Tennessee Valley Authority
Regulatory Submittal for Kingston Fossil Plant

Documents submitted:
Revised Temporary Ash Stockpile in the Peninsula Borrow Area Work Plan
Response to comments

Date submitted
8/ 14 / 2009

Submitted to whom
Leo Francendese, EPA

Concurrence

Received	Not Applicable	TVA
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☒	☐	Mike Scott
☐	☒	Kathryn Nash
☐	☒	Cynthia Anderson
☐	☒	Dennis Yankee
☐	☒	David Stephenson
☐	☐	_____
☐	☐	_____
☐	☐	_____

Received	Not Applicable	Jacobs
☐	☒	John Moebes
☒	☐	Julie Pfeffer
☒	☐	Jack Howard
☐	☒	Donna Cueroni
☐	☒	Paul Clay
☐	☐	_____

Approvals

TVA Michael D Scott Date 8/14/09

EPA Leo Francendese Date 8/14/09

Consulted w/ TDEC B. Scott.

cc:

- ☒ Anda Ray, TVA
- ☒ Barbara Scott, TDEC
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- ☒ Kathryn Nash, TVA
- ☒ Cynthia Anderson, TVA
- ☐ John Moebes, Jacobs
- ☒ EDM
- ☒ Julie Pfeffer, Jacobs
- ☒ David Stephenson, TVA
- ☒ Michelle Cagley, TVA
- ☒ Greg Signer, TVA
- ☒ KIF Incident Document Control
- ☒ Katie Kline, TVA
- ☒ Gretchen Wahl, Jacobs
- ☒ Dannena Bowman, EPA
- ☒ Jeff Gary, Jacobs

Temporary Ash Stockpile in the Peninsula Borrow Area Work Plan

1.0 Purpose of Work

This work plan is to construct a temporary ash stockpile in the peninsula borrow area. The borrow area would require little in the way of infrastructure upgrades to re-configure the area to accept ash materials. The borrow area would provide approximately 150,000 CY of ash storage area at a height of 30 feet. The area has been excavated down approximately 30' for clay materials to use in the construction of the gypsum pond area. This excavation has left a 10' to 12' berm along one side of the area and a sloping embankment along the opposite side. A 10' high berm is being constructed along the north end of the area. The south end is approximately 50' lower in elevation than the north end and slopes toward the storm run-off collection pond. If this pond overtops then the run-off is directed to the borrow area sediment basin. The area is surrounded by trees and other vegetation and will be difficult to see from off-site.

2.0 Design Components

The excavation of the ash would proceed as it is currently being accomplished. The ash would be hauled to the borrow area across the existing bridge. The exclusion zone would be expanded to include the borrow area and associated roads. The construction drop out in the borrow area is being repaired in accordance with the approved document "Work plan for Mitigation of Construction Drop-outs" (Issued September 2008 by Geosyntec, see attached cover sheet).

The major components of converting the borrow area to a temporary ash storage area are as follows:

- Construct a collection pond for the run off
- Place a GCL over the ash storage area and pond
- Place 12" of earth as a sacrificial layer
- Construct roads and ditches as needed to access the area

The major concern of using the borrow area is the possible migration of metals into the underlying soil. This occurs when water transports the metals into the soil. The area is sloped to the south at a slope greater than 7 percent. The GCL layer and the slope would ensure that water is not ponded thus minimizing the opportunity for metals to leach into the underlying soil. The underlying soil is a clayey material with a large quantity of chert rocks. This material was excavated to be used for the gypsum pond liner system and should provide some impermeability to the storage area. This existing impermeability, the slope of the storage area and the engineered features should minimize leaching of contaminates into the underlying soils. The water collected in the pond will be removed by a pumper truck and discharged into the rim ditch. The pond is sized to hold a 5 year-24 hour storm event. A series of ditches will be used to segregate the ash storage run off from the general borrow area run off. The area will be hydraulically isolated from run-on

from other areas, therefore a clean water ditch system and additional settling basins are not anticipated.

After removal of all ash the area will be sampled and any soils with elevated metals content will be removed. Baseline and post use soil samples will be obtained. A sample will be obtained in the center of the area and in all four directions half way between the center and the edge of the storage area. An additional sample will also be taken in the center of the collection pond. Samples will be obtained from the 0-1 ft, 1-5 ft, and each 5 ft depth interval thereafter to refusal. These samples will be analyzed for metals.

The ash materials will be placed in 12" loose lifts with 3:1 side slopes. The pile will be constructed with a 15' wide bench every 15' in vertical height. These considerations should minimize or eliminate forces which could cause sliding or sloughing of the ash materials.

To minimize the risk of spillage of ash on the haul road the material shall be relatively dry prior to loading and the haul vehicles should be slightly under-loaded.

3.0 Construction Management

The construction will be accomplished with track hoes, dozers and construction haul vehicles to both load, transport the ash. The construction will also include dust management through water trucks, etc.

4.0 Schedule

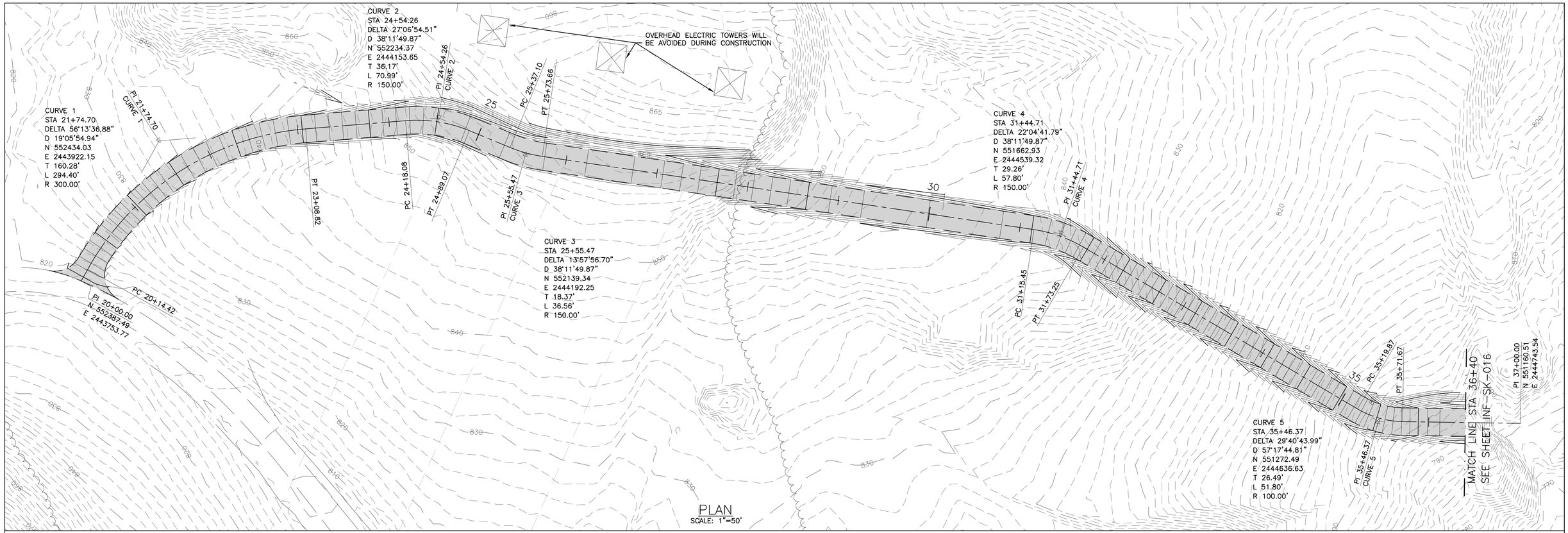
It is anticipated the construction would take approximately 2-4 weeks.

5.0 Waste Management

No waste will be generated by this work.

6.0 Health and Safety

All construction activities will be done in accordance with the site-wide Health and Safety Plan.



PLAN
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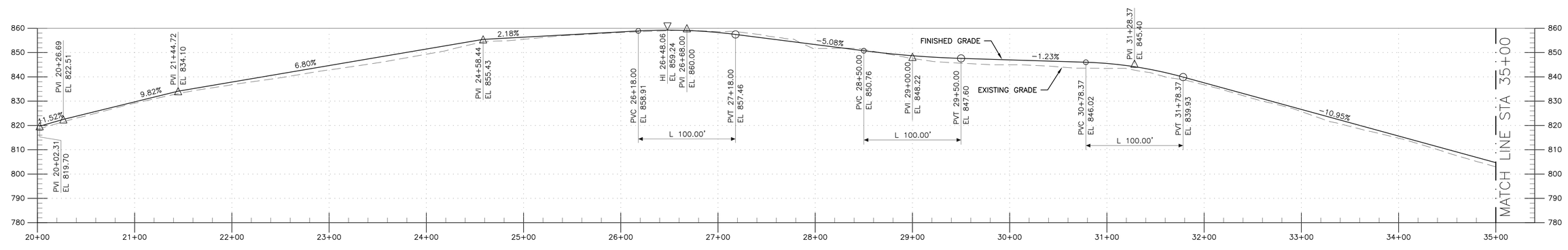

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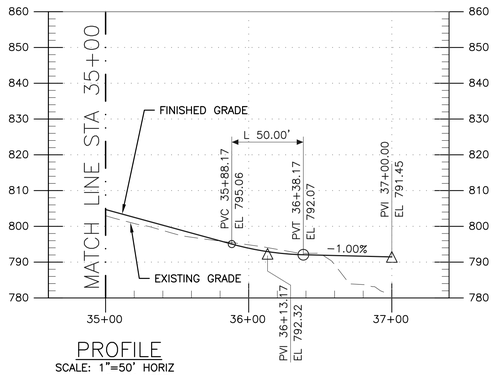
1"=20' VERT



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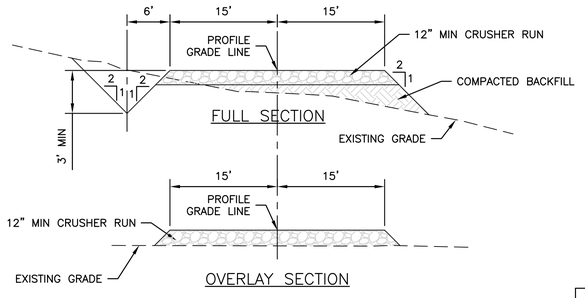

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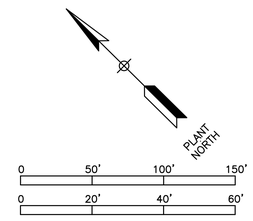

REVISION NO.	DATE	DESCRIPTION	DRAWN BY	CHECKED BY	PROJECT A/E	APPROVAL
A	7/14/09	ISSUED FOR CONSTRUCTION				

SEAL

JACOBS

KINGSTON FOSSIL PLANT
TENNESSE VALLEY AUTHORITY

BORROW AREA ACCESS ROAD PLAN AND PROFILE

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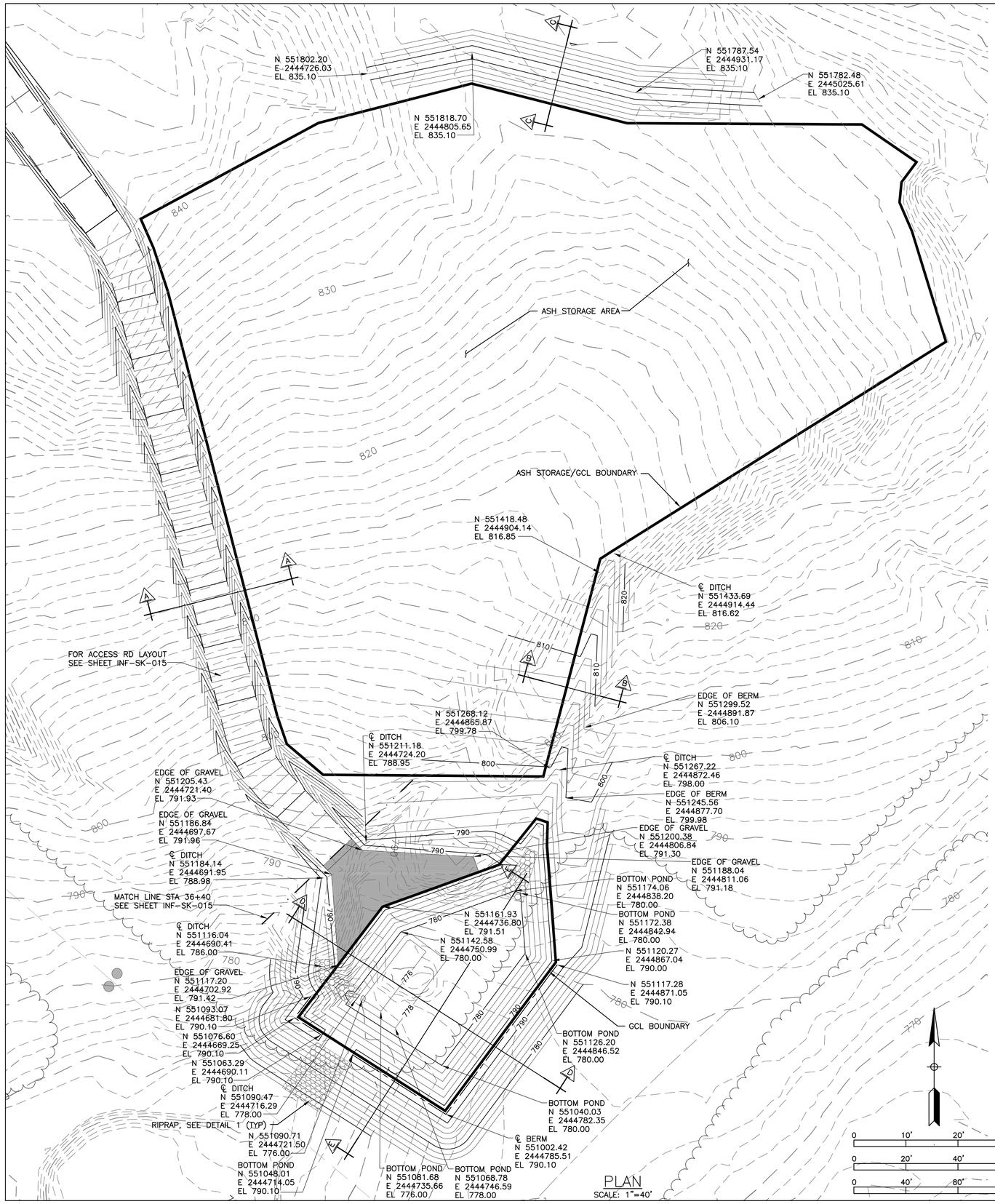
	INF-SK-015	A



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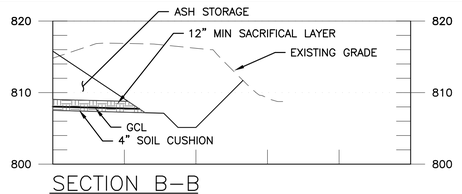

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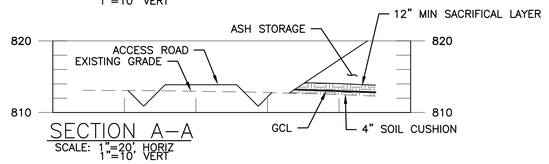

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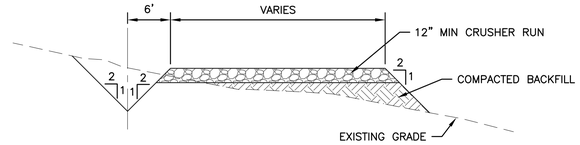

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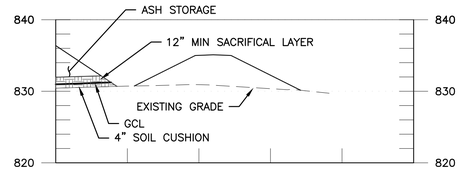

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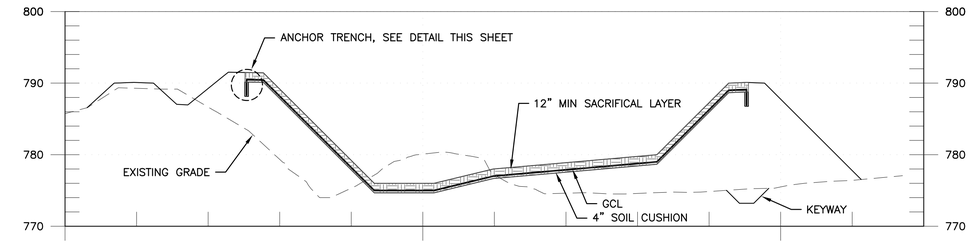

SECTION D–D
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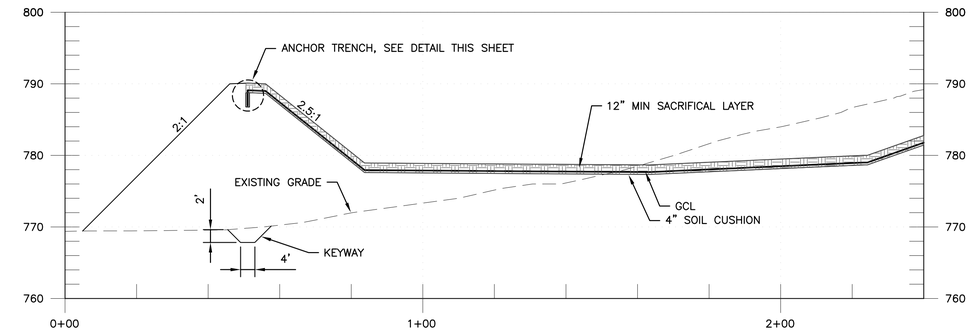
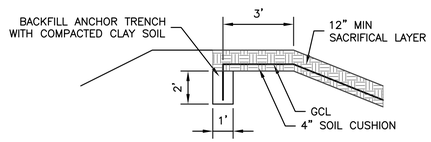


SECTION E–E
SCALE: 1"=20' HORIZ
1"=10' VERT

QUANTITY SUMMARY:

1. ASH STORAGE AREA
FOOTPRINT = 208,075 SF
ASH @ 30' HIGH = 153,300 CY
2. POND CAPACITY = 962,900 GAL
3. TOTAL AREA AFFECTED = 416,437 SF
4. EARTHWORK
CUT = 6,585 CY
FILL = 13,668 CY
5. AGGREGATE = 2,122 CY
6. RIPRAP = 113 CY
7. GCL = 232,176 SF



ANCHOR TRENCH DETAIL
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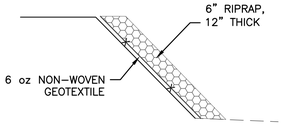


DETAIL 1
NOT TO SCALE

NOTES:
1. PLACE CLAY MATERIAL FOR POND DIKES IN 8" LOOSE LIFTS AND COMPACT TO ±90% STANDARD PROCTOR AT ±4% MOISTURE CONTENT.
2. GCL SHALL BE CLAY MAX 600 OR APPROVED EQUAL.

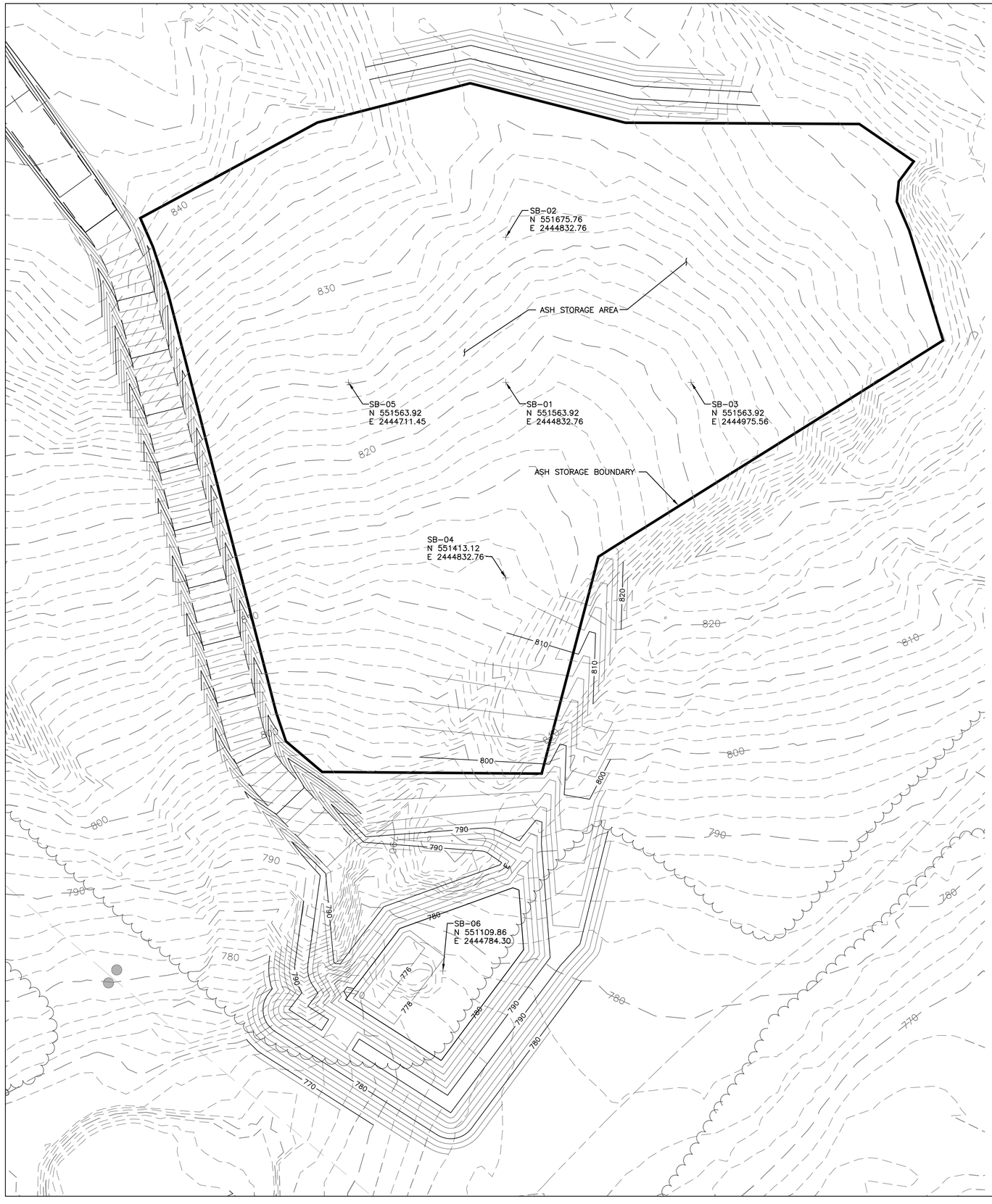
REVISION NO.	DATE	DESCRIPTION	DRAWN BY	CHECKED BY	PROJECT A/E	APPROVAL
B	8/12/09	ISSUED FOR CONSTRUCTION	JGA	FMP		
A	7/15/09	ISSUED FOR CONSTRUCTION	JGA	FMP		

SEAL

KINGSTON FOSSIL PLANT
TENNESSE VALLEY AUTHORITY

BORROW AREA - ASH STORAGE AREA PREPARATION PLAN

SCALE:	DRAWING NO.	REV.
SHOWN	INF-SK-016	B



PLANT
NORTH

0 40' 80' 120'

REV.	DATE	DESCRIPTION	DRAWN BY	CHECKED BY	PROJECT A/E	APPROVAL
A	8/06/09	ISSUED FOR CONSTRUCTION	JGA	FMP		FMP

SEAL

JACOBS

KINGSTON FOSSIL PLANT
TENNESSE VALLEY AUTHORITY

BORROW AREA - ASH STORAGE AREA
SOIL BORING PLAN

SCALE:	DRAWING NO.	REV.
SHOWN	INF-SK-016-SB	A

FILE COPY

REPORT OF GEOTECHNICAL EXPLORATION

PROPOSED BORROW AREA
KINGSTON FOSSIL PLANT
KINGSTON, TENNESSEE

Prepared For:

TENNESSEE VALLEY AUTHORITY

Chattanooga, Tennessee

Prepared By:

MACTEC ENGINEERING AND CONSULTING, INC.

Knoxville, Tennessee

MACTEC Project 3043091018/01

June 1, 2009

MACTEC

MACTEC

engineering and constructing a better tomorrow

June 1, 2009

Mr. Harold Lynn Petty
Tennessee Valley Authority
1101 Market Street, LP-2G
Chattanooga, Tennessee 37402

Subject: **Report of Geotechnical Exploration**
Proposed Borrow Area
TVA Kingston Fossil Plant
Kingston, Tennessee
MACTEC Project 3043091018/01

Dear Mr. Petty:

We at MACTEC Engineering and Consulting, Inc., (MACTEC) are pleased to submit this Report of Geotechnical Exploration for your project. Our services, as authorized through TAO No. 160 were provided in general accordance with our Proposal Number Prop09Knox-030, dated February 24, 2009.

This report reviews the information provided to us, discusses the site and subsurface conditions, and presents the results of our field and laboratory testing for the materials encountered at the proposed borrow area. The Appendices contain a brief description of the Field Exploratory Procedures, Test Boring Records, Laboratory Test Procedures and Laboratory Results.

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

Sincerely,

MACTEC ENGINEERING AND CONSULTING, INC.

April L. Brenneman
Project Professional

for Neal Brennan w/permission

Hussein A. Benkhayal, P.E.
Principal Engineer

ALB/HAB:sac

MACTEC Engineering and Consulting, Inc.
9725 Cogdill Road • Knoxville, TN 37932 • Phone: 865.588.8544 • 865.588.8026
www.mactec.com

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EXECUTIVE SUMMARY

MACTEC was selected by the Tennessee Valley Authority (TVA) to perform a geotechnical exploration for the proposed borrow area at the Kingston Fossil Plant in Kingston, Tennessee. The objectives of our exploration were to determine general subsurface conditions and to obtain data to evaluate the engineering characteristics of the on-site materials.

The exploration consisted of drilling twelve soil test borings to auger/split spoon sampler refusal in the proposed borrow area. The major findings of our geotechnical exploration are as follows:

- The test borings drilled in the proposed borrow area typically encountered residual soils consisting of clayey silt, silty clay, fat clay and elastic silt, generally increasing in plasticity with depth. The residual soils can generally be described as reddish-brown to strong brown with yellowish-brown mottling. Numerous chert fragments were present in the auger cuttings and split spoon samples obtained, generally increasing in amount with depth. A summary of the subsurface conditions are presented in Section 6.0.

- Ground-water measurements were performed in all test borings at the time of drilling. Ground-water was not encountered at the time of drilling in any of the borings. Long-term measurements for the presence or absence of ground-water were not obtained during this exploration.

- Laboratory tests were performed on selected standard penetration test samples, bulks samples and undisturbed samples. A summary of the tests performed and the results of testing are presented in Section 7.0. The test results are presented in Appendix C.

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.

1.0 INTRODUCTION

This report presents the findings of our subsurface exploration and laboratory testing recently performed for the borrow area at the Tennessee Valley Authority (TVA) Kingston Fossil Plant. Our services were authorized by Mr. H. Lynn Petty of TVA.

2.0 OBJECTIVES OF EXPLORATION

The objectives of our exploration were to determine general subsurface conditions and to obtain data to evaluate the engineering characteristics of the on-site materials. An assessment of site environmental conditions, or an assessment for the presence or absence of pollutants in the soil, bedrock, surface-water, or ground-water of the site was beyond the proposed objectives of our exploration.

3.0 SCOPE OF EXPLORATION

The scope of our exploration was based on our Proposal Number Prop09Knox-030, dated February 24, 2009. This geotechnical scope of work was developed through project teaming efforts between MACTEC, TVA and CTI Engineers, Inc. It includes the following:

- Mobilizing one ATV-mounted drill rig.
- Drilling twelve soil test borings to auger/split spoon refusal.
- Performing standard penetration testing (SPT) at 2.5-foot intervals to 10 feet from the ground surface and on 5-foot centers thereafter.
- Backfilling all borings with cement-bentonite grout.
- Collecting SPT samples, bulk samples and undisturbed (UD) samples within the borrow area.
- Conducting laboratory testing to sufficiently classify the on-site materials, to include Atterberg limits, moisture contents and sieve analysis.
- Preparing a geotechnical report summarizing the field and laboratory test methods and results.

The drilling and sampling were performed in general accordance with ASTM procedures summarized in Appendix A. The drilling was performed between February 26 and March 12, 2009. The equipment used during the exploration consisted of a CME Model 55 ATV track-mounted drill rig equipped with an automatic hammer.

Standard penetration tests (SPTs) were performed continuously to a depth of about 10 feet. Below that depth, SPTs were performed at 5-foot vertical intervals. The test borings were advanced to auger/split spoon sampler refusal, defined as 100 blows per foot (bpf) in less than or equal to 6 inches of driving. In addition to the SPT samples, bulk and relatively undisturbed (3-inch diameter Shelby tube) samples were obtained from selected test borings for laboratory testing.

Ground-water levels were measured in each boring after refusal was achieved. Upon completion of drilling and obtaining water level readings, the test borings were backfilled to the ground surface by tremie grouting with cement-bentonite grout.

Upon completion of drilling, samples were transported to our laboratory in Knoxville, Tennessee. MACTEC developed the laboratory testing assignments based on our proposal and the recommendations provided by CTI Engineers, Inc. The testing program for this project consisted of the following:

- 8 Atterberg Limits Tests
- 8 Particle-Size Analysis Tests
- 63 Natural Moisture Content Tests
- 8 Specific Gravity Tests
- 4 Unit Weight and Natural Moisture Content Tests for UD Samples
- 8 Standard Proctor Compaction Tests
- 5 Constant Head Permeability Tests

The laboratory testing results are presented in Appendix C.

4.0 PROJECT INFORMATION AND SITE CONDITIONS

Project information was provided to us on February 13, 2009 in email correspondence sent from Mr. Allen Stephens of CTI Engineers, Inc., at the request of Mr. H. Lynn Petty of TVA. A recommended scope of work and boring plan with a site location map and summary table was

provided to us. As shown on the Site Location Map (Figure 1), the site of the proposed borrow area is located east of the power generating plant, north of the gypsum pond and northwest of the confluence of the Emory and Clinch Rivers. The ground surface elevations at the boring locations ranged from approximately 817 to 849 feet, varying by as much as 32 feet (B-4 and B-5) in the areas explored.

At the time of drilling, most of the borrow area had been stripped of topsoil and some native soils during previous borrow excavation operations (with the exception of the area of Borings B-11 and B-12 which were covered with ankle high grass). Borrow operations were taking place within the borrow area at the time of the exploration.

5.0 AREA AND SITE GEOLOGY

Kingston, Tennessee is located in the Appalachian Valley and Ridge Physiographic Province. This province extends as a continuous belt from Central Alabama, through Georgia and Tennessee, northward into Pennsylvania. The formations that underlie this province consist primarily of limestone, dolostone, shale, and sandstone, which have been folded and faulted in the geologic past. These formations range in age from Cambrian to Pennsylvanian and have been subject to at least one extensive period of erosion since their structural deformation. The erosion has produced a series of subparallel, alternating ridges and valleys. The valleys are formed over more soluble bedrock (limestone and interbedded limestone and shale), whereas bedrock more resistant to solution weathering forms ridges (sandstone, shale, and cherty dolostone).

In particular, the site is geologically mapped to be underlain by the Knox Group. The Knox Group is mainly composed of light gray to dark gray and olive-gray, siliceous dolomite with a few limestone layers in the upper part. The rock usually weathers to reddish orange residuum containing chert fragments. Both limestone and dolostone are soluble types of bedrock, and because of this, these bedrock types usually weather deeply, producing a thick soil composed of cherty clay and silt overlying an irregular bedrock surface. The residual soils developed over the bedrock contain many of the weaknesses of the parent bedrock (such as fractures and bedding planes) as well as desiccation cracks. Consequently, these weaknesses may act as conduits for the downward migration of surface water.

