Focussed Remedial Investigation

Final Work Plan

July 10, 2000

00-096

Proposed for:

Site Code # 1-30-043U
36 Sylvester Street
Westbury, New York

Client:

Grand Machinery Exchange, Inc.
215 Centre Street
New York, New York

User:

New York State Department of Environmental Conservation
Bureau of Eastern Remedial Action
Division of Environmental Remediation
50 Wolf Road
Albany, New York

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a division of impact environmental consulting, inc.

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1. Introduction

This work plan details the various tasks that will be performed in the investigation of the property located at 36 Sylvester Street, Westbury, New York, herein identified as the "Site". In 1997, a Multi-site Preliminary Site Assessment (PSA) Task 4 Report prepared by Lawler, Matusky and Skelly Engineers (LMS) for the New York State Department of Environmental Conservation (NYSDEC) suggested that individual properties within the New Cassel Industrial Area (NCIA) contained the pollution sources responsible for the detected regional groundwater contamination. In recognition of this, the NYSDEC eliminated a regional listing approach that was used for the NCIA and adopted a strategy of locating individual properties within the NCIA for listing as Inactive Hazardous Waste Disposal Sites (IHWDSs). Based upon an interpretation of the data obtained by LMS, the NYSDEC determined that the Site was one of such properties.

Grand Machinery Exchange, Inc. is the current owner of the Site. The previous PSA indicated that groundwater beneath and down-gradient of the Site is contaminated with 1,1,1-Trichloroethane (TCA). As such, the Site has been designated by the NYSDEC as an IHWDS, as defined in ECL 27-1301.2. The site has been listed in the State Registry as Site Number 01-30-043U.

This Focused Remedial Investigation (FRI) will delineate the nature and extent of on-site contamination and the results will be submitted in a Focused Remedial Investigation Report in accordance with the provisions of the Draft Order on Consent between the NYSDEC and Grand Machinery Exchange, Inc. If necessary, a Focused Feasibility Study evaluating remedial action alternatives will later be submitted to the Department pursuant to the terms of the Order on Consent.

The Site is bordered by Sylvester Street to the west, New York Avenue to the east, and is situated between Main Street to the north and Old Country Road to the south. The Site was initially developed circa 1952 with a one-story, masonry building used for light industrial applications. The building was subsequently improved with an addition and various interior alterations. Presently, the Site is operated by Gel-Tec, a division of Tishcon Corp. The interior of the building is primarily utilized as warehouse space for Gel-Tec. The footprint of the building covers the majority of the property, with the exception of alleys on the north and south portions of the Site. The building is serviced with a natural gas fired heating system and was connected to the municipal sewer system circa 1987.

2. Proposed Site Background Study

2.1 Site Location and Topography

The Site is located at 36 Sylvester Street, Westbury, New York. This location is bordered by Sylvester Street to the west, New York Avenue to the east, and is situated between Main Street to the north and Old Country Road to the south. Refer to **Plate 1:** Site Location Map, *Westbury, New York.* The areal extent of the Site is approximately 20,000 square feet. The Site contains one single-story, masonry building with an approximate combined footprint of 12,125 square feet. The surface area of the Site consists of asphalt parking areas, and concrete walkways. The Site exhibits low topographic relief (one to three percent slopes). Refer to **Plate 2:** Site Map, Westbury, New York.

2.2 Site Background Study

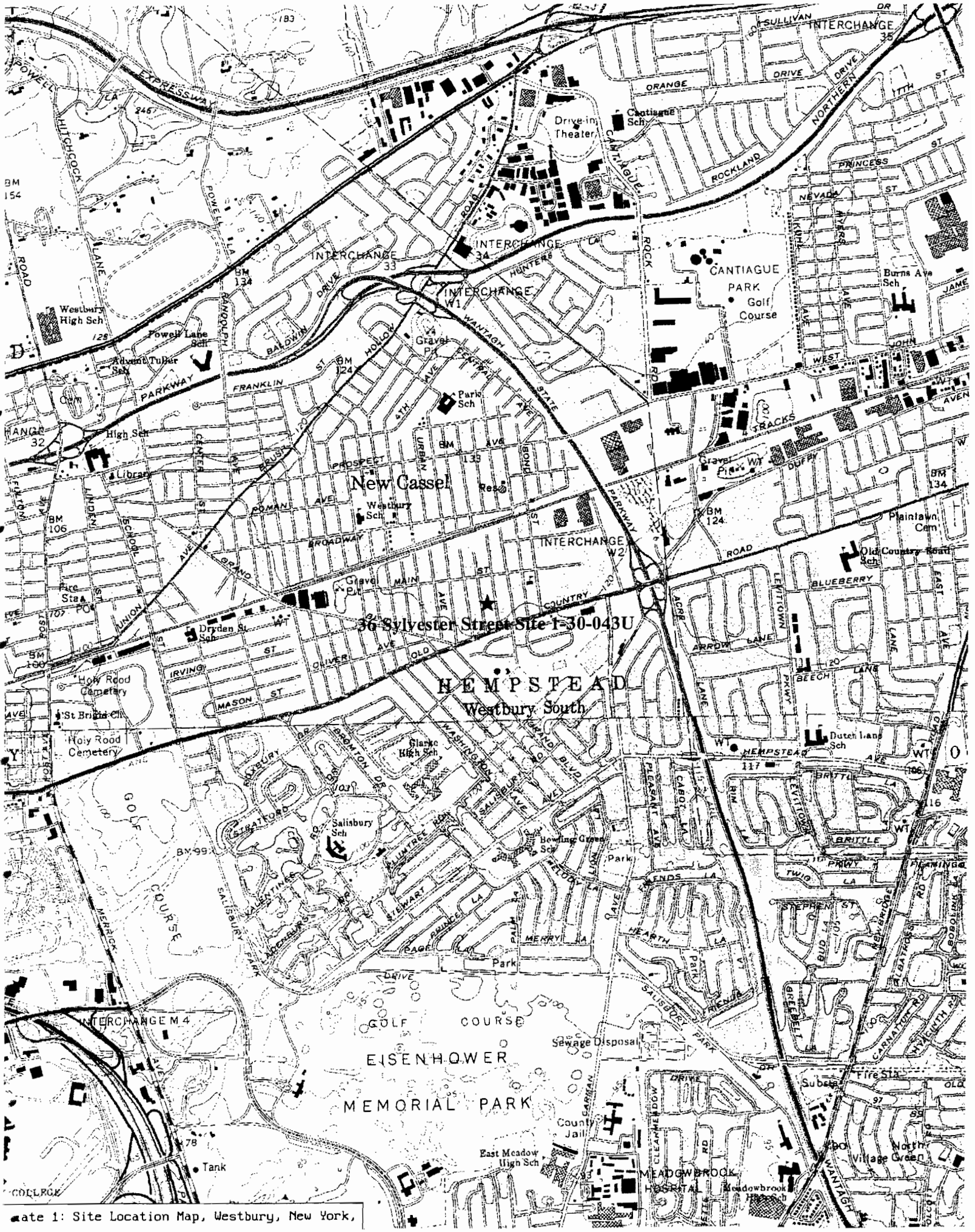
A 50-year site background study will be conducted that will include information on past land uses on and immediately off-site. Historic information will be compiled from various private and public sources including the Cole reverse telephone directories, Sanborn fire insurance maps, E. Belcher Hyde maps, LILCO (LIPA) records, Town of North Hempstead Building Department records (these records typically include the location of sanitary disposal structures) and aerial photographs. Information regarding past and current chemical and/or petroleum storage, handling, disposal practices, spills, and any previous environmental investigations will also be obtained from the Nassau County Department of Health, the NYSDEC (Region 1 Office – Stony Brook), and other related agencies.

2.3 Site Geology

A thorough discussion of site geology, including descriptions of surficial geology, unconsolidated deposits and the underlying bedrock will be presented. This data will be compiled from boring logs installed on-site and from reliable data sources, such as the U.S. Geological Survey (USGS).

2.4 Site Geohydrology

The geohydrology of the Site will be examined using available groundwater potentiometric surface maps provided by the USGS and data obtained from the results of the subsurface investigative activities proposed in this document. The investigation data will be used to compile a site-specific potentiometric map of the water table, determine groundwater transport rates and understand the dynamics of on-site contaminant migration. Additionally, the



ate 1: Site Location Map, Westbury, New York,

Sylvester Street

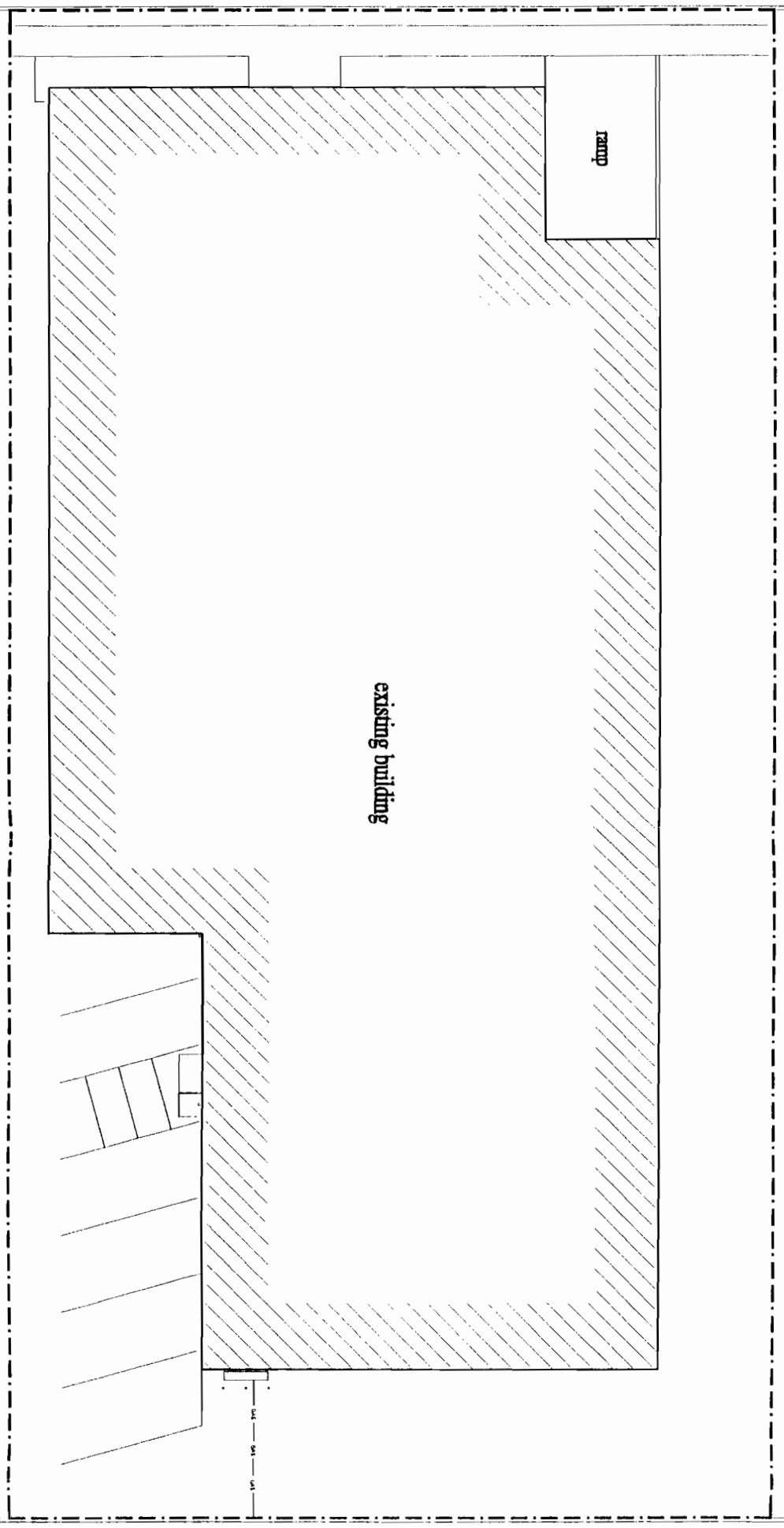


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Plate 2: Site Map

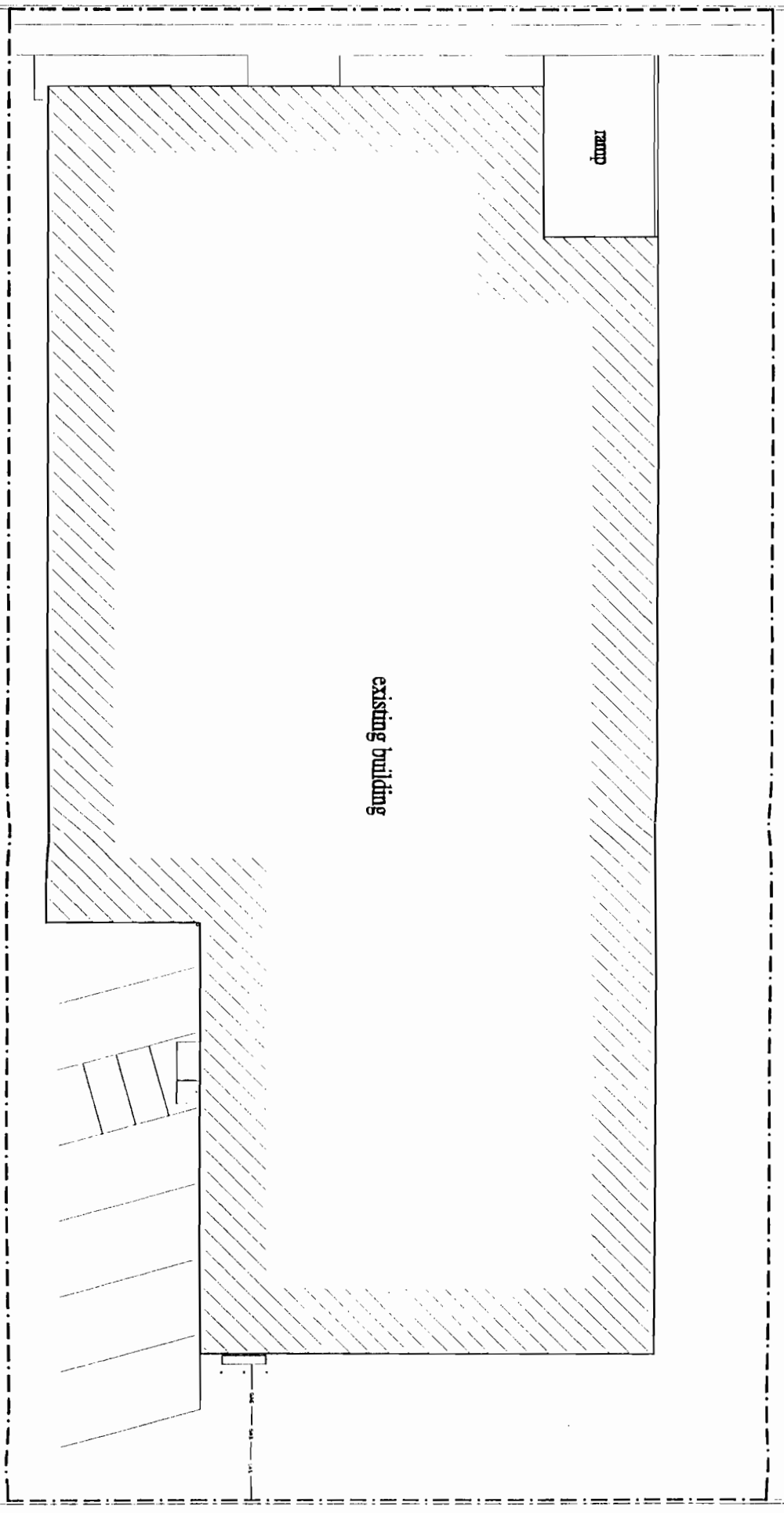
Westbury, New York

Legend:

- groundwater probe node
- soil probe node
- monitoring well

scale: 1" = 20'

Sylvester Street



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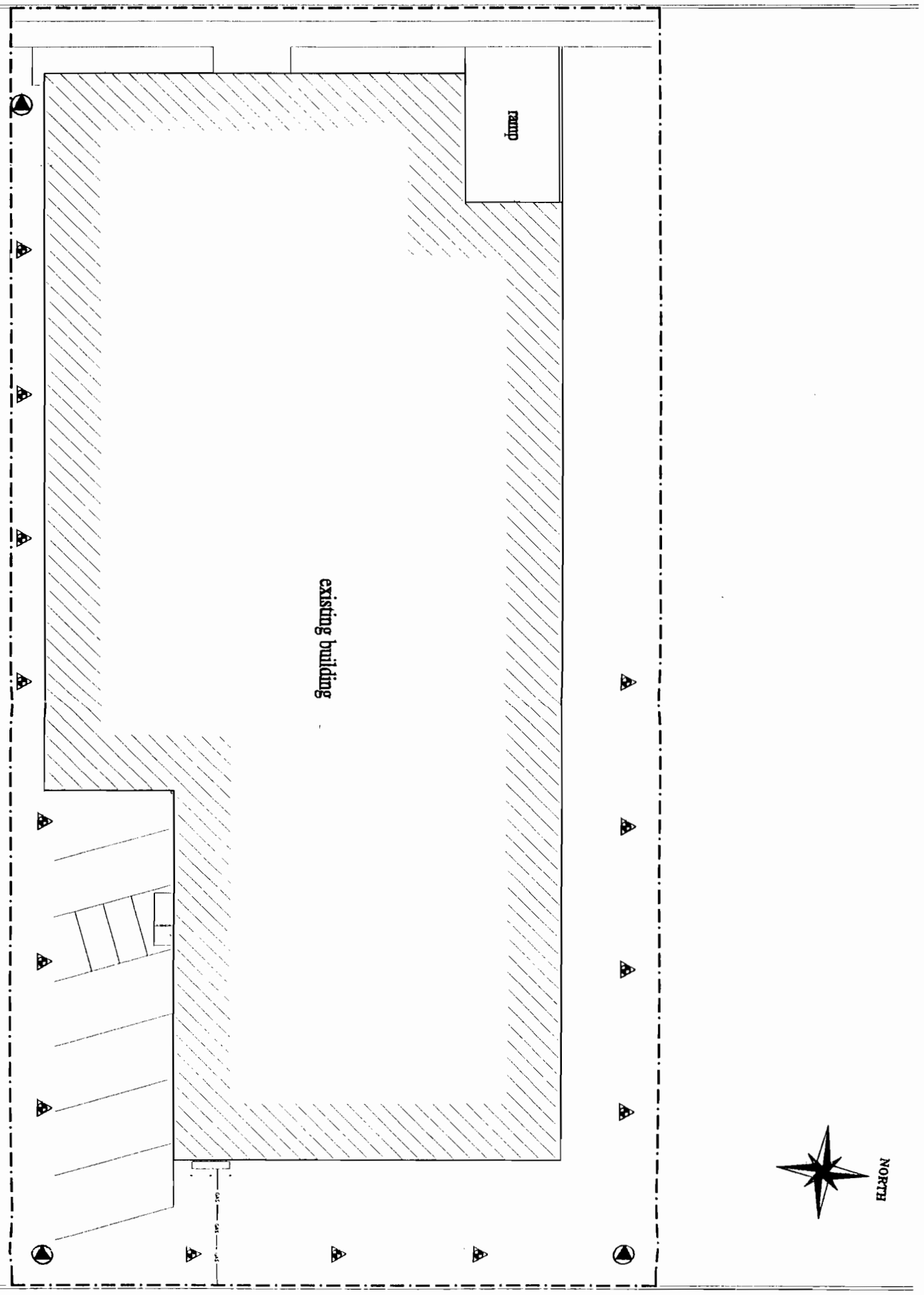

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Plate 3: Sample Acquisition Plan

Westbury, New York

Legend:

- groundwater probe node
- soil probe node
- monitoring well

scale: 1" = 20'

physical characteristics of the underlying aquifers will be identified. Such characteristics will include the aquifer's transmissivity, porosity and hydraulic conductivity.

3. Site Inspection Activities

3.1 Site Visit

A Site inspection will be performed under the auspices of the NYSDEC. The inspection will identify the location of on-site buildings, parking lots, drains, underground injection wells, and other potential sources of point and non-point contamination. Ten-day notice will be provided to the NYSDEC prior to the site visit.

3.2 Remote Sensing Survey

A remote sensing survey plan will be designed to identify any routes or mechanisms for the migration of contaminants released at the Site. Potential routes and mechanisms include underground storage tanks (USTs), underground injection wells (UIWs), sub-grade storage vaults and buried portable storage containers (drums). The survey will be performed with a ground penetrating radar (GPR) unit to locate the presence of any of these potential pollution sources that may exist on the Site.

The data collected during the survey will be reviewed by the operator and compared against past experience, technical judgment, and prior Site knowledge to classify anomalies. When a relevant structure is identified, the location will be marked using a small flag or marking paint and plotted onto a Site Plan.

The remote sensing survey may also incorporate the use of a remote camera transmitter snake and/or dye tablets to track any piping associated with any existing or former interior drainage features. If necessary, the survey may include a destructive investigation to identify the outfall location or migration paths of any potential pollution sources.

3.3 Locating and Mapping Subsurface Structures

Subsurface structures will be surveyed on the surface of the Site using various color marking paints and mapped on Site maps.

3.4 Evaluation of Emergency Procedures

The routes of emergency egress will be evaluated and marked with flagging, traffic cones or marking paint, if necessary. This will be done to ensure that equipment or on-site vehicles cannot temporarily block routes of emergency egress from all boring locations. Additionally, the site safety plan will be reviewed on-site by all workers to insure compliance.

3.5 Site Survey Report

The information compiled from the site inspection activities (site visit, remote sensing survey, locating and mapping subsurface structures) will be presented in a Site Survey Report. This report will provide site-specific details regarding potential point and non-point pollution sources. This report will establish the basis for proposing more specific and/or additional investigative parameters. Submission of the report will be provided to the NYSDEC.

4. Investigation of Soil and Groundwater Quality

4.1 Proposed Investigation of Point and Non-Point Sources

The information obtained from the Site inspection activities will be used to determine the locations that hazardous substances, if any, were released to specific (point sources) or non-specific (non-point sources) surface or subsurface areas of the Site.

4.1.1 Point Pollution Sources

Typical point sources of pollution include underground injection wells, underground storage tanks, and recognizable surface discharges. Soil probes will be installed within the confines of any underground injection wells (storm water drywells, leaching lagoons, wastewater disposal wells, retention pits or cesspools) identified on the Site. Where an UIW is identified, three subsurface samples will be secured at three depth intervals for analysis. Continuos soil sampling will be performed from grade to a depth of sixteen (16) feet below existing grade (BEG). One sediment sample representative of the invert of the structure will be secured for analysis. Sample selection for this sample will be based on field screening and measurements obtained with a photo ionization detector (assuming the UIW has been backfilled). The second soil sample will be secured at a depth interval of thirty-eight (38) to forty (40) feet BEG. The third soil sample will be secured at a two (2) foot depth interval at a minimum of ten (10) feet above the groundwater table (i.e. if the groundwater is at 55' BEG, the sample will be acquired from 43'-45'ft.). In addition, one (1) Geoprobe temporary groundwater monitoring well will be installed either from within or adjacent to each UIW identified on the site.

The laboratory analysis of the sediment sample obtained from the invert of an UIW will consist of USEPA Test Methods 8260 for total volatile organic analytes, 8270BN for total base neutral semi-volatile organic analytes and 6010 for total metals. The laboratory analysis of the soil samples obtained from the second and third depth interval (as described above) will consist of USEPA Test Method 8260 for total volatile organic analytes. Additionally, these samples will be analyzed for metals if the sediment sample (invert sample) detects concentrations of metals above ambient conditions. Refer to **Table 1:** Target Analyte List (Soil). The laboratory analysis of the groundwater samples (temporary wells) will be performed using USEPA test method 624 (modified to include target analytes and tentatively identified compounds (TICs) for volatile organic analytes). Refer to **Table 2:** Target Analyte List (Groundwater).

A minimum of three (3) soil probes will be installed surrounding any underground storage tanks identified on the Site. Samples will be secured and field screened from the probes on a 15-foot vertical interval to 45-ft BEG.

Table 1: Sampling Analysis in Soil

36 Sylvester Street Site No. 1-30-043U

USEPA Test Method 8260

Target Volatile Organic Analytes

Dichlorodifluromethane	Tetrachloroethene	Bromodichloromethane	4-Isopropyltoluene
1,1,1-Trichloroethane	1,1,1,2-Tetrachloroethane	Bromomethane	Bromobenzene
1,1,2-Trichloroethane	1,1,2,2-Tetrachloroethane	Carbon Disulfide	Bromoform
1,1-Dichloroethane	1,2,3-Trichlorobenzene	Carbon Tetrachloride	Chlorobenzene
1,1-Dichloroethene	1,2,3-Trichloropropane	Chloroethane	Dibromochloromethane
1,1-Dichloropropene	1,2,4-Trichlorobenzene	Chloroform	Ethylbenzene
1,2-Dichloroethane	1,2,4-Trimethylbenzene	Chloromethane	Hexachlorobutadiene
1,2-Dichloropropane	1,2-Dibromo-3-chloropropane	cis-1,2-Dichloroethene	Isopropylbenzene
2,2-Dichloropropane	1,2-Dibromoethane	cis-1,3-Dichloropropene	m+p-Xylenes
2-Butanone	1,2-Dichlorobenzene	Dibromoethane	Napthanlene
2-Chloroethyl Vinyl Ether	1,3,5-Trimethylbenzene	Methylene Chloride	n-Butylbenzene
4-Methyl-2-Pentanone	1,3-Dichlorobenzene	Toluene	n-Propylbenzene
Acetone	1,3-Dichloropropane	Trans-1,2-Dichloroethene	o-Xylene
Acrolein	1,4-Dichlorobenzene	trans-1,3-Dichloropropene	sec-Butylbenzene
Acrylonitrile	2-Chlorotoluene	Trichloroethene	Styrene
Benzene	2-Hexanone	Trichlorofluoromethane	tert-Butylbenzene
Bromochloromethane	4-Chlorotoluene	Vinyl Acetate	Vinyl Chloride

USEPA Test Method 8270BN

Target Semi-Volatile Organic Analytes

1,2,4-Trichlorobenzene	Acenapthene	Bis(2-Ethylhexyl)Phthalate	Hexachloroethane
1,2-Dichlorobenzene	Naphthalene	Butylbenzylphthalate	Hexaclorocyclopentadiene
1,3-Dichlorobenzene	Fluorene	o-Cresol	Isophorone
1,4-Dichlorobenzene	1,2-Diphenylhydrazine	Phenanthrene	Nitrobenzene
2,4-Dinitrotoluene	3,3-Dichlorobenzidine	Pyrene	N-Nitroso-di-n-Propylamine
2,6-Dinitrotoluene	4-Bromophenyl-phenylether	Carbazole	Chrysene
2-Chloronapthalene	4-Nitroaniline	Bis(2-Chloroethoxy)methane	Dibenzo-a,h-Anthracene
2-Methylnaphthalene	Anthracene	Bis(2-Chloroethyl)ether	Di-n-Butylphthalate
2-Nitroaniline	Benzo-a-Anthracene	Bis(2-Chloroisopropyl)ether	Di-n-Octylphthalate
3-Nitroaniline	Benzo-a-Pyrene	Dibenzofuran	Fluoranthene
4-Chloroaniline	Benzo-b-Fluoroanthene	Diethylphtalate	Hexaclorobenzene
4-Chlorophenyl ether	Benzo-g,h,i-Perylene	Dimethylphtalate	Indeno(1,2,3-c,d)Pyrene
Acenaphthene	Benzo-k-Fluoroanthene	Hexachlorobutadiene	m.p-Cresol
			N-Nitrosodiphenylamine

USEPA Test Method 6010

Target RCRA Inorganic Analytes

Alumimium	Calcium	Magnesium	Silver
Antimony	Chromium	Manganese	Sodium
Arsenic	Cobalt	Mercury	Thallium
Barium	Copper	Nickel	Vanadium
Beryllium	Iron	Potassium	Zinc
Cadmium	Lead	Selenium	

Table 2: Sampling Analysis in Groundwater

36 Sylvester Street Site No. 1-30-043U

USEPA Test Method 624

Target Volatile Organic Analytes

(This method will be modified to include Tentatively Identified Compounds)

1,1,1-Trichloroethane	Carbon Tetrachloride
1,1,2,2-Tetrachloroethane	Chlorobenzene
1,1,2-Trichloroethane	Chloroethane
1,1-Dichloroethane	Chloroform
1,1-Dichloroethene	Chloromethane
1,2-Dichlorobenzene	cis-1,3-Dichloropropene
1,2-Dichloroethane	Ethylbenzene
cis-1,2-Dichloroethene	m+p Xylenes
1,2-Dichloropropane	Methylene Chloride
1,3-Dichlorobenzene	o-Xylene
1,4-Dichlorobenzene	Tetrachloroethene
2-Chloroethyl Vinyl Ether	Toluene
Benzene	Trans-1,2-Dichloroethene
Bromochloromethane	trans-1,3-Dichloropropene
Bromodichloromethane	Trichloroethene
Bromoform	Trichlorofluoromethane
Bromomethane	Vinyl Chloride

Analysis of each sample interval will be performed utilizing USEPA Test Method 8260 for target volatile organic analytes.

A minimum of one (1) soil probe will be installed in any surface discharge area identified on the Site. Samples will be secured and field screened from the probes on a 15-foot vertical interval to 45-ft BEG. Analysis of each sample interval will be performed utilizing USEPA Test Method 8260 for target volatile organic analytes, USEPA Test Method 8270 for target base-neutral semi-volatile organic analytes and USEPA Test Method 6010 for priority pollutant inorganic analytes.

4.1.2 Non-Point Pollution Sources

Non-point pollution sources are those that impact a large area in a heterogeneous manner due to source variation. Such sources are difficult to detect from site inspection activities, therefore, the investigative approach to determine their impact on Site quality is intuitive. To detect such sources, groundwater quality entering and exiting the Site is gauges using a non-biased sampling plan (grid pattern). As part of the sampling plan, seventeen (17) groundwater sample locations will be sited on the Site. Three (3) of the seventeen groundwater samples will be acquired from permanent groundwater monitoring wells. The additional fourteen (14) groundwater sample locations will be acquired from temporary groundwater monitoring wells. These well points will be installed to compare up-gradient and down-gradient groundwater quality in conjunction with previously obtained data from the Site.

One (1) water sample obtained at the water table surface will be secured from each permanent groundwater monitoring well. Three (3) water samples obtained at three separate depths will be secured from each temporary groundwater monitoring well. Geoprobe groundwater sampling (temporary wells) depths will be based on actual groundwater depth measurements at the site. The presumed sampling depths will be in intervals representative of 55'-65', 66'-75' and 76'-85'below existing grade. If a significant difference in the presumed groundwater depth and actual groundwater depth is identified, any changes to groundwater sampling depth will be approved before installation. The multiple depth sampling is proposed to emulate historical groundwater quality data. Analysis of these samples (permanent and temporary wells) will be performed using USEPA test method 624 (modified to include target analytes and tentatively identified compounds (TICs) for volatile organic analytes). Additionally, the laboratory will perform the calibration on the samples every 12 hours. Refer to **Table 2:** Target Analyte List (Groundwater). All proposed locations can be referenced with **Plate #3:** Sample Acquisition Plan, Westbury, New York.

5. Investigative Procedures

5.1 GPR Survey

A qualified Impact Environmental Consulting, Inc. technician will specify a coordinate system on the plainmetric surface of the site to map any subsurface dielectric anomalies detected on the premises. The operator uses knowledge of the subsurface soil composition to calibrate the SIR-2 system to site specific conditions. Factor settings such as range, gain, number of gain points, and scans per unit will be modified to yield the most accurate data to describe the subsurface conditions.

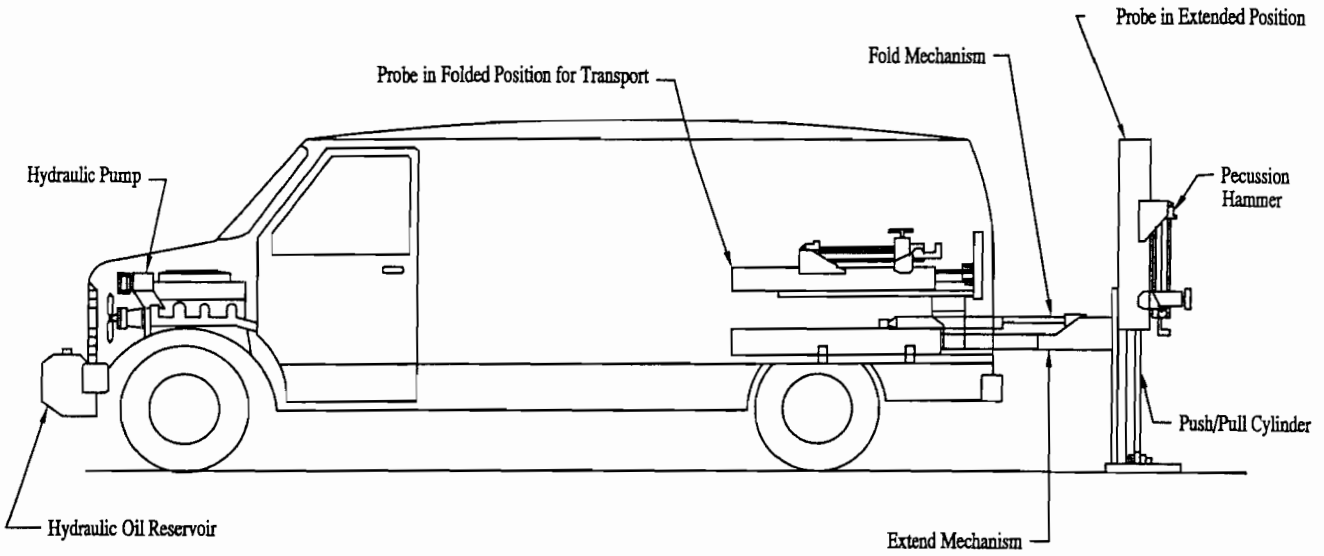
Upon finding a dielectric anomaly, a more spatially specific coordinate system will be designed over the area to determine its size, shape, and orientation.

5.2 Subsurface Probe Installation

Subsurface probes will be installed using a *Geoprobe* hydraulically powered probing tool (see **Diagram 1**: Geoprobe Operating System). Mechanized, vehicle mounted probe systems apply both static force and hydraulically powered percussion hammers for tool placement (static down forces up to 3,000 pounds combined with percussion hammers of eight horsepower continuous output). Recovery of large sample volumes will be facilitated with a probe-driven sampler. The probe-driven sampler consists of a hollow probe, which opens via a remote control mechanism at the selected sampling depth in the soil profile to allow soil to enter as it was advanced. Discrete media samples will be secured at the desired depths and contained within a non-reactive transparent plastic sleeve that lined the hollow probe. The plastic sleeves will be removed for subsequent inspection and sample aliquot acquisition.

5.3 Sample Characterization

A visual inspection of all samples recovered during the installation of each of the soil probes will be conducted to identify any gross signs of chemical contamination and to classify the sample media. Color classifications will be made in accordance with the Munsell Classification System. Gradation classifications will be made in accordance with the Unified Soil Classification System. In addition, samples will be screened for contamination using a photo ionization detector.



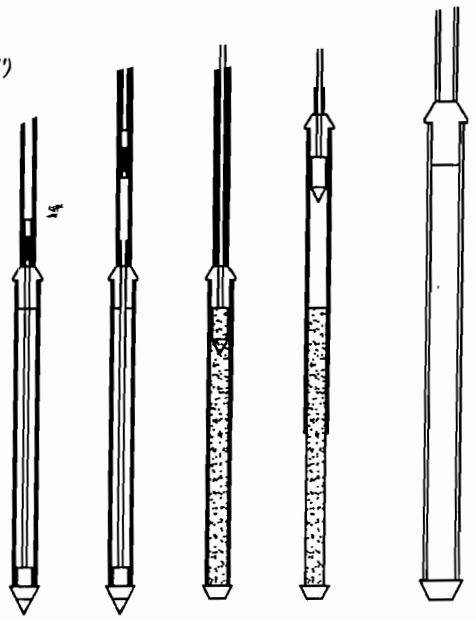
Basics

- Hydraulic powered probe unit isoperated from a engine driven pump.
- Remote vehicle ignition allows operator to start engine from probe unit.
- Belt driven hydraulic pump supplies 10 gpm @ 2000 rpm, 3000 psi operating pressure
- Probe unit folds for transport
- Unit utilizes static weight of vehicle and pecussion hammer to advance probing tools.
- Hydraulic hammer delivers pecussion rate of 30 Hz.
- Probes have greater than 18,000 lbs of down force and 25,000 lbs of retraction force.
- Drives multiple diameter probes (1", 1.25" and 2.25") to depths over 100 feet.

Soil Probing Tool

The tools are advanced and a sample is acquired in a non-reactive plastic sheathing. The system offers two sizes of sample retrieval:

Large bore - 1.5" x 2'
Macro - 2.25" x (2', 3' & 4')



Groundwater SP-15 Sampler

The tool allows a stainless steel, 4' screen to be delivered to the underlying groundwater. At the desired depth, the screen is retracted and samples are obtained via a check valve assembly.

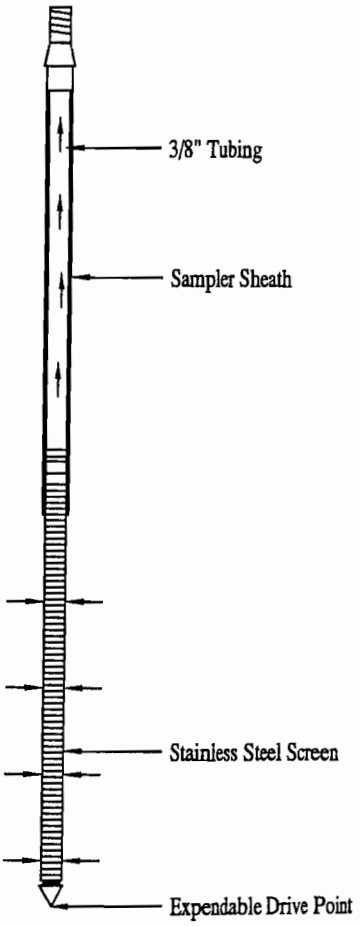


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Diagram 1: Geoprobe Operating System

Legend:
- groundwater probe node
- soil probe node

5.4 Field Screening

Headspace analysis will be performed on each of the acquired samples utilizing a portable photo ionization detection meter to measure what, if any, hydrocarbon concentrations were present in isolated portions of the secured samples. Headspace analysis will be conducted by partially filling a wide-mouth glass container with sample aliquot and sealing the top with aluminum foil, thereby creating a void. This void is referred to as the sample headspace.

To facilitate the detection of any hydrocarbons contained within the headspace, the container will be agitated for a period of thirty (30) seconds and will be set aside for fifteen minutes to allow any organic compounds to volatilize. The probe of the vapor analyzer will then be injected through the foil into the headspace to measure the hydrocarbon concentrations present. A Photovac Micro-Tip, photo ionization detection meter (PID) will be the organic vapor analyzer selected for the headspace analysis. A PID utilizes the principle of photo ionization for detection and measurement of hydrocarbon compounds. A PID does not respond to all compounds similarly; rather, each compound has its own response factor relative to its calibration. For this investigation, the PID will be calibrated to isobutylene. Hydrocarbon relative response factors for a PID calibrated to isobutylene are published by the manufacturer.

5.5 Temporary Well Point Sampling

The groundwater sampling system that will be used is the Screen Point 15 that is designed to accurately collect grab samples of groundwater. The Screen Point 15 uses a screen with a standard slot size of 0.004 inches that is sealed inside a 1.5-inch ID alloy steel sheath as it is driven to depth. The screen is sealed inside the sheath with Neoprene O-rings, which prevents infiltration of formation fluids until the desired depth is attained. When the screen has been driven to the depth of interest in the formation, extension rods are used to hold the screen in position as the driving rods are retracted approximately 4 feet. The 4-foot long sampler sheath forms a seal above the screen as it is retracted. A total of 41.5 inches of slotted screen is placed into contact with the formation. The Screen Point 15 groundwater sampler has a total boring diameter of 1.5 inches and the outside diameter of the screen is 1.0 inch. This provides for a maximum of 0.25 inches between the screen and the natural formation as the sampler sheath is retracted. These conditions approach the ideal for natural formation development that can be conducted when lower turbidity samples are required.

