

REPORT  
of  
HYDROGEOLOGICAL ASSESSMENT  
(PHASE II UNPERMITTED AREA)

North Mecklenburg Landfill  
15300 Holbrooks Road  
Huntersville, North Carolina

ESI Project No. ES-0675

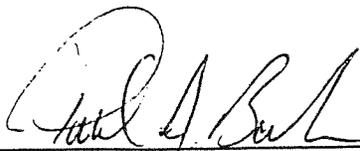
July 8, 1994

*-Prepared for-*

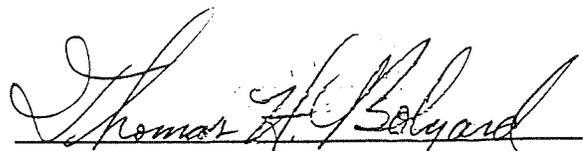
Mr. Larry Griffin, Sr.  
19141 Highway 73 West  
Davidson, North Carolina 28036

*-Prepared by-*

Ecological Services, Inc.  
P. O. Box 12146  
Charlotte, NC 28220



Paul A. Banks  
Project Geologist



Thomas H. Bolyard, P.G.  
Senior Hydrogeologist  
N.C. Registration No. 0492

## TABLE OF CONTENTS

### Hydrogeologic Assessment

1.0	PROJECT INFORMATION	1
2.0	FIELD EXPLORATION	2
2.1	Soil Test Borings	2
2.2	Temporary Piezometer Installation	3
2.3	Permanent Monitoring Well Installation	3
3.0	AREA GEOLOGY	4
4.0	SUBSURFACE CONDITIONS	4
4.1	Cover Soils	4
4.2	Cell Floor Soils	6
5.0	HYDROGEOLOGIC CONDITIONS	7
5.1	Regional Hydrogeology	7
5.2	Site Hydrogeology	8

### Proposed Monitoring Plan

1.0	MONITORING PLAN OBJECTIVE	10
2.0	MONITORING WELL SAMPLING PLAN	10
3.0	REPORT PREPARATION	11
	REFERENCES	12

### TABLES:

- 1: Constant Head Permeability Testing Data (Cover Soil Material)
- 2: Summary of Grain Size Distribution Testing (Cover Soil Material)
- 3: Constant Head Permeability Testing Data (Floor Soil Material)
- 4: Summary of Grain Size Distribution Testing (Floor Soil Material)
- 5: Summary of Groundwater Elevation Data

**TABLE OF CONTENTS**  
**(Continued)**

**FIGURES:**

- 1: Site Location Map
- 2: Site Configuration Map
- 3: Soil Test Boring Location Map
- 4: Cross Section Designation Map
- 5: Cross Section A-A'
- 6: Cross Section B-B'
- 7: Phreatic Surface Contour Map

**APPENDICES:**

- A: Soil Boring Records
- B: Report of Laboratory Constant Head Permeability and Classification Tests for Cover Soil Samples
- C: Report of Laboratory Constant Head Permeability and Classification Tests for Floor Soil Samples
- D: In-flow Permeability Calculations

## 1.0 PROJECT INFORMATION

The North Mecklenburg Landfill site is located at 15300 Holbrooks Road in Huntersville, North Carolina (Figure 1). The subject site is an active construction and debris (C & D) landfill and consists of approximately 71.6 acres. The C & D landfill permit was issued on June 24, 1993 by the North Carolina Department of Environment, Health and Natural Resources, Division of Solid Waste Management (NCDEHNR). As a part of the permit application requirements, Ecological Services, Inc. (ESI) was contracted by Mr. Larry Griffin, Sr. to perform a hydrogeological assessment, dated June 18, 1992 (ESI Job No. ES-0153), which was submitted to the State for their review and comment.

The original site survey, which was performed as part of the proposed monitoring well program outlined in our June 18, 1992 report, was incorrectly performed and thus, permanent monitoring well MW-4 was located in an unpermitted section of the landfill. This well was utilized by Mr. Larry Griffin, Sr. and his staff to determine the proposed permitted landfill area. Due to this incorrect survey, construction and debris material was landfilled outside the Phase I permitted area (Figure 2).

As soon as Mr. Larry Griffin, Sr. realized that the landfilling operations extended beyond the permitted area, he contacted the Mecklenburg County Department of Environmental Protection (MCDEP) and the NCDEHNR, Solid Waste Section. Subsequently, a meeting was held on November 30, 1993 with individuals from the Solid Waste Section and the MCDEP. During this meeting, Mr. Julian M. Foscue, III of the Solid Waste Section banned any further landfilling operations in the unpermitted area and ordered that a hydrogeological investigation of this area be performed to determine subsurface conditions and groundwater flow direction. ESI performed a hydrogeological assessment on the portion of the unpermitted area on which landfilling had occurred, and submitted the findings of the assessment to the MCDEP and NCDEHNR on March 8, 1994 (ESI Job No. 0675).

This report documents the continued hydrogeologic assessment of the remaining unpermitted portion of the 71.6 acre Phase II area (Figure 2), and was conducted by ESI during April, May, and June of 1994.

## **2.0 FIELD EXPLORATION**

### **2.1 Soil Test Borings**

Seven soil test borings (B-4, B-5, B-6, B-7, SB-1, SB-2, and SB-3), and five floor sample excavations (F-1, F-2, F-3, F-4, and F-5) were conducted during the assessment to classify subsurface lithology and soil geotechnical characteristics within the Phase II area (Figure 3).

Soil borings B-4, B-5, B-6, and B-7 were advanced to assess cover soil characteristics within the Phase II area. Soil samples were collected from each of these borings at a depth of 0 to 2 feet utilizing a stainless steel hand auger. Subsequent constant head permeability and classification tests were conducted on the soil samples by Law Engineering, Inc.

Soil borings SB-1, SB-2, and SB-3 were advanced on May 11, 1994 to assess subsurface lithologic conditions within the Phase II area. Soil samples were collected and described every five feet during the boring advancement. The borings were drilled with an all terrain drill rig employing hollow stem steel augers. Soil sampling was performed in general accordance with ASTM D1586 utilizing a standard 1.4-inch I.D., 2-inch O.D., split-tube sampler. The sampler was first seated 6 inches to penetrate any loose cuttings, and then driven an additional 12 inches with blows of a 140 pound hammer falling 30 inches. Soil boring records are included in Appendix A of this report.

Five floor soil samples (F-1, F-2, F-3, F-4, and F-5) were collected within the Phase II area to assess soil characteristics at the proposed base of the landfill cell. Each floor soil sample was collected at a depth of approximately 20 feet below ground surface utilizing a trackhoe provided by Mr. Larry Griffin, Sr. Following the collection of the five floor soil samples, constant head permeability and classifications tests were performed on each sample by Law Engineering, Inc.

## **2.2 Temporary Piezometer Installation**

Seven temporary piezometers (PZ-1 through PZ-7) were installed to depths ranging from 20 to 85 feet in the Phase II area to assess depth to groundwater and direction of groundwater flow. The locations of the newly installed piezometers are indicated on the attached Site Configuration Map (Figure 2).

The temporary piezometers were constructed with a 2-inch diameter, Schedule 40, PVC riser section with 10 to 20 feet of 2-inch diameter, schedule 40 PVC 0.010-inch slotted screen. Washed sand backfill was placed in the boring annulus to at least two feet above the top of the well screen, and sealed with at least two feet of bentonite. The remainder of the borehole was then backfilled with native material to the ground surface. Temporary piezometer boring records are included in Appendix A of this report.

## **2.3 Permanent Monitoring Well Installation**

Eight permanent groundwater monitoring wells (MW-2, MW-3, MW-4, MW-6, MW-7, MW-8, MW-9, and MW-10) are located within the Phase II area (Figure 2). Each permanent monitoring well was installed to aid in present and future groundwater flow determination, lithologic characterization, and to provide groundwater monitoring points for semi-annual groundwater quality analysis. Washed sand backfill was placed in the annulus of each monitoring well boring to at least two feet above the top of the well screen, followed by a two-foot thick (minimum) bentonite seal, and overlain by a cement bentonite mixture which filled the boring annulus to the ground surface. In addition, a lockable stand-up steel protective cover was placed over each well and secured with a lock. Groundwater monitoring well boring records are included in Appendix A of this report.

## **3.0 AREA GEOLOGY**

The site is located within the Charlotte Belt Geologic Province of North Carolina. The rocks of the Charlotte Belt range in age from late Proterozoic to Silurian or Middle Paleozoic. The

dominant rock types in the Charlotte Belt are metamorphosed intrusive rocks, with large areas of metavolcanic rocks, and lesser amounts of metasedimentary rocks (Goldsmith and others, 1988). Surface layers in the area of the Charlotte Belt consist of weathered bedrock which granulates readily near the surface of the ground producing cover soils which may be composed of individual quartz, hornblende and feldspar crystals. The bedrock at the subject site is characterized as metamorphosed quartz diorite and toaite, usually medium to coarse-grained with evident foliation. The diorite is composed dominantly of plagioclase, quartz and biotite, with varying amounts of hornblende and epidote.

#### **4.0 SUBSURFACE CONDITIONS**

##### **4.1 Cover Soils**

Characterization of surface cover soil conditions was conducted on soil samples obtained from borings B-4 through B-7. The cover soil samples were obtained from hand auger cuttings at a depth of 0-2 ft. below grade. Each collected soil sample was placed in a new 5 gallon plastic bucket, covered and delivered to Law Engineering to perform testing according to the appropriate sections of the following ASTM standards:

ASTM D 698	"Standard Test Method for Moisture Density Relations of Soils and Soil Aggregate Mixtures Using a 5.5 lb. (2.49 kg) Rammer and 12 in. (305 mm) Drop"
ASTM D 5084	"Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter"
ASTM D 4318	"Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils"

The results of Constant Head Permeability Testing and Grain Size Distribution Testing on each of the cover soil samples are summarized in Tables 1 and 2 respectively. The Report of Laboratory Constant Head Permeability and Classification Tests (Law Job No. 226-09423-01, dated January 6, 1994) is included as Appendix B.

The residual soil is fairly consistent across the Phase II area. A 12 to 20 foot surface layer of saprolitic brownish gray silty medium sand was identified at soil boring locations SB-1, SB-2, and SB-3. The soils became more resistant to drilling activities with depth. Evidence of the parent material in the form of rock fragments and increased grain size were also noted with increasing boring depth. Partially weathered bedrock was encountered in soil borings SB-1, SB-2, and SB-3, piezometer PZ-6 and monitoring well MW-7 ranging from 12 feet in SB-3 to 20 feet in MW-7. Cross section traverse orientations associated with the previously mentioned borings are illustrated in Figure 4. Cross sections A-A' and B-B' are included as Figures 5 and 6.

Lithologic tie lines connecting soil borings in cross sections A-A' and B-B' designate inferred lithologic changes in the residual soils located between borings. Actual lithologic changes may be more gradational or abrupt than depicted.

The above descriptions provide a general screening of the subsurface conditions encountered within the cover soils of the Phase II area. The attached soil boring records (Appendix A) contain detailed information recorded at each boring location.

#### **4.2 Cell Floor Soils**

Five floor soil samples (F-1 through F-5) were collected in the Phase II area at depths projected to be the floor of the fill area (Figure 3). Each soil sample approximates the soil characteristics associated with the residual/fill material contact in the area sampled.

Characterization of cell floor soil conditions was conducted on each sample obtained from samples F-1 through F-5. The floor soil samples were obtained from excavated soil obtained with a track hoe at an approximate depth of 20 feet below ground surface at each sampling location. Each collected soil sample was placed in a new 5 gallon plastic bucket, covered and delivered to Law Engineering to perform testing according to the appropriate sections of the following ASTM standards:

ASTM D 698	"Standard Test Method for Moisture Density Relations of Soils and Soil Aggregate Mixtures Using a 5.5 lb. (2.49 kg) Rammer and 12 in. (305 mm) Drop"
ASTM D 5084	"Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter"
ASTM D 4318	"Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils"
ASTM D 422	"Standard Test Method for Particle-Size Analysis of Soils"

The results of Constant Head Permeability Testing and Grain Size Distribution Testing on each of the cell floor soil samples are summarized in Tables 3 and 4 respectively. The Report of Laboratory Constant Head Permeability and Classification Tests (Law Job No. 226-09423-01, dated February 14, 1994) is included in Appendix C.

## **5.0 HYDROGEOLOGIC CONDITIONS**

### **5.1 Regional Hydrogeology**

Groundwater recharge in this area of North Mecklenburg County is derived from precipitation. The average annual rainfall of the area is approximately 47 inches. The surficial materials at

many places in the County are composed of relatively impermeable saprolite and the fraction of precipitation that reaches the water table may be less than one-third. Seasonal fluctuation of the water table may be considerable during dry or wet seasons. However, on average the net change in water level elevation is small, which indicates that the average annual discharge of groundwater is about equal to the average annual recharge.

Groundwater movement in crystallized rocks such as metamorphosed quartz diorite, which have little primary pore space is dependent upon secondary permeabilities created by features such as joints, fracture cleavage planes, planes of foliation, bedding planes, and solution channels.

The porosity of a rock is the percentage of the total volume that is occupied by the interstices. The porosity of different rock materials may cover a wide range. For example some clays may have porosity of more than 50 percent, while some crystallized rock may be less than 1 percent pore space.

A material may have a high porosity and yet yield little water. For example, clays have porosities as high as 50 percent, and yet yield little due to the flat particle shape which tends to layer and trap water. The same is true for crystallized rocks such as quartz diorite where the interstices are isolated or poorly interconnected.

## **5.2 Site Hydrogeology**

The site contains an aquifer which appears to extend into bedrock within both the Phase I and Phase II areas of the subject site. Bedrock was encountered at depths ranging from 20 feet below grade in MW-6 to 30 feet below grade in PZ-2. The bedrock consists of a metamorphosed quartz diorite. This diorite, in a semi-weathered state, is a dark blue or gray medium textured rock composed of quartz, hornblende and feldspar, containing varying amounts of biotite, pyroxene and other accessory minerals. Surface layers consist of weathered bedrock or saprolite, which granulates readily near the surface of the ground. The cover soils are typically composed of individual quartz, feldspar and hornblende crystals. In all the wells drilled in this phase of the project, the top of bedrock was encountered prior to the water table, with the exception of PZ-6.

During the installation of PZ-6 groundwater was encountered at approximately 8 feet and bedrock was encountered at 20 feet. Water bearing fractures were encountered in all wells in the top 10 feet of bedrock with the exception of well MW-6. Considering the high topographic elevation of well MW-6, apparent water bearing fractures were not encountered until reaching a vertical depth of approximately 90 feet below grade.

The top of casing elevation for each piezometer and monitoring well was surveyed by Richard Boyd Brooks Surveyors. The original survey was conducted on October 16, 1993, and updated on February 22, 1994 and June 10, 1994, as additional monitoring points were installed. Each survey was conducted using the same common datum point. This information was used to construct a phreatic surface contour map for the subject site (Figure 7). Water levels were measured in monitoring wells MW-2 through MW-10, excluding MW-5, and in piezometers PZ-1 through PZ-5 on February 10, 1994 and May 5, 1994 (Table 5). Each of the aforementioned monitoring points, with the addition of PZ-6 and PZ-7, were also gauged on May 27, 1994 (Table 5). The phreatic surface illustrated in Figure 7 was constructed utilizing the most recent water table elevation data obtained on May 27, 1994. A contour modeling program (SURFER version 4), utilizing X, Y, and Z (water table elevation) coordinate data for each monitoring location, was used in the construction of Figure 7. SURFER creates a regularly spaced grid from the coordinate data utilizing Kriging statistical interpolation.

The first determination in constructing the groundwater contour map was to ascertain if the bedrock monitoring wells are at atmospheric pressure and thus could be used in preparing a groundwater flow map in conjunction with data from the unconfined aquifer wells to the north (MW-1 through MW-5). The upper bedrock can be very competent with a few small fractures, or it can be highly fractured, which causes it to act much like an unconfined aquifer. An analysis of the static water levels and the drilling rates of the bedrock were all considered, and it was concluded that the data from all wells could be used in developing the groundwater contour map.

Groundwater flow within of the unconfined aquifer appears to follow the local topography within the immediate areas of the Phase I and Phase II C & D cell areas. The Phreatic Surface Contour Map indicates that the primary groundwater flow direction is to the northwest in the northern portion of the site and to the southeast in the southern portion of the site.

Geologic media variations in lithology and structures create directional and spatial variances in hydraulic conductivity (K), and well yield. Therefore, subsurface parameters, at best, are averages computed with various mathematical and graphical solutions utilizing empirical data and literature based assumptions of aquifer conditions. The assumptions in the calculation of hydraulic conductivity are that the aquifer is unconfined, homogeneous, isotropic, of infinite areal extent, and tested under non-steady state conditions. In-situ permeability ("slug") testing was conducted using piezometer PZ-7, to determine hydraulic conductivity. The Bouwer and Rice (1976) Method was used, assuming a partially penetrating screen and a radius which included the sand pack. The hydraulic conductivity calculated for PZ-7 is  $(5.59 \times 10^{-6} \text{ cm/sec})$ . This value agrees closely with the K values obtained in an earlier ESI report dated June 18, 1992. Appendix D contains graphs of the in-situ permeability test and the calculations used.

# **PROPOSED MONITORING PLAN**

## 1.0 MONITORING PLAN OBJECTIVE

The proposed groundwater monitoring plan is intended to determine the on-going groundwater quality associated with the continued operation of the Phase I and Phase II C & D landfill tracts. Groundwater sampling activities will be performed semi-annually. This plan presents our recommended groundwater monitoring program which includes well locations, and groundwater sampling and chemical testing.

## 2.0 MONITORING WELL SAMPLING PLAN

Ecological Services, Inc. recommends that a groundwater monitoring program be implemented following the Phase II permitting of the subject site. To ensure adequate site coverage, ESI proposes that the following groundwater monitoring locations be sampled:

### Site Border Monitoring Points

MW-4  
MW-5  
MW-6  
MW-7  
MW-8  
MW-9  
MW-10

### Site Interior Monitoring Point

MW-3

Water levels will be measured prior to each sampling event with an oil/water interface probe and groundwater elevations will be computed. The monitoring wells will then be purged by bailing or pumping at least 4 times the water volume within the well, including the sand pack, or to dryness. After allowing each well to recover at least 60% of the initial head, or 24 hours, whichever occurs first, the monitoring well will be sampled using disposable approved sampling bailers. Prior to the time the water samples are collected from the wells, pH, temperature, and specific conductivity will be recorded in the field to ensure that representative groundwater is being obtained for chemical analysis. One field blank sample will be obtained in the field by

pouring distilled water into a sampling bailer and then decanting the contents of the bailer into the appropriate glass container. A laboratory trip blank will also accompany the groundwater samples.

