REPORT OF GEOTECHNICAL EXPLORATION

ASH DISPOSAL AREA
KINGSTON FOSSIL PLANT
KINGSTON, TENNESSEE

Prepared For:

TENNESSEE VALLEY AUTHORITY

Chattanooga, Tennessee

Prepared By:

MACTEC ENGINEERING AND CONSULTING, INC.

Knoxville, Tennessee

MACTEC Project 3043041009/0001

May 4, 2004

MACTEC

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May 4, 2004

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

Subject: **Report of Geotechnical Exploration**
Ash Disposal Area
TVA Kingston Fossil Plant
Kingston, Tennessee
MACTEC Project 3043041009/0001

Dear Mr. Purkey:

We at MACTEC Engineering and Consulting, Inc., (MACTEC) are pleased to submit this Report of Geotechnical Exploration for your project. Our services, as authorized through TAO No. MAC-0692-00050 were provided in general accordance with our proposal number Prop04Knox/076 dated February 17, 2004.

This report reviews the information provided to us, discusses the site and subsurface conditions, and presents our results of field and laboratory testing of the materials at the existing Ash Disposal Area. The Appendices contain a brief description of the Field Exploratory Procedures, a Key Sheet and Test Boring Records, Subsurface Fence Diagrams, In-situ Hydraulic Conductivity Test Results, Cone Penetrometer Test Results, the Laboratory Test Procedures, and the Laboratory Test Results.

We anticipate further dialog and interaction with your team and will be happy to provide additional information or interpretation of the data and recommendations presented here in which may be necessary.

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

Sincerely,
MACTEC ENGINEERING AND CONSULTING, INC.

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Project Professional

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EXECUTIVE SUMMARY

MACTEC was selected by the Tennessee Valley Authority (TVA) to perform a geotechnical exploration for the existing Ash Disposal Area at the Kingston Fossil Plant in Kingston, Tennessee. The objectives of our exploration were to determine the subsurface conditions at the site, to obtain data to evaluate the strength and hydraulic conductivity characteristics of the ash materials, and also to evaluate the consolidation characteristics of the alluvial soils.

The exploration consisted of drilling a total of fifteen geotechnical test borings, installing three ground-water monitoring wells (piezometers), drilling three auger borings used to perform in-situ hydraulic conductivity testing, and performing Cone Penetrometer Test (CPT) probes at selected locations. The major findings and recommendations of our geotechnical exploration are as follows:

- The test borings typically encountered ash and intervals of fill soils overlying alluvial soils. The ash was typically comprised of silt and sand sized particles with lesser percentages of clay and gravel sized particles. The consistency and relative density of the ash varied from very soft to very stiff and very loose to very dense. The fill soils were typically comprised of silty clay and silty sand with chert fragments and some ash. The fill soils are judged to generally be of very soft to stiff consistency and firm relative density. The underlying alluvial soils were typically comprised of silty clay, clayey sand, and sand. The alluvial soils are judged to have very soft to very stiff consistencies and very loose to dense relative densities.

- Ground-water was measured in the test borings at the time of drilling. Table 2 summarizes the recorded ground-water data. Three ground-water monitoring wells identified as MW-1, MW-2, and MW-3, were installed along the slope of the Ash Disposal Area located adjacent to Swan Pond Road at the north end of the site (see Figure 2: Boring Location Plan). Long-term ground-water levels can be obtained from these well locations.

- In-situ hydraulic conductivity testing was conducted at auger boring locations B-1A, B-1B, and B-2A (see Figure 2: Boring Location Plan). A discussion of the field test results is found in Section 7.0. The test results are found in Appendix C.

- Cone Penetrometer Test soundings were performed at selected locations near some of the geotechnical test borings and on a newly constructed dike. The test locations are shown on Figure 2: Boring Location Plan. A discussion of the test results is found in Section 8.0. The CPT results are found in Appendix D.

