SPECTRUM FINISHING CORP.

PHASE II - HAZARDOUS WASTE FIELD INVESTIGATION

WORK PLAN

APRIL 1985

1.0 INTRODUCTION

In response to the New York State Department of Environmental Conservation's (DEC) consent order, SPECTRUM FINISHING CORPORATION submits herewith, a field investigation program for the PHASE II investigation. The objectives of the field investigation program are as follows:

- determine the nature of wastes at the site, including areal and vertical distribution.
- identify past or current episodes of chemical releases.
- evaluate on-site and off-site impacts from chemical spillage.

In order to accomplish the stated objectives, a hydrogeologic study will be performed at the site. Emphasis will be placed on identifying and quantifying the sites hydrodynamic and hydrochemical characteristics.

The project will be divided into 4 tasks as follows:

- Task I Obtain background information.
- Task II Preparation of specifications and performance of field programs.
- Task III Laboratory Analysis.
- Task IV Report Preparation.

2.0 TASK I

2.1 Background Information

Background information will be collected to develop the site's history and information such as past and present operations, chemical flow balance, identify spill areas, and storage and handling procedures of chemicals will be collected. In addition to the site's history, the following information will be obtained.

- Regional geology, ground water flow, water quality, stratigraphy, etc.
- Locations of nearby public and private wells.
- Identification of nearby industries.
- Ground water usage.

3.0 TASK II

3.1 Specification Preparation

The following specifications have been developed for field and laboratory activities. The specifications require that all procedures adhere to standard acceptable methods and/or USEPA methods, where applicable.

- Drilling and Testing (Attachment A)
- Laboratory Testing (Attachment B)
- Withdrawal, Storage, and Preservation of Ground Water Samples (Attachment C)
- Geophysical Survey (Attachment D)

Quality assurance and quality control measures are written into each specification.

3.2 Drilling and Testing

A qualified hydrogeologist or a professional engineer will supervise all field activities during drilling, testing, and well installation. Four (4) borings will be drilled at the site and soil samples collected continuously for the first 15 ft. and every 5 ft. thereafter. The samples will be classified in the field using the Unified Soil Classification System. During drilling, in-situ gravity tests will be performed in order to characterize the hydrodynamics of the site. Such testing will occur at each boring.

Upon the completion of drilling and testing, a 3" or 4" PVC monitoring well will be installed with a 10' screen at a depth of approximately 25' at each borehole. A typical installation design is illustrated on FIGURE 1. After installation, each well will be developed to assure a good hydraulic connection with the formation. Well development is necessary in order to obtain a representative ground water sample.

At the completion of well development, formation testing, (if possible), will be performed at each well with the use of a centrifugal pump. Water will be pumped from the well and drawdown within the well will be measured. Each test will run for approximately 30 minutes with a discharge rate of approximately 20 gpm. This information, along with the in-situ data, will be used to ascertain site hydrodynamics.

Well locations are shown on FIGURE 2.
The wells are positioned for the following reasons:

OW-1 To obtain background water quality data.

OW-2 To intercept possible ground water contamination from past practices of a company adjacent to SPECTRUM.

OW-3 To obtain ground water quality data down gradient from the site.

OW-4 To obtain ground water quality data down gradient from the site.

3.3 Ground Water Sampling

Upon completion of drilling and testing, one round of ground water sampling will be performed. Procedures outlined in Attachment C will be strictly adhered to. Techniques for ground water withdrawal, preservation and storage will be in accordance to USEPA standards. Samples will be stored at 4C and transported to an approved laboratory within 24 hours.

3.4 Total Combustible Gas (TCG) Readings of Soils

During drilling, TCG readings will be taken of soil samples for the first 25' to aid in the detection of downward migration of volatile chemicals. Background readings of TCG will be taken periodically. Prior to each use, the TCG meter will be calibrated. All data will be recorded in a field log book.

3.5 Field Log Book

The field engineer will keep a field log book and record daily progress, problems, and observations during the course of field activities. The log book will dedicated to this project.

3.6 Geophysical Survey

A geophysical survey will be performed at the site utilizing the terrain conductivity technique in order to identify the existence of any ground water pollution plumes. Data collected will be analyzed and plotted on a map and contoured. Readings will be taken for an exploration depth of approximately 25'.(Note: ground water elevation at the site is estimated to be at a depth of 16'.)

3.7 Ground Water Level Measurements

Periodically, say once every 24 hours, during the field program, ground water measurements will be taken at each well. All measurements will be recorded to the nearest one-hundreth of a foot. The data will be used to develop a site ground water contour map.

4.0 TASK III

4.1 Laboratory Analysis

Ground water and soil samples collected during the field program will be delivered to their respective laboratories for analyses. The following analyses will be performed:

Water Samples

1. pH
2. specific conductance
3. chlorides
4. toulene
5. 2-butanone
6. chromium
7. cadmium
8. iron
9. nickel
10. zinc
11. cyanide

Soil Samples

1. Grain size distribution
2. Atterburgh limits

For further details refer to Attachment B.

5.0 Report Preparation

Data collected in the field and in the laboratory will be evaluated, tabulated and submitted in report format. The main objectives of the report are identified in Section 1.0. A tentative report outline is given below and may change as new information becomes available.

5.1 REPORT OUTLINE

1.0 INTRODUCTION

- 1.1 Location
- 1.2 Scope of Work
- 1.3 Plant's History
- 1.4 Environmental Plant Audit
- 1.5 Plant Operations

2.0 FIELD INVESTIGATION

- 2.1 Drilling and Testing
- 2.2 Laboratory Testing
- 2.3 Geophysical Survey

3.0 REGIONAL HYDROGEOLOGY

- 3.1 Geology
- 3.2 Stratigraphy
- 3.3 Hydrology
- 3.4 Water Quality
- 3.5 Public and Private Wells

4.0 SITE HYDROGEOLOGY

- 4.1 Stratigraphy
- 4.2 Hydrology
- 4.3 Geophysics
- 4.4 Water Quality

5.0 MITIGATIVE MEASURES (Article 12)

6.0 HAZARD RATING

7.0 RECOMMENDATIONS

8.0 SUMMARY & CONCLUSIONS

Appendicies

5.2 DRAFT & FINAL REPORT

A draft report will be submitted to the state for review and comment. Comments submitted by the state will be incorporated into the final report where appropriate and a final report submitted.

FIGURE-1

EXISTING 1-STORY BUILDING

MW-1

MW-2

GRASS AREA

PAVED PARKING LOT

UNDERGROUND STORAGE
#2 FUEL OIL, 2000 gals

LEACHING POOL
BACKFILLED & SEALED
(1981) by order
Suffolk County

cover, below grade

cover

GRASS

STORM WATER
LEACHING POOLS
(5 typ)

GRASS AREA

DATUM floor slab
EL. 65.70'

SPECTRUM FINISHING CORP.

MW-3

CABOT STREET

DALE STREET

EXISTING 1-STORY BUILDING

GRASS AREA

GRASS

MW-4

PAVED PARKING LOT

LOCATION SITE PLAN
FOR PROPOSED PHASE II INVESTIGATION
SPECTRUM FINISHING Corp.

RICHARD D. GALLI, Inc.
CONSULTING ENGINEERS, HYDROGEOLOGISTS
East Northport, New York

dr by: WHT	scale: NTS	proj. no: 1001-001
ck'd by: RDG	date: 5 APRIL 85	fig. no: 1

SPECTRUM FINISHING CORPORATION

PHASE II - HAZARDOUS WASTE FIELD INVESTIGATION PROGRAM

SPECIFICATION FOR A DRILLING AND TESTING PROGRAM

April 1985

Specifications for a Drilling and Testing Program -

CONTENTS

CONTENTS (CONT'D)

SPECIFICATION FOR A DRILLING AND TESTING PROGRAM

1.0 PURPOSE OF WORK

1.1 The purpose of this program will be to assess the impacts of heavy metals and certain volatile organics local water resources and to evaluate site hydrodynamics.

1.2 By appropriate drilling, testing, and sampling procedures, information will be acquired to determine the type, sequence and hydrogeologic characteristics of the soil material underlying the sites.

1.3 By installation of a number of observation wells, information will be acquired on ground water elevation and chemical characteristics.

2.0 SITE DESCRIPTION

2.1 Introduction

The following description is provided for general information only, and may not represent the actual conditions to be encountered during the performance of this work

SPECTRUM FINISHING COMPANY and/or its Engineer will not be responsible for any deductions, interpretations, or conclusions drawn by the Contractor as to the nature of the subsurface materials or the efforts required to perform his work, that differ from the written description or the apparent conditions as determined by an onsite visit. The risk that actual conditions may vary should be reflected in the unit prices.

2.2 Location and Introduction

Figure 1 shows the location of the site. The site is located in the Town of Babylon.

2.3 Area and Site Geology

The region is underlain by several hundred feet of Pleistocene marine and glacial deposits represented, in descending order by: a) Upper Pleistocene Deposits (outwash sand and gravel, lacustrine clays); b) Gardiners Clay; and c) Jameco Gravel. Beneath the Pleistocene deposits lie Cretaceous age sands and clays, also several hundred feet thick, and represented by: a) Magothy-Matawan Sands (with interbedded clay); b) Raritan Clay; and c) Lloyd Sand. The Cretaceous deposits overlie pre-Cambrian bed-rock, consisting of schist and gneiss.

3.0 DEFINITIONS

Within the context of the work to be performed, the following definitions will apply:

3.1 Owner: defines SPECTRUM FINISHING CORPORATION and its representatives.

3.2 Engineer: defines Richard Galli, and his representatives, as consultant to the Owner.

3.3 Contractor: defines and its representatives, including subcontractors, who will perform the work hereinafter specified.

3.4 Others: defines any other firms, individuals or agencies who may be appointed to perform certain aspects of the work by the Owner or the Engineer.

4.0 SCOPE OF WORK AND RESPONSIBILITIES OF THE PARTIES

4.1 The work to be performed under this specification shall consist of: making soil borings; performing in-situ geotechnical and hydrologic tests; collecting and preserving soil samples; installing observation wells; and preparing field reports on the results obtained.

4.2 The Contractor shall furnish the qualified technical personnel, and all labor, equipment, tools, materials, supplies, transportation and incidentals required to complete the work.

4.3 The Contractor, at the request or with the approval of the Engineer, may change the location and number of borings and wells, the type of sampling required or the amount of services to be performed in any category as the work progresses. Such changes will be based on the needs of the job as they may vary with the information disclosed by the completed borings and/or by parallel studies which may be performed at the site. Work will be subject to inspection by the Owner and/or Engineer.

4.4 Responsibilities of the Contractor

4.4.1 Any and all arrangements required to gain access to the site and perform the specified services, including all drilling permits and clearances shall be the

responsibility of the Contractor.

4.4.2 The Contractor shall be responsible for supplying all services (including labor), equipment and material required to perform the drilling and testing program, the necessary soil testing, as well as maintenance and quality control of such required equipment.

4.4.3 The Contractor will be responsible for the correctness of the procedures to be used, as well as for the accurate reporting of the results thereof, as described in this specification and as required by the Engineer.

4.4.4 The Contractor shall be responsible for restoring all areas used by him in his work to the satisfaction of the Engineer.

4.4.5 The Contractor shall report any problem encountered in the field, which might preclude the successful performance of any items of this specification, to the Engineer within 24 hours.

4.4.6 The Contractor shall provide the Engineer advance written notification for any changes in field procedures, describing and justifying such changes with a copy to the Owner. No changes shall be made to the procedures, unless requested or authorized in writing by the Engineer. In certain cases, prior written

authorization may be waived by the Engineer, at his discretion, and the changes may be requested and/or authorized verbally. This waiver, however, will not release the Contractor of his obligation to follow up with a written explanation for the aforesaid changes.

4.5 Responsibilities of the Engineer and Owner

4.5.1 A representative of the Owner and/or Engineer will generally be present during the field operations for consultation. However, their physical presence is not to be construed as an obligation of either the Owner or Engineer, nor shall it relieve the Contractor in any way whatsoever of his obligations under this Contract.

4.5.2 The Owner and/or Engineer shall not be responsible for any loss or damage to equipment sustained by the Contractor, prior to, during, and after the performance of this contract.

4.6 Communication

4.6.1 All correspondence shall contain the following subject headings:

Job Order Number (J.O. NO.)

Letter's Serial Number (e.g., Contractor's Initials-NC - year - No.)

4.6.2 All correspondence shall be addressed to:

SPECTRUM FINISHING CORPORATION
50 Dale Street
West Babylon, New York 11708
Attn: Mr. William DeChirico

4.6.3 A cover letter shall accompany all technical reports, and shall include a summarized description of their content.

4.6.4 Boring logs and other drilling and testing information will be submitted as described in Section 9.0 and other parts of this Specification.

5.0 SERVICES AND PRICES

5.1 General Criteria

5.1.1 The Contractor shall supply all personnel, vehicles, equipment, instruments, services, facilities, power and support necessary for the successful completion of the proposed work. Deliverables, supervision, travel, subsistence and reports shall be included in the prices.

5.1.2 The Contractor understands that the compensation paid shall be based on the unit prices. With the approval of the Engineer, or if so ordered by him, modifications to the estimated quantities shall be made by the Contractor and payment shall be adjusted for the actual work done and accepted.

5.1.3 The Contractor should further note that the item quantities tabulated below may not represent true anticipated items or quantities, but are only used for the purpose of estimating the cost of work. The tabulated items include, but may not be limited to those that can be reasonably expected to be used efficiently and successfully, as alternatives or combinations thereof, in light of the Engineer's present state of knowledge and understanding of the site hydrogeologic conditions. The tabulated quantities have been selected with the same criteria.

5.1.4 The Engineer reserves the right to reject any items or prices if deemed, in his opinion, to be technically, costwise or otherwise inadequate and/or unrealistic.

5.1.5 The Contractor is encouraged to present and document, together with his contract bid, any ideas he might have on methods and procedures that, in his opinion, would be more effective both technically and cost-wise. The Owner and/or Engineer will review and consider, but not be bound to accept such alternative methods and procedures.

5.2 Price Schedule

The following is a tabulation to be used by the Contractor in preparing his estimate. Unit prices shall be furnished for all items, including those for which zero quantity has been estimated.

	Item	Unit	Est. Amt.	Unit Price	Total Price
1.0	Soil Borings				
1.1	Hollow Stem Auger dia. to accommodate 4" I.D. P.V.C. pipe				
1.1.1	0-50 feet	LF	120		
1.1.2	50-100 feet	LF	0		
1.2	Cased Hole, 6" dia.				
1.2.1	0-50 feet	LF	0		$ 0
1.2.2	50-100 feet	LF	0		$ 0
2.0	Undisturbed Samples				
2.1	Shelby Tube	Ea	0		
2.2	Stationary Piston or Osterberg	Ea	0		$ 0
2.3	3-3/4" Split Spoon	Ea	0		$ 0
3.0	Field Permeability Tests	Hour	6		
3.1	Gravity Tests				
4.0	PVC Observation Wells Installation				
4.1.1	3" I.D. Pipe	LF	90		$ 0
4.1.2	3" I.D. Screen	LF	40		$ 0
4.2.1	4" I.D. Pipe	LF	0		
4.2.2	4" I.D. Screen	LF	0		
4.3	Sealant Pellets	lb.	50		
4.4	1 Liter PVC Bailers (at cost)	Each	4		
5.0	Formation Tests, Including Pump Assembly				
5.1	Pumping Tests	Hour	4		
5.2	Slug Tests	Hour	0		
5.3	Bailer Tests	Hour	0		
6.0	Split Spoon Samples				
6.1	0-50 feet	Each	44		
6.2	51-100 feet	Each	0		
7.0	Protective Casing				
7.1	Steel Casing (6" x 5')	Each	2		
7.2	Casing Flush to Ground level	Each	2		
8.0	Decontamination of Drilling Tools	Hour	2		
9.0	Safety Equipment				
9.1	Total Combustible Gas Monitors	Each	1		
10.0	Well Survey	Lump sum			
11.0	Standby Time	Hour	2		
12.0	Mobilization & Demobilization	Each	1		
12.1	Rig	Each	1		
	TOTAL COST OF CONTRACT				

6.0 MEASUREMENT AND PAYMENT

6.1 Payment for the items included in this Contract shall be for the work actually done and accepted, according to the unit prices, or fraction thereof, listed in Section 5.2, Price Schedule, and except as described below.