All groundwater samples will be properly preserved and shipped to a North Carolina approved analytical laboratory for chemical analysis by EPA Method 8260 (volatile organics) and the 15 total metals as required by the Division of Solid Waste Management. Appropriate chain-of-custody records will be maintained during each stage of sample collection and transportation.

### **3.0 REPORT PREPARATION**

Within 30 days of the completion of each semi-annual sampling event, a summary of our field activities, collected data, and laboratory results will be provided to the DEHNR-Solid Waste Management in a letter report.

## REFERENCES

- Bouwer, H., and Rice, R.C., 1976, A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells, American Geophysical Union, 1976.
- Goldsmith, R., Milton, D.J., Horton, J.W. Jr., 1988, Geologic Map of the Charlotte 1 X 2 Quadrangle, North Carolina and South Carolina: Department of the Interior U.S. Geologic Survey.

# TABLES

**TABLE 1**  
**CONSTANT HEAD PERMEABILITY TESTING DATA**  
**(Cover Soil Material)**  
**North Mecklenburg Landfill**  
**Huntersville, North Carolina**

<b>Sample I.D.</b>	<b>Coefficient of Permeability (cm/sec)</b>
B-4	$3.2 \times 10^{-5}$
B-5	$1.3 \times 10^{-4}$
B-6	$1.1 \times 10^{-4}$
B-7	$5.3 \times 10^{-5}$

**TABLE 2**  
**SUMMARY OF GRAIN SIZE DISTRIBUTION TESTING**  
**(Cover Soil Material)**  
**North Mecklenburg Landfill**  
**Huntersville, North Carolina**

<b>Sample I.D.</b>	<b>% + 3"</b>	<b>% Gravel</b>	<b>% Sand</b>	<b>% Silt</b>	<b>% Clay</b>
B-4	0.0	5.3	67.3	17.5	9.9
B-5	0.0	4.0	85.3	4.8	5.9
B-6	0.0	28.0	68.2	1.4	2.4
B-7	0.0	10.5	82.3	3.3	3.9

TABLE 3  
CONSTANT HEAD PERMEABILITY TESTING DATA  
(Floor Soil Material)  
North Mecklenburg Landfill  
Huntersville, North Carolina

Sample I.D.	Coefficient of Permeability (cm/sec)
1	$6.7 \times 10^{-6}$
2	$2.9 \times 10^{-5}$
3	$5.2 \times 10^{-6}$
4	$2.9 \times 10^{-4}$
5	$1.2 \times 10^{-6}$

$6.508 \times 10^{-5}$

**TABLE 4**  
**SUMMARY OF GRAIN SIZE DISTRIBUTION TESTING**  
**(Floor Soil Material)**  
**North Mecklenburg Landfill**  
**Huntersville, North Carolina**

Sample I.D.	% + 3"	% Gravel	% Sand	% Silt	% Clay
1	0.0	1.0	87.1	8.3	3.6
2	0.0	3.8	78.8	11.0	6.4
3	0.0	0.0	82.4	9.2	8.4
4	0.0	0.0	82.0	13.2	4.8
5	0.0	1.7	84.5	8.9	4.9

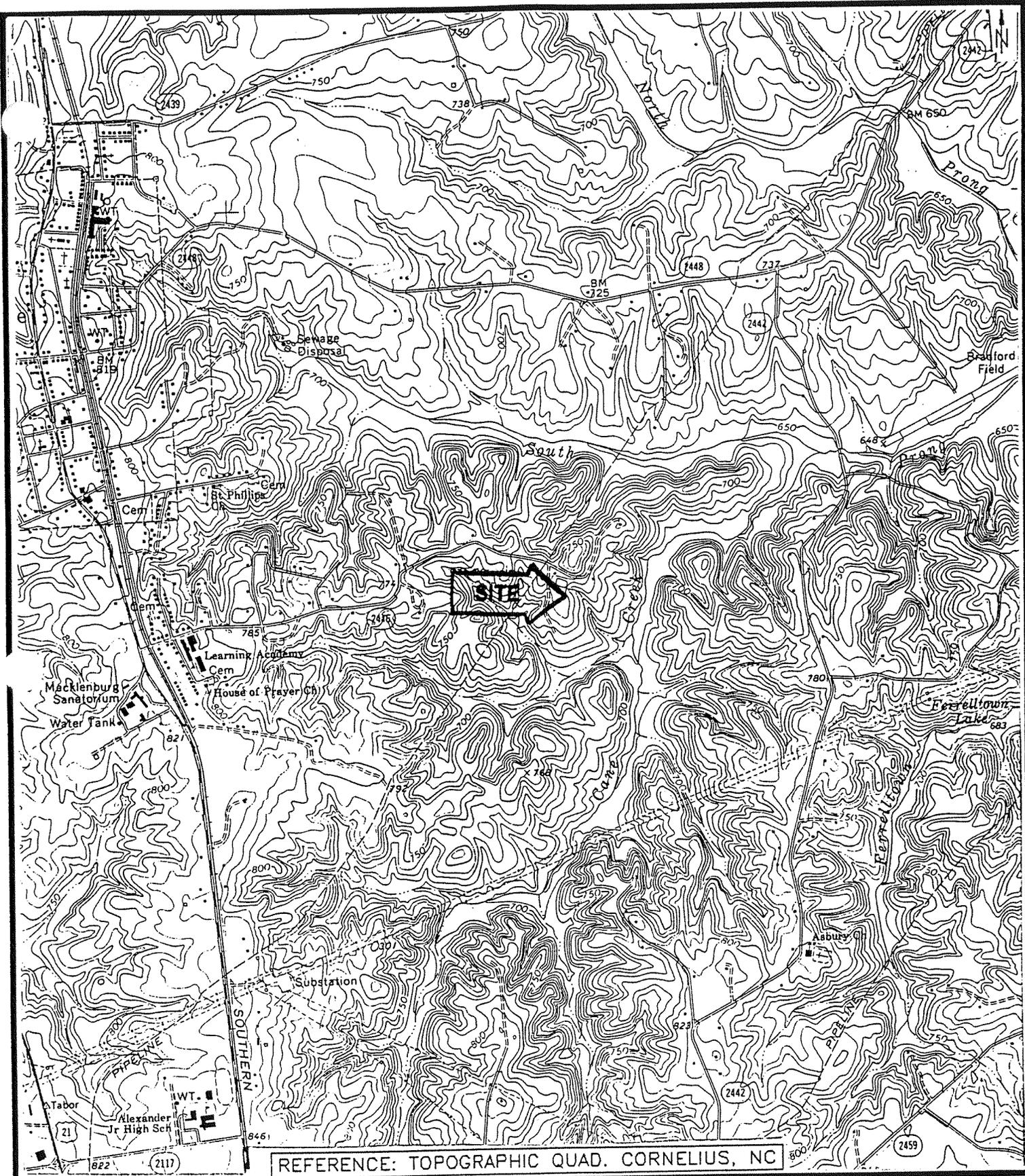
**TABLE 5**  
**SUMMARY OF GROUNDWATER ELEVATION DATA**  
**North Mecklenburg Landfill**  
**Huntersville, North Carolina**

Well No.	Date	Surveyed Elevation - TOC (Ft)	Depth to Water - TOC (Ft)	Groundwater Elevation (Ft)
MW-2	02-10-94	681.00	13.59	667.41
	05-05-94	681.00	12.40	668.60
	05-27-94	681.00	16.8	664.19
MW-3	02-10-94	706.44	16.96	689.48
	05-05-94	706.44	14.58	691.86
	05-27-94	706.44	17.57	688.87
MW-4	02-10-94	718.00	28.99	689.01
	05-05-94	718.00	28.95	689.05
	05-27-94	718.00	29.22	688.78
MW-6	02-10-94	740.62	58.59	682.03
	05-05-94	740.62	58.15	682.47
	05-27-94	740.62	50.18	690.44
MW-7	02-10-94	738.62	51.36	687.26
	05-05-94	738.62	50.93	687.69
	05-27-94	738.62	50.91	687.71
MW-8	02-10-94	767.25	69.71	697.54
	05-05-94	767.25	69.42	397.83
	05-27-94	767.25	69.45	697.80
MW-9	02-10-94	709.10	18.73	690.37
	05-05-94	709.10	18.42	690.68
	05-27-94	709.10	18.92	690.18
MW-10	02-10-94	692.64	11.85	680.79
	05-05-94	692.64	12.20	680.44
	05-27-94	692.64	11.01	681.63
PZ-1	02-10-94	717.51	27.28	690.23
	05-05-94	717.51	27.66	689.85
	05-27-94	717.51	27.91	689.60
PZ-2	02-10-94	714.54	28.78	685.76
	05-05-94	714.54	29.97	684.57
	05-27-94	714.54	30.61	683.93

TABLE 5  
(Continued)

Well No.	Date	Surveyed Elevation - TOC (Ft)	Depth to Water - TOC (Ft)	Groundwater Elevation (Ft)
PZ-3	02-10-94	735.00	38.21	696.79
	05-05-94	735.00	37.77	697.23
	05-27-94	735.00	38.65	696.35
PZ-4	02-10-94	724.63	29.14	695.49
	05-05-94	724.63	28.88	695.75
	05-27-94	724.63	28.83	695.80
PZ-5	02-10-94	737.64	49.26	688.39
	05-05-94	737.65	48.25	689.40
	05-27-94	737.65	49.27	688.38
PZ-6	05-27-94	696.59	8.30	688.29
PZ-7	05-27-94	744.78	47.93	693.85

# FIGURES



DATE: 07-07-94  
 SCALE 1:24,000



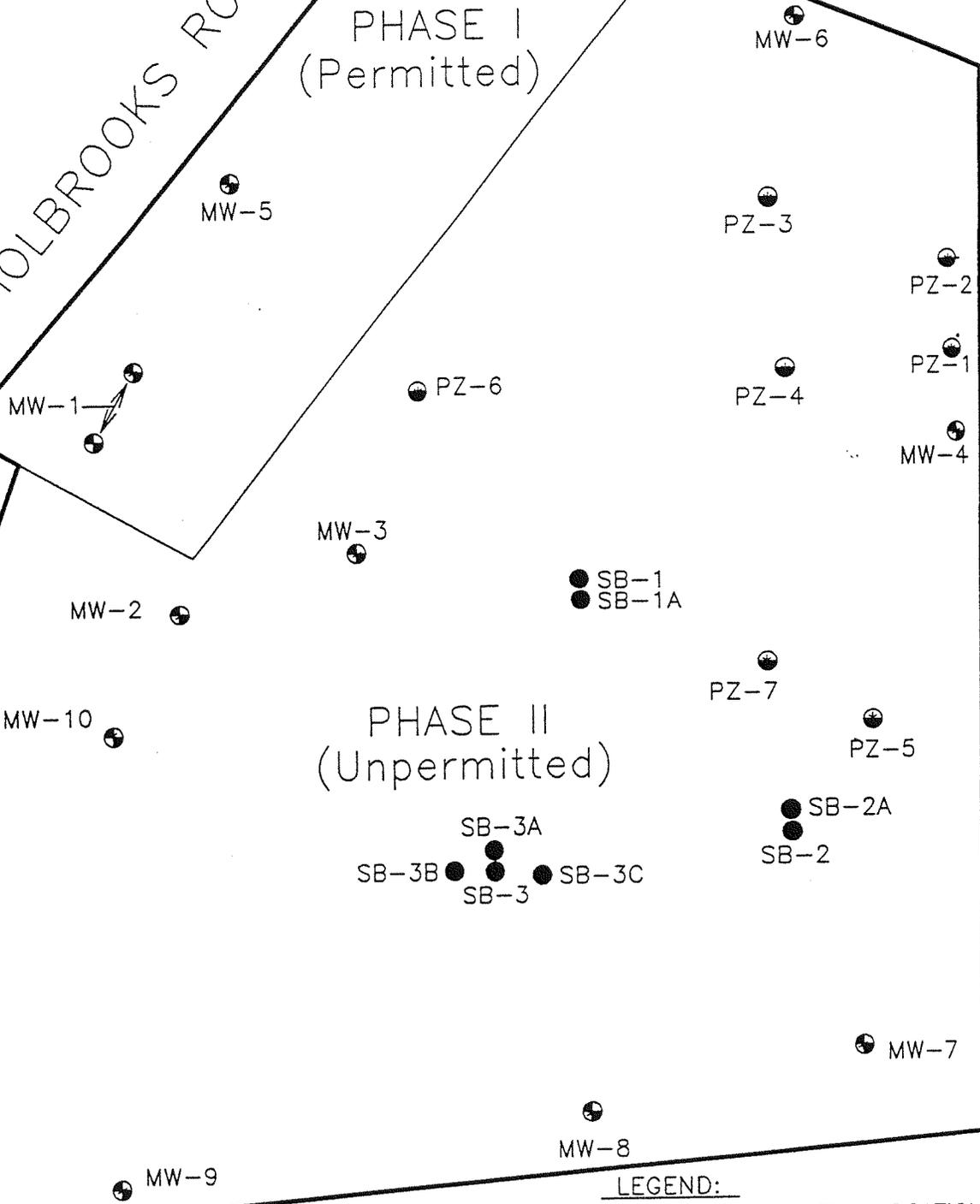
FIGURE 1: SITE LOCATION  
 MAP  
 N. MECK. LANDFILL  
 HUNTERSVILLE, NC



HOLBROOKS ROAD

PHASE I  
(Permitted)

PHASE II  
(Unpermitted)



DATE: 07-05-94  
 SCALE: 1" = 200'  
 DWG. NO.: ES-675-2



FIGURE 2: SITE CONFIGURATION  
 MAP  
 N. MECK. LANDFILL  
 HUNTERSVILLE, NC



HOLBROOKS ROAD

PHASE I  
(Permitted)

□ B-4      □ B-6

□ B-7      □ B-5

● SB-1

F-1  
△

F-2  
△

F-3  
△

PHASE II  
(Unpermitted)

● SB-2

● SB-3

F-4  
△

F-5  
△

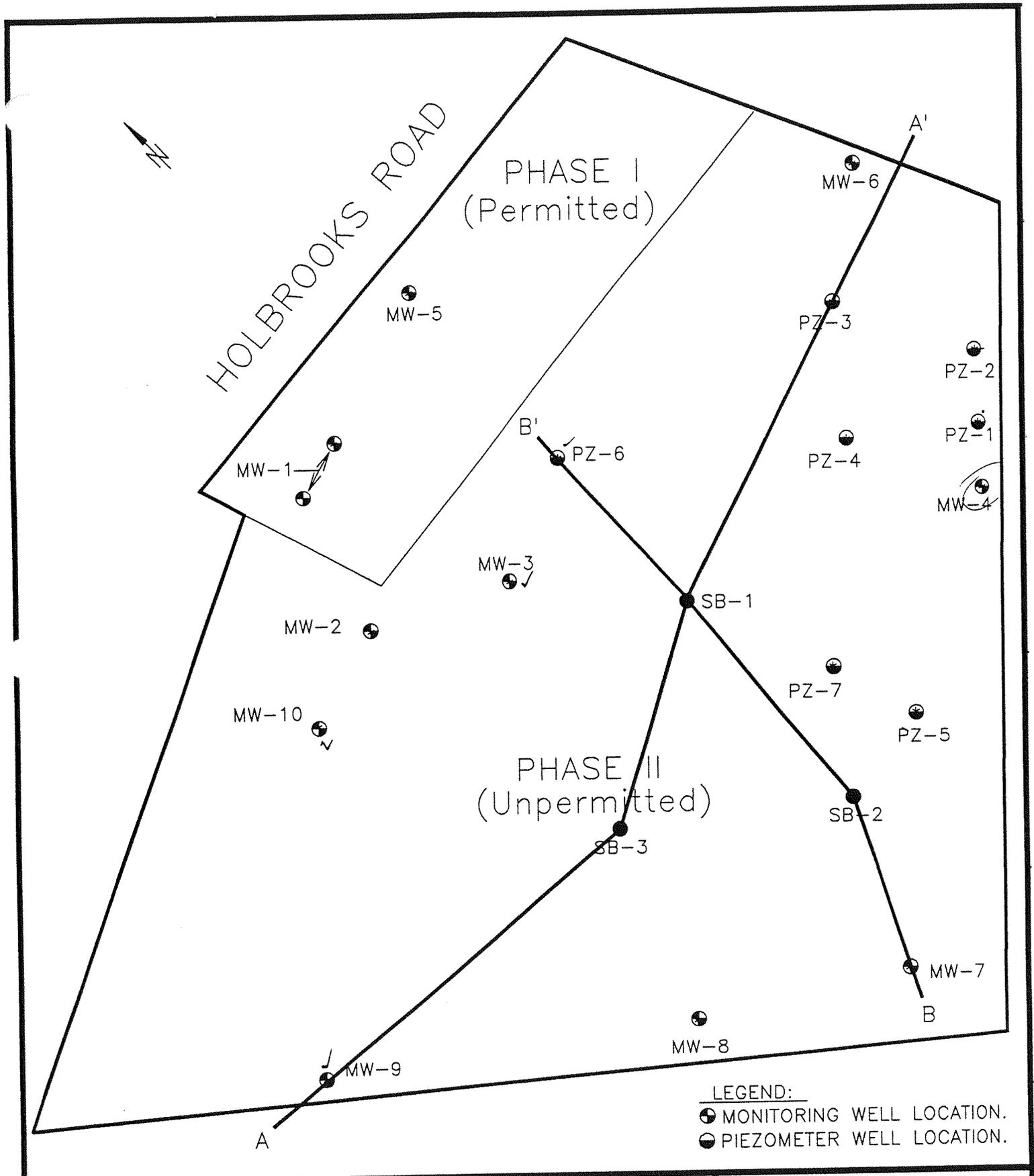
LEGEND:

- COVER SAMPLE LOCATION
- △ FLOOR SAMPLE LOCATION
- SOIL BORING LOCATION

DATE: 07-05-94  
SCALE: 1" = 200'  
DWG. NO.: ES-675-3



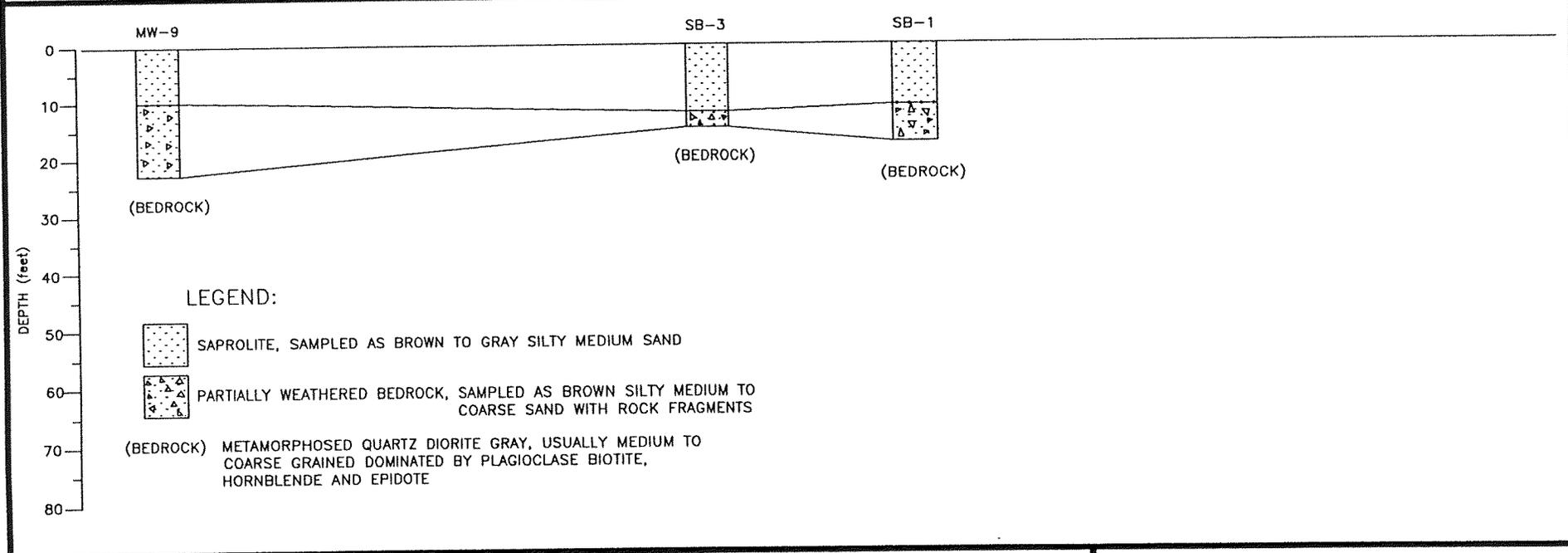
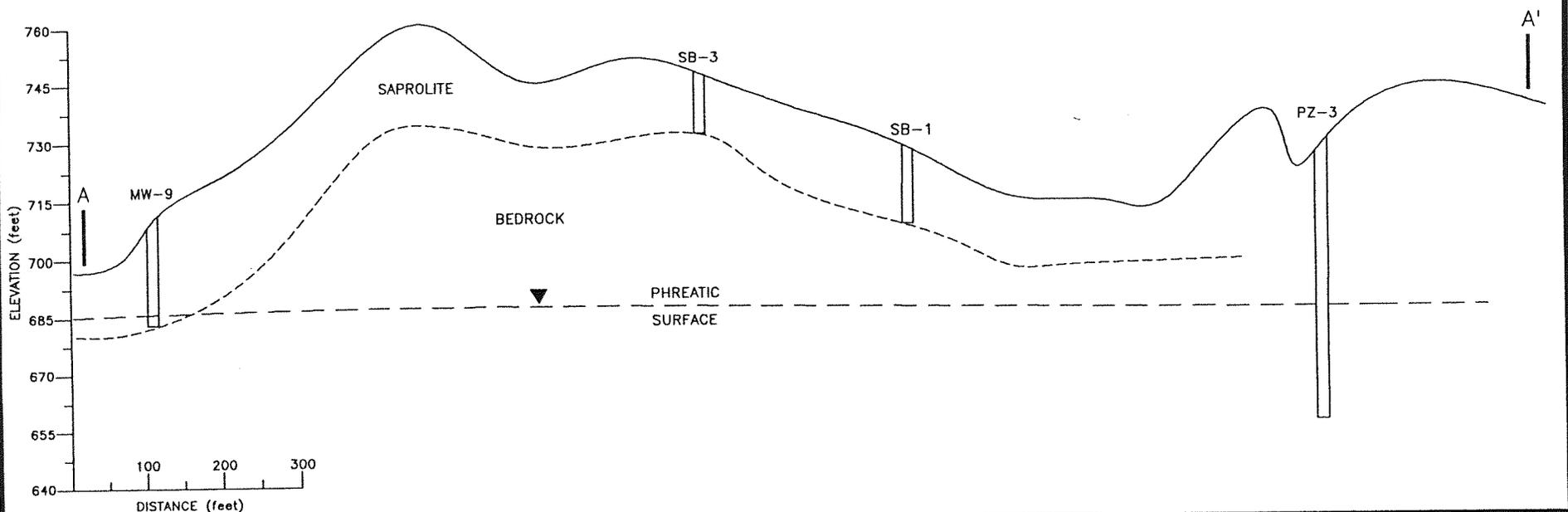
FIGURE 3: SOIL TEST BORING  
LOCATION MAP  
N. MECK. LANDFILL  
HUNTERVILLE, NC



DATE: 07-05-94  
 SCALE: 1" = 200'  
 DWG. NO.: ES-675-4



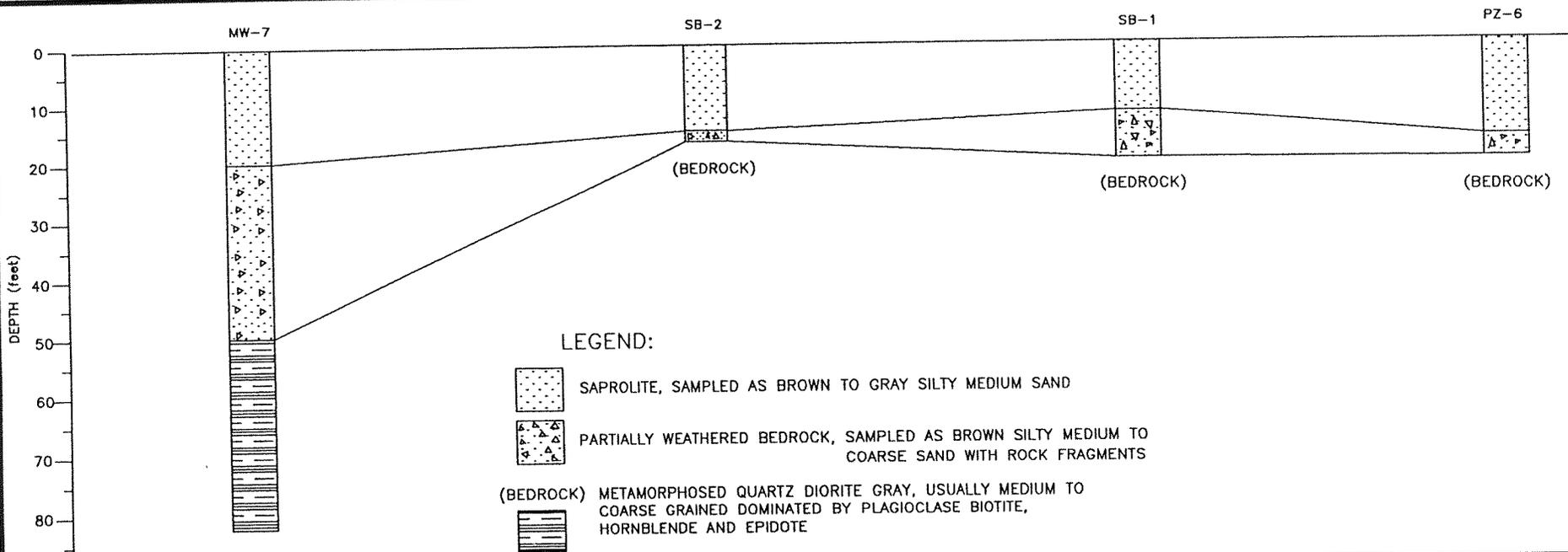
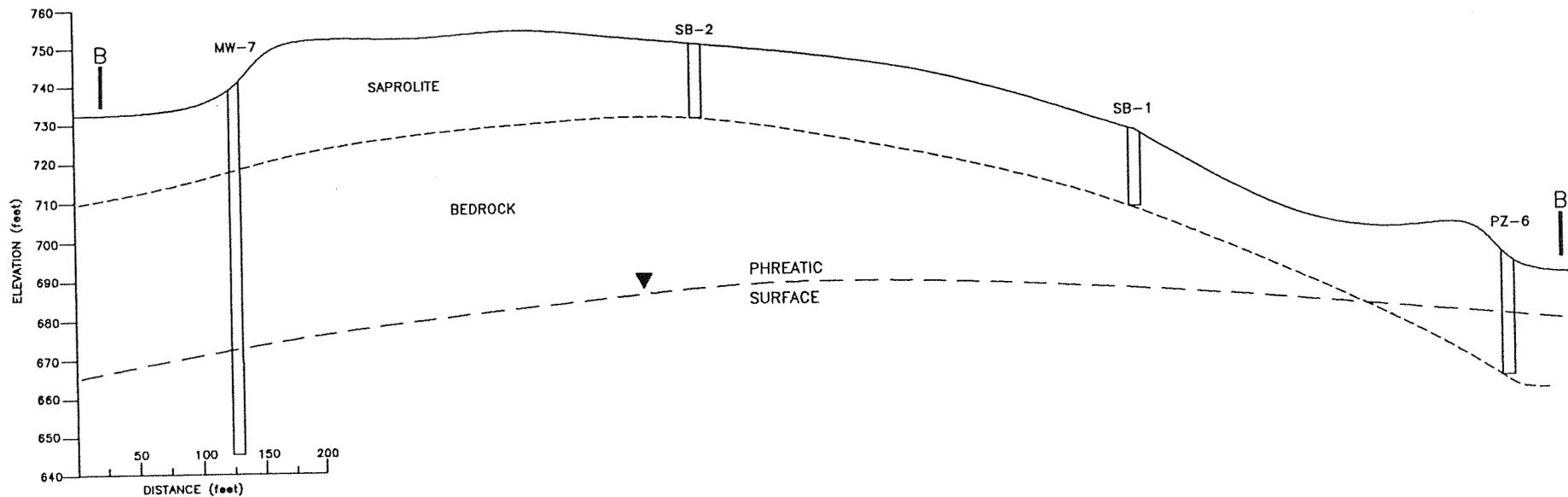
FIGURE 4: CROSS SECTION  
 DESIGNATION MAP  
 N. MECK. LANDFILL  
 HUNTERVILLE, NC



DATE: 07-06-94  
 SCALE: ON DRAWING  
 DWG. NO.: ES-675-5

**ESI**   
 ECOLOGICAL SERVICES, INC.

FIGURE 5: CROSS SECTION A - A'  
 NORTH MECKLENBURG LANDFILL  
 HUNTERVILLE, NC



DATE: 07-06-94  
 SCALE: ON DRAWING  
 DWG. NO.: ES-675-6

**ESI**



ECOLOGICAL SERVICES, INC.

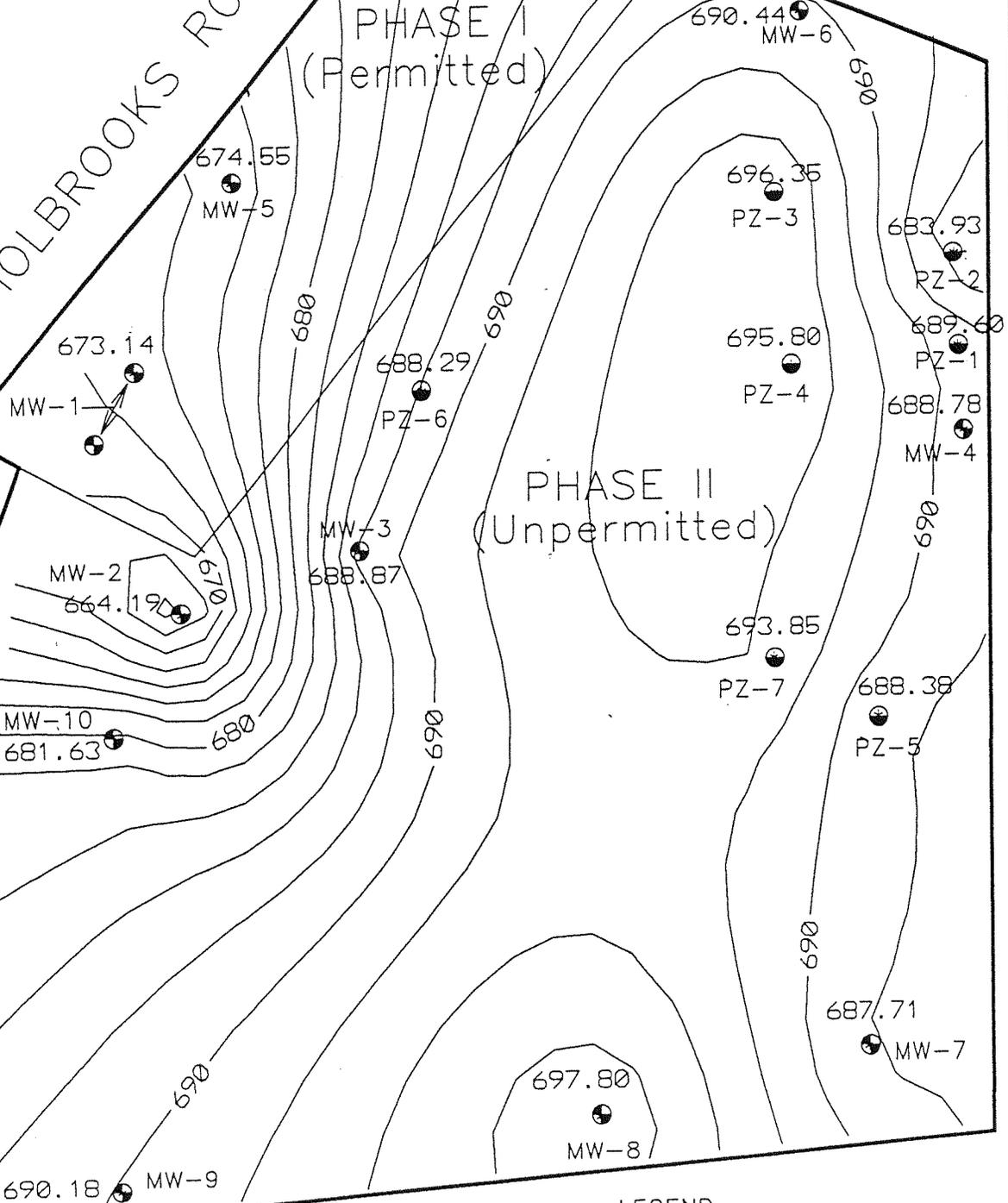
FIGURE 6: CROSS SECTION B - B'  
 NORTH MECKLENBURG LANDFILL  
 HUNTERVILLE, NC



HOLBROOKS ROAD

PHASE I  
(Permitted)

PHASE II  
(Unpermitted)



LEGEND:

- MONITORING WELL LOCATION.
- PIEZOMETER WELL LOCATION.

NOTE: Gauging Data Obtained on May 27, 1994

DATE: 07-05-94  
 SCALE: 1" = 200'  
 DWG. NO.: ES-675-7



FIGURE 7: PHREATIC SURFACE  
 COUNTOUR MAP  
 N. MECK. LANDFILL  
 HUNTERVILLE, NC

# **APPENDIX A**

Soil Boring Records





Geologist Log

Ecological Services, Inc

Job #: ES-0675		North Mecklenburg Landfill		Well #: MW-9	
County: Mecklenburg State: NC		Date Begin: 1-10-94 Date End: 1-11-94		Casing Height: Land Surface Elevation:	
Lat.: Long.:		Drilled By: Graham & Currie		Static Water Level:	
Grid Coord.:		Logged By: Ben Hope		Development Method:	
Tests:		Drilling Method: Hollow Stem		Sampling Method:	
Grout: 5% bentonite		Seal: bentonite 7 - 10 ft		Gravel Pack: FX 50 sand 10 - 22 ft	
Casing Type: Sch 40 PVC		Diameter: 2" Depth: 0 - 12 ft		Hole Diameter: 4"	
Screen Type: Sch 40 PVC		Diameter: 2" Slot: 0.010-inch		Depth: 12 - 22 ft Total Depth: 22 ft	
PID/FID Reading (ppm)	Penetration Resistance	Depth (ft)	Lithology/Remarks	Well Completion	
		0	0 - 10.0 ft: Brown Silty Medium Sand	0	
				Grout (0 - 7 ft)	
		10	10.0 - 20.0 ft: Grayish Brown Silty Medium Sand with Some Pebbles	Bentonite (7 - 10 ft)	
					Casing to 12 ft
		20		Sand (10 - 22 ft)	Screen (12 - 22 ft)
			Boring Terminated at 22 ft		
		30			
		40			
		50			
		60			

Geologist Log

Ecological Services, Inc

Job #: ES-0675		North Mecklenburg Landfill		Well #: MW-3	Page 1 of 1
County: Mecklenburg	State: NC	Date Begin:	Date End:	Casing Height:	Land Surface Elevation:
Lat:	Long:	Drilled By: Graham & Currie		Static Water Level:	
Grid Coord.:		Logged By: Paul Banks		Development Method:	
Tests:		Drilling Method: Hollow Stem		Sampling Method:	
Grout: 5% Bentonite		Seat: 6 - 8 ft		Gravel Pack: 80/20 Silica Sand (8 to 20 ft)	
Casing Type:		Diameter:	Depth: 0 - 10 ft	Hole Dia.: 4"	
Screen Type:		Diameter:	Slot: 0.010 inch	Depth: 9 - 19 ft	Total Depth: 20 ft
PID/FID Reading (ppm)	Penetration Resistance	Depth (ft)	Lithology/Remarks	Well Completion	
		0		0	
		3.0 - 5.0 ft	Brownish Green Fine Grained Sand with Little Silt	Grout (0 - 6 ft)	
		6.0 - 10.0 ft	Saprolite: Greenish Brown Fine Grained Silty Sand with Trace Clay	Bentonite (6 to 8 ft)	Casing (0 to 10 ft)
		13.0 - 15.0 ft	Saprolite: Greenish Brown Fine Grained Silty Sand with Trace Clay		
		18.0 - 20.0 ft	Partially Weathered Bedrock: Brown Silty Coarse Sand with Rock Fragments	Sand (8 - 20 ft)	Screen (10 to 20 ft)
		20	Boring Terminated at 20 ft	20	
		30		30	
		40		40	
		50		50	
		60		60	