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 field and laboratory testing recently performed for the existing Ash Disposal Area at TVA's 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 characterize the subsurface conditions at the Ash Disposal Area, and to obtain data to aid in the evaluation of the strength and hydraulic conductivity characteristics of the ash materials and consolidation characteristics of the alluvial 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 Prop04Knox/076 dated February 17, 2004, and the geotechnical scope of work outlined in the project's scope of work prepared by TVA and Parsons E & C. It included the following:

3.1 DRILLING AND SAMPLING

The subsurface exploration for this project consisted of drilling and sampling twelve geotechnical borings (designated B-1 through B-12), three offset geotechnical borings (designated B-4A, B-5A, and B-8A), drilling three auger borings used to perform in-situ hydraulic conductivity testing (designated B-1A, B-1B, and B-2A), and drilling and installing three ground-water monitoring wells (piezometers), (designated MW-1, MW-2, and MW-3). One of our geotechnical engineers estimated the boring locations in the field using a boring location map as a reference. The boring locations are shown on Figure 2: Boring Location Plan. TVA determined the coordinates, and ground surface elevations at the geotechnical boring locations relative to mean sea level (msl), using surveying techniques.

The borings were drilled with a truck-mounted Central Mine Equipment (CME) Model 75 drill rig and an all-terrain vehicle (ATV) mounted Central Mine Equipment (CME) Model 55 drill rig in general accordance with the procedures described in Appendix B. Standard Penetration Tests (SPTs) were performed in the geotechnical borings using a CME automatic hammer. The SPTs were performed using standard 2.00-inch OD split spoons with 1.38-inch ID barrels (i.e., no room for liners in the barrels). SPTs were performed at 5-foot intervals.

Three-inch-diameter relatively undisturbed (Shelby tube) samples were obtained from representative cohesive soils in the geotechnical borings. The Shelby tubes were pushed into the bottoms of the boreholes at the desired sampling depth. The samples were then sealed with wax and capped at both ends to minimize changes in the structure and moisture content of the samples.

A 3.5-inch OD, 3-inch ID split spoon with liner was used to sample the ash at varying depths. The spoon was pushed into the bottoms of the boreholes at the desired sampling depths. The ash samples, enclosed in the liners, were then sealed with a wax / motor oil mixture at both ends and capped to minimize changes in the structure and moisture content of the samples.

3.2 MEASUREMENT OF GROUND-WATER LEVELS

Ground-water levels in the geotechnical borings were generally measured and recorded when first encountered (at the time of drilling). Twenty-four-hour ground-water readings were not recorded in the geotechnical borings due to the necessity of grouting the borings immediately after termination of the borings. Ground water measurements taken at the termination of the borings were not recorded due to the introduction of water into the boreholes during drilling. The recorded ground-water levels are discussed in Section 9.0 and are summarized in Table 2.

3.3 PLUGGING AND ABANDONMENT OF BOREHOLES

Upon completion of drilling and sampling, the geotechnical boreholes were plugged with a Type I Portland cement-bentonite grout mixture using a tremie pipe method. The borings were backfilled in general accordance with the requirements specified by TVA. During plugging and abandonment precautions were taken to stabilize against cave-ins prior to and during plugging procedures, however, it was observed that at a few of the boring locations portions of the ash profiles collapsed (caved-in) within the borings due to the behavior of the saturated ash. However, it is noted that the alluvial and residual soil profiles encountered underlying the intervals of ash were successfully grouted.

3.4 ADDITIONAL FIELD TESTING

3.4.1 Field Hydraulic Conductivity Testing

Field measurements to assist in estimating the limiting hydraulic conductivity of the in-situ dike materials were performed near soil test borings B-1 and B-2. The locations of the in-situ hydraulic conductivity tests are shown on Figure 2: Boring Location Plan. The in-situ hydraulic conductivity test results are found in Appendix C. A discussion of the field test results is found in Section 7.0.

3.4.2 Cone Penetrometer Testing (CPT)

Eleven CPT soundings were performed to supplement the data obtained from the geotechnical borings. The CPT locations are shown on Figure 2: Boring Location Plan. Nine soundings were performed near geotechnical test boring locations while two were performed on a newly constructed dike. The CPT results are found in Appendix D. A discussion of the test results is found in Section 8.0.

CPT soundings were performed using an electric penetrometer with pore pressure measurements. The cone penetrometer equipment was mounted on a track vehicle. Continuous data was recorded with a computerized data acquisition system. Pore pressure measurements were performed to evaluate the rate of pore pressure dissipation within the ash and underlying soils.