6.2 No payment will be made for lost tools, drill rods, bits, or any other equipment normally involved in the operations. No payment will be made for casing left in place unless it has been left at the specific request of the Engineer.

6.3 No payment will be made for driller's boring logs. The cost shall be included in the unit prices for Soil Drilling.

No payment will be made for logs of field permeability or other tests. The cost shall be included in the unit prices for said Tests.

No payment will be made for marking, packaging and shipping soil samples. The cost shall be included in all the other items of work.

7.0 TECHNICAL REQUIREMENTS FOR DRILLING AND TESTING

7.1 General

7.1.1 Bore holes shall be made with heavy duty drilling equipment of a size and type designed to drill holes of the required sizes and depth specified herein. Drilling units shall be equipped with a hydraulic feed. The use of drilling fluids other than water will be subject to the Engineer's approval.

Field Permeability Tests shall be conducted with proper pumping and testing equipment, having adequate capacity as specified herein. The pumping and testing equipment shall include, but not be limited to, pumps, rods, hoses, water level indicators and other miscellaneous equipment required for conducting the tests.

7.1.2 Observation wells shall be installed by use of proper equipment, having adequate capacity and quantity and all required accessories. The installation equipment shall include, but not be limited to, drilling rigs, jacks, casing, pipes and screens of the required types, diameters and schedules, granular filter material, sealing material, and other miscellaneous equipment required for installation.

7.1.3 Where it is determined by the Engineer that muddy or

otherwise contaminated drilling or pumping test water might flow into any streams, or similar water bodies where such contamination is illegal or undesirable, the Contractor shall provide the necessary equipment and supplies to recirculate and/or clarify return water. Pumping supply lines at such locations shall be equipped with a bypass valve and discharge line so that when pumped clarified water is not being used for drilling, it may discharged at a suitable location away from the drilling units.

7.1.4 The Contractor shall dispose of any drilling fluid other than water in a manner approved by the Engineer. No discharge shall be allowed to flow directly to any natural surface water body. Random disposal at the boring locations or surrounding property is not acceptable.

7.1.5 The general areas in which the test holes are to be located are shown on Figure 2, (MONITORING WELL LOCATION PLAN), which is attached. Table 1 lists the proposed wells and their estimated depths. Additional drawings may be furnished or approved hereafter by the Engineer to explain the work in greater detail.

7.1.6 The boring locations shown or implied on the Plans are approximate. The exact location shall be determined in the field by the Engineer. In case of relocations or adjustments, the Engineer shall be consulted and his decisions shall be final.

7.1.7 The Contractor shall assist the Engineer in obtaining the following information:

a. A detailed log for each test hole. This log shall include a description of all materials sampled, the method of sampling, and any other pertinent drilling and testing information obtained as the work progresses.

b. A log of all testing and observation well installation procedures and results.

7.2 Access and Setup

The Contractor shall be responsible for providing access to all drilling and testing locations and for setting up all drilling, pumping, and associated equipment at each location. The manner of access shall be subject to the Engineer's approval.

8.0 TECHNICAL PROCEDURES FOR TEST HOLES

8.1 General

The purpose of these tests holes is to determine the type, thickness, and certain physical properties of various fill and soil strata which underlie the site. The physical properties are to be determined by field (in situ) tests. Soil samples are to be collected both for visual identification and for laboratory testing by others.

8.2 Drilling in Soils

This subsection applies to all drilling in soil materials including, but not being limited to, sand, gravel, clay, silt, cobbles, boulders, hardpan, and miscellaneous landfill material.

8.2.1 Drilling by Hollow - Stem Auger Method

8.2.1.1 This method shall be applicable wherever representative or in situ samples, or both, are required and formation is of an unconsolidated nature such as to permit auger drilling. This method shall be applicable instead of casing for sampling in any formation of such nature as to permit auger drilling.

8.2.1.2 A hollow-stem auger of appropriate size shall be used to

accommodate the installation of 4-inch I.D. P.V.C pipe for monitoring wells, or as approved by the Engineer, to an expected maximum depth of 130 ft. The procedures for performing hollow-stem auger soil investigation shall conform with the "Suggested Method for Soil Investigation and Sampling by Hollow-Stem Auger Borings," as outlined in ASTM 1970 edition of "Special Procedures for Testing Soil and Rock for Engineering Purposes."

8.2.1.3 The auger shall be advanced in stages of not more than five (5) feet, by rotating and hydraulically pressing the auger. Whenever possible, a measurement of the force required to advance the auger shall be obtained and recorded. Advancing the auger ahead of the soil sample to be taken will not be permitted.

8.2.1.4 The outside diameter (O.D.) and inside diameter (I.D.) of the auger rods shall be such as to permit undisturbed and disturbed soil sampling, monitoring well installation (4" I.D.), and in-situ permeability testing, as described herein.

8.2.1.5 Sampler clearance shall be such that no sampler barrel will be operated in or through a hollow-stem auger whose bore is less than 110 percent of the sampler outside diameter.

8.2.1.6 The hollow-stem auger may be advanced and sampling conducted by any power-operated drilling machine having sufficient torque and ram range to rotate and force the auger to the desired depth, provided the machine is equipped with the accessory equipment needed to take the required sample or core.

8.2.1.7 The hollow-stem auger shall be advanced with plug in place to the desired sampling depth. The plug shall be retracted by withdrawing the center drill rods. The plug shall be removed from the drill rods and replaced with desired sampling or coring tool. The sampling tool shall be lowered and seated through the hollow-stem auger into the exposed undisturbed material at the bottom of the hole. The sampling operation shall be performed by rotation, pressing, or driving in accordance with the standard or approved method governing use of the particular sampling tool. The loaded sampler shall be retracted by withdrawing the center drill rods. The sampler shall be replaced with plug and the plug returned to the bottom of the hole. The plug shall be locked in place and the entire auger string shall be rotated to the next desired sample depth. The sequence shall be repeated for each sampled desire.

8.2.1.8 The hollow-stem auger may be used without the plug at the discretion of the Engineer. When so used, a plug of soil may be expected to form at the mouth of the auger. This plug will seldom exceed 4 to 6 in. in thickness. Samplers can normally be pressed or driven through this plug. However, the plug of soil then becomes the upper part of the sample. Accordingly, samplers for use in the hollow-stem auger should be fitted with soil reservoirs or spoil barrels if the auger is to be used without a plug.

8.2.1.9 Hollow-stem auger will be used without the plug when operating below the water table or in other saturated formations. In such cases the hollow-stem auger shall be advanced to the desired sampling depth; then the hole shall be washed out in the same manner precribed for casing cleanout. Then sampling will be performed as in any cased hole.

8.2.1.10 When drilling below the water table, and in order to perform accurate field permeability tests, the connectors of the hollow-stem auger shall be made water-tight by use of an "O" ring seal or similar approved device.

8.2.1.11 When gravelly or hard material is encountered which prevents advancing the auger, the auger shall be pulled

out and casing shall be used.

8.2.2 Drilling by Cased Hole Method

8.2.2.1 This method shall be applicable wherever the formation and the ground water conditions are such as not to permit hollow-stem auger drilling, or as the Engineer's representative directs. With the cased hole method, soil samples shall be recovered only by means of a sampling spoon attached to the end of the hollow drill rod which shall be lowered at the bottom of the previously cleaned hole and driven into the undisturbed soil below the bottom of the hole.

8.2.2.2 Casing for soil boring shall be extra heavy pipe; the minimum nominal diameter shall be 6 inches. Overburden and observation well installation requirements may require the use of larger size casing than specified or of telescoping techniques. The contractor may use such casing and/or techniques without increase of cost. Flush joint casing equipped with a cutting bit may be required to drill through boulders or construction rubble. The Contractor may use such casing when conditions warrant without increase of cost.

8.2.2.3 The casing shall be driven down in stages of not more than five (5) feet, after which the material shall be cleaned out by rotary drilling, by washpipe and chopping

bit, or by some other method. Water shall generally be used for removing the loosened soil. When gravelly or other coarse materials are encountered, drilling mud may be used, subject to approval by the Engineer, to remove the cuttings. A continuous record shall be kept of the blows per foot in driving the casing.

8.2.2.4 Simultaneous washing and driving of the casing will not be permitted except when approved by the Engineer. The elevations between which water is used in driving the casing shall be recorded when this procedure is used.

8.2.2.5 The casing shall be used all the way down to the final depth of the hole. When stiff cohesive soils such as clays are encountered such that the borehole will not cave, the Contractor may drill through such soils without using casing, subject to approval by the Engineer.

8.2.2.6 The casing when driven shall be advanced by a three hundred (300) pound hammer falling freely through a height of thirty (30) inches.

8.2.2.7 It shall be the Contractor's responsibility when boulders or other obstacles are encountered to carry the drilling though or past such obstacles to enable normal spoon samples to be taken as required.

8.2.3 Mud Rotary

8.2.3.1 This method shall be applicable wherever the formation and the ground water conditions are such as not to permit hollow-stem auger drilling, or cased-hole drilling, or as the Engineer's representative directs.

8.2.3.2 During drilling, hydrostatic pressure of the drilling fluid shall exceed the earth pressures and any artesian pressures.

8.2.3.3 If during mud thickening, the drilling fluid becomes too viscous to pump down the hole, additives may be added to the drilling fluid with approval from the engineer.

8.2.3.4 The driller shall use a biodegradable organic mud such as "Revert", manufactured by UOP Johnson, or approved equivalent, which will eventually break down and permit the flow of ground water around the well screen.

8.2.3.5 Mud density shall be measured as pounds per gallon in the field with the use of a mud balance. A weight of approximately 9.0 pounds per gallon is regarded desirable. However, local geology and landfill material may result in a different pound per gallon number. It will be the responsibility of the driller to determine the appropriate mud weight on a per gallon basis.

8.2.3.6 Fluid viscosity shall be measured in the field by use of a Marsh funnel or equivalent device. The test is performed by filling the funnel to a volume of 1,500 cm^3, then noting the drainage time (in seconds) of the drilling fluid. Generally, a 9.0 lb per gallon fluid requires 35 to 45 seconds to drain.

8.2.3.7 For proper weight and viscosity, the drilling fluid should carry less than 5 percent sand.

8.3 Soil Sampling

8.3.1 General

As for the drilling methods, the sampling methods herein described will be used in accordance with the types of material encountered, and as approved or requested by the Engineer.

The following methods may be used as alternatives or in combination, as warranted by the field conditions and as approved by the Engineer.

8.3.2 Split - Spoon Sampling

8.3.2.1 During the process of driving the casing or hollow-stem auger, split barrel spoon drive samples shall be taken. Soil samples shall be taken every 5 feet, or as requested or approved by the Engineer, through soil material.

When boulders or other obstacles are encountered which render ordinary sampling impractical, the normal sampling at that depth may be omitted with approval of the Engineer. At locations where samples are to be taken, driving or washing of the casing or borehole shall be stopped, the loose material removed from the hole, and an approved spoon sampler lowered into the hole.

8.3.2.2 The sample spoons shall be of the standard split tube type, shall have a two (2) inch O.D. and 1-3/8 inch I.D. with or without 6-inch long brass or plastic liners, as requested or approved by the Engineer, and shall be equipped at the top with a reliable ball check valve. If difficulty is experienced in recovering samples, the split tube sampler shall be equipped with a basket-type retainer. The bottom edge of the drive shoe shall be sharpened to form a cutting edge at its inside circumference. The beveled edge of the drive shoe shall be maintained in good condition and, when excessively worn, shall be satisfactorily reshaped. The drive shoe of the sampler shall be replaced if damaged in such a manner as to cause projections within the interior surface of the shoe.

8.3.2.3 The sample shall be taken by mechanically driving the split barrel sampler twenty-four (24) inches into the undisturbed material below the bottom of the casing, borehole or auger with a 140 pound hammer. A record shall be kept of the number of blows for each six (6) inches of penetration. In hard materials requiring more than 50 blows per six inches of penetration, the blows for a smaller amount of penetration may be observed and recorded with a special note of the amount of penetration actually obtained.

8.3.2.4 To obtain a consistent determination of the relative resistance of the various strata, the split spoon sampler shall be driven by a 140 pound hammer having a free falling drop of thirty (30) inches. In no case will any deviation from maintaining a constant impact energy be permitted in obtaining the penetrating resistance.

8.3.2.5 Immediately upon removal from the hole, all soil samples shall be placed in 16-oz wide-mouth, screw-top, watertight, clear glass jars and promptly and clearly labeled for identification. All sample jars shall be sealed with a rubber or wax paper gasket.

8.3.2.6 Samples collected with the liners shall be wrapped in a plastic bag and put in a snug fitting can. The can shall be closed with a tight fitting lid and sealed with tape. The cans shall be promptly and clearly labeled for identification.

8.3.2.7 The Contractor shall store samples away from heat or cold. Storing of the samples prior to the completion of the work is the responsibility of the Contractor.

8.3.3 Undisturbed Soil Sampling

8.3.3.1 Undisturbed soil samples shall be taken in such holes and in such strata as requested or approved by the Engineer.

8.3.3.2 Before taking an undisturbed sample, the hole shall be cleaned out to the bottom of the borehole. Cleaning out shall be done in such a a manner that the soil immediately below the bottom of the drilling rods, casing or auger shall be as nearly undisturbed as possible.

8.3.3.3 Generally, cohesive and fine-grained cohesionless soil shall be recovered by means of a thin-wall piston-type sampling device, similar to the Acker Stationary Piston Type Sampler in which piston rods extend to the ground

surface, or by a self-contained, hydraulically operated piston sampler such as the "Osterberg" Sampler. When soil conditions permit, a thin wall sampling device similar to Acker's Shelby Thin Wall Tube Sampler may be used. The sampler shall yield an undisturbed sample of at least 2-7/8 inches in diameter and 24 inches long.

8.3.3.4 The sampling device connected to the drilling rod shall be lowered slowly to the bottom of the hole and the sampler forced into the soil for a distance of 24 inches. When obstructions, such as gravel particles, prevent the full penetration of the sampling tube, undisturbed soil samples less than 24 inches will be permitted.

8.3.3.5 Tubes for undisturbed samples shall be provided by the Contractor, and shall be of 16-gage seamless brass or hard aluminum. Steel tubes shall not be used without the express approval of the Engineer. If steel tubes are approved for use, they shall be of 16- or 18-gage seamless steel properly cleaned and polished on the inside and fully coated with lacquer on the outside. Sample tubes shall be drawn in to provide an inside clearance beyond the cutting edge of 0.015 inches ±0.005 inches.