Geologist Log

Ecological Services, Inc

Job #: ES-0675		North Mecklenburg Landfill		Well #: MW-4		Page 1 of 1	
County: Mecklenburg		State: NC		Date Begin:		Date End:	
Casing Height:		Land Surface Elevation:		Drilled By: Graham & Currie		Static Water Level:	
Lat:		Long:		Logged By: Bea Hope		Development Method:	
Grid Coord.:		Drilling Method: Air Rotary		Sampling Method:			
Tests:		Seal: 40-44 ft		Gravel Pack: FX 50 sand 44-67 ft			
GROUT: 5% bentonite		Diameter: 2"		Depth: 0 - 47 ft		Hole Dia.: 6"	
Screen Type: Sch 40 PVC		Diameter: 2"		Slot: 0.010-inch		Depth: 47-67 ft	
						Total Depth: 67 ft	
PID/FID Reading (ppm)	Penetration Resistance	Depth (ft)	Lithology/Remarks	WebCompletion			
		0	0 - 30.0 ft: Tan Silty Fine Sand				
		10					
		20					
		30	30.0 - 40.0 ft: Brown Silty Fine Sand				
		40	40.0 - 50.0 ft: Partly Weathered Bedrock Sampled as Tan Silty Fine Medium Sand with Rock Fragments				
						GROUT (0 - 40 ft)	
						Bentonite (40 - 44 ft)	
						Casing to 47 ft	
		50	50.0 - 67.0 ft: Gray Silty Medium Sand with Rock Fragments				
		60					
						Sand (44 - 67 ft)	Screen (47 - 67 ft)
			Boring Terminated at 67.0 ft				
		70					

Geologist Log

Ecological Services, Inc

Job #: ES-0675		North Mecklenburg Landfill		Well #: SB-1	Page 1 of 1
County: Mecklenburg	State: NC	Date Began: 5/11/94	Date End: 5/11/94	Casing Height:	
Lat:	Long:	Drilled By: Alliance		Static Water Level:	
Grid Coord:		Logged By: Paul Banks		Development Method:	
Tests:		Drilling Method: Hollow Stem		Sampling Method:	
Grout:		Seal:	Gravel Pack: NA		
Casing Type:		Diameter:	Depth:	Hole Diameter: 4"	
Screen Type:		Diameter:	Slot:	Depth:	Total Depth: 18 ft
PID/FID Reading (ppm)	Penetration Resistance	Depth (ft)	Lithology/Remarks	Well Completion	
		0		0	
	13-12-31		3 to 5 ft: Brownish Green Fine Grained Sand with Little Clay and Organics		
	50/5"		8 to 10 ft: Saprolite: Gray Silty Medium Grained Sand	10	
		10	13 to 15 ft: Alternating Layers of Weathered/Semi-Weathered Rock		
			Boring Terminated at 18 ft		
		20		20	
		30		30	
		40		40	
		50		50	

Geologist Log

Ecological Services, Inc

Job #: ES-0675		North Mecklenburg Landfill		Well #: SB-2	Page 1 of 1
County: Mecklenburg		State: NC	Date Began: 5/12/94	Date End: 5/12/94	Casing Height:
Lat:	Long:	Drilled By: Alliance		Static Water Level:	
Grid Coord.:		Logged By: Paul Banks		Development Method:	
Tests:		Drilling Method: Hollow Stem		Sampling Method:	
Grout:		Seal:	Gravel Pack: NA		
Casing Type:		Diameter:	Depth:	Hole Diameter: 4"	
Screen Type:		Diameter:	Slot:	Depth:	Total Depth: 18 ft
PID/FID Reading (ppm)	Penetration Resistance	Depth (ft)	Lithology/Remarks	Well Completion	
		0		0	
	50/5		3 to 5 ft: Tannish Brown Saprolite, Firm Grained Sand with Some Silt		
	20 - 50/5		8 to 10 ft: Brownish Gray Fine Grained Silty Sand	10	
	13 - 20 - 28		13 to 15 ft: Saprolite: Brown Medium Grained Silty Sand with Some Rock Fragments		
			Boring Terminated at 18 ft		
		20		20	
		30		30	
		40		40	
		50		50	

Geologist Log

Ecological Services, Inc

Job #: ES-0675		North Mecklenburg Landfill		Well #: SB-3	Page 1 of 1
County: Mecklenburg		State: NC	Date Began: 5/12/94	Date End: 5/12/94	Casing Height:
Lat:	Long:	Drilled By: Alliance		Static Water Level:	
Grid Coord.:		Logged By: Paul Banks		Development Method:	
Tests:		Drilling Method: Hollow Stem		Sampling Method:	
Grout: 5% bentonite		Seal: bentonite		Gravel Pack: 80/20 Silica Sand	
Casing Type:		Diameter:	Depth:	Hole Diameter: 4"	
Screen Type:		Diameter:	Slot:	Depth:	Total Depth: 14 ft
PID/FID Reading (ppm)	Penetration Resistance	Depth (ft)	Lithology/Remarks	Well Completion	
		0		0	
	36 - 50/5"		3 to 5 ft: Brown Medium Graveled Sand with Some Silt and Organics		
	24 - 35 - 50/1"		8 to 12 ft: Saprolite: Brown Medium Graveled Silty Sand	10	
	50/1"		12 to 14 ft: Saprolite: Brownish Gray Silty Sand with Some Rock Fragments		
			Boring Terminated at 14 ft		
		20		20	
		30		30	
		40		40	
		50		50	

Geologist Log

Ecological Services, Inc

Job #: ES-0675		North Mecklenburg Landfill		Well #: MW-2		Page 1 of 1	
County: Mecklenburg		State: NC		Date Begin:		Date End:	
Lat:		Long:		Drilled By: Graham & Currie		Static Water Level:	
Grid Coord:		Logged By: Ben Hope		Development Method:		Sampling Method:	
Tests:		Drilling Method: Hollow Stem		Gravel Pack: FX 50 sand 7 - 19 ft			
Grout: 5% bentonite 0 - 4.5 ft		Seal: 4.5 - 7 ft		Casing Type: Sch 40 PVC		Diameter: 2"	
				Depth: 0 - 9 ft		Hole Dia: 4"	
Screen Type: Sch 40 PVC		Diameter: 2"		Slot: 0.010 - inch		Depth: 9 - 19 ft	
						Total Depth: 19 ft	
PID/FID Reading (ppm)	Penetration Resistance	Depth (ft)	Lithology/Remarks	Well Completion			
		0	0 - 19.0 ft: Grayish Brown Sandy Fine Silt	0			
				GROUT			
				(0 - 4.5 ft)			
				BENTONITE			
				(4.5 - 7 ft)			
						Casing to 9 ft	
		10		10			
				SAND			
				(7 - 19 ft)		Screen	
			Boring Terminated at 19 ft			(9 - 19 ft)	
		20		20			
		30		30			
		40		40			
		50		50			
		60		60			

Geologist Log

Ecological Services, Inc

Job #: ES-0675		North Mecklenburg Landfill		Well #: MW-5		Page 1 of 2	
County: Mecklenburg		State: NC		Date Begin:		Date End:	
Casing Height:		Land Surface Elevation:		Static Water Level:			
Lat:		Long.:		Drilled By: Graham & Currie		Development Method:	
Grid Coord.:		Logged By: Ben Hope		Drilling Method: Air Rotary		Sampling Method:	
Grout: 5% bentonite 0-52 ft		Seal: 47-52 ft		Gravel Pack: FX 50 sand 40-75 ft			
Casing Type: Sch 40 PVC		Diameter: 2"		Depth: 0-45 ft		Hole Dia.: 6"	
Screen Type: Sch 40 PVC		Diameter: 2"		Slot: 0.010-inch		Depth: 55-75 ft	
						Total Depth: 75 ft	
PID/FID Reading (ppm)	Penetration Resistance	Depth (ft)	Lithology/Remarks	Well Completion			
		0	0 - 10.0 ft: Light Tan Silty Fine Sand	0			
		10	10.0 - 20.0 ft: Light Gray Silty Fine Sand	10			
		20	20.0 - 70.0 ft: Bedrock Sampled as Gray Silty Coarse Sand with Rock Fragments Adundant	20			
		30		30			
		40		40			
					Grout (0 - 47 ft)		
		50		50	Bentonite (47 - 52 ft)		
							Casing to 55 ft
		60		60			

**Geologist Log**

**Ecological Services, Inc**

Job #: ES-0675		North Mecklenburg Landfill		Well #: MW-5	Page 2 of 2
County: Mecklenburg	State: NC	Date Begin:	Date End:	Casing Height:	Land Surface Elevation:
Lat:	Long:	Drilled By: Graham & Currie		Static Water Level:	
Grid Coord.:		Logged By: Ben Hope		Development Method:	
Tests:		Drilling Method: Air Rotary		Sampling Method:	
Grout: 5% bentonite 0-52 ft		Seal: 47-52 ft		Gravel Pack: FX 50 sand 40-75 ft	
Casing Type: Sch 40 PVC		Diameter: 2"	Depth: 0-45 ft	Hole Dia.: 6"	
Screen Type: Sch 40 PVC		Diameter: 2"	Slot: 0.010-inch	Depth: 45-75 ft	Total Depth: 75 ft
PID/FID Reading (ppm)	Penetration Resistance	Depth (ft)	Lithology/Remarks	Well Completion	
		60		60	
		70	70 - 75 ft: Gray Silty Medium Sand with a Few Pebbles	70	
			Boring Terminated at 75 ft	Sand (52 - 75 ft)	Screen (55 - 75 ft)
		80		80	
		90		90	
		100		100	
		110		110	
		120		120	

Geologist Log

Ecological Services, Inc

Job #: ES-0675		North Mecklenburg Landfill		Well #: MW-6	Page 1 of 2
County: Mecklenburg	State: NC	Date Begin: 1-10-94 Date End: 1-14-94		Casing Height:	Land Surface Elevation:
Lat:	Long:	Drilled By: Graham & Currie		Static Water Level:	
Grid Coord.:		Logged By: Ben Hope		Development Method:	
Tests:		Drilling Method: Air Rotary		Sampling Method:	
Grout: 5% bentonite 0 - 57 ft		Seal: bentonite 57 - 62 ft		Gravel Pack: FX 50 sand 62 - 98 ft	
Casing Type:	Sch 40 PVC	Diameter: 2"	Depth: 0 - 78 ft		Hole Diameter: 6"
Screen Type:	Sch 40 PVC	Diameter: 2"	Slot: 0.010-inch	Depth: 78 - 98 ft	Total Depth: 98 ft
PID/FID Reading (ppm)	Penetration Resistance	Depth (ft)	Lithology/Remarks	Well Completion	
		0	0 - 10.0 ft: Light Tan Silty Fine Sand	0	
		10	10.0 - 20.0 ft: Light Gray Silty Fine Sand	10	
		20	20.0 - 90.0 ft: Bedrock Sampled as Gray Silty Coarse Sand with Rock Fragments Abundant	20	
		30		30	
		40		40	
		50		50	
					Grout (0 - 57 ft)
		60		60	

Geologist Log

Ecological Services, Inc

Job #: ES-0675	North Mecklenburg Landfill	Well #: MW-6	Page 2 of 2
County: Mecklenburg	State: NC	Date Begin: 1-10-94	Date End: 1-14-94
Casing Height:	Land Surface Elevation:		
Lat.:	Long.:	Drilled By: Graham & Currie	Static Water Level:
Grid Coord.:	Logged By: Ben Hope	Development Method:	
Tests:	Drilling Method: Air Rotary	Sampling Method:	

Grout: 5% bentonite	0 - 62 ft	Seal: bentonite	57 - 62 ft	Gravel Pack: FX 50 sand	62 - 98 ft
Casing Type:	Sch 40 PVC	Diameter: 2"	Depth: 0 - 78 ft	Hole Diameter: 6"	
Screen Type:	Sch 40 PVC	Diameter: 2"	Slot: 0.010-inch	Depth: 78 - 98 ft	Total Depth: 98 ft

PID/FID Reading (ppm)	Penetration Resistance	Depth (ft)	Lithology/Remarks	Well Completion
		60		- 60 - Bentonite - (57 - 62 ft)
		70		- 70
		80		- 80 Casing to 78 ft
		90	90.0 - 98.0 ft: Gray Silty Medium Sand with a few Pebbles	- 90
			Boring Terminated at 98.0 ft	- Sand - (62 - 98 ft) Screen (78 to 98 ft)
		100		- 100
		110		- 110
		120		- 120

Geologist Log

Ecological Services, Inc

Job #: ES-0675		North Mecklenburg Landfill		Well #: MW-7		Page 1 of 2	
County: Mecklenburg		State: NC		Date Begin: 1-10-94 Date End: 1-14-94		Casing Height: Land Surface Elevation:	
Lat.: Long.:		Drilled By: Graham & Currie		Static Water Level:			
Grid Coord.:		Logged By: Ben Hope		Development Method:			
Tests:		Drilling Method: Air Rotary		Sampling Method:			
Grout: 5% bentonite 0 - 56 ft		Seal: bentonite 0 - 61 ft		Gravel Pack: FX 50 sand 61 - 83 ft			
Casing Type: Sch 40 PVC		Diameter: 2"		Depth: 0 - 63 ft		Hole Diameter: 6"	
Screen Type: Sch 40 PVC		Diameter: 2"		Slot: 0.010 - inch		Depth: 61 - 83 ft	
						Total Depth: 83 ft	
PID/FID Reading (ppm)	Penetration Resistance	Depth (ft)	Lithology/Remarks			Well Completion	
		0	0 - 20.0 ft: Brown Silty Medium Sand			0	
		10				10	
		20	20.0 - 50.0 ft: Grayish Brown Silty Coarse Sand with Some Pebbles			20	
		30				30	
		40				40	
		50	50.0 - 60.0 ft: Gray Silty Fine Sand			50	
							Grout (0 - 56 ft)
		60	60.0 - 70.0 ft: Gray Silty Medium Sand with Some Pebbles			60	

Geologist Log

Ecological Services, Inc

Job #: ES-0675	North Mecklenburg Landfill	Well #: MW-7	Page 2 of 2
County: Mecklenburg	State: NC	Date Begin: 1-10-94 Date End: 1-14-94	Casing Height: Land Surface Elevation:
Lat:	Long:	Drilled By: Graham & Currie	Static Water Level:
Grid Coord.:	Logged By: Ben Hope	Development Method:	
Tests:	Drilling Method: Air Rotary	Sampling Method:	

Grout: 5% bentonite 0 - 56 ft	Seal: bentonite 56 - 61 ft	Gravel Pack: FX 50 sand 61 - 83 ft
Casing Type: Sch 40 PVC	Diameter: 2"	Depth: 0 - 63 ft
Screen Type: Sch 40 PVC	Diameter: 2"	Slot: 0.010-inch
		Depth: 61 to 83 ft
		Total Depth: 83 ft
		Hole Diameter: 6"

PID/FID Reading (ppm)	Penetration Resistance	Depth (ft)	Lithology/Remarks	Well Completion	
		60		60 Bentonite (56 - 61 ft)	
					Casing to 63 ft
		70	70.0 - 83.0 ft: Gray Silty Coarse Sand with Some Rock Fragments		
		80			
			Boring Terminated at 83 ft	Sand (61 - 83 ft)	Screen (63 - 83 ft)
		90			
		100			
		110			
		120			

Geologist Log

Ecological Services, Inc

Job #: ES-0675		North Mecklenburg Landfill		Well #: MW-8	Page 1 of 2
County: Mecklenburg		State: NC		Date Begin: 1-10-94	Date End: 1-14-94
Lat.:		Long.:		Drilled By: Graham & Currie	Static Water Level:
Grid Coord.:		Logged By: Ben Hope		Development Method:	
Tests:		Drilling Method: Air Rotary		Sampling Method:	
Grout: 5% bentonite 0 - 55 ft		Seal: bentonite 55 - 57.5 ft		Gravel Pack: FX 50 sand 57.5 to 80.0 ft	
Casing Type: Sch 40 PVC		Diameter: 2"		Depth: 0 - 60 ft	
Screen Type: Sch 40 PVC		Diameter: 2"		Slot: 0.010-inch	
				Depth: 60 - 80 ft	
				Total Depth: 80 ft	
PID/FID Reading (ppm)		Penetration Resistance		Depth (ft)	
				Lithology/Remarks	
				Well Completion	
		0	0 - 20.0 ft: Light Brown Silty Medium Sand with Some Pebbles		0
		10			10
		20	20.0 - 50.0 ft: Brown Silty Fine Sand		20
		30			30
		40			40
		50	50.0 - 80.0 ft: Bedrock Sampled as Gray Silty Coarse Sand with Pebbles and Rock Fragments Abundant		50
					Grout (0 - 55 ft)
					Bentonite (55 - 57 ft)
		60			60
					Casing to 60 ft

Job #: ES-0675		North Mecklenburg Landfill		Well #: MW-8		Page 2 of 2	
County: Mecklenburg		State: NC		Date Begin: 1-10-94 Date End: 1-14-94		Casing Height: Land Surface Elevation:	
Lat.: Long.:		Drilled By: Graham & Currie		Static Water Level:			
Grid Coord.:		Logged By: Ben Hope		Development Method:			
Tests:		Drilling Method: Air Rotary		Sampling Method:			
Grout: 5% bentonite 0 - 55 ft		Seal: bentonite 55 - 57.5 ft		Gravel Pack: FX 50 sand 57.5 to 80 ft			
Casing Type: Sch 40 PVC		Diameter: 2"		Depth: 0 - 60 ft		Hole Diameter: 6"	
Screen Type: Sch 40 PVC		Diameter: 2"		Slot: 0.010-inch		Depth: 60 to 80 ft Total Depth: 80 ft	
PID/FID Reading (ppm)	Penetration Resistance	Depth (ft)	Lithology/Remarks			Well Completion	
		60				60	
		70				70	
		80	Boring Terminated at 80.0ft			80	
		90				90	
		100				100	
		110				110	
		120				120	

Sand (57.5 - 80 ft) Screen (60 to 80 ft)

Geologist Log

Ecological Services, Inc

Job #: ES-0675		North Mecklenburg Landfill		Well #: PZ-1	
County: Mecklenburg	State: NC	Date Begin: 1-10-94 Date End: 1-11-94		Casing Height:	Land Surface Elevation:
Lat.:	Long.:	Drilled By: Graham & Currie		Static Water Level:	
Grid Coord.:		Logged By: Ben Hope		Development Method:	
Tests:		Drilling Method: Air Rotary		Sampling Method:	
Grout: 5% bentonite		Seal: bentonite 33 - 35 ft		Gravel Pack: FX 50 sand 35 - 37 ft	
Casing Type: Sch 40 PVC		Diameter: 2"	Depth: 0 - 37 ft		Hole Diameter: 6"
Screen Type: Sch 40 PVC		Diameter: 2"	Slot: 0.010-inch	Depth: 37 - 47 ft	Total Depth: 47 ft
PID/FID Reading (ppm)	Penetration Resistance	Depth (ft)	Lithology/Remarks		Well Completion
		0	0 - 30.0 ft: Brown Silty Medium Sand with Some Pebbles		0
		10			10
		20			20
		30	30.0 - 40.0 ft: Gray Silty Medium Sand with Pebbles		30
					Bentonite (33 - 35 ft)
					Casing to 37 ft
		40			40
					Sand (35 - 47 ft)
			Boring Terminated at 47 ft		Screen (37 - 47 ft)
		50			50
		60			60

