

REPORT OF GEOTECHNICAL INVESTIGATION

**GYPSUM STACK 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 3043051030.01

October 4, 2005



MACTEC



engineering and constructing a better tomorrow

October 4, 2005

Mr. Ron Purkey
Tennessee Valley Authority
1101 Market Street, LP-2G
Chattanooga, TN 37402

Subject: **Report of Geotechnical Investigation**
Gypsum Stack Borrow Area
TVA Kingston Fossil Plant
Kingston, Tennessee
MACTEC Project 3043051030.01

Dear Mr. Purkey:

We at MACTEC Engineering and Consulting, Inc., (MACTEC) are pleased to submit this Report of Geotechnical Investigation for your project. Our services, as authorized through TAO No. MAC-0724-00082, were provided in general accordance with our proposal number Prop05Knox/182, dated June 9, 2005.

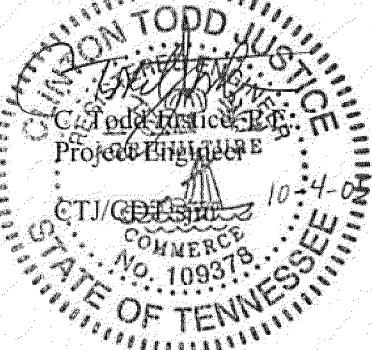
This report reviews the information provided to us, discusses the site and subsurface conditions, and presents the results of our laboratory testing for the materials at the Gypsum Stack Borrow Area. The Appendices contain a brief description of the Field Exploratory Procedures, Observation Trench Logs, the Laboratory Test Procedures, and the Laboratory Test Results. At the time of report finalization, samples of the composite geonet fabric were not available for laboratory testing purposes as required in this scope of work. MACTEC will provide the results of the geonet fabric testing within a separate letter report upon completion of the laboratory testing.

We anticipate further dialog and interaction with the designers as the design proceeds and will be happy to provide any additional information or interpretation of the data presented here in which may be necessary.

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.



Carl D. Tockstein, P.E.
Chief Engineer - Tennessee Operations

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EXECUTIVE SUMMARY

MACTEC was selected by the Tennessee Valley Authority (TVA) to perform a geotechnical investigation for the Gypsum Stack Borrow Area at the Kingston Fossil Plant in Kingston, Tennessee. The objectives of our exploration were to determine general subsurface conditions in the borrow area and to perform geotechnical laboratory testing in order to evaluate the engineering characteristics of the potential borrow soils.

The exploration consisted of excavating 5 observation trenches (OT-1 through OT-5) to maximum depths of 10 feet or refusal, whichever occurred first. The major findings of our geotechnical exploration are as follows:

- The observation trenches excavated in the Gypsum Stack Borrow Area typically encountered residual soils underlying minor amounts of topsoil. The residuum typically consisted of fat clay and lean clays with varying amounts of roots, sand, chert fragments, and manganese nodules. The observation trenches were terminated at depths of about 10 feet.
- Ground water was not encountered in the observation trenches during the time of our investigation. Long-term measurements for the presence or absence of ground water were not obtained during this exploration.
- Laboratory tests were performed on bulk soil samples from the potential borrow area. A summary of the tests performed and the test results is presented in Section 3.0 and Section 7.0, respectively. The test results are presented in Appendix C and are summarized in Tables C-1 through C-4.
- Figures 4, 5, and 6 show graphical plots that can be used to assist the constructors in field control and quality assurance during the placement of the compacted engineered fill. MACTEC recommends that additional hydraulic conductivity testing be performed in order to more accurately develop and verify the initially constructed Acceptable Zone boundaries. Section 8.0 describes the procedures to implement the use of the graphical plots in the field.

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 Gypsum Stack Borrow Area at the TVA Kingston Fossil Plant. Our services were authorized by Mr. Ron Purkey of TVA.

2.0 OBJECTIVES OF EXPLORATION

The objectives of our exploration were to determine general subsurface conditions in the borrow area and to perform geotechnical laboratory testing in order to evaluate the engineering characteristics of the potential borrow soils. 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 Prop05Knox/182, dated June 9, 2005 and the geotechnical scope of work outlined in the project's scope of work. It includes the following:

- Excavate 5 observation trenches including logging the soil strata and collecting samples within the Gypsum Stack Borrow Area
- Locate each observation trench using GPS
- Conduct laboratory testing on the potential borrow soils
- Develop moisture-density / hydraulic conductivity relationships for each soil type encountered
- Prepare a geotechnical report summarizing the field and laboratory test results with applicable recommendations

The field work was performed in accordance to the procedures included in Appendix A. The field work was performed on June 28, 2005. TVA provided the backhoe equipment used to excavate the observation trenches. A MACTEC geotechnical engineer was present to identify and log the various soil types encountered. Bulk soil samples of each soil type were obtained from the excavated soils

within the observation trenches. Photographs of the observation trenches and soils excavated from the trenches were made upon completion of sampling.

Upon completing the excavation of an observation trench, the trenches were backfilled with the excavated soils.

The samples were transported to our laboratories in Knoxville, Tennessee and Charlotte, North Carolina where the soil samples were tested. The testing program for this project consisted of the following:

- 9 Plasticity Index (Atterberg Limits) Tests
- 9 Grain Size Distribution Tests
- 3 Natural Moisture Content Tests
- 9 Standard Proctor Compaction Tests
- 9 Specific Gravity Tests
- 18 Hydraulic Conductivity Tests

Subsurface conditions encountered in the observation trenches are presented on the Observation Trench Logs in Appendix B. The laboratory testing results are presented in Appendix C.

4.0 PROJECT INFORMATION AND SITE CONDITIONS

Project information was provided to us by Mr. Lynn Petty with TVA in the form of a Geotechnical Investigation Scope of Work and a proposed Observation Trench location plan. The investigation was performed in the Gypsum Stack Borrow Area. The Gypsum Stack Borrow Area is located northwest of the proposed Gypsum Disposal Area and is shown in Figure 1- Site Location Map.

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 (interbedded limestone and dolomite), 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.

6.0 SUBSURFACE CONDITIONS

Subsurface conditions were explored with 5 observation trenches excavated in general accordance with the procedures presented in Appendix A. The trench locations and depths were selected by TVA. The trench locations were located by GPS by the MACTEC geotechnical engineer. The GPS coordinates are shown on the Observation Trench Logs. The trench locations are shown on Figure 2 - Observation Trench Location Plan.

Subsurface conditions encountered at the boring locations are shown on the Observation Trench Logs. These logs represent our interpretation of the subsurface conditions, based on observations of the materials exposed in the trenches by our geotechnical engineer. The depth intervals designating the interfaces between various strata on the logs represent the approximate interface locations.

The observation trenches excavated at this site encountered topsoil and residual soils. Topsoil is the dark-colored organic soil that forms naturally at the ground surface. Residual soils are soils that have developed from the in-place weathering of the underlying parent bedrock. The observation trenches were terminated at depths of about 10 feet.

A brief summary of subsurface conditions encountered in the trenches is discussed in the following portions of this section. For detailed conditions at each trench location, refer to the Observation Trench Logs in Appendix B.

Topsoil was encountered in observation trenches OT-1 through OT-4 to depths of about 0.5 feet. About 1 foot of topsoil was encountered in OT-5. Lean clay and fat clay residuum was typically encountered underlying the topsoil to termination depths. Large diameter roots (up to 1-inch) were encountered within the residuum to depths varying from about 2 to 4 feet below the existing ground

surface. The percentage of chert observed within the encountered soils was visually estimated and noted on the observation trench logs.

7.0 LABORATORY TESTING METHODOLOGY AND DISCUSSION OF TEST RESULTS

A detailed visual examination of the soils obtained from the observation trenches led to the identification of three distinct soil types based on color and chert content. The soil types have been designated as types "A", "B", and "C". Soil type A consists of reddish orange fat clay with varying amounts of chert fragments (observed in OT-1, OT-2 and OT-5). Soil type B consists of reddish brown lean clay / fat clay with varying amounts of sand and chert fragments (observed in OT-3). Soil type C consists of dark reddish brown lean clay with varying amounts of sand and black manganese nodules (observed in OT-4).

Laboratory tests were performed on bulk soil samples obtained from observation trenches OT-1 (soil type A), OT-3 (soil type B), and OT-4 (soil type C). The laboratory testing for each soil type included the following:

- 1 Natural Moisture Content Test
- 3 Plasticity Index (Atterberg Limits) Tests
- 3 Grain Size Distribution Tests
- 3 Specific Gravity Tests
- 3 Standard Proctor Compaction Tests
- 6 to 7 Hydraulic Conductivity Tests

Representative samples of each soil type were obtained from the bulk samples in preparation for laboratory testing. The results of the Proctor compaction tests were used to prepare remolded specimens at relative compactions of 90 and 95 percent maximum dry density, at moisture contents of -2, +1, and +4 percent of optimum. The remolded specimens were subjected to laboratory hydraulic conductivity testing. The data obtained from the laboratory test results was used to develop graphical plots showing relationships between molding moisture content and hydraulic conductivity for soils types A, B, and C at relative compactions of 90 and 95 percent standard Proctor density (Figures 3A, 3B, and 3C). Final graphical plots (Figures 4, 5, and 6), showing the compaction data points, were constructed in order to create an "acceptable zone" which includes data points for specimens with hydraulic conductivity values less than or equal to 1×10^{-6} cm/s.

The tests and test results are summarized below in the following paragraphs. Table C-1 summarizes the natural moisture content, compaction characteristics, specific gravity, Atterberg Limits, percent fines and Unified Soil Classification results for the soils tested. Tables C-2, C-3, and C-4 summarize the results of the hydraulic conductivity testing performed on the tested soils.

7.1 INDEX PROPERTIES

Natural moisture content, Atterberg limits, and grain size analysis tests were performed on bulk samples obtained from the potential borrow soils at trench locations OT-1, OT-3, and OT-4.

Natural moisture contents of the tested samples ranged from 22.5 percent (OT-4) to 24.6 percent boring (OT-1).

The Atterberg limits test results indicated that liquid limits for the on-site borrow soils tested ranged from 36 to 60, plastic limits ranged from 19 to 29, and plasticity indices ranged from 17 to 33. The tested on-site borrow soils were classified as CL and CH in accordance with the USCS.

The specific gravity of the tested samples ranged from 2.72 to 2.75.

7.2 MOISTURE-DENSITY RELATIONSHIP

Nine Standard Proctor compaction tests were performed on bulk samples obtained from trench locations OT-1, OT-3, and OT-4. The test results indicated that the maximum dry density for the soils tested ranged from 90.7 to 107.3 pcf, and the corresponding optimum moisture contents were 28.3 and 17.6, respectively.

7.3 HYDRAULIC CONDUCTIVITY

Constant head permeability tests were performed on remolded samples from bulk soil samples obtained at locations OT-1, OT-3, and OT-4. The samples were remolded to or near 90 and 95 percent of the standard Proctor maximum dry density and at or near -2, +1, and +4 percent of optimum moisture content for a total of 18 tests. Two additional permeability tests were performed on bulk soil samples from locations OT-1 and OT-4 remolded to or near 95 percent of standard Proctor maximum dry density and at or near +1.7 and +1.8 percent of optimum moisture content.

The permeability test results indicated that the permeability's ranged from 1.2×10^{-5} cm/s to 8.1×10^{-8} cm/s.

8.0 RECOMMENDATIONS

The laboratory testing program just described was used to develop the graphical plots shown in Figures 4, 5, and 6. These graphical plots show compaction data points with respect to an "Acceptable Zone" which includes data points for specimens with hydraulic conductivity values approximately less than or equal to 1×10^{-6} cm/s. The lower limit of the Acceptable Zone is typically parallel to the zero air voids curve. Figures 4, 5, and 6 utilize a specified degree of saturation as the lower boundary of the Acceptable Zone. It is observed that only a limited number of compaction data points were used to construct the Acceptable Zones which utilize a degree of saturation as the lower boundary for each of the soil types. MACTEC recommends that additional hydraulic conductivity testing be performed in order to more accurately develop and verify the initially constructed Acceptable Zone boundaries. Specifically, additional hydraulic conductivity testing should be performed on specimens of each soil type remolded to or near 98 to 100 percent standard Proctor maximum dry density at or near their respective optimum moisture contents and at -1 percent of optimum. An additional 12 hydraulic conductivity tests are recommended.

Once the additional testing has been performed to verify and/or modify the Acceptable Zones, the graphical plots can be used to assist the constructors in field control and quality assurance during the placement of the compacted engineered fill. In order to implement the use of the graphical plots in the field, the soil technicians will have to first classify the soils as types A, B, or C. One-point standard Proctor compaction tests can be occasionally performed in the field to aid in identification of questionable materials. After the materials have been placed and compacted in lifts, the technicians then measure the dry density and moisture content in the field. The field dry density-moisture content point is then plotted on the appropriate graphical plot (Figures 4, 5, or 6). If the field measured dry density value exceeds the minimum required dry density (falls within the acceptable zone) then no further action is needed. If the field measured dry density was less than the minimum required dry density, then additional compaction is performed until the field measured dry density exceeds the minimum required value.

9.0 BASIS OF RESULTS

The results and recommendations provided herein are based on the encountered subsurface conditions and laboratory testing 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 engineer 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.

TABLES

TABLE C-1
Index Property and Moisture-Density Test Results
TVA Kingston Gypsum Stack Borrow Area
MACTEC Project 3043051030/01

Test Location Number	Sample Depth (Feet)	Soil Type	Natural Moisture Content, %	Atterberg Limits			Percent Finer Than No. 200 Sieve	USCS Classification	Specific Gravity	Compaction Tests	
				Liquid Limit	Plastic Limit	Plasticity Index				Std. Proctor Max. Dry Density, pcf	Opt. Moisture Content, %
OT-1	2.5 - 10	A	24.6	58	29	29	87.8	CH	2.75	90.7	28.3
OT-1	2.5 - 10	A	24.6	59	26	33	87.5	CH	2.75	91.6	28.3
OT-1	2.5 - 10	A	24.6	60	28	32	87.7	CH	2.75	91.4	28.8
OT-3	3 - 10	B	23.3	47	23	24	74.0	CL	2.74	101.0	22.4
OT-3	3 - 10	B	23.3	50	23	27	74.6	CH	2.75	101.3	20.3
OT-3	3 - 10	B	23.3	45	22	23	74.1	CL	2.73	100.6	22.1
OT-4	4 - 10	C	22.5	36	19	17	82.4	CL	2.72	107.3	17.6
OT-4	4 - 10	C	22.5	38	20	18	83.8	CL	2.73	105.9	18.8
OT-4	4 - 10	C	22.5	39	19	20	83.5	CL	2.73	104.9	18.4

Prepared/Date: CTJ 07/29/05

Checked/Date: SDS 08/05/05

Table C-2**Hydraulic Conductivity****Soil Type A**

TVA Kingston Gypsum Stack Borrow Area

MACTEC Project 3043051030/01

Trench Location	Bulk Sample Depth (ft)	Target Remolded Proctor Dry Density %	Remolded Moisture (%)	Wet Unit wt (pcf)	Dry Unit wt (pcf)	Hydraulic Conductivity (cm/sec)
OT-1	2.5 - 10	90	26.4	103.1	81.6	6.0×10^{-6}
OT-1	2.5 - 10	90	29.3	105.5	81.6	3.9×10^{-6}
OT-1	2.5 - 10	90	32.5	108.0	81.5	4.3×10^{-7}
OT-1	2.5 - 10	95	26.4	109.0	86.2	1.1×10^{-6}
OT-1	2.5 - 10	95	29.3	111.5	86.2	1.8×10^{-6}
OT-1	2.5 - 10	95	30.0	112.1	86.2	1.4×10^{-7}
OT-1	2.5 - 10	95	32.5	114.0	86.0	2.2×10^{-7}

Note: Maximum dry density is 90.7 pcf and optimum moisture content is 28.3 % for soil type A

Table C-3
Hydraulic Conductivity
Soil Type B

TVA Kingston Gypsum Stack Borrow Area
MACTEC Project 3043051030/01

Trench Location	Bulk Sample Depth (ft)	Target Remolded Proctor Dry Density %	Remolded Moisture (%)	Wet Unit wt (pcf)	Dry Unit wt (pcf)	Hydraulic Conductivity (cm/sec)
OT-3	3 - 10	90	19.9	108.7	90.7	2.1×10^{-6}
OT-3	3 - 10	90	22.5	111.4	90.9	2.4×10^{-6}
OT-3	3 - 10	90	25.6	114.0	90.8	2.1×10^{-7}
OT-3	3 - 10	95	19.9	114.7	95.7	1.2×10^{-5}
OT-3	3 - 10	95	22.5	117.6	96.0	2.6×10^{-7}
OT-3	3 - 10	95	25.6	120.6	96.0	3.5×10^{-7}

Note: Maximum dry density is 100.6 pcf and optimum moisture is 22.1% for soil type B

Table C-4
Hydraulic Conductivity
Soil Type C

TVA Kingston Gypsum Stack Borrow Area
MACTEC Project 3043051030/01

Trench Location	Bulk Sample Depth (ft)	Target Remolded Proctor Dry Density %	Remolded Moisture (%)	Wet Unit wt (pcf)	Dry Unit wt (pcf)	Hydraulic Conductivity (cm/sec)
OT-4	4 - 10	90	17.1	111.2	95.0	1.1×10^{-5}
OT-4	4 - 10	90	19.8	114.2	95.3	3.5×10^{-6}
OT-4	4 - 10	90	22.7	117.1	95.4	4.0×10^{-7}
OT-4	4 - 10	95	17.1	117.5	100.3	4.8×10^{-6}
OT-4	4 - 10	95	19.8	120.5	100.6	1.6×10^{-6}
OT-4	4 - 10	95	20.6	121.3	100.6	1.1×10^{-6}
OT-4	4 - 10	95	22.7	123.6	100.7	8.1×10^{-8}

Note: Maximum dry density is 105.9 pcf and optimum moisture is 18.8 % for soil type C

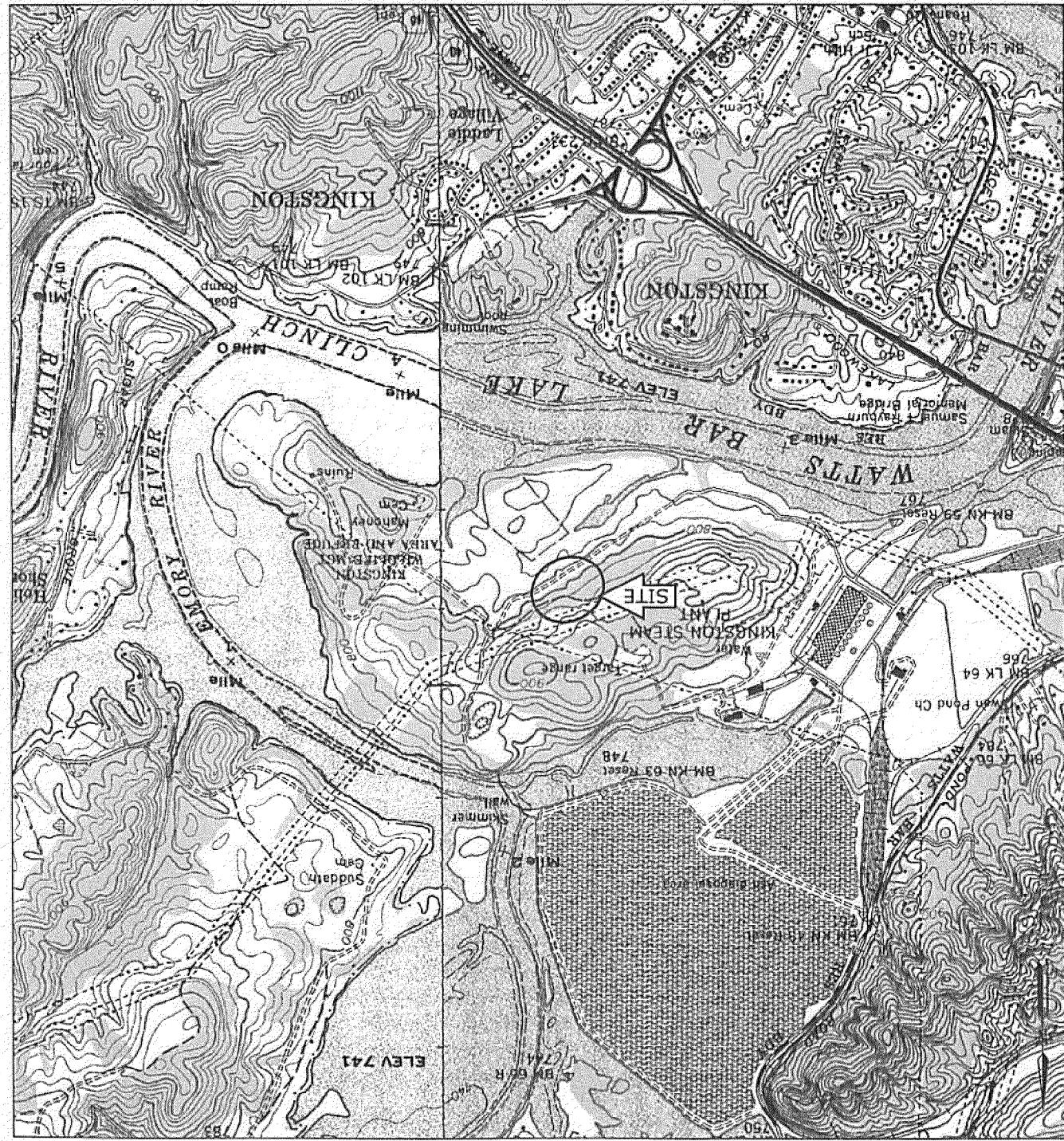
FIGURES

MACTEC Engineering and Consulting, Inc.
1725 Louisville Drive
Knoxville, Tennessee 37921-5904
865-588-8544 • Fax: 865-588-8026

MACTEC

FIGURE 1: SITE LOCATION MAP
TVA KINGSTON PROPOSED GYPSUM STACK BORROW AREA
KINGSTON, TENNESSEE

SOURCE: USGS TOPOGRAPHIC MAPS OF HARRIMAN AND ELMERTON, TN QUADRANGLES



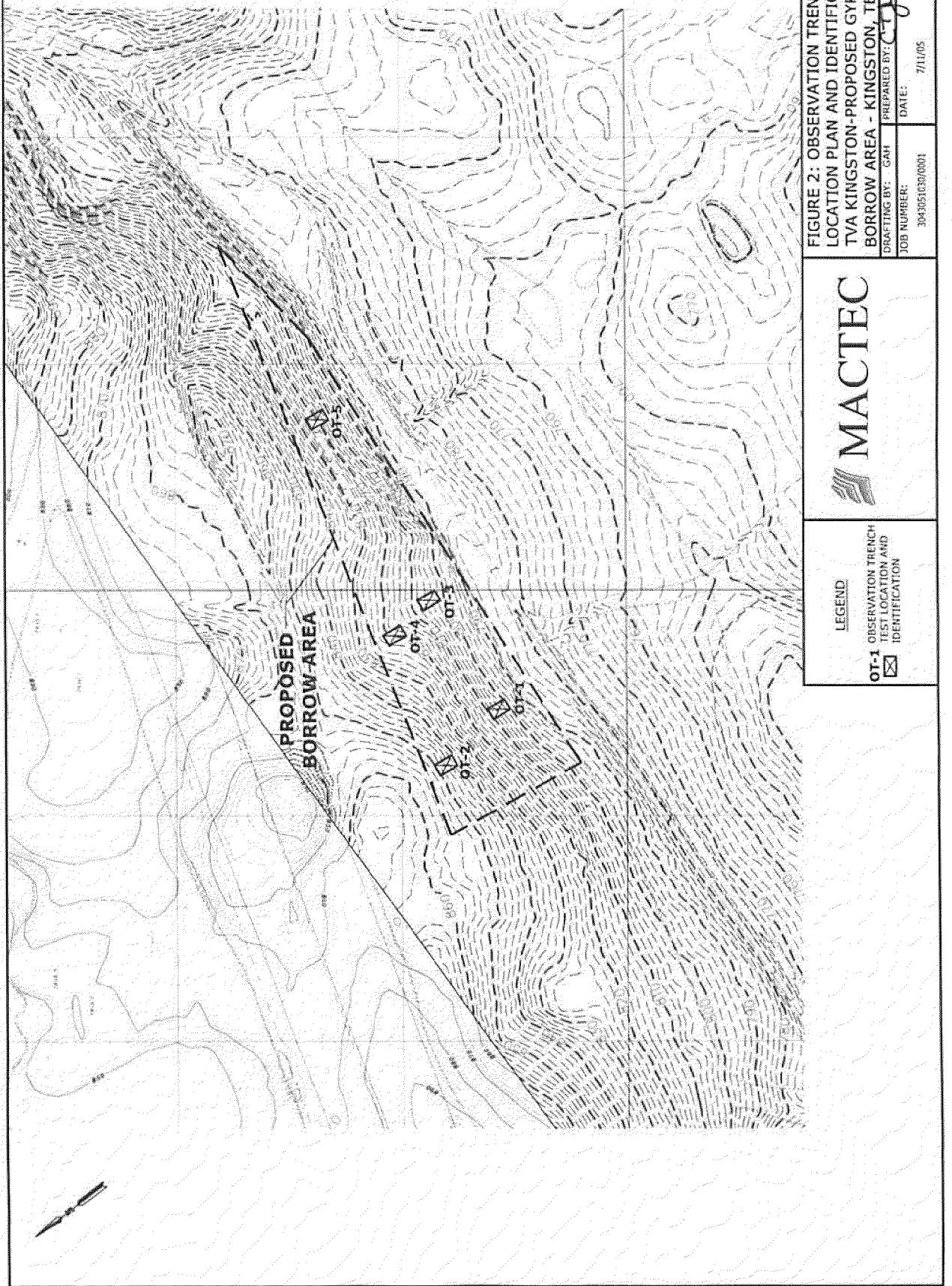


FIGURE 2: OBSERVATION TRENCH TEST
LOCATION PLAN AND IDENTIFICATION
TVA KINGSTON-PROPOSED GYPSUM STACK
BORROW AREA - KINGSTON, TENNESSEE

DRAFTING BY:	GAH	PREPARED BY:	CJL	CHECKED BY:	JZ
JOB NUMBER:	30-3051CD00001	DATE:	7/1/05	SCALE:	1:2000
		0	700' 000"	200'	100'
COORDINATES: NAD 1983 HARN					

TVA-00008295

Soil Type "A" - Reddish Orange Fat Clay with Chert Fragments (CH)
Standard Proctor Maximum Dry Density = 90.7 pcf, Optimum Moisture Content = 28.3%

HYDRAULIC CONDUCTIVITY DATA - SOIL TYPE "A"