Each groundwater sample will be collected from the sampler utilizing 3/8-inch in diameter disposable tubing equipped with a bottom check valve. The tubing is extended from the surface down to the sampler. The tubing is oscillated in a controlled manner to avoid excessive turbulence that would result in a loss of volatile analytes from the sample. The collection will continue until the check valve has trapped an adequate volume to expunge three

bore hole volumes, to develop the temporary well, before the groundwater sample is collected for analysis. The tubing is then removed and the water is poured into appropriate sample vessels for subsequent laboratory analysis.

5.6 Groundwater Monitoring Well Installation

The new wells will be constructed using a five and one-half inch diameter hollow stem auger. The auger annulus will allow for the installation of a two-inch monitoring well casing and wire wrapped screen section. The screen slot size will be a function of the gradation of the filter pack (able to hold back at 95% of the filter pack). A filter pack will be installed within the annular space of the auger. The filter pack will extend to a depth of six inches below the bottom of the well screen to a point one-foot above the water table. The material used for the filter pack will consist of clean siliceous sand. The grain size of the filter pack sand will be three to five times the average (50% passing) size of the formation material as determined from sieve analysis. This will minimize the amount of the material entering the well from the screened part of the formation and, at the same time, not inhibit water inflow into the well. A Bentonite seal will be placed above the filter pack using a tremie pipe to form a seal at least three feet thick. A finer grained siliceous sand pack will be utilized for the remainder of the well to a point approximately two feet below the manhole cover.

Each of the wells will be constructed of two-inch schedule PVC riser, screened at a discrete interval in the saturated soil column. Groundwater at the site occurs under unconfined conditions at approximately 55 feet below grade. The screen casing of the proposed wells will be installed at depths ranging from 8 feet below to 2 feet above the groundwater interface. The screened length of each of the wells will be ten-feet. The wells will be constructed of PVC, as it possesses the required tensile strength (risers and threading) to accommodate the required installation depths. Additionally, PVC is resistant and non-reactive with contaminants typically found in landfill plumes and thus will be appropriate material for long term performance without contributing or removing contaminants from the groundwater. The PVC riser and screens will be interconnected with standard flush threaded couplings (ASTM F-480) containing fluorocarbon (Viton) O-rings. A filter pack will be installed around the outside of each well using a tremie pipe. The material used for the filter pack will consist of uniform clean siliceous sand. The PVC screens will be wire wrapped.

A bentonite seal will be placed above the filter pack using a tremie pipe to form a seal at least three feet thick. The balance of the casing annulus will be filled with grout to the ground surface. The grout will consist of a commercially available high-solids cement/bentonite grout. The grout mixture will set up without being diluted by formation of water, and will displace water in the annular space to ensure a continuous seal. The grout will be placed under pressure using a tremie pipe.

An eight-inch steel casing (manway) will be placed over the two-inch diameter protective screened casing and secured in a surface well seal to adequately protect it. Each monitoring well will be fitted with a secured protective flush-mounted casing. The flush mounted casing will be outfitted with an internal drain consisting of a layer of Morie sand or equivalent in direct contact with the surrounding formation. A vent hole will be located near the top of the steel casing to prevent explosive gas build up and to allow well water levels to respond naturally to changes in barometric pressure. The annulus of the casing will be filled with gravel. A twelve-inch weather sealed locking cap will have at least two inches of clearance between the top of each well cap and the bottom of the locking cap. If necessary, duplicate keys to the locking cap will be submitted to the NYSDEC.

A concrete surface seal will be constructed. The surface seal will extend below the frost line. The top of the seal will be constructed by pouring concrete into a form with a minimum two-foot side. The seal will prevent surface runoff from ponding and entering the well casing. In areas of excessive vehicle traffic, protective bollards will be installed around the seal. Complete construction diagrams for the proposed wells are provided in **Appendix B**.

5.6.1 Groundwater Monitoring Well Development and Sampling Procedure

The development and sampling procedures will conform to NYSDEC protocol. A field log protocol will be conducted to record sampling data including; date, time, location, sample identification code, depth to water, total depth of the well, method of well development, and sampling technique.

The monitoring wells will be developed by purging a minimum of three (3) static well volumes utilizing a disposable bailer. A static well volume is defined as:

$$\textit{Static well volume} = \textit{height of water column} \times (\textit{well radius})^2 \times \pi \times 7.48$$

where 7.48 is the conversion factor for cubic feet to gallons

Groundwater samples will be acquired from each monitoring well utilizing a dedicated Voss disposable bailer to prevent cross-contamination. All of the samples will be transferred with minimal disturbance into the appropriate vessels, preserved at 4°C in a cooler and transported under proper chain-of-custody procedures laboratory for analysis.

6. Record Keeping and Documentation

A Site field log and a master sample log will be used on-site to record notes pertaining to the sampling. For the groundwater wells, a monitoring well boring log will be used to record information. A sample form is provided in Appendix C.

Chemtech Laboratories, Inc. will be used for all laboratory work in this study. A statement of qualifications for Chemtech can be found in Appendix D.

6.1 Sample Tracking System

In order to provide for proper identification in the field, and proper tracking in the laboratory, all samples must be labeled clear and in a consistent fashion using the procedures and protocols described below and with the following subsections.

Sample labels will be waterproof and have a pre-assigned, unique number that is indelible.
Field personnel must maintain a field notebook. This notebook must be water resistant with sequentially numbered pages. Field activities shall be sequentially recorded at a later time. The notebook, along with the chain of custody form, must contain sufficient information to allow reconstruction of the sample collection and handling procedure at a later time. Each sample shall have a corresponding notebook entry that includes:

Sample ID number
Well location and number
Date and time
Analysis for which sample was collected
Additional comments as necessary
Sampler's name

Each sample must have a corresponding notebook entry on a chain-of-custody form. The manifest entry for sampling at any one well is to be completed before sampling is initiated by the same sampling team at any other well. In cases where the samples leave the immediate control of the sampling team, the samples must be sealed.

6.2 Sample Identification System

Each sample collected shall be designated by an alphanumeric code that shall identify the type of sampling location, the specific location, the matrix sampled, and a specific sample designation. Site specific procedures are described below.

Sample identifications shall contain a sequential code consisting of three segments. The first segment shall designate the project number. The second segment shall identify the location type. Location types shall be identified by a two-letter code. For example, MW will be used for monitoring well and GP for geoprobe. The third segment shall identify the specific sample location. The specific sampling location shall be identified using a three-digit number.

The fourth segment shall identify the matrix type and sample designation or identifier that identifies the sample depth, the sample event number, or other designation depending on the sample type. The matrix type shall be designated by a two-letter code. For example: GW will be used for groundwater. The sample identifier shall be represented by a two digit numeric code. Sampling events or rounds, such as for groundwater sampling shall be numbered in sequence beginning with "01" that corresponds to the round of sampling.

The following shall be a general guide for sample identification:

First Segment	Second Segment	Third Segment	Fourth Segment
NNN	AA	NNN	AANN
Project #	Location Type	Specific Type	Matrix Sample Identifier
963	MW	281	GW01

Symbol Definitions:	Location Type:	Matrix Type:
A = Alphabetic	MW = Monitoring Well	S = Soil
N = Numeric	GP = Geoprobe	GW = Groundwater

Sample Identifier:
1st round of sampling = 01
2nd round of sampling = 02

6.3 Sample Containers and Analytical Requirements

As required in the NYSDEC Analytical Sampling Protocol (ASP), the laboratory must provide all sample containers. If glass bottles are used, extra glass bottles will be obtained from the laboratory to allow for accidental breakage that may occur. Necessary preservatives will be placed in the sample bottles by the laboratory. The sample bottles will be handled carefully so that preservatives and glassware are not inadvertently spilled. All soil samples will be put into 4-ounce glass jars with Teflon liners. All liquid samples will be put into 40-ml glass vials with Teflon liners.

6.4 Sample Packaging

Samples shall be packaged and shipped according to Section 6.2 of the USEPA's *Compendium of Superfund Field Operations Methods* entitled, "Packaging, Labeling, and Shipping." Chain of custody forms, sample labels, custody seals, and other sample documents shall be filled out as specified in the USEPA *CLP Users Guide*. Sample bottles and samples shall either be delivered/picked up at the site daily by Chemtech Laboratories, or delivered via overnight courier.

The proper procedures for packaging and shipping must be followed once the samples have been collected.

Packaging

Prior to shipment, samples must be packaged in accordance with current US DOT regulations. All required government and commercial carrier shipping papers must be filled out. The procedure below should be followed regardless of transport method.

As required in the NYSDEC ASP, samples will be transported in metal ice chests or sturdy plastic coolers.

Remove previously used labels, tape, and postage from cooler.

Ship filled sample bottles in same cooler in which empty bottles were received.

Check that all bottle labels are complete.

Check that all sample bottles are tightly capped.

Affix return address labels.

Be sure that chain-of-custody forms are complete.

Wrap sample bottles in bubble pack and place in cooler.

Pack bottles with extra bubble pack, vermiculite, or Styrofoam.

Keep samples refrigerated in cooler with bagged ice or frozen cold packs. Do not use ice for packing material.

Separate and retain the sampler's copy of chain-of-custody.

Tape paperwork in zipper bag to inside of cooler lid.

Close cooler and apply signed and dated custody seal in such a way that the seal must be broken to open the cooler.

Securely close cooler lid with packing or duct tape. Be sure to tape latches and drain plugs in closed position.

Shipping

Samples should arrive at the lab as soon as possible following sample collection to ensure holding times are not exceeded. All samples must be hand delivered on the same day as sampling or sent via overnight courier. Coolers will contain ice packs to maintain a temperature below 4 °F. Samples will be delivered to the laboratory within the seven-day holding period prescribed for VOC analysis.

6.5 Sampling Documentation

The sample team or individual performing a particular activity shall be required to keep a weatherproof field notebook. Field notebooks are intended to provide sufficient data and observations to enable participants to

reconstruct events that occurred during projects and to refresh the memory of the field personnel if called upon to give testimony during legal proceedings. In a legal proceeding, notes, if referred to, are subject to cross-examination and are admissible as evidence. The field notebook entries should be factual, detailed, and objective. All entries are to be signed and dated. All members of the field investigation team are to use this notebook, which shall be kept as a permanent record. The field notebook shall be filled out at the location of sample collection immediately after sampling. It shall contain sample descriptions including: sample number, sample collection time, sample location, sample description, sampling method used, daily weather conditions, field measurements, name of sampler, and other site-specific observations. The field notebook shall contain any deviations from the protocol contained herein, visitor's names, community contacts made during sampling, and geologic and other site-specific information that may be noteworthy.

Chain-of-custody forms, sample labels, custody seals, and other documents shall be filled out as specified in Section 4.0 of the USEPA *A Compendium of Superfund Field Operations Manual,* 1987. Additionally, a dedicated sampling master log shall be maintained as the field program progresses. The sample logbook shall contain the sample number, sample date/time, sampling team, and chain-of-custody.

6.6 Chain-of-Custody Protocol

The primary objective of the sample custody procedures is to create an accurate written record that can be used to trace the possession and handling of all samples from the moment of their collection, through analysis, until their final disposition. Sample custody for samples collected during the investigation will be maintained by the on-site hydrogeologist or the field personnel collecting the samples. Field personnel are responsible for documenting each sample transfer and maintaining custody of all samples until they are shipped to the laboratory.

Chain-of-custody forms will be completed at the time of sample collection and will accompany the samples inside the cooler for shipment to the selected laboratory.

7. Performance Criteria

7.1 Field and Consulting Engineering Services

Impact Environmental Consulting, Inc. ("contractor") and its designated subcontractors, will perform all field activities. The subcontractors that are anticipated to be used for the performance of the FRI are presented below:

Chemtech, Inc. (*Certified Laboratory*)
110 Route 4
Englewood, NJ 07631
(201) 567-6868

Fenley and Nicol Environmental (*Well Installation*)
445 Brook Avenue
Deer Park, New York 11729
(631) 586-4900

Tank Specialists, Inc. (*Excavation*)
2 Park Place
Glen Cove, New York
(516) 759-9318

7.2 Site Representation

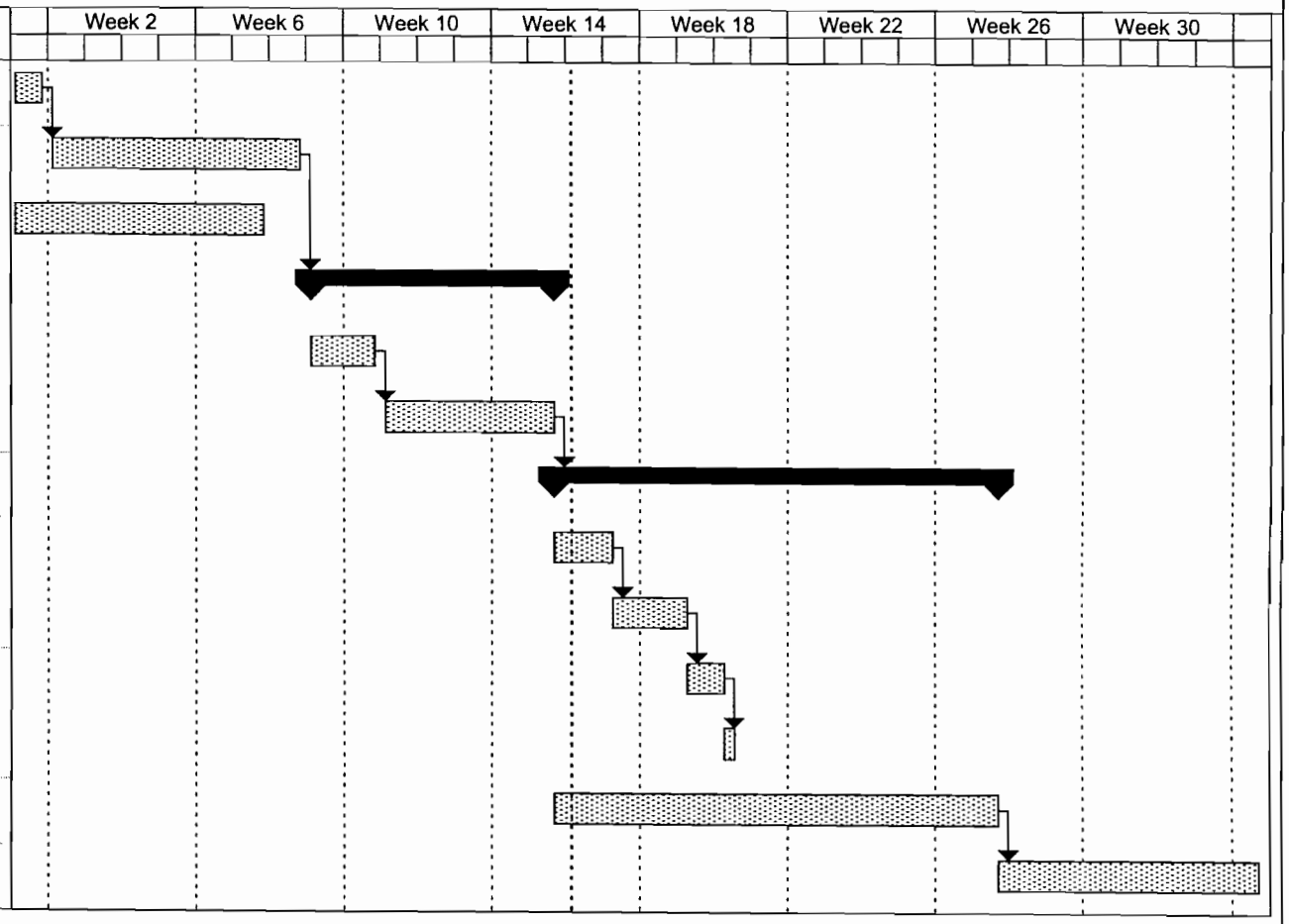
All on-site activities will be supervised by a representative of Grand Machinery Exchange, Inc. that is qualified to audit all field mobilization and investigative activities. Said representative will be identified as the Project Field Manager. The Project Field Manager will be on-site during the performance of all work performed by the contractor and its subcontractors. The qualifications of key personal including the Project Field Manager are provided in Appendix E.

7.3 Chronological Description of FRI

The time line that will be used for the study is outlined in **Table 3:** FRI Performance Schedule.

Table 3: FRI Performance Schedule
36 Sylvester Street Site No. 1-30-043U

ID	Task Name
1	Submittal of Work Plan
2	Approval of Work Plan
3	Site Background Study
4	**Site Investigation Activities**
5	Site Visit
6	Remote Sensing Survey
7	**Investigation of Soil and Groundwater Quality**
8	Soil Sampling
9	Geoprobe Groundwater Sampling
10	Monitoring Well Installation
11	Monitoring Well Sampling
12	Laboratory Analysis
13	Report Preparation



Impact Environmental
a division of impact environmental consulting, inc.

Task
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Milestone
Rolled Up Progress
Split
External Tasks
Project Summary

8. Health and Safety Plan

8.1 Introduction

This Health and Safety Plan (HASP) describes the procedures to be followed in order to reduce employee exposure to potential health hazards that may be present at the project site. The emergency response procedures necessary to respond to such hazards are also described within this HASP.

8.1.1 Purpose

The purpose of this HASP is to provide the contractor's field personnel, subcontractors, and other visitors with an understanding of the potential chemical and physical hazards that exist or may arise while the tasks of this project are being performed.

8.1.2 Objective

This Health and Safety Plan is required in accordance with OSHA 29 CFR 1910.120. The primary objective is to ensure the well being of all field personnel and the community surrounding this site. In order to accomplish this, project staff and approved subcontractors shall acknowledge and adhere to the policies and procedures established herein. Accordingly, all personnel assigned to this project shall read this HASP and sign the Agreement and Acknowledgment Statement (Appendix) to certify that they have read, understood, and agree to abide by its provisions.

The contractor's personnel have the authority to stop work performed by our sub-contractors at this site if said work is not performed in accordance with the requirements of this HASP.

8.1.3 Amendments

Any changes in the scope of work of this project and/or site conditions must be amended in writing and approved by the appropriate agency.

8.2 Emergency Response

In order to properly prepare for emergencies, personal protective equipment (PPE) will be worn by site workers and first aid equipment will be kept at the site. Material Safety Data Sheets (MSDS) will be maintained for all contaminants that workers may be exposed to.

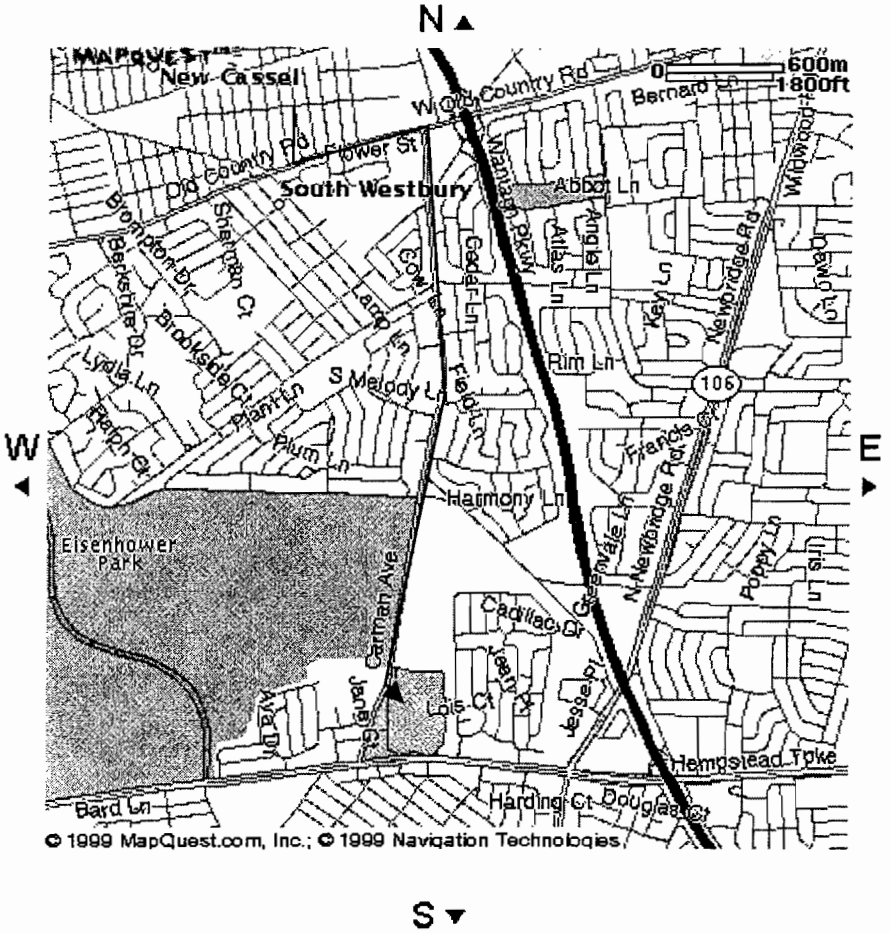
8.2.1 Onsite Emergency Response

In the event of an accident or emergency situation, emergency procedures will be executed. Said procedures can and will be executed by the first person to observe an accident or emergency situation. The Project Field Manager will be notified about the situation immediately after emergency procedures are implemented. A list of the pertinent personnel authorized to be present on site is as follows:

Title	Name	Telephone Number
Project Manager	Richard Parrish	(631) 269-8800
Project Field Manager	Keith Franzen	(631) 269-8800
Quality Assurance Officer	Kevin Kleaka	(631) 269-8800
Site Safety Officer	Eric Krist	(631) 269-8800
Site Contact	Paul Merandi	(212) 226-5356
State Agency Contact (NYS DEC)	Richard Lilly	(518) 457-1708

8.2.2 Emergency Contacts

Ambulance/Emergency:	*Nassau County Medical Center* 516-572-6655
Police:	911 or *Westbury Police Dept.* 516-573-5275
Fire Department:	*Westbury Fire Dept.* 516-921-0000
Poison Control Center:	800-336-6997
Hospital:	*Nassau County Medical Center* 516-572-0123
Directions:	Take Sylvester Street south and turn left onto Old Country Road. Continue east on Old Country Road and turn right onto Carman Ave. Travel approximately two miles south on Carman Ave. and the hospital will be on the left immediately after the Nassau County Jail. See map of route below.



State Police:	516-756-3300
National Response Center:	800-424-8802
US EPA (24-hour hotline):	800-424-9346

8.2.3 Who to Contact Before Initiating Subsurface Investigation Work

Impact Environmental Consulting, Inc. ("Impact") representatives are responsible for contacting appropriate agencies prior to conducting on-site activities when applicable.

Gas Company:	*Brooklyn Union Gas* 718-643-4050
Telephone Company:	*Bell Atlantic* 516-661-6000
Electric Company:	*Marketspan* 516-222-7700

8.2.4 Contingency / Evacuation Plan

It may be possible that a site emergency could necessitate the evacuation of all personnel from the site. If such a situation develops, an audible alarm shall be given for site evacuation (consisting of an air horn). Personnel shall evacuate the site in a calm and controlled fashion and regroup at a predetermined location. The route of evacuation will be dependent on wind direction, severity, type of incident, etc.

The site must not be re-entered until back-up help, monitoring equipment, and/or personal protective equipment are on hand and the appropriate regulatory agencies have been notified.

8.2.5 Standard Procedures for Injury

1. Telephone for ambulance/medical assistance if necessary. Whenever possible, notify the receiving hospital (listed in 9.1.2) of the nature of physical injury or chemical overexposure. If no phone is available, transport the person to the nearest hospital.
2. Bring this Health and Safety Plan with the attached MSDSs to the medical facility with the injured person.
3. If the injury is minor, proceed to administer first aid.
4. Notify the Site Safety Officer and Project Manager of all accidents, incidents, and near emergency situations.

8.2.6 Emergency Treatment

When transporting an injured person to a hospital, bring this Health and Safety Plan to assist medical personnel with diagnosis and treatment. In all cases of chemical overexposure, follow standard procedures as outlined below for poison management, first aid, and, if applicable, cardiopulmonary resuscitation. Different routes of exposure and their respective first aid/poison management procedures are outlined below.

8.2.7 Ingestion

Do not induce vomiting unless prompted by a health professional. Transport person to nearest hospital immediately.

8.2.8 Inhalation / Confined Space

Do not enter a confined space to rescue someone who has been overcome unless properly equipped and a standby person present.

8.2.9 Inhalation / Other

Move the person from the contaminated environment. Initiate CPR if necessary. Call or have someone call for medical assistance. Refer to MSDS for additional specific information. If necessary, transport the victim to the nearest hospital as soon as possible.

8.2.10 Skin Contact / Non-Caustic Contaminant (Petroleum, Gasoline, etc.)

Wash off skin with a large amount of water immediately. Remove any affected clothing and rewash skin using soap, if available. Transport person to a medical facility if necessary.

8.2.11 Skin Contact / Corrosive Contaminant (Acids, Hydrogen Peroxide, etc.)

Wash off skin with a large amount of water immediately. Remove any affected clothing and rewash skin with water. Transport person to a medical facility if necessary.

8.2.12 Eyes

Hold eyelids open and rinse the eyes immediately with large amounts of water for 15 minutes. Never permit the eyes to be rubbed. Transport person to a medical facility as soon as possible.

8.3 Informational Summary

8.3.1 Health and Safety Summary

Site Specific chemicals of Concern: Benzene, MTBE, Tetrachloroethene, Toluene, Trans 1,2 Dichloroethane, Trichloroethene, Xylene(s), 1,1,1 Trichloroethane, 1,1 Dichloroethane, 1,1 Dichloroethene and Vinyl Chloride.

These chemicals are of moderate to low hazard. Therefore, modified level D personal protective equipment will be required at all times when on site. Changes to this requirement will be required as follows.

Level C protection, as described in this plan, will be available at a minimum for those activities that involve surface and subsurface soil (strata disturbance, such as well installation, and all subsurface media sampling activities such as split-spoon sampling and borings).

The Site Safety Officer will determine whether or not a level of protection can be upgraded or downgraded. Changes in the level of protection will be recorded in the dedicated site logbook along with

the rationale for the changes. Level D protection may be used for those activities that do not pose a potential threat of exposure to toxic or hazardous substances. Typical Level D activities may include sediment, logging and groundwater sampling, as well as surficial site surveys. Level C protection equipment should be readily available at all times. Consistent with OSHA training, prior to donning Level C, oxygen percent must be continuously monitored.

Action levels represent those conditions that a person requires an upgrade of personal protective equipment (PPE). Organic concentrations are to be monitored in the field by the use of a flame ionization or photo ionization detector (FID or PID) with readings being taken in a breathing zone occupied by field personnel to determine whether an action level has been exceeded. The information presented below applies to the above chemical constituents. All air monitoring results should be logged in the Site Safety Log.

All initial site access and activities will be done in Level D attire.

Ionization Detector Response

Flame Ionization Detector (FID)

Concentrations (in ppm)	Level of PPE Required
0.0 to 5.0	Level D
5.0 to 250.0	Level C
250.0 to 750.0	Level B
Above 750.0	Immediately withdraw from the area

Combustible Gas Response

Combustible Gas Indicator (CGI)

Results (% of LEL)	Procedure
0.0 to 20.0	Continue with normal activity
Above 20.0	Immediately withdraw from the area

Oxygen Detector Response

Combustible Gas Indicator (CGI)

Results (% Oxygen)	Procedure
0.0 to 19.5	Level B PPE is required
19.5 to 23.0	Continue with normal activity
Above 23.0	Immediately withdraw from the area

8.4 Hazard Evaluation

8.4.1 Site Tasks

The field tasks covered by the HASP may include well installation, development, gauging, and bailing; soil & groundwater handling/sampling; and confined space (excavation) entry and job task hazards.

8.4.2 Job Task Hazards

The following hazards may be encountered.

• Organic Vapors

The inhalation of volatile organic vapors during all operations can pose a potential health hazard. Hazard reduction procedures include monitoring the ambient air with a FID and the use of appropriate PPE. Workers should stand upwind of the source of contamination whenever possible.

• Flammable Vapors

The presence of flammable vapors can pose a potential fire and health hazard. Hazard reduction procedures include monitoring the ambient air with an oxygen/LEL meter (combustible gas indicator). If the LEL reading exceeds 20%, leave the site immediately and contact the fire department.

• Oxygen

Atmospheres that contain a level of oxygen greater than 23% pose an extreme fire hazard (the usual ambient oxygen level is approximately 20.5%). This hazard can be compounded by the fact that vapors associated with this site are highly flammable. All personnel encountering atmospheres that contain a level of oxygen greater than 23% must evacuate the site immediately and must notify the Fire Department. If the oxygen level is less than 19.5%, do not enter the space without level B PPE.

• Vehicular Traffic

All employees will be required to wear a fluorescent safety vest at all times while on site. In addition, supplemental traffic safety equipment use can be exercised when warranted by specific task. Supplemental equipment can be items such as cones, flags, barricades, and/or caution tape.

8.4.3 Well Installation, Development, Gauging, Bailing; Soil & Groundwater Sampling

Skin and eye contact with contaminated groundwater and/or soil may occur during these tasks. Nitrile gloves and approved safety glasses must be worn.

8.4.4 Sample Preservation

When hydrochloric acid is used, skin and eye contact can occur. This hazard can be reduced with the use of Nitrile gloves and safety glasses. Safety goggles should be worn if there is a potential for a splash hazard.

8.4.5 Cleaning Equipment

Skin and eye contact with methanol, "Alconox", or other cleaning substances can occur while decontaminating equipment. This hazard can be reduced with the use of Nitrile gloves and safety glasses.

8.4.6 Confined Space Entry

Excavation pits, storage tanks, soil trenches, subsurface vaults, basements, and sheds are examples of confined spaces. Confined spaces can be identified as an area having one of the following characteristics:

- Limited access and egress
- Unfavorable for natural ventilation
- Not designed for continuous human occupancy

Organic and/or combustible vapors may be trapped in confined spaces, resulting in lack of oxygen (anoxia) and/or overexposure to vapors. When site work takes place in a confined space, the air must be monitored for oxygen level, flammable vapors, and toxic vapors. The following air monitoring procedures must be followed before entering a confined space.

a. Oxygen Level

Monitor for percent oxygen with an oxygen/LEL meter (e.g., CGI) to ensure an oxygen level between 19.5 and 23%. Because of the high vapor density of the contaminants associated with this site, there is a high probability that vapors in the enclosed spaces or vaults will replace any oxygen that is present, even if the space is open to the air. Therefore, oxygen level monitoring will be done at the top, middle, and bottom of the enclosed space to determine if there is a minimum acceptable oxygen level of 19.5% prior to entry. The oxygen/LEL meter is factory-set to sound an alarm at levels less than 19.5% oxygen. **If oxygen is less than 19.5% or greater than 23%, do not enter the space.**

b. Explosive Vapors

Monitor the percentage of the Lower Explosive Limit (LEL) with an oxygen/LEL meter to determine whether vapor concentrations within the confined space are within the flammable range. If LEL readings exceed 10%, personnel should exercise extreme caution, use non-sparking tools, and utilize ventilation engineering controls to reduce LEL levels. The oxygen/LEL meter is factory set to sound an alarm at

levels greater than 20% LEL. If LEL readings exceed 20%, **personnel MUST leave the site immediately and contact the project manager.**

c. Toxic Vapors

Monitor for toxic vapors with a FID (e.g., Photovac OVA) to determine whether toxic vapors within the confined space exceed the action levels. PID readings will be taken at the top, middle, and bottom of a vault, shed, or other confined space to determine vapor levels.

Summary

Do not enter the confined space unless:

- the oxygen concentration is between 19.5 and 23%;
- the LEL is less than 20%; and
- FID readings are less than 250 ppm (a respirator must be worn if the readings exceed 5 ppm)

All monitoring equipment must be calibrated and maintained in accordance with manufacturer's recommendations.

8.4.7 Occupational Noise

Requirements set forth in the OSHA Hearing Conservation Regulation (OSHA 1910.95) shall be adhered to during work on-site. Hearing protection shall be provided to the employees where sound pressure levels exceed 85 dB. Hearing protection shall be worn where sound pressure levels in areas and/or on equipment exceeds 90 dB. Typical drilling operations have been monitored with a sound level meter and indicate that hearing protection is required for all personnel while engaged in this action.

8.4.8 Heat Stress

Since climatic changes cannot be avoided, work schedules will be adjusted to provide time intervals for intake of juices, juice products, and water in an area free from contamination and in quantities appropriate for fluid replacement.

Heat stress may occur even in moderate temperature areas and may present any or all of the following:

A. Heat Rash

Result of continuous exposure to heat, humid air, and chafing clothes. Heat rash is uncomfortable and decreases the ability to tolerate heat.

B. Heat Cramps

Result of the inadequate replacement of body electrolytes lost through perspiration. Signs include severe spasms and pain in the extremities and abdomen.

C. Heat Exhaustion

Result of increased stress on the vital organs of the body in the effort to meet the body's cooling demands. Signs include shallow breathing; pale, cool, moist skin; profuse sweating; and dizziness.

D. Heat Stroke

Result of overworked cooling system. Heat stroke is the most serious form of heat stress. Body surfaces must be cooled and medical help must be obtained immediately to prevent severe injury and/or death. Signs include red, hot, dry skin, absence of perspiration, nausea, dizziness and confusion, strong, rapid pulse, coma, and death.

Heat Stress Prevention

A. Replace body fluids (water and electrolytes) lost through perspiration. Solutions may include a 0.1% salt and water solution or commercial mixes such as "Gatorade". Employees must be encouraged to drink more than the amount required in order to satisfy thirst.

B. Use cooling devices to aid the natural body ventilation. Cooling occurs through evaporation of perspiration and limited body contact with heat-absorbing protective clothing. Utilize fans and air conditioners to assist in evaporation. Long, cotton underwear is suggested to absorb perspiration and limit any contact with heat-absorbing protective clothing (i.e., coated Tyvek suits).

C. Conduct non-emergency response activities in the early morning or evening during very hot weather.

D. Provide shelter against heat and direct sunlight to protect personnel. Take breaks in shaded areas.

E. Rotate workers utilizing protective clothing during hot weather.

F. Establish a work regime that will provide adequate rest periods, with personnel working in shifts.

Heat Stress Monitoring

Heat stress may occur even in moderate temperatures and may present heat rash, heat cramps, heat exhaustion, and/or heat stroke.

Monitoring procedures should be implemented to prevent heat stress arising from environmental conditions, use of PPE, and/or intensity of workload.

For temperatures above 70 °F, the following regime shall be followed for workers wearing permeable coveralls:

Adjusted Temperature	Normal Ensemble	Impermeable Ensemble
90 °F or above	After 45 min. of work	After 15 min. of work
87.5 to 90 °F	After 60 min. of work	After 30 min. of work
82.5 to 87.5 °F	After 90 min. of work	After 60 min. of work

77.5 to 82.5 °F	After 120 min. of work	After 90 min. of work
72.5 to 77.5 °F	After 150 min. of work	After 120 min. of work

Workers wearing semi-permeable or impermeable encapsulating protective clothing should be monitored for heart rate and temperature when the temperature in the work area is above 70 °F. In order to monitor the worker, measure:

A. Heart rate - Count the radial pulse during a 30-second period as early as possible in the rest period. If the heart rate exceeds 110 beats per minute at the beginning of the rest period, shorten the next work cycle by one-third.
B. Oral temperature - Use a clinical thermometer or similar device to measure the oral temperature at the end of the work period (before drinking). If oral temperature exceeds 99.6 °F, shorten the next work cycle by one-third.

Do not permit a worker to wear a semi-permeable or impermeable garment if the core body temperature exceeds 100.6 °F.

Workers shall not be required to continue working if they feel any of the symptoms of heat stress. Rest periods should be a minimum of 15 minutes. Length of rest period should be extended as appropriate or as recommended by the Site Safety Officer or alternate.

8.4.9 Exposure: Cold Stress

Work schedules will be adjusted to provide sufficient rest periods in a heated area for warming up during operations conducted in cold weather. Also, thermal protective clothing such as wind and/or moisture resistant outerwear is recommended to be worn.

If work is performed continuously in the cold at or below -7 °C (20 °F), including wind chill factor, heated warming shelters (tents, cabins, company vehicles, rest rooms, etc.) shall be made available nearby and the worker should be encouraged to use these shelters at regular intervals, the frequency depending on the severity of the environmental exposure. The onset of heavy shivering, frostnip, the feeling of excessive fatigue, drowsiness, irritability, or euphoria, are indications for immediate return to the shelter. When entering the heated shelter, the outer layer of clothing shall be removed and the remainder of the clothing loosened to permit sweat evaporation. A change of dry work clothing shall be provided as necessary to prevent workers from returning to their work with wet clothing.

Dehydration, or the loss of body fluids, occurs in the cold environment and may increase the susceptibility of the worker to cold injury due to a significant change in blood flow to the extremities. Warm sweet

drinks and soups should be provided at the work site to provide caloric intake and fluid volume. The intake of coffee should be limited because of a diuretic and circulatory effect (Adapted from TLV's and Biological Exposure Indices 1988-1989, ACGIH).

8.5 Personal Protective Equipment

The following is a breakdown of the types of protective clothing and equipment to be used during the site activities. Personal protective equipment (PPE) is in conformance with EPA criteria for Level B, C, and D protection. All respiratory protective equipment used will be approved by NIOSH/MSHA.

Level C protection, as described in this plan, will be available at a minimum for those activities that involve surface and subsurface soil (strata disturbance such as well installation, and all subsurface media sampling activities such as split-spoon sampling and borings). Some activities may require Level B protection. In atmospheres potentially containing toluene and xylenes, the protective ensemble should include chemical resistant clothing since the two compounds have skin absorption potential.

The Site Safety Officer will determine whether or not a level of protection can be upgraded or downgraded. Changes in the level of protection will be recorded in the dedicated site logbook along with the rationale for the changes. Level D protection may be used for those activities that do not pose a potential threat of exposure to toxic or hazardous substances. Typical Level D activities may include sediment, logging and groundwater sampling, as well as surficial site surveys. Level C protection equipment should be readily available at all times. Consistent with OSHA training, prior to donning Level C, the percentage of oxygen must be continuously monitored.

<u>Level D</u>

- hard hat
- safety glasses
- steel toe and shank boots
- fluorescent vest
- splash goggles
- hearing protection (as appropriate)

<u>Modified Level D</u>

- hard hat
- safety glasses
- steel toe and shank boots

- fluorescent vest
- Nitrile "N-Dex" inner gloves
- latex outer boots (chemical resistant)
- splash goggles
- polyethylene coated Tyvek suit
- hearing protection (as appropriate)

Level C

- buddy system required at all times
- full face respirator with NIOSH approved OV/AG/HEPA combination cartridges (MSA GMC-H)
- Saranex coated Tyvek Suit
- inner Nitrile "N-Dex" gloves
- outer Nitrile (NBR) gloves
- steel toe and shank boots
- outer boots (chemical resistant)
- hard hat
- hearing protection (as appropriate)

Level B

Regional Health and Safety representatives must be on site upon start-up of any project requiring level B protection. This should be understood to include subcontractors conducting Level B activity.

- buddy system required at all times
- supplied air respirator or SCBA
- Saranex coated Tyvek Suit
- inner Nitrile "N-Dex" gloves
- outer Nitrile (NBR) gloves
- steel toe and shank boots
- outer boots (chemical resistant)
- hard hat
- hearing protection (as appropriate)

Note: Respirator cartridges will be changed once per day at a minimum. This can be accomplished at the end of the workday during respirator decontamination. If odor breakthrough is detected while wearing the respirator or if breathing becomes difficult, change cartridges immediately.

Contact with contaminated surfaces, or surfaces suspected of being contaminated, should be avoided. This includes walking through, kneeling in, or placing equipment in puddles, mud, discolored surfaces, or on drums and other containers. Eating, smoking, drinking, and/or the application of cosmetics in the immediate work area is prohibited.

When utilizing protective garments such as Tyvek suits, gloves, and booties, all seams between protective items will be sealed with duct tape.

The use of contact lenses on the job site is strongly advised against. However, when glasses are not available, contact lenses are preferred over faulty vision. When contact lenses are worn, safety glasses and/or goggles must be worn at all times while on the job site.

8.6 Decontamination

8.6.1 General

Personnel involved in work activities at the site may be exposed to compounds in a number of ways, despite the most stringent protective procedures. Site personnel may come in contact with vapors, gases, mists, or particulates in the air, or other site media while performing site duties. Use of monitoring instruments and site equipment can also result in exposure and transmittal of hazardous substances.

In general, decontamination involves scrubbing with a detergent water solution followed by clean water rinses. All disposable items shall be disposed of in a dry container. Certain parts of contaminated respirators, such as harness assemblies and leather or cloth components, are difficult to decontaminate. If grossly contaminated, they may have to be discarded. Rubber components can be soaked in detergent and water and scrubbed with a brush. In addition to being contaminated, all respirators, non-disposable protective clothing, and other personal articles must be sanitized or replaced before they can be used again if they become soiled from exhalation, body oils, and perspiration. The manufacturer's instructions should be followed in sanitizing the respirator masks.

