LAW

ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

REPORT OF SUBSURFACE EXPLORATION AND STABILITY ANALYSIS

TENNESSEE VALLEY AUTHORITY

JOHNSONVILLE FOSSIL PLANT ASH DISPOSAL AREA
NEW JOHNSONVILLE, TENNESSEE

Prepared for:

TENNESSEE VALLEY AUTHORITY

Chattanooga, Tennessee

53

September 19, 1997

LAW
ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

September 19, 1997

Mr. Kenneth W. Burnett
Tennessee Valley Authority
1101 Market Street, LP-2G
Chattanooga, TN 37402

Subject: **Report of Subsurface Exploration and Stability Analysis**
Tennessee Valley Authority
Johnsonville Fossil Plant, Ash Disposal Area
LAW Project 50385-5-0400/0035/0001

Dear Mr. Burnett:

We at Law Engineering and Environmental Services, Inc., (LAW) are pleased to submit this Report of Subsurface Exploration and Stability Analysis for the Johnsonville Fossil Plant, Ash Disposal Area. This work was conducted under TVA Contract No. TV-92657V, Task Assignment Order LA-035-1195170.

This report reviews the information provided to us, discusses the site and subsurface conditions, and presents the results of our stability analysis. The Appendices contain a Boring Location/Subsurface Section Plan, the Test Boring Logs, Subsurface Profile Sections, and the Laboratory Test Results.

We will be pleased to discuss our recommendations with you and would welcome the opportunity to provide the engineering and material testing services needed to successfully complete your project.

Sincerely,

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

JEFFERY A. ABSTON REGISTERED ENGINEER AGRICULTURE COMMERCE 0019433 STATE OF TENNESSEE

Jeffery A. Abston, P.E.
Senior Engineer

for Carl Tockstein JEN

Carl D. Tockstein, P.E.
Chief Engineer

JAA/CDT:jen

cc: Jerry Glover

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TABLE OF CONTENTS

Page

1.0 EXECUTIVE SUMMARY

We were selected by the Tennessee Valley Authority (TVA) to perform a subsurface exploration and stability analysis for the proposed Johnsonville Fossil Plant Ash Disposal Area. The objectives of our exploration were to determine general subsurface conditions, obtain data to evaluate the existing ash and insitu soils at the site and perform a stability analysis for the proposed disposal area configuration.

The exploration consisted of drilling nine test borings in the disposal area to depths ranging from about 20 to 70 feet. The major findings and recommendations are as follows:

- The proposed configuration has a global stability safety factor of about 1.8 under static conditions and about 1.1 under seismic conditions with a maximum horizontal acceleration coefficient of 0.15 (taken from the USGS Map of Maximum Horizontal Accelerations contained in the Tennessee Division of Solid Waste Management guidance document).

- For the maximum slope of 2.2H:1V and considering a critical interface angle of 22.6 degrees (based on triaxial shear strength data from previous studies of the ash at this site), the calculated factor of safety for the cover under seismic loading is 0.65. Consequently, it is likely the cover will slip/slough during the design seismic event and will require subsequent repair. If it were reasonably possible to increase the critical interface angle (by compaction of the ash and/or other methods) to a value of 33 degrees, the factor of safety would increase to 1.0.

This summary is only an overview and should not be used as a separate document or in place of reading the entire report, including the appendices.

2.0 INTRODUCTION

This report presents the results of our subsurface exploration and subsequent stability analysis for the proposed final configuration of the ash disposal area at the TVA Johnsonville Fossil Plant near New Johnsonville, Tennessee. This work was performed for TVA's use in preparing a revised closure plan for the ash disposal area.

3.0 OBJECTIVES OF EXPLORATION

The objectives of our exploration were to determine general subsurface conditions and to obtain data to evaluate engineering properties, the existing ash and insitu soils at the site, and perform a stability analysis for the proposed disposal area configuration. An assessment of site environmental

conditions, or for the presence or absence of pollutants in the soil, bedrock, surface water, or ground water of the site were beyond the proposed objectives of our exploration.

4.0 SCOPE OF SERVICES

The scope of services for this exploration has included the following:

- Layout and drilling of nine test borings to depths ranging from about 20 to about 70 feet. The borings were advanced about 6 to 22-½ feet into the insitu soils.
- Standard Penetration Testing was performed at 5-foot intervals in the borings, and undisturbed samples of the insitu soils were obtained for laboratory testing.
- Consolidated undrained with pore pressure measurements and unconsolidated undrained triaxial tests, grain size analysis, permeability testing, and unified soil classifications were performed on representative undisturbed soil samples.
- The data obtained, along with data available from previous LAW testing to determine ash parameters, was used to perform stability analysis on two cross sections of the proposed ash stack configuration.

5.0 PROJECT INFORMATION AND SITE CONDITIONS

Project information was provided to us by Mr. Jerry Glover of TVA during telephone conversations. We have also received from Mr. Mike Hranek, an autocad drawing depicting the proposed final configuration of the disposal area. We understand that TVA is preparing a revised closure plan for the ash disposal area at their Johnsonville Fossil Plant in New Johnsonville, Tennessee. The original closure plan did not include any investigation of the insitu overburden. The current revision requires geotechnical input parameters for use in stability analysis and hydrogeologic modeling of the area.

The site is about 40 to 50 acres in size and is presently occupied by two existing ash stacks about 40 to 50 feet high. There are several towers supporting power lines located across the site. The plan provided to us indicates that an additional 20 to 50 feet of ash will be placed across the site.

6.0 SUBSURFACE CONDITIONS

Subsurface conditions were explored with nine widely spaced borings drilled in general accordance with the procedures presented in Appendix A. The boring locations and depths were selected by TVA personnel. Our geotechnical engineer established the actual boring locations in the field by

taping distances and estimating right angles relative to on-site landmarks. Boring elevations were obtained by survey using an existing observation well top as a temporary benchmark. The boring locations are shown on the Boring Location/Subsurface Section Plan in Appendix B, and the elevations are shown on the Test Boring Logs in Appendix C.

Subsurface conditions encountered at the boring locations are shown on the Test Boring Logs in Appendix C. These Test Boring Logs represent our interpretation of the subsurface conditions, based on the field logs and visual examination of the field samples by one of our engineers. The lines designating the interfaces between various strata on the Test Boring Logs represent the approximate interface locations.

The test borings performed at this site typically encountered fill and alluvial soils. Fill is material that has been placed by man. Alluvial soils are soils that have been transported to their present location by running water.

After penetrating a layer of topsoil ranging in thickness from about ½-foot to 2½ feet or from the ground surface, the test borings except B-7 encountered fill to depths ranging from about 17½ to 62 feet. The fill was composed primarily of very loose to dense dark gray fine sand (flay ash). Standard penetration test (SPT) resistance values for the ash ranged from 0 blows per foot (bpf) to 50 bpf, and averaged about 8 bpf.

Beneath a 2-foot layer of topsoil in boring B-7 and after penetrating the ash in the remaining borings, alluvial soils were encountered to boring refusal or termination at depths ranging from 20-½ feet to 70-½ feet. The alluvial soils encountered were typically composed of very loose to very dense brown and tan silty sand and gravel and stiff to hard brown and tan silty sandy clay with gravel. SPT values for the alluvial soil ranged from 2 to 100 bpf and averaged about 32 bpf. All of the borings were terminated in or refused in the alluvial soils.

7.0 GROUND-WATER CONDITIONS

Ground water was observed in the test borings at depths ranging from about 10 to 55 feet at the time of drilling. For safety reasons, the borings were backfilled promptly after drilling; consequently, long-term measurements for the presence or absence of ground water were not obtained. Fluctuations in the ground-water level occur because of variations in rainfall, evaporation, construction activity, surface run-off, and other site-specific factors such as springs.

8.0 APPROACH TO STABILITY ANALYSIS

The stability analysis presented here evaluates the ability of the disposal area including its future cover system to maintain its integrity during long term static conditions and during a design earthquake event. Two potential failure mechanisms were considered:

1. Global stability of the landfill slopes under static conditions and under seismic loading.

2. Veneer stability of the landfill cover system under seismic loading.

8.1 Global Stability Under Static conditions and Seismic Loading

The global stability analysis of the slopes was performed using the computer program PCTABL5M. The input parameters for the analysis were based on :

- The proposed final configuration shown on the drawing provided to us,

- Laboratory testing of the insitu soils performed as part of this exploration,

- Laboratory testing of the ash from a previous study performed by LAW, dated November 7, 1995, titled **Fly Ash, Bottom Ash and Scrubber Gypsum Study,** and

- The estimated maximum horizontal acceleration (MHA) from the USGS Map of Maximum Horizontal Accelerations contained in the TDSWM guidance document.

We analyzed two cross sections of the proposed ash stack configuration, A-A' and B-B' shown on the Boring Location/Subsurface Section Plan in Appendix B. The following material parameters were used for the ash and underlying soil:

Material	Cohesion (PSF)	Friction Angle (Degrees)	Saturated Density (PCF)
Ash	0	22.6	103.0
Insitu Soil	400	27.0	130.0

Section A-A' was selected because it was the highest slope and B-B' was selected because it was the steepest slope. Section B-B' was the controlling section under static conditions with a

calculated safety factor of about 1.8. consequently, our seismic loading stability analysis was performed on section B-B'.

The seismic loading stability analysis material parameters were the same as those used in the static analysis. An estimated MHA of 0.15g was used to simulate the earthquake loading conditions. Our analysis indicated a safety factor of about 1.1 during the design seismic event.

8.2 Veneer Stability

When geosynthetic materials are used in a landfill cover system, the TDSWM requires that a veneer stability check be performed. The factor of safety against veneer failure is defined by the following equation:

$$\text{Factor of Safety} = \frac{\text{Resisting Forces}}{\text{Driving Forces}} = \frac{[\cos\alpha - a_{max}\sin\alpha]\tan\phi}{\sin\alpha + a_{max}\cos\alpha}$$

in which:

α = slope angle
ϕ = limiting interface friction coefficient
a_{max} = maximum horizontal acceleration (MHA)

For the maximum slope of 2.2 H:1V and considering a critical interface friction angle of 22.6 degrees (based on the lowest laboratory test value from the ash), the calculated factor of safety is 0.65. Therefore, we expect the cover will slip/slough during the design seismic event and will require subsequent repair.

If the value is unacceptable, a factor of safety equal to 1.0 can be obtained for the same slope configuration by increasing the critical interface friction angle to 33 degrees. This value may be attainable through compaction of the upper layers of the ash and use of a cap membrane designed with a higher strength.

9.0 LIMITATIONS

The analyses described in this report are based on LAW's understanding of the subsurface conditions at the site, proposed geometries, and the expectation that the additional ash to be added to the storage area will have properties similar to those previously tested from the site. If subsurface conditions, final configuration, or the nature of the additional ash change, the information contained in this report should be reviewed.

APPENDIX A

FIELD EXPLORATORY PROCEDURES

FIELD EXPLORATORY PROCEDURES

Soil Test Boring (Hollow Stem)

All boring and sampling operations were conducted in general accordance with ASTM D 1586. The borings were advanced by mechanically twisting continuous steel hollow-stem auger flights into the ground. At regular intervals, soil samples were obtained with 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 foot with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot of penetration was recorded and is designated the "standard penetration resistance (SPT)." Proper evaluation of the penetration resistance provides an index to the soil's strength, density, and ability to support foundations.

Representative portions of the soil samples obtained from the split-tube sampler were sealed in glass jars and transported to our laboratory, where they were examined by our engineer to verify the driller's field classifications. Test Boring Logs are attached, graphically showing the soil descriptions and penetration resistances.

Undisturbed Sampling

The relatively undisturbed samples were obtained by pushing a section of 3-inch O.D., 16-gauge steel tubing into the soil at the desired sampling level. The sampling procedure is described by ASTM D 1587. The tube, together with the encased soils, was carefully removed from the ground, made airtight, and transported to our laboratory.

APPENDIX B

BORING LOCATION/SUBSURFACE SECTION PLAN

APPENDIX C

KEY SHEET,

TEST BORING LOGS,

AND

SUBSURFACE PROFILE SECTIONS

CORRELATION OF PENETRATION RESISTANCE WITH RELATIVE DENSITY AND CONSISTENCY

	NO. OF BLOWS, N	RELATIVE DENSITY
SANDS:	0-4	Very Loose
	5-10	Loose
	11-30	Firm
	31-50	Dense
	OVER 50	Very Dense

		CONSISTENCY
SILTS & CLAYS:	0-2	Very Soft
	3-4	Soft
	5-8	Firm
	9-15	Stiff
	16-30	Very stiff
	31-50	Hard
	OVER 50	Very Hard

PARTICLE SIZE IDENTIFICATION

BOULDERS:		Greater than 300 mm
COBBLES:		75 mm to 300 mm
GRAVEL:	Coarse -	19.0 mm to 75 mm
	Fine -	4.75 mm to 19.0 mm
SANDS:	Coarse -	2.00 mm to 4.75 mm
	Medium -	0.425 mm to 2.00 mm
	Fine -	0.075 mm to 0.425 mm
SILTS & CLAYS:		Less than 0.075 mm

KEY TO DRILLING SYMBOLS

- Undisturbed Sample
- Split Spoon Sample
- Water Table 24 HR.
- Water Table at Time of Drilling
- 45/83 = RQD/Recovery
- Rock Coring

KEY TO SOIL AND ROCK CLASSIFICATIONS

- TOPSOIL
- ASPHALT AND GRAVEL
- CONCRETE AND GRAVEL
- FILL
- ALLUVIUM
- RESIDUUM - Soft to firm
- RESIDUUM - Stiff to very hard
- AUGER BORING
- UNDISTURBED SAMPLE ATTEMPT
- DOLOMITE
- LIMESTONE
- SHALE
- LIMESTONE/SHALE - Limestone with shale interbeds
- SANDSTONE
- GRANITE
- SILTSTONE
- SLATE

Revised 6/25/97

DEPTH (FT.)	DESCRIPTION	ELEVATION (FT.)	● PENETRATION - BLOWS/FOOT (0 10 20 30 40 60 80 100)	
0.0		437.1		
0.5	TOPSOIL VERY LOOSE TO DENSE LAYERS OF DARK GRAY SILTY FINE SAND - FLY ASH FILL			10
		432.1		8
		427.1		10
		422.1		13
		417.1		15
		412.1		15
		407.1		23
		402.1		6