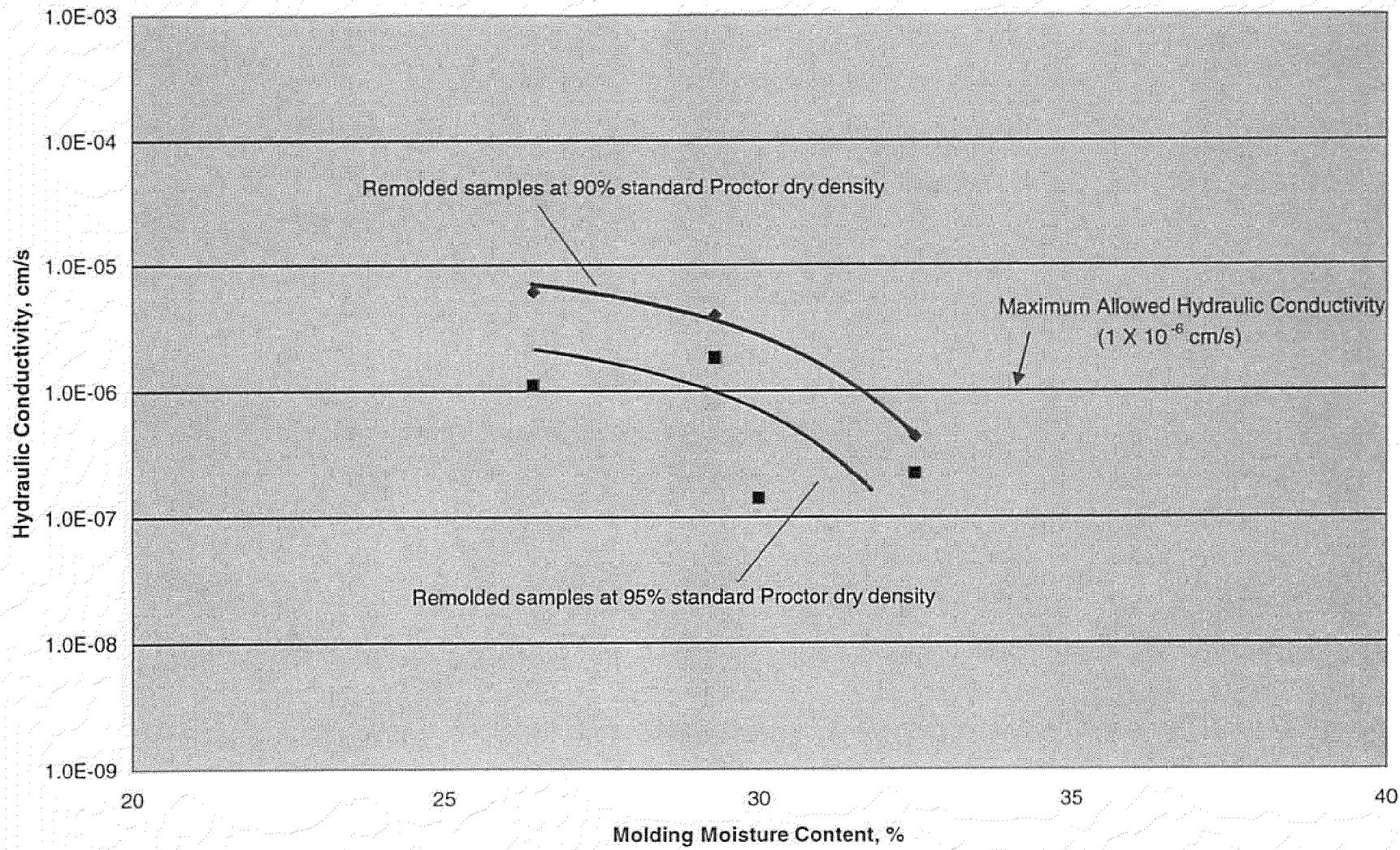


Figure 3A- Hydraulic Conductivity versus Molding Moisture Content for Type "A" Soil

Soil Type "B" - Reddish Brown Lean Clay / Fat Clay with Sand and Chert Fragments (CL/CH)
Standard Proctor Maximum Dry Density = 100.6pcf, Optimum Moisture Content = 22.1%

HYDRAULIC CONDUCTIVITY DATA - SOIL TYPE "B"

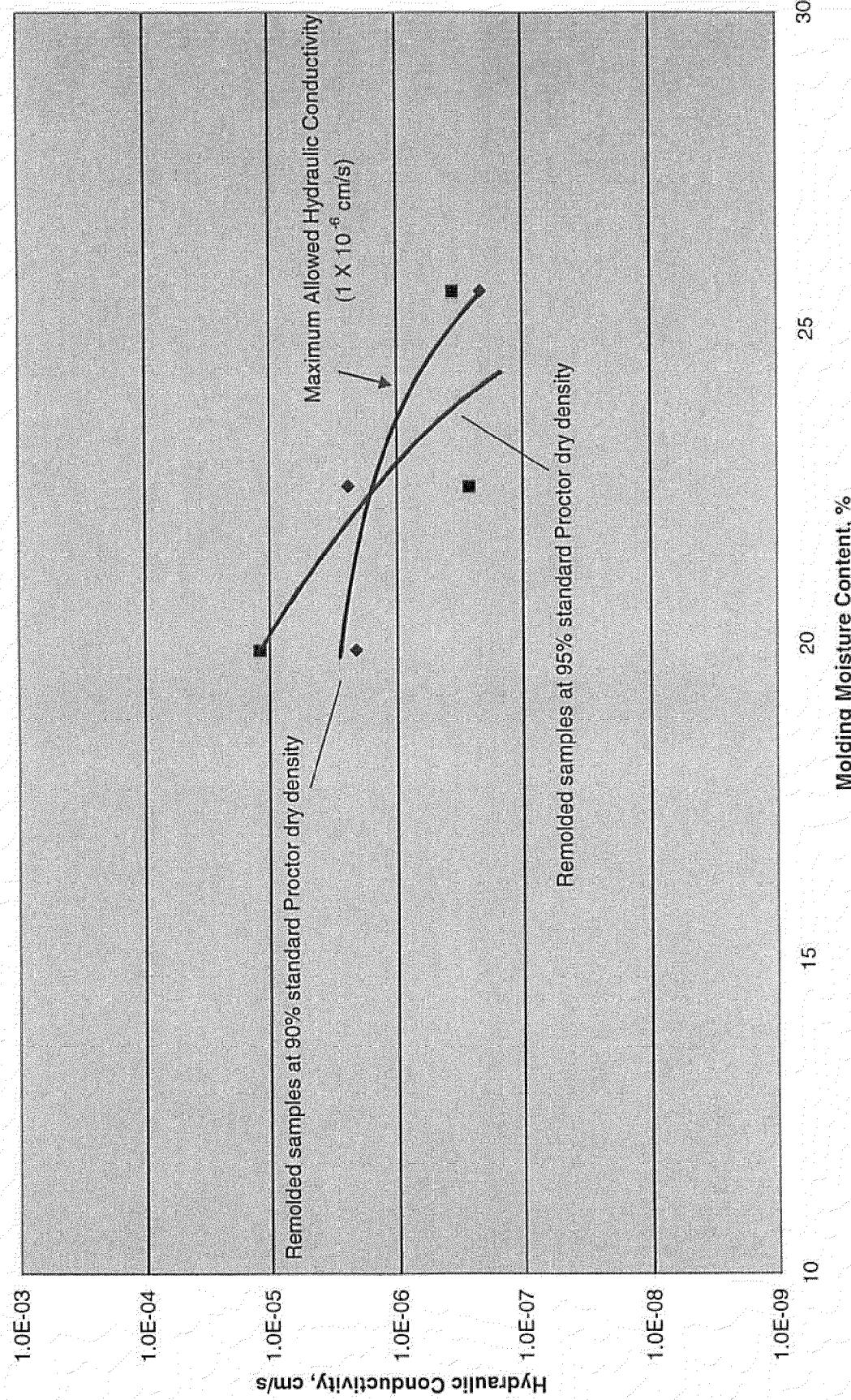


Figure 3B- Hydraulic Conductivity versus Molding Moisture Content for Type "B" Soil

Soil Type "C" - Dark Reddish Brown Lean Clay with Sand and Black Manganese Nodules (CL)

Standard Proctor Maximum Dry Density = 105.9pcf, Optimum Moisture Content = 18.8%

HYDRAULIC CONDUCTIVITY DATA - SOIL TYPE "C"

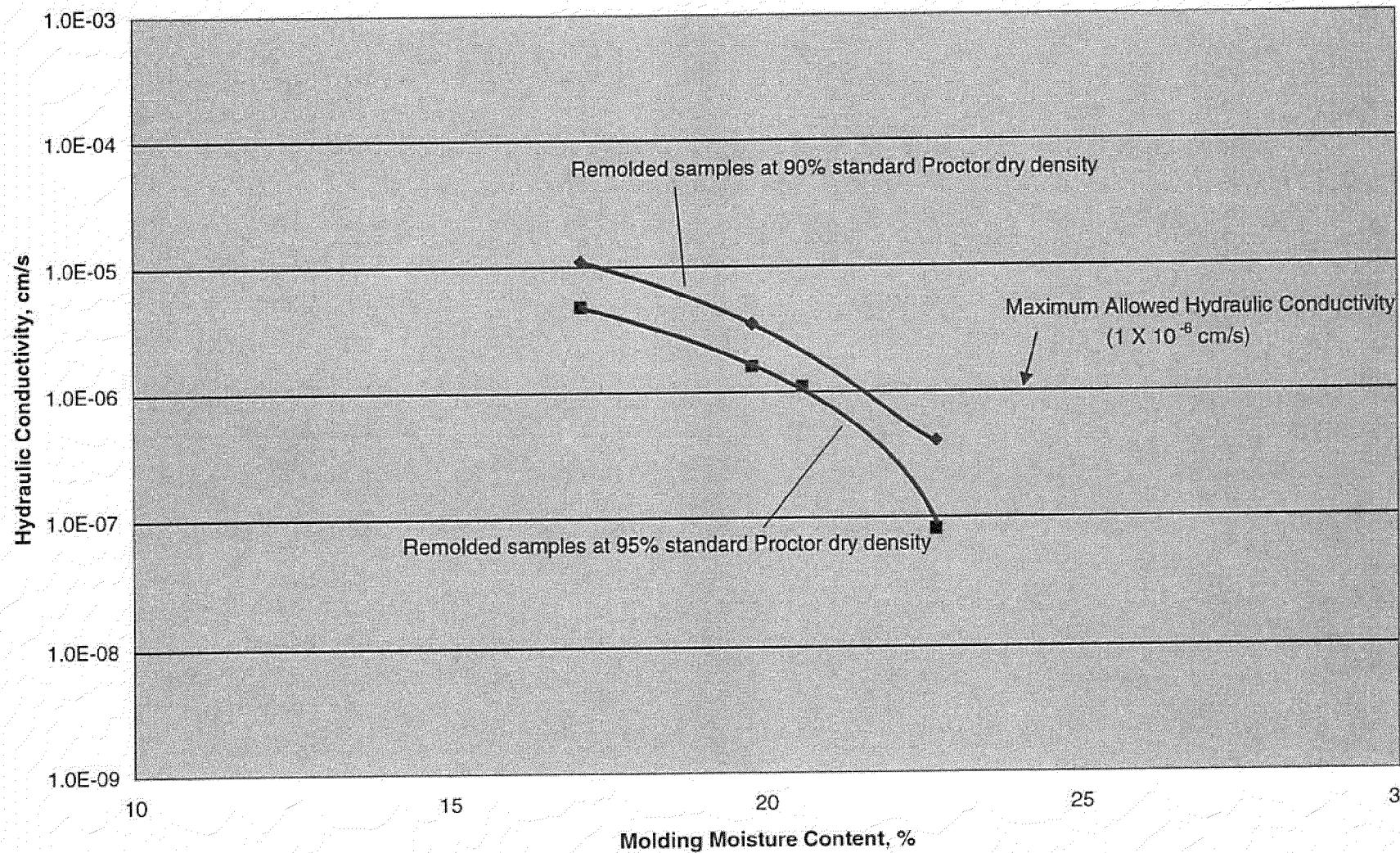


Figure 3C- Hydraulic Conductivity versus Molding Moisture Content for Type "C" Soil

Soil Type "A" - Reddish Orange Fat Clay with Chert Fragments (CH)
Standard Proctor Maximum Dry Density = 90.7pcf, Optimum Moisture Content = 28.3%

COMPACTION DATA FOR SOIL TYPE "A"

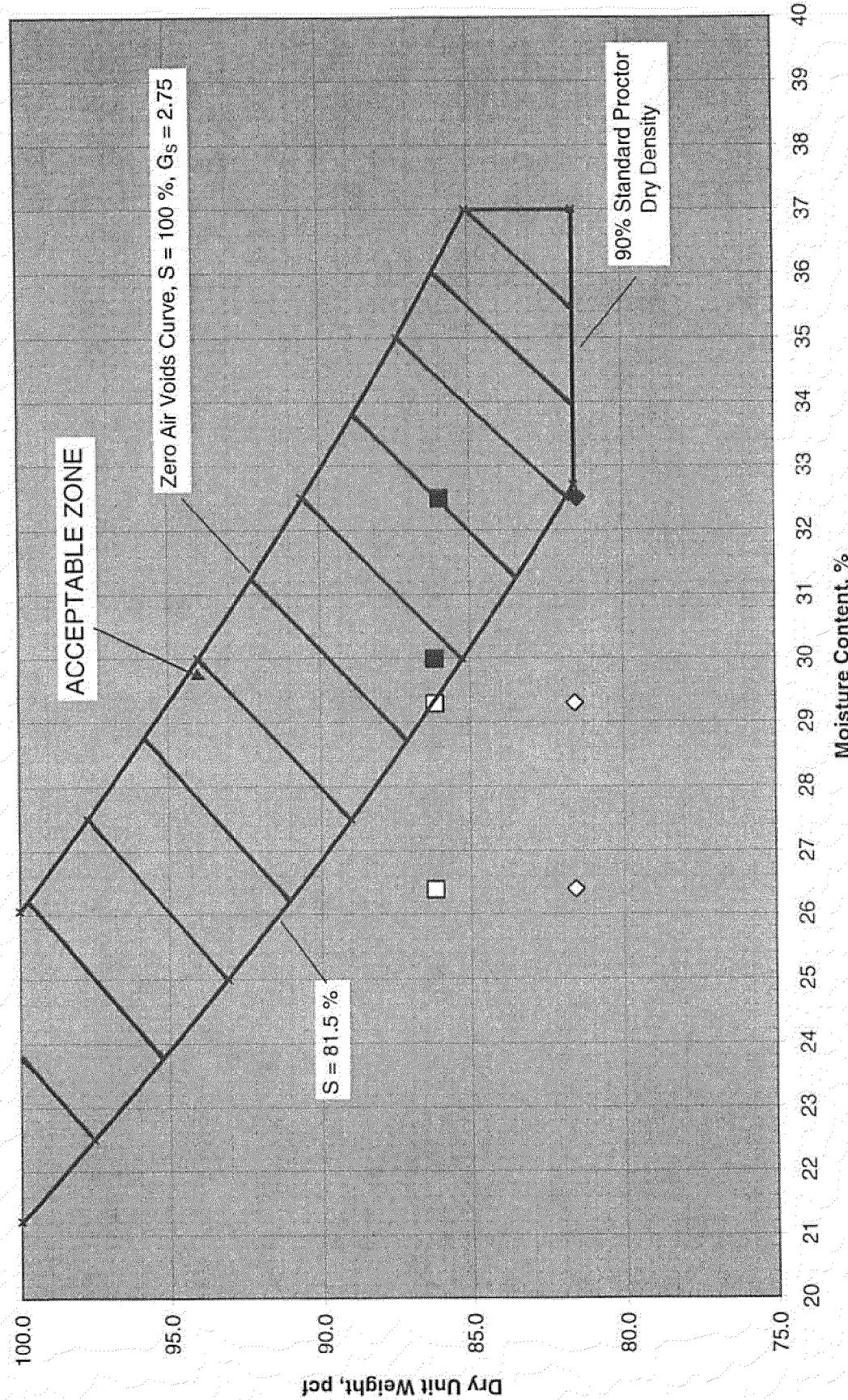


Figure 4- Solid symbols are for compacted specimens with a hydraulic conductivity $< 1 \times 10^{-6} \text{ cm/s}$ and open symbols for specimens with a hydraulic conductivity $> 1 \times 10^{-6} \text{ cm/s}$. Squares and Diamonds represent 95 and 90% compaction, respectively.

Soil Type "B" - Reddish Brown Lean Clay / Fat Clay with Sand and Chert Fragments (CL/CH)
Standard Proctor Maximum Dry Density = 100.6pcf, Optimum Moisture Content = 22.1%

COMPACTION DATA FOR SOIL TYPE "B"

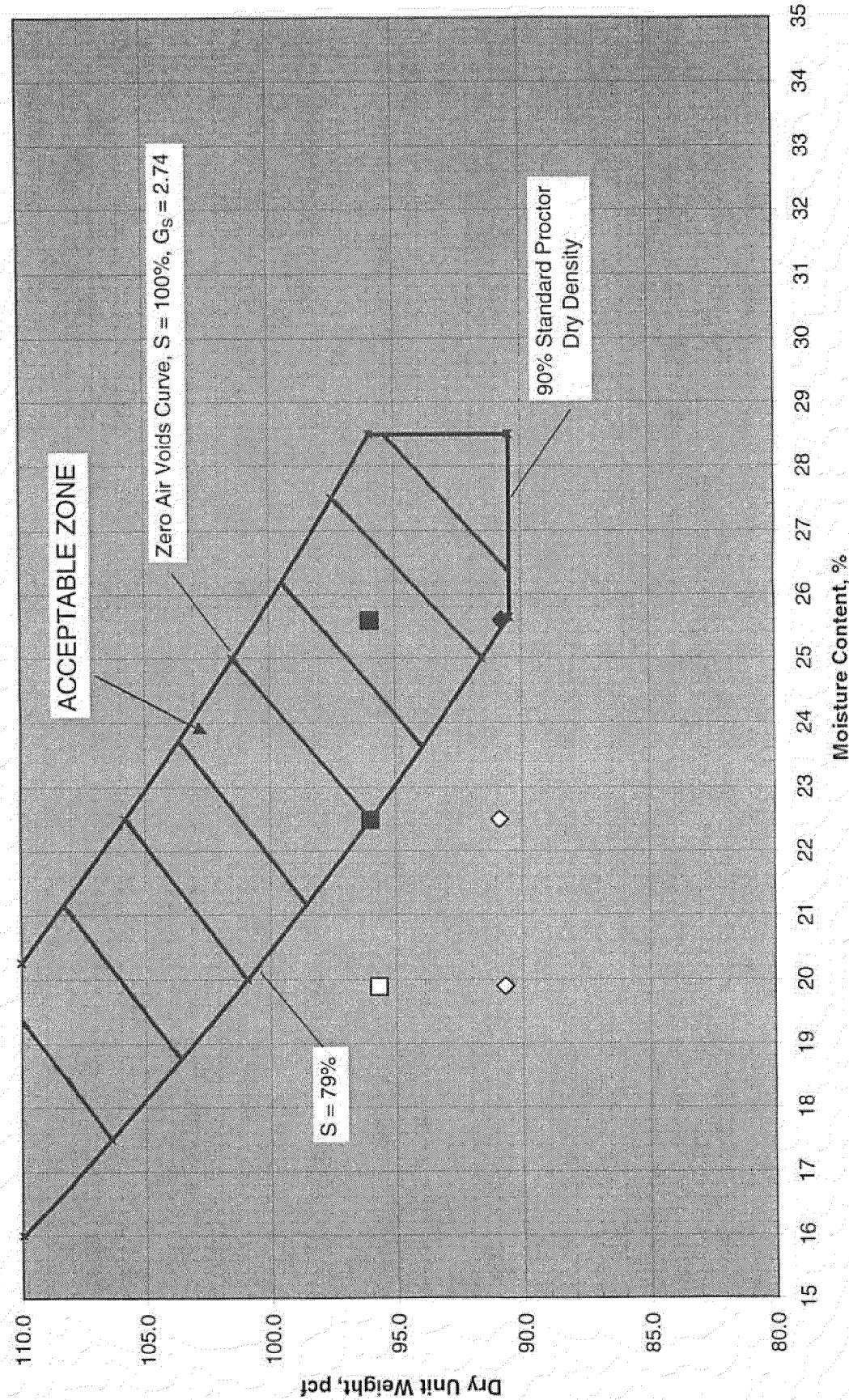


Figure 5- Solid symbols are for compacted specimens with a hydraulic conductivity $< 1 \times 10^{-6}$ cm/s and open symbols for specimens with a hydraulic conductivity $> 1 \times 10^{-6}$ cm/s. Squares and Diamonds represent 95 and 90% compaction, respectively.

Soil Type "C" - Dark Reddish Brown Lean Clay with Sand and Black Manganese Nodules (CL)
Standard Proctor Maximum Dry Density = 105.9pcf, Optimum Moisture Content = 18.8%

COMPACTION DATA FOR SOIL TYPE "C"

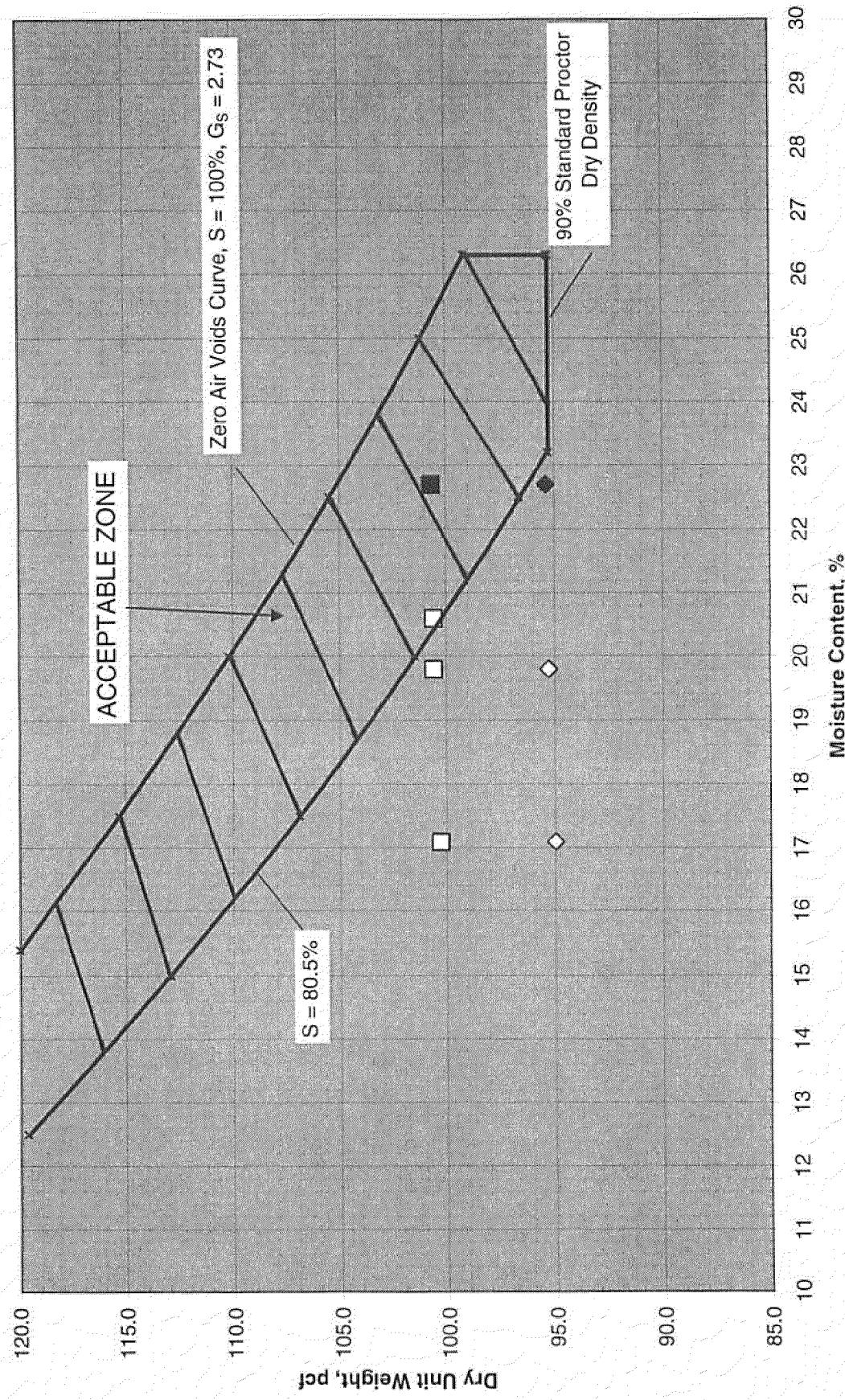


Figure 6- Solid symbols are for compacted specimens with a hydraulic conductivity $< 1 \times 10^{-6}$ cm/s and open symbols for specimens with a hydraulic conductivity $> 1 \times 10^{-6}$ cm/s. Squares and Diamonds represent 95 and 90% compaction, respectively.

APPENDIX A

FIELD EXPLORATORY PROCEDURES

FIELD EXPLORATORY PROCEDURES

Observation Trenches

The observation trenches were excavated by TVA using a Ford backhoe excavator. One of our geotechnical engineers observed the excavation and documented the materials exposed. The observation trenches were backfilled immediately after excavation for safety purposes. The operator tamped the materials in place with the excavator bucket. You are advised there is the probability of future backfill subsidence depending on actual subsurface conditions, surface drainage, etc.

APPENDIX B

OBSERVATION TRENCH LOGS

OBSERVATION TRENCH LOG			
Project Name: TVA Kingston Proposed Gypsum Stack Borrow Area		Logged By: Todd Justice	
Project Number: 3043051030/01		Date Logged: 6/28/05	
Observation Trench Number: OT-1		Degrees/Minutes (GPS): N35° 53.754' W84° 30.410'	
Depth (Feet)	From	To	Stratum Description
			Chert %
0.0	0.5		Topsoil with roots (up to 1-inch diameter) 0
0.5	2.5		Brown, clayey silt / silty clay with sand and roots (up to 1-inch diameter) 0
2.5	10.0		Reddish orange, fat clay with chert fragments 5 to 10
Remarks and Notes: Observation Trench OT-1 was terminated at approximately 10 feet. Bulk sample was obtained from 2.5 to 10.0 feet.			



Photograph 1 - Observation Trench OT-1.



Photograph 2 - Materials excavated from Observation Trench OT-1.

OBSERVATION TRENCH LOG				
Project Name: TVA Kingston Proposed Gypsum Stack Borrow Area		Logged By: Todd Justice		
Project Number: 3043051030/01		Date Logged: 6/28/05		
Observation Trench Number: OT-2		Degrees/Minutes (GPS): N35° 53.775' W84° 30.421'		
Depth (Feet)	From	To	Stratum Description	Chert %
0	0.5		Topsoil with roots (up to 1-inch diameter)	0
0.5	2.0		Light brown, clayey silt with sand and roots (up to 1-inch diameter)	0
2.0	10.0		Reddish orange, fat clay with chert fragments	<5
Remarks and Notes: Majority of chert encountered was severely weathered. Observation Trench OT-2 was terminated at approximately 10.0 feet. Bulk sample was obtained from 2.0 to 10.0 feet.				



Photograph 3 - Observation Trench OT-2.



Photograph 4 - Materials excavated from Observation Trench OT-2.

OBSERVATION TRENCH LOG				
Project Name: TVA Kingston Proposed Gypsum Stack Borrow Area		Logged By: Todd Justice		
Project Number: 3043051030/01		Date Logged: 6/28/05		
Observation Trench Number: OT-3		Degrees/Minutes (GPS): N35° 53.783' W84° 30.372'		
Depth (Feet)		Stratum Description	Chert %	
From	To			
0	0.5			
0.5	3.0			
3.0	10.0			
Remarks and Notes: Observation Trench OT-3 was terminated at approximately 10 feet. Bulk sample was obtained from 3.0 to 10.0 feet.				



Photograph 5 - Observation Trench OT-3.



Photograph 6 - Materials excavated from Observation Trench OT-3.

OBSERVATION TRENCH LOG				
Project Name: TVA Kingston Proposed Gypsum Stack Borrow Area		Logged By: Todd Justice		
Project Number: 3043051030/01		Date Logged: 6/28/05		
Observation Trench Number: OT-4		Degrees/Minutes (GPS): N35° 53.792' W84° 30.381'		
Depth (Feet)		Stratum Description		Chert %
From	To			
0	0.5	Topsoil with roots (up to 1-inch diameter)		0
0.5	4.0	Brown, clayey silt with sand and roots (up to 1-inch diameter)		0
4.0	10.0	Dark reddish brown, lean clay with sand and black manganese nodules		0
Remarks and Notes: Observation Trench OT-4 was terminated at approximately 10.0 feet. Bulk sample was obtained from 4.0 to 10.0 feet.				



Photograph 7 - Observation Trench OT-4.



Photograph 8 - Materials excavated from Observation Trench OT-4.

OBSERVATION TRENCH LOG

Project Name: TVA Kingston Proposed Gypsum Stack Borrow Area	Logged By: Todd Justice		
Project Number: 3043051030/01	Date Logged: 6/28/05		
Observation Trench Number: OT-5	Degrees/Minutes (GPS): N35° 53.826' W84° 30.272'		
Depth (Feet)		Stratum Description	Chert %
From	To		
0	1.0	Topsoil with roots (up to 1-inch diameter)	0
1.0	2.0	Light brown, clayey silt with roots (up to 1-inch diameter)	0
2.0	10.0	Reddish orange, fat clay with chert fragments	5

Remarks and Notes: Majority of chert encountered was severely weathered. Observation Trench OT-5 was terminated at approximately 10.0 feet. Bulk sample was obtained from 2.0 to 10.0 feet.