The Site Safety Officer will be responsible for the proper maintenance, decontamination, and sanitizing of all respirator equipment.

The decontamination zone layout and procedures should match the prescribed levels of personal protection. A detailed discussion for the establishment of the project decontamination zone and the procedures required for the various levels of personnel protection follows.

Exclusion Zone (EZ)

It is within this zone that the work activities are performed. No one shall enter this zone unless the appropriate PPE is donned.

Contaminant Reduction Zone (CRZ)

It is within this zone that the decontamination process is undertaken. Personnel and their equipment must be adequately decontaminated before leaving this zone for the support zone. This zone will be set up between the EZ and a well-ventilated open area.

Support Zone (SZ)

The support zone is considered to be uncontaminated; as such, protective clothing and equipment are not required but should be available for use in emergencies. All equipment and materials are stored and maintained within this zone. Protective clothing is put on in the SZ before entering the CRZ. The SZ will be established in a safe environment.

The following procedures have been established to provide site personnel with minimum guidelines for proper decontamination. Personnel leaving the point of operations designated as the EZ must follow these minimum procedures. The decontamination process shall take place at a reasonable distance away from any area of potential contamination.

8.6.2 Minimum Decontamination Procedure

Personnel leaving the point of operations should wash outer gloves and boots. At a minimum, the outer boots shall be removed first and stored in an appropriate area or disposed of properly. Outer boots must be properly washed where gross contamination is evident. Personnel shall then remove and dispose of the Tyvek suits. Personnel should remove the Tyvek suits so that the inner clothing does not come in contact with any contaminated surfaces. After Tyvek removal, personnel shall remove and discard outer Nitrile gloves. Personnel shall then remove the respirator, where applicable. Respirators shall be disinfected between uses with towelettes or other sanitary methods. Potable water, at a minimum, will be present so that site personnel can thoroughly wash hands and face after leaving the point of operations.

Portable wash stations shall be utilized for easy and efficient access. The wash station shall consist of a potable water supply, hand soap, and clean towels. Portable sprayer units filled with Alconox solution and potable water should also be available to wash and rinse off grossly contaminated boots, gloves, and equipment. The Site Safety Officer will monitor decontamination procedures to ensure their effectiveness. Modifications of the decontamination procedure may be necessary as determined by the Site Safety Officer's observations.

8.6.3 Standard Decontamination Procedure

The following decontamination procedures should be implemented during site operations for the appropriate level of protection.

Level B

Segregated equipment drop

Deposit equipment (tools, sampling devices, notes, monitoring instruments, radios, etc.) used on the site onto plastic drop cloths.

Boot covers and glove wash

Outer boots and outer gloves should be scrubbed with a decontamination solution of detergent and water or replaced.

Rinse off boot covers and gloves

Decontamination solution should be rinsed off boot covers and gloves using generous amounts of water. Repeat as many times as necessary.

Tape removal

Remove tape from around boots and gloves and place into container with plastic liner.

Boot cover removal

Remove disposable boot covers and place into container with plastic liner.

Outer glove removal

Remove outer gloves and deposit in container with plastic liner.

Suit / safety boot wash

Completely wash splash suit, SCBA, gloves, and safety boots. Care should be exercised that no water is allowed into the SCBA regulator. It is suggested that the SCBA regulator be wrapped in plastic.

Suit / safety boot rinse

Thoroughly rinse off all decontamination solution from protective clothing.

Tank or canister changes

This is the last step in the decontamination procedure for those workers wishing to change air tanks and return to the EZ. The worker's air tank or cartridge is exchanged, new outer glove and boot covers are donned, and joints taped.

Removal of safety boots

Remove safety boots and deposit in container with a plastic liner.

SCBA backpack removal

Without removing the face piece, the SCBA backpack should be removed and placed on a table. The face piece should then be disconnected from the remaining SCBA unit and then proceed to the next station.

Splash suit removal

With care, remove the splash suit. The exterior of the splash suit should not come in contact with any inner layers of clothing.

Inner glove wash

The inner gloves should be washed with a mild decontamination solution (detergent / water)

Inner glove rinse

Generously rinse the inner gloves with water.

Face piece removal

Without touching the face with gloves, remove the face piece. The face piece should be deposited into a container that has a plastic liner.

Inner glove removal

Remove the inner glove and deposit into a container that has a plastic liner.

Field wash

Wash hands and face thoroughly. If highly toxic, skin corrosive, or skin absorbent materials are known or suspected to be present, a shower should be taken.

Level C and Level D

The decontamination procedure for Level C and Level D personal protection will employ applicable steps detailed in the Level B decontamination process.

8.6.4 Sampling Equipment and Sample Container Decontamination

All non-disposable sampling equipment will be decontaminated with an Alconox / water solution followed by a clean water rinse. As an added precaution against cross-contamination, all non-disposable sampling equipment will be rinsed with distilled water. All disposable sampling equipment will be properly disposed of in dry containers.

Before leaving the site, all sample containers will be thoroughly decontaminated using a detergent and water solution followed by a clean water rinse. The decontamination procedure should include a complete scrubbing of the container's surface to remove possible contamination. Care must be exercised to prevent damage to sample container identification labels.

8.7 Health and Safety Requirements

8.7.1 Medical Monitoring Program

A baseline physical examination must be conducted on all employees before they are permitted to engage in sampling, cleanup, and remedial action work. A complete medical survey should be completed on each employee upon start of employment. Yearly re-examination should be performed to update information on employee health status. Additional re-evaluation will be considered in the event of a chemical overexposure. These medical surveillance requirements shall comply with OSHA regulations as defined in 29 CFR 1910.120.

8.7.2 Training

All personnel working at this site should have received a minimum of 40 hours of initial hazardous waste activity instruction, and a minimum of three days of field experience under direct supervision of a trained, experienced person. Personnel assigned to the site will also receive eight hours refresher training per year. On-site managers and supervisors directly responsible for employees engaged in hazardous waste operations have received an additional eight hours of supervisory training. These training requirements comply with the OSHA Hazardous Waste Operations and Emergency Response Regulation, 29 CFR 1910.120.

8.7.3 Visitor Policy

All visitors and/or trainees on site must submit to the limitations described herein.

8.7.4 Work Zone Area

Work and support areas shall be established based on ambient air data and proposed work sites. They shall be established in order to contain contamination within the smallest areas possible and shall ensure that each employee has the proper PPE for the area or zone in which work is to be performed.

8.7.5 First Aid Equipment

Vehicles used for site work will be equipped with a first aid kit and safety equipment including:

- fluorescent vests
- cones (and flags as needed)
- hazard tape (barricades as needed)
- mounted fire extinguisher (10 pound A/B/C type)
- working flashlight
- water, suitable for drinking
- portable eye wash
- first aid kit with appropriate bandage material
- full body harness with lifeline (for confined space entry)

8.7.6 Fire Prevention

During equipment operation, periodic vapor concentration measurements should be taken with an explosimeter or combustimeter. If at any time the vapor concentrations exceed 20% of the LEL, then the Site Safety Officer or designated field worker should immediately shut down all operations.

Only approved safety cans will be used to transport and store flammable liquids.

All gasoline and diesel-driven engines requiring refueling must be shut down and allowed to cool prior to filling.

Smoking is not allowed during any operations within the work area in which petroleum products or solvents in free-floating, dissolved, or vapor forms, or other flammable liquids may be present.

No open flame or spark is allowed in any area containing petroleum products or other flammable liquids.

8.7.7 Heavy Machinery / Equipment

All site employees must remain aware of those site activities that involve the use of heavy equipment and machinery. Respiratory protection and protective eyewear may be worn frequently during site activities. This protective equipment significantly reduces peripheral vision of the wearer. Therefore, it is essential that all employees at the site exercise extreme caution during operation of equipment and machinery to avoid physical injury to themselves or others.

8.7.8 Additional Safety Practices

The following are important safety precautions that will be enforced during work activities.

1. Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth transfer and ingestion of material is prohibited in any area designated as contaminated.
2. Hands and face must be thoroughly washed upon leaving the work area and before eating, drinking, or any other activity.
3. Whenever decontamination procedures for outer garments are in effect, the entire body should be thoroughly washed as soon as possible after the protective garments are removed.
4. No excessive facial hair that interferes with the effectiveness of a respirator will be permitted on personnel required to wear respiratory protection equipment. The respirator must seal against the face so that the wearer receives air only through the air purifying cartridges attached to the respirator. Fit testing shall be performed prior to respirator use to ensure the wearer obtains a proper seal.
5. Contact with potentially contaminated surfaces should be avoided whenever possible. One should not walk through puddles; kneel on the ground; lean, sit, or place equipment on drums, containers, vehicles, or the ground.
6. Medicine and alcohol can potentially increase the effect from exposure to certain compounds. Prescribed drugs and alcoholic beverages should not be consumed by personnel involved in the project.
7. Personnel and equipment in the work areas should be minimized, consistent with effective site operations.
8. Work areas for various operational activities should be established.
9. Procedures for leaving the work area must be planned and implemented prior to going to the site. Work areas and decontamination procedures must be established on the basis of prevailing site conditions.
10. Respirators will be issued for the exclusive use of one worker and will be cleaned and disinfected after each use.
11. Safety gloves and boots shall be taped to the disposable, chemical-protective suits as necessary.
12. All unsafe equipment left unattended will be identified by a "DANGER, DO NOT OPERATE" tag.
13. Noise mufflers or earplugs may be required for all site personnel working around heavy equipment. This requirement will be at the discretion of the Site Safety Officer. Disposable, form-fitting plugs are preferred.
14. Cartridges for air-purifying respirators in use will be changed daily at a minimum.

8.8 Project Personnel

8.8.1 Project Manager

The Project Manager will be responsible for implementing the project and obtaining any necessary personnel or resources for the completion of the project. Specific duties will include:

- coordinating the activities of all subcontractors, to include informing them of the required PPE and insuring their signature acknowledging this Site Safety Plan.
- selecting a Site Safety Officer and field personnel for the work to be undertaken on site.
- ensuring that the tasks assigned are being completed as planned and on schedule.
- providing authority and resources to ensure that the Site Safety Officer is able to implement and manage safety procedures.
- preparing reports and recommendations about the project to clients and affected personnel.
- ensuring that all persons allowed to enter the site (i.e., EPA, contractors, state officials, visitors are made aware of the potential hazards associated with the substances known or suspected to be on site, and are knowledgeable as to the on-site copy of the specific site safety plan.
- ensuring that the Site Safety Officer is aware of all of the provisions of this site safety plan and is instructing all personnel on site about the safety practices and emergency procedures defined in the plan.
- ensuring that the Site Safety Officer is making an effort to monitor site safety, and has designated a Field Team Leader to assist with the responsibility when necessary.

8.8.2 Site Safety Officer

The Site Safety Officer shall be responsible for the implementation of the site safety plan on site. Specific duties will include:

- monitoring the compliance of field personnel for the routine and proper use of the PPE that has been designated for each task.
- routinely inspecting PPE and clothing to ensure that it is in good condition and is being stored and maintained properly.
- stopping work on the site or changing work assignments or procedures if any operation threatens the health and safety of workers or the public.
- monitoring personnel who enter and exit the site and all controlled access points.
- reporting any signs of fatigue, work-related stress, or chemical exposures to the Project Manager.
- dismissing field personnel from the site if their actions or negligence endangers themselves, co-workers, or the public, and reporting the same to the Project Manager.
- reporting any accidents or violations of the site safety plan to the Project Manager and

documenting the same for the project in the records.

- knowing emergency procedures, evacuation routes, and the telephone numbers of the ambulance, local hospital, poison control center, fire and police departments.
- ensuring that all project-relating personnel have signed the personnel agreement and acknowledgments form contained in this site safety plan.
- coordinate upgrading and downgrading PPE as necessary due to changes in exposure levels, monitoring results, weather, and other site conditions.
- perform air monitoring with approved instruments in accordance with requirements stated in this Site Safety Plan.

8.8.3 Project Field Manager

In the event that the Project Manager and the Site Safety Officer are not on site, the Project Field Manger will assume all responsibility of the Site Safety Officer.

8.8.4 Quality Assurance Officer Responsibilities

The Quality Assurance Officer (QAO) is an employee of the same consulting firm generating the work plan and acts in conjunction with the project manager to develop a site-specific quality assurance plan. The QAO must not have another position on the project, such as a project or task manager, that involves project productivity or profitability as job-performance criteria.

The project QAO must have a minimum of a bachelor's degree in chemistry or natural science with a minimum of 20 hours in chemistry. The QAO must be proficient in analytical methodology, data interpretation and validation, the development of sampling plans, quality control procedures, and auditing techniques.

The QAO will assist the project manager in the development of the sampling and analytical portion of the Quality Assurance Project Plan. The QAO or his/her designee shall conduct periodic field and sampling audits, interface with the analytical laboratory to make requests and resolve problems, interface with the data validator and develop a project-specific data usability report. Because on-site work may be necessary, verification or completion of the 40-hour OSHA safety training course and 8-hour refresher is required.

8.8.5 Field Personnel

All field personnel shall be responsible for acting in compliance with all safety procedures outlined in the Site Safety Plan. Any hazardous work situations or procedures should be reported to the Site Safety Officer so that corrective steps can be taken.

9. Quality Assurance/Quality Control Protocol

The following sampling QA/QC protocol is in accordance with the United States Environmental Protection (USEPA) Agency's accepted sampling procedures for hazardous waste streams (Municipal Research Laboratory, 1980, *Sampling and Analysis Procedures for Hazardous Material Waste Streams*, Office of Emergency and Remedial Response, Cincinnati, Ohio. EPA-600/280-018) and The American Society of Testing and Material's (ASTM) sampling procedures.

9.1 Reporting of Results

All laboratory-reporting procedures will comply with the NYSDEC ASP and the New York State Department of Health Environmental Laboratory Approval Program (NYSDOH ELAP). In addition, all sample analyses will be done by a NYSDOH ELAP CLP certified laboratory and the data will be reported in the NYSDEC ASP Category B deliverables package format. The NYSDEC Department of Environmental Remediation (DER) Data Usability Summary Report (DUSR) will be used for data review. The data packages will be evaluated according to the DER DUSR Guidelines, Revised 9/97. Kevin Kleaka will author the DUSR.

9.2 Sampling Personnel

The activities associated with the remedial investigation plan will be performed by or under the auspices of a Quality Assurance Officer (Kevin Kleaka, see qualifications in Appendix E). The sample staff (samplers) will possess a minimum of a BA Degree in the Earth, Space or Biological Sciences or a BS Degree in Engineering. Samplers will have a minimum of one (1) year experience in environmental/geological fieldwork. Additionally, all samplers will have received mandatory forty-hour Occupational Safety and Health Administration (OSHA) training on working with potentially hazardous materials and appropriate Hazard Communication Program and "Right-To-Know" training.

The following table summarizes the approximate number of samples, field blanks, bottle type, EPA test method and preservatives for the proposed sampling plan.

EPA Test Method	Media	Samples	Field	Bottle	Preservative
8260	soil	~6	NA	40 ml VOA	4 deg. C
8270	soil	~6	NA	8 oz. Glass	4 deg. C
6010	soil	~6	NA	8 oz. Glass	none
624	gw	~45	~5	40 ml VOA	4 deg. C

The laboratory will receive samples within 48 hours of sampling. One trip blank shall be submitted per pickup from laboratory personnel. The selected laboratory shall choose the matrix spike and duplicate samples. The following summarizes the verified tie of sample receipt (holding time) for the proposed sampling plan. The holding times follow the NYSDEC ASP 95 revision, Exhibit I.

USEPA Test Method 8260: 7 days
USEPA Test Method 8270BN: 5 days
USEPA Test Method 6010: 6 months
USEPA Test Method: 624: 7 days

9.3 Sampling Equipment

Separate QA/QC measures will be implemented for each of the instruments used in the performance of the SAP.

9.3.1 Geoprobe

Prior to arrival on the Site and between sample locations, the probes will be decontaminated by steam cleaning, Alconox wash, and rinsing with distilled water. This will be followed by air drying as per project requirements. All sampling apparatus will be dedicated or disposable. A clean, new liner will be used for each sample. Parts will be inspected for wear and damage before each use.

9.3.2 Bailers

In order to prevent contamination, all bailers will be dedicated and disposable.

9.3.3 Photo Ionization Detector

Calibration of the PID will be conducted prior to sampling using a span gas of known concentration. The PID was a Photovac Micro-Tip, photo ionization detection meter.

9.3.4 Sample Vessels

All sample vessels will be "level A" certified decontaminated containers supplied by a New York State Certified Commercial Laboratory. Samples analyzed for hydrocarbons will be placed in containers with Teflon lined caps. All samples will be preserved by cooling them to a temperature of approximately four degrees Celsius.

9.4 Sample Documentation

A sample represents physical evidence. An essential part of liability reduction is the proper control of gathered evidence. To establish proper control, proper sample identification and chain-of custody procedures will be followed as discussed below.

9.4.1 Sample Identification

Sample identification will be executed by use of a sample tag, logbook and chain-of-custody form. Said documentation will provide the following information: 1) the project code; 2) the sample laboratory number; 3) the sample preservation; 4) the instrument used for source sample grabs; 5) the composite medium used for source sample grabs; 6) the date the sample was secured from the source media; 7) the time the sample was secured from the source media; and 8) the person who secured the sample from the source media.

9.4.2 Chain-of-Custody Procedures

Due to the evidential nature of samples, possession will be traced from the time the samples are collected until they are received by the testing laboratory. A sample will be considered under custody if it: is in a person's possession; if is in a person's view after being in possession; is in a person's possession and they locked it up; or, it is in a designated secure area. When transferring custody, the individuals relinquishing and receiving the samples will sign, date and note the time on the Chain-of-Custody Form.

9.4.3 Laboratory-Custody Procedures

A designated sample custodian will accept custody of the shipped samples and will verify that the information on the sample tags matches that on the Chain-of-Custody Records. Pertinent information as to shipment, pick-up, courier, etc., will be entered in the "remarks" section. The custodian will enter the sample tag data into a bound logbook.

The laboratory custodian will use the sample tag number, or assign a unique laboratory number to each sample tag, and assure that all samples will be transferred to the proper analyst or stored in the appropriate source area. The laboratory custodian will distribute samples to the appropriate analysts. Laboratory personnel will be responsible for the care and custody of samples, from the time they are received, until the sample is exhausted or returned to the sample custodian. All identifying data sheets and laboratory records will be retained as part of the permanent documentation. Samples received by the laboratory will be retained until after analysis and quality assurance checks are completed.

10. Community Health and Safety Plan

Due to the minimal ground disturbance that is anticipated during the sampling phase of the project, it is expected that only a small impact from generated dust could occur in the vicinity of the site. Well installation using the hollow stem auger, Geoprobe sampling, and GPR work can generate dust in small quantities. The ingress and egress of onsite vehicles can also create airborne dust.

To minimize the effects of dust on the community, sampling will only be performed on days that the local wind speeds (as measured by the National Weather Service at JFK Airport) are below 15 mph. All onsite vehicles will be required to travel at speeds no greater than 15 mph.

APPENDICES

36 Sylvester Street Site No. 1-30-043U
Westbury, New York
00-096

APPENDIX A:

Geoprobe System Information

36 Sylvester Street Site No. 1-30-043U

Westbury, New York

00-096

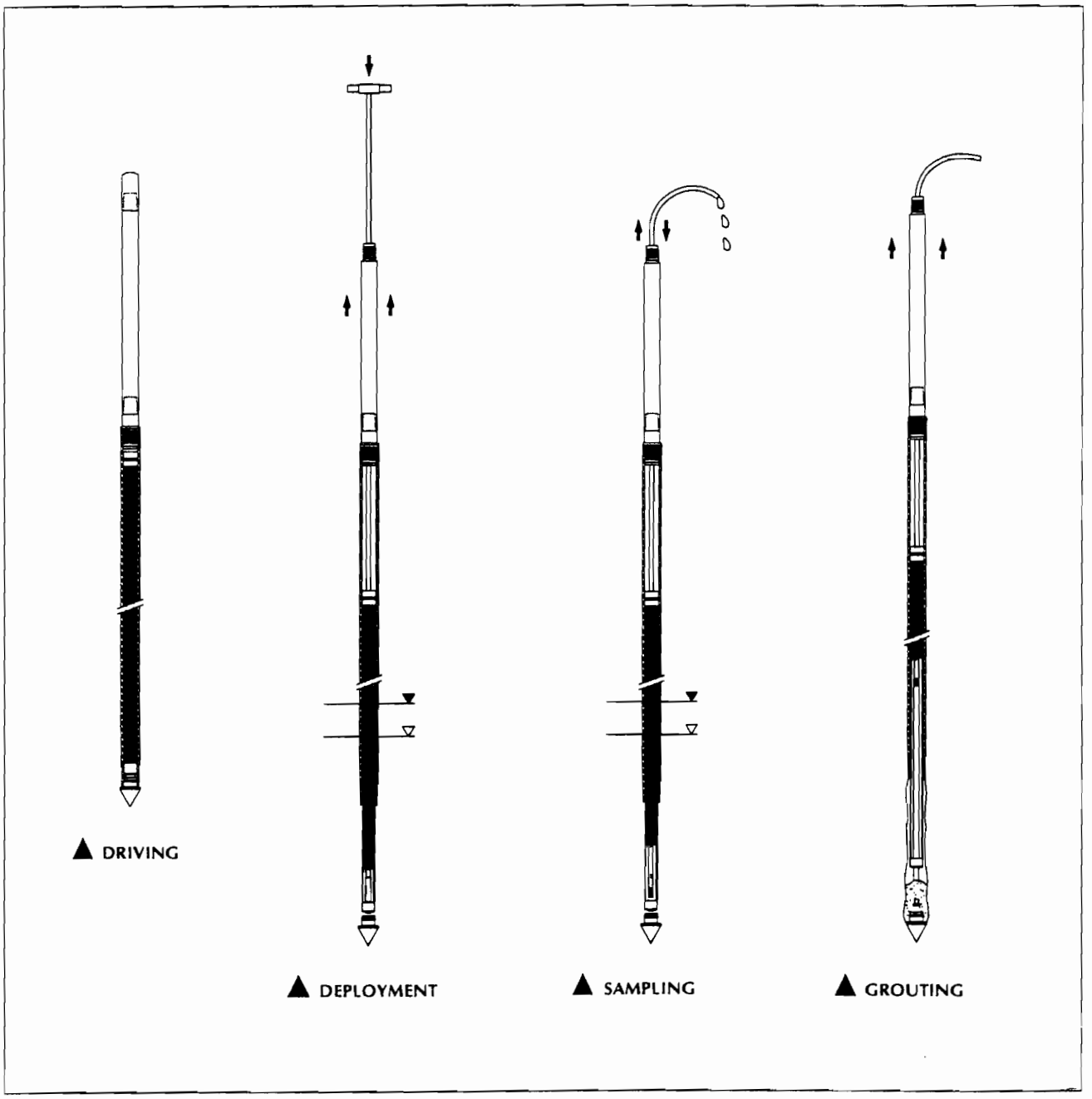
GEOPROBE SCREEN POINT 15 GROUNDWATER SAMPLER

STANDARD OPERATING PROCEDURE

Technical Bulletin No. 95-1500

PREPARED: October, 1995

REVISED: September, 1997



GEOPROBE SCREEN POINT 15 GROUNDWATER SAMPLER

Geoprobe® Systems

A DIVISION OF KEJR ENGINEERING

Geoprobe® is a Registered Trademark of
Kejr Engineering, Inc., Salina, Kansas
Screen Point 15 Groundwater Sampler manufactured
under U.S. Patent 5,612,498

1.0 OBJECTIVE

The objective of this procedure is to drive a sealed stainless steel or PVC screen to depth, deploy the screen, obtain a representative water sample from the screen interval, and grout the probe hole during abandonment. The Screen Point 15 Groundwater Sampler enables the operator to conduct abandonment grouting that meets American Society for Testing and Materials (ASTM) Method D 5299 requirements for decommissioning wells and borings for environmental activities (ASTM 1993).

2.0 BACKGROUND

2.1 Definitions

Geoprobe®: A brand name of high quality, hydraulically powered machines that utilize both static force and percussion to advance sampling and logging tools into the subsurface. The Geoprobe brand name refers to both machines and tools manufactured by Geoprobe Systems, Salina, Kansas. Geoprobe tools are used to perform soil core and soil gas sampling, groundwater sampling, soil conductivity and contaminant logging, grouting, and materials injection.

Screen Point 15 Groundwater Sampler: A direct push device consisting of a PVC or stainless steel screen that is driven to depth within a sealed, steel sheath and then deployed for the collection of representative groundwater samples. The assembled Screen Point 15 Sampler is 52 inches (1321 mm) long with an OD of 1.5 inches (38 mm). Upon deployment, up to 41 inches (1041 mm) of screen can be exposed to the formation.

Casing Puller: An assembly which makes it possible to retract the sampler string with extension rods protruding from the top of the probe rods. For units originally equipped with the GH40 Soil Probing Hammer, a Casing Pull Kit is available as part number GW4600K. Units originally equipped with the SK58 hammer, or retrofitted with the GH40 hammer require a different casing pull kit. Contact Geoprobe Systems for specific information.

Rod Grip Pull System: An attachment mounted on the GH40 Soil Probing Hammer which makes it possible to retract the sampler string with extension rods protruding from the top of the probe rods. The rod grip pull system utilizes hammer support brackets which greatly enhance probe unit durability. This system is therefore preferred over the Casing Pull Kit. The Rod Grip Pull System for use with 1.0- and 1.25-inch probe rods is available as GH1250K.

2.2 Discussion

In this procedure, the assembled Screen Point 15 Groundwater Sampler (Fig. 2.1A) is threaded onto the leading end of a Geoprobe probe rod and driven into the subsurface with a Geoprobe soil probing machine. Additional probe rods are subsequently added and driven until the desired sampling interval is reached. While the sampler is driven to depth, O-ring seals at the drive head and expendable drive point provide a watertight system. This system eliminates the threat of formation fluids entering the screen before deployment and assures sample integrity.

Once at the desired sampling interval, extension rods are sent downhole until the leading rod contacts the bottom of the sampler screen. The tool string is then retracted approximately 44 inches (1118 mm) while the screen is held in place with the extension rods (Fig. 2.1B). As the tool string is retracted, the expendable point is released from the sampler sheath. An O-ring on the screen head maintains the seal at the top of the screen. As a result, any liquid entering the sampler during screen deployment must first pass through the screen. The tool string and sheath may be retracted the full length of the screen or as little as a few inches if a small sampling interval is desired.

The Screen Point 15 Sampler utilizes either a stainless steel screen with a standard slot size of 0.004 inches (0.10 mm) or a PVC screen with a standard slot size of 0.010 inches (0.25mm). Both screen have an exposed length of 41 inches (1041 mm). Alternate slot sizes and lengths may be custom ordered. Contact Geoprobe Systems for available options. The screens are constructed such that a check valve or mini-bailer can be inserted into the screen cavity. This makes direct sampling possible from anywhere within the saturated zone. A removable plug in the lower end of the screens allows the user to grout as the sampler is extracted for further use.

Groundwater samples can be obtained in a number of ways. The most common method utilizes polyethylene or Teflon® tubing and a Tubing Bottom Check Valve (GW42). The check valve (with check ball) is attached to one end of the tubing and inserted down the casing until it is immersed in groundwater. Water is pumped through the tubing and to the ground surface by oscillating the tubing up and down. If oscillating the tubing is undesirable (such as when sampling for volatiles analysis), lower the check valve and tubing to the bottom of the sampler without the check ball. Then drop the check ball into the tubing from the ground surface. The ball will seat in the check valve and trap the sample in the tubing. Collect the sample by withdrawing and draining the tubing.

An alternative means of collecting groundwater samples is to attach a peristaltic or vacuum pump to the tubing. This method is limited in that water can be pumped to the surface from a maximum depth of approximately 26 feet (8 m). Another technique for groundwater sampling is to use a stainless steel Mini-Bailer Assembly (GW41). The mini-bailer is lowered down the inside of the casing below the water level where it fills with water and is then retrieved from the casing.

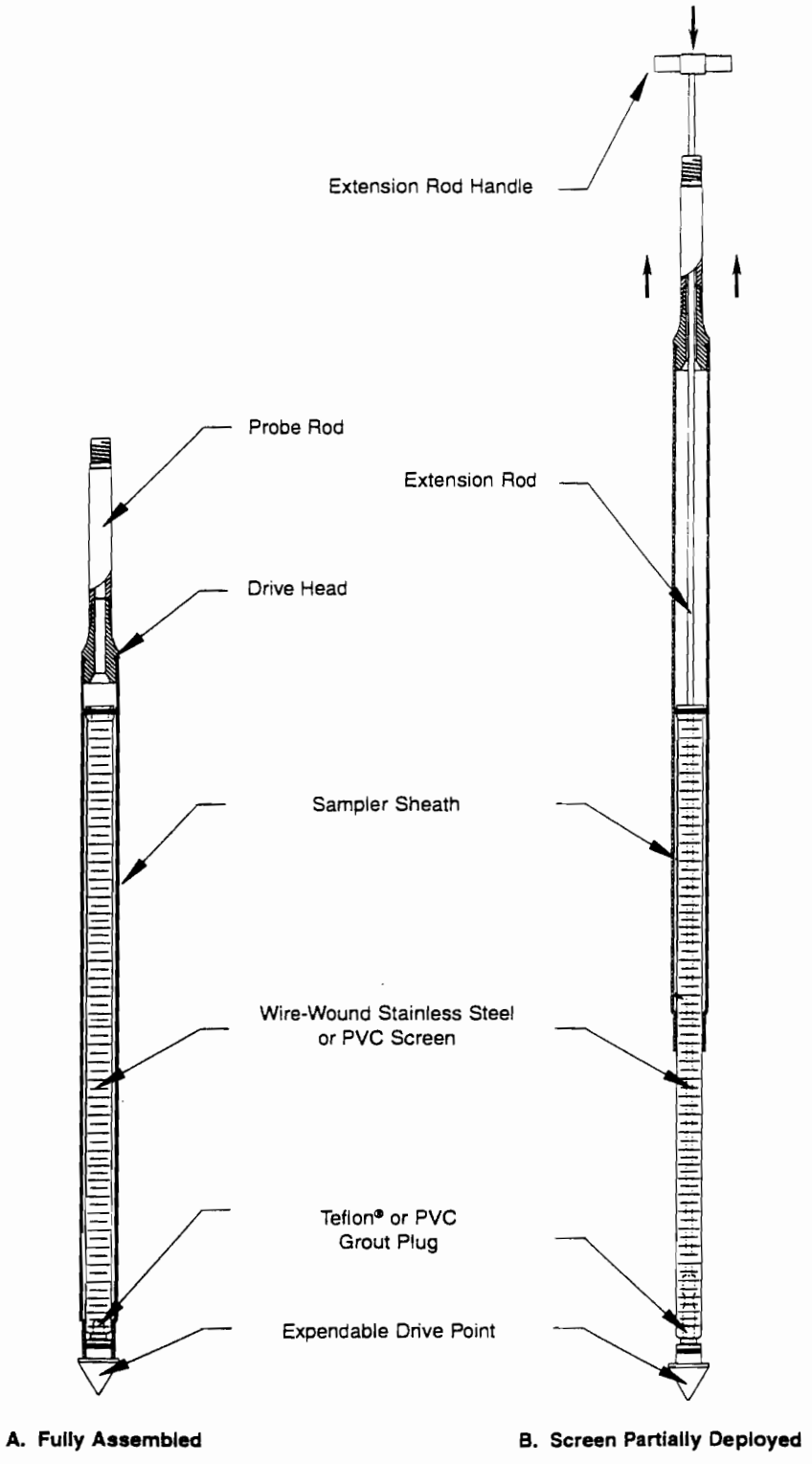


FIGURE 2.1
Screen Point 15 Groundwater Sampler

3.0 REQUIRED EQUIPMENT

The following equipment is required to successfully recover representative groundwater samples with the Geoprobe Screen Point 15 Groundwater Sampler and probing system. See Figure 3.1 for Screen Point 15 parts identification.

Screen Point 15 Groundwater Sampler Parts	**Quantity**	**Part Number**
O-ring Service Kit , 1.0-inch rods (100 of each O-ring)	-1-	GW1504K
O-ring Service Kit, 1.25-inch rods (100 of each O-ring)	-1-	GW1505K
Sampler Sheath	-1-	GW1510*
Drive Head, 0.625-inch bore, 1.25-inch rods (optional)	-1-	GW1512
Drive Head, 0.5-inch bore, 1.25-inch rods	-1-	GW1513
Drive Head, 1.0-inch rods	-1-	GW1515
Screen, Wire-Wound Stainless Steel, 4-Slot	-1-	GW1520*
Screen, PVC, 10-Slot (optional)	-1-	GW1530
Screen Push Adapter	-1-	GW1535*
Grout Plug Push Adapter	-1-	GW1540*
Grout Nozzle	-1-	GW1545
Grout Plugs, Teflon® (Pkg. of 25)	-1-	GW1550K
Grout Plugs, PVC (Pkg. of 25)	-1-	GW1551K*
Expendable Drive Points, Steel (Pkg. of 25)	-1-	GW1555K*
Expendable Drive Points, Aluminum (Pkg. of 25) (optional)	-1-	GW1555ALK
Screen Point 15 Groundwater Sampler Kit for 1.0-inch rods		GW1500K
Includes (*) items plus:		
O-ring Service Kit, 1.0-inch rods (100 or each O-ring)	-1-	GW1504K
Drive Head, 1.0-inch rods	-1-	GW1515
Screen Point 15 Groundwater Sampler Kit for 1.25-inch rods		GW1512K
Includes (*) items plus:		
O-ring Service Kit, 1.25-inch rods (100 or each O-ring)	-1-	GW1505K
Drive Head, 1.25-inch rods	-1-	GW1513

Geoprobe Tools	**Quantity**	**Part Number**
Drive Cap, 1.25-inch probe rods**	-1-	AT1200
Slotted Pull Cap, 1.25-inch probe rods (optional)**	-1-	AT1203
Pull Cap, 1.25-inch probe rods**	-1-	AT1204
Probe Rod, 1.25-inch x 48-inch***	Variable	AT1248
O-rings for 1.25-inch Probe Rods (Pkg. of 25)	Variable	AT1250R
Extension Rod, 36-inch (optional)	Variable	AT67
Extension Rod, 48-inch	Variable	AT671
Extension Rod, 1-meter (optional)	Variable	AT675
Extension Rod Coupler	Variable	AT68
Extension Rod Handle	-1-	AT69
Extension Rod Jig	-1-	AT690
Quick Link Extension Rod Connectors (Optional)	Variable	AT694K
Casing Pull Kit (for GH-40 hammer)	-1-	GW4600K
Rod Grip Pull System (may be used in place of GW4600K)	-1-	GH1250K

**Accessories for 1.0-inch OD probe rods are also available from Geoprobe Systems.
***Geoprobe 1.0-inch and 1.25-inch OD probe rods are available in lengths of 36-, 48-, and 60 inches, as well as 1 meter.

Additional Tools	**Quantity**
Adjustable Wrench	-1-
Pipe Wrenches	-2-

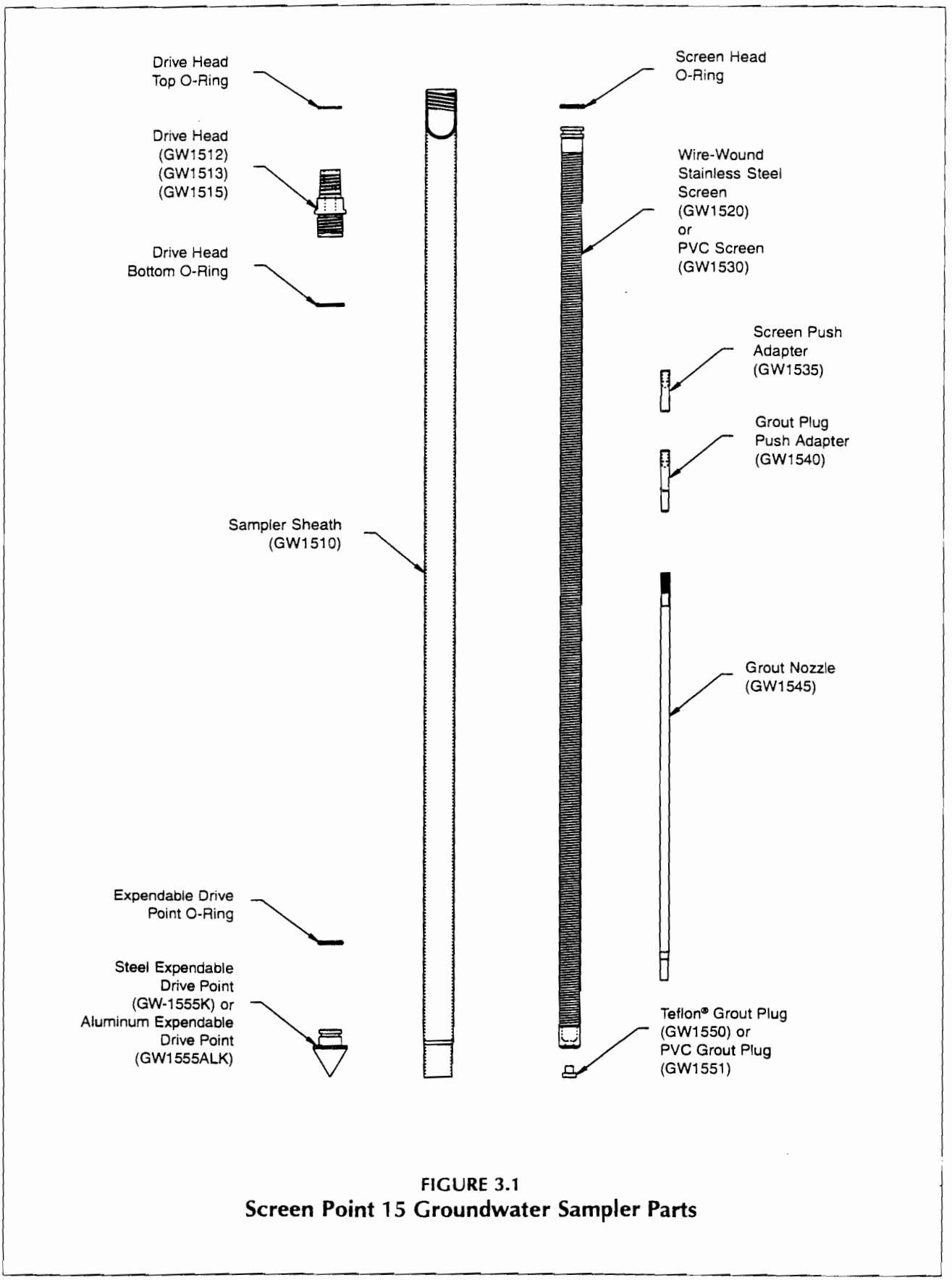


FIGURE 3.1
Screen Point 15 Groundwater Sampler Parts

4.0 OPERATION

4.1 Basic Operation

The Screen Point 15 Groundwater Sampler utilizes a stainless steel or PVC screen which is encased in an alloy steel sampler sheath. An expendable drive point is placed in the lower end of the sheath while a drive head is attached to the top. O-rings on the drive head and expendable point provide a watertight sheath which keeps contaminants out of the system as the sampler is driven to depth. Once the desired sampling interval is reached, extension rods equipped with a screen push adapter are inserted down the inside diameter of the probe rod string. The tool string is then retracted approximately 44 inches (1118 mm) while the screen is held in place with the extension rods. At this point the system is ready for groundwater sampling. When sampling is complete, a removable plug in the bottom of the screen allows for grouting below the sampler as the tool string is retrieved.

4.2 Decontamination

In order to collect representative groundwater samples, all Screen Point 15 parts must be thoroughly cleaned before and after each use. Scrub all metal parts using a stiff, long-bristle brush and a nonphosphate soap solution. Steam cleaning may be substituted for hand-washing if available. Rinse with distilled water and allow to air-dry before assembly.

4.3 Sampler Assembly (Fig. 4.1)

Part numbers are listed for a standard sampler using 1.25-inch x 48-inch probe rods. Refer to Page 6 for screen, grout plug, drive head, extension rod, and probe rod alternatives.

1. Install an O-ring on a steel expendable drive point (GW1555K). Firmly seat the expendable point in the necked end of a sampler sheath (GW1510).

