft. Type 316L stainless steel or other alloys should be considered for use in saline or sulfitic waters. Construction materials other than those previously specified will be considered on a case-by-case basis.

For deep wells(>35 ft), the screen must be chosen to withstand the column weight without collapsing. Water chemistry (corrosion or incrustation tendencies) must also be considered when selecting screen construction materials.

Bentonite pellets or chips will not fully hydrate in saline water. Polymer-bentonites, attapulgite, or ring gaskets should be considered for use as a annular seal in such situations.

ASTM Type II cements should be used where groundwater contains dissolved sulfates. Caps should be vented. Other design considerations are contained in the installation procedures in Sect. 5.2.

5.3 MONITOR WELL INSTALLATION IN UNCONFINED AQUIFERS

The following steps must be followed when installing monitor wells in unconfined aquifers:

1. Advance the borehole to the required depth using a bit or auger flight of a

diameter sufficient to allow for insertion of the tremie pipe when the casing is centered. It is preferred that the borehole be a least 2 in. in diameter larger than the combined length of casing and screen. The final completion depth should be sounded with a decontaminated, weighted tape before continuance of well placement.

2. With auger flights in place, prepare the surface for the wellhead pad by digging out surface soil to a depth of 4 to 6 in. in an area 3 ft in diameter around the borehole. If a square pad is to be built, the centers of the sides must be at least 1.5 ft from the borehole centerline. Construct a form, if necessary.
3. Condition the borehole by circulating air (or mud, if used) or by rotating augers without drilling until the hole is cleaned of cuttings. Remove the cuttings from the concrete form.
4. While performing Step 2, make up the riser and screen for installation. The riser and screen must be decontaminated in accordance with SOP 13 before makeup. Tighten joints to the manufacturer's specifications.
5. Withdraw the drill rods, bit and augers. Check the hole depth with a weighted surveyor's tape.
6. Lower the screen and riser into the well. Avoid bumping borehole walls to prevent formation sloughing.
7. Install centralizers every 30 to 40 ft as the casing string is lowered into the borehole. As a minimum requirement, one centralizer is required above the screen and bentonite seal. If a sediment trap is used, one centralizer must also be placed on the trap.
8. If a filter pack is required, prepare the dry sand or sand slurry while proceeding with Step 5.
9. When the screen and riser are set to the desired depth, place and insert the tremie pipe. There should be 2 to 3 ft of stickup once the well has been lowered to its final position unless the wellhead is flush mounted because of its location.
10. Install the filter pack through the tremie. Six inches or more of filter pack material must be spotted at the bottom of the hole, under the screen. The tremie should be slowly withdrawn so that the filter pack is placed evenly around the screen without bridging. If the well is being made in the augers, slowly pull up on the augers as the sand pack is being tremied or poured into the augers. As the augers are being pulled up, the sand pack will settle around the well screen and fill the borehole. Check the depth to the sand pack with a weighted tape at regular intervals. Filter pack must be installed to a least 2 to 3 ft above the top of the screen. A minimum of 2 to 3 ft of bentonite is required above the screen.
11. If the filter pack was installed as a slurry, withdraw the tremie pipe and flush with potable water (there is no need to contain this water). Allow the filter pack to settle out. The well may be developed by pump, bailer, or surge block to remove slurry water and settle the filter pack. Check the depth to

the top of the filter pack with a weighted tape.

12. Tremie, or for shallow wells (≤35 ft), gravity feed bentonite pellets or chips (not powder) onto the top of the filter pack. Bentonite pellets or chips must be used if the seal is to be seated below the water table. Granular, flake, or slurried bentonite may be used above the water table. If a tremie pipe is used, slowly withdraw the pipe as the bentonite is added to ensure even placement of the bentonite seal around the annulus. Check the depth with a weighted tape.
13. If the bentonite seal is installed above the water table, hydrate according to the manufacturer's specifications. Allow adequate hydration time before proceeding to Step 14.
14. Mix Portland cement with 2 to 5% powdered bentonite and water to make a pumpable slurry. Weigh the bentonite before mixing; addition of more than 5% bentonite will severely reduce grout strength.
15. If a polymer-bentonite grout (Volclay or E-2 Mud) is used as the annular seal, one bag of grout should be mechanically mixed with its initiator and the appropriate amount of water. Before placement, the polymer-bentonite grout should be weighed with a mud balance to ensure that the slurry has the required density. Assume, for planning purposes, a shrinkage factor of 10% of the grout seal after installation.
16. Tremie the grout into the annulus using a side exiting tremie. Slowly withdraw the tremie pipe as the annulus fills. Grout the well to within 2 to 3 ft of the surface but not higher than the average frost line. Compare actual volume of grout placed with calculated volume. Both should be annotated in the field logbook. If the two values differ, explain the reason for the difference in the field logbook.
17. After installing grout, dismantle and clean tremie equipment.
18. Mix and pour concrete for the wellhead pad. Concrete must extend below the frost line and to the top of grout. It may be convenient to first fill the annulus to the bottom of the pad form and then set the locking well cover or locking protective casing. After the protective casing has been installed, the remaining concrete should be poured into the pad form.
19. Finish the concrete pad so that it slopes away from the wellhead in all directions with a minimum thickness of 4 in. If weather conditions warrant, cover the concrete until cured. Lock the well cover.
20. If the well design specifies traffic barriers, dig the holes and set the barrier posts in concrete separate from the concrete pad. Posts and concrete must extend to a depth of 2 ft (or deeper if the front line is below 2 ft).
21. Record the appropriate construction/completion information in the field logbook and on the appropriate field log forms.
22. If a form was used for the concrete pad, return to the well site after the concrete has cured for at least 24 h and remove the form. Backfill around the pad with native soil. Drill two 0.25-in. weep holes on opposite sides of the protective casing and just above the concrete pad.
23. The well identification should be stamped in the protective casing. Paint the

well cover and posts, if required.

6.0 REFERENCES

Driscoll, F.G., *Groundwater and Wells*, Second Edition, St. Paul, Minnesota, Johnson Division, 1986.

U.S. Environmental Protection Agency, *A Compendium of Superfund Field Operations Methods*, EPA/540/P-87/001, 1987.

U.S. Environmental Protection Agency, *Manual of Water Well Construction Practices*, EPA/570/9-75-001, 1975.

STANDARD OPERATING PROCEDURE No. 6
WELL DEVELOPMENT AND PURGING

1.0 OBJECTIVE

The objective of this procedure is to define the procedural requirements for well development and purging.

2.0 BACKGROUND

Monitor wells are developed to remove skin (i.e., near-well-bore formation damage) and to settle and remove fines from the filter pack. Wells should not be developed for 24 h after completion when a cement bentonite grout is used to seal the annular space. However, wells may be developed before grouting if conditions warrant. Wells are purged immediately before groundwater sampling to remove stagnant water and a sample representative of groundwater conditions. Wells should be sampled within 3 h of purging (optimum) to 24 h after purging (maximum, for low recharge conditions).

3.0 RESPONSIBILITIES

Site Manager: The Site Manager is responsible for ensuring that field personnel are trained in the use of this procedure and for verifying that development and purging are carried out in accordance with this procedure.

Project Field Geologist/Engineer: The Project Field Geologist/Engineer is responsible for complying with this procedure.

4.0 REQUIRED EQUIPMENT

- Pump, pump tubing, or bailer and rope or wire line.
- Power source (e.g., generator), if required.
- Water-level meter or weighted surveyor's tape.
- Temperature, turbidity, conductivity, pH, and/or dissolved oxygen meters (for Sect. 5.3 below).
- Personnel protective equipment as specified in the site-specific health and safety plan.
- Decontamination supplies, if required on-site.
- Disposal drums, if required.

5.0 WELL DEVELOPMENT

The following steps must be followed when developing wells:

1. Put on personal protective clothing and equipment as specified in the site-specific health and safety plan.
2. Open and check the condition of the wellhead, including the condition of the surveyed reference mark, if any.
3. Determine the depth to static water level and depth to bottom of casing.
4. Prepare the necessary equipment for developing the well. There are a number of techniques that can be used to develop a well. Some of the more common methods are bailing, overpumping, mechanical surging, and surge and pump.
5. For screened intervals longer than 10 ft, develop the well in 2- to 3-ft intervals from bottom to top. This will ensure proper packaging in the filter pack. Note: It is good practice to develop all screened and filter-packed wells in stages.
6. Continue well development until produced water is clear and free of suspended solids. Record pertinent data in the field logbook and on appropriate well development forms per SOPs Nos. 8 and 9.
7. Remove the pump assembly or bailers from the well, decontaminate (if required), and clean up the site. Lock the well cover before leaving. Dispose of produced water as required by the project work plan.

5.2 VOLUMMETRIC METHOD OF WELL PURGING

The following steps should be followed when purging a well by the volummetric method.

1. Put on personal protective clothing and equipment as specified in the site-specific health and safety plan.
2. Open the well cover and check the condition of the wellhead, including the condition of the surveyed reference mark, if any.
3. Determine the depth to static water level and depth to bottom of well string. Calculate the well volume (volume of water within the well bore) using the following formula (or equivalent):

$$7.4805 \left(\frac{D^2\pi}{4}\right) (dH = \text{volume (in gallons,)}$$

where

D = casing diameter in feet. (NOTE: This equation is used for grouted wells with short screens. For wells with long screens and/or ungrouted wells, then

D = borehole diameter in feet.)
dH = the distance from well bottom to static water level in feet.

Note these data and calculations in the field logbook.

4. Prepare the pump and tubing, or bailer, and lower it into the casing.
5. Remove the number of well volumes specified in the project plans. Generally, three to five well volumes will be required. In low-recharge aquifers, the well will commonly pump or bail to dryness before three well volumes of water are removed. If this is the case, there is no need to continue with purging operations. Record pertinent data (e.g., water volume) in the field logbook.
6. Remove the pump assembly or bailer from the well, decontaminate it (if required), and clean up the site. Lock the well cover before leaving. Dispose of produced water as required by the project work plan.

5.3 INDICATOR PARAMETER METHOD OF WELL PURGING

1. Put on personal protective clothing and equipment as specified in the site-specific health and safety plan.
2. Open the well cover and check the condition of the wellhead, including the condition of the surveyed reference mark, if any.
3. Determine the depth to static water level and depth to bottom. Set up surface probe(s) (e.g., pH, temperature, conductivity) at the discharge office. Record the readings from surface probes in the field logbook together with the time.
4. Assemble the pump and tubing, or bailer, and lower into the casing.
5. Begin pumping or bailing the well. Record indicator parameter readings at predetermined intervals. Maintain a record of the approximate volumes of water produced.
6. continue pumping or bailing until indicator parameter readings meet the following criteria over three consecutive readings:

   - Temperature stabilizes within +/- 1°C
   - pH stabilizes within +/- 0.2 standard units
   - conductivity stabilizes within 10%
   - turbidity of 5 NTUs +/- 2 NTUs

   Purging should continue until these criteria are met. In low-recharge aquifers the well may pump or bail to dryness before indicator parameters stabilize. In this case, there is no need to continue purging. Record pertinent data (e.g., water volume) in the field logbook.
7. Remove the pump assembly or bailer from the well, decontaminate (if required), and clean up the site. Lock the well cover before leaving. Dispose of produced water as required by the project work plan.