Photograph 9 - Observation Trench OT-5.



Photograph 10 - Materials excavated from Observation Trench OT-5.

APPENDIX C

LABORATORY TEST PROCEDURES

LABORATORY 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 (Plasticity Index)

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 confined soils beneath foundations or grade slabs. 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 a soil solids to the mass of the same volume of gas-free distilled water at 20C. 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

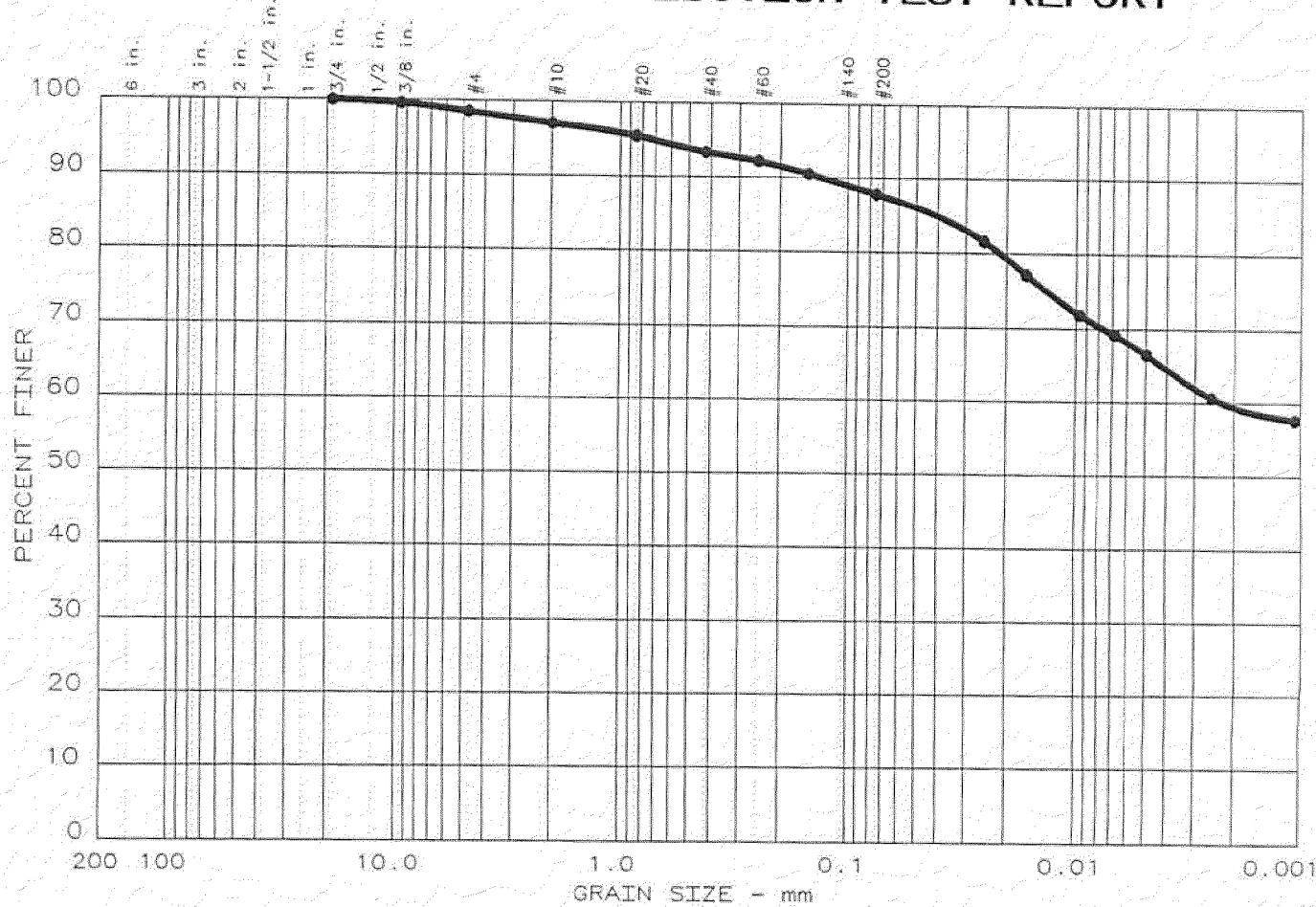
Test results are presented as a curve depicting dry unit weight versus moisture content. The compaction method used and any deviations from the recommended procedures are noted in the report.

Constant Head Permeability Test

The test was performed on undisturbed and 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 10-psi confining stress. Upon completion of consolidation, a constant head permeability test was performed.

GRAIN SIZE ANALYSIS TEST RESULTS

PARTICLE SIZE DISTRIBUTION TEST REPORT



Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
• 11	0.0	1.5	10.7	21.2	66.6	CH	58	29

SIEVE inches size	PERCENT FINER		
	#4	#10	#20
0.75	100.0		
0.375	99.6		
GRANULARITY			
D ₆₀	0.0022		
D ₃₀			
D ₁₀			
COEFFICIENTS			
C _C			
C _G			
C _U			

SIEVE number size	PERCENT FINER		
	#4	#10	#20
4	98.5		
10	97.1		
20	95.4		
40	93.3		
60	92.2		
100	90.5		
200	87.8		

Sample information:

• Borrow area OT-1, 2.5-10
Reddish orange fat clay
, Sample No. 3221

Remarks:

Methods: Particle Size:
ASTM D 422-63; Sieve
Analysis: AASHTO T27-99;
Specific Gravity: 2.75

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Fig. No.: 221

GRAIN SIZE DISTRIBUTION TEST DATA

Test No.: 11

Date: July 21, 2005

Project No.: 3043051030.0001

Project: TVA Kingston - Proposed Gypsum Stack

Sample Data

Location of Sample: Borrow area OT-1,2,5-10

Sample Description 1: Reddish Orange fat

Sample Description 2: clay, Sample No. 3221

JSCH Class: CH Liquid limit: 58 Plasticity index: 29

Notes

Remarks: Methods: Particle Size: ASTM D 422-63; Sieve
Analysis: AASHTO T27-99; Specific Gravity: 2.75

Fig. No.: 221

Mechanical Analysis Data

Initial

Dry sample and tare = 801.29

Tare = 0.00

Dry sample weight = 801.29

Sample split on number 40 sieve

Split sample data:

Sample and tare = 51.73 Tare = 0 Sample weight = 51.73

Cumulative weight retained tare = 0

Tare for cumulative weight retained = 0

Sieve Cumul. Wt. Percent

retained finer

0.75 inches	0.00	100.0
0.375 inches	3.44	99.6
# 4	11.78	98.5
# 10	23.63	97.1
# 20	36.62	95.4
# 40	53.40	93.3
# 60	0.64	92.2
# 100	1.58	90.5
# 200	3.08	87.8

Hydrometer Analysis Data

Separation sieve is number 40

Percent -# 40 based on complete sample= 93.3

Weight of hydrometer sample: 54.47

Hygroscopic moisture correction:

Moist weight & tare = 53.50

Dry weight & tare = 51.92

Tare = 22.22

Hygroscopic moisture= 5.3 %

Calculated biased weight= 55.41

Table of composite correction values:

Temp, deg C: 21.0 22.0 22.5 23.0 23.5

Comp. corr: - 6.4 - 6.1 - 5.9 - 5.8 - 5.6

Meniscus correction only= 0

Specific gravity of solids= 2.75

Specific gravity correction factor= 0.978

Hydrometer type: 152H Effective depth L= 16.294964 - 0.164 x Rm

Elapsed time, min	Temp, deg C	Actual reading	Corrected reading	K	Rm	Eff. depth	Diameter mm	Percent finer
2.0	23.0	52.0	46.2	0.0128	52.0	7.8	0.0252	81.6
5.0	23.0	49.5	43.7	0.0128	49.5	8.2	0.0163	77.2
15.0	23.0	46.5	40.7	0.0128	46.5	8.7	0.0097	71.9
31.0	23.0	45.0	39.2	0.0128	45.0	8.9	0.0068	69.2
60.0	23.0	43.5	37.7	0.0128	43.5	9.2	0.0050	66.6
250.0	22.0	40.5	34.4	0.0129	40.5	9.7	0.0025	60.7
1441.0	23.0	38.5	32.7	0.0128	38.5	10.0	0.0011	57.7

Fractional Components

Gravel/Sand based on #4 sieve

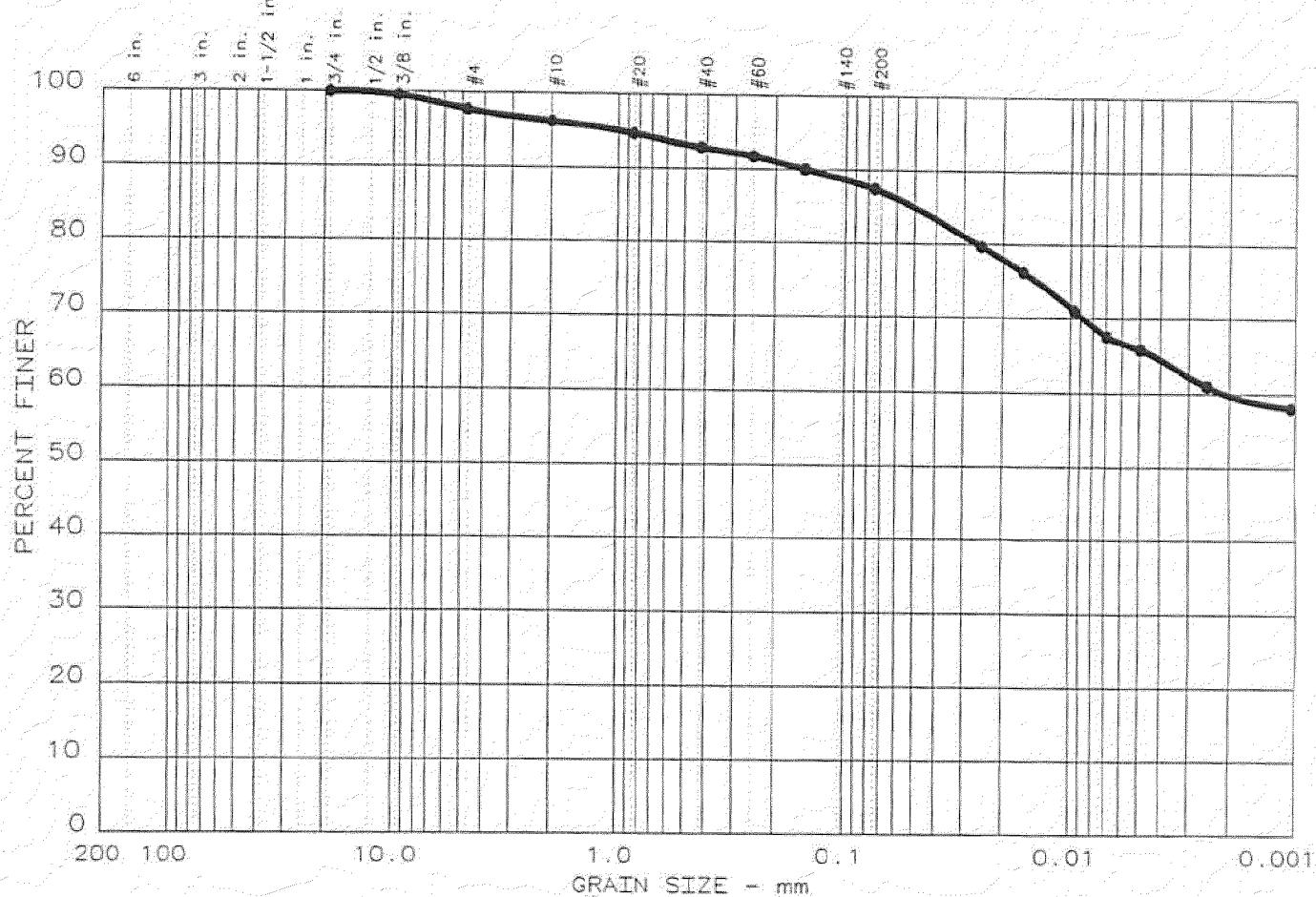
Sand/Fines based on #200 sieve

% + 3 in. = 0.0 % GRAVEL = 1.5 % SAND = 10.7

% SILT = 21.2 % CLAY = 66.6

D85= 0.04 D60= 0.002

PARTICLE SIZE DISTRIBUTION TEST REPORT



Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
• 12	0.0	2.3	10.2	21.6	65.9	CH	59	33

SIEVE inches size	PERCENT FINER		
0.75	100.0		
0.375	99.5		
GRAIN SIZE			
D ₆₀	0.0020		
D ₃₀			
D ₁₀			
COEFFICIENTS			
C _c			
C _u			

SIEVE number size	PERCENT FINER		
4	97.7		
10	96.2		
20	94.6		
40	92.8		
60	91.7		
100	90.0		
200	87.5		

Sample information:

• Borrow area OT-1,2,5-10
Reddish orange fat clay
, Sample No. 3222

Remarks:

Methods: Particle Size:
ASTM D-422-63; Sieve
Analysis: AASHTO T27-99;
Specific Gravity: 2.75



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Fig. No.: 222

TVA-00008323

GRAIN SIZE DISTRIBUTION TEST DATA

Test No.: 12

Date: July 20, 2005

Project No.: 3043051030.0001

Project: TVA Kingston - Proposed Gypsum Stack

Sample Data

Location of Sample: Borrow area OT-1, 2.5-10

Sample Description 1: Reddish Orange fat CTK

Sample Description 2: clay, Sample No. 3222

JSCS Class: CH Liquid limit: 59 Plasticity index: 33

Notes

Remarks: Methods: Particle Size: ASTM D 422-63; Sieve

Analysis: AASHTO T27-99; Specific Gravity: 2.75

Fig. No.: 222

Mechanical Analysis Data

Initial

Dry sample and tare= 849.43

Tare = 0.00

Dry sample weight = 849.43

Sample split on number 40 sieve

Split sample data:

Sample and tare = 52.65 Tare = 0 Sample weight = 52.65

Cumulative weight retained tare= 0

Tare for cumulative weight retained= 0

Sieve Cumul. Wt. Percent

	retained	finer
0.75 inches	0.00	100.0
0.375 inches	4.13	99.5
# 4	19.88	97.7
# 10	32.60	96.2
# 20	45.53	94.6
# 40	61.10	92.8
# 60	0.62	91.7
# 100	1.58	90.0
# 200	3.02	87.5

Hydrometer Analysis Data

Separation sieve is number 40

Percent -# 40 based on complete sample= 92.8

Weight of hydrometer sample: 56.02

Hygroscopic moisture correction:

Moist weight & tare = 54.00

Dry weight & tare = 52.09

Tare = 22.27

Hygroscopic moisture= 6.4 %

Calculated biased weight= 56.73

Table of composite correction values:

Temp, deg C: 21.0 22.0 22.5 23.0 23.5

Comp. corr: - 6.4 - 6.1 - 5.9 - 5.8 - 5.6

Meniscus correction only= 0

Specific gravity of solids= 2.75

Specific gravity correction factor= 0.978

Hydrometer type: 152H Effective depth L= 16.294964 - 0.164 x Rm

Elapsed time, min	Temp, deg C	Actual reading	Corrected reading	K	Rm	Eff. depth	Diameter mm	Percent finer
2.0	23.0	52.0	46.2	0.0128	52.0	7.8	0.0252	79.7
5.0	23.0	50.0	44.2	0.0128	50.0	8.1	0.0163	76.2
15.0	23.0	47.0	41.2	0.0128	47.0	8.6	0.0097	71.1
30.0	23.0	45.0	39.2	0.0128	45.0	8.9	0.0070	67.6
60.0	23.0	44.0	38.2	0.0128	44.0	9.1	0.0050	65.9
250.0	22.0	41.5	35.4	0.0129	41.5	9.5	0.0025	61.1
1440.0	23.0	39.5	33.7	0.0128	39.5	9.8	0.0011	58.1

Fractional Components

Gravel/Sand based on #4 sieve

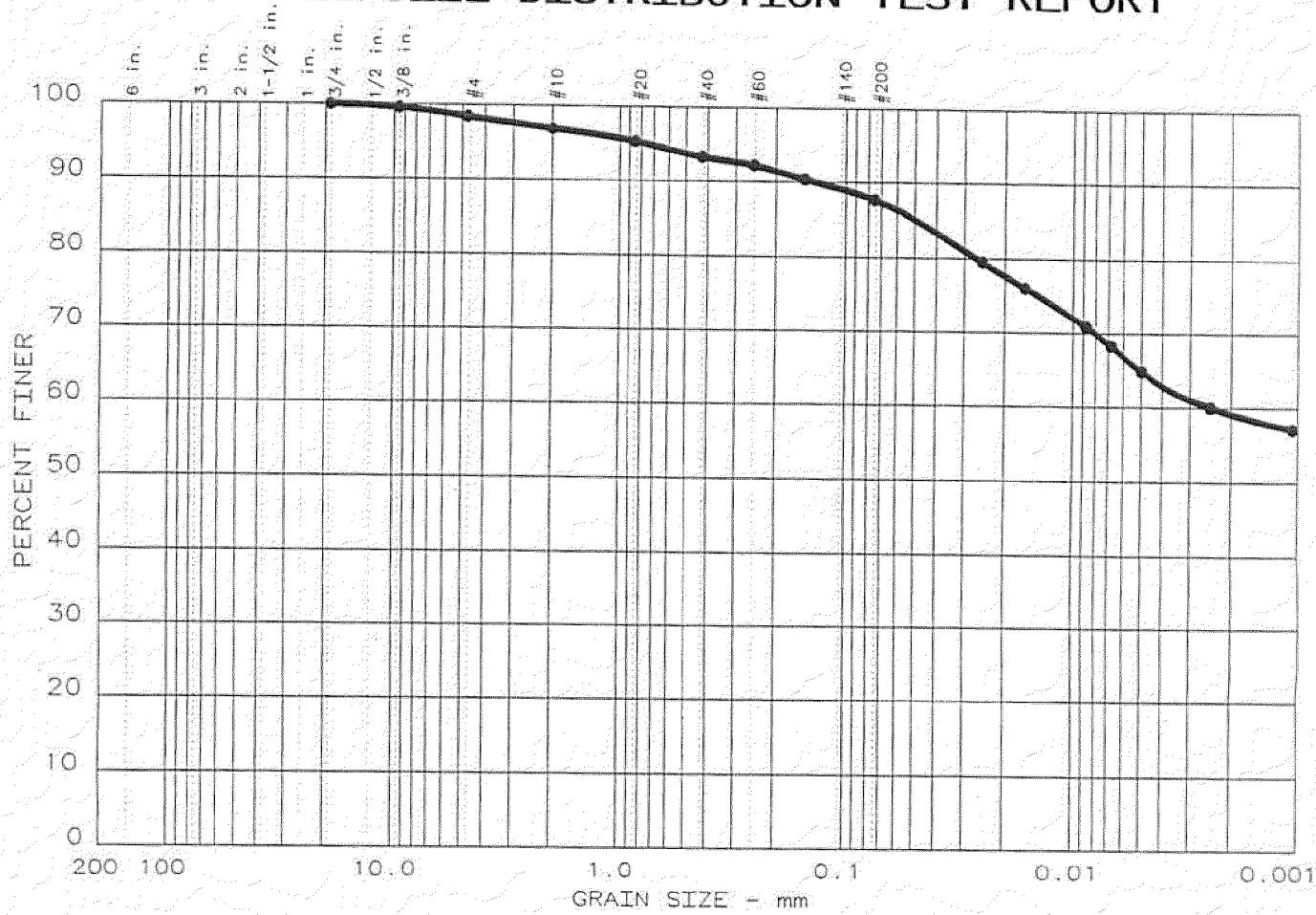
Sand/Fines based on #200 sieve

% + 3 in. = 0.0 % GRAVEL = 2.3 % SAND = 10.2

% SILT = 21.6 % CLAY = 65.9

D85= 0.05 D60= 0.002

PARTICLE SIZE DISTRIBUTION TEST REPORT



Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
• 13	0.0	1.6	10.7	22.8	64.9	CH	60	32

SIEVE inches size	PERCENT FINER		
	•		
0.75	100.0		
0.375	99.6		
GRAIN SIZE			
D ₆₀	0.0024		
D ₃₀			
D ₁₀			
COEFFICIENTS			
C _c			
C _u			

SIEVE number size	PERCENT FINER		
	•		
4	98.4		
10	96.9		
20	95.3		
40	93.3		
60	92.2		
100	90.4		
200	87.7		

Sample information:

• Borrow area OT-1,2,5-10
Reddish orange fat clay
, Sample No. 3223

Remarks:

Methods: Particle Size:
ASTM D-422-63; Sieve
Analysis: AASHTO T27-99;
Specific Gravity: 2.75

100
50
0

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Fig. No.: 223

GRAIN SIZE DISTRIBUTION TEST DATA

Test No.: 13

Date: July 21, 2005

Project No.: 3043051030.0001

Project: TVA Kingston - Proposed Gypsum Stack

Sample Data

Location of Sample: Borrow area OT-1, 2.5-10

Sample Description 1: Reddish Orange fat CTX

Sample Description 2: clay, Sample No. 3223

JSCS Class: CH Liquid limit: 60 Plasticity index: 32

Notes

Remarks: Methods: Particle Size: ASTM D 422-63; Sieve

Analysis: AASHTO T27-99; Specific Gravity: 2.75

Fig. No.: 223

Mechanical Analysis Data

Initial

Dry sample and tare= 821.53

Tare = 0.00

Dry sample weight = 821.53

Sample split on number 40 sieve

Split sample data:

Sample and tare = 53.02 Tare = 0 Sample weight = 53.02

Cumulative weight retained tare= 0

Tare for cumulative weight retained= 0

Sieve	Cumul. Wt.	Percent retained	Percent finer
0.75 inches	0.00	100.0	
0.375 inches	3.35	99.6	
# 4	12.86	98.4	
# 10	25.56	96.9	
# 20	38.86	95.3	
# 40	55.24	93.3	
# 60	0.62	92.2	
# 100	1.66	90.4	
# 200	3.17	87.7	

Hydrometer Analysis Data

Separation sieve is number 40

Percent -# 40 based on complete sample= 93.3

Weight of hydrometer sample: 54.24

Hygroscopic moisture correction:

Moist weight & tare = 56.01

Dry weight & tare = 55.25

Tare = 22.22

Hygroscopic moisture= 2.3 %

Calculated biased weight= 56.84

Table of composite correction values:

Temp, deg C: 21.0 22.0 22.5 23.0 23.5

Comp. corr: - 6.4 - 6.1 - 5.9 - 5.8 - 5.6

Meniscus correction only= 0

Specific gravity of solids= 2.75

Specific gravity correction factor= 0.978

Hydrometer type: 152H Effective depth L= 16.294964 - 0.164 x Rm

Elapsed time, min	Temp, deg C	Actual reading	Corrected reading	K	Rm	Eff. depth	Diameter mm	Percent finer
2.0	23.0	52.0	46.2	0.0128	52.0	7.8	0.0252	79.5
5.0	23.0	50.0	44.2	0.0128	50.0	8.1	0.0163	76.1
18.0	23.0	47.0	41.2	0.0128	47.0	8.6	0.0088	70.9
31.0	23.0	45.5	39.7	0.0128	45.5	8.8	0.0068	68.3
60.0	23.0	43.5	37.7	0.0128	43.5	9.2	0.0050	64.9
266.0	22.0	41.0	34.9	0.0129	41.0	9.6	0.0025	60.1
1440.0	23.0	39.0	33.2	0.0128	39.0	9.9	0.0011	57.1

Fractional Components

Gravel/Sand based on #4 sieve

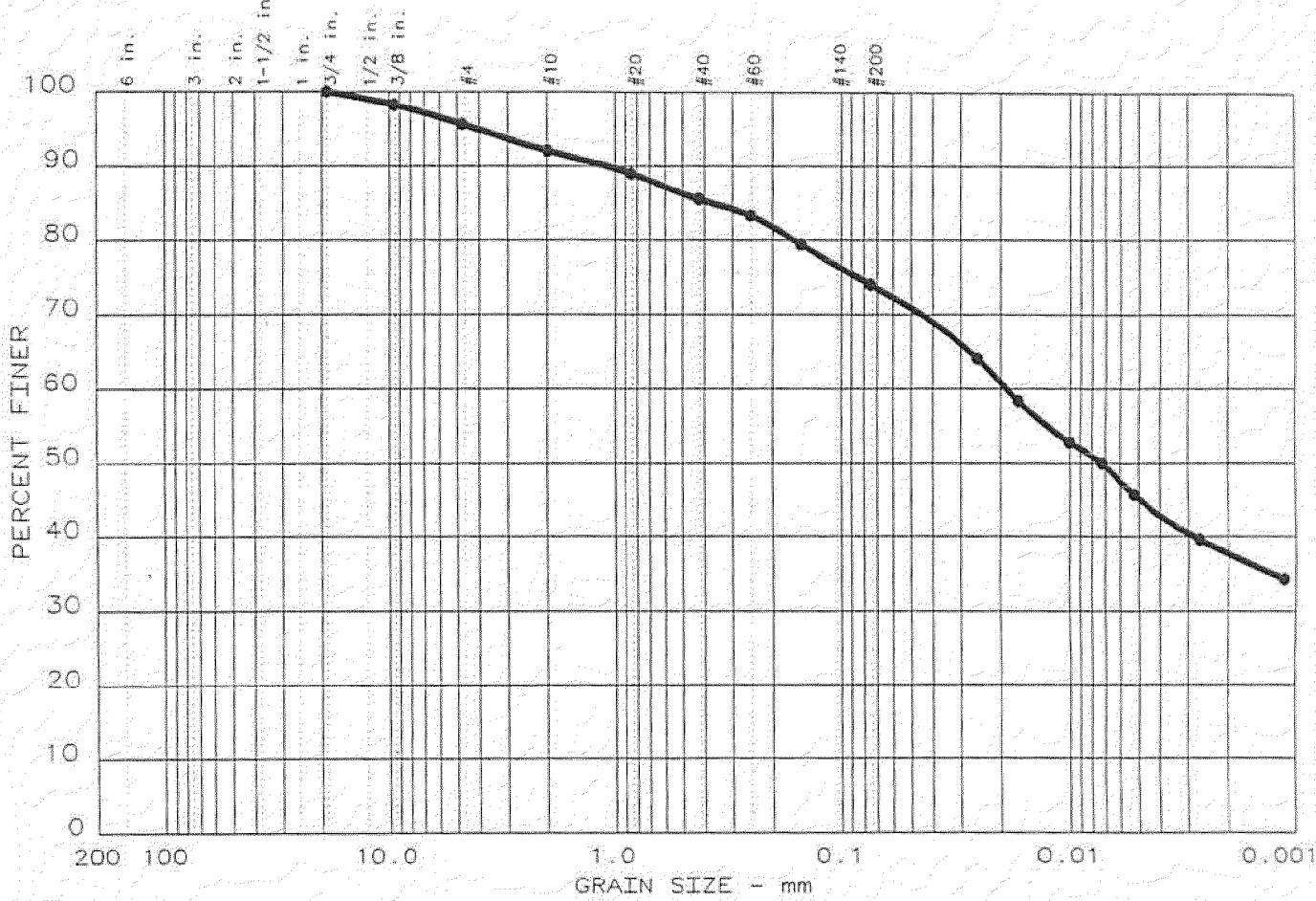
Sand/Fines based on #200 sieve

% + 3 in. = 0.0 % GRAVEL = 1.6 % SAND = 10.7

% SILT = 22.8 % CLAY = 64.9

D85= 0.05 D60= 0.002

PARTICLE SIZE DISTRIBUTION TEST REPORT



Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
• 14	0.0	4.3	21.7	28.9	45.1	CL	47	24

SIEVE inches size	PERCENT FINER		
	•		
0.75	100.0		
0.375	98.3		
GRAIN SIZE			
D ₆₀	0.0186		
D ₃₀			
D ₁₀			
COEFFICIENTS			
C _c			
C _u			

SIEVE number size	PERCENT FINER		
	•		
4	95.7		
10	92.1		
20	89.0		
40	85.5		
60	83.3		
100	79.4		
200	74.0		

Sample information:

• Borrow area OT-3, 3-10'
Reddish brown lean clay
with sand, Sample # 3224

Remarks:

Methods: Particle Size:
ASTM D 422-63; Sieve
Analysis: AASHTO T27-99;
Specific Gravity: 2.74