2. Place a PVC grout plug (GW1551) in the lower end of a wire-wound stainless steel screen (GW1520). Install an O-ring in the groove on the upper end of the screen. Slide the screen inside of the sampler sheath with the grout plug toward the bottom of the sampler. Ensure that the expendable point was not displaced by the screen.

3. Install a bottom O-ring on a drive head (GW1513). Thread the drive head onto the sampler sheath. Attach a drive cap (AT1200) to the top of the drive head. Ensure that the threads engage completely. Tighten with an adjustable wrench if necessary.

4. Sampler assembly is complete.

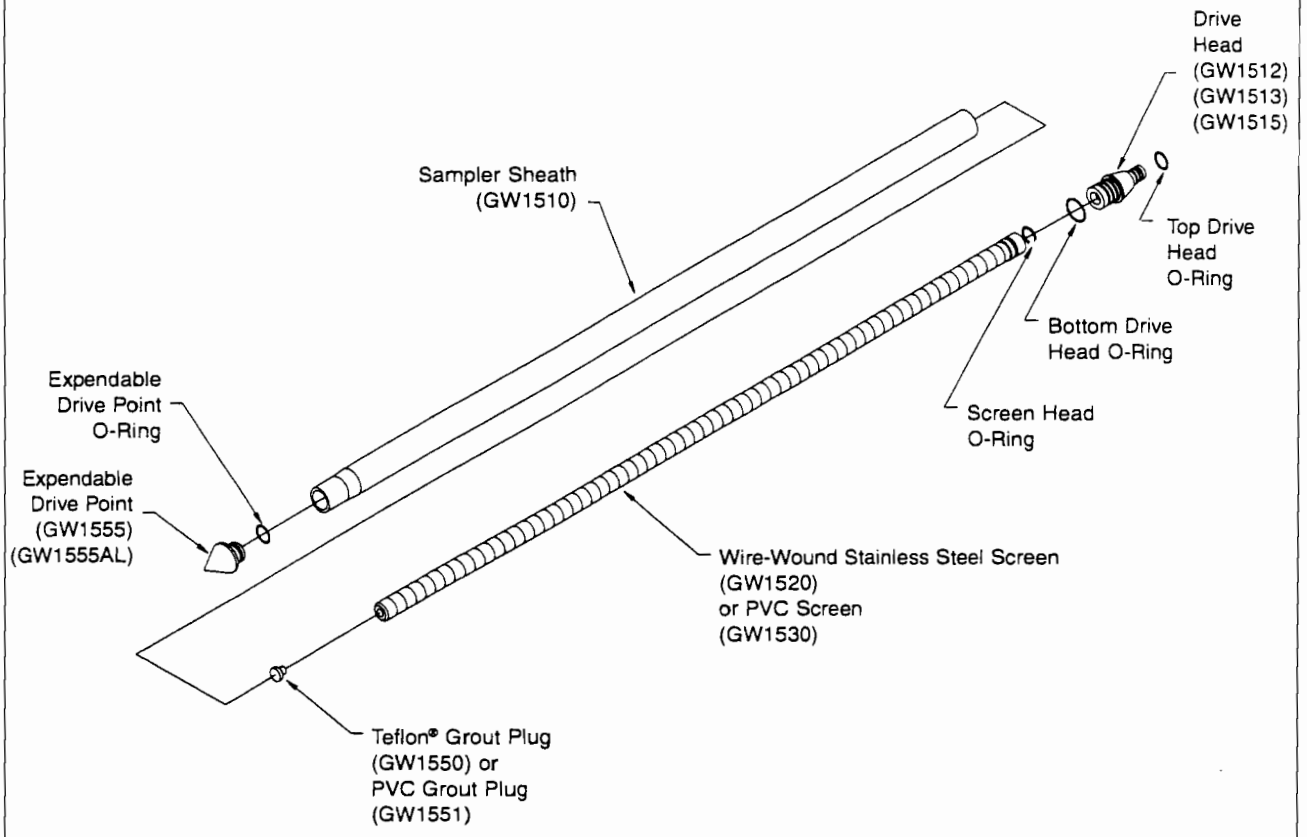


FIGURE 4.1
Screen Point 15 Groundwater Sampler Assembly

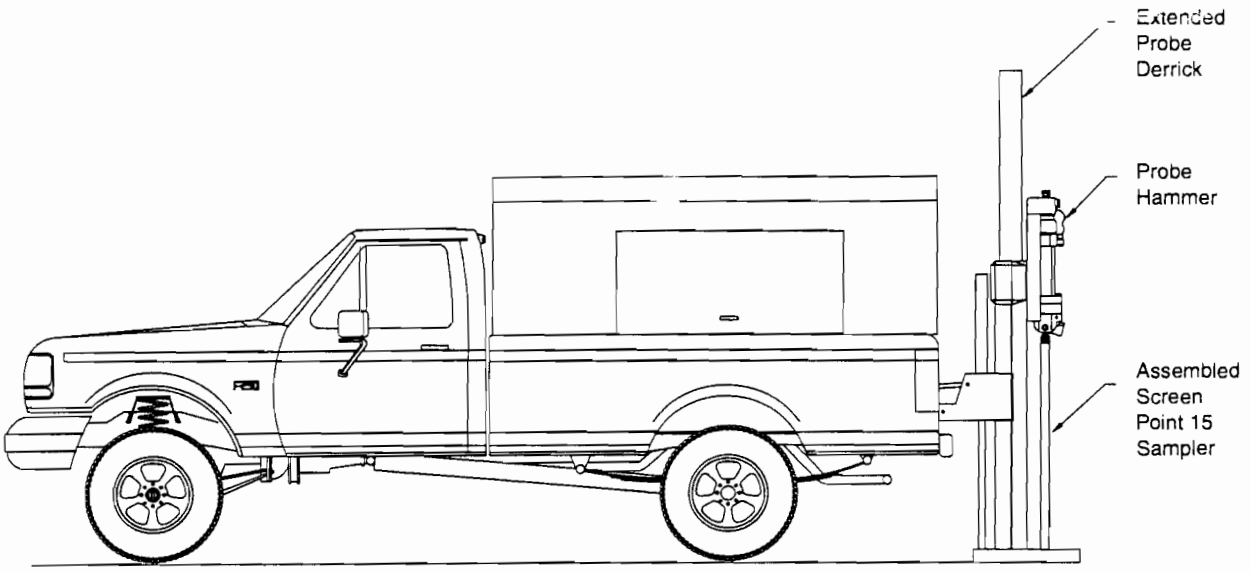


FIGURE 4.2
Screen Point 15 Groundwater Sampler in Driving Position

4.4 Driving the Screen Point 15 Sampler

To provide adequate room for screen deployment with the casing puller assembly, the probe derrick should be extended a little over halfway out of the carrier vehicle before driving the Screen Point 15 Sampler

1. Begin by placing the assembled sampler (Fig. 2.1) in the driving position beneath the hammer on the extended probe derrick (Fig. 4.2).

2. Drive the sampler with throttle control at slow speed for the first 1 or 2 feet to ensure that the sampler is driving straight. Switch the throttle control to fast speed for the remainder of the probe stroke.

3. Completely raise the hammer assembly. Remove the drive cap and place an O-ring in the top groove of the drive head. Distilled water may be used to lubricate the O-ring if needed. Add a 1.25-inch x 48-inch probe rod (AT1248) and reattach the drive cap to the rod string. Drive the sampler the entire length of the new rod with the throttle control at fast speed.

4. Repeat Step 3 until the desired sampling interval is reached. Approximately 12 inches (305 mm) of the last probe rod must extend above the ground surface to allow attachment of the puller assembly. A 12-inch (305 mm) rod may be added if the tool string is over-driven.

5. Remove the drive cap and retract the probe derrick away from the tool string.

4.5 Screen Deployment

1. Thread the screen push adapter (GW1535, Fig. 4.3) on an extension rod (AT67, AT671, or AT675). Attach a coupler (AT68) to the other end of the extension rod. Lower the extension rod inside of the probe rod taking care not to drop it down the tool string. An extension rod jig (AT690, Fig. 4.3) may be used to hold the rods.

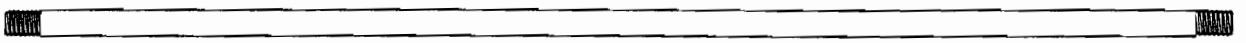
2. Add extensions until the adapter contacts the bottom of the screen. To speed up this step, extension rod Quick Links (AT694K, Fig. 4.3) are recommended.

3. Maneuver the probe assembly into position for pulling.

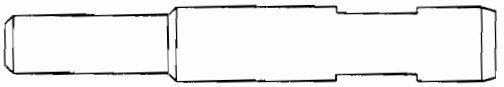
   Note: In this section, "Puller" refers to either the Casing Pull Kit (GW4600K) or Rod Grip Pull System (GH1250K). The operator may choose which option to use. Refer to Figures 4.4 and 4.5 for puller configurations.

4. Ensure that at least 48 inches (1219 mm) of extension rod protrudes from the probe rod. Thread an extension rod handle (AT-69, Fig. 4.3) on the top extension.

5. Retract probe rods and sampler sheath while physically holding the screen in place with the extension rods (Fig. 4.5B). A slight knock with the extension rod string will help to dislodge the expendable point and start the screen moving inside the sheath. Raise the hammer and pull bracket assembly about 44 inches (1118 cm). At this point the screen head will contact the necked portion of the sampler sheath (Fig. 4.5C.) and the extension rods will rise with the probe rods. The screen is now deployed. Use care when deploying a PVC screen so as not to break the screen when it contacts the bottom of the sampler sheath.

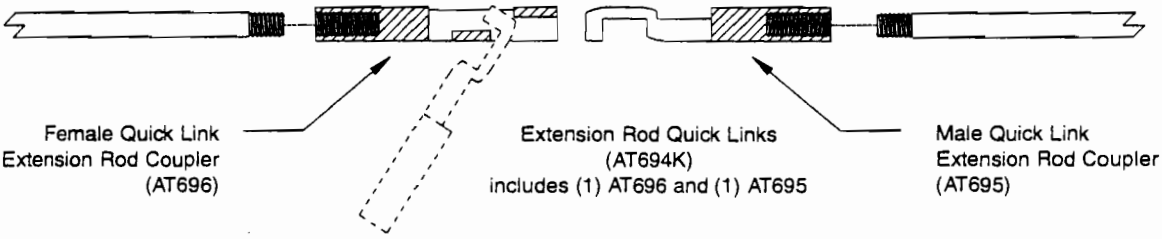


Extension Rod, 36-inch (AT67), 48-inch (AT671), or 1-meter (AT675)



Grout Plug Push Adapter
(GW1540)

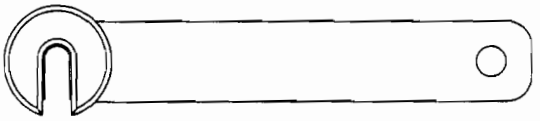
Screen Push Adapter
(GW1535)



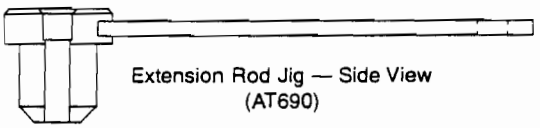
Female Quick Link
Extension Rod Coupler
(AT696)

Extension Rod Quick Links
(AT694K)
includes (1) AT696 and (1) AT695

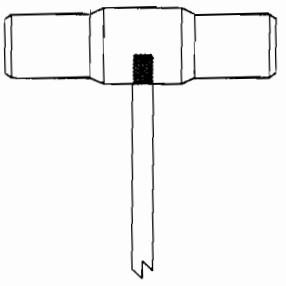
Male Quick Link
Extension Rod Coupler
(AT695)



Extension Rod Jig — Top View
(AT690)



Extension Rod Jig — Side View
(AT690)



Extension Rod Handle
(AT69)

FIGURE 4.3
Geoprobe Extension Rods and Accessories

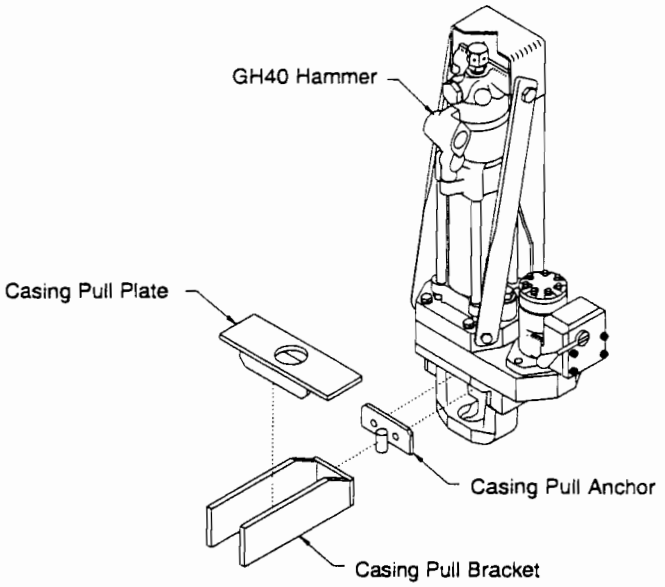


FIGURE 4.4
Casing Puller Assembly for Units Originally Equipped With The GH-40 Hammer

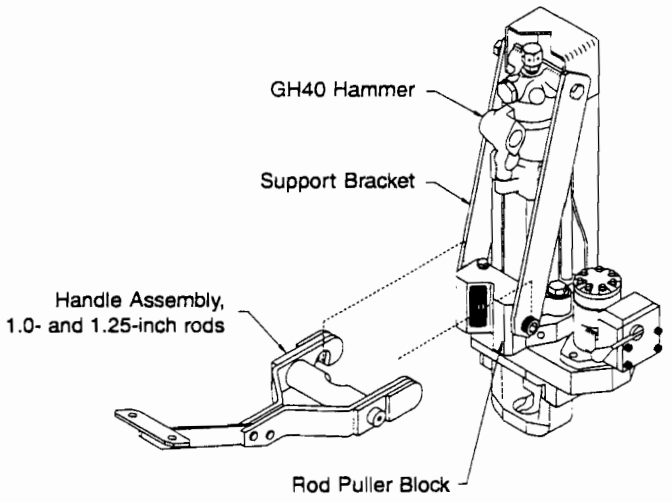


FIGURE 4.5
Rod Grip Pull System for Units Equipped With The GH-40 Hammer

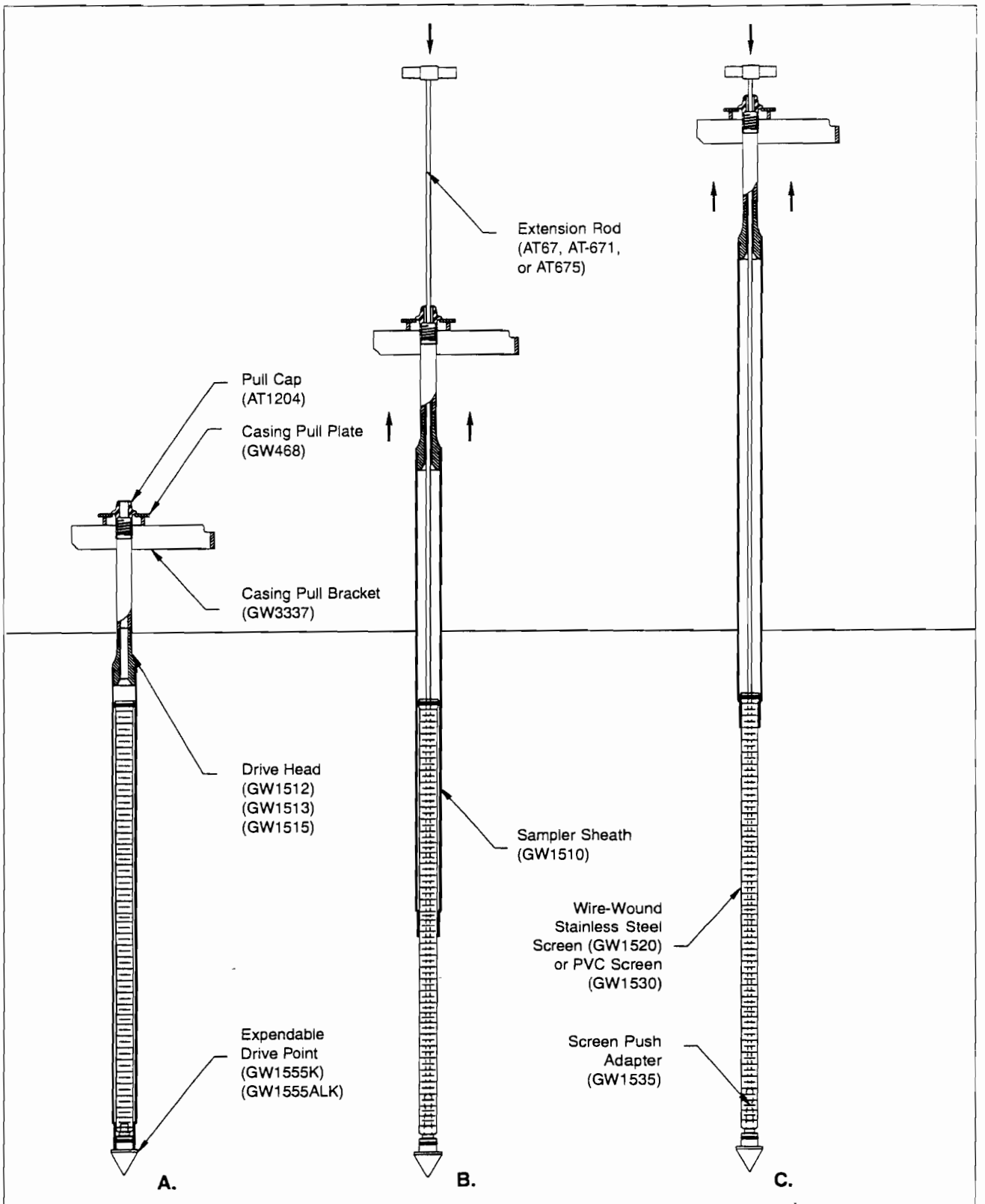


FIGURE 4.6
Screen Deployment Using a Casing Pull Kit

6. Lower the hammer assembly and retract the probe derrick. Remove the top extension rod and handle, pull cap, and top probe rod. Finally, extract all extension rods.

7. Groundwater samples can now be collected with a mini-bailer, peristaltic or vacuum pump, tubing bottom check valve assembly, or other acceptable small diameter sampling device.

8. When inserting the tubing down the rod string to collect a sample, ensure that the tubing enters the screen interval. The tubing will sometimes catch on the edge of the funnel opening of the screen head. An up-and-down motion combined with rotation helps move the tubing past the lip and into the screen.

4.6 Abandonment Grouting

The Screen Point 15 Sampler can meet ASTM D 5299 requirements for abandoning environmental wells or borings when grouting is conducted properly. A removable grout plug makes it possible to deploy tubing through the bottom of the screen. A GS500 or GS1000 Grout Machine is then used to pump grout into the open probe hole as the sampler is withdrawn. The following procedure is presented as an example only and should be modified to satisfy local abandonment grouting regulations.

1. Maneuver the probe assembly into position for pulling. Attach the puller to the top probe rod. Raise the tool string approximately 4 to 6 inches (102 to 152 cm) to allow removal of the grout plug.

   Note: A Slotted Pull Cap (AT1203) is needed if utilizing the Casing Pull Kit (GW4600K). This allows connection of the pull cap to the tool string with poly tubing extending from the top of the probe rod.

2. Thread the grout plug push adapter (GW1540, Fig. 4.3) onto an extension rod. Insert the adapter and extension rod inside the probe rod string. Add extensions until the adapter contacts the grout plug at the bottom of the screen. When the extension rods are slightly raised and lowered, a relatively soft rebound should be felt as the adapter contacts the grout plug. This is especially true when using a PVC screen.

3. Place a mark on the extension rod even with the top of the probe rod. Apply downward pressure on the extension rods and push the grout plug out of the screen. The mark placed on the extension rod should now be below the top of the probe rod. Remove all extension rods.

   Note: When working with a stainless steel screen, it may be necessary to raise and quickly lower the extension rods to jar the grout plug free. When the plug is successfully removed, a metal-on-metal sensation may be noted as the extension rods are gently "bounced" within the probe rods.

4. A grout nozzle (GW1545) is now connected to polyethylene tubing and inserted into the probe rods and down through the bottom of the screen (Fig. 4.7). It may be necessary to pump a small amount of clean water through the tubing during deployment to jet out sediments that settled in the bottom of the screen. Resistance will sometimes be felt as the grout nozzle passes through the drive head. Once again, rotate the tubing while moving it up-and-down to ensure that the nozzle has reached the bottom of the screen and is not hung up on the drive head.

   Note: All probe rods remain strung on the tubing as the tool string is pulled. Provide extra tubing length to allow sufficient room to lay the rods on the ground as they are removed. An additional 20 feet is generally enough.

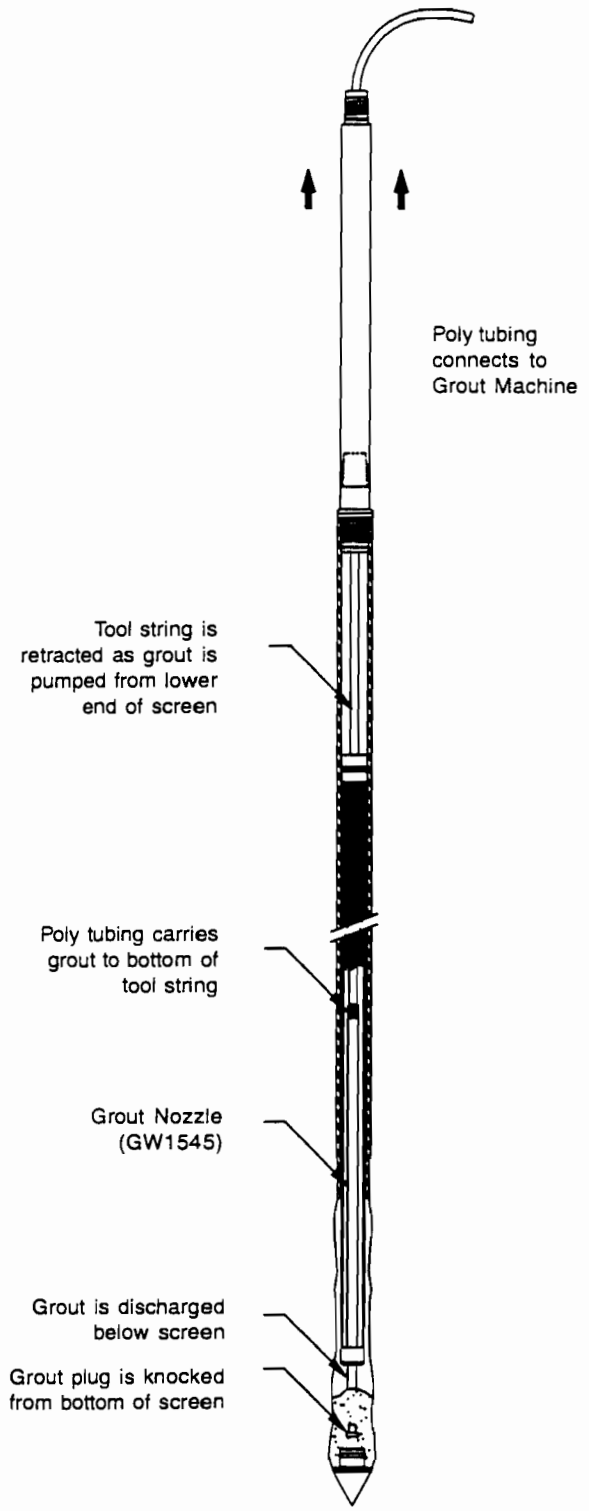


FIGURE 4.7
Grouting Through The Screen Point 15 Groundwater Sampler

Note: You may use the same poly tubing to grout the hole as was used to collect the groundwater sample. After sampling, completely lower the tubing to the bottom of the screen. Place a mark on the tubing even with the top of the rod string. Remove the tubing. Make a second mark on the tubing one grout nozzle length below the first mark. Now attach the nozzle to the leading end of the tubing and lower it to the bottom of the screen. The second mark on the tubing will be just below the top of the probe rods when the grout nozzle is fully deployed.

5. Position the probe assembly for pulling, taking care not to pinch or bind the tubing. Operate the grout pump while pulling the first rod. Coordinate pumping and pulling rates so that grout fills the void left by the sampler. Remove the split pull cap and unscrew the probe rod. Slide the rod over the tubing and place it on the ground near the end of the tubing to leave room for the remaining probe rods.

6. Repeat Step 5 until the sampler is retrieved. Do not bend or kink the tubing when pulling and laying out the probe rods. Sharp bends create weak spots in the tubing which may burst when pumping grout. Remember to operate the grout pump only when pulling the rod string. The probe hole is thus filled with grout from the bottom up as the rods are extracted.

7. Promptly clean all probe rods and sampler parts before the grout sets up and clogs the equipment.

4.7 Retrieving the Screen Point 15 Sampler

If grouting is not required, the Screen Point 15 sampler can be retrieved by pulling the probe rods as with most other Geoprobe sampling applications. The Rod Grip Pull System (GH1250K) should be used for this process as it allows the operator to remove rods without releasing the tool string. This keeps rods from falling to the bottom of the probe hole. If a rod grip pull system is not available, utilize a standard Pull Cap (AT1204). The process of retrieving the sampler with a standard pull cap is given below.

1. Position the probe derrick and hammer assembly over the tool string. Thread a pull cap (AT1204) onto the top probe rod.

2. Lower the hammer latch over the pull cap and retract the tool string one probe rod length.

3. Remove the pull cap and top probe rod and repeat Step 2 until the sampler sheath is at the ground surface.

4. Physically pull the sampler sheath and screen out of the ground taking care not to bend the screen on the way out. The Screen Point 15 Groundwater Sampler is now retrieved and ready to decontaminate for further use.

5.0 REFERENCES

American Society for Testing and Materials (ASTM), 1993. ASTM 5299 Standard Guide for Decommissioning of Groundwater Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities: *1993 Annual Book of ASTM Standards, Vol. 0408.* Philadelphia, PA.

Geoprobe Systems, 1997, "97-98 Tools and Equipment Catalog."

Geoprobe Systems, 1995, "1995-96 Tools and Equipment Catalog."

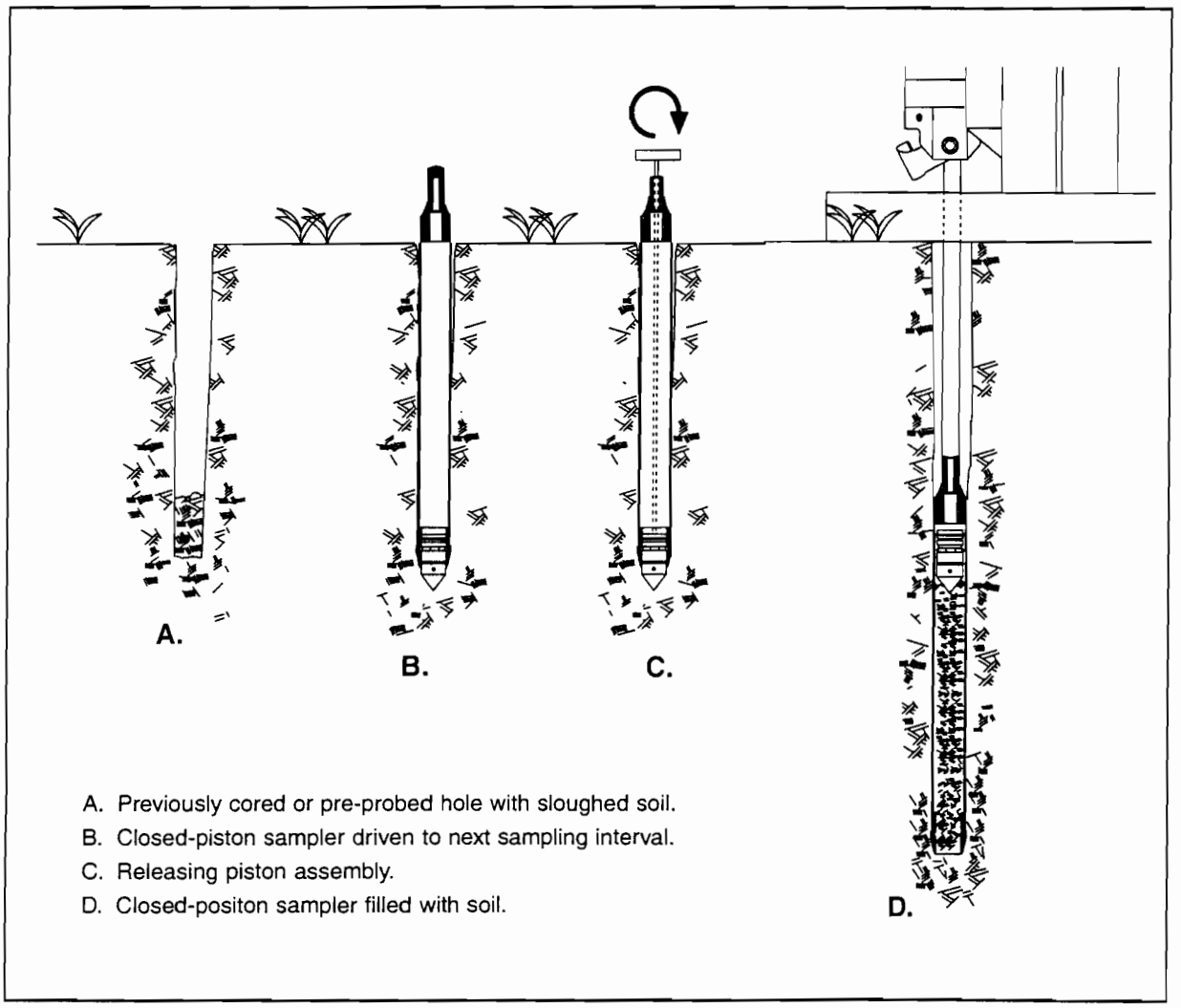
GEOPROBE MACRO-CORE® SOIL SAMPLER

STANDARD OPERATING PROCEDURE

Technical Bulletin No. 95-8500

PREPARED: November, 1995

REVISED: September, 1997



SAMPLING WITH THE MACRO-CORE® CLOSED-PISTON SOIL SAMPLER

Geoprobe® Systems

A DIVISION OF KEJR ENGINEERING

Geoprobe® is a Registered Trademark of Kejr Engineering, Inc., Salina, Kansas

Macro-Core® is a Registered Trademark of Kejr Engineering, Inc., Salina, Kansas

Macro-Core® Soil Sampler manufactured under US Patent 5,606,139.

Macro-Core® Closed-Piston Drive Point manufactured under US Patent 5,542,481

1.0 OBJECTIVE

The objective of this procedure is to collect a representative soil sample at depth and recover it for visual inspection and/or chemical analysis.

2.0 BACKGROUND

2.1 Definitions

Geoprobe®*: A brand name of high quality, hydraulically-powered machines that utilize both static force and percussion to advance sampling and logging tools into the subsurface.
** Geoprobe® is a registered trademark of Kejr Engineering, Inc., Salina, Kansas*

Macro-Core® Soil Sampler*: A solid barrel, direct push device for collecting continuous core samples of unconsolidated materials at depth. Although other lengths are available, the standard Macro-Core® Sampler has an assembled length of approximately 52 inches (1321 mm) with an outside diameter (OD) of 2.2 inches (56 mm). Collected samples measure up to 1300 ml in volume in the form of a 1.5-inch x 45-inch (38 mm x 1143 mm) core contained inside a removable liner. The Macro-Core® Sampler may be used for open-tube as well as closed-piston sampling.
** Macro-Core® is a registered trademark of Kejr Engineering, Inc., Salina, Kansas*

Liner: A 1.75-inch OD x 46-inch long (44 mm x 1168 mm) removable/replaceable, thin-walled tube inserted inside the Macro-Core® sample tube for the purpose of containing and storing soil samples. Liner materials include stainless steel, Teflon®, PVC, and PETG.

2.2 Discussion

In this procedure, the assembled Macro-Core Soil Sampler is attached to the leading end of a Geoprobe probe rod and driven into the subsurface using a Geoprobe soil probing machine. Additional probe rods are connected in succession to advance the sampler to depth. The Macro-Core Sampler may be used as an open-tube or closed-piston sampler.

The simplest and most common use of the Macro-Core Sampler is as an open-tube sampler (Fig. 2.1A). In this method, coring starts at the ground surface with an open-ended sampler. From the ground surface, the Macro-Core Sampler is advanced one sampling interval and then retrieved from the hole with the first soil core. In stable soils, the open-tube sampler is inserted back down the same hole to obtain the next core. Geoprobe operators have reported coring to depths exceeding 30 feet (9 m) with this method.

In unstable soils which tend to collapse into the core hole, the Macro-Core Sampler can be equipped with a piston assembly (Fig. 2.1B). This assembly actually locks into the cutting shoe and prevents soil from entering the sampler as it is advanced to the bottom of an existing hole.

The Macro-Core Closed-Piston Sampler is not designed to be driven through undisturbed soil. Soil is first removed to sampling depth with an open-tube sampler, or a pilot hole may be made with a Macro-Core Pre-Probe. A Macro-Core Piston Assembly is then installed and the sampler is inserted ~~or driven~~ back down the same hole. When the leading end of the sampler reaches the top of the next sampling interval, the piston is unlocked using extension rods inserted down the inside of the probe rods.

Once the piston is relieved, the tool string is simply driven another sampling interval. Soil entering the sampler pushes the piston assembly to the top of the sample liner where it is retrieved upon removal of the liner and soil core.

Loose soils will sometimes fall out of the Macro-Core Sampler as it is retrieved from depth. The Macro-Core Core Catcher (Fig. 2.1) was designed to alleviate this problem. Excellent results are obtained when the core catcher (sometimes called a basket retainer) is used with saturated sands and other non-cohesive soils. A core catcher is not necessary when sampling tight soils and may actually inhibit sample recovery. Constructed of PVC, the core catcher may be used with PVC, PETG, Teflon®, and stainless steel liners.

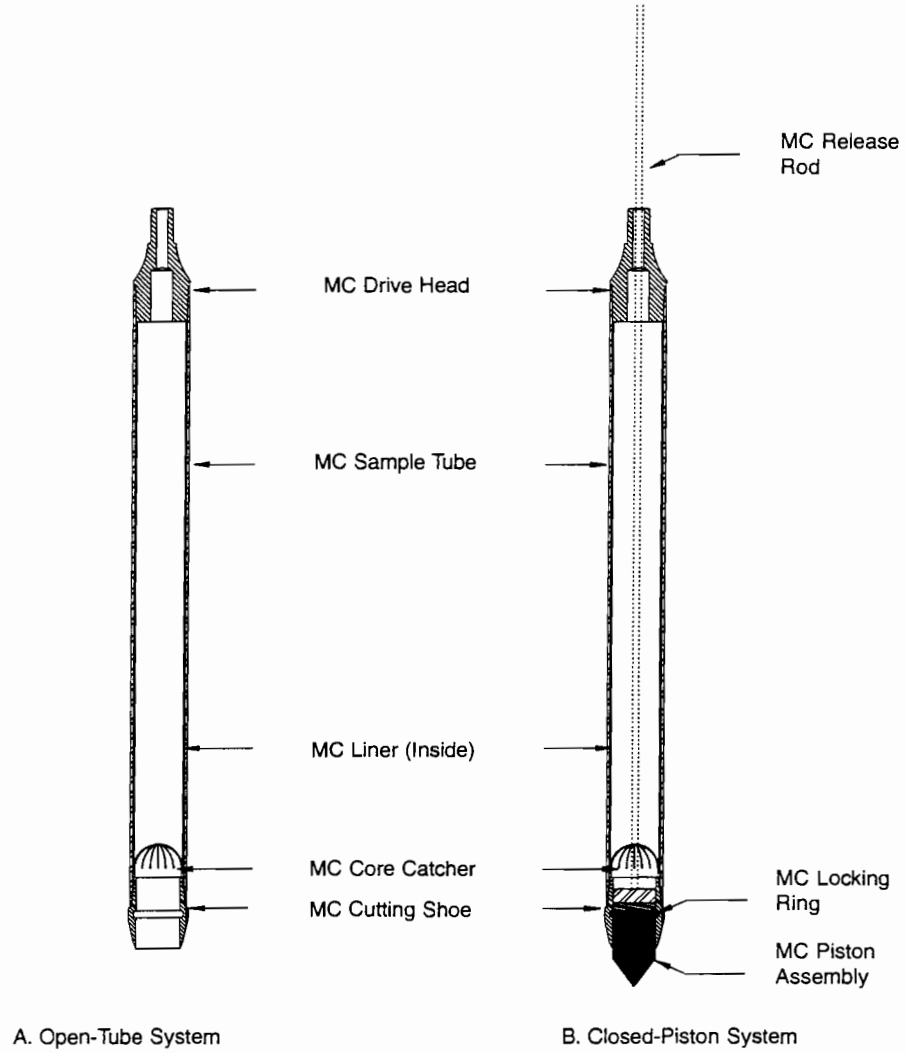


FIGURE 2.1
Macro-Core® Soil Sampler Assemblies

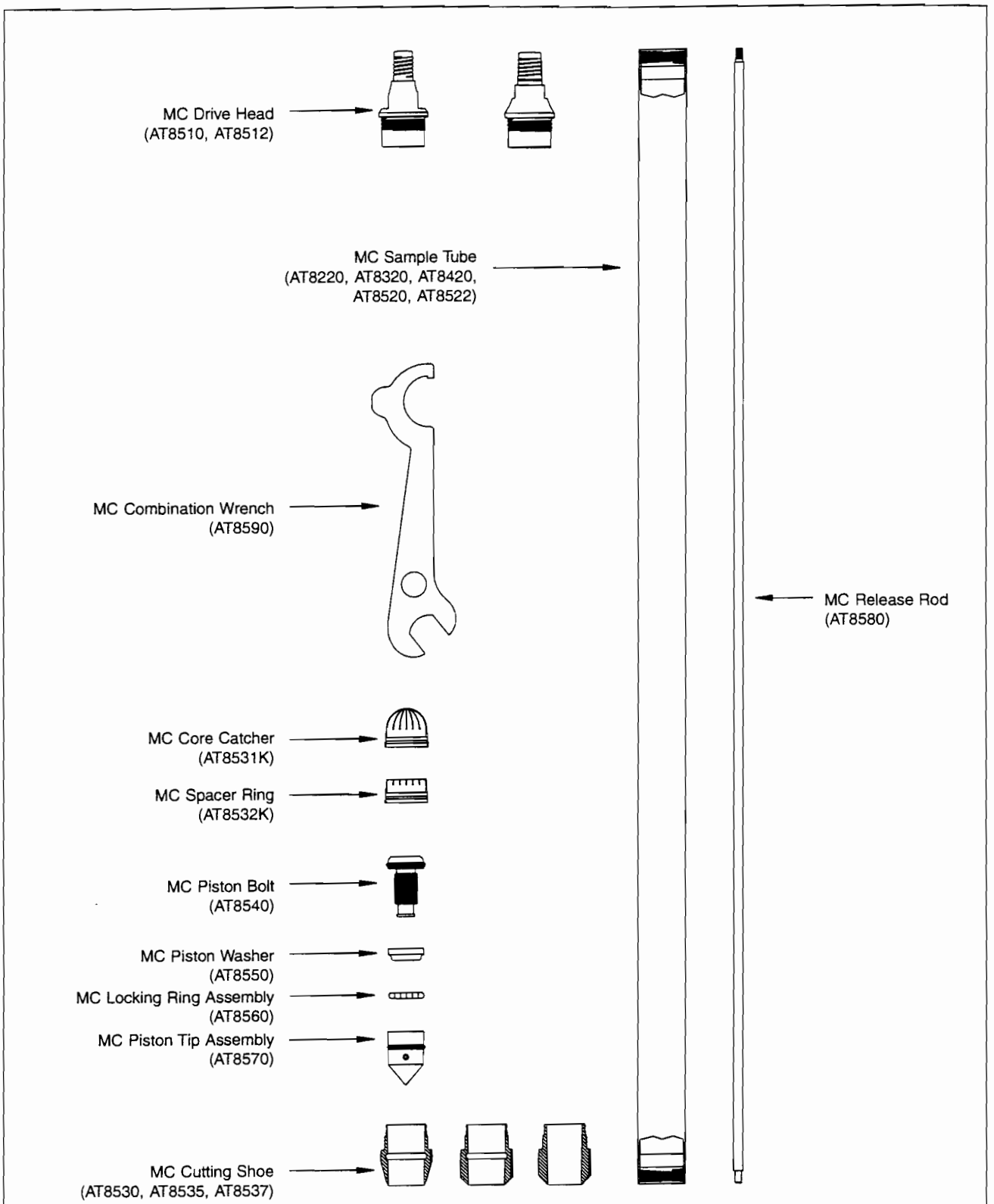


FIGURE 3.1
Macro-Core® Soil Sampler Parts

3.0 REQUIRED EQUIPMENT

The following equipment is used to recover samples using the Geoprobe Macro-Core Soil Sampler and probing system. Although many options are available (sampler length, liner material, etc.), the basic sampler configuration does not change. Refer to Figure 3.1 (previous page) to view the major components of the Macro-Core sampler.