REMARKS:

STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER. TVA PLANT COORDINATES ~~-1632'N, 2028'E~~
-1828'N, 2152'E

SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED ABOVE

TEST BORING LOG

BORING NUMBER	(97)B- 1
DATE DRILLED	June 27, 1997
PROJECT NUMBER	50385-5-0400/035/800
PROJECT	TVA Johnsonville
PAGE 1 OF 2	

LAW ENGINEERING

DEPTH (FT.)	DESCRIPTION	ELEVATION (FT.)	● PENETRATION - BLOWS/FOOT (0 10 20 30 40 60 80 100)	
	VERY LOOSE TO DENSE LAYERS OF DARK GRAY SILTY FINE SAND - FLY ASH FILL			2
		392.1		7
		387.1		0
		382.1		
56.0				30
57.0	FIRM BROWN SANDY GRAVELS WITH CLAYEY SILTS - ALLUVIUM			
	UNDISTURBED SAMPLE ATTEMPT			0.5/2.0
59.0				
60.0	FIRM BROWN SANDY GRAVELS WITH CLAYEY SILTS - ALLUVIUM	377.1		24
	UNDISTURBED SAMPLE ATTEMPT			1.3/1.7
61.7	AUGER REFUSAL			
	BORING TERMINATED			
		372.1		
		367.1		
		362.1		

REMARKS:

STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER. TVA PLANT COORDINATES ~~-1632'N, 2028'E~~ -1828'N, 2152'E

SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED ABOVE

TEST BORING LOG

BORING NUMBER	(97)B- 1
DATE DRILLED	June 27, 1997
PROJECT NUMBER	50385-5-0400/035/800
PROJECT	TVA Johnsonville
PAGE 2 OF 2	

LAW ENGINEERING

DEPTH (FT.)	DESCRIPTION	ELEVATION (FT.)	● PENETRATION - BLOWS/FOOT (0 10 20 30 40 60 80 100)	
0.0		440.7		
0.5	STIFF TAN-BROWN SANDY CLAYEY SILT AND GRAVEL - FILL			10
	VERY LOOSE TO FIRM DARK GRAY SILTY FINE SAND - FLY ASH FILL	435.7		6
		430.7		4
		425.7		3
		420.7		5
		415.7		5
		410.7		6
		405.7		2

REMARKS:

STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER. TVA PLANT COORDINATES ~~-1822'N, 2023'E~~
-1955'N, 2116E

SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED ABOVE

TEST BORING LOG

BORING NUMBER	(97)B- 2
DATE DRILLED	June 27, 1997
PROJECT NUMBER	50385-5-0400/035/800
PROJECT	TVA Johnsonville
PAGE 1 OF 2	

LAW ENGINEERING

DEPTH (FT.)	DESCRIPTION	ELEVATION (FT.)	● PENETRATION - BLOWS/FOOT (0 10 20 30 40 60 80 100)	
	VERY LOOSE TO FIRM DARK GRAY SILTY FINE SAND - FLY ASH FILL			2
		395.7		13
		390.7		0
		385.7		1
		380.7		
62.0				
63.5	FIRM TAN-BROWN SILTY CLAYEY SAND AND PEA GRAVEL - ALLUVIUM			23
	HARD TAN AND GRAY SILTY CLAYS AND GRAVELS - ALLUVIUM	375.7		36
69.0	AUGER REFUSAL			
	BORING TERMINATED	370.7		
		365.7		

REMARKS:

STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER. TVA PLANT COORDINATES - 1822'N, 2023'E

-1955'N, 2116'E

SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED ABOVE

TEST BORING LOG

BORING NUMBER	(97)B- 2
DATE DRILLED	June 27, 1997
PROJECT NUMBER	50385-5-0400/035/800
PROJECT	TVA Johnsonville
PAGE 2 OF 2	

LAW ENGINEERING

DEPTH (FT.)	DESCRIPTION	ELEVATION (FT.)	● PENETRATION - BLOWS/FOOT (0 10 20 30 40 60 80 100)
0.0		438.9	
0.3	TAN BROWN CLAYEY SILT - TOPSOIL		
	VERY LOOSE TO HARD DARK GRAY SILTY FINE SAND WITH SOME PEA GRAVEL SIZE PIECES OF CINDERS AND SLAG - FLY ASH FILL		15
		433.9	3
		428.9	2
		423.9	0
			0
		418.9	0
		413.9	33
		408.9	50
		403.9	10

REMARKS:

STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER. TVA PLANT COORDINATES ~~-2167'N, 1983'E~~
-2303'N, 2113E

SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED ABOVE

TEST BORING LOG

BORING NUMBER	(97)B- 3
DATE DRILLED	June 26, 1997
PROJECT NUMBER	50385-5-0400/035/800
PROJECT	TVA Johnsonville
PAGE 1 OF 2	

LAW ENGINEERING

DEPTH (FT.)	DESCRIPTION	ELEVATION (FT.)	● PENETRATION - BLOWS/FOOT (0, 10, 20, 30, 40, 60, 80, 100)	
	VERY LOOSE TO HARD DARK GRAY SILTY FINE SAND WITH SOME PEA GRAVEL SIZE PIECES OF CINDERS AND SLAG - FLY ASH FILL			0
		393.9		0
48.0				
	STIFF TAN-BROWN SILTY CLAY WITH GRAVEL, DRY - ALLUVIUM	388.9		9
52.0				.85/2.0
	UNDISTURBED SAMPLE ATTEMPT			
54.0				
	VERY STIFF TO HARD BROWN SANDY SILTY CLAY AND GRAVEL - ALLUVIUM	383.9		39
56.5				
	DENSE TO VERY DENSE BROWN SILTY COARSE TO VERY COARSE ANGULAR SAND, SOME ROUNDED GRAVELS, WET - ALLUVIUM	378.9		59
61.5				
	FIRM TAN SAND AND GRAVEL WITH TAN SILT AT BOTTOM OF SAMPLE, WET - ALLUVIUM			21
65.0		373.9		
	UNDISTURBED SAMPLE ATTEMPT			1.85/2.0
67.0				
	FIRM TO HARD TAN SAND AND GRAVEL WITH TAN SILT AT BOTTOM OF SAMPLE, WET - ALLUVIUM			100
70.5		368.9		
	BORING TERMINATED			
		363.9		

REMARKS:

STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER. TVA PLANT COORDINATES ~~-2167'N, 1983'E~~
-2303'N, 2113E

SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED ABOVE

TEST BORING LOG

BORING NUMBER	(97)B- 3
DATE DRILLED	June 26, 1997
PROJECT NUMBER	50385-5-0400/035/800
PROJECT	TVA Johnsonville
PAGE 2 OF 2	

LAW ENGINEERING

DEPTH (FT.)	DESCRIPTION	ELEVATION (FT.)	● PENETRATION - BLOWS/FOOT (0 10 20 30 40 60 80 100)
0.0	FIRM DARK GRAY SILTY CLAY - TOPSOIL	403.5	7
2.5	LOOSE TO DENSE DARK GRAY SILTY FINE SAND - FLY ASH FILL	398.5	3
		393.5	19
		388.5	5
17.5	FIRM TAN BROWN CLAYEY SANDY GRAVEL - ALLUVIUM	383.5	17
21.5			
22.0	VERY STIFF RED-BROWN AND GRAY SANDY CLAY - ALLUVIUM		
	UNDISTURBED SAMPLE ATTEMPT		2.0/2.0
24.0	VERY STIFF RED-BROWN AND GRAY SANDY CLAY - ALLUVIUM	378.5	25
27.0	DENSE BROWN GRAVELLY SAND - ALLUVIUM	373.5	31
31.0	VERY DENSE TAN GRAVELLY FINE TO MEDIUM GRAINED SAND - ALLUVIUM	368.5	44
37.0	VERY HARD DARK GRAY CLAYEY SILT - ALLUVIUM		

REMARKS:

STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER. TVA PLANT COORDINATES ~~2337'N, 2448'E~~
-2300'N, 2504'E

SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED ABOVE

TEST BORING LOG

BORING NUMBER	(97)B- 6
DATE DRILLED	June 28, 1997
PROJECT NUMBER	50385-5-0400/035/800
PROJECT	TVA Johnsonville
PAGE 1 OF 2	

LAW ENGINEERING

DEPTH (FT.)	DESCRIPTION	ELEVATION (FT.)	● PENETRATION - BLOWS/FOOT 0 10 20 30 40 60 80 100	
40.5	BORING TERMINATED			52
		358.5		
		353.5		
		348.5		
		343.5		
		338.5		
		333.5		
		328.5		

REMARKS:

STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER. TVA PLANT COORDINATES ~~-2337'N, 2448'E~~ -2300'N, 2504'E

SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED ABOVE

TEST BORING LOG

BORING NUMBER	(97)B- 6
DATE DRILLED	June 28, 1997
PROJECT NUMBER	50385-5-0400/035/800
PROJECT	TVA Johnsonville
PAGE 2 OF 2	

LAW ENGINEERING

DEPTH (FT.)	DESCRIPTION	ELEVATION (FT.)	● PENETRATION - BLOWS/FOOT (0 10 20 30 40 60 80 100)	
0.0	STIFF DARK GRAY SANDY CLAYEY SILT WITH GRAVELS - TOPSOIL/FILL	409.3		12
2.0	FIRM BROWN CLAYEY GRAVELLY SAND - ALLUVIUM	404.3		19
6.0	SOFT DARK BROWN SANDY CLAYEY SILT/SILTY CLAY - ALLUVIUM	399.3		4
13.0	FIRM DARK BROWN SANDY GRAVEL - ALLUVIUM			
14.0	UNDISTURBED SAMPLE ATTEMPT	394.3		2.0/2.0
16.0	FIRM DARK BROWN SANDY GRAVEL - ALLUVIUM			21
20.5	BORING TERMINATED	389.3		76
		384.3		
		379.3		
		374.3		

REMARKS:

STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER. TVA PLANT COORDINATES ~~2107'N, 2358'E~~

-2540'N, 2374'E

SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED ABOVE

TEST BORING LOG

BORING NUMBER	(97)B- 7
DATE DRILLED	June 29, 1997
PROJECT NUMBER	50385-5-0400/035/800
PROJECT	TVA Johnsonville
PAGE 1 OF 1	

LAW ENGINEERING

DEPTH (FT.)	DESCRIPTION	ELEVATION (FT.)	● PENETRATION - BLOWS/FOOT (0 10 20 30 40 60 80 100)
0.0	AUGER BORING TO OBTAIN UNDISTURBED SAMPLE	409.3	
		404.3	
8.0	UNDISTURBED SAMPLE ATTEMPT		2.0/2.0
10.0	BORING TERMINATED	399.3	
		394.3	
		389.3	
		384.3	
		379.3	
		374.3	

REMARKS:

STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER. NO GROUND WATER ENCOUNTERED AT TIME OF EXPLORATION.

SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED ABOVE

TEST BORING LOG

BORING NUMBER	(97)B-7A
DATE DRILLED	June 29, 1997
PROJECT NUMBER	50385-5-0400/035/800
PROJECT	TVA Johnsonville
PAGE 1 OF 1	

LAW ENGINEERING

DEPTH (FT.)	DESCRIPTION	ELEVATION (FT.)	● PENETRATION - BLOWS/FOOT (0 10 20 30 40 60 80 100)	
0.0		430.1		
	VERY LOOSE TO FIRM DARK GRAY SILTY FINE SAND - FLY ASH FILL			9
		425.1		13
		420.1		7
		415.1		3
		410.1		1
		405.1		7
		400.1		13
32.0				
	UNDISTURBED SAMPLE ATTEMPT			2.0/2.0
34.0				
	VERY LOOSE TO FIRM DARK GRAY SILTY FINE SAND - FLY ASH FILL	395.1		4

REMARKS:

STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER. TVA PLANT COORDINATES ~~-2532'N, 3298'E~~
-2405'N, 3349'E

SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED ABOVE

TEST BORING LOG

BORING NUMBER	(97)B- 8
DATE DRILLED	July 1, 1997
PROJECT NUMBER	50385-5-0400/035/800
PROJECT	TVA Johnsonville
PAGE 1 OF 2	

LAW ENGINEERING

DEPTH (FT.)	DESCRIPTION	ELEVATION (FT.)	PENETRATION - BLOWS/FOOT (0 10 20 30 40 60 80 100)	
42.0				3
44.0	DENSE BROWN SILTY CLAY WITH GRAVEL - ALLUVIUM			
46.0	UNDISTURBED SAMPLE ATTEMPT	385.1		2.0/2.0
48.0	DENSE BROWN SILTY CLAY WITH GRAVEL - ALLUVIUM		40	41
50.0	UNDISTURBED SAMPLE ATTEMPT			1.7/2.0
	DENSE BROWN SILTY CLAY WITH GRAVEL - ALLUVIUM	380.1	40	40
		375.1	35	35
		370.1		
62.0			30	31
	BORING TERMINATED			
		365.1		
		360.1		
		355.1		

REMARKS:

STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER. TVA PLANT COORDINATES ~~-2532'N, 3298'E~~
-2405'N, 3349'E

SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED ABOVE

TEST BORING LOG

BORING NUMBER	(97)B- 8
DATE DRILLED	July 1, 1997
PROJECT NUMBER	50385-5-0400/035/800
PROJECT	TVA Johnsonville
PAGE 2 OF 2	

LAW ENGINEERING

DEPTH (FT.)	DESCRIPTION	ELEVATION (FT.)	● PENETRATION - BLOWS/FOOT (0 10 20 30 40 60 80 100)	
0.0		434.8		
0.5	TOPSOIL			
	VERY LOOSE TO DENSE DARK GRAY SILTY FINE SAND - FLY ASH FILL			13
		429.8		8
		424.8		3
		419.8		2
		414.8		2
		409.8		0
		404.8		3
		399.8		0

REMARKS:

STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER. TVA PLANT COORDINATES ~~-2342'N, 2198'E~~ -2521'N, 3236E

SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED ABOVE

TEST BORING LOG

BORING NUMBER	(97)B- 9
DATE DRILLED	June 30, 1997
PROJECT NUMBER	50385-5-0400/035/800
PROJECT	TVA Johnsonville
PAGE 1 OF 2	