3.5 LABORATORY TESTING

This section outlines the geotechnical laboratory testing program. The discussion and summary of the results of the laboratory testing program are found in Section 9.0. The laboratory testing procedures and laboratory test results are included in Appendix E.

- 46 Natural Moisture Content Tests
- 13 Unit Weight with Moisture Content Tests
- 18 Specific Gravity Tests
- 6 Atterberg Limits Tests
- 27 Particle Size Distribution Tests
- 3 Consolidated Undrained Triaxial Compression (CU) Tests
- 2 Falling Head Permeability Tests
- 1 Consolidation Test

4.0 PROJECT INFORMATION AND SITE CONDITIONS

Project information was provided to us by TVA and Parsons E & C in the form of a Subsurface Exploration document and a boring location plan. The existing Ash Disposal Area consists of an upstream method of construction ash disposal facility with various cells, existing ash pond, and stilling pond. The site is located just north of the Kingston Fossil Plant. The ground surface elevation varies by as much as about 48 feet in the areas of our exploration program. The areas of exploration included existing cells, a perimeter slope of the disposal facility, and areas along the perimeter of the existing ash and stilling ponds.

5.0 AREA AND SITE GEOLOGY

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

The site and vicinity are blanketed with alluvial (water-transported) soils that have been deposited over time by the nearby Emory River. The alluvial soils typically consist of heterogeneous mixtures of clay, silt, sand and gravel. The alluvial soils typically grade coarser with depth and may contain rock fragments ranging up to cobble and boulder size. The published geologic map of this area shows that this site is underlain by bedrock of the Conasauga Shale. The Conasauga Shale is mainly composed of blue-gray shale with many lenses of limestone, conglomerate, and siltstone. The proportion of shale to other materials is about 4 to 1. The lenses of limestone typically range in thickness from about 1 inch to several feet.

6.0 SUBSURFACE CONDITIONS

Subsurface conditions encountered in our borings are described in the following paragraphs. The approximate boring locations are shown on Figure 2: Boring Location Plan. Subsurface conditions encountered at the boring locations are shown on the Boring Records. The Boring Records represent our interpretation of the subsurface conditions based on the field boring logs and visual examination of the field samples by one of our geotechnical engineers. The lines designating the interfaces between various strata on the Boring Records and Subsurface Profiles represent the approximate interface locations. Boring depths and types are summarized in Table 1. Descriptions of the materials encountered in the borings are given below:

- Ash – Ash was encountered at each boring location. The ash typically consisted of fine and coarse sized particles as described on the boring logs. Standard Penetration Test (SPT) N-values in the ash ranged from 0 (woh / "weight of hammer") to over 50 blows per foot (bpf).

- Fill Soils – Fill was encountered in borings B-1 through B-3, B-7, B-9, B-11, and B-12. Fill soils are soils that have been transported to their present location by man. These soils typically consisted of silty clay and silty sand with varying percentages of chert fragments, coal fragments, limestone fragments, and ash. N-values in the fill soils ranged from 1 to over 50 blows per foot (bpf). The higher N-values were likely inflated due to the presence of large rock fragments in the fill. Correspondingly, the fill soils are judged to generally be of very soft to stiff consistency and firm relative density. The depth to fill varied from ground surface at borings B-1 and B-2 to about 57.5 feet at boring B-3.

- Alluvium – Alluvial soils were encountered below the ash in borings B-1, B-2, B-4, B-5A, B-6, B-7, B-8A, and B-9 through B-12. Alluvial soils are soils that have been transported to their present location by running water. These soils consisted of silty clay, clayey sand, and sand with coal fragments and roots. The N-values in the alluvial soils ranged from 0 (woh / "weight of hammer") to 33 bpf. These soils are judged to have very soft to very stiff consistencies and very loose to dense relative densities. The depth to alluvium varied from about 26.2 ft at boring B-12 to about 83 ft at boring B-4. Based on the results of the laboratory testing, the alluvial soils were classified as CL and SM, in accordance with the USCS.