MACRO-CORE SAMPLER PARTS	PART NUMBER
MC Drive Head, for use with 1.0-inch probe rods	AT8510
MC Drive Head, for use with 1.25-inch probe rods	AT8512
MC Sample Tube, 24-inch, unplated	AT8220
MC Sample Tube, 36-inch, unplated	AT8320
MC Sample Tube, 1-meter, unplated	AT8420
MC Sample Tube, 48-inch, Ni-plated	AT8520
MC Sample Tube, 48-inch, unplated	AT8522
MC Cutting Shoe, standard	AT8530
MC Cutting Shoe, heavy-duty	AT8535
MC Cutting Shoe, 0.125 inches undersized	AT8537
MC Combination Wrench	AT8590
Nylon Brush for MC Sample Tubes	BU700

MACRO-CORE PISTON PARTS	PART NUMBER
MC Closed-Piston Kit*	AT8501K
MC Piston Assembly*	AT8505
MC Piston Bolt	AT8540
MC Piston Washer	AT8550
MC Locking Ring Assembly	AT8560
MC Locking Ring Springs (pkg. of 10)	AT8561K
MC Locking Ring Pins (pkg. of 12)	AT8562
MC Piston Tip Assembly	AT8570
MC Piston O-rings (pkg. of 25)	AT8570R
MC Piston Tip Cup Point Set Screws (pkg. of 10)	AT8571
MC Piston Tip Half-Dog Set Screws (pkg. of 10)	AT8572
MC Piston Release Rod	AT8580

MACRO-CORE LINERS AND ACCESSORIES	PART NUMBER
MC Stainless Steel Liner Assembly, 48-inch	AT7235
MC Teflon® Liner Assembly, 48-inch	AT724
MC PETG Liner, thin-wall, 48-inch, (box of 66)	AT725K
MC Vinyl End Caps (66 pair)	AT726K
MC Heavy-Duty PETG Liner Assembly, 48-inch (box of 66)	AT825K
MC PVC Liner Assembly, clear, 24-inch (box of 66)	AT922K
MC PVC Liner Assembly, clear, 36-inch (box of 66)	AT923K
MC PVC Liner Assembly, clear, 1-meter (box of 66)	AT924K
MC PVC Liner Assembly, clear, 48-inch (box of 66)	AT925K
MC Liner Cutter Kit*	AT8000K
MC Liner Cutting Tool	AT8010
MC Liner Cutter Holder	AT8020
MC Liner Cutter Blades (pkg. of 5)	AT8030
MC Liner Circular Cutting Tool	AT8050
MC Core Catchers (pkg. of 25)	AT8531K
MC Spacer Rings (pkg. of 25)	AT8532K

*See Page 7 for component listing.

GEOPROBE TOOLS**	PART NUMBER
Drive Cap, for use with 1.25-inch probe rods	AT1200
Pull Cap, for use with 1.25-inch probe rods	AT1204
Probe Rod, 1.25 inches x 36 inches	AT1236
Probe Rod, 1.25 inches x 1 meter	AT1239
Probe Rod, 1.25 inches x 48 inches	AT1248
Probe Rod, 1.25 inches x 60 inches	AT1260
MC Pre-Probe, 2-inch OD	AT1247
MC Pre-Probe, 2.5-inch OD	AT1242
MC Pre-Probe, 3-inch OD	AT1252
Extension Rod, 36-inch	AT67
Extension Rod, 48-inch	AT671
Extension Rod, 1-meter	AT675
Extension Rod Coupler	AT68
Extension Rod Handle	AT69
Extension Rod Quick Links	AT694K
Machine Vise	FA300

ADDITIONAL TOOLS

Allen Wrench, 1/8 inch
Pipe Wrenches (2)

Three items in the parts listing on Pages 6 were identified with an asterick (*). A listing of the components of each item is given below.

MACRO-CORE KIT / COMPONENT	QUANTITY	PART NUMBER
MC Liner Cutter Kit		AT8000K
MC Liner Cutting Tool	-1-	AT8010
MC Liner Cutter Holder	-1-	AT8020
MC Liner Cutter Blades (pkg. of 5)	-1-	AT8030
MC Closed-Piston Kit		AT8501K
MC Locking Ring Springs (pkg. of 10)	-1-	AT8561K
MC Cutting Shoe, standard	-1-	AT8530
MC Piston Assembly	-1-	AT8505
MC Piston Assembly		AT8505
MC Piston Bolt	-1-	AT8540
MC Piston Washer	-1-	AT8550
MC Locking Ring Assembly	-1-	AT8560
MC Piston Tip Assembly	-1-	AT8570

**Geoprobe tools and accessories are also available for use with 1.0-inch OD (outside diameter) probe rods.

4.0 OPERATION

Size and material options have resulted in an extensive list of Macro-Core part numbers. To simplify the instructions presented in this document, part numbers are listed in the illustrations only. Refer to Pages 6 and 7 for a complete parts listing.

4.1 Decontamination

Before and after each use, thoroughly clean all parts of the soil sampling system according to project requirements. A new, clean liner is recommended for each use if using PETG, PVC, or Teflon® liners.

Stainless Steel Liners from Geoprobe Systems are cleaned at the factory with an agitated detergent bath at a temperature of approximately 180 degrees F. After rinsing with 180-degree tap water, the liner is air dried, wrapped in PVC outer cladding, and capped with vinyl end caps.

Thoroughly clean the sampler before assembly, not only to remove contaminants but also to ensure correct operation. Dirty threads complicate assembly and may lead to sampler failure. Sand is particularly troublesome as it can bind liners in the sample tube resulting in wasted time and lost samples.

4.2 Field Blank

It is suggested that a field blank be taken on a representative sample liner prior to starting a project and at regular intervals during extended projects. Liners can become contaminated in storage. A field blank will prove that the liners do not carry contaminates which can be transferred to soil samples. The following information is offered as an example method which may be used to take a field blank. Make the appropriate modifications for the specific analytes of interest to the investigation.

Example Procedure:

REQUIRED EQUIPMENT

MC Liner ..... (1)
MC Vinyl End Caps ..... (2)
Distilled Water ..... (100 ml)
VOA Vial (or other appropriate sample container) ..... (1)

1. Place a vinyl end cap on one end of the liner.
2. Pour 100 milliliters of distilled water (or other suitable extracting fluid) into the liner.
3. Place a vinyl end cap on the open end of the liner.
4. From the vertical position, repeatedly invert the liner so that the distilled water contacts the entire inner surface. Repeat this step for one minute.
5. Remove one end cap from the liner, empty contents into an appropriate sample container, and cap the container.
6. Perform analysis on the extract water for the analytes of interest to the investigation.

4.3 Open-Tube Sampler Assembly

1a. With MC Core Catcher. Place the open end of an MC Core Catcher over the threaded end of an MC Cutting Shoe as shown in Figure 4.1. Apply pressure to the core catcher until it snaps into the machined groove on the cutting shoe.

NOTE: AT725K (thin-wall PETG) liners have a swedged end which is generally slipped directly over the groove in the cutting shoe (Fig. 4.2). To use a core catcher with these liners, cut approximately 3/8 inches (10 mm) of material from the swedged end of the liner and proceed to Step 2.

1b. Without MC Core Catcher. Push the base of an MC Spacer Ring onto the threaded end of a cutting shoe until it snaps into place (Fig. 4.3).

NOTE: With the exception of AT-725K (thin-wall PETG) liners, all liners must utilize either a spacer ring or core catcher. PETG liners have a swedged end which slides directly over the end of the cutting shoe. Attach the liner to the cutting shoe (Fig. 4.2) before proceeding to Step 2.

2. Thread the cutting shoe into one end of an MC Sample Tube (Fig. 4.4). Tighten until the end of the sample tube contacts the machined shoulder of the cutting shoe.

3. Insert the appropriate liner into the sample tube (Figure 4.4). (The liner is all ready installed if using thin-wall PETG liners (AT725K) without a core catcher).

4. Connect an MC Drive Head to the top of the sample tube (Fig. 4.4) and securely tighten with the MC Combination Wrench (Fig. 4.5). Ensure that the end of the sample tube contacts the machined shoulder of the drive head.

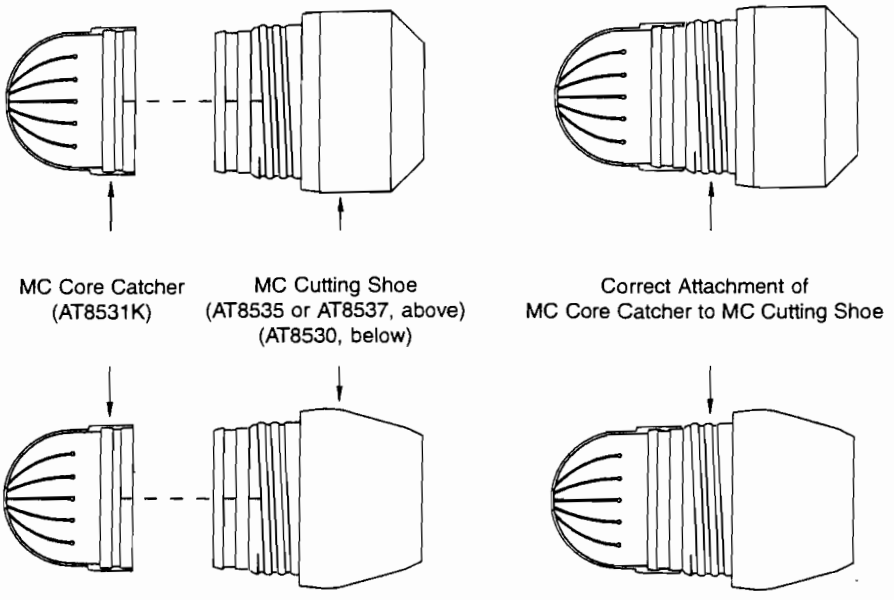


FIGURE 4.1
Macro-Core® Core Catcher Attachment

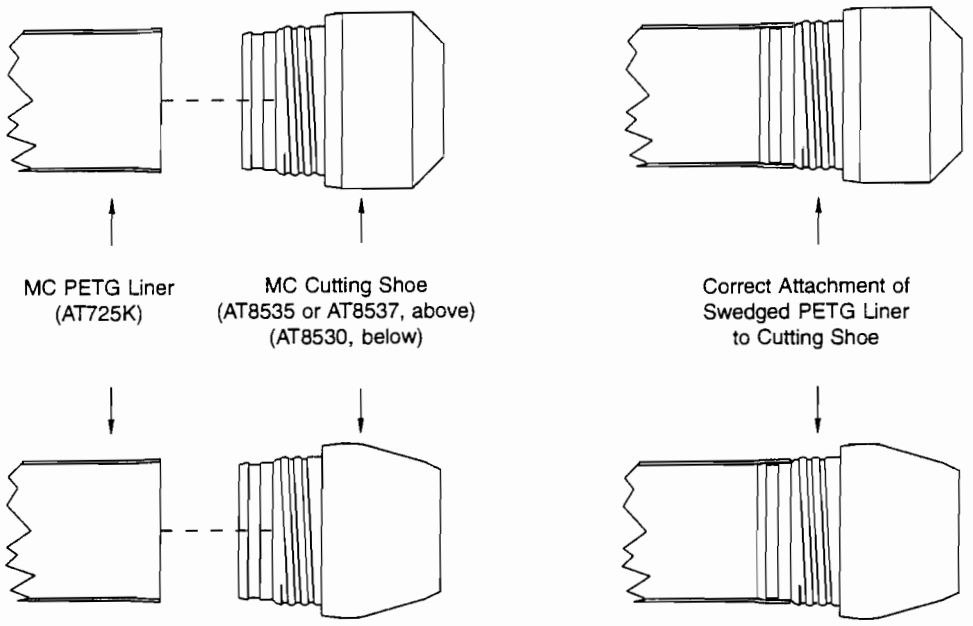


FIGURE 4.2
Macro-Core® PETG Liner Attachment

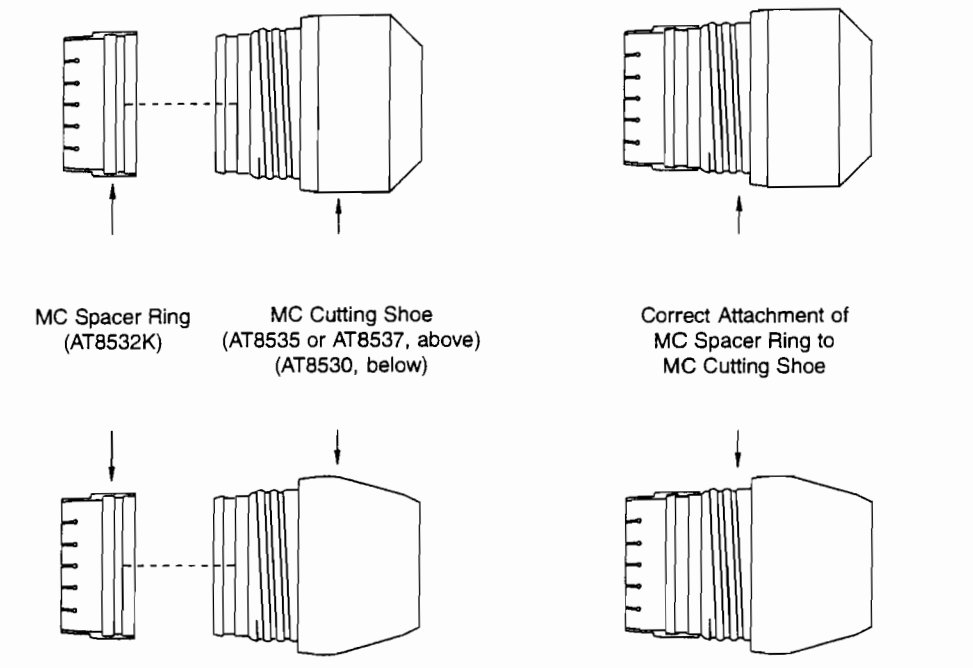


FIGURE 4.3
Macro-Core® Spacer Ring Attachment

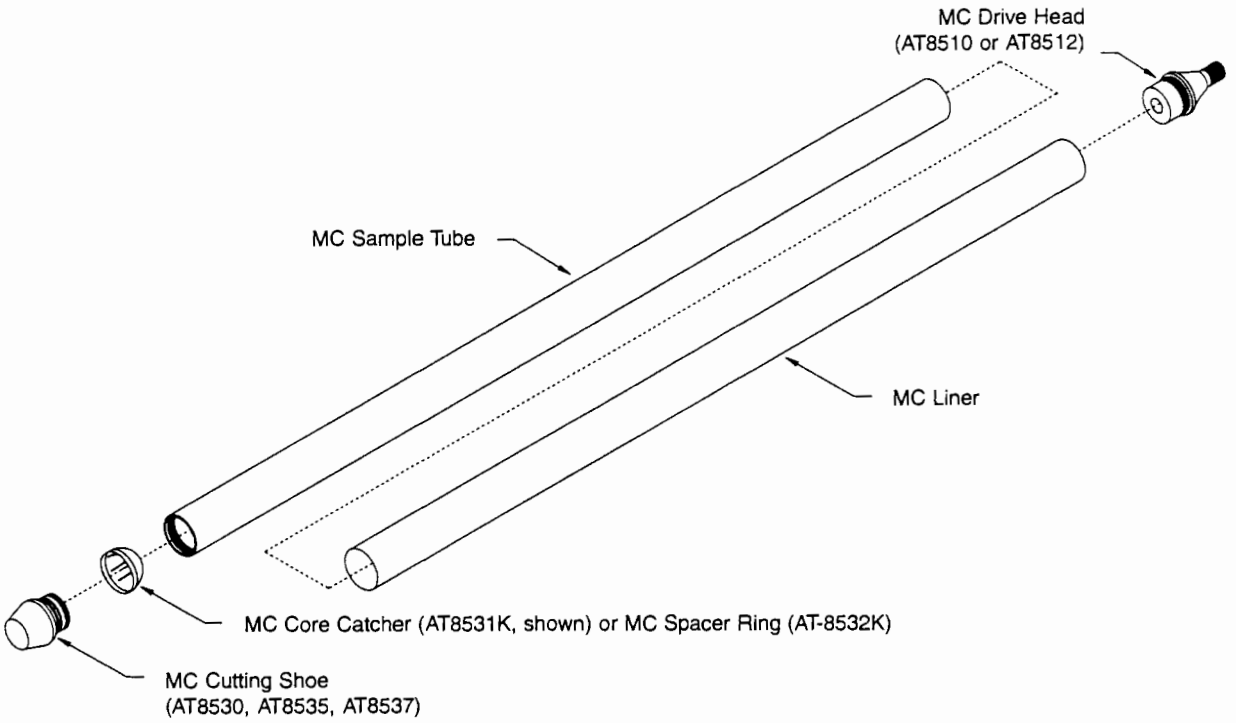


FIGURE 4.4
Macro-Core® Open-Tube Sampler Assembly

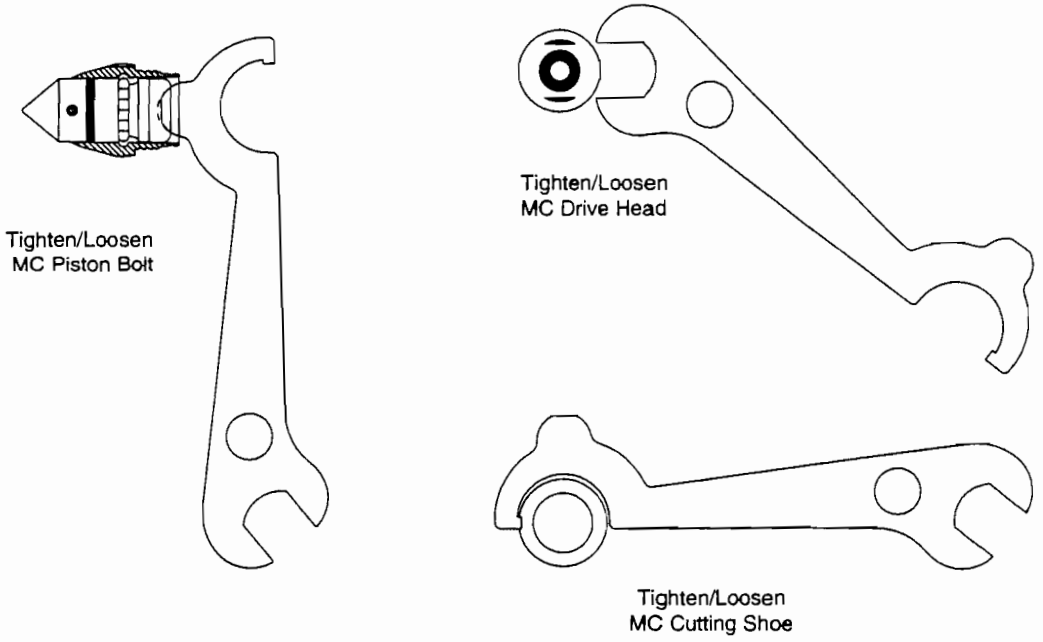


FIGURE 4.5
Macro-Core® Combination Wrench Applications

4.4 Closed-Piston Sampler Assembly (Fig. 4.6)

1. Install an O-ring in the machined groove on the piston bolt head (A) and piston tip (B).

2. Place a piston washer on a piston bolt with the radius side away from bolt head.

3. Position a locking ring on the piston bolt and thread the bolt into the piston tip.

   NOTE: Piston bolt and tip are left-hand threaded.

4. Screw the piston bolt down tight and install a half-dog set screw in the hole on the side of the piston tip. With a 1/8-inch allen wrench, tighten the set screw until it contacts the stem of the piston bolt, then back it out one-quarter turn.

5. Back the piston bolt out until the set screw hits the bottom shoulder on the bolt (approximately four full turns). The bolt must be tight against the set screw to prohibit the set screw from turning while completing Step 6.

6. Lock the half-dog set screw into place by installing a cup point set screw in the same hole. The cup point set screw should be tight but the piston bolt should remain free to turn approximately four full turns.

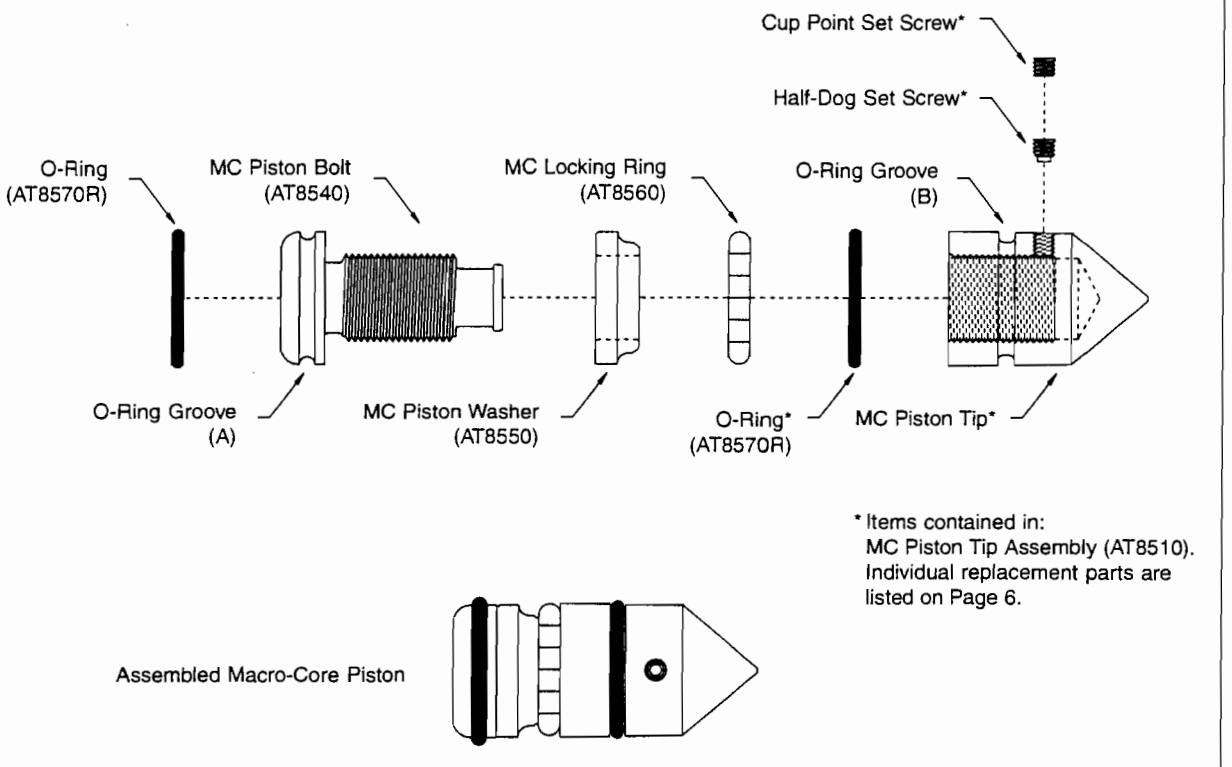


FIGURE 4.6
Macro-Core® Piston Assembly (AT8505)

NOTE: The top of the cup point set screw must not protrude from the piston tip. File or grind the set screw flush with the side of the tip if necessary. The piston assembly is ready to install in the cutting shoe.

7. Slide an assembled piston into a cutting shoe. The piston should be placed so that one half of the set screw (located on the side of the tip) protrudes from under the edge of the cutting shoe (Fig. 4.7).

8. Tighten the piston bolt (left-hand threads) using the combination wrench (Fig 4.8).

Figure 4.8. Using MC Combination Wrench to tighten MC Piston Bolt inside MC Cutting Shoe.

9a. With MC Core Catcher. Place the open end of a core catcher over the threaded end of a cutting shoe (Fig. 4.9). Apply pressure to the core catcher until it snaps into the machined groove on the cutting shoe.

NOTE: AT725K (thin-wall PETG) liners have a swedged end which is generally slipped directly over the groove in the cutting shoe (Fig. 4.10). To use a core catcher with these liners, simply cut approximately 3/8 inches (10 mm) of material from the swedged end of the liner and continue to Step 10.

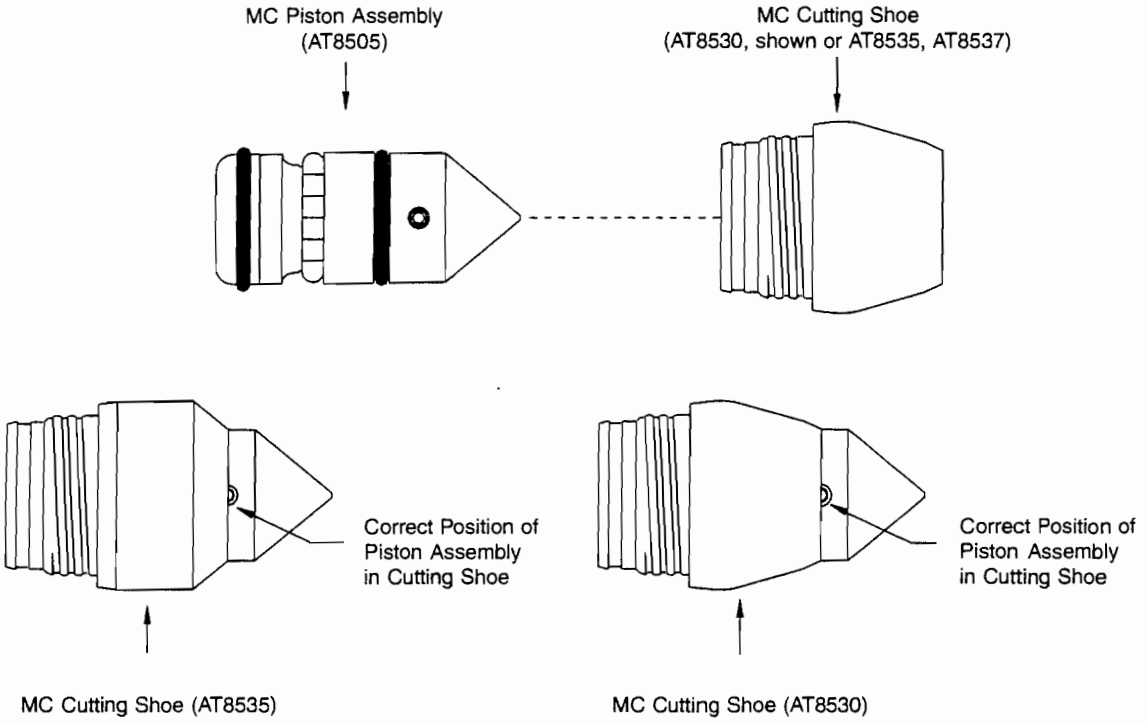


FIGURE 4.7
Installation of Macro-Core® Piston Assembly into Cutting Shoe

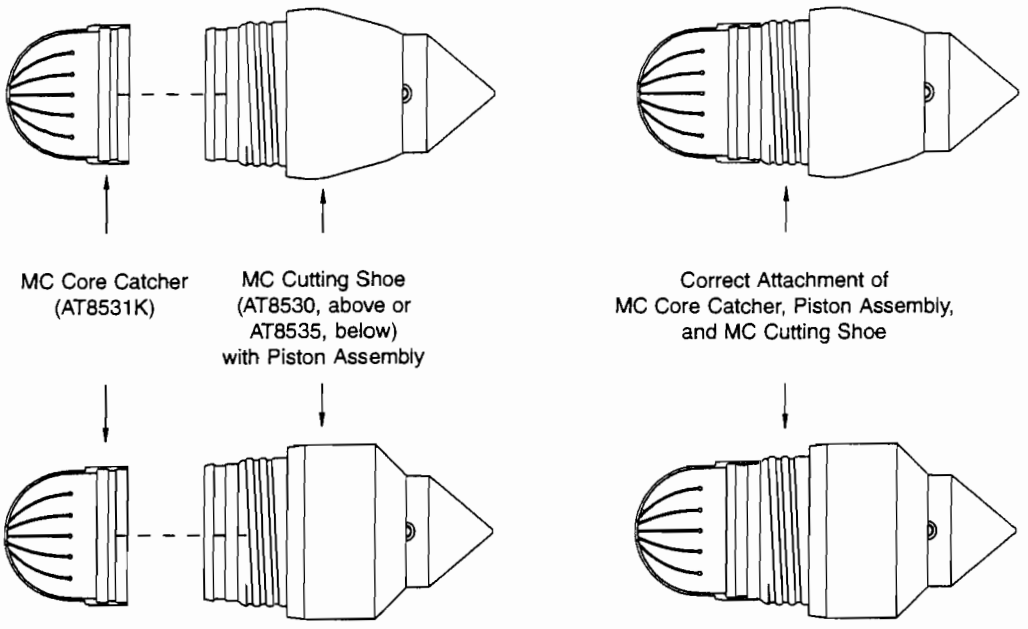


FIGURE 4.9
Macro-Core® Core Catcher Attachment with Piston Assembly

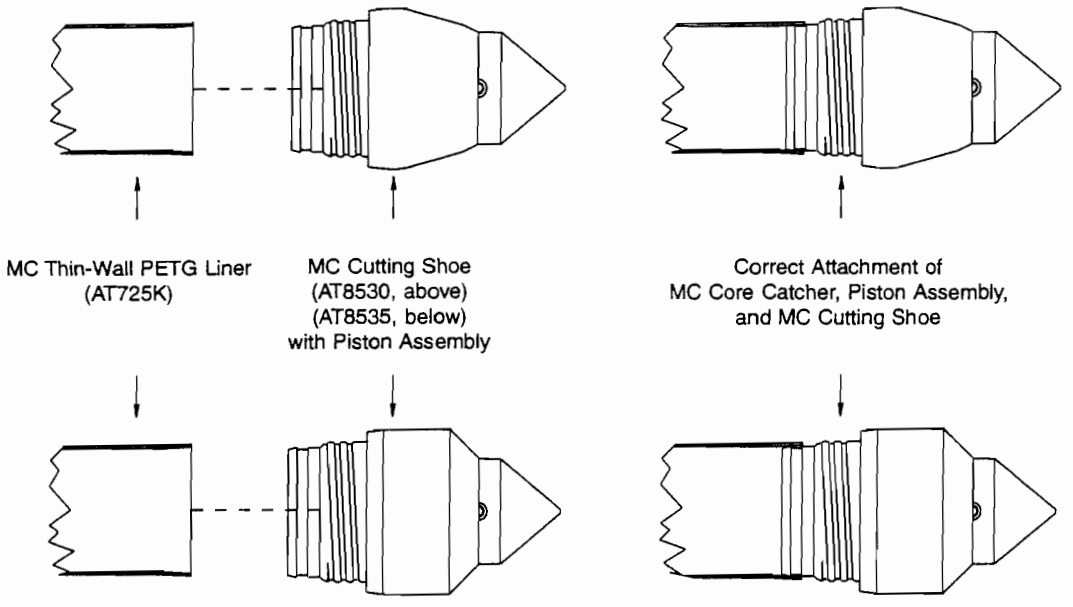


FIGURE 4.10
Macro-Core® Thin-Wall PETG Liner Attachment with Piston Assembly

9b. Without Core Catcher. Push the base of an MC Spacer Ring onto the threaded end of a cutting shoe until it snaps into place (Fig. 4.11).

NOTE: With the exception of AT725K (thin-wall PETG) liners, all liners must utilize either a spacer ring or core catcher. PETG liners have a swedged end which slides directly over the end of the cutting shoe. When using PETG liners, attach the liner to the cutting shoe (Fig. 4.10) before proceeding to Step 10.

10. Thread the cutting shoe into one end of an MC Sample Tube (Fig. 4.12). Tighten until the end of the sample tube contacts the machined shoulder of the cutting shoe.

11. Insert the appropriate liner into the sample tube (Fig. 4.12). (The liner is all ready installed if using PETG liners without a core catcher.)

12. Connect a drive head to the top of the sample tube (Fig. 4.12) and securely tighten with the combination wrench (Fig. 4.5) until the end of the sample tube contacts the machined shoulder of the drive head.

4.5 Pilot Hole

A pilot hole prevents excessive sampler wear in tough soils and saves time when a discrete soil core is desired. The pilot hole is created by driving a 2.0-, 2.5-, or 3.0-inch MC Pre-Probe (see page 6 for part numbers) to the top of the sampling interval. Soil surfaces containing gravel, asphalt, hard sands, or rubble should be pre-probed to reduce wear on the cutting shoe and to avoid damage to the sampler. To save time when collecting a discrete soil core, pre-probe to the sampling interval rather than coring to depth with the sampler.

4.6 Open-Tube Sampling

The Macro-Core Open-Tube Sampler is used to gather continuous soil cores from the surface to depths exceeding 30 feet. A representative soil sample is obtained by driving the sampler one sampling interval from ground surface into undisturbed soil. Upon retrieving the sampler, the liner and soil core are removed. The sampler is then properly decontaminated, reassembled with a new liner, and inserted back down the same hole to take the next soil core.

The Macro-Core Cutting Shoe is tapered to minimize the amount of soil scraped from the core walls when inserting the sampler back down an existing hole. In spite of this, non-cohesive soils will often collapse to the bottom of the hole. This slough material then enters the sampler as the next soil core is collected, resulting in a non-representative sample. A Closed-Piston Macro-Core Sampler is required under such conditions. Instructions for sampling with the Open-Tube Macro-Core Sampler follow.

1. Attach a drive cap to the sampler drive head of an assembled Open-Tube Macro-Core Sampler (Section 4.3).

2. Install a hammer anvil and anvil retainer cap assembly. Raise the hammer latch while driving the Macro-Core Sampler to avoid contact with the drive head.

3. Raise the hammer assembly to its highest position by fully extending the probe cylinder. If using a 48-inch or 1-meter sample tube with a Geoprobe Model 4200, 4220, or 420U Probe Unit, raise the machine-foot to allow sufficient room to position the sampler below the hammer.

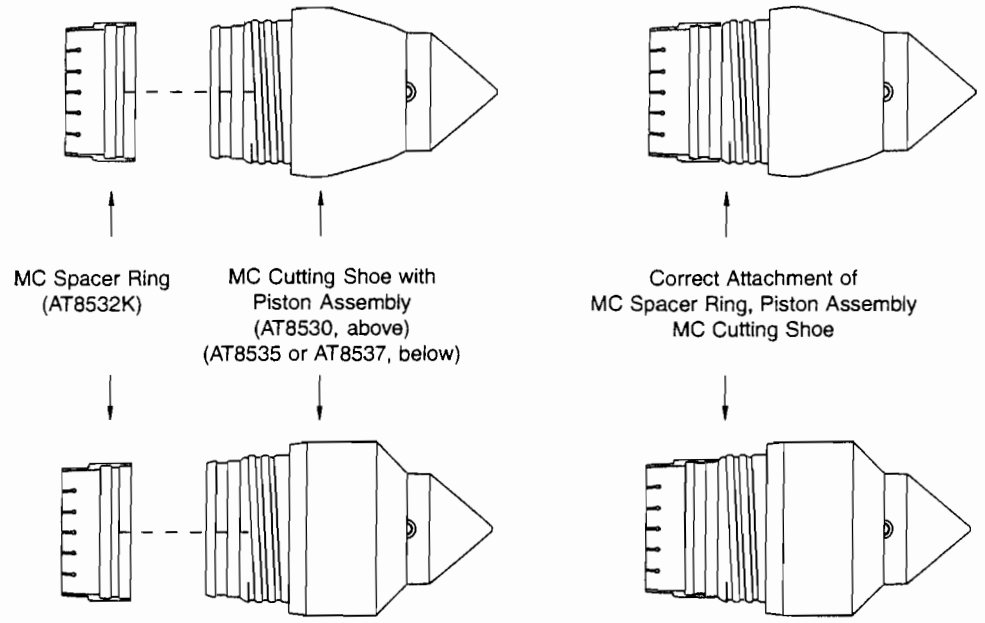


FIGURE 4.11
Macro-Core® Spacer Ring Attachment With Piston Assembly

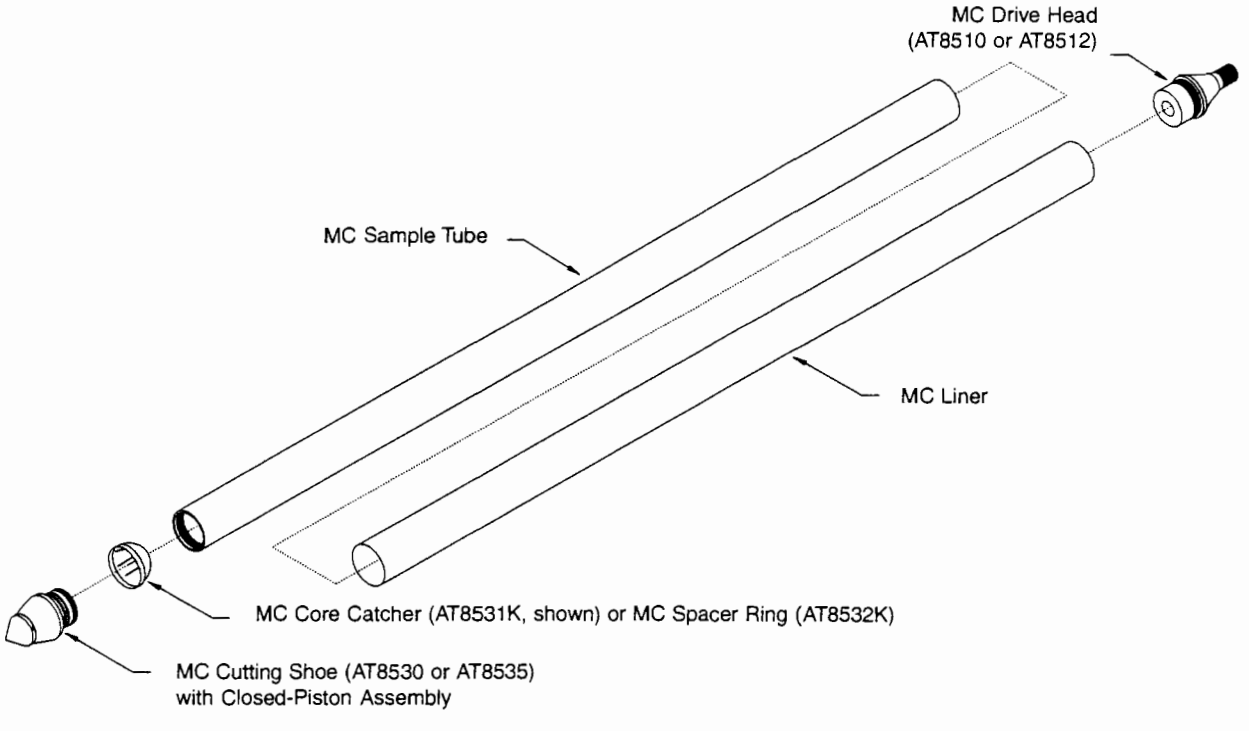


FIGURE 4.12
Macro-Core® Closed-Piston Sampler Assembly

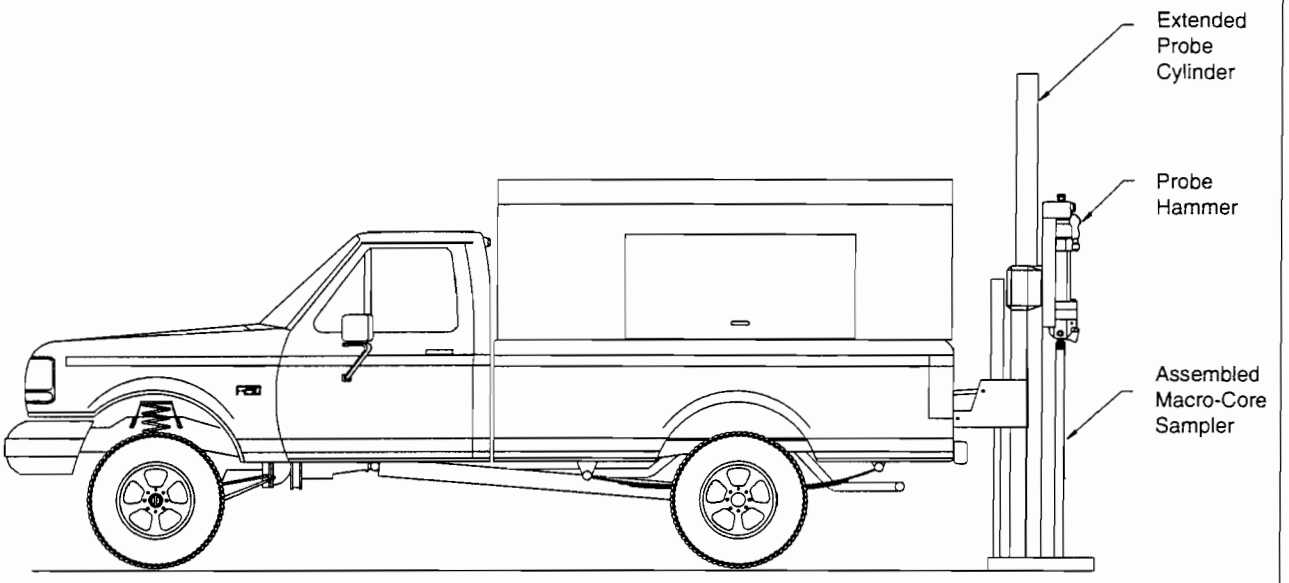


FIGURE 4.13
Macro-Core® Soil Sampler in Driving Position

4. Place the sampler in the driving position (Fig. 4.13). The sampler should always be positioned parallel to the derrick axis.