LAW ENGINEERING

DEPTH (FT.)	DESCRIPTION	ELEVATION (FT.)	● PENETRATION - BLOWS/FOOT (0 10 20 30 40 60 80 100)	
	VERY LOOSE TO DENSE DARK GRAY SILTY FINE SAND - FLY ASH FILL	389.8		24
				8
50.5		384.8		
	SOFT BROWN SANDY CLAY WITH GRAVEL - ALLUVIUM			2
54.0				
	UNDISTURBED SAMPLE ATTEMPT (COULD NOT PUSH)	379.8		54
56.0				
	VERY DENSE RED-BROWN SANDY GRAVEL/GRAVELLY SAND - ALLUVIUM			
59.0				
	UNDISTURBED SAMPLE ATTEMPT (COULD NOT PUSH)	374.8		29
61.0				
	VERY DENSE RED BROWN SANDY GRAVEL/GRAVELLY SAND - ALLUVIUM			
64.0				
	UNDISTURBED SAMPLE ATTEMPT (COULD NOT PUSH)	369.8		38
66.0				
67.0	DENSE BROWN SANDY GRAVEL WITH TAN AND RED CLAYEY SILT - ALLUVIUM			
	BORING TERMINATED	364.8		
		359.8		

REMARKS:

STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER. TVA PLANT COORDINATES ~~2342'N, 2198'E~~ -2521'N, 3236'E

SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED ABOVE

TEST BORING LOG

BORING NUMBER	(97)B- 9
DATE DRILLED	June 30, 1997
PROJECT NUMBER	50385-5-0400/035/800
PROJECT	TVA Johnsonville
PAGE 2 OF 2	

LAW ENGINEERING

DEPTH (FT.)	DESCRIPTION	ELEVATION (FT.)	● PENETRATION - BLOWS/FOOT (0 10 20 30 40 60 80 100)	
0.0		433.9		
0.5	TOPSOIL			
	VERY LOOSE TO DENSE DARK GRAY SILTY FINE SAND - FLY ASH FILL			14
		428.9		20
		423.9		6
		418.9		1
		413.9		3
		408.9		4
		403.9		0
		398.9		2

REMARKS:

STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER. TVA PLANT COORDINATES ~~-2212'N, 3118'E~~
-2677'N, 3124E

SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED ABOVE

TEST BORING LOG

BORING NUMBER	(97)B-10
DATE DRILLED	June 29, 1997
PROJECT NUMBER	50385-5-0400/035/800
PROJECT	TVA Johnsonville
PAGE 1 OF 2	

LAW ENGINEERING

DEPTH (FT.)	DESCRIPTION	ELEVATION (FT.)	● PENETRATION - BLOWS/FOOT (0 10 20 30 40 60 80 100)	
40.5	VERY LOOSE TAN SANDY CLAY - ALLUVIUM			2
44.0	UNDISTURBED SAMPLE ATTEMPT	388.9		0.0/2.0
46.0	HARD RED-BROWN SANDY CLAY AND GRAVEL - ALLUVIUM			
47.7	DENSE TAN CLAYEY SANDY PEA GRAVEL - ALLUVIUM	383.9	●	33
		378.9	●	44
59.0	AUGER REFUSAL	373.9		
		368.9		
		363.9		
		358.9		

REMARKS:

STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER. TVA PLANT COORDINATES ~~2212'N, 3118'E~~ -2677'N, 3124'E

SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED ABOVE

TEST BORING LOG

BORING NUMBER	(97)B-10
DATE DRILLED	June 29, 1997
PROJECT NUMBER	50385-5-0400/035/800
PROJECT	TVA Johnsonville
PAGE 2 OF 2	

LAW ENGINEERING

DEPTH (FT.)	DESCRIPTION	ELEVATION (FT.)	● PENETRATION - BLOWS/FOOT (0 10 20 30 40 60 80 100)	
0.0	VERY LOOSE TO DENSE SILTY FINE SAND - FLY ASH FILL	422.6		12
		417.6		8
		412.6		24
		407.6		6
		402.6		4
		397.6		1
30.0		392.6		25
32.0	HARD RED-BROWN GRAY AND MOTTLED SLIGHTLY SANDY SILTY CLAY - ALLUVIUM			
34.0	UNDISTURBED SAMPLE ATTEMPT (COULD NOT PUSH)			
35.0	HARD RED BROWN GRAY AND MOTTLED SLIGHTLY SANDY SILTY CLAY - ALLUVIUM	387.6		
37.0	UNDISTURBED SAMPLE ATTEMPT (COULD NOT PUSH)			66
39.0	VERY DENSE TO DENSE RED-BROWN GRAVELLY SAND - ALLUVIUM			
	UNDISTURBED SAMPLE ATTEMPT			

REMARKS:

STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER. TVA PLANT COORDINATES ~~2062'N, 2973'E~~ -2805'N, 2968'E

SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED ABOVE

TEST BORING LOG

BORING NUMBER	(97)B-11
DATE DRILLED	June 29, 1997
PROJECT NUMBER	50385-5-0400/035/800
PROJECT	TVA Johnsonville
PAGE 1 OF 2	

LAW ENGINEERING

DEPTH (FT.)	DESCRIPTION	ELEVATION (FT.)	● PENETRATION - BLOWS/FOOT (0 10 20 30 40 60 80 100)	
41.0	(COULD NOT PUSH)			38
	DENSE TAN CLAYEY GRAVELLY SAND - ALLUVIUM	377.6		41
50.5		372.6		36
	BORING TERMINATED	367.6		
		362.6		
		357.6		
		352.6		
		347.6		

REMARKS:

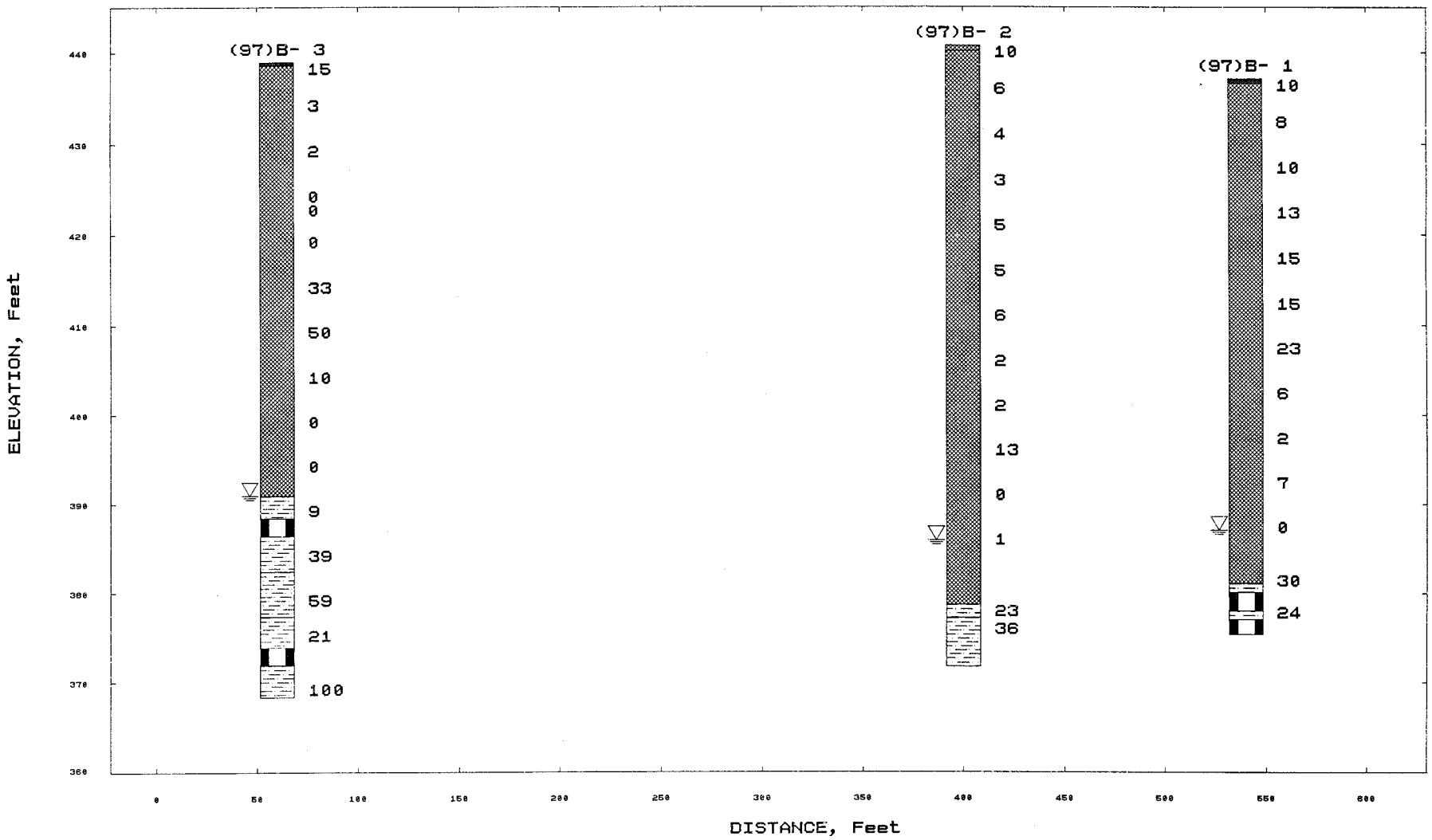
STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER. TVA PLANT COORDINATES ~~-2062'N, 2973'E~~
-2805'N, 2968E

SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS USED ABOVE

TEST BORING LOG

BORING NUMBER	(97)B-11
DATE DRILLED	June 29, 1997
PROJECT NUMBER	50385-5-0400/035/800
PROJECT	TVA Johnsonville
PAGE 2 OF 2	

LAW ENGINEERING



SUBSURFACE PROFILE SECTION 1-1'

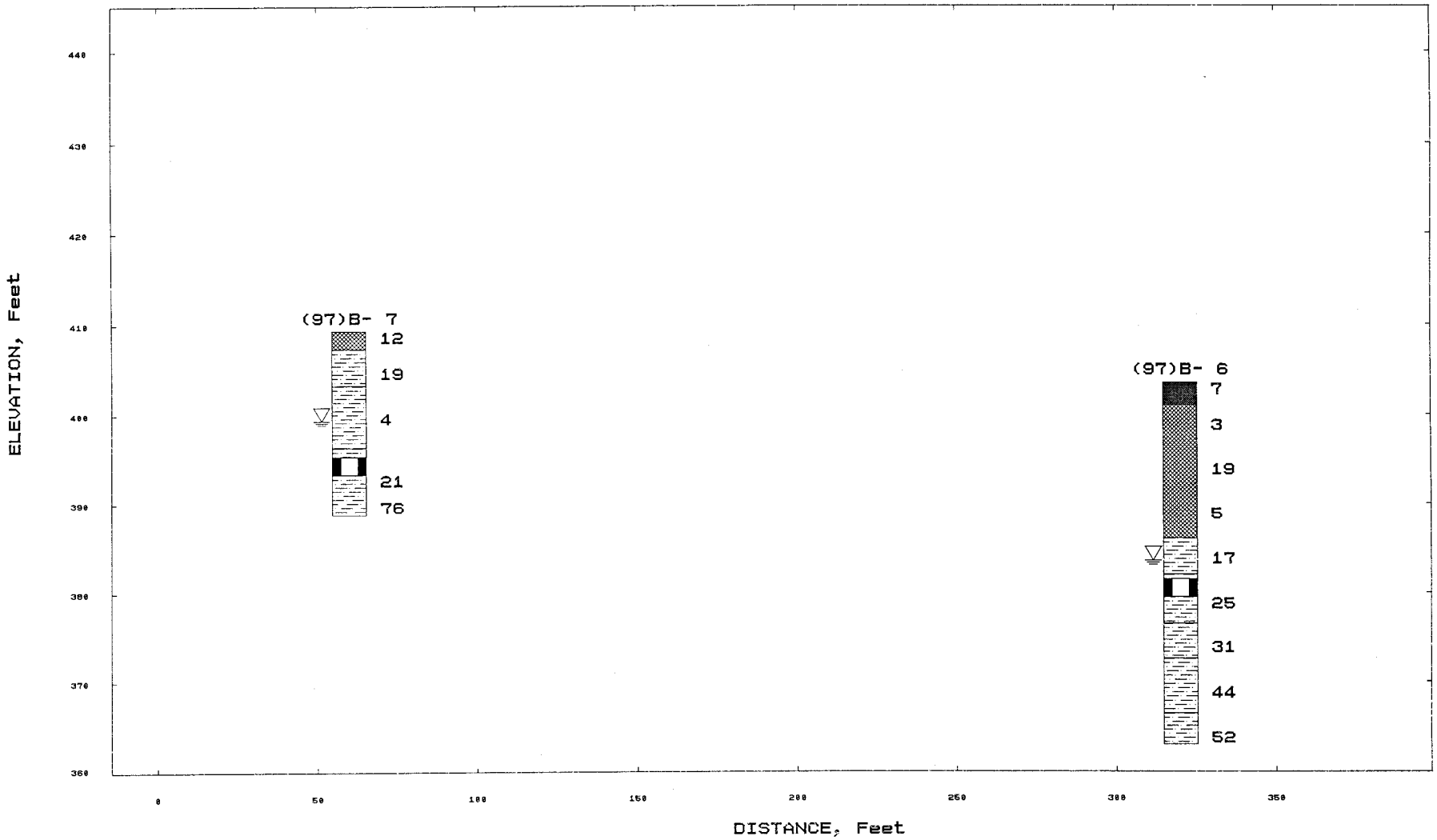
FIGURE 1

PROJECT TVA Johnsonville

PROJECT NO. 50385-5-0400/035/800

LAW ENGINEERING

NOTES:



SUBSURFACE PROFILE SECTION 2-2'