8.3.3.6 The sampler shall be forced into the soil in a continuous drive at a uniform rate consistent with soil conditions not to exceed approximately 2 inches per second. The sampler shall be pushed or jacketed downward, and not be driven unless the character of the soil is such that driving with the hammer is absolutely necessary.

8.3.3.7 After the sampler has been inserted to its full length into the soil, the driller shall wait approximately 2 minutes before beginning withdrawal. For Osterberg and stationary piston samples, the sampler shall be turned two revolutions to shear off the soil sample at the bottom of the tube. The sampler shall then be withdrawn from the bottom of the hole in a smooth constant motion, using hydraulic pressure to pull the tube at a rate of approximately 1 inch per second. After the tube has pulled free from the bottom of the hole (a clearance of approximately 1 to 2 ft), removal shall stop momentarily (approximately 30 seconds) to allow the drilling fluid to flow around the bottom of the tube. Removal shall then continue at a slow and uniform withdrawal rate which is not to exceed 1/2 ft. per second. Breaking the drill rod joints during withdrawal shall be done carefully, and in as large sections as can be handled

practically without disturbing the sample.

8.3.3.8 The soil sample in the tube shall be carefully squared at each end, not less than one-quarter (1/4) inch inside the ends of the tube. Both end spaces shall be completely filled with hot paraffin and allowed to cool. The ends of the tube shall be covered with snug fitting metal or plastic caps which shall be secured in place with adhesive or friction tape. The capped ends of the tube shall be dipped in hot wax several times to provide an airtight seal.

8.3.3.9 Undisturbed samples shall be taken from hardpan, hard clays, coarse-grained cohesionless soils, by using either a Denison or Pitcher type double tube core barrel sampling device or a large diameter split tube sampler with liner. The type of samplers to be used will be approved by the Engineer.

8.3.3.10 The Denison sampler shall be similar to that manufactured by Acker Drilling Co., and the Pitcher sampler shall be that manufactured by Pitcher Driller Co. The sampler shall yield a specimen at least 2-3/4 inches in diameter and 24 inches long. A brass liner shall be used. Either a basket spring type or a split ring type retainer shall be attached, if necessary.

8.3.3.11 During sampling, the sampler barrel shall be advanced by rotating the outer tube. The rate of feed and pump pressure shall be carefully controlled. The use of excessive pump pressure shall be avoided in order to keep circulating fluid from passing under the inner shoe and eroding the sample. Circulating fluid shall be decreased to a small amount or barely maintained while the core barrel is being seated on the bottom of the hole. The flow shall be increased slowly as the coring progresses and the length of the core increases.

8.3.3.12 The recovered sample in the tube shall be preserved and sealed in the manner as described in Subsection 8.3.3.8.

8.3.3.13 Large diameter split tube samplers for recovering relatively undisturbed samples shall be similar to that manufacturedby Acker Drilling Co. One-inch sections of brass liner shall be used. The sampler shall be at least 3-1/4 inches O.D. and yield a specimen of at least 2-1/2 inches diameter, and 24 inches long. The sampler shall be equipped with a multiflap type retainer.

8.3.3.14 The sampler shall be driven into the undisturbed soil by using a 300 lb hammer having a free fall of 30 inches. The number of blows shall be recorded for every six inches of penetration. The sampler shall be driven twenty-four (24) inches into the undisturbed material.

8.3.3.15 The recovered sample shall be cut in as many 6 inch sections as obtainable with the liners intact. Extreme care shall be exercised to prevent the brass liner ring from moving or slipping in any way that might disturb the sample it contains during cutting and handling. The sample shall then be wrapped in a plastic bag and put in a snug fitting can. The can shall be covered with a tight fitting lid and sealed with tape.

8.3.3.16 Undisturbed soil samples shall be clearly, accurately and permanently marked to show the number of the hole, top and bottom of sample, the number of the sample, the depth from which the sample was taken, the measured recovery and any other information which may be helpful in determining subsurface conditions. During the taking of thin-wall tube undisturbed samples, a measurement of the force required to push the sample tube into the soil shall be made and recorded, whenever possible.

8.3.3.17 The Contractor shall store the undisturbed samples away from heat or cold. The samples shall be carefully packed in wooden boxes, each sample being surrounded with suitable fill material, such as sawdust, excelsior, or pelleted styrofoam, as approved by the Engineer, to prevent it from shifting position in the box and to prevent it from vibrating in transit to the laboratory.

8.4 Decontamination

At the request of the engineer, the contractor shall decontaminate equipment such as casing, augers, drill bits, drill rods, and sampling devices. Generally, decontamination will consist of rinsing equipment with "clean" uncontaminated water, then rinsing with methyl alcohol or other approved fluid, followed by a final rinse with "clean" water again. If required, other reasonable decontamination procedures may be requested by the field engineer.

9.0 CLASSIFICATION OF SOIL SAMPLES

9.1 Classification of Soil Strata

9.1.1 Soils shall be described and recorded in accordance with the Unified Soil Classification System. The soil description shall include at least the items described below.

9.1.2 In general, soil shall be considered either as granular or cohesive. A granular soil shall be considered basically either a gravel or a sand. Soil in either category shall be described as fine, medium or coarse. A cohesive soil shall be considered basically either a silt or a clay. The textural description of either granular or cohesive soils may include the presence of organic materials or others, using measures as "trace", "little" or "some" to indicate the amounts. For soil with equal amounts of constituents, use "and", such as "sand and gravel."

9.1.3 Granular soils shall be defined in terms of compactness, as "loose," "medium dense," "dense" or "very dense." Cohesive soils shall be defined in terms of consistency, as "very soft," "soft," "medium," "stiff", "very stiff" or "hard," and in terms of plasticity.

9.1.4 The amount of moisture present in a soil sample shall be defined in terms of "wet," "moist" or "dry."

9.1.5 The basic color of a soil, as blue, brown, gray, red or yellow, shall be given and shall be modified if necessary by adjectives such as "light," "dark," "mottled" or "mixed."

9.1.6 In the description of the soil, its color shall be described first, followed by texture, composition, consistency and moisture. Example: Light gray silty clay with trace of fine sand, medium plastic, soft, wet (CL).

10.0 BORING LOGS

10.0.1 During the progress of each boring, the Contractor shall keep a continuous and accurate log of the materials encountered and a complete record of the operation of driving the casing (if any), recording the size and weight of casing, weight of hammer and number of blows per foot required to drive the casing. Alternatively, the diameter of hollow-stem auger or mud-rotary bit used shall be recorded, together with the pertinent depths. The Contractor shall record the number of blows required to drive the sampler spoon for each six (6) inches of penetration. On Friday of each week two copies of the boring logs for borings completed during that week shall be submitted to the Engineer, and one copy to the Engineer's Field Inspector.

10.0.2 The Contractor shall use forms similar to the attached "BORING LOG" Form (see Attachment A). Boring logs shall include at least the data described below.

10.1 General

10.1.1 Dates and times of start and completion

10.1.2 Names of Contractor, driller and inspector

10.1.3 Identifying number of location of test boring

10.1.4 Ground elevation at the boring

10.1.5 Miscellaneous information on the field operations, to be reported on an additional sheet similar to the attached "DRILLING AND SAMPLING INFORMATION" Form. (See Attachment A)

10.2 Borings

10.2.1 Results of boring details of each hole arranged in tabular form giving full information on the vertical sequence, thickness and classification including degree of compactness of the materials penetrated.

10.2.2 Size, length and m.s.l. elevation of bottom of casing, mud borehole or hollow-stem auger used in each borehole.

10.2.3 Height of drop and weight of hammer for taking drive samples and driving casing, if any.

10.2.4 Number of blows required for each six (6) inch penetration of split spoon sampler and for each twelve (12) inch penetration of casing, if any. Methods and forces used to push sampler tube when not driven.

10.2.5 Depth limits, type and number of each sample taken. All samples shall be numbered consecutively.

10.2.6 M.S.L. elevation of groundwater table at each hole, and time of observation. Water level observations shall be made and recorded at first detection and 24 hours after completion of the boring. If a hole is drilled over a period of more than one day, the water level shall be measured and recorded each morning prior to start of drilling, and each evening after the end of work.

10.2.7 Loss or gain of drilling water or mud. Type of drilling mud used.

10.3 Undisturbed Samples

All pertinent information related to the collection of undisturbed samples shall be recorded on the attached "FIELD THIN WALL TUBE LOG" Form. (See Attachment A).

11.0 MARKING, PACKAGING AND SHIPPING OF SOIL SAMPLES

11.1 All soil samples shall be marked and identified with legible labels which shall indicate the project, the number of the boring, the elevation or depth from which the sample was taken, the sample number, the blow count while taking the soil sample or the time of drilling the core sample, the date, and any other information that may be helpful in determining the character of the subsurface conditions.

11.2 All samples shall be properly packaged in suitable containers to protect against damage from shifting of samples in boxes or breakage of glass jars while in transit. All samples shall be protected from excessive heat or freezing.

11.3 All samples shall be delivered to a laboratory or to other locations designated by the Engineer along with one (1) copy of the boring logs.

12.0 FIELD PERMEABILITY TESTS

12.1 Field permeability tests may be performed in cased or augered boreholes in each type of soil encountered. Procedures for performing the tests are described in Section 12.2 (Gravity Tests). In general, gravity tests shall be made as drilling progresses in all cased or augered borings.

12.2 Gravity Tests

12.2.1 General

Gravity tests shall be made at selected zones of those borings which are approved or requested by the Engineer. Tests shall be conducted in stages as the drilling progresses. The Contractor shall furnish, maintain, and operate all pumps, flowmeters, hoses, drilling rigs and miscellaneous equipment required for conducting the tests. One copy of testing records will be kept by the Contractor, and a copy shall be kept by the Engineer as testing progresses.

12.2.2 Equipment

12.2.2.1 Water may be supplied through any suitable pump or by gravity flow from a tank or similar source so long as sufficient capacity to keep the casing or hollow-stem auger full of water is developed. Clean water for the

tests should be used to prevent the clogging or contamination of the test section. A settling tank or a filter shall be used to eliminate suspended particles from the water. A water truck will be needed since some holes are too far from easy water access.

12.2.2.2 Flowmeters (if required) shall read in gallons and shall be calibrated immediately prior to use on this project. The Contractor shall either furnish satisfactory evidence of factory or shop calibration or shall calibrate the meters in the field as directed by the Engineers. Field calibration checks shall be made both before and after gravity tests are made in a boring. Calibration deviations shall be recorded. Nonconformances shall be reported to and resolution approved by the Engineer.

12.2.2.3 The Contractor shall ensure that a complete gravity testing equipment setup is available in good working order at such times as the tests are required. All pumps or other water supply sources, flowmeters, hoses, and related equipment required for the gravity tests shall be kept available and properly maintained so that equipment will be ready for testing at such times as the tests are required. No payment will be made for any time required for on-site mobilization or for maintenance which could have been routinely accomplished

prior to the time when gravity tests are to be commenced.

12.2.3 Test Procedure

12.2.3.1 General

Gravity tests will be of the constant-head type or of the falling-head type, described below. With approval or at request of the Engineer, both types of tests may be run in combination at the same borehole depth.

a. Tests shall generally be conducted at depths approved by the Engineer in an open section of the borehole which extends not more than 5 ft. below the bottom elevation of the casing or hollow-stem auger. After the split-barrel sample has been removed from the bottom of the section of borehole to be tested, the casing shall be driven to the top of the interval to be tested.

b. The borehole interval to be tested shall be reamed and/or flushed to develop a relatively clean, uniform hole free of cuttings or loose soil. Care shall be taken to prevent jetting of the borehole walls or bottom during reaming and/or flushing. Flushing shall be continued until the return water is clear.

12.2.3.2 Constant Head Tests

These tests shall be performed in accordance with the Bureau of Reclamation "Earth Manual" Procedure for Field Permeability Tests in Boreholes, Designation E-18. After the boring has been flushed clean, clear water shall be added to the hole to bring the water level even with the top of the casing. The water level will then be maintained at the top of the casing for a period of approximately 10 minutes. The quantity of water required to maintain the level will be measured through the flowmeter. The test will be complete after the recording interval and normal drilling will be resumed.

12.2.3.3 Falling Head Tests

These tests shall be performed as described in the Navy Department "Design Manual for Soil Mechanics, Foundations, and Earth Structures," NAVFAC DM-7, Chapter 4, Section 3.3. After the boring has been flushed clean, clear water shall be added to the hole to bring the water level even with the top of the casing. The water will then be allowed to seep into soil. The rate of drop of the water level in the casing shall be observed by measuring the depth to the water below the top of the casing at 1, 2, 3, 4 and 5 minutes after the

start of the test and at 5-minute intervals thereafter, until the rate of drop becomes negligible and as approved by the Engineer.

12.2.3.4 In the event that there is caving in the overburden below the casing, the length of the test interval may be reduced to less than 5 feet. The testing procedure for shorter intervals shall be the same as specified above.

12.2.3.5 Gravity Test Records

Constant-head gravity test results shall be presented on a sheet similar to attached "PERMEABILITY TEST RECORD" Form. Falling head gravity tests shall be presented on a sheet similar to attached "PERMEABILITY DATA, FALLING HEAD TEST" Form. (See Attachment A)

13.0 MONITORING WELL INSTALLATION

13.0.1 General

Standpipe type monitoring wells shall be installed in all borings as specified by the Engineer. The Contractor shall furnish, maintain, and operate all drilling rigs and miscellaneous equipment required to install the wells, including all slotted and unslotted plastic pipe, steel guard pipe with cap, grout, sand backfill, and miscellaneous materials.

13.1 Materials

The monitoring well screens shall consist of slotted polyvinyl chloride (PVC) pipe having a 4 in. inside diameter and rows of slots of 0.01 in. or other suitable nominal width. Screens may be as manufactured by UOP Johnson, Thorofare, New Jersey; Timco Mfg., Prairie Du Sac, Wisconsin; Hydrophilic Industries, Puyallup, Washington; or equivalent as approved by the Engineer. The first piece placed in the hole may be a 5 ft PVC blind pipe sealed at the bottom end with a screw cap, above which will be the PVC slotted pipe or screen. The well screen shall be 5 ft long, or more, as required by the engineer. Unslotted 4 in. inside diameter PVC plastic pipe shall be used to complete the well to a level 3 ft above the existing grade. If warranted or

required by field conditions or other considerations, a 2 in. I.D. PVC pipe and screen may be installed at certain wells, with the approval or at the request of the Engineer.

The PVC plastic pipe shall be protected by a 6 in. diameter steel guard pipe, 5 ft long and set 2 ft into cement grout and tamped clay seal placed at the top of the borehole. The top of the steel guard pipe shall be threaded and have a cap and a 1/4 in. diameter hole drilled in it. A typical well installation is shown in the Attached "MONITORING WELL INSTALLATION" Form for reference only (see Attachment A).

13.2 Installation Procedure

All well installations shall be done in accordance with the general procedure outlined below.

13.2.1 After the drilling and sampling has been completed, the borehole shall be reamed and/or flushed to develop a relatively clean, uniform hole, free of cuttings or loose soil. Flushing shall be continued until the return fluid is clear.

13.2.2 The slotted and unslotted PVC plastic pipe shall be connected in lengths as approved by the Engineer, and placed in the borehole. Prior to placing the pipe in the borehole, the pipe shall be measured with a tape and the length marked in convenient increments on the upper 10 ft of pipe.