- Residuum - The residuum was encountered below the alluvial soils and extended to auger refusal or to auger termination depth in borings B-8A, B-9, B-10, and B-12. Residual soils (residuum) are soils that have developed from the in-place weathering of the underlying parent bedrock. The residuum typically consisted of weathered shale and shale with limestone. The N-values in the residuum ranged from 14 bpf to over 50 bpf. These residual materials are judged to have stiff to very hard consistencies. The depth to residuum varied from about 38 ft at boring B-10 to about 70.5 ft at boring B-8A.

7.0 IN-SITU HYDRAULIC CONDUCTIVITY TESTING AND DISCUSSION OF RESULTS

This section describes the hydraulic conductivity testing performed for this project. The results of the testing and a brief discussion of the test procedure is provided in Appendix C.

The hydraulic conductivity testing was performed at locations B-1A, adjacent to soil test boring B-1 and at B-2A, adjacent to soil test boring B-2. The temperature effect gage was installed at B-1B. These locations are shown on the Boring Location Plan, Figure 2, in the Appendix.

The in-situ hydraulic conductivity test provides the in-situ limiting hydraulic conductivity of the tested material. These limiting values are the maximum possible for the vertical direction, and the minimum possible for the horizontal direction.

The results of the tests indicated that the maximum vertical hydraulic conductivity at borings B-1 and B-2 was 5.13×10^{-6} and 3.59×10^{-6} centimeters per second (cm/s), respectively. The minimum horizontal hydraulic conductivity at borings B-1 and B-2 was measured as 1.42×10^{-5} and 3.67×10^{-6} cm/s, respectively.

8.0 CONE PENETROMETER TEST RESULTS

The subsurface profiles developed by the CPT soundings were consistent with those obtained from the geotechnical borings. Typically, the CPT soundings indicated that the tip resistance decreased from the coarser, cohesionless ash into the finer ash. Several pore pressure dissipation tests were performed at the CPT locations which give further indications of material types. Refer to Appendix D for details of the CPT results.

9.0 LABORATORY TESTING AND DISCUSSION OF LAB RESULTS

This section describes the geotechnical laboratory testing program performed for this project. The laboratory testing procedures and laboratory test results are included in Appendix E. The following paragraphs provide a short discussion of the laboratory testing conducted and summarize the results.

9.1 ASH SAMPLES

9.1.1 Index Properties, Specific Gravity, and Unit Weight

Natural moisture content, grain size distributions with hydrometer analyses, and specific gravity tests were performed on split-spoon and undisturbed ash samples. In addition, unit weight testing was performed on selected undisturbed ash samples.

Moisture contents of the tested ash ranged from 16 (B-3) to 48 (B-10) percent; most values ranged between 22 and 40 percent. Table 3 summarizes the results of the natural moisture content testing performed on selected split-spoon ash samples.

The grain size testing confirmed the variability of the grain size distributions of the sampled ash materials. Percent fines (percent silt and clay-size particles) varied from 30 to 98 percent.

Specific gravities for the ash samples tested varied from 2.27 to 2.58, with the preponderance of values in the 2.3 to 2.5 range. Moist unit weights in the ash material ranged from 76.7 to 114.0 pounds per cubic foot (pcf), and averaged 104.3 pcf. Dry unit weights in the ash material varied from 61.6 to 95.5 pcf and averaged 80.5 pcf.

9.1.2 Ash Sample Remolding

Remolded ash specimens were subjected to consolidated-undrained triaxial compression with pore pressure measurements (CU w/PP) and hydraulic conductivity testing. An undisturbed ash specimen (B-10, 5 to 7 feet), subjected to CU w/PP triaxial testing, was remolded to similar density and moisture content conditions as the undisturbed sample unit weight test results indicated. Bulk samples of ash (obtained from borings B-1A, B1B, and B-2A) subjected to hydraulic conductivity testing were remolded to density and moisture content conditions obtained from a unit weight test performed on an undisturbed ash specimen sampled from B-1 (4 to 4.5 feet).

9.1.3 Strength

Shear strength testing on ash material included consolidated-undrained triaxial compression with pore pressure measurements (CU w/PP). Tests were performed on relatively undisturbed and remolded ash specimens. The strength parameters from the triaxial shear strength testing are summarized in Table 4. The test results are discussed below.