6.0 SUBSURFACE CONDITIONS

Subsurface conditions at the site of the proposed borrow area were explored with twelve soil test borings (herein referred to as B-1 through B-9 and B-11 through B-13). The locations for the borings were proposed by TVA and CTI Engineers, Inc. The locations were established in the field by TVA. MACTEC was provided with a topographic survey of the borrow area from TVA. The elevations of the drilled locations (including offsets) were estimated from the topographic mapping and should be considered approximate. Offset distances with bearing information were recorded in the field and noted on the field logs. The drilled locations of the borings are shown on the Boring Location Plan (Figure 2), submitted with this report.

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

The test borings performed at this site typically encountered residual soils. Residual soils are soils that have developed from the in-place weathering of the underlying parent bedrock. A summary of the soil test boring depths is presented in Table 1.

Table 1
Soil Test Boring Summary

Boring Number	Ground Elevation* (Feet msl)	Auger / Split Spoon Sampler Refusal Depth (Feet bgs)	Refusal / Termination Elevation (Feet msl)
B-1	832.4	34.6	797.8
B-2	829.5	24.4	805.1
B-3	843.5	22.7	820.8
B-4**	817.4	29.2	788.2
B-5	849.4	49.3	800.1
B-6	830.6	51.3	779.3
B-7	838.9	75.7	763.2
B-8	835.6	98.1	737.5
B-9	832.1	50.5	781.6

Table 1
Soil Test Boring Summary

Boring Number	Ground Elevation* (Feet msl)	Auger / Split Spoon Sampler Refusal Depth (Feet bgs)	Refusal / Termination Elevation (Feet msl)
B-11	827.7	58.2	769.5
B-12	838.3	32.1	806.2
B-13	843.7	62.0	781.7

* Boring elevations interpolated from topographic mapping provided by TVA as shown in Figure 2 (should be considered approximate).

** Original location of boring encountered premature auger refusal at 8.7 feet. Boring was offset and re-drilled.

Prepared/Date: ALB 5/08/09
Checked/Date: HAB 5/11/09

6.1 Residual Soils

Residual soils were encountered in all the borings. In general, the residual soils were observed from the ground surface extending to auger/split spoon sampler refusal depths ranging from 22.7 feet (Boring B-3) to 98.1 feet (Boring B-8), with an average depth on the order of 49 feet. Generally, the soils consisted of reddish-brown to strong brown with yellowish-brown mottling, clayey silt, silty clay, fat clay and elastic silt, generally increasing in plasticity with depth. Numerous chert fragments were observed throughout the clayey soils. The standard penetration test (SPT) resistance N-values in the residual soils encountered ranged from 1 to over 100 blows per foot (bpf), with an average on the order of 14 bpf; indicating very soft to very hard consistency. The majority of the SPT N-values were within the range of 5 to 42 bpf, with an average on the order of 14 bpf; indicating firm to very hard consistencies.

7.0 LABORATORY TESTING AND DISCUSSION OF TEST RESULTS

This section describes the geotechnical laboratory testing program and summarizes the test results. The laboratory testing procedures and laboratory test results are included in Appendix C. The laboratory tests were performed on SPT, undisturbed (Shelby tube) and bulk samples obtained during drilling. The following paragraphs provide a brief discussion of the general types of testing conducted and the test results.

7.1 Index Properties, Specific Gravity, Unit Weights

Natural moisture content tests were performed on several of the SPT, undisturbed and bulk soil samples. Liquid limit and plastic limit tests (collectively referred to herein as Atterberg limits); specific gravity tests; grain size distributions with hydrometer analyses were performed on selected bulk samples. Unit weights and natural moisture contents were determined for selected undisturbed samples. These tests were used to confirm our visual-manual classifications. Table C-1 summarizes the index property test results.

The natural moisture content of the tested residual soils ranged from 6.1 percent (Boring B-5) to 53.2 percent (Boring B-2), with an average natural moisture content on the order of 29 percent.

Liquid limits for the residual soil samples tested ranged from 35 to 74; plastic limits ranged from 20 to 30; and plasticity indices ranged from 10 to 46. The residual soil samples tested were classified as ML, CL, CH and MH soils in accordance with the Unified Soil Classification System (USCS).

Specific gravities of the residual soil samples tested ranged from 2.74 to 2.78. The sieve analyses determined that the amount of material finer (percent passing) than the No. 200 sieve in the tested residual soils ranged from 57.1 percent (Boring B-3) to 81.7 percent (Boring B-7).

The dry unit weight of the tested residual soil samples collected from undisturbed (Shelby tube) samples ranged from 80.2 pounds per cubic foot (pcf) (Boring B-2) to 113.4 pcf (Boring B-13) with natural moisture content ranging from 16.9 percent (Boring B-9) to 53.2 percent (Boring B-2).

7.2 Moisture-Density Relationship

Standard Proctor compaction testing was performed on eight bulk samples collected within the borrow area. The optimum moisture contents of the tested residual soil samples ranged from 16.5 percent (Boring B-3) to 25.6 percent (Boring B-12). The maximum dry density of the residual soil samples tested ranged from 94.7 pcf (Boring B-12) to 111.8 pcf (Boring B-3). The test results are summarized in Table C-1.

7.3 Constant Head Permeability

Five constant head permeability tests were performed on remolded bulk samples of the residual soils obtained from the proposed borrow area. The permeability test results ranged from 2.4 x 10^{-8} centimeters per second (cm/s) (Boring B-3) to 5.7 x 10^{-5} cm/s (Boring B-7). Table C-2 summarizes the permeability test results.

8.0 GROUND-WATER CONDITIONS

Ground-water levels were measured in all test borings at the time of boring termination. Ground-water was not encountered in any of the borings advanced within the barrow area at the time of boring completion. For safety reasons, the borings were backfilled promptly; consequently, long-term measurements for the presence or absence of ground-water were not obtained.

Fluctuations in the ground-water level occur because of variation in rainfall, evaporation, construction activity, surface run-off, and other site-specific factors such as fluctuation of water levels in the adjacent bodies of water.

9.0 BASIS OF RESULTS

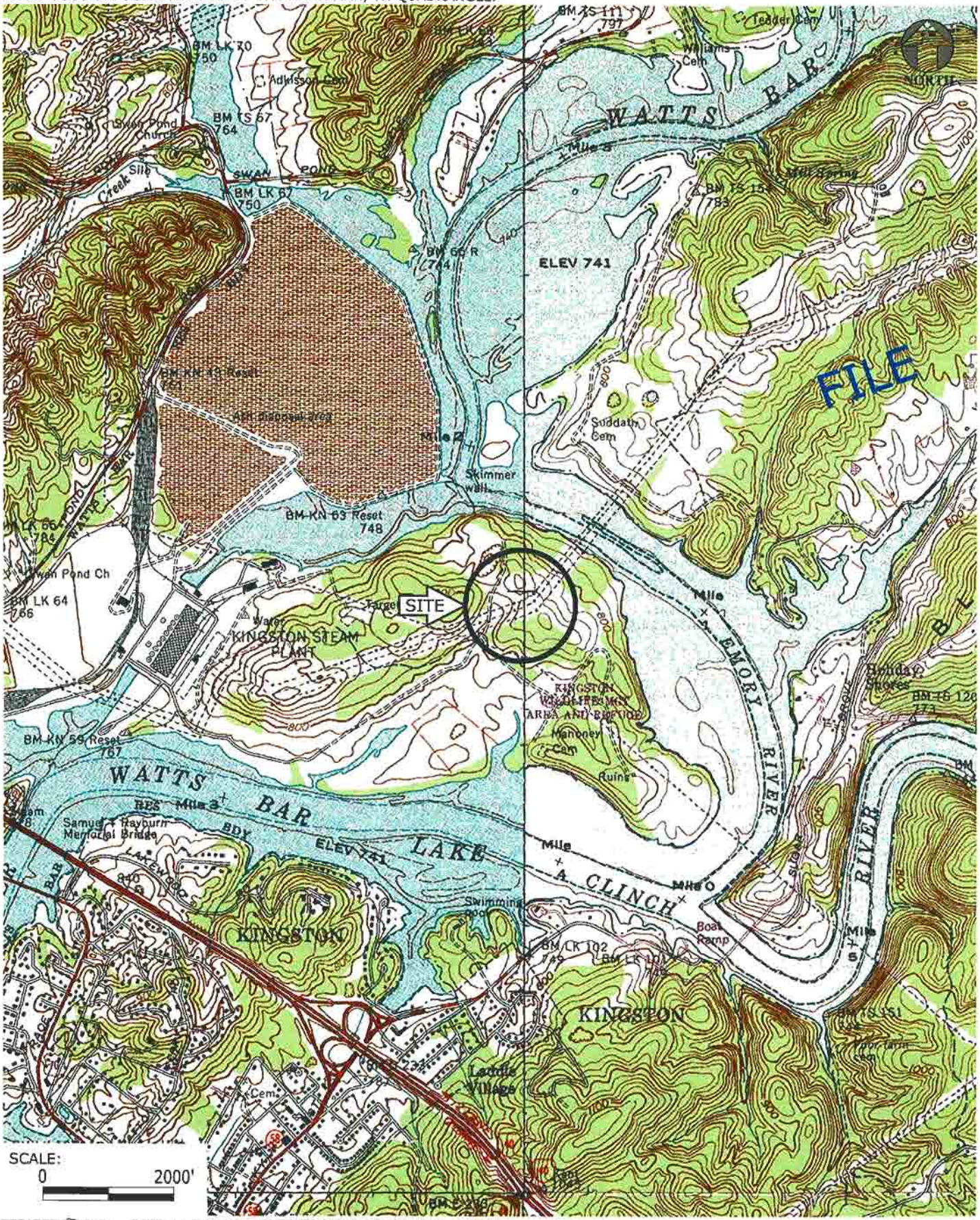
The results provided herein are based on the encountered subsurface conditions related to the specific project and site discussed in this report.

Regardless of the thoroughness of a field exploration, there is always a possibility that conditions between test locations will differ from those at specific test locations, and that conditions may not be anticipated. In addition, interpretation of the data is critical to the intended design and/or analysis. Therefore, experienced geotechnical engineers should interpret the field data and review any site-specific analysis or design that incorporates the field data. We recommend that TVA retain MACTEC to provide this service, based upon our familiarity with the subsurface conditions, the field and laboratory data, and our geotechnical experience.

Our exploration services include storing the collected samples and making them available for inspection for a period of 30 days. The samples are then discarded unless you request otherwise.

FIGURES

SOURCE: USGS TOPOGRAPHIC MAP OF THE HARRIMAN, TN QUADRANGLE.



PREPARED BY: DATE: 01 Jun 2009 CHECKED BY: H.A.B. DATE: 01 Jun 2009

TENNESSEE VALLEY AUTHORITY

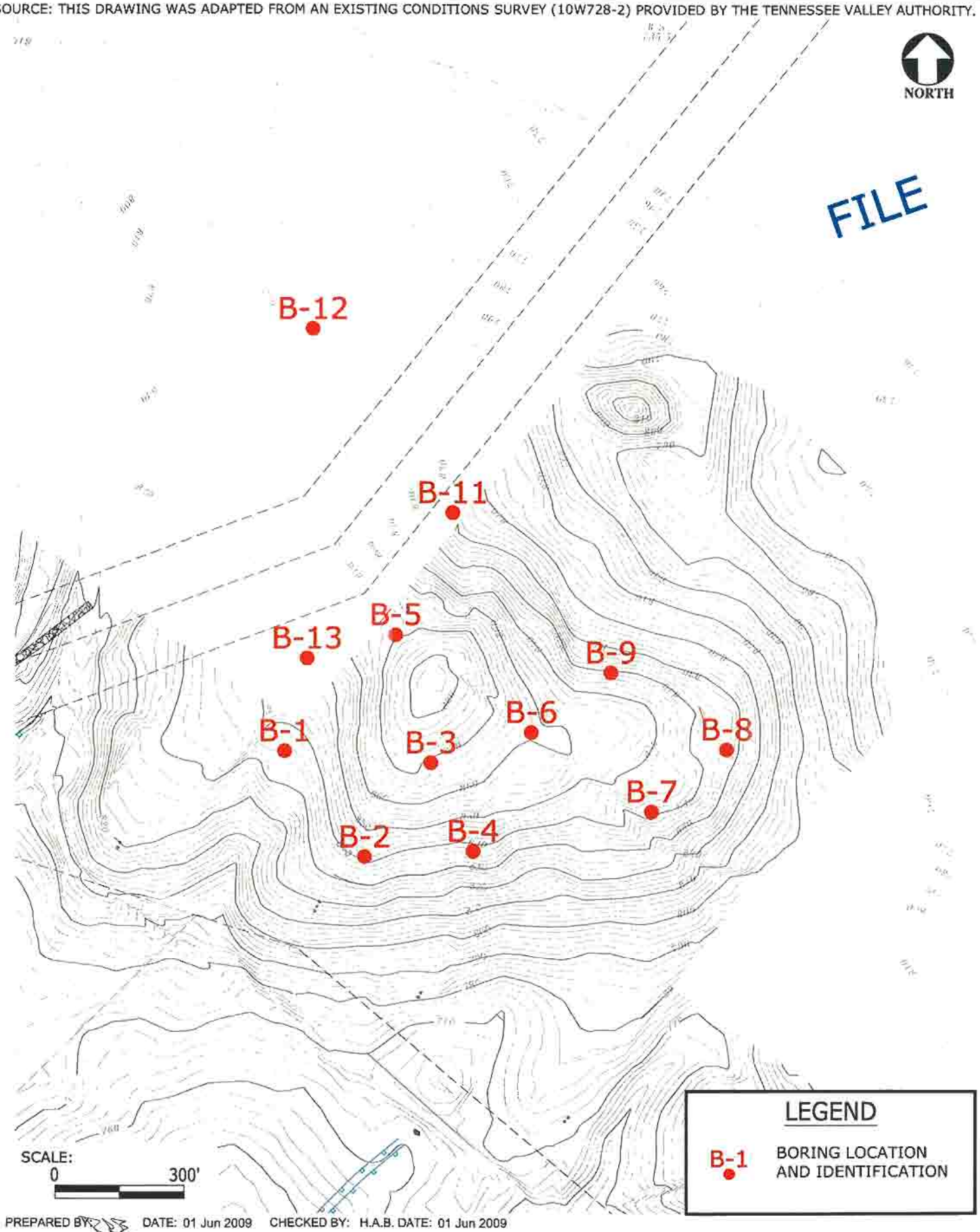
MACTEC

9275 Cogdill Road
Knoxville, Tennessee
Phone: 865-588-8544 Fax: 865-588-8026

SITE LOCATION MAP
TVA - KINGSTON BORROW AREA
KINGSTON, TENNESSEE

PROJECT NO. 3043-09-1018 FIGURE 1

SOURCE: THIS DRAWING WAS ADAPTED FROM AN EXISTING CONDITIONS SURVEY (10W728-2) PROVIDED BY THE TENNESSEE VALLEY AUTHORITY.



PREPARED BY: DATE: 01 Jun 2009 CHECKED BY: H.A.B. DATE: 01 Jun 2009

TENNESSEE VALLEY AUTHORITY

MACTEC

9725 Cogdill Road
Knoxville, TN 37932
Phone: 865-588-8544 Fax: 865-588-8026

BORING LOCATION PLAN
TVA - KINGSTON BORROW AREA
KINGSTON, TENNESSEE

PROJECT NO. 3043-09-1018 FIGURE 2

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 six inches to penetrate any loose cuttings and then driven an additional foot with blows of a 140-pound hammer constant 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 Records 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 was performed in general accordance with ASTM D-1587. The tube, together with the encased soils, was carefully removed from the ground, made airtight, and transported to our laboratory.

Boring Backfill

The borings were backfilled to the ground surface with cement-bentonite grout. The owner is advised that, even with this backfill technique, there is the possibility of future borehole subsidence depending on actual subsurface conditions, surface drainage, etc. The property owner should monitor the boring locations over time to discover subsidence and make the necessary repairs.

APPENDIX B

KEY TO SYMBOLS AND DESCRIPTIONS

TEST BORING RECORDS

GROUP SYMBOLS	TYPICAL NAMES	GROUP SYMBOLS	TYPICAL NAMES
	TOPSOIL		**CONCRETE**
	ASPHALT		**DOLOMITE**
	GRAVEL		**LIMESTONE**
	FILL		**SHALE**
	SUBSOIL		**LIMESTONE/SHALE** - Limestone with shale interbeds
	ALLUVIUM		**SANDSTONE**
	COLLUVIUM		**SILTSTONE**
	RESIDUUM - Soft to firm		**AUGER BORING**
	RESIDUUM - Stiff to very hard		**UNDISTURBED SAMPLE ATTEMPT**

	Undisturbed Sample 1.5-2.0 = Recovered (ft) / Pushed (ft)		
	Split Spoon Sample		Auger Cuttings
	Rock Core 60-100 = RQD / Recovery		Dilatometer
	No Sample		Crandall Sampler
	Rotary Drill		Pressure Meter
▽	Water Table at time of drilling	○	No Recovery
		▼	Water Table after 24 hours

Correlation of Penetration Resistance with Relative Density and Consistency

SAND & GRAVEL		SILT & CLAY	
No. of Blows	Relative Density	No. of Blows	Consistency
0 - 4	Very Loose	0 - 2	Very Soft
5 - 10	Loose	3 - 4	Soft
11 - 20	Firm	5 - 8	Firm
21 - 30	Very Firm	9 - 15	Stiff
31 - 50	Dense	16 - 30	Very Stiff
Over 50	Very Dense	31 - 50	Hard
		Over 50	Very Hard

BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

SILT OR CLAY	SAND			GRAVEL		Cobbles	Boulders
	Fine	Medium	Coarse	Fine	Coarse		

No.200 No.40 No.10 No.4 3/4" 3" 12"

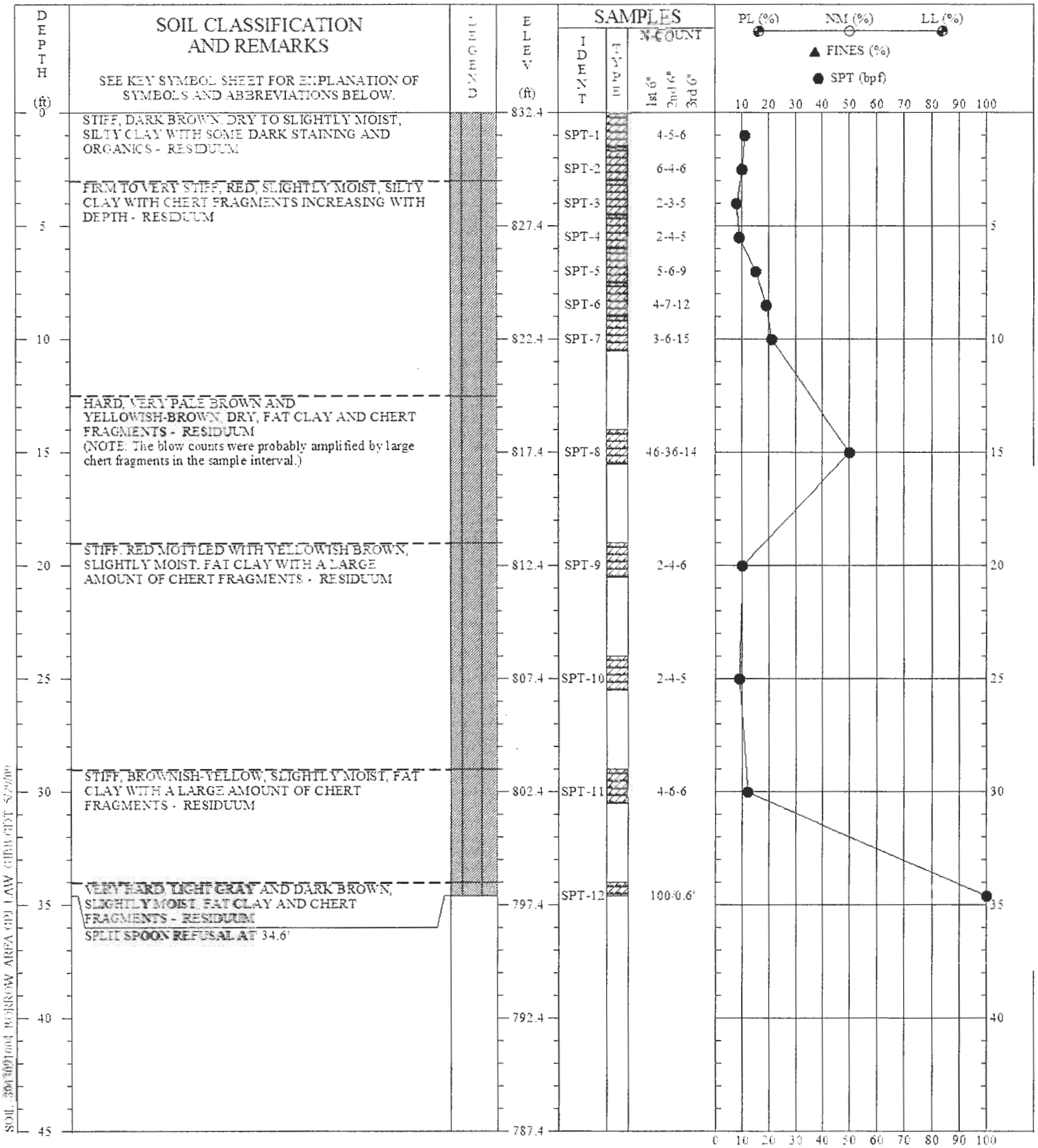
U.S. STANDARD SIEVE SIZE

Reference: The Unified Soil Classification System, Corps of Engineers, U.S. Army Technical Memorandum No. 3-357, Vol. 1, March, 1953 (Revised April, 1960)

KEY TO SYMBOLS AND DESCRIPTIONS

MACTEC

MACTEC Engineering and Consulting of Georgia, Inc.
9725 Cogdill Road
Knoxville, Tennessee 37932
865 588 0544 • Fax 865 588 0026



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

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE.

Driller : Tri-State
Logged By: JET
Checked By: HAB

SOIL TEST BORING RECORD

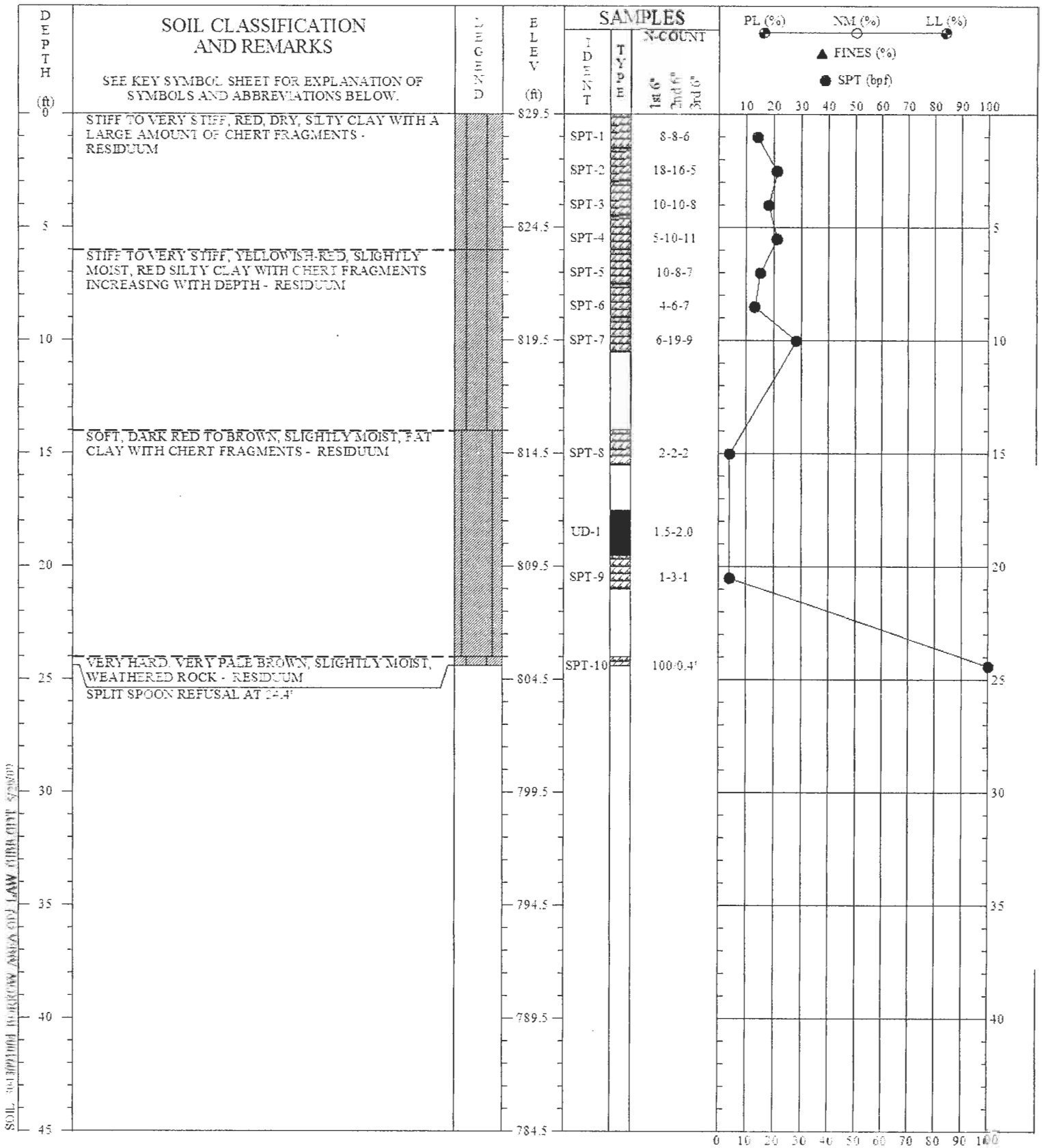
PROJECT: TVA Kingston - Borrow Area

DRILLED: March 10, 2009 **BORING NO.:** B-1

PROJ. NO.: 3043-09-1018-01 **PAGE 1 OF 1**

MACTEC

SOIL_3043091018.GPJ BORROW AREA.GPJ LAW.GDT 5/29/09



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

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE.

Driller : Tri-State	
Logged By: VM	
Checked By: WAL	

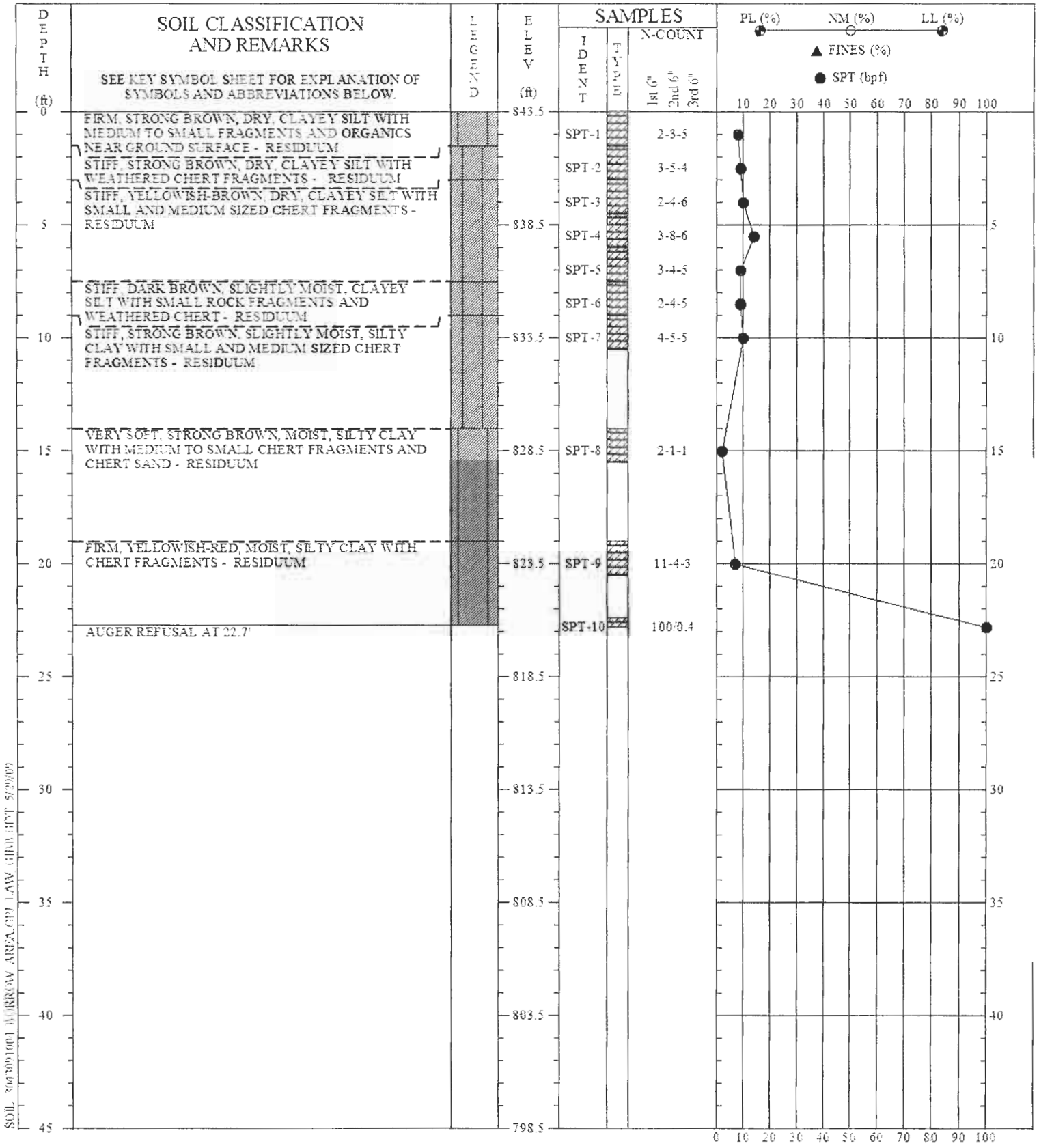
SOIL TEST BORING RECORD

PROJECT: TVA Kingston - Borrow Area

DRILLED: March 12, 2009 **BORING NO.:** B-2

PROJ. NO.: 3043-09-1018-01 **PAGE 1 OF 1**

MACTEC



SOIL 3043091001 BORROW AREA.GPJ LAW_GIBB.GPT 5/20/09

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

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE.