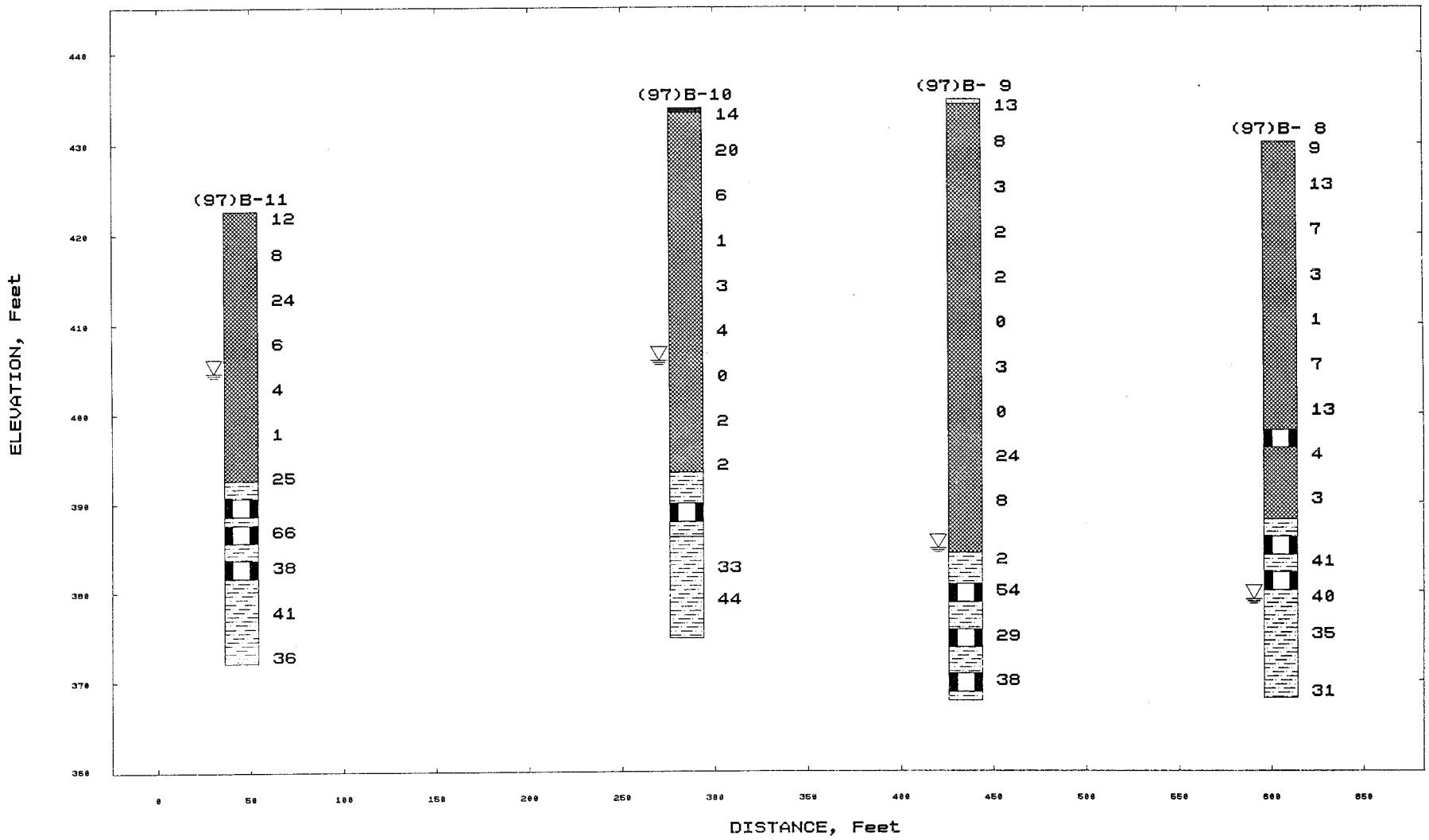
FIGURE 2

PROJECT TVA Johnsonville

PROJECT NO. 50385-5-0400/035/800

LAW ENGINEERING

NOTES:



SUBSURFACE PROFILE SECTION 3-3'

FIGURE 3

PROJECT TVA Johnsonville

PROJECT NO. 50385-5-0400/035/800

LAW ENGINEERING

NOTES:

APPENDIX D

LABORATORY TEST PROCEDURES

AND

TEST RESULTS

LABORATORY TEST PROCEDURES

Moisture Content

The moisture content in a given mass of soil is the ratio, expressed as a percentage, of the weight of the water to the weight of the solid particles. This test was conducted in accordance with ASTM D 2216.

Triaxial Shear Tests

Triaxial shear tests are used to determine the strength characteristics and friction angle of a given soil sample. Triaxial tests are also used to determine the elastic properties of the soil specimen.

Triaxial shear tests are performed on several sections of a relatively undisturbed sample extruded from the sampling tube. The samples are trimmed into cylinders 1.4 to 2.8 inches in diameter and encased in rubber membranes. Each is then placed in a compression chamber and confined by all-around air pressure. The test results are presented in the form of stress-strain curves and Mohr envelopes, or p-q plots on the accompanying Triaxial Shear Test Sheets.

One of three types of triaxial tests is normally performed, the most suitable type being determined by the loading conditions imposed on the soil in the field and the soil characteristics.

1. Consolidated-Undrained (Designated as a CU or R Test)
2. Consolidated-Drained (designated as a CD or S Test)
3. Unconsolidated-Undrained (designated as a UU or Q Test)

Falling Head Permeability Test

The test sample was taken from the bottom of the undisturbed sample. The physical dimensions and weight were obtained and the sample was encased in a rubber membrane and placed in a triaxial chamber. The sample was then back-pressure saturated until a B value of 0.95 or greater was reached. After saturation was obtained, the sample was consolidated under 10-psi confining stress. Upon completion of consolidation, a falling head permeability test was performed.

Grain Size Distribution

Grain Size Tests are performed to aid in determining the soil classification and the grain size distribution. The soil samples are prepared for testing according to ASTM D 421 (dry preparation) or ASTM D 2217 (wet preparation). If only the grain size distribution of soils coarser than a number 200 sieve (0.074-mm opening) is desired, the grain size distribution is determined by washing the sample over a number 200 sieve and, after drying, passing the samples through a standard set of nested sieves. If the grain size distribution of the soils finer than the number 200 sieve is also desired, the grain size distribution of the soils coarser than the number 10 sieve is determined by passing the sample through a set of nested sieves. Materials passing the number 10 sieve are dispersed with a dispersing agent and suspended in water, and the grain size distribution calculated from the measured settlement rate of the particles. These tests are conducted in accordance with ASTM D 422.

LAW

ENGINEERING AND ENVIRONMENTAL SERVICES

HYDRAULIC CONDUCTIVITY

Project No.	*50385-5-0400*	Tested By	*JTM*
Project Name	***Johnsonville Fossil Plant***	Test Date	*07/16/97*
Boring No.	*B-3*	Reviewed By	*HEJ*
Sample No.	*Ud*	Review Date	*07/25/97*
Sample Depth	*52-54 Ft.*		
Sample Description			

ASTM D5084 - Falling Head

Sample Type:	*Ud*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*19.6*
Wet Unit Weight, pcf:	*123.6*
Dry Unit Weight, pcf:	*103.4*
Compaction, %:	*N/A*
Hydraulic Conductivity, cm/sec. @20 °C	***2.0E-08***

LAW

ENGINEERING AND ENVIRONMENTAL SERVICES

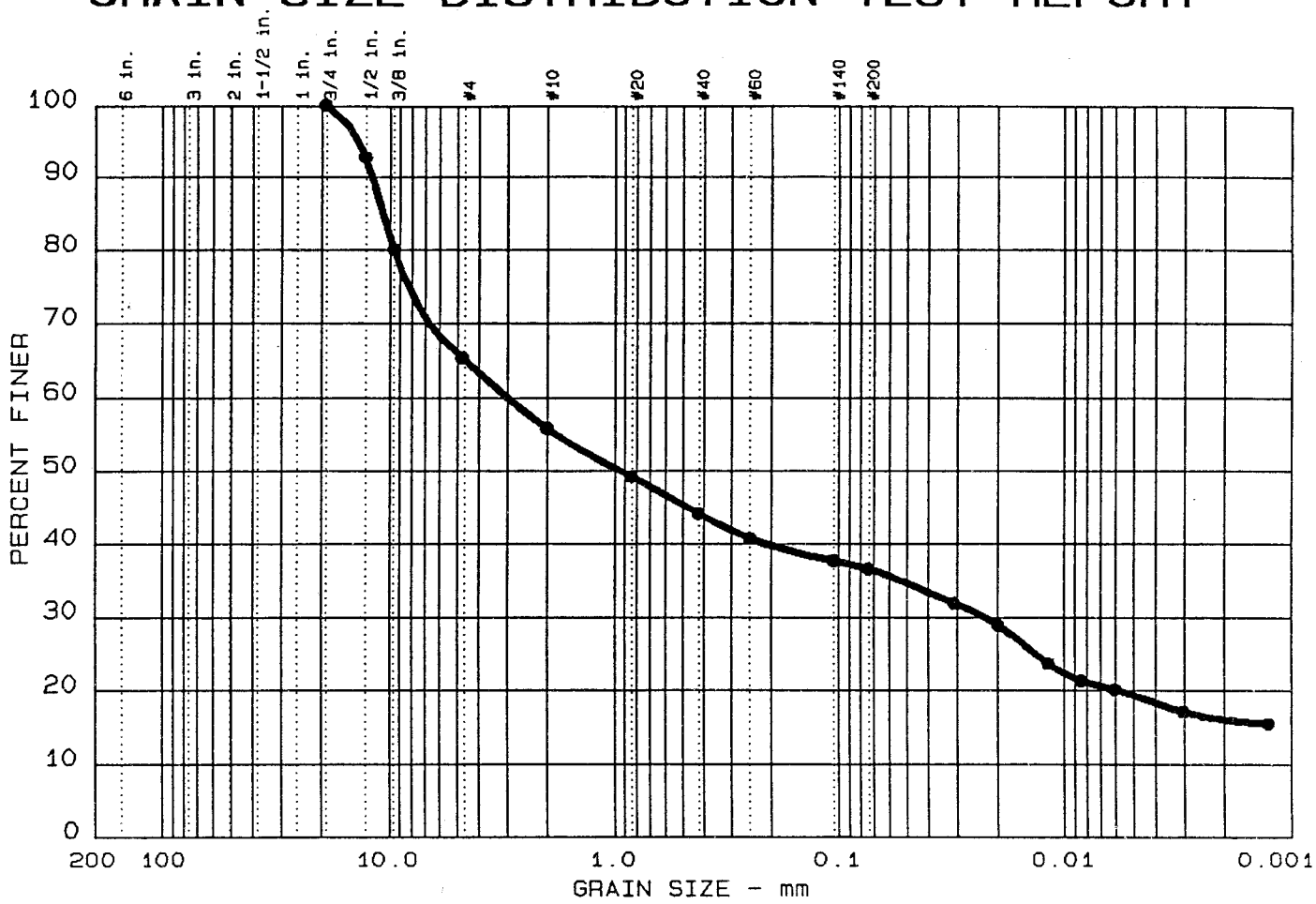
HYDRAULIC CONDUCTIVITY

Project No.	*50385-5-0400*	Tested By	*JTM*
Project Name	***Johnsonville Fossil Plant***	Test Date	*07/16/97*
Boring No.	*B-10*	Reviewed By	*HEJ*
Sample No.	*Ud*	Review Date	*07/25/97*
Sample Depth	*44-46 Ft.*		
Sample Description			

ASTM D5084 - Falling Head

Sample Type:	*Ud*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*21.3*
Wet Unit Weight, pcf:	*127.1*
Dry Unit Weight, pcf:	*104.7*
Compaction, %:	*N/A*
Hydraulic Conductivity, cm/sec. @20 °C	***6.9E-08***

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	14	0.0	34.6	28.9	17.1	19.4

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	45	20	10.59	2.99	0.94	0.023				

MATERIAL DESCRIPTION	USCS	AASHTO
● Brown Clayey Gravel with Sand	GC	A-7-6 (2.3)

Project No.: 50385-5-0400
Project: TVA Johnsonville Fossil Plant
● Location: B-3 Ud @ 52-54 Ft.

Date: Aug. 1, 1997

Remarks:

Tested by: JTM

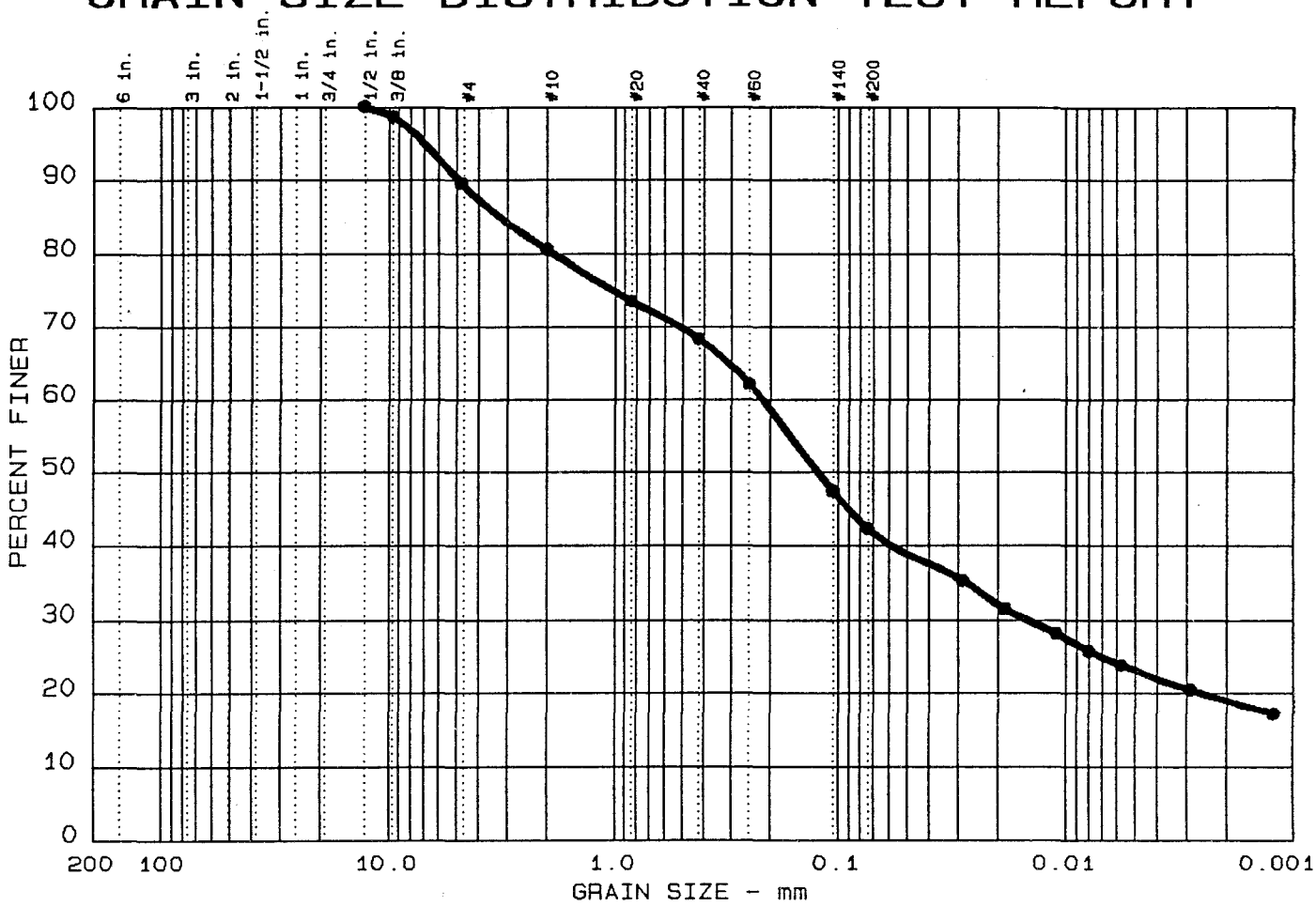
Reviewed by: HS

GRAIN SIZE DISTRIBUTION TEST REPORT

LAW ENGINEERING, INC.

Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	15	0.0	10.4	47.4	19.1	23.1

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	27	6	3.20	0.22	0.12	0.015				

MATERIAL DESCRIPTION	USCS	AASHTO
● Brown Silty Clayey Sand with Gravel	SC-SM	A-4 (0.0)

Project No.: 50385-5-0400
Project: TVA Johnsonville Fossil Plant
● Location: B-6 Ud @ 22-24 Ft.

Date: Aug. 1, 1997

Remarks:

Tested by: JTM

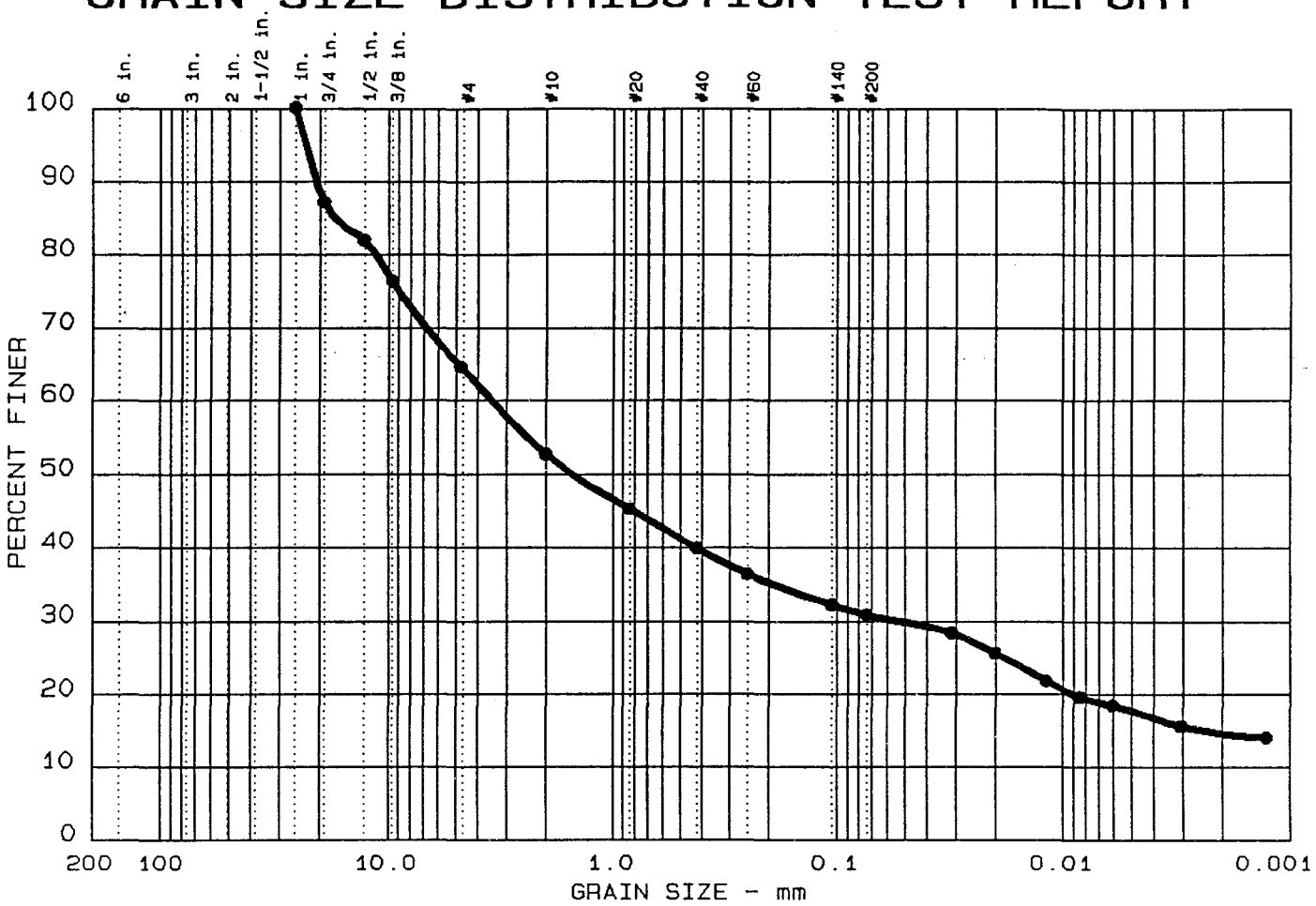
Reviewed by: HS

GRAIN SIZE DISTRIBUTION TEST REPORT

LAW ENGINEERING, INC.

Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	16	0.0	35.4	33.8	13.0	17.8

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	42	20	17.18	3.47	1.51	0.052	0.0024			

MATERIAL DESCRIPTION	USCS	AASHTO
● Brown Silty Clayey Sand with Gravel	GC	A-2-7 (1.6)

Project No.: 50385-5-0400
Project: TVA Johnsonville Fossil Plant
● Location: B-7 Ud @ 14-16 Ft.

Date: Aug. 1, 1997

Remarks:

Tested by: JTM

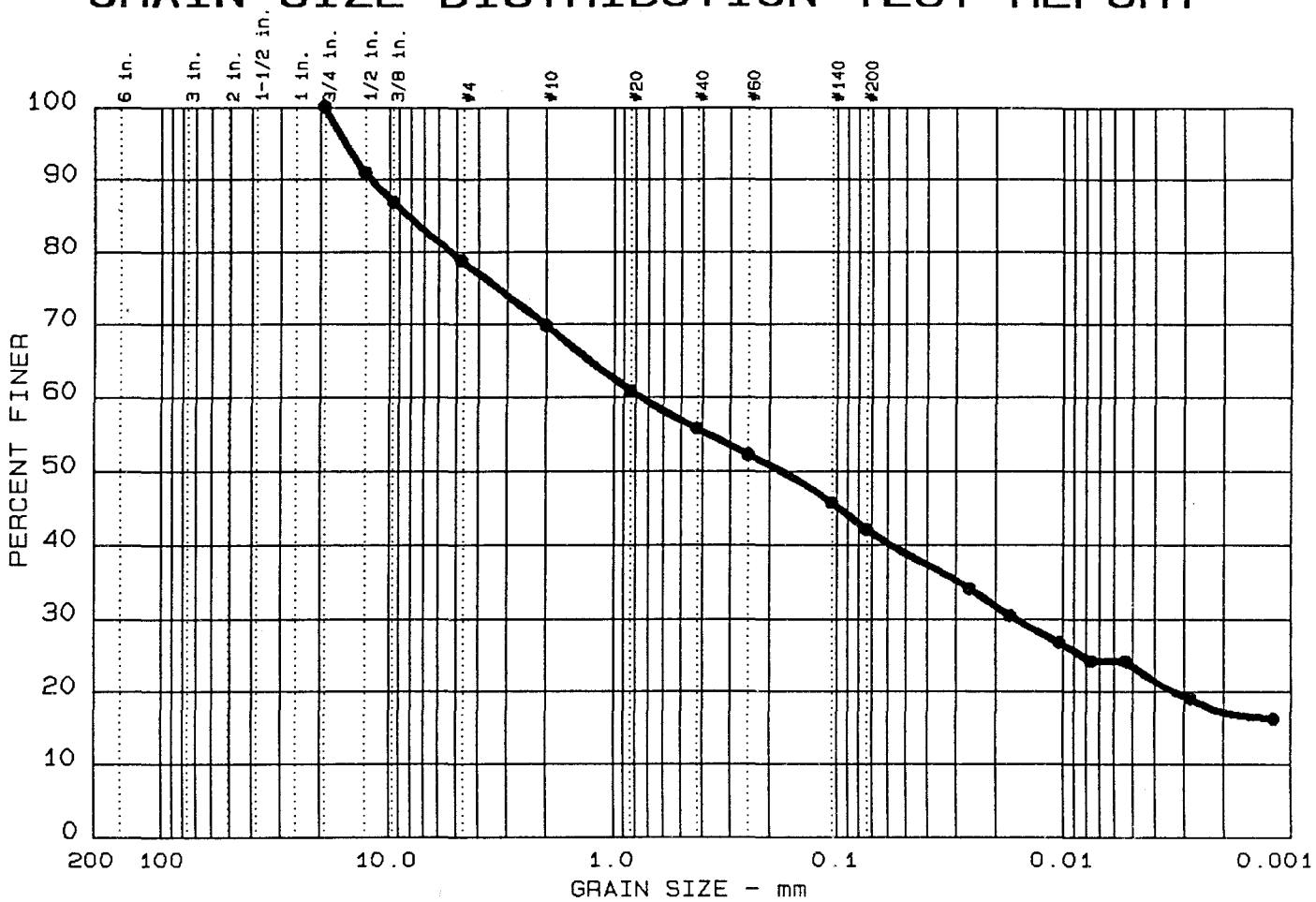
Reviewed by: HS

GRAIN SIZE DISTRIBUTION TEST REPORT

LAW ENGINEERING, INC.

Figure No.

GRAIN SIZE DISTRIBUTION TEST REPORT



	Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY
●	17	0.0	21.2	36.8	18.5	23.5

	LL	PI	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
●	38	17	8.13	0.76	0.18	0.016				

MATERIAL DESCRIPTION	USCS	AASHTO
● Brown Silty Clayey Sand with Gravel	SC	A-6 (3.2)

Project No.: 50385-5-0400
Project: TVA Johnsonville Fossil Plant
● Location: B-8 Ud @ 44-46 Ft.

Date: Aug. 1, 1997

Remarks:

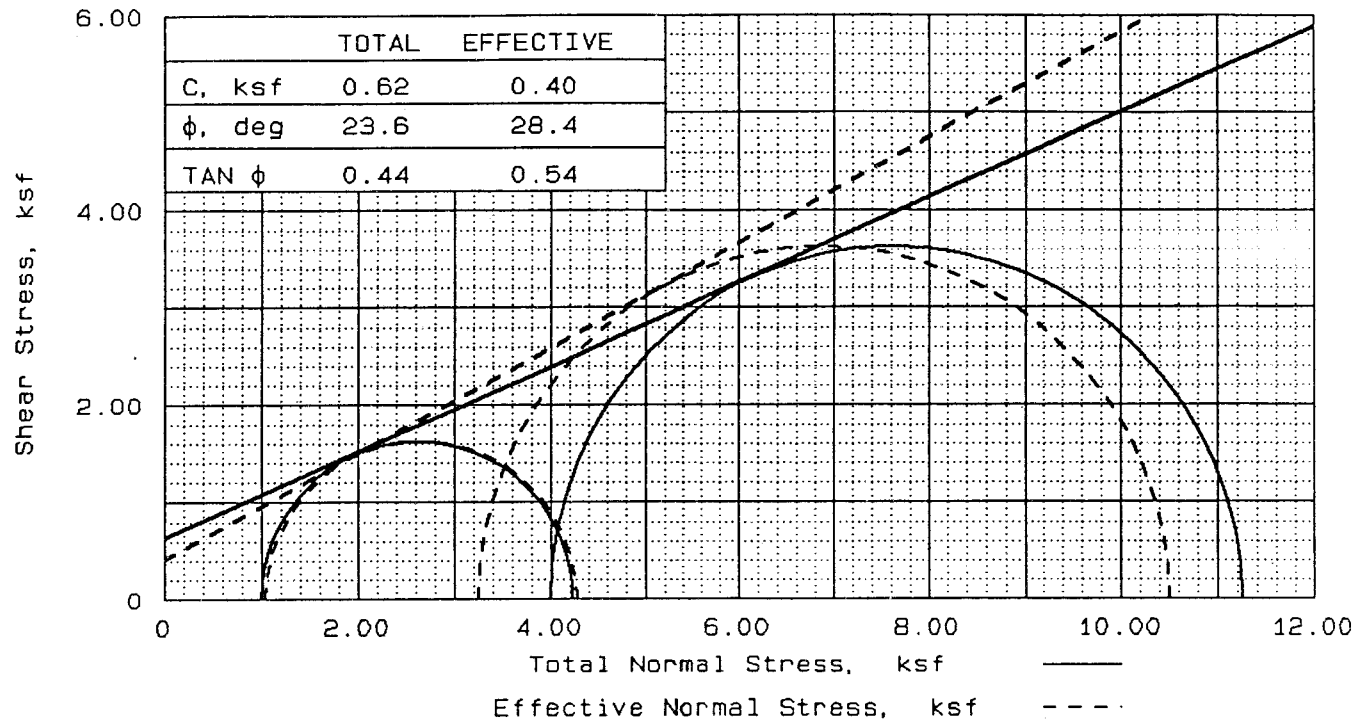
Tested by: JTM

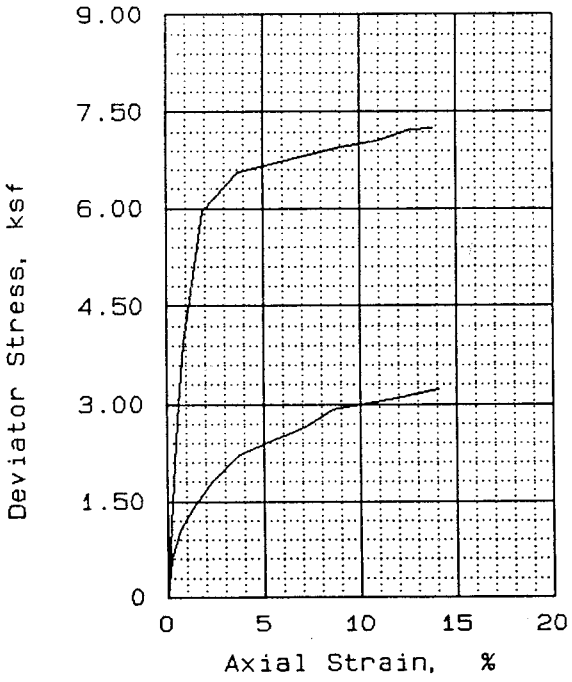
Reviewed by: HD

GRAIN SIZE DISTRIBUTION TEST REPORT

LAW ENGINEERING, INC.