As shown in Table 4, CU w/PP parameters consisted of total stress cohesion intercepts from 3.0 to 5.6 ksf and total stress friction angles of 25.0 to 32.7 degrees. Effective stress cohesion intercepts varied from 0 to 0.1 ksf, and effective stress friction angles varied from 32.1 to 36.6 degrees. The high total stress cohesion values may be indicative of chemical bonding within the ash.

9.1.4 Hydraulic Conductivity

Hydraulic conductivity tests were performed on remolded specimens of ash material obtained from bulk samples. The results of the hydraulic conductivity tests are presented in Table 5. Values of hydraulic conductivity for the two remolded specimens were 1.67×10^{-5} cm/sec and 1.87×10^{-5} cm/sec.

9.2 SOIL SAMPLES

9.2.1 Index Properties, Specific Gravity, and Unit Weight

Natural moisture content and specific gravity tests were performed on split-spoon and undisturbed soil samples. Liquid limit and plastic limits (collectively known as Atterberg limits tests); and grain size distributions with hydrometer analyses were performed on split-spoon and undisturbed soil samples, as well. These tests were used to confirm our visual-manual classifications and to evaluate the volume change potential of the samples tested. In addition, unit weight testing was performed on selected undisturbed soil samples. Table 3 summarizes the results of the natural moisture content and Atterberg limits testing performed on selected split-spoon soil samples.

Moisture contents of the tested alluvial soils ranged from 17 (B-2 and B-8A) to 27 (B-8A) percent. Liquid limits of the tested alluvial soils were 26, while the plastic limits varied from 15 to 16. Plasticity indices (PIs) varied from 10 to 11. The majority of the tested alluvial soils were non-viscous and non-plastic. The tested soils, having plasticity indices of less than 30, are considered to have a relatively low potential for volume change with changes in moisture content. The alluvial soils classified as CL and SM in accordance with the Unified Soil Classification System.

The grain size testing confirmed the variability of the grain size distributions of the sampled alluvial soils. Percent fines (percent silt and clay-size particles) varied from 17.3 to 57.2 percent. Specific gravities of the tested alluvial soil samples varied from 2.67 to 2.68. Moist unit weights in the alluvial soils ranged from 124.6 to 131.0 pounds per cubic foot (pcf), and averaged 127.6 pcf. Dry unit weights in the alluvial soils varied from 102.2 to 112.2 pcf and averaged 106.3 pcf.

9.2.2 Compressibility

One-dimensional consolidation testing was performed on an undisturbed specimen of alluvial soil. Compression properties of the soil subjected to one-dimensional consolidation testing are summarized in Table 6. The laboratory consolidation data is presented in Appendix E. The preconsolidation pressure listed in Table 6 was estimated graphically by hand using the Casagrande Method and checked by the Log-Log Method.

The coefficients of consolidation were computed for each load increment by the consolidation test software. The compression index for the "laboratory" void ratio versus log pressure curve also was computed by the consolidation test software. The "field" compression index was estimated graphically using the Schmertmann Method.

10.0 GROUND-WATER CONDITIONS

Ground-water level measurements made in the borings during drilling are summarized in Table 2. Ground water was observed in borings B-1 through B-4, B-6 through B-8, B-9 through B-12, and in B-5A and B-8A. Depths below the ground surface to ground-water levels at the time of drilling varied from 3.0 to 42.0 feet. The ground-water elevations at the time of drilling varied from 943.1 to 982.8 feet msl. Twenty-four-hour ground-water levels were not measured in the geotechnical borings because plugging and abandonment procedures were initiated immediately after drilling.

To provide long-term ground-water data for the site vicinity near borings B-1 through B-3, three ground-water monitoring wells (piezometers) were installed and identified as MW-1, MW-2, and MW-3. Twenty-four-hour ground-water measurements were taken at these locations after the installation of these monitoring wells. Initial readings indicate depths below the ground surface to ground-water levels of 6.9 ft, 15.4 ft, and 27.3 ft, at locations MW-1, MW-2, and MW-3, respectively. These correspond to ground-water elevations of 774.9, 779.9, and 783.5 feet msl.