5. If using a 48-inch or 1-meter sampler tube with a Geoprobe Model 4200, 4220, or 420U Probe Machine, begin applying downward force on the sampler by lowering the machine foot. When the foot contacts the ground surface, apply downward force with the probe cylinder control only. All other Geoprobe units may start initially with the probe cylinder control.

   GEOPROBE TIP: Activate the hammer whenever collecting soil. Hammering forces soil into the sample tube and increases recovery.

6. Drive the sampler until the drive head reaches the ground surface (Fig. 4.14A).

*** CAUTION**

Some soil conditions may warrant using an MC Pre-Probe before attempting to collect a soil core. Damage may occur if the sampler is driven into rock or any other impenetrable layer.

7. To sample at consecutive intervals, push a sampler down the previously opened hole (Fig. 4.14B) until the top of the next sampling interval is reached (Fig. 4.14C). Drive the tool string another sampling interval to fill the sampler with soil (Fig. 4.14D). An open-tube sampler may be used for consecutive sampling or, if soil slough is expected, a closed-piston sampler is available.

*** CAUTION**

All parts must be completely threaded together before being driven. Driving an improperly assembled sampler will result in component damage.

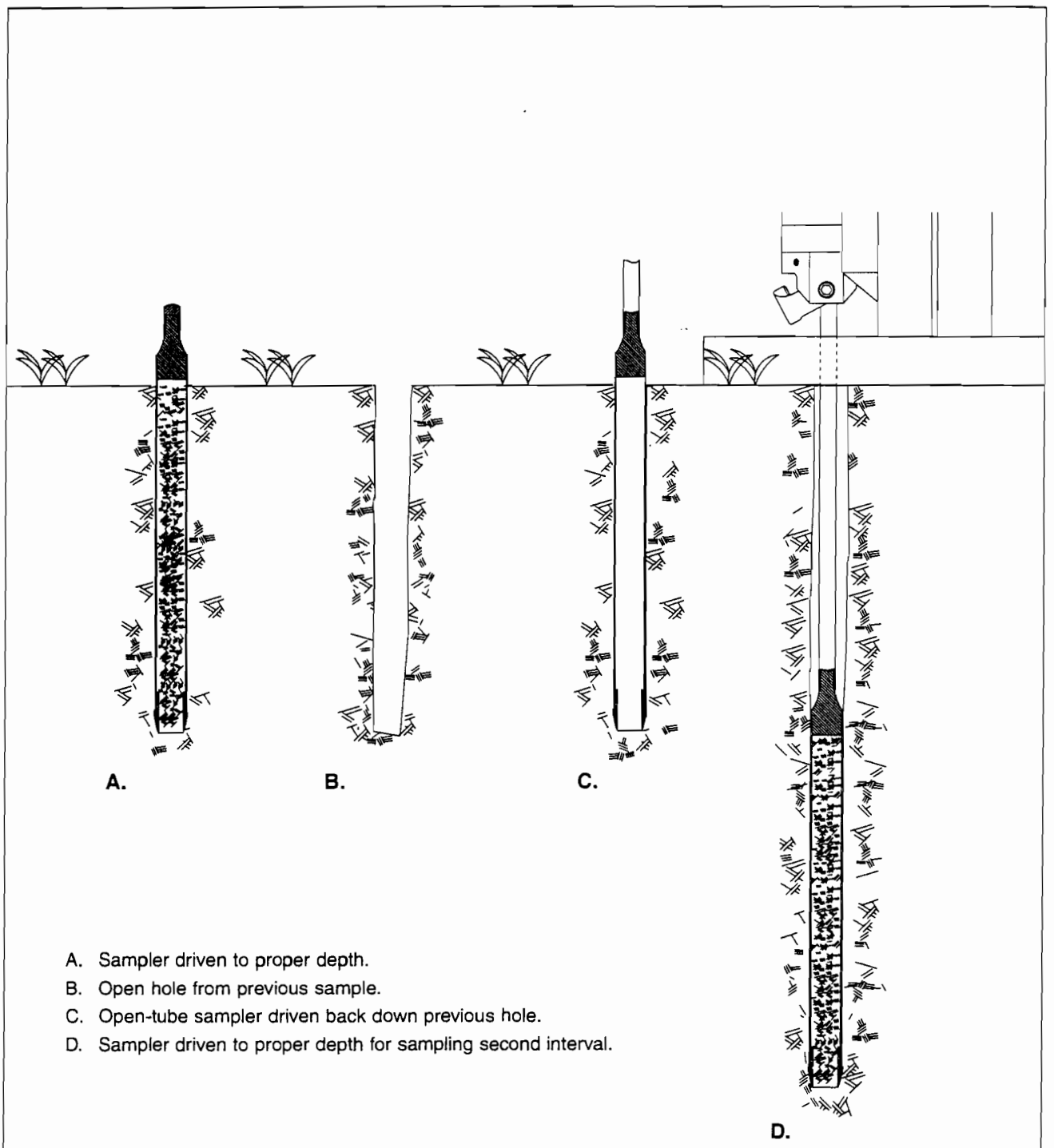
8. Retrieve the sampler as described in Section 4.8: Sampler Retrieval.

4.7 Closed-Piston Sampling

It is often difficult to collect representative soil cores from significant depths with an open-tube sampler due to soil slough. Because of this, the Macro-Core sampler can be equipped with a piston which locks into the cutting shoe. This allows the sealed sampler to pass through the slough material and be opened at the appropriate sampling interval.

NOTE: The closed piston system is meant to be inserted through previously opened holes. It is not designed to be driven from the surface through undisturbed materials.

The MC Closed-Piston System can be used only with AT8500 series Macro-Core tools. The AT8500 series replaces the AT720 series Macro-Core tools.



A. Sampler driven to proper depth.
B. Open hole from previous sample.
C. Open-tube sampler driven back down previous hole.
D. Sampler driven to proper depth for sampling second interval.

FIGURE 4.14
Phases of Macro-Core® Open-Tube Soil Sampling

1. Attach a drive cap to the drive head of an assembled Closed-Piston Macro-Core Sampler (Section 4.4).

2. Install a hammer anvil and anvil retainer cap assembly. Raise the hammer latch while driving the sampler to avoid contact with the drive head.

3. Raise the hammer assembly to its highest position by fully extending the probe cylinder. If using a 48-inch or 1-meter sample tube with a Geoprobe Model 4200, 4220, or 420U Probe Unit, raise the machine foot to allow sufficient room to place the sampler below the hammer.

4. Place the sampler tip in the **previously opened hole** (Fig. 4.15A). Lower the probe until the hammer anvil contacts the sampler drive head.

5. If using a 48-inch or 1-meter sample tube with a Geoprobe Model 4200, 4220, or 420U Probe Machine, begin applying downward force on the sampler by lowering the machine foot. When the foot contacts the ground surface, apply downward force with the probe cylinder control only. All other Geoprobe units may start initially with the probe cylinder control.

6. Drive the sampler until it reaches the desired sampling interval (Fig. 4.15B). Add probe rods as needed.

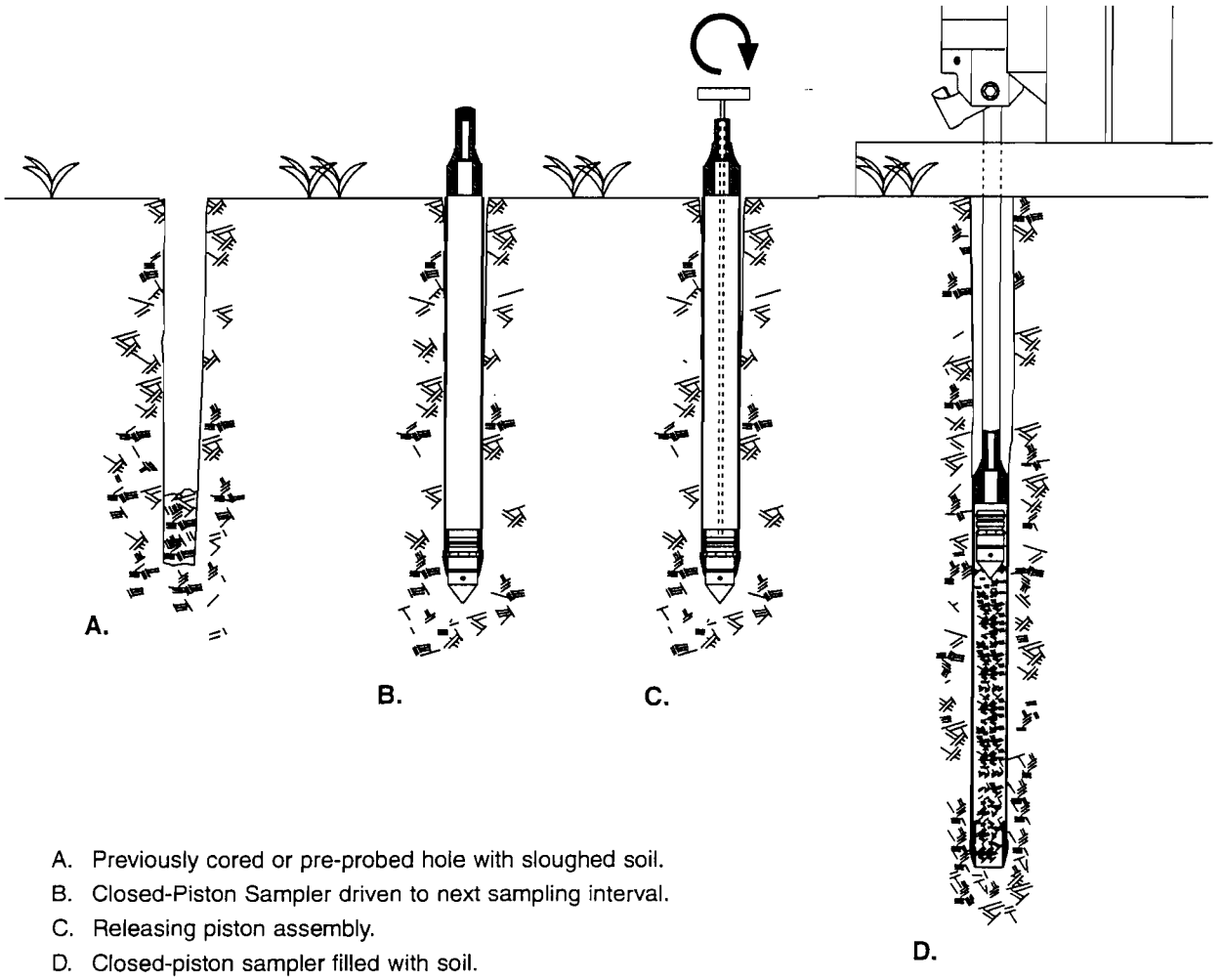
*** CAUTION**

Care should be taken when driving the Macro-Core Sampler down a previously opened hole. Low side friction may allow the sampler and probe rods to drop down the hole. To prevent equipment loss, attach a pipe wrench to the top of the rod string when advancing or retrieving the sampler.

7. Move the probe unit away from the top of the probe rods to allow room for work.

8. Remove the drive cap and insert an MC Piston Release Rod (Fig. 3.1) down the inside of the probe rods (Fig. 4.16). (Refer to Fig. 4.19 for identification of extension rod accessories.) Hold onto the release rod and attach an Extension Rod Coupler or Extension Rod Quick Links. Attach an Extension Rod to the release rod (Fig. 4.17) and lower the jointed rods down hole. Continue adding extensions until the release rod contacts the bottom of the sampler. The operator may opt to use the Extension Rod Jig to hold the down-hole extension rods while adding additional rods.

9. Attach an Extension Rod Handle to the top extension rod and slowly rotate the handle clockwise (Fig. 4.15C and 4.18). The release rod will drop into the groove in the piston bolt (Fig. 4.20). The operator should feel the extension rods move slightly as the release rod falls into the groove. Rotate the handle clockwise approximately four complete revolutions. Resistance to rotation is generally noted at this point. If the rods continue to rotate, however, do not continue for more than four complete revolutions. The piston assembly is now released and will be pushed to the top of the sampler as the liner is filled with soil (Fig. 4.15D).



A. Previously cored or pre-probed hole with sloughed soil.
B. Closed-Piston Sampler driven to next sampling interval.
C. Releasing piston assembly.
D. Closed-piston sampler filled with soil.

FIGURE 4.15
Phases of Macro-Core® Closed-Piston Soil Sampling

Figure 4.16. MC Release Rod is inserted down inside of the probe rods.

Figure 4.17. Extension Rods are attached to the MC Piston Release Rod using Extension Rod Quick Links.

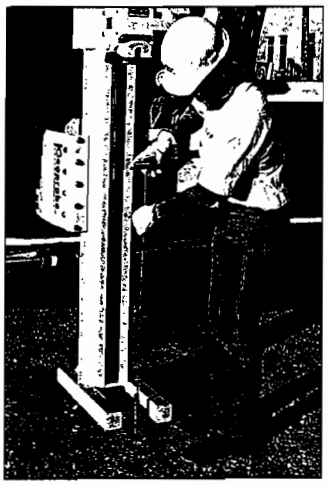


Figure 4.18. Extension Rods are rotated clockwise to release the MC Piston assembly.

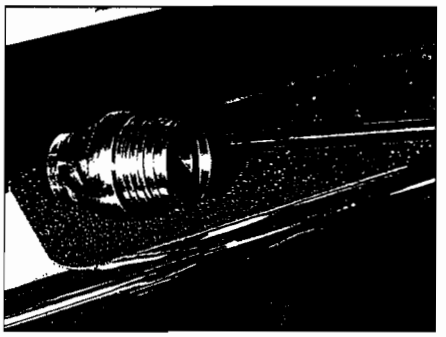


Figure 4.20. MC Release Rod fits into groove in MC Piston Bolt Head.

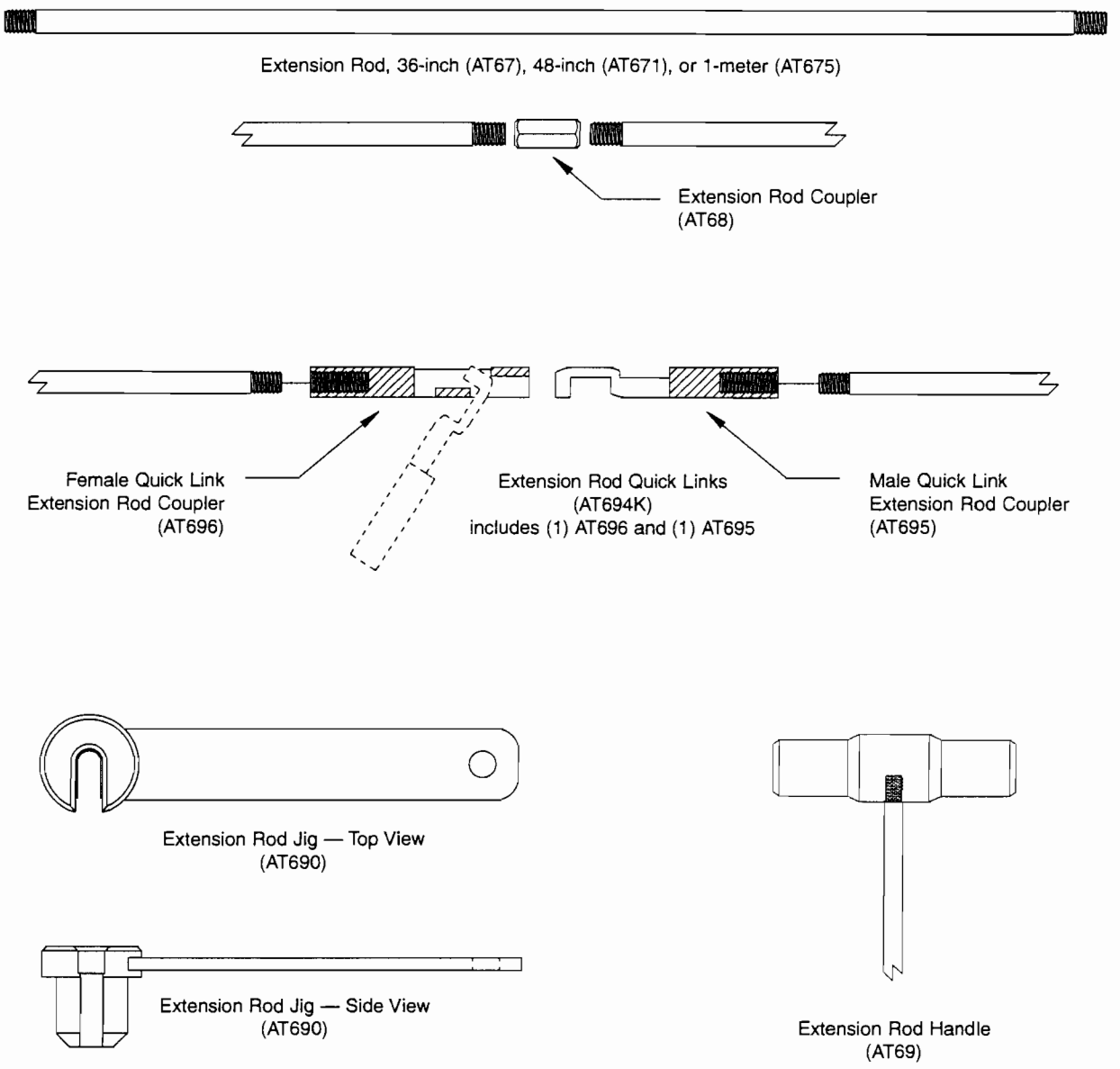


FIGURE 4.19
Geoprobe Extension Rods and Accessories

10. Remove the release rod and extension rods. The piston assembly will not be attached to the end of the extension rod but will remain inside the sample tube.

11. Add a probe rod to the tool string, attach the drive cap, and reposition the probe unit. Drive the tool string another sampling interval to fill the liner with soil. Do not over-drive the sampler.

GEOPROBE TIP: Activate the hammer whenever collecting soil. Hammering forces soil into the sampler tube and increases recovery.

4.8 Sampler Retrieval

1. Attach a pull cap to the top probe rod. Close the hammer latch over the pull cap and pull the tool string up one rod length by actuating the PROBE control lever.

2. Remove the rod and repeat Step 1 until the sampler drive head is just above the ground surface. Probe rods are sometimes difficult to loosen by hand. Use pipe wrenches to free tight threads.

*** CAUTION**

Care should be taken when retrieving the Macro-Core sampler. Low side friction may allow the sampler and probe rods to drop down the hole. Attach a pipe wrench to the top of the rod string to prevent equipment loss.

3. Attach the pull cap to the sampler drive head (Fig. 4.21). Pull the sampler out of the ground (Fig. 4.22) by raising the PROBE control lever. If using a 48-inch or 1-meter sample tube with a Geoprobe Model 4200, 420U, or 4220 Probe Machine, the probe cylinder will fully extend before the sampler is completely free. Attempt to raise the sampler by actuating the FOOT control.

*** CAUTION**

The rear of the carrier vehicle may be pulled downward as the foot cylinder is activated if the sampler is lodged tightly in the ground. Damage to the unit base frame may occur under such circumstances.

If the sampler cannot be retrieved without excessive resistance, follow these steps:

1. Lower the FOOT control and disengage the hammer latch from the pull cap.

2. Raise the probe foot at least 12 inches (305 mm) above the ground surface. Stack several boards or place timber blocks under the foot to act as a foot extension.

3. Lower the hammer assembly and close the hammer latch over the sampler pull cap.

4. Use the PROBE control to lift the sampler completely out of the ground.

4.9 Soil Core Recovery

The soil sample is easily removed from the Macro-Core Sampler by unscrewing the cutting shoe and pulling out the liner. A few sharp taps on the cutting shoe will often loosen the threads sufficiently to allow removal by hand. If needed, the exterior of the cutting shoe features a notch for attaching the combination wrench to loosen tight threads (Fig. 4.23). With the cutting shoe removed (Fig. 4.24), simply pull the liner and soil core from the sample tube (Fig. 4.25).

If the closed-piston sampler is used, the piston assembly is now retrieved from the end of the liner (Fig. 4.26). Secure the soil sample by placing a vinyl end cap on each end of the liner.

Undisturbed soil samples can be obtained from Teflon®, PVC, and PETG liners by splitting the liner. Geoprobe offers two tools for cutting sample liners. The MC Liner Cutter Kit (AT8000K) is used to make longitudinal cuts in the liner and includes a tool that holds the liner for cutting. The MC Liner Circular Cutting Tool (AT8050) is used to segment the liner by cutting around the outside circumference of the liner. Refer to Figures 4.27 and 4.28 for more information on liner cutting.

Figure 4.21. Pull Cap attached to MC Drive Head.

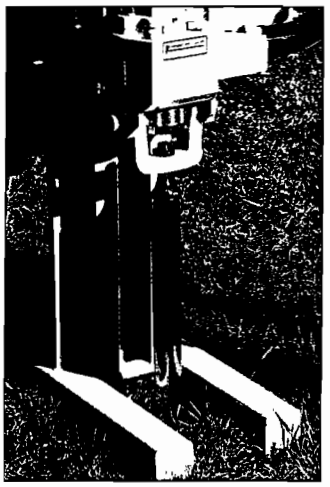


Figure 4.22. MC Soil Sampler is pulled with Geoprobe unit.

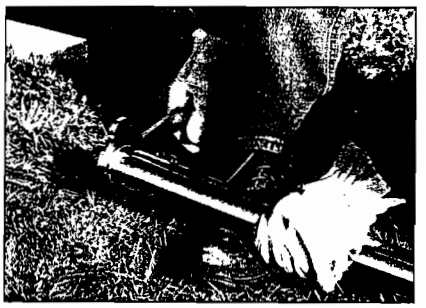


Figure 4.23. Loosening the MC Cutting Shoe with the MC Combination Wrench.

Figure 4.24. Removing MC Cutting Shoe and liner from MC Sampler Tube.

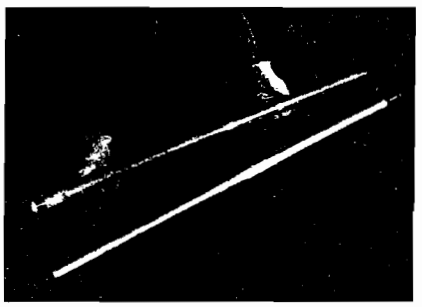


Figure 4.25. Macro-Core liner filled with soil core.

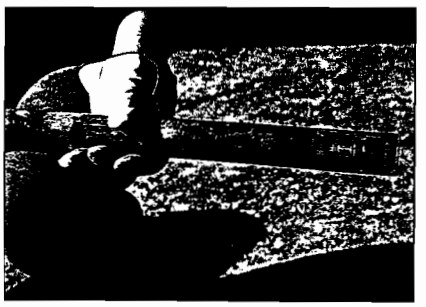


Figure 4.26. MC Piston assembly is retrieved from liner at the top of the soil core.

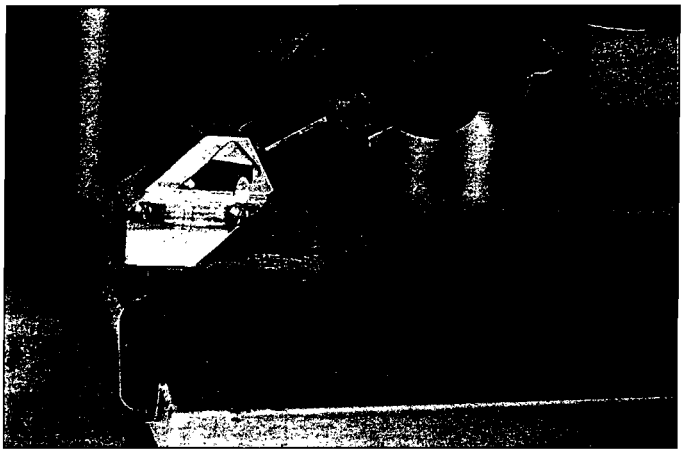


Figure 4.27. MC Liner Cutter (AT8000K) makes a quick, safe cut through even the toughest of liner materials.

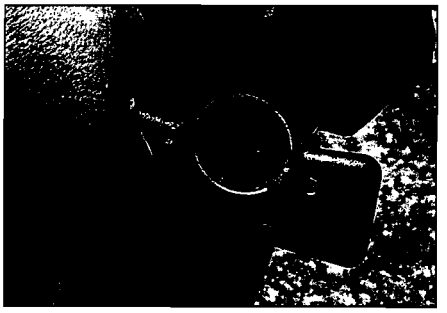


Figure 4.28. MC Circular Cutting Tool (AT8050) cuts around the outside of the filled MC liner.

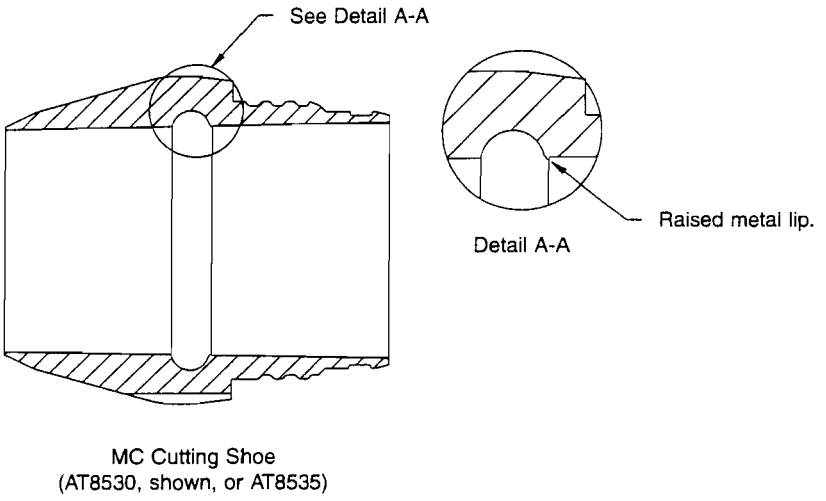


FIGURE 4.29
Macro-Core® Cutting Shoe with Mushroomed Locking Ring Groove

4.10 Macro-Core Closed-Piston Operating Tips

The Macro-Core piston assembly requires proper maintenance to ensure reliable operation. The following tips will increase the effectiveness of closed-piston sampling:

1. Cleanliness is the most important factor affecting piston operation. Ensure piston bolt threads and locking ring are free of soil particles and corrosion before each use. Completely thread and unthread the piston bolt to verify operation. Disassemble the piston tip and wash the individual parts using clean water and a Nylon Brush for MC Sample Tubes (BU700) if necessary. Allow parts to dry before assembling if piston is to be stored before use. Disassemble used pistons before storing to prevent piston bolt corrosion.

2. Never store a cutting shoe with the piston installed. Install the piston assembly immediately before sampling.

3. Lubricate piston assembly with distilled water before installing in the cutting shoe.

4. Once the assembly is fully seated in the cutting shoe, tighten the piston bolt with an oscillating movement; thread the bolt in 90 degrees then back 45 degrees. When the end of thread travel is reached, work the last 30 degrees of travel back and forth several times. Tightening the piston bolt in this manner allows the metal pins of the locking ring to correctly align in the cutting shoe.

5. Do not lock the piston bolt 100 percent counterclockwise. Fully tighten the bolt and then loosen approximately 10 degrees.

6. When releasing the piston downhole, only turn the piston bolt 4 clockwise revolutions.

7. Clean the piston assembly with distilled water and a nylon brush between samples. It is not necessary to completely disassemble the piston at this time. Pay particular attention to the locking ring and ensure that all sand and grit is removed from between the metal lock pins.

8. Locking rings are expensive but can be restrung on new springs. If a locking ring breaks, save the pieces for reuse. (Refer to Page 6 for replacement parts). To restring a locking ring, follow these simple steps:

   a. There is a small loop at each end of a new locking ring spring. Make sure one loop is bent perpendicular to the other. One loop should also be completely closed while the other is slightly open.

   b. Attach a clamp as close to the open end as possible (without contacting the loop) to hold the spring. Fisherman fly-tying pliers work well for this procedure. Take care not to damage the spring by applying too much pressure.

   c. String 12 locking ring pins (macaroni-shaped metal pieces) on the closed end, stretching the spring as necessary. Be careful not to overstretch and damage the spring.

   d. Hook the open end of the spring through the closed end and bend the loop closed.

   e. Remove the clamp and gently stretch the locking ring several times to ensure that the loops will not open.

9. A locking ring groove is machined into the cutting shoe. Over time, the edges of this groove may begin to mushroom from use (Fig. 4.29). The raised metal lip formed by the mushroomed groove may cause the locking ring (and subsequently the piston) to bind in the cutting shoe. Remove the raised metal with a file or die grinder

4.11 Tips to Maximize Sampling Productivity

The following suggestions are based on the collective experiences of Geoprobe operators:

1. Organize your truck or van to maximize efficiency. Assign storage areas to all tools and equipment for easy location. Store samplers, extension rods, and liners in racks. Above all, minimize the number of items lying loose in the back of the vehicle.

2. Take three or four samplers to the field. This allows the collection of several samples before stopping to clean and decontaminate the equipment. A system is sometimes used where one individual operates the probe while another marks the soil cores and decontaminates the used samplers.

3. A machine vise is a real plus. With the sampler held in a vise, the operator has both hands free to remove the cutting shoe (Fig. 4.30), drive head, and sample liner (Fig. 4.31). Cleanup is also easier with both hands free. Geoprobe offers an optional Machine Vise (FA300) which mounts directly on the probe derrick (Fig. 4.32).

4. Extension Rod Quick Links (Fig. 4.33) are the best choice among connectors. These are real time savers. The quickest and easiest method for deploying extension rods is to assemble sections of up to three rods with threaded connnectors. Each section is then connected with Quick Links. Up to three rods can be inserted or removed from the probe string at once, greatly reducing deployment time.

5. When releasing the piston assembly, a pair of locking pliers may be used to turn the extension rods. The locking pliers will be quicker and easier to install than the extension rod handle in some situations.

6. Organize your worksite. The best way to maximize sampling efficiency is to practice with the sampler and identify a comfortable setup. Lay out all tools and equipment before probing. An example layout is shown in Figure 4.34.

   A collapsible table or stand is handy to hold decontaminated sampler tubes and liners. Equipment may also be protected from contamination by placing it on a sheet of plastic on the ground.

   Keep probe rods separate by identifying a location for "new" rods as well as a "put down pile." Initially drive the sampler with a new rod. As the rod is removed during sampler retrieval, place it in the put down pile for reuse. Drive the sampler to the top of the next sampling interval by using all of the rods in the put down pile. A new rod (located in a separate pile) is added and the string is driven to collect the next soil core. Once again, each probe rod is removed and placed in the put down pile as the sampler is retrieved. The cycle is repeated until all of the soil cores are recovered. This method eliminates the need to count rods while driving the sampler.

7. Cleanup is very important from the standpoint of operation as well as decontamination. Remove all dirt and grit from the threads of the drive head, cutting shoe, and sample tube with a nylon brush (BU700). Without sufficient cleaning, the cutting shoe and drive head will not thread completely onto the sample tube. The threads may be damaged if the sampler is driven in this condition.

   Ensure that all soil is removed from inside the sample tube. Sand particles are especially troublesome as they can bind liners in the sampler. Full liners are difficult to remove under such conditions. In extreme cases the soil sample must be removed from the liner before it can be freed from the sample tube.

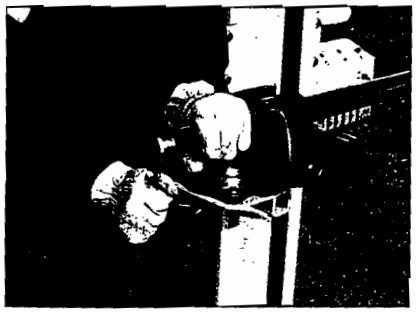


Figure 4.30. Removing MC Cutting Shoe with filled sampler tube held in Machine Vise.

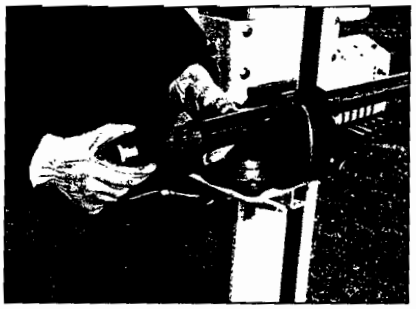


Figure 4.31. Removing filled liner with sampler tube held in Machine Vise.

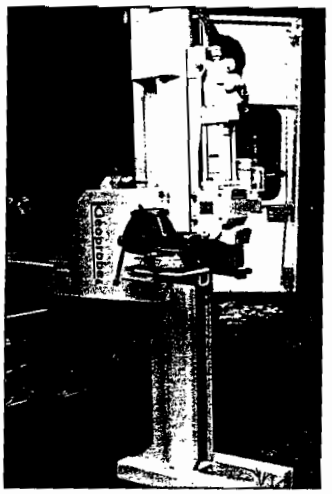


Figure 4.33. Machine Vise mounted directly on Geoprobe unit.

Figure 4.33. Using Extension Rod Quick Links to connect Extension Rods.

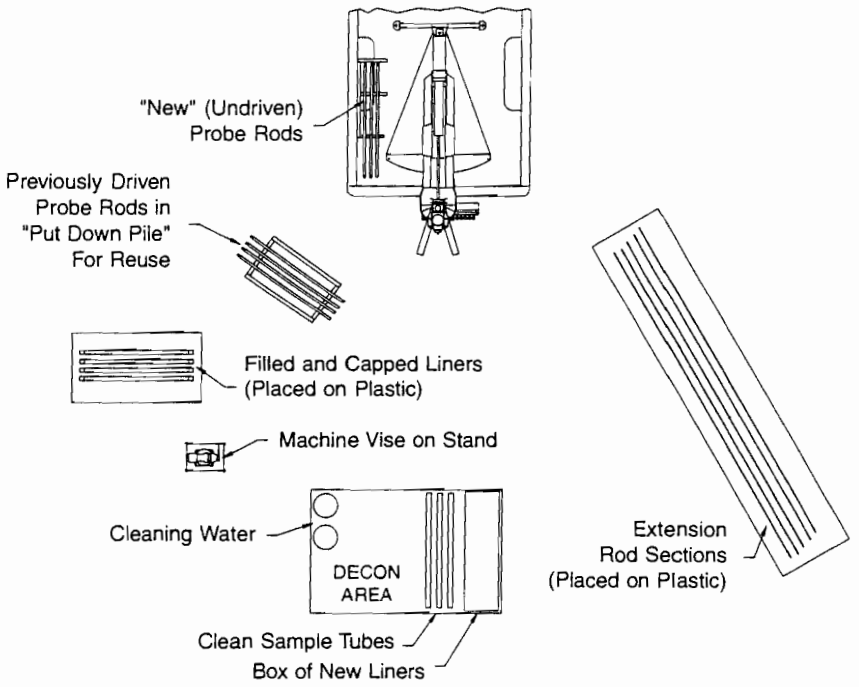


FIGURE 4.34
Equipment Layout Example to Maximize Sampling Productivity.

8. The piston assembly may remain lodged in the cutting shoe when disassembling by hand, even though the piston bolt is completely loosened. This is because the locking ring and piston washer do not release from the groove in the cutting shoe as the piston bolt unthreads out of the tip. Hammering on the piston tip will have no effect because you are, in essence, forcing the tip tighter against the locking ring. To dislodge the piston, turn the assembly over and tap the top of the cutting shoe on a solid object. If the assembly still does not release, tap on the piston bolt with a hammer (taking care not to damage the release rod slot). This will jar the piston tip and bolt enough to release the locking ring from the groove in the cutting shoe.

* CAUTION

Do not push the piston assembly out of the cutting shoe by placing your hands on the piston tip. The cutting shoe is sharp and may cause injury when the assembly suddenly comes free. It is best to place the tip against a solid object, grasp the cutting shoe, and push the shoe over the assembly.

9. Although available for use with two sizes of probe rods, 1.25-inch OD rods are recommended for the Macro-Core Sampler. The larger rod diameter limits downhole deflection of the tool string and ultimately provides a more durable system. A new thread design also makes the 1.25-inch rods quicker and easier to thread together than previous 1-inch probe rods.

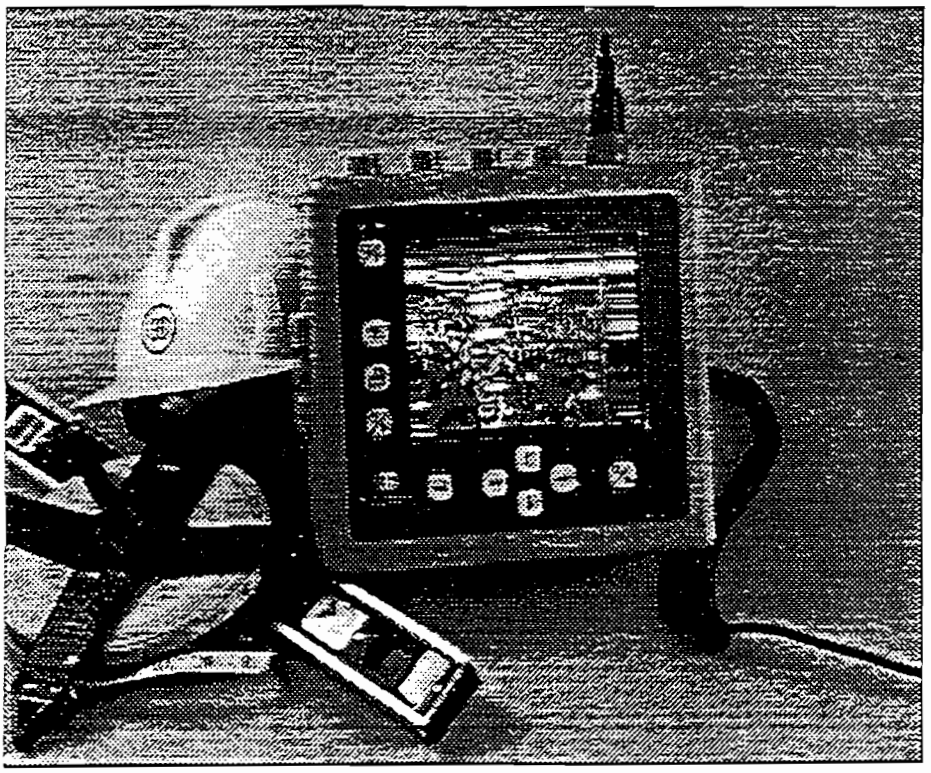
10. The Heavy-Duty MC Cutting Shoe (AT8535) is machined with more material at the critical wear areas. It can be used in place of the Standard MC Cutting Shoe (AT8530) and is designed to lengthen service life under tough probing conditions.

    Expansive clays and coarse sands can "grab" and collapse liners as the sample tube is filled with soil. A 1/8-inch Undersized MC Cutting Shoe (AT8537) will help alleviate this problem. The smaller diameter core (1.375 inches) allows expanding clays and coarse sands to travel up the sample liner without binding. The piston assembly can not be used with this cutting shoe.

11. Maximize the thread life of the sample tube by varying the ends in which the drive head and cutting shoe are installed. The dynamic forces developed while driving the sampler are such that the threads at the drive head wear more quickly than at the cutting shoe. Regularly switching ends will maintain relatively even wear on the sample tube.

SIR® SYSTEM-2

OPERATION MANUAL



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Manual #MN72-140A

How to Use This Manual

This manual is designed for both experienced and novice users of Subsurface Interface Radar (SIR) System-2. We recommend that all users read the entire manual.