13.2.3 The space surrounding the well pipe in the borehole (the "annulus") shall be filled with a clean medium to coarse sand as casing (if used) is being withdrawn. The Contractor shall exercise caution in the extraction of the casing to maintain sand within the casing at all times. However, an excessive height of sand within the casing will bind against the PVC pipe, lifting it with the casing. To avoid this problem, both the extraction of the casing and the placement of the sand shall be done in small increments not to exceed five (5) feet, or as approved by the Engineer.

13.2.4 It may be required to seal off the screened well from the upper portion of the hole by placing a seal on top of the sand in the annulus at a specified depth. The seal will consist of material such as "Peltonite," "Volclay" or "Pi-Pellets," or tremied bentonite-cement slurry. Where brackish or salt water is present, an appropriate sealant, such as "Zeogel" or approved equivalent, shall be used. Details of the seal placement will be subject to the Engineer's approval. The borehole above the seal may be filled with tremied grout or fine sand, as approved or requested by the Engineer. Casing (if used) shall be retrieved gradually as the filter sand and seal material is being placed, to ensure proper placement of filters and seals.

13.2.5 The top 2 ft of borehole shall be backfilled with tamped clay and cement grout. The 6 in. diameter steel guard pipe shall be left around the well pipe, and the borehole around the guard pipe shall be dug out approximately on a 2 ft square and to a depth of 2 ft, and filled with concrete which will be sloped away from the well to prevent ponding of water adjacent to the pipe.

13.2.6 The Engineer shall inspect and approve each section of pipe before its installation. PVC pipe joint sealant may not be used on any joints. All joints are to be threaded and PVC pipe shall be of a Schedule 80 thickness.

13.2.7 The details of the well installation shall be recorded by the contractor on a Monitoring Well Installation Report. The report shall include at least the following:

- Length and elevation of screen
- Length and elevation of riser pipe
- Height and elevation of top of casing
- Type, length and elevation of all seals
- Diameter of well
- Well material (i.e. PVC, Stainless Steel)

13.2.8 Monitoring Well Development

13.2.8.1 All wells shall be developed by means of pumping until the discharge water has been cleared of drilling fluid, sand, silt and other assorted sediment. The process shall be continued for 30 minutes afterwards, or as

directed by the Engineer so as to assure:

- a good hydraulic connection between the well and the aquifer; and
- collection of representative ground water samples

13.2.8.2 The pumped water shall be discharged onto the site as designated by the Engineer; the discharge mode shall be in compliance with all applicable Federal and State Regulations. No discharge shall be permitted to flow directly into any natural surface water body.

13.2.8.3 A detailed record of the techniques used shall be kept by the Contractor, who will submit one copy to the Engineer at the end of the work.

14.0 FORMATION TESTS

14.1 General

14.1.1 Formation tests shall be performed by the Contractor by pumping water from the observation wells, and observing the water level changes, if any, in the wells, as directed or approved by the Engineer.

14.1.2 The tests shall be performed in selected pre-existing and all new wells whose suction lift is less than 25 feet.

14.1.3 Formation Tests will be of the pumping test, the bailer test, or the slug test type, as described below.

14.1.4 In conjunction with the testing, the Contractor will aid the Engineer in obtaining ground water samples from the wells.

14.2 Pumping Tests

14.2.1 The test pump will be a centrifugal, or piston, pump with a suction lift of 28 feet and a capacity of at least 50 GPM, having a 1 inch (I.D.) intake hose at least 20 feet long and a 1 inch discharge line at least 10 feet long. The intake hose should be constructed of a material that will not collapse during pumping. PVC or rubber will be acceptable.

14.2.2 The tests shall be run by lowering the intake hose 5 feet below the ground water table, or as requested by the Engineer, and then starting the pump. The pumped water shall be discharged into a 5 gallon pail or other measuring container. Using a stop watch, the Engineer will time how long it takes to fill the pail. In the event that the discharge is 10 GPM or greater, the Contractor will use a 55 gallon drum to discharge the water into.

14.2.3 The test will generally run for 15 to 30 minutes with the intake hose 5 feet below the water table and 15 to 30 minutes at 10 feet below the water table, or as requested by the Engineer.

14.2.4 The pumped water shall be discharged to a distance from the well in order to eliminate possible effects on test measurements. Discharge shall not be allowed to flow directly into any natural surface water body. The mode of disposal shall be subject to approval by the Engineer.

14.2.5 Before and during pumping, water levels will be measured by tape or water level indicator, every 1/2 to 1 minute, or as required, and recorded by the Engineer. After pump shutoff, recovery will be measured every 1/2 to 1 minute, or as required, and also logged by the

Engineer.

14.3 Slug Tests

The Contractor shall instantaneously (or nearly so) lower a cylinder of known volume into a well below water level, and then assist the Engineer in measuring and recording the subsequent rate of fall in ground water elevation.

14.3.1 Ground water elevation shall be measured and recorded prior to any testing.

14.3.2 The cylinder shall first be lowered to a depth of 6 in. above the water table. Then an electrical indicator, or a measuring tape with a "plopper", will be lowered to 6 in. above the cylinder. In one motion, the Contractor will rapidly lower the cylinder 10 feet and immediately begin measuring ground water elevation. After the initial reading, the Engineer shall measure and record the fall in ground water elevation every 1/2 to 1 minute until the well has recovered.

14.4 Bailer Tests

The Contractor shall use a bailer of known volume to collect and discharge water from a well.

14.4.1 Prior to any testing the Engineer shall measure and

record ground water elevation.

14.4.2 At the request or approval of the Engineer, the Contractor shall bail a well a number of times recording each bail or fractions thereof if a bail is less than full. The number of bails and the time of each bail extraction shall be recorded. Bailed water shall not be allowed to drain directly into any natural surface water body.

14.4.3 At the completion of bailing, the Engineer shall immediately begin measuring and recording ground water elevation every 1/2 to 1 minute until the well has recovered.

14.5 Personnel and Equipment

The Contractor shall provide the following:

a. Two portable centrifugal pumps with all attachments: The pumps should have a minimum capacity of 50 gpm.

b. Power source for the pump to be a gasoline generator, or other approved system.

c. A 1 inch intake and discharge line of sufficient length to permit the performance of all required tests.

d. A valve at the end of the discharge line.

e. One water level indicators ("M-scopes") and one tape for water level measurements.

f. Two 5 gallon pails and one undamaged 55 gallon drums for discharge measurements.

g. One pump operator at all times. This man shall be responsible for the proper and smooth operation of the pump. The operator may have an assistant or helper to assist him and the Engineer in collecting the necessary data, such as discharge rate and water level measurements.

h. One bailer of known volumes.

i. One cylinder of known volumes.

j. Lighting equipment for night operations, if necessary.

15.0 SAFETY

15.1 Disposal of industrial hazardous liquid materials has occurred at the site. No drilling locations will be intentionally selected in areas known to contain hazardous materials. Also, there may be other areas containing hazardous materials, concerning which there is no information. The Contractor shall provide for his employees, and any subcontractor, all equipment necessary to provide adequate safety. This equipment shall be readily available at the site to the employees for safety from unexpected hazardous materials.

15.2 The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the work. The Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection, training and equipment to prevent damage, injury or loss to:

a. All employees on the work and other persons who may be affected thereby;

b. All the work and all materials or equipment to be incorporated therein, whether in storage on or off the site.

15.3 The Contractor shall comply with all applicable laws, ordinances, rules, regulations and orders of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss; and shall erect and maintain all necessary safeguards for such safety protection.

The Contractor's duties and responsibilities for the safety and protection of the personnel shall continue until such time as all the work is completed and the Contractor has left all three landfill sites.

15.4 The Engineer will monitor the bore holes for total combustible gases with a Combustible Gas Indicator (CGI) provided by the Contractor. If the CGI indicates that there are concentrations of combustible gases which the Engineer believes may constitute an unsafe condition, the Engineer will advise the Contractor of such conditions. The Engineer may then recommend that the drilling operations cease for an appropriate period, or that the drill rig be moved to another drilling location.

15.5 The Contractor shall designate a responsible member of his organization at the site whose duty shall be the prevention of accidents.

15.6 In emergencies affecting the safety of persons or property at the site, the Contractor, without waiting for special instruction or authorization from the Engineer or Owner, shall act to prevent threatened damage, injury or loss. The Contractor shall give the Engineer prompt written notice of any significant changes in the work or deviations from the contract documents caused thereby.

16.0 SPECIAL ITEMS

16.1 PVC Bailers

For each observation well drilled and installed, the Contractor shall provide a dedicated bailer. The bailers will be made of PVC and have a volume of at least 1 liter. The bailers may be purchased from TIMCO Manufacturing Company, Inc. (see Attachment B), or equivalent supplier.

16.2 Atmospheric Monitors

At each rig, the Contractor shall provide one (1) total combustible gas detector. All detectors must measure accurately and be in proper working condition.

17.0 INSPECTION

17.1 The Engineer shall have the right, at all reasonable times, to inspect the Contractor's work, material, equipment, or inspection procedures as applicable to the work covered by this Contract, to confirm that the specified requirements are being complied with. The Contractor shall provide all tools, instruments, etc, necessary to facilitate these inspections.

17.2 Nonconformance with the procedures detailed in the pertinent sections of this Contract for drilling and sampling test holes may be cosidered criteria for rejection.

17.3 It is not intended that the presence or activity of the Engineer shall relieve the Contractor in any way whatsoever of his obligations under this Contract. Furthermore, the fact that the Engineer may inadvertently overlook a deviation from some requirements of this Contract shall not constitute a waiver of that requirement, nor of the Contractor's obligation to correct the condition when it is discovered, nor of any other obligation under this Contract.

17.4 The specified duties assigned to the Engineer's Field Inspector are as follows:

17.4.1 Test Holes

The Engineer shall verify that boring procedures and samplers used by the Contractor throughout the progress of the work conform with this Contract. Prepare a complete log for each boring, including a description of all samples, and the boring methods and the types of samplers being used. Witness the recovery of all undisturbed samples and prepare a log for each sample recovered.

17.4.2 Permeability Tests and Formation Tests

Verify that the testing procedures and equipment, including pumps, valves, and related accessories, used by the Contractor throughout the progress of work conform with this Contract. Prepare a complete log for each test, including a description of flow rates, water levels, depth and characteristics of the holes, and the types of equipment being used. Nonconformance with the procedures detailed in the pertinent sections of this Contract for permeability tests and formation tests may be considered criteria for rejection.

17.4.4 Documentation Check

Check to ensure that all pertinent documentation has been submitted at the completion of the work.

18.0 MOBILIZATION AND DEMOBILIZATION

This term shall include the moving of men, equipment and materials to and from the project site as necessary to execute the drilling and testing work properly and in a timely fashion. It shall also include the furnishing and erection of any barricades, field installations, etc., necessary for the performance of the work as well as the final cleanup, and restoration of the site. Mobilization and Demobilization shall be paid on a per-rig basis (see Section 5.2, item 14.0).

T A B L E 1

PROPOSED WELLS

WELL NO.	APPROXIMATE DEPTH (ft)
OW-1	30
OW-2	30
OW-3	30
OW-4	30

F I G U R E S

ATTACHMENT A

BORING LOG

Sheet of

PROJECT: PROJECT NO. BORING NO.

Location: Coord: Ground Elev:

Contractor: Date Started: G.W.L. Hour: Date:

Inspector: Date Completed: G.W.L. Hour: Date:

Notes:

Depth Ft.	Elev Ft.	Sample Type & No.	Test Type & No.	Blows Casing Per Ft	Blows Sampler 6"	Blows Sampler 6"	Recovery %	ROD %	Drilling Rate Min./Ft.	Graphic Symbol	Description and Remarks
0											
5											
0											
5											
0											
5											
0											
5											
0											

I.D. Casing	Wgt. Hammer on Casing	Material Notations
I.D. Spoon	Wgt. Hammer on Spoon	
Type Core Drill	Drop Hammer on Casing	
Core Dia.	Drop Hammer on Spoon	
Sample & Test Notations		

Job No.: _____

Boring: _____

Summary of Drilling and Sampling Information

Client: _____ Project: _____

Rig: _____ Site: _____

Contractor: _____ Driller: _____

Drilling Method:

_____ ____ft. to ____ft. Dia._____in.

_____ ____ft. to ____ft. Dia._____in.

_____ ____ft. to ____ft. Dia._____in.

Drilling Fluid Used: ____Yes ____No Type: _____

Sampler Hammer: Weight_____lbs. Casing Hammer: Weight_____lbs.

Drop_____in. Drop_____in.

Rock Core Diameter_____in. Type core barrel/bit: _____

Date/Time Drilling Started: _____ Completed: _____

Down Time: _____hrs. Cause(s) _____

_____

Log Summary: Soil: _____

_____

Rock: _____

No. Samples: Split Spoon _____ Other: _____

Undisturbed: _____ _____

No. Permeability Tests: Constant Head _____ Pressure _____

Falling Head _____ Other: _____

No. and Type of Other Tests: _____

Piezometer Installation:

Pipe: Type: _____ Dia._____ Depth: From_____ft. to _____ft.

Screen: Type: _____ Dia._____ Depth: From_____ft. to _____ft.

Filter Material: Type: _____ Depth: From_____ft. to_____ft.

Seal Material: Type: _____ Depth: From_____ft. to _____ft.

_____ Depth: From_____ft. to _____ft.

_____ Depth: From_____ft. to _____ft.

Remarks: _____

_____

_____

_____

Inspector _____

_____

FIELD THIN WALL TUBE LOG

Client: _____ J.O. No. _____

Project: _____

Site: _____ Boring No. _____

Sample No.: _____ Depth: _____

Documented by: _____ Date: _____

Retrieval Information		Sample Information	
Boring cleaned to:	____ ft	Length thin wall tube:	_____ in
Sample from:	____ ft	Top Measurement Before Cleanout	
Piston stroke:	____ in.	Depth to soil:	_____ in.
Shelby push:	____ in.	Depth to water:	_____ in.
Denison core:	____ in.	Bottom Measurement Before Cleanout	
Sample to:	____ ft	Depth to soil:	_____ in.
Rig movement:	____ in.	Actual recovery:	_____ in.

Piston Sampler |_|
Hydraulic pressure ____ psi

Shelby Tube |_|
Hydraulic pressure: ____ psi

No. blows ____; with ____ lb hammer

Denison Sampler |_|
Hydraulic pressure: ____ psi

Top Measurement After Cleanout
Depth of soil: _____ in.

Bottom Measurement After Cleanout
Depth of soil: _____ in.

Preserved in

Sample jar: _____ in.
Thin wall tube: _____ in.

MATERIAL IDENTIFICATION

Top of tube
Bottom of tube

Remarks

Note: The only material to be "cleaned out" shall consist of loose cuttings and washed soil or obviously disturbed material.

PERMEABILITY DATA - FALLING HEAD TEST

PROJECT				PROJECT No	
SITE				DRILLER	
HOLE No.		DATE		INSPECTOR	
TEST NUMBER	1	2	3	4	5
HOLE DIAMETER					
REF. POINT FOR DEPTH MEASUREMENTS					
HEIGHT OF REF. POINT ON GROUND LEVEL					
DEPTH OF TEST ZONE					
SOIL OR ROCK TESTED					
G.W.L. MEASURED WITH:					

HOUR	MINUTES FROM T_o	DEPTH TO WATER LEVEL				
	$T_o = 0$					
PERMEABILITY						
REMARKS						

PROJECT _____ FILE NO. _____

SUBJECT _____ SHEET NO. _____ OF _____

COMPUTED BY _____ CHECKED BY _____ DATE _____

BORING No _____

STATION _____ OFFSET _____ REF. LINE. _____

GROUND ELEV. _____ POINT OF REF. _____ — _____ FT ABOVE O.G.