6.0 RESTRICTIONS/LIMITATIONS

Where flammable free or emulsified product is expected or known to exist on or in groundwater, use only intrinsically safe electrical devices and place portable power sources (e.g., generators) 50 ft or more from the wellhead and disposal drums.

7.0 REFERENCES

Driscoll, F.G., *Groundwater and Wells*, Second Edition, St. Paul, Minnesota, Johnson Division, 1986.

U.S. Environmental Protection Agency, *A Compendium of Superfund Field Operations Methods*, EPA/540/P-87/001, 1987.

U.S. Environmental Protection Agency, *Manual of Water Well Construction Practices*, EPA/570/9-75-001, 1975.

STANDARD OPERATING PROCEDURE No. 8
LOGBOOK DOCUMENTATION

1.0 OBJECTIVE

The objective of this procedure is to define the minimum requirements for field logbooks.

2.0 BACKGROUND

Field logbooks provide a daily handwritten record of all field activities at an investigation site. Logbooks are permanently bound by glue or thread into a hard cover; field logbooks should also be waterproof.

Field logbooks are detailed daily records kept in real time for each activity at a site. Field logbooks may be assigned to specific activities, positions, or areas within the site.

3.0 RESPONSIBILITIES

Site Manager: The Site Manager is responsible for ensuring that field logbooks are completed daily in accordance with this procedure.

Project Quality Assurance Manager: The Project Quality Assurance Manager is responsible for ensuring that field logbook entries meet the requirements of this procedure.

Project Field Geologist: The Project Field Geologist is responsible for making timely and complete entries in the field logbook, and for reporting daily activities to the site manager.

4.0 REQUIRED MATERIALS

1. Field logbook; surveyor's book or field book, bound with waterproof sequentially numbered pages.
2. Indelible black/blue-ink markers.

5.0 PROCEDURES

5.1 FIELD LOGBOOK COVER

Label the front cover of the field logbook with the project name, number, and contract number under which the investigation is being performed. Also include the start date and when complete, the finish date must also be labeled on the front cover of the logbook. Labeling must be done with indelible black ink.

5.2 DAILY ENTRIES IN FIELD LOGBOOK

The following steps must be followed when making entries in the field logbook:

1. Enter the day and date, time the task started, weather conditions, and the names, titles, and organizations of personnel performing the task.
2. Record the name, title, and organization of all visitors to the task area.
3. Describe all site activities in specific detail or indicate which forms were used to record such information (e.g., soil boring log, or well completion log).
4. Describe in specific detail any field tests that were conducted. Reference any forms that were used, other data records, and the procedures followed. If the final results of any field activity are obtained in the field, these data should be annotated in the field logbook.
5. Describe in specific detail any samples collected and whether splits, duplicates, matrix spikes, or blanks were prepared. Reference the procedure(s) followed in sample collection or split, duplicate, spike, and blank preparation. List all label or tag numbers, sample identification, sample containers and volume, preservation method, packaging, chain-of-custody form number and analysis required.
6. List all instrument calibrations, person(s) performing calibration, and the page number of the calibration log that provides specific information on calibration procedures.
7. List any equipment failures or breakdowns that occurred, together with a brief description of repairs or replacements.
8. The Project Field Geologist, Engineer or Task Leader must sign the field logbook at the bottom of each page.

6.0 RESTRICTIONS/LIMITATIONS

No pages may be removed from the field logbook for any reason. Blank pages must be marked "page intentionally left blank." Mistakes must be crossed out with a single line, initialed, and dated. Only persons authorized by the Site Manager may make entries in the logbook.

7.0 REFERENCE

U.S. Environmental Protection Agency, *A Compendium of Superfund Field Operations Methods*, EPA/540/P-87/001, 1987.

STANDARD OPERATING PROCEDURE No. 9
FIELD LOG FORMS

1.0 OBJECTIVE

The objective of this procedure is to define instructions for completing the appropriate field log form for the various field activities.

2.0 BACKGROUND

Field log forms provide a detailed graphic depiction of the field activity.

3.0 RESPONSIBILITY

Site Manager: The Site Manager is responsible for ensuring the Project Field Geologist has access to and completes all appropriate and relevant field activity forms.

Project Quality Assurance Manager: The Project Quality Assurance Manager is responsible for ensuring that the field activity form entries meet the requirements of this procedure.

Project Field Geologist/Engineer: The Project Field Geologist/Engineer is responsible for completing entries on the appropriate field activity forms and for reporting on daily activities to the Site Manager.

4.0 REQUIRED MATERIALS

- Field Activity Log Forms
- Indelible black-ink pens

5.0 PROCEDURES

5.1 MONITORING WELLS

For monitoring well installation choose the appropriate Monitoring Well Construction Log Form (MWCLF) 1 or 2. Fill out all appropriate information.

5.2 PIEZOMETERS

For temporary piezometer installation by the borehole method and driven piezometers choose the appropriate MWCLF and modify it. Fill out all appropriate information.

5.3 WELL DEVELOPMENT

For monitoring well development use Well Development Log.

5.4 PURGING

For monitoring well purging use Ground Water Sampling Form. Fill out all appropriate information.

5.5 SAMPLING

For monitoring well sampling use Monitoring Ground Water Sampling Log Form. Fill out all appropriate information.

5.6 SUBSURFACE SOIL SAMPLING

For subsurface soil sampling use Boring Log Form. Fill out all appropriate information.

5.7 SURFACE SOIL SAMPLING

For surface soil sampling use Field Activity Summary Sheet. Fill out all appropriate information.

6.0 REFERENCE

U.S. Environmental Protection Agency, *A Compendium of Superfund Field Operations Methods*, EPA/540/P-87/001, 1987.

ANEPTEK CORPORATION

Field Activity Summary Sheet

Project: Project No.:	Date:	Sheet ____ of ____
Activity:	Aneptek Personnel:	
Weather:	Subcontractor Personnel:	

Summary:

Sketch:

Deviations from Work Plan:

Photograph #	Roll ID	Description

Signed: ______________________

ANEPTEK CORPORATION

WELL DEVELOPMENT LOG

Well No.:

Page of

Installation:

Site:

Project No.:

Client/Project:

Contractor: Aneptek

Dev. Contractor:

Dev. Start (:____m)

Dev. End: (:____m)

Csg Dia.:

Developed by:

Dev. Rig (Y / N)

Dev. Method ____________________

____

____

Equipment ____________________

____

Pre-Dev. SWL__________ Maximum drawdown during pumping__________ft. at______gpm

Range and Average Discharge rate ____________________gpm

Total quantity of material bailed ____________________

Total quantity of water discharged by pumping ____________________

Disposition of discharge water ____________________

Time	Volume Removed (gals.)	Water Level ft. BTOC	Turbidity	Clarity/ Color	Temp. °C	pH	Conductivity	Remarks

ANEPTEK CORPORATION

Field Data Record
ound Water Sampling

Project: Project No.:		Date/Time:	Sheet of
Contractor Personnel:		Aneptek Personnel:	

Sample No.:

WELL INTEGRITY

	Yes	No
Protect. Casing Secure	☐	☐
Concrete Collar Intact	☐	☐
PVC Stick-up Intact	☐	☐
Well Cap Present	☐	☐
Security Lock Present	☐	☐

Protective Casing Stick-up ______ ft. (from ground)

Riser Stick-up (from ground) ______ ft.

WELL DIAMETER ☐ 2 inch ☐ 4 inch ☐ 6 inch ☐ ______

Well Depth ____ ft. ☐ top of riser ☐ top of casing ☐ ______ ☐ measured ☐ historical

Water Depth ____ ft.

Height of Water Column ____ ft. x ☐ .16 gal/ft(2in.) ☐ .65 gal/ft(4in.) ☐ 1.5 gal/ft(6in.) ☐ ____gal/ft(__in.)

PID SCREENING MEAS.

Background	
Well Mouth	

WELL MATERIAL ☐ PVC ☐ SS ☐ ____

Volume of Water in Well = _____gallon(s)

_____ Total gallons to purge

[Vol.=$r^2h(0.163)$]

FIELD WATER QUALITY MEASUREMENTS

Purge Volume (gal)							
pH (Std. Units)							
Eh (millivolts)							
Conduct.(uohms/cm)							
Temp. (C)							
Turb. (NTU)							
(mg/l)							

Sample Description

Clear ☐ Turbid ☐

Color ______

Odor ______

Other ______

SAMPLE EQUIP./DECON.	PURGE	SAMPLE
Peristaltic Pump	☐	☐
Submersible Pump	☐	☐
Bailer	☐	☐
Waterra	☐	☐
PVC/Silicon Tubing	☐	☐
Air Lift	☐	☐
Teflon/Silicon Tubing	☐	☐
In-line Filter	☐	☐
Pressure Vacuum Filter	☐	☐
Measuring Tape	☐	☐
______		

EQUIPMENT ID

______
______
______
______

DESCRIPTION OF DECON. PROC.

DECON. FLUID USED	
Tap Water	☐
Alconox	☐
Tap Water	☐
HNO_3(1 or10%)	☐
Tap Water	☐
Methanol	☐
Hexane	☐
Acetone	☐
Air Dry	☐
DI Water	☐
Air Dry	☐
None	☐

ANALYTICAL PARAMETERS	Filtered (circle)		Preservation Method	Volume Required	Time of Collection	Sample#	Date
☐ TCL Volatiles	Yes	No	HCL/4°C	2x40 mL			
☐ BNA Extractables	Yes	No	4°C	2x1 L Amb GL			
☐ PCBs/Pesticides	Yes	No	4°C	2x1 L Amb GL			
☐ TAL Metals	Yes	No	HNO_3/4°C	1 L PL			
☐ Cyanide	Yes	No	NaOH/4°C	1 L PL			
☐ ______	Yes	No					

Signed: ______________________

ANEPTEK CORPORATION

Boring Log

Client/Project/Contract No.:			Page 1 of
Sampler Type/Size:			Boring/Well No.:
Drilling Contractor:	Drilling Rig Make/Model:	Date/Time Started	Date/Time Finished
Logged By:	Drilling Method:	Screening Device (Type, make, model):	
Location (survey coord):	Ground El.: / Total Depth: / Bedrock Depth:	Water Table Depth:	Borehole Diameter:

Depth (ft)	Sample Interval	Sample Number	Blows/ 6-in.	Rec. (in.)	Lithologic Description	USCS Class.	PID/FID (ppm)

Penetration Resistance				Proportions
Granular Soils		Cohesive Soils		
Blows/ft	Density	Blows/ft	Density	
<4	V. Loose	<2	V. Soft	Trace: 0 - 10%
4 - 10	Loose	2 - 4	Soft	Little: 10 - 20%
10 - 30	M. Dense	4 - 8	M. Stiff	Some: 20 - 35%
30 - 50	Dense	8 - 15	Stiff	And: 35 - 50%
>50	V. Dense	15 - 30	V. Stiff	Water Content
		>50	Hard	D - Dry
				M - Moist
				W - Wet

Notes and Comments:

ANEPTEK CORPORATION

Boring Log

Client/Project/Contract No.:

Page of

Sampler Type/Size:

Boring/Well No.:

Depth (ft)	Sample Interval	Sample Number	Blows/ 6-in.	Rec. (in.)	Lithologic Description	USCS Class.	PID/FID (ppm)

Notes and Comments:

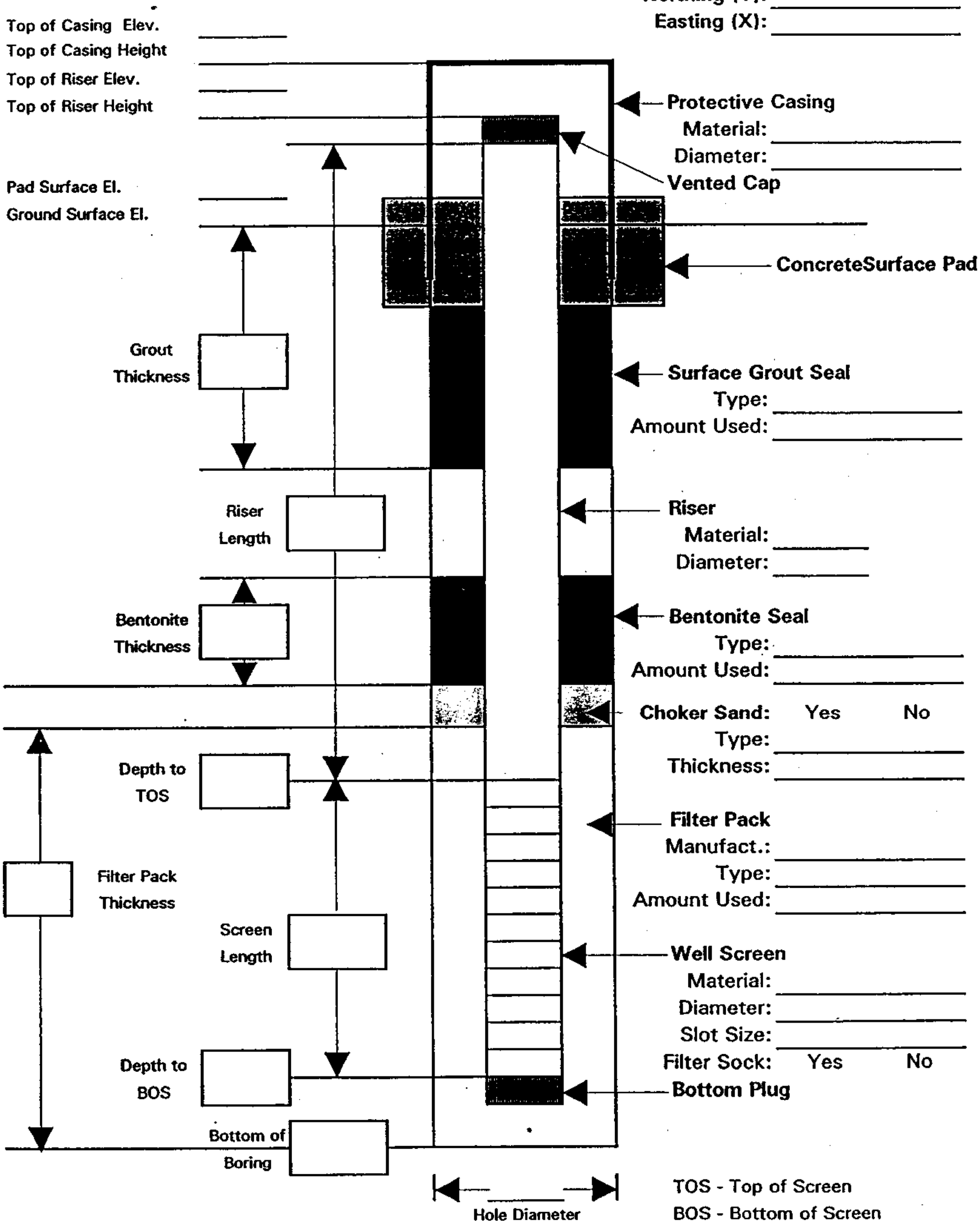
ANEPTEK CORPORATION Well Completion Log	Client/Project/Contract No.:		Well/Boring No.:
	Logged By:	Date/Time Started	Date/Time Finished
Drilling Contractor:	Drilling Rig Make/Model:	Drilling Method:	

All Depths in feet below ground surface

Survey Coordinates

Northing (Y): ______

Easting (X): ______



TOS - Top of Screen

BOS - Bottom of Screen

ANEPTEK
Corporation

ANEPTEK Corporation	Project:	Project No.:	Date/Time:	Sheet __ of __

Rock Core Log

Contractor Personnel:

Aneptek Personnel:

Boring/Well Number:

Driller/Equipment

Surface Elevation:____________

Depth to Bedrock:____________

Time Start:____________

Time Finish:____________

Depth	Comments: Coring Rate and Coring Fluid Loss	Core Run Length & Rec.(%)	Box No.	Discontinuities: RQD (%)	Discontinuities: Fractures per foot	Discontinuities: Description (Tightness, Planarity; Smoothness; Filling, Staining; Orientation)	Lithology: Classification; Minerology; Color, Grain Size; Hardness, Weathering	Graphic Log

$$\text{RQD} = \frac{\text{length of all naturally fractured core} \geq 4 \text{ in. (10 cm.)}}{\text{length of the cored interval}}$$

5/12/95

ANEPTEK CORPORATION

Test Pit Log

Client/Project/Contract No.:				Page of Test Pit No.:
Excavation Contractor:	Excavator Make/Model:		Date/Time Started	Date/Time Finished
Logged By:	Weather & Temperature:		Screening Device (Type, make, model):	
Location (survey coord):	Ground El.:	Total Depth:	Bedrock Depth:	Water Table Depth:

Depth (ft)	Sample Interval	Sample Number	Description of Materials	USCS Class.	PID/FID (ppm)

Test Pit Plan & Dimensions

North

Proportions
Trace: 0 - 10%
Little: 10 - 20%
Some: 20 - 35%
And: 35 - 50%
Water Content
D - Dry
M - Moist
W - Wet

Test Pit Volume:

_______ Length (ft) x
_______ Width (ft) x
_______ Depth (ft) =
_______ Volume (Cu. ft.)

Boulders

8 in. to 18 in = _______ Number
Over 18 in. Diam. = _______ Number

ANEPTEK CORPORATION

TEST PIT/TRENCH

Sheet ______ of ______

Test Pit No. __________

PROJECT ______________________

JOB NO. ______________________

CONTRACTOR ______________________

EXCAVATOR ______________________

CONSULTANT ______________________

LOGGED BY ______________________

DATE ______________________

TIMES ______________________

WEATHER/TEMP. ______________________

DEPTH TO WATER TABLE ________ FT.

LOCATION ______________________

GROUND SURFACE ELEVATION ______________________

COMMENTS ______________________

SKETCH MAP OF TEST PIT SITE
(SHOWN SURFACE MONITORING RESULTS)

N

MONITOR EQUIPMENT

PID/FID Y N

EXPLOSIVE GAS Y N

AVAIL. OXYGEN Y N

NOTES: ______________________

NO.	DEPTH (FT.)	SAMPLE I.D.	PI READING

PROFILE ALONG TEST PIT

30′ 25′ 20′ 15′ 10′ 5′ 0′

5′ 10′ 15′ 20′

DEPTH (FT)

STANDARD OPERATING PROCEDURE No. 10
DUPLICATE AND SPLIT SAMPLE PREPARATION

1.0 OBJECTIVE

The objective of this procedure is to define the requirements for the collection and preparation of duplicate and/or split samples.

2.0 BACKGROUND

Duplicate and split samples are typically obtained for either of two purposes: (1) as a means of quality control (QC) from the point of sample collection through all analytical processes (if the initial and duplicate samples are not within specification, the reasons for the discrepancy must be found and corrected, if possible) or (2) for later laboratory analyses, if needed.

Duplicate samples are samples collected from a location as close to the primary sample location as possible. They are collected to provide a means of assessing the reliability of field sampling methods and analytic data resulting from the field samples.

Split samples are normally obtained for the express purpose of submitting identical samples to different laboratories for comparative analytical results. None may be required if the lead laboratory has adequate internal quality assurance (QA)/QC. Duplicate and/or split samples may be collected as composite or grab samples from most media or waste types.

Basically the same equipment and techniques outlined in SOPs 3, 4, and 7 will be required when obtaining duplicate and/or split samples. Briefly, the sampling requirements are: (1) grab samples will be collected for surface soil, surface water, groundwater sediment, and sludge, destined for volatile organic compound (VOC) analysis, and composite or grab sampling techniques can be used for non-VOCs; and (2) for subsurface soils, sectioned liner (stainless steel) samples for VOCs and composite samples for non-VOCs.

Comparative analyses between laboratories can also be obtained from semivolatile organic compounds and/or metals. Duplicate samples can also be obtained fro VOC and non-VOC contaminated media by careful grab samples and/or selective use of the appropriate liner. For most split or duplicate sampling for non-VOC parameters, in all media, compositing is recommended.

3.0 RESPONSIBILITIES

<u>Site Manager:</u> The Site Manager will ensure that sampling efforts are conducted in accordance with this procedure and other SOPs pertaining to specific media sampling.

<u>Project Field Geologist/Engineer:</u> The Project Field Geologist/Engineer is responsible for ensuring that field personnel collect split and duplicate samples in accordance with this and other relevant procedures.

<u>Project QA/QC Manager:</u> The Project QA/QC Manager is responsible for ensuring that this procedure is correctly implemented and that the quantity and quality of split and duplicate samples collected meet the requirements of the Project QA/QC Plan.

4.0 REQUIRED EQUIPMENT

The equipment required to obtain duplicate and/or split samples is identical to that for other media sampling. Refer to SOPs for specifics.

5.0 PROCEDURES

5.1 DUPLICATE SAMPLES

The following steps must be followed when collecting duplicate samples:

1. Determine the frequency of obtaining duplicate samples as specified in the site-specific sampling plan.
2. Proceed with site sampling to the point that a duplicate sample is required.
3. The duplicate sample is a sample taken at the same time, as close as possible, and under the exact conditions as those required for the primary sample. NOTE: Any sample or portion of a sample that is to be analyzed for VOCs shall be collected and contained immediately. Do not stir, mix, or agitate samples for VOC analysis before containment.
4. Follow the specific media sampling plan outlined in SOPs. The preparation and disposition of the duplicates will be the same as those for the primary samples.
5. Obtain VOC samples first (without mixing or compositing), then proceed to Step 6. Mix all non-VOC duplicate samples as detailed in SOPs 7 when taking duplicates of groundwater samples. Mixing may be accomplished by pouring a portion of the sample directly from the sampling device into the original container, and then pouring an equal portion into the

duplicate container, alternating between the two until the sample containers are full.

6. Place the sample(s) in the appropriate sample container. Duplicate samples will be labeled/or tagged according to their intended use as detailed in the sampling plan. If the sampling plan duplicates are to be held for possible later analyses, they may be labeled as "sample XXX duplicate," where the number "XXX" refers to the primary sample. If the duplicates are intended for QC measures, they may be given discrete sample numbers. Duplicate samples must be properly identified in the field logbook.
7. Sealed, pack, and transport duplicate samples in the same manner as that used for other samples from the sampling site.
8. Decontaminate all equipment according to SOP 13. Place all disposable liquids and solids in the appropriate receptacles.
9. Remove personnel protective clothing and equipment and place in the designated receptacles. Field sampling personnel must be contamination-free before leaving the sampling site.