This manual contains an index and glossary of terms for quick reference. On-screen help has also been provided for you. To access this help section while operating the SIR-2, press the *Help* key (?) and an on-screen help menu will appear.

The following captions will help the SIR-2 user focus on key points in this manual:

NOTE:

This section will highlight important messages that point out the SIR-2's key features to help the user.

⚠ CAUTION:

This section will highlight important messages to help the user avoid processing pitfalls or fatal errors that could crash the system or result in the loss of data.

About this Manual

Certain conventions are used in this manual where they refer to commands, functions and menus.

- MENU NAMES will appear in small capital letters.
- Tools and Functions will appear with initial capital letters.
- **Commands** you choose from the menus will appear in bold with the first letter capitalized.
- *Keys* on the keyboard will appear in italics.
- *Buttons* and *Icons* will also appear in italics.

NOTE:

This manual assumes that you will have a SIR-2 available and in operation when reading this manual.

Help can be obtained on any command by pressing the *Help* (?) key for context-sensitive help and then the *Enter* (↵) key for general help.

CHAPTER 1: INTRODUCTION

1.1 Unpacking Your System

Thank you for purchasing a GSSI SIR® System-2 (from now on referred to as SIR-2). A packing list is included with your shipment that identifies all of the items that are in your order. You should check your shipment against the packing list upon receipt of your shipment. If you find an item is missing or damaged during shipment, please call or fax your sales representative immediately so that we can correct the problem.

Your SIR-2 contains the following items:

1 - Digital Control Unit (DC-2)
1 - Antenna control cable
1 - DC Power cable (SIR-2 power connector on one end and a cigarette lighter plug on the other end)
1 - Power Connector Adapter (Cigarette lighter socket on one end and a GSSI three pin power connector on the other end)
1 - ~~Upgrade adapter cable (keyboard and serial port cable)~~ > N/A RJW 12/1/96
1 - ~~Serial null modem cable (9 pin to 9 pin cable)~~
1 - DC-2 padded carrying case, with sunshade
1 - SIR System-2 Operation Manual
1 - PC operating system software, MS-DOS

If you purchased some the following available optional items they will also be included:

Portable Battery Kit
DPU-5400 Thermal Printer

1.2 General Description

The SIR-2 is a lightweight, portable, single channel general purpose ground penetrating radar system. The various components of the DC-2 control unit are briefly described below.

The major external components of the control unit are the keypad, video screen, connector panel and indicator lights. The keypad consists of 10 keys which are used to control operation of the unit. The VGA liquid crystal display (LCD) video screen provides real-time or playback viewing of the data. There are five connectors located on the SIR-2. The connector labeled BATTERY connects to the power supply. The connector labeled ANTENNA connects to a GSSI antenna. The PARALLEL connector is used to connect a thermal printer or to transfer data to a computer. The MULTIFUNCTION connector will connect to the upgrade adapter cable or optional Model 25 multifunction box. The XMIT connector provides a fiber optic transmit trigger output for the Model 3200 Multiple Low Frequency (MLF) antenna. The red and green indicator lights, located above the power switch, indicate power supply to the unit. The amber light on the upper right to indicate hard disk activity.

should shut down the system as soon as possible and replace or recharge your power source.

RED LIGHT - When the system is turned on the red light will illuminate.

The battery charger supplied by GSSI with the SIR-2 (if ordered with your system) has two lights on the front panel. One is a power indicator light which illuminates when input power is applied to the unit. The other is a "fast-charge" light which will illuminate only during the initial or "fast-charge" phase of battery recharge. When this light goes out, it does not mean that the battery is fully charged, only that the initial or high-current draw phase of the recharge has finished. To ensure that the battery is fully charged, leave it connected to the charger for at least 8 hours.

Note: When using a GSSI high or very high powered transmitter (Models 775, 776, 777 or 778) with the SIR-2 you should use the GSSI Model 570 fiber-optic trigger between the transmitting and receiving antennas. The SIR-2 does not have sufficient power to drive the high power pulse amplifiers at a satisfactory repetition rate when a coaxial cable is connecting the transmitting and receiving antennas.

1.4 Operating Environment

The SIR-2 is designed to operate from 0°C (32°F) to 40°C (104°F). The unit is environmentally sealed and can be used in dusty or humid environments. Though the system is designed to withstand occasional exposure to water it should not be deliberately subjected to rain or immersed in water. A heat-sink plate is located in the bottom of the system and used to regulate the internal temperature of the unit, and air must be free to circulate around it. Therefore, the system should not be operated while inside the carrying and storage pack .

The video screen is a color active-matrix liquid crystal display (LCD) covered by a polarizing screen to improve viewing in bright light. A velcro attachable sun shade is also included with your system. However, even with the polarizing screen, the data can be difficult to view in bright sunlight. Turning the system so that the screen does not directly face the sun and using the sun shade will make the data easier to view. Sometimes it will be necessary to completely shade the unit in order to see the image on the screen.

NOTE:

The SIR-2 is designed to operate from 0°C (32°F) to 40°C (104°F). The SIR-2 control unit can operate in dusty, humid or foggy environments but it should not be deliberately subjected to direct rain or immersed in water.

Turning the system so that the screen does not directly face the sun and using the sun shade will make the data easier to view in bright sunlight.

The screen on the SIR-2 is plastic and susceptible to scratching. Reasonable care should be exercised in protecting the screen from sharp objects which may scratch it. Do not use

CHAPTER 2: BASICS OF SYSTEM OPERATION

2.1 Hardware Connections

Only two simple connections need to be made before you can start the system.

1. The male end of the antenna control cable should be connected to the antenna connector on the SIR-2 control unit. The 11-pin connector at the other end of the control cable should be connected to a GSSI antenna. Because the control cable connector on the SIR-2 is different, older GSSI antenna cables will not connect directly to the control unit. You will need to connect the antenna cable provided with your SIR-2 system to the control unit and connect older GSSI antenna cables to that cable by connecting a cable adapter between the two cables.

NOTE:

If you are going to playback data, it is preferable not to connect the antenna to the SIR-2 before powering ON the system.

2. The male end of the DC power cable should be connected to the battery connector on the control unit.

The following connections are for optional items:

a) If a thermal printer is to be used, the male end of the thermal printer cable should be connected to the parallel connector of the control unit and the other end should be connected to the printer. See Chapter 6 for details on using thermal printers.

⚠ CAUTION:

If you connect a printer to the SIR-2, the printer must be powered ON before the SIR-2.

b) If a survey wheel is to be used, connect the survey wheel to the antenna.

After all other connections have been made connect the power cable to the power source. If the battery voltage is adequate, the green light above the power button will become illuminated and remain illuminated. If the battery voltage is low, the green light will flash. If the green light is flashing, you should correct the low voltage problem before starting the system.

- If an antenna is not connected to the system and you choose **Previous Setup,** the system will enter the PLAYBACK SETUP MENU block. See Chapter 5 for a description of the PLAYBACK SETUP MENU block. If you accidentally choose **Stored Setups**, press *Enter* ↵ and then **Cancel**. The system will then enter the PLAYBACK SETUP MENU BLOCK.

Once in the COLLECT SETUP MENU block, data coming from the antenna will show on the top left ¾ of the screen, and oscilloscope display of the data in the top right ¼ of the screen and the bottom portion of the screen will show the COLLECT SETUP MENU block. Note that the data being acquired at this time is only displayed to the screen and it is **not** saved on disk.

Review the remainder of Chapter 2 for a general description of how to use the system, then go to Chapter 3 for system data collection parameters setup.

2.2.1 System Startup for the SIR-2P

When the SIR-2P is turned on and goes through its boot routine, you will see a small window near the top of the screen that says: 1 or F1 Run SIR-2; 2 or F2, WIN95/RADAN. If you take no action for 30 seconds, the system will default to SIR-2 mode. When it boots into the SIR-2 mode, you will be given a choice of two modes of operation at the top screen: press **Run** for Automatic operation or press **Enter** for Standard operation.

Once in SIR-2 mode, if you want to switch to the Windows95 (WIN 95) mode you must turn the system OFF and reboot, then select option 2, **WIN95/RADAN**.

In WIN95 mode the system acts like a normal computer with the Windows 95 operating system. From here, you can launch RADAN or any other software that has been pre-loaded. To turn the system OFF in WIN95 mode, hold the power switch down for at least 8 seconds.

If you connect the SIR-2P to a network through the ethernet connection, the password to use is "sir2p".

2.3 Using The HELP Key To Get Help

Highlight any menu command and then press the ?(*Help*) ? key to get help on that command. Press the *Help* ? key and then the *Enter* ↵ key to get general help on the system. Help for some commands is longer than one screen, and in these cases use the *Down* ↓ arrow key to obtain the additional screens of help.

NOTE:

General system help can be obtained by pressing the *Help* ? key and then the *Enter* ↵ key. If at any time you are unsure of the current system parameter settings press the *Collect/Playback* % key until the system parameters screen appears.

2.5 Navigating Through The User Menus

2.5.1 The Major Menu Blocks

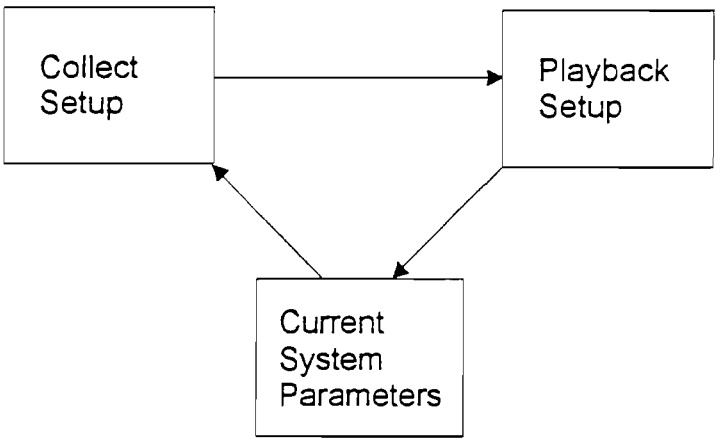
The SIR-2 has 4 major MENU blocks:

- COLLECT SETUP
- PLAYBACK SETUP
- PLAYBACK DATA
- COLLECT DATA

The system will identify which block is active by a message appearing in the lower portion of the menu block.

SETUP MENU BLOCKS

When the system is first turned ON, it is in Setup Mode. When in the SETUP MAJOR MENU block, pressing the *Collect/Playback* button cycles through the major menu blocks; COLLECT SETUP and PLAYBACK SETUP, and the Current System Parameters screen (Figure 2-1).



Cycling through the major menu blocks when in Setup Mode
by repeatedly pressing the *Collect/Playback* key
FIGURE 2-1

COLLECT DATA AND PLAYBACK DATA MENU BLOCKS

To put the system in Data Mode, press the *Run/Standby* key. This will start the system collecting data (**Note: By default the data will be stored in RAM. It will only be stored on the hard disk if you turn disk output ON. See Section 3.2.3**). In the Data Mode, pressing the *Collect/Playback* button cycles through the major menu blocks; COLLECT DATA and PLAYBACK DATA, the current system parameters screen and then the COLLECT SETUP MENU BLOCK (Figure 2-2).

- The middle columns consist of two types of system parameters: those whose values appear in a box and can be changed via the toggle switch method and those whose values can be changed by a parameter change box. When a parameter from these columns is highlighted and then the *Enter* ↵ key is pressed, one of two things will happen: If it is a toggle switch parameter, the value of the parameter will change each time *Enter* ↵ is pressed; if the parameter requires a wide range of values a parameter change box will appear as a third column. The *Up* ↑ and *Down* ↓ keys will be used to increment/ decrement value of the parameter by the step size; the *Left* ← and *Right* → keys will allow you to select step size. The *Enter* ↵ key will set the selected value of that parameter.

NOTE:

Throughout the remainder of the manual when the expression "select a command" is used, it means move the highlight bar to illuminate that command and then press the *Enter* ↵ key. This will select (i.e., activate) that command.

Let's look at some examples of using the menus.

1) PLAYBACK SETUP menu block, if you highlight the **Files** command from the leftmost column a list of commands will appear in a second column.

2 Now, using the *Arrow* ← ↑ ↓ → keys move to the second column and highlight the **Compress** command. A third column containing two compression commands appear, **Method** and **Do Compress**.

3) Finally, if you move the highlight bar to the **Method** command and press the *Enter* ↵ key three times slowly. Notice that this changes the type of compression method.

4) In the COLLECT SETUP MENU block move the highlight bar to the **Setup** command and then to the **Range** command. Notice that a parameter change box appears to the right. Move the highlight bar to the **Parameter Change** box to change the value of the range. Then press the *Enter* ↵ key to register the change.

2.6 Recalling Preset Files To Automatically Set The System For Data Acquisition

When the system is first turned ON or after switching antennas, the system can be easily set for data acquisition by selecting the operating parameters setup file that is most appropriate for the selected antenna and job. This is done using the **Recall Setup** command accessed from the **Setup** command in the COLLECT SETUP MENU block or the PLAYBACK SETUP MENU block. This command is next to the bottom of the second column of commands.

CHAPTER 3: SYSTEM SETUP FOR DATA COLLECTION

3.1 Simple (Quick) System Setup For Data Collection

After loading the appropriate system operating parameters setup file (see Appendix A for a description of the setup files), the following few parameters should be checked to ensure that they are optimal for your specific site.

The system should be in the COLLECT SETUP menu block.

1) Check the **Range** (i.e., depth) of viewing.

This is done by moving the highlight bar up to the Range parameter. The appropriate range value is calculated by the following formula:

RANGE VALUE = Maximum Depth of Interest * T * 1.5

Where T is the two-way travel time of the subsurface materials at your site. For a table of two-way travel time values see the discussion of range in Section 3.2.2. After the range value is changed, the system will automatically find the position of the ground surface reflection and place it at the top of the data screen. It will also readjust the gains (the message "servo in progress, please wait" will appear, and the speaker will emit a "clicking" sound while this is occurring).

2) Check the position of the ground surface reflection.

Normally, the surface reflection will appear in the color bar at the top of the O-scope data display. Occasionally the system will misidentify a different reflection for the ground surface reflection. (It is especially prone to do this with the horn antennas, 1000 MHz antenna, 3200 MLF antenna, bistatic 100 MHz and the bistatic 300 MHz antenna.) In this case, the real surface reflection will occur before the top of the signal (as displayed in the O-scope display). Move the highlight bar down until the **Position** command is highlighted and press the *Enter* ↵ key to change position to Manual Mode. Move to the parameter change box and use the *Down* ↓ arrow to decrease the position value by 5ns if the range is less than 20ns, by 10ns if the range is between 20ns and 100ns and by 50ns if the range is greater than 100ns. (Note that when changing the position value the system will often round off values.) Before you change the position value you should note the original value. Press the *Enter* ↵ key to implement the position change.

After changing the position value, you will observe one of two things:

1) If the oscilloscope display shows the data is flat (no signal) at the top and a strong surface reflection appears further down, the system correctly found the surface reflection. Move the highlight bar to the **Parameter Change** box again and set the position value back to the original number before you changed it.

2) If the data is not flat at the top of the record the wrong surface position was found. You should keep manually decreasing the surface position by increments of 5 or 10ns

3.2 Complete Description Of Collect Setup Menu Block

SETUP

When this command is highlighted, a set of system data collection parameters that can be set appears in the second column. The commands that will appear in the second column are: Setup Mode, Run Mode, Range, Gain, Position, Filters, Scan, Save Setup, Recall Setup, and Show Setup.

SETUP MODE

This parameter determines how the system parameters will be set. There are two setup modes: Automatic and Manual. The mode is changed by pressing the *Enter* ↵ key.

When the Setup Mode is set to **Automatic,** the system will automatically find the ground surface reflection and place it at the top of the screen, set the filters, gains, scan speed and data resolution. It will not automatically set the range. The range used will be that which is set prior to putting the system in Automatic Mode. After automatic setup the user can manually change any system settings.

When the Setup Mode is set to **Manual**, the user can manually set all system parameters to the desired settings.

> ⚠ **CAUTION:**
>
> When the Setup Mode is set to **Auto**, the Gain Position, Filters and Scan Parameters will be hidden.

3.2.1 Setting The Data Acquisition Method

RUN MODE

This parameter informs the system how the field survey will be conducted. There are three methods of data acquisition: Cont (continuous), Point and SW (survey wheel). The system Run Mode is changed using the *Enter* ↵ key.

CONTINUOUS DATA COLLECTION METHOD

When the Run Mode is set to **Cont** (Continuous), the system is continuously transmitting signals into the ground and recording data. The advantages of this mode are that a continuous profile of the subsurface is generated and it is the most rapid data collection method.

SURVEY WHEEL CONTROLLED DATA COLLECTION METHOD

When the Run Mode is set to **SW** (Survey Wheel), a third column of survey wheel data collection parameters appears. In this mode data collection is controlled by a survey wheel attached to the antenna. All lines will then have the same horizontal scaling. This mode is preferable for surveys which require precise line locations.

1) Choose a survey wheel calibration line that is at least 50% as long as your maximum survey line. Enter the distance of the survey calibration line in the distance parameter.
2) Select the survey units either meters or feet.
3) Set the antenna at the beginning of your survey calibration line with the middle of the antenna on the beginning of the line.
4) Activate the **Autocalibrate** function by pressing the *Enter* ↵ key and then the *Run/Standby* key.
5) Move the antenna over the survey calibration line very slowly (less than 0.5meters (1.5ft) per second), until the middle of the antenna reaches the end of the survey calibration line.
6) When finished calibrating, press the *Run/Standby* key to end the calibration.
7) Your survey wheel is now calibrated and ready for use.

UNITS

Use the *Enter* ↵ key to select the survey units **Meters** or **Feet**.

DISTANCE

Enter the distance of the survey wheel calibration line. The distance should be at least 50% of the longest line in the survey to be performed.

TICK/UNIT

If you know the number of electronic ticks per meter or feet that your survey wheel will send to the SIR-2 system, you can enter the number here. With this number it is not required to calibrate the survey wheel. We strongly recommend using the Autocalibrate function instead of entering a tick/unit value, because ground conditions change and when the system is Autocalibrated it will take this into account to some extent.

DISCRETE DATA POINT DATA COLLECTION METHOD

When the Run Mode is set to **Point,** the parameter Stat Stack appears in the third column. When in Point Mode, data is collected a predetermined number of scans per survey station (i.e., every time the *Run/Standby* key is pressed another number of scans are collected). This mode is useful in rough terrain where continuous data collection is impossible and in areas where the signal is very weak at deep depths and maximum signal enhancement is required. When using Point Mode, it is recommended that Wiggle Display Mode be used.

Be aware that the display shows a simulated stack while in Collect Setup. The system shows the actual stack when switched to Run Mode and you start acquiring data.

STAT STACK

In order to improve signal-to-noise in Point Mode, it is advantageous to stack (i.e., average) several input scans into one output scan at each station. The Stat Stack parameter allows you to set the number of scans that will be averaged. The value is typically set to 32, and the range is from 1 to 32768 in binary steps. Thus, when the value is set to 32 at each station, 32 scans will enter the system from the antenna and be summed

Material	T (ns/meters)	T (ns/feet)
Air	6.5	2
Ice	13	4
Snow	8	2.5
Water	59	18
Asphalt	14	4.5
Dry concrete	15	4.5
Wet concrete	23	7
Dry sands	13	4
Wet sands	25.5	7.5
Saturated sands	33	10
Dry sand & gravel	15.5	4.5
Frozen sand & gravel	14.5	4.5
Dry loamy/clayey soils	10.5	3
Dry mineral/sandy soils	16	5
Organic soils	52.5	16
Wet sandy soils	32	9.5
Frozen soil/permafrost	16	5
Tills	22	6.5
Peats	51.5	15.5
Wet clay	34	10.5
Dry clay	13	4
Dry granite	14.5	4.5
Wet granite	16.5	5
Wet basalt	19	6
Volcanic ash	23.5	7
Potash ore	15.	4.5
Dry bauxite	33	10
Syenite porphyry	16	5
Travertine	18.5	5.5
Coal	14	4
Dry limestone	15.5	4.5
Wet limestone	18.5	5.5
Wet sandstone	16	5
Dry salt	16	5

Approximate two-way travel time values of various materials

TABLE 1

NOTE:

When manually adjusting the gain curve, if the gains are set correctly, the largest signals (reflections) in the oscilloscope display should be 75% the width of the display and the data screen should show mostly (60% to 80%) red, orange and yellow reflections. The colors described above are based on color table 2. If you use a different color table the correct gain colors will be different.

GAIN POINTS

The number of gain points can be set from 1 to 8, and is normally set between 3 and 5. You may want to use fewer gain points (2 or 3) for shallow scans (5-15ns) made with our high-frequency, high resolution antennas for detecting steel reinforcing bars or mesh in concrete. Conversely, you may want to use more gain points (6 or 8) to allow greater adjustment flexibility when doing deep investigations (200-1000+ns).

POSITION

This parameter controls the vertical position of the surface reflection in the data viewing window. The surface reflection is the place in time where the radar pulse leaves the antenna, and enters the subsurface. It can therefore be considered to be "time zero", and its position should be at the top of the scan. When **Position** is set to Auto Mode, the system will attempt to identify the surface reflection and place it at the top of the data viewing window. The surface reflection is always a very strong reflection. The gain parameter should be set to **Auto** when using the Auto Position.

Note that the ability of the system to correctly identify the surface reflection depends upon the antenna selected and the ground conditions. It is important to check that the system has correctly identified the surface reflection. This is done by manually moving the scan down the viewing window by decreasing the range by a few nanoseconds. If the Auto Position has correctly identified the surface reflection, these data should be a nearly flat line (no signal) at the top of the scan above the surface reflection as you move the scan down the viewing window. If, as the scan is moved down the viewing window, more data appears above, then the Auto Position has not found the surface reflection. You should continue to move the scan down the window until the data becomes a nearly flat line at the top of the screen. The large reflection just below the flat data zone will be the surface reflection. The gain should be set to **Manual** when manually adjusting the scan position.

To manually move the data scan up or down in the window, set Position to **Manual**. A fourth column will appear which will allow you to move the scan. The Step parameter controls how much the scan is moved up and down and is changed using the *Right* → and *Left* ← arrow keys. Use the *Up* ↑ arrow key (increase time in ns) to move the data scan up in the window, and use the *Down* ↓ arrow key (decrease time in ns) to move the data scan down in the window. Gain should be set to **Manual** when manually adjusting the position. When using Manual signal position, keep the gains at a minimum when searching for the transmit pulse.

surveys this filter should be set no greater than 5. If you are looking for very small objects in the near subsurface (like wire mesh reinforcing in concrete), you should turn this filter off by setting it to zero. For subsurface layer mapping, the value of this parameter may be increased but is normally less than 20.

HOR BKGR RM

The Hor Bkgr RM (horizontal background removal) filter is used to improve the recognition of small targets and dipping reflectors.

This process filters the data horizontally by removing horizontal noise bands and reflecting layers. This filter **SHOULD NOT** be used in Data Collection Mode because it removes the surface reflection and any other real horizontal reflections.

When this parameter is highlighted, a fourth column appears. The input value is number of **Scans.** This is an IIR (infinite impulse response) running average subtraction filter. The filter works by taking an average of the data and subtracting the average from each scan. The smaller the selected filter value the more effect the filter has.

This filter is best used in playback when looking for point targets and there are significant horizontal noise bands. Use the *Cursor* to measure the width in terms of the number of scans of the largest point target and set the Hor Bkgr RM filter to this value. The filter will remove all horizontal banding that is equal to or longer than the set value of this parameter, provided there is no change in amplitude or depth of these horizontal signals.

SCAN

This menu item sets the parameters of the data scans. These parameters are samples/ scan, bits/sample and scans/second. **Scan** can be set to **Auto** (automatic) or **Manual** using the *Enter* ↵ key.

When in Auto Mode, the parameters are automatically set by the system. The samples/ scan will be set to 512, the bits/sample to 8 and the scans/second to 32, unless factory setups have been chose. In this case, the samples/scan and bits/sample may differ.

When in Manual Mode, the parameters, samples/scan, bits/sample and scans/second appear in the third column. The user can now manually set these parameters.

SAMP/SCAN

This parameter sets the number of data samples in a vertical scan. When it is highlighted, a fourth column appears which allows you to change the value of the parameter. The samp/scan can be set to 128, 256, 512, 1024, or 2048.

This value is normally set to 512 samples/scan which is the best value for most applications. However, for each antenna frequency there is a maximum value that the range should be set when recording 512 samples/scan and occasionally you may wish to set the range beyond this value. In this case you must increase the samples/scan to a higher value, otherwise your data will be under-sampled or aliased (i.e., resolution will be lost).

This maximum permissible range when recording 512 samples/scan is calculated by the following formula:

SAMPLESSCAN SETTING	SCANS/SECOND CHOICES
128	16,24,32,48,64
256	16,24,32,48
512	16,24,32
1024	16,24
2048	16

The normal setting is 32 scans/second. When surveying on foot at approximately 1 meter (3 feet) per second, a setting of 32 scans/second will result in a data scan about every 3 cm (1 inch) along the ground surface. If you wish to increase your scan density, you should walk slower. For example, a walking pace of 60 cm (2 feet) per second will result in a data scan approximately every 2 cm (1 inch) along the ground surface.

Often for large scale surveys (i.e., bedrock mapping), a coarser horizontal sampling is desired (ex. scans every 20 cm (8 inch)). In such cases, the scans/second value can be lowered to 24 or 16. This will result in smaller files, saving disk space and speeding up data transfer and post-processing.

Sometimes surveys are done pulling antennas with a vehicle at a higher rate of speed (ex. 2-5 meters (6-15 ft) per second). If a setting of 32 scans/second does not provide adequate horizontal sampling, you may increase the scans/second setting to 48 or 64. Note that scans/second settings of 48 and 64 are generally only available when the samples/scan are set to 128 or 256.

3.2.3 Setup Of Disk, Printer And Display Output Parameters

OUTPUT

When this command is highlighted, the Output Setup commands appear in the second column.

Pressing the *Enter* ↵ key when **Output** is highlighted will have no effect.

DISK

The hard drive storage device can be operated by highlighting the word **Disk** in the menu in the second row and toggling the **Disk On** or **Off** with the *Enter* ↵ key. If **Disk On** is selected, data will be stored to the hard disk, and the message "Out:D" will appear in the lower right corner of the screen. Each filename consists of the word FILE + a number (ex. FILE8), where the number increments for each file saved.

PRINT

This function turns the print output ON or OFF by using the *Enter* ↵ key. When it is turned ON, a third column of printer control commands appears. If the printer is not connected and turned ON, there will be a long delay (about a minute) when this parameter is selected.

PRINTER

Use this command to select the printer you will be using to print the data. The *Enter* ↵ key is used to toggle between the two selections, the GS-608P and the DPU5400.

The Linescan color display is the best display for most applications, especially good for identifying buried point targets (ex. drums, voids, pipes). The Linescan grayscale display is a good display to identify buried pipes. The Linescan color or gray shade displays are also good for displaying geologic layering. You should try different Linescan color and grayscale displays of the same data sets to determine which displays help you best with the interpretation.

Wiggle displays are sometimes better for interpreting layering in stratigraphic or geological surveys over long distances.

Oscilloscope display allows viewing of a single radar trace in detail.

LINESCAN DISPLAY PARAMETERS

COLOR TABLE

This parameter sets the Color (or gray scale) Table to be used to display the data. There are 15 possible Color Tables from which to choose. The *Enter* ↵ key is used to change the Color Table by toggling through the choices. The active Color Table is shown in the upper right hand corner of the SIR-2 screen, above the oscilloscope display.

Each Color Table consists of 16 colors, eight colors to represent positive amplitudes and eight colors to represent negative amplitudes. Each data point in a scan is represented by a color or gray shade depending upon its value. For example, using Color Table 2 low amplitude data values will show as black, high positive amplitudes as white and high negative amplitudes as gray. Thus, each scan results in a vertical line of colored (or gray shaded) dots on the SIR-2 screen. As each scan is collected by the system, the screen fills with vertical colored (or grayscale) lines to generate a profile image of the subsurface.

The Linescan color display is a good display for most applications, but it is especially good to identify buried point targets (ex. drums, voids, pipes). The Linescan grayscale display is a good display to identify buried pipes.

COLOR XFORM

This parameter sets the Color Xform (i.e., Transform) to be used to display the data. There are 8 possible Color Transforms from which to choose. The *Enter* ↵ key is used to change the transform. The active Color Transform is shown in the upper right hand corner of the SIR-2 screen.

The Color Transform determines whether the color scale applied to the radar signal's amplitude is linear, logarithmic, or exponential. This function can also be used to de-emphasize certain features. For example, in a logarithmic display, all low amplitude signals are assigned into a "compressed" lower color range, and the range of high amplitude signals is extended. If white represents a high amplitude signal, then there will be more white area for a given data set than a linear transform. Transforms 2 and 3 are used to emphasize weak reflections, and Transforms 4 and 5 are used to emphasize high amplitude reflections.

During system setup you should always use Color Xform 1, **which is linear**. Though not required, we recommend using Color Xform 1 when collecting data.

WIGGLE AND O-SCOPE DISPLAY PARAMETERS

SCALE

The scaling parameter defines the number of vertical lines used to represent each wiggle. The larger the scale value, the larger the wiggle representation.

In O-Scope Mode, the scaling parameter defines the section of the amplitude scale observed. When Scale is 1, the full amplitude scale is shown. When Scale is 2, only the bottom 50% of the amplitude scale is shown. When Scale is 3, only the bottom 30% of the amplitude scale is shown, etc. Increasing the Scale parameter allows one to progressively zoom in on the scan.

HOR SCALE

This parameter controls the Horizontal Scale labeling when in O-Scope Display Mode. The Horizontal Scale can be set to Time, Depth or None. If **None,** no horizontal scale will be printed in the Wiggle Mode, but a time scale will be printed in O-Scope Mode. If set to **Time,** the horizontal scale will be two-way travel time in nanoseconds.

If set to **Depth,** the horizontal scale will be in meters below the surface. Note that the depth scale is only approximate, based on the ASSUMED dielectric constant of the subsurface. See the DIEL parameter help for details.

SPACE

The spacing parameter sets how many vertical lines to move before printing the next wiggle. The higher the spacing value, the larger the spacing between wiggles.

STACK

The stacking refers to the number of incoming scans to stack for printing and display. This stacking does not apply to the recorded data. For example, a stack=4 will stack incoming scans into one (1) output scan for printing and display.

SKIP

Skip refers to the number of scans to skip for printing and display. This will have no effect on the scans recorded. For example, a skip=1 will skip every other scan for printing and display. A skip of 2 will print a scan, skip two scans and print the next scan.

3.3 Saving The System Parameter Settings For Future Use

After setting up the system operating parameters, you may wish to save the setting for future use. This is done by using the **Save Setup** command accessed from the **Setup** command in the COLLECT SETUP MENU block or the PLAYBACK SETUP MENU block. This command is at the bottom of the second column of commands.

SAVE SETUP

This command allows you to save all of the current system settings into a setup file. This file can then be recalled any time in the future and the system will be set to the current

CHAPTER 4: DATA COLLECTION

4.1 Preparing For Data Collection

After setting the operating system parameters, either automatically (see Sections 2.6 and 3.1) or manually (see Chapter 3), you are ready to collect data. As a reminder, we have listed below three critical parameters that you should verify:

- Is the **Disk Output** set to ON?
- Have you selected the correct Run Mode, either **Cont** (continuous), **SW** (survey wheel) or **Point** (point collection)? If you are using a survey wheel, has it been calibrated?
- If you are going to print data real-time, have you selected the correct printer and set **Print** to ON?

The COLLECT DATA MENU block is entered by pressing the *Run/Standby* key. What you see on the screen will depend upon the Run Mode you set.

- If the Run Mode is set to **Cont** (continuous), the system will begin collecting data and it will show across the screen. The file and scan number will appear in the lower right corner of the screen.
- If the Run Mode is set to **SW** (survey wheel), a scan will appear on the left end of the screen and the rest of the screen will remain blank until you begin to move the antenna/survey wheel.
- If the Run Mode is set to **Point** (point collection), a scan will appear on the left end of the screen. The rest of the screen will remain blank until you press the *Run/Standby* key or the marker to begin collect the next data point or survey station.

Section 4.2 describes continuous data acquisition and the parameters in the COLLECT DATA MENU block.

Section 4.3 will describe operation in the survey wheel controlled method and Section 4.4 will describe operation with the discrete data point method.

NOTE:

All users should read section 4.2.

4.2 Continuous Data Collection Method

The antenna is pulled continuously across the ground and the SIR-2 collects data at the number of scans per second selected. The data collection rate is independent of the speed at which the antenna is pulled. The resulting subsurface profile is referenced to a ground

2D GRID

This function is not operational at this time.

When 2d Grid is operational, this parameter is the line number that will be entered into the file header for the next line of data to be acquired.

STARTP

When 2d Grid is operational, this parameter is the Y coordinate value for the starting point of the line.

ENDP

When 2d Grid is operational, this parameter is the Y coordinate for the ending point of the line.

MARK INTVL

When 2d Grid is operational, this parameter is the Y coordinate interval between marker (survey grid) locations along the line.

STEP

For the parameter shown in the box above, this is the increment that will be used when changing the value of the parameter.

After the desired value of the parameter is set, press the *Enter* ↵ key to register that value in the system.

SELECT BLOCK

This command is used to select a block of data for printing or saving to disk. The block of data selected can be more than one screen size. When this command is selected, the command menu will disappear from the screen and a vertical line (cursor) will appear in the middle of the screen. Move the cursor using the *Right* → and *Left* ← arrow keys until it is on the first (leftmost) scan of the block of data you want to select. Press the *Down* ↓ arrow key to select the beginning of the block. Now, using the *Right* → arrow key, move the cursor until it is on the last (furthest to the right) scan of the block of data you wish to select. As you move the cursor, a cross-hatched diagonal highlighted area will appear over the data that will be selected. Press the *Up* ↑ arrow key to complete the selection. Press the *Print* 🖶 key to print the selected data block. Press *Enter* ↵ and then select **Dump To File** to save the selected block in a file. If **Disk On** is selected, data will be stored to the file with name FILENAME+L (a letter A-Z will be appended to the original file name), otherwise a file name with a number greater than the last file number recorded will be created. Press the *Enter* ↵ key to exit the **Select Block** function.

DUMP TO FILE

This command enables you to save a selected block to a separate data file. After a block of data has been selected, highlight the **Dump To File** command and press *Enter* ↵.

that station. Continue this collection technique until the end of the survey line. To stop collecting data at the end of a survey line press the *Run/Standby* key and hold for 2 seconds at the last station. This will close the file and the system will be ready for the next survey line.

NOTE:

The antenna marker switch cannot be used to close the data file at the end of a line in point mode. You must use the *Run/Standby* key to close the file in this mode. This is done by holding the *Run/Standby* key depressed for 2 seconds at the last station on the line.

CHAPTER 5: DATA PLAYBACK AND REVIEW

Selection of files to playback and setup of system display, processing and output during playback are done in the PLAYBACK SETUP MENU block. Playback of data already collected and stored on the disk is done via the PLAYBACK DATA MENU block.

5.1 Playback Setup Menu Block

This block is entered when the system is powered ON without an antenna, or from the PLAYBACK DATA MENU block by entering the **Setup** command. It is entered from the COLLECT SETUP MENU block by pressing the *Collect/Playback* (%) key.

5.1.1 Setup For Processing Of Playback Data

During playback, Gains, Horizontal Filters and Vertical Filters can be applied to the data to improve interpretation.

SETUP

When this command is highlighted, a set of playback processing parameters that can be set appears in the second column. The commands that will appear in the second column are; **Processing, Play All, Save Setup, Recall Setup,** and **Show Setup.**

Pressing the *Enter* (↵) key when **Setup** is highlighted will have no effect.

When **Processing** is highlighted, the following options appear in a menu box to the right:

GAIN

This function is used to apply an additional gain constant to the data files as they are played back to the system or transferred to a computer. You can apply this gain if the data acquired is too low in amplitude and difficult to interpret.

Activating this function will cause a parameter setup box to appear to the right. Use this box to adjust the value of the gain to be applied.

When setting the values of the gain, the *Up* (↑) arrow is used to increase the value of the parameter and the *Down* (↓) arrow is used to decrease the value of the parameter. The *Right* (→) and *Left* (←) arrows are used to increase or decrease the increment when setting the gain values. The gain values are in units of decibels (dB). Every 6 decibel increase is equivalent to doubling the amplitude of all points in the signal.

SHOW SETUP

Displays the current system setup parameters.

5.1.2 Data Display And Printing During Playback

There are three types of displays available during playback, Linescan, Wiggle and O-Scope. These displays can be printed during playback on the DPU-5400 (Seiko Model DPU5400 4" thermal plotter) or the GS-608P (OYO Model GS-608P 8" thermal plotter).

OUTPUT

When this command is highlighted, the output setup commands appear in the second column. Pressing the *Enter* ↵ key when **Output** is highlighted will have no effect.

PRINT

This function turns the print output ON or OFF by pressing the *Enter* ↵ key. When it is turned ON, a third column of printer control commands appears.

DISK

Disk ON writes the playback file to the hard drive and appends a letter to the filename each time the file is saved.

XFER

See Section 7.3.1.

PRINTER

Use this command to select the printer you will be using to print the data. The *Enter* ↵ key is used to toggle between two selections, the OYO Model GS-608P 8" thermal plotter, and the Seiko Model DPU5400 4" thermal plotter. Make sure the printer cable is connected and the printer turned ON before selecting the printer.

The maximum real-time scan rate when printing is 32 scans/sec.

HORIZONTAL ZOOM

This parameter stretches the data printout in the horizontal direction. The possible values are 1, 2, 3, or 4 and the *Enter* ↵ key is used to change the value.

A value of 1 means that each scan of a data file is printed as one scan on the printer. A value of 2 means that each scan of a file is output as 2 duplicate scans on the printer. A value of 3 means that each scan of file is output as 3 scans on the printer and a value of 4 means 4 scans are printed for each scan in a data file.

When in Linescan Mode the DPU5400 and the GS-608P print 200 and 203 scans per inch respectively. The SIR-2 video display displays 94 scans per inch. The Horizontal Zoom setting of 2 will give the best match between the aspect ratio of the video screen and that of the printout.

ORIENTATION

This parameter controls the orientation of the data as it is printed on the paper. The orientation can be Normal or Flipped and is changed by pressing the *Enter* ↵ key.

data with multiple colors, with Color Xform 5, which emphasizes the high data amplitudes and will decrease the amount of color representing the data.

During system setup you should always use Color Xform 1 (linear). We also recommend using Color Xform 1 when collecting data.

During data playback Color Xform 2 is useful when viewing low amplitude regions and Color Xform 4 is useful when the objective is to see only high amplitude targets (i.e., metal, or voids).

VERT SCALE

This parameter controls the vertical scale labeling. The vertical scale can be set to Time, Depth or None. If **None** is selected, no vertical scale will be printed. If set to **Time,** the vertical scale will show two-way travel time in nanoseconds.

If set to **Depth,** the vertical scale will display meters below the surface. Note that the depth scale is only approximate, and based on an *assumed* dielectric constant value for the subsurface. See the Diel parameter help for details.

DIEL

This parameter is the value of dielectric constant used to convert two-way travel time to depth. The value can range from 1 to 81 or more and varies greatly with electrical and physical properties of the subsurface materials. Note: The default dielectric value for a depth scale is 1. Be sure to select an appropriate dielectric value before collecting/playing back data.

WARNING: Dielectric constant values for various materials and the resulting depth scales are only approximations. For a description of methods for estimating the dielectric constant of the subsurface at your site, see your training notes.

Approximate dielectric constants for various common materials follow:

SPACE

The spacing parameter determines how many vertical line spaces to skip before printing the next wiggle. The higher the spacing value, the larger the spacing between wiggles. This function will have the effect of lengthening a radar profile.

STACK

Stacking refers to the number of incoming scans to stack (add) for print and display purposes only. Stacking does not apply to the recorded data. For example, setting Stack = 4 will stack 4 incoming scans into one (1) output scan for printing and display. This function will have the effect of shortening a radar profile.

SKIP

Skip refers to the number of scans to skip for print or display purposes only. This will have no effect on recorded data. For example, a Skip = 1 will skip every other scan for printing and display. A Skip of 2 will print (display) a scan, skip two scans and print (display) the next scan. This function will have the effect of shortening a radar profile.