Figure No.





SAMPLE NO.		1	2
INITIAL	WATER CONTENT, %	20.7	19.7
	DRY DENSITY, pcf	103.9	106.1
	SATURATION, %	90.1	90.5
	VOID RATIO	0.622	0.589
	DIAMETER, in	2.88	2.88
	HEIGHT, in	5.99	5.97
AT TEST	WATER CONTENT, %	21.7	20.6
	DRY DENSITY, pcf	106.2	108.4
	SATURATION, %	100.0	100.0
	VOID RATIO	0.587	0.555
	DIAMETER, in	2.85	2.86
	HEIGHT, in	5.98	5.94
BACK PRESSURE, ksf		2.92	2.92
CELL PRESSURE, ksf		3.92	6.92
FAILURE STRESS, ksf		3.24	7.25
PORE PRESSURE, ksf		2.88	3.67
STRAIN RATE, %/min.		0.010	0.010
ULTIMATE STRESS, ksf			
PORE PRESSURE, ksf			
$\bar{\sigma}_1$ FAILURE, ksf		4.28	10.50
$\bar{\sigma}_3$ FAILURE, ksf		1.04	3.25

TYPE OF TEST:
CU with pore pressures
SAMPLE TYPE: UD
DESCRIPTION:

LL= PL= PI=
SPECIFIC GRAVITY= 2.70
REMARKS: Tested by: JTM

Reviewed by: HJ

FIG. NO.

CLIENT: TVA

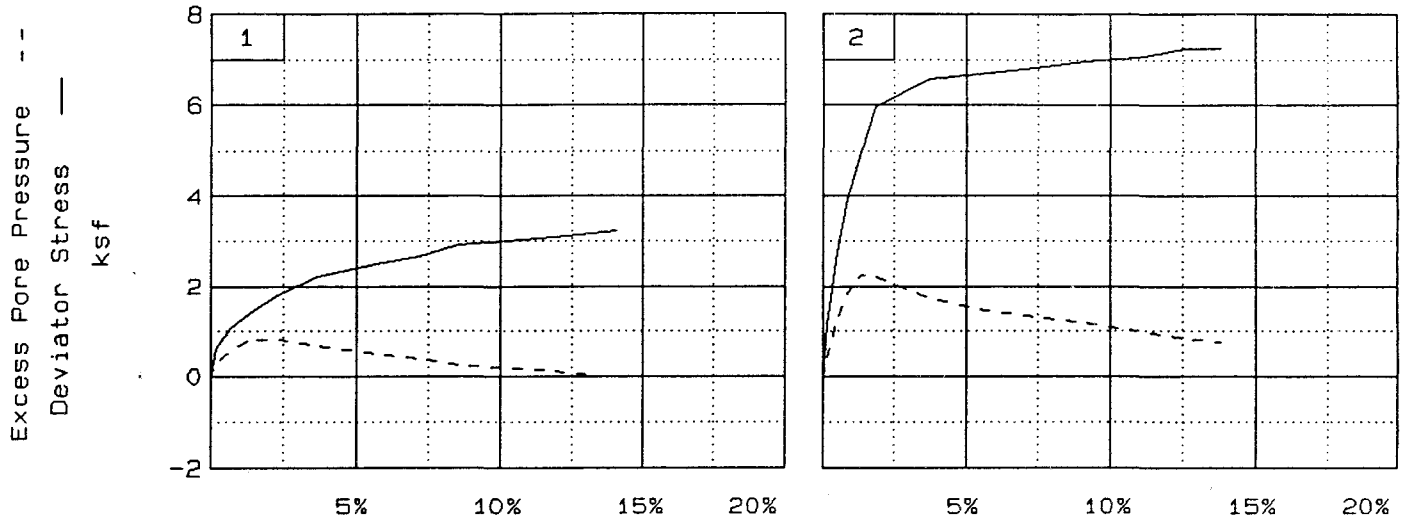
PROJECT: Johnsonville Fossil Plant

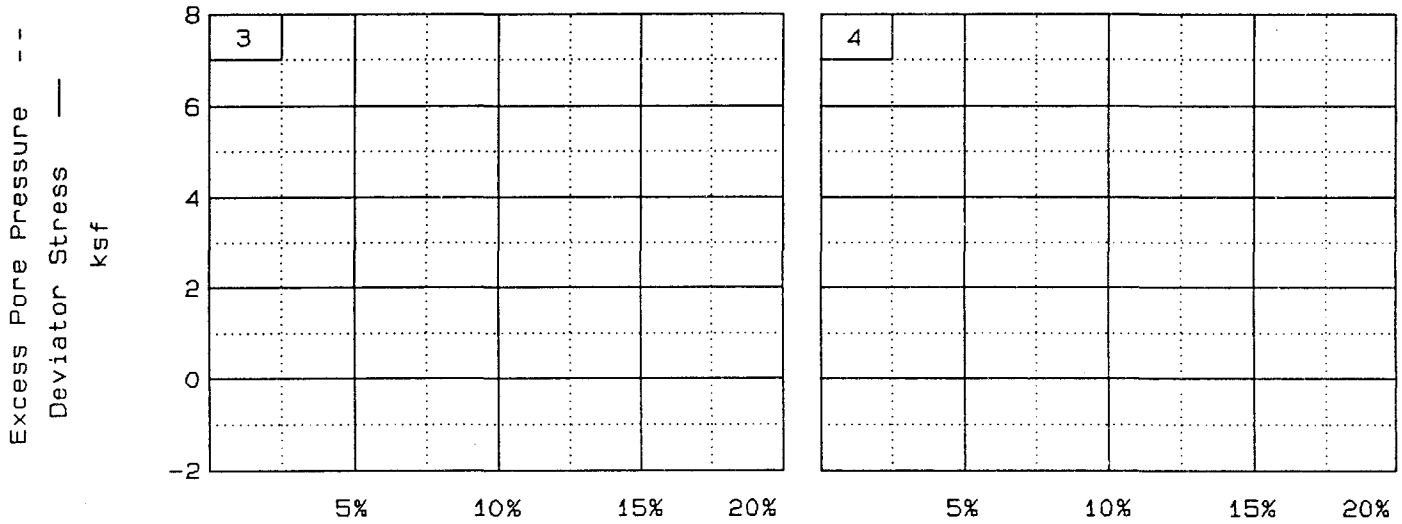
SAMPLE LOCATION: B-6 Ud @ 22-24 Ft.

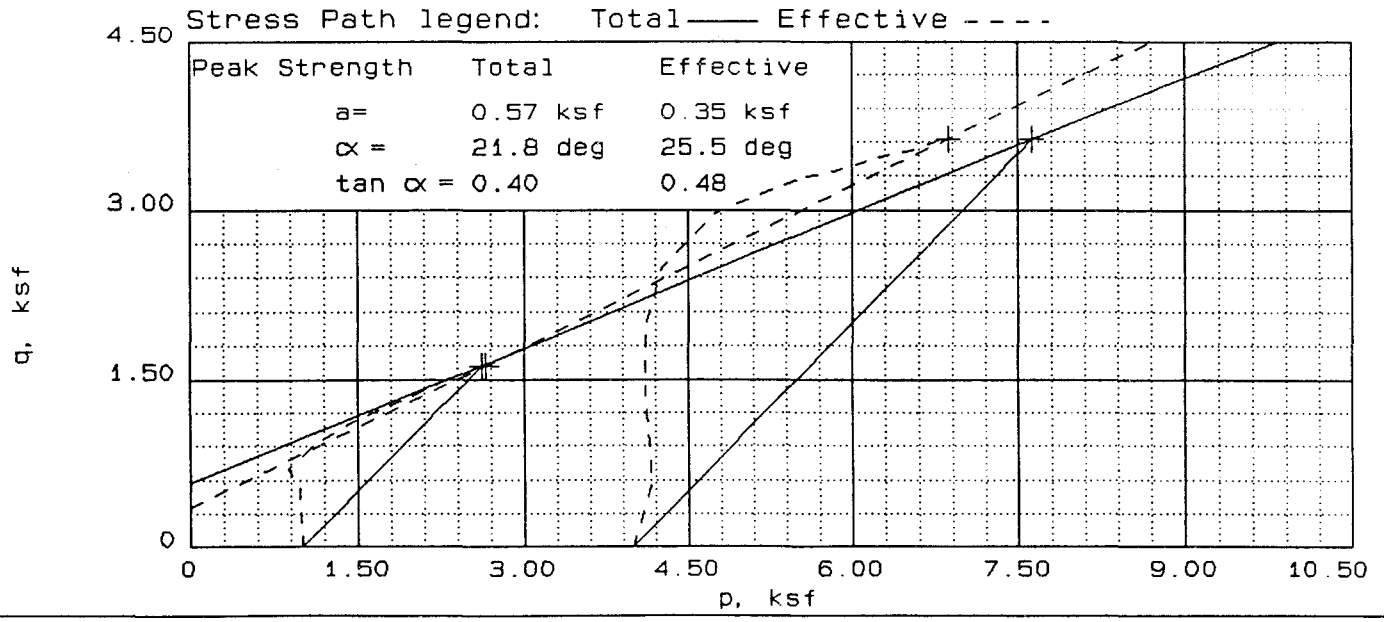
PROJ. NO.: 503850400 DATE: July 27, 1997

TRIAXIAL COMPRESSION TEST

LAW ENGINEERING, INC.





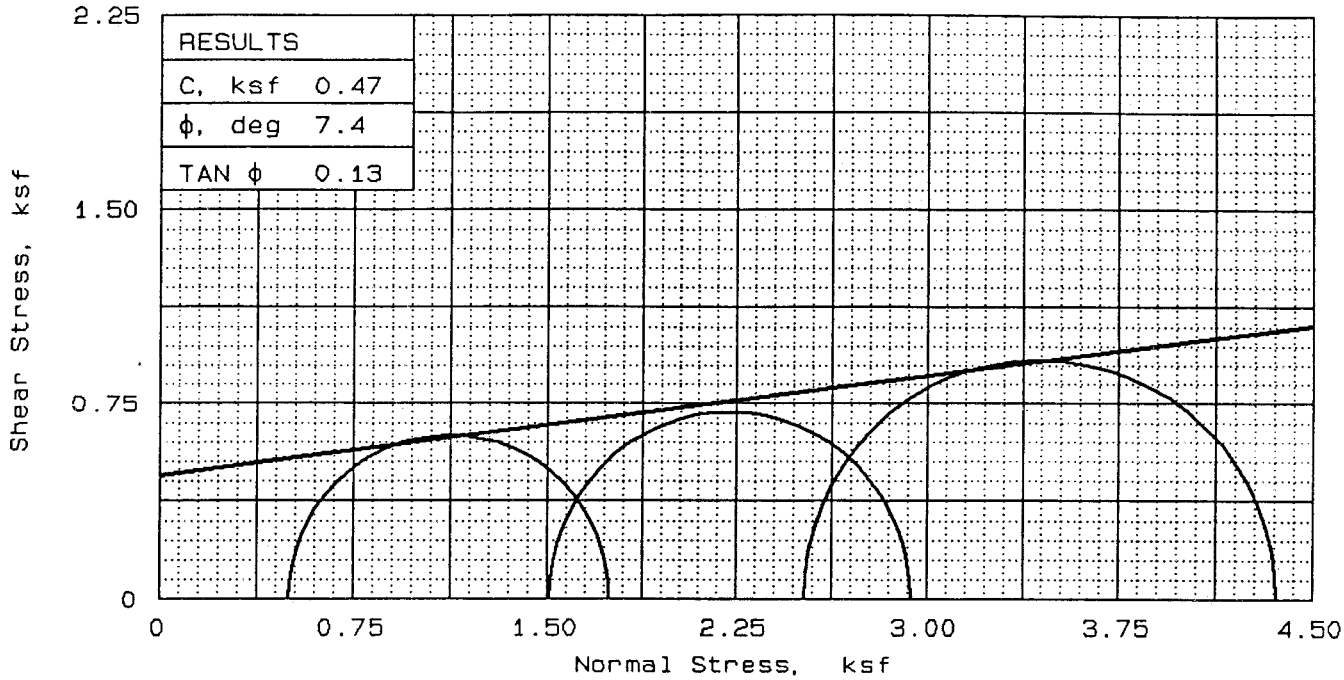


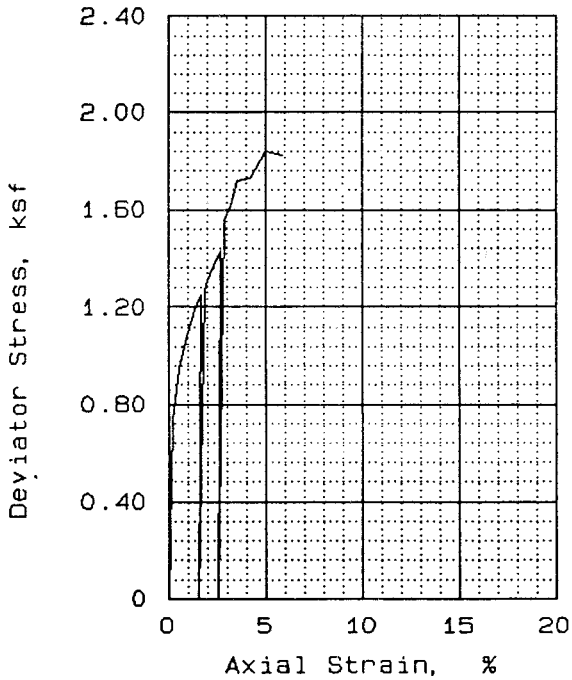
Client: TVA

Project: Johnsonville Fossil Plant

Location: B-6 Ud @ 22-24 Ft.