11.0 BASIS OF RESULTS

The results of our geotechnical exploration provided herein are based on the encountered subsurface conditions, and on the field and laboratory testing performed with respect to the specific project site and locations discussed in this report. Regardless of the thoroughness of a geotechnical exploration, there is always a possibility that conditions between test borings will differ from those at specific test boring locations, and that conditions may not be as anticipated. In addition, the interpretation and analysis of the results of a geotechnical exploration are critical related to proposed design criteria. Therefore, we recommend that experienced geotechnical engineers review any proposed site specific design plans that incorporate the results of our geotechnical exploration. We recommend that TVA retain MACTEC to provide this service, based upon our familiarity with the subsurface conditions, field and laboratory testing results, 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 1
BORING SUMMARY

Boring Number	Type	Ground Elevation msl (Feet)	Refusal Depth (Feet)	Refusal Elevation msl (Feet)	Refusal Type	Boring Termination Depth (Feet)	Boring Termination Elevation msl (Feet)
B-1	STB	781.8	82.2	699.6	AR	82.2	699.6
B-1A	HC	781.8*	NA	NA	NA	5.0	776.8
B-1B	HC	781.8*	NA	NA	NA	5.0	776.8
B-2	STB	795.3	87.5	707.8	AR	87.5	707.8
B-2A	HC	795.3*	NA	NA	NA	5.0	790.3
B-3	STB	810.8	NA	NA	NA	70.0	740.8
B-4	STB	810.6	NA	NA	NA	98.5	712.1
B-4A	STB	810.6*	NA	NA	NA	28.5	782.1
B-5	STB	810.2	NA	NA	NA	41.5	768.7
B-5A	STB	810.2	NA	NA	NA	101.5	708.7
B-6	STB	809.5	NA	NA	NA	86.5	723.0
B-7	STB	767.0*	NA	NA	NA	46.5	720.5
B-8	STB	773.6*	NA	NA	NA	35.0	738.6
B-8A	STB	773.6	70.7	702.9	AR	70.9	702.7
B-9	STB	764.4	61.9	702.5	AR	61.9	702.5
B-10	STB	762.6	39.2	723.4	AR	39.2	723.4
B-11	STB	765.0	62.5	702.5	AR	62.5	702.5
B-12	STB	763.9	59.7	704.2	AR	60.6	703.3
MW-1	MW	781.8*	NA	NA	NA	20.0	761.8
MW-2	MW	795.3*	NA	NA	NA	35.0	760.3
MW-3	MW	810.8*	NA	NA	NA	40.0	770.8

NA – Not Applicable
STB – Soil Test Boring
AR – Auger Refusal
HC – Auger Boring used for In-Situ Hydraulic Conductivity Testing
MW – Monitoring Well or Piezometer
* - Elevations were estimated based on nearby surveyed boring locations and field reconnaissance

Prepared By CTT Date 5/4/04 Checked By MBH Date 5/4/04

TABLE 2
GROUND-WATER DATA

Boring Number	Ground Elevation msl (Feet)	Depth to Ground Water at Time of Drilling (Feet)	Ground-Water Elevation, msl at Time of Drilling (Feet)	Depth to Ground Water 24 Hours After Drilling (Feet)	Ground-Water Elevation 24 Hours After Drilling msl (Feet)
B-1	781.8	7.4	774.4	Not Measured	Not Measured
B-1A	781.8	Not Encountered	Not Encountered	Not Measured	Not Measured
B-1B	781.8	Not Encountered	Not Encountered	Not Measured	Not Measured
B-2	795.3	26.2	769.1	Not Measured	Not Measured
B-2A	795.3	Not Encountered	Not Encountered	Not Measured	Not Measured
B-3	810.8	28.0	782.8	Not Measured	Not Measured
B-4	810.6	28.0	782.6	Not Measured	Not Measured
B-4A	810.6	Not Encountered	Not Encountered	Not Measured	Not Measured
B-5	810.2	Not Encountered	Not Encountered	Not Measured	Not Measured
B-5A	810.2	41.0	769.2	Not Measured	Not Measured
B-6	809.5	42.0	767.5	Not Measured	Not Measured
B-7	767.0	12.6	754.4	Not Measured	Not Measured
B-8	773.6	12.2	761.4	Not Measured	Not Measured
B-8A	773.6	12.0	761.6	Not Measured	Not Measured
B-9	764.4	9.0	755.4	Not Measured	Not Measured
B-10	762.6	3.0	759.6	Not Measured	Not Measured
B-11	765.0	21.9	743.1	Not Measured	Not Measured
B-12	763.9	18.5	745.4	Not Measured	Not Measured
MW-1	781.8	Not Measured	Not Measured	6.9 *	774.9
MW-2	795.3	Not Measured	Not Measured	15.4 *	779.9
MW-3	810.8	Not Measured	Not Measured	27.3 *	783.5

*Measurements were taken 24 hours after monitoring well (piezometer) installation.