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Fig. No.: 224

GRAIN SIZE DISTRIBUTION TEST DATA

Test No.: 14

Date: July 21, 2005

Project No.: 3043051030.0001

Project: TVA Kingston - Proposed Gypsum Stack

Sample Data

Location of Sample: Borrow area OT-3, 3-10'

Sample Description 1: Reddish brown lean CTK

Sample Description 2: clay w/sand, Sample 3224

JSCS Class: CL Liquid limit: 47 Plasticity index: 24

Notes

Remarks: Methods: Particle Size: ASTM D 422-63; Sieve

Analysis: AASHTO T27-99; Specific Gravity: 2.74

Fig. No.: 224

Mechanical Analysis Data

Initial

Dry sample and tare= 980.29

Tare = 0.00

Dry sample weight = 980.29

Sample split on number 40 sieve

Split sample data:

Sample and tare = 59.13 Tare = 0 Sample weight = 59.13

Cumulative weight retained tare= 0

Tare for cumulative weight retained= 0

Sieve	Cumul. Wt.	Percent retained	Percent finer
0.75 inches	0.00	100.0	
0.375 inches	17.15	98.3	
# 4	42.37	95.7	
# 10	77.60	92.1	
# 20	107.68	89.0	
# 40	141.66	85.5	
# 60	1.55	83.3	
# 100	4.26	79.4	
# 200	7.96	74.0	

Hydrometer Analysis Data

Separation sieve is number 40

Percent -# 40 based on complete sample= 85.5

Weight of hydrometer sample: 59.72

Hygroscopic moisture correction:

Moist weight & tare = 54.87

Dry weight & tare = 54.53

Tare = 22.14

Hygroscopic moisture= 1.0 %

Calculated biased weight= 69.08

Table of composite correction values:

Temp, deg C: 21.0 22.0 22.5 23.0 23.5

Comp. corr: - 6.4 - 6.1 - 5.9 - 5.8 - 5.6

Meniscus correction only= 0

Specific gravity of solids= 2.74

Specific gravity correction factor= 0.980

Hydrometer type: 152H Effective depth L= 16.294964 + 0.164 x Rm

Elapsed time, min	Temp, deg C	Actual reading	Corrected reading	K	Rm	Eff. depth	Diameter mm	Percent finer
2.0	23.0	51.0	45.2	0.0128	51.0	7.9	0.0255	64.2
5.0	23.0	47.0	41.2	0.0128	47.0	8.6	0.0168	58.5
15.0	23.0	43.0	37.2	0.0128	43.0	9.2	0.0101	52.8
30.0	23.0	41.0	35.2	0.0128	41.0	9.6	0.0072	50.0
60.0	23.0	38.0	32.2	0.0128	38.0	10.1	0.0052	45.7
250.0	22.0	34.0	27.9	0.0130	34.0	10.7	0.0027	39.6
1449.0	23.0	30.0	24.2	0.0128	30.0	11.4	0.0011	34.3

Fractional Components

Gravel/Sand based on #4 sieve

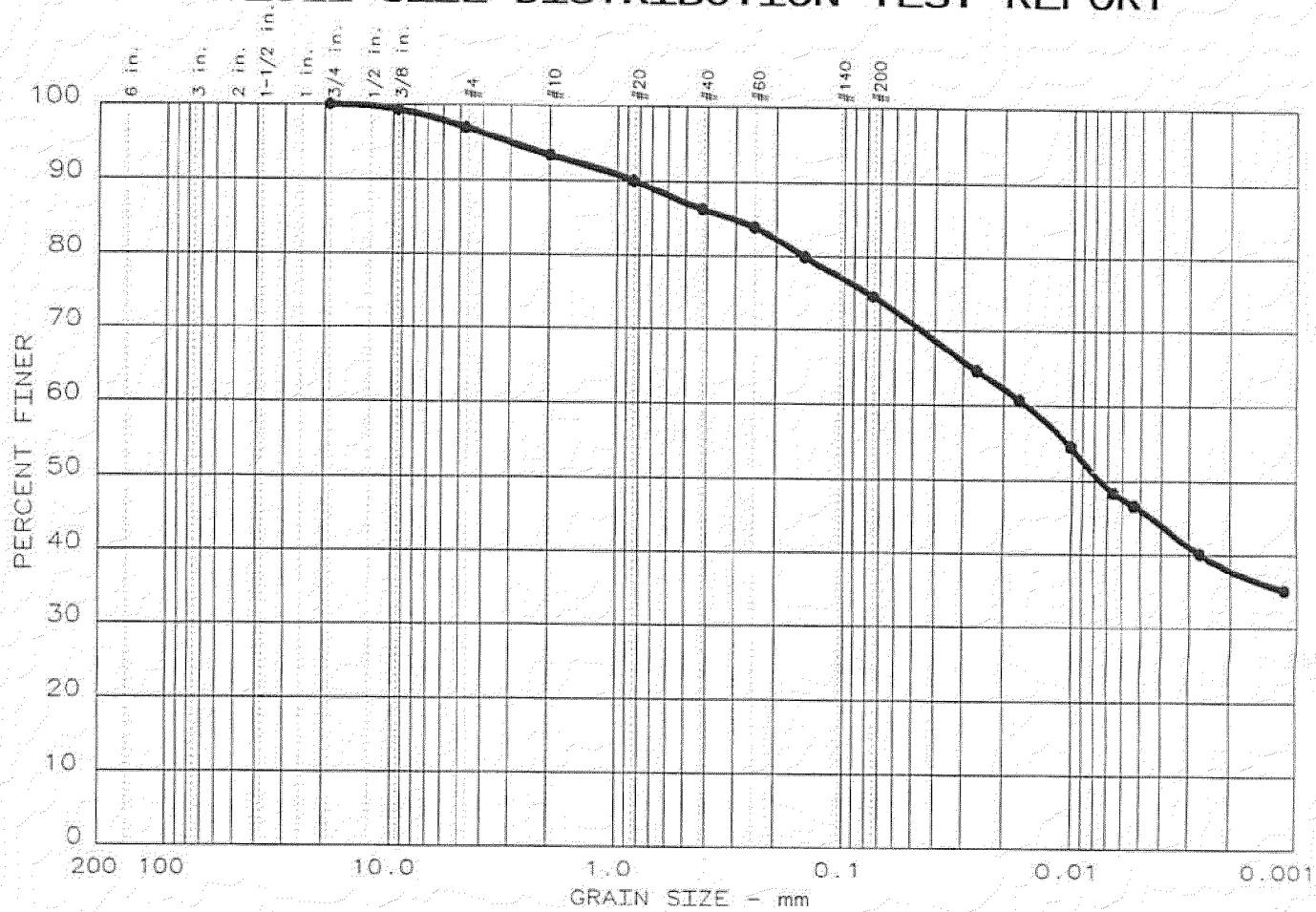
Sand/Fines based on #200 sieve

% + 3 in. = 0.0 % GRAVEL = 4.3 % SAND = 21.7

% SILT = 28.9 % CLAY = 45.1

D85= 0.37 D60= 0.019 D50= 0.007

PARTICLE SIZE DISTRIBUTION TEST REPORT



Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
• 15	0.0	3.0	22.4	28.5	46.1	CH	50	27

SIEVE inches size	PERCENT FINER		
	•		
0.75	100.0		
0.375	99.3		
GRAIN SIZE			
D ₆₀	0.0157		
D ₃₀			
D ₁₀			
COEFFICIENTS			
C _c			
C _u			

SIEVE number size	PERCENT FINER		
	•		
4	97.0		
10	93.4		
20	90.1		
40	86.4		
60	84.0		
100	80.0		
200	74.6		

Sample information:

• Borrow area OT-3, 3-10'
Reddish brown fat clay
with sand, Sample # 3225

Remarks:

Methods: Particle Size:
ASTM D 422-63; Sieve
Analysis: AASHTO T27-99;
Specific Gravity: 2.75



Project No.: 3043051030.0001

Project: TVA Kingston - Proposed Gypsum Stack

Date: July 28, 2005

Fig. No.: 225

GRAIN SIZE DISTRIBUTION TEST DATA

Test No.: 15

Date: July 21, 2005

Project No.: 3043051030.0001

Project: TVA Kingston - Proposed Gypsum Stack

Sample Data

Location of Sample: Borrow area OT-3, 3-10'

Sample Description 1: Reddish brown fat CTY

Sample Description 2: clay w/sand, Sample 3225

JSCS Class: CH Liquid limit: 50 Plasticity index: 27

Notes

Remarks: Methods: Particle Size: ASTM D 422-63; Sieve

Analysis: AASHTO T27-99; Specific Gravity: 2.75

Fig. No.: 225

Mechanical Analysis Data

Initial

Dry sample and tare= 836.50

Tare = 0.00

Dry sample weight = 836.50

Sample split on number 40 sieve

Split sample data:

Sample and tare = 54.49 Tare = 0 Sample weight = 54.49

Cumulative weight retained tare= 0

Tare for cumulative weight retained= 0

Sieve	Cumul. Wt.	Percent retained	Percent finer
0.75 inches	0.00	100.0	
0.375 inches	5.70	99.3	
# 4	25.34	97.0	
# 10	55.35	93.4	
# 20	82.95	90.1	
# 40	114.15	86.4	
# 60	1.51	84.0	
# 100	4.01	80.0	
# 200	7.41	74.6	

Hydrometer Analysis Data

Separation sieve is number 40

Percent -# 40 based on complete sample= 86.4

Weight of hydrometer sample: 56.02

Hygroscopic moisture correction:

Moist weight & tare = 53.51

Dry weight & tare = 52.66

Tare = 22.10

Hygroscopic moisture= 2.8 %

Calculated biased weight= 63.12

Table of composite correction values:

Temp, deg C: 21.0 22.0 22.5 23.0 23.5

Comp. corr: - 6.4 - 6.1 - 5.9 - 5.8 - 5.6

Meniscus correction only= 0

Specific gravity of solids= 2.75

Specific gravity correction factor= 0.978

Hydrometer type: 152H Effective depth L= 16.294964 - 0.164 x Rm

Elapsed time, min	Temp, deg C	Actual reading	Corrected reading	K	Rm	Eff. depth	Diameter mm	Percent finer
2.0	23.0	47.5	41.7	0.0128	47.5	8.5	0.0263	64.6
5.0	23.0	45.0	39.2	0.0128	45.0	8.9	0.0171	60.8
15.0	23.0	41.0	35.2	0.0128	41.0	9.6	0.0102	54.6
38.0	23.0	37.0	31.2	0.0128	37.0	10.2	0.0066	48.4
60.0	22.5	36.0	30.1	0.0128	36.0	10.4	0.0053	46.7
250.0	22.0	32.0	25.9	0.0129	32.0	11.0	0.0027	40.2
1442.0	23.0	28.5	22.7	0.0128	28.5	11.6	0.0011	35.2

Fractional Components

Gravel/Sand based on #4 sieve

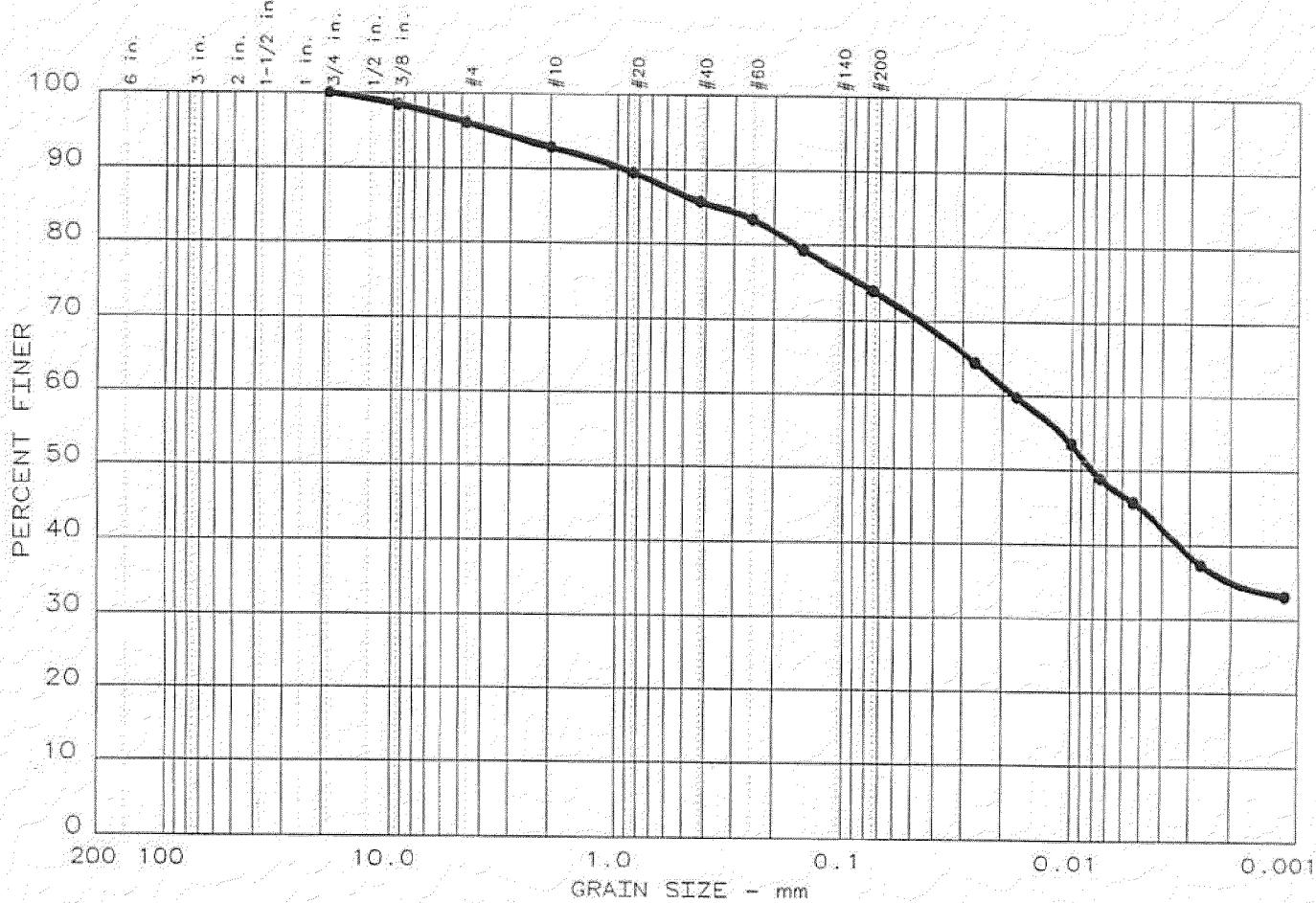
Sand/Fines based on #200 sieve

% + 3 in. = 0.0 % GRAVEL = 3.0 % SAND = 22.4

% SILT = 28.5 % CLAY = 46.1

D85= 0.30 D60= 0.016 D50= 0.007

PARTICLE SIZE DISTRIBUTION TEST REPORT



Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
• 16	0.0	3.9	22.0	29.2	44.9	CL	45	23

SIEVE inches size	PERCENT FINER		
	•		
0.75	100.0		
0.375	98.4		
GRAIN SIZE			
D ₆₀	0.0176		
D ₃₀			
D ₁₀			
COEFFICIENTS			
C _c			
C _u			

SIEVE number size	PERCENT FINER		
	•		
4	96.1		
10	92.9		
20	89.5		
40	85.7		
60	83.4		
100	79.4		
200	74.1		

Sample information:

• Borrow area OT-3, 3-10
Reddish brown lean clay
with sand, Sample # 3226

Remarks:

Methods: Particle Size:
ASTM D 422-63; Sieve
Analysis: AASHTO T27-99;
Specific Gravity: 2.73

Project No.: 3043051030.0001
Project: TVA Kingston - Proposed Gypsum Stack
Date: July 21, 2005
Fig. No.: 226

GRAIN SIZE DISTRIBUTION TEST DATA

Test No.: 16

Date: July 21, 2005

Project No.: 3043051030.0001

Project: TVA Kingston - Proposed Gypsum Stack

Sample Data

Location of Sample: Borrow area OT-3, 3-10'

Sample Description 1: Reddish brown lean

Sample Description 2: clay w/sand, Sample 3226

JSCS Class: CL Liquid limit: 45 Plasticity index: 23

Notes

Remarks: Methods: Particle Size: ASTM D 422-63; Sieve

Analysis: AASHTO T27-99; Specific Gravity: 2.73

Fig. No.: 226

Mechanical Analysis Data

Initial

Dry sample and tare= 902.40

Tare = 0.00

Dry sample weight = 902.40

Sample split on number 40 sieve

Split sample data:

Sample and tare = 53.77 Tare = 0 Sample weight = 53.77

Cumulative weight retained tare= 0

Tare for cumulative weight retained= 0

Sieve	Cumul. Wt.	Percent retained finer
0.75 inches	0.00	100.0
0.375 inches	14.25	98.4
# 4	35.33	96.1
# 10	64.17	92.9
# 20	94.51	89.5
# 40	129.34	85.7
# 60	1.45	83.4
# 100	3.95	79.4
# 200	7.29	74.1

Hydrometer Analysis Data

Separation sieve is number 40

Percent -# 40 based on complete sample= 85.7

Weight of hydrometer sample: 56.14

Hygroscopic moisture correction:

Moist weight & tare = 53.13

Dry weight & tare = 51.84

Tare = 22.50

Hygroscopic moisture= 4.4 %

Calculated biased weight= 62.77

Table of composite correction values:

Temp, deg C: 21.0 22.0 22.5 23.0 24.0

Comp. corr: - 6.4 - 6.1 - 5.9 - 5.8 - 5.4

Meniscus correction only= 0

Specific gravity of solids= 2.73

Specific gravity correction factor= 0.983

hydrometer type: 152H Effective depth L= 16.294964 - 0.164 x Rm

Elapsed time, min	Temp, deg C	Actual reading	Corrected reading	K	Rm	Eff. depth	Diameter mm	Percent finer
2.0	23.0	47.0	41.2	0.0128	47.0	8.6	0.0266	64.5
5.0	23.0	44.0	38.2	0.0128	44.0	9.1	0.0173	59.8
16.0	23.0	40.0	34.2	0.0128	40.0	9.7	0.0100	53.5
30.0	23.0	37.0	31.2	0.0128	37.0	10.2	0.0075	48.8
60.0	23.0	35.0	29.2	0.0128	35.0	10.6	0.0054	45.7
260.0	22.0	30.0	23.9	0.0130	30.0	11.4	0.0027	37.4
1441.0	23.0	27.0	21.2	0.0128	27.0	11.9	0.0012	33.2

Fractional Components

Gravel/Sand based on #4 sieve

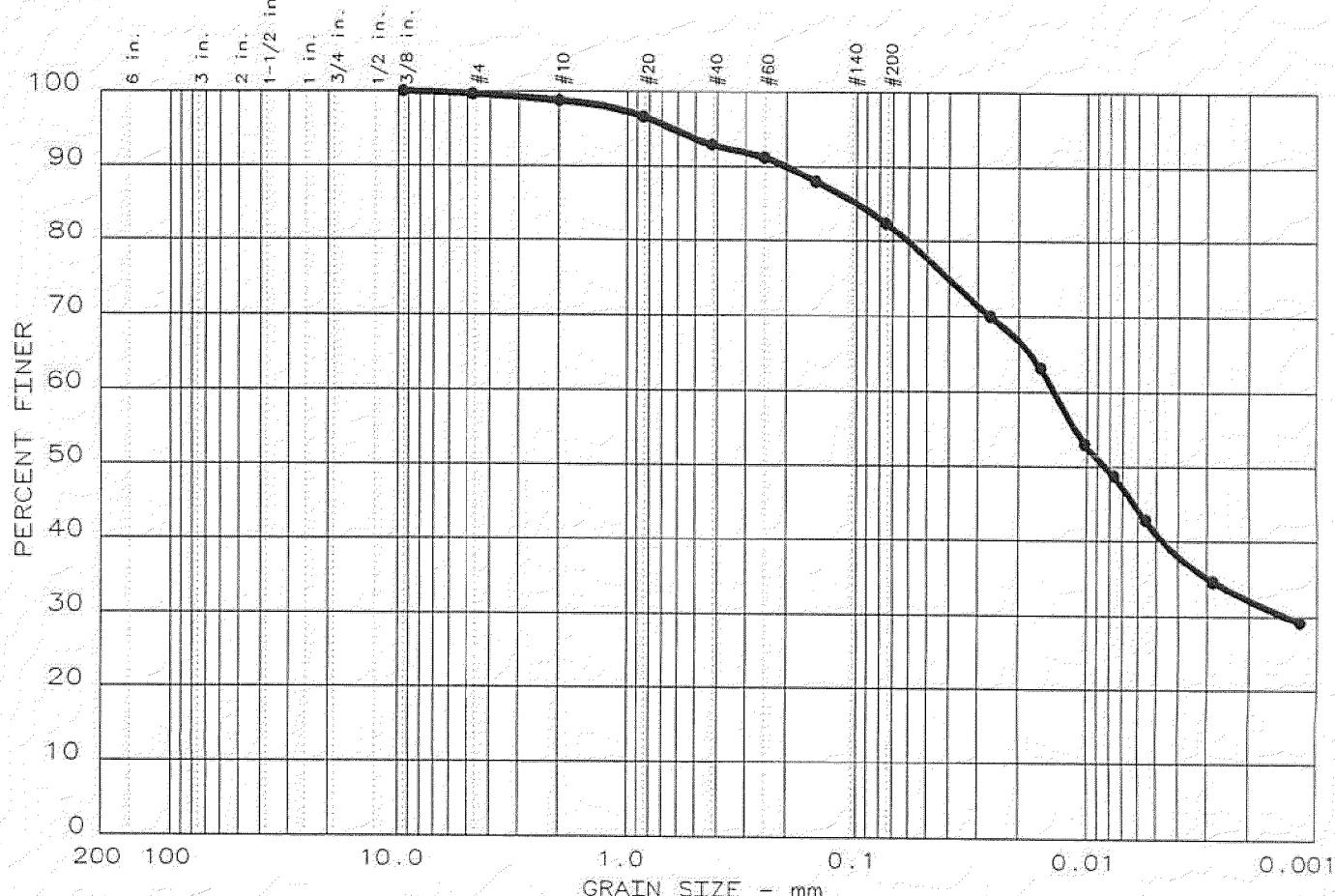
Sand/Fines based on #200 sieve

$\frac{1}{2} + 3$ in. = 0.0 % GRAVEL = 3.9 % SAND = 22.0

% SILT = 29.2 % CLAY = 44.9

D85= 0.36 D60= 0.018 D50= 0.008

PARTICLE SIZE DISTRIBUTION TEST REPORT



Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
• 17	0.0	0.4	17.2	41.4	41.0	CL	36	17

SIEVE inches size	PERCENT FINER		
	•		
0.375	100.0		
GRAIN SIZE			
D ₆₀	0.0138		
D ₃₀	0.0014		
D ₁₀			
COEFFICIENTS			
C _c			
C _u			

SIEVE number size	PERCENT FINER		
	•		
4	99.6		
10	98.8		
20	96.7		
40	92.9		
60	91.2		
100	88.0		
200	82.4		

Sample information:

• Barrow area OT-4, 4-10'
Dark red brown lean
clay w/sand, Sample 3227

Remarks:

Methods: Particle Size:
ASTM D 422-63; Sieve
Analysis: AASHTO T27-99;
Specific Gravity: 2.72

Project No.: 3043051030.0001

Project: TVA Kingston - Proposed Gypsum Stack

Date: July 21, 2005

Fig. No.: 227

GRAIN SIZE DISTRIBUTION TEST DATA

Test No.: 17

Date: July 21, 2005

Project No.: 3043051030.0001

Project: TVA Kingston - Proposed Gypsum Stack

Sample Data

Location of Sample: Borrow area OT-4, 4-10'

Sample Description 1: Dark red brown lean

Sample Description 2: clay with sand, # 3227

JSCS Class: CL Liquid limit: 36 Plasticity index: 17

Notes

Remarks: Methods: Particle Size: ASTM D 422-63; Sieve

Analysis: AASHTO T27-99; Specific Gravity: 2.72

Fig. No.: 227

Mechanical Analysis Data

Initial

Dry sample and tare= 766.97

Tare = 0.00

Dry sample weight = 766.97

Sample split on number 40 sieve

Split sample data:

Sample and tare = 53.78 Tare = 0 Sample weight = 53.78

Cumulative weight retained tare= 0

Tare for cumulative weight retained= 0

Sieve	Cumul. Wt.	Percent finer
	retained	
0.375 inches	0.00	100.0
# 4	2.93	99.6
# 10	9.58	98.8
# 20	25.58	96.7
# 40	54.33	92.9
# 60	0.99	91.2
# 100	2.84	88.0
# 200	6.09	82.4

Hydrometer Analysis Data

Separation sieve is number 40

Percent -# 40 based on complete sample= 92.9

Weight of hydrometer sample: 54.91

Hygroscopic moisture correction:

Moist weight & tare = 53.25

Dry weight & tare = 52.62

Tare = 21.93

Hygroscopic moisture= 2.1 %

Calculated biased weight= 57.91

Table of composite correction values:

Temp, deg C: 21.0 22.0 22.5 23.0 24.0

Comp. corr: - 6.4 - 6.1 - 5.9 - 5.8 - 5.4

Meniscus correction only= 0

Specific gravity of solids= 2.72

Specific gravity correction factor= 0.985

Hydrometer type: 152H Effective depth L= 16.294964 - 0.164 x Rm

Elapsed time, min	Temp, deg C	Actual reading	Corrected reading	K	Rm	Eff. depth	Diameter mm	Percent finer
2.0	23.0	47.0	41.2	0.0129	47.0	8.6	0.0267	70.1
6.0	23.0	43.0	37.2	0.0129	43.0	9.2	0.0160	63.3
16.0	23.0	37.0	31.2	0.0129	37.0	10.2	0.0103	53.1
30.0	23.0	34.5	28.7	0.0129	34.5	10.6	0.0077	48.8
60.0	23.0	31.0	25.2	0.0129	31.0	11.2	0.0056	42.8
250.0	22.0	26.5	20.4	0.0130	26.5	11.9	0.0029	34.7
1440.0	23.0	23.0	17.2	0.0129	23.0	12.5	0.0012	29.2