File: TVA0400A Project No.: 503850400 Page 2/2 Fig. No. ____





	SAMPLE NO.	1	2	3
INITIAL	WATER CONTENT, %	15.3	15.3	15.3
	DRY DENSITY, pcf	116.9	116.9	116.9
	SATURATION, %	93.4	93.4	93.4
	VOID RATIO	0.441	0.441	0.441
	DIAMETER, in	2.87	2.87	2.87
	HEIGHT, in	6.00	6.00	6.00
AT TEST	WATER CONTENT, %	15.3	15.3	15.3
	DRY DENSITY, pcf	116.9	116.9	116.9
	SATURATION, %	93.4	93.4	93.4
	VOID RATIO	0.441	0.441	0.441
	DIAMETER, in	2.87	2.87	2.87
	HEIGHT, in	6.00	6.00	6.00
	BACK PRESSURE, ksf	0.00	0.00	0.00
	CELL PRESSURE, ksf	0.50	1.51	2.52
	FAILURE STRESS, ksf	1.25	1.43	1.84
	PORE PRESSURE, ksf			
	STRAIN RATE, %/min.	1.000	1.000	1.000
	ULTIMATE STRESS, ksf			
	PORE PRESSURE, ksf			
	σ_1 FAILURE, ksf	1.75	2.94	4.36
	σ_3 FAILURE, ksf	0.5	1.51	2.52

TYPE OF TEST:
Unconsolidated undrained
SAMPLE TYPE: Ud
DESCRIPTION:

LL= PL= PI=
SPECIFIC GRAVITY= 2.70
REMARKS: Tested by: JTM

Reviewed by: HJ

FIG. NO.

CLIENT: TVA

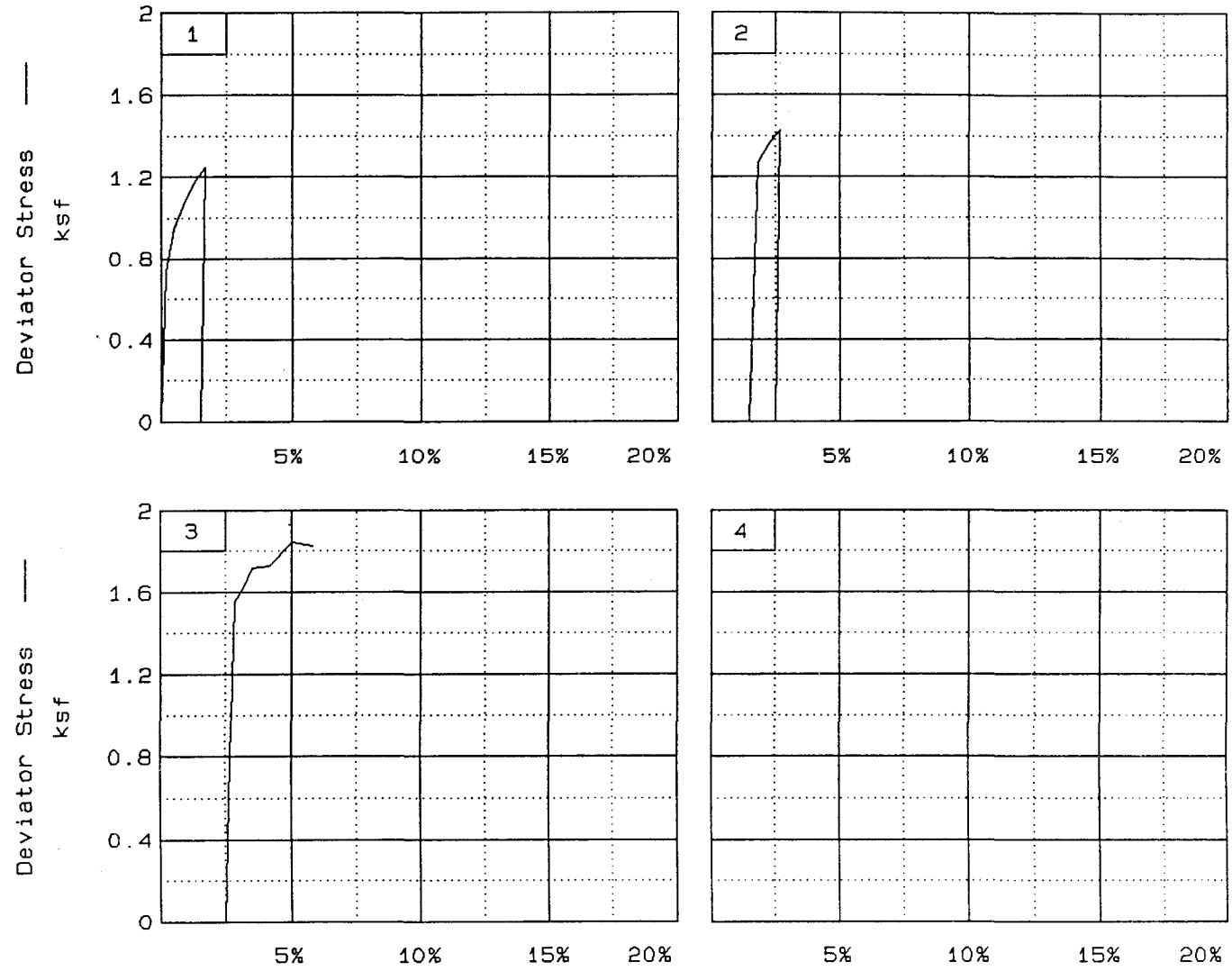
PROJECT: Johnsonville Fossil Plant

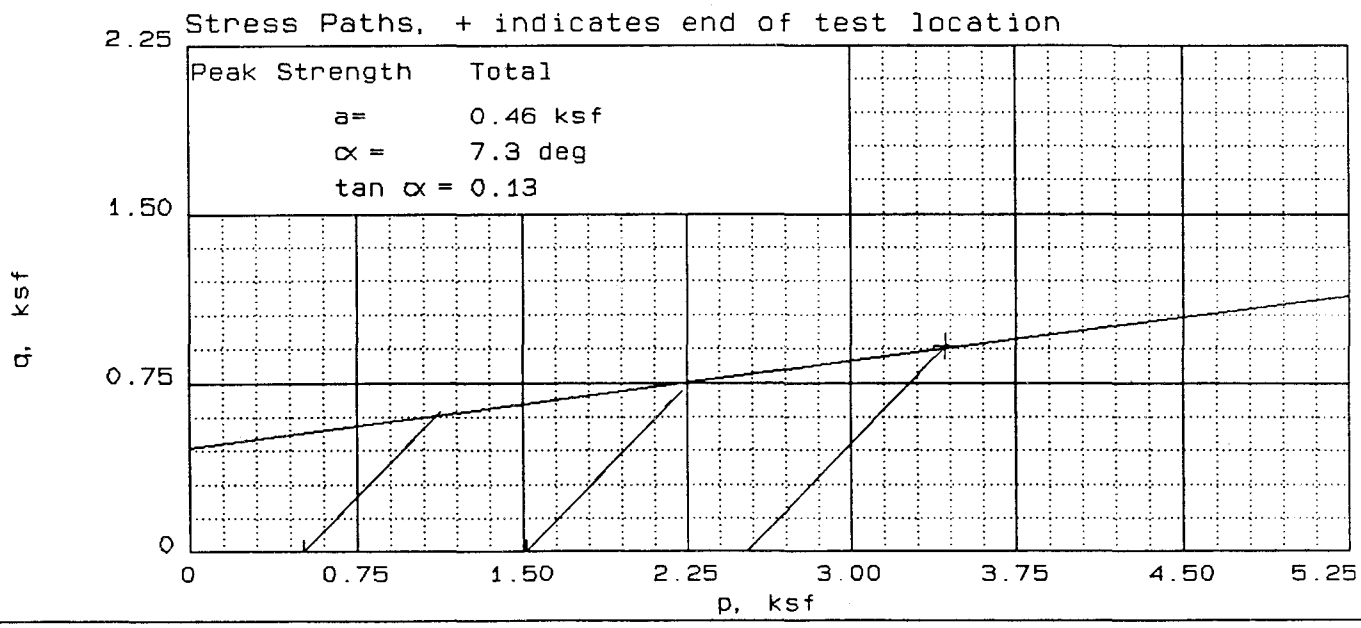
SAMPLE LOCATION: B-7 Ud @ 14-16 Ft

PROJ. NO.: 5038550400 DATE: July 27, 1997

TRIAXIAL COMPRESSION TEST

LAW ENGINEERING, INC.



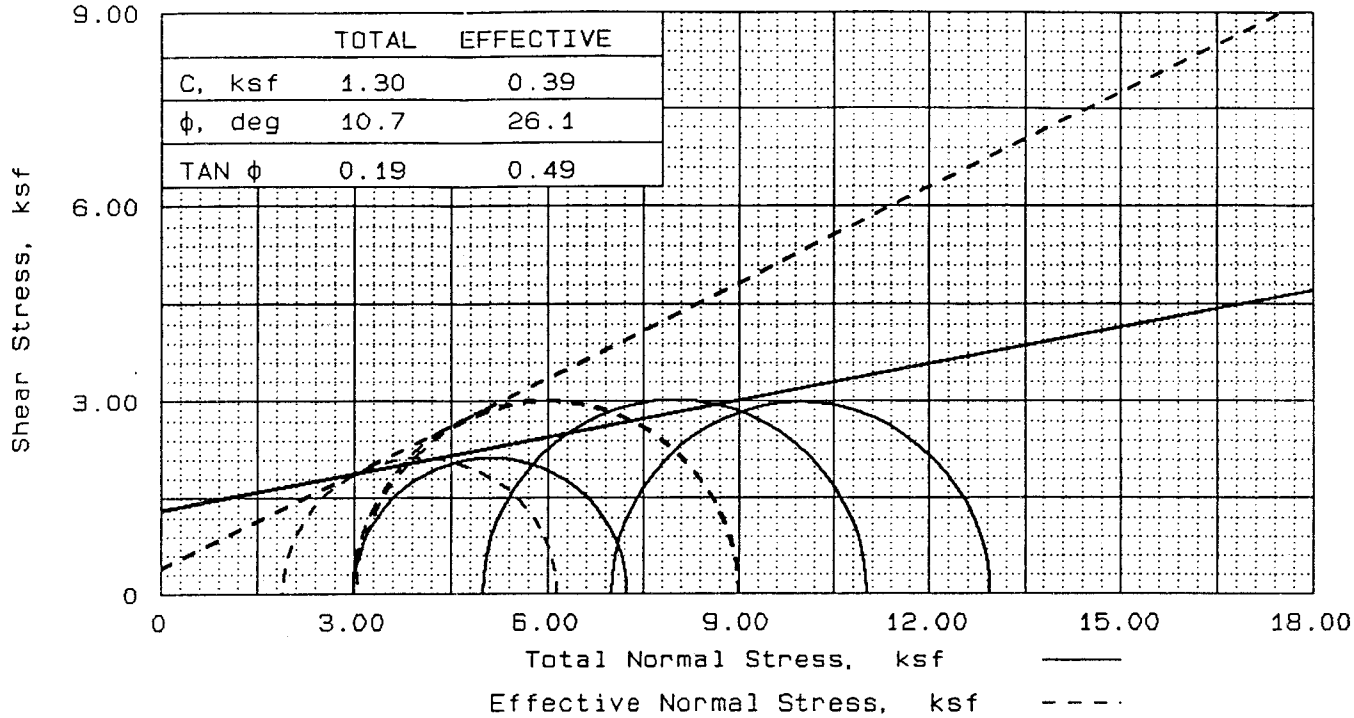


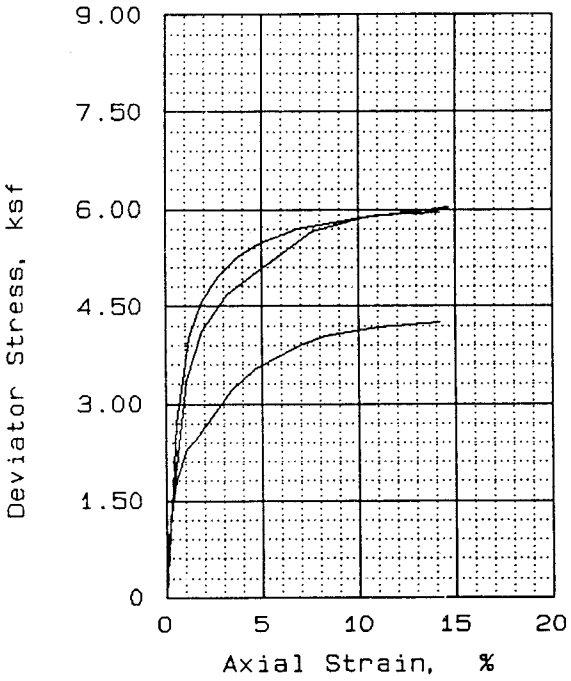
Client: TVA

Project: Johnsonville Fossil Plant

Location: B-7 Ud @ 14-16 Ft

File: TVA0400C Project No.: 5038550400 Page 2/2 Fig. No. ____





SAMPLE NO.		1	2	3
INITIAL	WATER CONTENT, %	22.9	22.5	21.0
	DRY DENSITY, pcf	100.0	101.9	103.4
	SATURATION, %	90.2	92.7	89.9
	VOID RATIO	0.685	0.655	0.631
	DIAMETER, in	2.89	2.87	2.87
	HEIGHT, in	5.96	5.98	5.97
AT TEST	WATER CONTENT, %	24.0	22.7	21.9
	DRY DENSITY, pcf	102.3	104.5	105.9
	SATURATION, %	100.0	100.0	100.0
	VOID RATIO	0.648	0.612	0.591
	DIAMETER, in	2.86	2.85	2.85
	HEIGHT, in	5.93	5.94	5.91
BACK PRESSURE, ksf		2.92	2.92	2.85
CELL PRESSURE, ksf		5.92	7.92	9.85
FAILURE STRESS, ksf		4.25	6.03	5.96
PORE PRESSURE, ksf		4.02	4.94	6.81
STRAIN RATE, %/min.		0.010	0.010	0.010
ULTIMATE STRESS, ksf				
PORE PRESSURE, ksf				
$\bar{\sigma}_1$ FAILURE, ksf		6.15	9.01	8.99
$\bar{\sigma}_3$ FAILURE, ksf		1.9	2.98	3.04

TYPE OF TEST:
CU with pore pressures
SAMPLE TYPE: Ud
DESCRIPTION:

LL= PL= PI=
SPECIFIC GRAVITY= 2.70
REMARKS: Tested by: JTM

Reviewed by: HJ

FIG. NO.