Driller: Tri-State
Logged By: JET

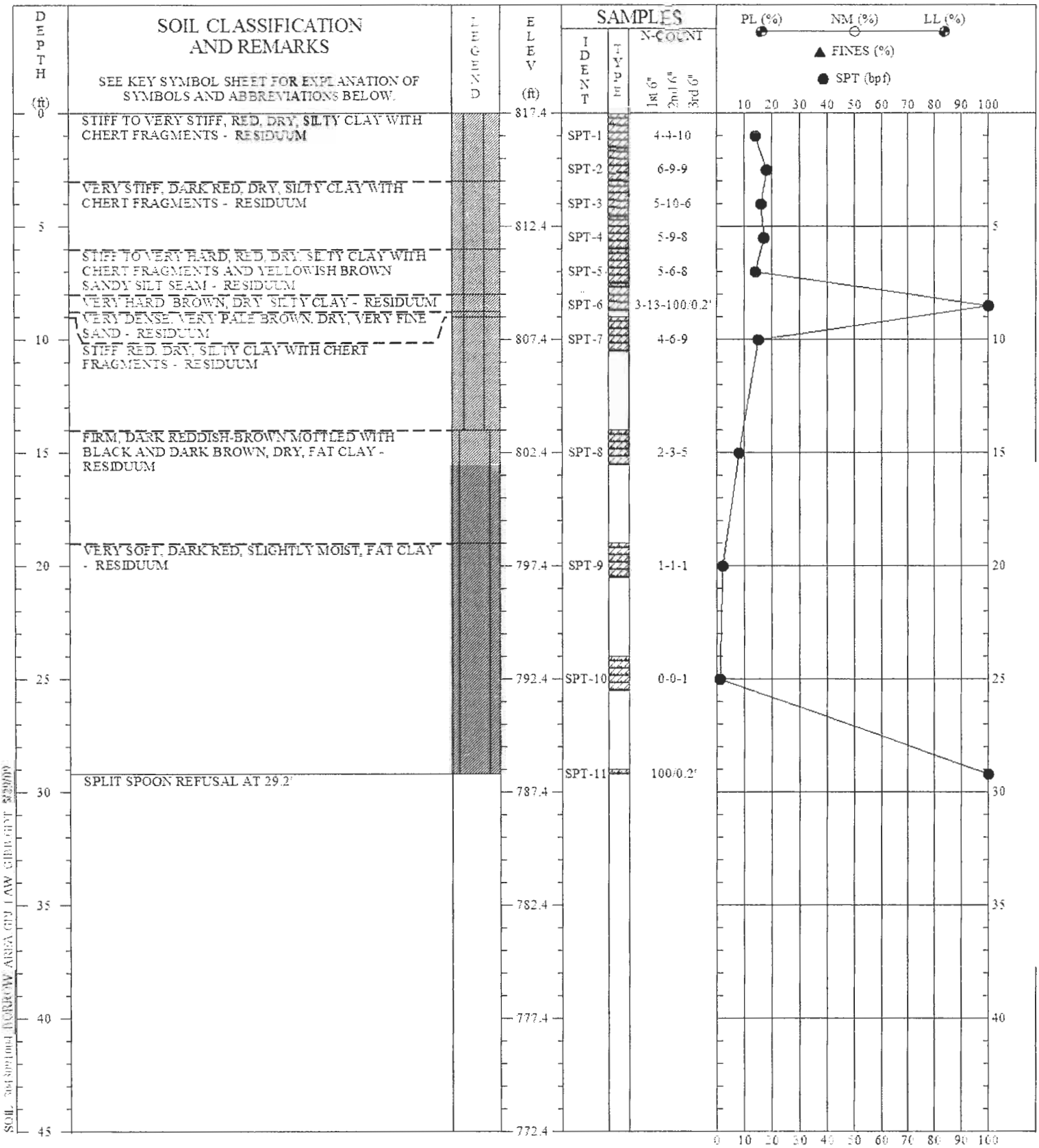
SOIL TEST BORING RECORD

PROJECT: TVA Kingston - Borrow Area

DRILLED: February 26, 2009 **BORING NO.:** B-3

PROJ. NO.: 3043-09-1018-01 **PAGE** 1 **OF** 1

MACTEC



REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER. NO GROUND WATER ENCOUNTERED AT TIME OF EXPLORATION. AUGER AND SPLIT SPOON REFUSAL WAS ENCOUNTERED AT 8.7'. THE BORING WAS OFFSET AND REDRILLED.

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE BORING LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER.

Driller : Tri-State	
Logged By: JET	

SOIL TEST BORING RECORD

PROJECT: TVA Kingston - Borrow Area

DRILLED: March 12, 2009 **BORING NO.:** B-4

PROJ. NO.: 3043-09-1018-01 **PAGE 1 OF 1**

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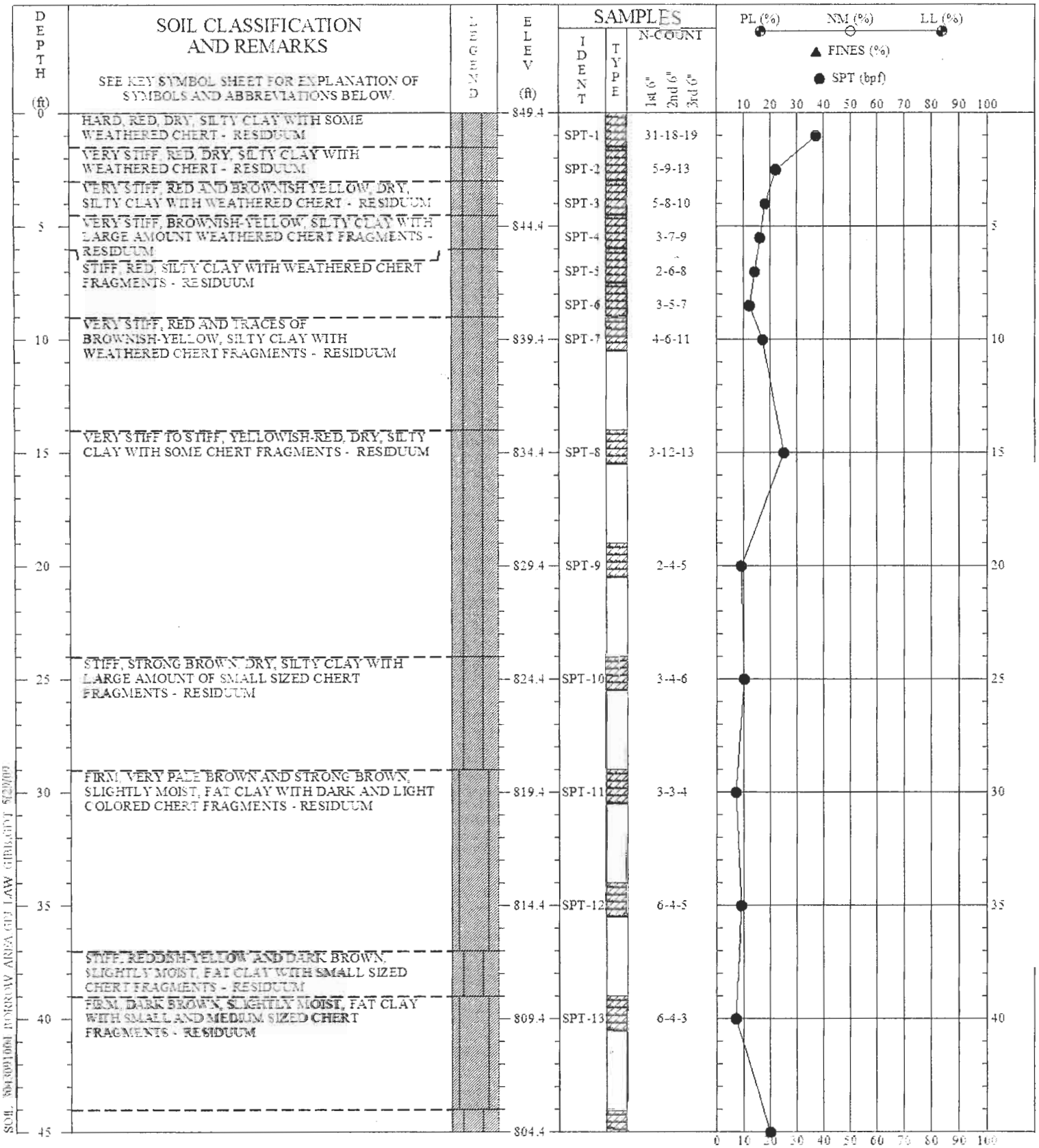


SOIL_3043091018 BORROW AREA GDT LAW GDT 5/20/09

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

THE RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATIONS. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN SOIL AND ROCK ARE APPROXIMATE

Driller :	Tri-State
Logged By:	JET

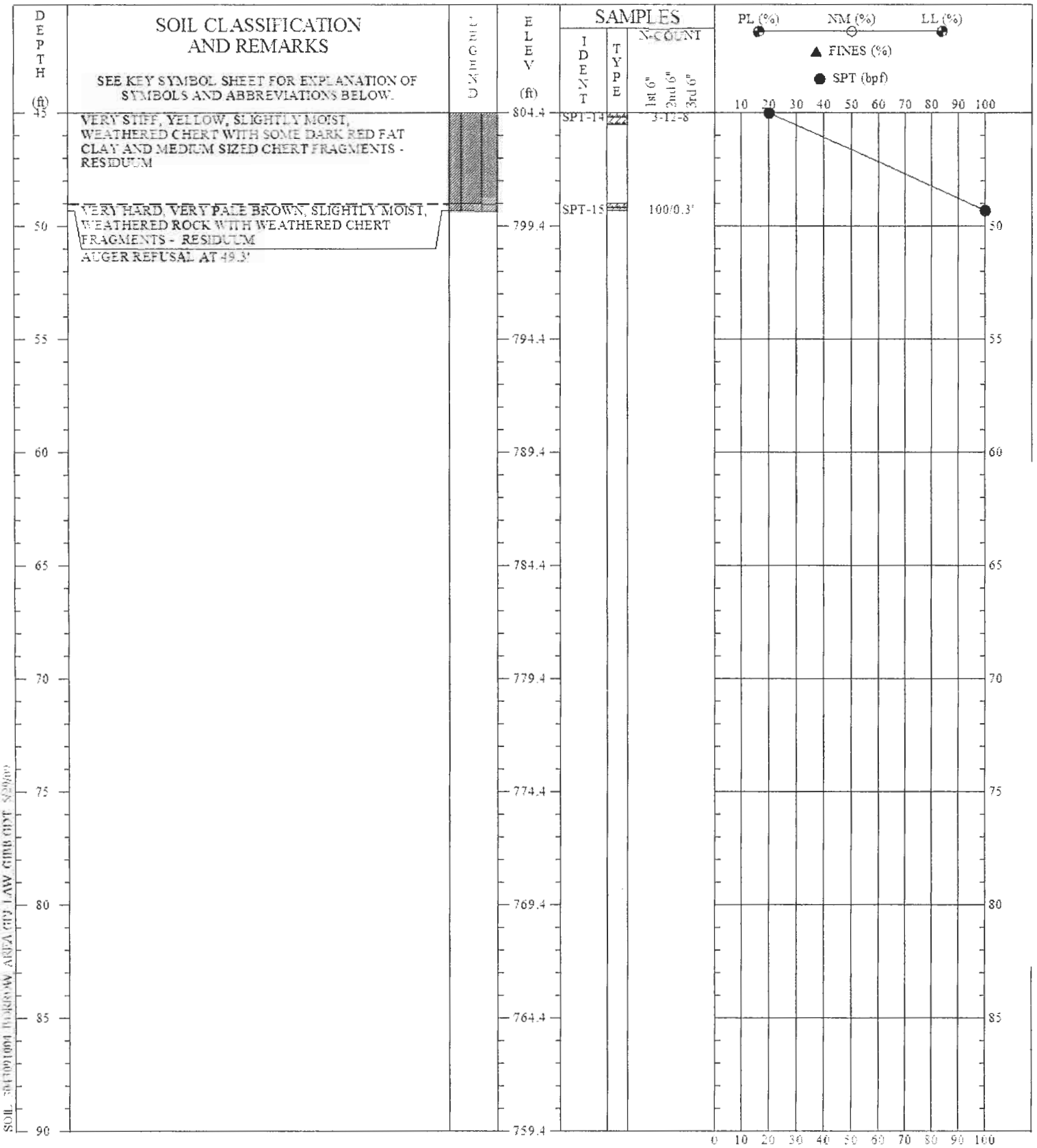
SOIL TEST BORING RECORD

PROJECT: TVA Kingston - Borrow Area

DRILLED: February 27, 2009 **BORING NO.:** B-5

PROJ. NO.: 3043-09-1018-01 **PAGE 1 OF 2**

MACTEC



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

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE.

Driller : Tri-State	
Logged By: JET	
Standard Pen. Wt./Drop	

SOIL TEST BORING RECORD

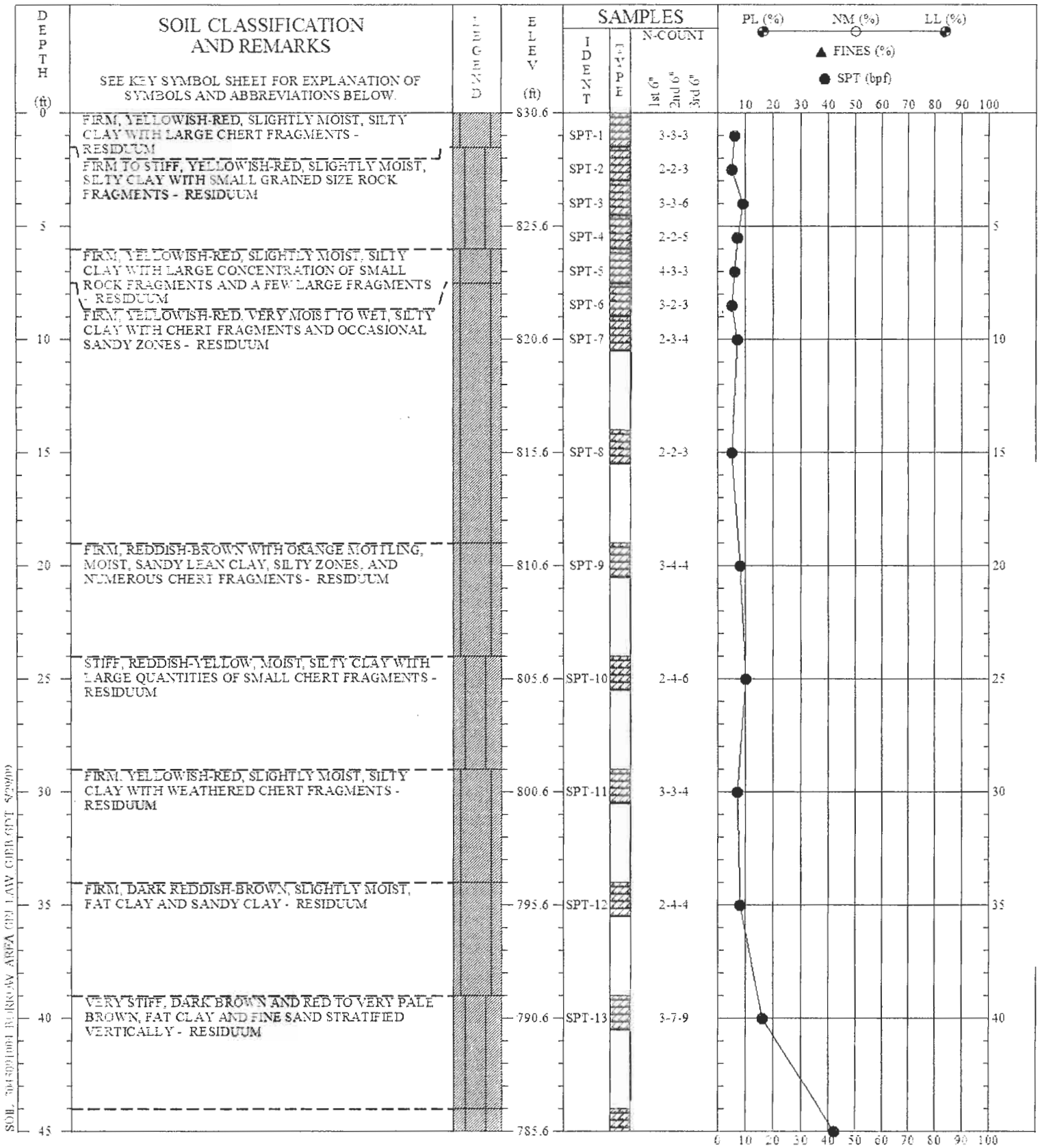
PROJECT: TVA Kingston - Borrow Area

DRILLED: February 27, 2009 **BORING NO.:** B-5

PROJ. NO.: 3043-09-1018-01 **PAGE 2 OF 2**

MACTEC

SOIL - 3043091018 BORROW AREA.GPJ LAW_GINT.GDT 8/20/09



SOIL_3043-09-1018-01 KINGSTON AREA GEOLOGY.GPJ GEO_DOT_STD.GDT 8/20/09

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

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE.

Driller: Tri-State
Logged By: JET

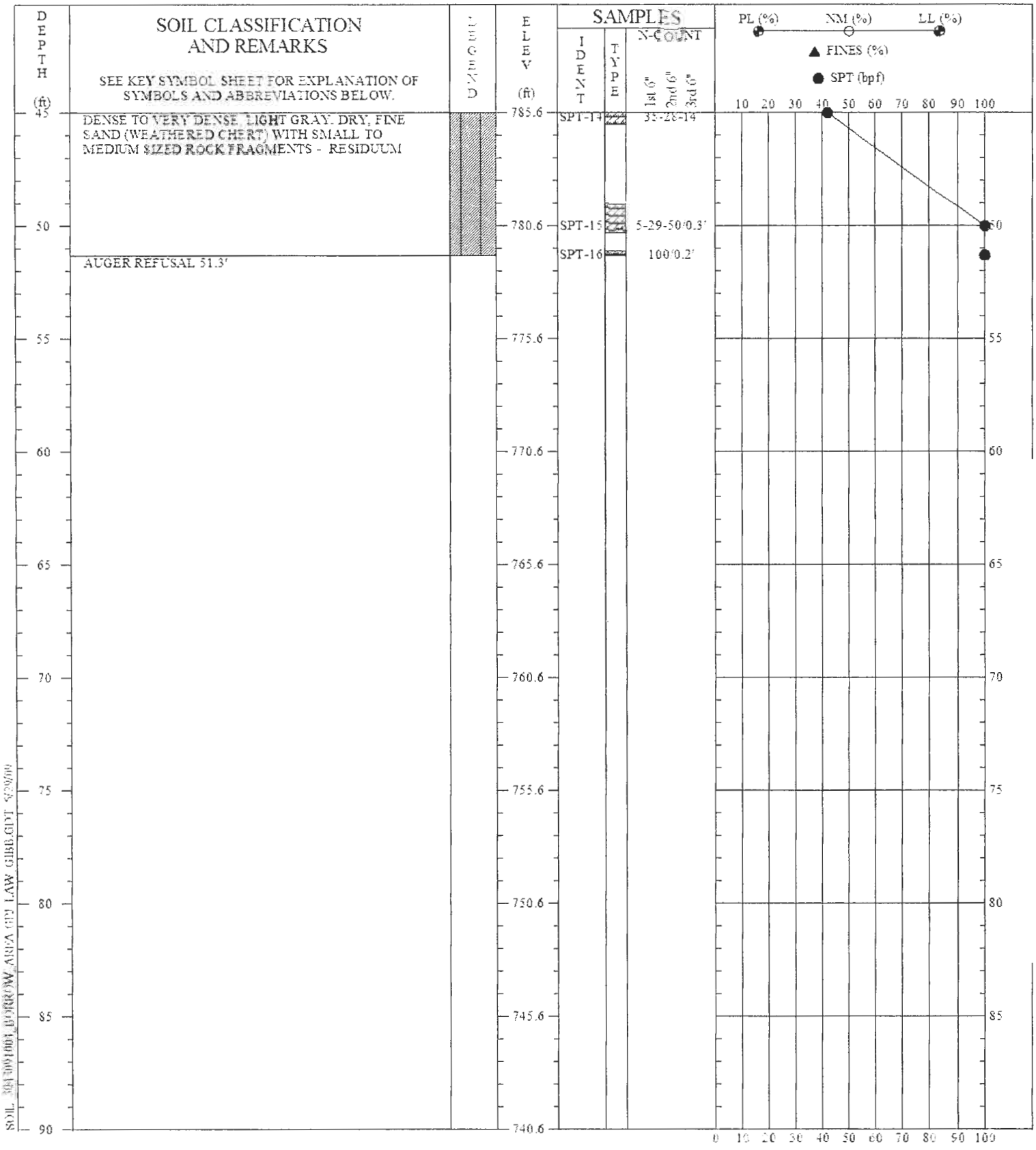
SOIL TEST BORING RECORD

PROJECT: TVA Kingston - Borrow Area

DRILLED: February 26, 2009 **BORING NO.:** B-6

PROJ. NO.: 3043-09-1018-01 **PAGE 1 OF 2**

MACTEC



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

THE RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER.

Driller : Tri-State	
Logged By: JET	

SOIL TEST BORING RECORD

PROJECT: TVA Kingston - Borrow Area

DRILLED: February 26, 2009 **BORING NO.:** B-6

PROJ. NO.: 3043-09-1018-01 **PAGE 2 OF 2**

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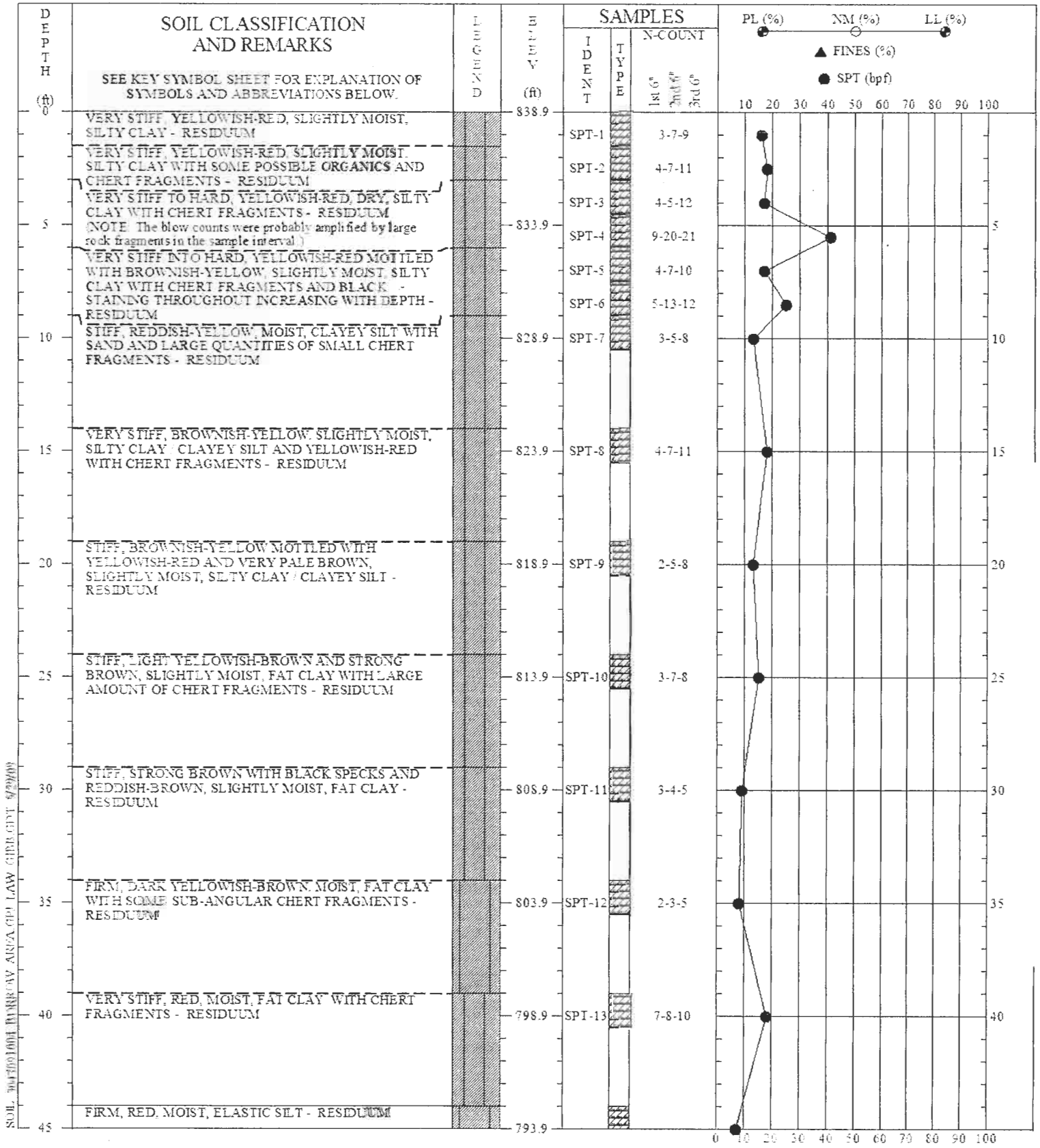


REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER. NO GROUND WATER ENCOUNTERED AT TIME OF EXPLORATION.

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THIS BORING LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE

Driller : Tri-State	
Logged By: JET	

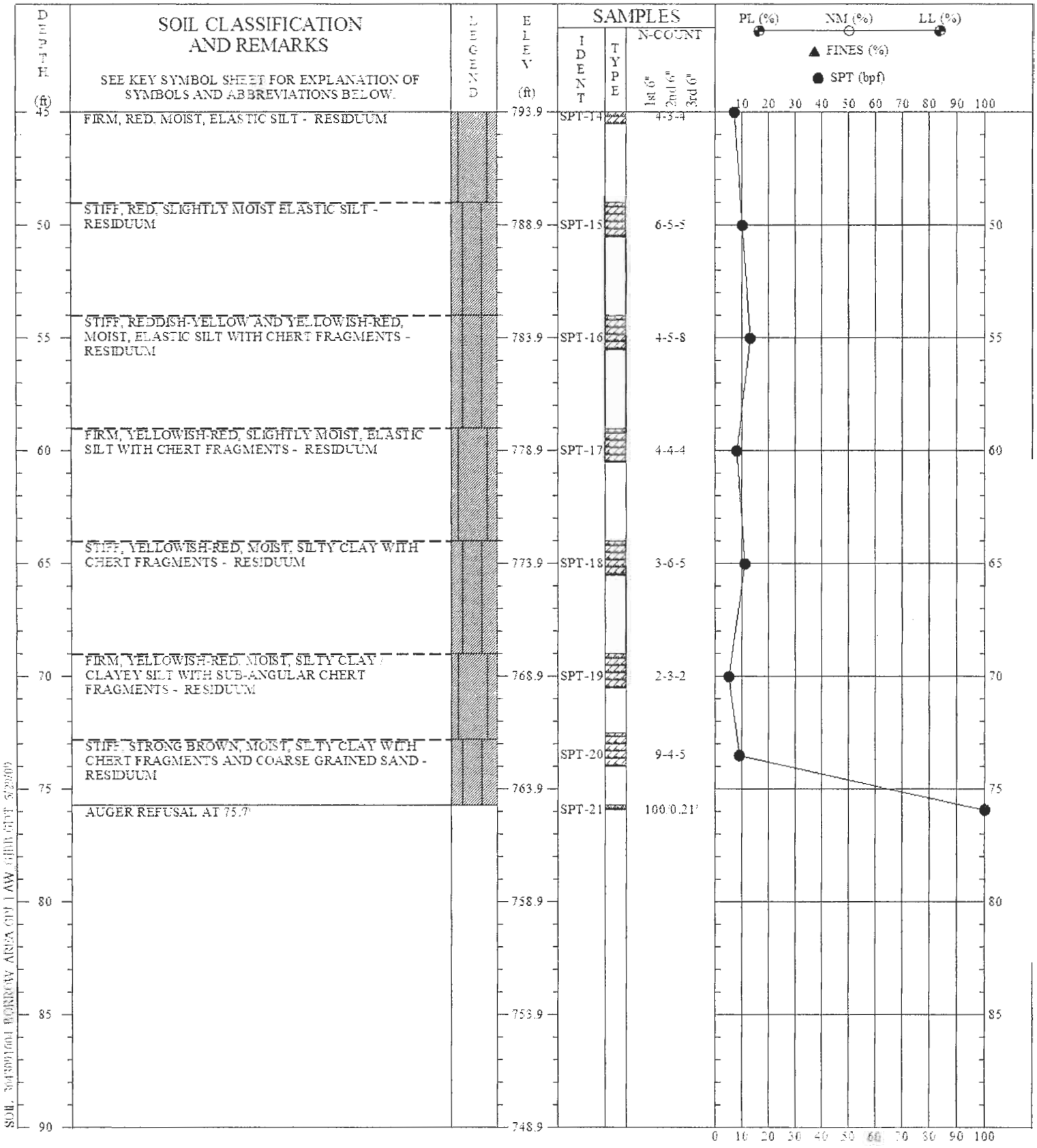
SOIL TEST BORING RECORD

PROJECT: TVA Kingston - Borrow Area

DRILLED: February 26, 2009 **BORING NO.:** B-7

PROJ. NO.: 3043-09-1018-01 **PAGE 1 OF 2**

MACTEC



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

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE.

Driller:	Tri-State
Logged By:	JET

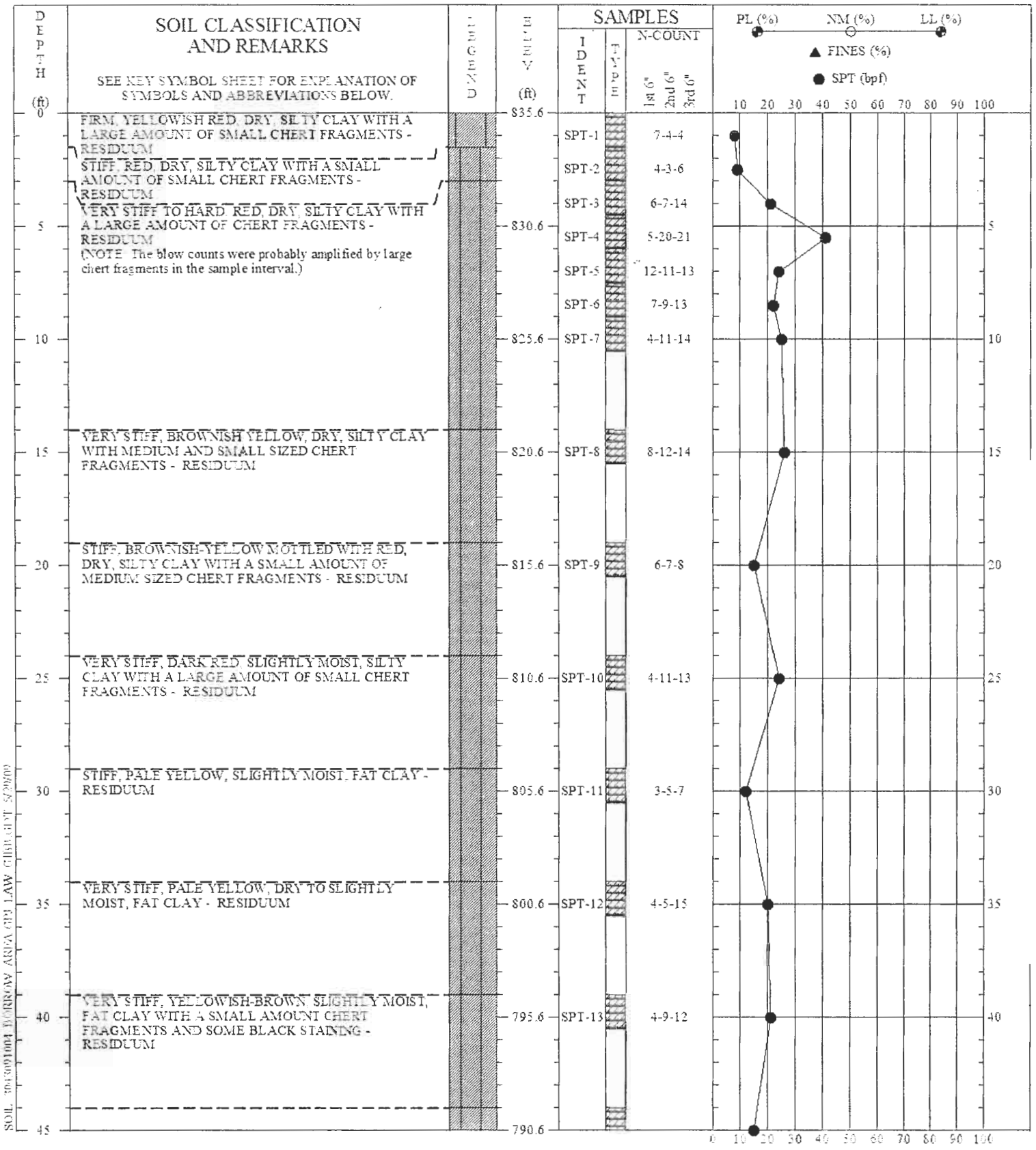
SOIL TEST BORING RECORD

PROJECT: TVA Kingston - Borrow Area

DRILLED: February 26, 2009 **BORING NO.:** B-7

PROJ. NO.: 3043-09-1018-01 **PAGE 2 OF 2**

MACTEC



SOIL_3043-09-1018-01 BORROW AREA.GPJ LAW_GIBBS.GDT 5/29/09

REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER. NO GROUND WATER ENCOUNTERED AT TIME OF EXPLORATION. BORING WAS OFFSET 24' EAST AND 4' IN THE VERTICAL DIRECTION.