Fractional Components

Gravel/Sand based on #4 sieve

Sand/Fines based on #200 sieve

% + 3 in. = 0.0 % GRAVEL = 0.4 % SAND = 17.2

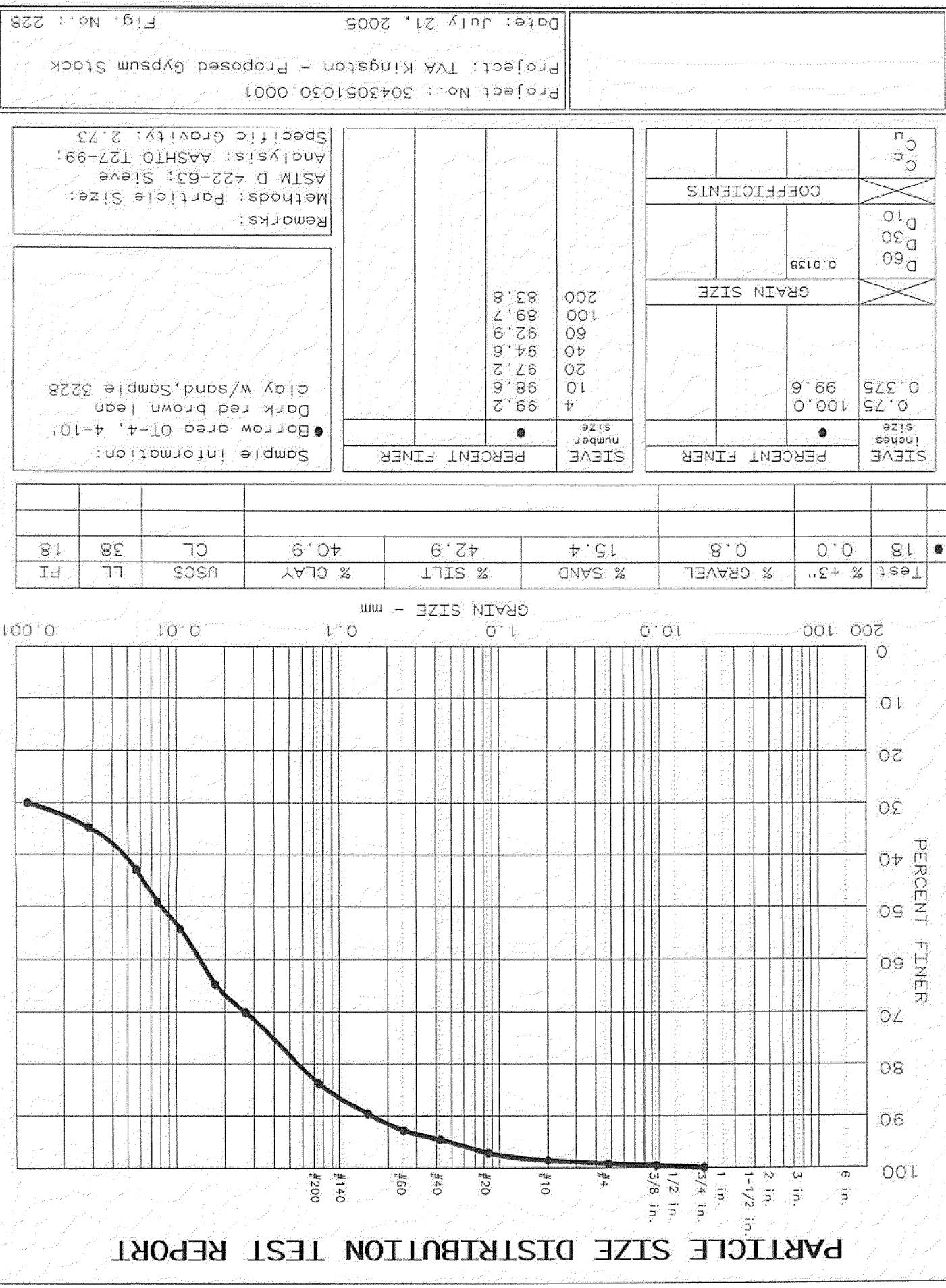
% SILT = 41.4 % CLAY = 41.0

D85= 0.10 D60= 0.014 D50= 0.008

D30= 0.0014

PARTICLE SIZE DISTRIBUTION TEST REPORT

TVA-00008341



GRAIN SIZE DISTRIBUTION TEST DATA

Test No.: 18

Date: July 21, 2005

Project No.: 3043051030.0001

Project: TVA Kingston - Proposed Gypsum Stack

Sample Data

Location of Sample: Borrow area OT-4, 4-10'

Sample Description 1: Dark red brown lean

Sample Description 2: clay with sand, # 3228

JSCS Class: CL Liquid limit: 38 Plasticity index: 18

Notes

Remarks: Methods: Particle Size: ASTM D 422-63; Sieve

Analysis: AASHTO T27-99; Specific Gravity: 2.73

Fig. No.: 228

Mechanical Analysis Data

Initial

Dry sample and tare= 736.29

Tare = 0.00

Dry sample weight = 736.29

Sample split on number 40 sieve

Split sample data:

Sample and tare = 53.35 Tare = 0 Sample weight = 53.35

Cumulative weight retained tare= 0

Tare for cumulative weight retained= 0

Sieve	Cumul. Wt. retained	Percent finer
0.75 inches	0.00	100.0
0.375 inches	3.01	99.6
# 4	5.77	99.2
# 10	10.49	98.6
# 20	20.88	97.2
# 40	39.58	94.6
# 60	0.97	92.9
# 100	2.79	89.7
# 200	6.11	83.8

Hydrometer Analysis Data

Separation sieve is number 40

Percent -# 40 based on complete sample= 94.6

Weight of hydrometer sample: 53.99

Hgrosopic moisture correction:

Moist weight & tare = 53.35

Dry weight & tare = 52.97

Tare = 22.26

Hygroscopic moisture= 1.2 %

Calculated biased weight= 56.36

Table of composite correction values:

Temp, deg C:	21.0	22.0	22.5	23.0	24.0
Comp. corr:	- 6.4	- 6.1	- 5.9	- 5.8	- 5.4

Meniscus correction only= 0

Specific gravity of solids= 2.73

Specific gravity correction factor= 0.983

Hydrometer type: 152H Effective depth L= 16.294964 - 0.164 x Rm

Elapsed time, min	Temp, deg C	Actual reading	Corrected reading	K	Rm	Eff. depth	Diameter mm	Percent finer
2.0	23.0	46.0	40.2	0.0128	46.0	8.8	0.0269	70.1
5.0	23.0	43.0	37.2	0.0128	43.0	9.2	0.0175	64.9
15.0	23.0	37.0	31.2	0.0128	37.0	10.2	0.0106	54.4
30.0	23.0	34.0	28.2	0.0128	34.0	10.7	0.0077	49.2
60.0	22.5	30.5	24.6	0.0129	30.5	11.3	0.0056	42.9
250.0	22.0	26.0	19.9	0.0130	26.0	12.0	0.0029	34.7
1444.0	23.0	23.0	17.2	0.0128	23.0	12.5	0.0012	30.0

Fractional Components

Gravel/Sand based on #4 sieve

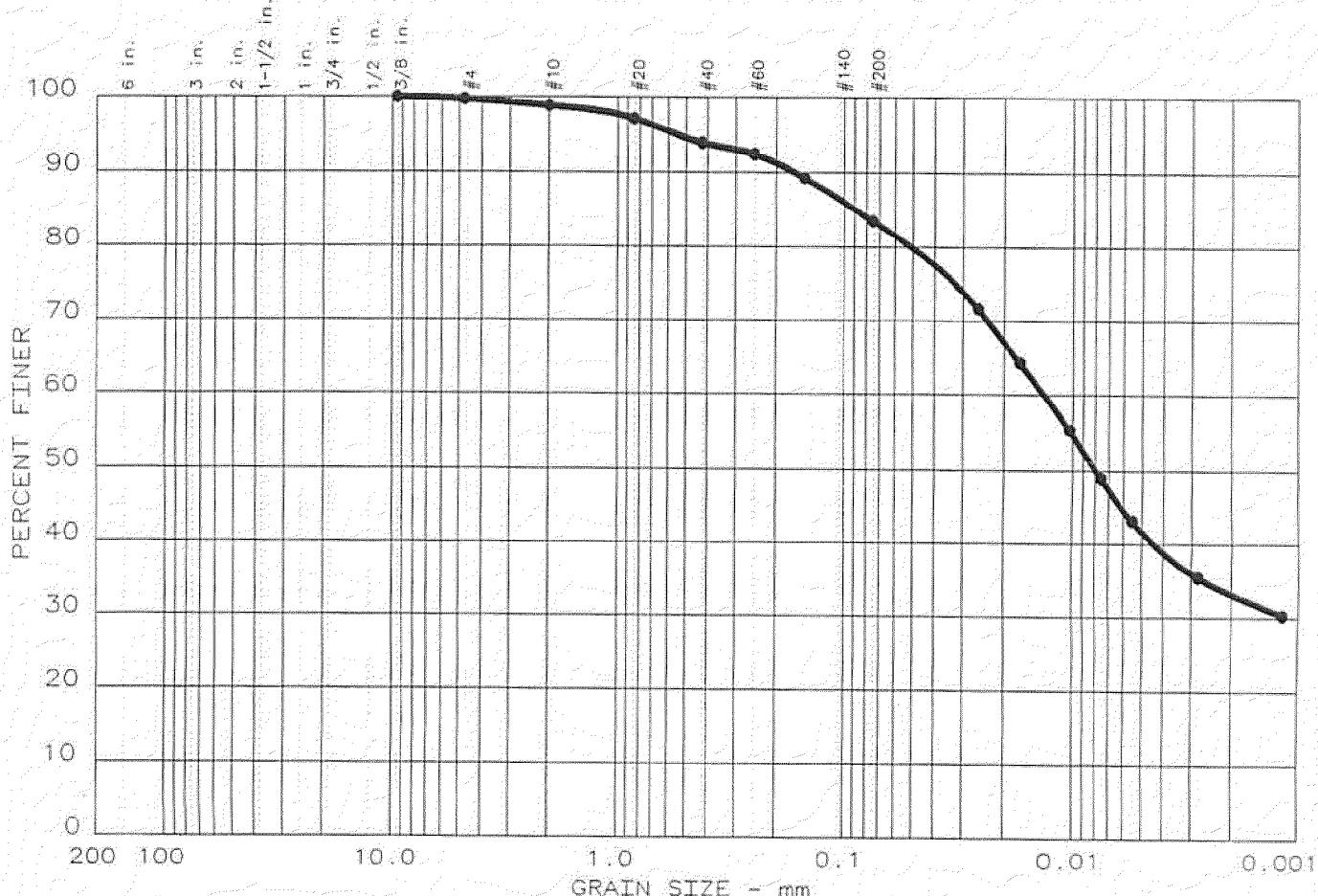
Sand/Fines based on #200 sieve

% + 3 in. = 0.0 % GRAVEL = 0.8 % SAND = 15.4

% SILT = 42.9 % CLAY = 40.9

D85= 0.08 D60= 0.014 D50= 0.008

PARTICLE SIZE DISTRIBUTION TEST REPORT



Test	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
• 19	0.0	0.3	16.2	41.9	41.6	CL	39	20

SIEVE inches size	PERCENT FINER		
0.375	100.0		
GRANULARITY			
D ₆₀	0.0132		
D ₃₀			
D ₁₀			
COEFFICIENTS			
C _c			
C _u			

SIEVE number size	PERCENT FINER		
4	99.7		
10	98.8		
20	97.1		
40	93.9		
60	92.4		
100	89.3		
200	83.5		

Sample information:

• Borrow area OT-4, 4-10
Dark red brown lean
clay w/sand, Sample 3229

Remarks:

Methods: Particle Size:
ASTM D 422-63; Sieve
Analysis: AASHTO T27-99;
Specific Gravity: 2.73

Project No.: 3043051030.0001

Project: TVA Kingston - Proposed Gypsum Stack

Date: July 21, 2005

Fig. No.: 229

GRAIN SIZE DISTRIBUTION TEST DATA

Test No.: 19

Date: July 21, 2005

Project No.: 3043051030.0001

Project: TVA Kingston - Proposed Gypsum Stack

Sample Data

Location of Sample: Borrow area OT-4, 4-10'

Sample Description 1: Dark red brown lean

Sample Description 2: clay with sand, # 3229

USCS Class: CL Liquid limit: 39 Plasticity index: 20

Notes

Remarks: Methods: Particle Size: ASTM D 422-63; Sieve

Analysis: AASHTO T27-99; Specific Gravity: 2.73

Fig. No.: 229

Mechanical Analysis Data

Initial

Dry sample and tare= 662.70

Tare = 0.00

Dry sample weight = 662.70

Sample split on number 40 sieve

Split sample data:

Sample and tare = 56.92 Tare = 0 Sample weight = 56.92

Cumulative weight retained tare= 0

Tare for cumulative weight retained= 0

Sieve	Cumul. Wt. retained	Percent finer
0.375 inches	0.00	100.0
# 4	1.90	99.7
# 10	7.78	98.8
# 20	19.16	97.1
# 40	40.45	93.9
# 60	0.89	92.4
# 100	2.81	89.3
# 200	6.30	83.5

Hydrometer Analysis Data

Separation sieve is number 40

Percent -# 40 based on complete sample= 93.9

Weight of hydrometer sample: 58.34

Hygroscopic moisture correction:

Moist weight & tare = 53.55

Dry weight & tare = 52.77

Tare = 21.97

Hygroscopic moisture= 2.5 %

Calculated biased weight= 60.60

Table of composite correction values:

Temp, deg C: 21.0 22.0 22.5 23.0 24.0

Comp. corr: - 6.4 - 6.1 - 5.9 - 5.8 - 5.4

Meniscus correction only= 0

Specific gravity of solids= 2.73

Specific gravity correction factor= 0.983

Hydrometer type: 152H Effective depth L= 16.294964 - 0.164 x Rm

Elapsed time, min	Temp, deg C	Actual reading	Corrected reading	K	Rm	Eff. depth	Diameter mm	Percent finer
2.0	23.0	50.0	44.2	0.0128	50.0	8.1	0.0258	71.7
5.0	23.0	45.5	39.7	0.0128	45.5	8.8	0.0171	64.4
15.0	23.0	40.0	34.2	0.0128	40.0	9.7	0.0103	55.5
30.0	23.0	36.0	30.2	0.0128	36.0	10.4	0.0076	49.0
60.0	22.5	32.5	26.6	0.0129	32.5	11.0	0.0055	43.1
250.0	22.0	28.0	21.9	0.0130	28.0	11.7	0.0028	35.5
1440.0	23.0	24.5	18.7	0.0128	24.5	12.3	0.0012	30.3

Fractional Components

Gravel/Sand based on #4 sieve

Sand/Fines based on #200 sieve

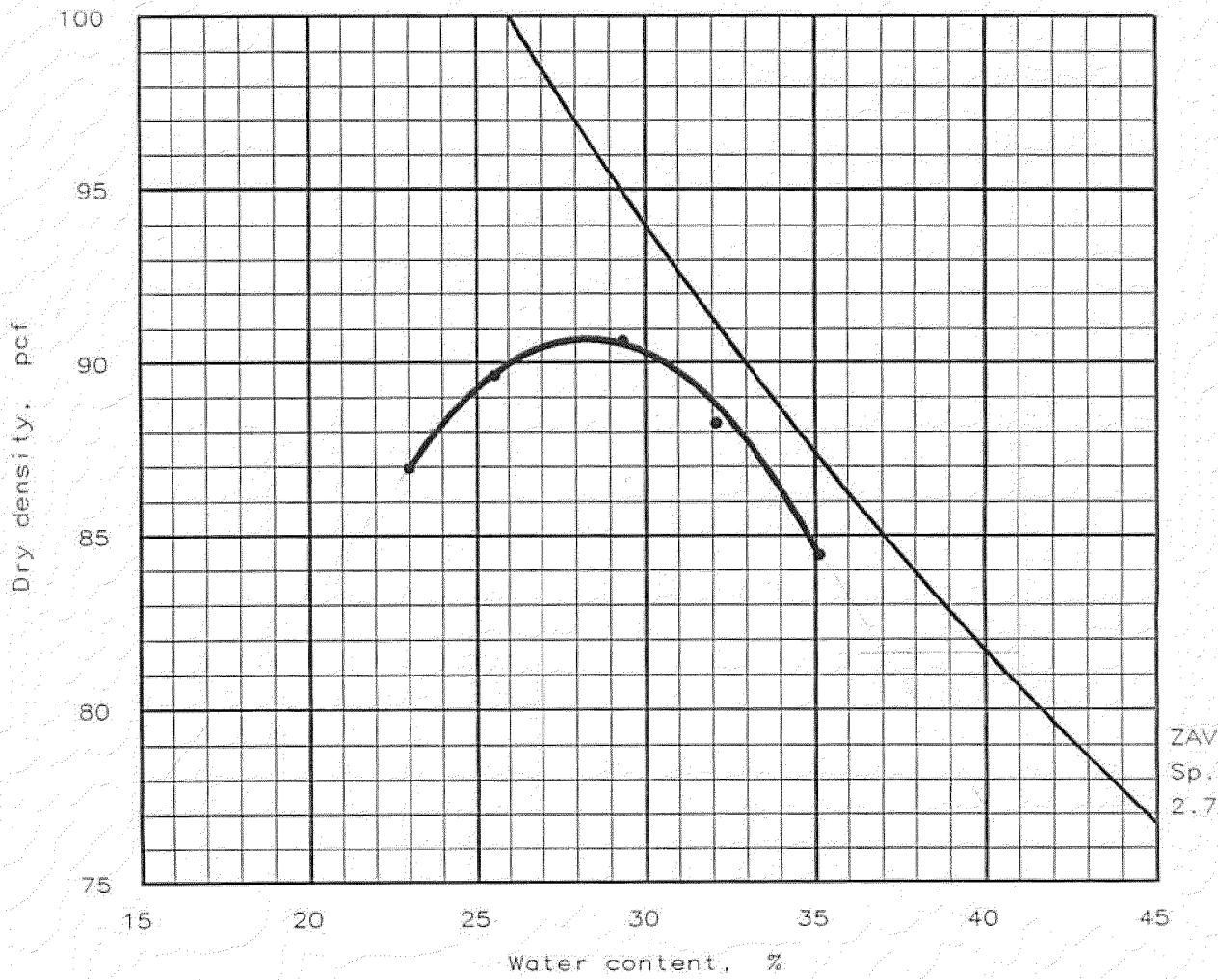
% + 3 in. = 0.0 % GRAVEL = 0.3 % SAND = 16.2

% SILT = 41.9 % CLAY = 41.6

D85= 0.09 D60= 0.013 D50= 0.008

MOISTURE-DENSITY RELATIONSHIP TEST RESULTS

MOISTURE-DENSITY RELATIONSHIP TEST

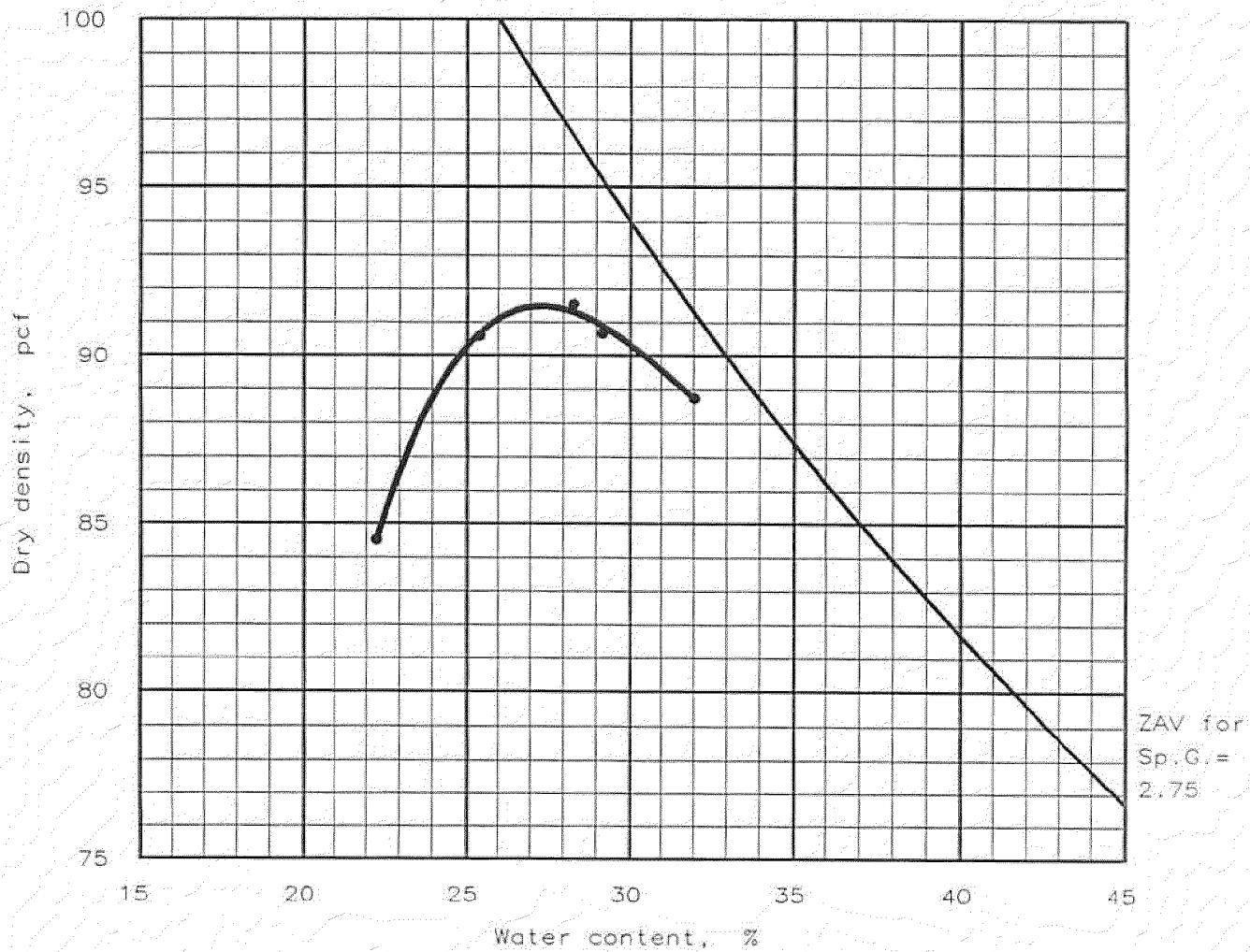


Test specification: ASTM D 698-00e1 Procedure B, Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/8 in	% < No. 200
	USCS	AASHTO						
2.5-10	CH	A-7-6(16)	24.6 %	2.75	58	29	0.4 %	87.8 %

TEST RESULTS		MATERIAL DESCRIPTION
Maximum dry density = 90.7 pcf Optimum moisture = 28.3 %		Reddish orange fat clay
Project No.:	3043051030.0001	Remarks:
Project:	TVA Kingston - Proposed Gypsum Stack	Sample Number 3221
Location:	Borrow Area Observation Trench OT-1	TIP - Test In Progress
Date:	7-28-2005	NT - No Test
MOISTURE-DENSITY RELATIONSHIP TEST		

MOISTURE-DENSITY RELATIONSHIP TEST



Test specification: ASTM D 698-00a(e1) Procedure B, Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/8 in	% < No. 200
	USCS	AASHTO						
2.5-10	CH	A-7-6(32)	24.6 %	2.75	59	33	0.5 %	87.5 %

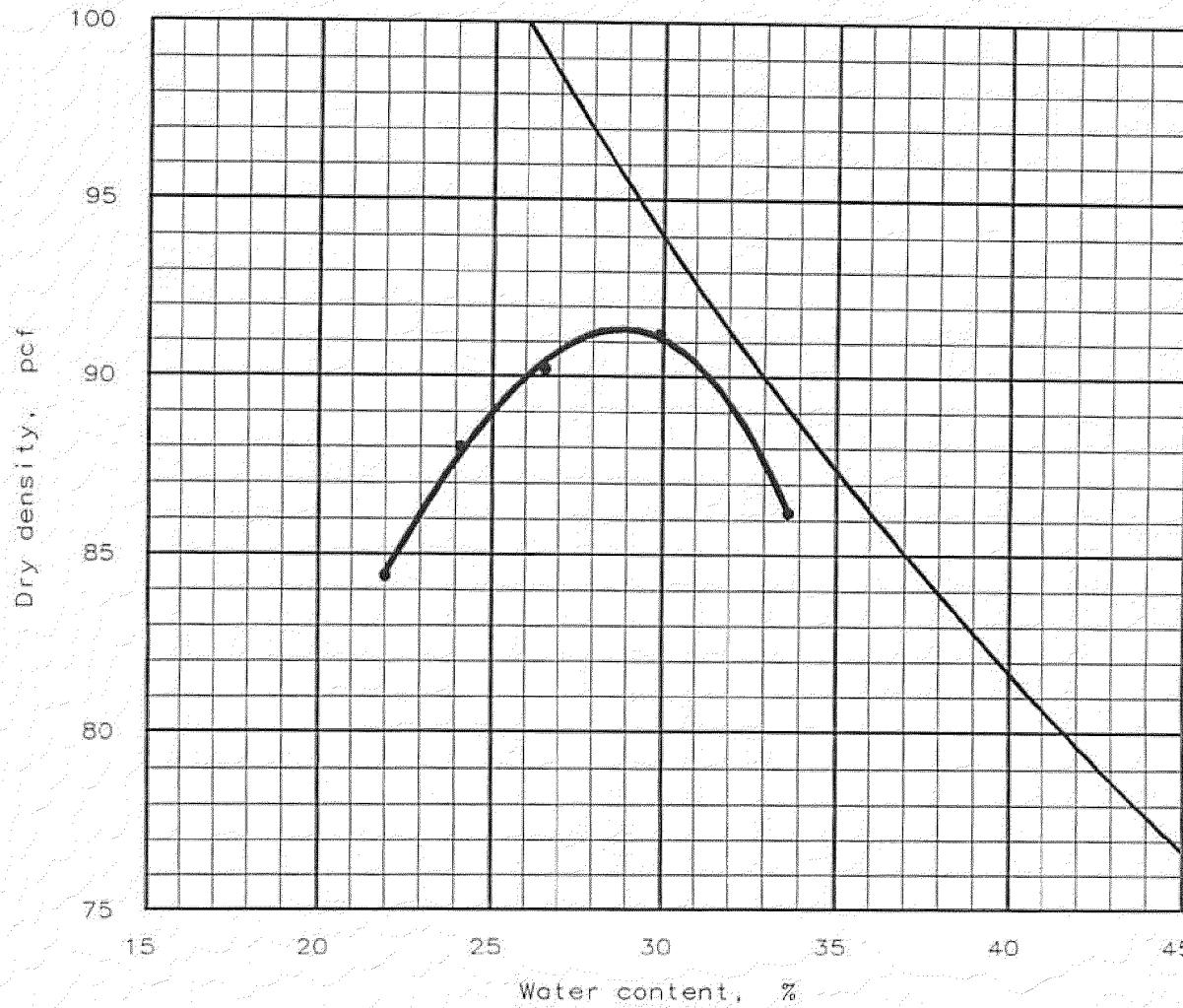
TEST RESULTS				MATERIAL DESCRIPTION			
Maximum dry density = 91.6 pcf Optimum moisture = 28.3 %				Reddish orange fat clay			

Project No.: 3043051030.0001
Project: TVA Kingston - Proposed Gypsum Stack
Location: Borrow Area Observation Trench OT-1
Date: 7-28-2005

Remarks:
Sample Number 3222
TIP - Test In Progress
NT - No Test

MOISTURE-DENSITY RELATIONSHIP TEST

MOISTURE-DENSITY RELATIONSHIP TEST

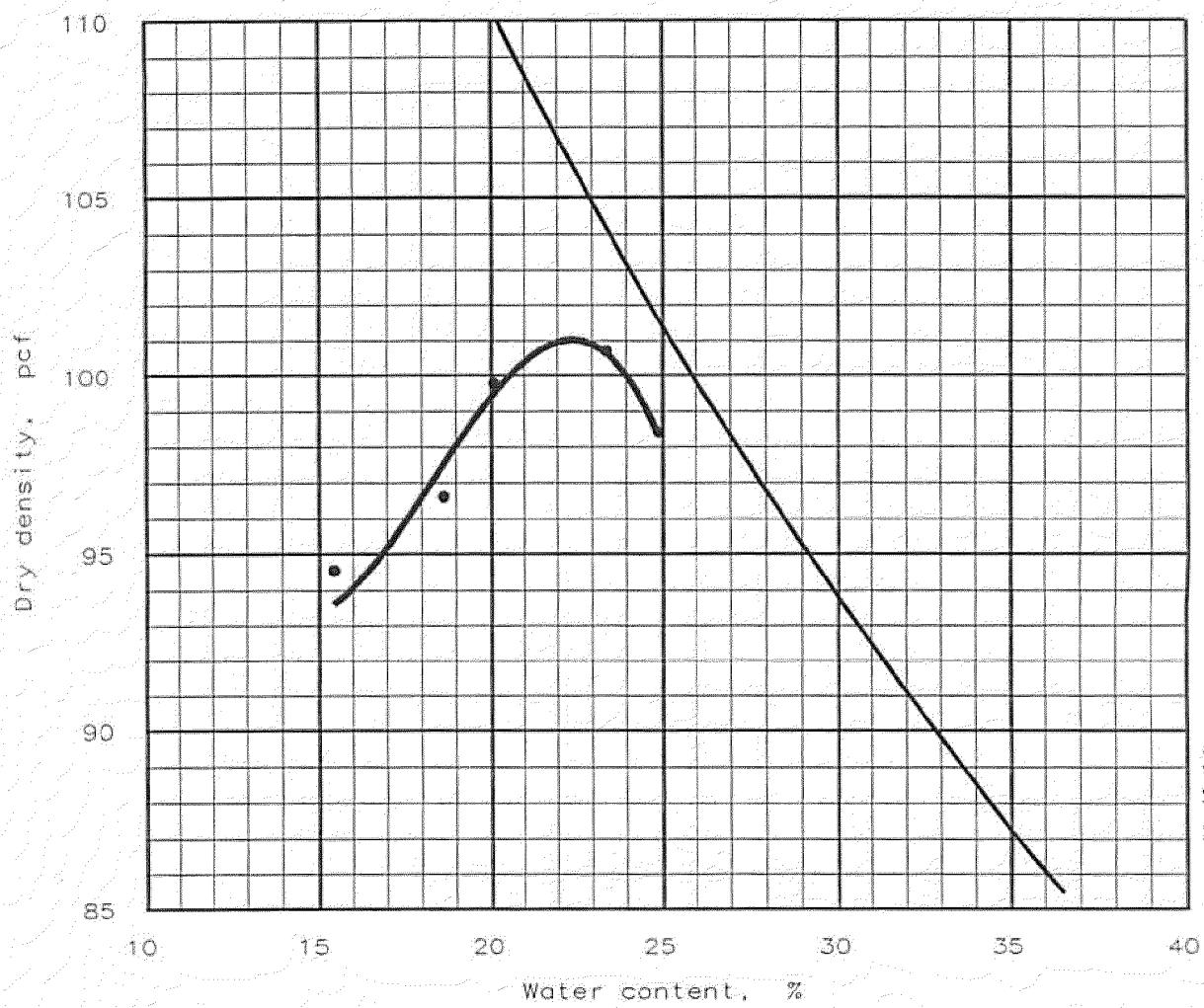


Test specification: ASTM D 698-00ae1 Procedure B, Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/8 in	% < No. 200
	USCS	AASHTO						
2.5-10	CH	A-7-6(32)	24.6 %	2.75	60	32	0.4 %	87.7 %