Prepared By CTJ Date 5/4/04 Checked By MBH Date 5/4/04

TABLE 3
NATURAL MOISTURE CONTENT AND
ATTERBERG LIMITS LABORATORY TEST RESULTS

Boring Number	Sample Number	Sample Type	Sample Description/ Origin	Sample Depth (Feet)	Moisture Content (%)	Atterberg Limits		
						Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)
B-1	UD-1	UD	ASH	4-4.5	19	NT	NT	NT
B-1	UD-2	UD	Alluvium	65-67	20	NV	NP	NP
B-2	UD-4	UD	Alluvium	70-72	17	NV	NP	NP
B-3	1	SPT	ASH	0-1.5	24	NT	NT	NT
B-3	2	SPT	ASH	5-6.5	20	NT	NT	NT
B-3	3	SPT	ASH	10-11.5	16	NT	NT	NT
B-3	4	SPT	ASH	15-16.5	17	NT	NT	NT
B-3	5	SPT	ASH	20-21.5	39	NT	NT	NT
B-3	6	SPT	ASH	25-26.5	40	NT	NT	NT
B-3	7	SPT	ASH	30-31.5	34	NT	NT	NT
B-3	8	SPT	ASH	35-36.5	22	NT	NT	NT
B-3	9	SPT	ASH	40-41.5	22	NT	NT	NT
B-3	10	SPT	ASH	45-46.5	31	NT	NT	NT
B-3	11	SPT	ASH	50-51.5	39	NT	NT	NT
B-3	12	SPT	ASH	55-56.5	43	NT	NT	NT
B-3	13	SPT	FILL/ASH	60-61.5	30	NT	NT	NT
B-3	14	SPT	ASH	65-66.5	16	NT	NT	NT
B-4A	UD-1	UD	ASH	15-17	37	NT	NT	NT
B-4A	UD-3	UD	ASH	25-27	38	NT	NT	NT
B-5	1	SPT	ASH	0-1.5	22	NT	NT	NT
B-5	2	SPT	ASH	5-6.5	39	NT	NT	NT
B-5	3	SPT	ASH	10-11.5	25	NT	NT	NT
B-5	4	SPT	ASH	15-16.5	32	NT	NT	NT
B-5	5	SPT	ASH	20-21.5	30	NT	NT	NT
B-5	6	SPT	ASH	25-26.5	39	NT	NT	NT
B-5	7	SPT	ASH	30-31.5	41	NT	NT	NT
B-5	8	SPT	ASH	35-36.5	29	NT	NT	NT
B-5	9	SPT	ASH	40-41.5	34	NT	NT	NT
B-8	1	SPT	ASH	0-1.5	25	NT	NT	NT
B-8	2	SPT	ASH	5.8-7.3	20	NT	NT	NT
B-8	UD-2	UD	ASH	10-12	19	NT	NT	NT
B-8	3	SPT	ASH	12-13.5	22	NT	NT	NT
B-8	4	SPT	ASH	15-16.5	45	NT	NT	NT
B-8	UD-3	UD	ASH	20-22	32	NT	NT	NT

TABLE 3
NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS LABORATORY TEST RESULTS