TESTED BY _____

TEST DATE _____ TESTING TIME _____

_____ _____

_____ _____

_____ _____

INSPECTOR _____

Values of C_1 vary with the size of casing as follows (see fig. 61):

Size of casing	EX	AX	BX	NX
C_1	204, 000	160, 000	129, 000	102, 000

TEST No	HOLE SIZE	DEPTH OF HOLE, FT	DEPTH OF G.W.L., FT	C_1	WATER FLOW				DIFFERENTIAL HEAD				$K_{FT/Y} = C_1 \frac{Q}{H}$
					VOLUME, CU. FT	VOLUME, GALS.	TIME MIN.	Q, GPM	H_G, FT	H_p, Psi	H_p, FT	H_{TOT} FT	

REMARKS _____

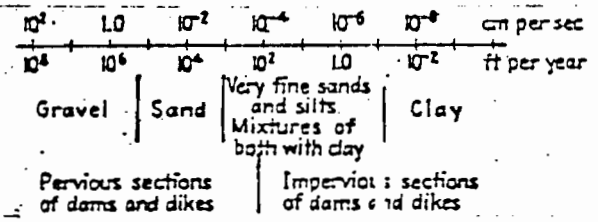
_____

_____

_____

_____

_____



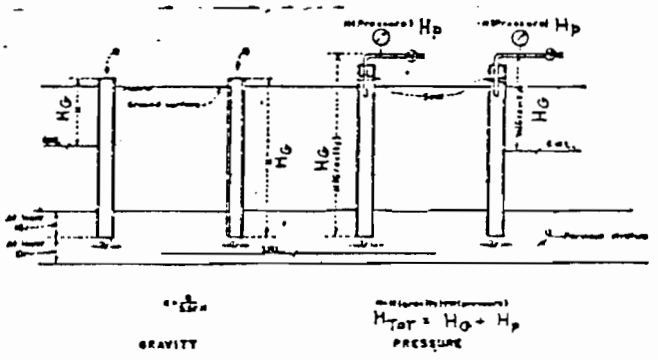


Figure 18–1.—An open-end pipe test for soil permeability, which can be made in the field. PX–D–16267.

PUMPING TEST DATA SHEET

WELL NO. _____ PUMPING ☐ OBSERVATION ☐

COORDINATES _____

PROJECT _____ LOCATION _____

PROPERTY OWNER _____ ADDRESS _____

DATE TEST BEGUN _____ PUMPING PERIOD _____ RECOVERY PERIOD _____

WELL DATA TOTAL DEPTH _____ FT

CASING
TYPE _____ DIA _____ FROM _____ TO _____ FT
TYPE _____ DIA _____ FROM _____ TO _____ FT

SCREEN
TYPE _____ DIA _____ SLOT ___ FROM ___ TO ___ FT
TYPE _____ DIA _____ SLOT ___ FROM ___ TO ___ FT
FILTER _____ FROM ___ TO ___ FT

MEASURING POINT (MP) _____ — _____ FT. ABOVE GROUND (O.G.)

PUMP DATA
TYPE _____
MAKE _____
DEPTH OF INTAKE _____ FT
DIAMETER OF COLUMN _____ FT
DEPTH OF AIR LINE _____ FT

ELEV. (MP-OG) _____ FT.
REFERENCE LEVEL _____

DISCHARGE MEASURED WITH: _____

HOUR	TIME FROM START	MEASUREMENT WITH TAPE		AIR LINE OR ELECTRIC INDICATOR	DEPTH TO WATER LEVEL	DRAWDOWN OR RECOVERY	DISCHARGE	REMARKS
		TOP	BOTTOM					
	MIN.	FEET	FEET		FEET	FEET		

MEASUREMENTS BY _____ FROM _____ TO _____
MEASUREMENTS BY _____ FROM _____ TO _____
MEASUREMENTS BY _____ FROM _____ TO _____

SHEET 1 OF ___

REVISIONS BY _____ DATE _____

FILE _____

BY _____ DATE _____
CHECKED BY _____

PLATE

GROUTING INSPECTION RECORD

CLIENT _____ J. O. _____

PROJECT _____ BORING NO. _____

DATE _____

CREW _____ INSPECTOR _____

TIME BEGUN _____ TIME FINISHED _____

ELAPSED TIME _____

NO. BAGS CEMENT _____ TYPE _____

CASING LEFT IN HOLE _____

DEPTH OF HOLE _____ SIZE BIT DURING DRILLING _____

DETAILS OF MIX: WATER _____ : CEMENT _____ BENTONITE _____ %

TREMIE ☐ PRESSURE ☐

PRESSURE GROUTING DETAILS

STAGE NO.	PACKER DEPTH FEET	COLLAR PRESSURE PSI	GROUT TAKE SACKS

REMARKS (GROUT WASTED ETC.) _____

HAS HOLE AREA BEEN CLEANED _____

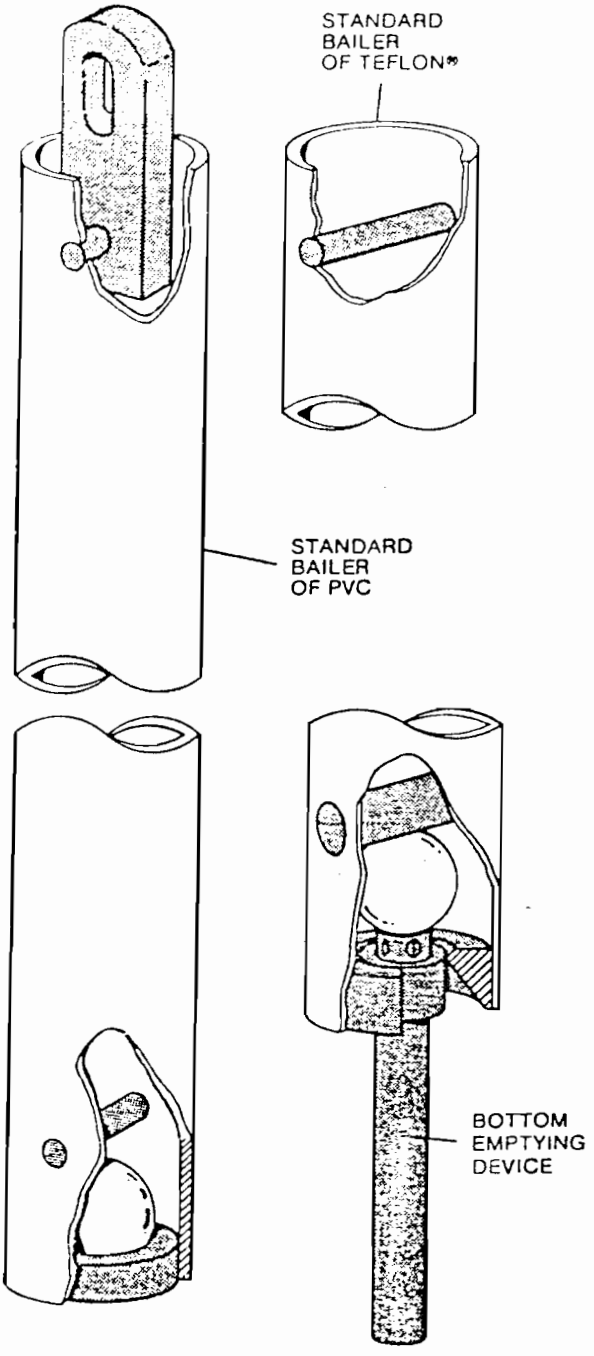
DRILLER _____

INSPECTOR _____

ATTACHMENT B

TIMCO™

Standard Bailer
(with or without Bottom Emptying Device)



- STANDARD BAILER is designed to retrieve a sample from a well employing basic bailing methods.
- Available in PVC or Teflon®.
- PVC unit available with no solvent welds.
- Teflon® unit is all Teflon® construction.
- Suspension cord of Teflon® coated fiberglass or of 3/16 inch polypropylene.

SIZES AVAILABLE
PVC 1/2 inch I.D. thru 6 inch I.D.
(12.7mm I.D. thru 152.4mm I.D.)
Teflon® 1/2 inch I.D. thru 3 inch I.D.
(12.7mm I.D. thru 76.2mm I.D.)
Lengths available to your specifications.

- BOTTOM EMPTYING DEVICE is designed to permit sample retrieval from the bottom of the BAILER.
- Press fit design.
- Available in PVC or Teflon®.

SIZES AVAILABLE
PVC: to fit all TIMCO™ BAILERS.
Teflon®: to fit all TIMCO™ BAILERS.

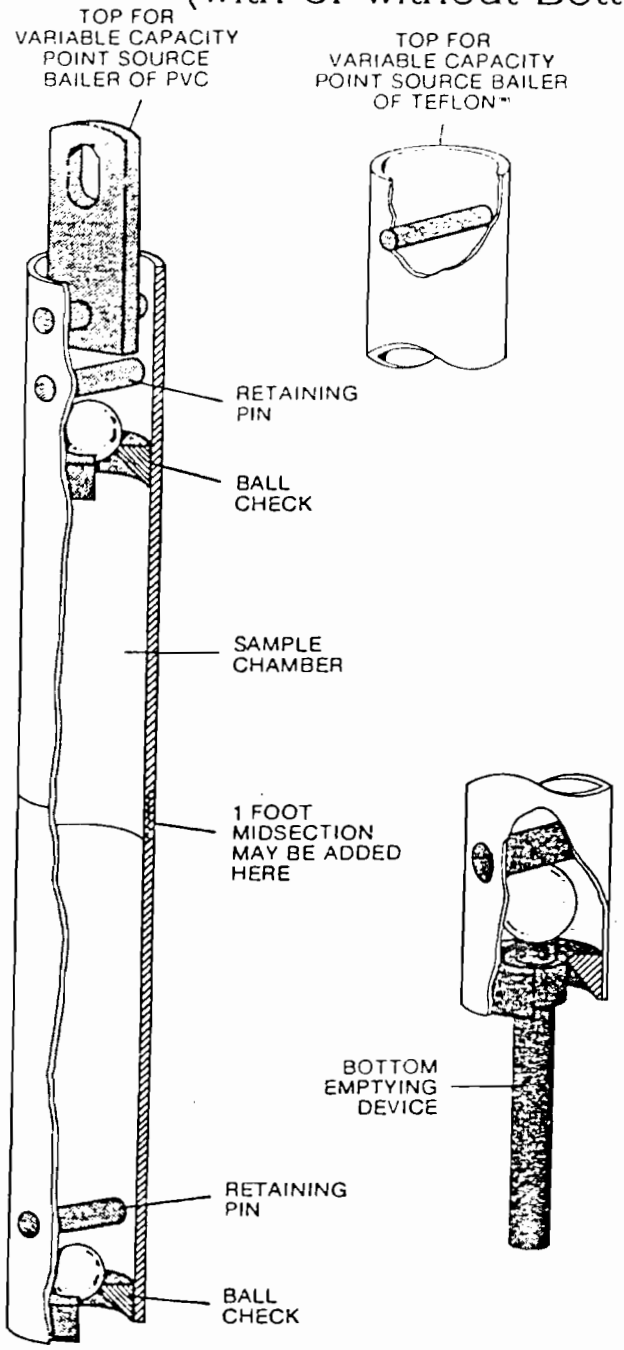
TIMCO™

Timco Mfg. Co., Inc. P.O.Box 35 Prairie du Sac, WI 53578 (608)643-8534

G 382-7

ATTACHMENT

TIMCO™
Variable Capacity Point Source Bailer
(with or without Bottom Emptying Device)



- VARIABLE CAPACITY POINT SOURCE BAILER allows sampling at a specific point within a monitoring well.
- Threaded and press-fitted construction allows for ease of decontamination.
- Additional 1 foot mid section may be added at center to increase the volume.
- Available in PVC or Teflon®.
- Suspension cord of Teflon® coated fiberglass or 3/16 inch polypropyiene available for use with all TIMCO™ BAILERS.

SIZES AVAILABLE

1/2 inch I.D. thru 3 inches I.D.
Standard length 24 inches (609.6mm)
Other lenghts available to your specifications.

VOLUME OF SAMPLE PER ONE FOOT SECTION

I.D. SIZE (inches)	FLUID OUNCES	MILLILITERS
1/2	1.49	44.0
3/4	2.77	82.0
1	4.78	141.4
1 1/4	8.52	252.0
1 1/2	11.74	347.3
2	19.61	580.1
3	43.90	1,298.8

- BOTTOM EMPTYING DEVICE is designed to permit sample retrieval from the bottom of the BAILER.
- Press fit design.
- Available in PVC or Teflon®.

SIZES AVAILABLE

PVC: to fit all TIMCO™ BAILERS.
Teflon®: to fit all TIMCO™ BAILERS.

NOTE: TIMCO'S™ recommended typical installation procedure instructions are available upon request.

TIMCO™

Timco Mfg. Co., Inc. P.O.Box 35 Prairie du Sac, WI 53578 (608)643-8534

G 382-8

ATTACHMENT

SPECTRUM FINISHING CORPORATION

Revision 1

PHASE II
HAZARDOUS WASTE FIELD INVESTIGATION PROGRAM

PROCEDURES FOR GROUND WATER SAMPLE WITHDRAWAL, PRESERVATION AND STORAGE

April 1985

TABLE OF CONTENTS

PROCEDURES FOR GROUNDWATER, SAMPLE WITHDRAWAL, PRESERVATION AND STORAGE

1.0 INTRODUCTION

The sampling of ground water, associated with a PHASE II Hazardous Waste Investigation Program is a critical operation. The samples collected will be analyzed to identify and quantify pollutants. The validity of analytical chemical results obtained from the samples is dependent on proper and consistently performed sampling procedures.

The purpose of this document is to set forth the procedures which shall be consistently followed to assure that the samples collected are representative of in-situ water quality and are properly prepared for transport to the laboratory.

The primary consideration is to obtain representative samples by guarding against sloppy field activities such as cross-contamination, use of inappropriate sampling devices, collecting stagnant well water, inappropriate preservation techniques, and use of improper storage containers. A Quality Assurance Field Data Sheet shall be filled out in the field to document adherence to the procedures (see Table 1).

2.0 GROUND WATER COLLECTION

Water standing in well columns may not be representative of in-situ ground water quality because the standing water can be affected by exposure to atmospheric gases in the well, and it may contain foreign material.

Procedures to assure that samples collected from wells are representative of ground water quality, are outlined below:

a. All monitoring wells shall be flushed by pumping or bailing prior to taking a sample. Generally, evacuation of three to five volumes is recommended for a representative sample. For this study, a minimum of three volumes shall be evacuated from each well before taking the sample.

b. To avoid re-stagnation of water prior to sampling, the sampling shall be done within 24 hours after the flushing.

c. For wells that are pumped or bailed dry in the process of evacuating standing water, the well shall be flushed and then allowed to recover prior to sample withdrawal.

2.1 Water Level Measurement

Ground water level shall be measured and recorded before bailing the well to be sampled. Ground water measurements shall be performed by one of the following methods:

a. A fiberglass tape equipped with a hollow weight ("plopper") is lowered into the well down to the water level. The tape is read where it is at the top of the well casing, as a reference point. The reading is then adjusted for the length of "plopper" and its attachment. Record tape reading, adjustment, depth to water level, and time of observation.

b. An electrical indicator ("M-Scope") is lowered into the well until the indicator's needle shows that the electrode is in contact with the ground water surface. Depth to water level is measured from the top of the well casing.