TEST RESULTS		MATERIAL DESCRIPTION
Maximum dry density = 91.4 pcf		Reddish orange fat clay
Optimum moisture = 28.8 %		
Project No.: 3043051030.0001 Project: TVA Kingston - Proposed Gypsum Stack Location: Borrow Area Observation Trench OT-1 Date: 7-28-2005		Remarks: Sample Number 3223 TIP - Test In Progress NT - No Test
MOISTURE-DENSITY RELATIONSHIP TEST		

MOISTURE-DENSITY RELATIONSHIP TEST



Test specification: ASTM D 698-00ae1 Procedure B, Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/8 in	% < No. 200
	USCS	AASHTO						
3-10'	CL	A-7-6(17)	23.3 %	2.74	47	24	1.7 %	74.0 %

TEST RESULTS

Maximum dry density = 101.0 pcf

Optimum moisture = 22.4 %

MATERIAL DESCRIPTION

Reddish brown lean clay
with sand

Project No.: 3043051030.0001

Project: TVA Kingston - Proposed Gypsum Stack

Location: Borrow Area Observation Trench OT-3

Date: 7-28-2005

Remarks:

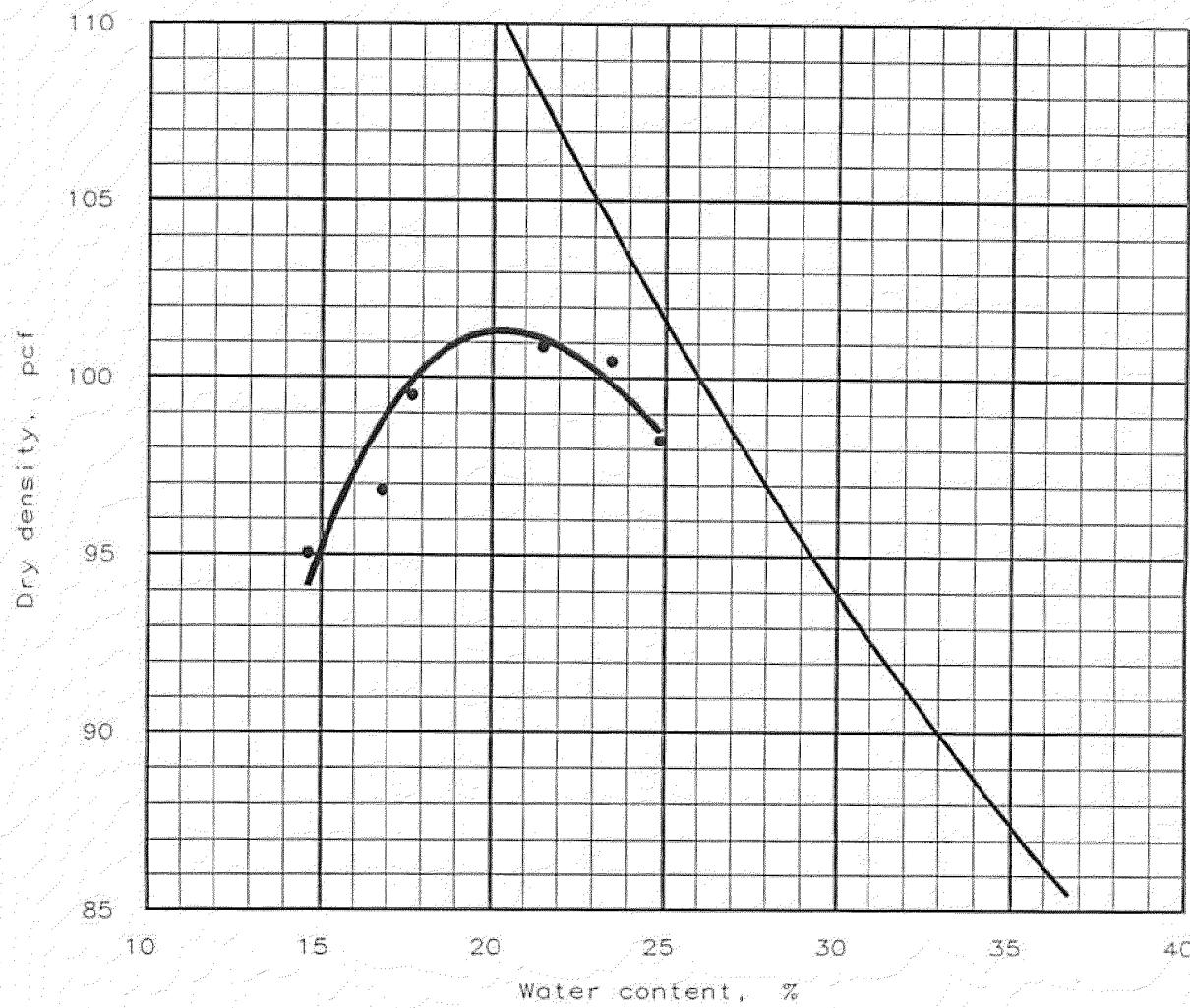
Sample Number 3224

TIP - Test In Progress

NT - No Test

MOISTURE-DENSITY RELATIONSHIP TEST

MOISTURE-DENSITY RELATIONSHIP TEST



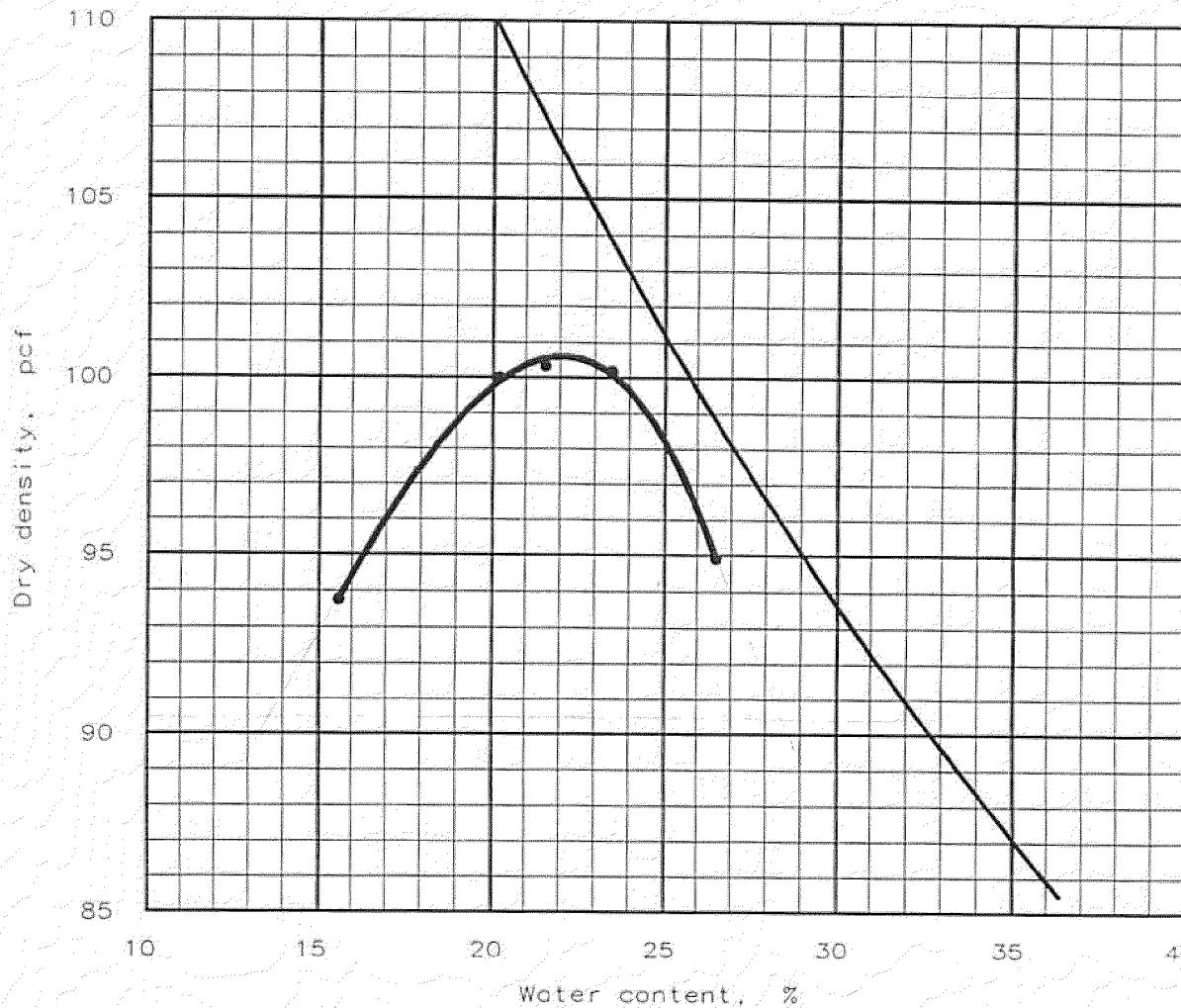
Test specification: ASTM D 698-00ae1 Procedure B, Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/8 in	% < No. 200
	USCS	AASHTO						
3-10'	CH	A-7-6(20)	23.3 %	2.75	50	27	0.7 %	74.6 %

TEST RESULTS		MATERIAL DESCRIPTION
Maximum dry density = 101.3 pcf		Reddish brown fat clay with sand
Optimum moisture = 20.3 %		
Project No.: 3043051030.0001	Remarks:	
Project: TVA Kingston - Proposed Gypsum Stack	Sample Number:	3225
Location: Borrow Area Observation Trench OT-3	TIP - Test In Progress	
Date: 7-28-2005	NT - No Test	

MOISTURE-DENSITY RELATIONSHIP TEST

MOISTURE-DENSITY RELATIONSHIP TEST

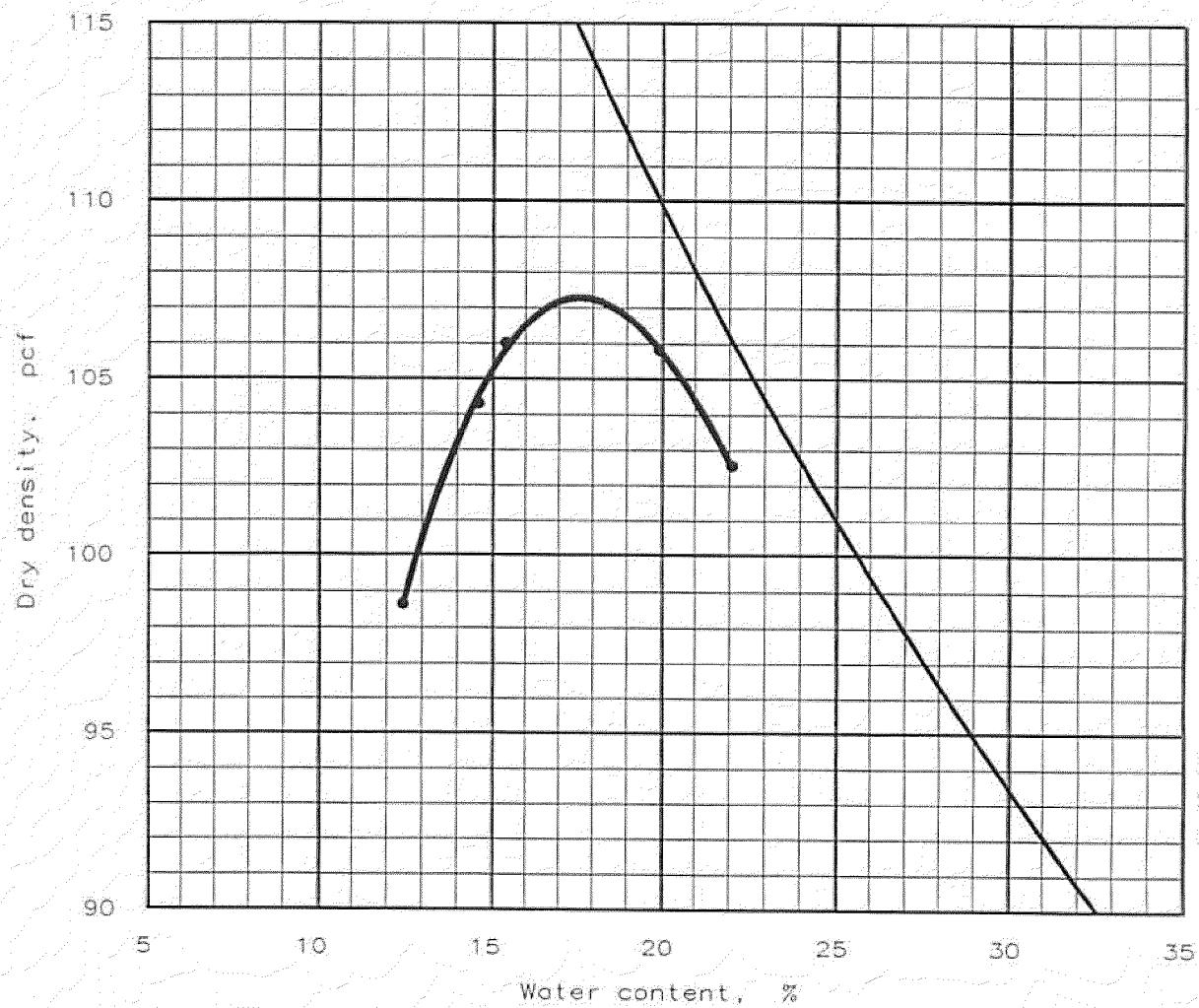


Test specification: ASTM D 698-00ae1 Procedure B, Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/8 in	% < No. 200
	USCS	AASHTO						
3-10'	CL	A-7-6(16)	23.3 %	2.73	45	23	1.6 %	74.1 %

TEST RESULTS		MATERIAL DESCRIPTION
Maximum dry density = 100.6 pcf		Reddish brown lean clay with sand
Optimum moisture = 22.1 %		
Project No.: 3043051030.0001		Remarks:
Project: TVA Kingston - Proposed Gypsum Stack		Sample Number 3226
Location: Borrow Area Observation Trench OT-3		TIP - Test In Progress
Date: 7-21-2005		NT - No Test
MOISTURE-DENSITY RELATIONSHIP TEST		

MOISTURE-DENSITY RELATIONSHIP TEST

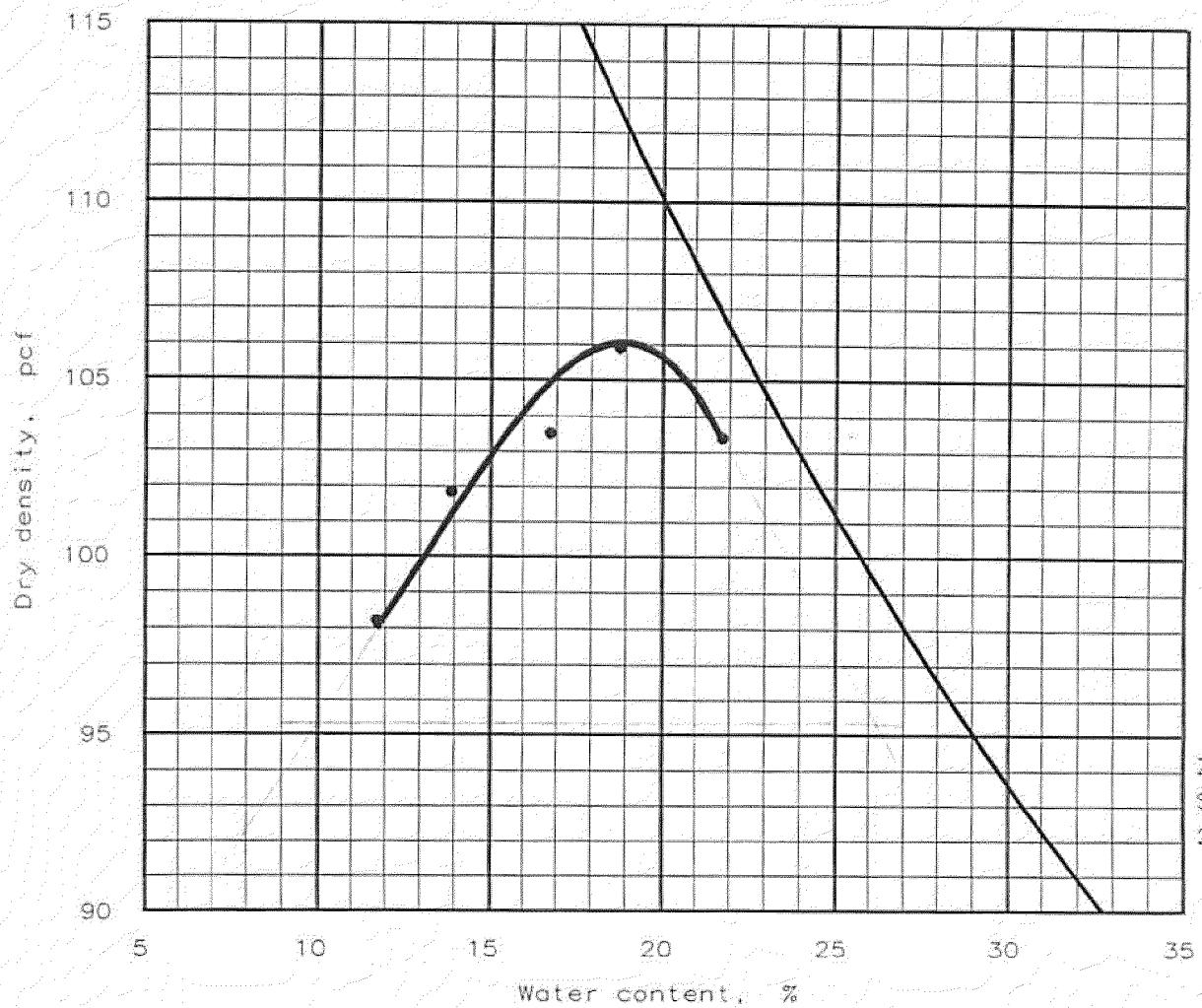


Test specification: ASTM D 698-00a(e1) Procedure B, Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/8 in	% < No. 200
	USCS	AASHTO						
4-10'	CL	A-6(13)	22.5 %	2.72	36	17	0.0 %	82.4 %

TEST RESULTS		MATERIAL DESCRIPTION
Maximum dry density = 107.3 pcf		Dark red brown lean clay with sand
Optimum moisture = 17.6 %		
Project No.: 3043051030.0001	Remarks:	
Project: TVA Kingston - Proposed Gypsum Stack	Sample Number 3227	
Location: Borrow Area Observation Trench OT-4	TIP - Test In Progress	
Date: 7-21-2005	NT - No Test	
MOISTURE-DENSITY RELATIONSHIP TEST		

MOISTURE-DENSITY RELATIONSHIP TEST



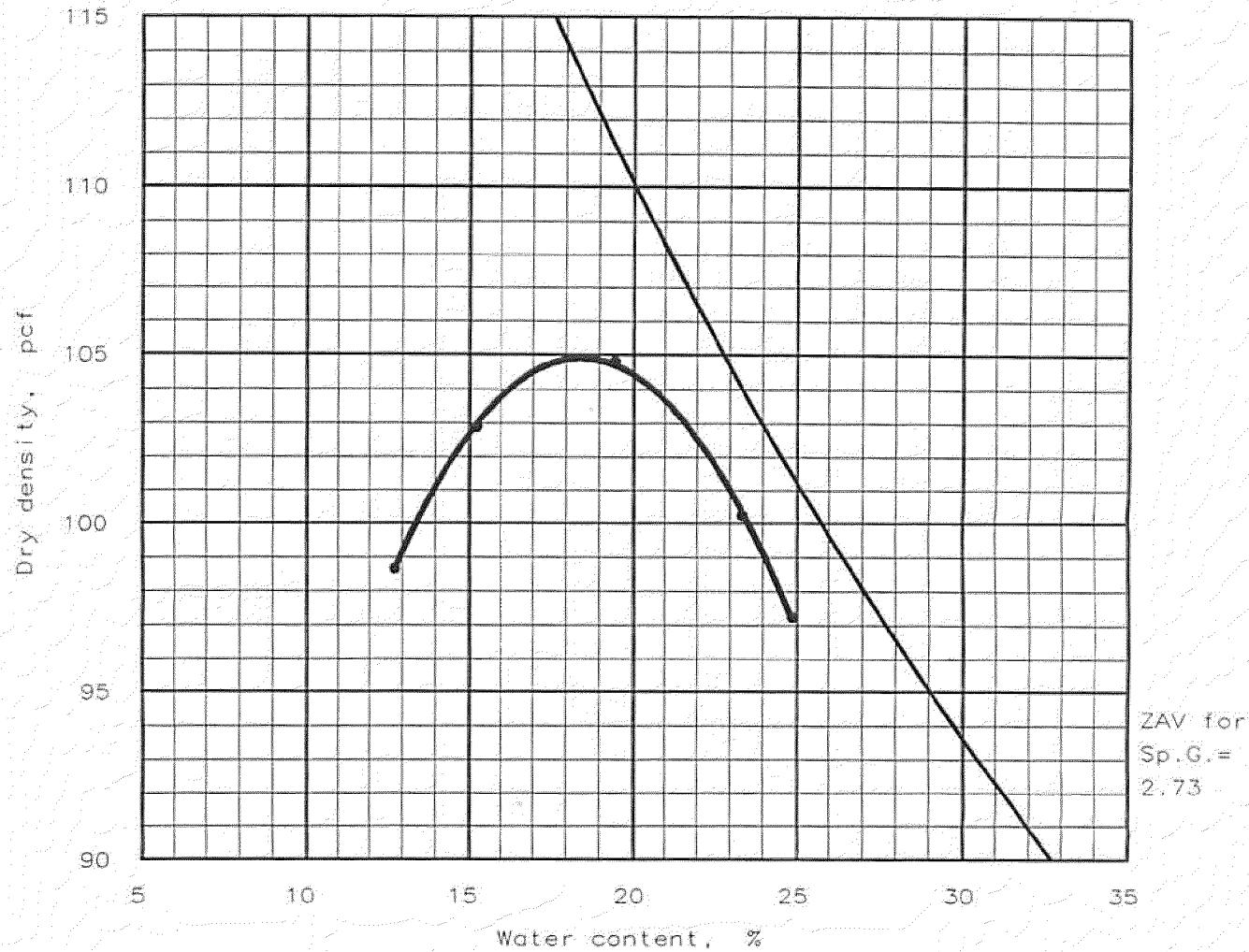
Test specification: ASTM D 698-00ae1 Procedure B, Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/8 in	% < No. 200
	USCS	AASHTO						
4-10'	CL	A-6(15)	22.5 %	2.73	38	18	0.4 %	83.8 %

TEST RESULTS		MATERIAL DESCRIPTION
Maximum dry density = 105.9 pcf		
Optimum moisture = 18.8 %		Dark red brown lean clay with sand
Project No.:	3043051030,0001	Remarks:
Project:	TVA Kingston - Proposed Gypsum Stack	Sample Number 3228
Location:	Borrow Area Observation Trench OT-4	TIP - Test In Progress
Date:	7-21-2005	NT - No Test

MOISTURE-DENSITY RELATIONSHIP TEST

MOISTURE-DENSITY RELATIONSHIP TEST



Test specification: ASTM D 698-00a(e1) Procedure B, Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/8 in	% < No. 200
	USCS	AASHTO						
4-10'	CL	A-6(16)	22.5 %	2.73	39	20	0.0 %	83.5 %

TEST RESULTS		MATERIAL DESCRIPTION
Maximum dry density = 104.9 pcf Optimum moisture = 18.4 %		Dark red brown lean clay with sand
Project No.: 3043051030.0001 Project: TVA Kingston - Proposed Gypsum Stack Location: Borrow Area Observation Trench OT-4 Date: 7-21-2005	Remarks: Sample Number 3229 TIP - Test In Progress NT - No Test	
MOISTURE-DENSITY RELATIONSHIP TEST		

HYDRAULIC CONDUCTIVITY TEST RESULTS



CONSTANT HEAD PERMEABILITY TEST

(ASTM D5084)

JOB NAME: TVA Kingston - Proposed Gypsum Stack
 JOB NO.: 3043-05-1030 Boring Area
 BORING NO.: OT-1
 DEPTH: 2.5-10'
 SAMPLE: Bulk
 DESCRIPTION: RMS - 90 ft, 26.3 (89.9%)

TECHNICIAN: J.P.
 DATE: 9/30/05

CHECKED BY: M
 CELL NO.: #3
 SYSTEM NO.: 14

SAMPLE INFORMATION

WEIGHT TUBE & SOIL (g):
 WEIGHT TUBE (g):
 WEIGHT SOIL (g):
 VOLUME SOIL (cu. ft.):
 DRY UNIT WEIGHT (pcf):
 WET UNIT WEIGHT (pcf):

(ACTUAL COMPACTION)

TUBE LENGTH: (in) (cm)
 TUBE DIAMETER: (in) (cm)
 SOIL LENGTH(L): 2.1435 (in) 5.444 (cm)
 SOIL DIAMETER: 2.8910 (in) 7.3431 (cm)
 AREA(A): (in²) 42.35 (cm²)

MOISTURE CONTENT

INITIAL WET WEIGHT (g): 351.45
 FINAL WET WEIGHT (g): 373.64
 FINAL DRY WEIGHT (g): 276.68
 INITIAL MOISTURE (%): 26.4 %
 FINAL MOISTURE (%):
 PAN NAME: 103

PERM INFORMATION

CELL PRESSURE(psi):
 FORE PRESSURE(psi):
 BACK PRESSURE (psi):
 HEAD,h (psi) x 70.34: 140.68
 TEMPERATURE (°F):
 VISCOSITY CORRECTION(R_T):
 PERMEANT LIQUID USED:
 BURET CORRECTION FACTOR(C):

TABLE OF HYDRAULIC CONDUCTIVITY

DATE		TIME		ELAPSED TIME (+)		READING		FLOW (CC)	
START	END	START	END	MINUTES	SECONDS	START	END	CC	L
8-31	8-31	8:19 ^{am}	8:24 ^{am}	5	300	14.4	5.9	11.8	8.3 ± 6 7.3 × 10 ⁻⁶
8-31	8-31	8:24 ^{am}	8:28 ^{am}	4	240	11.8	8.3	10.0	10.0 ± 8 6.4 × 10 ⁻⁶
8-31	8-31	8:28 ^{am}	8:32 ^{am}	4	240	10.0	10.0	8.5	11.5 ± 5 5.3 × 10 ⁻⁶
8-31	8-31	8:32 ^{am}	8:39 ^{am}	7	420	8.5	11.5	6.0	14.1 ± 2.5 5.1 × 10 ⁻⁶
8-31	8-31	8:39							
8-31	8-31								
TOTALS						1200		Q = 8.4	

COEFFICIENT OF PERMEABILITY, $k = Q \times L \times R_T \times C$ $\frac{Q}{L} = \frac{(5.474)(0.92)}{(140.68)(42.35)} = \frac{Q}{L} = 8.507 \times 10^{-4}$