Geologist Log

Ecological Services, Inc

Job #: ES-0675		North Mecklenburg Landfill		Well #: PZ-2	Page 1 of 2
County: Mecklenburg	State: NC	Date Begin: 1-10-94 Date End: 1-14-94		Casing Height:	Land Surface Elevation:
Lat.:	Long.:	Drilled By: Graham & Currie		Static Water Level:	
Grid Coord.:		Logged By: Ben Hope		Development Method:	
Tests:		Drilling Method: Air Rotary		Sampling Method:	
Grout: 5% bentonite		Seal: bentonite 55 - 63 ft		Gravel Pack: FX 50 sand 63 - 85 ft	
Casing Type: Sch 40 PVC		Diameter: 2"	Depth: 0 - 65 ft		Hole Diameter: 6"
Screen Type: Sch 40 PVC		Diameter: 2"	Slot: 0.010-inch	Depth: 65 - 85 ft	Total Depth: 85 ft
PID/FID Reading (ppm)	Penetration Resistance	Depth (ft)	Lithology/Remarks	Well Completion	
		0	0 - 40.0 ft: Light Gray Silty Fine Sand	0	
		10		10	
		20		20	
		30		30	
		40	40.0 - 80.0 ft: Bedrock Material Sampled as Grayish Brown Silty Coarse Sand with Pebbles and Rock Fragments	40	
		50		50	
		60		60	

Geologist Log

Ecological Services, Inc

Job #: ES-0675		North Mecklenburg Landfill		Well #: PZ-2		Page 2 of 2	
County: Mecklenburg		State: NC		Date Begin: 1-10-94 Date End: 1-14-94		Casing Height: Land Surface Elevation:	
Lat.: Long.:		Drilled By: Graham & Currie		Static Water Level:			
Grid Coord.:		Logged By: Ben Hope		Development Method:			
Tests:		Drilling Method: Air Rotary		Sampling Method:			
Grout: 5% bentonite		Seal: bentonite 55 - 63.0 ft		Gravel Pack: FX 50 sand 63 - 85 ft			
Casing Type: Sch 40 PVC		Diameter: 2"		Depth: 0 - 65 ft		Hole Diameter: 6"	
Screen Type: Sch 40 PVC		Diameter: 2"		Slot: 0.010 - inch		Depth: 65 to 85 ft	
						Total Depth: 85 ft	
PID/FID Reading (ppm)	Penetration Resistance	Depth (ft)	Lithology/Remarks	Well Completion			
		60		60			
				Bentonite (55 - 63 ft)			
					Casing to 65 ft		
		70		70			
		80		80			
			Boring Terminated at 85 ft	Sand (63 - 85 ft)	Screen (65 - 85 ft)		
		90		90			
		100		100			
		110		110			
		120		120			

**Geologist Log**

**Ecological Services, Inc**

Job #: ES-0675		North Mecklenburg Landfill		Well #: PZ-3	
County: Mecklenburg	State: NC	Date Begin: 1-10-94	Date End: 1-14-94	Casing Height:	Land Surface Elevation:
Lat:	Long:	Drilled By: Graham & Currie		Static Water Level:	
Grid Coord:		Logged By: Ben Hope		Development Method:	
Tests:		Drilling Method: Air Rotary		Sampling Method:	
Grout: 5% bentonite		Seal: bentonite 42 - 45 ft		Gravel Pack: FX 50 sand 45 to 67 ft	
Casing Type: Sch 40 PVC		Diameter: 2"	Depth: 0 - 47 ft	Hole Diameter: 6"	
Screen Type: Sch 40 PVC		Diameter: 2"	Slot: 0.010-inch	Depth: 47 - 67 ft	Total Depth: 67 ft
PID/FID Reading (ppm)	Penetration Resistance	Depth (ft)	Lithology/Remarks		Well Completion
		0	0 - 30.0 ft: Light Gray Brown Silty Fine Sand		0
		10			10
		20			20
		30	30.0 - 40.0 ft: Gray Silty Medium Sand		30
		40	40.0 - 50.0 ft: Partially Weathered Bedrock Sampled as Brown Silty Medium Course Sand with Rock Fragments		40
			Bentonite (42 - 45 ft)		
			Casing to 47 ft		
		50	50.0 - 67.0 ft: Dark Reddish Brown Silty Medium Course Sand with Rock Fragments		50
		60			60
			Boring Terminated at 67.0 ft		
			Sand (45 - 67 ft)		Screen (47 - 67 ft)
		70			

**Geologist Log**

**Ecological Services, Inc**

Job #: ES-0675		North Mecklenburg Landfill		Well #: PZ-4	
County: Mecklenburg State: NC		Date Begin: 1-10-94 Date End: 1-14-94		Casing Height: Land Surface Elevation:	
Lat: Long.:		Drilled By: Graham & Currie		Static Water Level:	
Grid Coord.:		Logged By: Ben Hope		Development Method:	
Tests:		Drilling Method: Air Rotary		Sampling Method:	
Grout: 5% bentonite		Seal: bentonite 40 - 44 ft		Gravel Pack: FX 50 sand 44 to 67 ft	
Casing Type: Sch 40 PVC		Diameter: 2"		Depth: 0 - 47 ft	
Screen Type: Sch 40 PVC		Diameter: 2"		Slot: 0.010-inch	
				Depth: 47 - 67 ft	
				Total Depth: 67 ft	
PID/FID Reading (ppm)		Penetration Resistance		Depth (ft)	
				Lithology/Remarks	
				Well Completion	
		0 - 30.0 ft: Tan Silty Fine Sand		0	
				10	
				20	
		30.0 - 40.0 ft: Brown Silty Fine Sand		30	
				40	
		40.0 - 50.0 ft: Partially Weathered Bedrock Sampled as Tan Silty Fine Medium Sand with Rock Fragments		40	
				Bentonite (40 - 44 ft)	
				Casing to 47 ft	
		50.0 - 67.0 ft: Gray Silty Medium Sand with Rock Fragments		50	
				60	
		Boring Terminated at 67.0 ft		Sand (44 - 67 ft)	
				Screen (47 - 67 ft)	
				70	

Geologist Log

Ecological Services, Inc

Job #: ES-0675	North Mecklenburg Landfill	Well #: PZ-7	Page 1 of 1
County: Mecklenburg	State: NC	Date Began: 5/13/94	Date End: 5/13/94
Lat.:	Long.:	Drilled By: Alliance	Static Water Level:
Grid Coord.:	Logged By: Michael Magnetti	Development Method:	
Tests:	Drilling Method: Air Rotary	Sampling Method:	

Grout: 5% Bentonite	Seal: 36 to 38 ft	Gravel Pack: 80/20 Silica Sand (38 to 60 ft)
Casing Type: Sch 40 PVC	Diameter: 2"	Depth: 0 to 40 ft
Screen Type: Sch 40 PVC	Diameter: 2"	Slot: 0.010"
		Depth: 40 to 60 ft
		Total Depth: 60 ft

PID/FID Reading (ppm)	Penetration Resistance	Depth (ft)	Lithology/Remarks	Well Completion
		0		0
		8 to 10 ft	Saprolite: Brown Fine Grained Sand with Trace Clay	
		10		10
		18 to 20 ft	Saprolite: Brown Fine Grained Silty Sand with Little Clay	
		20	20 to 27 ft: Partially Weathered Bedrock: Brownish Gray Silty Medium to Coarse Silty Sand with Rock Fragments	20
		27 to 60 ft	Bedrock: Quartz Diorite	
		30		30
				Bentonite (36 to 38 ft)
		40		40
				Casing (0 to 40 ft)
		50		50
				Sand (38 to 60 ft)
		60	Boring Terminated at 60 ft	60
				Screen (40 to 60 ft)

# **APPENDIX B**

Report of Laboratory Constant Head Permeability and Classification  
Tests for Cover Soil Samples



**LAW**

ENGINEERING AND ENVIRONMENTAL SERVICES

January 6, 1994

Ecological Services, Inc.  
PO Box 12146  
Charlotte North Carolina 28220

Attention: Mr. Ron Gilkerson  
Vice President

Subject: Report of Laboratory  
Constant Head Permeability and  
Classification Tests  
Ecological Services, Inc.  
Charlotte, North Carolina  
LAW Job No. 226-09423-01

Gentlemen:

As authorized by the acceptance of our Work Authorization Sheet dated May 27, 1992, Law Engineering has completed requested laboratory testing on the four soil samples submitted to our laboratory by Mr. Ron Gilkerson. Testing was performed according to the following ASTM standards:

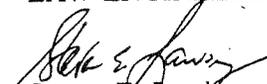
ASTM D 698	"Standard Test Method for Moisture Density Relations of Soils and Soil Aggregate Mixtures Using a 5.5lb (2.49kg) Rammer and 12 in (305mm) Drop"
ASTM D 5084	"Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter"
ASTM D 4318	"Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils"
ASTM D422	"Standard Test Method for Particle-Size Analysis of Soils"

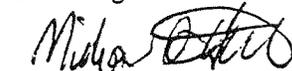
The results of our testing are summarized on the attached data sheets.

We appreciate the opportunity to be of service to you with this project. If you should have any questions concerning this report, or if we may be of further service to you, please do not hesitate to contact this office at (704) 357-8600.

Respectfully submitted,

LAW ENGINEERING

  
Steven E. Lawing  
Staff Engineer

  
Michael O. Hamlett, C.E.T.  
Laboratory Services Manager

SEL:MOH:kc  
Attachments

LAW ENGINEERING, INC.

2801 YORKMONT ROAD, SUITE 100 • CHARLOTTE, NC 28208  
P. O. BOX 11297 • CHARLOTTE, NC 28220  
(704) 357-8600 • FAX (704) 357-8639

ONE OF THE LAW COMPANIES 

# SUMMARY OF LABORATORY TESTING

Ecological Services, Inc.  
LAW Job No. 226-09423-01

## CONSTANT HEAD PERMEABILITY TEST

Sample ID	Optimum Proctor Values		Remolding Values		Coefficient of Permeability (cm/sec)
	$\gamma_{MAX}$ (pcf)	$W_o$ (%)	$\gamma$ (pcf)	$W_i$ (%)	
B-4	109.5	15.5	104.0	17.7	$3.2 \times 10^{-5}$
B-6	119.0	11.5	113.1	13.7	$1.1 \times 10^{-4}$
B-5	116.5	12.5	110.7	13.8	$1.3 \times 10^{-4}$
B-7	114.5	13.0	108.8	14.7	$5.3 \times 10^{-5}$

All samples tested at 2 psi head difference

$\gamma_{MAX}$  = Maximum Dry Unit Weight of Compacted Specimen

$\gamma$  = Dry Unit Weight of Remolded Test Sample

$W_o$  = Optimum Moisture Content of Compacted Specimen

$W_i$  = Initial Moisture Content of Remolded Test Sample

F = Final Value

P = Preliminary Value

# **APPENDIX C**

**Report of Laboratory Constant Head Permeability and Classification  
Tests for Floor Soil Samples**



**LAW**

ENGINEERING AND ENVIRONMENTAL SERVICES

February 14, 1994

Ecological Services, Inc.  
PO Box 12146  
Charlotte North Carolina 28220

Attention: Mr. Ron Gilkerson  
Vice President

Subject: **Report of Laboratory  
Constant Head Permeability and  
Classification Tests  
Ecological Services, Inc .  
Charlotte, North Carolina  
Law Engineering Job No. 226-09423-01**

Mr. Gilkerson:

As authorized by the acceptance of our Work Authorization Sheet dated May 27, 1992, Law Engineering has completed requested laboratory testing on the five soil samples submitted to our laboratory by Mr. Ron Gilkerson. Testing was performed according to the following ASTM standards:

ASTM D 698	"Standard Test Method for Moisture Density Relations of Soils and Soil Aggregate Mixtures Using a 5.5lb (2.49kg) Rammer and 12 in (305mm) Drop"
ASTM D 5084	"Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter"
ASTM D 4318	"Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils"
ASTM D422	"Standard Test Method for Particle-Size Analysis of Soils"

The results of our testing are summarized on the enclosed data sheets.

**LAW ENGINEERING, INC.**

2801 YORKMONT ROAD, SUITE 100 • CHARLOTTE, NC 28208  
P. O. BOX 11297 • CHARLOTTE, NC 28220  
(704) 357-8600 • FAX (704) 357-8639

ONE OF THE LAW COMPANIES 

February 14, 1994

We appreciate the opportunity to be of service to you with this project. If you should have any questions concerning this report, or if we may be of further service to you, please do not hesitate to contact this office at (704) 357-8600.

Sincerely,

Law Engineering, INC.

  
Steven E. Lawing  
Staff Engineer

  
Michael O. Hamlett, C.E.T.  
Laboratory Services Manager

SEL/MOH:kc

Enclosures (8)

## SUMMARY OF LABORATORY TESTING

Ecological Services, Inc.  
LAW Job No. 226-09423-01

### CONSTANT HEAD PERMEABILITY TEST

Sample ID	Optimum Proctor Values		Remolding Values		Coefficient of Permeability (cm/sec)
	$\gamma_{MAX}$ (pcf)	$W_o$ (%)	$\gamma$ (pcf)	$W_i$ (%)	
1	117.0	12.0	111.2	12.7	$6.7 \times 10^{-6}$
2	117.5	13.0	111.6	14.8	$2.9 \times 10^{-5}$
3	115.0	14.0	109.3	14.3	$5.2 \times 10^{-6}$
4	111.0	14.0	105.5	14.4	$2.9 \times 10^{-4}$
5	120.5	11.5	114.5	13.0	$1.2 \times 10^{-6}$

All samples tested at 2 psi head difference

$\gamma_{MAX}$  = Maximum Dry Unit Weight of Compacted Specimen

$\gamma$  = Dry Unit Weight of Remolded Test Sample

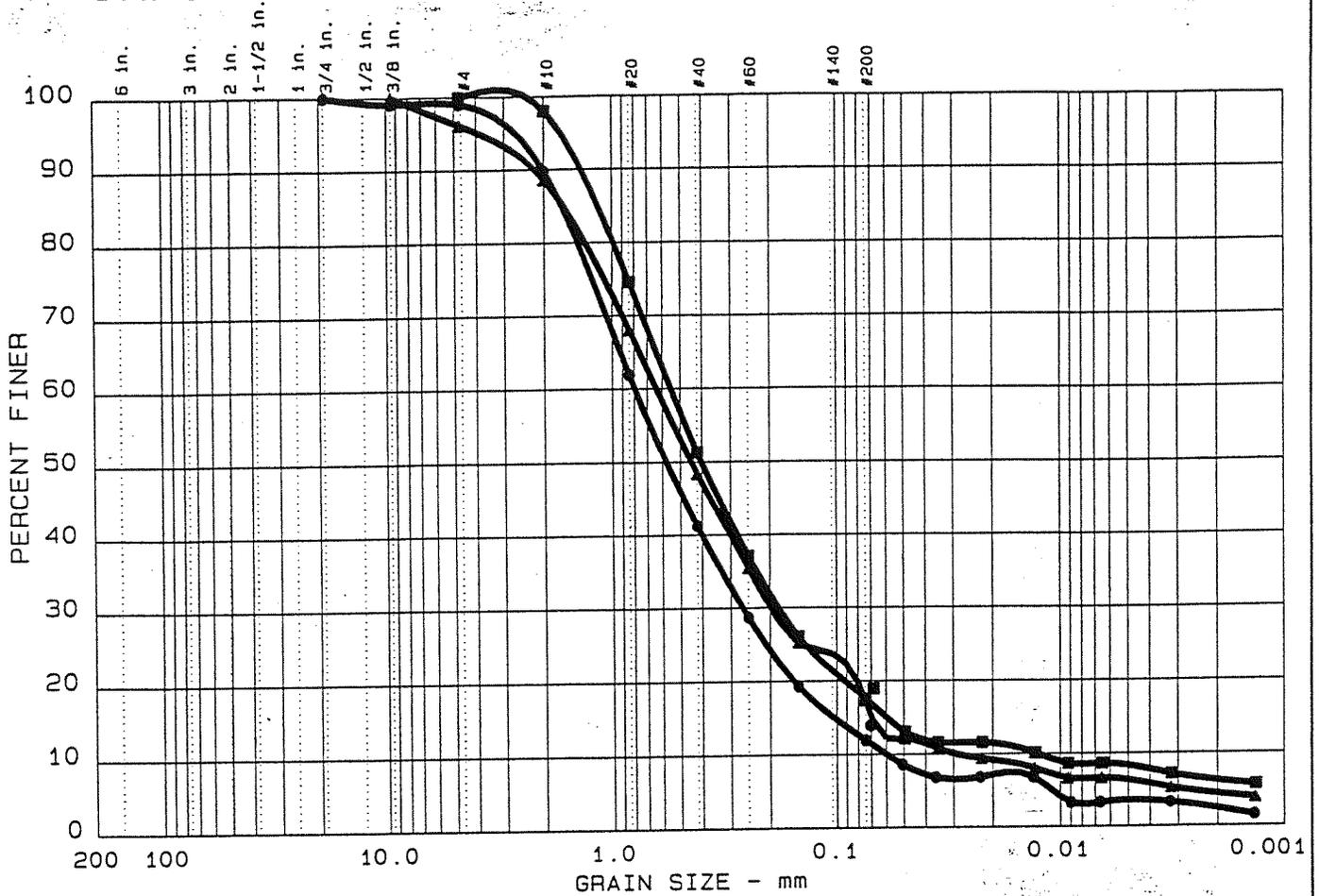
$W_o$  = Optimum Moisture Content of Compacted Specimen