5.2 SPLIT SAMPLES FOR SURFACE SOILS, SEDIMENTS, AND SLUDGES

The following steps must be followed when collecting split samples of surface soils, sediments, and sludges:

1. Determine the number and frequency of required sample splits as specified in the site-specific sampling plan.
2. Proceed with site sampling to the point of obtaining split sample(s).
3. Follow the specific media sampling procedure outlined in SOP 4.
4. All split samples for VOC analysis for the above media are grab samples taken as specified in Step (3), Sect. 5.1 of this SOP.
5. For non-VOC grab samples, obtain a sufficient volume to fill all required sample containers, including those required for splits.
6. Composite these samples according to SOP 11.
7. Split the composite sample equally and place the required volumes into the sample containers.
8. Seal and decontaminate the outside surfaces of the containers.
9. Label split samples as specified in the site sampling plan. Record all pertinent information in the field logbook.
10. Spilt samples will be sealed, packed, and transported in an identical manner as that specified for other samples from the site. The difference may be their destination (different laboratories) and the extent of analytical work. The site-specific sampling plan specifies the disposition of split samples.
11. Decontaminate all equipment according to SOP 13. Place all disposables in the appropriate receptacles.
12. Remove protective clothing and equipment and place in the designated

receptacles. Field sampling personnel must be contamination-free before leaving the sampling site.

5.3 SPLIT OR DUPLICATE VOLATILE ORGANIC COMPOUND SAMPLING OF SUBSURFACE SOILS WITH SPLIT SPOONS FITTED WITH BRASS OR STAINLESS STEEL LINERS OR SHELBY TUBES

The following steps must be followed when sampling subsurface soils with split spoons fitted with brass or stainless steel liners or Shelby tubes:

1. Determine the number and frequency of required sample splits as stated in the site-specific sampling plan.
2. Proceed with site sampling to the point of obtaining split sample(s).
3. Follow the specific media sampling procedure outlined in SOP 4.
4. For VOC samples, place four liner sections within the split-spoon barrel. Each liner section is to be sized to obtain at least one-half the volume necessary for a soil VOC sample. NOTE: Most split-spoon sampling in the field is accomplished with 2-in. OD split spoons. When split or duplicate samples are required, a 2-in. OD split spoon will usually not collect sufficient sample volume if a number of analytes are to be sampled. In such situations, it is advisable to follow the American Society for Testing Materials (ASTM) D-1584 modified method of split-spoon sampling using a 300-lb drop hammer and a 3-in. OD split spoon. If blow counts are not required for engineering purposes, and the site soils permit, attempts may be made to drive the 3-in. split spoon by the 140-lb weight. This deviation will ensure collection of enough sample volume. Additional liner sections for non-VOC samples may also be placed within the split spoon.
5. Liner sections intended for VOC sample collection should be identified with the letters A through D or any other distinctive identification scheme. In homogeneous soils, stack the liner sections in alphabetic order from the bottom of the split-spoon barrel. For heterogenous (stratified soils), sampling plans may call for alternating VOC and non-VOC liner sections.
6. For VOC analysis and upon retrieving the split spoon, liner section A is immediately capped and sealed on-site and becomes the original sample. Liner B is also immediately capped and sealed. It becomes the duplicate sample. Liner sections C and D may be composited for all other non-VOC analysis. NOTE: The top portion of liner D may consist of sluff which is not to be collected as part of an analytical sample.
7. Decontaminate the outside of the sample container after sealing.
8. Label split samples as specified in the site sampling plan. Record all pertinent information in the field logbook.
9. Split samples will be sealed, packed, and transported in an identical manner as other samples from the site. The difference may be their destination (different

laboratories) and the extent of analytical work. The site sampling plan specifies the disposition of split samples.

10. Decontaminate all equipment according to SOP 13. Place all disposables in the appropriate receptacles.
11. Remove protective clothing and equipment and place in the designated receptacles. Field sampling personnel must be contamination-free upon leaving the sampling site.
12. For non-VOC grab samples, obtain a sufficient volume to fill all required sample containers, including those required for splits.
13. Composite these samples according to SOP 11.
14. Split the composite sample equally and place the required volumes into the sample containers.
15. Seal and decontaminate the outside surfaces of the containers.
16. Label split samples as specified in the site sampling plan. Record all pertinent information in the field logbook.
17. Spilt samples will be sealed, packed, and transported in an identical manner as that specified for other samples from the site. The difference may be their destination (different laboratories) and the extent of analytical work. The site-specific sampling plan specifies the disposition of split samples.
18. Decontaminate all equipment according to SOP 13. Place all disposables in the appropriate receptacles.
19. Remove protective clothing and equipment and place in the designated receptacles. Field sampling personnel must be contamination-free before leaving the sampling site.

5.4 SPLIT OR DUPLICATE VOLATILE ORGANIC COMPOUND SAMPLING OF SUBSURFACE SOILS WITH SPLIT SPOONS WITHOUT LINERS OR SHELBY TUBES

The following steps must be followed when sampling subsurface soils with split spoons without liners or Shelby tubes:

1. Determine the number and frequency of required sample splits as stated in the site-specific sampling plan.
2. Proceed with site sampling to the point of obtaining split sample(s).
3. Follow the specific media sampling procedure outlined in SOP 4.
4. Upon withdrawal of each split spoon sampler, collection of soils for the VOC analytical fraction is to be performed first. After filling the required VOA bottles for the sample, the required VOA bottles are then filled for the split sample. NOTE: Most split-spoon sampling in the field is accomplished with 2-in. OD split spoons. When split or duplicate samples are required, a 2-in. OD split spoon will usually not collect sufficient sample volume if a number of analytes are to be sampled. In such situations, it is advisable to follow the American Society for Testing Materials (ASTM) D-1584 modified method of

split-spoon sampling using a 300-lb drop hammer and a 3-in. OD split spoon. If blow counts are not required for engineering purposes, and the site soils permit, attempts may be made to drive the 3-in. split spoon by the 140-lb weight. This deviation will ensure collection of enough sample volume.

5. Composite the remaining recovered material for all other non-VOC analysis. NOTE: The top portion of the recovered material may consist of sluff, which is not to be collected as part of an analytical sample.
6. Decontaminate the outside of the sample container after sealing.
7. Label split samples as specified in the site sampling plan. Record all pertinent information in the field logbook.
8. Split samples will be sealed, packed, and transported in an identical manner as other samples from the site. The difference may be their destination (different laboratories) and the extent of analytical work. The site sampling plan specifies the disposition of split samples.
9. Decontaminate all equipment according to SOP 13. Place all disposables in the appropriate receptacles.
10. Remove protective clothing and equipment and place in the designated receptacles. Field sampling personnel must be contamination-free upon leaving the sampling site.
11. For non-VOC grab samples, obtain a sufficient volume to fill all required sample containers, including those required for splits.
12. Composite these samples according to SOP 11.
13. Split the composite sample equally and place the required volumes into the sample containers.
14. Seal and decontaminate the outside surfaces of the containers.
15. Label split samples as specified in the site sampling plan. Record all pertinent information in the field logbook.
16. Spilt samples will be sealed, packed, and transported in an identical manner as that specified for other samples from the site. The difference may be their destination (different laboratories) and the extent of analytical work. The site-specific sampling plan specifies the disposition of split samples.
17. Decontaminate all equipment according to SOP 13. Place all disposables in the appropriate receptacles.
18. Remove protective clothing and equipment and place in the designated receptacles. Field sampling personnel must be contamination-free before leaving the sampling site.

5.5 SPLIT SAMPLES FOR SURFACE WATER AND GROUNDWATER

The following steps must be followed when collecting split samples for surface water and groundwater.

1. Determine the number and frequency of required sample splits as stated in the

site-specific sampling plan.

2. Proceed with site sampling to the point of obtaining split sample(s).
3. Follow the specific media sampling procedure outlined in SOP 7.
4. All split samples for VOC analysis for the above media are grab samples taken as specified in Step (3), Sect. 5.1 of this SOP.
5. For non-VOC grab samples, obtain a sufficient volume to fill all required sample containers, including those required for splits.
6. Obtain VOC samples first (without mixing or compositing). Mix all non-VOC duplicate samples as detailed in SOP 7 when taking duplicates of surface water or groundwater samples. Mixing may be accomplished by pouring a portion of the sample directly from the sampling device into the original container, and then pouring an equal portion into the duplicate container, alternating between the two until the sample containers are full.
7. Split the composited sample by placing the required volumes in the sample containers, including those for split samples.
8. Seal and decontaminate the outside surfaces of the containers.
9. Label split samples as specified in the site sampling plan. Record all pertinent information in the field logbook.
10. Split samples will be sealed, packed, and transported in a manner identical to that for other samples from the site. The difference may be their destination (different laboratories) and extent of analytical work. The site sampling plan specifies the disposition of split samples.
11. Decontaminate all equipment according to SOP 13. Place all disposables in the appropriate receptacles.
12. Remove personnel protective clothing and equipment and place in the designated receptacles. Field sampling personnel must be contamination-free before leaving the sampling site.

6.0 RESTRICTIONS/LIMITATIONS

Samples requiring VOAs must be collected and contained immediately. Agitation by mixing, stirring, or shaking will cause vaporization of the volatile fraction to a significant degree. Resample if agitation has occurred.

7.0 REFERENCES

U.S. Environmental Protection Agency, *Practical Guide for Groundwater Sampling*, EPOA/600/2-85/104, 1985.

U.S. Environmental Protection Agency, *Data Quality Objectives for Remedial Response Activities*, EPA/540/G-87/003, 1987.

U.S. Environmental Protection Agency, *A Compendium of Superfund Field Operations Methods*, EPA/540P-87/001, 1987.

STANDARD OPERATING PROCEDURE NO. 11
COMPOSITE SAMPLE PREPARATION

1.0 OBJECTIVE

The objective of this procedure is to define composite samples and the requirements for compositing techniques.

2.0 BACKGROUND

Composite samples, regardless of the media, consist of two or more subsamples taken from a specific media and site at a specific point in time. The subsamples are collected and mixed. A single average sample is taken from the mixture.

Composite samples are useful in estimating the overall contamination properties of a specific site. They are less expensive because one sample for analysis represents many subsample locations. Composite samples do not provide detailed information of contamination variability as a function of the location.

3.0 RESPONSIBILITIES

Site Manager: The Site Manager will ensure that sampling efforts are conducted in accordance with this procedure and other SOPs pertaining to specific media sampling.

Project Field Geologist/Engineer: The Project Field Geologist/Engineer is responsible for ensuring that field personnel collect and prepare composite samples in accordance with this procedure.

Project Quality Assurance/Quality Control (QA/QC) Manager: The Project QA/QC Manager is responsible for ensuring that this procedure is correctly implemented and that the quantity and quality of composite samples meet the requirements of the Project QA/QC Plan.

4.0 REQUIRED EQUIPMENT

The equipment required to obtain duplicate and/or split samples is identical to that for other media sampling.