2.2 Well Flushing with Centrifugal Pump

Where water levels are within pump suction lift (25 feet or less), wells may be flushed and sampled with a centrifugal pump. Prior to flushing, the intake line to the pump is rinsed with demineralized or distilled water to prevent

cross-contamination of wells.

The intake line to the sampling pump shall be placed just below the surface of the well water and three to five volumes of water shall be pumped at a rate equal to the well's recovery rate.

Care must be taken to prevent excessive pre-pumping of the monitoring well which could affect the normal ground water regimen in the vicinity of the well, and thereby lead to a non representative sample.

The depth to pump intake, and the rate of discharge shall be measured and recorded.

The sample shall be collected directly from the pump discharge line.

The total quantity of water flushed from the well shall be measured using a bucket of known volume. Flushing is considered complete when the required volume has been pumped out, and when the water has cleared of silt and other sediment.

A suggested centrifugal pump for use is a Homelite gasoline

engine driven pump, with suction lift of approximately 28 feet.

2.3 Well Flushing with Bailer or Water Sampler

Low capacity wells may be flushed utilizing either a bailer or a low volume pump.

A Bailer shall be constructed of PVC pipe approximately 1-1/2 inch diameter by 3 feet long with a volume of approximately 1.0 liter, as manufactured by Timco, Inc., of Prarie du Chein, Wisconsin or equivalent. As a substitute for a bailer, a portable pump capable of pumping 3 gpm may be used.

Low capacity wells shall be flushed until 3 to 5 times the volume of water standing in the well is evacuated, or until the well is dry. If the well becomes dry due to flushing, it shall be allowed to recover, and then sampled.

The bailer shall be rinsed with demineralized or distilled water before putting it in the well for flushing or sampling.

The volume of water required to purge wells is shown in Figures 1 and 2.

At the completion of bailing, recharge and stabilization of the water level, the well is sampled.

2.4 Well Sampling

A Kemmerer-type water sampler, as shown on Figure 3, is equipped with a sample cock which enables withdrawal of a sample from well below the well water surface.

To minimize loss of volatile constituents from the sample, transfer of the sample from the sampler to the sample bottle, shall be carefully done to minimize contact with air and agitation of the sample. Slow and careful transfer, placing the tip of the sampler's exit tube to the side of the sample bottle, is required.

If a sampler is used for more than one well, it shall be thoroughly flushed with demineralized or distilled water prior to use in each well.

Suspension lines shall be rinsed, and kept off the ground, by coiling and placing them on a clean plastic sheet.

2.5 Record Keeping

The following records shall be kept for each well sampled:

a. Quality Assurance - Field Data Sheet (Table 1)

b. Chain of Custody Sheet (Table 2)

c. Ground Water Elevations for each well, with date, time, and method of measurement.

3.0 SAMPLE CONTAINERS/PRESERVATION

All bottles and containers will be pre-cleaned, pre-labeled, and organized in ice-chests prior to field activities.

All preservation techniques shall conform to USEPA "Methods for Chemical Analysis of Water and Wastes," EPS-600/4-79-020. The related preservation techniques and storage containers are listed in the following table:

Parameter	Preservation Technique
Volatile Pollutants	40 ml teflon septum capped glass vials to the top with sample; no inclusion of air; keep @ 4°C; maximum holding time is 7 days.
Metals	1 liter plastic or glass container; pre-filter with an Elmeyer vacuum flash or equivalent; pH <2 with HNO_3; holding time is 6 months, exclusive of mercury which is 38 days (glass) or 13 days (plastic).

Cyanide	glass, 1 liter, 4°C NaOH to pH = 12; 24 hrs. holding.
Other	1 liter plastic or glass container; cool (4°C).

4.0 CHAIN OF CUSTODY

Proper chain of custody procedures play a crucial role in quality assurance of a sa-pling program. The following are some basic guidelines which will be used on this project:

- As few people as possible will handle the sample.
- The chain of custody records (see Table #2) will be attached to sample containers at the time samples are collected, and will contain the following information: sample number, date and time taken, source of the sample, analysis required, name of person taking sample. The prefilled side of the label will be signed, timed, and dated by the person sampling. The sample container may then be sealed so that the container cannot be opened without breaking the seal. The labels should be filled out in legible handwriting. When transferring the possession of samples, the transferee will sign and record the date and time on the chain of custody record. Custody transfers, if made to a sample custodian in the field, will

be recorded for each individual sample. To prevent undue proliferation of custody records, the number of custodians in the chain of possession will be kept to a minimum.

- Blank samples containing demineralized water will be collected in containers so that the laboratory analysis can be performed to show that there was no container contamination. Additionally, 1 blank volatile organic sample vial will be carried to the site so the laboratory can determine if contamination has occurred to volatile samples.

- The field engineer will be responsible for the care and custody of the samples collected until properly dispatched to the receiving laboratory or turned over to an assigned custodian. He will ensure that each container is in his physical possession or in his view at all times or stored in a locked place where no one can tamper with it.

- The laboratory will have a sample custodian to maintain a permanent log book in which he/she records for each sample delivered, the person receiving the sample, date and time received, source of sample, sample number, how transmitted to the lab, and a number assigned to each sample by the laboratory. The custodian will ensure that heat-sensitive or light-sensitive samples or other sample materials having unusual physical characteristics, or requiring special handling, are properly stored and maintained. Distribution of samples to laboratory personnel who are to perform analyses will be made only by the custodian. The custodian will enter into the log the laboratory sample number, time, date and signature of the person to whom the samples are given. Laboratory personnel will examine the seal on the container prior to opening and be prepared to testify that their examination of the container indicated that it had not been tampered with or opened.

TABLE 1

Quality Assurance - Field Data Sheet

TABLE 1

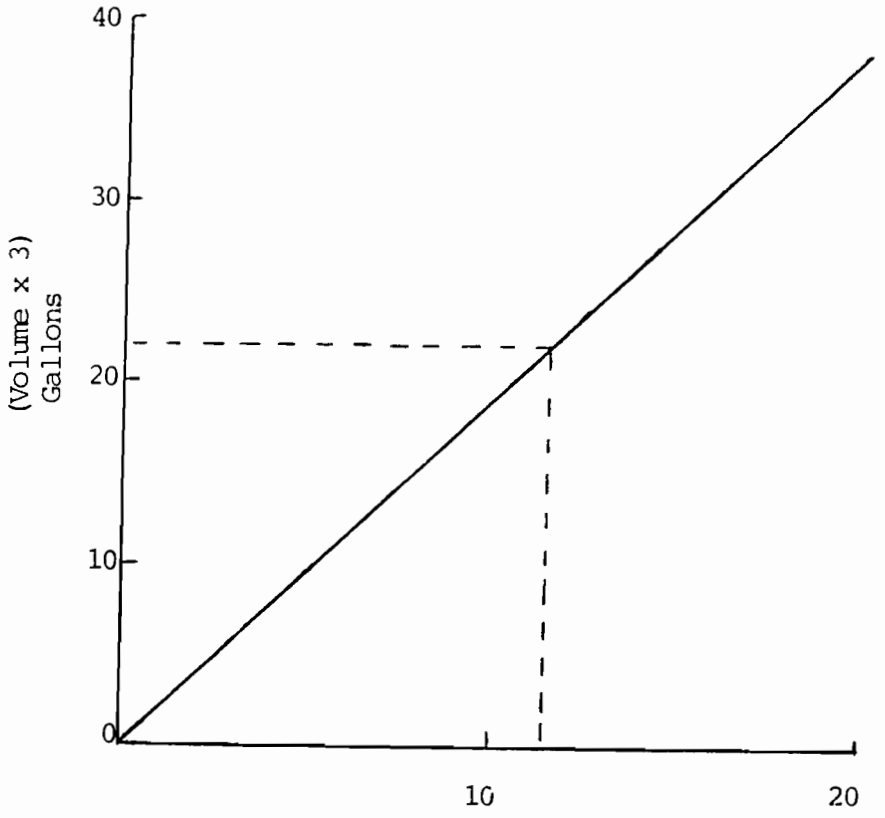
Quality Assurance - Field Data Sheet

Sampling Sta. No.	Sta. Type	Sampling Device	Sample No.	No. of Well Vol. Evac.	Preserv. Measures	Type of Stor. Cont.	Time Elapsed for Sample Shipment to Lab	Remarks

Table 2

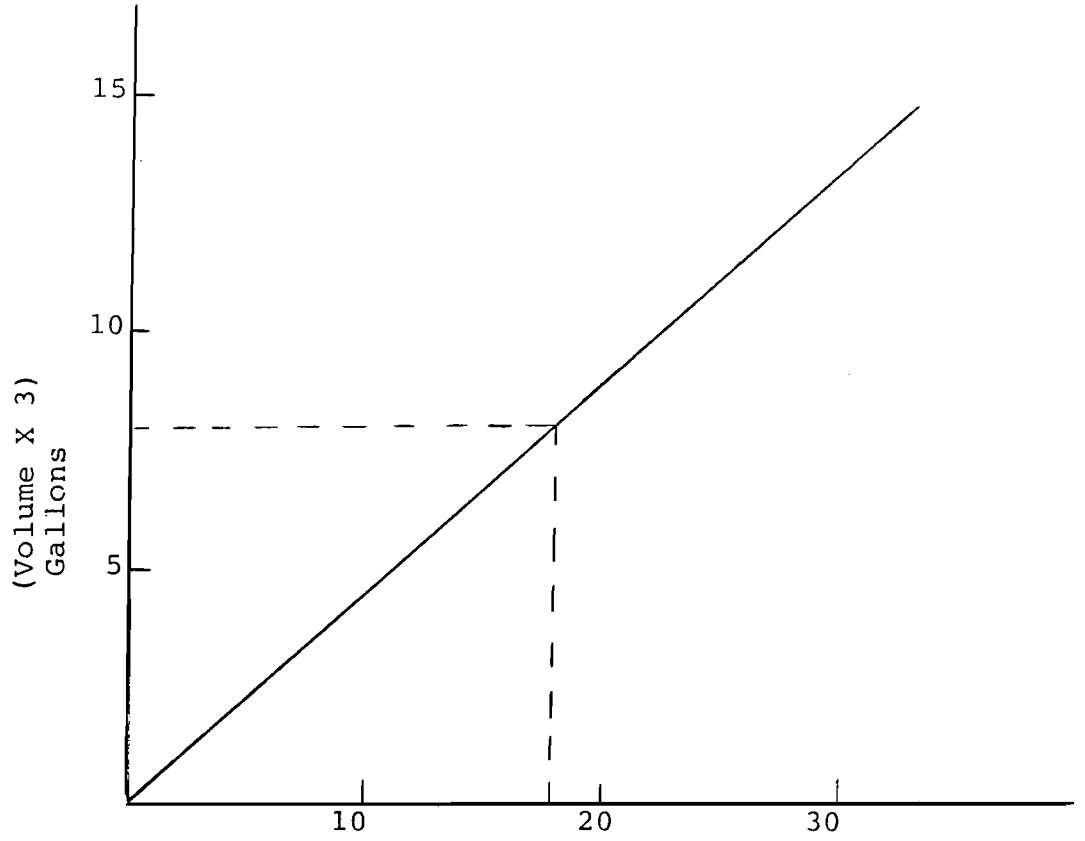
Chain of Custody Record

FIGURES



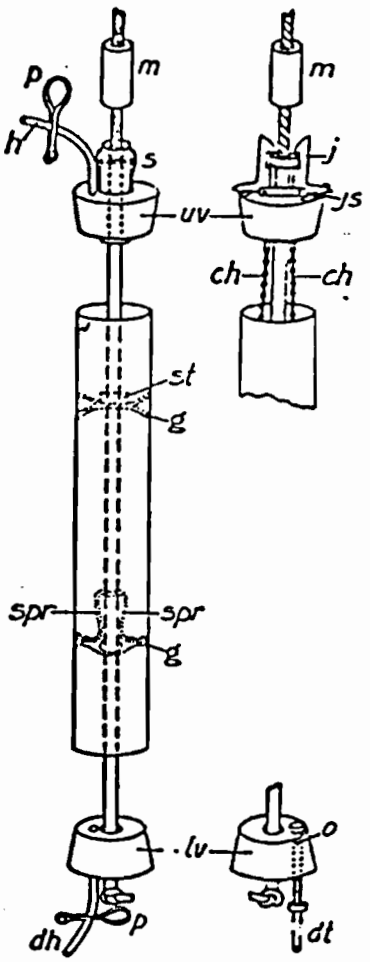
Graph to estimate amount of Water required to flush a 4 inch well 3 times.

FIGURE 1



Graph to Estimate Amount of Water
Required to Flush a 2" I.D. Well
3 Volumes

Figure 2



ch—chain which anchors upper valve to upper interior guide.
dh—rubber drain tube.
dt—brass drain tube.
g—interior guide fastened to inner surface of sampler.
h—rubber tube.
j—jaw of release.
js—jaw spring.
lv—lower valve.
m—messenger.
o—opening interior of drain tube.
p—pinch cock.
s—upper release spring operating on horizontal pin, one end of which fits into groove on central rod.
spr—spring fastened to lower internal guide and operating in groove on central rod to provide lower release.
st—stop on central rod.
uv—upper valve.
Left—View of complete sampler with valves open.
Top right—Another type of construction of upper valve and tripping device.
Bottom right—Another type of construction of lower valve and drain tube

FIGURE 1 STRUCTURAL FEATURES OF MODIFIED KEMMERER SAMPLER

Reference: USEPA, "Procedures Manual for Ground Water Monitoring at Solid Waste Disposal Facilities," EPA/530/SW-611, August 1977.

REFERENCES

1. Standard Methods for the Examination of Water and Wastewater. American Public health Association et al. Fifteenth Edition, 1980.

2. EPA-600/4-79-020. Methods for Chemical Analysis of Water and Wastes. EPA. 1979.

3. National Handbook of Recommended Methods for Water-Data Acquisition, U.S. Geological Survey, 1977.

4. USEPA, "Procedures Manual for Monitoring Solid Waste Disposal Sites", EPA/530/SW-611 August 1977.

APPENDIX A

EQUIPMENT FOR SAMPLING GROUND WATER WELLS

Tools

(1) 24 inch Chain Wrench
(2) Master Key to Well Padlocks
(3) Stopwatch
(4) Clipboards and Data Sheets
(5) Nylon and Steel Brushes
(6) Squeeze Rinse Bottles
(7) Assorted tools (screw-drivers, knife, hammer, wrench)

Sampling Materials

(1) Glass storage sample bottles with appropriate preservatives and covers
(2) Ice
(3) Insulated Ice Chests
(4) Marking Pens and Labels
(5) Demineralized or Distilled Water
(6) Quality Assurance Field Data Sheets
(7) Chain of Custody Sheets
(8) Ground Cloth or Plastic Sheets
(9) Clean Disposable Wiping Cloths
(10) Bailers
(11) Kemmerer Sampler
(12) Pump and Fuel

Protective Clothing

(1) Rubber Gloves and Rubber Boots
(2) Rubber Overalls
(3) Wide vision goggles and hardhat
(4) First Aid Kit

SPECTRUM FINISHING CORPORATION

PHASE II - HAZARDOUS WASTE FIELD INVESTIGATION PROGRAM
SPECIFICATIONS FOR A GEOPHYSICAL SURVEY PROGRAM

April 1985

TABLE OF CONTENTS

SPECTRUM FINISHING CORPORATION
PHASE II - HAZARDOUS WASTE FIELD INVESTIGATION PROGRAM
SPECIFICATIONS FOR A GEOPHYSICAL SURVEY PROGRAM

1.0 PURPOSE OF WORK

Purpose of the geophysical survey program will be two-fold, as described below.