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE.

Driller : Tri-State	
Logged By: JET	

SOIL TEST BORING RECORD

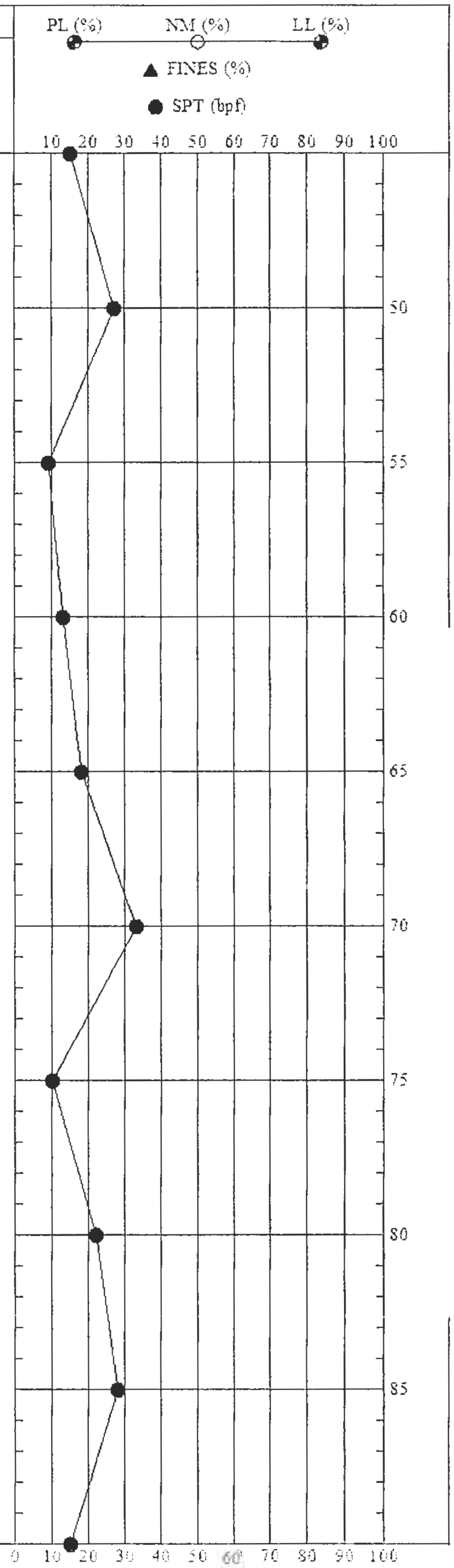
PROJECT: TVA Kingston - Borrow Area

DRILLED: March 11, 2009 **BORING NO.:** B-8

PROJ. NO.: 3043-09-1018-01 **PAGE 1 OF 3**

MACTEC

DEPTH (ft)	SOIL CLASSIFICATION AND REMARKS (SEE KEY SYMBOL SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS BELOW.)	ELEV (ft)	SAMPLES IDENT	N-COUNT (1st 6" - 2nd 6" - 3rd 6")
45	STIFF, YELLOWISH-BROWN, SLIGHTLY MOIST, FAT CLAY WITH A SMALL AMOUNT OF CHERT FRAGMENTS - RESIDUUM	790.6	SPT-14	3-6-9
50	VERY STIFF, DARK YELLOWISH-BROWN SLIGHTLY MOTTLED WITH YELLOWISH-RED, SLIGHTLY MOIST, FAT CLAY WITH A SMALL AMOUNT OF SMALL CHERT FRAGMENTS - RESIDUUM	785.6	SPT-15	5-13-14
55	STIFF, MOTTLED BROWNISH-YELLOW, REDDISH-YELLOW, AND DARK RED, SLIGHTLY MOIST, FAT CLAY - RESIDUUM	780.6	SPT-16	2-4-5
60	STIFF, STRONG BROWN SLIGHTLY MOTTLED WITH VERY PALE BROWN, SLIGHTLY MOIST, FAT CLAY - RESIDUUM	775.6	SPT-17	2-4-9
65	VERY STIFF, YELLOWISH-BROWN AND DARK YELLOWISH-BROWN, MOIST, SILTY CLAY WITH A FEW CHERT FRAGMENTS - RESIDUUM	770.6	SPT-18	2-2-16
70	HARD, VERY PALE BROWN, DRY, SILTY CLAY WITH CHERT FRAGMENTS - RESIDUUM (NOTE: The blow counts were probably amplified by large chert fragments in the sample interval.)	765.6	SPT-19	39-21-12
75	STIFF, REDDISH-BROWN, SLIGHTLY MOIST, SILTY CLAY - RESIDUUM	760.6	SPT-20	4-4-6
80	VERY STIFF, YELLOWISH-RED, MOIST, SILTY CLAY WITH A LARGE AMOUNT OF SMALL DARK COLORED CHERT FRAGMENTS - RESIDUUM	755.6	SPT-21	27-10-12
85	VERY STIFF, BROWNISH-YELLOW, VERY MOIST, SILTY CLAY - RESIDUUM	750.6	SPT-22	10-14-14
90		745.6		



REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER. NO GROUND WATER ENCOUNTERED AT TIME OF EXPLORATION. BORING WAS OFFSET 24' EAST AND 4' IN THE VERTICAL DIRECTION.

SOIL TEST BORING RECORD

PROJECT: TVA Kingston - Borrow Area

DRILLED: March 11, 2009 **BORING NO.:** B-8

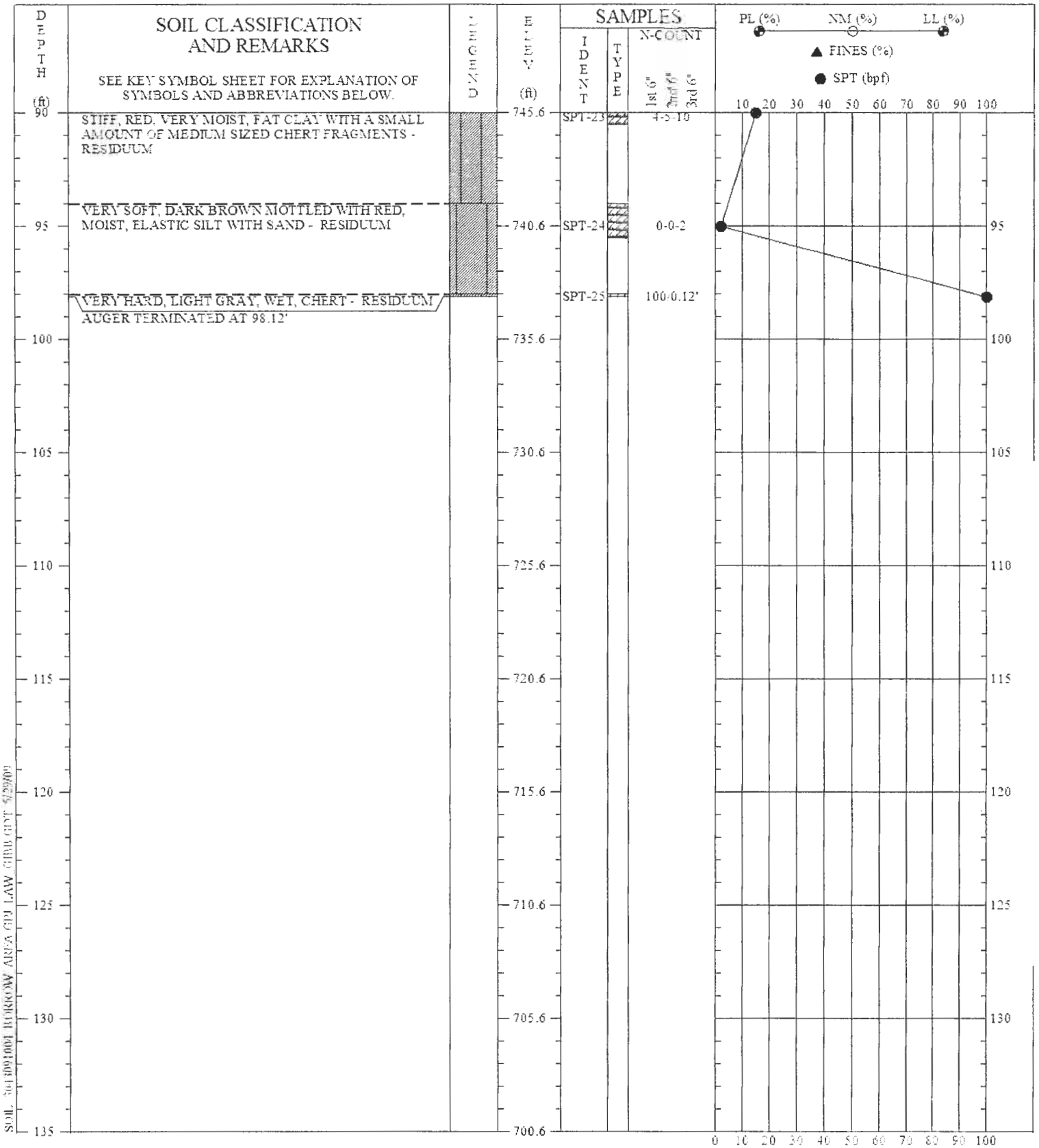
PROJ. NO.: 3043-09-1018-01 **PAGE 2 OF 3**

MACTEC

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE

Driller : Tri-State
Logged By: JET

SOIL 3043091018 BORROW AREA.GPJ LAW_CHIB.GDT 5/29/09



REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER. NO GROUND WATER ENCOUNTERED AT TIME OF EXPLORATION. BORING WAS OFFSET 24' EAST AND 4' IN THE VERTICAL DIRECTION.

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE

Driller : Tri-State	
Logged By: JET	

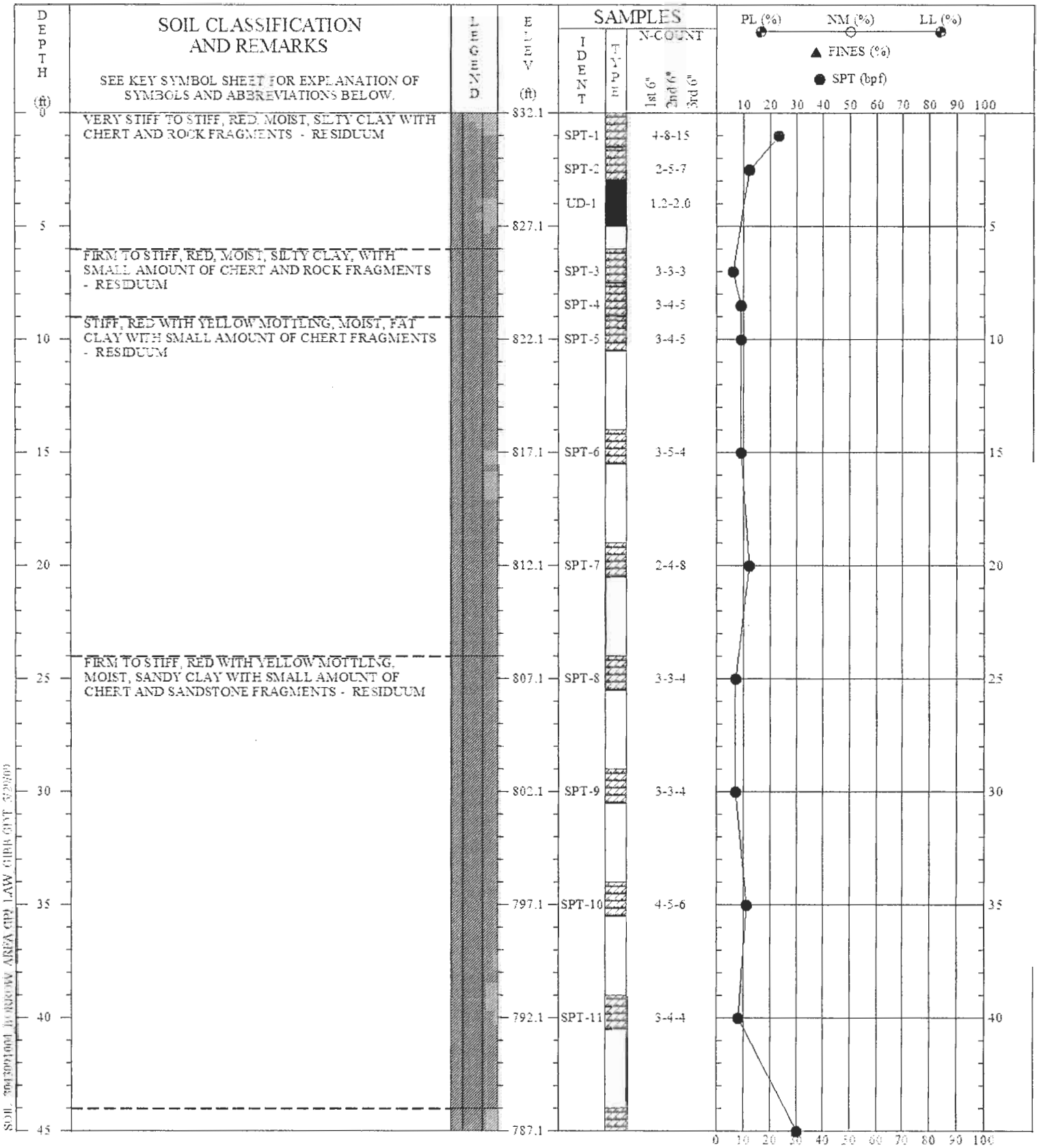
SOIL TEST BORING RECORD

PROJECT: TVA Kingston - Borrow Area

DRILLED: March 11, 2009 **BORING NO.:** B-8

PROJ. NO.: 3043-09-1018-01 **PAGE 3 OF 3**

MACTEC



REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER. NO GROUND WATER ENCOUNTERED AT TIME OF EXPLORATION. BORING OFFSET 30' WEST DUE TO PONDED WATER AT ORGINIAL STAKED LOCATION.

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE.

Driller : Tri-State
Logged By: VM

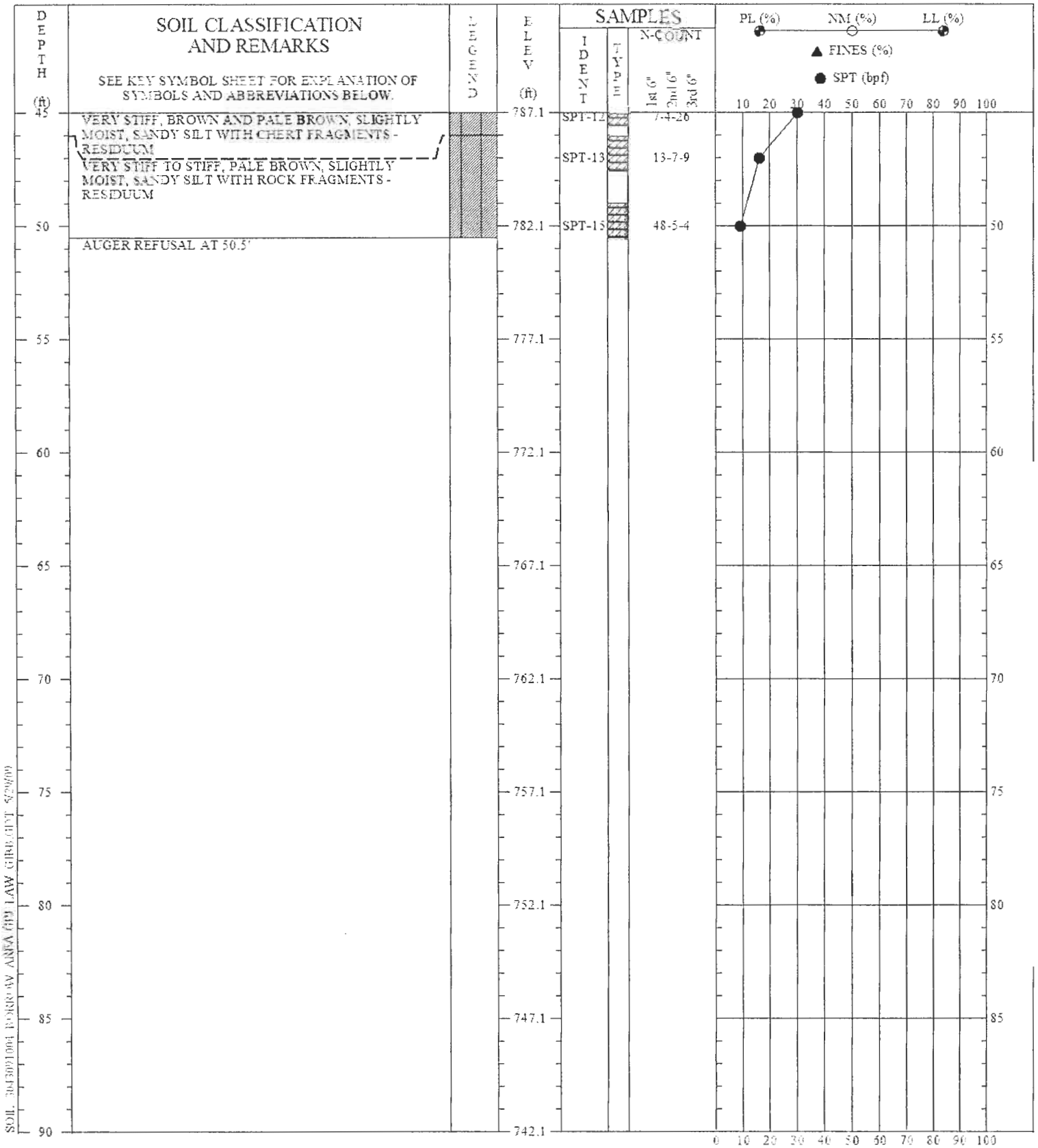
SOIL TEST BORING RECORD

PROJECT: TVA Kingston - Borrow Area

DRILLED: March 3, 2009 **BORING NO.:** B-9

PROJ. NO.: 3043-09-1018-01 **PAGE 1 OF 2**

MACTEC



SOIL_3043091004 BORROW AREA.GPJ LAW_GDT_5/29/09

REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER. NO GROUND WATER ENCOUNTERED AT TIME OF EXPLORATION. BORING OFFSET 30' WEST DUE TO PONDED WATER AT ORGINIAL STAKED LOCATION.

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. THE INTERFACES BETWEEN STRATA ARE APPROXIMATE.

Driller : Tri-State	
Logged By: VM	

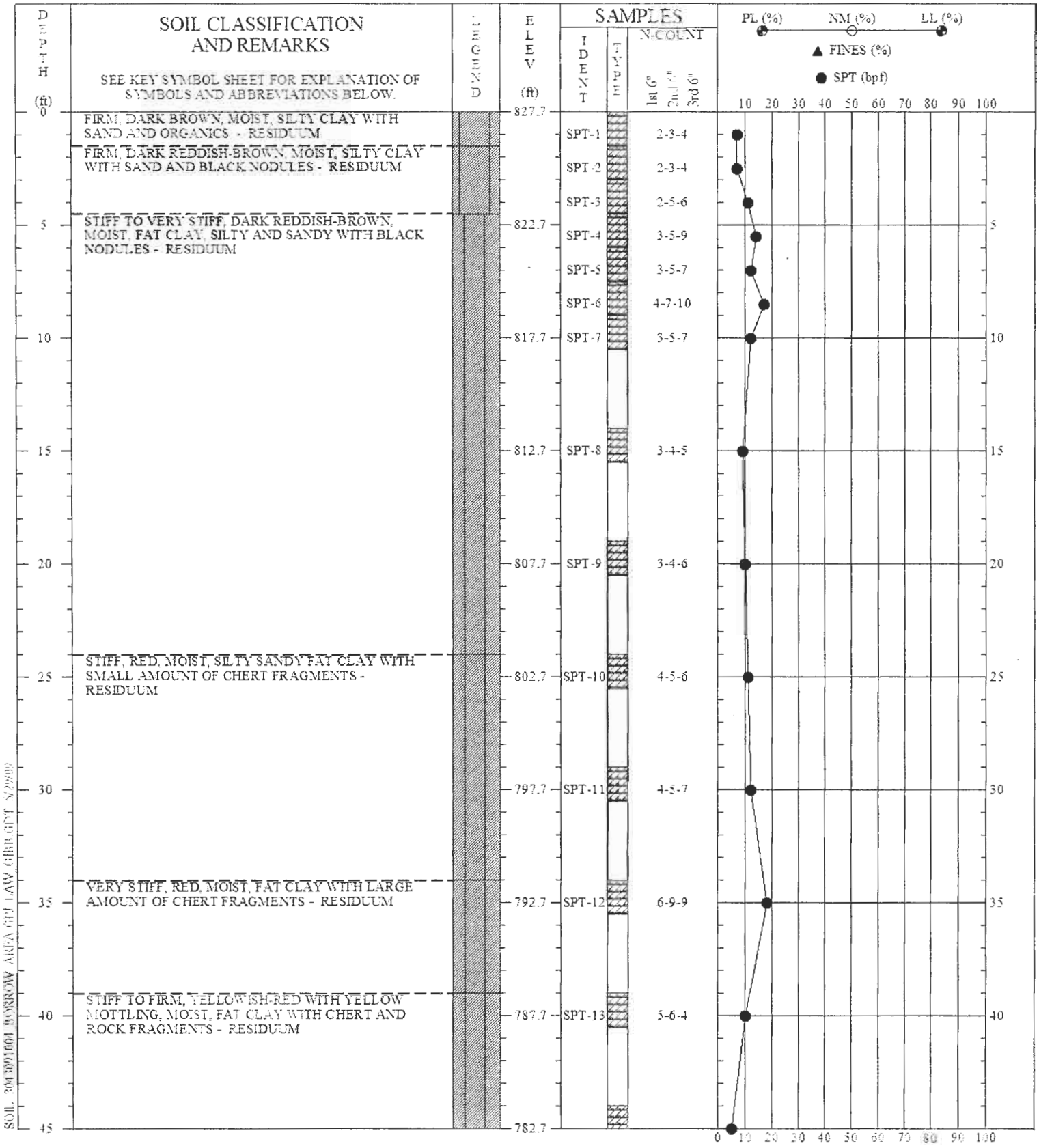
SOIL TEST BORING RECORD

PROJECT: TVA Kingston - Borrow Area

DRILLED: March 3, 2009 **BORING NO.:** B-9

PROJ. NO.: 3043-09-1018-01 **PAGE 2 OF 2**

MACTEC



SOIL 3043091004 BORROW AREA GDT LAW GINT 4/2009

REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER. NO GROUND WATER ENCOUNTERED AT TIME OF EXPLORATION. BORING OFFSET 25' SOUTH DUE TO OVERHEAD POWER LINES.

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE.

Driller: Tri-State
Logged By: VM

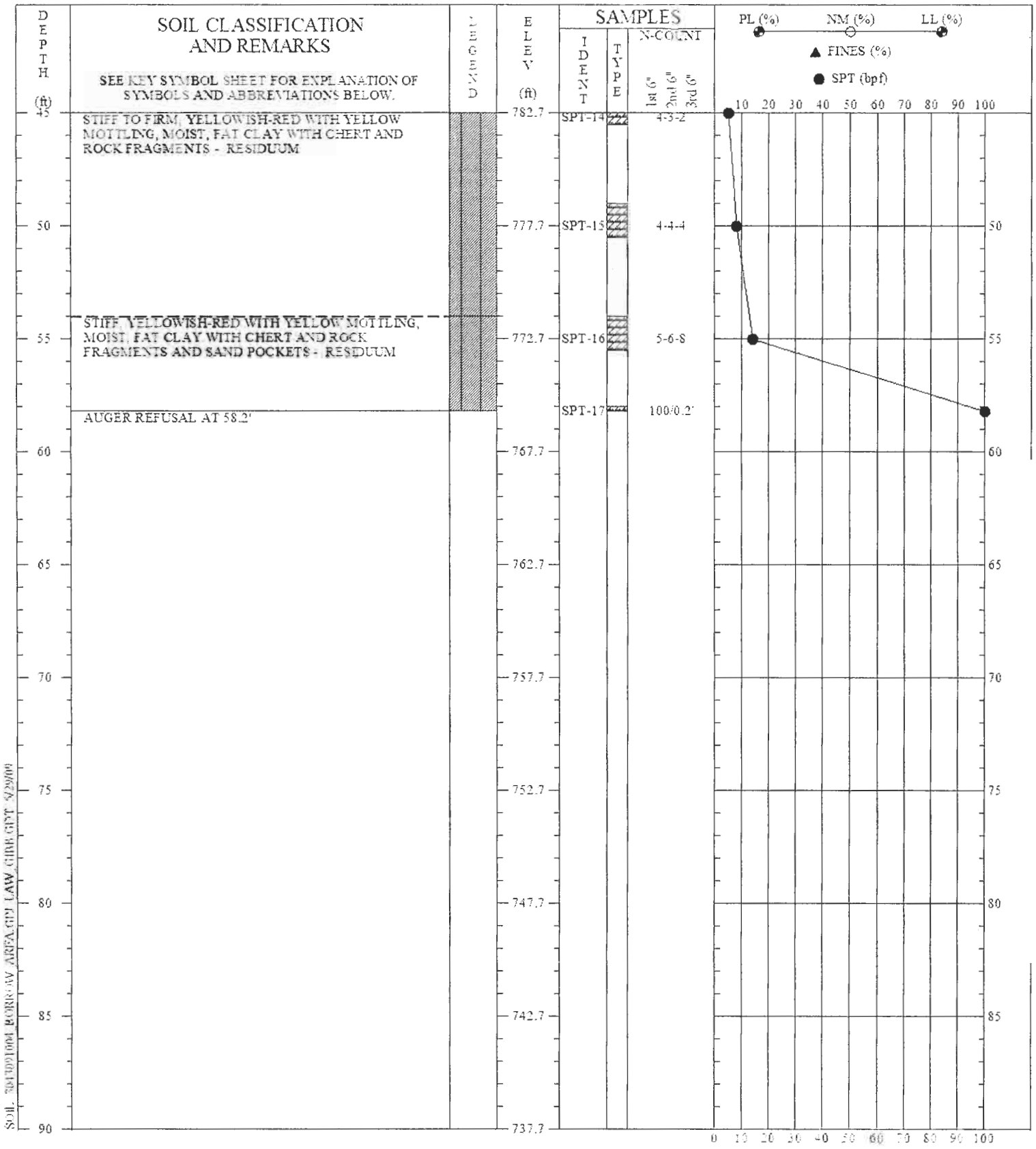
SOIL TEST BORING RECORD

PROJECT: TVA Kingston - Borrow Area

DRILLED: March 3, 2009 **BORING NO.:** B-11

PROJ. NO.: 3043-09-1018-01 **PAGE** 1 **OF** 2

MACTEC



SOIL_3043091004 BORROW AREA.GPJ LAW_GINT.GDT 4/29/09

REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER. NO GROUND WATER ENCOUNTERED AT TIME OF EXPLORATION. BORING OFFSET 25' SOUTH DUE TO OVERHEAD POWER LINES.

THE RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE.

Driller : Tri-State	
Logged By: VM	

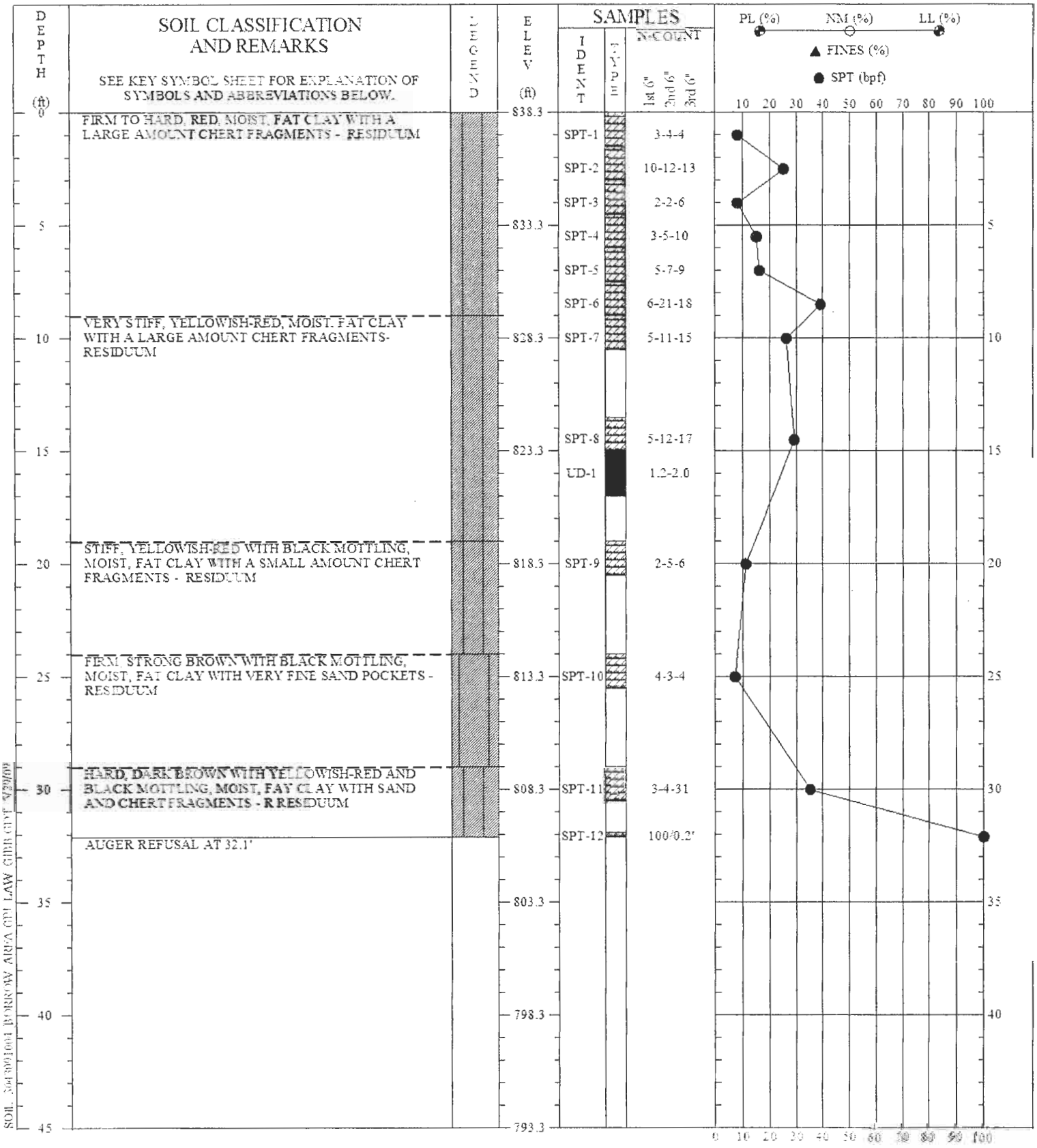
SOIL TEST BORING RECORD

PROJECT: TVA Kingston - Borrow Area

DRILLED: March 3, 2009 **BORING NO.:** B-11

PROJ. NO.: 3043-09-1018-01 **PAGE 2 OF 2**

MACTEC



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

THIS LOG IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER.