5.0 PROCEDURES

5.1 PREPARATION

Site preparation for the purpose of compositing samples is not different from that required for any of the media/waste sampling activities. Refer to SOPs 4, 5, and 7 for details of the site preparation for particular media sampling activities.

5.2 SURFACE SOIL, SLUDGE, AND SEDIMENT COMPOSITING

The following steps must be followed when compositing surface soil, sludge, and sediment samples.

1. Determine where composite sample(s) will be obtained as indicated in the site-specific sampling plan.
2. Volatile organic compound (VOC) and, in some cases, semi-volatile compound (SVOC) samples of solids (e.g., soils, sludge) must be collected and contained immediately as stand-alone samples and, therefore, <u>cannot</u> be composited.
3. Collect a minimum of three equal-volume samples for organic analysis and two equal-volume samples for inorganic analysis from the specified sample location by the method(s) in SOP 2. The volume of each sample must be at least the amount required for a single sample.
4. Place the samples on an appropriate mixing tray. Thoroughly homogenize the pooled samples using the appropriate equipment.
5. Transfer subsamples of the composited sample into the appropriate sample containers. Seal, decontaminate, and label sample containers. Use the same care in handling these samples as that used for other samples form the site.

5.3 SUBSURFACE SOIL COMPOSITING

The following steps must be followed when compositing subsurface soil samples:

1. Determine where composite sample(s) will be obtained as indicated in the site-specific sampling plan.
2. VOC and, in some cases, SVOC samples must be collected and contained immediately as stand-alone samples and, therefore <u>cannot</u> be composited.
3. Obtain samples by the methods outlined in SOP 4.
4. For split-spoon or Shelby-tube cores from a specified depth or range of depths:
   - Extract or extrude the sample from the split spoon or Shelby tube onto an appropriate mixing tray.
   - Continue with the four-quarters method as detailed in Sect. 5.2, Step (4) of this SOP.
5. For auger samples:
   - The sample is acquired directly from the withdrawn auger.
   - Extract or extrude the sample from the split spoon or Shelby tube onto an appropriate mixing tray.
   - Continue with the four-quarters method as detailed in Sect. 5.2, Step (4) of this SOP.

5.4 GROUNDWATER COMPOSITING

The following steps must be followed when compositing groundwater samples:

1. Determine where composite sample(s) will be obtained as stated in the site-specific sampling plan.
2. VOC and, in some case, SVOC samples must be collected and contained immediately as stand-alone samples and, therefore, cannot be composited.
3. Collect a minimum of three equal-volume samples from the specified sample location by method(s) described in SOP 7. The volume of each sample must be at least the amount required for a single sample.
4. Place the samples in the appropriate container. Thoroughly homogenize the pooled samples using the appropriate equipment.
5. Transfer aliquots of the composited sample into the appropriate sample containers. Seal, decontaminate, and label sample containers. Handle with the same care as that used for other samples from the site.

6.0 RESTRICTIONS/LIMITATIONS

The following restrictions/limitations apply to these procedures:

1. Composite samples should not be collected when there is a potential risk of dangerous chemical reaction.
2. Composite samples should not be collected when the measure of contamination variation as a function of the location is important.
3. Composite samples are average values that are useful in estimating overall site properties. They are not representative of the variability of contaminant levels at specific locations.
4. Composite samples are not normally an acceptable meas of collecting samples (VOAs, semi-VOAs in some cases, dissolved gases, or other compounds) that will or could be degraded by aeration or mixing.
5. Data collected from composite samples are considered to be screening data and, therefore, must meet data quality objective Level B requirements only.

7.0 REFERENCES

Department of Energy, *Environmental Survey Manual*, DOE/EH-0053, October 1987.
Hazardous Waste Remedial Actions Program, Martin Marietta Energy Systems, Inc., *Quality Control Requirements For Field Methods*, DOE/HWP-69, February 1989 (DOE/HWP-69/R1, July 1990).
U.S. Environmental Protection Agency, *Practical Guide for Groundwater Sampling*, EPA/600/2-85/104, 1985.
U.S. Environmental Protection Agency, *Data Quality Objectives for Remedial Response Activities*, EPA/540/G-87/003, 1987.

U.S. Environmental Protection Agency, *A Compendium of Superfund Field Operations Methods*, EPA/540K/P-87/001, 1987.

STANDARD OPERATING PROCEDURE NO. 12
MATRIX SPIKE AND MATRIX SPIKE DUPLICATE SAMPLING

1.0 OBJECTIVE

The objective of this procedure is to define the purpose of and the requirements for the collection of matrix spike (MS) and matrix spike duplicate (MSD) samples.

2.0 BACKGROUND

MS and MSD samples are samples from a specific media that have been spiked with known quantities of analytes. The analytes that will be added will depend upon the particular phase of analytical processes.

MS and MSD samples are a form of laboratory quality assurance/quality control (QA/QC) for determining matrix effects and the reliability of the analytical processes and equipment. The matrix effect is a condition in which sample composition interferes with the analysis of the desired analyte(s). Spiked sample recovery supplies percentage recovery information so that the laboratory can evaluate its measurement accuracy. MS and MSD samples are equal portions of a single initial sample that has been spiked with specific analytes in known quantities and must meet certain laboratory requirements to be acceptable.

The number of MS and MSD samples and the frequency at which they are obtained will be defined in the Project QA/QC Plan.

3.0 RESPONSIBILITIES

Site Manager: The Site Manager shall ensure that sampling efforts are conducted in accordance with this procedure and other Hazardous Waste Remedial Actions Program (HAZWRAP) SOPs pertaining to specific media sampling.

Project Field Geologist/Engineer: The Project Field Geologist/Engineer shall ensure that field sampling personnel collect MS and MSD samples in accordance with this procedure.

Project QA/QC Manager: The Project QA/QC Manager shall ensure that this procedure is followed correctly by field personnel and the quantity and quality of MS and MSD samples obtained meet the requirements of the Project QA/QC Plan.

4.0 REQUIRED EQUIPMENT

The equipment required to obtain MS and MSD samples is identical to that required for other media sampling. Refer to SOPS 4, 5, and 7 for specifics.

5.0 PROCEDURES

5.1 PREPARATION

The following steps must be followed when preparing MS/MSD samples:

1. Determine the frequency of obtaining MS and MSD samples as stated in the site-specific sampling plan.
2. Proceed with site sampling to the point of obtaining the MS and MSD samples. Refer to SOPS 4, 5, and 7 for specific media techniques.
3. Soils, sediments, thick sludge: Place the entire sample into the mixing bowl/tray (stainless steel or Teflon). Stir (mix) sample thoroughly to ensure homogeneity. Note: Refer to Sect. 6 of this SOP concerning volatile organic analysis (VOA) and semivolatile (SVOA) restrictions.
    a. Collect the sample according to the appropriate SOP.
    b. Fill three appropriate containers with the sample mixture. Seal the containers as soon as filled. Decontaminate the outside of the sample containers.
    c. Label the three containers as "sample XXX," "sample XXX MS," and "sample XXX MSD," respectively. The laboratory will add the appropriate spike analyte(s) to the MS and MSD portions of the samples.
    d. Pack and transport samples with other samples from the specific media. Suspected highly contaminated samples should be transported in separate coolers.
4. Aqueous solutions (water and low-viscosity sludge): Collect the sample according to the requirements of the appropriate SOP.
    a. Aqueous solutions are assumed to be fairly homogenous as collected. If appropriate, agitate/stir sample to ensure homogeneity.
    b. Fill three appropriate sample containers with the aqueous solution. Seal the containers as they are filled. Decontaminate the sample containers.
    c. Label the three containers as "sample XXX," "sample XXX MS," "sample XXX MSD," respectively. The laboratory will add the spike analyte(s) to the MS and MSD portions of the samples.
    d. Pack and transport samples with other samples from the specific media. Suspected highly contaminated samples should be transported in separate coolers.
5. Decontaminate all equipment according to SOP 13. Place all disposable

liquids, solids, paper, plastic, etc., in the appropriate containers.

6. Remove personnel protective clothing and equipment and place in the designated receptacle(s).

6.0 RESTRICTIONS/LIMITATIONS

The following restrictions/limitations apply to these procedures:

1. Field spiking of samples is not recommended. While field MS sampling provides the best overall assessment of accuracy for the entire sampling/analytical system, the potential for error and/or introduction of unknowns into the data system far outweigh this advantage. Spiking should remain as a laboratory function under controlled conditions.
2. Compositing of solid VOA samples to obtain one homogeneous sample for spiking is not recommended. While MS and MSD samples could be prepared, mixing induces the release and vaporization of VOA components, which invalidates the entire process. The laboratory can prepare MS and MSD samples to check matrix effect interference, if required.
3. Compositing of aqueous VOA samples in open containers is not allowed. Aqueous or liquid samples of low viscosity are normally considered to be homogeneous. Closed (sealed) collection devices with no headspace for the release of VOAs may be agitated slightly to ensure homogeneity. Agitation must not be induced until it is determined that no headspace exists. The movement of the aqueous solution will be slight, but could assure homogeneity.
4. Extreme care must also be taken in homogenizing samples for SVOA analyses. Under extreme conditions (elevated temperature and vigorous mixing) certain of the SVOA constituents may be released and vaporize.

The surest method of obtaining reliable MS and MSD samples from media being submitted for VOA or SVOA analyses is to collect, contain, preserve, and transport the sample(s) to the laboratory; indicate that it is to be an MS or MSD sample; and let the laboratory make all preparations under controlled conditions. This method should be established before sampling is initiated.

Samples for other than VOA and SVOA analyses must be thoroughly mixed to ensure a homogenous three-part sample as the initial, MS, and MSD portions.

7.0 REFERENCES

Hazardous Waste Remedial Actions Program, Martin Marietta Energy Systems, Inc., *Quality Control Requirements for Field Methods*, DOE/HWP-69, February 1989 (DOE/HWP-69/R1, July 1990).

U.S. Environmental Protection Agency, *Practical Guide for Groundwater Sampling*, EPA/600/2-85/104, 1985.
U.S. Environmental Protection Agency, *Data Quality Objectives for Remedial Response Activities*, EPA/540/G-87/003, 1987.
U.S. Environmental Protection Agency, *A Compendium of Superfund Field Operations Methods*, EPA/540/P-87/001, 1987.

STANDARD OPERATING PROCEDURE No. 13
FIELD EQUIPMENT DECONTAMINATION

1.0 OBJECTIVE

The objective of this procedure is to describe the procedures required for decontamination of field equipment.

2.0 BACKGROUND

Decontamination of field equipment is necessary to ensure the quality of samples by preventing cross-contamination. Further, decontamination reduces health hazards and prevents the spread of contaminants off-site.

3.0 RESPONSIBILITIES

Site Manager: The Site Manager is responsible for ensuring that field personnel are trained in the use of this procedure and that decontamination is conducted in accordance with this procedure.

Project Quality Assurance (QA) Manager: The Project QA Manager is responsible for verifying that this procedure is correctly implemented. The Project QA Manager may also be required to collect and document rinseate samples to provide quantitative verification that these procedures have been correctly implemented.