CLIENT: TVA

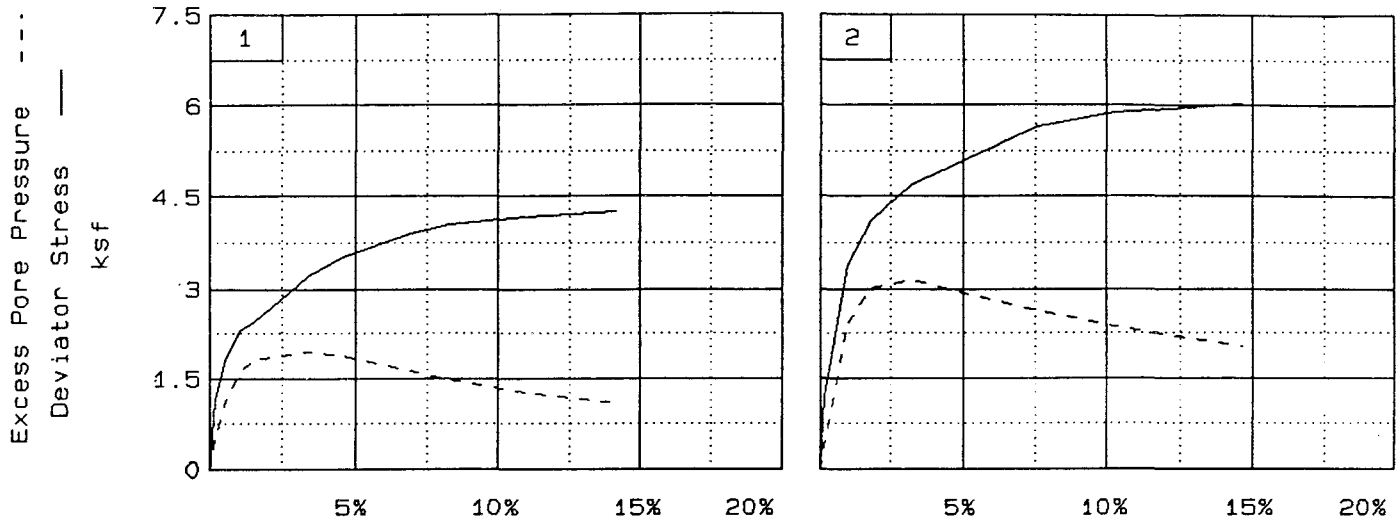
PROJECT: Johnsonville Fossil Plant

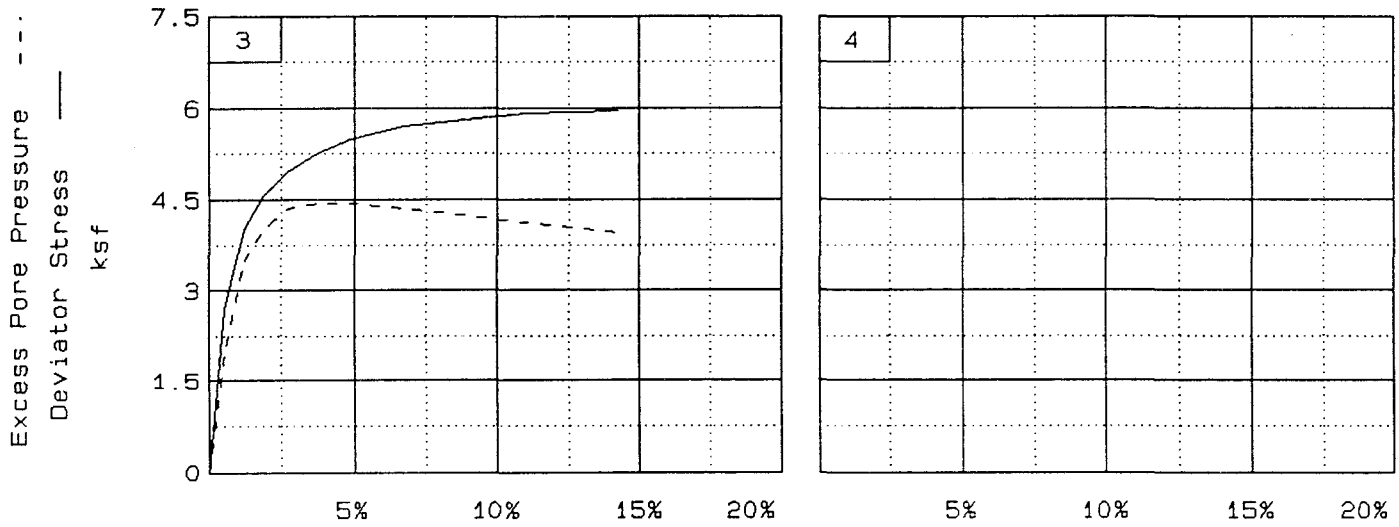
SAMPLE LOCATION: B-8 Ud @ 44-46 Ft.

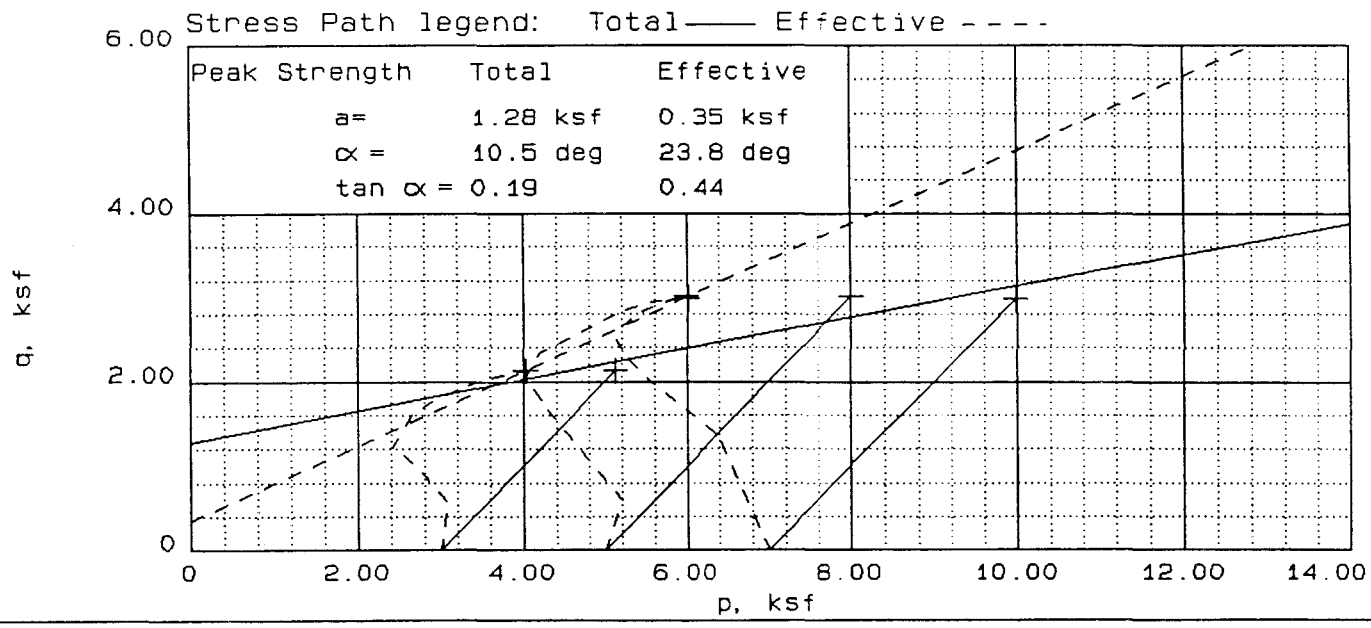
PROJ. NO.: 5038550400 DATE: July 27, 1997

TRIAXIAL COMPRESSION TEST

LAW ENGINEERING, INC.





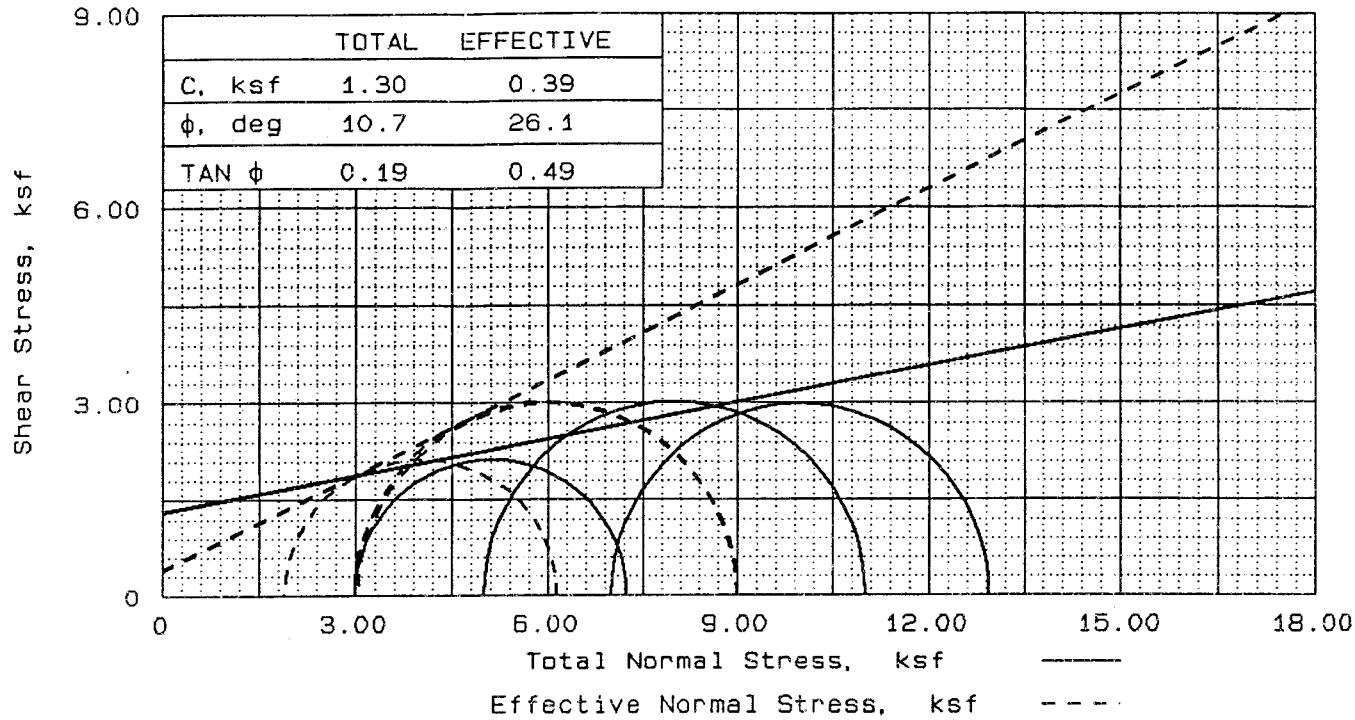


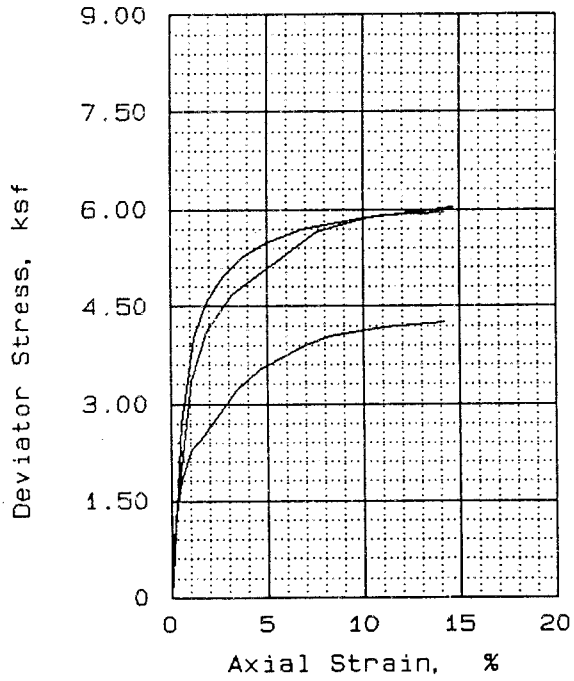
Client: TVA

Project: Johnsonville Fossil Plant

Location: B-B Ud @ 44-46 Ft.

File: TVA0400B Project No.: 5038550400 Page 2/2 Fig. No. ____





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	HEIGHT, in	5.96	5.98	5.97
AT TEST	WATER CONTENT, %	24.0	22.7	21.9
	DRY DENSITY, pcf	102.3	104.5	105.9
	SATURATION, %	100.0	100.0	100.0
	VOID RATIO	0.648	0.612	0.591
	DIAMETER, in	2.86	2.85	2.85
	HEIGHT, in	5.93	5.94	5.91
BACK PRESSURE, ksf		2.92	2.92	2.85
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CU with pore pressures
SAMPLE TYPE: Ud
DESCRIPTION:

LL= PL= PI=
SPECIFIC GRAVITY= 2.70
REMARKS: Tested by: JM

Reviewed by: HJ

FIG. NO.

CLIENT: TVA

PROJECT: Johnsonville Fossil Plant

SAMPLE LOCATION: B-8 Ud @ 44-46 Ft.

PROJ. NO.: 5038550400 DATE: July 27, 1997

TRIAXIAL COMPRESSION TEST

LAW ENGINEERING, INC.