1.1 By an appropriate conductivity, information will be acquired to help determine the type, sequence, structure, and thickness of the soil materials underlying the site, as well as the location of the local ground water table and the presence and extent of any ground water contamination plume.

1.2 The ultimate purpose of this program and of other studies will be to assess impacts (if any) on local water resources, and to identify and quantify certain hazardous constituents.

2.0 SITE DESCRIPTION

2.1 The following description is provided for general information only, and should not be construed to represent the conditions to be encountered during the performance of this work. The Owner and/or Engineer will not be responsible for any deductions, interpretations or conclusions drawn by the Contractor as to the nature of the subsurface materials or the efforts required to perform this work that are based

SPECTRUM FINISHING CORPORATION

PHASE II - HAZARDOUS WASTE FIELD INVESTIGATION PROGRAM SPECIFICATIONS FOR A GEOPHYSICAL SURVEY PROGRAM

April 1985

TABLE OF CONTENTS

SPECTRUM FINISHING CORPORATION
PHASE II - HAZARDOUS WASTE FIELD INVESTIGATION PROGRAM
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solely on the description of site conditions contained therein.

3.0 DEFINITIONS

Within the context of the work to be performed, the following definitions will apply:

3.1 Owner: defines SPECTRUM FINISHING CORPORATION, and its representatives.

3.2 Engineer: defines Richard Galli, and his representatives, as consultant to the Owner.

3.3 Contractor: defines the firm and its representatives, including subcontractors, who will perform the work hereinafter specified.

3.4 Others: defines any other firms, individuals or agencies who may be appointed to perform certain aspects of the work by the Owner or the Engineer.

4.0 SCOPE OF WORK

4.1 The work to be performed under this specification shall consist of field conductivity and magnetometer surveys, analysis of the results, and the preparation of a report on the results obtained.

4.2 The Contractor shall furnish the qualified technical personnel, and all labor, equipment, tools, materials, supplied, transportation and incidentals required to complete the work.

4.3 Preparations required to gain access to the site and to perform the specified services shall be the responsibility of the Contractor.

4.4 The Contractor shall be responsible for restoring all areas used by him in his work to or close to their original condition, to the satisfaction of the Owner and/or Engineer.

4.5 The Owner and/or Engineer shall not be responsible for any loss or damage to equipment sustained by the Contractor, prior to, during, and after the performance of this Contract.

5.0 SERVICES AND PRICES

5.1 General Criteria

5.1.1 The Contractor shall supply all personnel, vehicles, equipment, instruments, services, facilities, power and support necessary for the successful completion of the proposed survey. Deliverables, supervision, travel, subsistence and reports shall be included in the prices.

5.1.2 The Contractor understands that the compensation paid shall be the not-to-exceed amount. With approval of the Engineer, or if so ordered by him, modifications to the estimated quantities shall be made by the Contractor and payment shall be adjusted for the actual work done and accepted, based on the unit prices.

5.1.3 The Contractor should further note that the item quantities tabulated below may not represent true anticipated items or quantities. The tabulated items

include, but may not be limited to those that can be reasonably expected to be used efficiently and successfully, as alternatives or combinations thereof, in light of the Engineer's present state of knowledge and understanding of the site hydrogeologic conditions. The tabulated quantities have been selected with the same criteria.

5.1.4 The Owner and/or Engineer reserve the right to reject any bid that is deemed, in the Owner's and/or Engineer's opinion, to be technically, costwise or otherwise inadequate and/or unrealistic.

5.2 Price Schedule

The following is a tabulation to be used by the Contractor in preparing his bid. Unit prices shall be furnished for all items.

Item		Unit	Est. Amt.	Unit Price	Total Price
1.1	Conductivity Survey	(25' day spacing)*	1	$____	$____
1.2	Magnetometer Survey	(20' x 20' day)*	1	$____	$____
1.3	Mobilization & Demob.			$____	$____

5.3 Progress and Time of Completion

5.3.1 The field work under this Contract shall be commenced within ten (10) consecutive calendar days from the date of written notice to proceed, and shall be performed to completion within five (5) calendar days from the date of written notice to proceed.

*Linear Feet of horizontal spread

5.3.2 If the quantities stated in the proposal are increased the number of calendar days allowed for completion will be similarly increased. This increase will be in the same proportion as the increase in the total pyaments to the Contractor above the amount of the executed Contract.

5.3.3 The Contractor shall maintain upon the site of work sufficient amount of equipment and crews to complete the work within the time allowed.

5.3.4 Within seven days of the end of the field work, the Contractor shall submit to the Owner and Engineer one copy each of the records of all conductivity and magnetometer soundings. The record of each sounding shall be labeled to show the name of the site, the location and type of the sounding conductivity or magnetometer, the date and hour of the measurements, preliminary interpreted data sheets (graphical and/or numerical), methods used, the geophysical units, the type of equipment and the name of the operator-geophysicist. The Contractor shall also attach to each data sheet a sheet commenting on the characteristics of the subsurface in terms of structure, sequence, types, and thickness of layers.

6.0 RESPONSIBILITIES & REQUIREMENTS OF THE CONTRACTOR, ENGINEER & OWNER

6.1 Responsibilities of the Contractor

6.1.1 The Contractor shall be responsible for supplying all services (including labor), equipment and material required to perform the field conductivity and magnetometer surveys and analysis thereof, as well as maintenance and quality control of such required equipment.

6.1.2 The Contractor will be responsible for any and all work subcontracted out and shall ensure that said subcontractor(s) will abide by all aspects of this contract. The Contract will be responsible for supplying the complete requirements of this scope of work to all subcontractors.

6.1.3 The Contractor will be responsible for the correctness of the procedures to be used in the suveys and analysis, as well as for the accurate reporting of the results thereof, as described in this Contract and required by the Engineer.

6.1.4 The Contractor shall submit to the Owner and Engineer, for review, one copy each of a draft report within one (1) week from the last day of field work. A final typed report, including all the analyses and other pertinent information on the conductivity and magnetometer surveys shall be submitted by the Contractor to the Owner, with one copy to the Engineer, not later

than one (1) week after receipt by the Contractor of the reviewed draft from the Engineer.

6.2 Requirements of the Contractor

6.2.1 The Contractor shall be required to perform the field conductivity and magnetometer survey and analyze the results as described hereafter. All data and results obtained shall be tabulated in a summary by the Contractor for inclusion in the report.

6.2.2 The Contractor will be required to report any major technical or other problems encountered in the field and/or in the analysis, which might preclude the successful performance of any items of this Contract, to the Engineer within 24 hours.

6.2.3 The Contractor shall be required to send to the Engineer advance written notification for any changes in field or analytical procedures, describing and justifying such changes. No such changes shall be made to the procedures, unless requested or authorized in writing by the Engineer. In certain cases, prior written authorization may be waived by the Engineer, at his discretion, and the changes may be requested and/or authorized verbally. This waiver, however, will not release the Contractor of his obligation to follow up with a written explanation for the aforesaid changes.

6.3 Responsibilities of the Engineer and Owner

The conductivity and magnitometer survey traverses are shown on the attached SURVEY PLAN (Figure 2). A representative of the Owner and/or Engineer will generally be present during the field operations for consultation. However, this physical presence is not to be construed as an obligation of either the Owner or Engineer, nor shall it relieve the Contractor in any way whatsoever of his obligations under this Contract.

6.4 Communication

6.4.1 All correspondence from the Contractor to the Owner shall include a copy to the Engineer.

6.4.2 All correspondence shall contain the following subject headings:

Job Order Number (J.L.NO.)
Letter's Serial Number (e.g. Contractor's Initials - NC - Year - No.)
SPECTRUM FINISHING CORPORATION
PHASE II - Hazardous Waste Field Investigation Program

6.4.3 All administrative and technical correspondence shall be addressed to:

6.4.4 One copy of administrative and technical correspondence shall be addressed to:

6.4.5 A cover letter shall accompany all technical reports, and shall include a summarized description of their content.

6.4.6 Draft and final reports will be submitted as described in Subsections 11.2, 11.3 and 11.4.

7.0 Quality Assurance

A typewritten copy of the Bidder's Quality Assurance Programs shall be submitted with the Bid Package. The Bidder's Quality Assurance Programs shall include, but not be limited to, the following points:

7.1 Resumes of all personnel involved in field testing and analysis of results.

7.2 Calibration/Standardization

7.2.1 All instruments used for the survey shall be calibrated and/or standardized as specified by the manufacturer. All field measurements made with equipment that is found to be out of calibration shall be considered unacceptable and the measurements shall be redone at the Contractor's expense.

7.2.2 Each instrument, which is within the calibration/standardization program will bear a sticker containing the following information:

a. Identification and number of instrument
b. Date of last calibration/standardization
c. Expiration date of calibration/standardization
d. Signature and identification number of technician or operator performing calibration/standardization

7.2.3 Written preventive maintenance measures for each type of equipment used during the study shall be made available by the Contractor to the Engineer upon request.

7.3 A written document will be completed for each calibration made on all equipment within the calibration/standardization program and will contain the following information:

7.3.1 Instrument accuracy prior to calibration/standardization adjustment

7.3.2 Instrument accuracy after calibration/standardization adjustment

7.3.3 Relative error expressed in percent form

7.3.4 Date of calibration/standardization adjustment

7.3.5 Due date of calibration/standardization adjustment

7.3.6 Instrument identification

7.3.7 Signature of the operator performing calibration/standardization adjustment

7.4 Procedures used for calibration will assure the standardization and reliability of field work.

7.5 A typewritten letter will be sent by the Contractor to the Owner, with copy to the Engineer, at least one week in advance stating the date, time, and location of field work to allow personnel from the Engineer and/or Owner to be present during said operation, if so desired by the Owner and/or Engineer, and in any event to enable the Owner to alert the pertinent Plant personnel of the forthcoming visit by the Contractor. A report will be sent along with the letter describing how the field work will be carried out, what equipment will be used, explanation of any special preparation of equipment and a schedule of field work.

7.6 The Contractor shall keep a log book exclusively for this project, containing information regarding field work (i.e., methods used for data collection, type of equipment used, type of problems encountered, etc.).

7.7 Upon request, all records (i.e., log books, documents, data sheets, calculations, etc.) shall be made available to authorized Engineer and/or Owner's personnel for audit at the Contractor's office or in the field, during reasonable hours. Examination of field procedures by the Engineer and/or Owner's authorized personnel may be carried out during the course of work to verify compliance with all aspects of this program; however, this examination is not to be construed as an obligation of either the Owner or Engineer, nor shall it relieve the Contractor in any way whatsoever of his obligations under this Contract.

7.8 Subcontractors will comply with all parts of this program (i.e., keeping of records, calibration/standardization, auditing by the Engineer and/or Owner). It is the responsibility of the Contractor to ensure that subcontractors comply with all aspects of this program.

7.9 A written letter form the Contractor shall be sent to all subcontractors stating that the Engineer and/or Owner's authorized personnel will be allowed to inspect both field and laboratory procedures and quality control measures, as applicable.

8.0 TECHNICAL REQUIREMENTS FOR CONDUCTIVITY & MAGNITOMETER SURVEYS

8.1 General

8.1.1 Magnetometer equipment used by the Contractor should be able to detect metallic objects to a depth of 10' (ft). Data collected from the instrument should be accurate enough to identify any buried drums, pipelines, or storage tanks.

The instrument chosen by the Contractor should have an accuracy of 1.0 gammas and a resolution of 0.1 gammas.

8.1.2 The magnetometer survey shall have a grid spacing of 20' (ft) apart and stations along each grid line shall be 20' (ft) apart. The general area to be investigated is shown on Figure 2.

8.1.3 Conductivity equipment used by the Contractor shall have an accuracy of $\pm$ 1% at 100 milliohms, or better, with a resolution of 1 milliohm, and will be able to measure down to depths of 100' (ft). Grid spacing in the field shall be 25' (ft) apart (see Figure 3).

The conductivity equipment sued shall be able to identify the presence and extent of any ground water pollution plumes, the presence of underlying clay strata and the top of water table.

9.0 INSPECTION

9.1 The Engineer's or Owner's Field Inspector shall have the right, at all reasonable times, to inspect the Contractor's work, equipment, or quality control procedures, as applicable to the work covered by this Contract, to confirm that the specified requirements are being complied with. The Contractor shall provide all tools, instruments, etc. necessary to facilitate these inspections.

9.2 The Engineer's Field Inspector shall discuss with the Contractor anything he notices that may lead to rejection of the work.

9.3 It is not intended that the presence or activity of the Engineer's Field Inspector shall relieve the Contractor in any way whatsoever of his obligations under this Contract. Furthermore, the fact that the Engineer may inadvertently overlook a deviation from some requirements of this Contract shall not constitute a waiver of that requirement, nor of the Contractor's obligation to correct the condition when it is disdovered, nor of any other obligation under this Contract.

10.0 PRESENTATION OF RESULTS

10.1 All draft and final reports shall contain, but not be limited to the following information.

10.2 Conductivity: All Conductivity data shall be tabulated and submitted for the following:

A) Conductivity Date Sheet (see attachment).

B) Conductivity Measurements (see attachment) interpreted for depth and conductivity of the strata sequence.

C) Conductivity cross-sectional Profile of each transect illustrating depth to ground water, strata sequence with corresponding conductivity.

D) Conductivity contour map showing the interpreted extent of any existing onsite groundwater contamination plume.

E) All calculations.

10.3 Magnetometer: All magnetometer data shall be tabulated and submitted for the following:

A)

B)

C)

D)

10.4 The final report shall contain, but not be limited to, the following information in addition to that detailed in Sections 11.2 and 11.3.

A) Table of Contents

B) Field Methodology

C) Description of the results and summary of interpretative analysis.

D) A map showing locations of transect lines

E) Personnel

11.0 MOBILIZATION AND DEMOBILIZATION

This term shall include the moving of men, equipment and materials to and from the project site as necessary to execute the conductivity and magnitomer survey work properly and in a timely fashion. It shall also include the furnishing and erection of any barricades, field installations, etc., necessary for the performance of the work as well as the final clean-up, and resotration of the site.