4.0 REQUIRED EQUIPMENT

4.1 NON-SAMPLING EQUIPMENT

- Rigs, backhoes, augers, drill pipe, bits, casing, and screen.
- High-pressure pump with metered soap dispenser or steam-spray unit.
- 2- to 5- gal manual-pump sprayer (pump sprayer material must be compatible with the solution used).
- Stiff-bristle brushes.
- Gloves, goggles, boots, and other protective clothing as specified in the site-specific health and safety plan.

4.2 SMALL EQUIPMENT

Small equipment includes:

- Split spoons, bailers, bowls, dredges, kemmer or wheaton water samplers, and filtration equipment.
- 5-gal plastic buckets and/or troughs.
- Laboratory-grade detergent (phosphate free).
- Stiff-bristle brushes
- Nalgene or Teflon sprayers or wash bottles or 2- to 5- gal manual-pump sprayer (pump sprayer material must be compatible with the solution used.
- Plastic sheeting.
- Disposable wipes or rags.
- Distilled water [American Society for Testing and Materials (ASTM) Type II or better].
- Appropriate decontamination solutions (laboratory grade methanol, hexane, 10% nitric acid solution).
- Gloves, goggles, and other protective clothing as specified in the site-specific health and safety plan.

4.3 PUMPS AND PUMP ASSEMBLIES

The required pumps and pump assemblies include:

- Three or more empty 55-gal drums.
- Plastic sheeting
- 5-gal (or larger) containers of distilled water (ASTM Type II or better) and other required decontamination solutions.
- Disposable wipes or rags.
- Gloves, goggles, and other protective clothing as specified in the site-specific health and safety plan.

5.0 PROCEDURES

5.1 HEAVY EQUIPMENT DECONTAMINATION

Heavy equipment includes drilling rig and backhoe. The following steps must be followed when decontaminating this equipment.

1. Set up a decontamination pad that is large enough to fully contain the equipment to be cleaned. Use one or more layers of heavy plastic sheeting to

cover the ground surface.

2. With rig in place, spray areas (rear or rig or backhoe) exposed to contaminated soils using steam or high-pressure sprayer. Be sure to spray down all surfaces, including the undercarriage. It is also good practice to clean motor, hydraulic lift, oil fill, and fuel tank areas to avoid introducing contaminants to the work site.
3. If soapy water was used for the washdown step, rinse the equipment with potable (tap) water.
4. Remove equipment from the decontamination pad and allow to air dry before returning it to the work site.
5. Record equipment type and serial number, date, time, and method of decontamination in the appropriate logbook.

5.2 DOWNHOLE EQUIPMENT DECONTAMINATION

Downhole equipment includes hollow-stem augers, drill pipe, casing, and screen. The following steps must be followed when decontaminating this equipment.

1. Set up a centralized decontamination area, if possible. This area should be set up to contain contaminated rinse waters and to minimize the spread of airborne spray.
2. Set up a "clean" area upwind of the decontamination area to receive cleaned equipment for air drying. At a minimum, clean plastic sheeting must be used to cover the ground, tables, or other surfaces on which decontaminated equipment is to be placed.
3. Put on gloves, boots, goggles, and any other personnel protective clothing and equipment as specified in the site-specific health and safety plan.
4. Place object to be cleaned on metal or plastic-covered wooden sawhorses or other supports.
5. Using soapy water in the high-pressure sprayer (or steam unit), spray the contaminated equipment. Aim downward to avoid spraying outside the decontamination area. Be sure to spray inside corners and gaps especially well. Use a brush, if necessary, to dislodge dirt.
6. If using soapy water, rinse the equipment using clean, clear tap water. If using steam, the rinse step is not necessary if the steam does not contain a detergent. If the steam contains a detergent, a final clean water rinse is required.
7. Using the manual-pump sprayer, rinse the equipment thoroughly with distilled water.
8. Remove the equipment from the decontamination area and place in the clean area to air-dry.
9. Record the equipment number (if assigned) or type, date, and time of decontamination in the appropriate logbook.

10. Record the decontamination protocol, equipment number, or description together with the date and time of decontamination in the appropriate logbook.
11. After decontamination activities are completed, collect all contaminated waters, used solvents and acids, plastic sheeting, and disposable gloves, boots, and clothing in separate containers or receptacles. All receptacles containing contaminated items must be properly labeled for disposal. Liquids and solids must be drummed separately.

5.3 SAMPLING EQUIPMENT DECONTAMINATION

Sampling equipment includes split spoons, spatulas, and compositing bowls that directly contact samples. The following steps must be followed when decontaminating this equipment.

1. Set up a decontamination line on plastic sheeting. The decontamination line should progress from "dirty" to "clean" and end with an area for drying decontaminated equipment. At a minimum, clean plastic sheeting must be used to cover the ground, tables, or other surfaces on which decontaminated equipment is to be placed.
2. Wash the item thoroughly in a 5-gal bucket of soapy water. Use a stiff-bristle brush to dislodge any clinging dirt. Disassemble any items that might trap contaminants internally before washing. Do not reassemble until decontamination is complete.
3. Rinse the item in clear tap water. Rinse water should be replaced as needed, generally when cloudy.
4. Repeat step 3 in a separate bucket (optional).
5. If trace metals are to be sampled for, rinse the item with 10% nitric acid (for stainless steel, glass, plastic, and Teflon; items made of low-carbon steel should be rinsed with a 1% acid solution). Note: Care should be taken not to get nitric acid on skin or clothing. This step should not be used unless required by sampling needs. Caution: Do not allow nitric acid to contact methanol or hexane. Contain nitric acid waste separate from organic solvents.
6. Using hand sprayer, wash bottles, or manual pump sprayer, rinse the item with potable water.
7. Rinse item with methanol.
8. If polar organic compounds such as pesticides, polychlorinated biphenyls (PCBs), and fuels are to be sampled, rinse the item with hexane. This step should not be used unless required by sampling needs. A second hexane rinse may be used to aid in drying on wet days.
9. After the hexane has volatilized off, a final rinse with deionized water is required.
10. After drying, wrap the cleaned item in aluminum foil, shiny side out, for storage.

11. Record the decontamination protocol, equipment number, or description together with the date and time of decontamination in the appropriate logbook.
12. After decontamination activities are completed, collect all contaminated waters, used solvents and acids, plastic sheeting, and disposable gloves, boots, and clothing. Place contaminated items in properly labeled drums for disposal. Liquids and solids must be drummed separately.

5.4 PUMP DECONTAMINATION

The following steps must be followed when decontaminating pumps:

1. Set up decontamination area and separate "clean" storage area using plastic sheeting to cover the ground, tables, and other porous surfaces. Set up three 55-gal drums in a triangle. The two drums at the base of the triangle will be used to contain dilute (non-foaming) soapy water and potable water. The drum at the apex will receive wastewater. Place 5-gal cans of distilled water adjacent to the waste drum on the same side as the potable water drum.
2. Pump should be set up in the same configuration as for sampling. Submerge pump intake (or pump if submersible) and all downhole wetted parts (tubing, piping, fot valve) in soapy water of the first drum. Place the discharge outlet in the waste drum above the level of wastewater. Pump soapy water through the pump assembly until it discharges to the waste drum.
3. Move pump assembly to the potable water drum while leaving discharge outlet in the waste drum. All downhole wetted parts must be immersed in the potable water rinse. Pump potable water through the pump assembly until it runs clear.
4. Move the pump intake to the distilled water can. Pump distilled water through the pump assembly. Usually, three pump-and-line assembly volumes will be required.
5. Decontaminate the discharge outlet by hand following the steps outlined in Sect. 5.3.
6. Remove the decontaminated pump assembly to the "clean" area and allow to air dry. Intake and outlet orifices should be covered with aluminum foil to prevent the entry of airborne contaminants and particles.
7. Record the equipment type and identification, and the date, time, and method of decontamination in the appropriate logbook.

5.5 WASTE DISPOSAL

The following steps must be followed when disposing of wastes:

1. All wash water, rinse water, and decontamination solutions that have come in contact with contaminated equipment are to be handled, packaged, labeled, marked, stored, and disposed of as hazardous waste unless other arrangements are approved in advance.
2. Small quantities of decontamination solutions may be allowed to evaporate to dryness.
3. If large quantities of used decontamination solutions are to be generated, it may be best to segregate each type of waste in separate containers. This may permit the disposal of wash water and rinse water in a sanitary sewage treatment plant rather than as a hazardous waste. If an industrial wastewater treatment plant is available, the disposal of acid solutions and methanol-water solutions may be permitted.
4. Unless required, plastic sheeting and disposable protective clothing may be treated as a solid nonhazardous waste.

6.0 RESTRICTIONS/LIMITATIONS

Nitric acid and polar solvent rinses are necessary only when sampling for metals or polar organics (pesticides, PCBs, and fuels), respectively. These steps should not be used unless required because of acid burn and ignitablity hazards.

7.0 REFERENCES

U.S. Environmental Protection Agency, Region IV, *Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual*, 1986.
U.S. Environmental Protection Agency, *A Compendium of Superfund Field Operations Methods*, EPA/540/P-87/001.1, 1987.

STANDARD OPERATING PROCEDURE NO. 14
WATER LEVEL MEASUREMENT

1.0 OBJECTIVE

The objective of this procedure is to define the requirements for obtaining accurate water level measurements from observation wells.

2.0 BACKGROUND

Accurate water level measurements are fundamental to the assessment of groundwater flow direction and gradient required for groundwater flow and transport studies. Manual measurements of water levels can also be obtained during in-situ permeability testing or pumping tests to determine drawdowns or recoveries in observation or test wells.

2.1 Definitions

Water Level Indicator - A portable device for measuring the depth from a fixed point at the ground surface or above ground surface to the groundwater inside a well, borehole or other underground opening. The device consists of a graduated tape, usually marked in increments of 0.01 feet, onto which a water-sensitive electrode is connected. When the electrode circuit is closed, the device will electronically signal the presence of water. The system is contained on a hand-cranked reel and the electrodes are mounted in a weighted probe attached to the end of the tape.

Measurement Point - An easily-located and clearly-defined mark at the top of a well or borehole from which all water level measurements from that particular site are made. The measurement point should be as permanent as possible to provide consistency in measurements.

Interface Probe - An electronic water level measuring device, similar to a water level indicator, that also contains a sensor capable of detecting the presence of immiscible free-phase product.

Immiscible Fluids - Two or more fluid substances which will not mix, and therefore will exist together in a layered form. The fluids denser than water will exist as the bottom layer (dense non-aqueous phase liquid or DNAPL) and the fluid lighter than water will exist as the top layer (light non-aqueous phase liquid or LNAPL).

Static Water Level - The level of water in a well that is not influenced by discharge or recharge.

Well Riser - A pipe which extends into a borehole and is connected to the well screen or sealed at the bedrock surface in open-hole wells. The well riser is normally enclosed by an outer steel protective casing.

Protective Casing - A steel pipe or protective sleeve that extends approximately 3 to 5 feet into the ground, surrounding the well riser, that may extend above the ground surface approximately 2 to 3 feet. The protective casing protects the well riser.

3.0 RESPONSIBILITIES

Site Manager - The site manager is responsible for ensuring that measurements are conducted in accordance with this procedure and any other SOP pertaining to site activities related to obtaining groundwater level measurements.

Project Field Geologist/Engineer - The Project Field Geologist/Engineer is responsible for complying with this procedure.