Driller : Tri-State
Logged By: VM

SOIL TEST BORING RECORD

PROJECT: TVA Kingston - Borrow Area

DRILLED: March 3, 2009 **BORING NO.:** B-12

PROJ. NO.: 3043-09-1018-01 **PAGE** 1 **OF** 1

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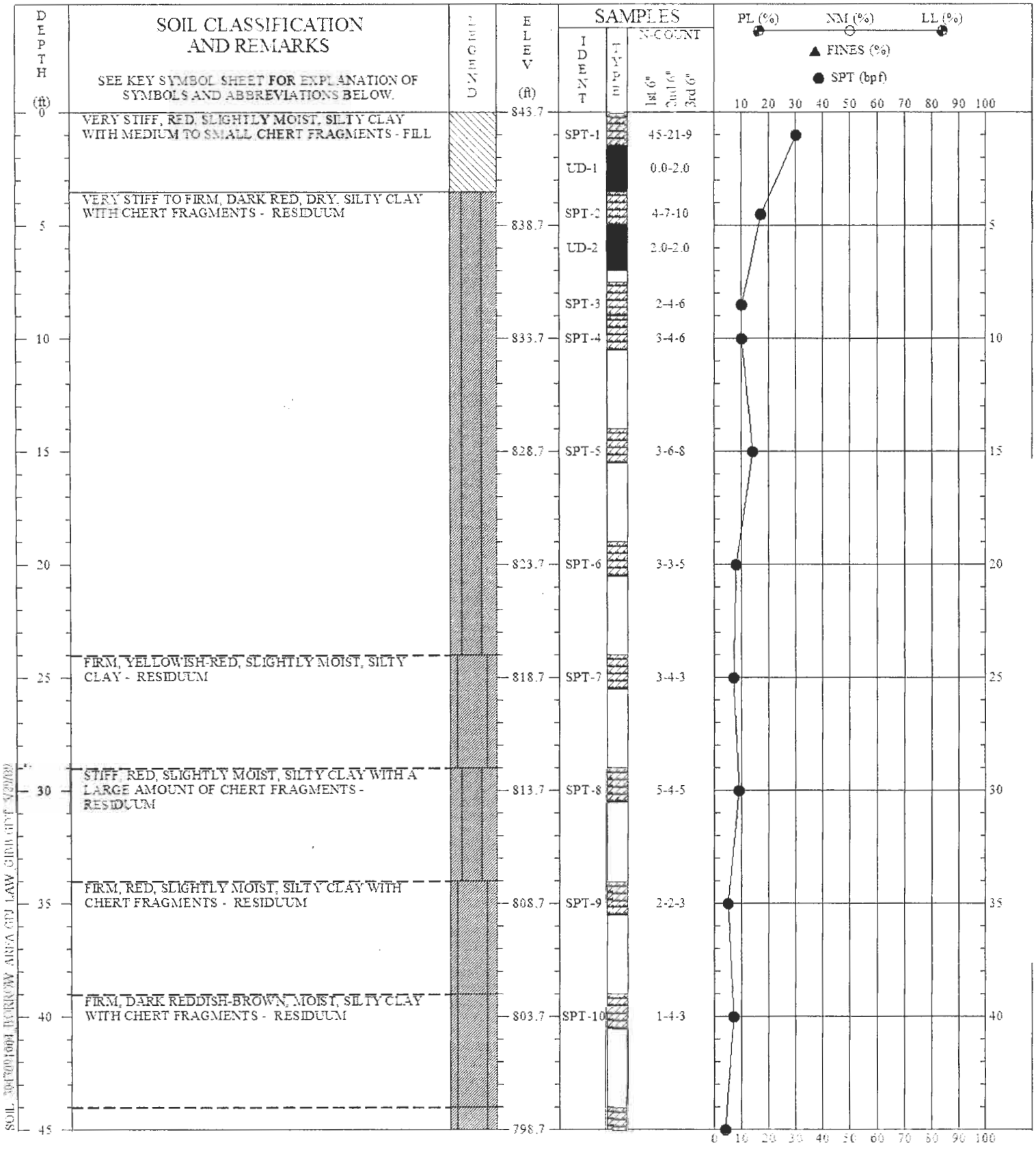


REMARKS: STANDARD PENETRATION RESISTANCE TESTING PERFORMED USING AN AUTOMATIC HAMMER. NO GROUND WATER ENCOUNTERED AT TIME OF EXPLORATION.

THE RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES PRESENTED AS BEING APPROXIMATE

Driller :	Tri-State
Logged By:	JET

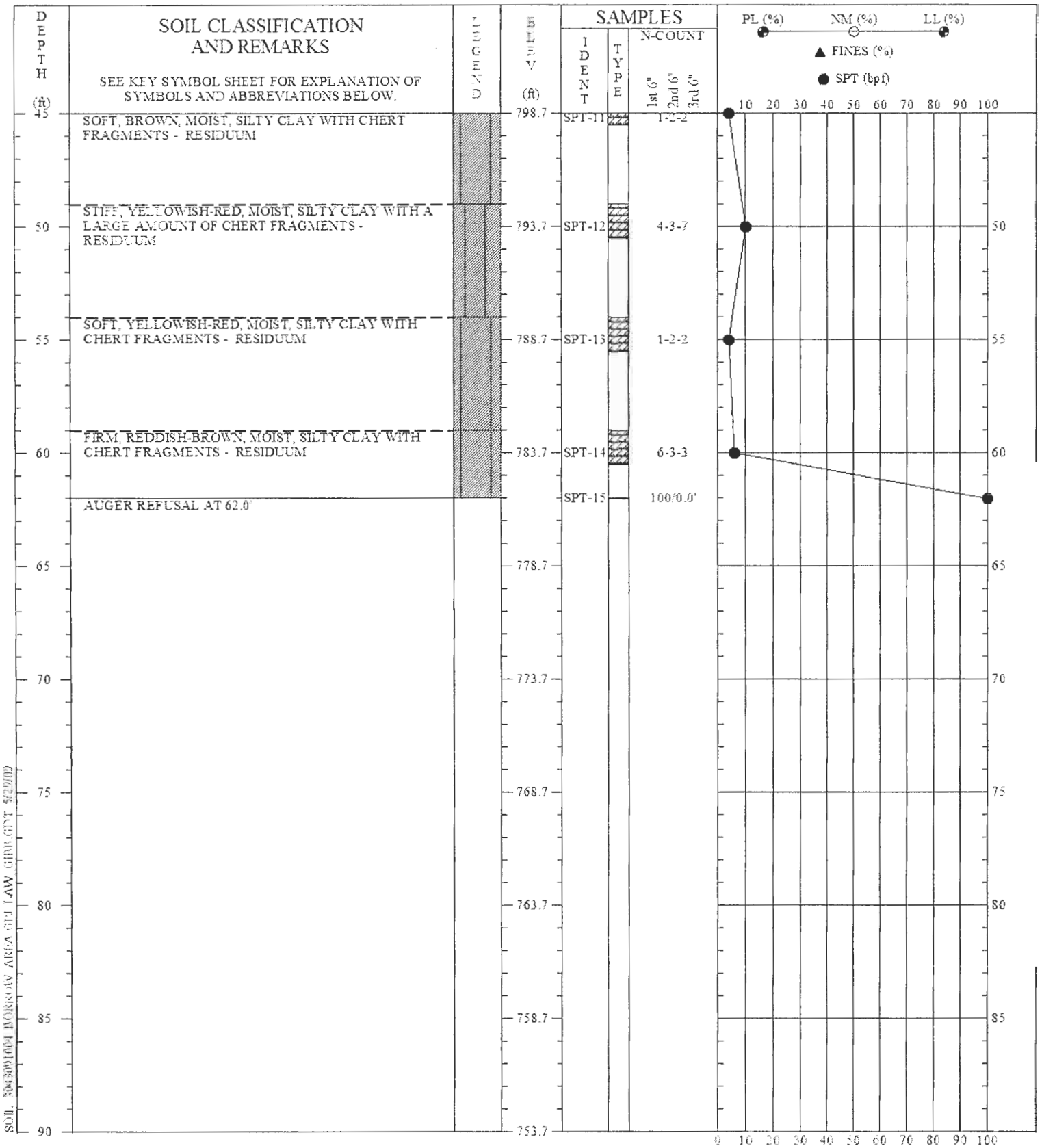
SOIL TEST BORING RECORD

PROJECT: TVA Kingston - Borrow Area

DRILLED: February 27, 2009 **BORING NO.:** B-13

PROJ. NO.: 3043-09-1018-01 **PAGE 1 OF 2**

MACTEC



SOIL 3043091004 BORROW AREA GPJ LAW_GINT.GDT 5/20/09

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

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BETWEEN STRATA ARE APPROXIMATE

Driller : Tri-State
Logged By: JET

SOIL TEST BORING RECORD

PROJECT: TVA Kingston - Borrow Area

DRILLED: February 27, 2009 **BORING NO.:** B-13

PROJ. NO.: 3043-09-1018-01 **PAGE 2 OF 2**

MACTEC

APPENDIX C

LABORATORY TEST PROCEDURES

MOISTURE CONTENT TEST RESULTS

PARTICLE-SIZE ANALYSIS TEST RESULTS

ATTERBERG LIMITS TEST RESULTS

SPECIFIC GRAVITY TEST RESULTS

MOISTURE CONTENT AND UNIT WEIGHT (UD) TEST RESULTS

STANDARD PROCTOR TEST RESULTS

PERMEABILITY (CONSTANT HEAD) 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.

Atterberg Limits

Originally, the Atterberg Limits consisted of seven "limits of consistency" of fine-grained soils. In current engineering usage, the term usually refers only to the liquid limit (LL) and plastic limit (PL). The LL (between the liquid and plastic states) is the water content at which a trapezoidal groove of specified shape, cut in moist soil held in a special cup, is closed after 25 taps on a hard rubber plate. The PL (between plastic and semi-solid states) is the water content at which the soil crumbles when rolled into threads of 1/8-inch in diameter.

The LL has been found to be proportional to the compressibility of the normally consolidated soil. The Plasticity Index (PI) is the calculated difference in water contents between the LL and PL. Together the LL and PI are used to classify silts and clays according to the Unified Soils Classification System (ASTM D 2487). The PI is used to predict the potential for volume changes in soils. The LL, PL, and PI are determined in accordance with ASTM D 4318.

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. The percentage of clay, silt,

sand, and gravel which are given on the individual particle size analysis sheets presented later in this appendix, were obtained on particle size boundaries in accordance with AASHTO M145-94 (1995).

Specific Gravity

The specific gravity of soil solids is the ratio of the mass of a unit volume of soil solids to the mass of the same volume of gas-free distilled water at 20°C. The test method for determining the specific gravity of soil solids that passes the 4.75-mm (No. 4) sieve using a water pycnometer is described in ASTM D 854, Method B, "Test Methods for Specific Gravity of Soil Solids by Water Pycnometer".

Compaction Tests (Moisture-Density Relationship)

Compaction tests are performed on representative soil samples to determine the maximum dry density and optimum moisture content. The results of the tests are used in conjunction with other tests to determine engineering properties relating to settlement, bearing capacity, shear strength, and permeability. The results may also be used as a standard to determine the percent compaction of any soil embankment.

The two most commonly used compaction tests are the standard Proctor test and the modified Proctor test. They are performed in accordance with ASTM D 698 and D 1557, respectively. Generally, the standard Proctor compaction test is run on samples from building areas and areas where moderate loads are anticipated. The modified Proctor compaction test is generally used for analyses of highways and other areas where large building loads are expected. Both tests have three procedures, depending upon soil particle size:

Test	Procedure	Hammer Weight (Pounds)	Hammer Fall (Inches)	Mold Diameter (Inches)	Screen Size (Material Finer Than)	Number of Layers	Number of Blows per Layer
Standard (D 698)	A	5.5	12	4	No. 4 sieve	3	25
	B	5.5	12	4	No. 3/8" sieve	3	25
	C	5.5	12	6	3/4" sieve	3	56
Modified (D 1557)	A	10	18	4	No. 4 sieve	5	25
	B	10	18	4	No. 3/8" sieve	5	25
	C	10	18	6	3/4" sieve	5	56

Test results are presented as a curve depicting dry unit weight versus moisture content. The compaction method used and any deviations from the recommended procedures are noted in the report.

Constant Head Permeability Test

The test was performed on remolded samples. 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 a confining pressure of 10 psi. Upon completion of consolidation, a constant head permeability test was performed.

TABLE C-1
Index Property and Moisture-Density Test Results
TVA Kingston - Borrow Area
MACTEC Project 3043091018/01

							Atterberg Limits					
Boring Number	Sample Depth (Feet)	Sample Type	Natural Moisture Content, %	Dry Unit Weight, pcf	Optimum Moisture Content, %	Maximum Dry Density, pcf	Liquid Limit	Plastic Limit	Plasticity Index	USCS	Percent Finer Than No. 200 Sieve	Specific Gravity
B-2	17.5 - 19.5	UD	53.2	80.2	-	-	-	-	-	-	-	-
B-3	0.0 - 10.0	BULK	17.5	-	16.5	111.8	35	25	10	ML	57.1	2.77
B-3	0.0 - 1.5	SPT	21.9	-	-	-	-	-	-	-	-	-
B-3	1.5 - 3.0	SPT	18.7	-	-	-	-	-	-	-	-	-
B-3	3.0 - 4.5	SPT	21.0	-	-	-	-	-	-	-	-	-
B-3	4.5 - 6.0	SPT	16.9	-	-	-	-	-	-	-	-	-
B-3	6.0 - 7.5	SPT	21.5	-	-	-	-	-	-	-	-	-
B-3	7.5 - 9.0	SPT	20.2	-	-	-	-	-	-	-	-	-
B-3	9.0 - 10.5	SPT	25.7	-	-	-	-	-	-	-	-	-
B-3	10.0 - 20.0	BULK	31.8	-	17.2	109.0	36	20	16	CL	78.0	2.78
B-3	14.0 - 15.5	SPT	24.3	-	-	-	-	-	-	-	-	-
B-3	19.0 - 20.5	SPT	32.3	-	-	-	-	-	-	-	-	-
B-5	0.0 - 1.5	SPT	24.0	-	-	-	-	-	-	-	-	-
B-5	1.5 - 3.0	SPT	27.1	-	-	-	-	-	-	-	-	-
B-5	3.0 - 4.5	SPT	23.1	-	-	-	-	-	-	-	-	-
B-5	4.5 - 6.0	SPT	22.0	-	-	-	-	-	-	-	-	-
B-5	6.0 - 7.5	SPT	29.4	-	-	-	-	-	-	-	-	-
B-5	7.5 - 9.0	SPT	26.8	-	-	-	-	-	-	-	-	-
B-5	9.0 - 10.5	SPT	24.2	-	-	-	-	-	-	-	-	-
B-5	10.0 - 29.0	BULK	24.0	-	18.5	107.7	44	22	22	CL	65.1	2.74
B-5	14.0 - 15.5	SPT	22.2	-	-	-	-	-	-	-	-	-
B-5	19.0 - 20.5	SPT	24.8	-	-	-	-	-	-	-	-	-
B-5	24.0 - 25.5	SPT	31.5	-	-	-	-	-	-	-	-	-
B-5	29.0 - 30.5	SPT	25.8	-	-	-	-	-	-	-	-	-
B-5	30.0 - 49.0	BULK	28.2	-	19.6	105.8	51	27	24	CH	66.0	2.74

TABLE C-1
Index Property and Moisture-Density Test Results
TVA Kingston - Borrow Area
MACTEC Project 3043091018/01

							Atterberg Limits					
Boring Number	Sample Depth (Feet)	Sample Type	Natural Moisture Content, %	Dry Unit Weight, pcf	Optimum Moisture Content, %	Maximum Dry Density, pcf	Liquid Limit	Plastic Limit	Plasticity Index	USCS	Percent Finer Than No. 200 Sieve	Specific Gravity
B-5	34.0 - 35.5	SPT	24.4	-	-	-	-	-	-	-	-	-
B-5	39.0 - 40.5	SPT	25.5	-	-	-	-	-	-	-	-	-
B-5	44.0 - 45.5	SPT	21.6	-	-	-	-	-	-	-	-	-
B-5	49.0 - 49.3	SPT	6.1	-	-	-	-	-	-	-	-	-
B-7	0.0 - 1.5	SPT	38.8	-	-	-	-	-	-	-	-	-
B-7	1.5 - 3.0	SPT	39.4	-	-	-	-	-	-	-	-	-
B-7	3.0 - 4.5	SPT	34.7	-	-	-	-	-	-	-	-	-
B-7	4.5 - 6.0	SPT	21.7	-	-	-	-	-	-	-	-	-
B-7	6.0 - 7.5	SPT	29.5	-	-	-	-	-	-	-	-	-
B-7	7.5 - 9.0	SPT	30.7	-	-	-	-	-	-	-	-	-
B-7	9.0 - 10.5	SPT	27.0	-	-	-	-	-	-	-	-	-
B-7	14.0 - 15.5	SPT	23.5	-	-	-	-	-	-	-	-	-
B-7	19.0 - 20.5	SPT	38.2	-	-	-	-	-	-	-	-	-
B-7	24.0 - 25.5	SPT	28.8	-	-	-	-	-	-	-	-	-
B-7	24.0 - 34.0	BULK	34.9	-	24.0	96.2	52	29	23	CH	81.7	2.74
B-7	29.0 - 30.5	SPT	42.3	-	-	-	-	-	-	-	-	-
B-7	34.0 - 35.5	SPT	39.3	-	-	-	-	-	-	-	-	-
B-7	39.0 - 40.5	SPT	28.9	-	-	-	-	-	-	-	-	-
B-7	44.0 - 45.5	SPT	50.2	-	-	-	-	-	-	-	-	-
B-7	44.0 - 54.0	BULK	33.7	-	23.3	98.3	55	30	25	MH	73.3	2.74
B-7	49.0 - 50.5	SPT	43.1	-	-	-	-	-	-	-	-	-
B-7	54.0 - 55.5	SPT	30.5	-	-	-	-	-	-	-	-	-
B-7	59.0 - 60.5	SPT	38.6	-	-	-	-	-	-	-	-	-
B-7	64.0 - 65.5	SPT	25.1	-	-	-	-	-	-	-	-	-
B-7	69.0 - 70.5	SPT	39.2	-	-	-	-	-	-	-	-	-

TABLE C-1
Index Property and Moisture-Density Test Results
TVA Kingston - Borrow Area
MACTEC Project 3043091018/01

							Atterberg Limits					
Boring Number	Sample Depth (Feet)	Sample Type	Natural Moisture Content, %	Dry Unit Weight, pcf	Optimum Moisture Content, %	Maximum Dry Density, pcf	Liquid Limit	Plastic Limit	Plasticity Index	USCS	Percent Finer Than No. 200 Sieve	Specific Gravity
B-7	72.8 - 74.3	SPT	25.8	-	-	-	-	-	-	-	-	-
B-9	3.0 - 5.0	UD	16.9	98.1	-	-	-	-	-	-	-	-
B-12	0.0 - 1.5	SPT	23.3	-	-	-	-	-	-	-	-	-
B-12	1.5 - 3.0	SPT	21.2	-	-	-	-	-	-	-	-	-
B-12	3.0 - 4.5	SPT	26.8	-	-	-	-	-	-	-	-	-
B-12	4.5 - 6.0	SPT	28.1	-	-	-	-	-	-	-	-	-
B-12	5.0 - 10.0	BULK	33.5	-	23.6	95.7	57	26	31	CH	77.4	2.77
B-12	6.0 - 7.5	SPT	30.5	-	-	-	-	-	-	-	-	-
B-12	7.5 - 9.0	SPT	32.5	-	-	-	-	-	-	-	-	-
B-12	9.0 - 10.5	SPT	37.6	-	-	-	-	-	-	-	-	-
B-12	14.0 - 15.5	SPT	23.0	-	-	-	-	-	-	-	-	-
B-12	15.0 - 17.0	UD	26.4	97.4	-	-	-	-	-	-	-	-
B-12	19.0 - 20.5	SPT	37.5	-	-	-	-	-	-	-	-	-
B-12	20.0 - 25.0	BULK	32.5	-	25.6	94.7	74	28	46	CH	81.5	2.75
B-12	24.0 - 25.5	SPT	34.6	-	-	-	-	-	-	-	-	-
B-12	29.0 - 30.5	SPT	42.7	-	-	-	-	-	-	-	-	-
B-13	5.0 - 7.0	UD	28.4	113.4	-	-	-	-	-	-	-	-

UD - Undisturbed Sample
SPT - Standard Penetration Test Sample

Prepated/Date: ALB 5/8/09
Checked/Date: HAB 5/8/09

TABLE C-2
Falling Head Permeability Test Results
TVA Kingston - Borrow Area
MACTEC Project 3043091018/01

Boring Number	Sample Depth (Feet)	Sample Type	Moisture Content, %	Dry Density, pcf	Wet Density, pcf	Permeability, cm/s
B-3	0.0 - 10.0	REMOLDED	19.1	108.4	129.1	2.4×10^{-8}
B-3	10.0 - 20.0	REMOLDED	19.7	108.3	129.7	3.7×10^{-8}
B-5	10.0 - 29.0	REMOLDED	20.0	105.5	126.5	9.8×10^{-8}
B-7	24.0 - 34.0	REMOLDED	25.8	93.1	117.2	5.7×10^{-5}
B-12	5.0 - 10.0	REMOLDED	26.1	90.8	114.6	3.2×10^{-6}

Prepared/Date: ALB 5/8/09
Checked/Date: HAB 5/8/09

MOISTURE CONTENT TEST RESULTS

Natural Moisture Content and Atterberg Limits Laboratory Test Results

TVA - Kingston Fossil Plant Proposed Borrow Area

Project Number **3043091018.02**

Boring Number	Sample Number	Sample Type	Sample Depth (Feet)	Moisture Content (%)	Atterberg Limits		
					Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)
B-3	1	SPT	0.0-1.5	21.9	NT	NT	NT
B-3	2	SPT	1.5-3	18.7	NT	NT	NT
B-3	3	SPT	3.0-4.5	21.0	NT	NT	NT
B-3	4	SPT	4.5-6.0	16.9	NT	NT	NT
B-3	5	SPT	6.0-7.5	21.5	NT	NT	NT
B-3	6	SPT	7.5-9.0	20.2	NT	NT	NT
B-3	7	SPT	9.0-10.5	25.7	NT	NT	NT
B-3	8	SPT	14.0-15.5	24.3	NT	NT	NT
B-3	9	SPT	19.0-20.5	32.3	NT	NT	NT
B-3	10	SPT	22.4-22.7	NR	NT	NT	NT

NR - No Recoverty NT - No Test

SPT - Standard Penetration Test

Prepared By: REF Date: 3/31/2009 Checked By JC Date 4.1.09

Natural Moisture Content and Atterberg Limits Laboratory Test Results

TVA - Kingston Fossil Plant Proposed Borrow Area

Project Number 3043091018.02

					Atterberg Limits		
Boring Number	**Sample Number**	**Sample Type**	**Sample Depth (Feet)**	**Moisture Content (%)**	**Liquid Limit (LL)**	**Plastic Limit (PL)**	**Plasticity Index (PI)**
B-5	1	SPT	0.0-1.5	24.0	NT	NT	NT
B-5	2	SPT	1.5-3	27.1	NT	NT	NT
B-5	3	SPT	3.0-4.5	23.1	NT	NT	NT
B-5	4	SPT	4.5-6.0	22.0	NT	NT	NT
B-5	5	SPT	6.0-7.5	29.4	NT	NT	NT
B-5	6	SPT	7.5-9.0	26.8	NT	NT	NT
B-5	7	SPT	9.0-10.5	24.2	NT	NT	NT
B-5	8	SPT	14.0-15.5	22.2	NT	NT	NT
B-5	9	SPT	19.0-20.5	24.8	NT	NT	NT
B-5	10	SPT	24-25.5	31.5	NT	NT	NT
B-5	11	SPT	29-30.5	25.8	NT	NT	NT
B-5	12	SPT	34-35.5	24.4	NT	NT	NT
B-5	13	SPT	39-40.5	25.5	NT	NT	NT
B-5	14	SPT	44-45.5	21.6	NT	NT	NT
B-5	15	SPT	49-49.3	6.1	NT	NT	NT

NR - No Recoverty NT - No Test

SPT - Standard Penetration Test

Prepared By: REF Date: 3/31/2009 Checked By _____ Date 4.1.09

Natural Moisture Content and Atterberg Limits Laboratory Test Results

TVA - Kingston Fossil Plant Proposed Borrow Area

Project Number 3043091018.02

Boring Number	Sample Number	Sample Type	Sample Depth (Feet)	Moisture Content (%)	Atterberg Limits		
					Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)
B-7	1	SPT	0.0-1.5	38.8	NT	NT	NT
B-7	2	SPT	1.5-3	39.4	NT	NT	NT
B-7	3	SPT	3.0-4.5	34.7	NT	NT	NT
B-7	4	SPT	4.5-6.0	21.7	NT	NT	NT
B-7	5	SPT	6.0-7.5	29.5	NT	NT	NT
B-7	6	SPT	7.5-9.0	30.7	NT	NT	NT
B-7	7	SPT	9.0-10.5	27.0	NT	NT	NT
B-7	8	SPT	14.0-15.5	23.5	NT	NT	NT
B-7	9	SPT	19.0-20.5	38.2	NT	NT	NT
B-7	10	SPT	24-25.5	28.8	NT	NT	NT
B-7	11	SPT	29-30.5	42.3	NT	NT	NT
B-7	12	SPT	34-35.5	39.3	NT	NT	NT
B-7	13	SPT	39-40.5	28.9	NT	NT	NT
B-7	14	SPT	44-45.5	50.2	NT	NT	NT
B-7	15	SPT	49-50.5	43.1	NT	NT	NT
B-7	16	SPT	54-55.5	30.5	NT	NT	NT
B-7	17	SPT	59-60.5	38.6	NT	NT	NT
B-7	18	SPT	64-65.5	25.1	NT	NT	NT
B-7	19	SPT	69-70.5	39.2	NT	NT	NT
B-7	20	SPT	72.8-74.3	25.8	NT	NT	NT
B-7	21	SPT	75.7-75.9	NR	NT	NT	NT

NR - No Recoverty NT - No Test

SPT - Standard Penetration Test

Prepared By: REF Date: 3/31/2009 Checked By JL Date 4.1.09

JL

Natural Moisture Content and Atterberg Limits Laboratory Test Results

TVA - Kingston Fossil Plant Proposed Borrow Area

Project Number 3043091004.02

					Atterberg Limits		
Boring Number	**Sample Number**	**Sample Type**	**Sample Depth (Feet)**	**Moisture Content (%)**	**Liquid Limit (LL)**	**Plastic Limit (PL)**	**Plasticity Index (PI)**
B-12	1	SPT	0.0-1.5	23.3	NT	NT	NT
B-12	2	SPT	1.5-3	21.2	NT	NT	NT
B-12	3	SPT	3.0-4.5	26.8	NT	NT	NT
B-12	4	SPT	4.5-6.0	28.1	NT	NT	NT
B-12	5	SPT	6.0-7.5	30.5	NT	NT	NT
B-12	6	SPT	7.5-9.0	32.5	NT	NT	NT
B-12	7	SPT	9.0-10.5	37.6	NT	NT	NT
B-12	8	SPT	14.0-15.5	23.0	NT	NT	NT
B-12	9	SPT	19.0-20.5	37.5	NT	NT	NT
B-12	10	SPT	24-25.5	34.6	NT	NT	NT
B-12	11	SPT	29-30.5	42.7	NT	NT	NT

NT - No Test

SPT - Standard Penetration Test

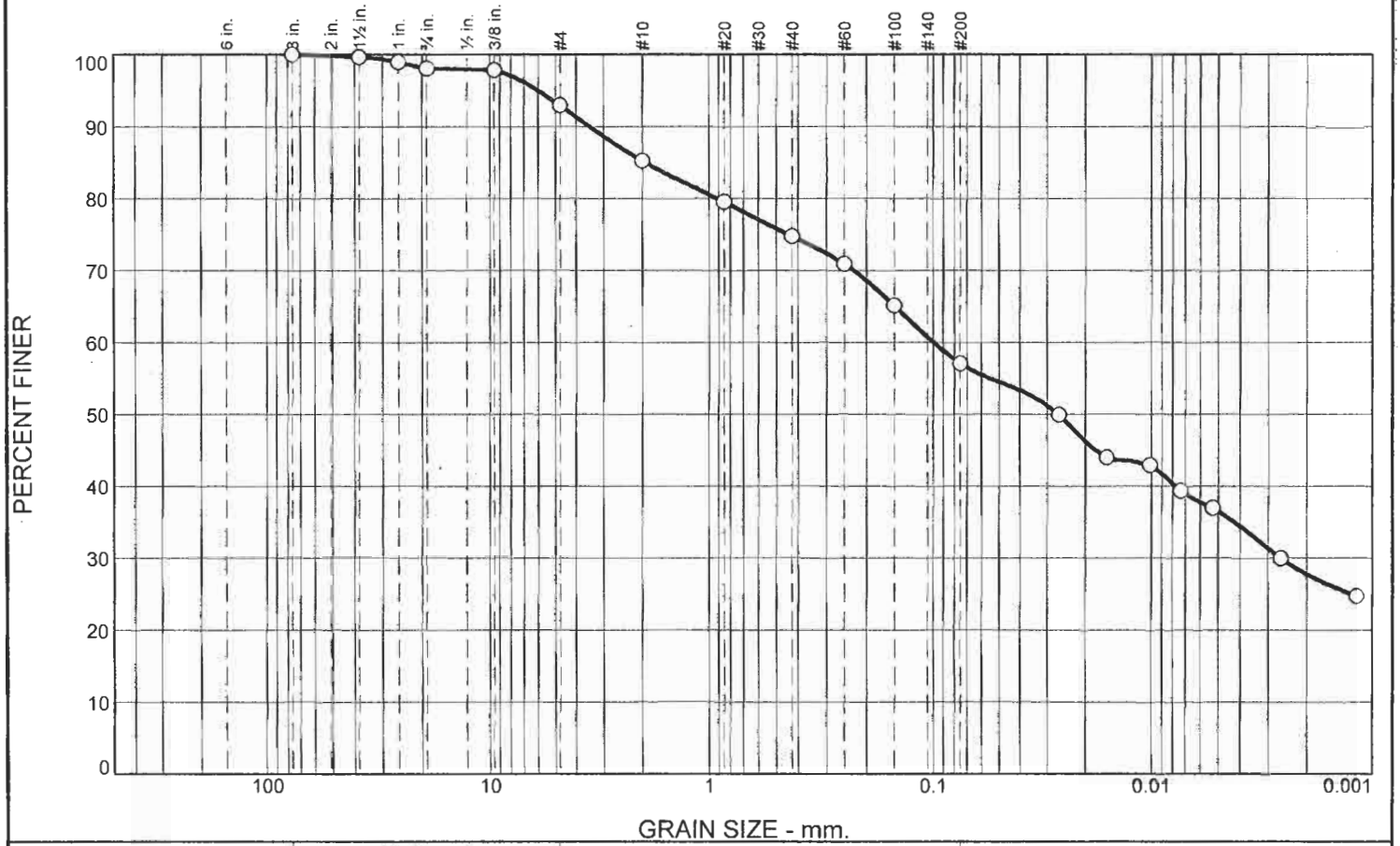
Prepared By: REF Date: 3/13/2009 Checked By _____ Date 4/2/09

PARTICLE-SIZE ANALYSIS TEST RESULTS

ATTERBERG LIMITS TEST RESULTS

SPECIFIC GRAVITY TEST RESULTS

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	1.9	5.2	7.6	10.5	17.7	20.5	36.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
1.5	99.7		
1	99.0		
.75	98.1		
.375	97.9		
#4	92.9		
#10	85.3		
#20	79.5		
#40	74.8		
#60	70.9		
#100	65.2		
#200	57.1		

* (no specification provided)

Material Description

Orange brown sandy silt

Atterberg Limits

PL= 25 LL= 35 PI= 10

Coefficients

D_{85}= 1.9303 D_{60}= 0.0999 D_{50}= 0.0266
D_{30}= 0.0026 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO= A-4(4)

Remarks

DNS - Data Not Submitted; NT - No Test

Sample Number: 3953
Source of Sample: Boring B-3, SN1, Bulk **Depth:** 0-10' **Date:** 3/25/2009

MACTEC Engineering and Consulting, Inc.