$W_i$  = Initial Moisture Content of Remolded Test Sample

F = Final Value

P = Preliminary Value

# GRAIN SIZE DISTRIBUTION TEST REPORT



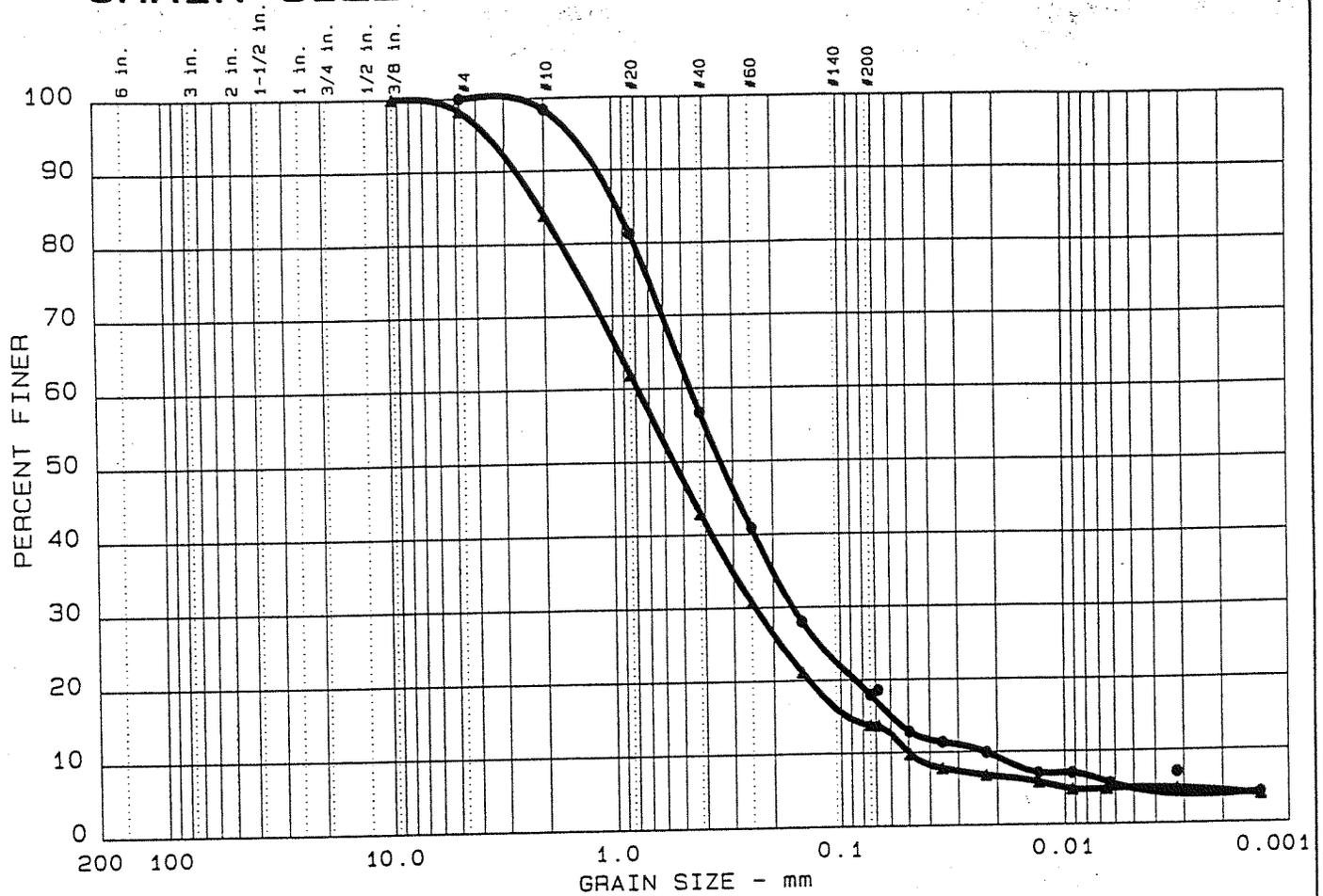
	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	0.0	1.0	87.1	8.3	3.6
▲	0.0	3.8	78.8	11.0	6.4
■	0.0	0.0	82.4	9.2	8.4

	LL	PI	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
●	NP	NP	1.66	0.79	0.57	0.263	0.1022	0.0595	1.46	13.3
▲	NP	NP	1.64	0.64	0.45	0.198	0.0692	0.0279	2.22	22.8
■	NP	NP	1.15	0.55	0.40	0.183	0.0594	0.0125	4.88	43.8

MATERIAL DESCRIPTION	USCS	AASHTO
●		
▲		
■		

Project No.: 226-09423-01 Project: ECOLOGICAL SERVICES ● Location: SAMPLE 1 ▲ Location: SAMPLE 2 ■ Location: SAMPLE 3 Date: FEBRUARY 10, 1994	Remarks:
<b>GRAIN SIZE DISTRIBUTION TEST REPORT</b> <b>LAW ENGINEERING</b>	
Figure No. _____	

# GRAIN SIZE DISTRIBUTION TEST REPORT



	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	0.0	0.0	82.0	13.2	4.8
▲	0.0	1.7	84.5	8.9	4.9

	LL	PI	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>	C <sub>c</sub>	C <sub>u</sub>
●	NP	NP	0.95	0.46	0.34	0.163	0.0594	0.0226	2.57	20.4
▲	NP	NP	2.09	0.78	0.55	0.242	0.0940	0.0499	1.49	15.7

MATERIAL DESCRIPTION	USCS	AASHTO
●		
▲		

Project No.: 226-09423-01  
 Project: ECOLOGICAL SERVICES  
 ● Location: SAMPLE 4  
 ▲ Location: SAMPLE 5

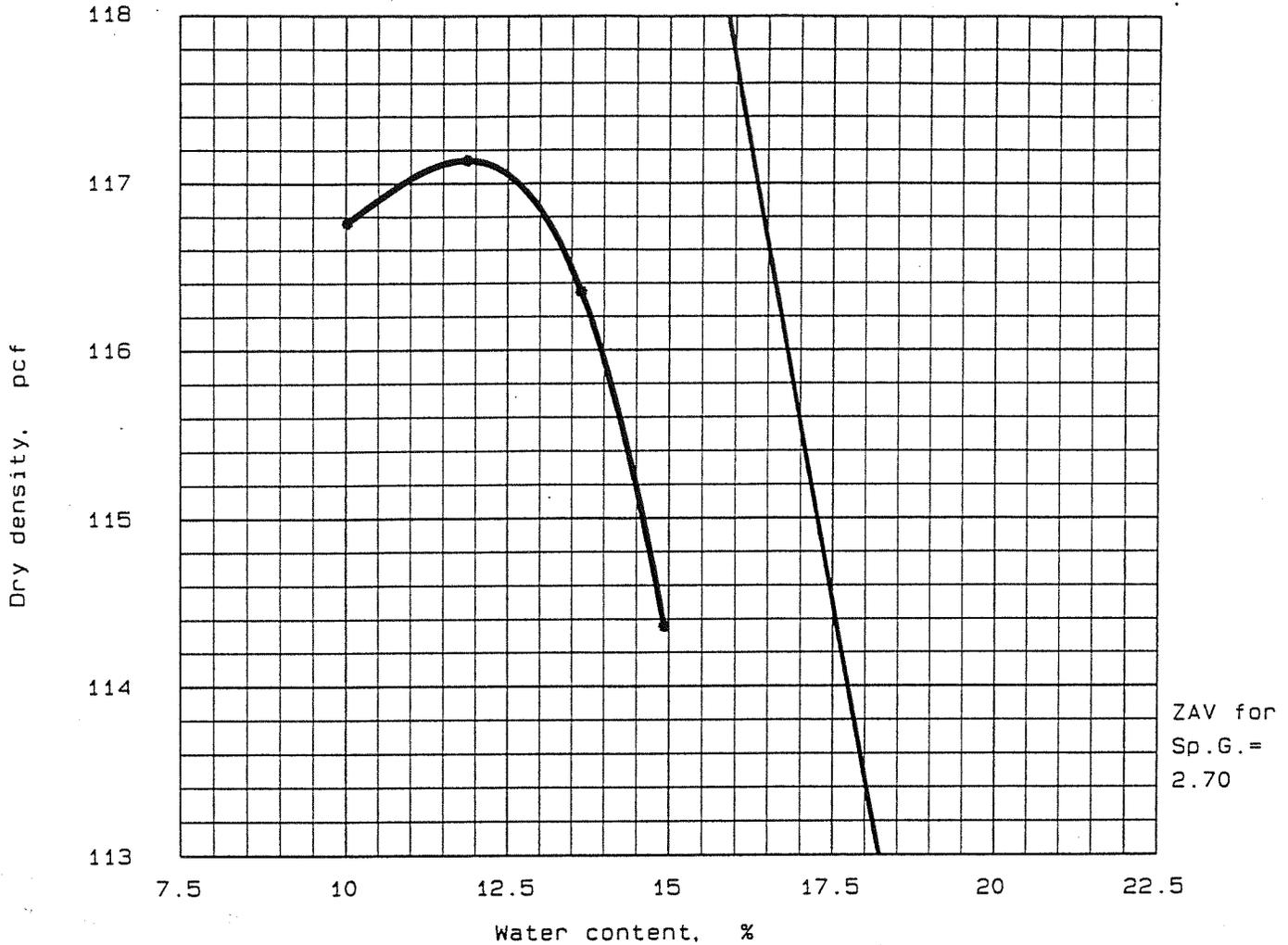
Date: FEBRUARY 10, 1994

GRAIN SIZE DISTRIBUTION TEST REPORT  
**LAW ENGINEERING**

Remarks:

Figure No. \_\_\_\_\_

# PROCTOR TEST REPORT



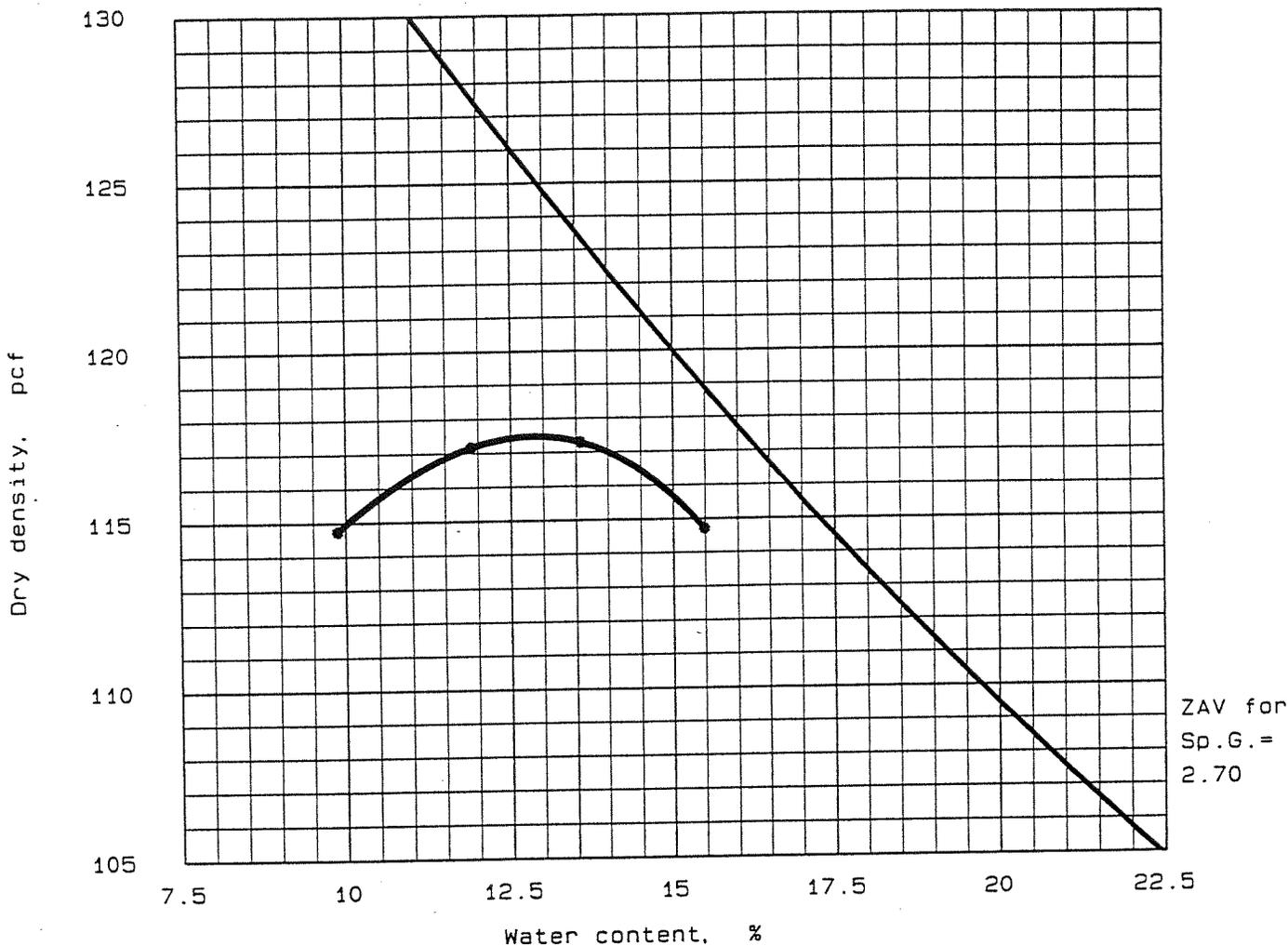
"Standard" Proctor, ASTM D 698, Method A

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						

TEST RESULTS	MATERIAL DESCRIPTION
Optimum moisture = 12.0 % Maximum dry density = 117.0 pcf	BROWN FINE TO COARSE SILTY SAND WITH WEATHERED ROCK

Project No.: 226-09423-01 Project: ECOLOGICAL SERVICES Location: SAMPLE 1 Date: 2-01-1994	Client: ECOLOGICAL SERVICES Proposed Use: Remarks:
PROCTOR TEST REPORT <b>LAW ENGINEERING, INC.</b>	Curve No. 7

# PROCTOR TEST REPORT



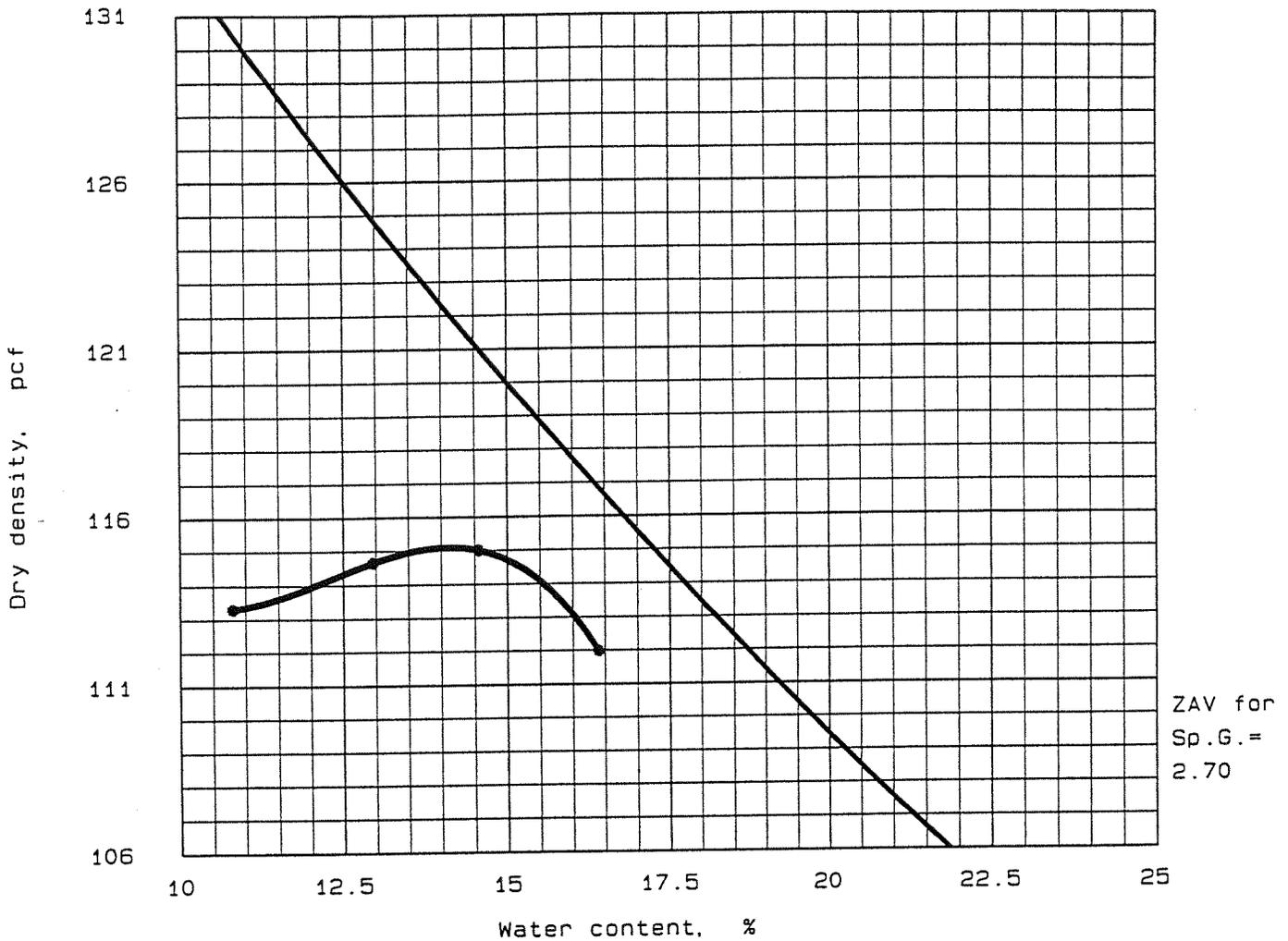
"Standard" Proctor, ASTM D 698, Method A

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						

TEST RESULTS	MATERIAL DESCRIPTION
Optimum moisture = 13.0 % Maximum dry density = 117.5 pcf	BROWN MICACEOUS SILTY FINE TO COARSE SAND

Project No.: 226-09423-01 Project: ECOLOGICAL SERVICES, INC.  Location: SAMPLE 2 Date: 2-01-1994	Client: ECOLOGICAL SERVICES, INC. Proposed Use:  Remarks:  Curve No. 5
PROCTOR TEST REPORT <b>LAW ENGINEERING, INC.</b>	