CONSTANT HEAD PERMEABILITY TEST

(ASTM D5084)

JOB NAME: TVA Kingston - Proposed Gypsum Stack
 JOB NO.: 3043-05-1030 Boring Area
 BORING NO.: OT-1
 DEPTH: 7.5 - 10'
 SAMPLE: Bulk
 DESCRIPTION: RMS - 95 @ 26.3 95.03

TECHNICIAN: J.C.
 DATE: 8/30/05

CHECKED BY: J.O.
 CELL NO.: #5
 SYSTEM NO.: 15

SAMPLE INFORMATION

WEIGHT TUBE & SOIL (g):
 WEIGHT TUBE (g):
 WEIGHT SOIL (g):
 VOLUME SOIL (cu ft):
 DRY UNIT WEIGHT (pcf):
 WET UNIT WEIGHT (pcf):

(ACTUAL COMPACTION)

TUBE LENGTH: _____ (in) _____ (cm)
 TUBE DIAMETER: _____ (in) _____ (cm)
 SOIL LENGTH(L): 19.53 (in) 4.961 (cm)
 SOIL DIAMETER: 2.9750 (in) 7.303 (cm)
 AREA(A): (in²) 41.88 (cm²)

MOISTURE CONTENT

INITIAL WET WEIGHT (g): 371.92
 FINAL WET WEIGHT (g): 391.94
 FINAL DRY WEIGHT (g): 293.11
 INITIAL MOISTURE (%): 26.4%
 FINAL MOISTURE (%):
 PAN NAME: II

PERM INFORMATION

CELL PRESSURE(psi): 57
 FORE PRESSURE(psi): 52
 BACK PRESSURE (psi): 50
 HEAD,h (psi) x 70.34: 140.68
 TEMPERATURE (°F): 73°F
 VISCOSITY CORRECTION(R_T): 0.931
 PERMEANT LIQUID USED: H₂O
 BURET CORRECTION FACTOR(C): 1.0

TABLE OF HYDRAULIC CONDUCTIVITY

DATE		TIME		ELASPED TIME (+)		READING		FLOW (CC)	
START	END	START	END	MINUTES	SECONDS	START	END	cc	K
8-31	8-31	8:18 ^{am}	8:47 ^{am}	29	1740	15.4	4.6	(2.7)	7.1 (2.7) 1.2×10^{-6}
8-31	8-31	8:47 ^{am}	9:13 ^{am}	26	1560	12.7	7.1	10.4	9.3 (2.3) 1.2×10^{-6}
8-31	8-31	9:13 ^{am}	10:08 ^{am}	55	3300	10.4	9.3	5.8	13.8 (4.6) 1.1×10^{-6}
8-31	8-31	10:08 ^{am}	10:16 ^{am}	8	480	5.8	13.8	5.1	14.4 (0.7) 1.1×10^{-6}
TOTALS						$\therefore = 7080^{\text{cc}}$		$Q = 10.3$	

COEFFICIENT OF PERMEABILITY, $k = \frac{Q \times L \times R_T \times C}{h \times A \times t}$ $Q = \frac{4.961 (0.431)}{140.68 (41.88)} = 1.1 \times 10^{-6}$

MACTEC

CONSTANT HEAD PERMEABILITY TEST

(ASTM D5084)

JOB NAME: TVA Kingston - Proposed Gypsum Stack
 JOB NO.: 3043-05-1030 Boring Area
 BORING NO.: OT-1
 DEPTH: 2.5-10'
 SAMPLE: Bulk
 DESCRIPTION: RMS-90 @ 29.3 90.0%

TECHNICIAN: JC
 DATE: 8/30/05

CHECKED BY: JO
 CELL NO.: #1
 SYSTEM NO.: _____

SAMPLE INFORMATION

(Actual Compaction)

WEIGHT TUBE & SOIL (g):
 WEIGHT TUBE (g):
 WEIGHT SOIL (g):
 VOLUME SOIL (cu ft):
 DRY UNIT WEIGHT (pcf):
 WET UNIT WEIGHT (pcf):

TUBE LENGTH: _____ (in) _____ (cm)
 TUBE DIAMETER: _____ (in) _____ (cm)
 SOIL LENGTH(L): 2.090 (in) 5.331 (cm)
 SOIL DIAMETER: 2.8765 (in) 7.332 (cm)
 AREA(A): (in²) 42.22 (cm²)

MOISTURE CONTENT

INITIAL WET WEIGHT (g): 359.68
 FINAL WET WEIGHT (g): 374.57
 FINAL DRY WEIGHT (g): 279.08
 INITIAL MOISTURE (%): 29.3%
 FINAL MOISTURE (%):
 PAN NAME: Bot

PERM INFORMATION

CELL PRESSURE (psi):
 FORE PRESSURE (psi):
 BACK PRESSURE (psi):
 HEAD,h (psi) x 70.34: 140.68
 TEMPERATURE (°F):
 VISCOSITY CORRECTION(R_T):
 PERMEANT LIQUID USED:
 BURET CORRECTION FACTOR(C):

TABLE OF HYDRAULIC CONDUCTIVITY

DATE		TIME		ELASPED TIME (+)		READING		FLOW (CC)	
START	END	START	END	MINUTES	SECONDS	START	END	CC	K
8-31	8-31	8:21 AM	8:33 AM	12	720	15.6	4.7	11.8	83 3.8 4.4×10^{-6}
8-31	8-31	8:33 AM	8:40 AM	7	420	11.8	8.3	9.8	10.4 2.1 4.2×10^{-6}
8-31	8-31	8:40 AM	8:46 AM	6	360	9.8	10.4	8.1	12.0 1.7 3.9×10^{-6}
8-31	8-31	8:46 AM	9:10	24	1440	8.1	12.0	2.0	18.1 6.1 3.5×10^{-6}
TOTALS				= 2940				Q = 13.7	

COEFFICIENT OF PERMEABILITY, $k = Q \times L \times R_T \times C$
 $\frac{Q}{h \times A \times t}$

$$\frac{Q}{t} = 8.356 \times 10^{-4}$$

$$3.9 \times 10^{-6}$$



CONSTANT HEAD PERMEABILITY TEST

(ASTM D5084)

JOB NAME: TVA Kingston - Proposed Gypsum Stack
 JOB NO.: 3043-05-1030 Boring Area
 BORING NO.: OT-1
 DEPTH: 2.5 - 10'
 SAMPLE: Bulk
 DESCRIPTION: RMS-95 @ 29.3 (95.1%)

TECHNICIAN: J.C.
 DATE: 8/30/05

CHECKED BY: J.D.
 CELL NO.: #2
 SYSTEM NO.: 13/14

SAMPLE INFORMATION

WEIGHT TUBE & SOIL (g):
 WEIGHT TUBE (g):
 WEIGHT SOIL (g):
 VOLUME SOIL (cu ft):
 DRY UNIT WEIGHT (pcf):
 WET UNIT WEIGHT (pcf):

(ACTUAL COMPOSITION)

TUBE LENGTH: (in) (cm)
 TUBE DIAMETER: (in) (cm)
 SOIL LENGTH(L): 2.0690 (in) 5.2553 (cm)
 SOIL DIAMETER: 2.8745 (in) 7.3063 (cm)
 AREA(A): (in²) 41.93 (cm²)

MOISTURE CONTENT

INITIAL WET WEIGHT (g): 379.82
 FINAL WET WEIGHT (g): 395.03
 FINAL DRY WEIGHT (g): 294.71
 INITIAL MOISTURE (%): 29.3%
 FINAL MOISTURE (%):
 PAN NAME: FF

PERM INFORMATION

CELL PRESSURE(psi): 57
 FORE PRESSURE(psi): 52
 BACK PRESSURE (psi): 59
 HEAD,h (psi) x 70.34: 140.68
 TEMPERATURE (°F): 73°F
 VISCOSITY CORRECTION(R_T): 0.931
 PERMEANT LIQUID USED: H₂O
 BURET CORRECTION FACTOR(C): 1.0

TABLE OF HYDRAULIC CONDUCTIVITY

DATE		TIME		ELAPSED TIME (+)		READING		FLOW (CC)	
START	END	START	END	MINUTES	SECONDS	START	END	C	K
8-31	8-31	8:20 ^{am}	8:34 ^{am}	14	840	15.0	5.2	12.8	7.5 (2.2) 2.2×10^{-6}
8-31	8-31	8:34 ^{am}	9:11 ^{am}	37	2220	12.8	7.5	12.9 (5.3)	2.0×10^{-6}
8-31	8-31	9:11 ^{am}	10:05 ^{am}	54	3240	7.5	12.9 0.8	19.7 (6.7)	1.7×10^{-6}
8-31	8-31	10:07 ^{am}	10:21 ^{am}	14	840	12.4	7.8	11.0 9.6 (1.4)	1.4×10^{-6}
TOTALS									Q = 15.6

$$\text{COEFFICIENT OF PERMEABILITY, } k = Q \times L \times R_T \times C \quad \frac{Q}{h \times A \times t} \cdot \frac{(5.255)(0.931)}{(140.68)(41.93)} =$$

$$1.8 \times 10^{-6}$$

MACTEC

CONSTANT HEAD PERMEABILITY TEST

(ASTM D5084)

JOB NAME: TVA Kingston - Proposed Gypsum Stack
 JOB NO.: 3043-05-1030 Boring Area
 BORING NO.: OT-1
 DEPTH: 2-5 - 10'
 SAMPLE: Bulk
 DESCRIPTION: RMS-90 @ 32.3 89.9 %

TECHNICIAN: J.C.
 DATE: 8/30/05

CHECKED BY: S.O.
 CELL NO.: A
 SYSTEM NO.: 2

SAMPLE INFORMATION

WEIGHT TUBE & SOIL (g):
 WEIGHT TUBE (g):
 WEIGHT SOIL (g):
 VOLUME SOIL (cu ft):
 DRY UNIT WEIGHT (pcf):
 WET UNIT WEIGHT (pcf):

(ACTUAL COMPACTION)

TUBE LENGTH: _____ (in) _____ (cm)
 TUBE DIAMETER: _____ (in) _____ (cm)
 SOIL LENGTH(L): 1.9945 (in) 5.066 (cm)
 SOIL DIAMETER: 2.8910 (in) 7.343 (cm)
 AREA(A): (in²) 42.35 (cm²)

MOISTURE CONTENT

INITIAL WET WEIGHT (g): 374.52
 FINAL WET WEIGHT (g): 319.99
 FINAL DRY WEIGHT (g): 274.18
 INITIAL MOISTURE (%): 32.5 %
 FINAL MOISTURE (%):
 PAN NAME: PR

PERM INFORMATION

CELL PRESSURE(psi): 57
 FORE PRESSURE(psi): 52
 BACK PRESSURE (psi): 59
 HEAD,h (psi) x 70.34: 140.68
 TEMPERATURE (°F): 73°F
 VISCOSITY CORRECTION(R_T): 0.931
 PERMEANT LIQUID USED: H₂O
 BURET CORRECTION FACTOR(C): 1.0

TABLE OF HYDRAULIC CONDUCTIVITY

DATE		TIME		ELAPSED TIME (+)		READING		FLOW (CC)	
START	END	START	END	MINUTES	SECONDS	START	END	CC	k
8-31	8-31	8:23 AM	9:13 AM	50	3000	25.4	15.5	23.4	17.7 2.0 5.3x10 ⁻⁷
8-31	8-31	9:13 AM	10:09 AM	56	3360	23.4	17.7	21.4	19.8 2.0 4.7x10 ⁻⁷
8-31	8-31	10:09 AM	10:21 AM	12	720	21.4	19.8	21.0	20.2 0.4 4.4x10 ⁻⁷
8-31	8-31	10:21 AM	11:25 AM	64	3840	21.0	20.2	18.9	22.4 2.1 4.3x10 ⁻⁷
8-31	8-31	11:25 AM	1:15 PM	110	6600	18.9	22.4	15.6	25.8 3.3 4.0x10 ⁻⁷
TOTALS						$i = 14.520$		$Q = 7.8$	

COEFFICIENT OF PERMEABILITY, $k = \frac{Q \times L \times R_T \times C}{h \times A \times t}$

$$\frac{(5.066)(0.931)}{(140.68)(42.35)} = 4.3 \times 10^{-7}$$



CONSTANT HEAD PERMEABILITY TEST

(ASTM D5084)

JOB NAME: TVA Kingston - Proposed Gypsum Stack
 JOB NO.: 3043-05-1030 Barmw Area
 BORING NO.: OT-1
 DEPTH: 2.5 - 10'
 SAMPLE: Bulk
 DESCRIPTION: RMS - 951@ 32.3 (94.9 %)

TECHNICIAN: J.P.
 DATE: 8/30/05

CHECKED BY: G.O.
 CELL NO.: 1113
 SYSTEM NO.: _____

SAMPLE INFORMATION

WEIGHT TUBE & SOIL (g):
 WEIGHT TUBE (g):
 WEIGHT SOIL (g):
 VOLUME SOIL (cu ft):
 DRY UNIT WEIGHT (pcf):
 WET UNIT WEIGHT (pcf):

(ACTUAL COMPACTION)

TUBE LENGTH: _____ (in) (cm)
 TUBE DIAMETER: _____ (in) (cm)
 SOIL LENGTH(L): 2.0435 (in) 5.190 (cm)
 SOIL DIAMETER: 2.8870 (in) 7.338 (cm)
 AREA(A): (in²) 42.29 (cm²)

MOISTURE CONTENT

INITIAL WET WEIGHT (g): 399.92
 FINAL WET WEIGHT (g): 391.39
 FINAL DRY WEIGHT (g): 292.95
 INITIAL MOISTURE (%): 32.5%
 FINAL MOISTURE (%):
 PAN NAME: 55

PERM INFORMATION

CELL PRESSURE(psi): 57
 FORE PRESSURE(psi): 52
 BACK PRESSURE (psi): 50
 HEAD,h (psi) x 70.34: 140.68
 TEMPERATURE (°F): 73°F
 VISCOSITY CORRECTION(R_T): 0.951
 PERMEANT LIQUID USED: H₂O
 BURET CORRECTION FACTOR(C): 1.0

TABLE OF HYDRAULIC CONDUCTIVITY

DATE		TIME		ELAPSED TIME (+)		READING		FLOW (CC)	
START	END	START	END	MINUTES	SECONDS	START	END	C	K
8-31	8-31	8:22 AM	9:28 AM	66	27	26.5	15.1	25.3	16.2 1.2 2.5x10 ⁻⁷
8-31	8-31	7:28 AM	11:38 AM	130	7800	25.3	16.2	23.3	18.5 2.9 2.1x10 ⁻⁷
8-31	8-31	11:38 AM	1:15 PM	97	5820	23.3	18.5	21.8	20.1 1.9 2.1x10 ⁻⁷
8-31	8-31	1:15 PM	1:50	35	2100	21.8	20.1	21.2	20.7 6.6 2.3x10 ⁻⁷
TOTALS						P=19680		Q= 5.3	

$$\text{COEFFICIENT OF PERMEABILITY, } k = \frac{Q \times L \times R_T \times C}{h \times A \times t} = \frac{5.190 (0.951)}{(140.68)(42.29)} = 2.2 \times 10^{-7}$$

MACTEC

CONSTANT HEAD PERMEABILITY TEST

(ASTM D5084)

JOB NAME: TVA KINGSTON - B.A.

JOB NO.: 3043-05-1030

BORING NO.: OT-1

DEPTH: 2.5 - 10'

SAMPLE: Bulk

DESCRIPTION: RM S \leq 95% @ 30.0% CT

TECHNICIAN: JAMES J.C.
DATE: 9-13-5

CHECKED BY: JA

CELL NO.: #15

SYSTEM NO.: #15

SAMPLE INFORMATION

WEIGHT TUBE & SOIL (g):

WEIGHT TUBE (g):

WEIGHT SOIL (g):

VOLUME SOIL (cu ft):

DRY UNIT WEIGHT (pcf):

WET UNIT WEIGHT (pcf):

TUBE LENGTH: _____ (in) _____ (cm)

TUBE DIAMETER: _____ (in) _____ (cm)

SOIL LENGTH(L): 1.990 (in) 5.055 (cm)

SOIL DIAMETER: 2.881 (in) 7.318 (cm)

AREA(A): (in²) 42.06 (cm²)

MOISTURE CONTENT

INITIAL WET WEIGHT (g): 381.76

FINAL WET WEIGHT (g): 389.79

FINAL DRY WEIGHT (g): 294.32

INITIAL MOISTURE (%): 29.7

FINAL MOISTURE (%): 32.4

PAN NAME: SS

PERM INFORMATION

CELL PRESSURE(psi):

FORE PRESSURE(psi):

BACK PRESSURE (psi):

HEAD,h (psi) \times 70.34: 140.68

TEMPERATURE (°F): 73

VISCOOSITY CORRECTION(R_T): .931

PERMEANT LIQUID USED: H₂O

BURET CORRECTION FACTOR(C): 1.0

TABLE OF HYDRAULIC CONDUCTIVITY

DATE		TIME		ELASPED TIME (+)		READING		FLOW (CC)	
START	END	START	END	MINUTES	SECONDS	START	END	Q	K
9-15	9-15	9:14	11:14	120	7200	13.1	6.8	11.8	8.2
9-15	9-15	11:14	11:49	35	2100	11.8	8.2	11.4	8.6
9-15	9-15	11:49	1:00	71	4260	11.4	8.6	10.7	9.3
9-15	9-15	1:00	2:07	67	4020	10.7	9.3	10.0	10.0
TOTALS						$= 17580$		$Q = 3.1$	

$$\text{COEFFICIENT OF PERMEABILITY}, k = \frac{Q \times L \times R_T \times C}{h \times A \times t}$$

$$\frac{Q}{t} = \frac{5.055 (.931) (1.0)}{(140.68)(42.06)} = 1.4 \times 10^{-7}$$



CONSTANT HEAD PERMEABILITY TEST

(ASTM D5084)

JOB NAME: TVA Kingston - Proposed Gypsum Stack
 JOB NO.: 3043-05-1030 Boring Area
 BORING NO.: OT-3
 DEPTH: 3' - 10'
 SAMPLE: Bulk
 DESCRIPTION: RMS - 90@ 20.1 (90.19)

TECHNICIAN: J.C.
 DATE: 8/31/05

CHECKED BY: JA
 CELL NO.: 13
 SYSTEM NO.: 4

SAMPLE INFORMATION

WEIGHT TUBE & SOIL (g):
 WEIGHT TUBE (g):
 WEIGHT SOIL (g):
 VOLUME SOIL (cu ft):
 DRY UNIT WEIGHT (pcf):
 WET UNIT WEIGHT (pcf):

(Actual Compaction)

TUBE LENGTH: _____ (in) _____ (cm)
 TUBE DIAMETER: _____ (in) _____ (cm)
 SOIL LENGTH(L): 1.9730 (in) 5.011 (cm)
 SOIL DIAMETER: 2.8820 (in) 7.320 (cm)
 AREA(A): (in²) 42.09 (cm²)

MOISTURE CONTENT

INITIAL WET WEIGHT (g): 357.15
 FINAL WET WEIGHT (g): 393.66
 FINAL DRY WEIGHT (g): 308.70
 INITIAL MOISTURE (%): 19.9%
 FINAL MOISTURE (%):
 PAN NAME: 4011

PERM INFORMATION

CELL PRESSURE(psi):
 FORE PRESSURE(psi):
 BACK PRESSURE (psi):
 HEAD,h (psi) x 70.34: 140.68
 TEMPERATURE (°F):
 VISCOSITY CORRECTION(R_v):
 PERMEANT LIQUID USED:
 BURET CORRECTION FACTOR(C):

TABLE OF HYDRAULIC CONDUCTIVITY

DATE		TIME		ELAPSED TIME (+)		READING		FLOW (CC)
START	END	START	END	MINUTES	SECONDS	START	END	
9-1		10:02	10:13	11	160	28.8	49.2	5.3x10 ⁻⁶
		10:13	10:58	45	2700	33.2	44.8	4.0x10 ⁻⁶
		10:58	11:11	13	780	46.6	31.1	2.7x10 ⁻⁶
		11:11	11:45	34	2040	49.3	28.4	2.2x10 ⁻⁶
		11:45	12:03	18	1080	55.0	22.6	1.8x10 ⁻⁶
		12:03	12:21	18	1080	57.4	20.2	1.8x10 ⁻⁶
TOTALS						= 1980		Q = 13.2

COEFFICIENT OF PERMEABILITY, $k = Q \times L \times R_v \times C$ $\frac{Q}{L} = \frac{13.2}{(1.9730)(42.09)} = 2.1 \times 10^{-6}$

CONSTANT HEAD PERMEABILITY TEST

MACTEC

(ASTM D5084)

JOE NAME: TVA Kingston - Proposed Gypsum Stake
JOB NO.: 3043-C5-1030 Boring Area
DEPTH: 30 - 100
SAMPLE: Bulk
DESCRIPTION: RM5 - 95@20.1

CHEKED BY: A
CELL NO.: 100
SYSTEM NO.: 5

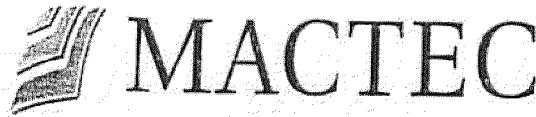
WEIGHT TUBE & SOIL (g):
WEIGHT SOIL (g):
SOIL LENGTH(L): 19945 (in) 50.06
SOIL DIAMETER: 2.8840 (in) 7.325 (cm)
AREA(A): (in) 42.15 (cm)

TUBE LENGTH: (in) 15.0
TUBE DIAMETER: (in) (cm)
WEIGHT TUBE (g):
WEIGHT SOIL (g):
SOIL LENGTH(L): 19945 (in) 50.06
SOIL DIAMETER: 2.8840 (in) 7.325 (cm)
AREA(A): (in) 42.15 (cm)

WEIGHT TUBE & SOIL (g):
WEIGHT SOIL (g):
VOLUME SOIL (cu ft):
DRY UNIT WEIGHT (psi):
WET UNIT WEIGHT (psi):
INITIAL WET WEIGHT (g): 378.18
FINAL WET WEIGHT (g): 415.15
FORCE PRESSURE (psi): 19.94
HEAD(h (psi) x 70.34: 140.68
INITIAL MOISTURE (%): 19.9%
FINAL MOISTURE (%):
PAN NAME: B51
VISCOSEITY CORRECTION(%):
TEMPERATURE (F):
HEAD(h (psi) x 70.34: 140.68
BACK PRESSURE (psi):
FORCE PRESSURE (psi):
INITIAL WET WEIGHT (g):
FINAL DRY WEIGHT (g): 326.86
HEAD(h (psi) x 70.34: 140.68
VISCOSEITY CORRECTION(%):
TEMPERATURE (F):
PERMEANT LIQUID USED:
BURET CORRECTION FACTOR(C):

TABLE OF HYDRAULIC CONDUCTIVITY

DATE	TIME	ELAPSED TIME (+)	READING	FLOW (CC)	
START	END	MINUTES	SECONDS	START	END
12.29	12:30	1	10.0	304	38.3 313 37.4 (5) 1.2x10 ⁻⁵
12.29	12:31	1	10.0	31.3	37.4 32.3 37.3 31.0 (3) 1.3x10 ⁻⁵
12.30	12:32	1	10.0	32.3	39.3 33.2 35.5 (9) 1.2x10 ⁻⁵
12.31	12:32	1	10.0	33.2	35.5 34.0 34.7 (8) 1.1x10 ⁻⁵
12.32	12:33	1	10.0	34.2	37.5 34.0 34.7 (8) 1.1x10 ⁻⁵
12.32	12:33	1	10.0	35.2	37.5 34.0 34.7 (8) 1.1x10 ⁻⁵
12.33	12:33	1	10.0	36.2	37.5 34.0 34.7 (8) 1.1x10 ⁻⁵
12.33	12:33	1	10.0	37.2	37.5 34.0 34.7 (8) 1.1x10 ⁻⁵
12.33	12:33	1	10.0	38.2	37.5 34.0 34.7 (8) 1.1x10 ⁻⁵
12.33	12:33	1	10.0	39.2	37.5 34.0 34.7 (8) 1.1x10 ⁻⁵
12.34	12:34	1	10.0	40.2	37.5 34.0 34.7 (8) 1.1x10 ⁻⁵
12.34	12:34	1	10.0	41.2	37.5 34.0 34.7 (8) 1.1x10 ⁻⁵
12.34	12:34	1	10.0	42.2	37.5 34.0 34.7 (8) 1.1x10 ⁻⁵



CONSTANT HEAD PERMEABILITY TEST

(ASTM D5084)

JOB NAME: TVA Kingston - Proposed Gypsum Stack
 JOB NO.: 3043-05-1030 Boring Area
 BORING NO.: OT-3
 DEPTH: 3'-10"
 SAMPLE: Bulk
 DESCRIPTION: RMS-90 ft. 23. (90 ± 3) (Actual composition)

TECHNICIAN: J.C.
 DATE: 8/31/05
 CHECKED BY: J
 CELL NO.: A
 SYSTEM NO.: 3

SAMPLE INFORMATION

WEIGHT TUBE & SOIL (g):
 WEIGHT TUBE (g):
 WEIGHT SOIL (g):
 VOLUME SOIL (cu ft):
 DRY UNIT WEIGHT (pcf):
 WET UNIT WEIGHT (pcf):

TUBE LENGTH: _____ (in) _____ (cm)
 TUBE DIAMETER: _____ (in) _____ (cm)
 SOIL LENGTH(L): 195.55 (in) 4.962 (cm)
 SOIL DIAMETER: 2.8810 (in) 7.318 (cm)
 AREA(A): _____ (in²) 42.06 (cm²)

MOISTURE CONTENT

INITIAL WET WEIGHT (g): 379.92
 FINAL WET WEIGHT (g): 393.66
 FINAL DRY WEIGHT (g): 309.10
 INITIAL MOISTURE (%): 22.5%
 FINAL MOISTURE (%):
 PAN NAME: NN

PERM INFORMATION

CELL PRESSURE(psi):
 FORE PRESSURE(psi):
 BACK PRESSURE (psi):
 HEAD.h (psi) × 70.34: 140.68
 TEMPERATURE (°F):
 VISCOSITY CORRECTION(R_T):
 PERMEANT LIQUID USED:
 BURET CORRECTION FACTOR(C):

TABLE OF HYDRAULIC CONDUCTIVITY

DATE		TIME		ELAPSED TIME (+)		READING		FLOW (CC)			
START	END	START	END	MINUTES	SECONDS	START	END				
9-1	9:12	9:49	10:03	37	2220	25.0	15.2	17.8	22.4	7.2	2.6x10 ⁻⁶
		9:49	10:03	14	840	17.8	22.4	15.5	24.7	2.3	2.1x10 ⁻⁶
		10:03	10:10	7	420	15.5	24.7	14.3	26.0	1.2	2.2x10 ⁻⁶
		10:10	10:20	10	600	14.3	26.0	12.6	22.8	1.7	2.2x10 ⁻⁶
TOTALS						1600				0	

COEFFICIENT OF PERMEABILITY, $k = \frac{Q \times L \times R_T \times C}{h \times A \times t}$ $\frac{12.4}{4060} \cdot \frac{4.962}{140.68} \cdot \frac{0.931}{4200} \cdot \frac{1.0}{1.0} = 2.4 \times 10^{-6}$



MACTEC

CONSTANT HEAD PERMEABILITY TEST

(ASTM D5084)

JOB NAME: TVA Kingston - Proposed Gypsum Stack
 JOB NO.: 3043-05-1030 Boring Area
 BORING NO.: OT-3
 DEPTH: 3' - 10'
 SAMPLE: Bulk
 DESCRIPTION: RMS - 95% 23.1 (95.4%)

TECHNICIAN: J.C
 DATE: 9/1/05

CHECKED BY: JA
 CELL NO.: 2-N
 SYSTEM NO.: C

SAMPLE INFORMATION

WEIGHT TUBE & SOIL (g):
 WEIGHT TUBE (g):
 WEIGHT SOIL (g):
 VOLUME SOIL (cu ft):
 DRY UNIT WEIGHT (pcf):
 WET UNIT WEIGHT (pcf):

(Actual compaction)