5.1.3 Selecting Files For Playback

Activate the **Files** command and then from the second column choose **Select** or **Select All** (the **Select All** command is at the bottom of the second column). The **Select** command allows you to choose individual files or groups of files to playback. This is accomplished by highlighting the file or files you want to playback with the cursor, and then pressing the *Enter* ↵ key. This action will place a box around the file(s) you have selected, and the SIR-2 will play them back when the *Run/Standby* is pressed. The first time the *Run/Standby* key is pressed, the file header will be displayed. The second time the *Run/Standby* key is pressed, the file will play back. If the file is longer than one screen, you can scroll back and forth through the file using the *Right* → and *Left* ← arrow keys. The **Select All** command will select all files on the disk for playback.

5.2 Playback Data Menu Block

This block is entered from the COLLECT DATA MENU block by pressing the *Collect/ Playback* key. It is entered from the PLAYBACK SETUP MENU block by pressing the *Run/Standby* key.

REVIEWING THE CURRENT DATA FILE BY SCROLLING

If the current data file size is greater than one screen, the data file (up to the limit of system memory) can be reviewed using the SIR-2 scroll capability. Press the *Run/Standby* key to put the system in Standby. Use the *Right* → arrow key to view data to the left of the current data screen and use the *Left* ← arrow to view data to the right of the current data screen.

the cursor until it is on the last (right-most) scan of the block of data you wish to print. As you move the cursor, a cross-hatched diagonal highlight box will appear over the data that you select. Press the *Up* ↑ arrow key to input the end of the block you are interested in. Press the *Print* key to print the selected data block, or use the **Dump To File** command to save the selected block into its own file. If **Disk On** is selected, data will be stored to the file with name FILENAME+L (a letter A-Z will be appended to the original file name), otherwise a new file name with one higher number than the last file name will be created. Press the *Enter* ↵ key to exit the **Select Block** function.

DUMP TO FILE

This command enables you to save a selected block to a separate data file. After a block of data has been selected, highlight the **Dump To File** command and press *Enter* ↵.

DROP MENU

This command will cause the command menu to disappear, allowing the bottom of the data to be viewed.

GO TO SETUP

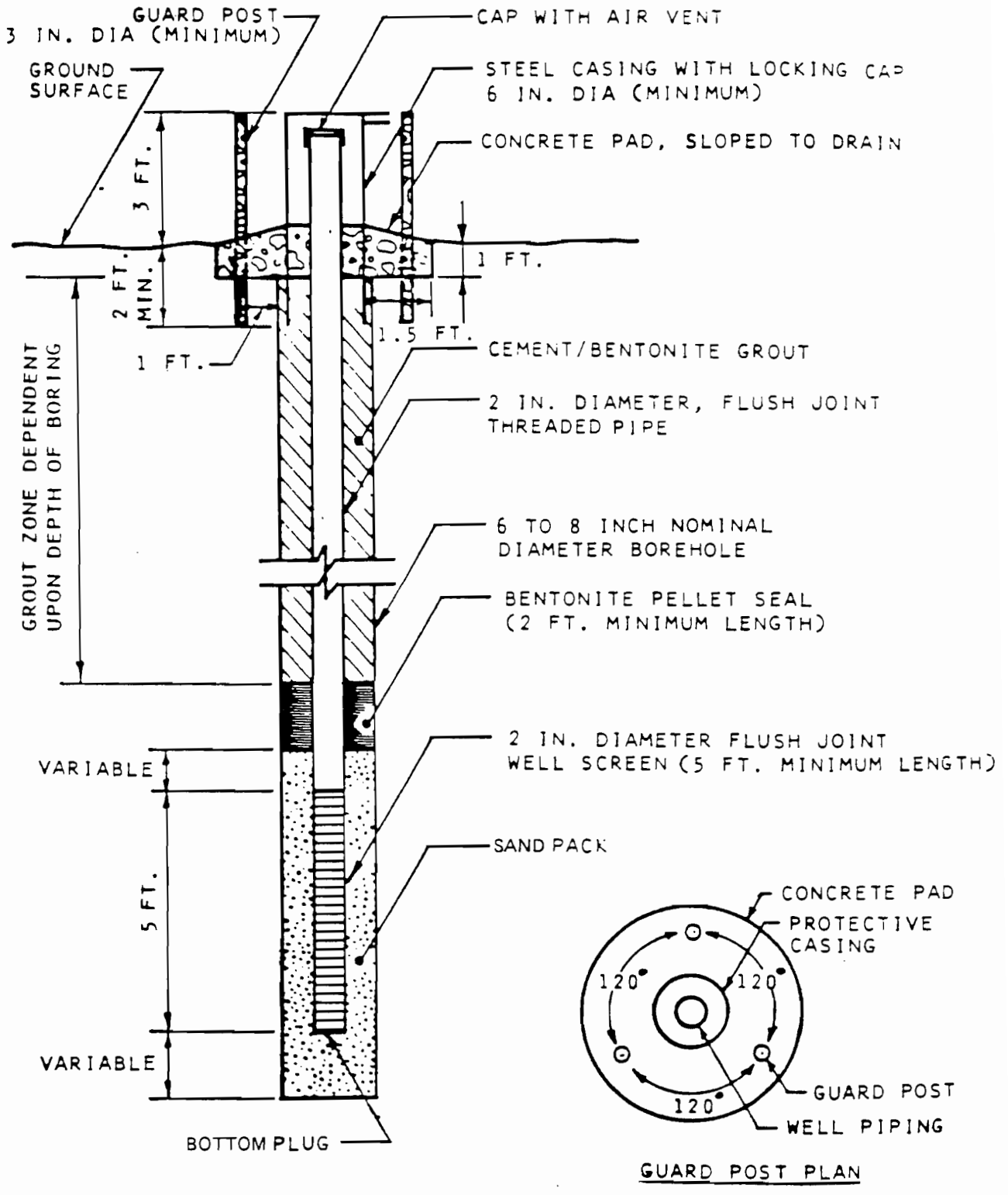
When the system is in the Collect Data Mode, selecting this command will put the system in the collect setup mode. When the system is in the Playback Data Mode, selecting this command will put the system in the Playback Setup Mode.

APPENDIX B:

Monitoring Well Construction Diagrams

36 Sylvester Street Site No. 1-30-043U
Westbury, New York
00-096

TYPICAL MONITORING WELL INSTALLATION



Taken from USEPA "A Compendium of Superfund Field Operation Methods", 1987

APPENDIX C:

Monitoring Well Boring Log
36 Sylvester Street Site No. 1-30-043U
Westbury, New York
00-096

Impact Environmental

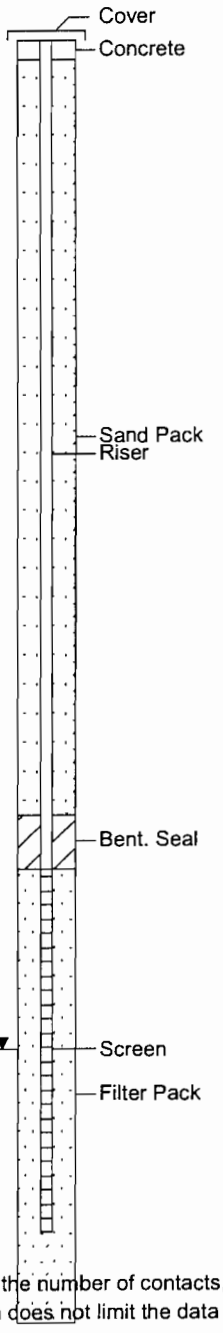
LOG OF BORING MW-1

Remedial Investigation
36 Sylvester Street Site No. 1-30-043U

Date Drilled :
Equipment :
Surface Elevation :
Logged By :

Well: MW
Elev.:

Depth in Feet	REMARKS	Water Levels	USCS	DESCRIPTION	GRAPHIC	Formation
0				SAND, Well Graded,		
10						
20						
30			GW			
40						
50						
60						
70						



For this demonstration version, the number of contacts, samples, and general parameter data points are limited to 5, 5, and 10. The full version does not limit the data this way.

05-01-2000 C:\KEVIN'S DOCUMENTS\CURRENT\00-096 WESTBURY\00-096.BOR

APPENDIX D:

Chemtech, Inc. Statement of Qualifications

36 Sylvester Street Site No. 1-30-043U
Westbury, New York
00-096

CHEMTECH

STATEMENT

OF

QUALIFICATIONS

TABLE OF CONTENTS

- NYSDEC, ASP Validation

- Legal and Regulatory Enforcement

1.1 Field Services and Sample Collection

Proper sample collection is critical to the integrity of the data resulting from analyses. Chemtech provides proper sample containers and preservatives as per the governing regulations to assist the client with proper sample collection.

Each sample collection kit includes a cooler containing all the necessary labeled bottles, Custody seals, Chain of Custody forms, preservatives and directions.

If preferred, Chemtech's field technicians can collect or direct the collection of air, water and soil samples.

1.2 Sample Control and Preparation

If sampling is performed by the client, samples are either picked up by our delivery staff or received by overnight couriers. If Chemtech is collecting the samples, they are delivered to the laboratory by the sampling staff. The sample control area is equipped with walk-in coolers (4° C) and dry storage areas for used and unused samples. The samples remain under stringent chain-of-custody control throughout the preparation, analysis and disposal process.

After analysis, any unused portion of sample, digestion or extract volumes are returned to Sample Control for storage or return to the customer. After the 30 days storage time, samples are properly disposed by licensed waste management companies in federally approved facilities.

1.3 Laboratory Analytical Services

As a full service environmental laboratory, Chemtech is capable of analyzing samples by a variety of methodologies, using various instrumentation and classical techniques.

1.3.1 Metals

1.3.1.a. Atomic Absorption Spectroscopy (AA):

After the sample preparation is completed, determination of trace concentrations of inorganic elements is performed by Atomic Absorption Spectroscopy (AA), either by Flame, Cold Vapor or Furnace techniques.

1.3.1.b Inductively Coupled Argon Plasma Spectroscopy (ICAP):

A majority of metals analyses are performed by ICAP simultaneous instrumentation. This technique can analyze each sample for up to 30 metallic elements in a single aspiration. Analytical tests routinely performed by ICAP include:

- Total Characteristic Leaching Procedure (TCLP) Metals
- Priority Pollutant Metals (PPM)
- NYSDEC, ASP
- Appendix IX Metals
- Target Analyte List (TAL) Metals (CLP and SW 846)
- Primary and Secondary Drinking Water Metals
- Metals Speciation

1.3.2 Organic

1.3.2.a Gas Chromatography/Mass Spectrometry (GC/MS)

Gas chromatography combined with a mass spectrometer detector is the most powerful tool for accurate identification and quantification of complex mixtures of organic compounds. This technique is widely used in analysis of groundwater, wastewater and soil for industrial pollutants, and in special concerns where the identity of unknown but suspected trace organic contaminants must be determined.

Chemtech offers many customized analytical services as well as the following types of standard services and analytical methods:

- USEPA Contract Laboratory Program (CLP) Methodologies
- US EPA Superfund CLP, Target Compound List Analyses (TCL)
- New York State DEC Superfund ASP Organic Analyses
- Solid Waste Manual Methodologies (SW846-8000 Series)
- Priority Pollutant Analyses (US EPA 600 Series)
- Drinking Water Analyses (US EPA 500 Series)
- Appendix IX Organic Analyses
- Identification of Tentative Compounds (TICs)

1.3.2.b Gas Chromatography (GC)

Chemtech is capable of performing many GC methods for analysis of samples suspected of containing pesticides or PCBs, or other known organic substances as a less expensive and often more sensitive (lower detection limit) alternative to GC/MS methods. Chemtech has six Gas Chromatographs with a wide range of detectors, including Halls Electrolytic Conductivity, Electron Capture, Flame Ionization and Photoionization.

All GC's are equipped with autosamplers and are integrated into a computerized data management system. These instruments are generally used for analyzing many types of organic compounds, including:

- Halogenated Volatile Organics (EPA 601, 8010)
- Aromatic Volatile Organics (EPA 602, 8020)
- Halogenated and Aromatic Volatile Organics (8021)
- Pesticides and PCB's (EPA 608, 8081/8082)
- PCB Congeners (8082)
- Chlorinated Herbicides (EPA 615, 8151)
- Organophosphorus Pesticides (EPA 8140)
- Gasoline and Diesel Range Organics (GRO/DRO EPA 8015M)
- USEPA Contract Laboratory Program Methodologies (CLP)
- NIOSH Air analysis Methods

1.3.2.c High Performance Liquid Chromatography (HPLC)

- PAHs (SW-846, Method 8310)
- Low Level Explosives (SW-846, Method 8330)

1.3.2.d TOC, TOX, TPH and IR Analysis

Samples are screened and analyzed for Total Organic Carbon , Total Organic Halides, Total Petroleum Hydrocarbons and Infra-Red (IR).

1.3.3 Classical & General Chemistry

Chemtech is uniquely qualified to process a large number of samples for a variety of limited chemistry. Chemtech's Wet Laboratory includes instrumentation such as Technicon Auto Analyzer II with multiple modules, UV-Visible Spectrophotometer, Ion Analyzers and multi distillation apparatus for cyanide and phenols analysis.

1.4 Waste Characterization and Treatability

Chemtech has extensive experience in the sampling and analysis of waste drums. The following are some of the analyses performed on these types of samples:

- Physical Characteristics
- Chemical Compositions
- Hazardous Characteristics
- Ignitability, Corrosivity Reactivity
- Toxicity Characteristic Leaching Procedure (TCLP)
- Synthetic Leaching Procedure (SPLP)
- ASTM Leaching Procedure

2.0 SAMPLING AND ANALYTICAL METHODOLOGIES

Sampling and analysis are performed using Chemtech's Standard Operating Procedures (SOP's) for analysis which are prepared based on US EPA and States Regulatory Agencies approved analytical and sampling procedures.

3.0 DATA PROCESSING AND REPORTING

The data processing and report generation department coordinates the data management requests and the assembly of a report in accordance with the specific requirements of the customer. Chemtech's data management capabilities complement its analytical services, by providing a solution for understanding, assessment and evaluation of large volume and complex analytical data.

3.1 Report Formats:

Chemtech is capable of providing different levels of reporting to meet specific regulatory and customer requirements; including standard, EPA Superfund, Contract Laboratory Protocol (CLP), NJDEP Reduced Deliverables, NJDEP Regulatory Deliverables-US EPA/CLP Methods and Non- USEPA/CLP Methods, and NYSDEC ASP formats

3.2 Electronic Data Deliverables (EDD):

Computer readable diskettes in DOS, ASCII formats are available for CLP and ASP packages. These disks can be used to directly load analytical results into most database softwares. Other customized spreadsheets EDD based on the specific projects requirements are available in other ASCII, Quattro pro, Excel, or Lotus database formats.

Chemtech can also provide ERPIMS and IRDMIS EDD in support of US Department of Defense-Air Force and Army Corps of Engineers Projects.

3.3 Data Archival/Data Retrieval

Chemtech maintains all raw data, laboratory notebooks, and other documentation pertinent to each project for three years from the date of report. Data retrieval from archives will be handled in a similar fashion to a request for analysis.

To maintain the client confidentiality, a specific written work request authorized by the original client must be submitted for retrieval of any data.

4.0 FACILITIES

Chemtech occupies over 18,000 square feet of space at 205 Campus Plaza 1, Edison, NJ. The single level facility houses the corporate headquarters as well as the laboratory facilities. The facility allows for contiguous space expansion.

Entrance to the laboratory is controlled by a security system. During regular business hours, entrance is into the Office/Reception area or directly into the sample receiving area (doorway or loading dock). After normal business hours, entrance and exit is by authorized personnel only. This entrance requires a security code.

All critical temperature areas, such as freezers, ovens, refrigerators, data processing rooms, phone and modem system rooms are closely monitored to ensure the integrity of the samples, analysis and reporting of the data. All temperatures are properly documented in the appropriate logbooks.

4.1 Sample Receipt Area

A separate portion of the laboratory equipped with hoods and adequate ventilation is designated as sample receipt area. The provided work space includes the benches with chemical resistant tops for receiving and safe handling of the coolers and samples.

4.2 Storage Area

Walking cooler and large commercial size refrigerators equipped with locks for security, are used to store the samples. Standards are stored in separate refrigerators away from the samples. The cool storage capacity is designed for simultaneous processing of large size projects.

4.3 Sample Preparation Laboratories

The sample preparation laboratories are isolated from the other sections to prevent cross contamination between the digested and undigested samples. These laboratories are equipped with four large hoods and digestion of Low, Medium and High Concentration for organic and inorganic samples according to the EPA CLP and Non-CLP methodologies.

4.4 Classical and General Chemistry Laboratory

An area encompassing over 2000 square feet and 300 square feet of bench space enables this laboratory to handle large and multi parameter projects for all matrices.

4.5 Instrumentation Laboratories

These laboratories consist of AA Lab, ICAP Lab, GC Lab and GC/MS Lab. Separated from each other and the rest of the operation, these laboratories are designed for a clean and contamination free environment to process a large number of samples for CLP and Non-CLP analyses.

4.6 Laboratory Hood Ventilation System

All hoods are monitored for air velocity and the information is logged in the logbooks. Every instrument is operated under a separate ventilation system and the entire laboratory is under negative pressure and is designed for a very safe working environment.

4.7 Chemical Hygiene Plan

Chemtech has taken all of the required steps to bring each of the division facilities into compliance with the OSHA Laboratory Standard. A site specific CHP is located at each facility. The CHP was prepared by an independent qualified consulting firm.

On site safety and hazardous substance training has been completed, as required, by the Laboratory Standard.

5.0 INSTRUMENTATION

Partial list of instruments includes:

GAS CHROMATOGRAPH/MASS SPECTROMETRY SYSTEMS

Instrumentation	Make	Model	Autosampler	Data System
GC/MS # 1	Hewlett-Packard	5971A	Tekmar	HP Chemstation
GC/MS # 2	Hewlett-Packard	5971A	Tekmar	HP Chemstation
GC/MS # 3	Hewlett-Packard	5971A	Tekmar	HP Chemstation
GC/MS # 4	Hewlett-Packard	5970	Tekmar	HP Chemstation
GC/MS # 5	Hewlett-Packard	5970	Tekmar	HP Chemstation
GC/MS # 6	Hewlett-Packard	5970	Arcon	HP Chemstation
GC/MS # 7	Hewlett-Packard	5970	Arcon	HP Chemstation
GC/MS # 8	Hewlett-Packard	5970	Precept	HP Chemstation
GC/MS # 9	Hewlett-Packard	5970	HP7673	HP Chemstation
GC/MS # 10	Hewlett-Packard	5970	HP7673	HP Chemstation
GC/MS # 11	Hewlett-Packard	5970	HP7673	HP Chemstation
GC/MS # 12	Hewlett-Packard	5970	HP7673	HP Chemstation
GC/MS # 13	Hewlett-Packard	5970	HP7673	HP Chemstation
GC/MS # 14	Hewlett-Packard	5970	HP7673	HP Chemstation
GC/MS # 15 *	Hewlett-Packard	5971	HP7673	HP Chemstation
GC/MS # 16 *	Hewlett-Packard	5995	HP7673	HP Chemstation

- Note: Presently not in use. 2/29/00

GAS CHROMATOGRAPHS

Instrumentation	Make	Model	Autosampler	Detector	Data System
GC # 1	Hewlett-Packard	5890	HP7673	Dual ECD	HP Chem
GC # 2	Hewlett-Packard	5890	HP7673	Dual ECD	HP Chem
GC # 3	Hewlett-Packard	5890	HP7673A	Dual ECD	HP Chem
GC # 4	Hewlett-Packard	5890	HP7673A	Dual ECD	HP Chem
GC # 5	Hewlett-Packard	5890	HP7673A	Dual ECD	HP Chem
GC # 6	Hewlett-Packard	5890	HP7673A	Dual ECD	HP Chem
GC # 7	Hewlett-Packard	5890II	HP7673A	Dual ECD	HP Chem
GC # 8	Hewlett-Packard	5890	HP7673A	Dual FID	HP Chem
GC # 9	Hewlett-Packard	5890II	HP7673A	Dual FID	HP Chem
GC # 10	Perken Elmer	Autosy	PE Autosys.	Hall/PID	HP Chem
GC # 11	Tracor	540	Tekmar	Hall/PID	HP Chem
GC # 12	Varian	3400	Tekmar	PID	HP Chem
GC # 13	Tremetrics	9000	Demension	PID/Hall/FID	HP Chem

TOTAL ORGANIC HALOGENS

Instrumentation	Make	Model	Autosampler	Detector	Data System
TOX Analyzer	Mitsubishi	TOX-10E	TOX-10E	NA	Chemtech LIMS/Labtrol

HPLC SYSTEMS

Make	Model	Autosampler	Detector	Data System
Hewlett Packard	1100 (UVD)	HP Series	UV/Fluorescent	PC

ORGANIC EXTRACTION SYSTEM

Instrumentation	Make	Model	Autosampler
GPC	ABC	AS2000	ABC-1000
GPC	OI	AP-500	AP-500
Turbovap	Zymark	II	NA

SPECTROPHOTOMETERS

Instrumentation	Make	Model	Data System
ICP	Thermo Jarrell Ash	TRACE 61E	Chemtech LIMS/Labtrol
ICP	Thermo Jarrell Ash	TRACE 61E	Chemtech LIMS/Labtrol
GFAA	Perkin Elmer	5100	Chemtech LIMS/Labtrol
GFAA	Perkin Elmer	5100	Chemtech LIMS/Labtrol
AACV	Spectro	Spectro Product	Chemtech LIMS/Labtrol
IR	Perkin Elmer	1310	Chemtech LIMS/Labtrol
UV/VIS	GBC	UV/VIS 918	Chemtech LIMS/Labtrol

6.0 STATE CERTIFICATIONS:

A. New York State, Department of Health (NYSDOH # 11376):

1. Potable Water:
2. Non-Potable Water / Wastewater
3. Environmental Analyses / Air and Emissions
4. Environmental Analyses / Solid And Hazardous Waste

B. New York State Department of Health, ASP Certification

ASP / CLP Inorganic and Organic Analysis

C. State of New Jersey, Department of Environmental Protection (NJDEP # 12013):

1. Potable Water
2. Non-Potable Water
3. Solid Waste
4. CLP

D. State of Oklahoma, Department of Environmental Quality (# 9705)

1. Drinking Water
2. Wastewater
3. Solid Waste

E. Commonwealth of Pennsylvania, Department of Environmental Protection (# 68548)

1. Drinking Water

F. State of Connecticut Department of Health (# PH 0649)

1. Potable Water
2. Wastewater
3. Sewage
4. Effluent
5. Soil

7.0 LABORATORY ORGANIZATION AND MANAGEMENT STRUCTURE

Prior to start of any analytical work on any project, the requirements of the client and Statement of Work are fully discussed among project manager, supervisors, analysts, and the staff assigned to the project. During these meetings laboratory personnel are familiarized with the requirements, and are asked to participate in the planning and implementation of the project.

Chemtech uses a Project Management system to plan, coordinate, integrate and monitor project activities. Efficient and effective project management is critical to the successful execution of any contract and to building lasting customer relationships. To assure that there is a clear and specific understanding of all the technical and administrative aspects of a project, an initial "project kick off meeting" is scheduled with the customer and our project management team.

At Chemtech, Project Management Teams are organized as a unit separate from laboratory operations. In this manner, laboratory project managers work with the customer to address the project requirements and with the laboratory operations staff to schedule and track the project's progress. Our Technical Director is an integral part of the Project Management Team. His responsibilities include the review of all technical issues as they relate to analytical protocols and regulatory requirements.

This team approach to project management provides the customer with a team of qualified laboratory professionals who can answer all questions and solve problems in a responsive manner.

As soon as samples are scheduled to arrive at the laboratory the Laboratory Supervisor, QA/QC Supervisor, and Laboratory Manager are notified. Laboratory procedures and personnel involved shall be reviewed and analysts shall be scheduled to process the upcoming workload.

After the samples arrive in the laboratory, the sample custodian will check the containers, verifying the content. He will follow the SOP for sample receipt, making sure that all the necessary documents have been received, and that all the information is correct, and all the samples are in good condition. In case any problem is encountered, the information will be given to the Laboratory Manager, who will call the project officer in charge, for further guidance. Upon adopting the project officer's recommendations regarding the found discrepancies, or if all the documentation and samples are in a good condition, the sample custodian will sign and date the chain-of-custody form and will start the logging-in process. The samples will be logged into the computer according to the SOP. Log page, and labels will be produced. The labels will be placed on each appropriate bottle, and they will be matched to the information on the bottles for the second time. These labels shall contain the project sample numbers, and Chemtech case and sample numbers. The log pages will be placed in the case folders and a copy will be given to Laboratory Manager.

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The Laboratory Manager at this point will prepare the sample preparation log page. This sheet will be reviewed by the QA/QC Supervisor for completeness. This sheet will list all of the samples of the same matrix.

Sample log pages will indicate the matrices of the samples, project sample and case numbers, Chemtech sample and case numbers, dilution factors, balance standardization check weight (in case of digestion by weight), and name of the analyst. The Laboratory Supervisor shall oversee the sample preparation and make sure that all the requirements of the contract are fully implemented. He also will check by estimation the sample volume for liquids and sample weight for soil and sludges, ensuring adequate sample volume for completion of the analyses.

After completion of sample preparation, the digestion log page will be signed and dated by the analyst. The digestion log page is submitted to the QA/QC Supervisor and is placed in the permanent case folder, in order to be sent out as part of the documentation.

Analysts will start the analyses for indicated parameters utilizing contract required instrumentation, and methodologies.

Sample duplicates, spikes and all the other QC involved shall be completed. If at any time any analyst has a problem with any part of the analysis, he will contact the Laboratory Manager and QA/QC Supervisor requesting guidance.

All the information regarding the analyses shall be recorded in permanent logbooks and a copy of these log pages will be placed in the folder, as part of the submittal. If at any time there is a problem with one of instruments, the analysis will be performed on the back-up unit. Every instrument and every analyst performing the analyses has at least one backup. When necessary the laboratory has and will operate twenty-four hours in three consecutive shifts per day, seven days a week.

After each section of the analyses is completed, the computer printout containing the results and all information pertaining to the case, with the analyst's signature shall be submitted to the QA/QC Supervisor. QA/QC will immediately review the printout making sure that all the contract requirements have been met.

All analytical data produced by the analysts are reviewed by the QA/QC Supervisor for completeness, correctness, and contractual requirements. After completion of reviewing the data it is then given to data reduction personnel for reporting. After the case is complete it is again reviewed by the QA/QC Supervisor. If everything is correct it will be submitted to the Laboratory Manager for final review and signature.

8.0 PERSONNEL QUALIFICATIONS

Emanuel Hedvat, President - Mr. Hedvat is responsible for the management of the laboratory. His responsibilities include establishing the objectives of the laboratory including the planning and implementation required to meeting the objectives. Mr. Hedvat has a BS & MS in Chemistry and over 19 years of environmental laboratory experience.

Divya Mehta, Chief Operating Officer - Mr. Mehta is responsible for all the operating functions of the laboratory, including the overall technical performance and data quality. He also provides technical expertise and the resources as required to meet contractual requirements. Mr. Mehta has a BS & MS in Chemical Engineering and over 15 years of environmental laboratory experience.

Katherine Santacana, QA/QC Director - Ms. Santacana is responsible for the QA/QC programs and ensures compliance to all Standard Operating Procedures. She is also responsible for the data validation and reporting requirements. Ms Santacana has a BA in Biology and over 13 years of environmental laboratory experience.

Suketu Shah, Systems Manager - Mr. Shah is responsible for managing and updating all the computer systems including the LIMS. He is also responsible for generating and updating the automated deliverables including coordinating the preparation of all electronic deliverables. Mr. Shah has a BS in electronics and an MS in Computer Science with over 5 years of laboratory computer experience.

Thomas Mancuso, Laboratory Director & Organic Manager - Mr. Mancuso is responsible for managing the day to day functions of the laboratory including the accurate and timely reporting of data in compliance with the regulatory requirements. He is also in charge of the Organic Department, including Sample Prep, GC and GC/MS. Mr. Mancuso has a BS in Chemistry and over 18 years of environmental laboratory experience.

Hamex Patel, Inorganic Manger - Mr. Patel is in charge of the Inorganic Department, including Sample Prep, Wet Chemistry and Trace Metals. He is responsible for managing the day to day functions of the department including scheduling data processing and data quality. Mr. Patel has a BS in Chemical Engineering over 3 years of environmental laboratory experience.

APPENDIX E:

Qualifications of Key Personnel
36 Sylvester Street Site No. 1-30-043U
Westbury, New York
00-096

Richard Parrish, P.G.

6 Florida Avenue
Commack, New York 11725
(516) 543-8822

Highlights of Qualifications

- Proven success in implementing productivity-enhancement programs
- Excellent personnel and financial management skills and experience
- Strong practical and theoretical foundation in improving engineering and production methods
- Solid experience working with government regulatory agencies

Professional Experience

Impact Environmental, Kings Park, New York — 1989-Present
Senior Geologist

Supervised geologists, industrial engineers, environmental biologists and computer analysts to develop and implement sampling and analysis operations, quality assurance programs and performance measurement systems. Managed all aspects of corporate finance and budgeting (one million dollar gross per year). Performed staffing analysis, computer systems analysis, computer simulation programming.

Served as supervisor and contract manager on over three hundred petrochemical spill sites throughout New York State, representing both generators and government agencies. Provided contract and sub-contract services to Fortune-500 companies including: Pepsicola Bottling Co. (Pespsico), Coca-Cola Bottling Co., Texaco (Star Enterprises), Burger King Corp., AT&T, Laidlaw, Blockbuster Video, Gencor and Reith-Rieley Construction Co. Provided contract and sub-contract services to regional financial institutions including: European American Bank, The Dime Savings Bank, Key Bank of New York, Fleet Bank, State Bank of Long Island, Long Island Commercial Bank, Shawmut, Roslyn Savings Bank, Home Federal Savings and Sterling Commercial Capital.

Pioneered the solid waste recycling industry. Major projects included the first beneficial use determinations (BUD) issued in the State of New York and the State of Indiana for the utilization of non-hazardous petroleum hydrocarbon contaminated soils as an asphalt aggregate. Said projects included designing, installing, permitting and testing pollution control apparatus (thermal oxidizers). Authored twelve BUD petitions for various other solid waste related projects in New York State. Developed new process for the recycling of petroleum hydrocarbon contaminated soils in the State of New York. Process was approved by the New York State Department of Environmental Conservation in November 1995.

Supervised RI/FS work plans development for Grove Cleaners and select sites within the New Cassel Industrial Park, Inactive Hazardous Waste Disposal Site.

Achievements

- Certified Professional Geologist, Tennessee Department of Commerce, 1994.
- Senior Project Manager for the Mt. Hope Soil Recycling Facility, Calverton, NY.
- Senior Project Manager for the Prima Soil Recycling Facility, Holtsville, NY.
- Senior Project Manager for the Rason Soil Recycling Facility, Cedarhurst, NY.
- Senior Project Manager for the ART Soil Recycling Facility, Indianapolis, IN.
- Recipient of the Long Island Association Young Entrepreneur of the Year, 1992.
- Recipient of Hofstra University School of Business Achievement Award, 1992.

Town of Smithtown, Department of Environmental Protection, Smithtown, New York 1985-1988

Investigator/Aide

Incident response supervisor for town hazardous material spill unit. Enforced the town health and safety codes. Assisted Suffolk County Health Department in enforcing sanitary codes. Investigated and prepared detailed reports of violations of the \New York State Environmental Conservation Laws for submission to State Conservation Officers. Worked on various marine habitat/population surveys. Supervised all town sampling and analysis programs. Trained town employees on OSHA issues including the Written Hazard Communication Laws and "Right to Know" legislation.

Achievements

- Coauthored the Town of Smithtown Underground Storage Tank Management Program.
- Senior Project Manager for the State funded Nissequogue River Pollution Study.
- Senior Project Manager, Town of Smithtown Landfill Worker Safety and Hazardous Material Exposure Reduction Program; received an award for meritorious achievement.
- Lead Agent for a joint investigation between the Town of Smithtown and the Suffolk County District Attorneys Office to prosecute Chemtronics Corporation of Hauppauge.
- Senior Project Manager, Town of Smithtown Beach Water Quality Management Plan; included the sampling of beach waters in Smithtown by town officials and analysis by the county forensic laboratory for fecal coliform

Education

Masters in Waste Management - SUNY Stony Brook, Candidate (1996)
Bachelors of Arts - Earth and Space Science - SUNY Stony Brook, 1989
Waste Management Certificate Program, Waste Management Institute, CED, 1994

Training

United State Environmental Protection Agency, Office of Remedial and Emergency Response, forth hour training for Hazardous Materials Response for First Responders, Rochester, New York, 1988.

United State Environmental Protection Agency, Office of Remedial and Emergency Response, twenty-four hour training for Sampling for Hazardous Materials, Princeton, New Jersey, 1989.

New York State Law Enforcement Seminar, Stony Brook, New York, 1989.

Organizations

Member of the New York State Department of Environmental Conservation's Citizens Advisory Committee for Inactive Hazardous Material Waste Disposal Sites, 1989

National Wellwater Association, 1992

Member of the National Association of Environmental Professionals, 1992

National Asphalt Manufacturers Association, 1993

Long Island Association, 1990

Long Island Venture Group, 1992

Environmental Assessment Association, 1994

Keith M. Franzen
27 Winston Road. Centereach, New York. 11720 • (516) 732-2842

EDUCATION:

Bachelors of Engineering Degree, Mechanical Engineering, December 1993
State University of New York at Stony Brook

Bachelors of Science Degree, Construction Management, December 1991
Utica College of Syracuse University
Dean's Honor List - Spring 1991

Professional Engineer Candidate - Part A Satisfied

EMPLOYMENT:

Impact Environmental, Kings Park, New York
Engineering Geologist [May 1993 - Present]
Employed to perform geological engineering and design engineering tasks for Phase I and II Environmental Site Assessments and Corrective Action Plans. Responsible for scheduling projects, the preparation of reports and supervision of field personnel. Managed the design and construction of various hazardous substance containment structures.

Employment Highlights

- Project Manager for the Suffolk County Health Department Remedial Investigation Project conducted at the New York Institute of Technology Central Islip Campus. Involved defining the periphery of contamination originating from eight abandoned waste water lagoons.

- Project Manager for the New York State Department of Transportation Farragut Service Station Corrective Action Plan. Integral in the design and execution of an Investigation Report to determine the nature and extent of site contamination. Participated in the installation and operation of a groundwater pump and treat system to mitigate a dissolved product plume. Project value $200,000.

- Project Manager for over fifty active New York State Department of Environmental Conservation spill sites. Projects have included all phases of Corrective Action Plan stipulations between clients and the State of New York. Average project value $25,000.

Franzen Construction, Centereach, New York
Owner [August 1990 - May 1994]
Self-employed construction contractor. Performed design work, construction and evaluations of structural integrity of wood frame structures. Contracted for residential home improvements requiring carpentry, mason, plumbing and electrical skills.

TRAINING:

Geoprobe Operating Seminar, Kejr Engineering, Salina Kansas - Trained in the operation of the *Geoprobe* Model 8L Hydraulic Probing System. Interface with both standard and macro-bore assemblies. Member of the *Geoprobe* 100 Plus Club.

Knowledgeable in both Macintosh and IBM - compatible operating systems: System Software; MacDraw, MacWrite, Claris CAD, Claris Works, Excel, Surfer, Autocad R12, Harvard Graphics and Quattro Pro.

Kevin Kleaka

88 Madison Avenue
Westbury, New York

EDUCATION

Bachelor of Science in Environmental Science, with a minor in Chemistry.
State University of New York at Plattsburgh, December 1995 .

Applied Environmental Science and Agricultural Program at Miner Institute, Chazy, NY, 1994.

Scholastic Excellence: Lake Champlain PCB Analysis, Fall 1995
Certificate of Academic Excellence, Spring 1994.
Dean's List, Spring 1993.

EMPLOYMENT EXPERIENCE

Pharmacy Technician IV, Wyeth Ayerst Laboratories, Rouses Point, New York.
December 1995-June 1997. Assigned to the division of chromatographic separations. Perform laboratory procedures and analyses, in accordance with USFDA approved analytical test methods, for Quality Assurance and Technical Services by Liquid, Gas and Thin Layer Chromatography. Proficiency in data analysis through acquisition system Access*Chrom, utilization of computerized LIMS database, calibration and maintenance of laboratory equipment.

Environmental Scientist, Impact Environmental, Kings Park, New York.
June 1997-Present. Technical operator for Geoprobe sampling system for the acquisition of subsurface soil and groundwater (June 97-August 98). Technical operator for ground penetrating radar (GPR) unit to locate subsurface structures (December 97-Present). Performance of Phase II Environmental Site Assessments for various lending institutions and private clients. Includes supervision of quality assurance and control of sample acquisition, sample design and laboratory analysis plans, map generation, interpretation of laboratory data in comparison to federal, state and local regulations, and report generation (August 98-present). Performance of Phase I Environmental Site Assessments in accordance with ASTM industry standards. Includes database research, on-site inspections, report generations (September 98-Present) .

SPECIAL SKILLS

IBM Computer Application Programs: WordPerfect, Quattro Pro, Surfer, Stella 2, Access*Chrom.
Macintosh Computer Application Programs: Microsoft Word, Excel, Claris Works, Claris CAD.

RELEVANT COURSEWORK

Chemistry I and II, Environmental Chemistry, Water Quality Modeling, Chemical processes in the Environment, Aquatic Chemistry, Geology, Geochemistry, Hydrology, Soil Science.

REFERENCES

Available upon request.

347 Concord Ave.
Lindenhurst, NY 11757
Home (516) 226-4130

Eric P. Krist

Objective

To secure a position as an Environmental Technician

Work experience

1998 – present Control Mechanical Inc. Copiague, NY

Plumbing Apprentice

- Assist plumbing mechanics with all aspects of plumbing

1994 – 1998 Power House Sheet Metal Hicksville, NY

Driver / Warehouse /Fork Lift Operator

- Ensured completion of daily deliveries, Handled the fabrication of orders, received merchandise

Volunteer experience

Member of the Copiague Volunteer Fire Department since July, 1990

- (Related certificate) **Hazardous Materials First Responder**
  (16 Hours of instruction)

References

Furnished upon request

Education

High School Equivalency Diploma University of the State of New York

GED

Charles K. Buccino
5 Ireland Place
Copiague, NY 11726
(516) 264-7117

OBJECTIVE: To obtain a position with a company where I can potentially grow, and utilize my mechanical skills, education and experience.

EXPERIENCE:

5/96-2/98: Sam Axinn Lumber, Amityville, NY - Home Improvement Center
Driver/ Yard Worker
Responsibilities included:
- Matching job orders to the correct material, and delivery of same
- Safe use of heavy equipment within the yard
- Repair and maintenance of machinery used everyday
- Customer service

3/95-12/95: Century 21, Bayshore, NY – Real Estate
Maintenance/ Repair, Construction
Responsibilities included:
- Rebuild and repair of houses purchased by the company
- Maintenance of occupied homes rented through the company

5/90- 9/94 Ancon Gear, Farmingdale, NY – Machine shop / Gear manufacturer
Machine operator
Responsibilities included:
- Set up and operation of computer programmed milling machines
- Set up and operation of lathes and screw machines
- Operation of gear cutting machinery
- Established and maintained a preventative maintenance schedule
- Repair of machinery as needed
- Established and maintained a complete inventory of equipment and tools in stock and operation.
- Operated fork lift

8/85- 4/90 South Bay Construction, Amityville, NY – Construction company
Carpenter's assistant/ truck driver
Responsibilities included:
- Assisted with the framing of new houses
- Application of roof layers and shingles
- Pick up and deliver materials to various sites
- Maintained and repaired tools and machinery as needed

10/76- 6/85 Controlled Alloy, Commack, NY – Sheet metal manufacturer
Sheet metal mechanic
Responsibilities included:

- Fabricated parts from sheet steel from blue prints
- Set up and operated punch and power presses, brakes, power shears
- Setup a maintenance schedule for all machinery
- Repaired and maintained equipment and machinery
- Use of heavy operating equipment
- Delivered material when needed

EDUCATION:

Graduated 6/76 Copiague High School, Copiague, NY
General High school diploma

1975-1976 Lewis A. Wilson Technical School, Dix Hills, NY

- Diploma in Carpentry

Additional training classes included:

- Blue print reading
- Auto Cad R12

MEMBERSHIPS:

10/76- Present: Copiague Volunteer Fire Department, Copiague, NY
New York State Certified Class A Fireman
Member of the Eagle Engine Company
Responsibilities include:

- Advanced firefighting
- Training members in all aspects of firefighting, pump operations, and emergency vehicle operations

OTHER:

New York State valid Class B drivers license

REFERENCES:

Available upon request