# PROCTOR TEST REPORT

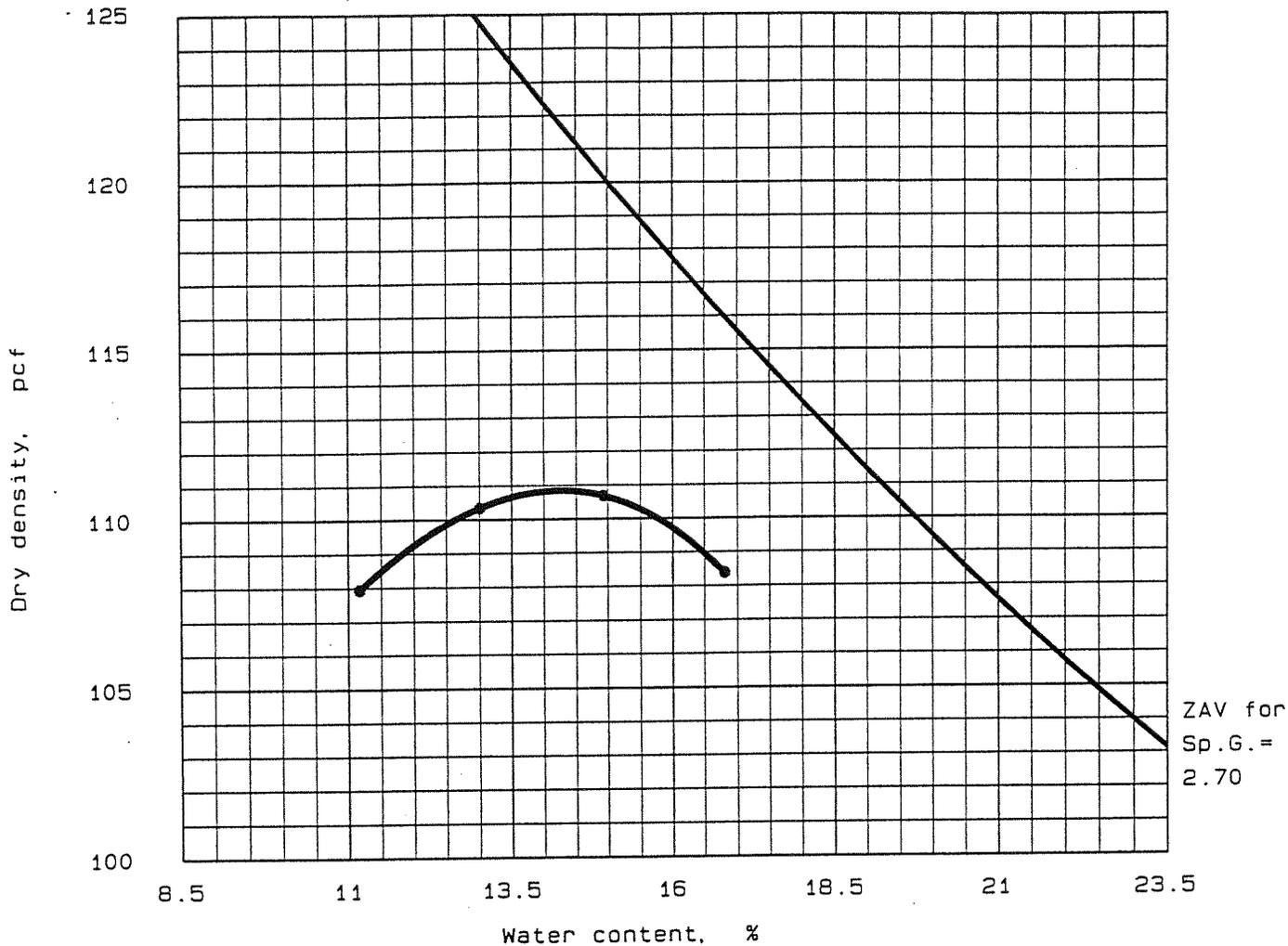


"Standard" Proctor, ASTM D 698, Method A

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						

TEST RESULTS	MATERIAL DESCRIPTION
Optimum moisture = 14.0 % Maximum dry density = 115.0 pcf	TAN BROWN FINE TO COARSE SILTY SAND
Project No.: 226-09423-01 Project: ECOLOGICAL SERVICES, INC.  Location: SAMPLE 3 Date: 2-01-1994	Client: ECOLOGICAL SERVICES, INC. Proposed Use:  Remarks:
PROCTOR TEST REPORT <b>LAW ENGINEERING, INC.</b>	Curve No. 6

# PROCTOR TEST REPORT



"Standard" Proctor, ASTM D 698, Method A

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						

TEST RESULTS	MATERIAL DESCRIPTION
--------------	----------------------

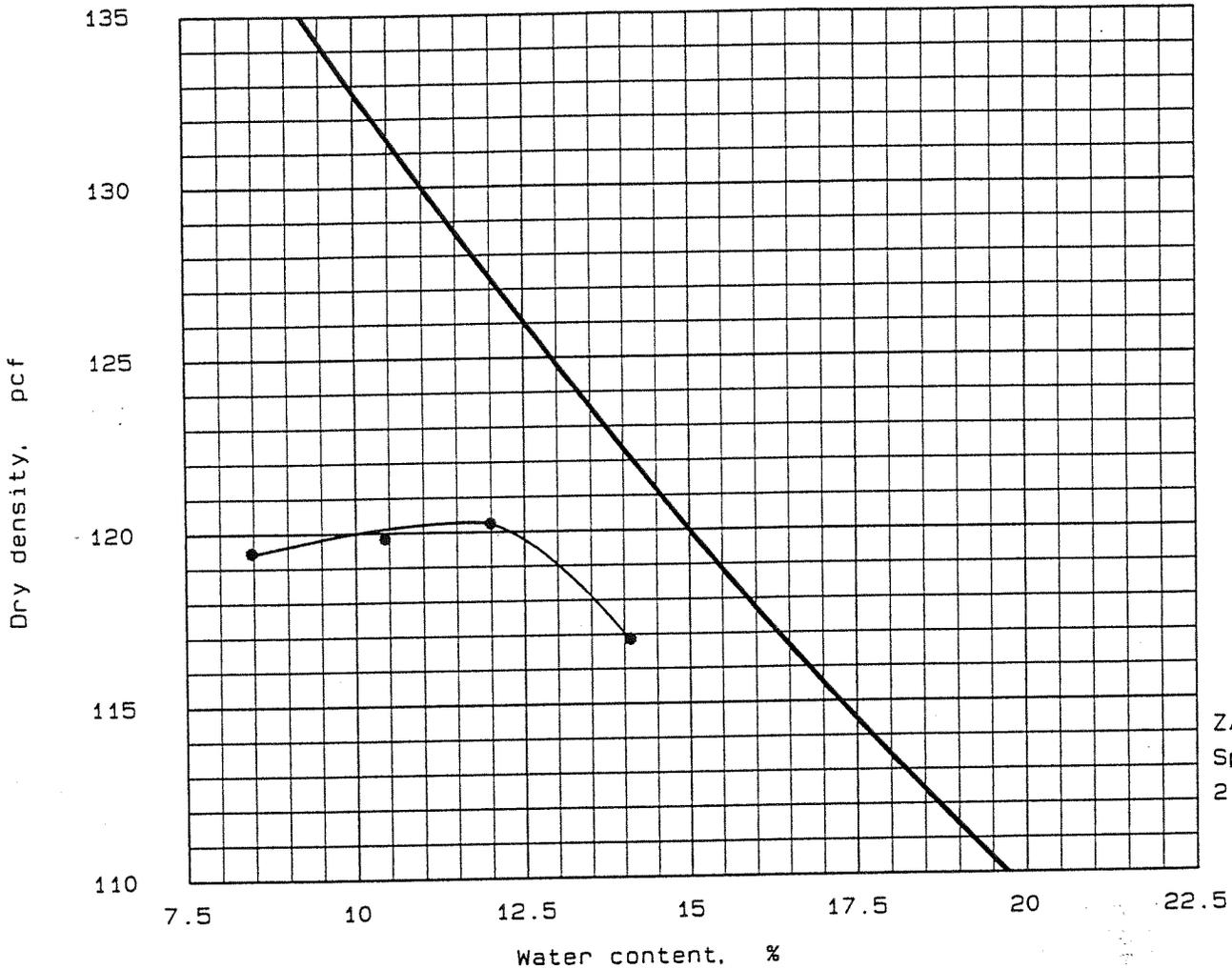
Optimum moisture = 14.0 % Maximum dry density = 111.0 pcf	TAN BROWN MICACEOUS SILTY FINE TO COARSE SANDY SILT
--	---

Project No.: 226-09423-01 Project: ECOLOGICAL SERVICES Location: SAMPLE 4 Date: 2-02-1994
--

Client: ECOLOGICAL SERVICES Proposed Use: Remarks: Curve No. 9
--

PROCTOR TEST REPORT <b>LAW ENGINEERING, INC.</b>
---

# PROCTOR TEST REPORT



"Standard" Proctor, ASTM D 698, Method A

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						

TEST RESULTS	MATERIAL DESCRIPTION
Optimum moisture =            % Maximum dry density = 120.5 pcf	TAN GREEN FINE TO COARSE SILTY SAND WITH WEATHERED ROCK
Project No.: 226-09423-01 Project: ECOLOGICAL SERVICES  Location: SAMPLE 5 Date: 2-01-1994	Client: ECOLOGICAL SERVICES Proposed Use:  Remarks:
PROCTOR TEST REPORT <b>LAW ENGINEERING, INC.</b>	Curve No. 8

# ESI COMPUTATION SHEET

PROJECT TITLE: N. MICK LANDFILL PROJECT NO. ES-675  
 DESCRIPTION: IN-FLOW PERMEABILITY TEST PC-7 SHEET     OF      
 PREPARED BY:     DATE:     CHK'D BY:     DATE:    

## COUWEL AND RILEY METHOD

Variables:

$$y_t = 1.9'$$

$$t = 27 \text{ min.}$$

$$y_0 = 10.11'$$

$$L = 20'$$

$$r_e = 0.08'$$

$$r_w = 0.25'$$

$$L/r_w = 80$$

$$H = 11.81'$$

$$C = 3.5$$

$$K =$$

## EQUATIONS

$$\ln \frac{r_e}{r_w} = \left( \frac{1.1}{\ln(H/r_w)} + \frac{C}{L/r_w} \right)^{-1}$$

$$\ln \frac{r_e}{r_w} = \left( \frac{1.1}{\ln(11.81/0.25)} + \frac{3.5}{20/0.25} \right)^{-1}$$

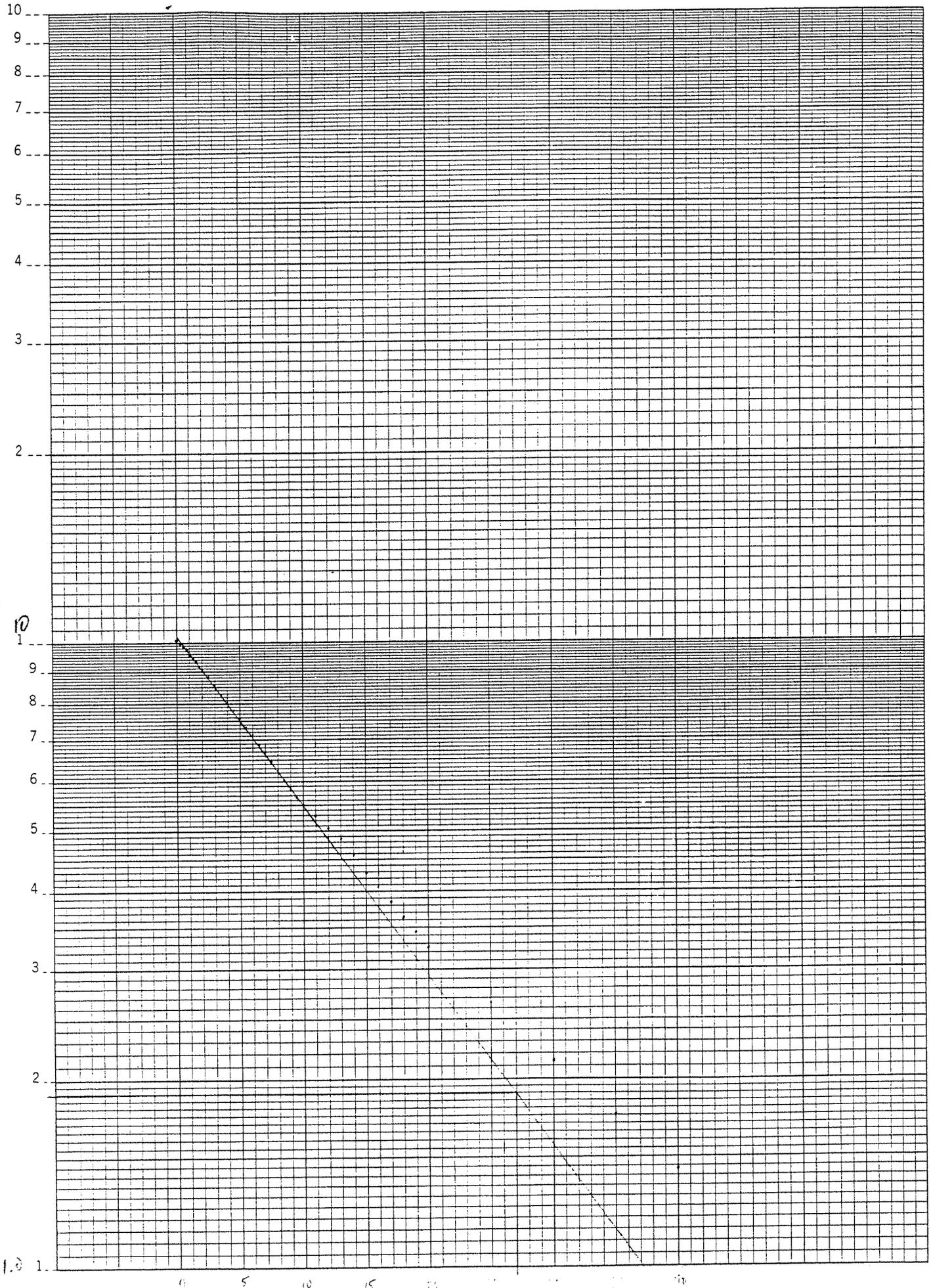
$$\ln \frac{r_e}{r_w} = 3.04$$

$$K = \frac{r_e^2 \ln \left( \frac{r_e}{r_w} \right)}{2L} \cdot \frac{1}{t} \cdot \ln \frac{y_0}{y_t}$$

$$K = \frac{0.08^2 \ln(3.04)}{40} \cdot \frac{1}{27} \cdot \ln \frac{10.11}{1.9}$$

$$K = 1.10 \times 10^{-5} \text{ ft/min} = 5.69 \times 10^{-6}$$

$y_t$  (Feet)



# **APPENDIX D**

## **In-Flow Permeability Calculations**

BAIL TEST RECOVERY DATA  
 N. MECK. LANDFILL

PZ-7, JULY 6, 1994

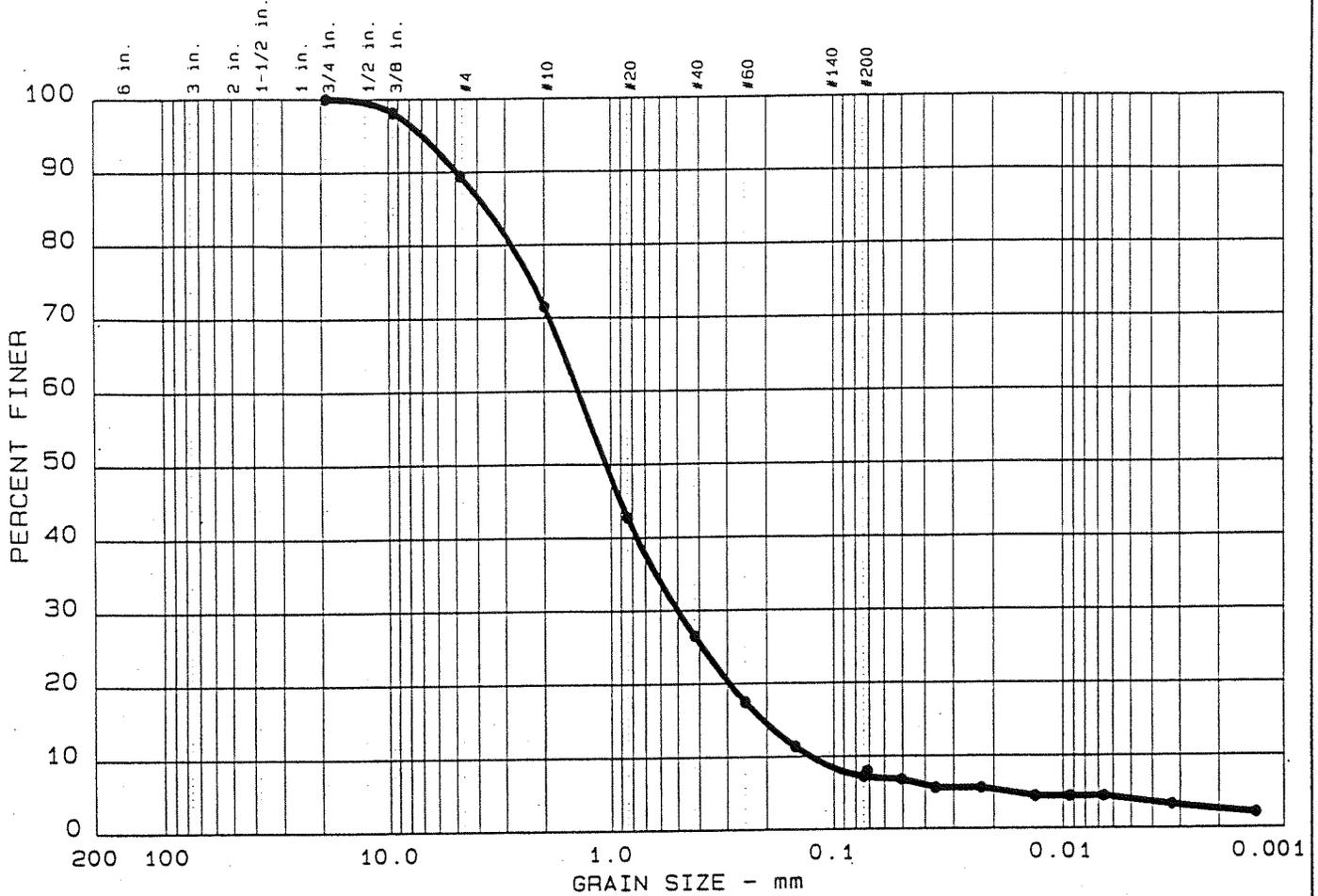
INITIAL DTW: 48.19

ELAPSED TIME (Min)	DEPTH TO WATER TABLE (feet)	MEASURED W.T. DEPTH MINUS EQUILIBRIUM W.T. DEPTH (feet)
0.00	58.30	10.11
0.25	58.17	9.98
0.50	58.05	9.86
0.75	57.91	9.72
1.00	57.77	9.58
1.25	57.63	9.44
1.50	57.52	9.33
1.75	57.38	9.19
2.00	57.26	9.07
2.50	57.00	8.81
3.00	56.75	8.56
3.50	56.46	8.27
4.00	56.22	8.03
4.50	55.99	7.80
5.00	55.76	7.57
5.50	55.52	7.33
6.00	55.32	7.13
6.50	55.08	6.89
7.00	54.85	6.66
7.50	54.64	6.45
8.00	54.43	6.24
8.50	54.22	6.03
9.00	54.02	5.83
9.50	53.86	5.67
10.00	53.70	5.51
11.00	53.49	5.30
12.00	53.24	5.05
13.00	53.04	4.85
14.00	52.76	4.57
15.00	52.48	4.29
16.00	52.25	4.06
17.00	52.03	3.84
18.00	51.80	3.61
19.00	51.62	3.43
20.00	51.45	3.26
25.00	50.86	2.67
30.00	50.33	2.14
35.00	49.95	1.76
40.00	49.63	1.44