4.0 REQUIRED EQUIPMENT

- Site-specific plans showing well locations and access
- Field logbook
- Indelible black-ink pens
- Decontamination equipment and supplies, including rinse bottles, deionized water, and disposal containers
- Personal protective clothing and equipment as required by the site-specific health and safety plan
- Water level measuring device (water level indicator or interface probe) as dictated by site conditions (that is, potential presence of free-phase product).

5.0 PROCEDURES

The following steps must be followed when measuring water levels in monitoring wells:

1. Record all data in the designated field logbook for the project (see SOP No. 8 - Logbook Documentation). Document any and all deviations from this SOP and other site specific plans in the logbook and include a rationale for changes.

2. Check function of the water level indicator or interface probe by dipping the probe into distilled water to ensure that the signaling device responds to probe submergence.

3. Open the well while standing upwind. Measure the concentration of volatile compounds or gases in the well with an appropriate air-monitoring instrument as soon as the cap is opened and record the levels in the logbook.

4. Identify the measurement reference point for the well. The measurement point must be as permanent as possible, clearly marked and easily located. The measurement point should be the top of the inner PVC riser. Since the riser top is frequently not smooth or horizontal, if no reference point is observed, then a point should be designated and marked by cutting a notch on the top of the riser pipe and then highlighting the notch with a permanent marker (paint or other liquid marking materials should not be used). The protective outer casing should be used as a reference point only if the inner casing is not accessible. The protective casing elevation can move due to frost heaving, so as a matter of standard practice, this reference should not be used routinely. Always note in the logbook whether measurements are taken in reference to the well riser or protective casing.

5. Lower the device slowly into the well until contact with the water surface is indicated. If LNAPL is suspected, set the interface probe to detect the presence of free product before measuring the level of water in the well.

6. Read the depth to water on the measuring device tape at the measuring reference point on the well riser or casing. Take a second check reading before completely withdrawing the device from the well to verify the measurement.

7. If DNAPL is suspected, set the interface probe to detect the presence of free product and lower the device towards the bottom of the well.

8. Withdraw the device from the well and decontaminate the probe and measuring tape according to SOP No. 13 before proceeding to the next well, in order to minimize cross-contamination.

6.0 RESTRICTIONS/LIMITATIONS

In a well where water is rapidly dripping or flowing into the wellbore, either from the top of the well or from fractures, obtaining an accurate reading may not be possible because water will be splashing down onto the device, which can cause false readings.

When measuring water levels in wells containing free-product, be aware that very heavy or thick free product may coat the probe, which will cause anomalous readings and possibly lead to an overestimate of product thickness. If the withdrawn probe is coated with a thick residue of free product, the measurement should be repeated and the presence of the product should be noted in the logbook.

7.0 REFERENCES

U.S. Environmental Protection Agency, 1987, Compendium of Superfund Field Operations Methods. EPA/540/P-87/001.

STANDARD OPERATING PROCEDURE No. 16
GROUNDWATER SAMPLING WITH BAILERS
OR
CHECK-VALVE INERTIAL PUMPS

1.0 OBJECTIVE

The purpose of this procedure is to define requirements for the collection of groundwater samples.

2.0 BACKGROUND

Methods used for the collection of groundwater samples include bailing and a variety of pumping techniques. Bailers are hollow cylinders with unidirectional (open up) check valves at the bottom end. Some bailers may also be closed or valved at the upper end. Bailers used in environmental applications are typically constructed of stainless steel, Teflon, disposable nylon string, disposable monofilament polypropylene or Teflon-coated stainless steel wire. The bailer is lowered into the monitoring well on an acceptable line or coated wire line until submerged. The bailer is then retrieved to the surface for sample collection.

Inertial pumps are constructed of inert plastic or teflon tubing with a unidirectional (open up) check valve at the bottom end. The pump is usually dedicated to a given well and is lowered to the bottom of the well. The well is purged and sampled by alternately lifting and lowering the pump tubing in the well, which closes and opens the check valve, allowing water to be pushed into and up through the pump tubing to the surface.

This procedure describes groundwater sampling with bailers or check-valve inertial pumps. For the best results, the sequence of sampling is from least to most contaminated wells. It is preferable for most sampling events using bailers or inertial pumps to have dedicated equipment or, in the case of bailers, enough bailers to last for 1 day's worth of sampling.

3.0 RESPONSIBILITIES

<u>Site Manager:</u> The Site Manager is responsible for ensuring that field personnel are trained in the use of this procedure and for verifying that groundwater samples are collected in accordance with this procedure.

<u>Project Field Geologist/Engineer:</u> The Project Field Geologist/Engineer is responsible

for complying with this procedure, including sample collection, packaging, and documentation.

4.0 REQUIRED EQUIPMENT

- Bottom-filling, bottom-emptying bailer (with bottom release, if needed) of the appropriate material (bailer sampling)
- Clean rope or wire line of sufficient length for conditions (bailer sampling).
- Check valve inertial pump and inert plastic tubing of sufficient length for conditions (inertial pump sampling).
- Appropriate sample containers with labels and preservatives, as required.
- Hard plastic or steel cooler with cold packs (or ice).
- Water-level meter and/or other water-level measuring deice.
- Temperature, conductivity, pH, dissolved oxygen, and organic vapor meters, if required.
- Plastic sheeting.
- Decontamination supplies, as required.
- Personal protective clothing and equipment, if required by the site-specific health and safety plan.
- Latex or polyvinyl chloride (PVC) gloves.
- Standard 0.45 micron filter (optional)

5.0 PROCEDURE

5.1 Sampling with Bailers

The following steps must be followed when sampling groundwater with bailers.

1. Put on protective clothing and equipment as specified in the site-specific health and safety plan.
2. Prepare the site for sample acquisition by covering the ground surface around the monitoring well head with plastic sheeting. Arrange the required sampling equipment for convenient use. If on-site decontamination is required, arrange the necessary supplies in a nearby but separate location, away from the monitoring well head.
3. Open the monitoring well and note the condition of the casing and cap. Check for vapors using vapor analyzing equipment. Using a water-level meter, determine the static water level and depth to monitoring well bottom. Record this information in the field logbook or on the water sampling form.
4. Purge the monitoring well according to Standard Operating Procedure (SOP) 6, if not already accomplished. Allow the water level to recover to a depth at least

sufficient for the complete submergence of the bailer without contacting the monitoring well bottom.

5. While the monitoring well is recovering from purging, decontaminate the bailer. If the bailer was decontaminated before arrival at the site, remove the protective wrappings. Securely attach the bailer to the line. The end of the line should also be secured.
6. Arrange the sample containers in the order of use. Volatile organic analyte (VOC) samples, if required, will be obtained first, followed in order by semivolatiles (SVOC) and other samples.
7. Lower the bailer into the monitoring well. Do not allow the bailer to touch the casing. The bailer should enter the water slowly to prevent aeration, particularly when VOC and SVOC samples are being collected. Do not permit the bailer to contact the monitoring well bottom.
8. Retrieve the filled bailer to the surface. Do not allow the line to contact the ground. Hang the bailer from a bailer stand or other support, if available, or have an assistant hold it off the ground. The first bailer of water should be used as a rinse and then discarded. Immediately obtain any required VOC and SVOC samples by using the release valve to gently transfer water to the sample bottle. The sample bottle should be tilted when filling to prevent aeration. Check the filled vial for bubbles. The first volume of sample should be used as a rinse and then discarded, unless the sample bottles contain preservative. If sample filtration is required, it should be done as soon as possible, or after sample retrieval. If, after collecting VOC and SVOC samples, the total required sample volume is greater than the water remaining in the bailer, decant the water into a clean compositing container. The compositing container must have adequate volume to contain the entire volume necessary for collection. Again lower the bailer to collect water for additional sample volume, if needed.
9. When the composited sample volume is sufficient, decant water into the remaining sample containers. Add preservative (if needed), cap, seal, and properly label all containers. Place the filled containers in the cooler(s) immediately.
10. Samples collected for dissolved metals will be filtered in the field with a Norwell® Posi-Filter Kit which utilizes a hand-operated pump and a 0.45 micron filter.
11. Record sample types and amounts collected, and time and date of collection in the field logbook and on the groundwater sampling forms per SOPs 8 and 9. Prepare chain-of-custody and analytic request documents as required by the project quality assurance plan.
12. Clean up the area and place disposable materials (plastic sheeting, gloves, Tyvek) in the designated receptacle. Close and lock the monitoring well cover.

5.2 Sampling with Inertial Pumps

The following steps must be followed when sampling groundwater with inertial check-valve pumps:

1. Put on protective clothing and equipment as specified in the site-specific health and safety plan.
2. Prepare the site for sample acquisition by covering the ground surface around the monitoring well head with plastic sheeting. Arrange the required sampling equipment for convenient use. If on-site decontamination is required, arrange the necessary supplies in a nearby but separate location, away from the monitoring well head.
3. Open the monitoring well and note the condition of the casing and cap. Check for vapors using vapor analyzing equipment. Using a water-level meter, determine the static water level and depth to monitoring well bottom. Record this information in the field logbook or on the water sampling form.
4. Decontaminate the pump foot valve. Pump tubing comes decontaminated from the factory.
5. Install the inertial pump by attaching the check valve to the base of the tubing and lowering the tubing into the well. A minimum of three (3) feet of tubing must extend beyond the top of the well riser to allow for the vertical oscillation of the pump tubing and filling of sample bottles.
6. Purge the monitoring well according to Standard Operating Procedure (SOP) 6, if not already accomplished, using the inertial pump.
7. Arrange the sample containers in the order of use. VOC samples, if required, will be obtained first, followed in order by SVOC and other samples.
7. To collect sample, begin to oscillate the pump tubing up and down either manually or with the aid of a motorized oscillating arm. For sample collection, the pump should be moved at a slow rate to minimize aeration, particularly when VOC and SVOC samples are being collected. Do not permit allow the pump check valve to contact the monitoring well bottom.
8. As water is produced, prepare to start filling sample bottles. If using a pump of 0.5 inch diameter or larger, insert a small diameter (0.125-inch diameter) inert plastic tube in the mouth of the pump to be used for collection of VOC samples. Continue to purge the water through the pump and the smaller diameter tubing until flow is established in the smaller tubing. Stop pumping and fill the VOC sample vials with the water remaining in the small diameter tubing. This additional procedure minimizes volatilization of VOCs and is not required for other analyte suites (other than ethylene dibromide) or for small diameter inertial pump tube sizes (0.25 inch diameter or less). In these latter cases, sample bottle can be filled directly from the larger diameter tubing.
9. For VOC samples, the sample bottle should be tilted when filling to prevent aeration. Check the filled vial for bubbles. The first volume of sample should be used as a rinse and then discarded, unless the sample bottles contain preservative. If sample filtration is required, it should be done as soon as

possible, or after sample retrieval.

9. Continue pumping to allow collection of sufficient volume for all remaining analyses. Add preservative (if needed), cap, seal, and properly label all containers. Place the filled containers in the cooler(s) immediately.
10. Samples collected for dissolved metals will be filtered in the field with a Norwell® Posi-Filter Kit which utilizes a hand-operated pump and a 0.45 micron filter.
11. Record sample types and amounts collected, and time and date of collection in the field logbook and on the groundwater sampling forms per SOPs 8 and 9. Prepare chain-of-custody and analytic request documents as required by the project quality assurance plan.
12. Clean up the area and place disposable materials (plastic sheeting, gloves, Tyvek) in the designated receptacle. Pull the pump tubing 4 to 6 feet out of the well and fold the tubing over. Insert the folded tubing back into the well so that the bend in the tubing is close to the top of the well riser. Close and lock the monitoring well cover.