Boring Number	Sample Number	Sample Type	Sample Description/ Origin	Sample Depth (Feet)	Moisture Content (%)	Atterberg Limits Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)
B-8	5	SPT	ASH	22-23.5	43	NT	NT	NT
B-8	6	SPT	ASH	25.6-27.1	27	NT	NT	NT
B-8	7	SPT	ASH	30-31.5	25	NT	NT	NT
B-8A	1	SPT	ASH	35-36.5	37	NT	NT	NT
B-8A	2	SPT	ASH	40-41.5	47	NT	NT	NT
B-8A	3	SPT	ASH	45-46.5	37	NT	NT	NT
B-8A	4	SPT	ASH	50-51.5	36	NT	NT	NT
B-8A	5	SPT	Alluvium	57-58.5	24	26	15	11
B-8A	6	SPT	Alluvium	62-63.5	24			
B-8A	UD-2	UD	Alluvium	60-62	22	26	16	10
B-8A	7	SPT	Alluvium	65-66.5	27	NV	NP	NP
B-8A	8	SPT	Alluvium	70-70.9	17			
B-10	1	SPT	ASH	0-1.5	18	NT	NT	NT
B-10	UD-1	UD	ASH	5-7	25	NT	NT	NT
B-10	2	SPT	ASH	7-8.5	28	NT	NT	NT
B-10	UD-2	UD	ASH	10-12	25	NT	NT	NT
B-10	3	SPT	ASH	12-13.5	30	NT	NT	NT
B-10	UD-3	UD	ASH	15-17	38	NT	NT	NT
B-10	4	SPT	ASH	17-18.5	45	NT	NT	NT
B-10	UD-4	UD	ASH	20-22	37	NT	NT	NT
B-10	5	SPT	ASH	22-23.5	32	NT	NT	NT
B-10	6	SPT	ASH	25-26.5	48	NT	NT	NT
B-10	7	SPT	Alluvium	30-31.5	25	NT	NT	NT
B-10	UD-5	UD	Alluvium	35-37	22	NV	NP	NP
B-10	8	SPT	Alluvium	37-38.5	20	NT	NT	NT

NT - Not Tested
NV – Non-Viscous
NP - Non-Plastic
SPT - Standard Penetration Test

Prepared By CTJ Date 5/4/04 Checked By MBH Date 5/4/04

TABLE 4
ASH TRIAXIAL SHEAR STRENGTH TEST DATA
CONSOLIDATED-UNDRAINED WITH PORE PRESSURE MEASUREMENTS FOR ASH SAMPLES

Boring Number	Sample Depth (Feet)	Sample Type[1, 2]	Description	Standard Penetration Test N-Value (Blows Per Foot)[3]	Average Initial Moisture Content (%)	Average Initial Dry Density (pcf)	Strength Parameters			
							Total		Effective	
							Cohesion, C (ksf)	Friction Angle, ϕ (Degrees)	Cohesion, C′ (ksf)	Friction Angle, ϕ' (Degrees)
B-4A	15-17	1	Gray Ash	1	32.0	83.1	5.6	32.7	0	34.7
B-10	5- 7	2	Gray Ash	17	24.7	89.4	3.0	28.5	0.1	36.6
B-10	20-22	1	Gray Ash	3	36.5	79.2	5.0	25.0	0	32.1

(1) UD = Undisturbed Sample

(2) Remolded

(3) Performed after undisturbed sample retrieval

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TABLE 5
LABORATORY HYDRAULIC CONDUCTIVITY TEST DATA FOR ASH SAMPLES

Boring Number	Sample Depth (Feet)	Sample Type	Description	Initial Moisture Content (%)	Initial Dry Density (pcf)	Average or Mean Hydraulic Conductivity (cm/Sec)
B-1A, 1B	0 - 5	1	Gray Ash	21.4	87.8	1.87×10^{-5}
B-2A	0 - 5	1	Gray Ash	19.4	90.9	1.67×10^{-5}

(1) Bulk samples remolded to dry density and moisture content conditions determined from laboratory tests performed on an undisturbed sample obtained at a depth of 4 to 4.5 feet from boring B-1.

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TABLE 6
CONSOLIDATION TEST DATA FOR SOIL SAMPLES

Boring Number	Sample Depth (Feet)	Sample Type	Origin	Initial Moisture Content (%)	Initial Dry Density (pcf)	e Initial Void Ratio	"Laboratory" Cc Compression Index	"Field" Cc Compression Index	Pc Preconsolidation Pressure (ksf)
B-8A	60-62	UD	Alluvium	21.9	102.0	0.6795	0.19	0.21	5.0

UD - Undisturbed Sample (ASTM D 1587)

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