12.0 MEASUREMENT AND PAYMENT

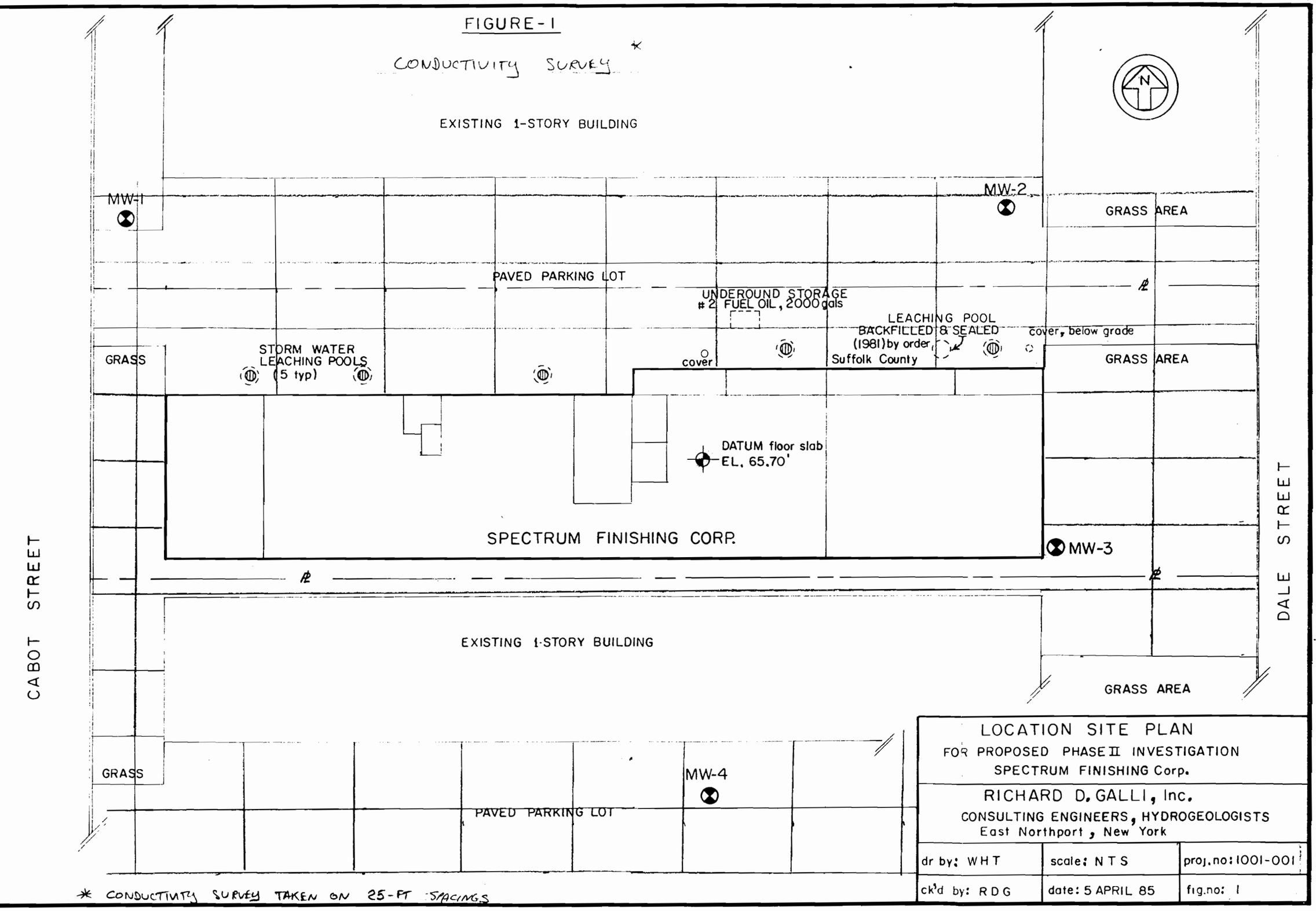
12.1 Payment for the items included in this Contract shall be for the work actually done and accepted, according to the unit prices, or fraction thereof, listed in Section 5.2 Price Schedule, and except as described below.

12.2 No payment will be made for lost tools, recorders, or any other equipment normally involved in the operations.

12.3 No payment will be made for the information requested in Section 11. The cost shall be included in the unit prices for Seismic and Resistivity Surveys.

FIGURE-1

CONDUCTIVITY SURVEY *



LOCATION SITE PLAN
FOR PROPOSED PHASE II INVESTIGATION
SPECTRUM FINISHING Corp.

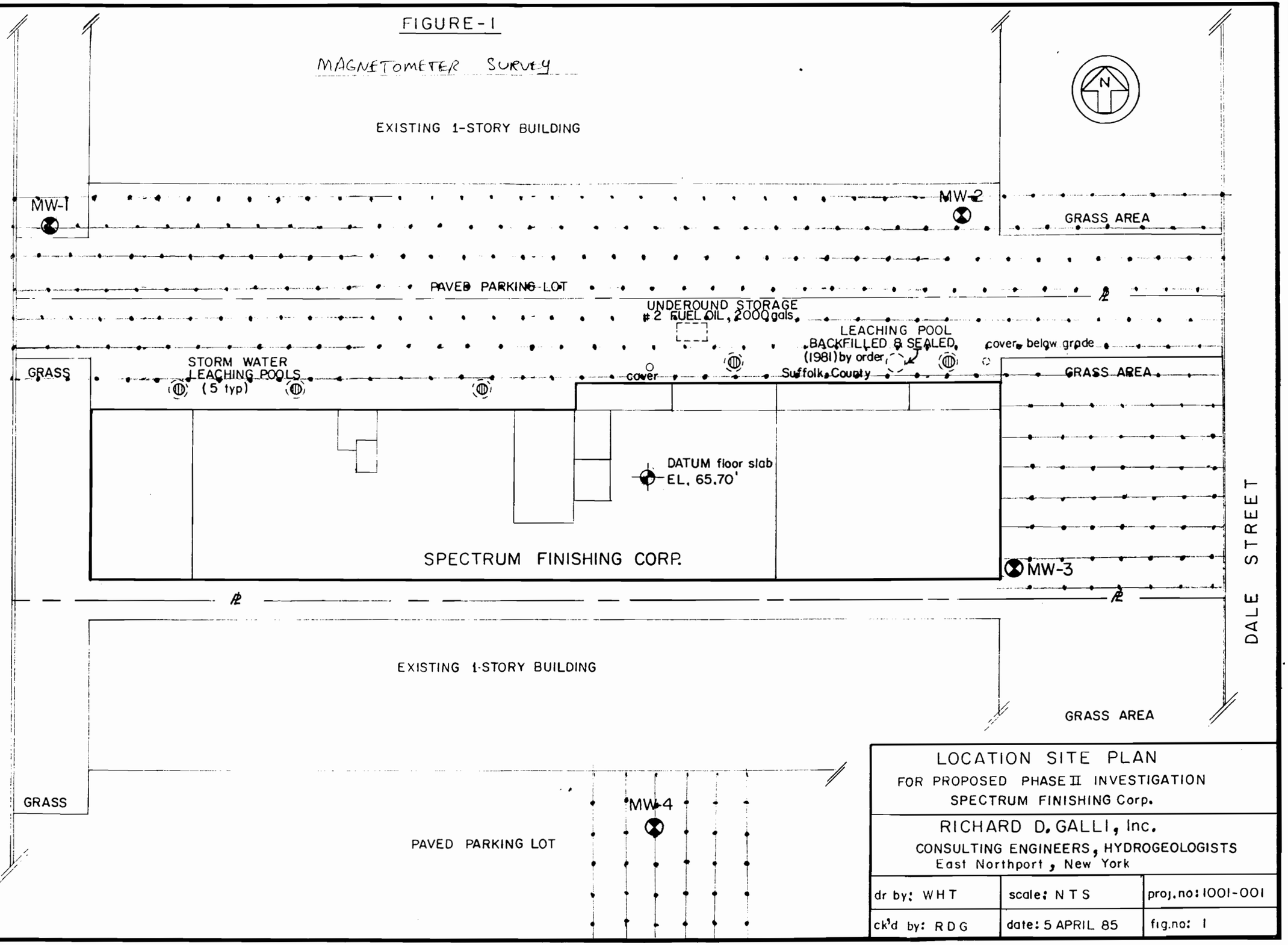
RICHARD D. GALLI, Inc.
CONSULTING ENGINEERS, HYDROGEOLOGISTS
East Northport, New York

dr by: WHT	scale: N T S	proj.no: 1001-001
ck'd by: RDG	date: 5 APRIL 85	fig.no: 1

* CONDUCTIVITY SURVEY TAKEN ON 25-FT SPACINGS

FIGURE-1

MAGNETOMETER SURVEY



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SPECTRUM FINISHING CORPORATION

PHASE II - HAZARDOUS WASTE FIELD INVESTIGATION

SPECIFICATION FOR A GEOTECHNICAL LABORATORY TESTING PROGRAM

March 1985

SPECIFICATION FOR A GEOTECHNICAL LABORATORY TESTING PROGRAM

CONTENTS

SPECIFICATION FOR A GEOTECHNICAL TESTING PROGRAM

1.0 PURPOSE OF WORK

1.1 The purpose of this program will be to determine the physical characteristics of site soils by appropriate laboratory analysis.

2.0 DEFINITIONS

The following definitions apply to all parties involved with the work.

2.1 Owner: Defines SPECTRUM FINISHING CORPORATION and its representatives.

2.2 Engineer: Defines Richard Galli and his representatives.

2.3 Contractor: Defines GEO-TECH ASSOCIATES and its representatives.

2.4 Others: Defines any other firms, individuals or agencies who may be appointed to perform certain aspects of the work by the NYC DOS or the Engineer.

3.0 REQUIREMENTS OF GEO-TECH ASSOCIATES

3.1 GEO-TECH Associates shall be required to analyze and/or test site soil samples as described later. All data and results obtained shall be tabulated by GEO-TECH for inclusion in a report.

3.2 GEO-TECH shall submit to the Engineer, for review, draft analysis reports within two (2) weeks of submittal of any soil samples to the laboratory. A final typed

report, including all the analyses and other pertinent information on the laboratory testing program for the preliminary phase, shall be submitted by GEO-TECH to the Engineer, not later than three (3) weeks after receipt by the laboratory of the last soil sample.

3.3 GEO-TECH will report to SPECTRUM FINISHING within 48 hours, and log any major technical or analytical problems encountered in the laboratory, which might preclude the successful performance of any item of this Specification.

3.4 GEO-TECH shall send to the Engineer advance written notice for any changes in laboratory analytical procedures, describing and justifying changes with a copy to SPECTRUM FINISHING. No changes shall be made to the procedures, unless requested or authorized in writing by the Engineer. In certain cases, prior written authorization may be waived by the Engineer, at its discretion, and the changes may be requested and/or authorized verbally. This waiver, however, will not release GEO-TECH from its obligation to follow up with a written explanation for the requested changes.

3.5 Unles otherwise requested by SPECTRUM FINISHING, GEO-TECH shall store the unused samples, or any portions thereof, through the sixth month after the acceptance of the Final Report by SPECTRUM FINISHING and the Engineer.

4.0 RESPONSIBILITIES OF THE ENGINEER

The Engineer will be responsible for delivering the soil samples to GEO-TECH. The Engineer will select a number of soil samples for analysis and determine which tests will be performed on the selected samples. A Field Sample Data Sheet for laboratory testing, indicating which Laboratory Tests should be performed will accompany each soil sample (see Attachment).

5.0 COMMUNICATION

5.1 GEO-TECH shall send all correspondence directly to SPECTRUM FINISHING corporation.

5.2 All correspondence shall contain the following subject headings:

- Job Order Number (J.O. No.)
- Letter's Serial Number (e.g., Contractor's Initials - GT - year - No.)
- SPECTRUM FINISHING CORPORATION
- PHASE II HAZARDOUS WASTE INVESTIGATION

5.3 A cover letter shall accompany all technical reports, and shall include a summarized description of their content.

6.0 SERVICES AND PRICES

6.1 General Criteria

GEO-TECH shall supply all personnel, equipment, instruments, services, facilities, and support necessary for the

successful completion of the proposed work. Deliverables, supervision, and reports shall be included in the prices.

6.2 Compensation paid shall be based on the unit prices. With the approval or at the request of SPECTRUM FINISHING, modifications to the estimated quantities shall be made by SPECTRUM FINISHING and payment shall be adjusted for the actual work done and accepted.

6.3 Item quantities tabulated below may not represent true anticipated items or quantities. The tabulated items include, but may not be limited to those that can be reasonably expected to be used efficiently and successfully, as alternatives or combinations thereof, in light of present state of knowledge and understanding of the site's condition.

6.4 Price Schedule

The following itemization sheet shall be used to prepare an estimate. Unit prices shall be furnished for all items.

	ITEM	UNIT	EST. AMT	UNIT PRICE	TOTAL PRICE
1.0	Grain Size Distribution	ea.	10		
2.0	Hydrometer Analysis	ea.			

Total Cost of Contract

7.0 QUALITY ASSURANCE

7.1 Calibration/Standardization

All instruments used for testing shall be calibrated and/or standardized according to manufacturer's specifications. All items tested with equipment that is found to be out of calibration shall be considered unacceptable and the items shall be retested at GEO-TECH's expense.

7.2 GEO-TECH shall keep all samples in the laboratory and protect them from moisture, freezing or extreme heat. No samples shall be exposed to air where loss of moisture may result.

7.3 Procedures used for calibration will assure the standardization and reliability of laboratory tests.

7.4 GEO-TECH shall keep a log book exclusively for this project, containing information regarding laboratory procedures (i.e., instrument readings, standards used for equipment calibration, calculations and methods used for calculations; calculators, computers, etc.)

person(s) performing anlaysis and pertinent comments.

7.5 Upon request, all records (i.e., log books, documents, data sheets, calculations, etc.) shall be made available to SPECTRUM FINISHING for audit at GEO-TECH's office during reasonable hours. Examination of laboratory procedures by SPECTRUM FINISHING and/or its consultant may be carried out during the course of work to verify compliance with all aspects of this program; however, this examination is not to be construed as an obligation of either SPECTRUM FINISHING or its consultant, nor shall it relieve GEO-TECH in any way whatsoever of this obligation under this Contract.

8.0 LABORATORY TESTS

Laboratory Tests shall be performed on soil samples from the test-holes as designated, requested or otherwise approved by SPECTRUM FINISHING, and as described below.

8.1 Grain Size Distribution

Determination of the grain size distribution of the portion retained on No. 200 sieve, shall be made according to ASTM D422. If only the amount (per percentage) passing a No. 200 sieve is required, it shall be determined according to ASTM D1140.

8.2 Hydrometer Analysis

The particle size analysis of the fine fraction of soils passing a No. 200 sieve shall be determined according to ASTM D422.

9.0 DISPOSITION OF SAMPLES AFTER TESTING

9.1 GEO-TECH shall store all samples in the laboratory for six months following acceptance of the Final Report by SPECTRUM FINISHING and protect them from moisture, freezing or extreme heat. No samples shall be exposed to air where loss of moisture may result. Undistrubed samples shall be protected against any damage or disturbance.

9.2 Upon instruction from SPECTRUM FINISHING, GEO-TECH shall ship the samples back to SPECTRUM's office or to another destination designated by SPECTRUM FINISHING. All samples shall be properly packed in suitable containers to prevent shifting of the samples in boxes, or breakage of glass jars or other damage while in transit. The labor, materials for packaging and crating, and the freight shall be invoiced to SPECTRUM FINISHING CORPORATION.

10.0 PRESENTATION OF RESULTS

10.1 Laboratory analysis shall be presented in a report format which will include at least the following:

a. Introduction

b. Summary of Testing program

c. Brief description of laboratory procedures for each test.

d. Data tables

e. Grain size distribution curves.

10.2 Data tables shall include at least the following:

a) Table Title
b) Project
c) Client
d) Date
e) Well No.
f) Sample No.
g) Sample Depth(s)
h) Sample Description

FIELD SAMPLE DATA SHEET FOR LABORATORY TESTING

Project _____

Client _____

Laboratory _____

Sample No. _____

Well No. ___ Depth: From___ To ___ Date Collected ___

Soil Sample _____ Rock Sample _____

Disturbed _____

Undisturbed _____

Method of Collection:

Shelby ____ Other ____
Denison ____
Stationary Piston ____
Split Spoon ____

PHYSICAL CHARACTERISTICS

Grain Size Distribution ____
Hydrometer Analysis ____

Sample Stored at ____
Shipped to Lab by ____
Date Shipped ____

Comments: _____

_____

Received by Lab, Date _____

Engineer's Representative _____

Lab Representative _____