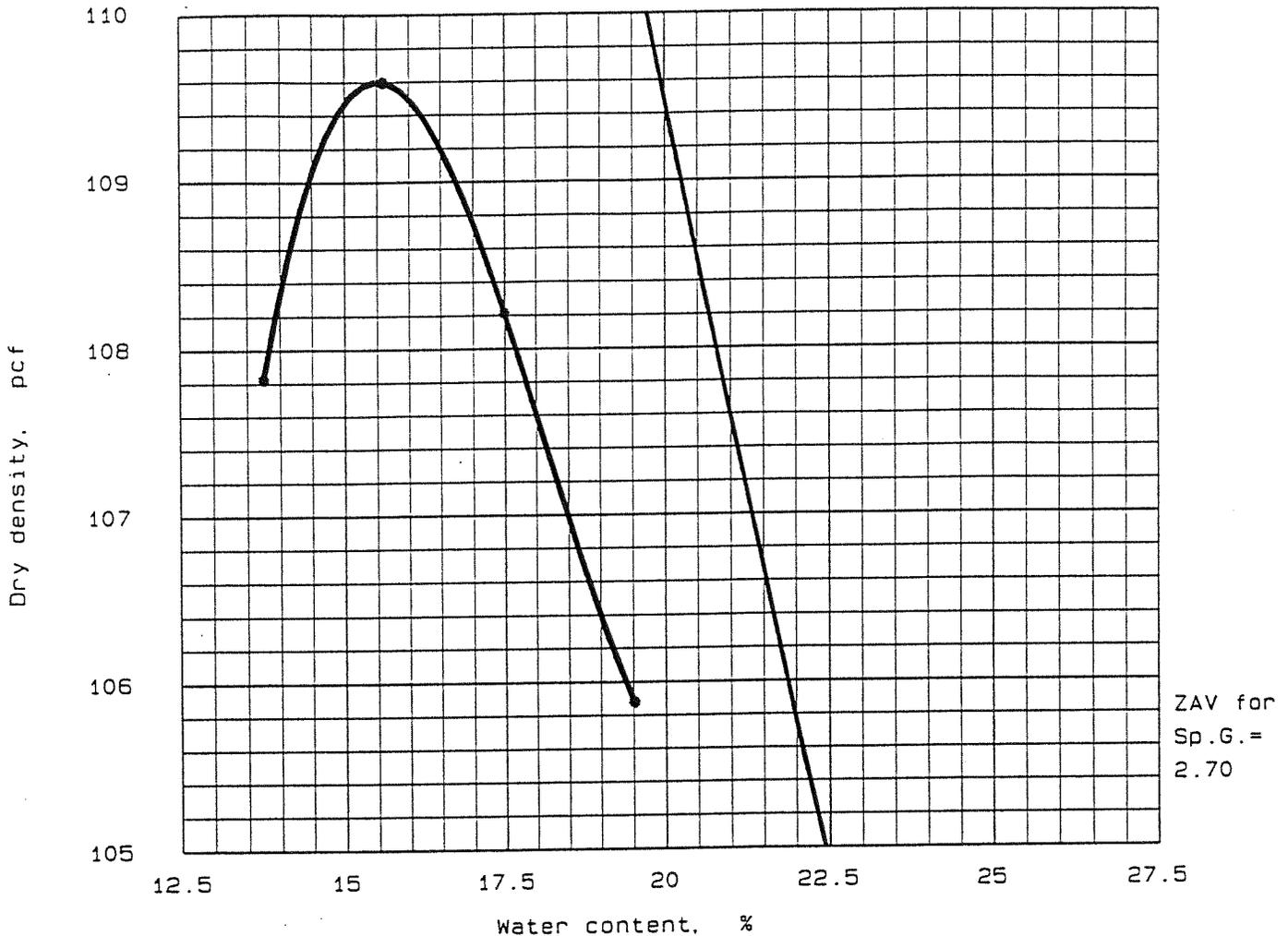




# GRAIN SIZE DISTRIBUTION TEST REPORT



# PROCTOR TEST REPORT

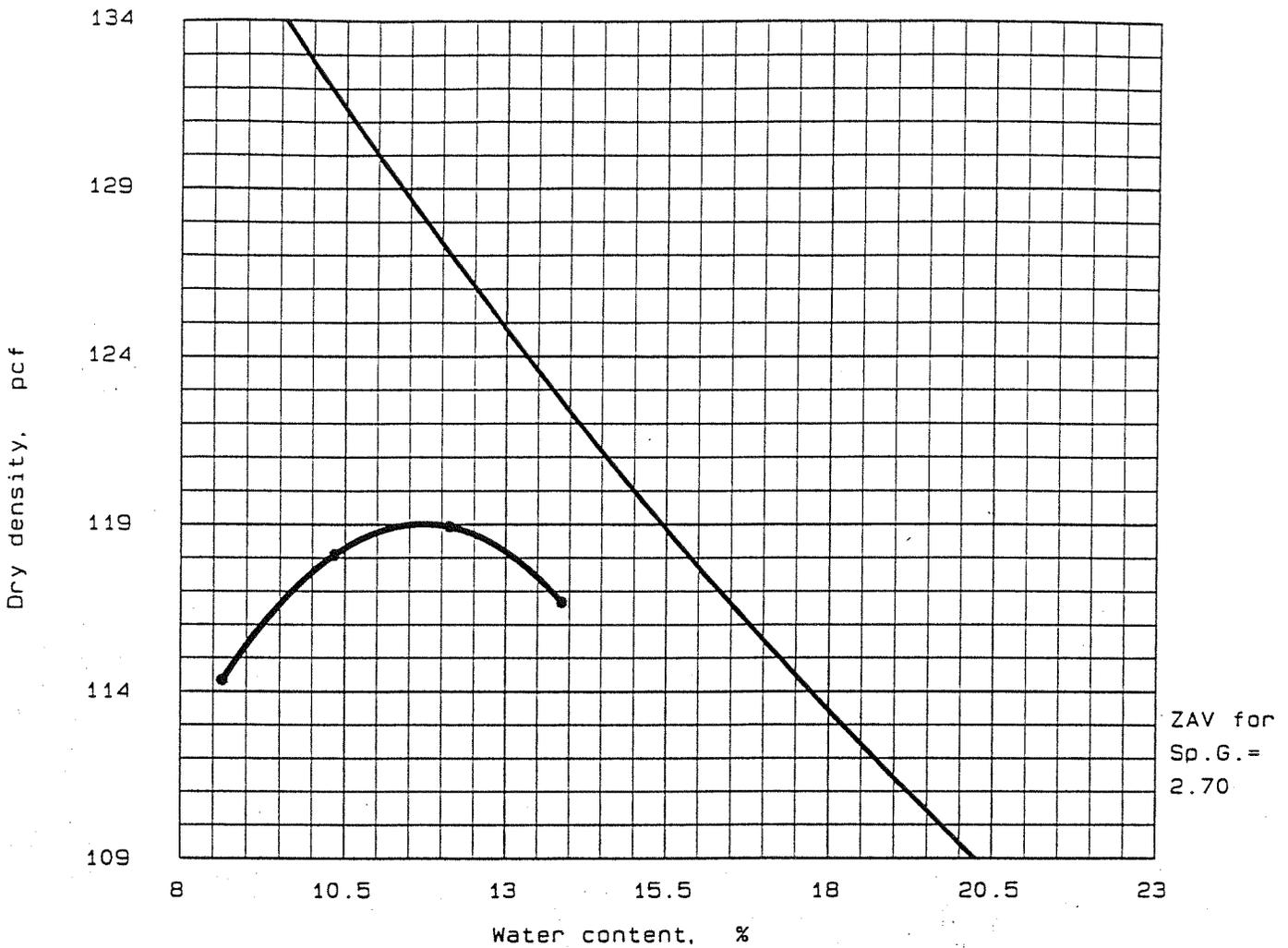


"Standard" Proctor, ASTM D 698, Method A

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						

TEST RESULTS	MATERIAL DESCRIPTION
<p>Optimum moisture = 15.5 % Maximum dry density = 109.5 pcf</p>	<p>WHITE TAN BROWN MICACEOUS SILTY FINE TO COARSE SAND WITH PARTIALLY WEATHERED ROCK</p>
<p>Project No.: 226-09423-01 Project: ECOLOGICAL SERVICES, INC.  Location: B-4 Date: 12-27-1993</p>	<p>Client: ECOLOGICAL SERVICES, INC. Proposed Use:  Remarks:  Curve No. 1</p>
<p>PROCTOR TEST REPORT <b>LAW ENGINEERING, INC.</b></p>	

# PROCTOR TEST REPORT

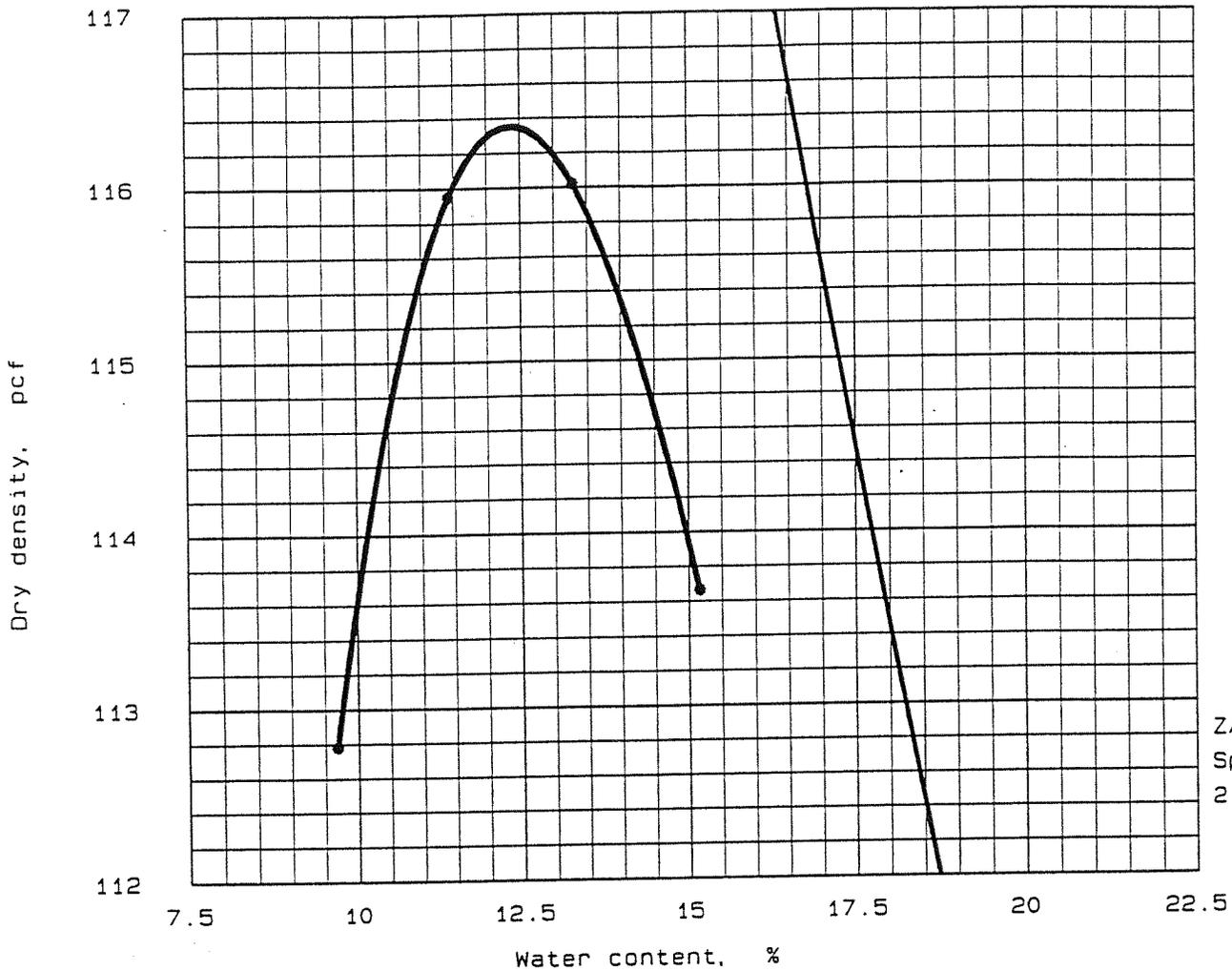


"Standard" Proctor, ASTM D 698, Method A

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						

TEST RESULTS	MATERIAL DESCRIPTION
<p>Optimum moisture = 11.5 % Maximum dry density = 119.0 pcf</p>	<p>BROWN MICACEOUS FINE TO COARSE SAND WITH PARTIALLY WEATHERED ROCK</p>
<p>Project No.: 226-09423-01 Project: ECOLOGICAL SERVICES, INC.  Location: B-6 Date: 12-27-1993</p>	<p>Client: ECOLOGICAL SERVICES, INC. Proposed Use:  Remarks:  Curve No. 3</p>
<p>PROCTOR TEST REPORT <b>LAW ENGINEERING, INC.</b></p>	

# PROCTOR TEST REPORT



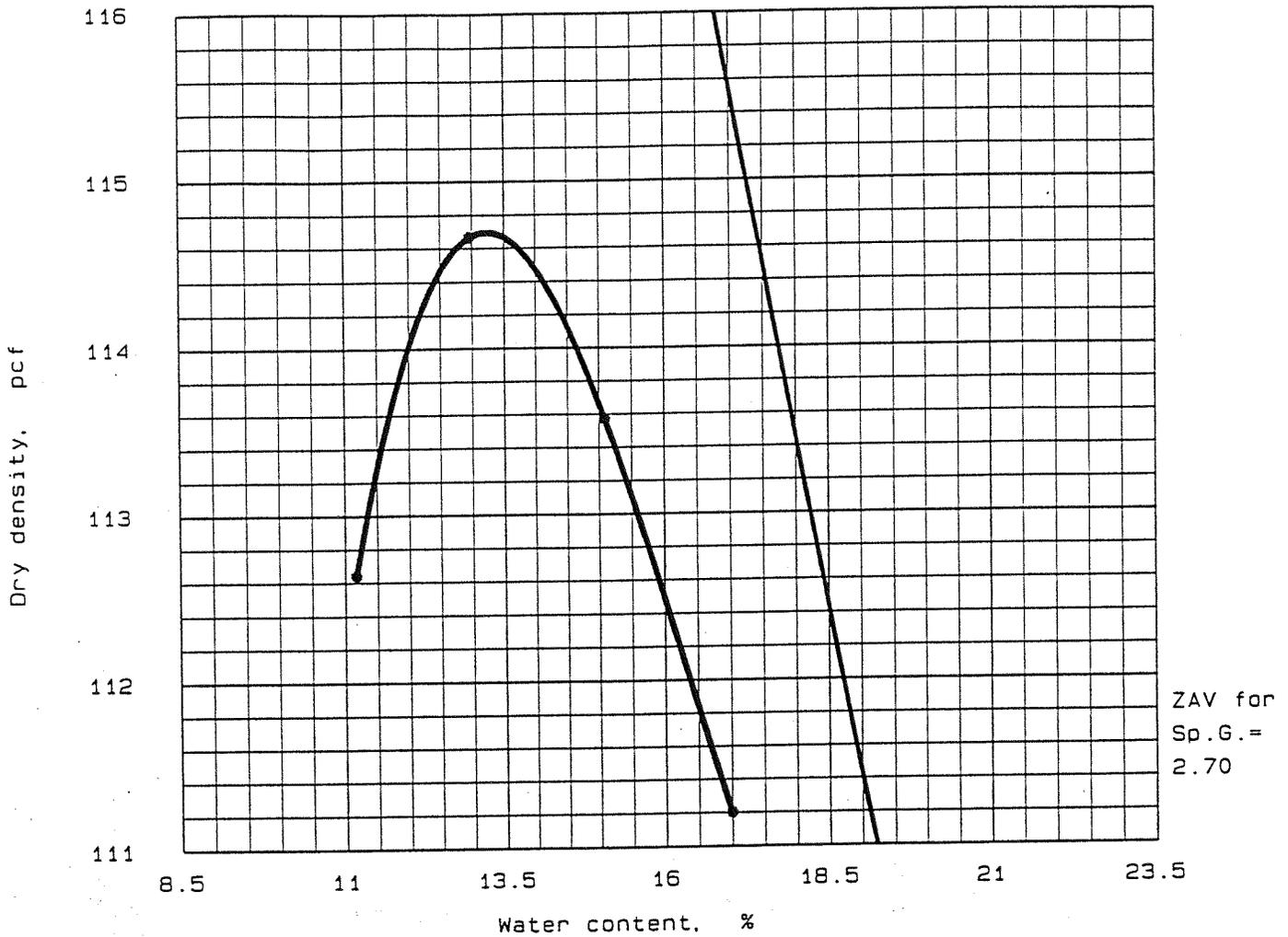
ZAV for  
Sp.G. =  
2.70

"Standard" Proctor, ASTM D 698, Method A

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						

TEST RESULTS	MATERIAL DESCRIPTION
<p>Optimum moisture = 12.5 % Maximum dry density = 116.5 pcf</p>	<p>BROWN MICACEOUS SILTY FINE TO COARSE SAND WITH PARTIALLY WEATHERED ROCK</p>
<p>Project No.: 226-09423-01 Project: ECOLOGICAL SERVICES</p> <p>Location: B-5 Date: 12-27-1993</p>	<p>Client: ECOLOGICAL SERVICES</p> <p>Proposed Use:</p>
<p>PROCTOR TEST REPORT</p> <p><b>LAW ENGINEERING, INC.</b></p>	<p>Remarks:</p> <p>Curve No. 2</p>

# PROCTOR TEST REPORT



"Standard" Proctor, ASTM D 698, Method A

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No. 4	% < No. 200
	USCS	AASHTO						

TEST RESULTS	MATERIAL DESCRIPTION
<p>Optimum moisture = 13.0 % Maximum dry density = 114.5 pcf</p>	<p>BROWN MICACEOUS SILTY FINE TO COARSE SAND WITH PARTIALLY WEATHERED ROCK</p>
<p>Project No.: 226-09423-01 Project: ECOLOGICAL SERVICES, INC.  Location: B-7 Date: 12-27-1993</p>	<p>Client: ECOLOGICAL SERVICES, INC. Proposed Use:</p>
<p style="text-align: center;">PROCTOR TEST REPORT</p> <p style="text-align: center;"><b>LAW ENGINEERING, INC.</b></p>	<p>Remarks:</p> <p>Curve No. 4</p>