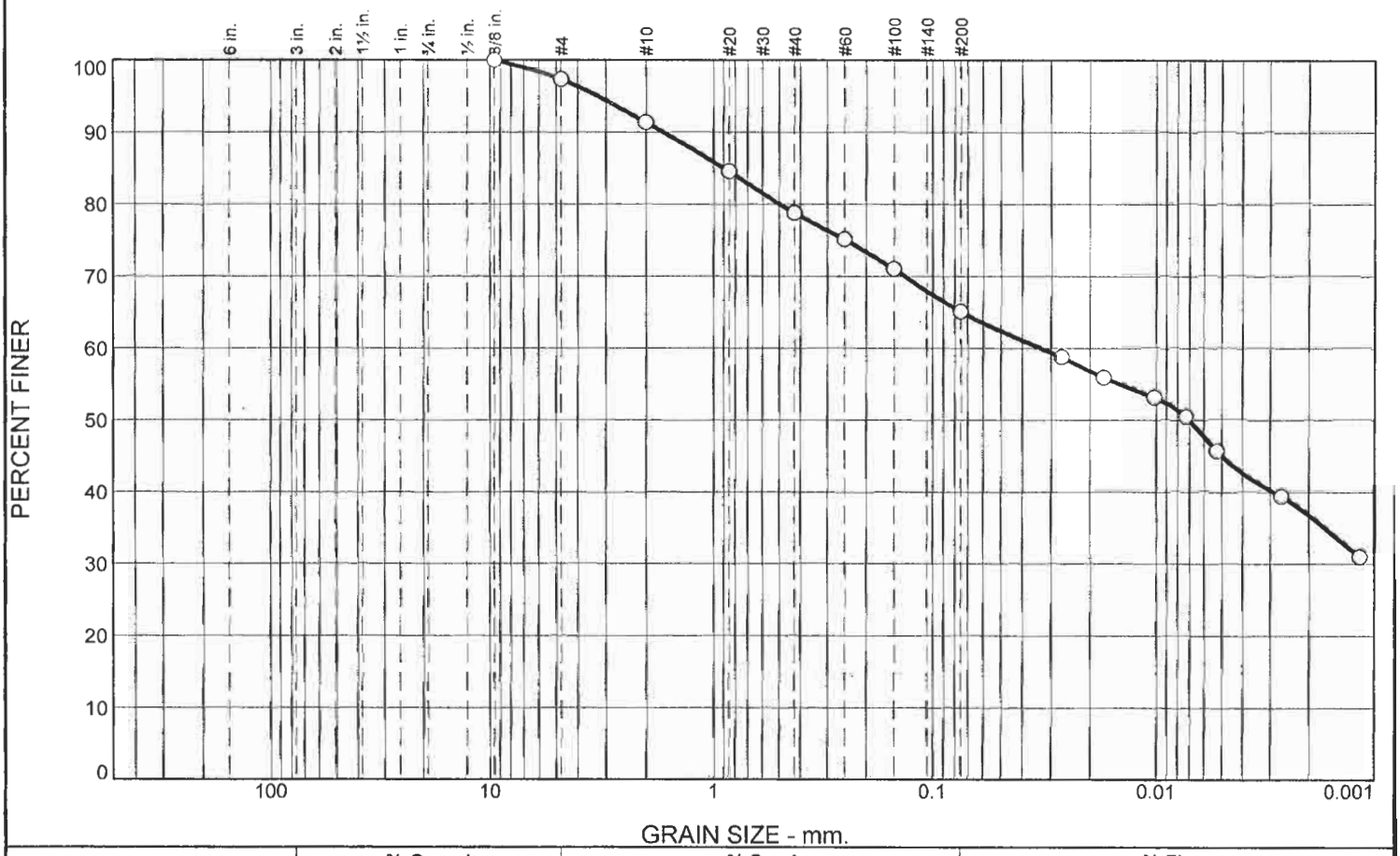
Knoxville, TN

Client: TVA
Project: TVA - Kingston Fossil Plant Proposed Borrow Area

Project No: 3043091018 **Figure** 3953

Tested By: REF **Checked By:** Comp.Calc.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.7	5.9	12.6	13.7	20.1	45.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	97.3		
#10	91.4		
#20	84.6		
#40	78.8		
#60	75.1		
#100	71.0		
#200	65.1		

* (no specification provided)

Material Description

Orange brown sandy lean clay

Atterberg Limits

PL= 22 LL= 44 PI= 22

Coefficients

D_{85}= 0.8941 D_{60}= 0.0330 D_{50}= 0.0070
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL AASHTO= A-7-6(13)

Remarks

DNS - Data Not Submitted; NT - No Test

Sample Number: 3955
Source of Sample: Boring B-5, SN2 Bulk **Depth:** 10-29' **Date:** 3/25/2009

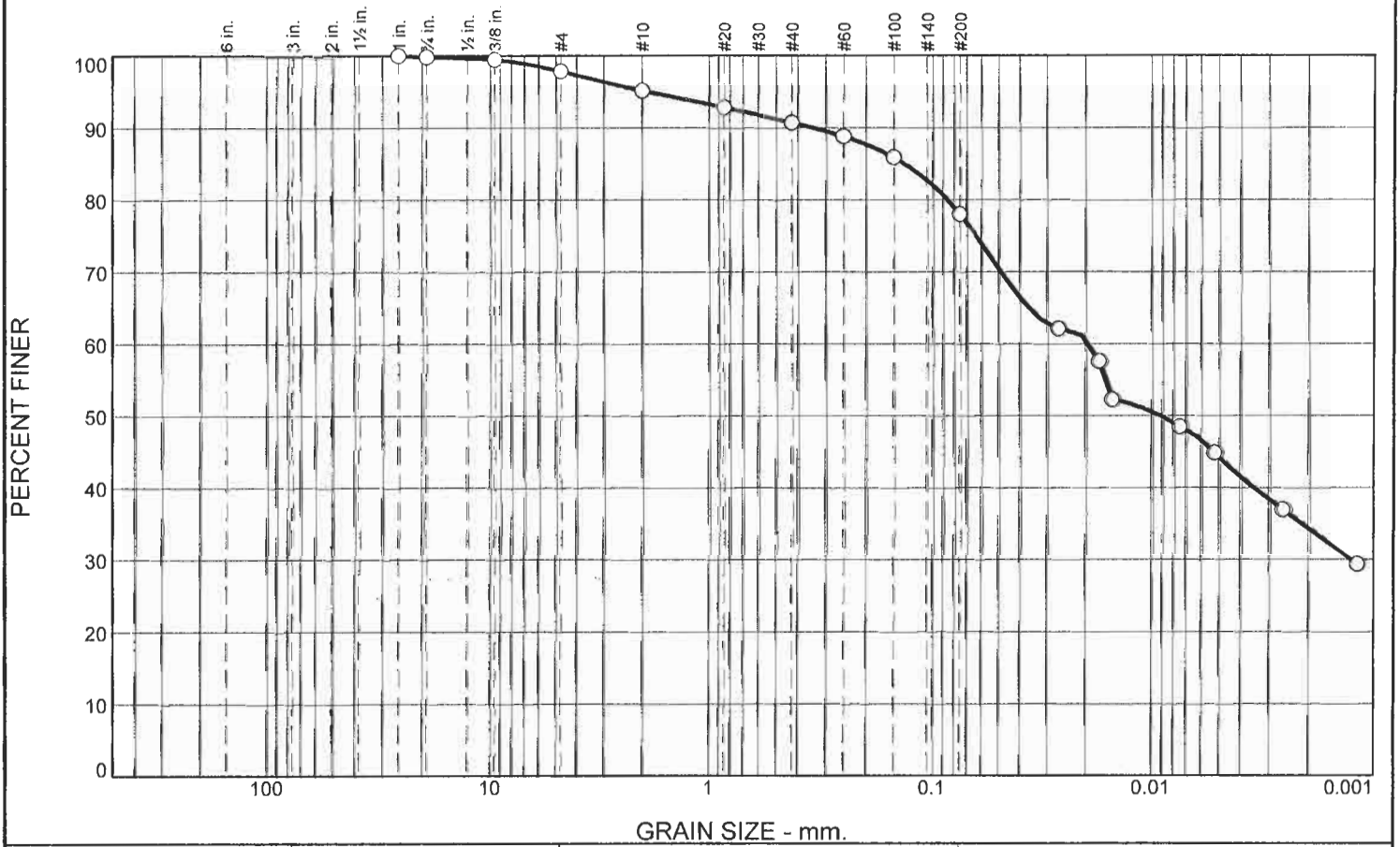
MACTEC Engineering and Consulting, Inc.

Knoxville, TN

Client: TVA
Project: TVA - Kingston Fossil Plant Proposed Borrow Area
Project No: 3043091018 **Figure** 3955

Tested By: GBH/REF **Checked By:** REF/Comp.Calc.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.2	1.9	2.7	4.5	12.7	33.7	44.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	99.8		
.375	99.5		
#4	97.9		
#10	95.2		
#20	92.8		
#40	90.7		
#60	88.8		
#100	85.9		
#200	78.0		

* (no specification provided)

Material Description

Orange brown lean clay with chert sand

Atterberg Limits

PL= 20 LL= 36 PI= 16

Coefficients

D_{85}= 0.1338 D_{60}= 0.0191 D_{50}= 0.0091
D_{30}= 0.0013 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CL AASHTO= A-6(12)

Remarks

DNS - Data Not Submitted; NT - No Test

Sample Number: 3958
Source of Sample: Boring B-3, SN1, Bulk **Depth:** 10-20' **Date:** 3/25/2009

MACTEC Engineering and Consulting, Inc.

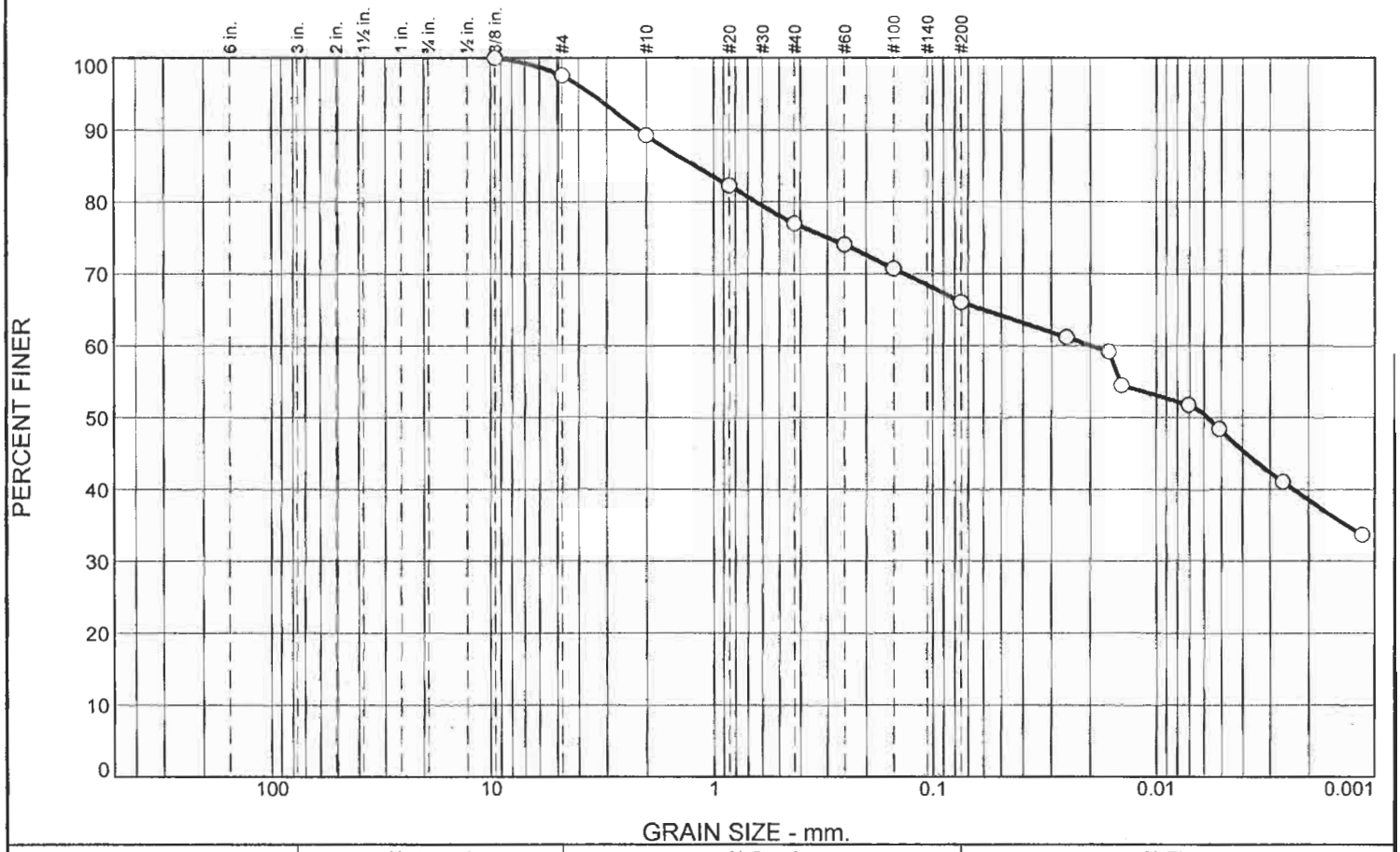
Knoxville, TN

Client: TVA
Project: TVA - Kingston Fossil Plant Proposed Borrow Area

Project No: 3043091018 **Figure** 3958

Tested By: GBH/REF **Checked By:** Comp. Calc.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.5	8.2	12.3	11.0	17.9	48.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	97.5		
#10	89.3		
#20	82.3		
#40	77.0		
#60	74.1		
#100	70.7		
#200	66.0		

* (no specification provided)

Material Description

Brown or Orange brown sandy fat clay

Atterberg Limits

PL= 27 LL= 51 PI= 24

Coefficients

D_{85}= 1.2071 D_{60}= 0.0197 D_{50}= 0.0058
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CH AASHTO= A-7-6(15)

Remarks

DNS - Data Not Submitted; NT - No Test

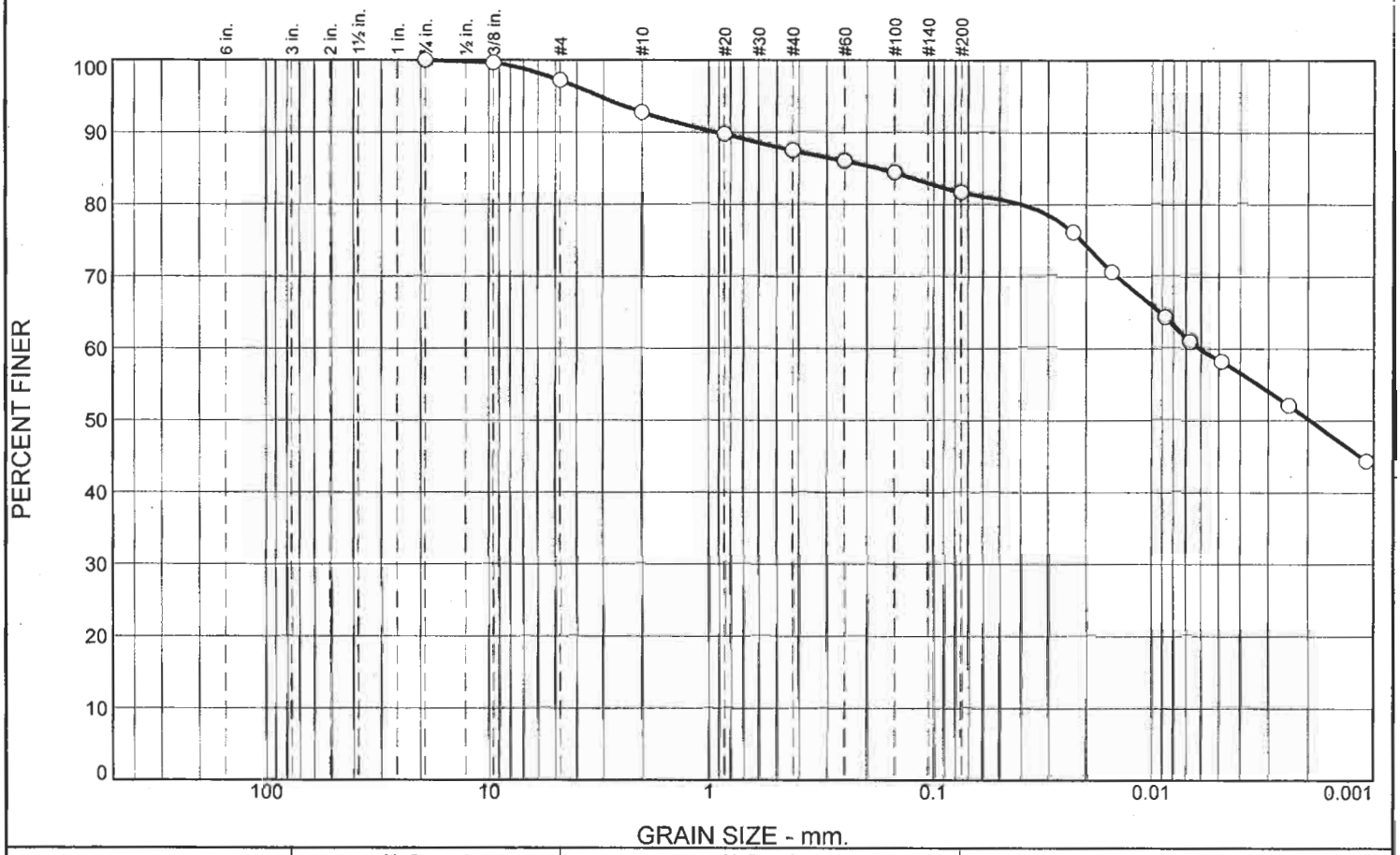
Sample Number: 3959
Source of Sample: Boring B-5, SN3 Bulk **Depth:** 30-49' **Date:**

MACTEC Engineering and Consulting, Inc.	**Client:** TVA
	Project: TVA - Kingston Fossil Plant Proposed Borrow Area
Knoxville, TN	**Project No:** 3043091018 **Figure** 3959

JC

Tested By: GBH/REF **Checked By:** Comp.Calc.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.8	4.4	5.3	5.8	23.3	58.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.375	99.7		
#4	97.2		
#10	92.8		
#20	89.8		
#40	87.5		
#60	86.1		
#100	84.4		
#200	81.7		

* (no specification provided)

Material Description

Orange brown fat clay with chert sand

Atterberg Limits

PL= 29 LL= 52 PI= 23

Coefficients

D_{85}= 0.1757 D_{60}= 0.0061 D_{50}= 0.0019
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CH AASHTO= A-7-6(21)

Remarks

DNS - Data Not Submitted; NT - No Test

Sample Number: 3960
Source of Sample: Boring B-7, BS3 Bulk **Depth:** 24-34' **Date:** 3/26/2009

MACTEC Engineering and Consulting, Inc.

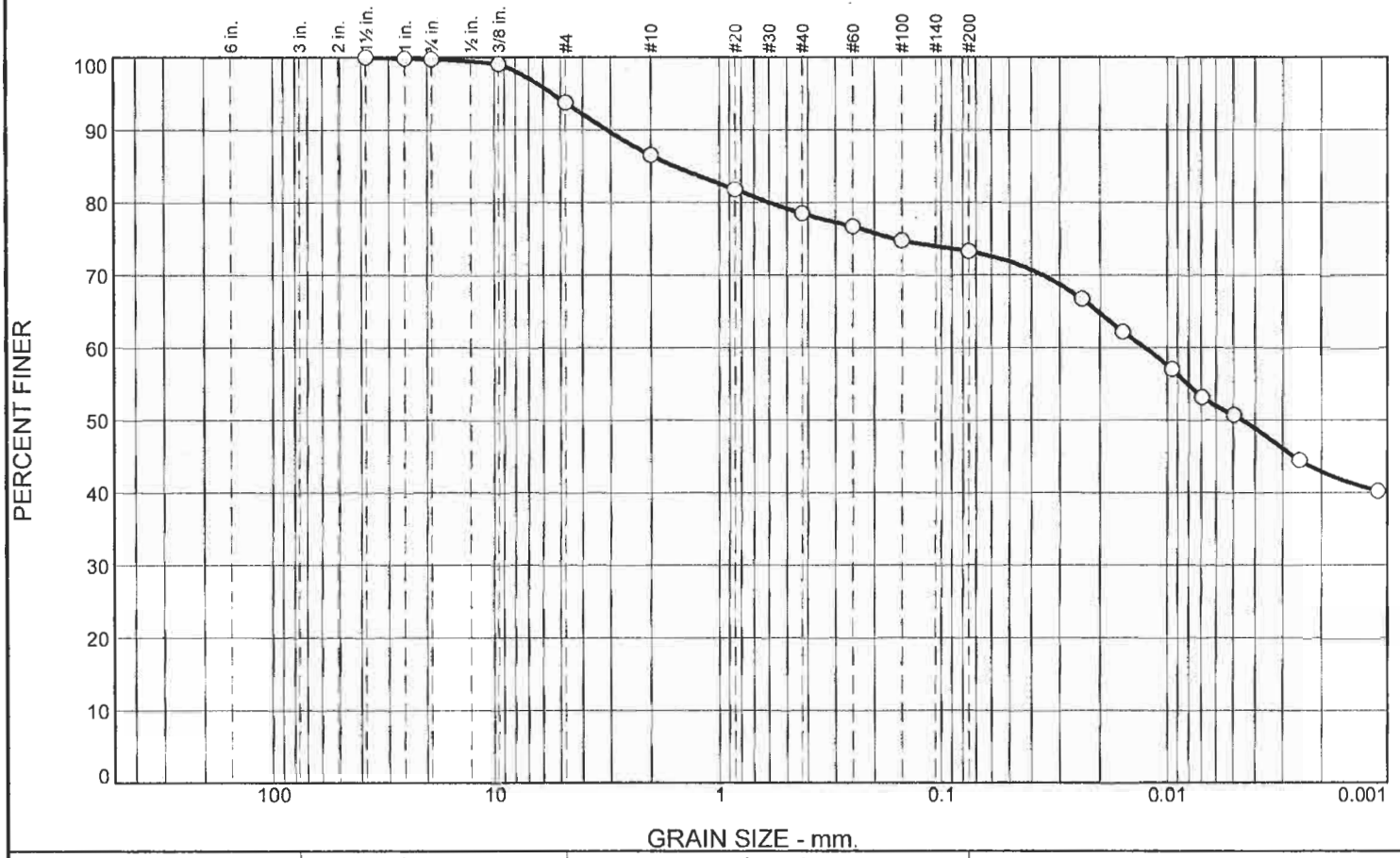
Knoxville, TN

Client: TVA
Project: TVA - Kingston Fossil Plant Proposed Borrow Area

Project No: 3043091018 **Figure** 3960

Tested By: GBH/REF **Checked By:** Comp.Calc./REF

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.3	5.9	7.3	8.0	5.2	22.5	50.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1	99.8		
.75	99.7		
.375	99.1		
#4	93.8		
#10	86.5		
#20	81.8		
#40	78.5		
#60	76.7		
#100	74.8		
#200	73.3		

* (no specification provided)

Material Description

Light brown elastic silt with sand

Atterberg Limits

PL= 30 LL= 55 PI= 25

Coefficients

D_{85}= 1.5621 D_{60}= 0.0126 D_{50}= 0.0045
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= MH AASHTO= A-7-5(19)

Remarks

DNS - Data Not Submitted; NT - No Test

Sample Number: 3961
Source of Sample: Boring B-7, BS5 Bulk **Depth:** 44-54' **Date:** 3/25/2009

MACTEC Engineering and Consulting, Inc.

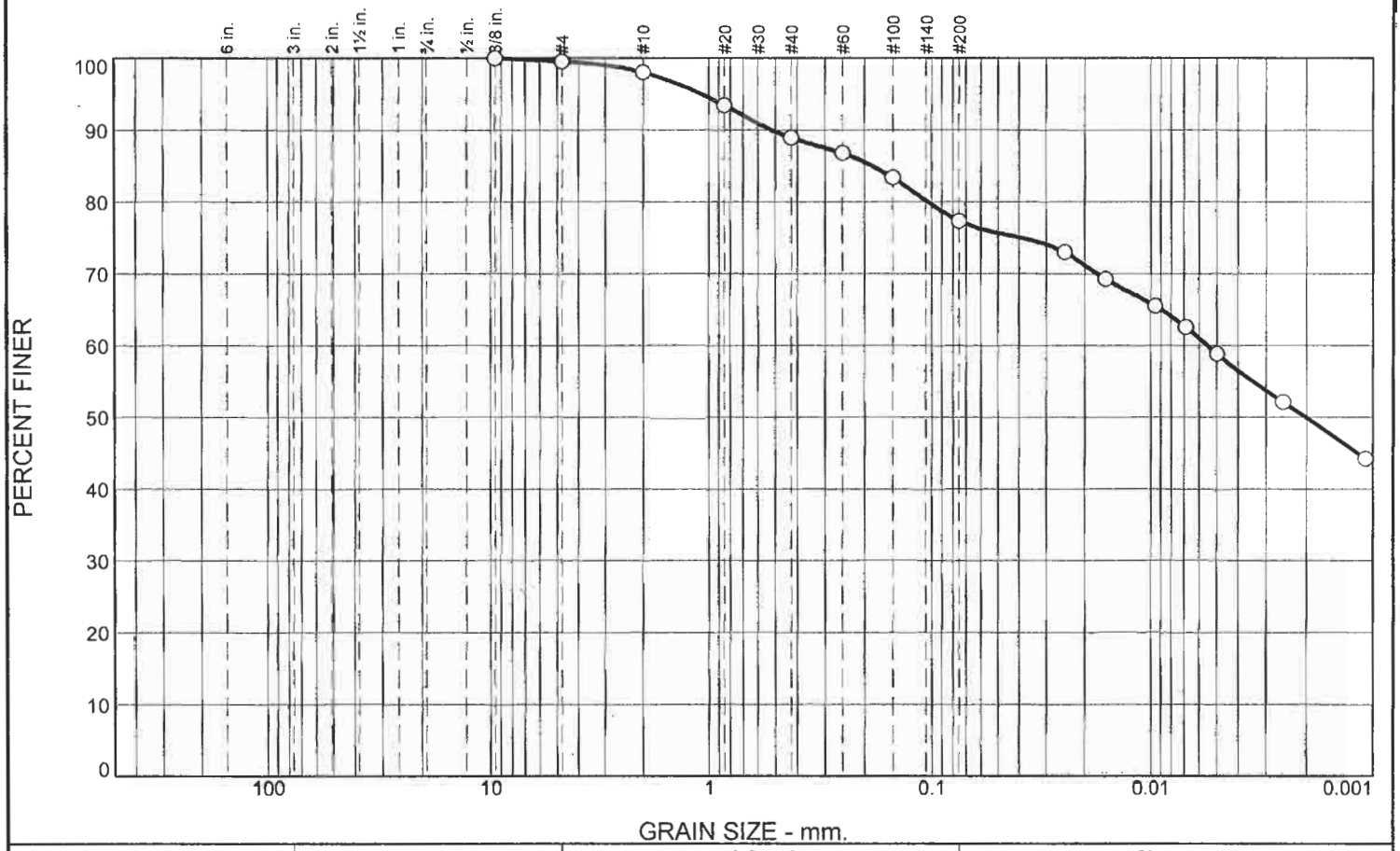
Knoxville, TN

Client: TVA
Project: TVA - Kingston Fossil Plant Proposed Borrow Area

Project No: 3043091018 **Figure** 3961

Tested By: GBH **Checked By:** REF

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.5	1.5	9.1	11.5	18.5	58.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.5		
#10	98.0		
#20	93.5		
#40	88.9		
#60	86.8		
#100	83.4		
#200	77.4		

* (no specification provided)

Material Description

Orange brown fat clay with chert sand

Atterberg Limits

PL= 26 LL= 57 PI= 31

Coefficients

D_{85}= 0.1834 D_{60}= 0.0055 D_{50}= 0.0020
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CH AASHTO= A-7-6(25)

Remarks

DNS - Data Not Submitted; NT - No Test

Sample Number: 3962
Source of Sample: Boring B-12, BG1 Bulk **Depth:** 5-10' **Date:** 4/9/2009

MACTEC Engineering and Consulting, Inc.

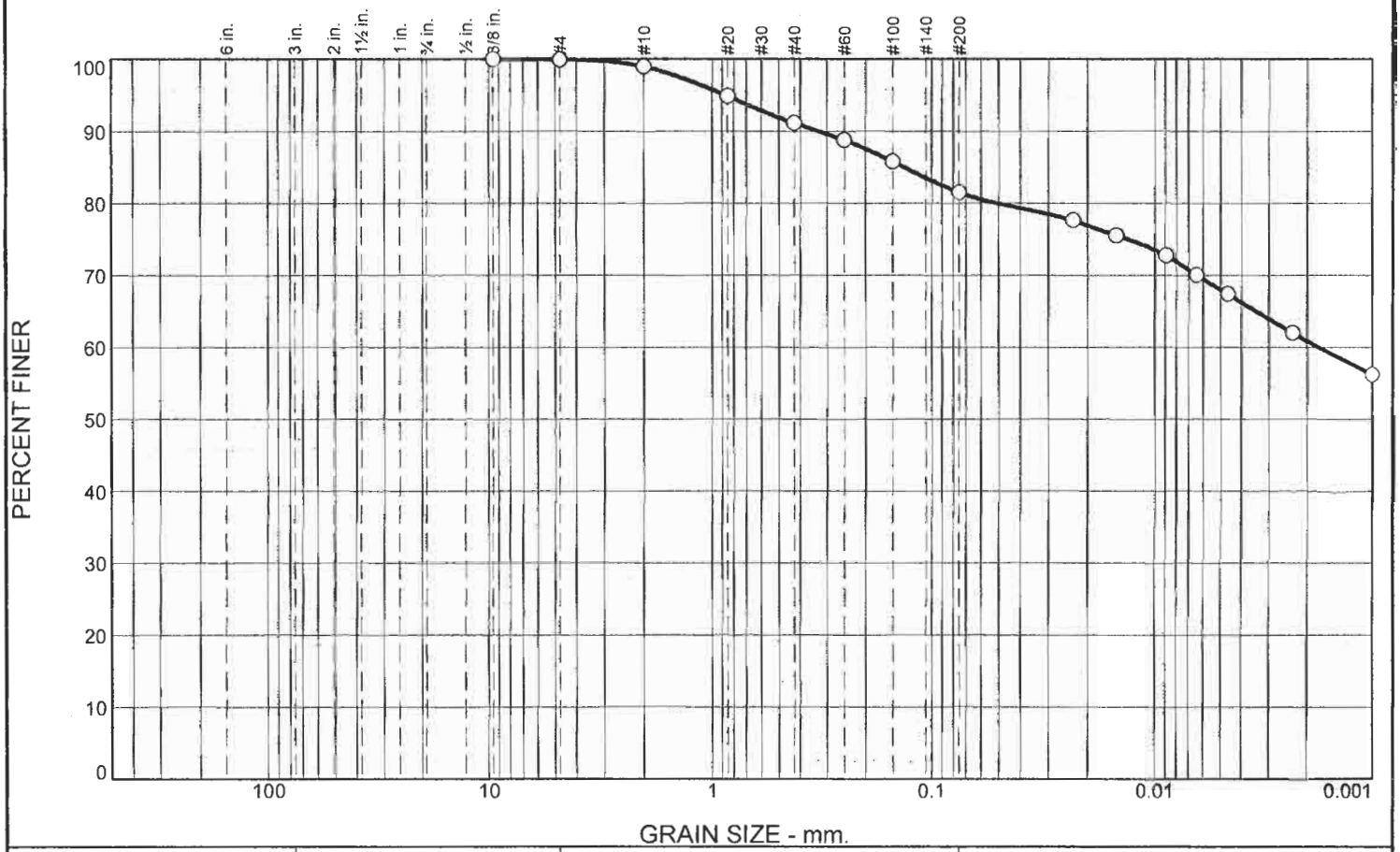
Knoxville, TN

Client: TVA
Project: TVA - Kingston Fossil Plant Proposed Borrow Area

Project No: 3043091018 **Figure** 3962

Tested By: RDB/REF **Checked By:** REF, Comp.Calc.