TUBE LENGTH: _____ (in) _____ (cm)
 TUBE DIAMETER: _____ (in) _____ (cm)
 SOIL LENGTH(L): 2.0085 (in) 5.102 (cm)
 SOIL DIAMETER: 2.8805 (in) 7.316 (cm)
 AREA(A): (in²) 42.04 (cm²)

MOISTURE CONTENT

INITIAL WET WEIGHT (g): 401.57
 FINAL WET WEIGHT (g): 412.71
 FINAL DRY WEIGHT (g): 326.50
 INITIAL MOISTURE (%): 22.5%
 FINAL MOISTURE (%):
 PAN NAME: RR

PERM INFORMATION

CELL PRESSURE(psi):
 FORE PRESSURE(psi):
 BACK PRESSURE (psi):
 HEAD,h (psi) x 70.34: 140.68
 TEMPERATURE (°F):
 VISCOSITY CORRECTION(R_T):
 PERMEANT LIQUID USED:
 BURET CORRECTION FACTOR(C):

TABLE OF HYDRAULIC CONDUCTIVITY

DATE		TIME		ELASPED TIME (+)		READING		FLOW (CC)	
START	END	START	END	MINUTES	SECONDS	START	END		
9-1		10:04							
		11:02	12:04	62	(3720)	24.8	35.3	26.1	34.1 (1.2) 2.6x10 ⁻⁷
		12:04	12:34	30	(1800)	26.1	34.1	26.6	33.6 (5) 2.2x10 ⁻⁷
		12:34	1:09	35	(2100)	26.6	33.6	27.2	33.0 (7) 2.7x10 ⁻⁷
		1:09	1:54	25	(1300)	27.2	33.6	27.7	32.5 (5) 2.7x10 ⁻⁷
TOTALS						= 9120			Q = 2.9

$$\text{COEFFICIENT OF PERMEABILITY}, k = \frac{Q \times L \times R_T \times C}{h \times A \times t} = \frac{2.6 \times 10^{-7}}{\frac{140.68 \times 42.04}{9120}} = 2.6 \times 10^{-7}$$



CONSTANT HEAD PERMEABILITY TEST

(ASTM D5084)

JOB NAME: TVA Kingston - Proposed Gypsum Stack
 JOB NO.: 3043-05-1030 Borrow Area
 BORING NO.: OT-3
 DEPTH: 2' - 10'
 SAMPLE: Bulk
 DESCRIPTION: RMS - 90% 26.1 (90.3%)

TECHNICIAN: JC
 DATE: 8/13/05

CHECKED BY:
 CELL NO.: 3
 SYSTEM NO.: 18

SAMPLE INFORMATION

WEIGHT TUBE & SOIL (g):
 WEIGHT TUBE (g):
 WEIGHT SOIL (g):
 VOLUME SOIL (cu ft):
 DRY UNIT WEIGHT (pcf):
 WET UNIT WEIGHT (pcf):

(Actual Compaction)

TUBE LENGTH: 5.5 (in) (cm)
 TUBE DIAMETER: 2.8835 (in) (cm)
 SOIL LENGTH(L): 1.7965 (in) 5.046 (cm)
 SOIL DIAMETER: 2.8835 (in) 7.324 (cm)
 AREA(A): .4213 (in) (cm)

MOISTURE CONTENT

INITIAL WET WEIGHT (g): 388.29
 FINAL WET WEIGHT (g): 393.55
 FINAL DRY WEIGHT (g): 308.39
 INITIAL MOISTURE (%): 25.69
 FINAL MOISTURE (%):
 PAN NAME: SS

PERM INFORMATION

D-TI 4
 CELL PRESSURE(psi):
 FORE PRESSURE(psi):
 BACK PRESSURE (psi):
 HEAD,h (psi) x 70.34: 140.68
 TEMPERATURE (°F): 73 °F
 VISCOSITY CORRECTION(R_T):
 PERMEANT LIQUID USED:
 BURET CORRECTION FACTOR(C):

TABLE OF HYDRAULIC CONDUCTIVITY

DATE		TIME		ELAPSED TIME (+)		READING		FLOW (cc)	
START	END	START	END	MINUTES	SECONDS	START	END		
9/1		9:05	9:48	43	2580	24.8	15.5	24.2	16.3 .6 1.8x10 ⁻⁷
		9:48	10:06	18	1080	24.2	16.2	23.9	16.5 3 2.2x10 ⁻⁷
		10:06	10:54	48	2880	23.9	16.5	23.7	17.4 7 2.2x10 ⁻⁷
		10:54	11:40	46	27160	23.1	17.4	22.8	18.1 7 2.0x10 ⁻⁷
		11:40	12:37	57	3420	22.8	18.1	21.9	19.8 7 2.1x10 ⁻⁷

$$(2.7)(5.046)(0.931)$$

$$(140.68)(42.13)(10140)$$

$$= 10140$$

$$= 2.7$$

$$\text{COEFFICIENT OF PERMEABILITY, } k = \frac{Q \times L \times R_T \times C}{h \times A \times t}$$

$$= 2.11 \times 10^{-7}$$



CONSTANT HEAD PERMEABILITY TEST

(ASTM D5084)

JOB NAME: TVA Kingston - Proposed Gypsum Stack
 JOB NO.: 3043-05-1030 Boring Area
 BORING NO.: OT-3
 DEPTH: 3'-10'
 SAMPLE: Bulk
 DESCRIPTION: RMS - 95% 26.1 95.4%

TECHNICIAN: J.C.
 DATE: 8/31/05

CHECKED BY: JA
 CELL NO.: B
 SYSTEM NO.: 2

SAMPLE INFORMATION

WEIGHT TUBE & SOIL (g):
 WEIGHT TUBE (g):
 WEIGHT SOIL (g):
 VOLUME SOIL (cu ft):
 DRY UNIT WEIGHT (pcf):
 WET UNIT WEIGHT (pcf):

(Actual Compaction)

TUBE LENGTH: _____ (in) _____ (cm)
 TUBE DIAMETER: _____ (in) _____ (cm)
 SOIL LENGTH(L): 2.0808 (in) 5.284 (cm)
 SOIL DIAMETER: 2.8815 (in) 7.316 (cm)
 AREA(A): (in²) 42.04 (cm²)

MOISTURE CONTENT

INITIAL WET WEIGHT (g): 411.37
 FINAL WET WEIGHT (g): 417.73
 FINAL DRY WEIGHT (g): 326.41
 INITIAL MOISTURE (%): 25.16% ← 25.16%
 FINAL MOISTURE (%):
 PAN NAME: WALLACE

PERM INFORMATION

CELL PRESSURE(psi):
 FORE PRESSURE(psi):
 BACK PRESSURE (psi):
 HEAD,h (psi) x 70.34: 140.68
 TEMPERATURE (°F): 73°F
 VISCOSITY CORRECTION(R_T): 0.931
 PERMEANT LIQUID USED: H₂O
 BURET CORRECTION FACTOR(C): 1.0

TABLE OF HYDRAULIC CONDUCTIVITY

DATE		TIME		ELAPSED TIME (+)		READING		FLOW (CC)	
START	END	START	END	MINUTES	SECONDS	START	END		
9-1		9:09	9:48	39	2340	25.2	15.0	24.1	16.1 1.1 3.9x10 ⁻⁷
		9:49	10:04	16	960	24.1	16.1	23.6	16.6 .5 4.3x10 ⁻⁷
		10:04	10:19	15	900	23.6	16.6	23.2	16.9 .3 2.8x10 ⁻⁷
		10:19	10:51	32	1920	23.2	16.9	22.4	17.7 .8 3.5x10 ⁻⁷
		10:51	11:08	17	1020	22.4	17.7	21.9	18.2 .5 4.1x10 ⁻⁷
		11:39	12:09	30	1800	21.8	18.4	21.0	19.2 .4 3.7x10 ⁻⁷
		12:09	12:36	27	1620	21.0	19.2	20.4	19.8 .6 3.1x10 ⁻⁷
		12:36	1:12	36	2160	20.4	19.8	19.5	20.7 .9 3.5x10 ⁻⁷
Q = 5286 (0.931)		140.68 (42.04)		R = 66.70		C = 2.8		= 3.5x10 ⁻⁷	
TOTALS									

$$\text{COEFFICIENT OF PERMEABILITY, } K = Q \times L \times R^{-1} \times C^{-1} = \frac{5286 (0.931) (0.001)}{140.68 (42.04)} = 1.140168 / 42.04 = 2.74 \times 10^{-7}$$

$$= 3.5 \times 10^{-7}$$



CONSTANT HEAD PERMEABILITY TEST

(ASTM D5084)

JOB NAME: TVA Kingston - Proposed Gypsum Stack
 JOB NO.: 3043-05-1030 Boring Area
 BORING NO.: OT-4
 DEPTH: 4'-10'
 SAMPLE: Bulk
 DESCRIPTION: RMS-90% Kao.8 (89.8%)

TECHNICIAN: J.C.
 DATE: 8/13/05

CHECKED BY:
 CELL NO.: #3
 SYSTEM NO.: 13/14

SAMPLE INFORMATION

WEIGHT TUBE & SOIL (g):
 WEIGHT TUBE (g):
 WEIGHT SOIL (g):
 VOLUME SOIL (cu ft):
 DRY UNIT WEIGHT (pcf):
 WET UNIT WEIGHT (pcf):

(ACTUAL % COMPACTION)

TUBE LENGTH: _____ (in) _____ (cm)
 TUBE DIAMETER: _____ (in) _____ (cm)
 SOIL LENGTH(L): 2.0615 (in) 5.236 (cm)
 SOIL DIAMETER: 2.8875 (in) 7.333 (cm)
 AREA(A): (in²) 42.23 (cm²)

MOISTURE CONTENT

INITIAL WET WEIGHT (g): 379.35
 FINAL WET WEIGHT (g): 412.34
 FINAL DRY WEIGHT (g): 323.33
 INITIAL MOISTURE (%): 17.19
 FINAL MOISTURE (%):
 PAN NAME: B-9

PERM INFORMATION

CELL PRESSURE(psi):
 FORE PRESSURE(psi):
 BACK PRESSURE (psi):
 HEAD,h (psi) x 70.34: 140.68
 TEMPERATURE (°F):
 VISCOSITY CORRECTION(R_v):
 PERMEANT LIQUID USED:
 BURET CORRECTION FACTOR(C):

TABLE OF HYDRAULIC CONDUCTIVITY

DATE		TIME		ELASPED TIME (+)		READING		FLOW (cc)
START	END	START	END	MINUTES	SECONDS	START	END	
9/1		9:24	9:37			14.3	5.5	4.0 16.0
		9:40	9:52			18.7	2.2	10.0 10.9
		9:52	10:01			10.0	10.9	3.6 17.4
		10:49				14.4	9.7	
		12:15	12:17	2	(120)	15.5	5.0	13.8 6.7 (1.7) 1.2x10 ⁻⁵
		12:17	12:19	2	(120)	13.8	6.7	12.3 7.9 (1.3) 1.0x10 ⁻⁵
		12:19	12:21	2	(120)	12.3	7.9	11.0 7.4 (1.5) 1.0x10 ⁻⁵
		12:21	12:23	2	(120)	11	9.4	9.5 10.8 (1.5) 1.0x10 ⁻⁵
TOTALS								Q = 10.2
COEFFICIENT OF PERMEABILITY, $k = \frac{Q}{h \times A \times t}$						Q = $\frac{(5.236)(-9.81)(1.0)}{(140.68)(42.23)} = 1.1 \times 10^{-5}$		



CONSTANT HEAD PERMEABILITY TEST

(ASTM D5084)

JOB NAME: TVA Kingston - Proposed Gypsum Stack
 JOB NO.: 3043-05-1030 Boring Area
 BORING NO.: OT-4
 DEPTH: 4'-10'
 SAMPLE: Bulk
 DESCRIPTION: RMS - 95% 16.8 (94.8%)

TECHNICIAN: J.C.
 DATE: 8/13/05

CHECKED BY: ✓
 CELL NO.: #1
 SYSTEM NO.: 13

SAMPLE INFORMATION

WEIGHT TUBE & SOIL (g):
 WEIGHT TUBE (g):
 WEIGHT SOIL (g):
 VOLUME SOIL (cu ft):
 DRY UNIT WEIGHT (pcf):
 WET UNIT WEIGHT (pcf):

(ACTUAL % COMPACTION)

TUBE LENGTH: _____ (in) _____ (cm)
 TUBE DIAMETER: _____ (in) _____ (cm)
 SOIL LENGTH(L): 2.1175 (in) 5.377 (cm)
 SOIL DIAMETER: 2.883 (in) 7.323 (cm)
 AREA(A): (in²) 42.12 (cm²)

MOISTURE CONTENT

INITIAL WET WEIGHT (g): 400.50
 FINAL WET WEIGHT (g): 432.17
 FINAL DRY WEIGHT (g): 341.20
 INITIAL MOISTURE (%): 17.19
 FINAL MOISTURE (%):
 PAN NAME: CMS

PERM INFORMATION

CELL PRESSURE(psi):
 FORE PRESSURE(psi):
 BACK PRESSURE (psi):
 HEAD,h (psi) x 70.34: 140.68
 TEMPERATURE (°F):
 VISCOSITY CORRECTION(R_T):
 PERMEANT LIQUID USED:
 BURET CORRECTION FACTOR(C):

TABLE OF HYDRAULIC CONDUCTIVITY

DATE		TIME		ELAPSED TIME (+)		READING		FLOW (CC)	
START	END	START	END	MINUTES	SECONDS	START	END		
9-1		9:18	9:36	18		1080	12.7 6.1 4.6 14.2 8.1	6.3x10 ⁻⁶	
9-1		9:39	9:51	12		720	17.2 2.3 11.9 7.4 5.1	6.0x10 ⁻⁶	
		9:51	10:02	11		600	11.9 7.4 8.0 11.4 3.3	5.0x10 ⁻⁶	
		10:02	10:09	7		420	8.0 11.4 5.6 13.8 2.4	4.8x10 ⁻⁶	
		10:09	10:17	8		480	5.6 13.9 3.0 11.4 2.6	4.6x10 ⁻⁶	
		10:55	11:07	12		720	11.1 9.5 7.1 13.0 4.0	4.7x10 ⁻⁶	
TOTALS									12.9 ✓

COEFFICIENT OF PERMEABILITY, $k = \frac{Q}{h \times A \times t}$

$$\frac{Q}{t} \cdot 8.45 \times 10^{-4} = 4.8 \times 10^{-6}$$



CONSTANT HEAD PERMEABILITY TEST

(ASTM D5084)

JOB NAME: TVA - KINGSTON - Prop Gyp. Stl.
 JOB NO.: 3043-05-1030 BORROWEAD
 BORING NO.: OT-4
 DEPTH: 4'-10'
 SAMPLE: BULK
 DESCRIPTION: RMS - .900 19.8 (90.0%)

TECHNICIAN: J.C.
 DATE: 8/31/05

CHECKED BY: M
 CELL NO.: #2
 SYSTEM NO.: #14

SAMPLE INFORMATION

WEIGHT TUBE & SOIL (g):
 WEIGHT TUBE (g):
 WEIGHT SOIL (g):
 VOLUME SOIL (cu ft):
 DRY UNIT WEIGHT (pcf):
 WET UNIT WEIGHT (pcf):

(Actual composition)

TUBE LENGTH: (in) (cm)
 TUBE DIAMETER: (in) (cm)
 SOIL LENGTH(L): 2.0755 (in) 5.272 (cm)
 SOIL DIAMETER: 2.8735 (in) 7.3047.2 (ft)
 AREA(A): (in²) 41.95 (cm²) 41.87

MOISTURE CONTENT

INITIAL WET WEIGHT (g): 384.65
 FINAL WET WEIGHT (g): 406.14
 FINAL DRY WEIGHT (g): 320.86
 INITIAL MOISTURE (%): 19.8%
 FINAL MOISTURE (%):
 PAN NAME: INAKE

PERM INFORMATION

CELL PRESSURE(psi): 57
 FORE PRESSURE(psi): 52
 BACK PRESSURE (psi): 59
 HEAD.h (psi) x 70.34: 140.68
 TEMPERATURE (°F): 73°F
 VISCOSITY CORRECTION(R_v): 0.931
 PERMEANT LIQUID USED: H₂O
 BURET CORRECTION FACTOR(C): 1.0

TABLE OF HYDRAULIC CONDUCTIVITY

DATE		TIME		ELASPED TIME (+)		READING		FLOW (CC)	
START	END	START	END	MINUTES	SECONDS	START	END	cc	K
9-5	9-5	4:08 PM	4:14 PM	6	360	10.9	9.4	9.1	11.1 1.8 4.2x10 ⁻⁶
9-5	9-5	4:15 PM	4:21 PM	6	360	10.9	7.3	9.3	10.8 1.6 3.7x10 ⁻⁶
9-5	9-5	4:22 PM	4:35 PM	13	780	11.2	9.1	8.7	11.6 2.5 2.7x10 ⁻⁶
9-5	9-5	4:36 PM	4:42	6	360	11.2	9.0	9.3	10.9 1.9 4.4x10 ⁻⁶
TOTALS					= 1860				Q = 7.8

$$\text{COEFFICIENT OF PERMEABILITY}, k = \frac{Q \times L \times R_v \times C}{h \times A \times t} = \frac{7.8 \times 0.5272 (0.931)}{140.68 (41.87)} =$$

$$3.5 \times 10^{-6}$$



CONSTANT HEAD PERMEABILITY TEST

(ASTM D5084)

JOB NAME: TVA Kingston - Proposed Gypsum Stack
 JOB NO.: 3043-05-1030 Boring Area
 BORING NO.: OT-4
 DEPTH: 4' - 10'
 SAMPLE: Bulk
 DESCRIPTION: RMS-95% 19.9 (95.0%)

TECHNICIAN: J.C.
 DATE: 9/12/05

CHECKED BY: M
 CELL NO.: 3
 SYSTEM NO.: 15

SAMPLE INFORMATION

WEIGHT TUBE & SOIL (g):
 WEIGHT TUBE (g):
 WEIGHT SOIL (g):
 VOLUME SOIL (cu ft):
 DRY UNIT WEIGHT (pcf):
 WET UNIT WEIGHT (pcf):

(Actual composition)

TUBE LENGTH: _____ (in) _____ (cm)
 TUBE DIAMETER: _____ (in) _____ (cm)
 SOIL LENGTH(L): 1.9900 (in) 5.055 (cm)
 SOIL DIAMETER: 7.8665 (in) 7.281 (cm)
 AREA(A): (in²) 41.64 (cm²)

MOISTURE CONTENT

INITIAL WET WEIGHT (g): 404.15
 FINAL WET WEIGHT (g): 419.31
 FINAL DRY WEIGHT (g): 336.51
 INITIAL MOISTURE (%): 19.83
 FINAL MOISTURE (%):
 PAN NAME: B-3

PERM INFORMATION

CELL PRESSURE(psi):
 FORE PRESSURE(psi):
 BACK PRESSURE (psi):
 HEAD,h (psi) x 70.34: 140.68
 TEMPERATURE (°F):
 VISCOSITY CORRECTION(R_v):
 PERMEANT LIQUID USED:
 BURET CORRECTION FACTOR(C):

TABLE OF HYDRAULIC CONDUCTIVITY

DATE		TIME		ELAPSED TIME (+)		READING		FLOW (CC)	
START	END	START	END	MINUTES	SECONDS	START	END		
9-1	9:30	9:54		24	1440	15.2	5.1	12.2	9.0 3.0 1.7×10^{-6}
	9:54	10:00		6	(360)	12.2	8.0	11.6	8.7 (.7) 1.6×10^{-6}
	10:00	10:07		7	(420)	11.6	8.7	10.8	9.5 (.8) 1.5×10^{-6}
	10:07	10:15		8	(480)	10.8	9.5	9.8	10.5 (1.0) 1.7×10^{-6}
	10:51	11:04		13	(780)	16.1	3.8	15.0	5.5 (1.6) 1.6×10^{-6}
TOTALS									4.1 ✓
									Q =

$$\text{COEFFICIENT OF PERMEABILITY, } k = \frac{Q \times L \times R_v \times C}{h \times A \times t} = \frac{4.1 \times 5.055 \times 0.91 \times 10^{-6}}{2040 \times 41.64 \times 64.64} = 1.6 \times 10^{-6}$$



CONSTANT HEAD PERMEABILITY TEST

(ASTM D5084)

JOB NAME: TVA Kingston - Proposed Gypsum Stack
 JOB NO.: 3043-05-1030 Boring Area
 BORING NO.: OT-4
 DEPTH: 4' - 10'
 SAMPLE: Bulk
 DESCRIPTION: RMS-90 @ 22.7% 90.0 g/cm³

TECHNICIAN: J.C.
 DATE: 8/31/05

CHECKED BY: JA
 CELL NO.: 4
 SYSTEM NO.: 9

SAMPLE INFORMATION

WEIGHT TUBE & SOIL (g):
 WEIGHT TUBE (g):
 WEIGHT SOIL (g):
 VOLUME SOIL (cu ft):
 DRY UNIT WEIGHT (pcf):
 WET UNIT WEIGHT (pcf):

(ACTUAL COMPACTION)

TUBE LENGTH: _____ (in) _____ (cm)
 TUBE DIAMETER: _____ (in) _____ (cm)
 SOIL LENGTH(L): 1.9840 (in) 5.039 (cm)
 SOIL DIAMETER: 2.9705 (in) 7.342 (cm)
 AREA(A): (in²) 42.34 (cm²)

MOISTURE CONTENT

INITIAL WET WEIGHT (g): 399.44
 FINAL WET WEIGHT (g): 405.29
 FINAL DRY WEIGHT (g): 324.43
 INITIAL MOISTURE (%): 22.7%
 FINAL MOISTURE (%):
 PAN NAME: FF

PERM INFORMATION

CELL PRESSURE(psi):
 FORE PRESSURE(psi):
 BACK PRESSURE (psi):
 HEAD,h (psi) x 70.34: 140.68
 TEMPERATURE (°F):
 VISCOSITY CORRECTION(R_v):
 PERMEANT LIQUID USED:
 BURET CORRECTION FACTOR(C):

TABLE OF HYDRAULIC CONDUCTIVITY

DATE		TIME		ELAPSED TIME (+)		READING		FLOW (CC)				
START	END	START	END	MINUTES	SECONDS	START	END					
9/1		10:01	10:57	56	)	33.60	19.3	39.4	21.1	31.5	1.8	4.2×10^{-7}
		10:57	11:44	47	)	28.20	21.1	37.5	22.7	32.1	1.5	4.2×10^{-7}
		11:44	12:28	44	)	21.40	22.7	36.1	29.0	34.5	1.3	3.9×10^{-7}
		12:28	1:03	35	)	21.00	24.0	34.5	25.0	33.3	1.1	3.8×10^{-7}
TOTALS						$\therefore 109.204$					$Q = 5.6$	

$$\text{COEFFICIENT OF PERMEABILITY, } k = \frac{Q \times L \times R_v \times C}{h \times A \times t}$$

$$k = \frac{5.039(0.93)(1.0)}{(140.68)(42.34)} = 4.0 \times 10^{-7}$$



CONSTANT HEAD PERMEABILITY TEST

(ASTM D5084)

JOB NAME: TVA Kingston - Proposed Gypsum Stack
 JOB NO.: 3043-05-1030 Boring Area
 BORING NO.: OT-4
 DEPTH: 4'-10'
 SAMPLE: Bulk
 DESCRIPTION: PMS-95-22.8 (95.0%)

TECHNICIAN: J.C.
 DATE: 8/31/05

CHECKED BY: JL
 CELL NO.: #1
 SYSTEM NO.: 8

SAMPLE INFORMATION

WEIGHT TUBE & SOIL (g):
 WEIGHT TUBE (g):
 WEIGHT SOIL (g):
 VOLUME SOIL (cu ft):
 DRY UNIT WEIGHT (pcf):
 WET UNIT WEIGHT (pcf):

(ACTUAL Compaction)

TUBE LENGTH: _____ (in) (cm)
 TUBE DIAMETER: _____ (in) (cm)
 SOIL LENGTH(L): 2.0760 (in) 5.273 (cm)
 SOIL DIAMETER: 2.8835 (in) 7.324 (cm)
 AREA(A): (in²) 42.13 (cm²)

MOISTURE CONTENT

INITIAL WET WEIGHT (g): 421.08
 FINAL WET WEIGHT (g): 427.70
 FINAL DRY WEIGHT (g): 342.09
 INITIAL MOISTURE (%): 22.79
 FINAL MOISTURE (%):
 PAN NAME: II

PERM INFORMATION

CELL PRESSURE(psi):
 FORE PRESSURE(psi):
 BACK PRESSURE (psi):
 HEAD,h (psi) x 70.34: 140.68
 TEMPERATURE (°F):
 VISCOSITY CORRECTION(R_T):
 PERMEANT LIQUID USED:
 BURET CORRECTION FACTOR(C):

TABLE OF HYDRAULIC CONDUCTIVITY

DATE		TIME		ELASPED TIME (+)		READING		FLOW (CC)		
START	END	START	END	MINUTES	SECONDS	L START (R)	L END (R)	Q	K	
9/1	9:52	10:56		64	(3840)	27.6	38.6	28.0	38.2 (.4)	8.6×10^{-8}
	10:56	11:43		47	(2820)	28.0	38.2	28.3	37.9 (.3)	8.8×10^{-8}
	11:43	1:02		79	(4740)	28.3	37.9	28.7	37.4 (.4)	7.0×10^{-8}
	1:02	1:33		31	(1860)	28.7	37.4	28.9	37.2 (.2)	8.9×10^{-8}
TOTALS						$t = 13760^{\circ}$		$Q = 1.3^{\circ}$		

COEFFICIENT OF PERMEABILITY, $k = Q \times L \times R_T \times C$
 $\frac{Q}{L} \times \frac{(5.273)(.931)(1.0)}{(140.68)(42.13)} = 8.1 \times 10^{-8}$



CONSTANT HEAD PERMEABILITY TEST

(ASTM D5084)

JOB NAME: TVA KINGSTON - B.A.

JOB NO.: 3043-05-1030

BORING NO.: QT-4

DEPTH: 41-101

SAMPLE: Bulk

DESCRIPTION: Rms \cong 95%_{oc} 20.6% CT

TECHNICIAN: J. ALEX. / J.C.

DATE: 9-12-5

CHECKED BY: JA

CELL NO.: #2

SYSTEM NO.: #14

SAMPLE INFORMATION

WEIGHT TUBE & SOIL (g):

WEIGHT TUBE (g):

WEIGHT SOIL (g):

VOLUME SOIL (cu ft):

DRY UNIT WEIGHT (pcf):

WET UNIT WEIGHT (pcf):

TUBE LENGTH: _____ (in) _____ (cm)

TUBE DIAMETER: _____ (in) _____ (cm)

SOIL LENGTH(L): 2.06 (in) 5.095 (cm)

SOIL DIAMETER: 2.888 (in) 7.336 (cm)

AREA(A): (in²) 42.26 (cm²)**MOISTURE CONTENT**

INITIAL WET WEIGHT (g): 416.04

FINAL WET WEIGHT (g): 429.77

FINAL DRY WEIGHT (g): 345.82

INITIAL MOISTURE (%): 20.3

FINAL MOISTURE (%): 24.3

PAN NAME: FF

PERM INFORMATION

CELL PRESSURE(psi):

FORE PRESSURE(psi):

BACK PRESSURE (psi):

HEAD,h (psi) \times 70.34: 140.68

TEMPERATURE (°F): 73°F

VISCOSITY CORRECTION(R_v): .931PERMEANT LIQUID USED: H₂O distilled

BURET CORRECTION FACTOR(C): 1.0

TABLE OF HYDRAULIC CONDUCTIVITY

DATE		TIME		ELASPED TIME (+)		READING		FLOW (CC)	
START	END	START	END	MINUTES	SECONDS	START	END	Q	K
9-15	9-15	9:13	11:14	121	7260	13.0	7.3	2.6	18.2
9-15	9-15	11:14	11:45	31	1860	2.6	18.2	.2	20.6
9-15	9-15	11:48	12:59	71	4260	13.8	2.9	7.3	9.4
9-15	9-15	12:59	2:06	67	4020	7.3	9.4	20	14.9
TOTALS						17400		Q=24.6	

$$\text{COEFFICIENT OF PERMEABILITY, } K = \frac{Q \times L \times R_v \times C}{h \times A \times t} = \frac{Q}{E} \cdot (.00079787) = 1.1 \times 10^{-6}$$