6.0 RESTRICTIONS/LIMITATIONS

Obtain on-site data such as temperature, conductivity, pH, or dissolved oxygen measurements after samples have been collected. This may require additional time for monitoring well recovery.

7.0 REFERENCES

Driscoll, F.G., *Groundwater and Wells*, Second Edition, St. Paul, Minnesota, Johnson Division, 1986.

U.S. Environmental Protection Agency, *A Compendium of Superfund Field Operations Methods*, EPA/540/P-87/001, 1987.

U.S. Environmental Protection Agency, *Manual of Water Well Construction Practices*, EPA/570/9-75-001, 1975.

STANDARD OPERATING PROCEDURE No. 17
LITHOLOGIC LOGGING OF SOIL SAMPLES

1.0 OBJECTIVE

The purpose of this standard operating procedure (SOP) is to define a lithologic logging and description procedure for unconsolidated subsurface soil split spoon samples collected from glacial depositional environments.

2.0 BACKGROUND

2.1 Definitions

The following definitions will apply to lithologic logging of unconsolidated materials:

Color - Sample color description will use a basic descriptor (such as brown, tan, dark brown, reddish brown, orange brown) followed (optionally) by the Munsell hue and chroma in parentheses.

Moisture - Moisture content will be described as follows:

- **Dry** - dry to touch, no visible moisture, sheen or cohesiveness
- **Moist** - wet to touch, but no visible water droplets
- **Wet** - soil is saturated with water

Density - Density will be based upon total blow counts of the middle foot of a two-foot, 2-inch diameter split spoon. If cobbles are found in the nose of the spoon, this observation should be noted on the log: density based upon blow counts in this case will not be accurate. Density definitions are as follows:

Granular Soils:		**Cohesive Soils:**	
0 - 4	very loose	< 2	very soft
4 - 10	loose	2 - 4	soft
10 - 30	medium dense	4 - 8	medium stiff
30 - 50	dense	8 - 15	stiff
> 50	very dense	15 - 30	very stiff
		> 30	hard

Geologic Modifiers - Geologic modifiers that apply to samples collected from a glacial environment include notable sedimentological features that are observed:

Stratified - the presence of alternating layers of non-cohesive materials of different grain sizes. May be poorly or well stratified depending on how distinct the contact between grain sizes is.

Laminated or Varved - the presence of alternating very thin layers of fine materials such as silt and clay. Silts are usually soft and clays are relatively stiffer or harder.

Sorting - a geologic term used to describe how close in size the grains in a sample are to each other. A well sorted sample contains grains of similar size. A poorly sorted sample contains grains of many sizes.

Angularity or Rounding - the general appearance of grains in the sample. The closer to spherical in shape the grain is, the better rounded the grain is. An illustration of rounding and angularity is appended to this SOP.

If samples are collected in sleeves, the use of geologic modifiers may be limited to estimates of rounding or sorting, unless samples are extruded from the sleeves after a selected portion of the samples are sent to the laboratory for geotechnical or chemical analysis.

Major Constituent - The major constituent will constitute at least 50 percent of the sample by visual estimate and will be capitalized in the description.

Minor Constituents - Minor constituents will be described in order of decreasing presence in the sample by visual estimate. The description will be in small letters. Proportions are as follows:

Trace (tr.):	0 - 10%
Little (ll. or l.):	10 - 20%
Some (so.):	20 - 35%
And (&):	35 - 50%

If a minor constiutent is thought to be in the 35 to 50 percent range, it is also capitalized in the description. The modifiers may be spelled out or abbreviated (as shown above) as necessary, depending upon space limitations and can be used interchangably in the description.

Grain Size - Grain sizes will be presented as follows (based on distributions in the Unified Soil Classification System (USCS)):

Cobble:	75 - 300 mm
Coarse Gravel:	19 - 75 mm
Fine Gravel:	4.8 - 18 mm
Coarse Sand:	2.0 - 4.8 mm
Medium Sand:	0.43 - 2.0 mm
Fine Sand:	0.08 - 0.43 mm
Silt and finer:	< 0.08 mm

Geologic Descriptions - Common lithologies encountered in glacial environments include the following:

Outwash - fluvially (river) deposited sands, gravels and fines, often well sorted and/or stratified on a fine or coarse scale.

Ablation Till - material deposited directly from the leading edge of a glacier. Ablation till is usually poorly sorted and has not been subject to significant transport by water. Content of fines will vary from location to location, but the material will usually not be dense and compacted.

Lodgement Till - dense or compact, poorly sorted material deposited beneath an advancing glacier. Usually seen as the last overburden material directly above bedrock. Usually contains substantial fines and larger materials within the fine matrix are angular. High blow counts are often indicative of lodgement tills, and the sample often comes out of the split spoon as a cohesive cylinder that does not crumble.

Lacustrine Sediments - fine sands, silts and/or clays deposited in a water body or other "low energy" environment, as opposed to a river. Dark colored, often laminated or varved. Clays and silts can also be present as lenses within outwash. The boundary or contact between outwash and glacio-lacustrine sediments can also be gradual.

2.2 Discussion

To evaluate lithologic descriptions from different boreholes, it is sometimes possible to correlate similar units. To help in this task, it is important to provide uniform and consistent descriptions.

In describing unconsolidated materials, it is helpful to have a set of references that cover grain-size percentage estimation, particle shape, grain-size charts and lithologic symbols. It is suggested that staff be equiped with a field-durable reference chart, such as the Geotechnical Guage (manufactured by W.F. McCollough, Inc. Beltsville, MD) or similar reference.

3.0 RESPONSIBILITIES

Field Person - The field person performing lithologic logging is responsible for making a consistent and uniform log and for turning in field forms and logbooks to the Field Team Leader (FTL).

Field Team Leader - The FTL is responsible for maintaining logbooks and forms.

4.0 REQUIRED EQUIPMENT

The description of soil lithologies requires a minor amount of field equipment for the geologist. This section provides a list of equipment to be used by the logger, but does not include equipment such as drill rigs, sampling equipment and personal protection equipment. The following is a general list of equipment that may be used:

- Field logbook and Lithologic Log form
- Clipboard
- Waterproof pens
- 10x magnifying hand lens
- Reference Field Charts
- PID/FID
- Plastic Sheeting
- PVC sampling Trays
- Scale or Ruler
- Camera and film (slide or print)

5.0 PROCEDURES

5.1 Office

- Obtain field logbook and Lithologic Log (Boring Log) forms
- Coordinate schedules/actions with FTL
- Obtain necessary field equipment
- Obtain reference charts
- Review field support documents (such as sampling plan, and health and safety plan)
- Review available references on the geology of the site or vicinity (such as previous investigations or USGS geologic maps or reports)

5.1.1 Documentation

Individuals performing lithologic logging will record their observations in a commercially available bound field logbook and transcribe the descriptions to lithologic Log forms. Lithologic loggers will follow the general procedures for keeping a field logbook (SOP No. 8). Data recorded in the logbook will be transcribed without alteration onto the appropriate lithologic log form within one day of the original data recording. All blanks on the lithologic log form must be filled out. If an item is not applicable, an "NA" should be entered.

The lithologic log form sould be filled out according to the following instructions:

The top part of the form contains general information. The project and number must be filled in to identify the site. The date that drilling was started and completed, and the well/boring number within the site shall be stated. The name of the person logging the well is recorded as is the total depth (TD) drilled. The name of the drilling company, driller, rig type, borehole diameter, boring device and sampling device shall also be provided. Survey coordinates and ground surface elevations will be entered in the office after surveying data are received.

The bottom part of the form shall be completed according to the instructions below.

1. The depth column refers to the depth below ground surface and should be provided in feet. The tick marks can be arbitrarily set to any depth depending upon the scale needed.

2. In the sample column, provide the depth interval from which the samples was obtained. Note that when split spoon recovery is less than 100 %, the missing samples is assumed to come from the bottom of the split spoon, for logging purposes.

3. The sample number column is used to record the sample number and/or the lab shipment number of the sample, if applicable.

4. Blow counts are recorded in the "Blow 6 in." column. Blow counts specifically refer to the number of hammer blows it takes to drive a split spoon sampler 6 inches into the ground. If anything other than a 140 pound hammer is used, this observation should be recorded in this column below the blow counts in the following manner: (300 lb.) The recording of blow counts provides a relative feel for the cohesiveness and/or density of a formation.

5. The recovery column is a ratio, in inches of the portion of the split spoon that is filled with recovered sample. Recovery is usually written in the form "12/24" or "9/24."

6. The lithologic description column is the most important part of the lithologic log form and is where the lithology is described. In completing this section, use the applicable reference charts and complete according to the following sequence:

   - Color (munsell hue and chroma, optional)
   - moisture content
   - density

- geologic modifier
- major constituent
- minor constituents
- geologic description

Examples:

Tan (10YR 6/4) wet, loose, stratified, subrounded coarse SAND, little medium sand, tr. silt (glacial outwash)

Light brown (10 YR 3/5), wet, medium dense, poorly sorted, subrounded fine to medium SAND, some silt, trace gravel (ablation till)

Dark gray (5BG 5/1), moist, stiff, varved CLAY and SILT (lacustrine deposits). Laminae are 1 to 4 mm thick.

It is not necessary to describe in detail, every change in lithology in the split spoon (such as individual strata in a sand or laminae in a clay/silt). Only major changes in lithology require a seperate description (such as overall sandy to overall clay). Each description should be seperate and stand alone, be preceded by the depth interval in the split spoon in which the lithology occurs, and be recorded in sequence from top to bottom of the split spoon as shown in the following example:

0 - 9" - Tan (10YR 6/4) wet, loose, stratified, subrounded coarse SAND, little medium sand, tr. silt (glacial outwash)

9 - 22" - Dark gray (5BG 5/1), moist, stiff, varved CLAY and SILT (lacustrine deposits). Laminae are 1 to 4 mm thick.

Keep descriptions of each lithology seperate as shown. Do not mix descriptions of each lithology (that is, state each color, then state each moisture content and so on).

Also note that it is not normally possible to recover cobbles in a split spoon unless a cobble fragment is recovered. The logger can note after the sample description that the auger cuttings contain cobbles and boulders or that difficult drilling indicated the presence of cobbles or boulders. Do not state that cobbles are present in a sample if they are not observed in the split spoon.

It is ultimately up to the lithologic logger to decide what is important to record. The advice of the FTL or the senior hydrogeologist in the office should be sought if there are any doubts regarding how to describe samples.

7. The two letter USCS classification of the sample is provided in this column.

9. PID/FID readings shall be recorded in the "PID/FID (ppm)" column at the appropriate depth regardless of the reading. Not-detected or background level readings shall be noted as "BG" or background.

6.0 RESTRICTIONS/LIMITATIONS

Only geologists, or similarly qualified persons trained in lithologic description are qualified to perform the duties described in this SOP. The FTL for a project will have the authority to decide whether or not an individual is qualified.