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.1	0.9	7.9	9.6	13.5	68.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.9		
#10	99.0		
#20	94.9		
#40	91.1		
#60	88.8		
#100	85.8		
#200	81.5		

* (no specification provided)

Material Description

Orange brown fat clay with chert sand

Atterberg Limits

PL= 28 LL= 74 PI= 46

Coefficients

D_{85}= 0.1323 D_{60}= 0.0018 D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= CH AASHTO= A-7-6(42)

Remarks

DNS - Data Not Submitted; NT - No Test

Sample Number: 3963
Source of Sample: Boring B-12, BG 2 Bulk **Depth:** 20-25' **Date:** 4/9/2009

MACTEC Engineering and Consulting, Inc. **Knoxville, TN**	**Client:** TVA **Project:** TVA - Kingston Fossil Plant Proposed Borrow Area **Project No:** 3043091018 **Figure** 3963

Tested By: RDB/REF **Checked By:** REF, Comp.Calc.

MOISTURE CONTENT AND UNIT WEIGHT (UD) TEST RESULTS

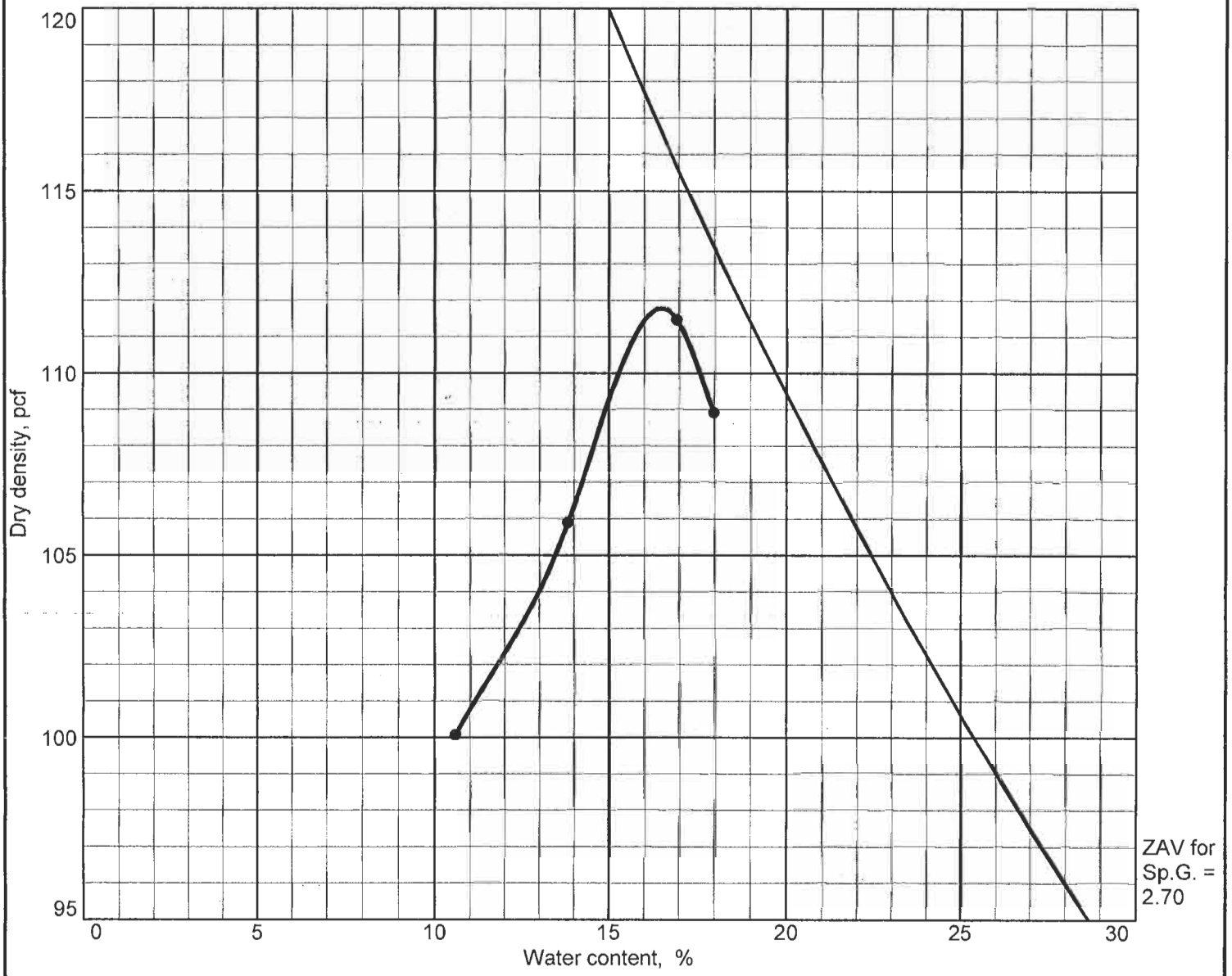
Natural Moisture and Unit Weight
Laboratory Test Results
TVA - Kingston Proposed Borrow Area
MACTEC Project
3043091018.20

Boring Number	Sample Number	Sample Type	Sample Depth (ft)	Moisture Content (%)	Dry Unit Weight (pounds per cubic foot)
B-2	UD-1	UD	17.5-19.5	53.2	80.2
B-9	UD-1	UD	3.0-5.0	16.9	98.1
B-12	UD-1	UD	15.0-17.0	26.4	97.4
B-13	UD-2	UD	5.0-7.0	28.4	113.4

UD - UnDisturbed Sample

STANDARD PROCTOR TEST RESULTS

COMPACTION TEST REPORT



Test specification: ASTM D 698-07e1 Method C Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in.	% < No.200
	USCS	AASHTO						
0-10'	ML	A-4(4)	17.5	2.773	35	10	1.9	57.1

TEST RESULTS

Maximum dry density = 111.8 pcf

Optimum moisture = 16.5 %

MATERIAL DESCRIPTION

Orange brown sandy silt

Project No.: 3043091018 **Client:** TVA

Project: TVA - Kingston Fossil Plant Proposed Borrow Area

● **Source:** Boring B-3, SN1, **Sample No.:** 3953 **Elev./Depth:** 0-10'

MACTEC Engineering and Consulting, Inc.

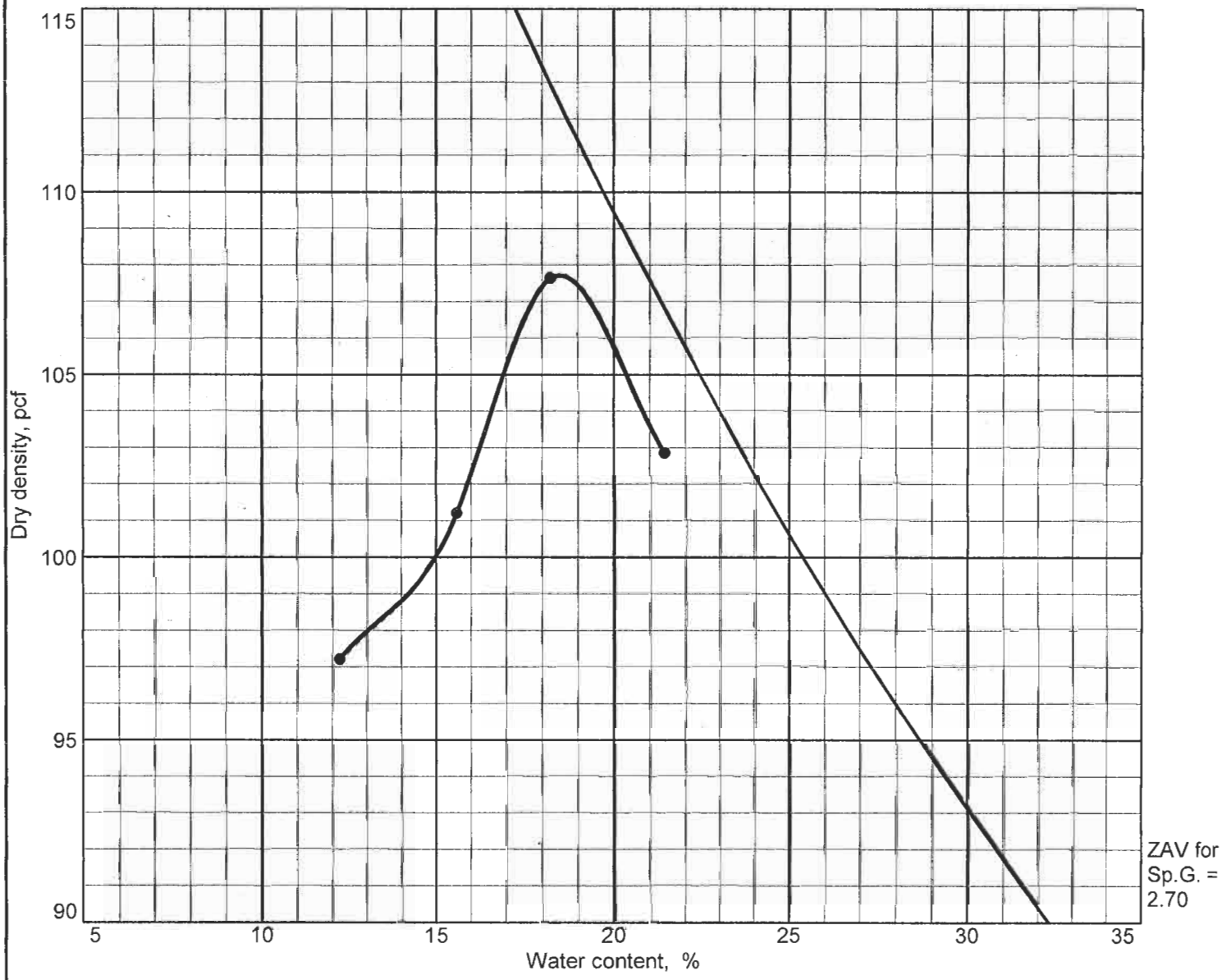
Knoxville, TN

Remarks:

DNS - Data Not Submitted; NT - No Test;
Date:4/1/2009

Figure 3953

COMPACTION TEST REPORT



Test specification: ASTM D 698-07e1 Method C Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	Pi	% > 3/4 in.	% < No.200
	USCS	AASHTO						
10-29'	CL	A-7-6(13)	24.0	2.739	44	22	0.0	65.1

TEST RESULTS

Maximum dry density = 107.7 pcf

Optimum moisture = 18.5 %

MATERIAL DESCRIPTION

Orange brown sandy lean clay

Project No.: 3043091018 **Client:** TVA

Project: TVA - Kingston Fossil Plant Proposed Borrow Area

● **Source:** Boring B-5, SN2 **Sample No.:** 3955 **Elev./Depth:** 10-29'

MACTEC Engineering and Consulting, Inc.

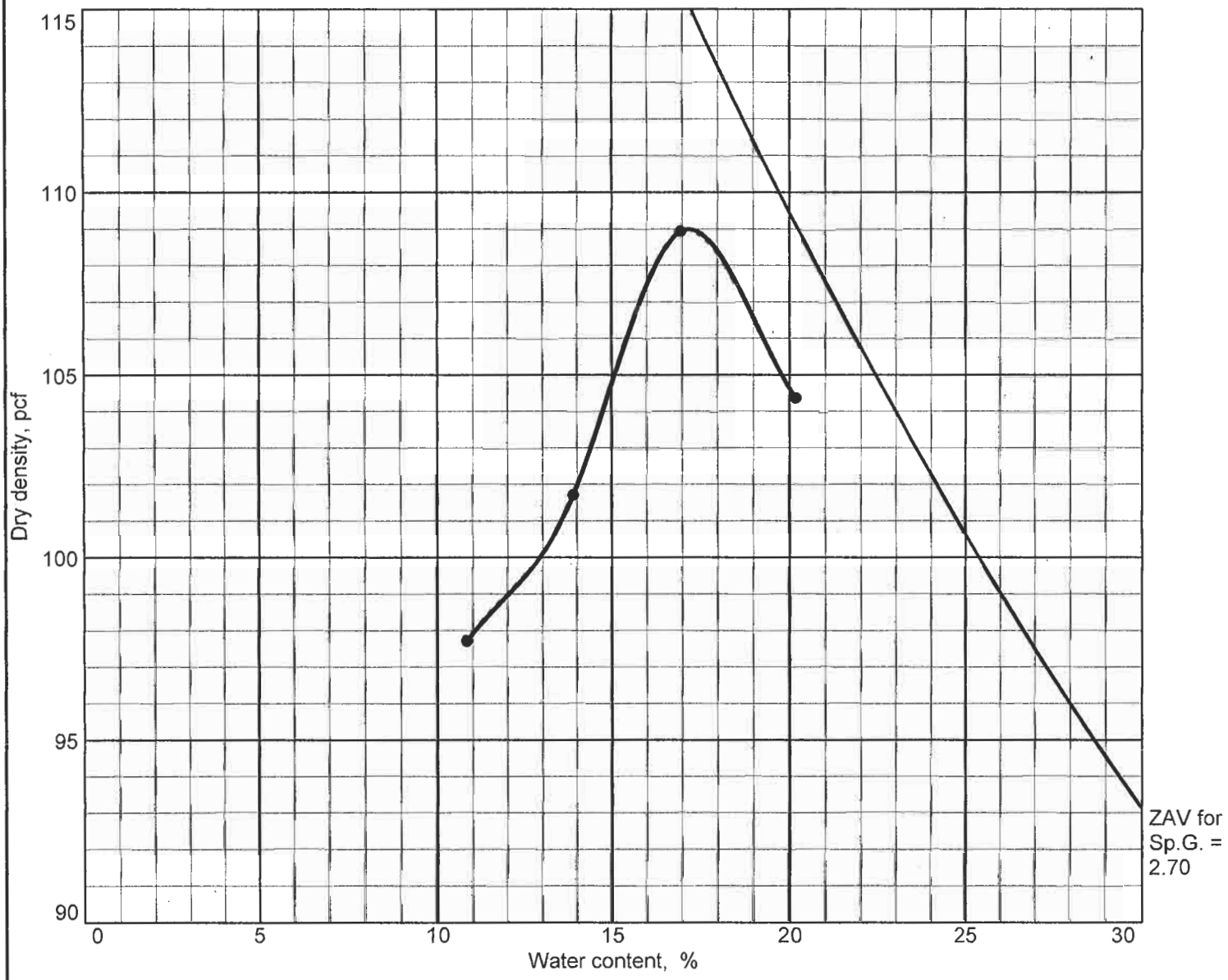
Knoxville, TN

Remarks:

DNS - Data Not Submitted; NT - No Test
ASTM D 854-06 Specific Gravity of -No. 4 sieve material.
Date: 4/1/2009

Figure 3955

COMPACTION TEST REPORT



Test specification: ASTM D 698-07e1 Method C Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in.	% < No.200
	USCS	AASHTO						
10-20'	CL	A-6(12)	31.8	2.776	36	16	0.2	78.0

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 109.0 pcf Optimum moisture = 17.2 %	Orange brown lean clay with chert sand

Project No.: 3043091018 **Client:** TVA

Project: TVA - Kingston Fossil Plant Proposed Borrow Area

● **Source:** Boring B-3, SN1, **Sample No.:** 3958 **Elev./Depth:** 10-20'

MACTEC Engineering and Consulting, Inc.

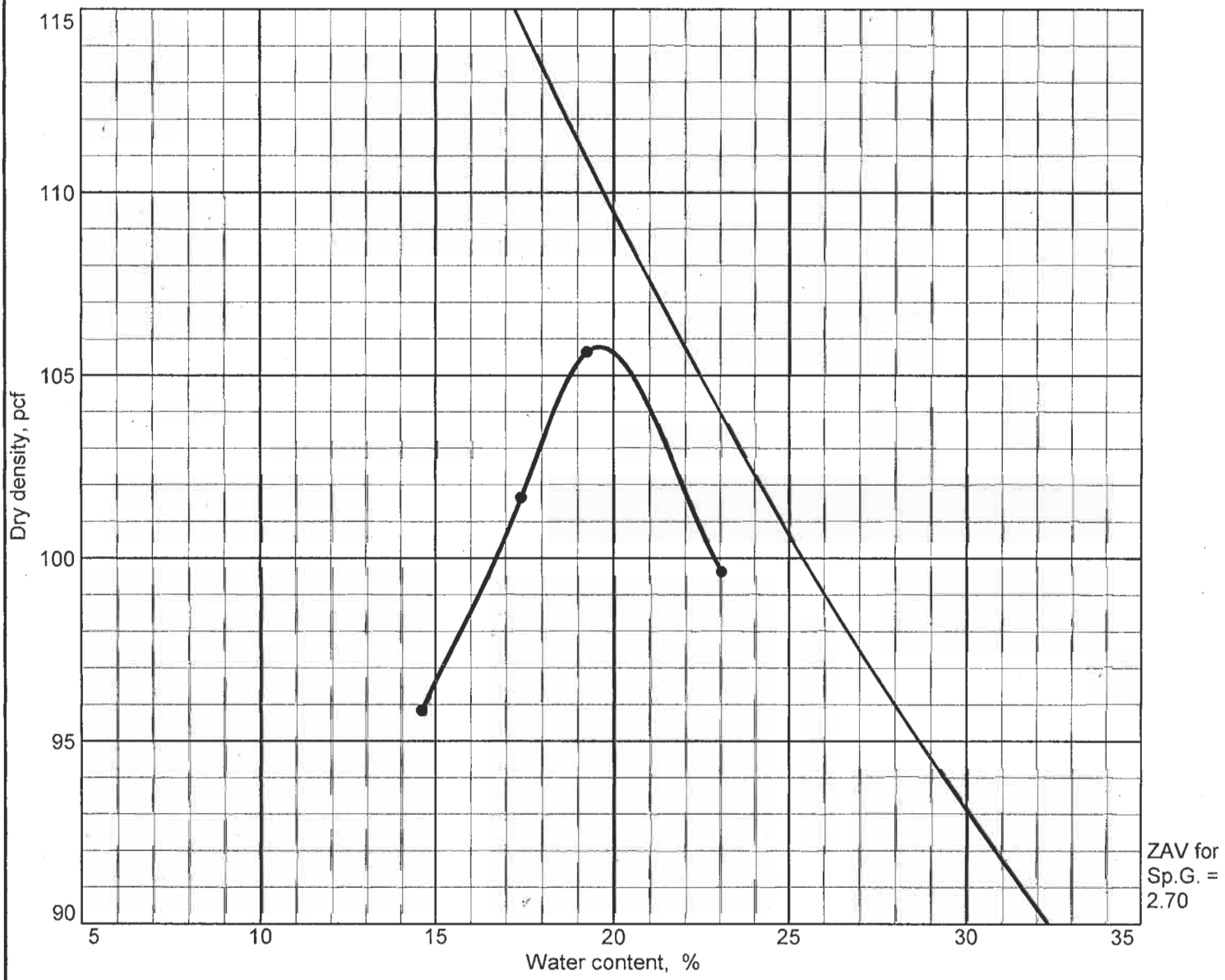
Knoxville, TN

Remarks:

DNS - Data Not Submitted; NT - No Test
ASTM D 854-06 Specific Gravity of -No. 4 sieve material.
Date: 4/1/2009

Figure 3958

COMPACTION TEST REPORT



Test specification: ASTM D 698-07e1 Method C Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in.	% < No.200
	USCS	AASHTO						
30-49'	CH	A-7-6(15)	28.2	2.742	51	24	0.0	66.0

TEST RESULTS

Maximum dry density = 105.8 pcf

Optimum moisture = 19.6 %

MATERIAL DESCRIPTION

Brown or Orange brown sandy fat clay

Project No.: 3043091018 **Client:** TVA

Project: TVA - Kingston Fossil Plant Proposed Borrow Area

● **Source:** Boring B-5, SN3 **Sample No.:** 3959 **Elev./Depth:** 30-49'

MACTEC Engineering and Consulting, Inc.

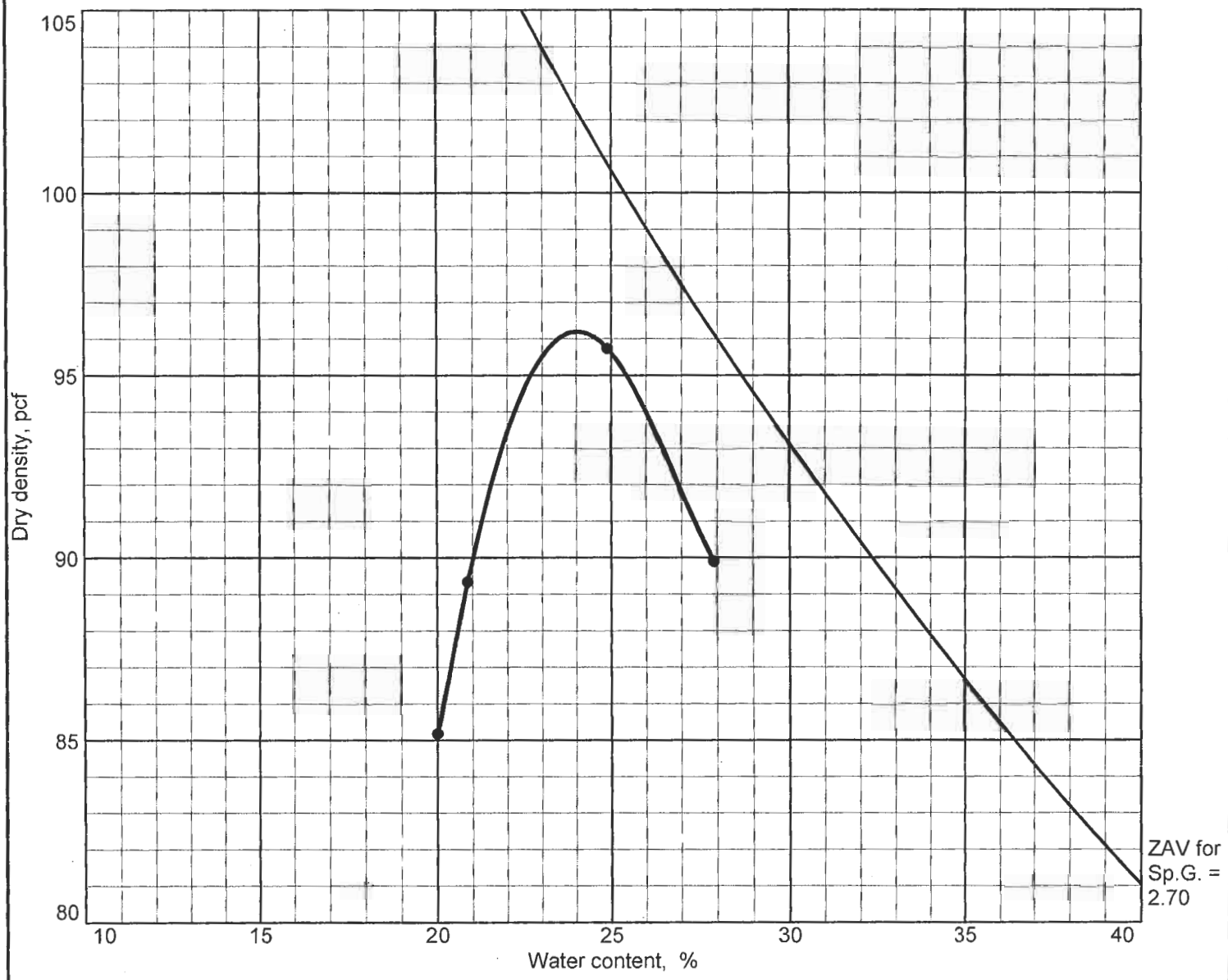
Knoxville, TN

Remarks:

DNS - Data Not Submitted; NT - No Test
ASTM D 854-06 Specific Gravity of -No. 4 sieve material.
Date: 4/1/2009

Figure 3959

COMPACTION TEST REPORT



Test specification: ASTM D 698-07e1 Method C Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in.	% < No.200
	USCS	AASHTO						
24-34'	CH	A-7-6(21)	34.9	2.739	52	23	0.0	81.7

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 96.2 pcf Optimum moisture = 24.0 %	Orange brown fat clay with chert sand

Project No.: 3043091018 **Client:** TVA

Project: TVA - Kingston Fossil Plant Proposed Borrow Area

● **Source:** Boring B-7, BS3 **Sample No.:** 3960 **Elev./Depth:** 24-34'

MACTEC Engineering and Consulting, Inc.

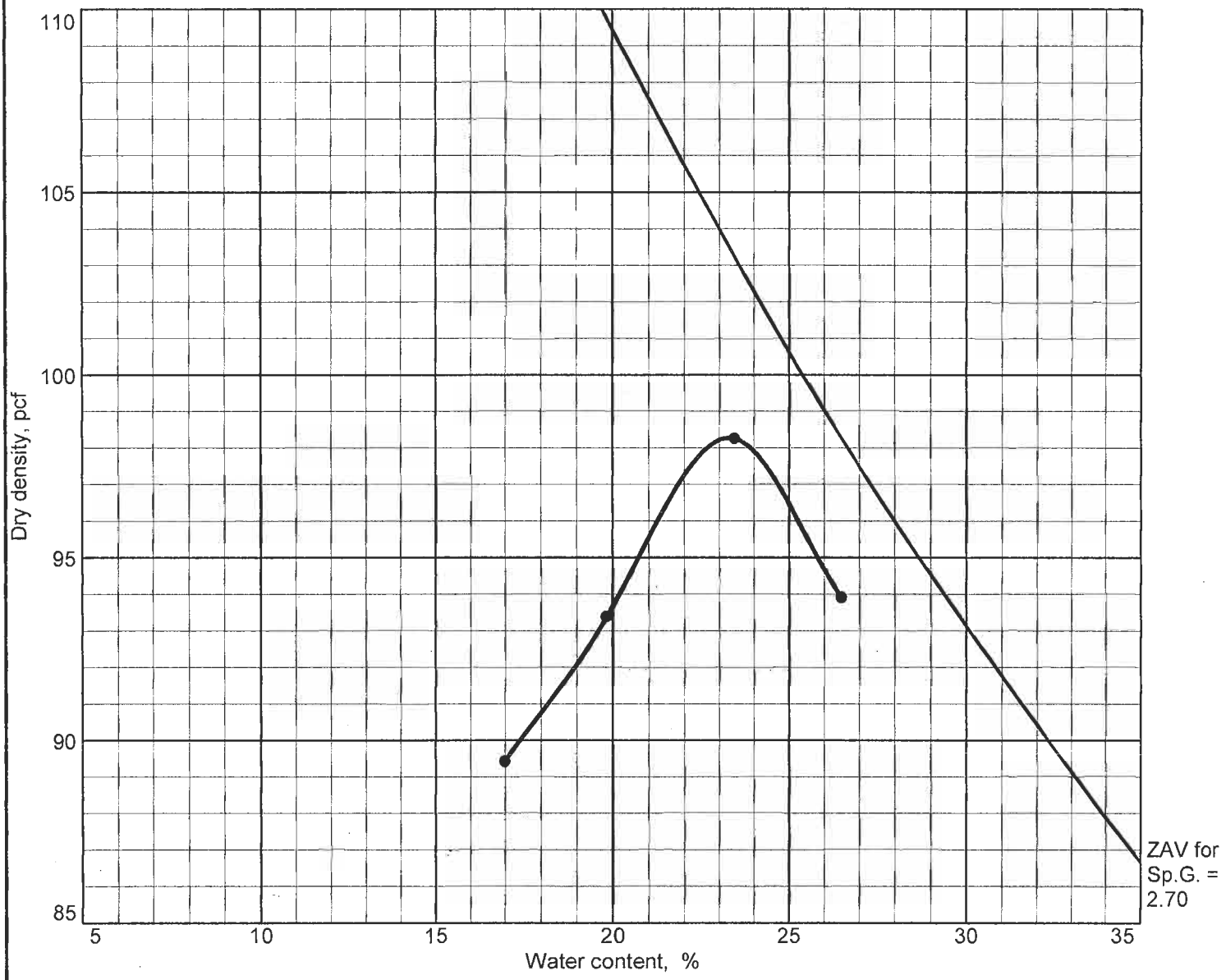
Knoxville, TN

Remarks:

DNS - Data Not Submitted; NT - No Test
ASTM D 854-06 Specific Gravity of -No. 4 sieve material
Date: 4/1/2009

Figure 3960

COMPACTION TEST REPORT



Test specification: ASTM D 698-07e1 Method C Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in.	% < No.200
	USCS	AASHTO						
44-54'	MH	A-7-5(19)	33.7	2.742	55	25	0.3	73.3

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 98.3 pcf Optimum moisture = 23.3 %	Light brown elastic silt with sand

Project No.: 3043091018 **Client:** TVA

Project: TVA - Kingston Fossil Plant Proposed Borrow Area

● **Source:** Boring B-7, BS5 **Sample No.:** 3961 **Elev./Depth:** 44-54'

MACTEC Engineering and Consulting, Inc.

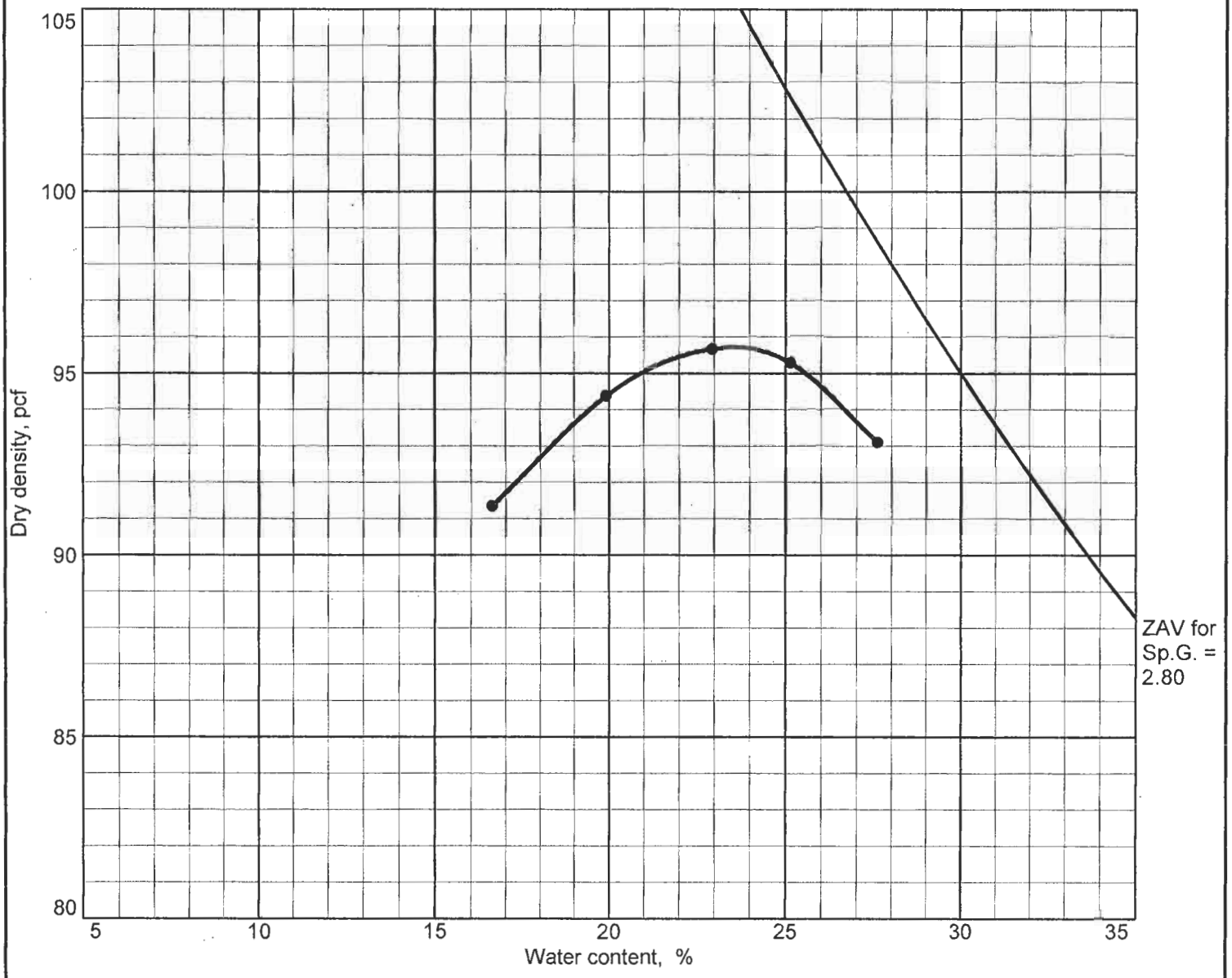
Knoxville, TN

Remarks:

DNS - Data Not Submitted; NT - No Test
ASTM D 854-06 Specific Gravity of -No. 4 sieve material.
Date: 4/1/2009

Figure 3961

COMPACTION TEST REPORT



Test specification: ASTM D 698-07e1 Method C Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in.	% < No.200
	USCS	AASHTO						
5-10'	CH	A-7-6(25)	33.5	2.770	57	31	0.0	77.4

TEST RESULTS

Maximum dry density = 95.7 pcf

Optimum moisture = 23.6 %

MATERIAL DESCRIPTION

Orange brown fat clay with chert sand

Project No.: 3043091018 **Client:** TVA

Project: TVA - Kingston Fossil Plant Proposed Borrow Area

● **Source:** Boring B-12, BG1 **Sample No.:** 3962 **Elev./Depth:** 5-10'

MACTEC Engineering and Consulting, Inc.

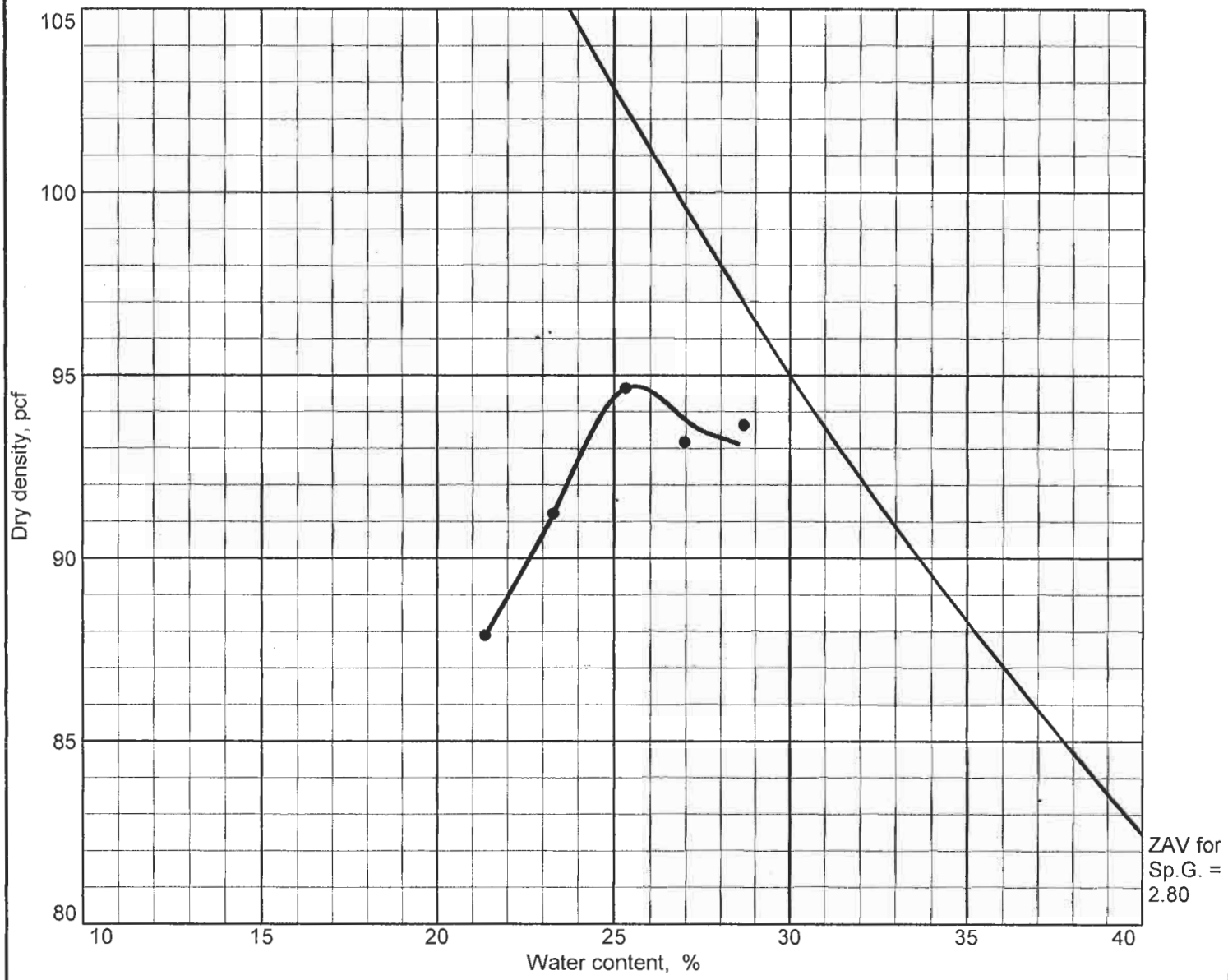
Knoxville, TN

Remarks:

DNS - Data Not Submitted; NT - No Test
ASTM D 854-06 Specific Gravity of - No. 4 sieve material: 2.770
Date: 4/9/2009

Figure 3962

COMPACTION TEST REPORT



Test specification: ASTM D 698-07e1 Method B Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/8 in.	% < No.200
	USCS	AASHTO						
20-25'	CH	A-7-6(42)	32.5	2.747	74	46	0.0	81.5

TEST RESULTS

Maximum dry density = 94.7 pcf

Optimum moisture = 25.6 %

MATERIAL DESCRIPTION

Orange brown fat clay with chert sand

Project No.: 3043091018 **Client:** TVA

Project: TVA - Kingston Fossil Plant Proposed Borrow Area

● **Source:** Boring B-12, BG 2 **Sample No.:** 3963 **Elev./Depth:** 20-25'

MACTEC Engineering and Consulting, Inc.

Knoxville, TN

Remarks:

DNS - Data Not Submitted; NT - No Test
ASTM D 854-06 Specific Gravity of -No. 4 sieve material: 2.747
Date: 4/9/2009

Figure 3963

PERMEABILITY (CONSTANT HEAD) TEST RESULTS

MACTEC

REPORT OF SOIL PERMEABILITY TESTING

Project: TVA Kingston Borrow Area **Project Number:** 3043-09-1018

Client Tennessee Valley Authority **Date Completed:** April 24, 2009

Sample Number: **Lab ID: 3953** **B-3 (0 - 10 ft)**

Sample Information:

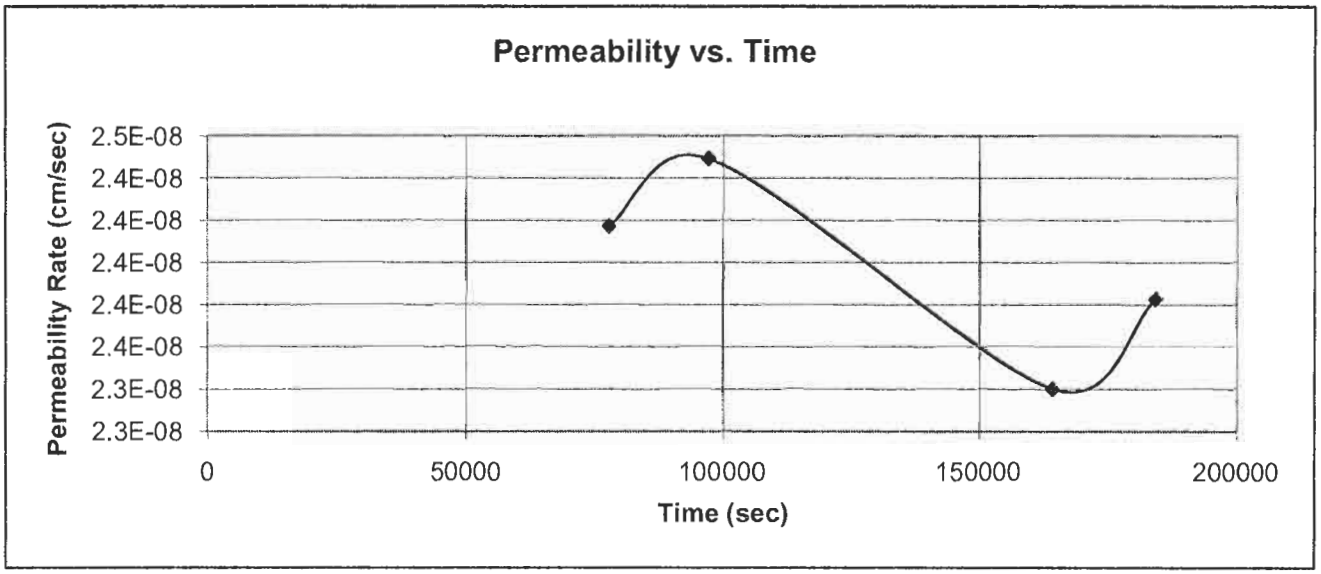
Dia. (in.)	2.85	**Length (in)**	3.23	**Weight (gr)**	697.3
Wet Density (pcf)	129.1	**Moisture Content (%)**	19.1	**Dry Density (pcf)**	108.4

Test Parameters

Test Method Used:	ASTM D-5084, method A	**Permeant Fluid:**	Deionized water
Maximum Hydraulic Gradient:	6.1	**Minimum Hydraulic Gradient**	3.0
Maximum Consolidation Stress (psi)	10	**Minimum Consolidation Stress (psi)**	3

Permeability Rate

2.4E-08



Reviewed By:

Hussein Benkhayal, P.E.

MACTEC

REPORT OF SOIL PERMEABILITY TESTING

Project: TVA Kingston Borrow Area **Project Number:** 3043-09-1018

Client Tennessee Valley Authority **Date Completed:** April 20, 2009

Sample Number: **Lab ID: 3955** **B-5 (10 - 29 ft)**

Sample Information:

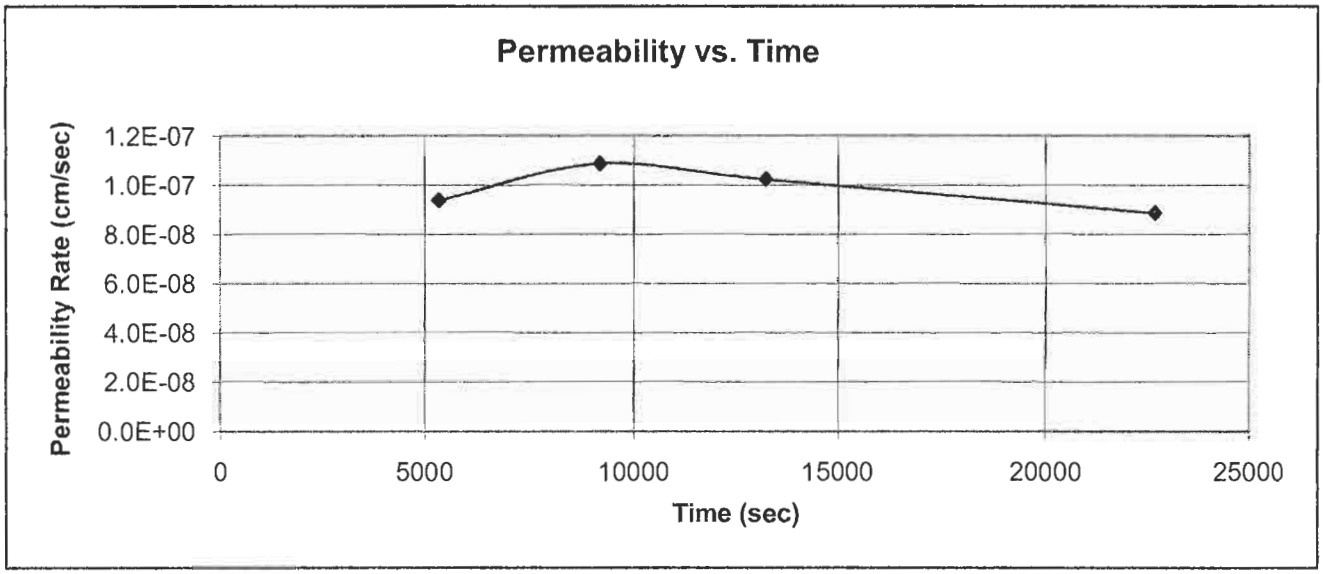
Dia. (in.)	2.82	**Length (in)**	3.37	**Weight (gr)**	701.1
Wet Density (pcf)	126.5	**Moisture Content (%)**	20.0	**Dry Density (pcf)**	105.5

Test Parameters

Test Method Used:	ASTM D-5084, method A	**Permeant Fluid:**	Deionized water
Maximum Hydraulic Gradient:	5.9	**Minimum Hydraulic Gradient**	3.0
Maximum Consolidation Stress (psi)	10	**Minimum Consolidation Stress (psi)**	5

Permeability Rate

9.8E-08



Reviewed By:

Hussein Benkhayal, P.E.

MACTEC

REPORT OF SOIL PERMEABILITY TESTING

Project: TVA Kingston Borrow Area **Project Number:** 3043-09-1018

Client Tennessee Valley Authority **Date Completed:** April 30, 2009

Sample Number: **Lab ID: 3958** **B-3 (10 - 20 ft)**

Sample Information:

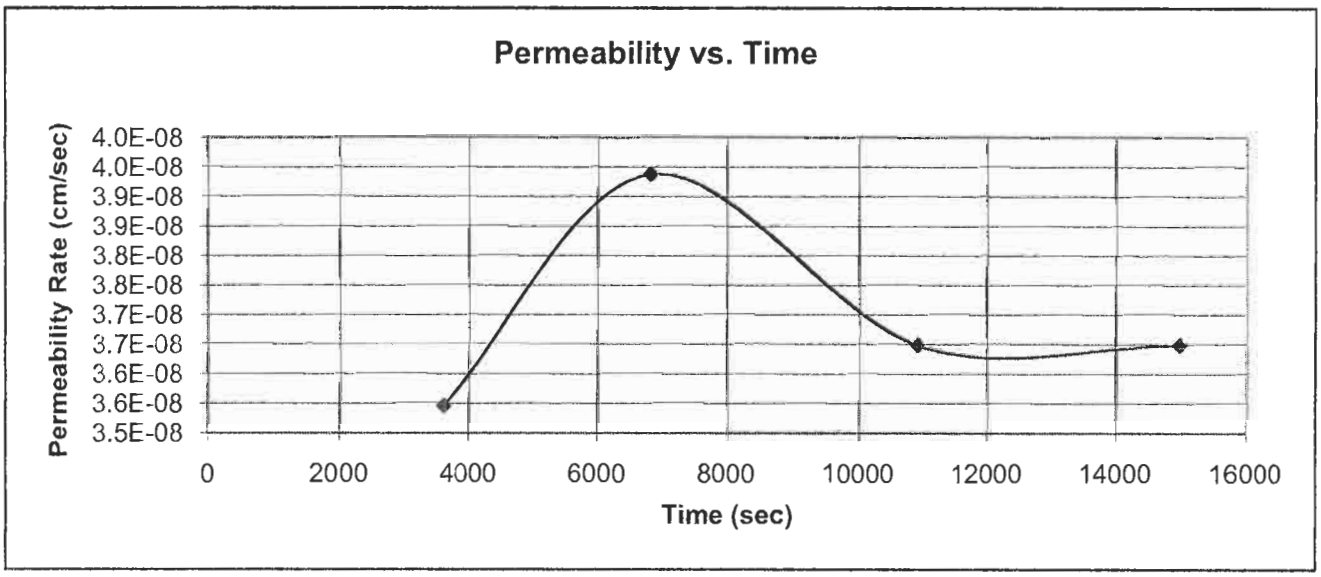
Dia. (in.)	2.82	**Length (in)**	3.23	**Weight (gr)**	684.3
Wet Density (pcf)	129.7	**Moisture Content (%)**	19.7	**Dry Density (pcf)**	108.3

Test Parameters

Test Method Used:	ASTM D-5084, method A	**Permeant Fluid:**	Deionized water
Maximum Hydraulic Gradient:	23.4	**Minimum Hydraulic Gradient**	20.3
Maximum Consolidation Stress (psi)	12	**Minimum Consolidation Stress (psi)**	3

Permeability Rate

3.7E-08



Reviewed By:

Hussein Benkhayal, P.E.

MACTEC

REPORT OF SOIL PERMEABILITY TESTING

Project: TVA Kingston Borrow Area **Project Number:** 3043-09-1018

Client Tennessee Valley Authority **Date Completed:** April 30, 2009

Sample Number: **Lab ID: 3960** **B-7 (24 - 34 ft)**

Sample Information:

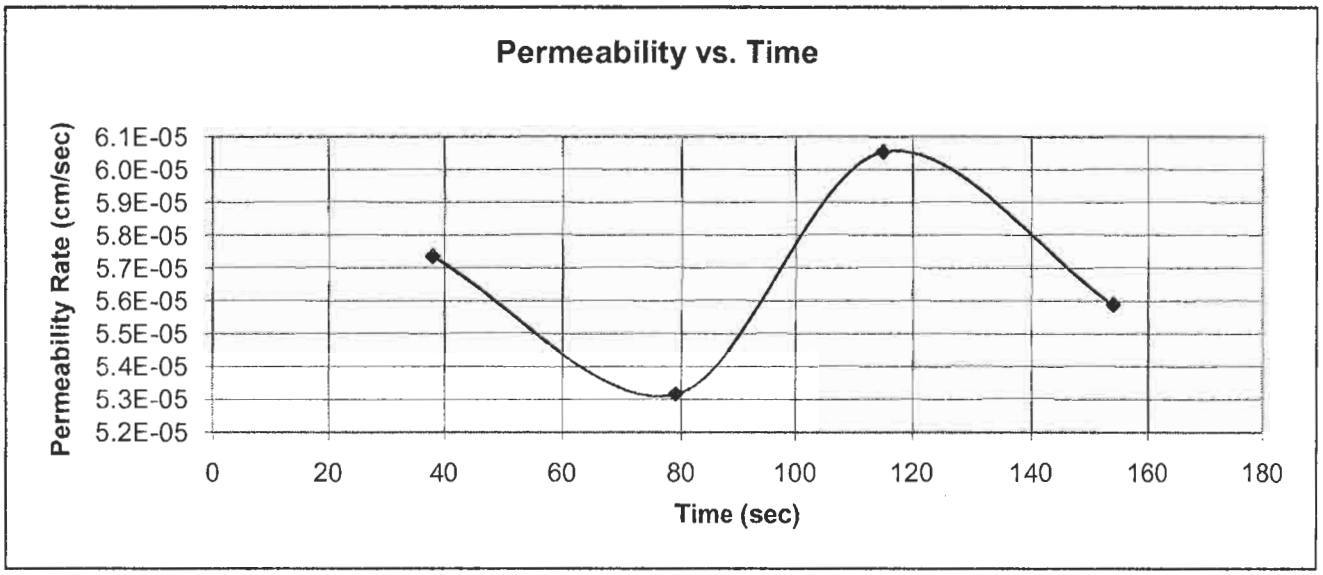
Dia. (in.)	2.80	**Length (in)**	3.46	**Weight (gr)**	653.2
Wet Density (pcf)	117.2	**Moisture Content (%)**	25.8	**Dry Density (pcf)**	93.1

Test Parameters

Test Method Used:	ASTM D-5084, method A	**Permeant Fluid:**	Deionized water
Maximum Hydraulic Gradient:	5.7	**Minimum Hydraulic Gradient**	2.8
Maximum Consolidation Stress (psi)	10	**Minimum Consolidation Stress (psi)**	3

Permeability Rate

5.7E-05



Reviewed By:

Hussein Benkhayal, P.E.

MACTEC

REPORT OF SOIL PERMEABILITY TESTING

Project: TVA Kingston Borrow Area **Project Number:** 3043-09-1018

Client Tennessee Valley Authority **Date Completed:** April 17, 2009

Sample Number: **Lab ID: 3962** **B-12 (5 - 10 ft)**

Sample Information:

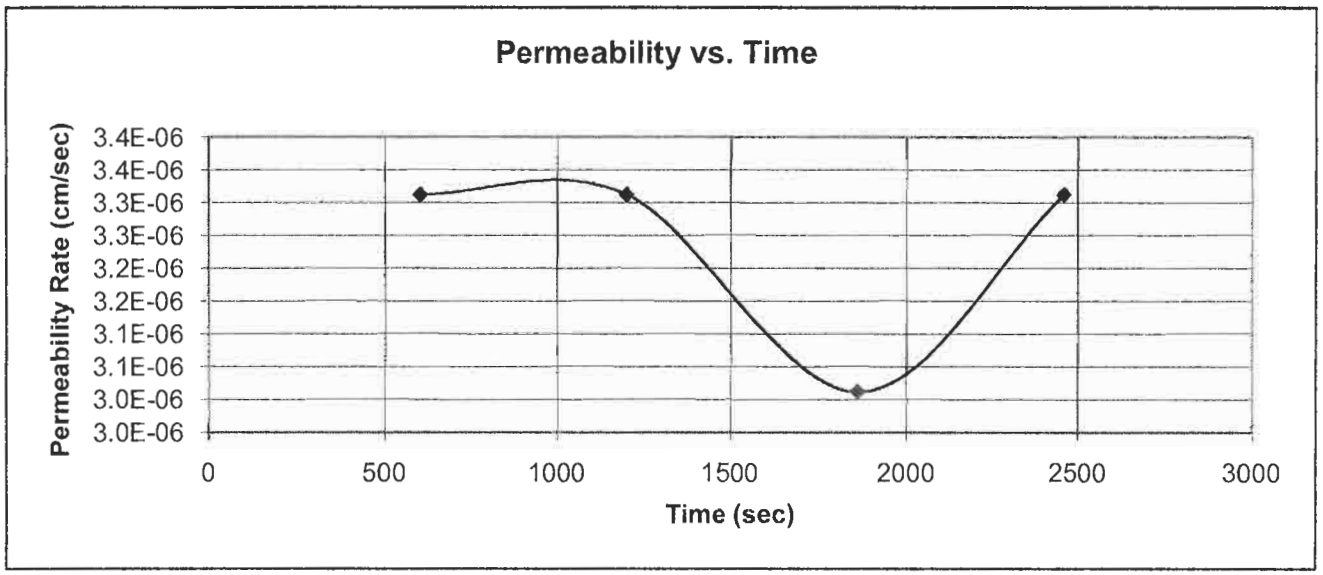
Dia. (in.)	2.85	**Length (in)**	3.28	**Weight (gr)**	630.8
Wet Density (pcf)	114.6	**Moisture Content (%)**	26.1	**Dry Density (pcf)**	90.8

Test Parameters

Test Method Used:	ASTM D-5084, method A	**Permeant Fluid:**	Deionized water
Maximum Hydraulic Gradient:	6.0	**Minimum Hydraulic Gradient**	3.0
Maximum Consolidation Stress (psi)	10	**Minimum Consolidation Stress (psi)**	5

Permeability Rate

3.2E-06



Reviewed By:

Hussein Benkhayal, P.E.

Review of a Work Plan for Temporary Ash Stockpile in the Peninsula Borrow Area

Prepared by Michael J. Gobla, P.E. July 21, 2009
Peer Review by Dave Paul, P.E.

Reclamation received an incomplete work plan for review, therefore these comments are preliminary.

The work plan proposes the temporary storage of coal combustion ash in a former clay soil borrow area. It is proposed to cover the ground with a foundation made from of the following layers from existing ground up: geotextle, geonet, geotextile, 12-inch layer of crusher stone, and up to 30 feet of flyash. The DRAFT Work Plan states that after removal of all ash the ground will be sampled and soils with elevated metals content will be removed; however, no details regarding sampling frequency or methods are provided. The ground surface slopes to the south where a 943,385 gallon (3 acre-feet) runoff collection pond will be built. The pond embankment fill will be up to 20 feet high. Flood hydrology information for the facility was not provided. No schedule as to how long the storage area will be operated was proposed.

1. This will expand the waste footprint at the site. No geologic data was included. The amounts of residual clay soils, depth to bedrock, and groundwater conditions need to be provided and discussed.
2. There is a reasonable probability that leachate passing through the geotextile and geonet will end up draining through fractures and other defects in the underlying clay soil. It is also possible that a metals-laden plume could form in the groundwater over time. Consideration should be given to constructing a more impermeable liner in the emporary storage area and the pond. The liner could be constructed of compacted clay covered by a geomembrane. This would minimize the amount of soil that needs removal afterwards and will protect groundwater. Details as to how groundwater will be monitored should be included in the Work Plan.
3. Pond cross section E-E shows a 10-ft wide crest with a 12 ft. tall upstream slope and a 20-foot tall downstream embankment slope. Both slopes are drawn as being 2H:1V which seems to be too steep for the upstream slope. If there is no stability analysis, then a 2 1/2H:1V slope is recommended for the upstream slope. The embankment should include a keyway trench and placement in thin lifts with proper moisture control and compaction.
4. The pond overflow spillway needs a filter under the riprap.

Howard, Jack

From: Moebes, John [jmoebes@tva.gov] **Sent:** Mon 7/27/2009 7:54 AM
To: Ray, Anda Andrews; Scott, Michael T
Cc: Howard, Jack
Subject: RE: peninsula temporary storage
Attachments:

Anda,
We developing ROM and timelime to do what Chuck wants. I would argue that the natural clay in the borrow area has a 10 to the -5 permeability factor, which is why it was used to line the gyp pond. It looks like Chuck wants to apply Class 1 construction standards to this tempoirary storage area. We will develop options for discussion with you and Mike.
John

From: Ray, Anda Andrews
Sent: Saturday, July 25, 2009 8:30 PM
To: Scott, Michael T; Moebes, John
Subject: FW: peninsula temporary storage

Mike and John,
Just making sure you have TDEC comments regarding the peninsula for additional storage in the first email in this chain.
Anda

From: Francendese.Leo@epamail.epa.gov [mailto:Francendese.Leo@epamail.epa.gov]
Sent: Fri 07/24/2009 4:22 PM
To: Glen Pugh; Barbara Scott; Ray, Anda Andrews
Cc: Chuck Head
Subject: Re: peninsula temporary storage

Tnx .. Will work w TVA on these.
Sent by EPA Wireless E-Mail Services

From: "Glen Pugh" [Glen.Pugh@tn.gov]
Sent: 07/24/2009 03:10 PM EST
To: Leo Francendese; "Barbara Scott" <Barbara.Scott@tn.gov>
Cc: "Chuck Head" <Chuck.Head@tn.gov>
Subject: peninsula temporary storage

hello Leo
These comments include input from our Knoxville staff since they were familiar with the permitting of the adjacent gypsum pond. The work plan is a little short on detail but I understand there is some urgency here.
There are three issues for your consideration.

Sampling

- since the plan speaks of removing impacted soils at closure, there should be sufficient soil samples taken now to determine existing levels of ash constituents in the borrow area soils.
- A ground water monitoring point(s) near the proposed runoff collection pond would be appropriate. There should already be some background data from the wells near the gypsum pond area. I doubt the gypsum pond wells are close enough to function as a monitoring point for the storage area though.

Collection Pond

- Soil voids were a problem in the construction of the adjacent gypsum pond. Test pits or borings in the collection pond area are warranted to look for any large voids. Since the collection pond will have considerable head level after storm events, some type of liner should be considered. A GCL liner is quickest to install but needs protection from scour due to pumping or flow currents.
- The pond may have to be oversized so that it will not discharge. I trust that there will be some type of dedicated pumper truck readily available.

Borrow Area

- Proof rolling to check for soil voids in the borrow area should undertaken. This could be done as part of the surface preparation for placement of the geocomposite.
- Use of some type of liner beneath the geocomposite would minimize the possibility of leachable constituents migrating into and through the soil layer. Even a woven geotextile (if it didn't create the possibility of a slip failure) would provide some extra protection.

From: Howard, Jack
To: Cagley, April M;
CC:
Subject: FW: peninsula temporary storage
Date: Friday, August 07, 2009 11:29:39 AM
Attachments:

Michelle: These are TDEC's comments on Peninsula Ash Storage Area Work Plan.

Jack Howard

From: Ray, Anda Andrews
Sent: Saturday, July 25, 2009 8:30 PM
To: Scott, Michael T; Moebes, John
Subject: FW: peninsula temporary storage

Mike and John,
Just making sure you have TDEC comments regarding the peninsula for additional storage in the first email in this chain.
Anda

From: Francendese.Leo@epamail.epa.gov [mailto:Francendese.Leo@epamail.epa.gov]
Sent: Fri 07/24/2009 4:22 PM
To: Glen Pugh; Barbara Scott; Ray, Anda Andrews
Cc: Chuck Head
Subject: Re: peninsula temporary storage

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Sent by EPA Wireless E-Mail Services

From: "Glen Pugh" [Glen.Pugh@tn.gov]
Sent: 07/24/2009 03:10 PM EST
To: Leo Francendese; "Barbara Scott" <Barbara.Scott@tn.gov>
Cc: "Chuck Head" <Chuck.Head@tn.gov>

Subject: peninsula temporary storage

hello Leo
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Borrow Area

- Proof rolling to check for soil voids in the borrow area should undertaken. This could be done as part of the surface preparation for placement of the geocomposite.
- Use of some type of liner beneath the geocomposite would minimize the possibility of leachable constituents migrating into and through the soil layer. Even a woven geotextile (if it didn't create the possibility of a slip failure) would provide some extra protection.

Response to Glen Pugh Comments

Sampling

1. The area where the storage area will be is a clean site that has no ash present, however the sampling listed below will be accomplished prior to construction (see sketch attached to work plan).
2. The need for a ground water monitoring point has been evaluated by a consultant and his recommendation is quoted below:

"The proposed Gypsum Cell Temporary Ash Retention Basin is located in the southeastern portion of the KIF property. The basin is developed as a nominal 30 ft deep cut in Knox Group residual soil which is characterized by dense, reddish-orange clay with chert fragments throughout. While the Knox Group is known as a regional aquifer, hydraulic conductivity values for the residual clay soils are commonly from 1E-5 to 1E-7 cm/s which makes these soils amenable for use as natural impermeable membranes.

Because contaminants must leach through soil to reach groundwater, soil sampling is recommended as the most cost effective way to assess the potential impact of the use of the basin for temporary ash storage on groundwater. Both baseline and post-use soil data acquisition is recommended. Five sampling locations are recommended; one near the center of the basin and four in cardinal directions nominally midway between the center and edge of the basin. Samples should be obtained from the 0-1 ft, 1-5 ft, and each 5 ft depth interval thereafter to refusal. Because the shape of the bedrock surface is highly irregular, locations should be moved if shallow refusal is encountered. Analyses should be for metals. Coordinates should be obtained from each sample location so each location can be resampled following closure of the basin. Closure should include removal of the upper 1 ft of soil in the event contaminants might have breached a defective or torn liner."

Borrow Area Collection Pond

1. There are several existing borings in the storage area. It was first used as a borrow source for the Gypsum Pond project. The area will be proof-rolled prior to ash placement. The existing soil material is a cherty clay therefore it will be smooth drum rolled and a GCL placed on it with a 1' soil cover prior to ash placement.
2. The pond has been sized for the 5 year- 24 hour storm event and there are 2 pumper trucks on-site that are available to de-water the pond.

Borrow Area

1. There are several existing borings in the storage area. It was first used as a borrow source for the Gypsum Pond project. The area will be proof-rolled prior to ash placement. The existing soil material is a cherty clay therefore it will be smooth drum rolled and a GCL placed on it with a 1' soil cover prior to ash placement.
2. Same as No. 1 above

Response to Michael J. Gobla Comments

1. The storage area is proposed to be used for the duration of the time critical removal east of Dike 2. This should be through May of 2011.
2. Geotechnical borings are now provided.
3. The design has be re-evaluated and a GCL will be used instead of the geonet sandwich for the bottom of the storage area and pond.
4. Groundwater monitoring will be addressed via soil sampling (see response to TDEC ground water comment).
5. The slopes of the pond will be revised to 2.5 to 1.
6. A geotextile will be added under the overflow spillway riprap.